

Ostracoda (Myodocopina) of the  
SE Australian Continental Slope,  
Part 2

LOUIS S. KORNICKER

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 562

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## ABSTRACT

Kornicker, Louis S. Ostracoda (Myodocopina) of the SE Australian Continental Slope, Part 2. *Smithsonian Contributions to Zoology*, number 562, 97 pages, 54 figures, 1995.—Twenty species (all new) of benthic Myodocopina in 8 genera (1 new) collected at depths of 204–1850 m on the SE Australian continental slope under the auspices of the Museum of Victoria and Victorian Institute of Marine Sciences, Australia, are described and illustrated. A study of the relationship between carapace length of ovigerous females and egg length indicates that egg length varies directly with carapace length in the Cypridinidae, and probably also in the Cylindrolebriidae and Sarsiellinae, and possibly in the Philomedidae. Isopod parasites were found in one philomedid ostracode and choniostomatid copepods in some sarsiellids.

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# Ostracoda (Myodocopina) of the SE Australian Continental Slope, Part 2

*Louis S. Kornicker*

## Introduction

Part 1 (Kornicker, 1994) reported on 35 species of Ostracoda in the suborder Myodocopina collected on the SE Australian continental slope in the Tasman Sea in the area between Sydney, New South Wales, and central eastern Tasmania by personnel of the Museum of Victoria and the Victorian Institute of Marine Sciences, Australia. Part 2 reports on 20 additional species in the Philomedidae and Sarsiellidae, completing those families. The distribution of samples with depth is shown in Table 1, and the geographic distribution in the study area in Table 2. Also included herein is a study of the relationship between carapace size of ovigerous females and egg length based on all species in the collections (Part 1 (Kornicker, 1994), Part 2 (herein), and Part 3 (Kornicker and Poore, in press)) plus some records of species from elsewhere reported in the literature.

STATIONS.—The localities of stations containing specimens reported upon herein are presented in Appendix 1: Station Data with Species in Samples in which the samples are listed chronologically. I have followed the literature received from the Museum of Victoria in designating stations as Slope 1, 2, etc. According to Gary C.B. Poore (1990, in litt.) the stations are on 4 very short transects perpendicular to the shore: Stations Slope 1–18 and Slope 50–64 are off Nowra, southern New South Wales; Stations Slope 19–22 are off Eden, southern New South Wales; Stations Slope 23–41 and Slope 65–72 are off eastern Victoria; Stations Slope 42–49 and Slope 73–85 are off eastern Tasmania. The distribution of species in the 4 transects is shown in Table 2.

SAMPLING.—All samples reported upon herein were collected using a WHOI epibenthic sled. All specimens of Philomedidae and Rutidermatidae were identified and removed

from samples; except for the sample from Slope 40 in which the sarsiellids and cylindroleberids are abundant, most specimens of Sarsiellidae and Cylindroleberididae were identified and removed from samples; relatively few specimens of Cypridinidae (especially those of the genera *Metavargula* and *Paradoloria*) were removed from samples in which they were abundant; many juveniles that could not be identified readily with certainty have been excluded from the study. In only a few instances did I attempt to describe a new species represented in the collection by only juveniles; almost all identifications are based on ovigerous females.

DISPOSITION OF SPECIMENS.—All holotypes have been deposited in the Museum of Victoria, Abbotsford, Australia. Some specimens have been deposited at the National Museum of Natural History, Smithsonian Institution; these have been assigned USNM numbers. All unnumbered identified specimens as well as unidentified specimens have been returned to the Museum of Victoria. Because I have observed that appendages that I have mounted in glycerin dry out in time, most holotypes have been placed in vials with alcohol.

ABBREVIATIONS.—In the figures, Arabic numerals indicate limbs 1–7, as well as individual joints of each limb (the location of the numerals indicating whether a limb or joint is indicated). Roman numerals indicate the endites. Arrows on illustrations indicate anterior.

The following abbreviations are used in the illustrations and legends:

am	central adductor muscle attachments
ant	antenna
ap	anterior process
av	anterior view
bas	basale
Bo	Bellonci organ
br	brush organ
co	copulatory organ

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TABLE 1.—Distribution of species with depth (X = a single sample).

Species	Depth (m)		
	201-500	501-1000	1001-2000
<b>PHILOMEDIDAE</b>			
<i>Euphilomedes ernyx</i>	X		
<i>Harbansus felix</i>	XX		
<i>Harbansus hapax</i>	XX		
<i>Harbansus tenax</i>	X		
<i>Harbansus vatrax</i>	X		
<i>Harbansus vortex</i>	X		
<i>Igene illex</i>		XX	
<i>Scleroconcha solox</i>	X	XXX	X
<b>SARSIELLIDAE</b>			
<i>Alphasarsiella atrix</i>	X		
<i>Alphasarsiella anax</i>	X		
<i>Cymbicopia cervix</i>	XX		
<i>Cymbicopia climax</i>	X		
<i>Neomuelleriella klomax</i>		X	
<i>Neomuelleriella nex</i>	XX		
<i>Spinacopia crux</i>	X		
<i>Spinacopia illex</i>	X		
<i>Spinacopia rex</i>		X	XXXXXX
<i>Spinacopia sandix</i>	XX		
<i>Spinacopia syrinx</i>	X		
<i>Spinacopia trox</i>	X		

cx	coxale
end	endopodite
epip	epipodite
esop	esophagus
ex	exopodite
fu	furca
go	genital organ
gird	girdle
im	inner margin of infold
iv	inside view
le	lateral eye
lv	lateral view
me	medial eye
mnd	mandible
mo	mouth
mv	medial view
mx	maxilla
ov	outside view
p	parasite
precx	precoxale
prot	protopodite
pv	posterior view
5	sensory bristle of 5th joint of 1st antenna
t	testis
ul	upper lip
Y-scl	Y-sclerite

ACKNOWLEDGMENTS.—Initial correspondence concerning the ostracodes received from the Museum of Victoria was with

TABLE 2.—Geographic distribution of species (X = a single sample).

Species	Transect			
	Southern NSW		Victoria S of Point Hicks	Off eastern Tasmania
	off Nowra	off Eden		
<b>PHILOMEDIDAE</b>				
<i>Euphilomedes ernyx</i>		X		
<i>Harbansus felix</i>	X		X	
<i>Harbansus hapax</i>	XX			
<i>Harbansus tenax</i>			X	
<i>Harbansus vatrax</i>	X			
<i>Harbansus vortex</i>		X		
<i>Igene illex</i>	XX			
<i>Scleroconcha solox</i>	X		X	XX
<b>SARSIELLIDAE</b>				
<i>Alphasarsiella atrix</i>			X	
<i>Alphasarsiella anax</i>		X		
<i>Cymbicopia cervix</i>			X	
<i>Cymbicopia climax</i>		X		
<i>Neomuelleriella klomax</i>		X		
<i>Neomuelleriella nex</i>		X	X	
<i>Spinacopia crux</i>	X			
<i>Spinacopia illex</i>		X		
<i>Spinacopia rex</i>			XXXXXX	XX
<i>Spinacopia sandix</i>	X	X		
<i>Spinacopia syrinx</i>			X	
<i>Spinacopia trox</i>	X			



Jean Just; later correspondence was with Gary C.B. Poore, who with others, collected the specimens aboard the ORV *Franklin* and their assistance is very much appreciated. I am grateful to several people who assisted in preparation of this paper: the final drawings were inked by Jack Schroeder, Jack Schroeder Associates, Molly Ryan, Smithsonian Institution, and two volunteers: Marsha Leaders and Patricia Condit; and Elizabeth Harrison-Nelson, Smithsonian Institution, prepared the Literature Cited section, labeled figures, cataloged specimens, and helped in many other tasks. I also thank Anne C. Cohen for reviewing the manuscript, and Craig Warren, Smithsonian Institution Press, for editing and preparing the manuscript.

### Suborder MYODOCOPINA Sars, 1866

This suborder includes five families, all represented on the Australian continental slope. The Philomedidae and the Sarsiellidae are concluded herein.

#### PHILOMEDIDAE Müller, 1906

The Philomedidae include the two subfamilies Philomedinae and Pseudophilomedinae; both were reported in Part 1 and are concluded herein.

#### PHILOMEDINAE Müller, 1906

Species of *Philomedes* and *Pleoschisma* were described in Part 1. Species of *Euphilomedes*, *Igene*, and *Scleroconcha* are described herein.

#### *Igene* Kornicker, 1975

TYPE SPECIES.—*Igene walleni* Kornicker, 1975:367, by monotypy.

DISTRIBUTION.—Pacific Quadrant within the Antarctic Convergence, 3386–3817 m; off Pacific Coast of Chile, 4303 m; northwest Pacific, 4945–5240 m; southeast of Glorioso islands, Indian Ocean, 3716 m; and southern slope of Australia, 770–996 m. The Australian record is the first from bathyal depth; known depth range 770–5240 m.

COMPOSITION.—Including the new species described herein, four species are known in the genus: *I. walleni* Kornicker, 1975:368; *I. curtus* Chavtur, 1983:72; *I. bryx* Kornicker, 1992:117; and *I. illex*, new species.

#### *Igene illex*, new species

FIGURES 1–3

ETYMOLOGY.—From the Latin *illex* (contrary to law, lawless).

HOLOTYPE.—Undissected adult female in alcohol in the collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 6, 34°51.90'S, 151°12.60'E, New South Wales, off Nowra; depth 770 m.

PARATYPES.—Slope 6: ovigerous female on slide and in alcohol. Slope 53: USNM 194008, A–1 male on slide and in alcohol; 1 instar I in alcohol; 2 late instars in alcohol.

DISTRIBUTION.—Slope 6, 770 m. Slope 53, 996 m.

REMARKS.—The A–1 male was described prior to finding an adult female in the collection. Because of that sequence the description of the adult female follows that of the A–1 male.

DESCRIPTION OF A–1 MALE (Figures 1, 2).—Carapace oval in lateral view with prominent rostrum, broad incisur, rounded posterior, and slight bulge at anteroventral corner (Figure 1a,c). Outer surface with long undivided bristles abundant along margins and sparse elsewhere (Figure 1a), and sparse short slender bristles. Carapace of USNM 194008 uncalcified, flexible.

*Infold*: Infold of rostrum with row of 12 or 13 divided bristles (some spinous) parallel to anterior edge of rostrum (Figure 1b); 2 additional bristles on ventral edge near incisur; 1 small bristle present on infold posterior to inner end of incisur; anteroventral infold with 8 striae but no bristles (Figure 1c); 2nd of the striae from outer edge of valve continues as narrow list along ventral and posterior margins; list located at about midwidth of infold along anterior  $\frac{2}{3}$  of ventral margin but close to inner margin of infold along posterior  $\frac{1}{3}$  of ventral and posterior margins; ventral infold without bristles; infold of posteroventral corner and posterior margin with about 24 bare undivided short bristles between list and shell edge, most bristles close to list (not all bristles shown in Figure 1d); outer edge of posterior infold with numerous minute pores or processes (not all shown in Figure 1d).

*Selvage*: Broad lamellar prolongation with marginal fringe of long hairs along anterior and ventral margins but narrow without fringe along posterior margin (Figure 1d); prolongation segmented along edge of rostrum and along inner part of ventral margin of incisur; prolongation divided at inner end of incisur; anteroventral and anterior half of ventral prolongation with long streamers (some with bases on prolongation near proximal edge, but most with bases on valve edge).

*Central Adductor Muscle Attachments* (Figure 1e): With 3 elongate and about 14 oval attachments.

*Carapace Size* (length, height in mm): USNM 194008, 1.62, 1.08.

*First Antenna* (Figure 1f): 1st joint with long medial hairs. 2nd joint with long spines along ventral and dorsal margins and distally on lateral side near ventral margin, and 3 spinous bristles (1 dorsal, 1 ventral, 1 lateral). 3rd joint short with dorsal margin longer than ventral, with 3 bristles (1 ventral, 2 dorsal). 4th joint with 4 spinous bristles (3 ventral, 1 dorsal). Sensory bristle of 5th joint with about 5 short proximal and 5 longer terminal filaments. 6th joint fused to 5th, with small medial bristle. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with short marginal spines; b-bristle about twice length of a-bristle, with 1 short proximal and 4 longer terminal filaments;

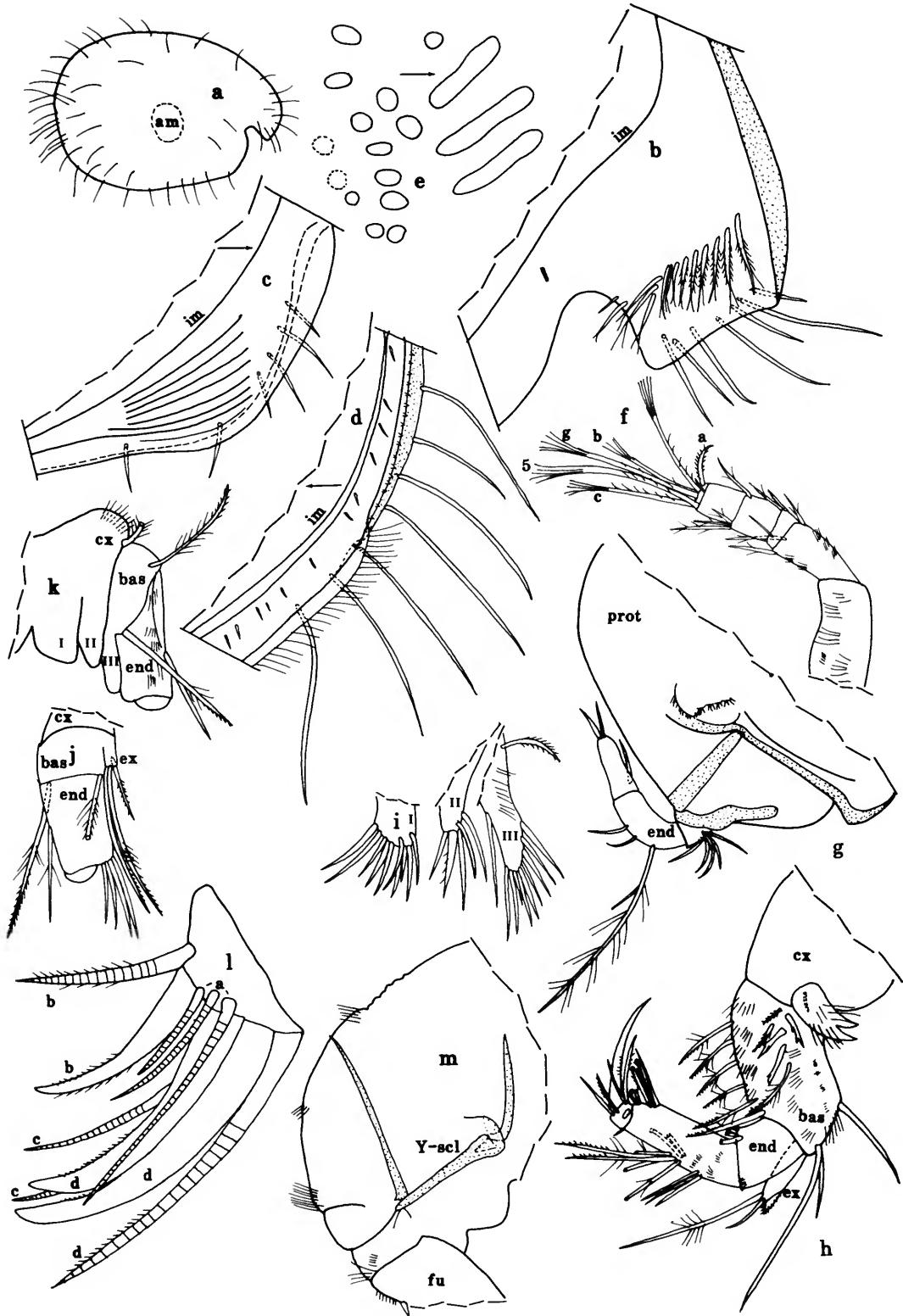


FIGURE 1.—*Igene illex*, new species, A-1 male, paratype, USNM 194008: *a*, complete specimen from right side, length 1.62 mm (dashed oval indicates location of central adductor muscle attachments); *b*, rostrum, left valve, iv; *c*, anteroventral corner, left valve, iv; *d*, posteroventral corner, right valve, iv; *e*, central adductor muscle attachments of right valve (body removed), ov; *f*, right 1st antenna, mv; *g*, protopodite and endopodite of left 2nd antenna, mv; *h*, left mandible, mv; *i*, endites of maxilla (limb B); *j*, basale, exopodite, and endopodite of maxilla (limb B, not all bristles shown); *k*, maxilla (limb A, not all bristles shown); *l*, 2nd endopodial joint of maxilla (limb A); *m*, posterior of body from right side showing sclerites (stippled).

c-bristle shorter than sensory bristle of 5th joint, with 6 short proximal and 5 longer terminal filaments. 8th joint: d- and e-bristles same length as sensory bristle of 5th joint, bare with blunt tips; f-bristle shorter than c-bristle, with 5 short proximal and 5 longer terminal filaments; g-bristle same length as bristle of 5th joint, with 3 short proximal and 5 longer terminal filaments.

**Second Antenna:** Protopodite with rows of medial spines near midlength (Figure 1g). Endopodite 3-jointed (Figure 1g): 1st joint short with 5 small bare bristles; 2nd joint elongate with 1 long spinous bristle and 2 short bristles with terminal spine; 3rd joint elongate with 3 bristles (1 proximal, 2 terminal) with terminal spine. Exopodite: 1st joint with minute, straight, tubular, medial bristle; bristles of joints 2-8 slightly longer than combined lengths of joints 2-8, bare, each with minute talon-like tip; 9th joint with 6 bristles (3 shortest form dorsal group and bear short marginal spines; 3 longer bristles terminal, bare or with few distal ventral spines and talon-like tips); joints 2-8 with terminal rows of short and long spines.

**Mandible** (Figure 1h): Coxale endite deeply bifurcate, spinous, with minute ringed bristle near base (dashed in Figure 1h). Basale: medial surface with rows of spines and long hairs, 5 proximal bristles (3 stout pectinate, 2 short slender spinous ringed), and 1 longer bristle (with long proximal and short distal spines) at midlength; 6 bristles (with long proximal and short distal spines) on or near ventral margin (terminal bristle longest); lateral surface with proximal spines; dorsal margin with 3 bristles (1 near midlength, 2 subterminal). Exopodite about same length as dorsal margin of 1st endopodial joint, with hirsute distal pad and 2 subterminal bristles (proximal bristle longer, with long spines near midlength; distal short bristle with indistinct short marginal spines). 1st endopodial joint with 4 spinous ventral bristles (3 long, 1 short), and row of spines along distal dorsal corner. 2nd endopodial joint: medial surface with proximal rows of spines; ventral margin with distal spinous bristles forming 2 groups (proximal with 3 bristles; distal with 2 or 3); dorsal margin with spinous bristles forming 2 closely spaced groups (proximal with 3 bristles; distal with 7 longer bristles). 3rd endopodial joint with 2 claws (dorsal claw short) and 3 ringed bristles (an oval "socket" proximal to base of terminal claw on both limbs of USNM 194008 probably indicates a missing medial claw). (Rings and spines of bristles not always shown.)

**Maxilla** (Figure 1i-l): Coxale with dorsal fringe and long

dorsal bristle with long proximal hairs and short distal spines. Endite I broad with 10 spinous and pectinate bristles (Figure 1i); endite II narrow, with 5 spinous and pectinate bristles; endite III long narrow, hirsute, with 10 spinous and pectinate bristles; 1 additional long proximal bristle (with short spines) on either endite II or III. Basale with 3 long spinous bristles (2 ventral, 1 dorsal). Exopodite short with 3 bristles (proximal short with short spines, 2 terminal long with long proximal and short distal spines). 1st endopodial joint with spines along anterior margin, 1 long alpha-bristle and 4 beta-bristles. 2nd endopodial joint with 3 slender a-bristles, 2 b-bristles (anterior ringed, posterior claw-like), 2 ringed c-bristles, and 3 d-bristles (2 anterior claw-like, posterior bristle-like ringed).

**Fifth Limb** (Figure 2a-c): Endites I and II each with 6 or 7 spinous bristles; endite III with about 10 spinous bristles (not all bristles shown in Figure 2c). 1st exopodial joint: main tooth with 4 pectinate teeth (distal tooth largest and with large anterior triangular cusp) (Figure 2b); spinous ringed bristle proximal to main tooth; anterior side of joint with 2 long bristles at midwidth and 1 smaller spinous bristle as well as stout spines on lobe at outer corner (Figure 2c). 2nd exopodial joint: large flat triangular with 2 small cusps on inner edge; posterior side with stout c-bristle and row of 3 bristles (1 small bristle on each side of stout bristle (Figure 2a)). Inner lobe of 3rd exopodial joint with 3 bristles (bare or with minute spines); outer lobe with 2 bristles with long hairs. Fused 4th and 5th exopodial joints with total of 6 spinous bristles (Figure 2a).

**Sixth Limb** (Figure 2d): With 3 short epipodial bristles with long proximal hairs. Endite I with 2 short plumose medial and 1 long terminal bristle with wreaths of long spines; endite II with 1 spinous medial and 3 long spinous terminal bristles; endite III with 1 spinous medial and 7 or 8 spinous terminal bristles; endite IV with 1 spinous medial and 7 spinous terminal bristles. End joint with 12 or 13 spinous and hirsute bristles (include 2 slender bristles with long proximal and short distal spines on distal posterior edge of joint (bristles of this type not previously reported on posterior edge of Philomedidae)).

**Seventh Limb** (Figure 2e): Proximal group with 4 bristles (2 on each side) of similar length, each with 2 or 3 bells; terminal group with 5 bristles (2 on comb side, each with 3 or 4 bells; 3 on peg side, each with 2-4 bells), some with few distal spines; short bristles slightly bulbous proximally (juvenile character). Terminus with comb of about 14 short alate teeth opposite 2 pegs with rounded tips.

**Furca** (Figure 2f,g): Each lamella with 9 articulated claws decreasing in length and width posteriorly along lamella; all claws with stout teeth along posterior edge; claw 1 with posterior teeth 2-6 stouter than teeth 1, 7-10, and with row of stout medial teeth; claws 7-9 with small teeth along anterior edge; claws 1-8 with row of very long medial hairs near base (Figure 2g); long spines present on edge of lamella after last claw; anterior edge of right lamella with distal spines.

**Bellonci Organ** (Figure 2h): Short bare with minute triangular process at tip.

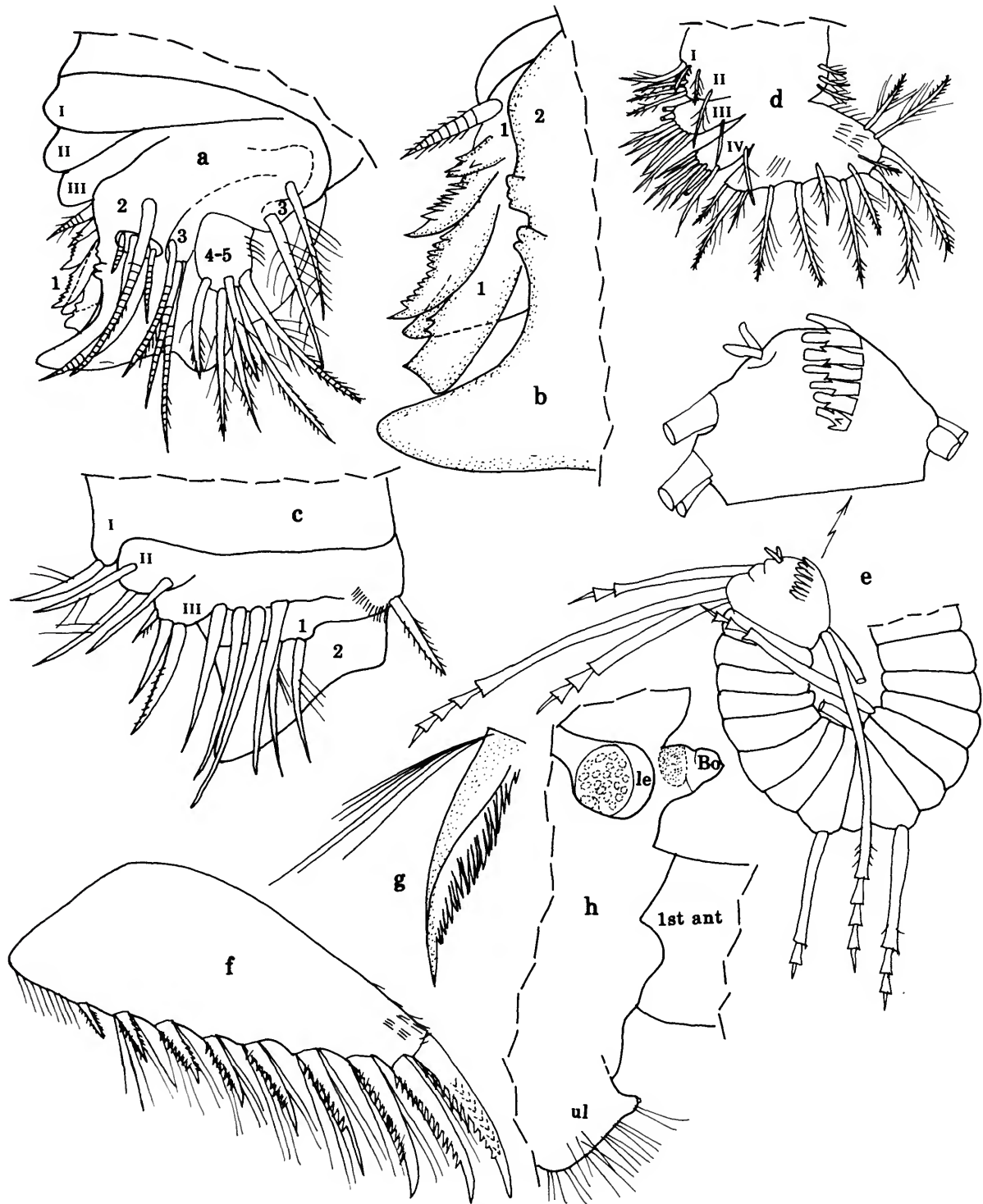


FIGURE 2.—*Igene illex*, new species, A-1 male, paratype, USNM 194008: a, right 5th limb, pv (endite bristles not shown); b, detail from a; c, part left 5th limb, av (not all bristles or spines shown); d, right 6th limb, mv; e, 7th limb; f, right furcal lamella; g, claw 5 of right lamella, mv; h, anterior of body from right side showing right lateral eye, medial eye, Bellonci organ, proximal part of 1st joint of right 1st antenna, and upper lip.

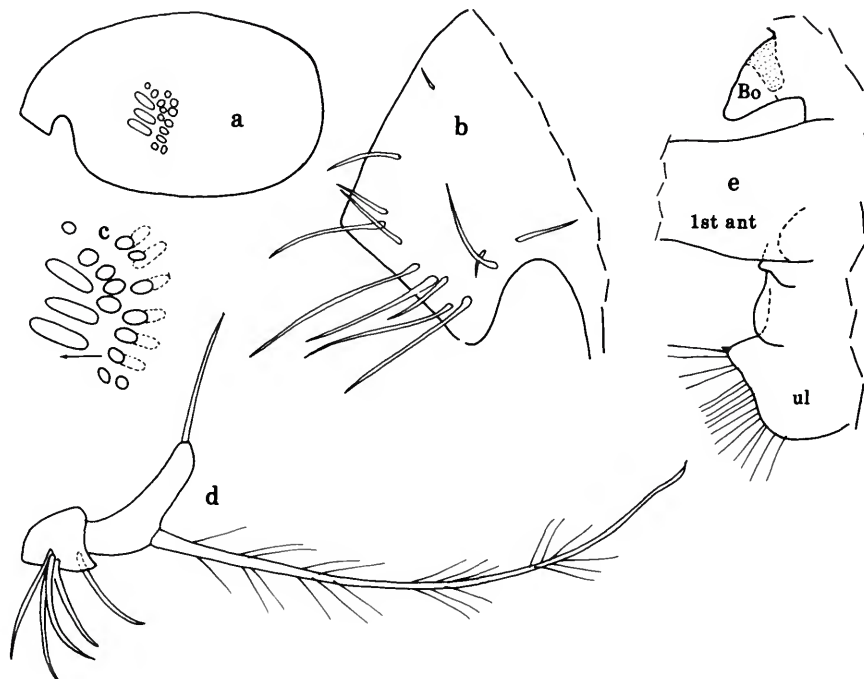


FIGURE 3.—*Igene illex*, new species, ovigerous female from Slope 6, paratype: a, complete specimen from left side showing central adductor muscle attachments, length 1.74 mm; b, rostrum, left valve, ov; c, detail of central adductor muscle attachments from a; d, endopodite of right 2nd antenna, mv; e, anterior of body from left side showing medial eye and Bellonci organ, part of 1st joint of left 1st antenna, and upper lip.

**Eyes** (Figure 2h): Medial eye small with dark brown pigment. Lateral eye larger than medial eye with numerous small amber-colored cells.

**Upper Lip** (Figure 2h): Conical with minute process on anterior tip, hirsute.

**Genitalia**: Not developed.

**Posterior of Body** (Figure 1m): Posterior with rows of hairs and spines; posterodorsal corner with row of spines.

**Y-Sclerite** (Figure 1m): Unbranched with broad club-like anterior end.

**DESCRIPTION OF ADULT FEMALE** (Figure 3).—Carapace similar in shape and ornamentation to that of A-1 male (Figure 3a,b).

**Infold**: Infold of rostrum with 17 bristles parallel to anterior edge and 2 additional bristles on ventral edge near incisur. Remainder of infold not examined.

**Selvage and Central Adductor Muscle Attachments** (Figure 3c): Similar to those of A-1 male.

**Carapace Size** (length, height in mm): Slope 6: holotype and paratype, 1.74, 1.18.

**First Antenna**: Joints 1-6 similar to those of A-1 male. C-bristle of 7th joint about same length as f-bristle of 8th joint, and both only slightly shorter than g-bristle of 8th joint; g-bristle same length as sensory bristle of 5th joint; filaments of bristle of 5th joint and bristles of 7th and 8th joints not counted but appear similar to those of A-1 male.

**Second Antenna**: Protopodite similar to that of A-1 male. Endopodite 2-jointed (Figure 3d): 1st joint short, with 5 slender bare bristles; 2nd joint elongate, tapering distally, with long spinous ventral and short bare terminal bristle. Exopodite: 1st joint with minute, straight, tubular, medial terminal bristle; bristles of joints 2-5 about same length as combined joints 2-8, bare, each with minute talon-like tip (tip broken off on most bristles); bristles of joints 6-8 broken, without spines or hairs on remaining part; 9th joint with 7 bristles (4 shortest with short spines form dorsal group; 3 longer bristles broken, without spines or hairs on remaining part); most joints without usual row of terminal spines.

**Mandible**: Coxale endite, exopodite, and 1st endopodial joint similar to those of A-1 male. Basale with 7 bristles on or near ventral margin, otherwise similar to that of A-1 male. 2nd endopodial joint: dorsal margin with 4 bristles in proximal group and 6 longer bristles in distal group; ventral margin with 3 spinous bristles in both proximal and distal groups; medial surface with spines. 3rd endopodial joint with 3 claws (dorsal claw  $\frac{1}{4}$  to  $\frac{1}{2}$  length of longest claw; medial claw about  $\frac{3}{4}$  length of lateral claw) and 3 bristles.

**Maxilla**: Coxale, basale, exopodite, and 1st endopodial joint similar to those of A-1 male. Endites similar to those of A-1 male except endite II with 6 bristles. Bristles of 2nd endopodial joint obscured.

**Fifth Limb:** Endites with about same number of bristles as on A-1 male. Exopodite similar to that of A-1 male.

**Sixth Limb:** Epipodite and endites similar to those of A-1 male. End joint with 16 bristles including 3 slender bristles (with long thin hairs at midlength) along posterior edge dorsal to the 2 stout plumose bristles on posteroventral corner; shape of end joint similar to that of A-1 male.

**Seventh Limb:** Proximal group with 4 bristles (2 on each side) of similar length, each with 4 bells. Terminal group with 5 bristles (2 or 3 on comb side, each with 3-5 bells; 2 or 3 on peg side, each with 3-5 bells), some with indistinct distal spines. Comb and pegs similar to those of A-1 male.

**Furca:** Paratype from Slope 6 with 9 claws on right lamella and 10 on left; claws and lamellae, in general, similar to those of A-1 male.

