

Myodocopid Ostracoda of
Hydrothermal Vents in the
Eastern Pacific Ocean

LOUIS S. KORNICKER

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ABSTRACT

Kornicker, Louis S. Mydocopid Ostracoda of Hydrothermal Vents in the Eastern Pacific Ocean. *Smithsonian Contributions to Zoology*, number 516, 46 pages, 25 figures, 2 tables, 1991.—Two new species of Ostracoda in the suborder Mydocopina are described and illustrated from hydrothermal vents in the eastern Pacific Ocean at depths of 1570–2600 m. One species, *Euphilomedes climax*, is from vents along the Explorer and Juan de Fuca Ridges, and another, *Prionotoleberis styx*, is from vents along the East Pacific Rise. Both species are from depths not previously reported for members of the genera. During ontogeny *E. climax* passes through 5 juvenile instars, the same number previously reported for a shallow water species of the genus, and changes in appendages during ontogeny are similar for both species. A key is presented to blind species of *Prionotoleberis*. A compilation from the literature shows differences in the number of bristles on the 9th exopodial joint of the 2nd antennae between species of the Pseudophilomedinae and the Philomedinae, and a key based on the number of bristles is presented for identifying instars of five genera of the Philomedinae (*Anarthron*, *Euphilomedes*, *Paraphilomedes*, *Philomedes*, *Scleroconcha*). Interesting differences between the Philomedinae and Pseudophilomedinae are noted: (1) known members of Philomedinae have 4–7 bristles on the 9th exopodial joint of the 2nd antenna compared to 2 or 3 bristles for known Pseudophilomedinae; (2) except for *Zeugophilomedes*, known female Philomedinae have more bristles on the 9th joint than the male whereas known female Pseudophilomedinae have either the same number or fewer bristles than the male; (3) known Philomedinae have 6 stages whereas known Pseudophilomedinae have 5. Also collected at the vents were four species of the halocyprid genus *Bathyconchoecia* from the Guaymas Basin, and many specimens of Conchoecinae from the East Pacific Rise and Guaymas Basin.

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Myodocopid Ostracoda of Hydrothermal Vents in the Eastern Pacific Ocean

Louis S. Kornicker

Introduction

Samples are from vents along the Explorer and Juan de Fuca ridges in the northeast Pacific (about 49°46'N to 45°57'N) at depths of 1570–2250 m, from the Guaymas Basin (about 27°00'42"N) at a depth of 2000 m, and from two more southerly localities on the East Pacific Rise (20°49'48"N and 20°51'00"N) at depths of 2592–2600 m (Figure 1). Samples from the Explorer and Juan de Fuca ridges were collected on the bottom, whereas those from the Guaymas Basin and the East Pacific Rise were collected in plankton nets towed above the bottom. Collections were made during 1984 and 1985 in the submersibles *Pisces* and *Alvin*.

The Ostracoda studied herein were mentioned previously in the literature by Berg, Jr. and Van Dover (1987:391) and Tunnicliffe (1988:353). In both publications by those authors the vents and associated biota are discussed broadly. The present contribution further identifies the Ostracoda.

Two new species of Myodocopina were collected: *Euphiomedes climax* is present in 17 samples from the Explorer and Juan de Fuca ridges; and *Prionotoleberis styx* is present in two samples from the East Pacific Rise. The specimens collected in the Guaymas Basin are almost all Halocypridina, of which, species of the genus *Bathyconchoecia* (*B. paulula* Deevey, 1968, *B. deeveyae* Kornicker, 1969, *B. sp. A*, *B. sp. B*) are identified herein. Other genera from the Guaymas Basin and East Pacific Rise are grouped together as members of the subfamily Conchoecinae, and have been sent to Martin V. Angel, Institute of Oceanographic Sciences, Godalming, England, for study. One Cladocopa and one Podocopa were collected from the East Pacific Rise, and one Podocopa from the Guaymas Basin.

ABBREVIATIONS.—The following abbreviations are used in the illustrations: am = central adductor muscle attachments; an

= anus; ant = antenna; ap = anterior process; bas = basale; bo = Bellonci organ; br = brush organ; co = copulatory organ; cox = coxale; end = endopodite; ep = epipodite; esop = esophagus; ex = exopodite; fb = food ball; fu = furca; gen = genitalia; gi = girdle; go = glandular opening; im = inner margin of infold; ll = lower lip; md = mandible; me = medial eye; mo = mouth; pr = protopodite; sens = sensory bristle; ul = upper lip; Y-scl = Y-sclerite. Arabic numbers indicate limbs 1–7, as well as individual joints of each limb (the location of the numeral indicating whether a limb or joint is indicated). Roman numerals I–III indicate the endites as well as instar stage (the latter only on Figure 9). Letters applied to bristles are either standard in the literature, or are explained in the text.

The following abbreviations are used in legends: av = anterior view; iv = inside view; lv = lateral view; mv = medial view; ov = outside view; pv = posterior view.

USNM specimen numbers indicate the collections of the former United States National Museum, which are housed in the National Museum of Natural History (NMNH), Smithsonian Institution.

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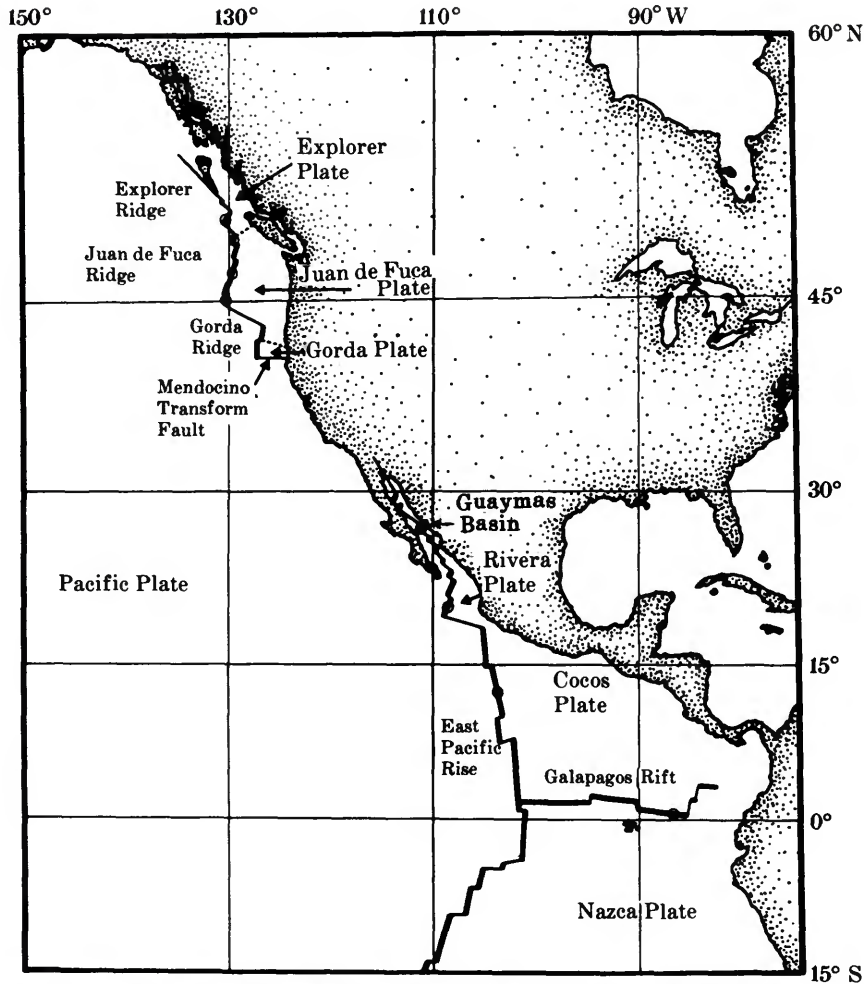


FIGURE 1.—Eastern Pacific showing spreading ridges and principal hydrothermal vent sampling and exploration sites (open circles). (From Tunncliffe, 1988; fig. 1). Specific locations of samples with myodocopid Ostracoda are given in Appendix 1. No specimens were received from the Galapagos Rift.

Nelson, Smithsonian Institution, prepared the Literature Cited section and assisted in final assemblage of the paper; and Craig Warren, Smithsonian Institution Press, edited and prepared the manuscript for publication.

Discussion

Euphilomedes climax was abundant in the bottom samples from the Explorer and Juan de Fuca ridges (165 specimens total) and the absence of other species indicates low diversity. All stages (6) were collected indicating the population to be complete and long lasting; however, no adult males were collected suggesting that they are either not present during June, July, and August or dwell elsewhere, possibly in water above the bottom. Only three ovigerous females were collected. Females are without eyes and lateral eyes of males (based on

observations of juvenile males) are degenerate; this condition is not unusual for members of the family collected elsewhere at depths equivalent to those at the vents (1570–2600 m). Ontogeny was studied and found similar to that of *E. nipponica* Hiruta, 1976, a shallow water species from the vicinity of Japan (Hiruta, 1980:145). Most members of the Philomedidae are detritus feeders and specimens of *E. climax* examined have particulate matter in the gut that could not be identified (generally amber colored with black particles or rarely with orange particles), but the gut of one specimen had two small copepods. Of possible significance is that other species (16) of the genus have not been reported previously from water deeper than 401 m, and are absent in Antarctic and Arctic waters. This suggests that the presence of *E. climax* at the depths associated with the vents might be the result of the higher temperature of water in the vicinity of vents; however, the temperature of the

water at the precise localities of the ostracode samples is unknown.

Prionotoleberis styx is present in two plankton samples collected 1–5 m above the bottom at the East Pacific Rise; the samples are from localities about one kilometer apart suggesting that the species is probably widespread in the area. The 6th limb of *P. styx* differs considerably from other species in the Cyndroleberidinae but not enough for proposal of a new genus for the species. One of the 6 previously known species of *Prionotoleberis* has been reported as deep as 1913 m in the Bay of Biscay (Kornicker, 1989, table 3), so although *P. styx* extends the known depth for the genus down to 2600 m, its presence probably should not be interpreted as being influenced by higher temperatures in the vicinity of the vents. *P. styx* is blind, which is not unusual for members of the Cyndroleberidinae living at that depth. Like other members of the family, *P. styx* is a filter-feeder and the particulate matter (amber colored) in the gut of the two specimens in the collection could not be identified. Because the samples from the East Pacific Rise were collected above the bottom and those from the Explorer–Juan de Fuca vents were collected on the bottom, it is not possible to conclude with certainty that the myodocopid populations differ at the two locales. Most specimens of *E. climax* collected at the Explorer and Juan de Fuca vents are juveniles, which are non-swimmers not normally collected above the bottom.

Four species (two left in open nomenclature) of the halocyprid *Bathyoconchoecia* were collected in a plankton tow 3 to 4 m above the bottom (2000 m) in the Guaymas Basin. The genus is circumglobal at bathyal and abyssal depths, and the two identified species have been collected elsewhere in non-vent areas.

Superorder MYODOCOPA Sars, 1866

The Myodocopa includes the orders Myodocopida Sars, 1866, and Halocyprida Dana, 1853, both are represented in the collections studied herein.

Order MYODOCOPIDA Sars, 1866

The Myodocopida comprise the suborder Myodocopina Sars, 1866.

Suborder MYODOCOPINA Sars, 1866

The Myodocopina include 5 families: Cyndroleberididae, Cypridinidae, Philomedidae, Rutidermatidae, and Sarsiellidae. Only the Philomedidae and Cyndroleberididae are represented in the collections reported upon herein.

PHILOMEDIDAE Müller, 1906

The Philomedidae include 2 subfamilies: Philomedinae Müller, 1906, and Pseudophilomedinae Kornicker, 1967. Only the former is represented at the vents.

PHILOMEDINAE Müller, 1906

The Philomedinae is represented in the collections by 1 species in the genus *Euphilomedes* Kornicker, 1967a.

Euphilomedes Kornicker, 1967

TYPE SPECIES.—*Euphilomedes nodosa* Poulsen, 1962 (subsequent designation by Kornicker (1967a:1).

COMPOSITION AND DISTRIBUTION.—Including the new species described herein this genus includes 17 species plus 1 subspecies: *E. africana* (Klie, 1940) from the western coast of South Africa in shallow water; *E. asper* (Müller, 1894) from the Gulf of Naples at depths of 52–187 m; *E. bradyi* Poulsen, 1962, from the Red Sea (male collected at night at surface); *E. carcharodonta* (Smith, 1952) from the Pacific coast of Canada at depths of 5.5–7.3 m; *E. corrugata* (Brady, 1897) from off Port Jackson and in Flinders Passage, Australia, at depths of 3.7–18.3 m; *E. ijimai* (Kajiyama, 1912) from Misaki, Japan, in shallow water; *E. japonica* (Müller, 1890) from the vicinity of Japan at depths of 18.3–36.6 m; *E. kornickeri* Hartmann, 1974, from the western coast of South Africa in shallow water; *E. longiseta* (Juday, 1907) from the western coast of North America at depths of 5.5–7.3 m (also surface); *E. nipponica* Hiruta, 1976, from the vicinity of Japan at depths of 0–4 m; *E. nodosa* Poulsen, 1962, from south coast of Thailand at a depth of about 2 m; *E. producta* Poulsen, 1962, from off the western coast of North America at depths of 13–401 m; *E. sinister pentathrix* Kornicker and Caraion, 1977, from off Mauritania at a depth of 250 m; *E. sinister sinister* Kornicker, 1974, from the Gulf of Naples at a depth of 90 m; *E. smithi* Poulsen, 1962, from the bay at San José, Pearl Islands, East Pacific, at a depth of 9 m; *E. sordida* (Müller, 1890) from the vicinity of Japan at depths of 0–4 m; *E. walfordi* Poulsen, 1962, from the Coral Sea at a depth of 50 m; and the new species *E. climax*. The distribution of claws on the furca of *Euphilomedes debilis* (Brady, 1902) from Trincomali, Sri Lanka, suggests that the species probably will be referred to the genus *Zeugophilomedes* Kornicker, 1983, when it becomes better known.

Euphilomedes climax, new species

FIGURES 2–9

Euphilomedes n. sp.—Tunnicliffe, 1988:table 2.

ETYMOLOGY.—From the Latin *climax*, ladder, staircase.

HOLOTYPE.—USNM 193793, 1 adult female on 2 slides (carapace dried).

TYPE LOCALITY.—*Pisces* 1497-1015, Upper Magic Mountain Vent, Explorer Ridge, 49°46'N, 130°116'W, bottom depth 1700 m.

PARATYPES.—See Appendix 1; all specimens of new species listed, other than the holotype, are paratypes.

DISTRIBUTION.—Explorer Ridge (1700 m): Pogo Peaks Vent, *Pisces* 1492-1004 and 1492-1014; Gulati Gusher Vent,

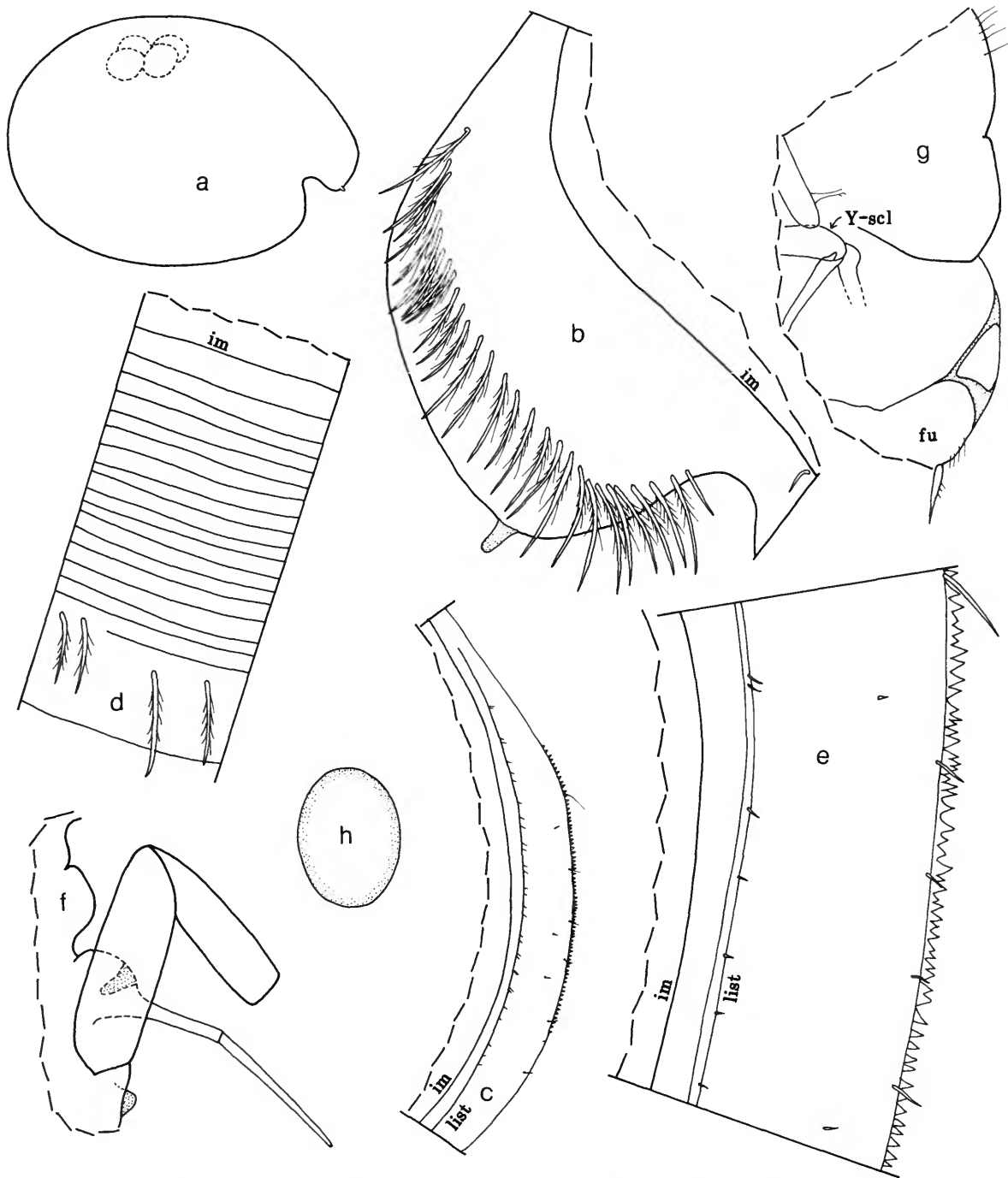


FIGURE 2.—*Euphilomedes climax*, new species, USNM 193806, paratype, ovigerous female: a, complete specimen from right side showing 4 eggs (dashed), length 2.79 mm; b, rostrum of right valve, iv; c, posterior of right valve, iv; d, anteroventral infold of right valve, iv; e, detail from c; f, anterior of body from right side (pigmented part of medial eye and sclerotized anterior process stippled); g, posterior of body from left side (sclerites near furca stippled); h, egg.

Pisces 1494-1008, 1494-1016, 1494-1017, and 1494-1019; Lunch Hour Vent, *Pisces* 1495-1010 and 1495-1012; Crab Vent, *Pisces* 1497-1006 and 1497-1013; Upper Magic Mountain Vent, *Pisces* 1497-1015; Busted Thruster Vent, *Pisces* 1505-1005 and 1505-1018. Juan de Fuca Ridge: Endeavor Segment (2250 m); Long Time Observatory Vent, *Alvin* 1447-1021 and 1452-1020. Juan de Fuca Ridge: Axial Seamount (1570 m); Hammond's Hell Vent, *Pisces* 1723-1027 and 1724-1026.

DESCRIPTION OF ADULT FEMALE (Figures 2-5a-e, 9j).—Carapace oval in lateral view with broad rostrum and deep incisure (Figure 2a). Tip of rostrum with small process (Figure 2a,b). Posterior edge with minute but distinct spines (Figure 2c,e; spines not shown in Figure 2a). Surface with many short pointed bristles, and long widely separated bristles more numerous along valve edge.

Infold: Rostral infold with 28 long spinous bristles forming row parallel to outer edge and 1 shorter bristle at ventral edge of row near incisure (Figure 2b); 1 short bristle near inner margin of infold posterior to inner end of incisure (Figure 2b). Anteroventral infold with about 17 parallel ridges, 5 spinous bristles in row anterior to anterior end of ridges, and 15 spinous bristles in row between ventral ridge and valve edge (not all bristles shown in Figure 2d). Ventral infold with narrow list at infold midwidth with anterior end at posterior end of anteroventral ridges; anterior $\frac{1}{3}$ of ventral infold without bristles; posterior $\frac{2}{3}$ with about 60 long thin bare bristles along list; right valve of USNM 193806 with 1 long thin bare bristle between list and valve edge at about valve midlength. Ventral list continuing on posterior infold but closer to inner margin of infold at about $\frac{1}{3}$ infold width; posterior list with about 45 fairly long thin bristles (some in pairs); posterior infold with 3 widely separated short bare bristles in row about $\frac{1}{4}$ infold width from posterior valve edge, and 6 longer bare bristles along valve edge medial to selvage (Figure 2c,e; not all bristles shown).

Selvage: Lamellar prolongation broad along edge of rostrum, with fringe of long and short slender hairs; divided at inner end of incisure; anteroventral prolongation broad near incisure then narrower, with fringe of long and short hairs; ventral prolongation with marginal fringe of short hairs and longer and stouter proximal hairs on lateral surface; prolongation along posterior edge very narrow, striate, with few short hairs along outer edge.

Carapace Size: USNM 193793, length 2.79 mm, height 2.05 mm; USNM 193795, length 2.90 mm, height 2.22 mm; USNM 193806, length 2.79 mm, height 2.00 mm; USNM 193799, length 2.92 mm, height 2.00 mm; USNM 193810, length 2.82 mm, height 1.82 mm. Averages: length 2.84 mm, height 2.02 mm.

First Antenna (Figures 2f, 3a,b): 1st joint with few distal lateral spines in rows. 2nd joint spinous, with 3 bristles (1 ventral, 1 dorsal, 1 lateral). 3rd joint with 3 bristles (1 ventral, 2 dorsal). 4th joint with 6 bristles (4 ventral, 2 dorsal). Long sensory bristle of 5th joint with several short marginal and 4

longer terminal filaments (not all shown). Medial bristle of 6th joint with long spines. 7th joint: a-bristle spinous; b-bristles with 1 or 2 proximal marginal filaments and 4 terminal filaments; c-bristle with several short marginal and 4 longer terminal filaments (not all shown). 8th joint: d- and e-bristles long, bare; f- and g-bristles with several short marginal and 4 longer terminal filaments (not all shown). (Note: in this description of the 1st antenna and those below one of the terminal filaments of bristles of the 7th and 8th joints is the stem.)

Second Antenna: Protopodite bare. Endopodite 2-jointed (Figure 3c): 1st joint with 6 short bristles; 2nd joint with 1 long spinous ventral bristle at midlength and 1 recurved terminal bristle. Exopodite: 1st joint with small straight medial spine on distal edge; bristle of 2nd joint reaching well past 9th joint, with numerous ventral spines; bristles of joints 3-5 about $\frac{1}{3}$ longer than bristle of 2nd joint, with ventral spines, no natatory hairs; bristles of joints 6-8 very long, with natatory hairs, no spines; 9th joint with 7 bristles (4 long with natatory hairs, 1 medium either with only spines or with proximal spines and distal natatory hairs, 2 short bare or with short hairs) (Figure 9j). Joints 2-8 with long pointed basal spines and minute spines in row along distal margins; 9th joint without lateral spine (Figure 3d).