**Bellonci Organ** (Figure 3e): Similar to that of A-1 male except minute triangular terminal process absent.

**Eyes:** Medial eye similar to that of A-1 male (Figure 3e). Lateral eyes absent.

**Upper Lip** (Figure 3e), **Posterior of Body**, and **Y-Sclerite:** Similar to those of A-1 male.

**Genitalia:** Small oval on each side of body anterior to furca.

**Number of Eggs:** Paratype from Slope 1 with 5 eggs in marsupium (length of typical egg 0.42 mm).

**Behavior:** Long bristles of joints 6-9 of the exopodite of the 2nd antenna of the ovigerous paratype from Slope 6 as well as the holotype (adult female without eggs in marsupium) are broken, indicating that those females are no longer capable of swimming. Broken bristles have been reported previously on other genera of the Philomedidae (Kornicker, 1975:74), but not on *Igene*. Natatory hairs are absent on exopodial bristles of adult females of *I. walleni* and *I. bryx* but no bristles are broken. The broken bristles of the female *I. illex* suggest that the missing parts have natatory hairs.

**COMPARISONS.**—The carapace of *I. bryx* differs from that of *I. illex* in having a projecting caudal process. The 2nd endopodial joint of the female 2nd antenna of *I. illex* differs from those of *I. walleni* and *I. curtus* in having a terminal bristle; the terminal bristle of *I. illex* is much longer than that of *I. bryx*. The 7th limbs of *I. illex* differ from those of *I. curtus* and *I. walleni* in having more comb teeth and terminal pegs. The Y-sclerite is unknown for *I. curtus*, but on *I. walleni* and *I. bryx* the sclerite is branched; whereas it is unbranched with a broad anterior end on *I. illex*. The posterior margin of the end joint of the 6th limb of *I. illex* bears 2 or 3 slender bristles dorsal to the 2 stout plumose bristles on the posteroventral corner; these have not been reported on previously described species of Philomedidae. The male *I. illex* has lateral eyes; they are absent on *I. walleni* and *I. bryx*, which are from much deeper water; the male is unknown for *I. curtus*.

**REMARKS.**—The Y-sclerite of *I. illex* resembles that of species of *Zeugophilomedes* Kornicker, 1983b:478. The distribution of the furcal claws of *I. illex* clearly shows that the

species should not be referred to *Zeugophilomedes*. Species of *Tetragonodon* Brady and Norman, 1896:667, as revised by Kornicker (1989:82), also have an unbranched Y-sclerite, but unlike that of *I. illex*, it is slender and without a broad tip. *Igene illex* is referred to the Philomedinae rather than the Pseudo-philomedinae because of the backward projecting end joint of the 6th limb; however, without knowledge of the morphology of the sensory bristle of the 5th joint of the 1st antenna of the adult male, the referral cannot be made with certainty. The unusual Y-sclerite of *I. illex* may warrant proposal of a new genus for species of Philomedinae having the club-like sclerite and a furca having no secondary claws between primary claws.

### *Scleroconcha* Skogsberg, 1920

**TYPE SPECIES.**—*Philomedes (Scleroconcha) appelloefi* Skogsberg, 1920.

**COMPOSITION.**—Only one species is known from the vicinity of Australia, *S. solox*, new species, herein.

**DISTRIBUTION.**—The genus is cosmopolitan; members have been collected at shelf and slope depths (intertidal to 1264 m).

### *Scleroconcha solox*, new species

FIGURES 4-7

**ETYMOLOGY.**—From the Latin *solox* (coarse, rough, bristly).

**HOLOTYPE.**—Partly dissected A-1 male in alcohol in collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 46, 42°0.20'S, 148°37.70'E, Tasmania off Freycinet Peninsula, depth 720 m.

**PARATYPES.**—Slope 39: USNM 194014, ovigerous female on slide and in alcohol (furca, eyes, and Bellonci organ lost). Slope 45: 6 juveniles in alcohol. Slope 46: 2 A-2 instars in alcohol. Slope 56: USNM 194015, adult male on slide and in alcohol. Slope 81: 8 juveniles in alcohol.

**DISTRIBUTION.**—Slope 39, 600 m. Slope 45, 800 m. Slope 46, 720 m. Slope 56, 429 m. Slope 81, 1264 m. Known depth range 429-1264 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 4, 5).—Carapace oval in lateral view with prominent rostrum (Figure 4a); posterior edge of left valve overlaps posterior edge of right valve resulting in more acute caudal process on right valve than on left; a triangular lateral process extends slightly past anteroventral corner of rostrum (Figure 4b).

**Ornamentation** (Figure 4a-c): Lateral surface with prominent rib just within ventral margin terminating anteriorly in small triangular process, and terminating posteriorly on caudal process; a 2nd short rib with anterior end at valve midlength just posterior to central adductor muscle attachments, and posterior end just anterior to caudal process; a 3rd rib dorsal to central adductor muscle attachments terminates anteriorly as process extending just past anterior end of triangular lateral process of rostrum and posteriorly joins an oblique rib

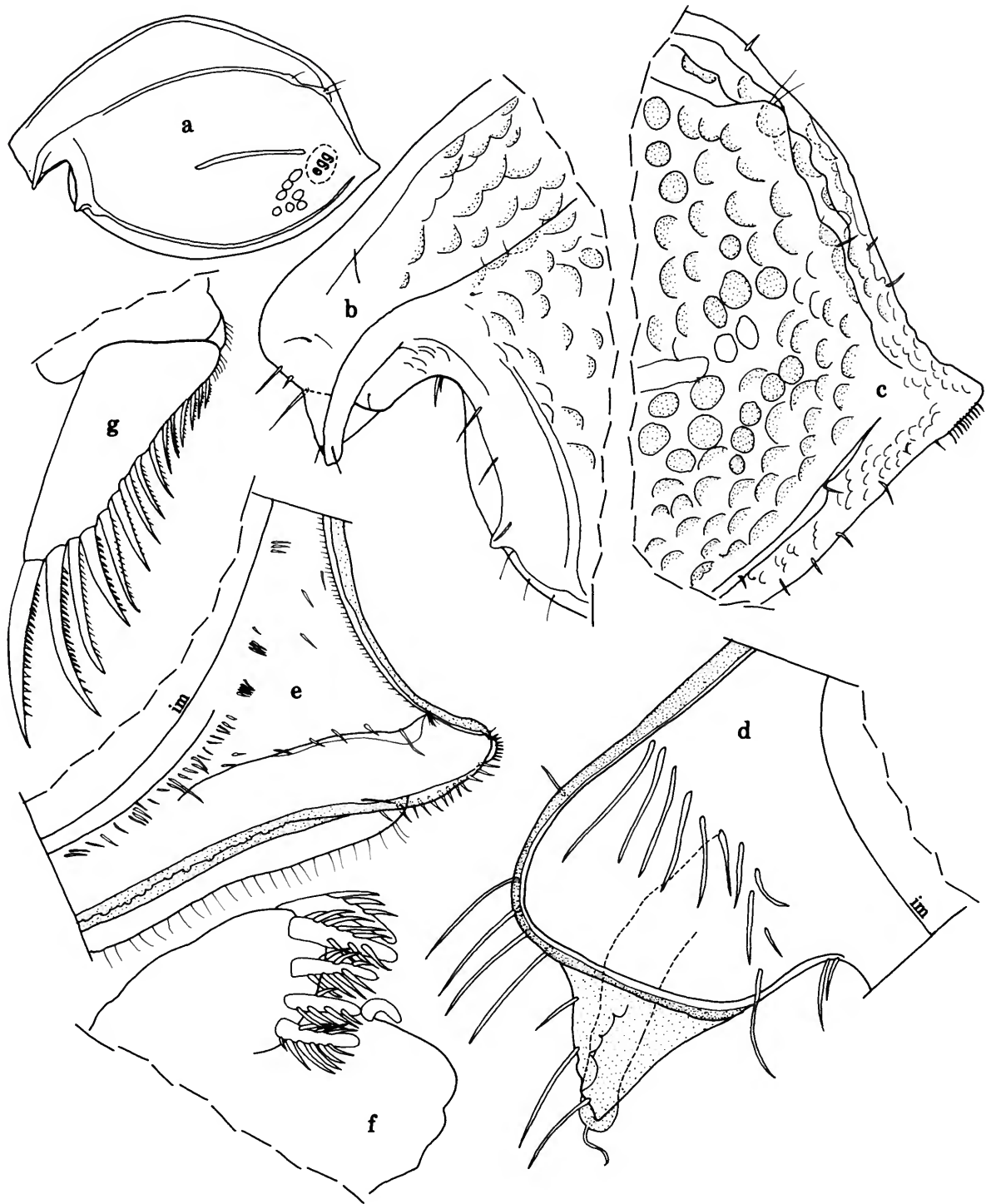


FIGURE 4.—*Scleroconcha solox*, new species, ovigerous female, paratype, USNM 194014: a, complete specimen from left side showing 1 egg (dashed oval) and representative fossae, length 3.03 mm; b, c, anterior and posterior of left valve, ov; d, rostrum, right valve, iv; e, caudal process, right valve, iv; f, tip of 7th limb (bristles not shown); g, left furcal lamella.

terminating on caudal process (posterior end of 3rd rib bears 2 weakly defined processes); a 4th rib lies just within dorsal margin of valve. Surface of valve with abundant round fossae; part of edge of those fossae away from middle part of valve more strongly developed and appearing as crescents with convex edge facing middle of valve; surface between fossae with abundant minute pustules; ventral margin of valve with row of small button-like processes (processes just anterior to caudal process shown in Figure 4e). Undivided bristles, some with broad bases, sparsely distributed over valve surface, more numerous along ventral margin; a row of about 10 short closely spaced bristles present along ventral margin of caudal process (Figure 4c,e).

*Infold:* Rostral infold with 11–13 bristles (Figure 4d); 2 bristles present on valve edge at inner end of incisur; 1 small bristle present ventral to inner edge of incisur; anteroventral infold with 10 or 11 ridges and, also, 17–21 bristles forming row parallel to valve edge; infold along middle of ventral margin bare; posterior end of ventral infold and posterior infold in vicinity of caudal process with about 80 slender bristles forming groups of up to 5 bristles; infold of caudal process with narrow flap bearing 6 or 7 small bristles (posterior bristle longer); 1 small bristle between shelf and ventral edge of valve (close to edge); edge of flap with narrow bare lamellar prolongation (Figure 4e). Area dorsal to flap and between row of slender bristles and valve edge of USNM 194014 with 3 bristles on right valve (Figure 4e) and 6 on left valve.

*Selvae:* Broad lamellar prolongation with marginal fringe present along anterodorsal, anterior, and ventral margins of valve; lamellar prolongation narrower and with shorter fringe along posterior edge of valve; lamellar prolongation narrow or absent along ventral edge of caudal process in vicinity of row of closely spaced bristles (Figure 4e); selvae along anterior ventral margin with long slender bristles with bases appearing to be on prolongation but having pore canals reaching valve edge. Selvae divided at inner end of incisur.

*Carapace Size* (length, height in mm): USNM 194014, 3.03, 1.95.

*First Antenna:* 1st joint with few medial and lateral spines. 2nd joint spinous, with 3 bristles (1 ventral, 1 dorsal, 1 lateral) with long proximal spines. 3rd joint with ventral and dorsal spines and 3 bristles (1 ventral, 2 dorsal) with long proximal and short distal spines. 4th joint spinous, with 5 bristles (3 ventral, 2 dorsal) with long proximal spines. 5th joint without spines; sensory bristle with about 8 short proximal filaments and 5 terminal filaments including stem. Medial bristle of minute 6th joint with long proximal and short distal spines. 7th joint: a-bristle about  $\frac{1}{4}$  longer than bristle of 6th joint, with long proximal and short distal spines; b-bristle about  $\frac{1}{3}$  longer than a-bristle, shorter than bristle of 5th joint (filaments not counted); c-bristle about same length as bristle of 5th joint, with short proximal filaments and 5 distal filaments. 8th joint: d- and e-bristles bare with blunt tips, about same length as b-bristle; f- and g-bristles about same length as c-bristle with short

proximal filaments and 5 distal filaments. Shape of joints similar to those of *S. ruffi* (Kornicker, 1988, fig. 12a).

*Second Antenna:* Protopodite bare (Figure 5a). Endopodite 2 jointed (Figure 5a): 1st joint with 6 subequal bristles (5 proximal, 1 distal); 2nd joint with long proximal bristle with 9 wreaths of long spines, and 1 short slender straight terminal bristle. Exopodite: 1st joint with minute medial bristle on distal margin; bristles of joints 2–4 bare, fairly short but all reaching well past 9th joint; bristles of joints 5–8 or 6–8 broken, with natatory hairs on remaining part; 9th joint with 7 bristles (3 long (broken), 2 medium (1 or 2 broken), 1 short, all with natatory hairs, and 1 minute with short hairs); joints 5–8 each with slender basal spine slightly shorter than 9th joint; joints 2–8 with row of small spines along distal edge.

*Mandible:* Coxale bare or with few medial spines; endite with numerous spines and bifurcate tip bearing small teeth; minute indistinct bristle near base; minute spine-like process between terminal bifurcations. Basale: dorsal margin with 3 spinous bristles (1 at distal  $\frac{3}{4}$ , 2 subterminal); medial surface hirsute, with 5 bristles (3 pectinate unringed, 2 ringed with long proximal and short distal spines) in proximal ventral corner, and 1 ringed spinous bristle closer to middle of joint; ventral margin with 9 spinous bristles (some with bases on medial surface near ventral margin). Exopodite hirsute with pointed tip reaching  $\frac{3}{4}$  length of dorsal margin of 1st endopodial joint, with 2 bristles bearing wreaths of long spines (distal bristle about  $\frac{3}{4}$  length of proximal bristle). 1st endopodial joint with medial spines and 4 ventral bristles bearing wreaths of long spines. 2nd endopodial joint: ventral margin with bristles (with short spines) forming 2 distal groups (3 bristles in each group); dorsal margin with 8–11 spinous bristles near midlength, some with bases on medial and lateral sides of joints; medial surface and proximal dorsal margin spinous. 3rd endopodial joint with 3 claws (dorsal claw about half length of lateral claw; medial claw about  $\frac{3}{5}$  length of lateral claw; dorsal and lateral claw with indistinct proximal ventral teeth) and 4 ringed bristles.

*Maxilla:* Endite I with 11 spinous bristles (1 minute); endite II with 6 spinous bristles; endite III with abundant long proximal hairs, 1 proximal bristle and about 8 terminal bristles. Basale with 2 long bristles (1 ventral, 1 dorsal); usual short dorsal bristle absent (possibly obscured). Exopodite with 1 short proximal and 2 long terminal bristles. 1st endopodial joint with 1 alpha-bristle with long proximal and short distal spines and 5 beta-bristles. 2nd endopodial joint: 2 b-bristles (anterior ringed, spinous; posterior claw-like); 2 of d-bristles claw-like; remaining a-, c-, and d-bristles ringed. Usual dorsal bristle of coxale missing, possibly broken off.

*Fifth Limb:* With 3 endites. 1st exopodial joint: main tooth with 4 pectinate cusps (Figure 5b); distal cusp with proximal smooth triangular anterior cusp (Figure 5c); 1 bristle (with long proximal and short distal spines) proximal to smallest pectinate cusp; anterior side with 2 bristles (1 with long proximal and short distal spines, other with only short spines) at midwidth; outer corner with small lobe with small bristle (Figure 5c). 2nd



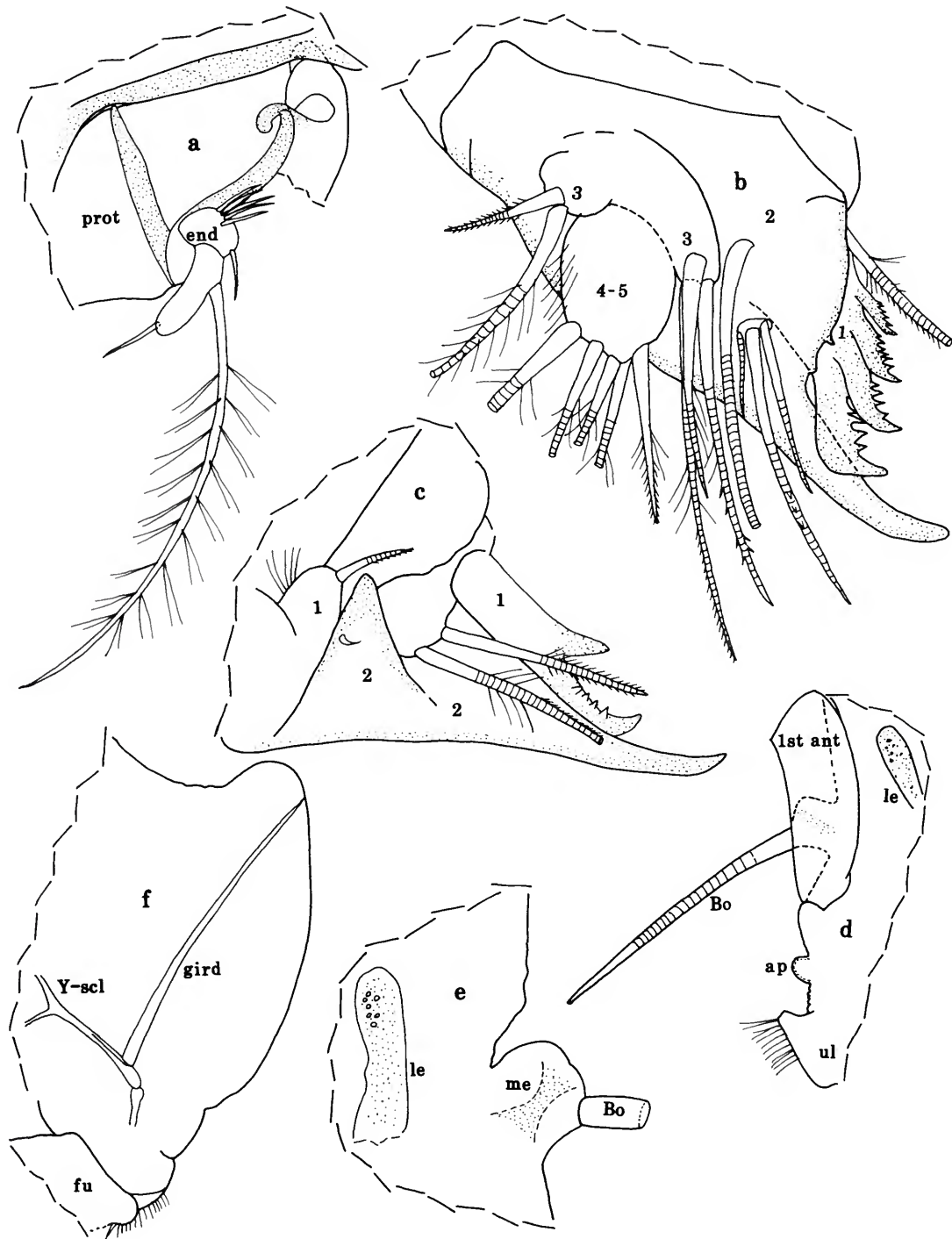


FIGURE 5.—*Scleroconcha solox*, new species, oviger female, paratype, USNM 194014: *a*, distal protopodite, endopodite, and proximal part of 1st joint of exopodite, left 2nd antenna, mv; *b*, distal end of left 5th limb, pv; *c*, distal end of right 5th limb, av (only distal cusp of main tooth of 1st joint shown; endite bristles not shown); *d*, anterior of body from left side showing left lateral eye, medial eye, Bellonci organ, anterior process, and upper lip; *e*, anterior of body from right side showing right lateral eye, medial eye, and proximal part of Bellonci organ; *f*, posterior of body from left side showing internal sclerites.

exopodial joint: large tooth with 1 small pointed tooth along inner margin (Figure 5b) and minute indistinct bristle on triangular outer corner (Figure 5c); posterior side with long proximal bristle with few spines and 3 closely spaced distal bristles (inner bare, about half length of middle bristle; middle bristle with few spines; outer bare, about half length of inner). 3rd exopodial joint: inner lobe with 3 bristles with long proximal and short distal spines; outer lobe with 2 bristles (1 long with long proximal and short distal spines, 1 short with short spines). 4th and 5th exopodial joints fused, hirsute, with 5 bristles with long proximal and short distal spines.

*Sixth Limb:* With 4 epipodial bristles with long proximal hairs and short distal spines. Endite I with 2 or 3 spinous bristles; endite II with 1 proximal and 3 terminal spinous bristles; endite III with 1 proximal and 8 terminal spinous bristles; endite IV with 1 proximal and 7 terminal spinous bristles. Skirt with 32 or 33 spinous and plumose bristles.

*Seventh Limb:* Each limb with 10 bristles (4 in proximal group, 2 on each side, each with 3 or 4 bells; 6 in terminal group, 3 on each side, each with 3–6 bells) with distal spines. Terminus consisting of comb with 8 teeth with long marginal spines opposite smooth peg (Figure 4f).

*Furca* (Figure 4g): Each lamella with 15 claws; claw 3 slenderer than claw 4; teeth along posterior margins of all claws; claw 1 with row of medial teeth; medial hairs at bases of claws and on lamella following claws.

*Bellonci Organ* (Figure 5d): Elongate with about 20 sutures; tip narrowly rounded, with few long spines (not shown).

*Eyes:* Medial eye with black pigment (Figure 5d,e). Lateral eye small, unpigmented, with few rounded cells but no ommatidia (Figure 5d,e).

*Upper Lip* (Figure 5d): Hirsute.

*Anterior of Body* (Figure 5d): Single rounded process between upper lip and medial eye.

*Posterior of Body* (Figure 5f): With few hairs near furca.

*Y-Sclerite* (Figure 5f): Normal for genus.

*Number of Eggs:* USNM 194014 with 16 eggs in marsupium; length of typical egg 0.36 mm (location of 1 egg shown in Figure 4a).

**DESCRIPTION OF ADULT MALE** (Figures 6, 7a–g).—Carapace more elongate than that of female and with more open incisur (Figure 6a).

*Ornamentation* (Figure 6a): Ribs more subdued than those of female; surface with minute crescents (representative crescents shown in Figure 6a).

*Infold:* Not examined.

*Carapace Size* (length, height in mm): USNM 194015, 2.61, 1.27.

*First Antenna* (Figure 6b): 1st joint with rows of medial spines. 2nd joint with medial, ventral, dorsal, and distal lateral spines, and 3 spinous bristles (1 ventral, 1 dorsal, 1 lateral). 3rd joint longer on lateral side, with medial, ventral, dorsal, and lateral spines, and 3 spinous bristles (1 ventral, 2 dorsal). 4th

joint with ventral, dorsal, medial, and lateral spines, and 6 bristles (4 ventral, 2 dorsal). 5th joint minute, wedged ventrally between 4th and 6th joints, with stout sensory bristle bearing abundant long thin filaments on broad proximal half, 2 or 3 short distal filaments, and bifurcate tip. 6th joint about same length as 4th joint, with distal lateral spines, and medial bristle with short spines. 7th joint: distal end of joint with sclerotized rim; a-bristle longer than bristle of 6th joint, with short spines; b-bristle about twice length of a-bristle, with 3 proximal filaments, 2 small distal filaments, and bifurcate tip; c-bristle very long, with 13 or 14 marginal filaments. 8th joint: joint smaller than 7th joint and lateral to it; d- and e-bristle about same length as b-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 12 marginal filaments; g-bristle slightly longer than b-bristle, with 6 proximal filaments, 3 distal filaments, and bifurcate tip; filaments of bristles of 7th and 8th joints with 2 minute terminal spines (not shown).

*Second Antenna:* Protopodite bare (Figure 6c). Endopodite 3-jointed (Figure 6c,d): 1st joint short, with 5 short proximal bristles and 1 short distal bristle; 2nd joint elongate, with 1 bare proximal bristle, and 2 slightly stouter spinous bristles at midlength; 3rd joint elongate, reflexed on 2nd joint, with 1 short proximal bristle, 2 short slender subterminal bristles, and ridges at tip. Exopodite: 1st joint with minute medial bristle on distal margin; 2nd joint about  $\frac{1}{3}$  length of 1st joint and about half length of 3rd joint; bristle of 2nd joint bare, reaching to 8th joint; bristles of joints 3–8 long, with natatory hairs; 9th joint with 6 bristles with natatory hairs (3 long, 1 medium, 2 short); joints 3–8 each with slender basal spine longer on distal joints (spine of 8th joint same length as 9th joint); joints 2–8 with row of small spines along distal margin.

*Mandible:* Coxale endite represented by 3 small bare bristles (Figure 6e,f). Basale (Figure 6e): dorsal margin with 3 bristles (1 at distal  $\frac{2}{3}$ , 2 subterminal) with long proximal and short distal spines; medial surface spinous, with 5 spinous bristles in proximal ventral corner, and 1 spinous bristle closer to midlength; ventral margin with 8 spinous bristles (some with bases on lateral surface near ventral margin). Exopodite similar to that of female. 1st endopodial joint with medial spines and 5 ventral bristles (2 long with long proximal and short distal spines, 3 short with indistinct short spines). 2nd endopodial joint: ventral margin with bristles (with short spines) forming 2 distal groups (3 bristle in each group); dorsal margin with 9 spinous bristles, some with bases on medial and lateral sides of joint; medial surface and proximal dorsal margin spinous. 3rd endopodial joint with 3 stout claws (all with indistinct proximal ventral teeth; dorsal claw about half length of lateral claw; medial claw about  $\frac{5}{6}$  length of lateral claw) and 4 ringed bristles.

*Maxilla:* Limb reduced; 3 endites with weakly developed bristles. Precoxale and coxale with dorsal hairs; coxale with stout plumose dorsal bristle (Figure 6g). Basale with 2 long bristles near ventral margin (1 medial, 1 lateral, both with long

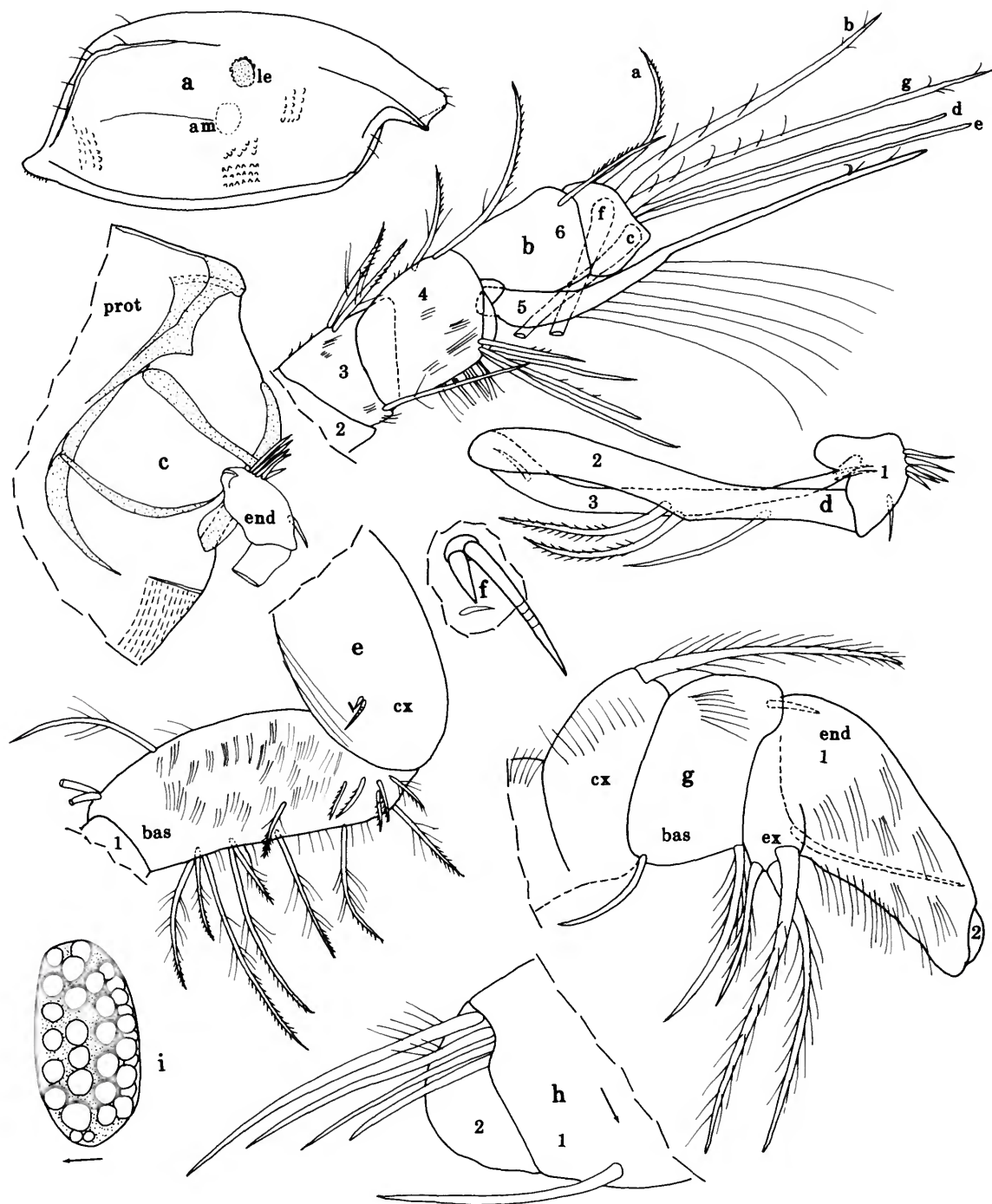


FIGURE 6.—*Scleroconcha solox*, new species, adult male, paratype, USNM 194015: *a*, complete specimen from right side showing right lateral eye (stippled), location of central adductor muscle attachments (dashed oval), and representative shallow fossae (half-circles), length 2.61 mm; *b*, distal end of left 1st antenna, mv; *c*, distal protopodite and proximal part of endopodite, left 2nd antenna, mv; *d*, endopodite, left 2nd antenna, mv; *e*, coxale and basale, right mandible, mv; *f*, detail of coxale endite in *e*; *g*, right maxilla, lv (bristles of endites and endopodite not shown); *h*, bristles of 1st endopodial joint, right maxilla, mv; *i*, left lateral eye, anterior to left (area of black pigment stippled).



FIGURE 7.—*Scleroconcha solox*, new species, adult male, paratype, USNM 194015: *a*, 5th limb (not all bristles of endites or 1st and 2nd exopodial joints shown); *b*, tip of 7th limb (only proximal part of bristles shown); *c*, right lamella of furca and copulatory limbs (stippled); *d*, medial eye (area of black pigment stippled) and Bellonci organ; *e*, anterior of body from left side showing medial eye (area of black pigment stippled), Bellonci organ, and upper lip; *f*, posterior of body showing bifurcate gut (stippled) and copulatory limbs (stippled) and internal sclerites; *g*, right Y-sclerite. A–I male from Slope 46; *h*, outline of complete specimen from left side showing location of central adductor muscle attachments (dashed oval), length 2.44 mm; *i*, anterior of right valve, ov; *j*, endopodite of left 2nd antenna, mv; *k*, left lateral eye, anterior to left (area of black pigment stippled).

proximal hairs) and 1 short dorsal bristle. Exopodite well developed, with 3 bristles (1 short, 2 long) with long marginal hairs. 1st endopodial joint with very long hairs, 1 alpha-bristle, and 4 beta-bristles (Figure 6h). 2nd endopodial joint with about 11 weakly developed bristles (2 stouter than others).

**Fifth Limb (Figure 7a):** Limb reduced. Endites I and II each with about 5 slender ringed bristles; endite III with about 8 slender ringed hirsute bristles. 1st exopodial joint with 2 finger-like hirsute terminal bristles (1 much thinner than other and weakly ringed) and about 5 slender ringed bristles (2 proximal). 2nd exopodial joint with 1 finger-like hirsute bristle and about 5 slender ringed bristles (1 proximal). 3rd exopodial joint: outer lobe with 2 stout hirsute bristles; inner lobe with 3 slender hirsute bristles. 4th and 5th exopodial joints fused, hirsute, with 6 ringed bristles (1 very long), mostly bare or with short spines. (Not all bristles shown on endites and 1st and 2nd exopodial joints in Figure 7a.)

**Sixth Limb:** With 4 epipodial bristles with long proximal hairs. Endite I with 3 spinous bristles; endite 2 with 1 proximal and 3 terminal spinous bristles; endite III with 1 proximal and 8 terminal spinous bristles; endite IV with 1 proximal and 7 spinous terminal bristles. Skirt with 29 or 30 spinous and plumose bristles.

**Seventh Limb:** Each limb with 10 bristles (4 in proximal group, 2 on each side, each with 2 or 3 bells; 6 in terminal group, 3 on each side, each with 2–6 bells) with distal spines. Terminus consisting of comb of 5 or 6 teeth with long marginal spines opposite smooth peg (Figure 7b).

**Furca (Figure 7c):** Each lamella with 15 or 16 claws (USNM 194015 with 15 on right lamella and 16 on left); claw 3 slenderer and about half length of claw 4; all claws with teeth along posterior margins, and claws 2–16 also with some teeth along anterior margin; claw 1 with row of medial teeth; medial hairs present at bases of claws, on lamella following claws, and adjacent to anterior margin of right lamella; right lamella anterior to left by less than width of claw 1, and with few long spines along anterior margin.

**Bellonci Organ (Figure 7d):** Elongate with about 18 sutures, and long spines on narrowly rounded tip.

**Eyes:** Medial eye with black pigment (Figure 7d,e). Lateral eye about twice size of medial eye, with 33 ommatidia in 5 rows and black pigment between ommatidia (Figure 6i).

**Upper Lip (Figure 7e):** Less hirsute than that of female.

**Genitalia (Figure 7f):** Lobate with few bristles.

**Anterior of Body (Figure 7e):** Broad rounded bulge between medial eye and upper lip.

**Posterior of Body (Figure 7f):** With abundant spines ventral to midheight, and few spines on posterodorsal corner.

**Y-Sclerite (Figure 7f,g):** With long dorsal branch.

**Gut:** Posterior end of the gut appears bifurcate: 1 branch leading to anus, and 2nd branch leading to anterodorsal corner of furca (Figure 7f).

**DESCRIPTION OF A-1 MALE (Figure 7h-k).**—Carapace shape similar to that of adult female (Figure 7h).

**Ornamentation (Figure 7i):** Differs from female in having

2nd rib extending anteriorly well past central adductor muscle attachments, and in not having anterior end of 3rd rib reaching past edge of triangular lateral process of rostrum.

**Infold:** Rostral infold with row of 7 or 8 bristles and 2 bristles at inner end of incisur; infold of caudal process with narrow flap similar to that of adult female, with 3 or 4 bristles (posterior bristle longer); 1 small bristle between flap and ventral edge of valve (close to edge); other bristles of infold not counted.

**Carapace Size (length, height in mm):** Specimen from Slope 46: 2.44, 1.56.

**First Antenna, Mandible, Maxilla, Fifth Limb, and Sixth Limbs** Not examined in detail but of similar type to those of adult female.

**Second Antenna:** Endopodite 3-jointed (Figure 7j): short 1st joint with 4 or 5 short bristles (3 or 4 proximal, 1 distal); ventral margin of elongate 2nd joint with 1 very long bristle (about  $\frac{1}{3}$  longer than endopodite) with 7 wreaths of long spines, and 2 short bristles with length similar to width of joint; 3rd joint elongate with 3 short bristles (1 proximal, 2 subterminal). Exopodite: joints 2–9 decreasing in size; all bristles fairly short, no bristles with natatory hairs; 9th joint with 6 bristles.

**Seventh Limb:** Not examined in detail but comb teeth with long spines.

**Furca:** Each lamella with 15 claws; claw 3 slenderer than claw 4.

**Bellonci Organ:** Not examined in detail but similar to that of adult male and female.

**Eyes:** Medial eye similar to those of adult male and female. Lateral eye slightly larger than medial eye, with about 12 ommatidia and black pigment between ommatidia (Figure 7k).

**Upper Lip:** Similar to lip of adult female, hirsute.

**Anterior of Body:** With anterior process similar to that of adult female.

**Posterior of Body:** Distribution of spines similar to those of adult male.

**COMPARISONS.**—The only previously described species of *Scleroconcha* with long spines on the comb teeth of the 7th limb is *S. frons* Kornicker, 1975:329, known from A-1 males collected west of Chile at depths of 957–1226 m. The furca of A-1 males of *S. frons* bears 12 or 13 claws on each lamella compared to 15 on the A-1 male of *S. solox*, and the rostral infold of A-1 males of *S. frons* bears 14–17 bristles compared to 9 or 10 on the A-1 male of *S. solox*, but the main difference is in the lateral eyes: the lateral eye of the A-1 male of *S. frons* is either without ommatidia or has 4 poorly defined ?ommatidia (Kornicker, 1975:333) compared to about 12 ommatidia and black pigment between ommatidia on the A-1 male of *S. solox*.

### *Euphilomedes* Kornicker, 1967

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

**COMPOSITION.**—Including the new species described herein

this genus includes 18 species plus one subspecies (Komicker, 1991b:3). *Euphilomedes corrugata* (Brady, 1897:91) has been reported previously from the vicinity of Australia (from off Port Jackson and in Flinders Passage).

**DISTRIBUTION.**—The genus is cosmopolitan but has not been reported from the Arctic or Antarctic regions. The known depth range is surface to 2250 m (Komicker, 1991b:3).

***Euphilomedes ernyx*, new species**

FIGURES 8–10

**ETYMOLOGY.**—From the Greek *ernyx* (sprout, shoot).

**HOLOTYPE.**—Undissected adult female in alcohol in the collection of the Victoria Museum.

**TYPE LOCALITY.**—Slope 21, 36°57.40'S, 150°18.80'E, New South Wales, off Eden; depth 220 m.

**PARATYPES.**—Slope 21: USNM 194024, adult female on slide and in alcohol; partly dissected adult female with male and female cyproniscid isopod in marsupium; 2 juveniles (length 0.99 mm, height 0.69 mm; length 1.24 mm, height 0.92 mm).

**DISTRIBUTION.**—Slope 21, 220 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 8–10).—Carapace oval in lateral view with projecting rostrum, shallow incisur, and evenly rounded posterior (Figure 8a). Inner end of incisur with internal sclerotized slightly curved finger-like “process” visible in transmitted light (crosshatched in Figure 8d) (“process” not previously reported in *Myodocopa*).

**Ornamentation:** Surface with abundant small round fossae with minute pustules between fossae (Figure 8a); about 35 larger fossae in vicinity of central adductor muscle attachments (Figure 8c); the larger fossae with beaded row of minute pustules along edge (Figure 8b); some smaller fossae with bristle emerging from center (Figure 8c); additional bristles along valve edge (Figure 8d,e); minute pustules along posterior edge of valve pointed, spine-like (Figure 8d-f).

**Infold:** Rostral infold of right valve with 14 or 15 undivided bristles in oblique row and 5 additional undivided bristles along dorsal edge (Figure 8d); rostral infold of left valve with 13–16 undivided bristles in oblique row but without bristles along dorsal edge; narrow list with anterior end at ventral end of rostrum continues along ventral margin then broadens along posterior  $\frac{3}{4}$  of ventral margin and posteroventral margin (Figure 8e,f); anteroventral infold with about 6 striae dorsal to list; 1 small bristle on anteroventral infold just ventral to incisur (Figure 8d) and 16 or 17 small bristles along anteroventral list; 15 minute bristles along broad posteroventral list (not all shown in Figure 8e,f); posterior infold of right valve with 4 small bristles and left valve with 1 bristle near inner margin (Figure 8e,f).

**Selvae:** Broad lamellar prolongation with marginal fringe present along edge of rostrum, ventral margin, and ventral half of posterior margin (prolongation not shown in Figure 8d but inner edge of selvae shown as striated band). Lamellar

prolongation indistinctly divided at inner end of incisur near sclerotized “process.”

**Central Adductor Muscle Attachments** (Figure 8g): Comprising about 25 oval attachments (ends of attachments do not coincide with large round fossae on valve surface in vicinity of attachments).

**Carapace Size** (length, height in mm): Slope 21: holotype, 1.43, 0.99; specimen with cyproniscids 1.38, 0.94; USNM 194024, 1.37, 0.95.

**First Antenna** (Figure 8h,i): 1st joint spinous. 2nd joint spinous with 3 spinous bristles (1 ventral, 1 dorsal, 1 lateral). 3rd joint short, with 3 or 4 bristles (1 ventral, 2 or 3 dorsal). 4th joint with 6 bristles (4 ventral, 2 dorsal). Long bristle of 5th joint with 5 short proximal filaments and 4 or 5 long terminal filaments. 6th joint fused to 5th; medial bristle of 6th joint with few long proximal spines. 7th joint: a-bristle spinous; b-bristle with 2 proximal and 4 terminal filaments; c-bristle with 2 proximal and 5 terminal filaments. 8th joint: d- and e-bristles long bare; f-bristle with 2 proximal and 5 terminal filaments; g-bristle with 3 proximal and 5 terminal filaments. (Numbers given for terminal filaments include stem.)

**Second Antenna:** Protopodite bare (Figure 8j). Endopodite 2-jointed (Figure 8j): 1st joint with 7 bristles (6 short, 1 long); 2nd joint with long spinous ventral bristle near midlength and long terminal bristle. Exopodite: 1st joint with small straight medial bristle on distal edge; bristle of 2nd joint reaching just past 9th joint, with numerous slender ventral spines; bristles of joints 3–5 about  $\frac{1}{3}$  to  $\frac{1}{2}$  times length of bristle of 2nd joint, with stout ventral spines, no natatory hairs; on USNM 194024 bristles of joints 6–8 about 4 times length of bristle of 2nd joint, with stout ventral spines and no natatory hairs (?aberrancy), but on holotype bristles of joints 6–8 longer and with natatory hairs; 9th joint with 7 bristles (3 short bare, 4 long with slender proximal spines on both edges and distal natatory hairs); joints 2–8 with row of fairly long spines (about  $\frac{1}{3}$  to  $\frac{1}{2}$  length of joint) along distal edges.

**Mandible** (Figure 9a): Coxale endite stout, spinous, bifurcate, with small ringed bristle near base. Basale: dorsal margin with 5 bristles (distal shortest and bare, others with long proximal spines (not all spines shown) near midlength, and 2 spinous terminal bristles; lateral surface with 5 spinous bristles with bases near ventral margin; medial surface with numerous rows of spines, 5 short bristles (3 stout unringed pectinate, 2 slender ringed spinous) in proximal ventral corner, and 1 ringed spinous bristle at midlength; ventral margin with 2 distal ringed spinous bristles. Exopodite more than  $\frac{1}{2}$  length of dorsal margin of 1st endopodial joint, with spinous terminal process and 2 subterminal bristles (distal bristle bare and about  $\frac{1}{2}$  length of spinous proximal bristle). 1st endopodial joint with 5 ringed ventral bristles (3 long with long proximal and short distal spines, 1 short with few short spines, 1 minute bare); dorsal margin with row of minute terminal spines. 2nd endopodial joint: ventral margin with distal spines, 2 ringed spinous subterminal bristles, and 3 ringed spinous terminal bristles; dorsal margin with 11 bristles (5 slender short

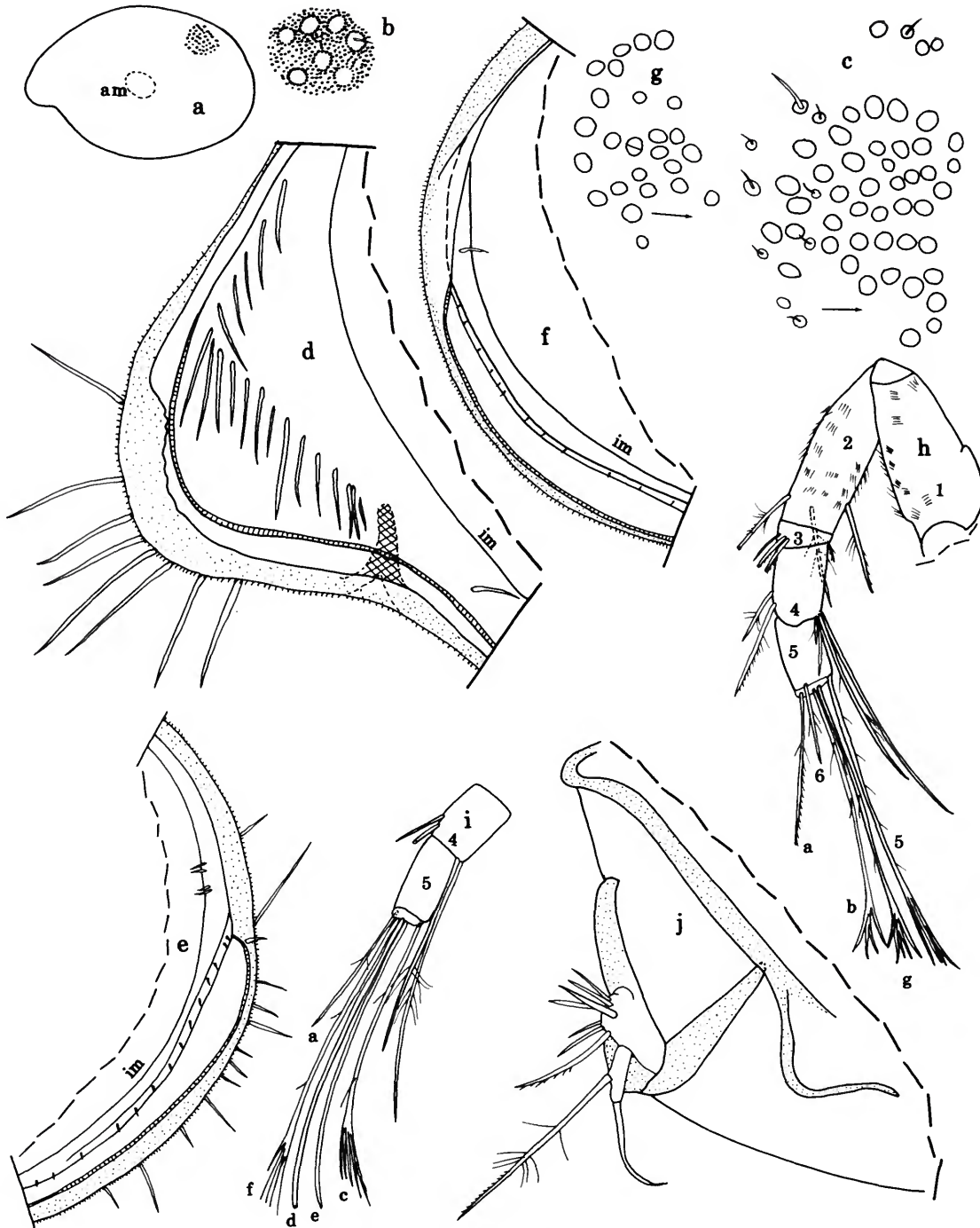


FIGURE 8.—*Euphilomedes ernyx*, new species, adult female, paratype, USNM 194024: a, complete specimen from left side showing location of central adductor muscle attachments (dashed oval) and representative fossae, length 1.37 mm; b, detail of surface fossae in c; c, fossae and bristles on right valve in vicinity of central adductor muscle attachments (fossae do not coincide with muscle ends but many are close to them), anterior to right; d, rostrum, right valve, iv; e, f, posterior of right and left valves, iv; g, central adductor muscle attachments, right valve, anterior to right; h, right 1st antenna, mv (c- to f-bristles not shown); i, tip of left 1st antenna, lv (bristles not shown: bristles of 5th and 6th joints, b-bristle of 7th joint, and g-bristle of 8th joint); j, protopodite and endopodite of right 2nd antenna, mv.



FIGURE 9.—*Euphilomedes ernyx*, new species, adult female, paratype, USNM 194024: a, right mandible, mv; b, endite I, left maxilla, mv; c, b- and c-bristles of 2nd endopodial joint, left maxilla, mv; d, right maxilla, lv (terminal bristles of endites not shown; only outer b-bristle of 2nd endopodial joint shown); e, b-bristles of 2nd endopodial joint, right maxilla, lv; f, posterior of body from left side showing left furcal lamella, left Y-sclerite, and part of girdle (claw 1 of right lamella striate); g, right lateral eye, medial eye (area of brown pigment stippled), and Bellonci organ; h, anterior of body from right side showing right lateral eye, medial eye, Bellonci organ, anterior process, upper lip, and part of right 1st antenna.



proximal followed by 1 shorter with long spines, then 5 (4 long with long proximal spines, 1 short with short spines)). 3rd endopodial joint with short slender unringed dorsal claw (claw about  $\frac{1}{4}$  length of longest claw), 2 stout claws with proximal ventral spines, and 4 slender ringed bristles. (Not all rings shown on bristles.)

**Maxilla:** Endite I with 9 spinous and pectinate bristles (Figure 9b); endite II narrow with about 6 spinous and pectinate bristles; endite III narrow with 1 proximal and about 7 terminal spinous and pectinate bristles. Coxale with dorsal fringe of long hairs and 5 bristles (4 slender bare, 1 stout plumose) (Figure 9d). Basale with 4 bristles on distal margin (2 dorsal bare (1 short, 1 long), 1 ventral, and 1 lateral (with long spines) at midwidth) (Figure 9d). Exopodite short with 3 bristles (1 short proximal, 2 long terminal). 1st endopodial joint with dorsal spines, 1 ringed alpha-bristle with long proximal spines, and 4 ringed beta-bristles (bare or with short spines). 2nd endopodial joint with 3 slender ringed a-bristles, 2 b-bristles (outer ringed spinous, inner unringed pectinate claw-like), 3 slender ringed c-bristles, and 3 d-bristles (outer ringed spinous, others unringed pectinate claw-like) (Figure 9c-e). (Not all rings or spines shown on bristles.)

**Fifth Limb:** Endite I with 6 spinous bristles (Figure 10a); endite II with about 10 bristles (Figure 10a); endite III with about 11 bristles. 1st exopodial joint (Figure 10b,d): triangular cusp anterior to main tooth bifurcate; main tooth with 4 pectinate cusps; spinous bristle present proximal to proximal cusp; anterior side of joint with 2 ringed bristles at midwidth (outer with long proximal spines), and small blunt bristle at outer corner (Figure 10d). 2nd exopodial joint (Figure 10b,d): flat tooth with long triangular distal inner projection with 2 small bifurcate cusps on inner curvature (Figure 10b); posterior side with long stout proximal and 3 distal bristles in row (middle bristle long spinous, flanking bristles short); minute posterior bristle near outer distal corner of flat tooth (Figure 10d). 3rd exopodial joint with 3 bristles (shortest bare, others with short spines) on inner lobe and 2 bristles (with long proximal hairs and short distal spines) on outer lobe (Figure 10c). 4th and 5th exopodial joints fused, hirsute, with total of 7 spinous bristles.

**Sixth Limb** (Figure 10e): With 4 spinous epipodial bristles. Endite I with 3 spinous bristles; endite II with 4 spinous bristles (1 proximal, 3 terminal); endites III and IV each with 9 spinous bristles (1 proximal, 8 terminal). End joint with 21 spinous and plumose bristles; medial surface hirsute.

**Seventh Limb** (Figure 10f,g): Each limb with 11 bristles with distal spines and 4-7 bells; terminal segment with 2 bristles on comb side and 3 on peg side; segments proximal to terminal segment with 6 bristles, 3 on each side. Comb with 13 or 14 alate teeth; side opposite comb with single bare peg with slightly bulbous tip.

**Furca** (Figure 9f): Each lamella with 11 claws; claw 3 short secondary, remaining claws decreasing in length along lamella; claws 1, 2, 4, and 5 with stout teeth along posterior edges; remaining claws with indistinct posterior teeth and some

with few minute proximal anterior teeth; claw 1 with row of medial teeth, some stouter than those along posterior edge; teeth along posterior edges of claws 3 and 5 much slenderer than those on claws 1 and 2; right lamella anterior to left by width of base of claw 1 (see detail in Figure 9f).

**Bellonci Organ** (Figure 9g,h): Elongate with suture proximal to midlength, slightly broader distal to suture, then tapering to narrowly rounded tip with minute spine.

**Eyes:** Lateral eye minute, light amber colored, with about 5 minute ommatidia and several additional smaller cells (Figure 9g,h). Medial eye well developed, bare, with dark brown pigment (Figure 9g,h).

**Upper Lip** (Figure 9h): Projecting anteriorly, with ventral hairs but no visible glandular processes.

**Genitalia:** None observed.

**Anterior of Body** (Figure 9h): With small rounded anterior process about midway between medial eye and upper lip.

**Posterior of Body** (Figure 9f): Evenly rounded, bare except for few small spines near proximal end of furca.

**Y-Sclerite** (Figure 9f): With ventral branch.

**Number of Eggs:** No females from Slope 21 with eggs in marsupium.

**Parasites:** 1 specimen from Slope 21 with a male and female cyproniscid isopod in marsupium.

**COMPARISONS.**—*Euphilomedes ernyx* differs from previously described species of the genus in three characters: (1) each valve has a sclerotized finger-like internal "process" just ventral to the rostrum; (2) the dorsal margin of the basale of the mandible bears 7 bristles (other species have no more than 3); and (3) the dorsal margin of the coxale of the maxilla has 5 bristles (other species have 1). The furca of *E. ernyx* differs from that of *E. corrugata* in having only claw 3 secondary between main claws.

**REMARKS.**—Females from Slope 21 are without eggs in marsupium, and genitalia were not observed on a specimen examined in detail (USNM 194024) so it is possible that the specimens identified as adult females are not adult. USNM 194024 is interpreted to be adult because the bristles of the 7th limb are cylindrical and the 9th joint of the exopodite of the 2nd antenna has 7 bristles, the number generally present on adult females of species of *Euphilomedes* (Kornicker, 1991b:43).

#### PSEUDOPHILOMEDINAE Kornicker, 1967

A species of *Pseudophilomedes* was described in Part 1; five species of *Harbansus* are described herein.

#### *Harbansus* Kornicker, 1978

**TYPE SPECIES.**—*Harbansus bradmyersi* Kornicker, 1978:13.

**COMPOSITION.**—Six species are known from the vicinity of Australia, *H. slatteryi* Kornicker, 1983a:181, from the Great Barrier Reef, and five new species described herein.

**DISTRIBUTION.**—This genus is cosmopolitan at depths of

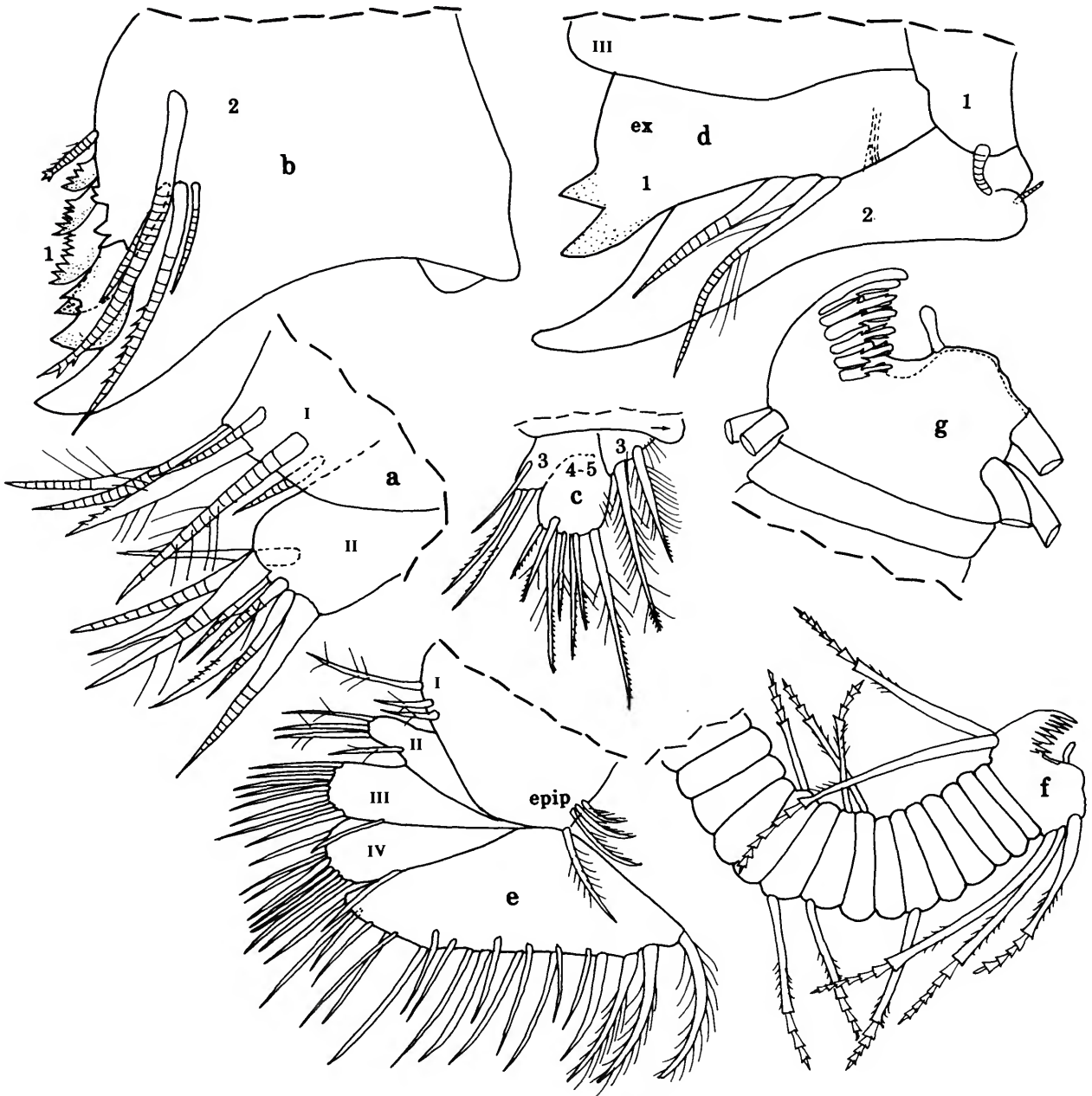


FIGURE 10.—*Euphilomedes ernyx*, new species, adult female, paratype, USNM 194024: *a*, endites I and II of right 5th limb, pv; *b*, distal end of right 5th limb, pv (joints 3-5 not shown); *c*, exopodial joints 3-5 of right 5th limb, pv; *d*, distal part of left 5th limb, av (not all cusps of 1st exopodial joint shown); *e*, right 6th limb, mv (spines and hairs not shown on most bristles); *f*, 7th limb; *g*, detail of tip of 7th limb in *f*.

intertidal to 1015 m, but has not been collected in Antarctic or Arctic waters; the present report extends the known range of the genus south to about 38°S. The known depth range in the vicinity of Australia is 2–996 m (204–996 m in present collection).

**MOTILITY.**—The bristles of exopodites of the 2nd antennae

of *H. slatteryi* and *H. vatrax* have natatory hairs and are therefore capable of swimming (both males and females known). The bristles of exopodites of the 2nd antennae of *H. hapax*, *H. vortex*, *H. tenax*, and *H. felix* are without distal natatory hairs, and therefore, are either not capable of efficient swimming or are nonswimmers (only females known).

**Key to Species of *Harbansus* in the Vicinity of Australia**

(Adult female)

1. Carapace with lateral rib near midheight . . . . . 2  
Carapace without lateral rib near midheight . . . . . 4
2. Carapace triangular in anterior or posterior view; tip of 2nd endopodial joint of 2nd antenna with short bristle . . . . . *H. vatrax*, new species  
Carapace ovoid in anterior or posterior view; tip of 2nd endopodial joint of 2nd antenna either bare or with small sclerotized peg-like process . . . . . 3
3. Tip of 2nd endopodial joint of 2nd antenna bare . . . . . *H. slatteryi*  
Tip of 2nd endopodial joint of 2nd antenna with small sclerotized peg-like process . . . . . *H. vortex*, new species
4. Carapace with lateral alar spine over central adductor muscle attachments . . . . .  
. . . . . *H. felix*, new species  
Carapace without lateral alar spine over central adductor muscle attachments . . . . . 5
5. Anterior tip of rostrum overlaps oblique valve edge; furca with 8 or 9 claws on each lamella . . . . . *H. hapax*, new species  
Anterior tip of rostrum does not overlap valve edge; furca with 6 claws on each lamella . . . . . *H. tenax*, new species

***Harbansus vatrax*, new species**

FIGURES 11–14

*Harbansus* species B.—Kornicker, 1994, fig. 109g.

**ETYMOLOGY.**—From the Latin *vatrax* (crooked feet).

**HOLOTYPE.**—Undissected ovigerous female in alcohol in the collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 1, 34°59.52'S, 151°5.94'E, New South Wales, off Nowra, depth 204 m.

**PARATYPES.**—Slope 1: USNM 193923, 1 adult female on slide and in alcohol; USNM 193924, 1 adult male on slide and in alcohol; USNM 193925, 1 adult female on slide and in alcohol; 1 dissected instar III male in alcohol; 26 adult females and juveniles in alcohol.

**DISTRIBUTION.**—Slope 1, 204 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 11–13a–k).—Carapace elongate with prominent rostrum and broad projecting caudal process (Figures 11, 12a–h); tip of rostrum and anteroventral and ventral margins with lateral overlap (Figure 12g). Shape of carapace unusual in being triangular in anterior (Figure 12d) and posterior views (broad near ventral base and narrower dorsally) (Figure 12e) (body inside shell also broad

near base and narrower near apex). Hinge straight and depressed (Figure 12f).

**Ornamentation:** Lateral rib extends from rostrum to caudal process; rib actually widest part of valve from which surface slopes to ventral and dorsal margins of valve (Figures 11, 12d,e). Valve surface including rib with abundant well defined small fossae (representative fossae shown in Figure 12a,g).

**Infold:** Rostral infold with row of 4 spinous bristles, and a pair of bristles at inner end of incisur (Figure 12g); anteroventral infold with 1 bristle near incisur and about 10 narrow ridges (Figure 12g). Infold of caudal process with 6 frond-like bristles along ridge forming “pocket” (Figure 12h) (left valve of USNM 193923 with additional frond-like bristle near dorsal edge of infold slightly anterior to row along edge); about 6 small bristles on infold near inner margin anterior to caudal process (Figure 12h).

**Selvae:** Narrow along straight distal edge of rostrum, broad and divided at inner end of incisur, broad with fringe along ventral edge of valve, absent along posterior edge of caudal process, and narrow along posterior edge of valve dorsal to caudal process.

**Central Adductor Muscle Attachments:** Located in lateral

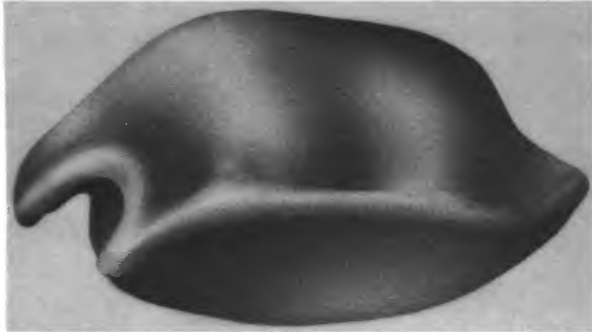


FIGURE 11.—*Harbansus vatrax*, new species, adult female, paratype, USNM 193923, complete specimen from left side, length 1.53 mm.

rib at anterior  $\frac{1}{3}$  of valve (Figure 12f); 3 nonadductor stout muscles attached to shell at about  $\frac{1}{3}$  height from dorsal end of valve and about  $\frac{1}{3}$  length from posterior end (these terminate anteriorly near base of 1st antenna (anterior ends of muscles broken in Figure 12f)).

**Carapace Size** (length, height in mm): Slope 1: holotype, 1.52, 0.83; USNM 193923, 1.53, 0.84 (maximum width 0.87 mm); USNM 193925, 1.56, 0.88; 1.54, 0.82; 1.56, 0.83; 1.57, 0.86; 1.56, 0.89.

**First Antenna:** 1st joint bare. 2nd joint with ventral spines and 1 dorsal bristle (with long proximal spines) at distal  $\frac{2}{3}$ . 3rd joint short with 3 bristles (1 ventral, 2 dorsal). 4th joint with ventral spines and 3 bristles (2 ventral, 1 dorsal). Sensory bristle of 5th joint with 2 short proximal filaments and 3 distal filaments (1 short, 2 long) excluding stem. Medial bristle of 6th joint about  $\frac{3}{4}$  length of 5th joint. 7th joint: a-bristle about 3 times length of bristle of 6th joint; b-bristle about  $\frac{3}{4}$  length of sensory bristle of 5th joint, with 1 short filament at midlength and 2 spines or papillae at tip; c-bristle about same length as sensory bristle, with 5 filaments excluding stem and 2 minute papillae at tip. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with 2 short proximal filaments and 3 distal filaments (1 short, 2 long) excluding stem; g-bristle similar to f-bristle.