Mandible: Coxale endite stout, spinous, bifurcate, with small ringed bristle near base (Figure 3e). Basale (Figure 3f): dorsal margin with 1 spinous bristle at about $\frac{2}{3}$ joint length, and 2 terminal bristles (lateral spinous, medial longer, bare); lateral surface with 5 spinous bristles with bases in row near ventral margin (base of proximal bristle may be on ventral margin); medial surface with numerous long spines in rows (not shown), 5 short bristles (3 stout unringed pectinate, 2 slender ringed spinous) in proximal ventral corner, 1 ringed spinous bristle at midlength (about $\frac{1}{3}$ joint width from ventral margin), and 3 distal ringed spinous bristles with bases near ventral margin (distal longest and base may be on margin) (rings of bristles not shown in Figure). Exopodite about $\frac{1}{2}$ length dorsal margin of 1st endopodial joint, with spinous terminal process and 2 spinous ringed terminal bristles (outer distal bristle 78%-90% length of inner more proximal bristle) and 68%-77% of dorsal margin of 1st endopodial joint (rings of bristles not shown in Figure 3f). 1st endopodial joint with 4 ringed spinous ventral bristles (3 long, 1 short). 2nd endopodial joint (Figure 3f, rings of bristles not shown): ventral margin with bristles forming 2 groups: proximal group with 3 ringed spinous bristles; distal group with 4 weakly ringed bristles (2 proximal with short spines along anterior edges; 2 distal shorter, with short spines along posterior edges); dorsal margin with 8 or 9 long and short ringed bristles near midlength divisible into 2 or 3 closely spaced groups (most bristles in distal group); medial surface with numerous small spines in rows (not shown). 3rd endopodial joint with 3 stout unringed spinous claws (dorsal claw about $\frac{1}{2}$ length of longest claw), and 4 slender ringed bristles (Figure 3g, rings not shown).



FIGURE 3.—*Euphilomedes climax*, new species, USNM 193793, holotype, adult female: *a*, left 1st antenna, lv (bristles of joints 7 and 8 not shown); *b*, joints 7 and 8 of left 1st antenna, lv; *c*, endopodite of left 2nd antenna, lv; *d*, joints 7–9 of exopodite of left 2nd antenna, lv; *e*, coxale and part of basale of right mandible, lv (although coxale endite and basale bristles are not shown dashed they are actually on medial surface); *f*, right mandible, lv (bristles of 3rd endopodial joint not shown); *g*, 3rd endopodial joint of right mandible, lv; *h*, right maxilla, lv (bristles of 2nd endopodial joint not shown); *i, j*, endites II and III of right maxilla, lv; *k, l*, bristles of 2nd endopodial joint of right maxilla, lv; *m*, right lamella of furca, lv.

Maxilla: Endite I with 9 spinous and pectinate bristles (4 unringed, 5 ringed) (Figure 3*h*); endite II with 6 spinous and pectinate bristles (2 unringed, 4 ringed) (Figure 3*i*); endite III narrow, with 1 ringed proximal bristle (Figure 3*h*) and 8 spinous and pectinate distal bristles (3 unringed, 5 ringed) (Figure 3*j*). Precoxale and coxale with dorsal fringe of long hairs; coxale with plumose dorsal bristle (Figure 3*h*). Basale with 3 bristles on distal margin (1 dorsal, 1 ventral, 1 medial at midwidth) (Figure 3*h*). Exopodite short with 3 bristles (1 short proximal, 2 long terminal) (Figure 3*h*). 1st endopodial joint with 1 long ringed slender spinous alpha-bristle and 5 ringed spinous beta-bristles; medial surface with long hairs near dorsal margin (not shown) (Figure 3*h*). 2nd endopodial joint with 5 slender ringed spinous a-bristles (Figure 3*k*), 2 b-bristles (outer ringed, with long proximal spines; inner unringed claw-like, with marginal spines) (Figure 3*k, l*), 5 slender ringed c-bristles (Figure 3*k*), and 3 spinous d-bristles (outer ringed, 2 inner unringed claw-like) (Figure 3*l*).

Fifth Limb: Endite I with 5 ringed spinous bristles (Figure 4*a*); endite II with 11 spinous bristles, some more weakly ringed than others (Figure 4*b*); endite III with about 10 spinous bristles, most only weakly ringed (Figure 4*c*). 1st exopodial joint (Figures 4*d*, 5*e*): triangular cusp anterior to main tooth with small triangular cusp at base; main tooth with 3 pectinate cusps and small bare pointed proximal cusp; bristle proximal to main tooth stout, terminating in 3 teeth, and with small distal marginal spines; anterior side of joint with 2 ringed bristles at midwidth (outer with long proximal spines, inner with indistinct short spines); outer distal corner with short spinous bristle with broad base. 2nd exopodial joint (Figure 4*d, e*): flat tooth with long triangular distal inner projection with 2 small pectinate pointed cusps on inner curvature (Figure 4*e*); posterior side with long stout proximal bristle and 3 distal bristles in row (middle bristle long stout spinous, flanking bristles small) (Figure 4*e*); short slender indistinct ringed posterior bristle near outer distal corner of flat tooth. 3rd exopodial joint with 3 bristles (shortest bare, others with long spines) on inner lobe and 2 spinous bristles on outer lobe (Figure 4*f*). 4th + 5th exopodial joints fused, with total of 8 spinous bristles (Figure 4*f*).

Sixth Limb (Figure 4*g, h*): With 4 spinous epipodial bristles. Endite I with 2 or 3 spinous bristles; endite II with 4 spinous bristles (1 proximal medial, 3 terminal); endites III and IV each with 9 or 10 spinous bristles (1 proximal medial, 8 or 9 terminal). End joint projecting posteriorly, with convex

posterior margin; ventral margin with 32–34 spinous and plumose bristles; medial surface hirsute.

Seventh Limb (Figure 5*a, b*): Each limb with 17–19 bristles, each with 7–10 bells (terminal segment with 2 bristles on comb side, 3 on peg side; segments proximal to terminal segment with 6 or 7 bristles on comb side, and same on peg side). Comb with 13 alate teeth with 2 small teeth on each side of base; side opposite comb of USNM 193795 with 3 smooth pegs (middle peg slightly longer and pointed; flanking pegs with flat tips); side opposite comb of USNM 193793 with smooth peg with flat tip and longer smooth peg with pointed tip (Figure 5*b*).

Furca (Figure 3*m*): Claw 3 small secondary, remaining claws decreasing in length along lamella. USNM 193793 with total of 11 claws on right lamella and 12 on left; USNM 193795 with total of 14 claws on right lamella and 13 on left. Claw 1 with few slender anterior spines, lateral row of slender teeth proximal to about midlength of posterior edge, and medial to these 3 slightly stouter teeth also along posterior edge (not shown); distal to about midlength of claw posterior edge with 4 or 5 stout teeth with pointed or rounded tips, and medial surface with 5 stout teeth and several smaller teeth. Claws 2 and 4 with slender lateral teeth along posterior edge and slender spines along anterior edge. Claw 3 and claws following claw 4 with slender lateral teeth along posterior edge and medial teeth near anterior edge. Claws 1, 2, 4–6 with long spines in row near base. Few spines along anterior edge of lamella and more numerous spines on lateral surface along ventral edge following last claw.

Bellonci Organ (Figure 2*f*): Elongate, 2-jointed, with pointed or narrowly rounded tip.

Eyes: Lateral eyes absent. Medial eye with small reddish brown band (Figure 2*f*).

Upper Lip (Figure 5*c*): Projecting anteriorly, with lateral field of small glandular openings on each side.

Genitalia (Figure 5*d*): Oval ring on each side of body anterior to furca.

Brush-like Organ (Figure 5*d*): About 5 small bare bristles on each side near genitalia.

Anterior of Body (Figure 2*f*): With rounded sclerotized anterior process between medial eye and upper lip just ventral to base of 1st antenna.

Posterior of Body (Figure 2*g*): With few long spines in segment near furca.

Y-Sclerite (Figure 2*g*): Ventral branch short; anastomosing structure on the distodorsal edge of the dorsal branch.

Eggs (Figure 2*h*): USNM 193806 with 4 elliptical eggs in marsupium (maximum length 0.33 mm).

DESCRIPTION OF INSTAR I FEMALE (Figures 5*f–n*, 6, 9*j*).—Shape of carapace similar to that of adult female (Figure 5*f*); with spines along posterior edge similar to those of adult female (not shown).

Selvage: Rostral infold with about 11 bristles in row (Figure 5*g*).

Carapace Size: USNM 193800, length 0.80 mm; height

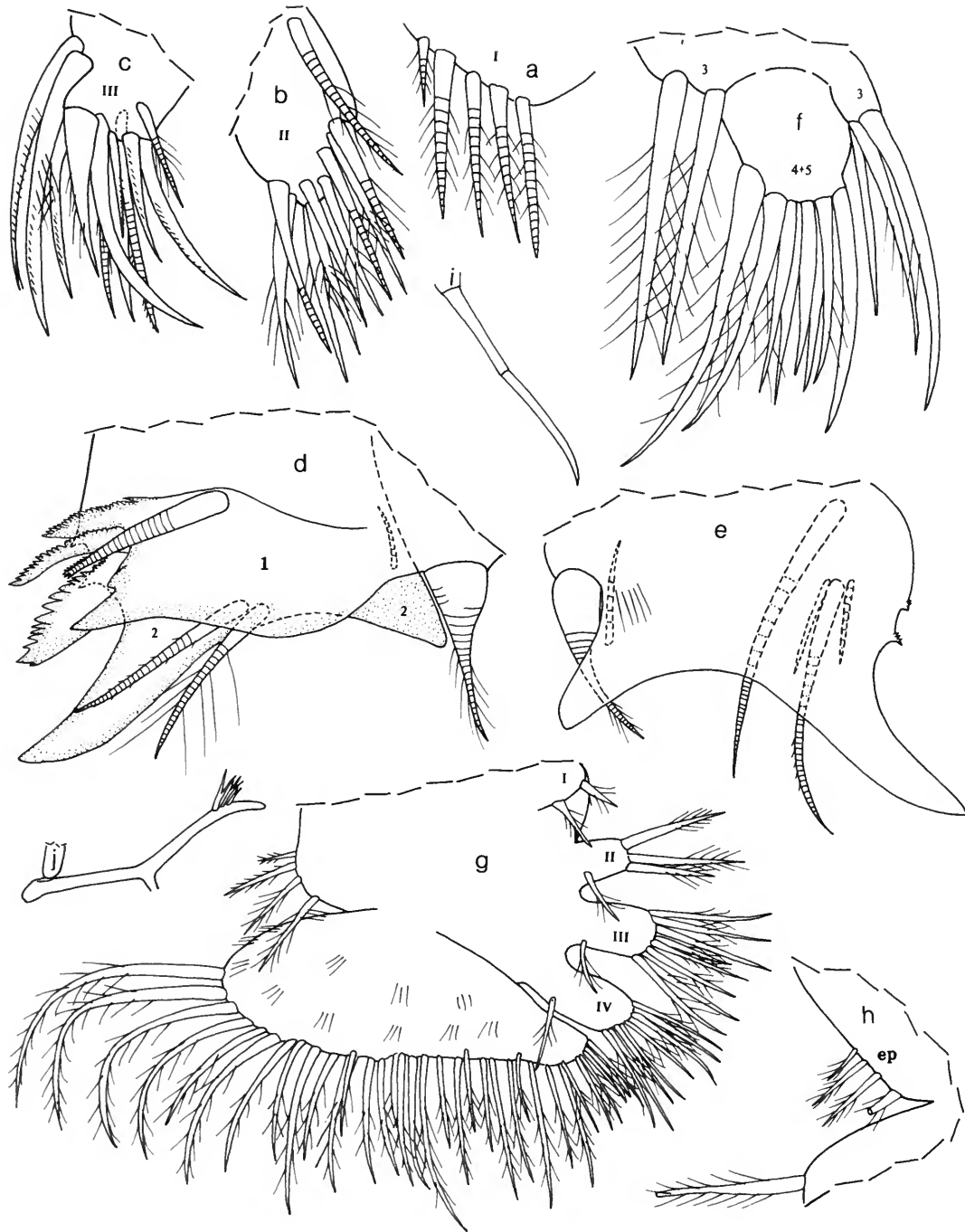


FIGURE 4.—*Euphilomedes climax*, new species, USNM 193793, holotype, adult female: *a-c*, endites I, II, and III of left 5th limb, av; *d*, exopodite of left 5th limb, av; *e*, 2nd exopodial joint of right 5th limb, av; *f*, exopodial joints 3-5 of right 5th limb, av; *g*, left 6th limb, mv; *h*, epipodial bristles of right 6th limb, lv; *i*, Bellonci organ; *j*, Y-Sclerite, anterior to right.

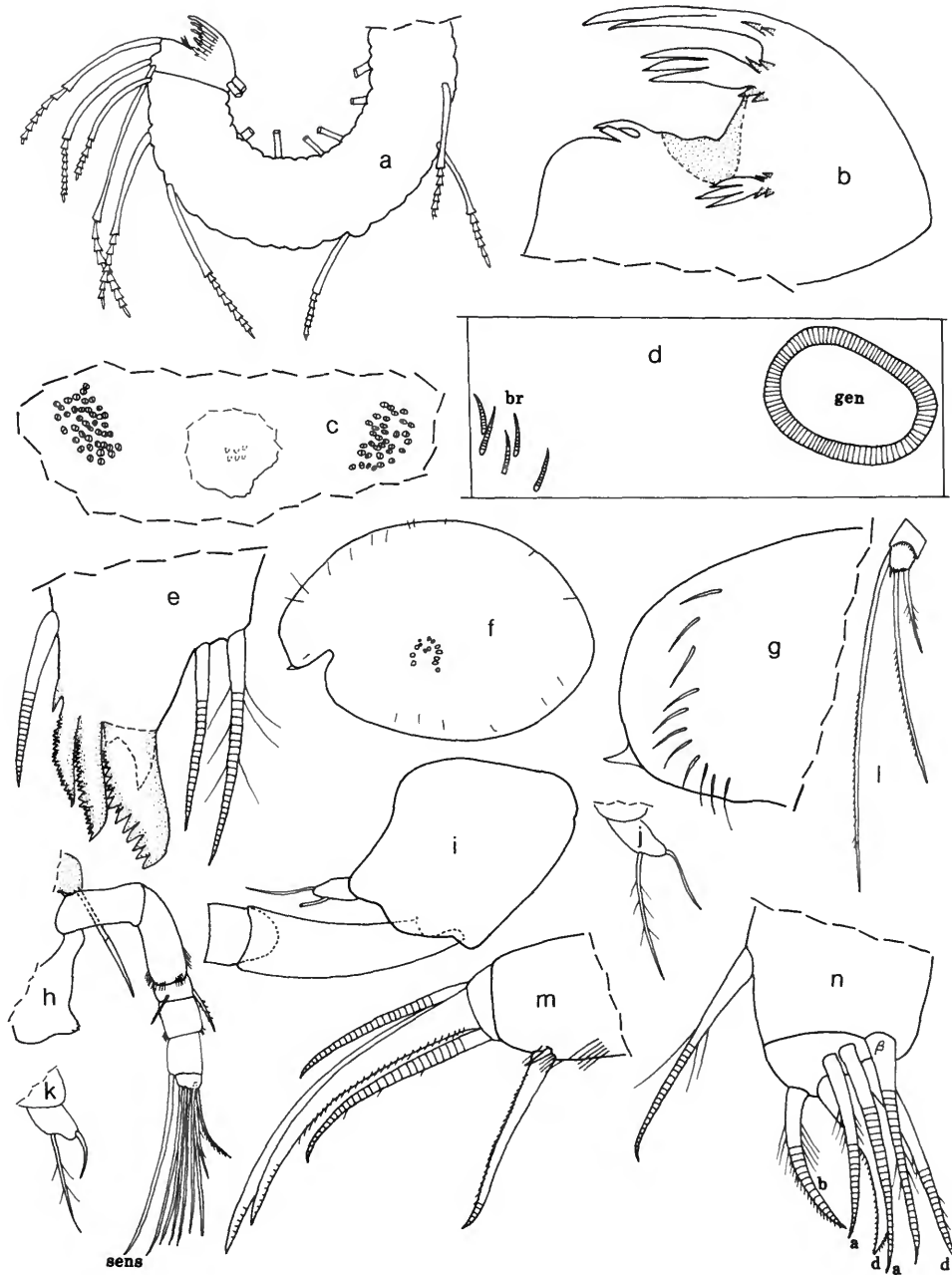


FIGURE 5.—*Euphilomedes climax*, new species, USNM 193793, holotype, adult female: *a*, 7th limb (only proximal part of some bristles shown); *b*, detail from *a* (only 3 comb teeth shown); *c*, upper lip flattened under cover slip, pv (clusters of small circles represent lateral glandular fields); *d*, brush organ and genitalia. USNM 193795, paratype, adult female: *e*, 1st exopodial joint of 5th limb, pv. USNM 193800, paratype, instar I female: *f*, complete specimen from left side (not all adductor muscle attachments shown), length 0.80 mm; *g*, inside oblique view of rostrum of right valve; *h*, anterior of body, 1st antenna, medial eye, Bellonci organ from right side; *i*, part of right 2nd antenna, lv; *j*, endopodite of right 2nd antenna, mv; *k*, endopodite of left 2nd antenna, lv; *l*, tip of exopodite of left 2nd antenna, lv; *m*, tip of right mandible, mv; *n*, tip of left maxilla, lv.

0.53 mm; USNM 193802, length 0.74 mm, height 0.48 mm. USNM 193808A, 2 specimens: length 0.76 mm, height 0.51 mm; length 0.79 mm, height 0.52 mm. Averages: length 0.77 mm, height 51 mm.

First Antenna (Figure 5h): 1st joint bare. 2nd joint with distal spines on ventral and dorsal margins and lateral and medial surfaces. 3rd joint with spines in row on medial surface (not shown), and 2 bristles (1 dorsal with short spines, 1 ventral bare). 4th joint with spines at distal ventral and dorsal corners. Sensory bristle of 5th joint bare. Medial bristle of 6th joint with few long hairs. 7th joint: a-bristle with short spines; b- and c-bristles bare except for small ventrally curved spine at tip. 8th joint: d-, e-bristles bare with blunt tips; f- and g-bristles bare except for small ventrally curved spine at tip.

Second Antenna: Protopodite with long medial spines in 3 distal rows in dorsal half (not shown in Figure). Endopodite 2-jointed (Figure 5i-k): 1st joint bare; 2nd joint with long ventral bristle with few long spines, and shorter bare terminal bristle. Exopodite (Figures 5i,l, 9j): bristle of 2nd joint reaching 9th joint, with small spine-like dorsal extension almost on tip, and minute distal ventral crenulations (incipient spines?); bristles of joints 3-8 with ventral spines, no hairs; 9th joint with 2 bristles (ventral long with ventral spines (Figure 9j); dorsal short with few slender spines). Joint 1 with small straight medial spine on distal margin (not shown in Figure 5i); joints 2-9 with spines in row along distal edge (spines at ventral and dorsal corners stouter); basal spines present on adult female absent, but each represented by small rounded sclerotized node; 9th joint without lateral spine but ventral spine in lateral row along distal edge much stouter than others.

Mandible (Figure 5m): Coxale endite similar to that of adult female; coxale with long lateral spines in rows near dorsal margin. Basale: medial surface with long spines in rows, 4 bristles (2 stout unringed pectinate, 2 slender ringed, with long proximal and short distal spines) in proximal ventral corner, and 1 bristle (with short marginal spines) at joint midlength set back from ventral margin; dorsal margin with short spinous bristle at about $\frac{2}{3}$ joint length and 2 terminal bristles (lateral about $\frac{1}{2}$ length medial, bare, reaching tip of exopodite, about same length as more proximal dorsal bristle; medial long with few long spines); lateral surface with long spines in rows. Exopodite similar to that of adult female. 1st endopodial joint with medial spines in rows and 2 long ventral bristles with long spines. 2nd endopodial joint with medial spines in rows near dorsal margin and distally near ventral margin; ventral margin with stout unringed subterminal bristle with spines along dorsal edge and short stout spine near base; dorsal margin with 4 or 5 bristles (with long or short spines) near midlength. 3rd endopodial joint with 2 stout terminal claws (with ventral spines) and 2 ringed bristles (1 ventral, 1 dorsal).

Maxilla (Figure 5n): Endite I with 6 spinous terminal bristles; endite II with 5 spinous terminal bristles; endite III with 4 spinous terminal bristles. Precoxale and coxale with dorsal fringe of long hairs; coxale with plumose dorsal bristle.

Basale with 1 long spinous ventral bristle and 1 long spinous medial bristle near ventral margin. Exopodite similar to that of adult female. 1st endopodial joint with hairs in rows near dorsal margin, 1 spinous alpha-bristle and 1 spinous beta-bristle. 2nd endopodial joint with 2 a-bristles, 1 b-bristle, and 2 d-bristles (anterior unringed claw-like, posterior ringed).

Fifth Limb: Epipodite well developed. Endite I with 1 stout pointed unringed tooth and 1 spinous ringed bristle (Figure 6a,b); endite II with 1 stout pointed unringed tooth and 3 spinous bristles (Figure 6a,c); endite III with 1 stout pointed unringed tooth and 4 spinous ringed bristles (Figure 6a,d). 1st and 2nd exopodial joints difficult to interpret: joint 1 forming large flat tooth with 2 stout cusps on distal inner edge (Figure 6a,e,i); proximal cusp with bilobed cusp at midlength of posterior side; distal cusp long curved pointed, with many cusps in row (Figure 6a,e); 1 stout spinous bristle at midwidth of distal edge of flat tooth (Figure 6a); 1 stout spinous posterior bristle; 2nd exopodial joint poorly developed, indicated by sclerotized node fused to inner lobe of 3rd joint (Figure 6a,e) (slightly better developed on instar I male described below (Figure 7b)); joint 3 with 3 bristles on inner lobe (1 short and 1 long proximal (could be on joint 2), 1 long terminal), and 2 stout spinous bristles on outer lobe (Figure 6a). Exopodial joints 4 and 5 fused, spinous, with 2 stout spinous terminal bristles.

Sixth Limb (Figure 6f,i): Elongate with spinous lobes along distal anterior and ventral margins but without bristles; posterior margin with 5 or 6 clusters of long spines; lateral surface with short spines in rows.

Seventh Limb: Absent.

Furca (Figure 6g-j): Each lamella with 2 well-developed articulated claws followed by 2 or 3 unarticulated processes with long spines; spines along lamella following processes.

Bellonci Organ (Figure 5h): Similar to that of adult female.

Eyes: Medial eye similar to that of adult female (Figure 5h), unpigmented. Lateral eye absent.

Upper Lip (Figures 5h, 6i): Similar to that of adult female, with minute processes on anterior tip, but not examined at sufficiently high magnification to show lateral glandular openings, if present.

Genitalia: Absent. Lobe present anterior to anus (Figure 6i).

Anterior of Body (Figure 5h): With small rounded anterior process between medial eye and upper lip.

Posterior of Body (Figure 6i,j): Row of spines just proximal to furca (Figure 6i).

Y-Sclerite: Absent.

Gut (Figure 6j): Broad; USNM 193800, and USNM 193802 containing unrecognizable fine-grained particles, mostly light amber colored, but some black (areas of black particles indicated by stippling). Body of USNM 193800 and USNM 193802 without small globules present in some later instars.

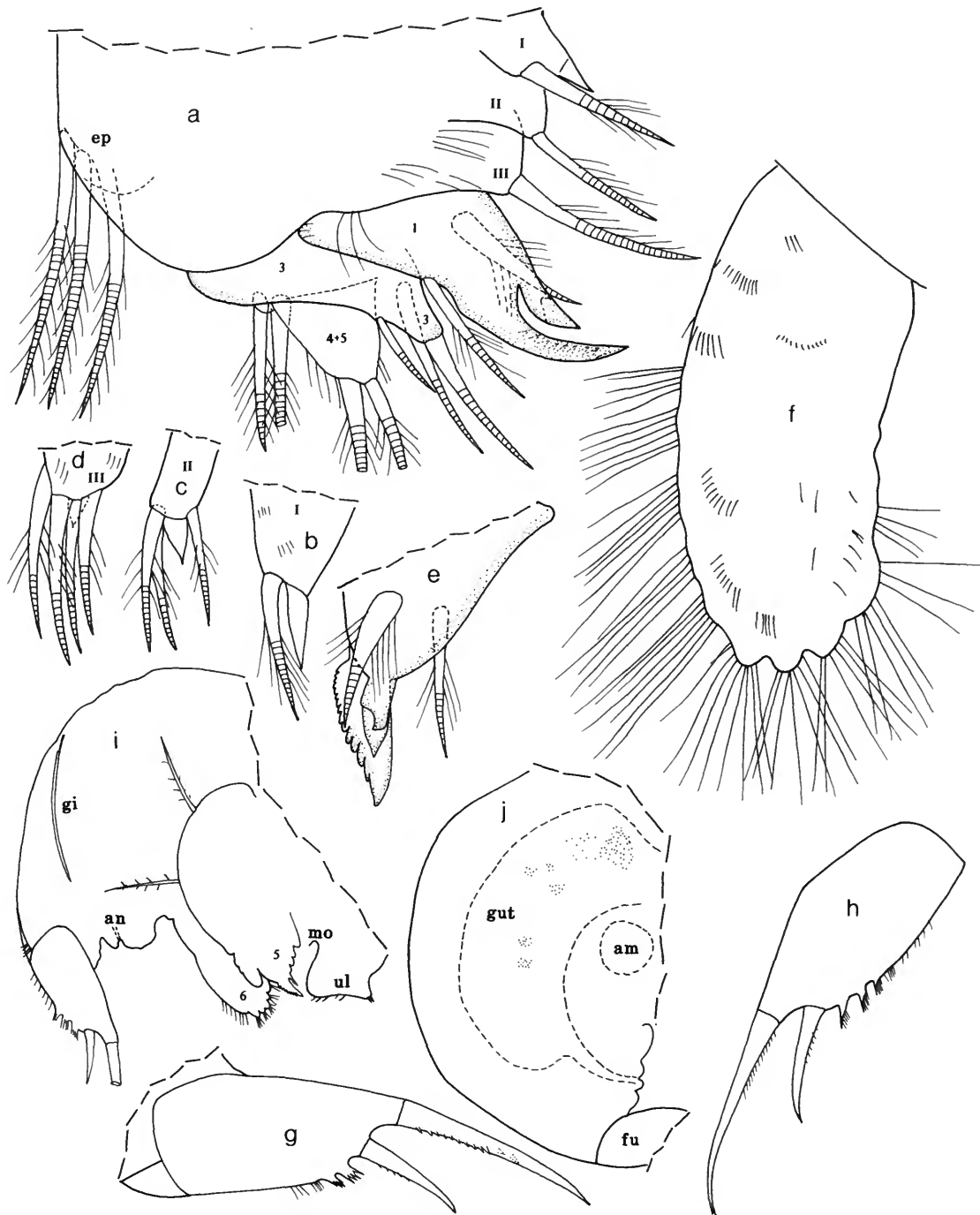


FIGURE 6.—*Euphilomedes climax*, new species, USNM 193800, paratype, instar I female: *a*, right 5th limb, av (not all bristles shown); *b, c, d*, endites I, II, and III of right 5th limb, av; *e*, 1st exopodial joint of left 5th limb, pv; *f*, right 6th limb, lv; *g, h*, right and left furcal lamellae, lv; *i*, part of body from right side (not all bristles shown); *j*, posterior of body from right side showing gut with black particles (stippled).



FIGURE 7.—*Euphilomedes climax*, new species, USNM 193808C, paratype, instar I male: *a*, endopodite of right 2nd antenna, mv; *b*, right 5th limb, av (only 1 tooth shown on endite III); *c*, anterior of body from right side; *d*, right and left lateral eyes. USNM 193805, paratype, instar II female: *e*, complete specimen from right side, length 0.91 mm; *f*, protopodite and endopodite of right 2nd antenna, mv; *g*, exopodite of left 5th limb, av; *h*, main tooth of 1st exopodial joint of right 5th limb, av; *i*, posterior of body from left side; *j*, right 6th limb, lv; *k*, left 7th limb; *l*, posterior of body from left side showing food ball (stippled) in gut; *m*, right lamella of furca, lv.; *n, o*, left and right views of anterior of body.

Remarks: The specimens are identified as females herein because of absence of lateral eyes. The carapaces of USNM 193808A (2 specimens) were not opened but no lateral eyes were visible through shell (it is possible that they are obscured; however, the lateral eyes of USNM 193808C (male described below) were visible through shell, though indistinct).

DESCRIPTION OF INSTAR I MALE (Figure 7a-d).—Carapace similar to that of instar I female.

Carapace Size: USNM 193808C, length 0.74 mm, height 0.50 mm.

First Antenna, Second Antenna (Figure 7a): Similar to those of instar I female.

Mandible: Dorsal margin of 2nd endopodial joint with 5 bristles. Limb otherwise similar to that of instar I female.

Maxilla: Similar to that of instar I female.

Fifth Limb (Figure 7b): Endite II with 1 stout unringed tooth and 3 or 4 spinous ringed bristles. 2nd exopodial joint slightly better developed than on instar I female described above. Limb otherwise similar to that of instar I female.

Sixth Limb: Similar to that of instar I female.

Seventh limb: Absent.

Furca: Similar to that of instar I female.

Bellonci Organ (Figure 7c): Organ of USNM 193808C aberrant, unsegmented, with bifurcate tip.

Eyes: Medial eye similar to that of instar I female (Figure 7c). Lateral eye indistinct about same size as medial eye, with light amber colored cells but no ommatidia (Figure 7d).

Genitalia: Absent.

Anterior of Body (Figure 7c), *Posterior of Body*, and *Y-Sclerite:* Similar to those of instar I female.

Heart: Well developed.

Gut: With fine-grained unrecognizable light amber colored particles.

Remarks: USNM 193808C with abundant small amber colored globules in anterior part of body.

DESCRIPTION OF INSTAR II FEMALE (Figures 7e-o, 9j).—Carapace similar in shape to that of adult female (Figure 7e); with minute spines along posterior edge (not shown).

Carapace Size: USNM 193805, length 0.91 mm, height 0.60 mm. USNM 193808A, length 1.00 mm, height 0.60 mm. Averages: length 0.96 mm, height 0.60 mm.

First Antenna (Figure 7o): 1st and 2nd joints spinous; 2nd joint with 2 spinous bristles (1 lateral, 1 dorsal). 3rd joint with 2 bristles (1 ventral, 1 short spinous dorsal). 4th joint with 1 spinous dorsal bristle. Sensory bristle of 5th joint with 4 proximal and 3 terminal filaments. Medial bristle of 6th joint indistinctly spinous, with terminal spine. 7th joint: a-bristle slightly longer than 6th joint, spinous; b-bristle almost twice length of a-bristle, with 1 subterminal and 1 terminal filaments; c-bristle shorter than sensory bristle of 5th joint, with 3 proximal and 2 terminal filaments. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 2 proximal and 2 terminal filaments; g-bristle same length as c-bristle, with 4 proximal and 2 terminal filaments.

Second Antenna: Protopodite with many medial rows of spines in dorsal half (Figure 7f). Endopodite 2-jointed (Figure 7f): 1st joint with 1 bare ventral bristle; 2nd joint with 1 long spinous ventral bristle and 1 curved bare terminal bristle. Exopodite: bristle of 2nd joint reaching just past 9th joint, with ventral spines; bristles of joint 3–8 shorter than those of adult female, all with ventral spines but no natatory hairs; 9th joint with 3 bristles (1 long (ventral) (Figure 9j), 1 medium, 1 short (dorsal)), all with ventral spines but no natatory hairs; spines of joints 1–8 similar to those of adult female; 9th joint without spines.

Mandible: Coxale including endite similar to that of adult female. Basale: bristles of dorsal margin similar to those of adult female; lateral surface spinous, with 1 spinous proximal bristle near ventral margin; medial surface spinous, with 5 short bristles (3 stout unringed pectinate, 2 slender ringed spinous) in proximal ventral corner and 1 ringed, bare, at midlength (base at about $\frac{1}{4}$ width of joint from ventral margin). Exopodite similar to that of adult female; distal bristle 57% length of dorsal margin of 1st endopodial joint. 1st endopodial joint with many medial rows of spines in dorsal half and 2 long spinous ventral bristles. 2nd endopodial joint: ventral margin with short bristles in 2 groups; proximal group with 1 ringed bristle; distal group with 2 bristles, both with spines along anterior margin (inner bristle shorter and more strongly ringed); dorsal margin with 7 or 8 ringed bristles near midlength. 3rd endopodial joint with 3 spinous claws (dorsal claw about $\frac{1}{3}$ length of longest claw) and 3 bristles.

Maxilla: Endite I with 7 spinous bristles; endite II with 6 spinous bristles; endite III with 1 proximal and about 7 distal spinous bristles. Precoxale and coxale with dorsal fringe of hairs; coxale with short dorsal bristle with indistinct short hairs. exopodite similar to those of adult female. 1st endopodial joint with spines along dorsal margin and on medial surface near dorsal margin, 1 spinous alpha-bristle, and 1 bare beta-bristle (1st joint of left limb of USNM 193805 aberrant in having 1 spinous distal lateral bristle inward from base of alpha-bristle). 2nd endopodial joint with 3 slender ringed a-bristles, 2 b-bristles, 1 short ringed c-bristle, and 3 d-bristles similar to those of adult female.

Fifth Limb (Figure 7g-i): Endite I with 5 spinous bristles; endite II with 6 spinous bristles; endite III with about 9 spinous and pectinate bristles. 1st exopodial joint (Figure 7g,h): triangular cusp anterior to main tooth without small cusp at base; main tooth with 2 pectinate cusps and small bare pointed proximal cusp; stout bristle proximal to main tooth spinous; short stout spinous bristle on outer corner of adult observed only on right limb of USNM 193805; anterior side of joint with 2 bristles at midwidth (outer with long spines). 2nd exopodial joint similar to that of adult female (Figure 7g). 3rd exopodial joint with 2 or 3 bristles on inner lobe and 2 on outer lobe. 4th and 5th exopodial joints fused, with total of 4 bristles.

Sixth Limb (Figure 7i,j): Elongate, unsegmented, with single anterior endite with spinous bristle; distal margin with 7

or 8 spinous processes; long spines along anterior and posterior margins and short medial rows of small spines.

Seventh Limb (Figure 7i,k): Small, bare, thumb-like.

Furca (Figure 7l,m): Each lamella with 2 stout claws followed by 4 or 5 small claws (USNM 193805 with total of 7 claws on left lamella and 6 on right). Claw 1 with large distal medial tooth.

Bellonci Organ (Figure 7n,o): Elongate, tapering to narrow tip; suture proximal to midlength like on adult not seen with certainty.

Eyes: Lateral eyes absent. Medial eye unpigmented (Figure 7n,o).

Upper Lip (Figure 7n,o): Similar to that of adult female but lateral field of glandular openings not observed at magnification used ($\times 20$ objective, $\times 15$ ocular).

Anterior of Body (Figure 7n,o): With small rounded anterior process between medial eye and upper lip.

Posterior of Body (Figure 7i,l): With spines along margin near furca.

Y-Sclerite (Figure 7i): Differs from adult in not having anastomosing structure on distodorsal margin.

Gut Content (Figure 7l): USNM 193805 with unidentifiable particulate matter (some black) and 2 juvenile copepods with most appendages in place but without internal protoplasm (Order: Poecilostomatoida, identified by Janet Ried and Thomas E. Bowman). USNM 193808A with unidentifiable orange and black particles (in reflected light); orange particles also adhering to the outside of some appendages and the body.

DESCRIPTION OF INSTAR III MALE (Figure 8a-l, 9j).—Carapace similar in shape to that of adult female (Figure 8a); with minute spines along posterior edge (not shown).

Carapace Size: USNM 193804, length 1.23 mm, height 0.93 mm; USNM 193808B, length 1.16 mm, height 0.81 mm; USNM 193814A, length 1.24 mm, height 0.82 mm; USNM 193811, length 1.33 mm, height 0.88 mm; USNM 193815A (sex not determined), length 1.31 mm, height 0.90 mm. Averages: length 1.24 mm, height 86 μ m.

First Antenna (Figure 8b,k): 1st joint with many rows of medial and lateral spines. 2nd joint similar to that of adult female. 3rd joint with small spines forming distal lateral row near dorsal margin, and rows of small spines on medial surface, with 3 bristles (1 ventral, 2 dorsal). 4th joint with 2 or 3 bristles (1 ventral, 1 or 2 dorsal). 5th joint with distal row of lateral spines near dorsal corner; sensory bristle with 4 proximal and 4 terminal filaments. Medial bristle of 6th joint with spines. 7th joint: a-bristle slightly longer than bristle of 6th joint, with short marginal spines; b-bristle about twice length of a-bristle, shorter than sensory bristle of 5th joint, with 1 subterminal and 2 terminal filaments; c-bristle reaching tip of sensory bristle of 5th joint, with 4 proximal and 3 terminal filaments. 8th joint: d- and e-bristles same length as c-bristle, bare except for slender spine or process at tip; f-bristle slightly shorter than c-bristle, with 4 proximal and 3 terminal filaments; g-bristle same length

as c-bristle, with 4 proximal and 3 terminal filaments. All filaments with terminal spine, otherwise bare.

Second Antenna: Protopodite with rows of medial spines. Endopodite 2-jointed (Figure 8c,d, rings of bristles not shown): 1st joint with 3 ringed bristles; 2nd joint elongate with 1 long ringed spinous ventral bristle and 1 ringed recurved terminal bristle (2nd joint of right limb of USNM 193804 (Figure 8c) broader than that of left limb (Figure 8d)). Exopodite: bristles of joints 1–8 similar to those of adult female except bristle of 2nd joint just reaching 9th joint, and bristles of joints 6–8 shorter, with ventral spines and without natatory hairs; 9th joint with 4 bristles (1 long (Figure 9j), 2 medium, 1 short), all with ventral spines; spines of joints similar to those of adult female.

Mandible: Coxale including endite similar to that of adult female. Basale: bristles of dorsal margin similar to those of adult female; lateral surface with 2 ringed spinous bristles near ventral margin (1 proximal, 1 at joint midlength); medial and lateral surfaces with rows of long spines, 5 bristles (3 stout unringed pectinate, 2 slender ringed spinous) in proximal ventral corner, 1 ringed spinous bristle at joint midlength (base at about $\frac{1}{3}$ joint width from ventral margin), and 1 ringed spinous terminal bristle with base on ventral margin. Exopodite similar to that of adult female. 1st endopodial joint with 3 long ventral bristles. 2nd endopodial joint: ventral margin with bristles forming 2 groups; proximal group with 2 ringed spinous bristles; distal group with 2 stout weakly ringed bristles with spines along anterior margins, and 1 smaller ringed bristle with spines along posterior margin; dorsal margin with 8 ringed bristles near midlength; medial surface with spines in rows. 3rd endopodial joint with 3 stout unringed spinous claws (dorsal claw less than half length of longest claw), and 4 ringed bristles.

Maxilla: Endite I with 9 or 10 spinous and pectinate bristles (4 unringed, 5 or 6 ringed); endite II with 6 spinous and pectinate bristles; endite III with 1 short spinous proximal bristle and 9 spinous distal bristles, most ringed. Precoxale and coxale with fringe of dorsal hairs; coxale with stout dorsal bristle with short marginal spines. Basale and exopodite similar to those of adult female. 1st endopodial joint with rows of medial spines, 1 ringed spinous alpha-bristle and 2 ringed spinous beta-bristles. 2nd endopodial joint with 3 or 4 slender ringed a-bristles, 2 b-bristles and 3 d-bristles similar to those of adult female, and 2 slender ringed c-bristles.

Fifth Limb (Figure 8e): Endite I with 5 ringed spinous bristles; endite II with 8 ringed spinous bristles; endite III with 10 spinous and pectinate bristles. Exopodial joints 1–3 similar to those of adult female; joints 4 and 5 fused with total of 6 spinous bristles.

Sixth Limb (Figure 8f): With 1 spinous epipodial bristle. Endite I with 1 short ringed proximal spinous medial bristle and 1 longer ringed spinous terminal bristle; endite II with 1 ringed spinous proximal medial bristle and 3 ringed spinous terminal bristles; endite III with 5 or 6 ringed spinous terminal bristles; endite IV with 5 ringed spinous terminal bristles. End joint



FIGURE 8.—*Euphilomedes climax*, new species, USNM 193804, paratype, instar III male: *a*, complete specimen from left side (location of adductor muscle attachments dashed), length 1.23 mm; *b*, part of anterior of body from left side showing tip of left lateral eye, Bellonci organ and joints 1 and 2 of left 1st antenna; *c, d*, endopodites of right (venter up) and left 2nd antennae, mv; *e*, main tooth of left 5th limb, av; *f*, right 6th limb, mv (only epipodial bristle and anterior and posterior bristles of end joint shown); *g*, left 7th limb; *h*, anterior of body from right side; *i, j*, claw 1 of left lamella (lv) and right lamella (mv) of furca; *k*, left lateral eye and 1st joint of left 1st antenna, lv; *l*, upper lip flattened under a cover slip, anterior to left. USNM 193803, paratype, instar IV male: *m*, complete specimen from right side, length 1.78 mm (location of adductor muscle attachments dashed); *n*, endopodite of left 2nd antenna, mv; *o*, main tooth of 1st exopodial joint and tip of 2nd exopodial joint of right 5th limb, pv.

projecting posteriorly less than that of adult female, with 11 ringed spinous and plumose bristles; medial surface hirsute. Medial surfaces of endites II-IV and end joint with spines forming rows.

Seventh Limb (Figure 8g): Elongate, bare.

Furca: Distribution of claws similar to that of adult female. USNM 193804 with 8 claws on each lamella. Lateral and medial teeth of claw 1 shown in Figure 8i,j; teeth of other claws similar to those of adult female.

Bellonci Organ (Figure 8b,h): Elongate tapering distally with minutely digitate tip (Figure 8b); 1 or 2 weak sutures may be present at proximal $\frac{1}{3}$.

Eyes: Medial eye small light amber colored. Lateral eyes with light amber colored cells but no ommatidia (Figure 8b,k) (eyes similar to those observed on instar IV male).

Upper Lip (Figure 8h,l): Projecting anteriorly with few small processes at tip; with 5 glandular processes in each proximal lateral field.

Posterior of Body: With spines near furca.

Y-Sclerite: Similar to that of adult female.

Protistans: Few stalked bell-like epizoa attached to appendages, also thread-like protistans.

Remarks: Bodies of both USNM 193804 and USNM 193808B almost completely filled with small closely packed amber colored globules; they fill gut, extend into body away from gut and into maxilla but are sparse in other appendages.

DESCRIPTION OF INSTAR IV MALE (Figures 8m-o, 9a-d,j).—carapace similar in shape to that of adult female (Figure 8m); with minute spines along posterior edge (not shown).

Carapace Size: USNM 193803, length 1.78 mm, height 1.20 mm; USNM 193814B, length 1.61 mm, height 1.22 mm. Averages: length 1.70 mm, height 1.21 mm.

First Antenna: 1st joint with medial spines in row near dorsal margin. 2nd joint spinous, with 3 spinous bristles (1 ventral, 1 dorsal, 1 lateral). 3rd joint with few medial and lateral rows of small spines and 3 spinous bristles (1 ventral, 2 dorsal). 4th joint with medial spines in rows near ventral margin, 2 spinous ventral bristles and 2 dorsal bristles (inner with spines). 5th joint with few distal rows of minute lateral spines; sensory bristle with 5 short proximal filaments and 4 longer terminal filaments. Medial bristle of 6th joint long with few marginal spines and spine at tip. 7th joint: a-bristle slightly longer than bristle of 6th joint, with short marginal spines; b-bristle about twice length of a-bristle with 2 proximal and 3 terminal filaments; c-bristle longer than b-bristle, about same length as sensory bristle of 5th joint, with 6 proximal and 3 terminal filaments. 8th joint: d- and e-bristles slightly longer than b-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 5 proximal and 4 terminal filaments; g-bristle as long as c-bristle, with 4 proximal and 3 terminal filaments.

Second Antenna: Protopodite with few medial rows of short spines near dorsal margin. Endopodite 3-jointed (Figure 8n): 1st joint with 4 bristles (3 short proximal either bare or with indistinct short spines, and 1 slightly longer distal with

short marginal spines); 2nd joint with 2 ventral bristles (proximal long with long proximal and short distal spines; distal short with short spines); 3rd joint with 2 or 3 bristles (1 fairly long proximal, 1 or 2 short terminal). Exopodite: joints 1-8 similar to those of instar IV female; 9th joint with 5 bristles (2 long (Figure 9j), 2 medium, 1 short), all with short spines, and without lateral spine.

Mandible: Coxale similar to that of adult female. Basale: dorsal margin with 3 bristles similar to those of adult female; lateral surface with 3 ringed spinous proximal bristles in row near ventral margin (base of proximal bristle on medial side of left limb of USNM 193803); medial surface spinous, with 5 bristles (3 stout unringed pectinate, 2 slender ringed spinous) in proximal ventral corner, 1 ringed spinous bristle at midlength just ventral to midwidth, and 2 distal ringed spinous bristles near ventral margin. Exopodite similar to that of adult female. 1st endopodial joint similar to that of adult female. 2nd endopodial joint: ventral margin with bristles forming 2 groups; proximal group with 3 ringed spinous bristles; distal group with 3 weakly ringed spinous bristles (2 proximal with spines along anterior edges, 1 distal shorter with spines along posterior edge); dorsal margin with 9 ringed spinous bristles near midlength. 3rd endopodial joint similar to that of adult female.

Maxilla: Endite I with 10 spinous and pectinate bristles; endite II with 7 spinous and pectinate bristles; endite III with 1 proximal ringed bristle with short spines and 10 spinous and pectinate terminal bristles. Precoxale and coxale with fringe of long hairs; coxale with plumose dorsal bristle. Basale and exopodite similar to those of adult female. 1st endopodial joint with 1 spinous alpha-bristle, 3 spinous beta-bristles, and medial hairs near dorsal margin. 2nd endopodial joint with 4 slender ringed spinous a-bristles, 2 b-bristles and 3 d-bristles similar to those of adult female, and 3 slender ringed c-bristles.

Fifth Limb: Endite I with 5 ringed spinous bristles; endite II with 9 ringed spinous bristles (some more weakly ringed than others); endite III with 12 ringed and unringed spinous and pectinate bristles. 1st exopodial joint: triangular cusp anterior to main tooth without small triangular cusp at base, joint otherwise similar to that of adult female (Figure 9b). 2nd exopodial joint similar to that of adult female (Figures 8o, 9b). 3rd exopodial joint similar to that of adult female. 4th and 5th exopodial joints fused spinous, with total of 7 spinous bristles.

Sixth Limb: With 2 short spinous epipodial bristles. Endite I with 3 spinous bristles (2 short proximal medial, 1 long terminal); endite II with 4 spinous bristles (1 proximal medial, 3 longer terminal); endites III and IV each with 9 spinous bristles (1 proximal medial, 8 longer terminal). End joint similar to that of adult female but with only 20-22 bristles.

Seventh Limb: Each limb with 18 or 19 tapering bristles, each with 2-4 bells (terminal segment with 2 bristles on each side; segments proximal to terminal segment with 7 or 8 bristles on comb side, and 7 on peg side). Comb with 7 alate

teeth with 2 small teeth on each side of base; side opposite comb with 2 or 3 smooth pegs (one limb of USNM 193803 with 3 pegs (middle peg slightly longer and pointed, flanking pegs with broadly rounded tips); other limb of USNM 193803 with 2 pegs (longer peg with pointed tip, other with oblique flat tip)).

Furca (Figure 9c): Distribution of claws similar to those of adult female. Left limb of USNM 193803 with 9 claws, right limb with 10; USNM 193814B with 9 claws on each lamella.

Bellonci Organ (Figure 9a): Similar to that of adult female.

Eyes: Medial eye small, light amber colored (Figure 9a). Lateral eye about same size and color of medial eye, with many indistinct cells but no recognizable ommatidia (Figure 9a,d).

Upper Lip (Figure 9a): Similar to that of adult female but lateral glandular openings not observed at low magnification at which lip examined ($\times 20$ objective, $\times 15$ ocular).

Genitalia: Small spinous lobe observed on left of body anterior to furca could be undeveloped copulatory organ (Figure 9c), but its absence on right side makes it unlikely.

Anterior of Body (Figure 9a): With single rounded sclerotized process between medial eye and upper lip.

Posterior of Body (Figure 9c): With long distal hairs on segment near furca.

Y-Sclerite (Figure 9c): Right sclerite of USNM 193803 similar to that of adult female; left sclerite aberrant (Figure 9c).

Gut Content: Unrecognizable particles, a few black but most light amber colored.