**Second Antenna:** Protopodite bare. Endopodite 2-jointed (Figure 12i): 1st joint with 2 small ventral bristles; 2nd joint elongate with long ventral bristle (with or without spines) at midlength and short terminal bristle about 1 to  $1\frac{1}{2}$  times width of joint at midlength. Exopodite: 1st joint with or without minute medial terminal bristle; bristles of joints 2–8 with stout ventral spines on proximal  $\frac{2}{3}$  to  $\frac{3}{4}$  and natatory hairs on thinner distal  $\frac{1}{4}$  to  $\frac{1}{3}$  (hairs may be absent on some bristles) (Figure 12j); 9th joint narrow, with 2 bristles; joints 5–7 with small basal spines (spine of 7th joint shown in Figure 12j). Right limb of USNM 193923 aberrant in having only 7 joints (1 bristle of 7th joint shown in Figure 12k).

**Mandible** (Figure 12l-m): Coxale endite hirsute and spinous, with small unringed bristle near base (Figure 12l). Basale: dorsal margin with 3 bristles (1 near midlength, 2

terminal); ventral margin with 1 terminal bristle with long spines; medial surface spinous, with 4 bristles near ventral margin (3 proximal, 1 distal); lateral side with 2 bristles (with long spines) near ventral margin. Exopodite slender, about  $\frac{3}{4}$  length of dorsal margin of 1st endopodial joint, hirsute in distal half, with 2 subterminal bristles (lateral and proximal of these longer, spinous). 1st endopodial joint with medial spines and 3 ventral bristles (2 long with long spines, 1 short with indistinct short spines); dorsal margin with small terminal spines. 2nd endopodial joint: dorsal margin with 2 or 3 long bristles near midlength; ventral margin with 4 bristles forming 2 distal groups (2 bristles in each group); usual medial spines not observed. 3rd endopodial joint with 2 stout claws, 1 minute dorsal claw (absent on right limb of USNM 193923 (Figure 12l) but present on left limb (Figure 12m), and on both limbs of USNM 193925) and 3 slender ringed bristles.

**Maxilla:** Precoxale and coxale with dorsal fringe of long hairs; coxale with long, stout, plumose, dorsal bristle. Endite I wider than endites II and III, with 6 bristles; endite II also with 6 bristles; endite III with 1 proximal lateral bristle and 7 distal bristles. Basale with 3 long bristles along distal margin (2 ventral, 1 dorsal). Exopodite small with 3 bristles (2 long, 1 short). Endopodite: 1st joint with 1 alpha-bristle with long spines and 2 beta-bristles (outer longer and with long spines, other without long spines); 2nd joint with 9 claws and bristles (Figure 13h).

**Fifth Limb** (Figures 12n,o, 13i-k): Epipodite with 41 bristles. Endite I with 2 bristles (1 long with long hairs, 1 short with short spines); endite II with 3 bristles; endite III with about 8 bristles (Figure 13i). 1st exopodial joint: main tooth with proximal bristle, 1 smooth tooth followed by 3 pectinate teeth and 1 smooth tooth anterior to distal pectinate tooth (Figures 12n, 13k); anterior side with 2 bristles along distal edge proximal to main tooth (Figure 13k). 2nd exopodial joint with large square tooth with 2 minute teeth on inner side at midheight (Figure 13j); posterior side with 3 bristles in row (1 long with smaller bristle on each side) and 1 long bristle proximal to row (Figure 13j). 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer lobe (Figures 12o, 13j). 4th and 5th exopodial joints fused, with total of 4 bristles (Figures 12o, 13j).

**Sixth Limb** (Figure 13a): With 1 epipodial bristle. Endite I with 3 bristles; endite II with 2 or 3 bristles; endites III and IV each with 5 bristles. End joint not projecting posteriorly, with 4 anterior spinous bristles followed by short space and 2 plumose bristles. Limb hirsute.

**Seventh Limb** (Figure 13b): 2 bristles in proximal group (1 on each side); 5 bristles on terminal segment (2 on comb side, 3 on peg side), each bristle with 1 to 4 bells and distal marginal spines; terminal comb with 5–7 recurved teeth; 2 or 3 spinous pegs opposite comb.

**Furca** (Figure 13c): Each lamella with 6 claws; claws 1, 2, and 4 stout; claws 3, 5, and 6 short, slender; medial row of teeth on claw 1 with large teeth distally; 1 or 2 small rounded teeth on lamella following claws. Right lamella with few spines

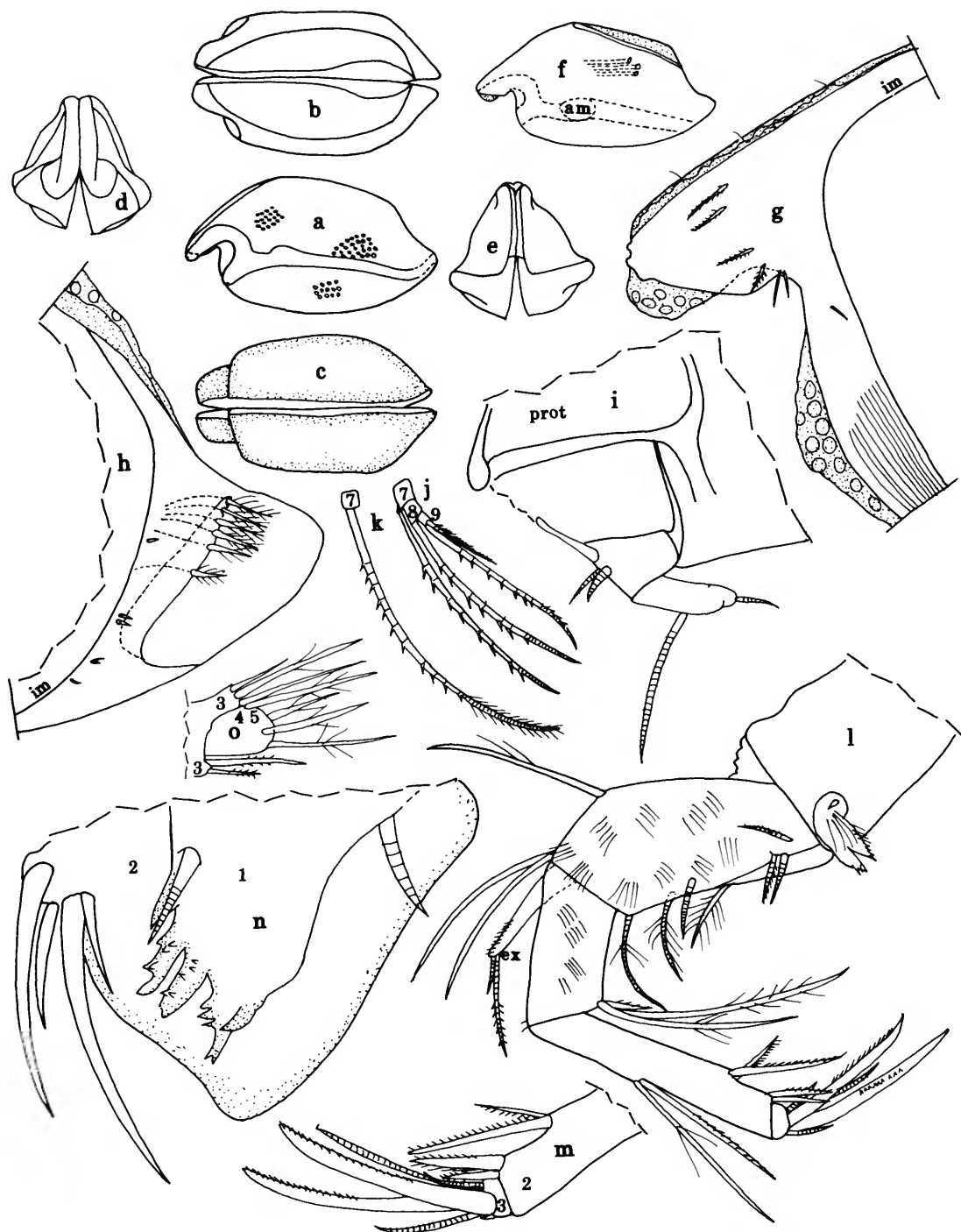


FIGURE 12.—*Harbansus vatrax*, new species, adult female, paratype, USNM 193923: *a-e*, complete specimen, length 1.53 mm: *a*, from left side showing representative fossae; *b*, dorsal view (anterior to left); *c*, ventral view (anterior to left); *d*, anterior view (dorsal to top); *e*, posterior view (dorsal to top); *f*, right valve showing 3 muscles attached to valve (dashed) and location of central adductor muscle attachments (dashed oval), *iv*; *g*, anterior, right valve, *iv*; *h*, posterior, right valve, *iv*; *i*, protopodite and endopodite, right 2nd antenna, *mv*; *j*, exopodial joints 7-9, left 2nd antenna, *lv*; *k*, bristle of 7th (terminal) joint of aberrant exopodite, right 2nd antenna, *mv*; *l*, right mandible, *mv*; *m*, tip of left mandible, *mv*; *n*, tip of left 5th limb, *av*; *o*, joints 3-5, left 5th limb, *av*.



FIGURE 13.—*Harbansus vatrax*, new species, adult female, paratype, USNM 193923: *a*, 6th limb; *b*, 7th limb; *c*, left furcal lamella, mv; *d*, Bellonci organ and distal part of medial eye; *e*, left lateral eye; *f*, upper lip, anterior to left; *g*, right Y-sclerite and part of girdle. Adult female, paratype, USNM 193925: *h*, bristles of 2nd endopodial joint, left maxilla, mv (not all spines of bristles shown); *i*, tip of right 5th limb, av; *j*, tip of left 5th limb, pv; *k*, 1st exopodial joint, right 5th limb, av. Adult male, paratype, USNM 193924: *l*, complete specimen from right side, length 1.35 mm; *m*, distal part of 2nd joint and aberrant 3rd joint of endopodite, right 2nd antenna, mv (aberrant in having 3rd joint divided into 2 parts); *n*, endopodite, left 2nd antenna, mv; *o*, right mandible, mv (only proximal part of exopodite shown); *p*, maxilla; *q*, exopodite of 5th limb; *r*, tip of 7th limb; *s*, Bellonci organ and medial eye; *t*, left and right lateral eyes; *u*, anterior of body from left side showing part of 1st joint of left 1st antenna (top) and upper lip (bottom).

along anterior edge and long hairs forming rows on medial side near anterior margin. Hairs present laterally on lamellae following claws. Right lamella anterior to left by width of base of claw 1.

**Bellonci Organ** (Figure 13*d*): Elongate, with 5 weak proximal sutures and small spine at tip.

**Eyes**: Lateral eye small, unpigmented, with 4 or 5 minute amber-colored divided ommatidia and many smaller cells (Figure 13*e*). Medial eye partly fragmented (distal part shown in Figure 13*d*).

**Upper Lip** (Figure 13*f*): With 2 fairly large glandular tubes at tip.

**Genitalia**: USNM 193923 with oval ring with attached spermatophore on each side of body anterior to furca.

**Y-Sclerite** (Figure 13*g*): With well-developed ventral branch.

**Eggs**: USNM 193923 with unextruded eggs in ovaries. Holotype with 4 eggs in marsupium; length of typical egg 0.33 mm.

**DESCRIPTION OF ADULT MALE** (Figures 13*l-u*, 14*a-c*).—Shape of carapace similar to that of adult female except for dorsal margin having greater slope posteriorly, and for being smaller (Figure 13*l*).

**Ornamentation**: Similar to that of adult female.

**Infold**: Rostral and anteroventral infolds similar to those of adult female. Ridge of caudal process with 5 or 6 frond-like bristles.

**Carapace Size** (length, height in mm): USNM 193924, 1.35, 0.69.

**First Antenna**: 1st joint bare. 2nd joint with 1 dorsal bristle distal to middle. 3rd joint short with 3 bristles (1 ventral, 2 dorsal). 4th joint long with 1 dorsal bristle. 5th joint wedged ventrally between 4th and 6th joints; stem with bulbous proximal part with abundant filaments, 2–4 short filaments near midlength, and 2 spines or papillae at tip. Long 6th joint with short medial bristle. 7th joint: a-bristle twice length of bristle of 6th joint; b-bristle about twice length of a-bristle, with 2 filaments near midlength and 2 papillae at tip; c-bristle long with 6 filaments and bifurcate tip, each with papilla. 8th joint: d- and e-bristles as long as c-bristle, bare with blunt tips;

f-bristle almost as long as c-bristle with 7 filaments and bifurcate tip, each with terminal papilla; g-bristle similar to c-bristle.

**Second Antenna**: Protopodite bare. Endopodite 3-jointed (Figure 13*n*): 1st joint short with 3 or 4 small ringed bristles; 2nd joint elongate with 2 long spinous proximal bristles; 3rd joint reflexed, with 0 or 1 small proximal bristle and 2 slender subterminal bristles; tip of joint with few minute ridges (right limb of USNM 193925 aberrant in having distal 3rd bent appearing to form 4th joint (Figure 13*m*)). Exopodite: 1st joint with minute medial bristle on terminal margin; bristles of joints 2–8 differ from those of adult female in having spines restricted to proximal  $\frac{1}{3}$  to  $\frac{1}{2}$ , and longer natatory hairs on distal  $\frac{1}{2}$  to  $\frac{2}{3}$ ; bristles also with long hairs on long segment proximal to 1st spine; 9th joint with 2 bristles (longer similar to others, shorter with many slender spines); basal spines on joints similar to those of adult female; joints 2–8 with row of minute spines along distal edges.

**Mandible** (Figure 13*o*): Coxale endite represented by minute indistinct spine. Basale with same number of bristles as on adult female, but 4 medial bristles weaker, and the single ventral and 2 lateral bristles much longer; dorsal bristles similar those of adult female. Exopodite and 1st endopodial joint similar to those of adult female. 2nd endopodial joint: with 3 dorsal bristles, and 4 ventral bristles in 2 groups, each with 2 bristles (medial bristle of proximal ventral group much longer than that of adult female). 3rd endopodial joint with 2 long claws, 1 minute dorsal claw, and 3 ringed bristles (the 2 long claws much longer than those of adult female).

**Maxilla** (Figure 13*p*): Limb reduced. Dorsal margins of precoxale, coxale, and basale with fringe of long hairs; coxale with dorsal bristle; endite I with 5 or 6 unringed weak bristles; endite II with 5 unringed weak bristles; endite III with 7 unringed bristles (1 proximal, 2 distal, 4 terminal, all except one terminal bristle weak). Basale with long, ringed, strong, dorsal bristle and 2 long, unringed, weak, ventral bristles. Exopodite with 3 ringed strong bristles (middle bristle with long hairs). 1st endopodial joint with long hairs and 2 unringed weak beta-bristles (alpha-bristle not observed, possibly broken off). 2nd endopodial joint with 6 unringed weak bristles, some with a minute tubular process at tip.

**Fifth Limb** (Figure 13*q*): Limb reduced. Epipodite with 41 bristles. Endites I–III and 1st and 2nd exopodial joints with mostly unringed weak bristles. 3rd exopodial joint with 3 weak bristles on inner lobe and 2 stronger ringed bristles on outer lobe. 4th and 5th joints fused, with 4 ringed strong bristles.

**Sixth Limb** (Figure 14*a*): With 1 epipodial bristle. Endite I with 3 small bristles; endite II with 3 bristles; endites III and IV each with 5 bristles. End joint with 3 anterior bristles with long and short spines and 2 plumose posterior bristles. All bristles strong and ringed. (Limb similar in size to that of adult female but some bristles of endites III and IV much longer.)

**Seventh Limb**: Without proximal bristles; terminal segment with 4 equilength bristles, 2 on each side, each with 4

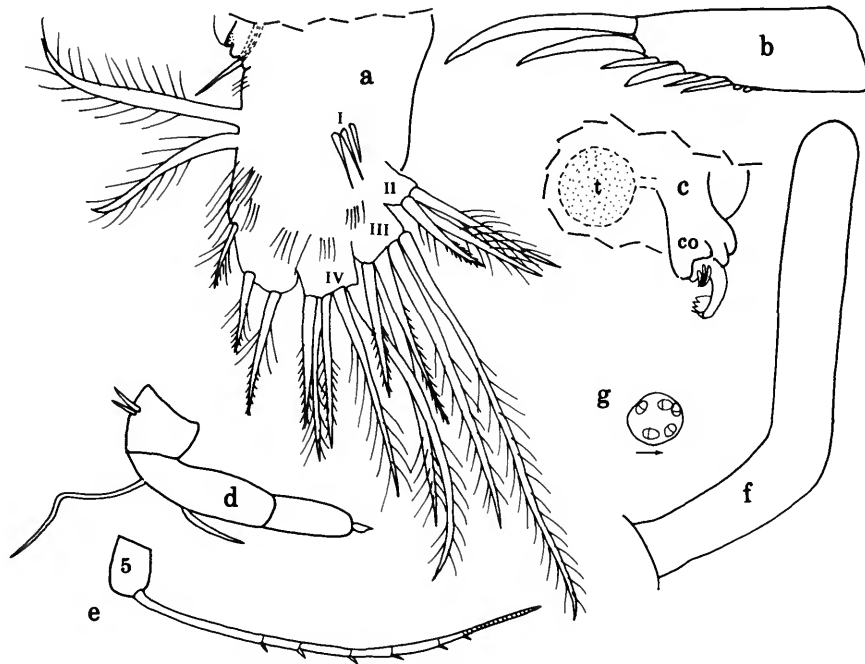


FIGURE 14.—*Harbansus vatrax*, new species, adult male, paratype, USNM 193924: a, left 6th limb, mv; b, left furcal lamella; c, left copulatory organ (testis stippled, anterior to left). Male Instar III: d, endopodite, right 2nd antenna, mv; e, bristle of joint 5 of exopodite, right 2nd antenna, mv; f, right 7th limb; g, right lateral eye.

bells and few distal marginal spines. Terminus with comb of 4 or 5 alate teeth and small triangular spine between teeth; side opposite comb bare (Figure 13r).

**Furca** (Figure 14b): Same number and distribution of claws as on adult female, but claws 1 and 2 longer, and claw 1 without distal larger teeth in medial row. USNM 193924 with 2 or 3 low rounded teeth on lamella following claws.

**Bellonci Organ** (Figure 13s): Similar to that of adult female.

**Eyes:** Medial eye small, unpigmented (Figure 13s). Lateral eye about same size as medial eye, with 5 well-developed, light amber-colored ommatidia (Figure 13t) (eye similar in size to that of adult female, but more distinct and with larger ommatidia).

**Upper Lip** (Figure 13u): Similar to that of adult female.

**Genitalia** (Figure 14c): With lobate copulatory organ with bristles and terminal hook with 5 or 6 distinct teeth.

**Anterior of Body** (Figure 13u): Without anterior process.

**Posterior of Body:** Evenly rounded, bare.

**Y-Sclerite:** Similar to that of adult female.

**DESCRIPTION OF INSTAR III MALE** (Figure 14d-g).—Carapace similar in shape to that of adult female.

**Carapace Size** (length, height in mm): 1.02, 0.50.

**First Antenna:** 1st joint bare. 2nd joint with 1 dorsal bristle. 3rd joint with 3 bristles (1 ventral, 2 dorsal). 4th joint

with 2 bristles (2 ventral, 1 dorsal). Joints 5–8 with same number of bristles as on adult female; filaments not counted on bristles having them.

**Second Antenna:** Protopodite bare. Endopodite 3-jointed (Figure 14d): 1st joint with 2 small proximal bristles; 2nd joint elongate with 2 long ventral bristles; 3rd joint elongate with small terminal process (process present on both limbs). Exopodite: similar to that of adult female except terminal closely ringed section of bristles bare and only about  $1/5$  length of bristle (Figure 13e); 9th joint with 2 bristles.

**Mandible, Maxilla, and Fifth Limb:** Well developed but not examined in detail.

**Sixth Limb:** With many bristles.

**Seventh Limb** (Figure 13f): Elongate, bare.

**Furca:** Similar number and distribution of claws as on adult female.

**Bellonci Organ:** Not observed.

**Eyes:** Lateral eye small with 5 minute ommatidia (Figure 14g). Medial eye not observed.

**Genitalia:** Absent.

**Anterior of Body:** With low rounded anterior process.

**Posterior of Body:** Evenly rounded, bare.

**COMPARISONS.**—The triangular shape of *H. vatrax* when viewed anteriorly or posteriorly separates it from other species referred to the genus.



REMARKS.—The juvenile (instar III male) examined is without natatory hairs on exopodial bristles of the 2nd antenna indicating that the juvenile is either not an efficient swimmer or incapable of swimming. The distal  $1/4$  to  $1/3$  of some exopodial bristles of the adult female bear natatory hairs indicating that adult females are capable of swimming. The hairs are thinner and much shorter than those of the adult male. The exopodial bristles of the adult male bear long natatory hairs on the distal  $1/2$  to  $2/3$  and males are probably more powerful swimmers than adult females. The sample from Slope 1 contains 31 specimens of the species; most are adult females, and only 1 is an adult male, suggesting that adult males are relatively sparse in the benthos. Only 1 adult female has eggs in the marsupium but many have unextruded eggs.

*Harbansus felix*, new species

Figures 15–17

ETYMOLOGY.—From the Latin *felix* (happy).

HOLOTYPE.—Undissected adult female in alcohol in the Museum of Victoria.

TYPE LOCALITY.—Slope 1,  $34^{\circ}59.52'S$ ,  $151^{\circ}5.94'E$ , New South Wales, off Nowra, depth 204 m.

PARATYPES.—Slope 1: USNM 193943, adult female with large unextruded eggs on slide and in alcohol; undissected adult female in alcohol. Slope 40: 1 undissected adult female in alcohol.

DISTRIBUTION.—Slope 1, 204 m. Slope 40, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 15–17).—Carapace elongate with prominent rostrum with lateral process and broad projecting caudal process (Figure 15a,b); central adductor muscle attachments covered by broad spine terminating posteriorly in point (Figure 15c,d).

*Ornamentation:* Rostrum with long narrow lateral projection (Figure 15a,b); lateral spine covering central adductor muscle attachments. Surface with numerous large fairly deep fossae (Figure 15a,b), and scattered bristles (some with stout triangular base); bristles more abundant along anteroventral and ventral margins (Figure 15a,b).

*Infold:* Rostral infold with 4 bristles plus a pair of bristles at inner end of incisur (Figure 15e); anteroventral infold with 1 bristle near inner end of incisur, about 7 ridges parallel to outer edge of valve, and 1 bristle near posterior end of ridges; infold of caudal process with 6 frond-like bristles on ridge at anterior end of “pocket” (Figure 15f); several small bristles present at inner edge of infold anterior to caudal process (Figure 15f).

*Central Adductor Muscle Attachments* (Figure 15d): Comprising about 23 oval and elongate attachments.

*Carapace Size* (length, height in mm): Slope 1: holotype, 0.99, 0.59; USNM 193943, 1.04, 0.60; 0.96, 0.61. Slope 40: 1.06, 0.61.

*First Antenna* (Figure 16a,b): 1st joint bare. 2nd joint with dorsal spines and 1 spinous dorsal bristle. 3rd joint with 3

spinous bristles (2 dorsal, 1 ventral). 4th joint with 3 spinous bristles (1 dorsal, 2 ventral). Ventral bristle of 5th joint with 3 short proximal filaments, 1 long distal filament, and 2 minute spines at tip. 6th joint fused to 5th, with fairly long spinous medial bristle. 7th joint: a-bristle slightly longer than bristle of 6th joint, with short marginal spines; b-bristle longer than a-bristle, with short distal filament and 2 minute spines at tip; c-bristle slightly longer than bristle of 5th joint, with 3 short proximal filaments, 2 long distal filaments, and 2 minute spines at tip. 8th joint: d- and e-bristles as long as c-bristle, bare with blunt tips; f-bristle about same length as bristle of 5th joint, with 2 short proximal filaments, 1 short and 2 long distal filaments, and 2 minute spines at tip; g-bristle same length as c-bristle, with 2 short proximal filaments, 1 short and 2 long distal filaments, and 2 minute spines at tip.

*Second Antenna:* Protopodite bare (Figure 16c,d). Endopodite 2-jointed (Figure 16c): 1st joint with 2 short bare proximal bristles; 2nd joint elongate with rounded tip and 1 long spinous bristle at midlength. Exopodite: 1st joint with small terminal medial bristle; bristles of joints 2–8 about same length as combined lengths of joints 1–4 or 5, with few dorsal hairs proximal to ventral spines, and without distal hairs; 9th joint with 3 bristles (ventral about same length as bristle of 8th joint, with ventral spines and distal dorsal spines; middle short with short slender spines; dorsal very short, with few hair-like short spines); joints 2–8 with short spines along distal margins (basal spines, if present, obscured). (Note: absence of long distal hairs on exopodial bristles indicates female to be nonswimmer.)

*Mandible* (Figure 17a): Coxale endite bifurcate, spinous, without small bristle at base. Basale: dorsal margin with 3 bristles (1 at distal  $3/4$ , 2 subterminal); ventral margin and medial surface at ventral margin with total of 5 bristles (3 proximal and 1 at midlength short, 1 distal longer); lateral surface with 2 bristles (with long and short spines) near ventral margin; medial surface spinous. Exopodite spinous, about  $2/3$  length of dorsal margin of 1st endopodial joint, with 2 bristles (proximal longer and with long spines). 1st endopodial joint with medial spines and 3 ventral bristles (2 long, 1 minute). 2nd endopodial joint: dorsal margin with 4 bristles near midlength in 2 groups (proximal group with 1 bristle, distal group with 3); ventral margin with spines and 4 short distal bristles in 2 groups (2 bristles in each group); medial surface with rows of spines. 3rd endopodial joint with 1 short dorsal claw and 2 long claws, all with indistinct spines, and 3 slender ringed bristles.

*Maxilla* (Figure 16e–i): Coxale with fringe of dorsal hairs and dorsal bristle (Figure 16g). Endite I wider than endites II and III, with 7 bristles (Figure 16e); endite II with 4 or 5 bristles; endite III with 1 proximal and 4 terminal bristles (Figure 16f,g). Basale with 3 bristles along distal margin (1 dorsal, 1 ventral, 1 medial). Exopodite small with 3 bristles (2 long, 1 short) (Figure 16g). 1st endopodial joint with 1 alpha-bristle with long hairs, and 2 beta-bristles (inner bare, outer longer with short marginal spines) (Figure 16g). 2nd

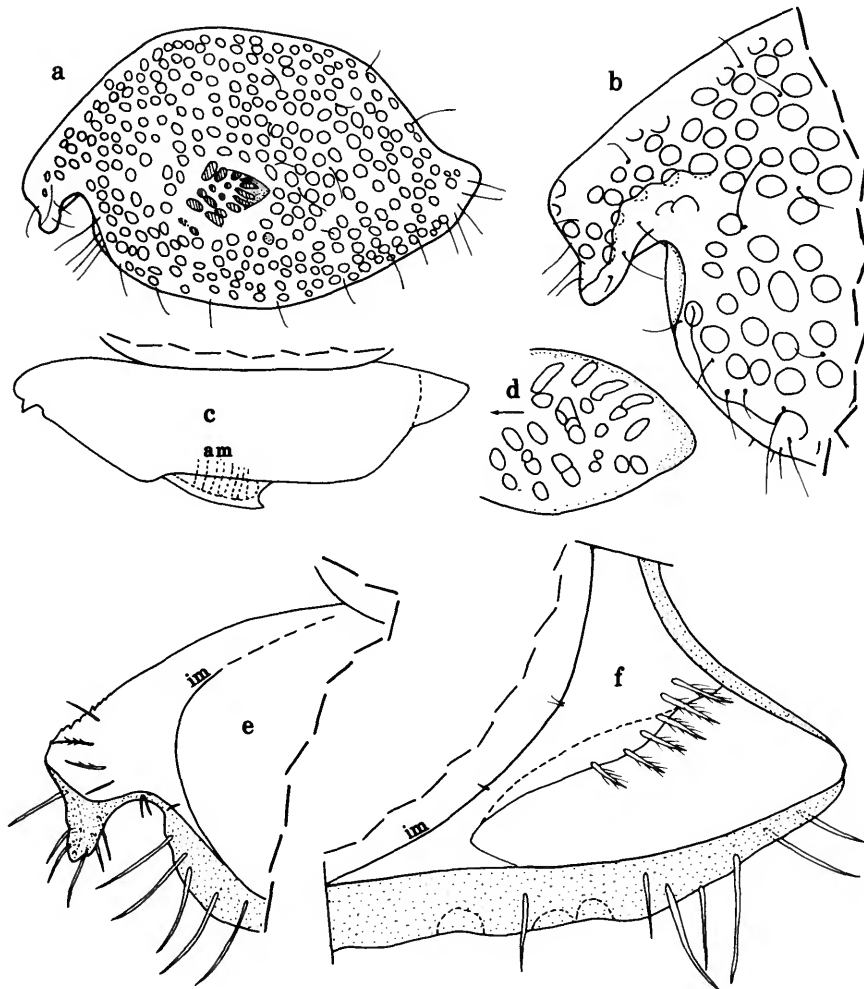


FIGURE 15.—*Harbansus felix*, new species, adult female, paratype, USNM 193943: a, complete specimen from left side, length 1.04 mm; b, detail from a; c, dorsal view of left valve, anterior to left (some adductor muscles within spine shown by dashed lines); d, lateral spine and some central adductor muscle attachments, left valve, ov; e, oblique view of inside of anterior of right valve (small part of attached left valve shown at top); f, caudal process, right valve, iv.

endopodial joint with 2 long ringed a-bristles plus 2 unringed claw-like d-bristles and 4 ringed bristles (1b, 2c, 1d) (Figure 16h,i).

**Fifth Limb** (Figure 17b-g): Epipodite with 34 bristles. Endite I with 2 bristles; endite II with 3 or 4 bristles; endite III with 7 or 8 bristles (Figure 16d-g). 1st exopodial joint: main tooth with 3 teeth (1 distal pectinate tooth with large smooth triangular cusp on anterior side, 1 middle pectinate tooth, and 1 proximal peg-like tooth with few spines); short spinous bristle proximal to peg-like tooth; anterior side with pair of long bristles along distal edge near midwidth, and few spines on outer corner (Figure 17c). 2nd exopodial joint with large flat tooth with 2 short cusps near middle of inner margin and 3 or

4 low nodes on inner edge between cusps and tip of tooth; posterior side with row of 3 bristles (long bristle in middle, 1 short bristle on each side) and long bristle proximal to row (Figure 17b). 3rd exopodial joint with 2 bristles on inner lobe and 2 on outer lobe. 4th and 5th exopodial joints fused, with total of 5 bristles (Figure 17b).

**Sixth Limb** (Figure 17h): 1 short epipodial bristle with long proximal hairs. Endite I small with 4 bristles; endite II with 3 spinous bristles; endite III broad with 5 spinous bristles; endite IV narrower than endite III, with 3 spinous bristles. End joint not prolonged posteriorly, with 6 bristles (4 anterior spinous separated by space from 2 posterior hirsute). Limb hirsute.