Protistans: Body and appendages with numerous stalked bell-shaped epizoa, and thread-like protistans, some segmented.

DESCRIPTION OF INSTAR IV FEMALE (Figure 9e).—Carapace similar in shape to that of adult female.

Carapace Size: USNM 193794B, length 1.76 mm, height 1.21 mm; USNM 193809B, length 1.61 mm, height 1.10 mm. Averages: length 1.69 mm, height 1.16 mm.

First Antenna: Similar to that of instar IV male.

Second Antenna: Protopodite and exopodite similar to those of instar IV male. Endopodite 2-jointed: 1st joint with 4 small bristles; 2nd joint with long spinous ventral bristle and shorter bare terminal bristle (Figure 9e).

Mandible: Similar to that of instar IV male.

Maxilla: Endite I with 9 bristles; endite II with 6 bristles; endite III with 1 proximal and 9 distal and terminal bristles. Dorsal bristle of coxale with fairly short spines. Maxilla otherwise similar to that of instar IV male.

Fifth Limb: 1st exopodial joint with small triangular cusp at base of large triangular cusp anterior to main tooth. Limb otherwise similar to that of instar IV male. Epipodite with 58 plumose bristles.

Sixth Limb: End joint with 19–21 bristles. Limb otherwise similar to that of instar IV male.

Seventh Limb: Each limb with 17 or 18 tapering bristles, each with 2–4 bells (terminal segment with 2 bristles on each

side; segments proximal to terminal segment with 6 or 7 on comb side and 7 on peg side). Comb with 7 alate teeth; side opposite peg with 2 or 3 small pegs, 1 longer than others.

Furca: Distribution of primary and secondary claws similar to those of adult female. USNM 193794B with 10 and USNM 193809B with 9 claws on each lamella.

Bellonci Organ: Similar to that of adult female except narrow tip digitate.

Eyes: Lateral eye absent. Medial eye similar to that of Instar IV male.

Upper Lip: Similar to that of instar IV male.

Genitalia: Absent. Boot-shaped process anterior to anus similar to that of instar V male shown in Figure 9i.

Anterior of Body, Posterior of Body, and Y-Sclerite: Similar to those of instar IV male.

Protistans: Appendages of USNM 193808B with many stemmed bell-shaped epizoa.

Remarks: Body of USNM 193794B filled with small amber colored globules.

DESCRIPTION OF INSTAR V FEMALE (Figure 9j).—Carapace similar in shape to that of adult female; with minute spines along posterior edge.

Carapace Size: USNM 193796, length 2.34 mm, height 1.70 mm.

First Antenna: 4th joint with 3 instead of 4 ventral bristles; limb otherwise similar to that of adult female, but number of filaments on bristles of 7th and 8th joints not counted.

Second Antenna: Endopodite: 1st joint with 5 instead of 6 bristles; otherwise similar to that of adult female. Exopodite (Figure 9j): bristles of joints 6–8 with ventral spines and without natatory hairs; 9th joint with 6 bristles (4 long and 1 medium with ventral spines and no natatory hairs, 1 short bare); bristles of joints 6–9 relatively short. Limb otherwise similar to that of adult female.

Mandible: Lateral surface of basale with 4 instead of 5 bristles in row near ventral margin; dorsal margin of 2nd endopodial joint with 8 rather than 8 or 9 bristles on dorsal margin; limb otherwise similar to that of adult female.

Maxilla: 1st endopodial joint with 4 instead of 5 beta-bristles; 2nd endopodial joint with 4 or 5 instead of 5 a-bristles, and 4 or 5 rather than 5 c-bristles; limb otherwise similar to that of adult female.

Fifth Limb: Similar to that of adult female but endite bristles not counted.

Sixth limb: With 3 instead of 4 epipodial bristles; end joint with 30 or 31 instead of 32–34 bristles; limb otherwise similar to that of adult female.

Seventh Limb: Most bristles more tapered than those of adult female (juvenile character); each limb with 19 bristles, each with 2–7 bells (terminal segment with 2 bristles on comb side, 3 on peg side; segments proximal to terminal segment with 6 bristles on comb side, 8 on peg side). Comb with 8 or 9 alate teeth with 2 small teeth on each side of base; side opposite



FIGURE 9.—*Euphilomedes climax*. new species, USNM 193803, paratype, instar IV male: a, anterior of body from left side; b, 1st and 2nd exopodial joints of left 5th limb, av; c, posterior of body from left side; d, right lateral eye. USNM 193794B, paratype, instar IV female: e, endopodite of right 2nd antenna, mv. USNM 193794A, paratype, instar V male: f, anterior of body from left side; g, endopodite of right 2nd antenna, mv; h, main tooth of 1st exopodial joint of left 5th limb, pv; i, part of posterior of body from left side. Ventral bristle of 9th joint of exopodite of 2nd antenna (ventral margin of joint at top): j, I = instar I female (USNM 193800); II = instar II female (USNM 193805); III = instar III male (USNM 193804); IV = instar IV male (USNM 193803); V = instar V female (USNM 193796); VI = adult female (USNM 193795).

comb with 2 small pegs (1 with flat tip, 1 longer with pointed tip).

Furca: Distribution and armature of claws similar to those of adult female; USNM 193796 with 10 claws on left lamella and 11 on right.

Bellonci Organ, Eyes, Upper Lip, and Y-Sclerite: Similar to those of adult female.

Genitalia: Absent.

DESCRIPTION OF INSTAR V MALE (Figure 9f-i).—Carapace similar in shape to that of adult female; with minute teeth along posterior margin.

Carapace Size: USNM 193794A, length 2.20 mm, height 1.48 mm.

First Antenna: Similar to that of instar V female.

Second Antenna: Endopodite 3-jointed (Figure 9g): 1st joint short with 5 small bristles; 2nd joint elongate with 1 long and 2 short ventral bristles; 3rd elongate with 1 long proximal and 2 short terminal bristles. Limb otherwise similar to that of instar V female.

Mandible: Dorsal margin of 2nd endopodial joint with 9 bristles. Limb otherwise similar to that of instar V female.

Maxilla: Similar to that of instar V female.

Fifth Limb (Figure 9h): Fused 4th and 5th joints with total of 8 or 9 bristles. Limb otherwise similar to that of instar V female.

Sixth Limb: Endite I with 2 short medial and 1 long proximal bristle on both limbs. End joint with 27 or 28 bristles. Limb otherwise similar to that of instar V female.

Seventh Limb: Bristles tapered similar to those on instar V female. Each limb with 18 or 19 bristles, each with 3–8 bells (bristles of terminal segment similar to those of instar V female; segments proximal to terminal segment with 6 or 7 bristles on comb side, 7 on peg side). Comb and pegs similar to those of instar V female.

Furca: Distribution of primary and secondary claws similar to those of adult female; USNM 193794A with 12 claws on left lamella and 11 on right.

Bellonci Organ (Figure 9f): Elongate, 2-jointed, with narrowly rounded tip.

Eyes (Figure 9f): Lateral eye small, with brown pigment but no ommatidia. Medial eye slightly larger than lateral eye, with brown pigment.

Upper Lip (Figure 9f): Similar to that of adult female.

Genitalia (Figure 9i): Each side with 3 small lobes (2 anterior, 1 posterior), posterior lobe with minute papilla at tip, one of anterior lobes with 3 minute papillae at tip. Boot-like process with crenulate ventral edge between genitalia and anus (Figure 9i).

Anterior of Body (Figure 9f): With small rounded sclerotized process between medial eye and upper lip just ventral to base of 1st antenna.

Posterior of Body: With few small hairs near furca.

Y-Sclerite: Similar to that of adult female.

Protostans: Appendages with many stemmed bell-shaped epizoa.

Remarks: The body of USNM 193794A is filled with small globules.

COMPARISONS.—Previously described species of *Euphilomedes* having only secondary claw 3 between primary claws of the furca are *E. asper* (Müller, 1894), *E. bradyi* Poulsen, 1962, *E. nipponica* Hiruta, 1976, and *E. sordida* (Müller, 1890). The furca of *E. bradyi* bears only 6 claws on each lamella compared to 11–14 for *E. climax*. The 7th limbs of *E. asper*, *E. nipponica*, and *E. sordida* have 8–12 cleaning bristles compared to 17–19 for *E. climax*. *E. agilis* (Thomson, 1879) and *E. ferox* Poulsen, 1962, which also have only secondary claw 3 between primary claws of the furca, were referred to the genus *Pleoschisma* Brady, 1890, by Kornicker (1981b:1).

FOOD.—Members of the Philomedidae are detritus feeders (Kornicker, 1975:41); the mandible is used to kick up particles from the sediment, which are sucked into the shell by a current created by the epipodite of the fifth limb and then pushed into the mouth by appendages around the mouth (Cannon, 1933:755, 756). The guts of specimens dissected in this study were examined and most contained unidentifiable particles, generally amber colored but a small amount are black or orange. In addition to the particles one instar II (USNM 193805) contained 2 small copepods.

ONTOGENY.—Hiruta (1980:145) described the ontogeny of *Euphilomedes nipponica* collected in shallow water off Japan. The present collection from Pacific vents includes all juvenile growth stages of *E. climax*, so it seemed of value to compare the ontogenies of the 2 species to determine whether the diverse environments from which they were collected might have affected their development. The presence of lateral eyes was used to distinguish males from females, which are without lateral eyes. Appendage morphology of instars of *E. climax* are compared in Table 1. Both *E. nipponica* and *E. climax* have 5 juvenile instars, and no significant differences in development between the 2 species were observed.

Of interest is that on instar I the sensory bristle of the 5th joint of the 1st antenna as well as the b- and c-bristles of the 7th joint, and f- and g-bristles of the 8th joint are bare, the 9th exopodial joint of the 2nd antenna bears 2 bristles, the main tooth of the 5th limb differs considerably from that of later instars, and the Y-sclerite is undeveloped. These characters are probably useful for identifying 1st instars of many Myodocopina. Proximal joints of the 1st antenna as well as the protopodite of the 2nd antenna of *E. climax* are more spinous on early instars. The length and spinosity of the ventral bristles of the 9th joint of the 2nd antenna are compared in Figure 9j.

THE IDENTIFICATION OF INSTARS IN THE PHILOMEDINAE

A key to instars I–III of Myodocopina presented by Kornicker (1969b:3) based on the morphology of the 6th and 7th limbs has proved with few exceptions to be generally applicable, but a means of identifying later instars applicable to all families, or to all genera in a family, has not been

TABLE 1.—Morphometrics and meristics for selected characters of instars of *Euphilomedes climax* (b = bristles, c = claws, d = dorsal, F = female, l = lateral, M = male, m = medial, na = not applicable, nd = no data, v = ventral).

Character	I	II	III	IV	V	Adult
	F	F	M	F	F	F
Carapace length (avg. mm)	0.77	0.96	1.24	1.69	2.34	2.84
First Antenna						
1st joint bristles	0	0	0	0	0	0
2nd joint bristles (v/d/l)	0/0/0	0/1/1	1/1/1	1/1/1	1/1/1	1/1/1
3rd joint bristles (v/d)	1/2	1/1	1/2	1/2	1/2	1/2
4th joint bristles (v/d)	0/0	0/1	1/1-2	2/2	3/2	4/2
Second Antenna						
Endopodite						
1st joint bristles	0	1	3	4	5	6
2nd joint bristles	2	2	2	2	2	2
Exopodite						
9th joint bristles	2	3	4	5	6	7
Mandible						
Basale bristles (m/l)	5/0	6/1	7/2	8/3	9/4	9/5
Exopodial bristles	2	2	2	2	2	2
1st endopodial joint (v)	2	2	3	4	4	4
2nd endopodial joint (v/d)	1/4-5	3/7-8	5/8	6/9	7/8	7/8-9
3rd endopodial joint (c/b)	2/2	3/3	3/4	3/4	3/4	3/4
Maxilla						
Endite bristles	15	21	25-26	25	25	24
Basale bristles	2	3	3	3	3	3
Exopodial bristles	3	3	3	3	3	3
1st endopodial joint						
alpha-bristles	1	1	1	1	1	1
beta-bristles	1	1	2	3	4	5
2nd endopodial joint						
a-bristles	2	3	3-4	4	4-5	5
b-bristles	1	2	2	2	2	2
c-bristles	0	1	2	3	4-5	5
d-bristles	2	3	3	3	3	3
Fifth limb						
Endite bristles	11	20	23	26	nd	25
1st exopodial joint, pectinate teeth	1	2	3	3	3	3
4th + 5th joint bristles	2	4	6	7	8	8
Sixth Limb						
Epipodial bristles	0	0	1	2	3	4
Endite bristles	0	1	16-17	25	25-26	24-26
End joint bristles	0	0	11	19-21	30-31	32-34
Seventh Limb bristles	na	0	0	17-18	19	17-19
Bells on bristles	na	na	na	2-4	2-7	7-10
Comb teeth	na	0	0	7	8-9	13
Furca, claws	2	6-7	8	9-10	10-11	11-14

forthcoming. Apparently, it will be necessary to devise keys to later instars on a piecemeal basis for each genus or group of genera in a family. For example, Kornicker (1991) determined that the number of teeth on the 1st exopodial joint of the 5th limb is useful for identifying instars in certain Cypridinidae. A study of the ontogeny of *Euphilomedes nipponica* (Hiruta, 1976:579) by Hiruta (1980:156) showed that 2 bristles are on the 9th exopodial joint of the 2nd antenna of instar I and that an additional bristle is added on each later instar with 6 present on instar V, then 1 additional bristle is added on the adult female, but none on the adult male. A similar distribution of bristles was observed herein on instars of *Euphilomedes climax* (adult

male unknown) suggesting that, if this distribution is present on many members of the family, the number of exopodial bristles on the 9th joint might be useful in identifying instars. A nonexhaustive survey of the literature (Appendix 2; Table 2) revealed little information on instars other than the adult, but does show that 5 of the 8 genera referred to the Philomedinae fairly consistently have 7 bristles on the adult female and 6 on the adult male. Also relevant is that instar I of both *E. nipponica* and *E. climax* has 2 bristles on the 9th exopodial joint of the 2nd antenna, the same number on instar I of members of the Cypridinidae (Kornicker, in prep.). This suggests that 2 bristles also may be widespread in the Philomedinae. If 2 bristles are

TABLE 2.—Distribution of species and subspecies within genera of Philomedidae according to (a) number of bristles on the 9th exopodial joint of the adult female 2nd antenna; (b) relationship of the number of these bristles to those of the males (where known) of the same species; and (c) number of stages (including adults). (Data from Appendix 2 and bibliographic references indicated in footnotes; F = female, M = male, nd = no data.)

Taxon	Number of adult female bristles							Number of F bristles vs M bristles		Number of stages	
	1	2	3	4	5	6	7	F > M	F ≤ M	5	6
	PHILOMEDINAE										
<i>Anarthron</i>						4		nd	nd	nd	nd
<i>Euphilomedes</i>						8		4	0	nd	(2)*
<i>Igene</i>					2			1	0	nd	nd
<i>Paraphilomedes</i>						1		1	0	nd	nd
<i>Philomedes</i>						1	20	8	0	nd	(2)*
<i>Pleoschisma</i>					(nd, 1 adult male with 6)			nd	nd	nd	nd
<i>Scleroconcha</i>						6		1	0	nd	(1)*
<i>Zeugophilomedes</i>				2		1		0	3	nd	nd
PSEUDOPHILOMEDINAE											
<i>Angulostrum</i>			3					0	1	nd	nd
<i>Harbansus</i>		6	5					0	5	nd	nd
<i>Paramekodon</i>		2						nd	nd	nd	nd
<i>Pseudophilomedes</i>		2	7					0	6	(1)†	nd
<i>Streptoleberis</i>		1						nd	nd	nd	nd
<i>Tetragonodon</i>			4					0	2	nd	nd

*Hiruta, 1983:675

†Kornicker and Iliffe, 1989b:26

the norm for instar I, it seems reasonable to conclude that for species having 7 bristles on the adult female, 1 bristle is added by each instar. A tabular key for identifying instars based on the number of bristles on the 9th joint of the 2nd antenna is presented below. Because so little data are on hand, the key must be considered speculative, and proof of its usefulness most await future observations.

Tabular key to instars of certain genera of Philomedinae based on number of bristles on 9th exopodial joint of 2nd antenna (*Anarthron*, *Euphilomedes*, *Paraphilomedes*, *Philomedes**, *Scleroconcha*).

Instar #	Number of bristles	
	Male	Female
I	2	2
II	3	3
III	4	4
IV	5	5
V	6	6
Adult	6†	7

*Not *Philomedes orbicularis*.

†The adult male is easily identified by sexual characters.

COMPARISON OF THE PHILOMEDINAE AND PSEUDOPHILOMEDINAE

The information in Table 2 reveals interesting differences between the Philomedinae and Pseudophilomedinae: (1) known members of Philomedinae have 4–7 bristles on the 9th exopodial joint of the 2nd antenna compared to 2 or 3 bristles

for known Pseudophilomedinae; (2) except for *Zeugophilomedes*, known female Philomedinae have more bristles on the 9th joint than the male whereas, known female Pseudophilomedinae have either fewer bristles than the male, or the same number; (3) known Philomedinae have 6 stages whereas known Pseudophilomedinae have 5.

CYLINDROLEBERIDIDAE Müller, 1906

This family includes 3 subfamilies: Cyindroleberidinae Müller, 1906; Cyclasteropinae Poulsen, 1965; and Asteropter-oninae Kornicker, 1981. Only the first is represented at the vents.

CYLINDROLEBERIDINAE Müller, 1906

The Cyindroleberidinae is represented in the collections by 1 species in the genus *Prionotoleberis* Kornicker, 1974.

Prionotoleberis Kornicker, 1974

TYPE SPECIES.—*Prionotoleberis gyion* Kornicker, 1974:43, by monotypy.

COMPOSITION AND DISTRIBUTION.—With the new species described herein this genus includes seven species: *P. abyssicola* (Sars, 1870) [new combination] from the vicinity of the Lofoten Islands and between Finmark and Beeren Island at depths of 290–345 m; *P. gyion* Kornicker, 1974, from the Gulf of Naples at a depth of 55 m; *P. lux* Kornicker, in prep., from near Mayotte, Indian Ocean, at depths of 300–350 m; *P.*

norvegica (Sars, 1869) from the vicinity of Sweden and Norway at depths of 70–160 m; *P. pax* Kornicker and Caraion, 1974, from the Atlantic Ocean off Mauritania at depths of

96–338 m; *P. rex* Kornicker, 1989, from the Bay of Biscay at a depth of 1845–1913 m; and the new species *P. styx*. This is the first report of the genus in the Pacific Ocean.

Key to Species of *Prionotoleberis*

(without lateral eyes)

1. Female 1st antenna with d-bristle $\frac{1}{6}$ length of e-bristle *P. lux*
Female 1st antenna with minute d-bristle 2
2. Anterior margin of 6th joint with more than 10 bristles *P. styx*
Anterior margin of 6th joint with 2 bristles 3
3. Ventral margin of basale of maxilla with single proximal bristle
. *P. abyssicola*
Ventral margin of basale of maxilla with paired proximal bristles *P. rex*

Prionotoleberis styx, new species

FIGURES 10–13

Ostracoda.—Berg, Jr. and Van Dover, 1987, table 4 (part).
Cylindroleberididae.—Berg, Jr. and Van Dover, 1987:391.

ETYMOLOGY.—From the Latin and Greek *Styx*, name of the river in the nether world.

HOLOTYPE.—USNM 193792, adult female with unextruded eggs, in alcohol.

TYPE LOCALITY.—*Alvin* dive 1633, 2 Sep 1985, National Geographic Site, 20°51'00"N, 109°04'00"W, bottom depth 2592 m, capture depth above bottom 1–5 m.

PARATYPES.—*Alvin* dive 1635: USNM 193791, 1 adult female on slide and in alcohol.

DISTRIBUTION.—East Pacific Rise: National Geographic Site, *Alvin* dive 1633; Clam Acres, *Alvin* dive 1635.

DESCRIPTION OF ADULT FEMALE (Figures 10–13).—In lateral view carapace elongate with evenly rounded anterior and posterior margins, slightly convex dorsal margin, and slight concavity along anterior $\frac{1}{3}$ of ventral margin (Figure 10a,b). Hemocoel with numerous ovoid clusters of globules just beneath shell surface; clusters elongate along valve margin and perpendicular to margin (Figure 10f).

Infold: Rostral infold with about 20 long bristles in row parallel to ventral edge, and about 10 bristles away from edge (Figure 10c, 2 bristles in figure represented by empty sockets); 8 bristles in row just within dorsal edge of valve posterior to rostrum (not shown). Anteroventral infold with numerous long bristles along edge and few shorter bristles near midwidth (Figure 10d). Ventral infold with about 13 widely separated bristles in row between list and valve edge. Narrow list with anterior end ventral to incisur, extending along ventral margin and then broadening along posteroventral and posterior infolds. Posteroventral infold with 5 or 6 bristles in row between anteroventral part of broad list and posteroventral valve margin (only posterior of these shown in Figure 10e). Broad posteroventral and posterior list with about 30 transparent flap-like bristles (not all shown in Figure 10e). A few minute

bristles between flap-like bristles (not more than 1 between each pair of flap-like bristles). About 6 minute processes between broad posterior list and posterior valve edge (Figure 10e).

Selvage: Narrow lamellar prolongation with fringe of hairs present along ventral edge of incisur close to inner end. Narrow lamellar prolongation with smooth outer edge observed along anteroventral part of list.

Central Adductor Muscle Attachments (Figure 10a): 16 or 17 small ovoid attachments just anterior to midlength of valve (not all shown in Figure 10b).

Carapace Size: USNM 193792 (holotype), length 1.89 mm, height 1.09 mm; USNM 193791, length 1.73 mm, height 1.00 mm.

First Antenna (Figure 10g–i): 1st joint without spines. 2nd joint without spines, with 1 spinous dorsal bristle and 1 shorter bare lateral bristle. 3rd joint with 1 short bare ventral bristle and 6 dorsal bristles (proximal 2 single and with long spines, next 2 single with indistinct short spines (right limb of USNM 193791 with few long proximal spines on 4th bristle), last 2 paired with short indistinct spines). 4th joint (not all marginal spines of bristles shown in Figure 10g): ventral margin with 2 terminal bristles with indistinct short spines; dorsal margin unusually long, with 1 spinous terminal bristle. Sensory bristle of 5th joint with fairly long proximal filament and 6 long terminal filaments. 6th joint with 1 long medial bristle with small indistinct spines (spines not shown in Figure 10h). 7th joint (Figure 10h,i): a-bristle claw-like with few minute dorsal teeth near tip (not shown); b-bristle more than twice length of a-bristle, with 1 short proximal filament and 3 longer distal filaments including stem (not shown); c-bristle reaching well past sensory bristle of 5th joint, with 9 marginal filaments (not shown). 8th joint (Figure 10h,i): d-bristle represented by minute spine; e-bristle long, not reaching tip of sensory bristle of 5th joint, bare with blunt tip; f-bristle bent dorsally, broken off both limbs of USNM 193791, with 2 short marginal filaments on stump; g-bristle shorter than c-bristle, with 8 marginal filaments (not shown).



FIGURE 10.—*Prionotoleberis styx*, new species, USNM 193792, holotype, adult female: *a*, complete specimen from left side with detail of central adductor muscle attachments, length 1.89 mm. USNM 193791, paratype, adult female: *b*, complete specimen, length 1.73 mm (not all adductor muscle attachments shown); *c*, rostrum and incisur of right valve, iv; *d*, anteroventral corner of right valve, iv; *e*, posteroventral corner of right valve, iv; *f*, part of anterodorsal margin of rostrum of right valve, iv; *g*, left 1st antenna, lv; *h*, tip of right 1st antenna, mv; *i*, tip of left 1st antenna, lv.



FIGURE 11.—*Prionotoleberis styx*, new species, USNM 193791, paratype, adult female: *a*, distal part of protopodite of left 2nd antenna, mv; *b*, endopodite of left 2nd antenna, mv; *c*, coxale endite of left mandible, lv; *d*, left mandible, mv (coxale endite not shown); *e*, 3rd endopodial joint of left mandible, mv (rings of all bristles not shown); *f*, anterior of body from left side; *g*, part of upper and lower lips showing left mandibular coxale endite (stippled) in mouth; *h*, medial eye and Bellonci organ.

Second Antenna: Protopodite without spines, with minute distomedial bristle (Figure 11a). Endopodite 3-jointed, but suture between 2nd and 3rd joints indistinct; 3rd joint with long terminal filament (Figure 11b). Exopodite: 1st joint with small straight distomedial bristle; bristle of 2nd joint reaching 7th or 8th joints, with abundant short slender ventral spines; bristles of joints 3–8 with small ventral spines and long natatory hairs (fewer and smaller spines on distal bristles); 9th joint with 4 bristles (2 long with natatory hairs, 1 medium with short hairs, 1 short with short spines). Joints 3–8 with small basal spines only slightly longer on distal joints; basal spine of 8th joint about half length of 9th joint; 9th joint with lateral spine about same length as basal spine of 8th joint but broader. Joints 2–8 with minute spines in row along distal edges.

Mandible (Figure 11c–g): Coxale endite (Figure 11c): small medial bristle near base of ventral branch; ventral branch with spines forming about 7 oblique rows and tip with 3 small spines; dorsal branch: ventral margin with 5 groups of teeth (proximal 3 groups each with 2 pointed teeth; next 2 groups each with 4 or 5 pointed teeth), then long slender spinous main spine; margin between main spine and short terminal spine smooth; dorsal margin serrate distally; small spine at base of posterior bristle (bristle missing on endite of left limb studied, endite of right limb lost) (left endite originally broken off in mouth (Figure 11g)). Basale endite with 4 long spinous end bristles, 2 triaenid bristles with 4 or 5 paired spines excluding terminal pair, 2 dwarf bristles, and small indistinct glandular peg (Figure 11d). Basale: very broad; ventral margin near base of endite with slender ringed bristle with few small distal spines and broad U-shaped depression; dorsal margin with 2 terminal bristles (medial about half length lateral). Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, hirsute, with 2 unusually long terminal bristles with marginal spines. 1st endopodial joint with 3 long spinous bristles. 2nd endopodial joint: dorsal margin with stout spinous a-, b-, c-, and d-bristles (base of d-bristle stouter than base of c-bristle) (marginal spines not shown), without lateral bristle (e-bristle) between b- and c-bristles, with long spinous lateral bristle (f-bristle) between c- and d-bristles, long spinous medial bristle (g-bristle) just distal to base of d-bristle, 3 short slender bristles near base of a-bristle (2 with bases just on medial surface); medial side with 32 cleaning bristles (not all shown) forming 4 oblique rows of 4, 10, 10, 8 spinous bristles (2 outer bristles in distal row stout and with longer spines), and slender medial spines in short rows (not shown); ventral margin with 1 short and 2 long spinous terminal bristles. 3rd endopodial joint (Figure 11d,e): a-claw with slender tip and small ventral teeth; b-bristle long stout with base slightly lateral to plane of a-claw, with small teeth-like spines; c-bristle with base slightly lateral to b-bristle, otherwise similar; d-bristle slightly slenderer than b- and c-bristles, otherwise similar; e-bristle short slender spinous; f-bristle with base lateral to b-bristle and on same plane as c-bristle, about $\frac{1}{3}$ longer than a-claw, with small teeth-like spines. (Lettering system for bristles of 2nd and 3rd endopodial joints from Kornicker (in prep.).)

Maxilla (Figure 12a–e): Endite I with 3 stout bristles, each with long thin hairs followed by few long stout spines, then short teeth to tip (Figure 12a,c); endite without usual short bristle. Endite II with proximal medial hairs and 3 bristles more slender than those of endite I (posterior bristle with hairs, spines, and teeth similar to bristles of endite I; 2 anterior bristles with only short spines (Figure 12a,d)). Epipodite fairly short with elongate tip, hirsute (Figure 12c). Basale (Figure 12b,e): medial surface with short ringed proximal bristle slightly closer to dorsal than ventral margin, short distal bristle and hairs in rows near dorsal margin; ventral margin with long spinous terminal bristle. 1st endopodial joint hirsute, without usual alpha-bristle, with beta-bristle with short marginal spines (spines not shown). 2nd endopodial joint with long spinous terminal bristle. (Both limbs of USNM 193791 fragmented during dissection; although all parts were preserved and visible, it is possible that the absence on the basale of the usual proximal lateral bristle and proximal ventral bristle is the result of fragmentation.)

Fifth Limb (Figure 12f): Lateral side of comb with stout spinous exopodial bristle reaching past end of comb, 1 slender bristle just ventral to base of exopodial bristle, 2 pairs of bristles near ventral margin, and 4 bristles almost on ventral margin (1 proximal, 1 just proximal to proximal paired bristles, and 2 distal near anterior end).

Sixth Limb (Figure 12g,h): More elongate than usual in subfamily, with projecting posteroventral part. Anterior margin with 2 endites indicated by sutures; with 18–20 small bare ringed (rings not shown) marginal bristles with bases on medial surface (13 or 14 dorsal to upper suture and 5 or 6 between upper and lower sutures); medial surface with 2 small bristles in anterodorsal corner (observed only on right limb but the place where bristles would have been is torn off on left limb); anteroventral corner with 13 or 14 long spinous bristles in row; lateral anteroventral flap with 0 or 1 short slender plumose bristle (bristle observed only on left limb (not shown)); middle part of ventral margin with 12 bristles with long proximal hairs and short distal spines (bases of bristles on medial side); posteroventral corner with 1 spinous bristle.

Seventh Limb (Figure 13a): Each limb with 12 or 13 bristles (6 or 7 on each side) in proximal group, each bristle with 4 or 5 bells, and 12 bristles in distal group (6 on each side), each with 4 or 5 bells; 1 bristle of terminal segment stouter and much longer than others. Terminus with opposing combs each with 17 or 18 spinous teeth.

Furca (Figure 13b): Each lamella with 10 claws; 3 posterior claws bristle-like; posterior 2 bristle-like claws oriented posteriorly; anterior 7 claws with small teeth along posterior edge; few teeth on anterior 3 claws slightly longer than others; distal part of claw 1 relatively more slender than distal ends of claws 2–4.

Bellonci Organ (Figure 11f,h): Short, tapering to rounded tip.

Eyes: Lateral eyes absent. Medial eye small, light amber colored (Figure 11f,h).



FIGURE 12.—*Prionotoleberis styx*, new species, USNM 193791, paratype, adult female: *a*, endites of left maxilla, mv; *b*, basale and endopodite of left maxilla, mv; *c*, epipodite, endite I, and proximal part of basale of right maxilla, mv; *d*, endite II of right maxilla, mv; *e*, basale and endopodite of right maxilla, lv; *f*, comb of left 5th limb, mv; *g*, part of right 6th limb, mv; *h*, left 6th limb, mv.

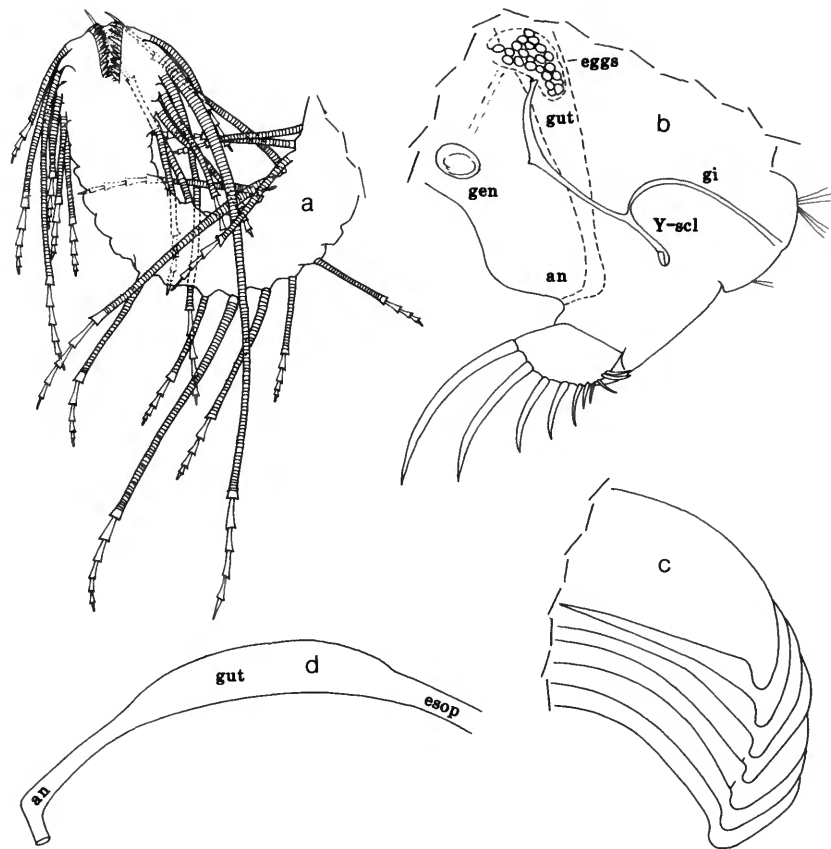


FIGURE 13.—*Prionotoleberis styx*, new species, USNM 193791, paratype, adult female: a, 7th limb; b, posterior of body from left side; c, gills on left side of body; d, outline of gut.

Lips (Figure 11f): Upper lip comprising 2 hirsute lobes without anterior spines. Lower lip comprising hirsute flap on each side of mouth.

Genitalia (Figure 13b): Small oval on each side of body; narrow tube appears to extend from oval to sack containing small amber colored ?eggs.

Anterior of Body (Figure 11f): Without anterior processes.

Posterior of Body (Figure 13b): With few hairs on posterior ventral to intersection of girdle with posterior margin of body; posterodorsal corner rounded with few long spines.

Y-Sclerite (Figure 13b): Typical for subfamily.

Pigmentation: None observed in shell or appendages.

Gills (Figure 13c): Well developed, 7 on each side of body.

Eggs (Figure 13b): Small ?eggs in sack at end of tube leading to genitalia.

Gut (Figure 13d): Slender, cylindrical, containing fine-grained material.

COMPARISONS.—The high number of bristles (13 or 14) on

the anterior margin of the 6th limb distinguishes *P. styx* from all known species of *Cylindroleberidinae*. The highest number previously recorded was 4–9 on *Synasterope hirpax*. Other known species of *Prionotoleberis* have only 2. The concave posterior margin of the 6th limb of *P. styx* has been reported in the *Cylindroleberidinae* only on species of *Bruuniella*. In many respects the 6th limb of *P. styx* resembles those of members of the *Asteropteroninae* and *Cyclasteropinae*. Two other unusual characters of *P. styx* are the long dorsal margin of the 4th joint of the 1st antenna and the considerable length of the 2 terminal bristles of the mandibular exopodite.

Order HALOCYPRIDA Dana, 1853

This order includes the suborder Halocypridina Dana, 1853, and Cladocopina Sars, 1866 (Kornicker and Sohn, 1976, fig. 2). Both are represented in the collections, but the Cladocopina by only 1 specimen (*Polycopidae*), which is listed in Appendix 1 but not identified further.

Suborder HALOCYPRIDINA Dana, 1853

This suborder includes the superfamilies Thaumatoocypridoidea Müller, 1906, and Halocypridoidea Dana, 1853 (Kornicker and Sohn, 1976, fig. 2). Only the latter is represented in the collections.

Superfamily HALOCYPRIDOIDEA Dana, 1853

This superfamily includes the single family Halocyprididae Dana, 1853.

HALOCYPRIDIDAE Dana, 1853

This family includes five subfamilies (Kornicker and Iliffe, 1989a:19). Only the Euconchoecinae Poulsen, 1969, and Conchoecinae Claus, 1891, are represented in the collections, and only species in the subfamily Euconchoecinae are studied in detail. Remaining specimens are listed in Appendix 1 as Conchoecinae, but not identified further.

EUCONCHOECINAE Poulsen, 1969

This subfamily includes the genera: *Euconchoecia* Müller, 1890, and *Bathyonchoecia* Deevey, 1968. Only the latter is represented in the collections.

Bathyonchoecia Deevey, 1968

TYPE SPECIES.—*Bathyonchoecia paulula* Deevey, 1968.

COMPOSITION AND DISTRIBUTION.—This genus includes about 20 known species (Ellis, 1987:83) mostly from bathyal and abyssal depths. Members of the genus are circumglobal but relatively rare in the Arctic and Antarctic. The collection from the Guaymas Basin contains many specimens that have been referred herein to four species: *B. paulula* previously known from the Gulf of Mexico and the eastern tropical Atlantic (Deevey, 1968:547; Poulsen, 1972:452), *B. deeveyae* previously known from the Peru-Chile Trench System and the western tropical Atlantic (Kornicker, 1969a:403, 1981c:1237), and two left in open nomenclature.

Bathyonchoecia paulula Deevey, 1968

FIGURES 14–19

Bathyonchoecia paulula Deevey, 1968:547, figs. 1–3.—Poulsen, 1972:452, fig. 4.

MATERIAL.—Guaymas Basin (Southern Trough), *Alvin* dive 1629: USNM 193822, 1 adult male on slide and in alcohol; USNM 193823, 1 undissected adult male in alcohol; USNM 193824, 26 juveniles in alcohol. Also examined male holotype (USNM 123209) and male paratype (USNM 123210) from the Gulf of Mexico.

DISTRIBUTION.—Gulf of Mexico (specimens from intestines

of bottom fish), depth 1000 m (Deevey, 1968:547). Southwest of São Miguel, Azores (about 37°23'N, 25°45'W), bottom depth 620–800 m, plankton net open between 680 and 780 m (Poulsen, 1972:445, 452). Guaymas Basin (Southern Trough), *Alvin* dive 1629, bottom depth 2000 m, collected in plankton net 3 to 4 m above bottom.

REMARKS.—The specimens from the Guaymas Basin are the first reported in the Pacific and from depths greater than 1000 m. The specimens differ in some small details from type specimens from the Gulf of Mexico and could be a new subspecies; however, additional studies of populations from both areas would be necessary to determine variability of the species.

SUPPLEMENTARY DESCRIPTION OF ADULT MALE HOLOTYPE AND PARATYPE (Figures 14, 23f).—Tip of rostrum of paratype (Figure 14a) more elongate than that of holotype (Figure 14b).

Infold: Ventral margin with 17 glandular openings between list and valve edge, some paired (anterior opening shown in Figure 14a,b; 2 posterior openings shown in Figure 14d). Narrow list extending from inner end of incisur to posterodorsal corner of valve; list along posterior infold with transparent lamella forming 4 long flagella-like cusps (Figure 14c); list just ventral to posterior cusps with short section with small outward pointed spines (Figure 14d). (Flagella also present on adult female USNM 123211.) (A flagellate lamella has not been described previously on species of *Bathyonchoecia*, but was also observed herein on the male *B. laqueata* (USNM 123212, holotype.)

Hinge Teeth (Figure 14c): Each valve with 2 elongate sclerotized bars in posterodorsal corner; upper bar striate. (Similar to structures illustrated on *Bathyonchoecia septemspinosa* by Kornicker and Angel (1975:fig. 11b)).

Second Antenna: Deevey (1968:549) stated that only 2 bristles were found on the basal part of the hook of the 3rd endopodial joint, but a 3rd bristle may have broken off or is obscured. Using an oil immersion objective (×100) I was able to detect a small indistinct 3rd bristle on both limbs of the holotype (Figure 14e).

Maxilla: See Figure 23f.

Penis (Figure 14f): Tip with pointed sclerotized spine and terminal sclerotized ridge with many small cusps.

DESCRIPTION OF ADULT MALE FROM GUAYMAS BASIN (Figures 15–19, 23g).—Carapace similar in shape to that of type specimens (Figure 15), but rostrum with greater overhang (Figures 15, 16a,b). Glands in posterodorsal corners of each valve (Figure 16c,d).

Infold: Upper of 4 cusps on list of posterior infold of USNM 193822 triangular, without flagella (Figure 16e).

Carapace Size: USNM 193822, length 0.95 mm, height 0.61 mm; USNM 193823, length 0.95 mm, height 0.60 mm.

First Antenna (Figure 16f,g): Proximal part with internal dark brown pigment spots. Limb otherwise similar to that of type specimens.

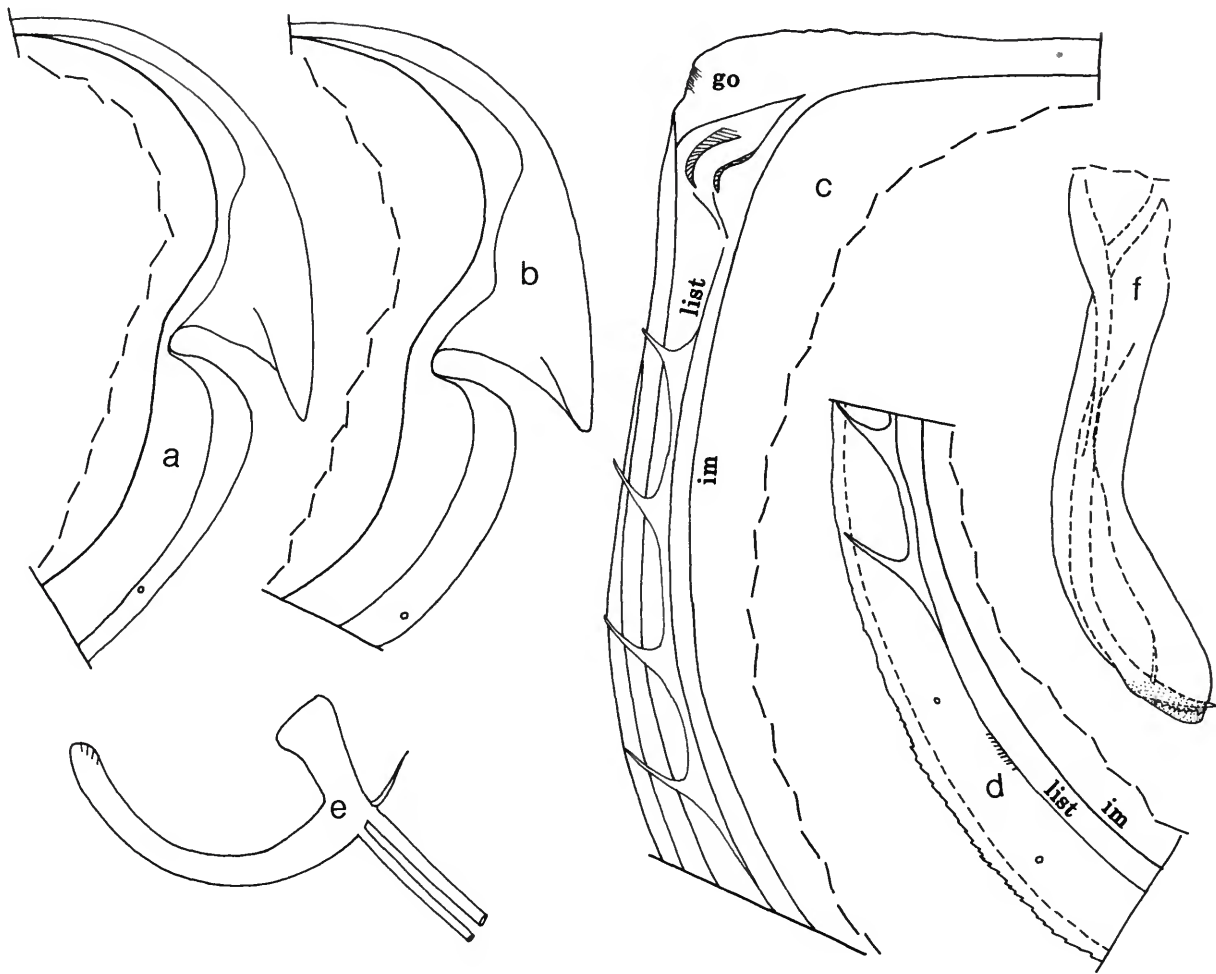


FIGURE 14.—*Bathyconchoecia paulula* Deevy, USNM 123210, paratype, adult male: a, anterior of left valve, iv; USNM 193209, holotype, adult male: b, anterior of left valve, iv; c, posterior of left valve, iv; d, posteroventral corner of left valve, iv; e, 3rd endopodial joint of right 2nd antenna, mv; f, copulatory organ, mv.

Second Antenna (Figures 16h-n, 17a,b): Exopodite: some joints with row of small teeth along distal edge (visible with oil immersion lens) (Figure 16j,m); 9th joint with 3 bristles (Figure 16l,n). Endopodite (Figures 16k, 17a,b): proximal part of hook with 3 bristles (1 long, 2 short). Limb otherwise similar to type specimens.

Mandible (Figures 17c-f, 18a-c): Basale: dorsal margin with 2 spinous bristles (Figure 17e, f); without lateral tooth just proximal to row of teeth along margin (Figure 18a). 1st endopodial joint with 2 or 3 distal medial bristles (Figure 18b,c). Limb otherwise similar to type specimens.

Maxilla (Figures 18d-f, 23g): 1st endopodial joint of USNM 193822 with 3 bristles near midlength (Figure 18e, f)

and long claw of 2nd joint without distal rings. Limb otherwise similar to type specimens.

Fifth Limb (Figure 19a-c): Protopodite and endopodite fused; endites I and II each with 2 bristles; endopodite with 2 claw-like bristles and 6 spinous ringed bristles. 1st exopodial joint partly divided into proximal and distal parts by suture on only 1 side: proximal part with 4 or 5 short bristles and 1 very long dorsal bristle; distal part with 4 bristles near ventral margin. 2nd exopodial joint with 3 or 4 bristles (2 or 3 ventral, 1 dorsal) at midlength. Limb otherwise similar to that of type specimens.

Sixth Limb (Figures 17c, 19a,d-f): Protopodite bare. Basale with 4 spinous bristles. Endopodite represented by 1 long

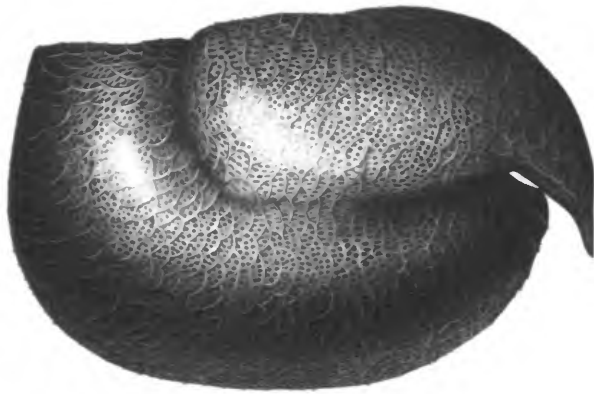


FIGURE 15.—*Bathyonchoecia paulula* Deevey, USNM 193822, adult male, complete specimen, length 0.95 mm.

bristle. Exopodite 3-jointed: 1st joint with 4 ventral bristles; 2nd joint elongate, with 2 bristles at midlength (1 ventral, 1 dorsal); 3rd joint with 3 bristles (dorsal 3 times length of others). Proximal bristle of proximal group of epipodial bristles short (Figure 19d). Limb otherwise similar to that of type specimens.

Seventh Limb (Figures 17c, 18g): With 2 bristles (Deevey (1968:549) stated that limb is missing from male she studied, but 2 bristles are on 7th limb of adult female).

Furca (Figure 19g): Lateral surface of lamella with spines near anterior edge proximal to claw 1 and near claws 6 and 7; abundant spines on medial side of lamella proximal to joints 3-7 (not shown). Furca with same number of claws as on type specimens.

Upper Lip (Figure 19h): With minute spines on tip.

Penis (Figure 19i,j): Tip with sclerotized pointed process adjacent to ridge with few cusps.

Anterior of Body (Figure 19h): With row of spines at about midheight. Head region with dark brown pigment spots.

Proistans: USNM 193822 with elongate transparent object attached to 1st or 2nd exopodial joints of right 2nd antenna (Figure 16m).