**Seventh Limb** (Figure 16j): Proximal group with 2 bristles

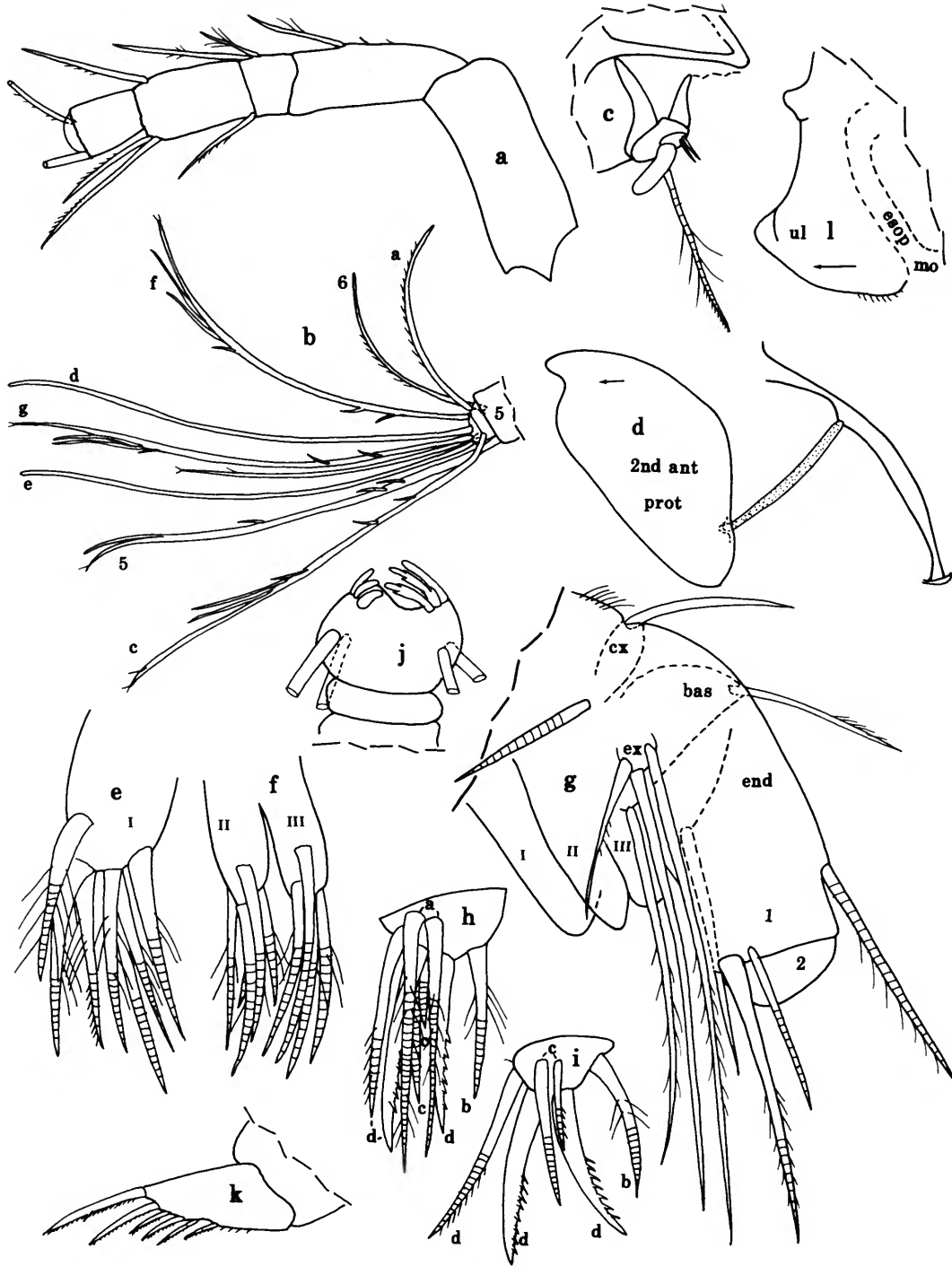


FIGURE 16.—*Harbansus felix*, new species, adult female, paratype, USNM 193943: a, left 1st antenna, lv (bristles of joints 7 and 8 not shown); b, joints 5-8, left 1st antenna, lv; c, distal protopodite and endopodite, left 2nd antenna, mv; d, protopodite and attached sclerite (stippled), left 2nd antenna, lv; e, endite I, left maxilla, lv (anterior to left); f, endites II (left) and III (right), right maxilla, lv (anterior to right); g, right maxilla, lv (not all bristles shown); h, 2nd endopodial joint, right maxilla, lv; i, 2nd endopodial joint, left maxilla, mv (a-bristles not shown); j, tip of 7th limb; k, left furcal lamella.



FIGURE 17.—*Harbansus felix*, new species, adult female, paratype, USNM 193943: *a*, left mandible, mv; *b*, tip of left 5th limb, pv; *c*, tip of right 5th limb, av; *d-f*, endites I, II, and III, respectively, left 5th limb, pv; *g*, endites I (right), II (middle), and III (left), right 5th limb, av; *h*, 6th limb; *i*, medial eye and Bellonci organ, lv; *j*, medial eye and Bellonci organ, dorsal view (under cover slip); *k*, posterior of body showing part of furca, right Y-sclerite, girdle, unextruded egg (dashed oval), and right genital organ.

(on segments 6–8 counting from segment proximal to terminal segment), 1 on each side, each with distal spines and 2 bells. Terminal group with 4 bristles, 2 on each side, each with distal spines and 4 bells. Terminal segment with 2 combs: 1 with 5 long recurved alate teeth, other with 5 or 6 short recurved smooth peg-like teeth.

*Furca* (Figure 16k): Each lamella with 6 claws; claws 1, 2, and 4 stout; claws 3, 5, and 6 slender; all claws with teeth along posterior edge (tooth at midlength of claw 1 stouter than others); claw 1 with row of medial teeth (distal medial tooth very large); spines on lamella following claw 6; right lamella anterior to left by width of base of claw 1 and with few spines along anterior edge; claw 1 with row of medial spines near base (not shown).

*Bellonci Organ* (Figure 17i,j): Elongate, with 4–6 very weakly developed sutures indicated mainly by constrictions along edge of organ; tip rounded, with 2 minute processes.

*Eyes*: Lateral eyes absent. Medial eye unpigmented, bare (Figure 17i,j).

*Upper Lip* (Figure 16l): Comprised of single lobe; glandular openings not observed.

*Genitalia* (Figure 17k): Small sclerotized oval enclosing small granules; spermatophore absent.

*Posterior of Body* (Figure 17k): Evenly rounded, bare.

*Y-Sclerite* (Figure 17k): With ventral branch.

*Number of Eggs*: USNM 193943 with 5 unextruded eggs; length of 1 egg 0.14 mm. Unextruded egg shown by dashed oval in Figure 17k.

COMPARISONS.—The carapace of *H. felix* differs from those of other species in the genus in having a stout, lateral, backward pointing spine over the central adductor muscle attachments.

### *Harbansus tenax*, new species

FIGURES 18–20

ETYMOLOGY.—From the Latin *tenax* (holding fast).

HOLOTYPE.—Undissected adult female in alcohol in the collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 40, 38°17.70'S, 149°11.30'E, Victoria, S of Point Hicks; depth 400 m.

PARATYPES.—Slope 40: USNM 193977, ovigerous female on slide and in alcohol; USNM 193978, partly dissected ovigerous female in alcohol; 20 undissected specimens including ovigerous females, adult females, and juveniles, in alcohol.

DISTRIBUTION.—Slope 40, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 18–20).—Carapace elongate with prominent rostrum and projecting caudal process (Figure 18a).

*Ornamentation*: Anterior edge of rostrum with minute scallops (Figure 18a,b); surface with scattered undivided bristles and without ribs or distinct fossae.

*Infold*: Rostral infold with 8–10 bristles and a pair of

bristles at inner end of incisur (Figure 18b); anteroventral infold with 1 bristle near inner end of incisur, 6 narrow ridges, and 4 bristles (3 shown in Figure 18b) between outer ridge and valve edge. Infold of caudal process with 6 frond-like bristles along ridge forming “pocket” (Figure 18c); additional small bristles near inner margin of infold anterior to caudal process.

*Central Adductor Muscle Attachments* (Figure 18a): Comprising about 34 oval attachments, most forming rows.

*Carapace Size* (length, height in mm): Slope 40: holotype, 1.26, 0.74; USNM 193977, 1.24, 0.77; USNM 193778, 1.28, 0.85; 1.23, 0.73; 1.24, 0.73.

*First Antenna* (Figure 18d,e): 1st joint bare. 2nd joint with lateral and dorsal spines and 1 spinous dorsal bristle. 3rd joint with ventral and dorsal spines and 3 bristles (2 dorsal, 1 ventral). 4th joint with dorsal spines and 4 bristles (2 dorsal, 2 ventral). Ventral bristle of 5th joint with 5 marginal filaments and 2 minute spines at tip (Figure 18e). 6th joint fused to 5th, with fairly long medial bristle with indistinct short spines. 7th joint: a-bristle about same length as bristle of 6th joint or about  $\frac{1}{3}$  longer, with short marginal spines; b-bristle more than twice length of a-bristle, with 2 marginal filaments and 2 minute spines at tip; c-bristle slightly longer than bristle of 5th joint, with 3 proximal and 2 distal marginal filaments and 2 minute spines at tip. 8th joint: d- and e-bristles as long as c-bristle, bare with blunt tips; f-bristle slightly shorter than bristle of 5th joint, with 5 marginal filaments and 2 spines at tip; g-bristle about same length as c-bristle, with 5 marginal filaments and 2 spines at tip.

*Second Antenna*: Protopodite bare. Endopodite 2-jointed (Figure 18f,g): 1st joint with 2 short bare proximal bristles; 2nd joint elongate with 1 long spinous bristle at midlength and rounded tip with minute bristle (Figure 18g). Exopodite (Figure 18h,i): 1st joint with minute recurved terminal medial bristle with tubular tip; bristles of joint 2–8 about same length as combined lengths of joints 1–3, with few long hairs on long 1st segment and ventral spines, and without hairs on distal segments; 9th joint with 2 bristles (ventral slightly shorter than bristle of 8th joint, with few long hairs on proximal segment, ventral spines, and distal dorsal spines; dorsal short with short slender ventral spines); joints 2–8 with short spines along distal margins; joints 5–8 with basal spines (Figure 18i). (Note: absence of distal hairs on exopodial bristles indicates female to be nonswimmer.)

*Mandible* (Figure 19a): Coxale endite bifurcate, spinous, without small bristle at base. Basale: dorsal margin with 3 ringed bristles (1 at distal  $\frac{2}{3}$ , 2 terminal); ventral margin and medial surface near ventral margin with total of 5 bristles (3 proximal and 1 at midlength short, 1 longer distal); lateral surface with 2 bristles (with long and short spines) extending past ventral margin; medial surface spinous. Exopodite spinous, reaching past midlength of dorsal margin of 1st endopodial joint, with 2 bristles (proximal longer and with long spines). 1st endopodial joint with medial spines and 3 ventral

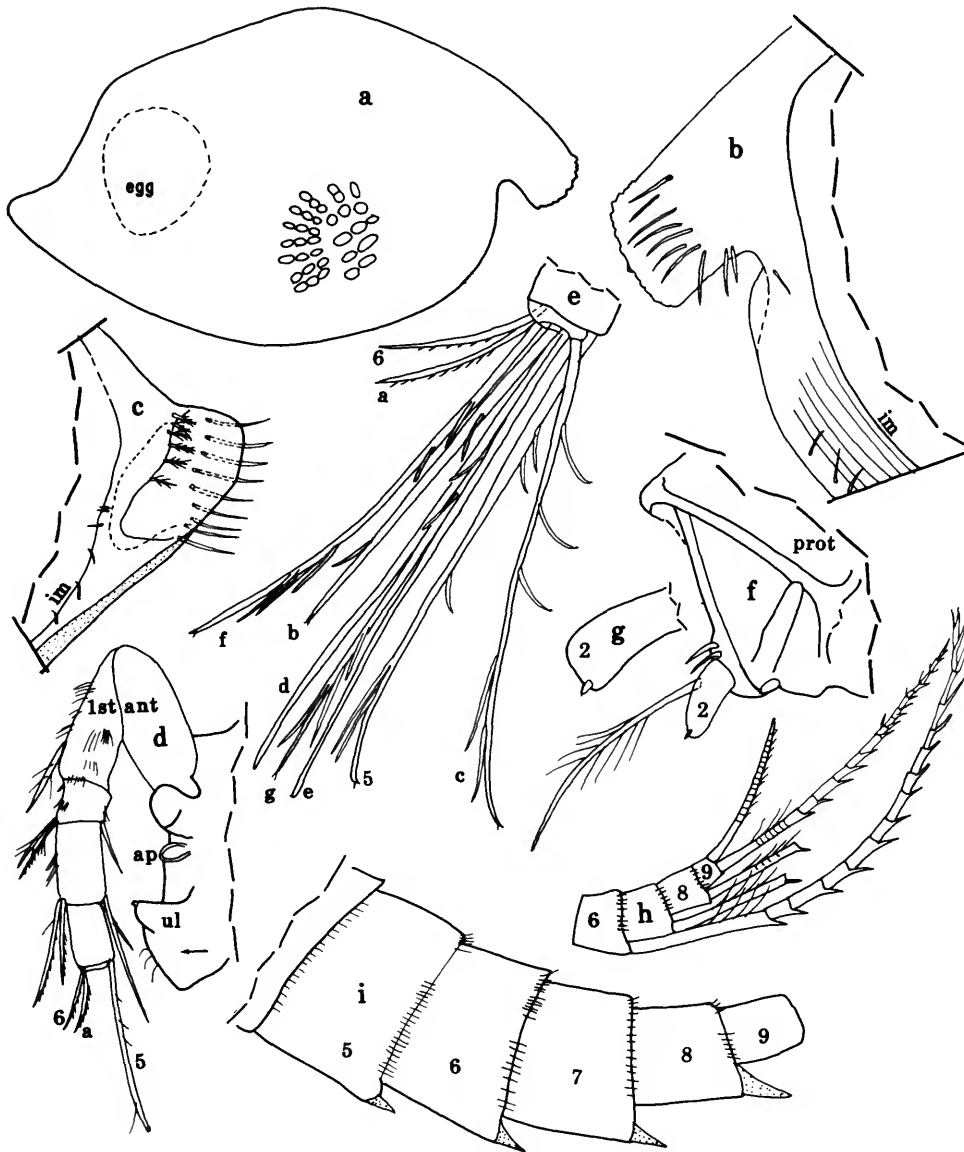


FIGURE 18.—*Harbansus tenax*, new species, ovigerous female, paratype, USNM 193977: a, complete specimen from right side showing location of egg (dashed oval), length 1.24 mm; b, anterior, right valve, iv; c, caudal process, right valve, iv; d, anterior of body from left side showing left 1st antenna (only a-bristle of 7th joint, and no bristles of 8th joint shown), anterior process, and upper lip; e, joints 5-8, left 1st antenna, iv; f, distal protopodite and endopodite, right 2nd antenna, mv; g, tip of 2nd endopodial joint, left 2nd antenna; h, joints 6-9, exopodite, right 2nd antenna, mv (only proximal parts of bristles of joints 7 and 8 shown); i, joints 5-9, exopodite, left 2nd antenna, iv (bristles not shown).

bristles (2 long, 1 short). 2nd endopodial joint: dorsal margin with 6 or 7 bristles near midlength in 2 groups (2 bristles in proximal group, 4 or 5 in distal group); ventral margin with spines and 4 short distal bristles in 2 groups (2 bristles in each group); medial surface with rows of spines. 3rd endopodial joint with small dorsal claw, 2 long claws with proximal ventral spines, and 3 slender ringed bristles.

**Maxilla** (Figure 19b,c): Precoxale with fringe of dorsal hairs. Coxale with dorsal hairs, spinous dorsal bristle, and 1 lateral bristle near midheight (Figure 19b). Endite I broader than endites II and III, with 6 spinous bristles (Figure 19b); endites II and III each with 6 spinous bristles (Figure 19b). Basale with 3 spinous bristles along distal margin (1 dorsal, 1 medial ventral, 1 lateral ventral). Exopodite small with 3

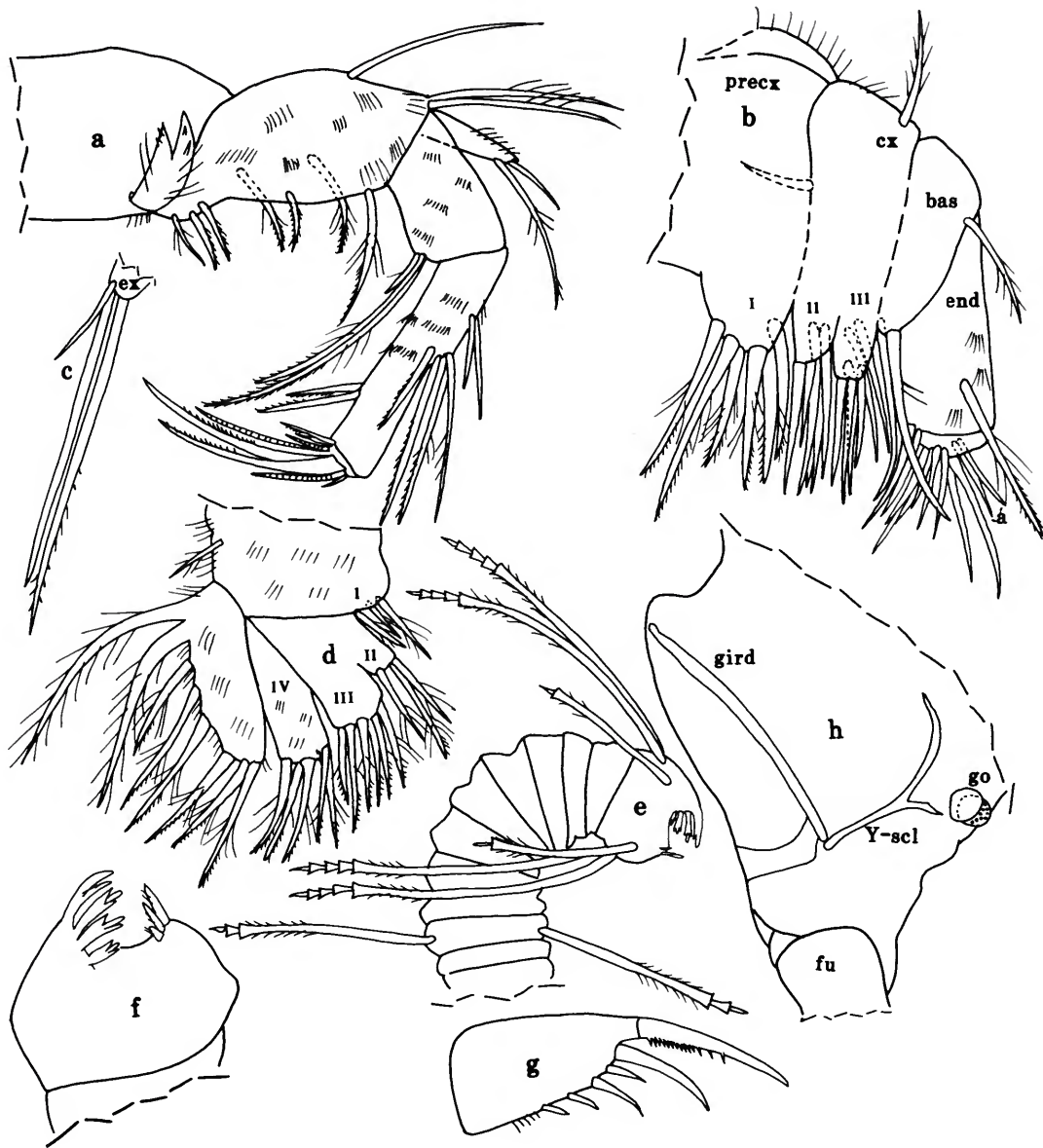


FIGURE 19.—*Harbansus tenax*, new species, ovigerous female, paratype, USNM 193977: a, left mandible, mv; b, left maxilla, mv (exopodite, spines and rings of most bristles not shown); c, exopodite, left maxilla, mv; d, 6th limb (rings and spines on some bristles not shown); e, 7th limb; f, detail of tip of e; g, right furcal lamella; h, posterior of body from right side showing Y-sclerite, girdle, and right genital organ.

bristles (2 long, 1 short) (Figure 19c). 1st endopodial joint with 1 alpha-bristle with long and short spines, and 2 beta-bristles. 2nd endopodial joint obscured on USNM 193977 but with about 10 bristles.

**Fifth Limb** (Figure 20a-d): Endite I with 2 bristles (Figure 20c); endites II and III each with 6 bristles (Figure 20c). 1st exopodial joint: main tooth complex, with 3 pectinate teeth, small slender bare proximal tooth, and short spinous ringed bristle proximal to teeth (Figure 20a); anterior side with pair of

long bristles along distal edge near midwidth, small ringed spinous bristle on outer corner, and spines near outer corner (Figure 20b). 2nd endopodial joint with large flat tooth with uneven inner margin; posterior side with row of 3 bristles (long bristle in middle, 1 short bristle on each side) and long bristle proximal to row (Figure 20a). 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer lobe (Figure 20d). 4th and 5th exopodial joints fused, with total of 7 bristles (Figure 20d).

**Sixth Limb** (Figure 19d): 1 short epipodial bristle with long

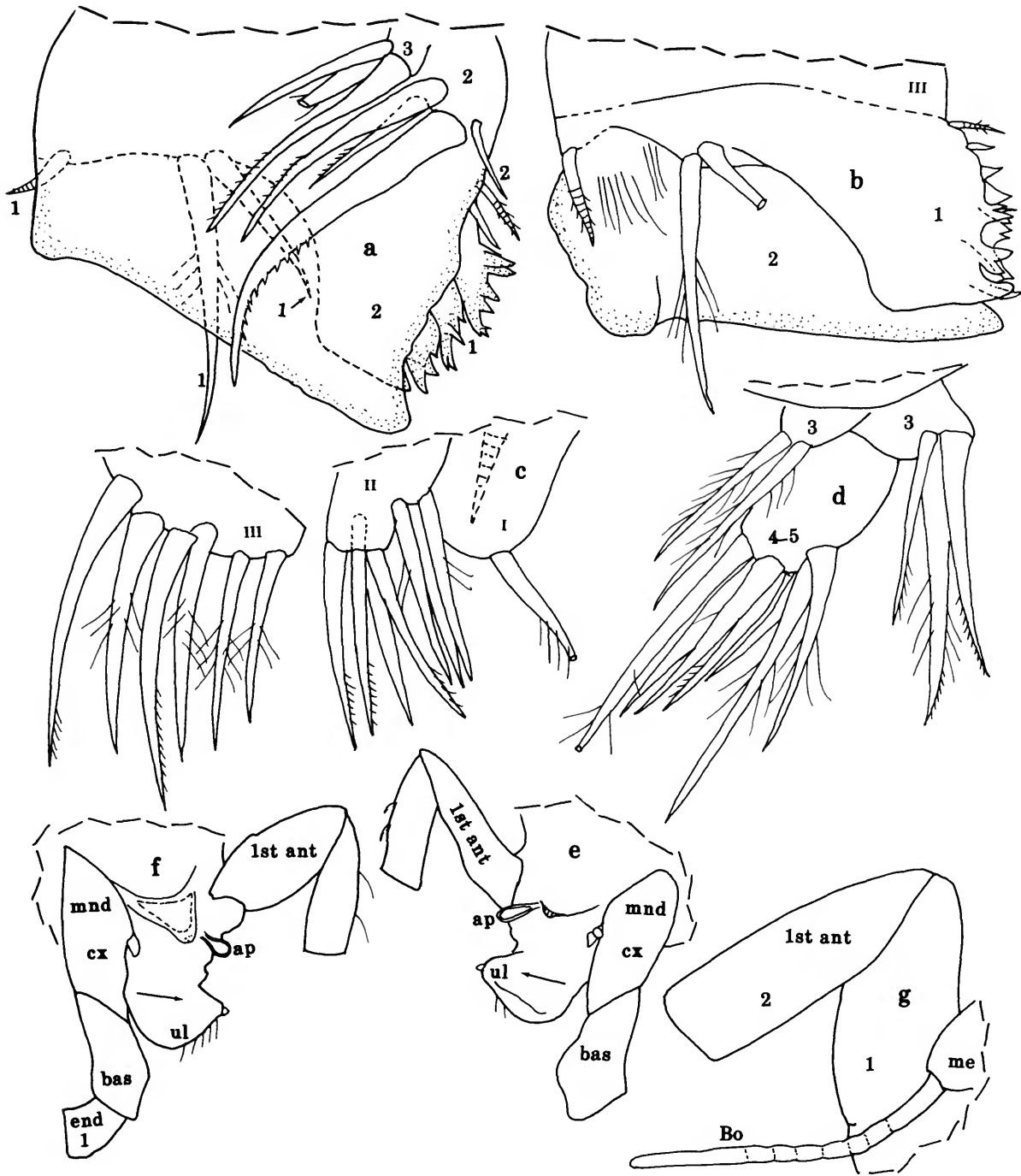


FIGURE 20.—*Harbansus tenax*, new species, ovigerous female, paratype, USNM 193977: *a*, tip of part of left 5th limb, pv (spines not shown on some bristles); *b*, tip of part of right 5th limb, av; *c*, endites I (right), II (middle), and III (left), right 5th limb, av; *d*, exopodial joints 3-5 (4th and 5th joints fused), left 5th limb, pv; *e, f*, anterior of body from left and right sides showing parts of 1st antenna, mandible, anterior process, and upper lip. *g*, ovigerous female, paratype, USNM 193978, joints 1 and 2 of right 1st antenna (bristles and hairs not shown), medial eye, and Bellonci organ.



hairs. Endites I and II each with 3 spinous bristles; endite III with 6 spinous bristles; endite IV narrower than endite III, with 5 spinous bristles. End joint not prolonged posteriorly, with 7 or 8 bristles (5 or 6 anterior with long proximal and short distal spines; 2 posterior plumose). Limb hirsute.

*Seventh Limb* (Figure 19e,f): Proximal group with 2 bristles (on segments 9 or 10 counting from segment proximal to terminal segment), 1 on each side, each with distal spines and 2 bells. Terminal group with 6 bristles, 3 on each side, each with distal spines and terminal bells (2 with 1 bell, 4 with 4 bells). Terminal segment with terminal comb with 8 or 9 alate teeth opposite comb of 5 small peg-like teeth with indistinct marginal spines (Figure 19f).

*Furca* (Figure 19g): Each lamella with 6 claws; claws 1, 2, and 4 stout; claws 3, 5, and 6 short slender; all claws with teeth along posterior edge (not shown) (tooth at midlength of claw 1 stouter than others; length of tooth about equal to width of claw at midlength); claw 1 with row of medial teeth (distal medial tooth large); spines on lamella following claw 6; right lamella anterior to left by width of base of claw 1.

*Bellonci Organ* (Figure 20g): Elongate, with about 7 indistinct weakly developed sutures.

*Eyes*: Lateral eyes absent. Medial eye small unpigmented (Figure 20g).

*Upper Lip* (Figure 20e,f): Single hirsute lobe tapering anteriorly and with glandular process at tip.

*Genitalia*: Rimmed oval at each side of body anterior to furca; USNM 193977 with spermatophore attached to each oval (Figure 19h).

*Anterior of Body* (Figure 20e,f): Elongate anterior process with sclerotised edge present ventral to bases of 1st antennae.

*Posterior of Body* (Figure 19h): Bare.

*Y-Sclerite* (Figure 19h): With ventral branch.

*Number of Eggs*: USNM 193977 with 4 eggs in marsupium; length of 1 egg 0.27 mm. USNM 193978 with 5 eggs in marsupium; individual lengths of 2 eggs 0.38 mm. Location of 1 egg shown in Figure 18a.

**COMPARISONS.**—The carapace of *H. tenax* differs from that of *H. vatrax* and *H. vix* Kornicker (1991a:74) in not having lateral ribs, and from *H. felix* in not having a rib along the ventral edge of the rostrum. In the “Key to Adult Females of Species of *Harbansus*” in Kornicker (1992:97), *H. tenax* keys out to *H. mayeri* Kornicker, 1978. *Harbansus tenax* differs from *H. mayeri* in not having lateral eyes and in not having a small 3rd joint on the endopodite of the 2nd antenna.

### *Harbansus hapax*, new species

FIGURES 21–23

*Harbansus* species A.—Kornicker, 1994, fig. 109f.

**ETYMOLOGY.**—From the Greek *hapax* (once only).

**HOLOTYPE.**—Undissected ovigerous female in alcohol in collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 53, 34°52.72'S, 151°15.04'E, New South Wales, 54 km ESE of Nowra; depth 996 m.

**PARATYPES.**—USNM 193998, ovigerous female on slide and in alcohol.

**DISTRIBUTION.**—Slope 53, 996 m. Slope 56, 429 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 21–23).—Carapace elongate with prominent rostrum and broad caudal process (Figure 21a,c).

**Ornamentation:** Rostrum with lateral rib curving around incisur and forming low rib at anteroventral corner of valve (Figure 21a,b); rostrum of left valve (Figure 21d) broader than that of right (Figure 21b), and with narrow irregular low rib near dorsal margin (Figure 21a); anteroventral tip of rostrum extending laterally past oblique valve edge (Figure 21d,f). Surface with large irregular fossae (Figure 21a,b) (fossae on USNM 193998 filled with debris appearing brown in transmitted light). Long single bristles sparsely distributed on valve surface, and more numerous (about 13 bristles) along ventral margin (not all shown in Figure 21a).

**Infold:** Rostral infold with row of 4 long spinous bristles parallel to anterior margin, and a pair of bristles at inner end of incisur (these appear to be external to lamellar prolongation of selvage) (Figure 21d,f); anteroventral infold with 1 small bristle near inner end of incisur and 5 or 6 narrow ridges (no bristles near ridges). Infold of caudal process with 6 frond-like bristles along ridge forming “pocket” (Figure 21e); additional small bristles near inner margin of infold anterior to caudal process.

**Selvage:** Lamellar prolongation with marginal fringe present along anterodorsal, anterior, and ventral margins, and along posterior margin dorsal to caudal process; prolongation absent along posterior edge of caudal process; prolongation very broad in vicinity of incisur and divided at inner end of incisur (Figure 21f).

**Central Adductor Muscle Attachments** (Figure 21g): Comprising about 27 oval attachments.

**Carapace Size** (length, height in mm): Slope 53, holotype, 1.42, 0.87. Slope 56, USNM 193998, 1.45, 0.89.

**First Antenna** (Figure 21h): 1st joint with lateral and medial rows of spines. 2nd joint with dorsal, ventral, medial, and lateral slender spines, and 1 spinous dorsal bristle. 3rd joint with ventral spines, short row of lateral spines in distal ventral corner, and 3 spinous bristles (1 ventral, 2 dorsal). 4th joint with ventral and dorsal spines and 3 spinous bristles (2 ventral, 1 dorsal). Ventral bristle of 5th joint with 2 proximal and 2 or 3 subterminal filaments and 2 minute spines at tip. 6th joint fused to 5th, with short slender medial bristle. 7th joint: a-bristle  $\frac{1}{4}$  to  $\frac{1}{2}$  longer than bristle of 6th joint, with short spines; b-bristle about twice length of a-bristle, with 1 short distal filament and 2 minute spines at tip; c-bristle about same length as bristle of 5th joint, with 1 or 2 proximal and 3 distal filaments and 2 minute spines at tip. 8th joint: d- and e-bristles as long as c-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with 2 proximal and 2 or 3 distal filaments and 2 minute spines at tip; g-bristle slightly longer than

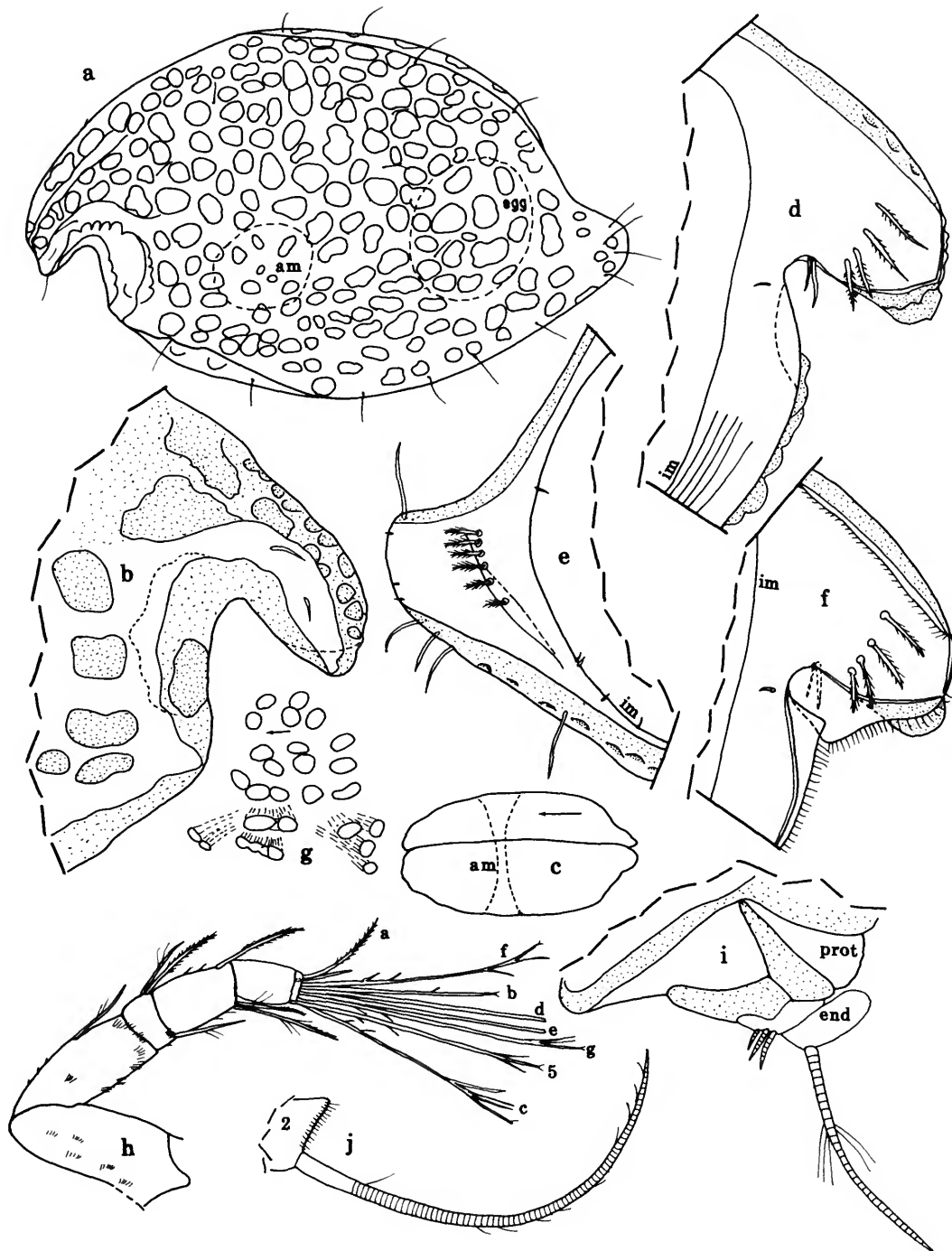


FIGURE 21.—*Harbansus hapax*, new species, ovigerous female, paratype, USNM 193998: *a*, complete specimen from left side, length 1.45 mm (dashed anterior oval shows location of central adductor muscles; posterior dashed oval shows location of an egg); *b*, anterior, right valve, ov; *c*, dorsal view of complete specimen (anterior to left; outline of central adductor muscles dashed); *d*, anterior, left valve, iv; *e*, caudal process, left valve, iv; *f*, anterior of left valve showing lamellar prolongation of selva with marginal fringe, iv; *g*, central adductor muscle attachments, left valve, ov (anterior to left); *h*, right 1st antenna, lv; *i*, protopodite and endopodite, right 2nd antenna, mv; *j*, bristle of 2nd exopodial joint, right 2nd antenna, mv.

f-bristle, with 2 proximal and 2 distal filaments and 2 minute spines at tip.