REMARKS.—A male from the Guaymas Basin differs from the type specimens in the characters listed above. In particular it differs in having 2 rather than 3 dorsal bristles on the mandibular basale, and in having 3 rather than 4 proximal bristles on the 1st endopodial joint of the maxilla. Another observed difference is that the carapaces of both male type specimens have flagella on the 4 cusps of the lamellar prolongation of the posterior list (Figure 14c), whereas, the male from the Guaymas Basin has only 3 flagella (a triangular cusp is in place of the 4th flagella) (Figure 16e). All the noted differences could be the result of intraspecific variability, but Deevey considered the presence of 4 proximal bristles on the

1st endopodial joint of the maxilla of the type specimens of to be of systematic importance, so perhaps the Guaymas Basin specimens could be a subspecies.

Bathyonchoecia deeveyae Kornicker, 1969

FIGURE 20

Bathyonchoecia deeveyae Kornicker, 1969a:403, pl. 1: figs. 1,2; 1981c:1237, figs. 1-4.—George, 1971:141-144, figs. 1-9.

MATERIAL.—USNM 193828, 1 A-4 instar in alcohol (body removed from valves).

DISTRIBUTION.—Peru-Chile Trench System, 7°53'S, 80°30'W, depth 520 m (Kornicker, 1969a:403). Western Atlantic off Surinam, 7°45'18"N, 54°24'00"W, depth 508-523 m (Kornicker, 1981c:1237). Guaymas Basin (Southern Trough), *Alvin* dive 1629, bottom depth 2000 m, collected in plankton net 3 or 4 m above bottom.

SUPPLEMENTARY DESCRIPTION OF INSTAR A-4 (Figure 20).—Carapace with missing fragments (Figure 20). Surface with arcuate ridges between punctae (Figure 20). (Lower lateral spine (present on specimens previously described) absent but an underlying structure (visible in transmitted light) where spine is normally located suggests that lack of spine may be aberrancy (structure not shown)).

Carapace Size: USNM 193828, Length including anterior and posterior spines 0.87 mm, length excluding spines 0.66 mm, height excluding spines 0.46 mm.

Appendages: Limbs 1-6 present. 7th limb not observed, possibly obscured.

Furca: Each lamella with 4 claws followed by small protuberance; single bristle on left lamella following claws.

REMARKS.—The number of furcal claws and carapace size are similar to an A-4 instar of the closely related species *Bathyonchoecia septemspinosa* Angel, 1970, described by Kornicker and Angel (1975:19), and is the basis for identifying the present unique specimen as the A-4 instar. The specimen is referred to *B. deeveyae* rather than to other spinous members of the genus because of the proximity of the type locality of *B. deeveyae*.

Bathyonchoecia species A

FIGURES 21, 22, 23d

MATERIAL.—USNM 193827, 1 adult female on slide and in alcohol.

DISTRIBUTION.—Guaymas Basin (Southern Trough), *Alvin* dive 1629, bottom depth 2000 m, collected in plankton net 3 or 4 m above bottom.

REMARKS.—The species is left in open nomenclature because the poor condition of the carapace did not permit its adequate description, and only one specimen is in the collection.

DESCRIPTION OF ADULT FEMALE (Figures 21, 22, 23d).—In



FIGURE 16.—*Bathyconchoecia paulula* Deevey, USNM 193823, adult male: *a*, outline of rostrum and incisor of left valve, ov. USNM 193822, adult male: *b*, anterior of left valve, iv; *c, d*, posterodorsal corners of left and right valves (glands dashed); *e*, posterior of right valve, iv; *f*, 1st antenna (stippled circles represent pigmented areas); *g*, left 1st antenna (bristles not shown; circles represent pigmented areas); *h*, protopodite of left 2nd antenna and pigmented head region (stippled); *i*, exopodite of left 2nd antenna, lv (bristles not shown); *j*, detail from *i*; *k*, endopodite of right 2nd antenna, lv; *l*, tip of exopodite of left 2nd antenna, lv; *m*, joints 1–3 of exopodite of right 2nd antenna with attached elongate protistan, lv; *n*, tip of exopodite of right 2nd antenna, lv.

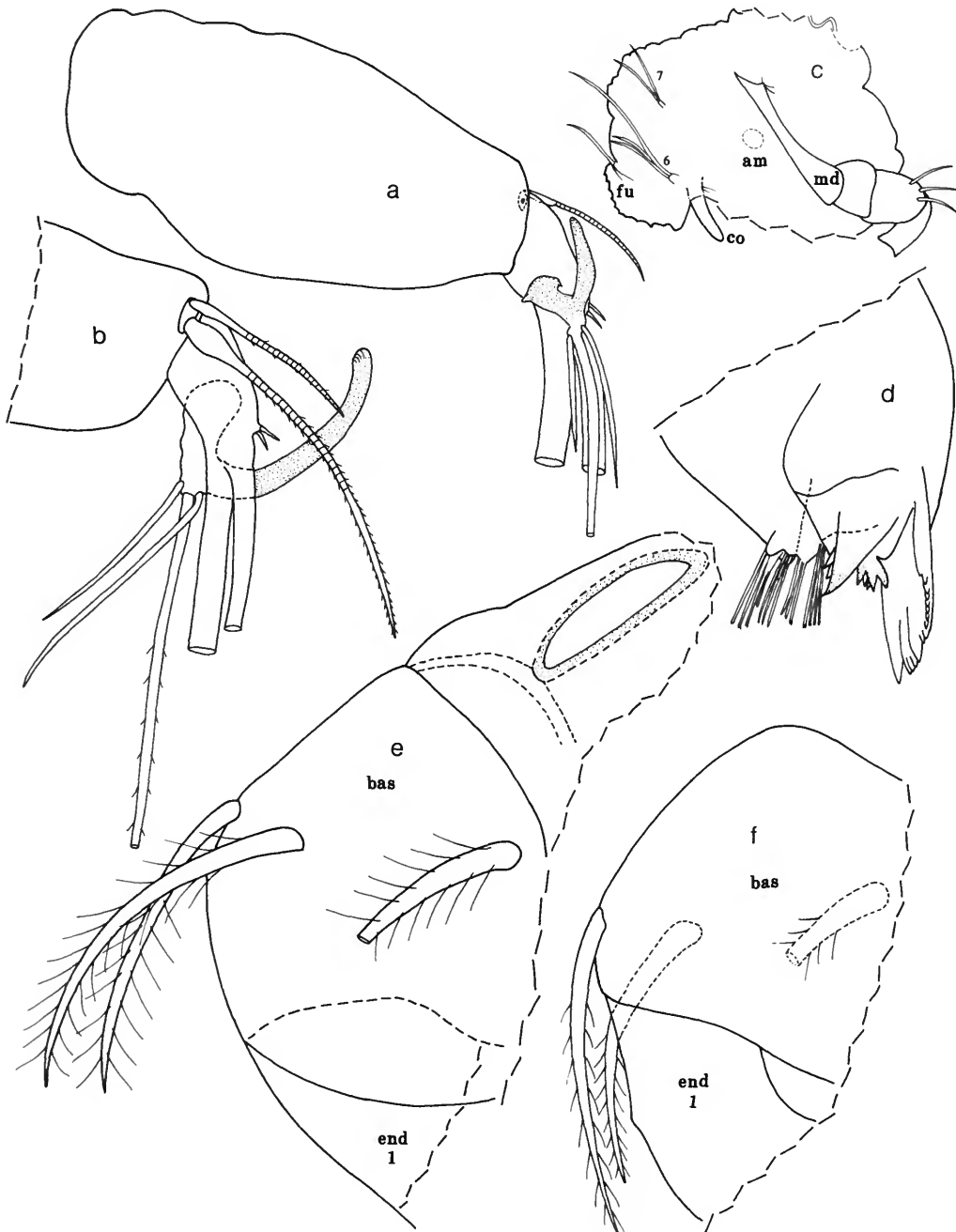


FIGURE 17.—*Bathyoconchoecia paulula* Deevy, USNM 193822, adult male: *a*, endopodite of left 2nd antenna, mv; *b*, endopodite of right 2nd antenna, lv; *c*, right side of body showing location of copulatory organ (base on left side of body) and some other appendages (only terminal joint of 6th limb and part of mandible and furca shown); *d*, coxale endite of right mandible, mv; *e*, part of right mandible, mv; *f*, part of left mandible, mv.

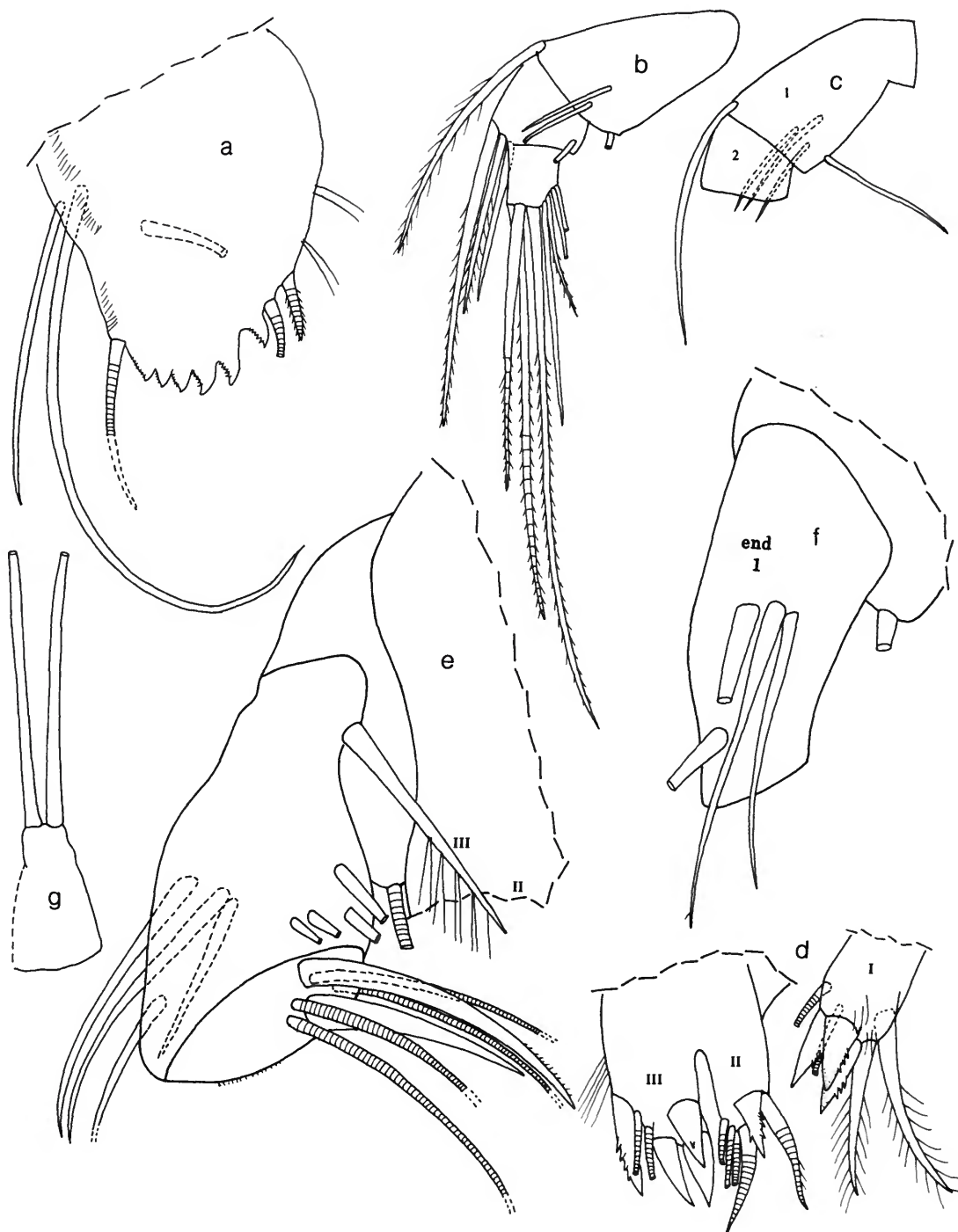


FIGURE 18.—*Bathyoconchoecia paulula* Deevey, USNM 193822, adult male: a, distal part of basale of right mandible, mv; b, endopodite of right mandible, mv; c, part of endopodite of left mandible, lv; d, endites I, II, and III of maxilla; e, maxilla (without endites shown in d); f, part of other maxilla; g, 7th limb (only proximal parts of bristles shown).

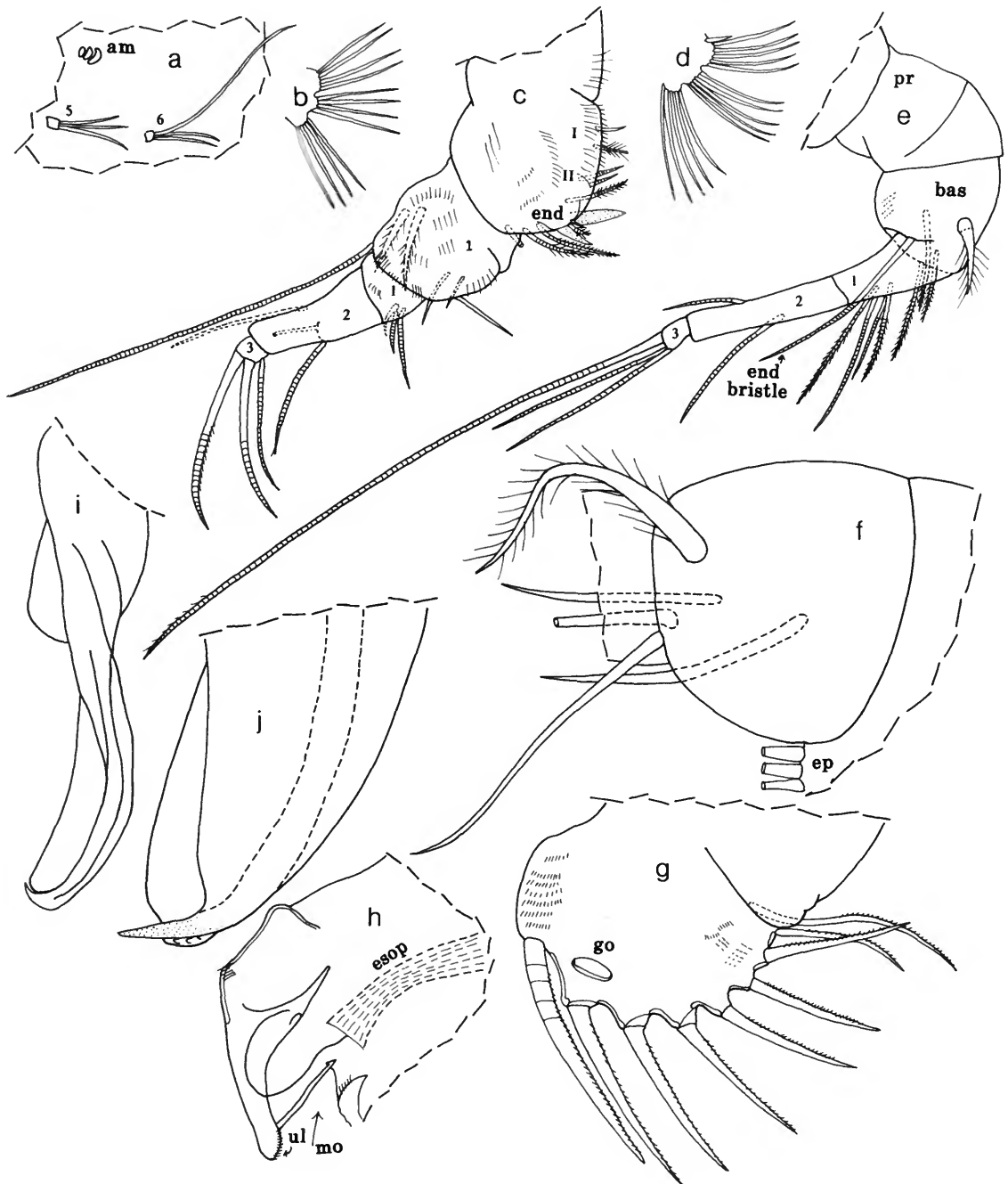


FIGURE 19.—*Bathyonchoecia paulula* Deevey, USNM 193822, adult male: *a*, left side of body showing location of end joints of 5th and 6th limbs and central adductor muscles; *b*, epipodite of 5th limb; *c*, 5th limb; *d*, epipodite of 6th limb; *e*, 6th limb; *f*, basale of other 6th limb; *g*, left lamella of furca, lv; *h*, part of anterior of body; *i, j*, copulatory organ, lv.

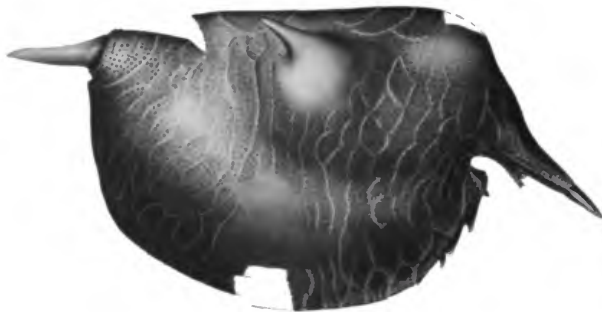


FIGURE 20.—*Bathyconchoecia deeveyae* Kornicker, USNM 193828, A-4 instar, length with spines 0.87 mm.P

general, carapace similar to that of *Bathyconchoecia* sp. B (Figure 24), but probably with rostrum more rounded in lateral view (Figure 21a).

Carapace Size: Length less than 2 mm, height 0.88 mm.

First Antenna (Figure 21b): Left limb typical for genus. Right limb aberrant in having no filaments within cup of 5th joint (cup present).

Second Antenna: Exopodite: 1st joint 72% length of shaft (Figure 21c), with small distal medial bristle just reaching 3rd joint (Figure 21d); bristles of joints 2-9 with small hair-like spines proximal to natatory hairs; 9th joint with 3 bristles. Endopodite (Figure 21e): 1st joint slender with short a-bristle and long b-bristle, both spinous; 2nd joint with 2 long terminal f- and g-bristles; 3rd joint not well defined, with h-, i-, and j-bristles (i-bristle about twice length of h- and j-bristles).

Mandible: Coxale: ventral margin divided into posterior part with teeth and anterior part with long spines (Figure 21f-i); posterior part consisting of lateral and medial parts; lateral part with 5 cusps along distal edge and 35 minute serrations along posterior edge (Figure 21i); medial part with anterior and posterior lists (Figure 21g); anterior list with 21 cusps in rows of 9, 6, and 6 teeth; posterior list with 23 cusps comprising proximal row of 5 cusps, distal row of 9 cusps, and 9 cusps between proximal and distal rows. Anterior spined part of coxale with long ventral spines (with digitate tips) divided roughly into 5 low lobes (Figure 21f,h), with most spines on broad anterior lobe and fewest spines on narrow posterior lobe; broad anterior lobe with small triangular spines along ventral margin and on lateral side, few long medial hairs near anterior end, and stout spinous bristle on anteroventral corner (Figure 21h). Basale (Figure 21j,k): dorsal margin with 3 diaphanous plumose bristles; lateral surface with few long hairs, 1 diaphanous plumose bristle about $\frac{1}{3}$ distance from dorsal margin, 3 spinous bristles just distal to midlength, and small sclerotized tooth close to distal margin (Figure 21k); anterior margin with 1 spinous distal bristle; posterior margin with distal hairs and 2 short distal bristles (most distal one tubular); ventral margin with 6 pairs of triangular teeth with minute

marginal cusps (Figure 21k); medial surface with few long hairs near terminal margin (not shown). Endopodite (Figure 21l): 1st joint with 3 or 4 bristles (1 dorsal with stout spines, 2 or 3 ventral, bare, or with indistinct spines); 2nd joint with 4 bristles (1 ventral bare or with indistinct spines, 3 dorsal spinous); 3rd joint with medial hairs and 7 bristles (4 short slender on ventral half of terminal margin (1 with base on lateral side), 1 long (unringed, spinous) with base at midwidth on terminal margin, 2 shorter ringed spinous bristles dorsal to long bristle (shortest with base medial)).

Maxilla (Figures 22a-c, 23d): Precoxale endite I with 1 pointed ringed spinous posterior bristle adjacent to stout spinous unringed bristle, 3 unringed claw-like bristles with minute teeth along posterior edge, and 2 ringed tubular proximal medial bristles (Figure 22a); coxale endite II with 1 pointed ringed spinous posterior bristle adjacent to short stout unringed claw-like bristle, 1 pointed ringed spinous bristle, 3 ringed tubular bristles, and 1 pointed unringed spinous anterior bristle; coxale endite III with 4 unringed claw-like bristles and 2 ringed bristles. Coxale with plumose dorsal bristle. Basale with posterior medial bristle (with indistinct short spines) on distal margin. Endopodite (Figures 22b,c, 23d): 1st joint with 5 anterior bristles (4 proximal, 1 distal) and 5 posterior bristles (1 proximal, 4 distal); 2nd joint with 2 stout recurved spinous claws with proximal hairs and 4 ringed bristles (2 lateral (1 about same length as long claw, 1 about same length as short claw), 2 medial about same length as long claw (only stumps of bristles shown)).

Fifth limb (Figure 22d): Epipodite with 4, 4, and 4 bristles. Endite I with 3 bristles (1 short tubular, 1 long plumose, 1 long with short spines); endite II with 3 spinous bristles (2 tubular). Endopodite separated from endite II by minute indentation in ventral margin, with 2 short stout unringed spinous tooth-like bristles and 5 slender bristles (1 on anterior edge near dorsal margin very long (with long proximal hairs and short distal spines), 2 short on ventral margin near tooth-like bristles, and 2 plumose near longer of tooth-like bristles (plumose bristles could be on 1st exopodial joint). Exopodite: 1st joint with 9 bristles (1 very long distal dorsal bristle with widely separated marginal spines, 2 diaphanous plumose bristles on or near dorsal margin at joint midlength, 1 proximal either near ventral margin or near joint midheight, 1 proximal on ventral margin, and 4 distal near ventral margin). 2nd exopodial joint with 6 bristles (4 ventral, 2 dorsal). 3rd exopodial joint with 3 equilength bristles (2 dorsal claw-like (weakly ringed distally), 1 ventral slender ringed). Endites and endopodite hirsute (hairs not shown).

Sixth Limb (Figure 22e): Epipodite with 7 (proximal bristle small), 5, and 5 bristles. Protopodite with suture distally on ventral margin forming triangular corner with long hairs, and 1 ventral bristle with few indistinct short marginal hairs. Basale with 4 or 5 ventral bristles (2 plumose) and 1 plumose dorsal bristle at joint midlength. Endopodite represented by single bristle (with widely separated small marginal hairs) on

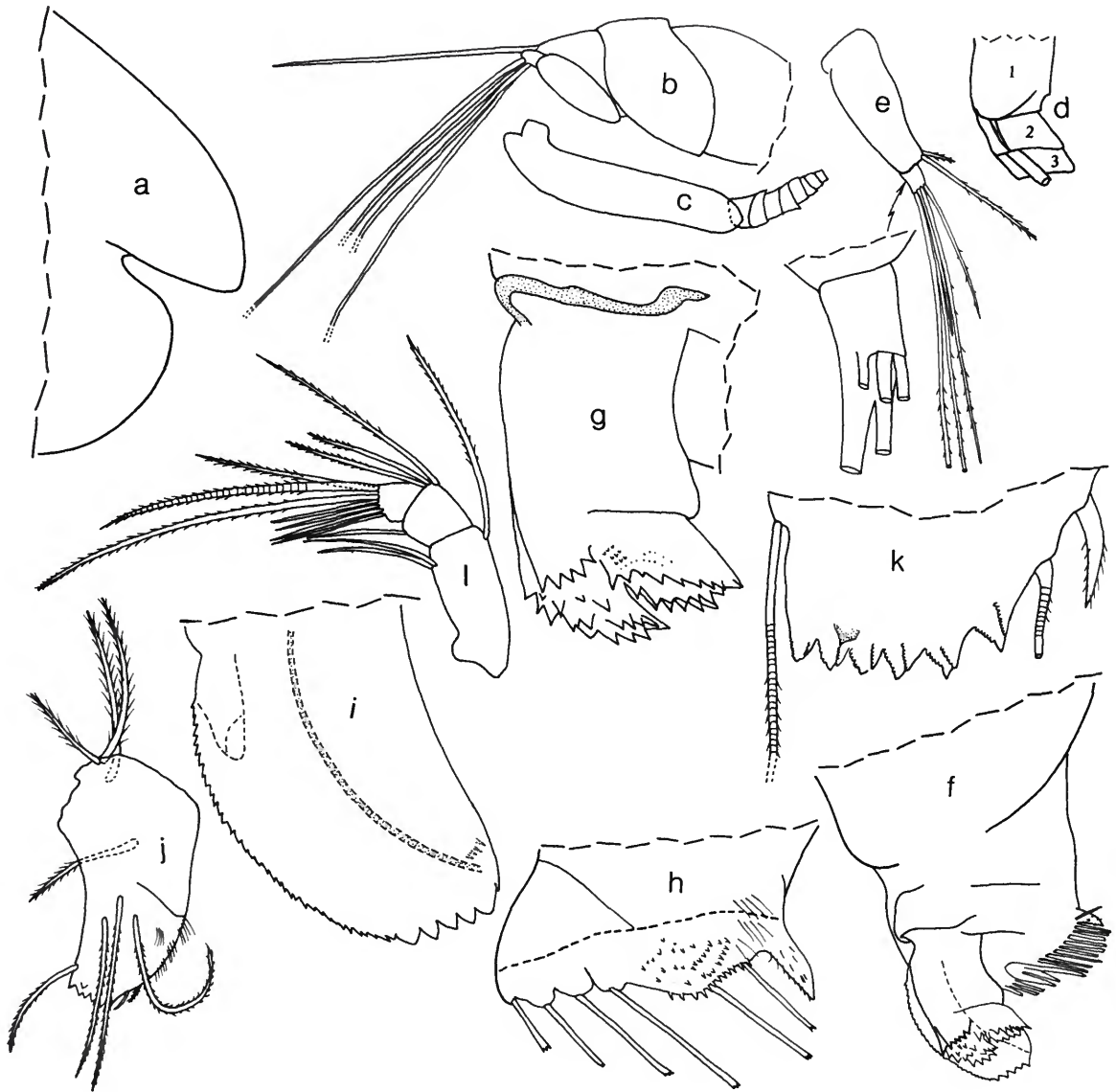


FIGURE 21.—*Bathyonchoecia* species A, USNM 193827, adult female: *a*, outline of anterior of left valve, lv; *b*, left 1st antenna, lv (bristles and filaments not shown); *c*, exopodite of left 2nd antenna, lv (filaments not shown); *d*, joints 1-3 of exopodite of right 2nd antenna, mv; *e*, endopodite of left 2nd antenna, mv; *f*, coxale endite of left mandible, mv; *g, h, i*, details of teeth shown in *f*; *j*, basale of left mandible, lv; *k*, detail from *f*; *l*, endopodite of left mandible, lv.

small peg. Exopodite: 1st joint with 6 bristles (3 ventral, 3 set in from ventral margin, none dorsal); 2nd joint with 3 bristles (1 ventral, 2 dorsal); 3rd joint with 3 ringed bare bristles (middle slightly longer).

Seventh Limb (Figure 22*f*): Dorsal bristle longer and stouter than ventral bristle.

Furca (Figure 22*g*): Each lamella with 8 slender claws; claw 1 with 4 weak sutures proximally; all claws with double

row of small teeth along posterior margin (2 or 3 teeth slightly larger than others); unpaired long spinous bristle following claw 8; small elliptical lateral glandular opening between bases of claws 1 and 2.

Bellonci Organ: Not observed.

Upper Lip and Anterior of Body (Figure 22*h*): Typical for genus.

COMPARISONS.—The 2 claws of the 2nd endopodial joint of

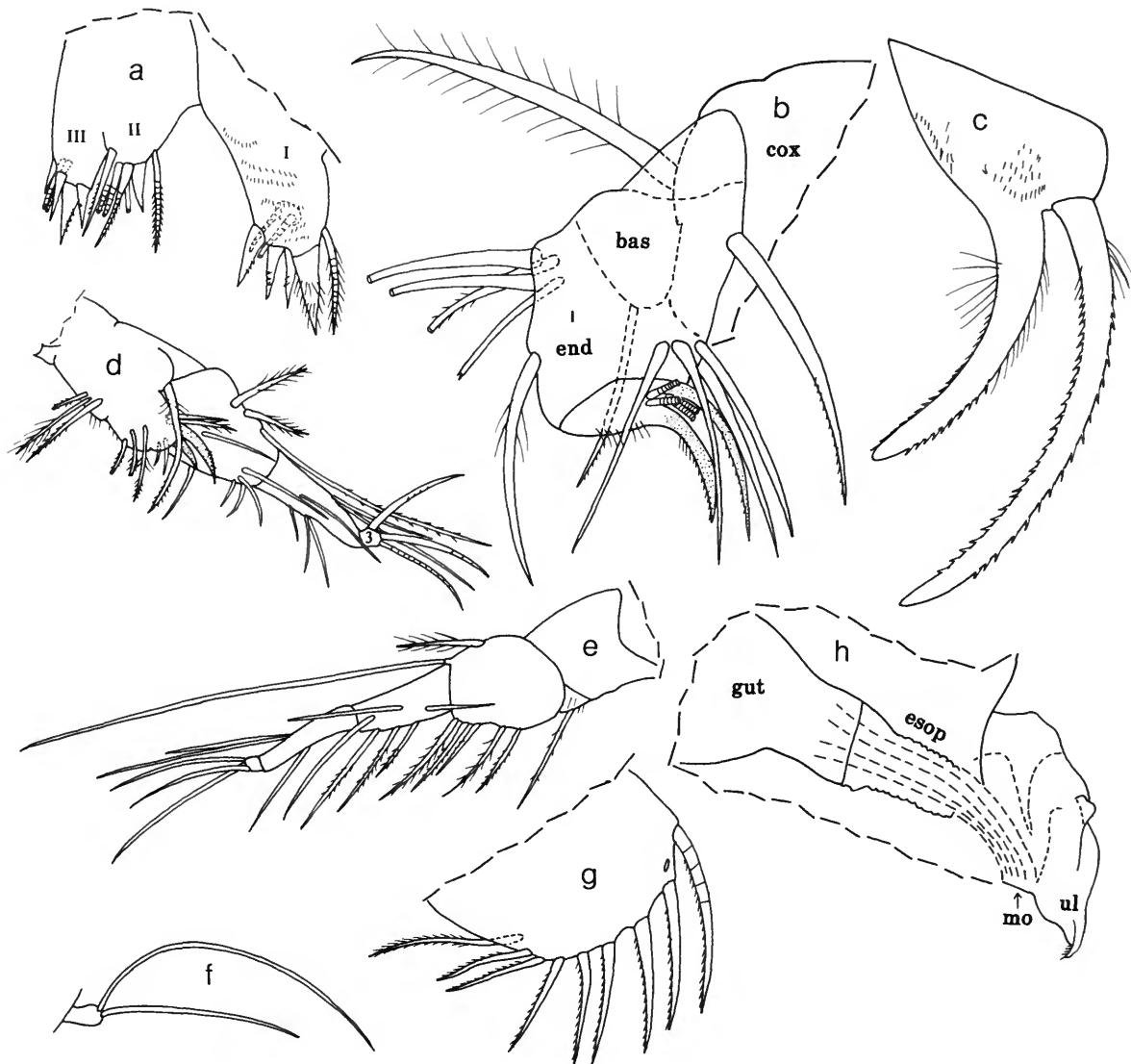


FIGURE 22.—*Bathyoconchoecia* species A, USNM 193827, adult female: a, endites I, II, and III of left maxilla, lv; b, left maxilla, lv; c, claws of 2nd endopodial joint of right maxilla, mv; d, 5th limb; e, 6th limb; f, left 7th limb, lv; g, right lamella of furca, lv; h, anterior of body from right side.

the maxilla of *Bathyoconchoecia* sp. A differ from previously described species for which that character is known in being more spinous and in having long proximal hairs on the shorter claw (Figure 22c). The claws of several species of *Bathyoconchoecia* in the collection of this museum are compared in Figure 23. *Bathyoconchoecia* sp. A also differs from some known species as follows: from *B. laqueata* Deevey, 1968, in having longer medial bristles on precoxale endite of maxilla, 4 instead of 3 proximal anterior bristles on 1st endopodial joint of maxilla, a much longer distal dorsal bristle on 1st endopodial

joint of 5th limb, and a much longer endopodial bristle on 6th limb; from *B. kornickeri* Deevey, 1968, in being smaller, in having a much shorter bristle on end joint of 6th limb relative to length of shaft, 4 rather than 3 proximal anterior bristles on 1st endopodial joint of maxilla, and unequal bristles on 7th limb; from *B. galerita* Deevey, 1968, in being much smaller, in having 4 rather than 3 proximal anterior bristles on 1st endopodial joint of maxilla, and a longer endopodial bristle on 6th limb; from *B. sagittarius* Deevey, 1968, in not having teeth along the posterior valve margin; from *B. foveolata* Deevey,

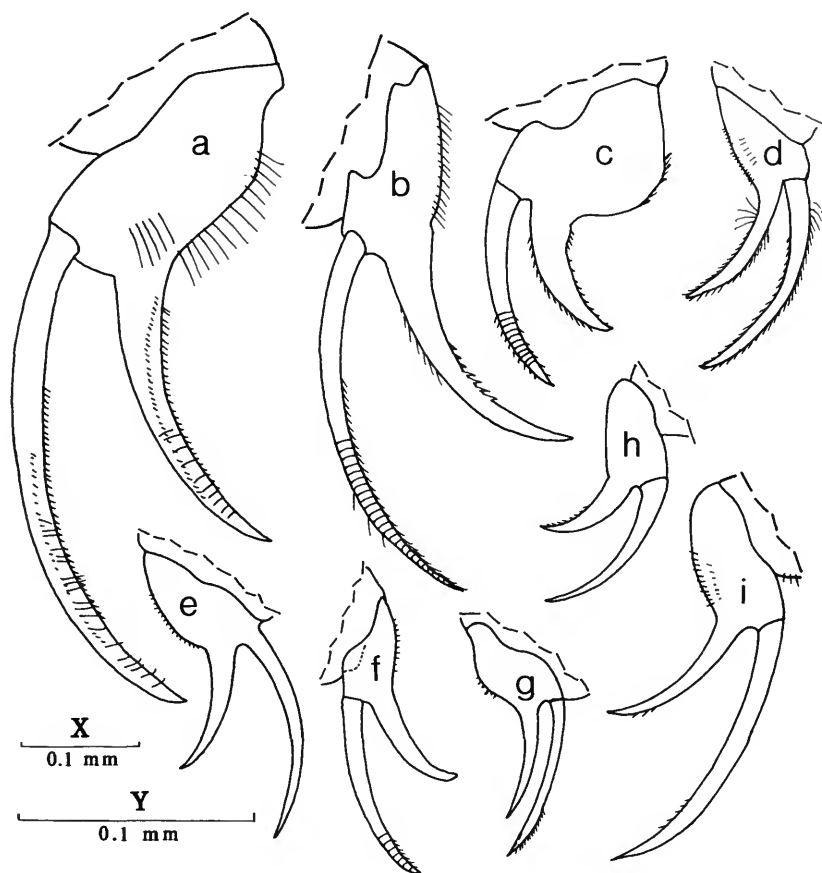


FIGURE 23—Claws and spines of 2nd endopodial joint of maxillae of certain species of *Bathyconchoecia*: a, *B. sagittarius*, USNM 123216, holotype, male; b, *B. foveolata*, USNM 123217, holotype, male; c, *B. galerita*, USNM 123215, holotype, female; d, *B. species A*, USNM 193827, female; e, *B. species B*, USNM 193825, A-1 male; f, *B. paulula*, USNM 123210, paratype, male; g, *B. paulula*, USNM 193822, male; h, *B. laqueata*, USNM 123212, holotype, male; i, *B. kornickeri*, USNM 123214, holotype, male. Scale X: b; scale Y: a, c-i.

1968, in being much smaller and not having teeth along posterior valve margin; from *B. paulula* Deevey, 1968, in being larger, and having longest bristle of the end joint of the 6th limb being much shorter relative to length of shaft; from *B. angeli* George, 1977, in being much smaller, and in morphology of teeth on lists of coxale endite of mandible; from *B. arctica* Angel, 1976, in being smaller and in morphology of teeth and bristles on coxale endite and basale of mandible; from *B. subrufa* Angel, 1970, and *B. crosnieri* Poulsen, 1969, in being smaller and in morphology of teeth of coxale endite; from *B. nodosa* Poulsen, 1972, in not having posterodorsal process on valves; from *B. latirostris* Poulsen, 1972, in shape of carapace, morphology of coxale endite of mandible, and in having fewer posterior bristles on 1st endopodial joint of maxilla; from *B. baskiae* Poulsen, 1969, in being much smaller.

Bathyconchoecia species B

FIGURES 24, 25

MATERIAL.—USNM 193825, 1 A-1 male on slide and in alcohol; USNM 193826, 1 A-1 female on slide and in alcohol; USNM 193829, 1 A-2 instar in alcohol; USNM 193830, 1 A-1 male in alcohol; USNM 193831, 12 early instars in alcohol.

DISTRIBUTION.—Guaymas Basin (Southern Trough), Alvin dive 1629, bottom depth 2000 m, collected in plankton 3 to 4 m above bottom.

DESCRIPTION OF INSTAR A-1 MALE (Figures 24, 25).—Carapace elongate, with pointed rostrum overhanging incisure (Figures 24, 25a); concavity at inner side of dorsal margin at midlength (Figure 25a). Surface strongly sculptured in fresh material, with abundant punctae between reticulations (Figure

24). Glandular process in posterodorsal corner of each valve (Figure 25b,c).

Selvage: Lamellar prolongation along posterior valve margin without flagella.

Carapace Size: USNM 193825, length 1.24 mm, height 0.83 mm.

First Antenna (Figure 25d): Similar to that of adult female *Bathyconchoecia* sp. A except joints better defined.

Second Antenna: Protopodite and exopodite similar to those of adult female *Bathyconchoecia* sp. A except short proximal hairs not observed on exopodial bristles. Endopodite (Figure 25e, f): 1st joint with 2 spinous dorsal a- and b-bristles (a-bristle about $\frac{1}{4}$ length of b-bristle); 2nd joint with 2 minute unringed c- and d-bristles (Figure 25f) and 2 long f- and g-bristles; 3rd joint with base medial to 2nd joint, and tip with sclerotized rim (joint of right limb with small terminal node), with h-, i-, and j-bristles.

Mandible (Figure 25g,h): Mandible similar to that of adult female *Bathyconchoecia* sp. A (illustrated lists apparently twisted, Figure 25h).

Maxilla (Figures 23e, 25i): Endopodite: anterior margin of 1st joint with 4 bristles (3 proximal, 1 distal); 2 claws of 2nd joint bare. Limb otherwise similar to that of adult female *Bathyconchoecia* sp. A.

Fifth Limb (Figure 25j): Epipodite with 4 (proximal short), 4, and 4 bristles. Endite I with 2 ventral bristles; endite II with 4 ventral bristles (2 tubular). Endopodite separated from endite II by minute indentation in ventral margin, with 2 short stout unringed indistinctly spinous tooth-like bristles and 3 slender spinous bristles. Exopodite: 1st joint with 7 bristles near ventral margin, 2 diaphanous plumose bristles near dorsal margin, and 1 very long spinous bristle on dorsal margin; 2nd joint with 3 bristles on ventral margin and 2 on dorsal margin; 3rd joint with 2 claw-like dorsal bristles and 1 slender ringed ventral bristle (middle bristle longest).

Sixth Limb (Figure 25k): Epipodite with 7 (proximal

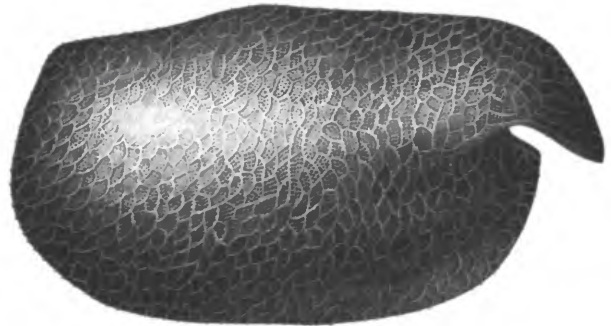


FIGURE 24.—*Bathyconchoecia* species B, USNM 193825, A-1 male, length 1.04 mm.

short), 5, and 5 bristles. Protopodite with 1 ventral bristle (not shown). Basale with 3 (1 plumose) ventral bristles and 1 plumose bristle near ventral margin. Endopodite represented by 1 very long spinous bristle. Exopodite: 1st joint with 4 bristles on or near ventral margin; 2nd joint with 2 bristles (1 ventral, 1 dorsal); 3rd joint with 3 ringed bristles.

Seventh Limb: Lost.

Furca (Figure 25l): Each limb with 7 claws with double row of teeth along posterior edge; claw 1 with 3 proximal weakly developed sutures; 1 unpaired long spinous bristle on lamellae following claws; lamellae hirsute.

Lips (Figure 25m-o): Typical for genus.

Penis (Figure 25p-r): With 2 branches: anterior branch broad with minute process on posteroventral corner; posterior branch narrow with minute subterminal spine.

REMARKS.—Early juveniles of *Bathyconchoecia* that could not be referred either to *B. paulula*, *B. deeveyae*, or *B. sp. A* are included in this taxon, but not with certainty. The specimens referred to *B. sp. B* have no unusual characters for the genus, and being juveniles could not be referred with certainty to known species.



FIGURE 25.—*Bathynchoecia* species B, USNM 193825, A-1 male: a, left valve, iv; b, posterodorsal corner of left valve, iv (glandular opening dashed, sclerites stippled); c, posterodorsal corner of right valve, ov (glandular opening dashed, shell edge stippled); d, 1st antenna (stippling indicates amber-colored area); e, endopodite of left 2nd antenna, mv; f, endopodite of right 2nd antenna, mv; g, part of coxale endite of left mandible, lv; h, right mandible, mv; i, right maxilla, mv; j, 5th limb; k, 6th limb; l, right lamella of furca, lv; m, n, o, lateral (from right side), posterior, and anterior views of mouth area (upper and lower lips shown in m, only lower lips shown in n and o); p, part of body from left side showing tips of anterior and posterior branches of copulatory organ and claw 1 of furca (stippled); q, r, tips of posterior and anterior branches of copulatory organ, respectively.

Appendix 1

Station Data with Specimens Examined

(Arranged north to south and in chronological order of samples for each locale; number immediately following name of submersible is dive number)

Explorer Ridge

(49°46'N, 130°16'W; bottom depth 1700 m)

- Pisces* 1492-1004; 23 Jun 1984; Pogo Peaks Vent; snail sample, plankton.
Euphilomedes climax: USNM 193794A, 1 instar V male; USNM 193794B, 1 instar IV female.
- Pisces* 1492-1014; 23 Jun 1984; Pogo Peaks Vent.
Euphilomedes climax: USNM 193814A, 1 instar III male; USNM 193814B, 1 instar IV male.
- Pisces* 1494-1008; 1 Jul 1984; Gulati Gusher Vent; detrital rock sample from south side, plankton.
Euphilomedes climax: USNM 193798, 13 late juveniles.
- Pisces* 1494-1016; 1 Jul 1984; Gulati Gusher Vent; sediment slurp from bottom of chimney, plankton.
Euphilomedes climax: USNM 193797, 4 late juveniles.
- Pisces* 1494-1017; 1 Jul 1984; Gulati Gusher Vent.
Euphilomedes climax: USNM 193818, 21 specimens (includes adults and juveniles) + 1 right valve.
- Pisces* 1494-1019; 1 Jul 1984; Gulati Gusher Vent; biomass.
Euphilomedes climax: USNM 193800, 1 instar I female; USNM 193801, 52 adult females and late juveniles; USNM 193802, 1 instar I female; USNM 193803, 1 instar IV male; USNM 193809A, 8 late juveniles; USNM 193809B, 1 instar IV female; USNM 193810, 1 adult female.
- Pisces* 1495-1010; 2 Jul 1984; Lunch Hour Vent; plankton.
Euphilomedes climax: USNM 193799, 1 adult female + 4 late juveniles.
- Pisces* 1495-1012; 2 Jul 1984; Lunch Hour Vent.
Euphilomedes climax: USNM 193804, 1 instar III male; USNM 193805, 1 instar II female; USNM 193806, 1 ovigerous female; USNM 193807, 15 adult females (including 1 ovigerous female) + juveniles; USNM 193808A 2 instar I female + 1 instar II female; USNM 193808B, 1 instar III male; USNM 193808C, 1 instar I male.
- Pisces* 1497-1006; 4 Jul 1984; Crab Vent; UMM; 49°46'N, 130°18'W.
Euphilomedes climax: USNM 193820, 2 adult females.
- Pisces* 1497-1013; 4 Jul 1984; Crab Vent.
Euphilomedes climax: USNM 193816, 2 adult females.
- Pisces* 1497-1015; 4 Jul 1984; Upper Magic Mountain Vent; snail and ampharetid sample, plankton.
Euphilomedes climax: USNM 193793 (holotype), 1 adult female; USNM 193795, 1 adult female; USNM 193796, 1 instar V female.
- Pisces* 1505-1005; 19 Aug 1984; Busted Thruster Vent; 49°46'N, 130°18'W.
Euphilomedes climax: USNM 193819, 4 specimens (includes 1 ovigerous female).
- Pisces* 1505-1018; 19 Aug 1984; Busted Thruster Vent; CASM IV; bulk sample.
Euphilomedes climax: USNM 193813, 4 late juveniles.

Juan de Fuca Ridge

Endeavor Segment

(about 47°57'N, 129°05'W, bottom depth 2250 m)

- Alvin* 1447-1021; 9 Mar 1984; Long Term Observatory Vent; 47°57'06"N, 129°06'18"W.

- Euphilomedes climax*: USNM 193811, 1 instar III male; USNM 193812, 4 late juveniles.
- Alvin* 1452-1020; 8 Sep 1984; Long Term Observatory Vent; 47°57'N, 129°05'W.
Euphilomedes climax: USNM 193815A, 1 instar III (sex not determined); USNM 193815B, 6 late juveniles.

Axial Seamount

(about 45°57'N, 130°02'W, bottom depth 1570 m)

- Pisces* 1723-1027; 19 Jul 1984; base of Hammond's Hell Vent; 45°55'N, 130°03'W.
Euphilomedes climax: USNM 193821, 1 adult female.
- Pisces* 1724-1026; 20 Jul 1984; Hammond's Hell Vent; 45°55'N, 130°03'W.
Euphilomedes climax: USNM 193817, 1 instar I.

Guaymas Basin

Southern Trough

- Alvin* 1628; 23 Aug 1985; 27°00'42"N, 111°24'30"W; bottom depth 2000 m; height above bottom 1–5 m; plankton tow (for mechanical details see Berg, Jr. and Van Dover (1987:383)); length of tow 37 min.
Conchoecinae: 1 adult male.
Podocopa: 1 specimen.
- Alvin* 1629; 24 Aug 1985; 27°00'42"N, 111°24'30"W; Sayles study site; 27°00'N, 111°30'W; bottom depth 2000 m; height above bottom 3–4 m; plankton tow (for mechanical details see Berg, Jr. and Van Dover (1987:383)); length of tow 28 min.
Bathymochoecia paulula: USNM 193822, 1 adult male; USNM 193823, 1 adult male; USNM 193824, 26 juveniles.
Bathymochoecia deevyae: USNM 193828, 1 A–4 instar.
Bathymochoecia species A: USNM 193827, 1 adult female.
Bathymochoecia species B: USNM 193825, 1 A–1 male; USNM 193826, 1 A–1 female; USNM 193829, 1 A–2 instar; USNM 193830, 1 A–1 male; USNM 193831, 12 early instars.
Conchoecinae: 14 specimens.
- Alvin* 1630; 25 Aug 1985; 27°00'42"N, 111°24'30"W; bottom depth 2000 m; height above bottom 186–207 m; plankton tow (for mechanical details see Berg, Jr. and Van Dover (1987:383)); length of tow 32 min.
Conchoecinae: 8 specimens.