*Second Antenna:* Protopodite bare (Figures 21i, 23g). Endopodite 2-jointed (Figure 21i): 1st joint with 3 short proximal bristles (bare or with indistinct spines); 2nd joint elongate with long spinous ventral bristle in proximal  $\frac{1}{3}$  and broadly rounded bare tip. Exopodite: 1st joint with minute recurved terminal medial bristle with tubular tip; bristles of joints 2–8 about same length as combined lengths of joints 1 and 2, with slender ventral and dorsal spines, none or few (1–4) long proximal dorsal hairs, and without distal hairs (most exopodial bristles of left limb of USNM 193998 bare, probably aberrancy); 9th joint with 3 bristles (ventral bristle slightly shorter than bristle of 8th joint, with slender ventral and dorsal spines; middle and dorsal bristle short, with short ventral and dorsal spines; joints 2–8 with short spines along distal margins; basal spines absent; exopodial bristles with closely spaced rings (Figure 21j) (not with long joints like those of *H. tenax*). (Note: absence of distal hairs on exopodial bristles indicates female to be nonswimmer.)

*Mandible* (Figure 22a): Coxale endite bifurcate, spinous, without small bristle at base. Basale: dorsal margin with 3 bristles (1 at distal  $\frac{2}{3}$ , 2 terminal); ventral margin and medial surface near ventral margin with total of 5 bristles (3 proximal and 1 near midlength short, 1 distal longer); lateral surface with 2 bristles (with long proximal and short distal spines) extending past ventral margin; medial surface spinous. Exopodite spinous, reaching past midlength of dorsal margin of 1st endopodial joint, with 2 bristles (proximal longer and with long spines). 1st endopodial joint with medial spines and 3 ventral bristles (2 long, 1 short). 2nd endopodial joint: dorsal margin with spines, and 7 bristles near midlength; ventral margin with spines, and 4 short bristles in 2 groups (2 spinous bristles in each group; outer slightly medial bristle in distal group broader, unringed, and about twice length of inner bristle); medial surface with rows of spines. 3rd endopodial joint with small dorsal claw, 2 long claws with proximal ventral spines, and 3 slender ringed bristles.

*Maxilla* (Figure 22b–d): Precoxale and coxale with fringe of dorsal hairs. Coxale with dorsal bristle, and 1 lateral bristle near midheight (Figure 22b). Endite I broader than endites II and III, with 6 spinous distal bristles; endites II and III with 5 or 6 spinous or pectinate distal bristles. Basale with 3 spinous bristles along distal margin (1 dorsal, 1 medial ventral, 1 lateral ventral). Exopodite small with 3 bristles (2 long, 1 short (Figure 22b)). 1st endopodial joint with 1 alpha-bristle with long and short spines and 2 beta-bristles with short spines. 2nd endopodial joint with 3 stout unringed claws (1b, 2d) and 6 ringed bristles (2a, 1b, 2c, 1d) (Figure 22c,d).

*Fifth Limb:* With 3 endites (bristles not counted). 1st exopodial joint: main tooth complex with 1 smooth spine-like proximal tooth, 1 pectinate middle tooth, and 1 pectinate large bifurcate distal tooth (Figure 23b,c); ringed bristle proximal to spine-like tooth; anterior side of joint with pair of long bristles

along distal edge near midwidth (Figure 23b). 2nd exopodial joint with large flat tooth with uneven inner margin (Figure 23a,c); posterior side with row of 3 bristles (long bristle in middle, 1 short bristle on each side) and long bristle proximal to row (Figure 23a). 3rd exopodial joint with 3 bristles on inner lobe and 2 on smaller outer lobe. 4th and 5th exopodial joints fused, with total of 5 bristles with long proximal spines (Figure 23a).

*Sixth Limb* (Figure 22e): With 1 short epipodial bristle with long hairs. Endites I and II each with 3 spinous bristles; endite III with 5 or 6 spinous bristles; endite IV about same width or slightly broader than endite III, with 5 spinous bristles. End joint not prolonged posteriorly, with 4 anterior spinous bristles followed by space and 2 stout plumose bristles; anteroventral corner with small spinous process. Limb hirsute.

*Seventh Limb* (Figure 23d): Proximal group with 4 bristles (on segments 7–10 counting from segment proximal to terminal segment), 2 on each side, each with distal spines and 2 (usual) or 4 bells. Terminal group with 4 bristles, 2 on each side, each with distal spines and 3 or 4 bells. Some tufts protruding from terminal bells with spines, others similar in shape to bell but smaller. Terminal segment with comb with 5 alate teeth opposite comb with 3 smaller alate teeth.

*Furca* (Figure 23e,f): Each lamella with 8 or 9 claws; claws 1, 2, and 4 stout, remaining claws short slender; all claws with teeth along posterior edge (tooth at midlength of claw 1 not stouter than some of the more proximal teeth; length of tooth less than width of claw at midlength); claw 1 with row of medial teeth (1 distal medial tooth large, pointing downward); spines present on lamella following claws, and on anterior margin; right lamella with medial spines near anterior edge, and anterior to left lamella by width of base of claw 1. (Second claw in Figure 23e,f is on left lamella.)

*Bellonci Organ* (Figure 23h): Elongate with 5 or 6 proximal sutures and rounded tip.

*Eyes:* Lateral eyes absent. Medial eye unpigmented (part of eye missing in Figure 23h).

*Upper Lip* (Figure 23h): Single hirsute lobe tapering anteriorly and with glandular processes at tip.

*Genitalia* (Figure 23e): Rimmed oval at each side of body anterior to furca.

*Anterior of Body* (Figure 23 g,h): Single large rounded anterior process present ventral to bases of 1st antennae.

*Posterior of Body* (Figure 22f): Posterodorsal corner with long spines.

*Y-Sclerite* (Figures 22f, 23e): With ventral branch.

*Number of Eggs:* Holotype with 2 eggs in marsupium, length of 1 egg measured through shell 0.29 mm. USNM 193998 with 2 eggs in marsupium, length of 1 egg 0.32 mm (outline of egg shown in Figure 21a).

COMPARISONS.—In the key to species of *Harbansus* in Kornicker (1992:97) *H. hapax* keys out to *H. schornikovi* (Kornicker and Caraion, 1977:27). It differs from that species in having 8 or 9 claws instead of 6 on each lamella of the furca.

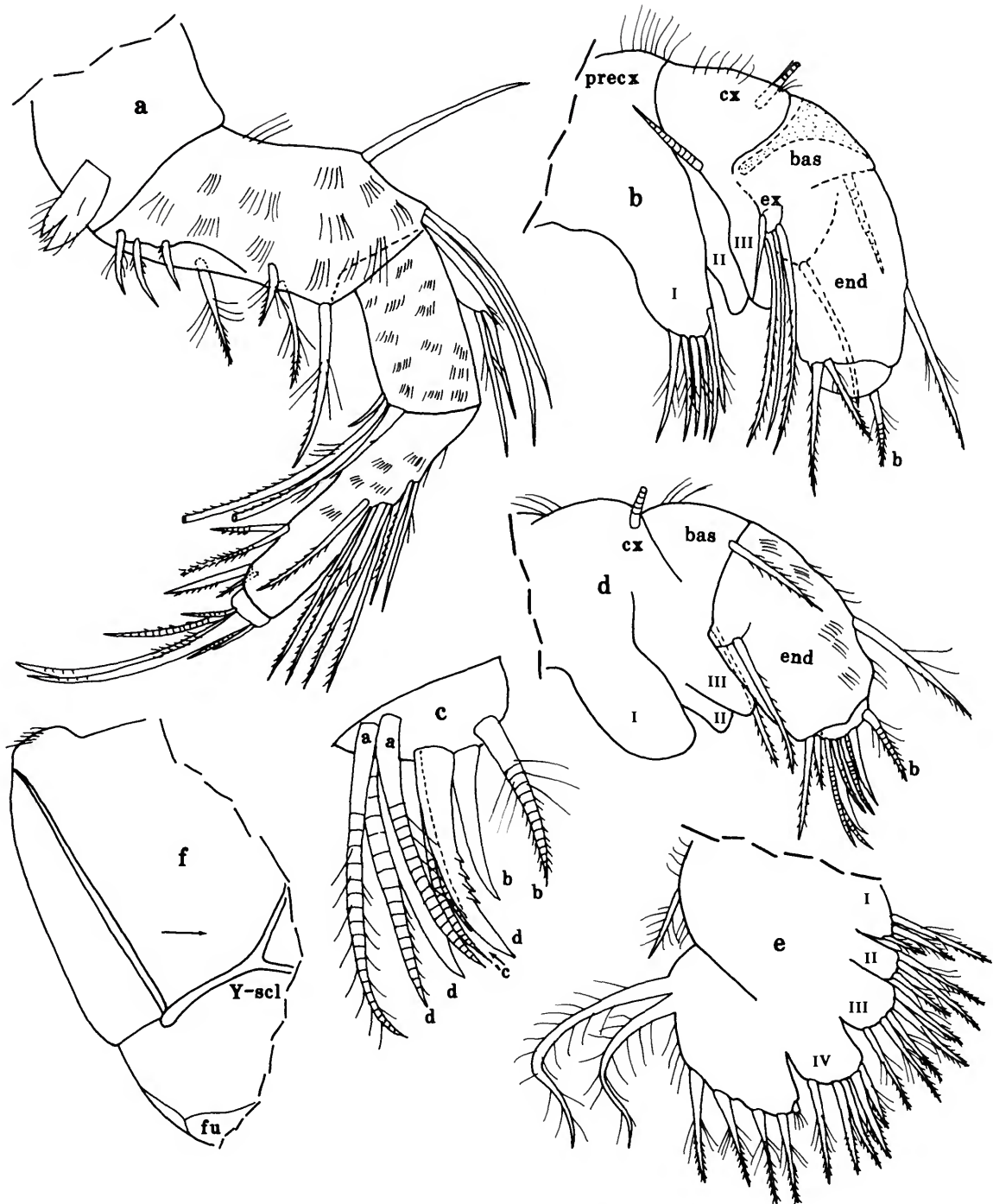


FIGURE 22.—*Harbansus hapax*, new species, ovigerous female, paratype, USNM 193998: *a*, left mandible, mv; *b*, right maxilla, lv (not all bristles shown); *c*, bristles of 2nd endopodial joint, right maxilla, lv; *d*, left maxilla, mv (not all bristles shown); *e*, right 6th limb, lv; *f*, posterior of body from right side showing hairs on dorsal corner, Y-sclerite, and girdle.

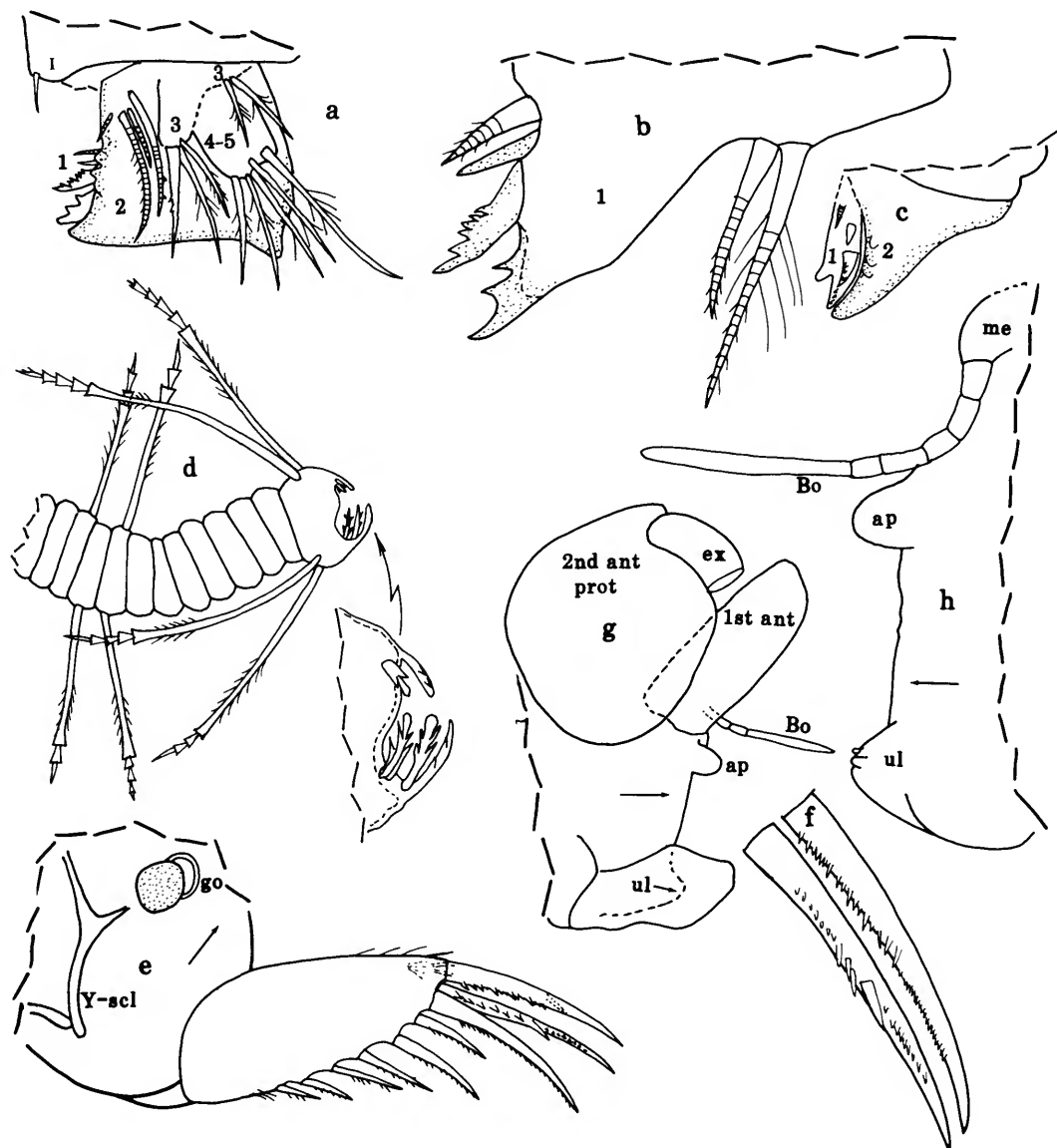


FIGURE 23.—*Harbansus hapax*, new species, ovigerous female, paratype, USNM 193998: a, tip of right 5th limb, pv; b, 1st exopodial joint of right 5th limb as seen through 2nd exopodial joint, pv; c, 1st and 2nd exopodial joints of right 5th limb, pv (limb not under cover slip); d, 7th limb; e, right furcal lamella and claw 1 of left lamella (2nd claw counting from right), Y-sclerite, and genital organ; f, claw 1 of right lamella on right showing row of lateral teeth, and claw 1 of left lamella on left showing row of medial teeth (both claws in place as in e); g, anterior of body from right side showing protopodite of right 2nd antenna, 1st joint of right 1st antenna; part of Bellonci organ, anterior process, basale of mandible (without bristles), and upper lip (dashed); h, anterior of body from left side showing medial eye, Bellonci organ, anterior process, and upper lip.

Four previously described species from the vicinity of Australia, *H. felix*, *H. slatteryi*, *H. tenax*, and *H. vatrax*, also have only 6 furcal claws. The carapace of *H. hapax* is without either the lateral alar process of *H. felix* or the lateral ribs of *H. slatteryi* and *H. vatrax*. The anterior tip of the rostrum of *H. tenax* does not overlap the oblique valve edge as on *H. hapax*.

***Harbansus vortex*, new species**

FIGURES 24, 25

ETYMOLOGY.—From the Latin *vortex* (whirlpool, eddy).

HOLOTYPE.—Adult female on slide and in alcohol in the collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden; depth 363 m.

PARATYPES.—Slope 22, 3 paratypes in alcohol.

DISTRIBUTION.—Slope 22, 363 m.

DESCRIPTION OF ADULT FEMALE (Figures 24, 25).—Carapace elongate with prominent rostrum and broad projecting caudal process (Figure 24*a,c,d*); in anterior and posterior views carapace broadly rounded except for angular dorsal  $1/4$  (Figure 24*d*); inferior tip of rostrum with lateral overlap (Figure 24*a,e*). Posterodorsal hinge fairly straight and slightly indented. Edge of left valve along dorsal margin of caudal process and margin dorsal to caudal process folds inward, probably overlapping right valve when valves closed (Figure 24*a*).

*Ornamentation:* Lateral rib on rostrum branching at posterior end of rostrum to form slightly oblique ridge on anterior dorsal part of valve (extending to about  $1/3$  valve length) and vertical rib extending to anteroventral part of valve where it forms right angle and continues horizontally to posteroventral part of valve where it terminates in bulge anterior to caudal process (Figure 24*a*); the rib expands as bulge over central adductor muscle attachments (Figure 24*a-d*); valve at anterior end of rib (in vicinity of right-angle) overhangs valve edge (Figure 24*a,e*); posterodorsal corner of valve with low but distinct lateral process (Figure 24*a*). Surface of valve with abundant fairly large distinct round fossae (Figure 24*a*) [fossae much larger than those of *H. vatrax*]; minute pustules form patches between fossae and line rims of fossae. Long undivided bristles forming lateral row along ventral edge of valves (Figure 24*e*) and very sparsely distributed on valve surface.

*Infold:* Rostral infold with 9 spinous bristles and a pair of bristles at inner end of incisur (Figure 24*e*); anteroventral infold with 1 small bristle at inner end of incisur, 7 or 8 narrow ridges, and 1 small bristle near posterior end of ridges (Figure 24*e*). Infold of caudal process with 7 frond-like bristles along ridge forming "pocket" (Figure 24*f*); about 8 small bristles on infold near inner margin anterior to caudal process (posterior 5 bristles shown in Figure 24*f*).

*Selvage:* Narrow along distal edge of rostrum, broad and divided at inner end of incisur, broad with fringe along anteroventral and ventral edge of valve, absent along posterior edge of caudal process, and narrow along posterior edge dorsal to tip of caudal process.

*Central Adductor Muscle Attachments* (Figure 24*a*): About 26 oval attachments located in lateral rib at anterior  $1/3$  of valve.

*Carapace Size* (length, height in mm): Holotype, 1.62, 0.86.

*First Antenna:* 1st joint bare. 2nd joint with indistinct ventral and dorsal spines and 1 dorsal bristle (with long proximal spines) at distal  $3/4$ . 3rd joint short, with 3 terminal bristles (1 ventral, 2 dorsal). 4th joint with 4 bristles (3 ventral,

1 dorsal). Sensory bristle of 5th joint with 2 short proximal filaments, 3 longer distal filaments, and minute terminal papilla. Medial bristle of 6th joint about same length as 5th joint, with short marginal spines. 7th joint: a-bristle about twice length of bristle of 6th joint, with short marginal spines; b-bristle slightly shorter than sensory bristle of 5th joint, with short distal filament and 2 minute terminal papillae; c-bristle same length as sensory bristle, with 5 distal filaments excluding stem and 2 minute terminal papillae. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with 2 short proximal and 3 distal filaments (1 short proximal, 2 longer); g-bristle similar to f-bristle.

*Second Antenna:* Protopodite bare (Figure 25*a*). Endopodite 2-jointed (Figure 25*a*): 1st joint with 3 small ventral bristles; 2nd joint elongate with long spinous ventral bristle at midlength and small sclerotized terminal peg-like process. Exopodite (Figure 25*b*): 1st joint with minute medial terminal bristle; bristles of joints 2–8 with stout ventral spines (last spine extending past tip of bristle), no natatory hairs; 9th joint with 2 bristles (dorsal short with indistinct minute spines; ventral long with stout ventral spines); joints 3–8 with basal spines increasing in length on distal joints; spine of 8th joint  $1/2$  to same length as 9th joint; 9th joint with minute medial spine adjacent to short dorsal bristle; joints 2–8 with small spines along distal edges.

*Mandible* (Figure 25*c*): Coxale endite hirsute and spinous, with 1 minute unringed bristle near base. Basale: dorsal margin with 3 bristles (1 near midlength, 2 terminal); ventral margin with 1 terminal bristle with long spines; medial surface spinous, with 4 bristles near ventral margin (3 proximal, 1 distal); lateral side with 2 bristles (with long spines) near ventral margin. Exopodite slender, about  $3/4$  length of dorsal margin of 1st endopodial joint, with hirsute dorsal pad and 2 subterminal bristles (lateral and proximal of these longer, spinous). 1st endopodial joint with medial spines and 3 ventral bristles (2 long with long proximal and short distal spines, 1 short); dorsal margin with small terminal spines. 2nd endopodial joint: dorsal margin with 7 bristles (5 long, 2 short); ventral margin with 4 spinous bristles forming 2 distal groups (2 bristles in each group; bristles in proximal group ringed; those in distal group unringed); medial surface without spines. 3rd endopodial joint with 3 claws (2 long stout, 1 short dorsal) with ventral spines, and 3 slender ringed bristles.

*Maxilla:* Precoxale and coxale with dorsal fringe of long hairs; coxale with long stout plumose dorsal bristle. Endite I wider than endites II and III, with 6 spinous and pectinate bristles; endite II also with 6 spinous and pectinate bristles; endite III with 1 proximal lateral bristle and 8 distal spinous and pectinate bristles. Basale with 3 long bristles along distal margin (2 ventral, 1 dorsal). Exopodite small with 3 bristles (2 long, 1 short). Endopodite: 1st joint with 1 alpha-bristle with

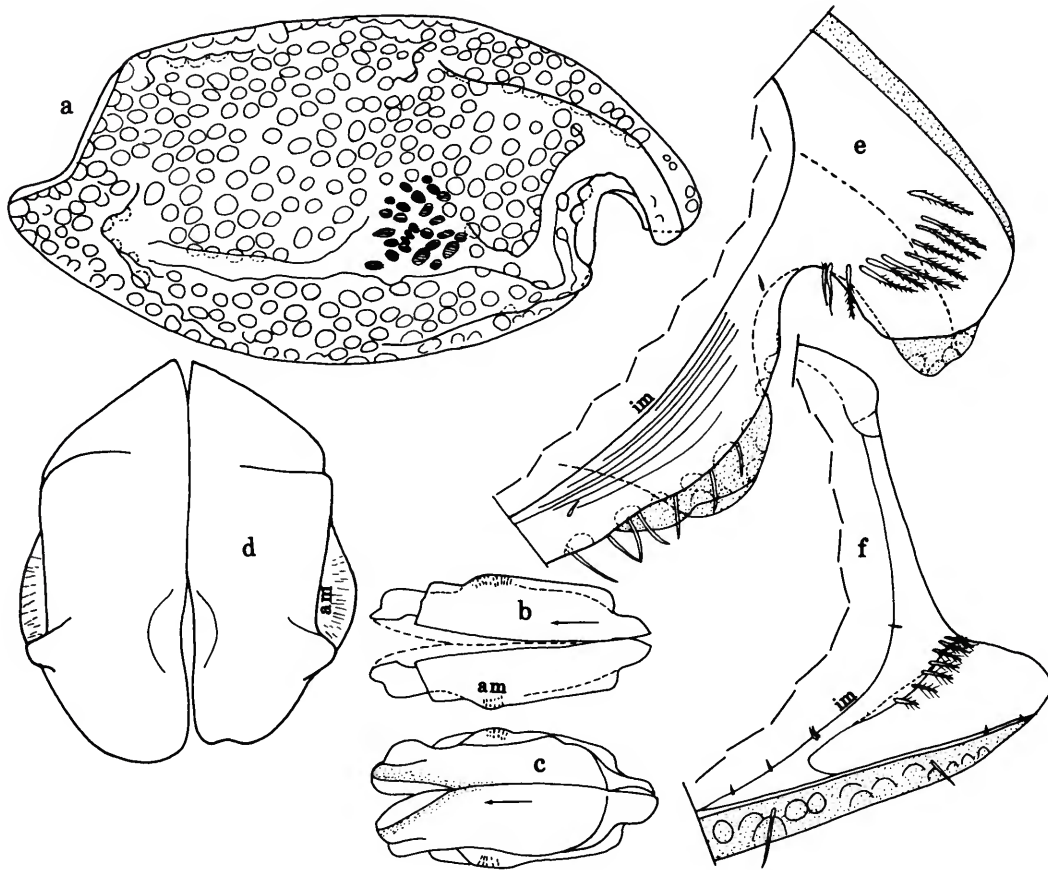


FIGURE 24.—*Harbansus vortex*, new species, adult female, holotype: *a-d*, complete specimen, length 1.62 mm: *a*, from right side; *b*, ventral view (anterior to left); *c*, dorsal view (anterior to left); *d*, posterior view (dorsal to top); *e*, anterior, left valve, *iv*; *f*, posterior, right valve, *iv*.

long spines and 3 spinous beta-bristles (outer longer, with broad base and longer spines); 2nd joint with 9 claws and bristles.

**Fifth Limb:** Epipodite with about 40 bristles. Endite I with 2 bristles (1 long, 1 short); endite II with 5 bristles; endite III with about 8 bristles. 1st exopodial joint: main tooth with proximal bristle, 1 smooth tooth followed by 3 pectinate teeth, and 1 smooth tooth anterior to distal pectinate tooth (Figure 25*d*); anterior side of joint with 2 bristles along distal edge (Figure 25*d*); outer distal corner with spines and 1 minute bristle (Figure 25*d*). 2nd exopodial joint with large square tooth with 2 minute teeth on edge of inner side at midheight (Figure 25*d,e*); posterior side with row of 3 bristles (1 long with smaller bristle on each side) and 1 long bristle just proximal to row (Figure 25*e*). 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer lobe. 4th and 5th exopodial joints fused, with total of 5 bristles.

**Sixth Limb (Figure 25*f*):** With 1 epipodial bristle. Endites I and II each with 3 bristles; endite III with 6 bristles; endite IV

with 5 bristles. End joint not projecting posteriorly, with 6 spinous bristles followed by 2 plumose bristles. Limb hirsute.

**Seventh Limb (Figure 25*g*):** 2 bristles in proximal group (1 on each side); 6 bristles on terminal segment (3 on each side); each bristle with 4–6 bells and distal marginal spines; terminal comb with 7 recurved teeth (not all shown); row of about 5 minute smooth pegs opposite comb (not all shown). Limb with 52 segments excluding terminal segment; distal 10 segments broader than others.

**Furca (Figure 25*h*):** Each lamella with 6 claws; claws 1, 2, and 4 stout; claws 3, 5, and 6 short, slender; all claws with small teeth along posterior edge (not shown); medial row of teeth on claw 1 with large teeth distally; small spine (with marginal spines) closely following last claw; several additional minute spines on lamella following claws. Right lamella with few spines along anterior edge, rows of long hairs on medial side near anterior margin, and anterior to left lamella by width of base of claw 1.

**Bellonci Organ (Figure 25*i,k*):** Elongate with 7 proximal

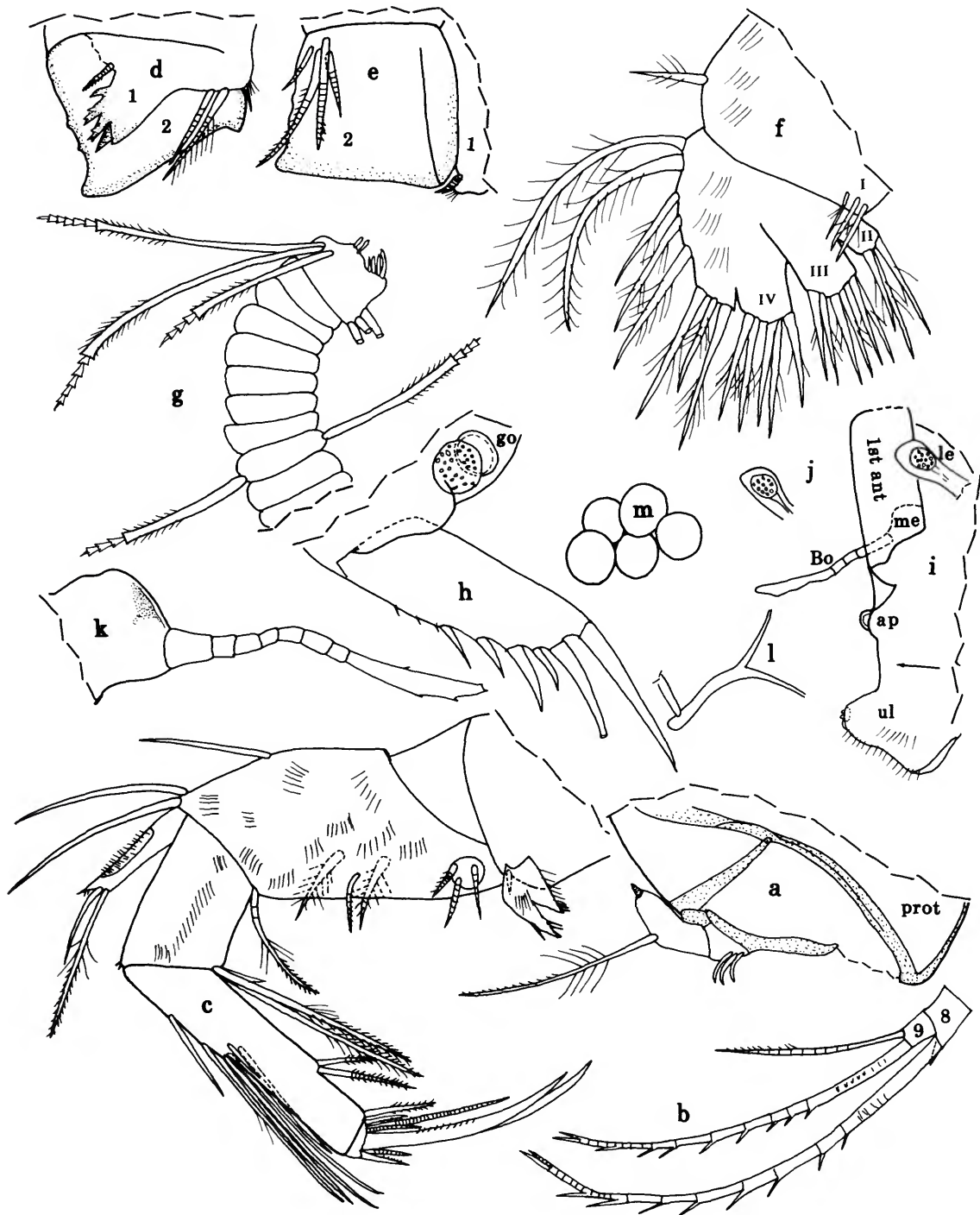


FIGURE 25.—*Harbansus vortex*, new species, adult female, holotype: *a*, distal protopodite and endopodite, left 2nd antenna, mv; *b*, joints 8 and 9, exopodite, right 2nd antenna, mv; *c*, right mandible, mv; *d*, tip of left 5th limb, av; *e*, tip of right 5th limb, pv; *f*, left 6th limb, mv; *g*, 7th limb; *h*, right furcal lamella and right genital organ; *i*, anterior of body showing left lateral eye, 1st joint of left 1st antenna, medial eye (dashed), Bellonci organ, anterior process, and upper lip; *j*, right lateral eye; *k*, medial eye (area of brown pigment stippled) and Bellonci organ; *l*, right Y-sclerite; *m*, unextruded eggs on one side of body.



sutures; organ broader distal to sutures, and with few indistinct minute spines.