East Pacific Rise

National Geographic Site

- Alvin* 1633; 2 Sep 1985; 20°51'00"N, 109°04'00"W; bottom depth 2592 m; height above bottom 1–5 m; plankton tow (for mechanical details see Berg, Jr. and Van Dover (1987:383)); length of tow 21 min.
Prionotoleberis styx: USNM 193792 (holotype), 1 adult female.
Cladocopa (Polycopidae): 1 specimen (1 valve missing).
Podocopa: 1 specimen (part missing).

Clam Acres

Alvin dive 1635; 4 Sep 1985; 20°49'48"N, 109°05'54"W; bottom depth 2600 m; height above bottom 1-3 m; plankton tow (for mechanical details see Berg, Jr. and Van Dover (1987:383)); length of tow 38 min.

Prionotoleberis styx: USNM 193791, 1 adult female.

Rift Valley

Alvin 1637; 6 Sep 1985; 20°50'30"N, 109°05'48"W; bottom depth 2600 m; height above bottom 17-23 m; plankton tow (for mechanical details see Berg, Jr. and Van Dover (1987:383)); length of tow 47 min.

Conchoecinae: 4 specimens.

Appendix 2

Number of Bristles on the Adult Ninth Exopodial Joint of the Second Antenna of Selected Species of the Philomedidae

(Arranged in each subfamily alphabetically; nd = no data)

Taxon	Number of bristles		Reference
	Male	Female	
PHILOMEDINAE			
<i>Anarthron chilensis</i>	nd	7	Kornicker (1975:353)
<i>Anarthron dithrix</i>	nd	7	Kornicker (1975:357)
<i>Anarthron evexum</i>	nd	7	Kornicker (1975:364)
<i>Anarthron reticulata</i>	nd	7	Kornicker (1975:343)
<i>Euphilomedes asper</i>	6	7	Kornicker (1967d:20; 1974:17), Kornicker and Caraión (1977:20)
<i>Euphilomedes bradyi</i>	4	nd	Poulsen (1962:387)
<i>Euphilomedes carcharodonta</i>	7	nd	Poulsen (1962:377)
<i>Euphilomedes nipponica</i>	6	7	Hiruta (1976:582, 586)
<i>Euphilomedes nodosa</i>	6	7	Poulsen (1962:360, 366)
<i>Euphilomedes producta</i>	nd	7	Poulsen (1962:384)
<i>Euphilomedes sinister pentathrix</i>	nd	7	Kornicker and Caraión (1977:25)
<i>Euphilomedes sinister sinister</i>	nd	7	Kornicker (1974:19)
<i>Euphilomedes smüthi</i>	nd	7	Poulsen (1962:373)
<i>Euphilomedes sordida</i>	6	7	Hiruta (1976:591, 595)
<i>Euphilomedes walfordi</i>	6	nd	Poulsen (1962:371)
<i>Igene bryx</i>	nd	6	Kornicker (in prep.)
<i>Igene walleni</i>	5	6	Kornicker (1975:370)
<i>Paraphilomedes tricornuta</i>	7*	nd	Poulsen (1962:409)
<i>Paraphilomedes unicolornuta</i>	6	7	Poulsen (1962:404, 407)
<i>Philomedes albatross</i>	nd	7	Kornicker (1982:21)
<i>Philomedes assimilis</i>	nd	7	Kornicker (1971:188)
<i>Philomedes brenda</i>	6	7	Skogsberg (1920:385), Kornicker (1988:7, 15)
<i>Philomedes charcoti</i>	6	7	Kornicker (1971:172, 174)
<i>Philomedes cubitum</i>	nd	7	Kornicker (1975:291)
<i>Philomedes curvata</i>	nd	7	Poulsen (1962:355)
<i>Philomedes dentata</i>	nd	7	Poulsen (1962:352)
<i>Philomedes duplex</i>	6	7	Kornicker (1984:16, 20)
<i>Philomedes heptathrix</i>	6	7	Kornicker (1975:250)
<i>Philomedes hirutai</i>	nd	7	Kornicker (1984:29)
<i>Philomedes horikoshii</i>	nd	7	Hiruta (1987:51)
<i>Philomedes keslingi</i>	nd	7	Kornicker (1984:25)
<i>Philomedes liljeborgii</i>	6	7	Poulsen (1962:348), Kornicker (1987:881; 1989:67, 72)
<i>Philomedes lofthousae</i>	nd	6-7	Kornicker (1975:285)
<i>Philomedes minys</i>	nd	7	Kornicker (1975:274)
<i>Philomedes orbicularis</i>	5	6	Kornicker (1971:178)
<i>Philomedes pentathrix</i>	6	7	Kornicker (1989:76, 78)
<i>Philomedes ramus</i>	nd	7	Kornicker (1975:279)
<i>Philomedes subantarctica</i>	6	7	Kornicker (1975:263)
<i>Philomedes tetradens</i>	nd	7	Kornicker and Caraión (1977:17)
<i>Philomedes tetrathrix</i>	nd	7	Kornicker (1975:258)
<i>Pleoschisma agilis</i>	6	nd	Poulsen (1962:390), Kornicker (1975:298)
<i>Scleroconcha arcuata</i>	6	nd	Kornicker (1975:314)
<i>Scleroconcha arcuata</i>	nd	7	Poulsen (1962:400)
<i>Scleroconcha folinii</i>	nd	7	Kornicker and Caraión (1977:43)
<i>Scleroconcha gallardoi</i>	nd	7	Kornicker (1971:194)
<i>Scleroconcha kuboti</i>	5	7	Hiruta (1981:61, 68)
<i>Scleroconcha ruffi</i>	nd	7	Kornicker (1988:21)
<i>Scleroconcha wolffi</i>	nd	7	Kornicker (1975:337)
<i>Zeugophilomedes arostratus</i>	6	5-6	Kornicker (1967a:4, 8; 1967c:16)
<i>Zeugophilomedes multichelatus</i>	6	4	Kornicker (1967b:4, 7)
<i>Zeugophilomedes polae</i>	6	4	Kornicker (1967c:6, 10)

Taxon	Number of bristles		Reference
	Male	Female	
PSEUDOPHOLOMEDINAE			
<i>Angulorostrum costatum</i>	nd	3	Kornicker (1981a:12)
<i>Angulorostrum monothrix</i>	3	3	Kornicker (1981a:4)
<i>Angulorostrum segonzaci</i>	nd	3	Kornicker (1981a:15)
<i>Harbansus barnardi</i>	nd ^b	1-2	Kornicker (1978:47)
<i>Harbansus bowenae</i>	3	3	Kornicker (1978:40; 1984:75)
<i>Harbansus bradmyersi</i>	2	2	Kornicker (1978:27; 1979:1006)
<i>Harbansus dayi</i>	4 ^c	3	Kornicker (1978:35)
<i>Harbansus ferox</i>	nd	3	Kornicker (in prep.)
<i>Harbansus magnus</i>	nd	nd ^d	Kornicker (1984:72)
<i>Harbansus mayeri</i>	nd	2	Kornicker (1978:31)
<i>Harbansus paucichelatus</i>	2	2	Kornicker (1978:20, 21; 1984:66)
<i>Harbansus rhabdion</i>	nd	3	Kornicker (1970:33)
<i>Harbansus slatteryi</i>	3	3	Kornicker (1981e:183)
<i>Harbansus thrix</i>	nd	2	Kornicker (in prep.)
<i>Harbansus vix</i>	nd	2	Kornicker (1991)
<i>Paramekodon inflatus</i>	nd	2	Kornicker (1968:462)
<i>Paramekodon poulsen</i>	nd	2	Kornicker (1968:467)
<i>Pseudophilomedes ambon</i>	4	3	Kornicker (1984:41, 45)
<i>Pseudophilomedes angulatus</i>	4	3	Kornicker and Caraion (1977:50)
<i>Pseudophilomedes darbyi</i>	4	3	Kornicker (1967d:9; 1984:36)
<i>Pseudophilomedes foveolatus</i>	nd ^e	2 ^f	Kornicker (1967d:14; 1974:20, 25)
<i>Pseudophilomedes kyllix</i>	4	3	Kornicker and Iliffe (1989b:14, 16)
<i>Pseudophilomedes polyancistrus</i>	3-4	3	Kornicker (1984:50, 51)
<i>Pseudophilomedes thalassa</i>	4	3	Kornicker and Caraion (1977:58, 61)
<i>Pseudophilomedes tetrathrix</i>	nd	2	Kornicker and Caraion (1977:65)
<i>Pseudophilomedes zeta</i>	nd	3	Kornicker (1984:57)
<i>Streptoleberis crenulata</i>	nd	2	Kornicker (1978:54)
<i>Tetragonodon ctenorynchus</i>	3	3	Kornicker and Caraion (1977:30, 38)
<i>Tetragonodon currax</i>	nd	3	Kornicker (in prep.)
<i>Tetragonodon pallax</i>	3	3	Kornicker (1989:86, 88)
<i>Tetragonodon rhamphodes</i>	nd	3	Kornicker (1968:457)

^aIt is not clear whether Poulsen is referring to the male or female, or both.

^bA-1 male with 2 bristles on 9th joint (Kornicker, 1978:48).

^cCorrection: Kornicker (1978:36) reported male USNM 193641 to have 2nd antennae with aberrant exopodites having only 8 joints. I reexamined the specimen and found each limb to have 9 exopodial joints, with the left limb having 4 bristles on the 9th joint, and the 9th joint of the right limb obscured but with at least 3 bristles, possibly 4.

^dA-1 female with 4 bristles on 9th exopodial joint (Kornicker, 1984:72).

^eA-1 male with 4 bristles.

^fCould be A-1 female (Kornicker, 1974:23).

Literature Cited

- Angel, M.V.
 1970. *Bathyconchoecia subrufa* n. sp. and *B. septemspinosa* n. sp., Two New Halocyprids (Ostracoda, Myodocopida) from the Tropical North Atlantic and the Description of the Larval Development of *B. subrufa*. *Crustaceana*, 19(2):181-199.
 1976. *Bathyconchoecia arctica* n. sp., a New Species of Ostracod (Halocyprididae, Myodocopidae) from the Arctic. *Crustaceana*, 31(1):59-65, 2 figures.
- Berg, Jr., Carl J., and Cindy Lee Van Dover
 1987. Benthopelagic Macrozooplankton Communities at and Near Deep-Sea Hydrothermal Vents in the Eastern Pacific Ocean and the Gulf of California. *Deep-Sea Research*, 34(3):379-401, figures 1-2, tables 1-6.
- Brady, G.S.
 1890. On Ostracoda Collected by H.B. Brady, Esq., L.L.D.F.R.S., in the South Sea Islands. *Transactions of the Royal Society of Edinburgh*, 35(part 2, number 14):489-525.
 1897. A Supplementary Report on the Crustaceans of the Group Myodocopa Obtained during the *Challenger* Expedition, with Notes on Other New or Imperfectly Known Species. *Transactions of the Zoological Society of London*, 14(3):7:85-100, plates 15-17.
 1902. On New or Imperfectly-Known Ostracoda, Chiefly from a Collection in the Zoological Museum, Copenhagen. *Transactions of the Zoological Society of London*, 16(4):1:179-210, plates 21-25.
- Cannon, H. Graham
 1933. On the Feeding Mechanism of Certain Marine Ostracods. *Transactions of the Royal Society of Edinburgh*, 57(3):30:739-764, figures 1-11, table 1.
- Claus, C.
 1891. *Die Halocypriden des Atlantischen Oceans und Mittelmeeres*, 83 pages, 26 plates. Vienna: Alfred Hölder.
- Dana, J.D.
 1853. Tribe III. Cyproidea = Ostracoda. In *Crustacea*. In *United States Exploring Expedition During the Years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U.S.N., with Atlas of 96 plates*, 13(2):1277-1304, plates 90-91. Philadelphia: C. Sherman.
- Deevey, Georgiana B.
 1968. *Bathyconchoecia*, a New Genus of Pelagic Ostracods (Myodocopa Halocyprididae) with Six New Species from the Deeper Waters of the Gulf of Mexico. *Proceedings of the Biological Society of Washington*, 81:539-570, figures 1-13.
- Ellis, Celia J.
 1987. *Bathyconchoecia longispinata* n. sp., a New Species of Halocyprid Ostracod with Seven Carapace Spines. *Crustaceana*, 53(1):83-93, figures 1-4, tables 1-3.
- George, J.
 1971. On the Occurrence of *Bathyconchoecia deeveyae* Kornicker (Ostracoda, Halocyprididae) in the Indian Ocean. *Crustaceana*, 21:141-144.
 1977. *Bathyconchoecia angeli* sp. nov., a New Halocyprid Ostracod from the Malacca Strait, Indian Ocean. *Crustaceana*, 33(1):70-74, figures A-L.
- Hartmann, Gerd
 1974. Zur Kenntnis des Eulitorals der afrikanischen Westküste zwischen Angol und Kap der Guten Hoffnung und der afrikanischen Ostküste von Südafrika und Moçambique unter besondere Berücksichtigung der Polychaeten und Ostracoden, 3: Die Ostracoden des Untersuchungsgebiets. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 69:229-520, figures 1-151.
- Hiruta, Shinichi
 1976. *Euphilomedes nipponica* n. sp. from Hokkaido, with a Redescription of *E. sordida* (G.W. Müller) (Ostracoda: Myodocopina). *Journal of the Faculty of Science of Hokkaido University*, series 6, Zoology, 20(3):579-599.
 1980. Morphology of the Larval Stages of *Vargula hilgendorfi* (G.W. Müller) and *Euphilomedes nipponica* Hiruta from Japan (Ostracoda: Myodocopina.) *Journal of the Hokkaido University of Education*, (Section IIB), 30(2):145-167.
 1981. A New Species of the Genus *Scleroconcha* Skogsberg from Hokkaido (Ostracoda: Myodocopina). *Journal of the Hokkaido University of Education*, (Section IIB), 31(2):59-71, figures 1-8.
 1983. Post-Embryonic Development of Myodocopid Ostracoda. In Rosalie F. Maddocks, editor, *Applications of Ostracoda*, pages 667-677. University Park, Houston: Department of Geosciences, University of Houston.
 1987. A New Species of the Genus *Philomedes* Lilljeborg (Ostracoda: Myodocopina) from Suruga Bay, Central Japan. *Researches on Crustacea*, 16:47-56, figures 1-5, table 1. [Carcinological Society of Japan, Odawara Carcinological Museum, Tokyo.]
- Juday, Chauncy
 1907. Ostracoda of the San Diego Region, II: Littoral Forms. *University of California Publications in Zoology*, 3(9):135-156, plates 18-20.
- Kajiyama, E.
 1912. The Ostracoda of Misaki, Part 2. *Dobutsugaku-zasshi*, 24:609-619, plate 9.
- Klie, Walter
 1940. Beiträge zur Fauna Eulitorals von Deutsch-Südwest-Afrika, II: Ostracoden von der Küste Deutsch-Südwest-Afrikas. *Kieler Meeresforschungen*, 3:403-448.
- Kornicker, L.S.
 1967a. *Euphilomedes arostrata* a New Myodocopid Ostracod from Maldive Islands, Indian Ocean. *Proceedings of the United States National Museum*, 120(3563): 21 pages.
 1967b. *Euphilomedes multichelaia* from the Great Bahama Bank. *Proceedings of the United States National Museum*, 120(3566): 16 pages, 6 figures.
 1967c. Supplementary Descriptions of Two Myodocopid Ostracods from the Red Sea. *Proceedings of the United States National Museum*, 121(3571): 18 pages, 6 figures.
 1967d. The Myodocopid Ostracod Families Philomedidae and Pseudo-philomedidae (New Family). *Proceedings of the United States National Museum*, 120(3580): 35 pages, 12 figures, 1 plate, 2 tables.
 1968. Bathyal Myodocopid Ostracoda from the Northeastern Gulf of Mexico. *Proceedings of the Biological Society of Washington*, 81:439-472, figures 1-10, table 1.
 1969a. *Bathyconchoecia deeveyae*, a Highly Ornamented New Species of Ostracoda (Halocyprididae) from the Peru-Chile Trench System. *Proceedings of the Biological Society of Washington*, 82:403-408, figures 1-2.
 1969b. Morphology, Ontogeny, and Intraspecific Variation of *Spinacopia*, a New Genus of Myodocopid Ostracod (Sarsiellidae). *Smithsonian Contributions to Zoology*, 8: 50 pages, 26 figures, 6 plates, 7 tables.
 1970. Ostracoda (Myodocopina) from the Peru-Chile Trench and the Antarctic Ocean. *Smithsonian Contributions to Zoology*, 32: 42 pages, 25 figures.
 1971. Benthic Ostracoda (Myodocopina: Cypridinacea) from the South Shetland Islands and the Palmer Archipelago, Antarctica. *Antarctic Research Series*, 17:167-216, figures 1-32.
 1974. Revision of the Cypridinacea of the Gulf of Naples (Ostracoda).

- Smithsonian Contributions to Zoology*, 178: 64 pages, 26 figures, 2 tables.
1975. Antarctic Ostracoda (Myodocopina) Parts 1 and 2. *Smithsonian Contributions to Zoology*, 163: 720 pages, 432 figures, 9 plates, 21 tables.
1978. *Harbansus*, a New Genus of Marine Ostracoda, and a Revision of the Philomedidae (Myodocopina). *Smithsonian Contributions to Zoology*, 260: 75 pages, 37 figures, 16 plates, 2 tables.
1979. The Adult Male of *Harbansus bradmyersi* Kornicker, 1978, and a Key to Subfamilies of the Philomedidae (Ostracoda: Myodocopina). *Proceedings of the Biological Society of Washington*, 91(4): 999-1007, figures 1-3.
- 1981a. *Angulorostrum*, a New Genus of Myodocopid Ostracoda (Philomedidae: Pseudophilomedinae). *Smithsonian Contributions to Zoology*, 340: 20 pages, 11 figures, 2 plates.
- 1981b. A Restudy of the Ostracode Genus *Pleoschisma* Brady, 1890 (Myodocopina). *Smithsonian Contributions to Zoology*, 332: 16 pages, 5 figures.
- 1981c. Range Extension and Supplementary Description of *Bathyconchoecia deeveyae* (Ostracoda: Halocyprididae). *Proceedings of the Biological Society of Washington*, 94(4):1237-1243.
- 1981d. Revision, Distribution, Ecology, and Ontogeny of the Ostracode Subfamily Cyclasteropinae (Myodocopina: Cyindroleberididae). *Smithsonian Contributions to Zoology*, 319: 548 pages, 174 figures, 185 plates, 23 tables.
- 1981e. *Harbansus slatteryi*, a New Species of Myodocopine Ostracode from the Great Barrier Reef of Australia (Philomedidae). *Proceedings of the Biological Society of Washington*, 96(1):181-188, figures 1-4.
1982. A Restudy of the Amphiatlantic Ostracode *Philomedes brenda* (Baird, 1850) (Myodocopina). *Smithsonian Contributions to Zoology*, 358: 28 pages, 9 figures, 1 table.
1983. *Zeugophilomedes*, a New Genus of Myodocopine Ostracode. *Proceedings of the Biological Society of Washington*, 93(3): 478-480, figures 1-3.
1984. Philomedidae of the Continental Shelf of Eastern North America and the Northern Gulf of Mexico (Ostracoda: Myodocopina). *Smithsonian Contributions to Zoology*, 393: 78 pages, 45 figures, 3 maps, 1 table.
1987. Ostracoda from the Skagerrak, North Sea (Myodocopina). *Proceedings of the Biological Society of Washington*, 100(4):876-891, figures 1-3.
1988. Myodocopid Ostracoda of the Beaufort Sea, Arctic Ocean. *Smithsonian Contributions to Zoology*, 456: 40 pages, 19 figures, 3 tables.
1989. Bathyal and Abyssal Myodocopid Ostracoda of the Bay of Biscay and Vicinity. *Smithsonian Contributions to Zoology*, 467: 134 pages, 73 figures, 7 tables.
1991. Myodocopid Ostracoda of Enewetak and Bikini Atolls. *Smithsonian Contributions to Zoology*, 505: 140 pages, 71 figures, 7 tables.
- In prep. Myodocopid Ostracoda of the Benthédi Expedition, 1977, to the NE Mozambique Channel, Indian Ocean.
- Kornicker, Louis S., and Martin V. Angel
1975. Morphology and Ontogeny of *Bathyconchoecia septempinosa* Angel, 1970 (Ostracoda: Halocyprididae). *Smithsonian Contributions to Zoology*, 195: 21 pages, 14 figures.
- Kornicker, Louis S., and Francisca Elena Caraión
1974. West African Myodocopid Ostracoda (Cyindroleberididae). *Smithsonian Contributions to Zoology*, 179: 78 pages, 43 figures, 1 table.
1977. West African Myodocopid Ostracoda (Cypridinidae, Philomedidae). *Smithsonian Contributions to Zoology*, 241: 100 pages, 52 figures, 28 plates.
- Kornicker, Louis S., and Thomas M. Illiffe
- 1989a. New Ostracoda (Halocyprida: Thaumatoocyprididae and Halocyprididae) from Anchialine Caves in the Bahamas, Palau, and Mexico. *Smithsonian Contributions to Zoology*, 470: 47 pages, 22 figures, 8 tables.
- 1989b. Ostracoda (Myodocopina, Cladocopina, Halocypridina) Mainly from Anchialine Caves in Bermuda. *Smithsonian Contributions to Zoology*, 475: 88 pages, 49 figures, 22 tables.
- Kornicker, Louis S., and I.G. Sohn
1976. Phylogeny, Ontogeny, and Morphology of Living and Fossil Thaumatoocypridacea (Myodocopa: Ostracoda). *Smithsonian Contributions to Zoology*, 219: 124 pages, 93 figures.
- Müller, G.W.
1890. Neue Cypridiniden. *Zoologische Jahrbücher*, 5:211-252, plates 25-27.
1894. Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. In *Fauna und Flora des Golfes von Neapel*, 21: 404 pages, 40 plates.
1906. Die Ostracoden der Siboga-Expedition. In *Uitkomsten op Zoologisch, Botanisch, Oceanographischen en Geologische Gebeid verzameld in Nederlandsch Oost-Indie, 1899-1900*, 30: 40 pages, 9 plates. Leiden: E.J. Brill.
- Poulsen, E.M.
1962. Ostracoda-Myodocopa, 1: Cypridiniformes—Cypridinidae. *Dana Report*, 57: 414 pages, 181 figures. Copenhagen: Carlsberg Foundation.
1965. Ostracoda-Myodocopa, 2: Cypridiniformes—Rutidermatidae, Sarsiellidae, and Asteropidae. *Dana Report*, 65: 484 pages, 156 figures. Copenhagen: Carlsberg Foundation.
1969. Ostracoda-Myodocopa, 3a: Halocypriformes—Thaumatoocypridae and Halocypridae. *Dana Report*, 75: 100 pages, 40 figures. Copenhagen: Carlsberg Foundation.
1972. On the *Bathyconchoecia* (Ostracoda Myodocopa) from the Azores Collected by the Bathyscaph *Archimede* in 1969. *Tethys*, 4(2): 445-456, figures 1-5.
- Sars, G.O.
1866. Oversigt af Norges marine Ostracoder. *Forhandling i Videnskabs-selskabet i Christiania*, 7(1865):1-130. [Preprint: 1865.]
1869. Undersogelser over Christianiafjordens Dybvandsfauna. *Nyt Magazin for Naturvidenskaberne*, 16:305-362.
1870. Nye Dybvandscrustaceer fra Lofoten. *Forhandling i Videnskabs-selskabet i Christiania*, 12 (1869):169-174.
- Skogsberg, T.
1920. Studies on Marine Ostracods, I: Cypridinids, Halocyprids, and Polycopids. *Zoologiska Bidrag från Uppsala* (supplement), 1: 784 pages, 153 figures.
- Smith, Verna Z.
1952. Further Ostracoda of the Vancouver Island Region. *Journal of the Fisheries Research Board of Canada*, 9(1):19-41, plates 1-11.
- Thomson, G.M.
1879. On the New Zealand Entomostraca. *Transactions and Proceedings of the New Zealand Institute*, 11:251-263, plate 11.
- Tunnicliffe, Verena
1988. Biogeography and Evolution of Hydrothermal-Vent Fauna in the Eastern Pacific Ocean. *Proceedings of the Royal Society of London*, B(233):347-366, figures 1-3, tables 1-3.

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