*Eyes:* Lateral eye small, with numerous minute amber-colored cells (Figure 25i,j). Medial eye small, bare, with small area of brown pigment near dorsal edge at midlength (Figure 25k).

*Upper Lip* (Figure 25i): With broadly rounded anterior tip with 2 indistinct glandular tubes.

*Genitalia* (Figure 25h): USNM 194038 with oval ring with attached spermatophore on each side of body anterior to furca.

*Anterior of Body* (Figure 25i): With small rounded anterior process about midway between medial eye and upper lip.

*Posterior of Body:* Evenly rounded bare.

*Y-Sclerite* (Figure 25l): With well-developed ventral branch.

*Number of Eggs:* USNM 194038 with 10 unextruded eggs (5 on each side) (Figure 25m); length of largest egg 0.068 mm.

COMPARISONS.—Only two other species of *Harbansus* with lateral ribs are known from the vicinity of Australia: *H. slatteryi* Kornicker, 1983a, from the Great Barrier Reef, and *H. vatrax*, new species, herein. The tip of the 2nd joint of the 2nd antenna of the female *H. vortex* bears a small sclerotized peg-like process; whereas, it bears a small bristle on *H. vatrax* and is bare on *H. slatteryi*. In anterior or posterior view the carapace of *H. vatrax* is triangular; whereas that of *H. vortex* is oval. The rostral infolds of both *H. vatrax* and *H. slatteryi* have

4 bristles compared to 9 on *H. vortex*. Most exopodial bristles of the female 2nd antennae of both *H. vatrax* and *H. slatteryi* have natatory hairs, which are absent on *H. vortex*.

**SARSIELLIDAE Brady and Norman, 1896**

The Sarsiellidae include the two subfamilies Dantyninae and Sarsiellinae. The Dantyninae and three genera of Sarsiellinae were reported in Part 1. The Sarsiellinae are concluded herein.

**SARSIELLINAE Brady and Norman, 1896**

Species of *Chelicopia*, *Eusarsiella*, and *Parasarsiella* were described in Part 1; species of *Cymbicopia*, *Neomuelleriella*, *Spinacopia*, and *Alphasarsiella*, new genus, are described herein.

***Spinacopia* Kornicker, 1969**

TYPE SPECIES.—*Spinacopia sandersi* Kornicker, 1969:23.

COMPOSITION.—Six new species described herein are known from the vicinity of Australia.

DISTRIBUTION.—Cosmopolitan between latitudes of 32°19'24"N and 73°29'S and at depths of 133–4758 m (Kornicker, 1975:585; Hartmann, 1986:154, 185). Known depth range in the vicinity of Australia 204–1850 m.

**Key to Species of *Spinacopia* in the Vicinity of Australia**

(Adult females)

1. Carapace longer than 1.7 mm and with abundant bristles on lateral surface . . . . . *S. rex*, new species  
Carapace shorter than 1.6 mm and with sparse bristles on lateral surface . . . . . 2
2. Carapace longer than 1.4 mm . . . . . *S. trox*, new species  
Carapace shorter than 1.3 mm . . . . . 3
3. Caudal process projecting posteriorly and valves with indistinct radial riblets . . . . . *S. sandix*, new species  
Caudal process projecting posteroventrally and valves without radial riblets . . . . . 4
4. Lateral eyes absent . . . . . *S. syrinx*, new species  
Lateral eyes present . . . . . 5
5. First antenna without ventral spines on 2nd and 4th joints . . . . . *S. illex*, new species  
First antenna with ventral spines on 2nd and 4th joints . . . . . *S. crux*, new species

***Spinacopia rex*, new species**

FIGURES 26–30

ETMOLOGY.—From the Latin *rex* (king).

HOLOTYPE.—Undissected adult female in alcohol in collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 27, 38°25.00'S, 149°0.00'E, Victoria, south of Point Hicks, depth 1500 m.

PARATYPES.—Slope 25: 4 specimens in alcohol. Slope 27: USNM 193868, adult female on slide and in alcohol; 4 specimens including adult females and juveniles in alcohol. Slope 32: USNM 193834, adult female in alcohol (body

removed from shell); 12 specimens including adult females and juveniles in alcohol. Slope 67: 4 undissected specimens in alcohol. Slope 69: USNM 193945, 1 adult male on slide and in alcohol; 12 specimens including adult females and juveniles in alcohol. Slope 81: 2 adult females and 2 juveniles. Slope 82: 2 adult females (1 ovigerous) and 4 juveniles.

**DISTRIBUTION.**—Slope 25, 1850 m. Slope 27, 1500 m. Slope 32, 1000 m. Slope 67, 1277 m. Slope 69, 1840 m. Slope 81, 1264 m. Slope 82, 1770 m. Known depth range 1000–1850 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 26–28).—Carapace oval in lateral view with greatest height near midlength (Figure 26a); anterior margin with obtuse angle dorsal to minute indentation marking incisur (Figure 26a,d); posterior with short caudal process; adult female with large posterodorsal bulge well defined along ventral edge by steep slope; hairs along ventral margin of bulge about same length as hairs on remaining part of bulge (Figure 26b). Surface without gel-like coating.

**Ornamentation** (Figure 26b,c): Shallow fossae (without peripheral circle of small spines) distributed over valve surface. Long hairs with proximal enlargement (a-hairs) common along valve edge and present but less common on lateral surface; short-to-medium hairs tapering at a more-or-less constant angle

from base to tip (b-hairs) abundant; hairs not arranged in bunches or rows. (For explanation of lettering system for hairs see Kornicker (1975:583).)

**Infold:** Anterior infold ventral to minute incisur with small bristle near inner margin (Figure 26d). Infold of caudal process with a row of 4 or 5 long and 4 short spinous bristles (Figure 26e). Small bristles along inner margin of infold anterior to caudal process.

**Central Adductor Muscle Attachments** (Figure 26f): Not clearly seen but comprising about 13 oval attachments.

**Carapace Size** (length, height including caudal process, mm): Slope 27: holotype, 1.94, 1.71; USNM 193868, 1.86, 1.67; unnumbered specimen, 1.83, 1.51. Slope 32: USNM 193834, 1.77, 1.65; unnumbered specimen, 1.80, 1.62. Slope 81: 2 specimens, 1.93, 1.62; 1.93, 1.56. Slope 82: 1.82, 1.64.

**First Antenna** (Figure 27a,b): 1st joint bare. 2nd joint with spines on ventral and dorsal margins and on lateral side near ventral and dorsal margins, and 1 dorsal bristle with long proximal and short distal spines. 3rd joint fused to 4th, with 2 long bristles with short spines (1 ventral, 1 dorsal). 4th joint with 3 spinous bristles (2 ventral, 1 dorsal). Sensory bristle of 5th joint with small proximal filament and 1 or 2 minute distal spines. 6th joint fused to 5th, with minute medial spine-like

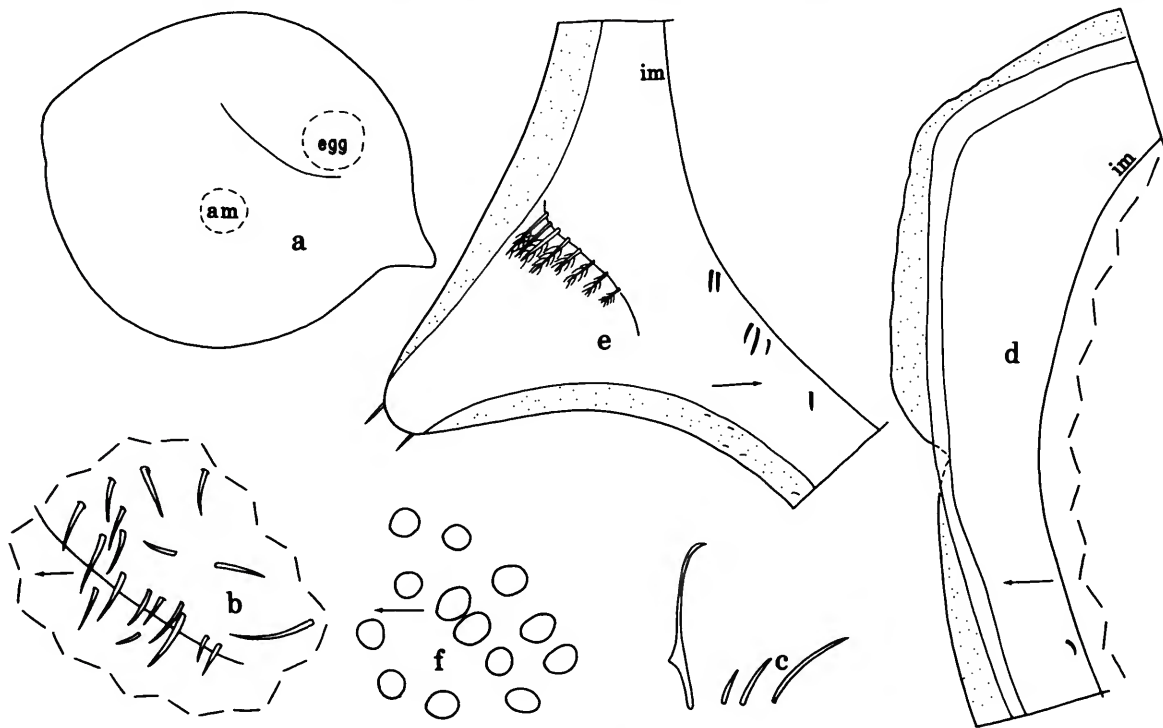


FIGURE 26.—*Spinacopia rex*, new species, adult female, paratype, USNM 193868: a, complete specimen from left side, length 1.86 mm (anterior dashed oval shows location of central adductor muscle attachments; posterior dashed oval shows location of egg in marsupium); b, bristles near ventral edge of posterodorsal bulge, left valve, ov (anterior to left); c, typical bristles on left valve, ov; d, anterior, right valve, iv; e, caudal process, left valve, iv; f, central adductor muscle attachments, left valve, ov (anterior to left).

bristle (easily overlooked) (Figure 27a,b). 7th joint: a-bristle spinous, about  $\frac{1}{3}$  length of sensory bristle of 5th joint (Figure 27b); b-bristle longer than a-bristle but not reaching midlength of sensory bristle, with minute spine near midlength (Figure 27b); c-bristle same length as sensory bristle, with 4 minute distal spines. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f- and g-bristles similar to c-bristle. (Note: left limb of USNM 193868 with additional bristle similar in length and type to d-bristle but with base lateral to bases of d- and e-bristles and adjacent to f-bristle; the additional bristle not observed on right limb, nor on USNM 193834, and probably its presence is an aberrancy.)

**Second Antenna:** Protopodite bare. Endopodite 2-jointed (Figure 27c): 1st joint with 3 small bare proximal bristles; 2nd joint with long stout spinous bristle. Exopodite: joint 1 with small recurved medial terminal bristle; bristles of joints 2–8 with few natatory hairs; 9th joint with 2 bristles (1 long with natatory hairs, 1 short with short spines); joints 2–7 with minute spines forming row along distal edges.

**Mandible** (Figure 27d–g): Coxale endite bifurcate, with few stout spines, and with long hairs at base (Figure 27d,e). Ventral margin of coxale with long spines. Basale: dorsal margin with 1 bristle near midlength and 2 subterminal; ventral margin with 7 or 8 bristles (including 2 or 3 short bristles in lateral row) (Figure 27d,f). Exopodite small with blunt tip and subterminal bristle (Figure 27d). Endopodite (Figure 27g): 1st joint: medial side with distal spines and 2 small spine-like bristles at base of slender ventral claw; 2nd joint with 2 subterminal spine-like bristles on dorsal margin and 1 small spine-like lateral bristle near base of slender ventral claw; 3rd joint with 3 small spinelike bristles (2 ventral, 1 dorsal) at base of slender terminal claw.

**Maxilla** (Figure 27h–j): Coxale with spinous dorsal bristle (Figure 27j). Endite I with 6 bristles (Figure 27i); endite II with 5 bristles; endite III with 6 bristles (Figure 27h). Basale with bare medial bristle some distance from exopodite. Exopodite with 3 bristles (1 long, 2 short) (Figure 27h). Endopodite: 1st joint with spinous alpha- and beta-bristle; 2nd joint with 2 fairly long spinous a-bristles, 1 spinous c-bristle, and 5 pectinate end bristles (Figure 27j).

**Fifth Limb** (Figure 28a): Epipodite with 40 or 41 plumose bristles. Endite with 1 small bare bristle. Exopodite: 1st joint with 3 spinous bristles; 2nd joint with 4 or 5 long spinous terminal bristles, and 1 short bare bristle near inner lobe of 3rd joint; 3rd joint with 4 spinous bristles (3 on inner and 1 on outer lobe); fused 4th and 5th joints with total of 4 spinous bristles. Joints 1 and 2 hirsute.

**Sixth Limb** (Figure 27k): With 4 endites: endite I with 2 small bristles (1 with few indistinct spines, other bare); endite II with 2 long spinous bristles; endite III with 4 spinous bristles; endite IV with 2 or 3 spinous bristles. End joint with 2 spinous

anterior bristles, 1 spinous bristle at midwidth, and 2 plumose posterior bristles. Posterior half of limb hirsute.

**Seventh Limb** (Figure 28b): Proximal group with 4 bristles, 2 on each side, each with 3 bells; terminal group with 6 bristles, 3 on each side, each with 2–4 bells. Terminus with opposing combs each with 9–11 teeth.

**Furca** (Figure 28c): Each lamella with 7 or 8 claws; claw 1 nonarticulated; claw 3  $\frac{1}{2}$  to  $\frac{3}{4}$  length of claw 4; right lamella anterior to left by width of base of claw 1. Right lamella of USNM 193868 differs in having only 6 claws and in 3rd claw being longer than 4th.

**Bellonci Organ** (Figure 27l): 1-jointed, elongate with rounded tip.

**Eyes:** Lateral eyes absent. Medial eye bare, unpigmented (Figure 27l).

**Upper Lip** (Figure 28f,g): Evenly rounded with few hairs on anterior corner.

**Genitalia and Brush-like Organ** (Figure 28d): Oval genitalia with attached spermatophore on each side of body anterior to furca. Several small ringed bristles near genitalia.

**Anterior of Body** (Figure 28g): Each mandibular socket dorsal to lip with anterior prong.

**Posterior of Body** (Figure 28e): Long hairs at midheight.

**Y-Sclerite** (Figure 28d,e): Without ventral branch.

**Number of Eggs:** USNM 193868 with 4 eggs in marsupium and 5 smaller unextruded eggs; length of typical extruded egg 0.37 mm; length of typical unextruded egg 0.26 mm; egg inside shell shown in Figure 26a. Specimen from Slope 32 with 5 eggs in marsupium.

**DESCRIPTION OF ADULT MALE** (Figures 29, 30).—Carapace more elongate than that of female, with prominent rostrum and shallow incisur (Figure 29a); carapace highest just anterior to midlength and widest at about midlength (Figure 29a,b).

**Ornamentation:** Similar to that of adult female.

**Infold:** Not examined.

**Central Adductor Muscle Attachments:** Similar to those of adult female.

**Carapace Size** (length, height in mm): USNM 193945, 1.78, 1.17.

**First Antenna** (Figure 29c,d): 1st joint bare. 2nd joint with rows of minute medial and lateral spines, and 1 ringed dorsal bristle with long proximal and short distal spines (bristle missing on illustrated left limb so bristle of right limb shown in its place dashed). 3rd joint fused to 4th, with 2 long ringed bristles (1 ventral, 1 dorsal) with short spines. 4th joint with 3 ringed bristles (2 ventral, 1 dorsal) with short spines. 5th joint triangular and placed ventrally between 4th and 6th joints, with basal part with abundant filaments and 1 long stout ringed bristle with 4 marginal filaments and bifurcate tip (proximal part of bristle shown in Figure 29c). 6th joint with short ringed bare medial bristle (Figure 29c). 7th joint (Figure 29c,d): a-bristle with short marginal spines; b-bristle long, with 2 marginal filaments and undivided tip; c-bristle longer than

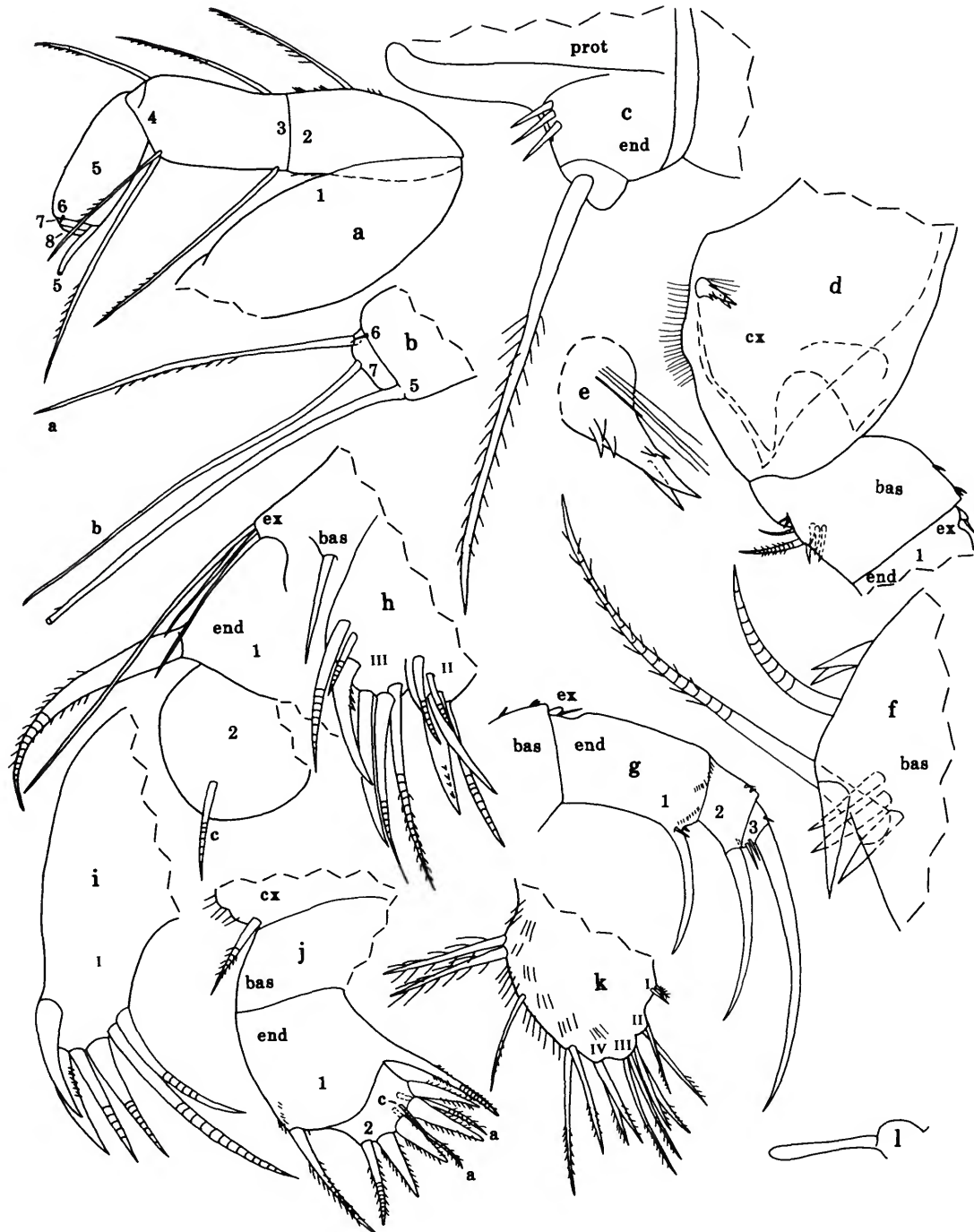


FIGURE 27.—*Spinacopia rex*, new species, adult female, paratype, USNM 193868: a, right 1st antenna, mv (bristles of joints 7 and 8 not shown); b, bristles of 5th and 6th joints and a- and b-bristles of 7th joint, right 1st antenna, mv; c, distal protopodite and endopodite, right 2nd antenna, mv; d, coxale, basale, exopodite, left mandible, mv; e, detail of coxale endite in d; f, detail of bristles of ventral margin of basale in d; g, distal joints of left mandible, mv; h, part of right maxilla, mv (on endopodite only alpha-bristle of 1st joint, and c-bristle of 2nd joint shown; bristles of endite I not shown); i, endite I, right maxilla, mv; j, right maxilla, mv (endites and exopodite not shown); k, 6th limb; l, medial eye and Bellonci organ.

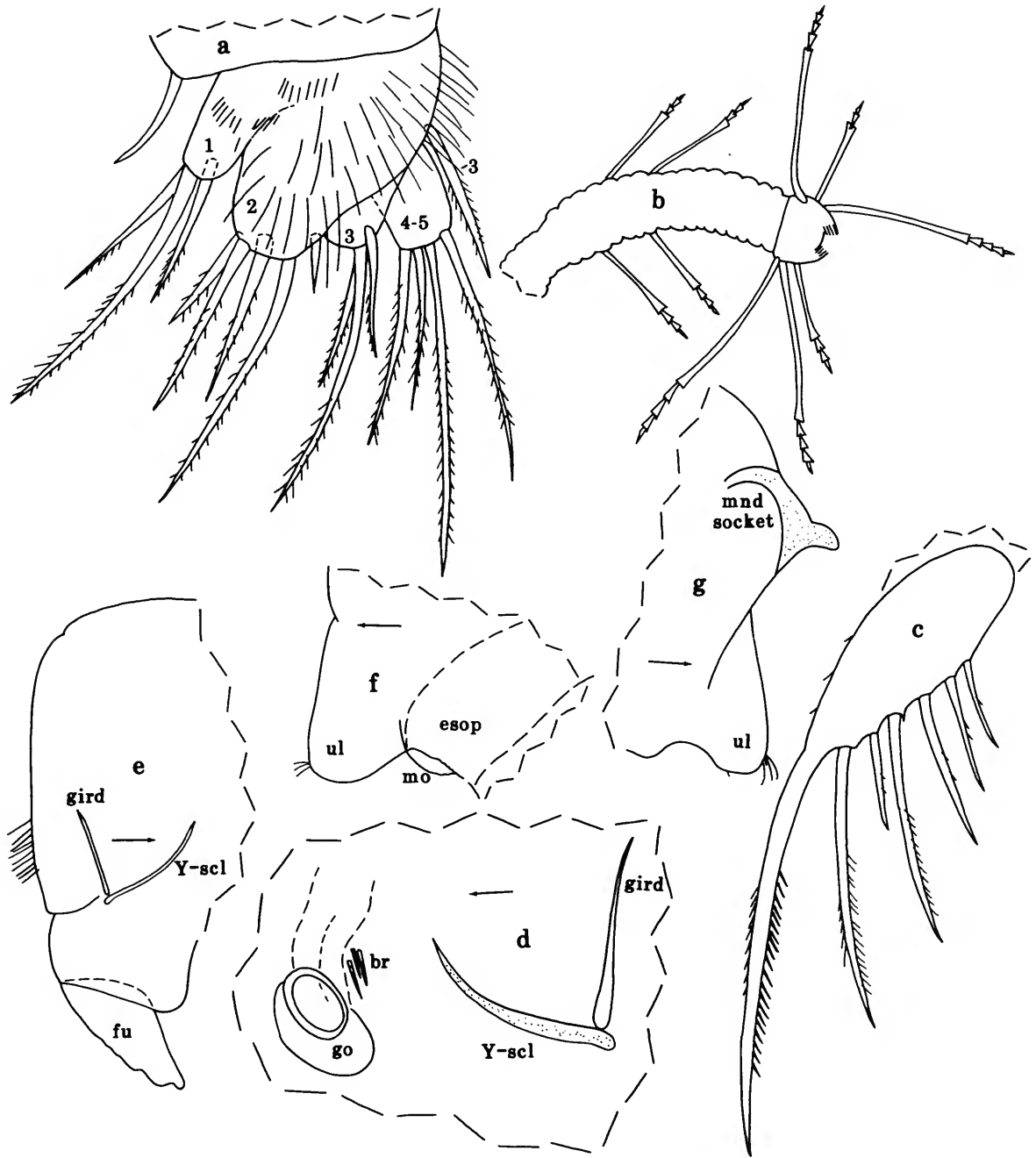


FIGURE 28.—*Spinacopia rex*, new species, adult female, paratype, USNM 193868: a, tip of 5th limb; b, 7th limb; c, left furcal lamella; d, left side of body near posterior end showing Y-sclerite (stippled), girdle, brush-like organ, and genital organ; e, posterior of body from right side; f, anterior of body from left side showing upper lip and esophagus (dashed); g, anterior of body from right side showing upper lip and socket of mandible (stippled).

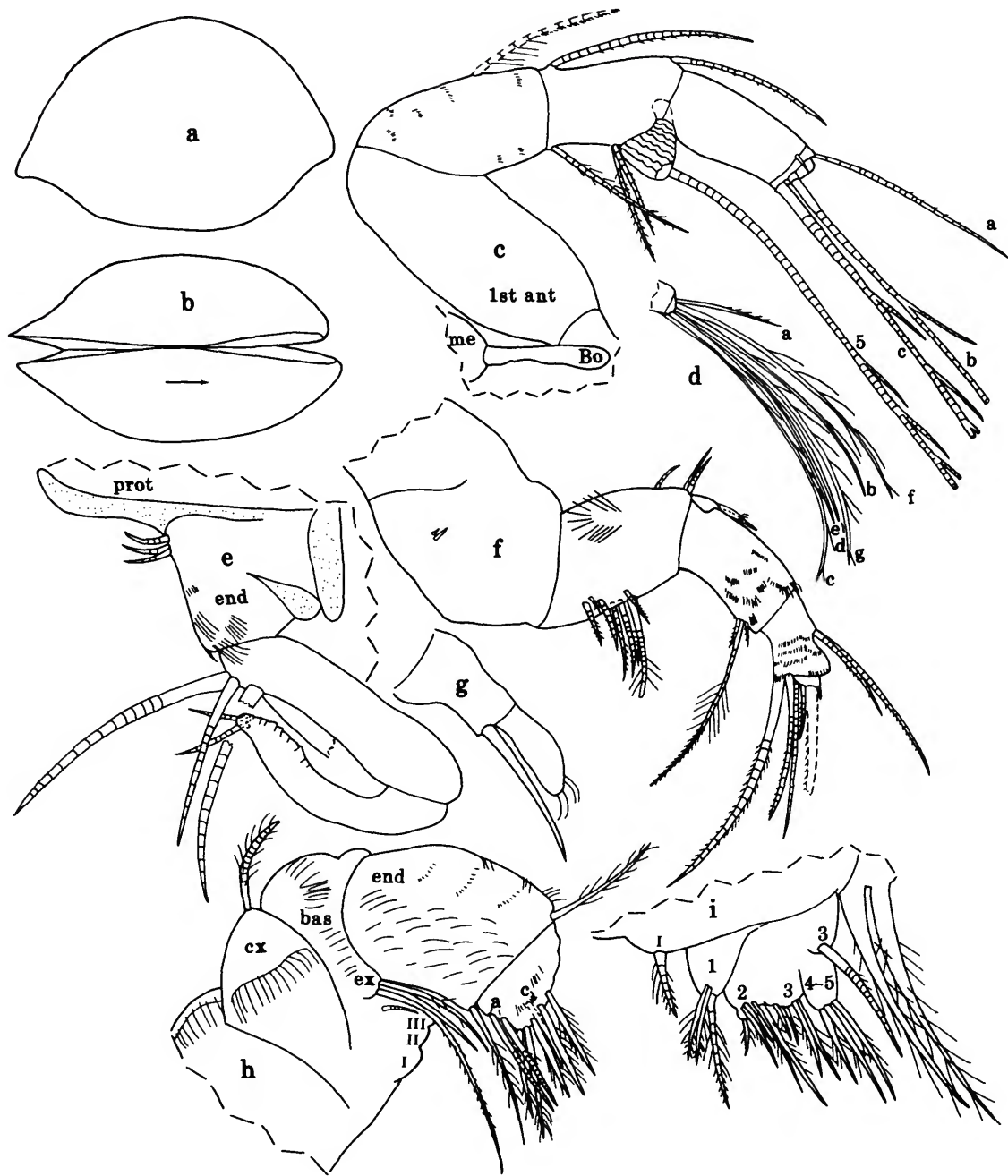


FIGURE 29.—*Spinacopia rex*, new species, adult male, paratype, USNM 193945: *a*, complete specimen from right side, length 1.78 mm; *b*, ventral view of carapace with body removed, anterior to right; *c*, left 1st antenna, mv (only *a*- and *b*-bristles of 7th joint and no bristles of 8th joint shown) and medial eye and Bellonci organ; *d*, bristles of 7th and 8th joints, left 1st antenna, mv; *e*, protopodite and endopodite, right 2nd antenna, mv; *f*, left mandible, mv; *g*, exopodite, right mandible, lv; *h*, right maxilla, lv (endite bristles not shown); *i*, tip of 5th limb.

b-bristle, reaching slightly past stout bristle of 5th joint, with 6 marginal filaments and bifurcate tip. 8th joint (Figure 29d): d- and e-bristles about same length as b-bristle, bare with blunt tips; f-bristle slightly longer than b-bristle, with 5 filaments and bifurcate tip; g-bristle stouter and longer than f-bristle, with 6 filaments and bifurcate tip. (Rings of bristles of 7th and 8th joints not shown in Figure 29d.)

**Second Antenna:** Protopodite bare. Endopodite 3-jointed (Figure 29e): 1st joint with 3 small bare proximal bristles and 4 distal rows of medial spines; 2nd joint elongate, with 3 bare proximal bristles; 3rd joint recurved, with 2 small bare bristles and about 11 ridges at tip. Exopodite: 1st joint with small recurved medial terminal bristle; bristles of joints 2–8 with natatory hairs, no spines; 9th joint with 2 bristles (1 long with natatory hairs, 1 short with small hair-like spines); joints 2–8 with minute spines forming row along distal edges.

**Mandible** (Figure 29f,g): Coxale endite represented by 2 spines; coxale with long distal lateral spines in cluster at midheight (these could be on basale) (not shown). Basale: ventral margin with 1 long spinous ringed bristle (broken on both limbs of USNM 194945) and 7 shorter spinous ringed bristles (4 short with bases on medial side, 3 longer with bases on lateral side); dorsal margin with 3 short bare ringed distal bristles; medial surface with long proximal spines near dorsal margin. Exopodite 2-jointed (unusual), about  $\frac{1}{3}$  length of dorsal margin of 1st endopodial joint, with suture near midlength, rounded tip with indistinct hairs, and bare ringed bristle with base at suture (Figure 29g). Endopodite (Figure 29f): 1st joint with proximal indentation in dorsal margin adjacent to exopodite, distal rows of medial spines, and 3 subterminal ventral bristles (1 long with long proximal and short distal spines, 2 short with short spines); 2nd joint with rows of medial spines, 2 spinous ringed dorsal bristles at midlength, and 2 spinous ringed terminal ventral bristles; 3rd endopodial joint with 1 small dorsal weakly-ringed a-bristle, 1 long claw-like b-bristle with short ventral spines (bristle broken off on illustrated left limb on which right claw of right limb is shown dashed; claw of right limb with tip broken off), 1 short ringed c-bristle with short ventral spines, and 1 longer bare ringed d-bristle. (Lettering of bristles of 3rd endopodial joint from Kornicker, 1969:27.)

**Maxilla** (Figure 29h): Limb reduced. Precoxale, coxale and basale with dorsal fringe of long hairs. Coxale with plumose ringed dorsal bristle. Endites I, II, and III small with weakly developed plumose ringed bristles (bristles not shown). Basale with short ringed bristle near exopodite and numerous lateral hairs. Exopodite with 3 well-developed ringed bristles (1 long, 2 shorter). Endopodite: 1st joint with abundant lateral hairs, few rows of minute lateral spines, and a plumose alpha- and beta-bristle; 2nd joint with rows of lateral spines, 2 well-developed ringed bristles with small spines (may be a-bristles), 1 plumose ringed medial bristle (may be c-bristle) and 5 plumose weakly developed plumose ringed terminal bristles. (Rings of most bristles not shown.)

**Fifth Limb** (Figure 29i): Limb reduced. Epipodite of illustrated limb with small part broken off, with 32 bristles on remaining part (only 2 shown). Single endite with short ringed bristle with long proximal and short distal hairs. Exopodite: 1st joint with 3 ringed bristles with long proximal and short distal hairs. 2nd and 3rd joints fused; 2nd joint with 4 plumose ringed bristles and distal hirsute lobe bearing short plumose ringed bristle; inner lobe of 3rd joint with 4 plumose ringed bristles (1 bristle close to 2nd joint); outer lobe of 3rd joint with 1 ringed bristle with few indistinct small spines. 4th and 5th joints fused, with total of 3 plumose ringed bristles. (Rings not shown on all bristles.)

**Sixth Limb** (Figure 30a): Interpreted as having 4 endites: endite I with 3 ringed bristles (2 small with short spines, 1 longer with long proximal and short distal hairs); endite II with 2 ringed bristles (1 long with long proximal hairs, 1 short with long proximal and short distal spines); endite III with 4 ringed bristles (3 long with long marginal spines, 1 short with long proximal and short distal spines); endite IV separated from end joint by shallow concavity, with 3 ringed bristles (2 long with long spines, 1 shorter with long proximal and short distal spines). End joint with 3 or 4 spinous anterior bristles, 2 spinous bristles at midwidth, and 2 plumose posterior bristles, all bristles ringed. Limb hirsute. (Rings of bristles not shown.)

**Seventh Limb** (Figure 30b): Proximal group with 4 bristles, 2 on each side, each with 2 bells; terminal group with 4 bristles, 2 on each side, each with 3 bells. Terminus with opposing combs, each with 6–8 teeth.

**Furca** (Figure 30c): Each lamella with 7 claws; claw 1 nonarticulated; claw 3 about half length of claw 4.

**Bellonci Organ** (Figure 30d,e): 1-jointed, elongate, broadening distally, with rounded tip with minute processes.

**Eyes:** Lateral eyes absent. Medial eye bare, unpigmented (Figure 30d).

**Genitalia** (Figure 30f,g): Elliptical paired seminal vesicles appearing brownish red in both transmitted and reflected light, with small distinctly red part at anterior end. A complex copulatory organ of 3 lobes at each side of body, all with small ringed bristles; main lobe with elongate sclerotized hook-like clasper.

**Posterior of Body** (Figure 30h): Evenly rounded, bare.

**Y-Sclerite** (Figure 30h): Without ventral branch.

**COMPARISONS.**—The Y-sclerite of previously described species of Sarsiellinae on which it is known have a distal ventral branch. The ventral branch is absent on *S. rex* (Figures 28d, 30h). The Y-sclerite is known for only 3 previously described species of *Spinacopia* (*S. menziesi* (Kornicker, 1969, fig. 4e; 1975, fig. 362g), *S. octo* (Kornicker, 1975, fig. 432c), *S. variabilis* (Kornicker, 1969, fig. 6n)), and 6 new species described herein; all except *S. rex* have a ventral branch. In the key to species of *Spinacopia* in Kornicker (1975:584), specimens referred to *S. rex* herein run down to *S. variabilis*, a species having a ventral branch on the Y-sclerite but otherwise very similar to *S. rex*.

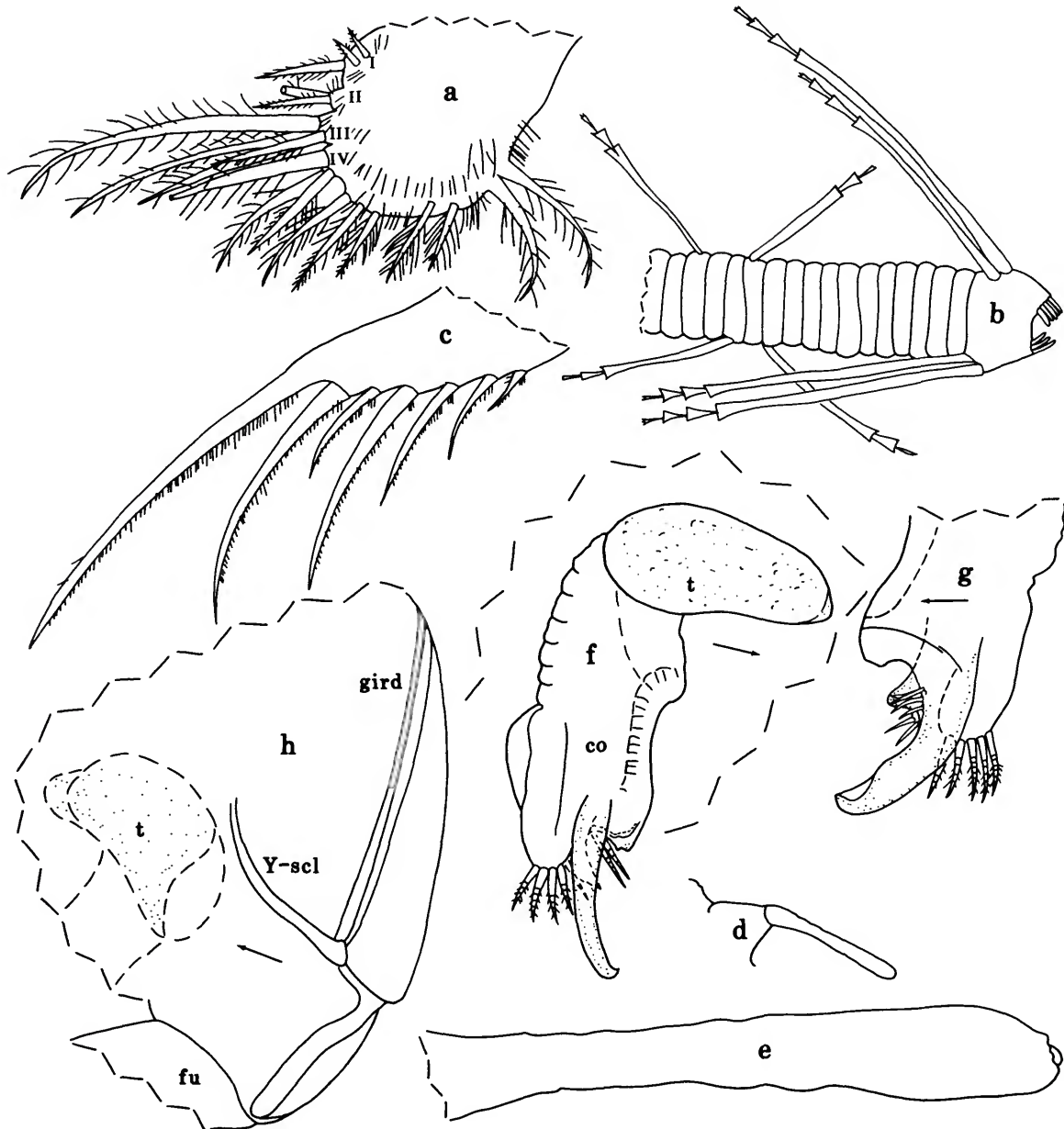


FIGURE 30.—*Spinacopia rex*, new species, adult male, paratype, USNM 193945: a, 6th limb; b, 7th limb; c, left furcal lamella; d, medial eye and Bellonci organ; e, detail of Bellonci organ in d; f, g, right and left copulatory organs; h, posterior of body from left side showing internal sclerites and testis (stippled).

***Spinacopia crux*, new species**

FIGURES 31, 32

ETYMOLOGY.—From the Latin *crux* (cross).

HOLOTYPE.—Ovigerous female on slide and in alcohol in the Museum of Victoria.

TYPE LOCALITY.—Slope 1, 34°59.52'S, 151°5.94'E, New South Wales, off Nowra, depth 204 m.

PARATYPES.—None.

DISTRIBUTION.—Slope 1, 204 m.

DESCRIPTION OF ADULT FEMALE (Figures 31, 32).—Carapace oval in lateral view with greatest height near



midlength (Figure 31a); carapace with broadly rounded posterior in dorsal view (Figure 31b); anterior margin with minute indentation marking incisur; small caudal process with broadly rounded tip; valves with narrow lateral overlap along anterior and ventral margins. Surface without gel-like coating.

**Ornamentation:** Carapace of holotype decalcified, with dimly visible small fossae and closely packed minute pustules, the latter more apparent along valve margins (Figure 31c). Long undivided bristles, most with broad triangular basal part, very sparsely distributed on lateral surface of valves, also very few small divided bristles; long and short undivided bristles (stouter in proximal half) fairly numerous along valve margins (Figure 31c).

**Infold:** Anteroventral infold with small bristle near inner margin (Figure 31c). Infold of caudal process with row of 8 spinous bristles on ridge anterior to pocket; 6 small bristles in 3 groups along inner margin of infold (5 bristles anterior to caudal process (Figure 31d), and 1 dorsal to caudal process at about  $\frac{1}{4}$  valve midheight measured from dorsal margin (not shown)).

**Selvae:** Broad lamellar prolongation with smooth outer edge along anterior and ventral margins, narrower along posterior margin dorsal to caudal process, and very narrow along posterior edge of caudal process; prolongation not divided at anterior indentation marking incisur.

**Central Adductor Muscle Attachments** (Figure 31a): Comprising about 20 small, mostly oval, individual attachments.

**Carapace Size** (length, height in mm): USNM 193927, 1.10, 0.95.

**First Antenna** (Figure 31e): 1st joint bare. 2nd joint with spines on ventral and dorsal margins and on lateral side near ventral margin, and 1 spinous dorsal bristle. 3rd and 4th joints fused; small 3rd joint with 2 long spinous bristles (1 ventral, 1 dorsal); long 4th joint with ventral and dorsal spines and 2 long spinous bristles (1 ventral, 1 dorsal). Long 5th joint with few dorsal spines and long ventral bristle, bare except for spine at tip. 6th joint fused to 5th, minute, with small spinous medial bristle. 7th joint: a-bristle about  $\frac{1}{2}$  length of bristle of 5th joint, with indistinct spines; b-bristle slightly longer than a-bristle, bare; c-bristle slightly longer than bristle of 5th joint, bare except for spine at tip. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle very slightly longer than e-bristle, bare except for spine at tip; g-bristle about same length as bristle of 5th joint, bare except for spine at tip. Marginal spines on bristles of joints 2–4 and 6 indistinct, but visible at high magnification ( $\times 15$  ocular,  $\times 100$  objective).

**Second Antenna:** Protopodite with long lateral and medial spines along ventral margin near endopodite (Figure 32a). Endopodite 2-jointed (Figure 32a): 1st joint with rows of short medial spines and 2 small proximal bristles (bare or with few indistinct spines); 2nd joint small with long spinous terminal bristle. Exopodite: joint 1 with small recurved medial terminal bristle; bristles of joints 2–8 with stout proximal ventral spines and distal natatory hairs; 9th joint with 3 bristles (ventral long

with small proximal ventral spines and distal natatory hairs, middle short with small marginal spines; dorsal short bare and with base medial to middle bristle); joint 2 with single medial spine; joints 3–8 with row of minute spines along distal edges.

**Mandible** (Figure 32b): Coxale endite with 2 stout terminal spines (with small marginal spines) and long slender proximal spines. Ventral margin of coxale with long spines (distal spines longer). Basale: dorsal margin with small unringed spine-like bristle near midlength and 2 bristles (longer ringed spinous) subterminal; medial surface with 5 bristles including 1 very long bristle and 1 small bristle near ventral margin; lateral surface with 2 or 3 small ringed bristles near ventral margin, and minute unringed bristle or spine on distal edge near dorsal margin (?exopodite). 1st endopodial joint: dorsal margin with several slender terminal spines; ventral margin with several minute spines, 2 or 3 stout spines, and long slender terminal claw with minute proximal spines on dorsal edge; medial surface with slender spines near ventral margin, row of slender spines on distal edge near dorsal margin, and 1 small unringed spine-like bristle at base of ventral claw. 2nd endopodial joint: dorsal margin with 2 fairly long unringed spine-like subterminal bristles; ventral margin with slender spines and long terminal claw; medial surface with small spines near ventral margin and row of indistinct spines along distal edge. 3rd endopodial joint with long terminal claw, 2 short unringed ventral bristles, and 1 minute subterminal unringed dorsal bristle.

**Maxilla** (Figure 32c,d): Coxale with short dorsal bristle with small indistinct spines. Endite I with 6 bristles; endite II with 4 or 5 bristles; endite III with 6 or 7 bristles. Basale with 1 bristle near exopodite (not shown). Exopodite small with 2 bristles (1 very long and 1 about half its length). 1st endopodial joint with spines along anterior margin, 1 spinous alpha-bristle and 1 spinous beta-bristle. 2nd endopodial joint with 2 lateral spinous a-bristles, 1 medial spinous c-bristle, and 5 pectinate end bristles (anterior bristle ringed distally; middle bristle shortest).

**Fifth Limb** (Figure 32e): Single endite with 1 long spinous bristle. Exopodite: 1st joint with 3 spinous bristles; 2nd joint with 6 spinous bristles; 3rd joint with 3 spinous bristles on inner and 1 long spinous bristle on outer lobe; fused 4th and 5th joints with 2 spinous bristles; limb hirsute (not all hairs shown). All bristles ringed (not shown). (An alternate interpretation of joints 2–5 is 2nd joint and inner lobe of 3rd joint fused, with 4 bristles on 2nd joint and 2 on inner lobe of 3rd joint (1 on outer lobe), 3 bristles on 4th joint, and 2 on 5th joint.)

**Sixth Limb** (Figure 32f): Endite I with 2 short spinous bristles; endite II with 2 long spinous bristles. End joint with 12–14 spinous bristles followed by 2 plumose posterior bristles. (An alternative interpretation is that the anterior part of the end joint includes poorly defined endites III and IV (endite III with 2 bristles, endite IV with 2 or 3 bristles).)

**Seventh Limb:** Proximal group with 2 bristles on same segment (segment 7 or 8 counting from segment proximal to

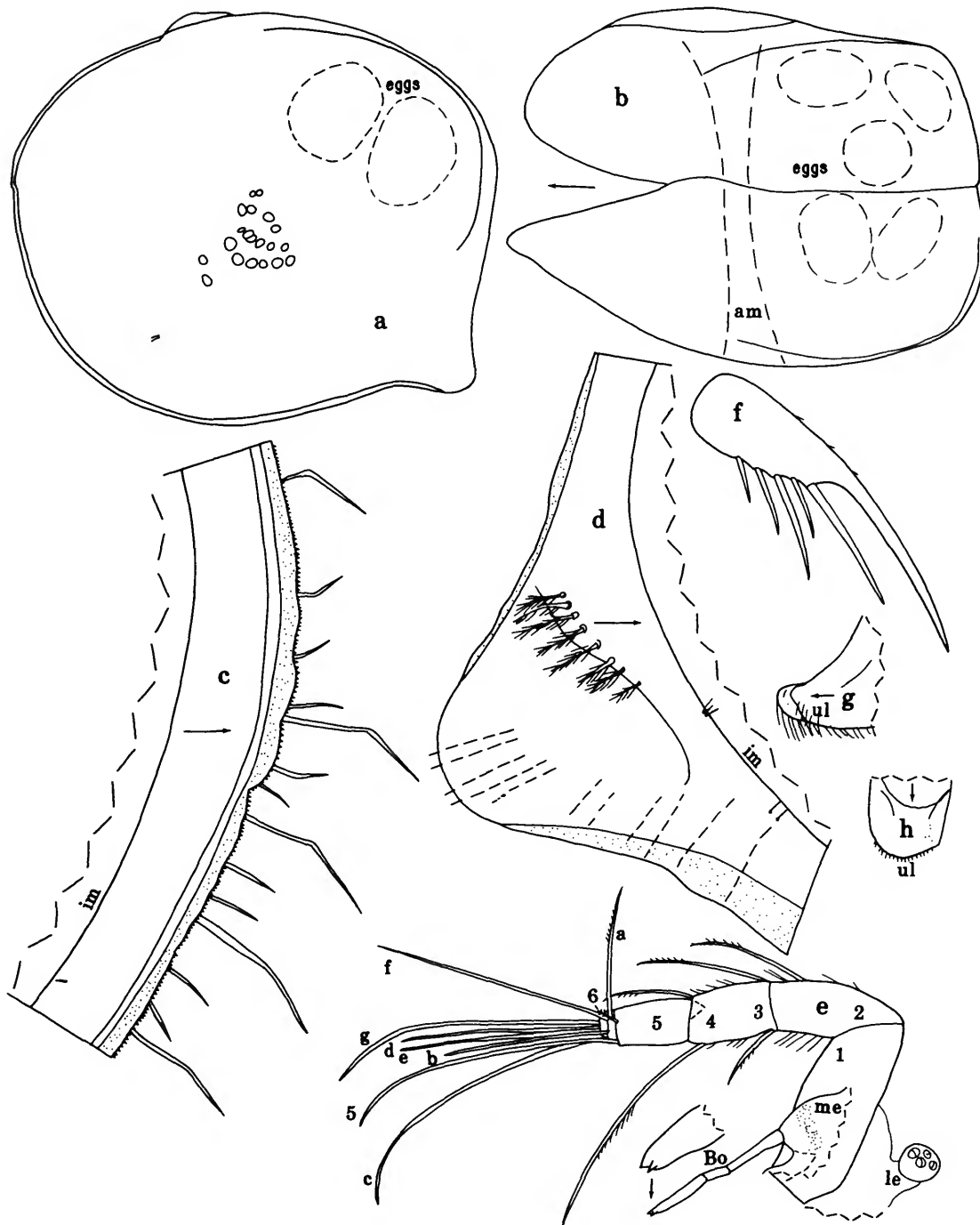


FIGURE 31.—*Spinacopia crux*, new species, adult female, paratype, USNM 193927: *a*, complete specimen from left side, length 1.10 mm (location of 2 eggs shown by dashed ovals); *b*, dorsal view of complete specimen showing location of 5 eggs (dashed ovals) and outline of adductor muscles (dashed lines); *c*, anterior, left valve, iv; *d*, caudal process, left valve, iv; *e*, anterior of body showing right 1st antenna (mv), medial eye, Bellonci organ, and right lateral eye; *f*, right furcal lamella; *g, h*, lateral and dorsal views of upper lip.



FIGURE 32.—*Spinacopia crux*, new species, adult female, paratype, USNM 193927: a, distal protopodite and endopodite, right 2nd antenna, mv; b, left mandible, mv; c, ends I (right), II (middle), and III (left), left maxilla, mv; d, left maxilla, mv (endite bristles not shown); e, 5th limb; f, 6th limb; g, tip of 7th limb; h, right genital organ and attached spermatophore (anterior to right).

terminus), 1 on each side, each with 3 or 4 bells; terminal group with 6 bristles, 3 on each side, each with 2–4 bells. Terminus with opposing combs each with 2 or 3 weak elongate teeth (Figure 32g).

*Furca* (Figure 31f): Each lamella with 6 claws; claw 1 nonarticulated; claw 3 about  $\frac{2}{3}$  length of claw 4; claws 1 and 2 with medial and lateral teeth along posterior edges, a few teeth slightly longer and stouter than others; claw 4 with teeth along posterior edge (proximal teeth longer); claw 5 with few proximal teeth along posterior edge; teeth not observed on claws 3 and 6; claw 1 with few indistinct hairs or spines along anterior edge; right lamella anterior to left by about  $\frac{3}{4}$  width of base of claw 1, and with small spines along anterior edge. Teeth of claws not shown.

*Bellonci Organ* (Figure 31e): Elongate with 2 sutures at midlength and minute tooth at tip.

*Eyes* (Figure 31e): Lateral eye small with 4 small amber-colored ommatidia. Medial eye larger than lateral eye, bare, with brown pigment.

*Upper Lip* (Figure 31g,h): Single hirsute lobe without anterior spines.

*Genitalia* (Figure 32h): A cup-like spermatophore attached to oval genitalia on each side of body anterior to furca.

*Posterior of Body*: Evenly rounded, bare.

*Y-Sclerite*: With ventral branch.

*Number of Eggs*: USNM 193927 with 5 fairly round eggs; length of 1 egg 0.25 mm; location of 2 eggs in carapace shown in Figure 31a, and 5 eggs in Figure 31b.

**COMPARISONS.**—The carapace of *S. crux* is smaller (length 1.10 mm) than those of previously described species of the genus (length 1.17–2.70 mm). The tip of the caudal process of *S. crux* is more broadly rounded than that of other species of the genus, and the carapaces of other species have abundant surface bristles, whereas, *S. crux* has very few. The 1st endopodial joint of the mandible of the female *S. crux* bears 2 or 3 stout ventral spines absent on previously described species. Each lamella of the furca of *S. crux* bears 6 claws compared to 7 or 8 on previously described species, but the variability of this character on *S. crux* is unknown.

### *Spinacopia trox*, new species

FIGURES 33, 34

**ETYMOLOGY.**—From the Greek *trox* (nibbler, gnawer).

**HOLOTYPE.**—Ovigerous female in alcohol in collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 1, 34°59.52'S, 151°5.94'E, New South Wales, off Nowra, depth 204 m.

**PARATYPES.**—Slope 1: USNM 193939, adult female with parasitic copepod and copepod egg sacs in marsupium, on slide and in alcohol.

**DISTRIBUTION.**—Slope 1, 204 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 33, 34).—

Carapace oval in lateral view, with projecting caudal process and with very slight indentation in anterior outline suggesting location of incisur (Figure 33a,d), but no indentation in valve edge (Figure 33d). Posterodorsal part of valve with prominent bulge with rounded posterior edge (Figure 33b–d). Surface without gel-like coating.

**Ornamentation:** With prominent posterodorsal bulge (holds eggs in ovigerous female, and also copepod egg sacs (Figure 33c)). Long undivided bristles, most with broad base, very sparsely distributed on outer surface of valves; long and short undivided bristles, some with broad proximal half, fairly numerous along anterior and ventral valve margins (Figure 33e). Outer surface with minute indistinct pustules; small round areas (with pustules more closely packed and slightly more distinct than surrounding pustules) fairly numerous over valve surface.

**Infold:** Anteroventral infold with small bristle near inner margin (Figure 33d,e). Infold of caudal process with row of 8 or 9 spinous bristles on ridge anterior to pocket, 2 small bare bristles at ventral end of ridge, and several small bristles along inner margin of infold (Figure 33f); 1 slender bare bristle on infold dorsal to caudal process at about  $\frac{1}{4}$  valve midheight measured from dorsal margin (not shown).

**Selvage:** Wide lamellar prolongation with smooth outer edge present along anterior, ventral, and posterior margins of valves.

**Central Adductor Muscle Attachments** (Figure 33a,c): Comprising 17–19 ovoid attachments.

**Carapace Size** (length, height in mm): Holotype, 1.51, 1.30; USNM 193939, 1.52, 1.27.

**First Antenna** (Figure 33g): 1st joint bare. 2nd joint with 1 spinous dorsal bristle and spines on ventral and dorsal margins and on lateral side near ventral margin. 3rd and 4th joints fused; small 3rd joint with 2 spinous bristles (1 dorsal, 1 ventral); long 4th joint with 2 bristles (1 ventral, 1 dorsal). Long 5th joint with long ventral bristle with row of minute spines near midlength. Minute 6th joint fused to 5th, with small spinous medial bristle. 7th joint: a-bristle spinous, about 4 times length of bristle of 6th joint; b-bristle almost twice length of a-bristle, bare except for spine at tip; c-bristle about same length as bristle of 5th joint, with row of minute spines near midlength and spine at tip. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle about same length as e-bristle, with row of minute spines at distal  $\frac{2}{3}$  and with spine at tip; g-bristle about same length as bristle of 5th joint, bare except for spine at tip. Marginal spines of bristles of joints 2–4 and 6 indistinct, but visible at high magnification ( $\times 15$  ocular,  $\times 100$  objective).

**Second Antenna:** Protodite bare (Figure 33h) (without long spines present on *S. crux*). Endopodite 2-jointed (Figure 33h): 1st joint with 2 small proximal bristles and without medial spines present on *S. crux*; 2nd joint small with spinous terminal bristle about  $\frac{1}{3}$  longer than bristles of 1st joint. Exopodite: joint 1 with small recurved medial terminal bristle; bristles of joints 2–8 with stout proximal ventral spines and

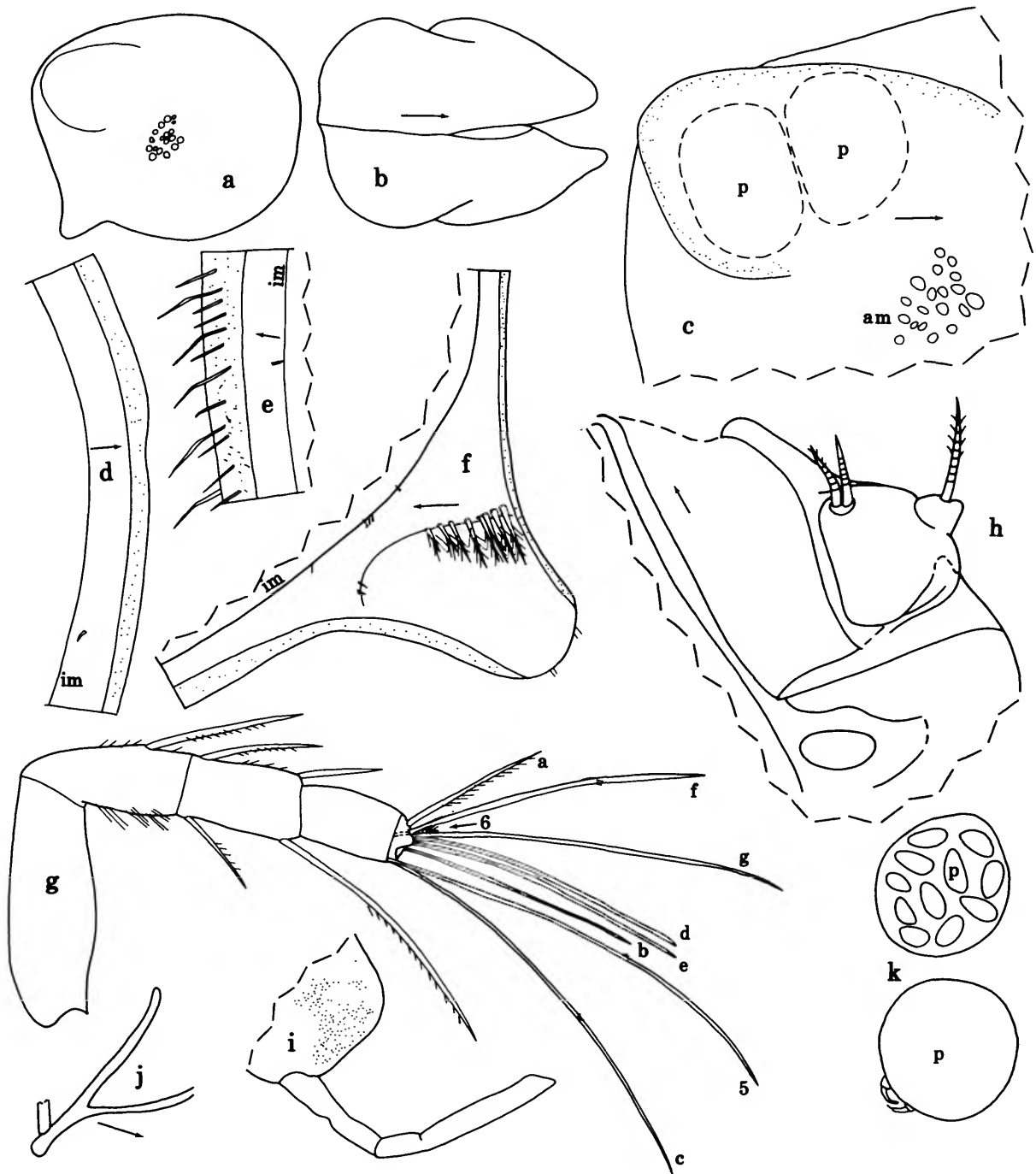


FIGURE 33.—*Spinacopia trox*, new species, adult female, paratype, USNM 193939: *a*, complete specimen from right side, length 1.52 mm; *b*, dorsal view of complete specimen, anterior to right; *c*, posterior of complete specimen from right side (anterior to right) showing location of copepod egg sac (dashed oval on left) and copepod (dashed oval on right); *d*, anterior, left valve, iv; *e*, anterior of right valve ventral to midlength, iv; *f*, caudal process, right valve, iv; *g*, right 1st antenna, mv; *h*, distal protopodite and endopodite, left 2nd antenna, mv; *i*, medial eye (area of brown pigment stippled) and Bellonci organ; *j*, right Y-sclerite; *k*, copepod (lower) and copepod egg sac (upper) within marsupium.

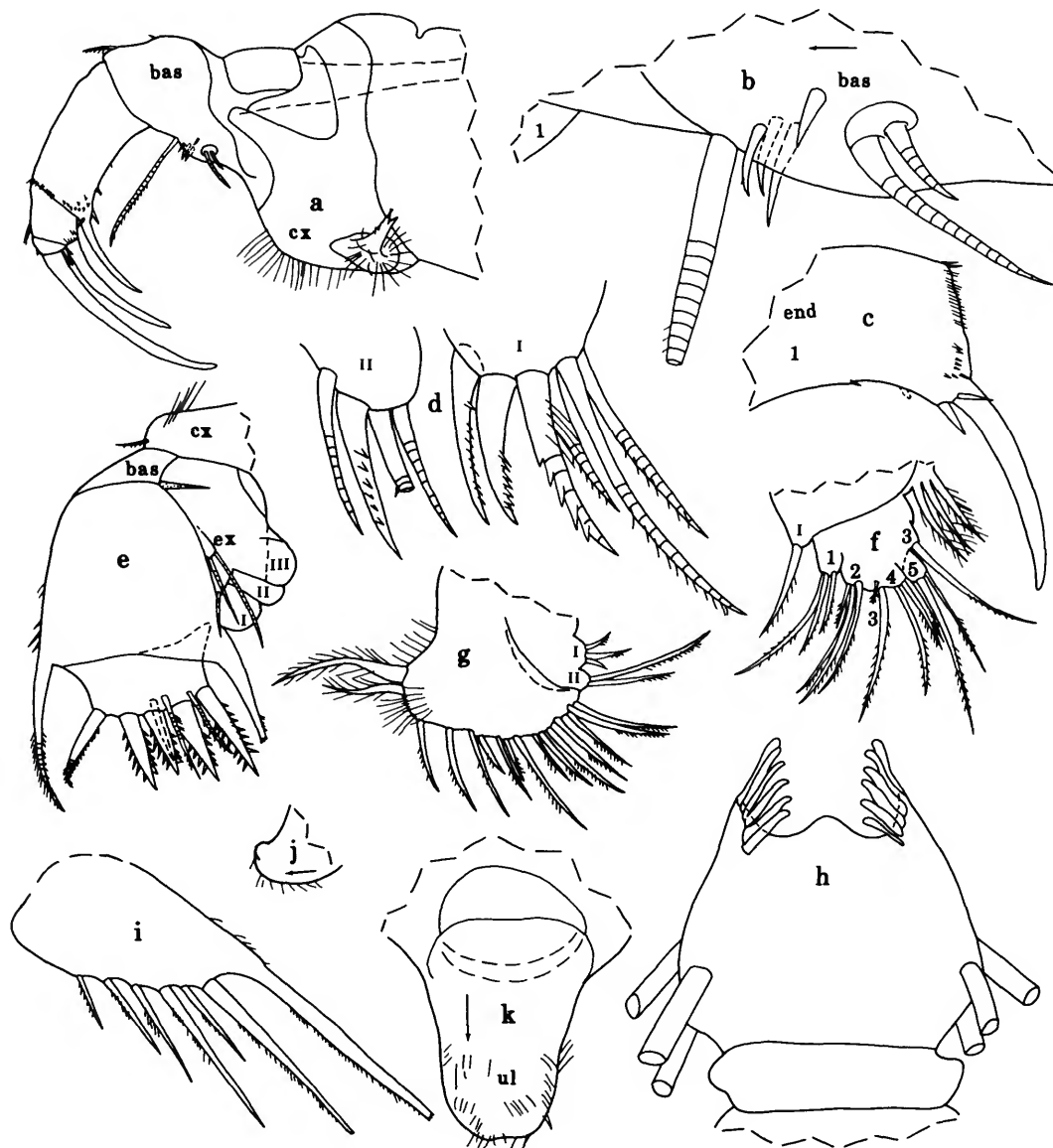


FIGURE 34.—*Spinacopia trox*, new species, adult female, paratype, USNM 193939: *a*, right mandible, mv; *b*, detail of ventral bristles of mandibular basale in *a*; *c*, 1st endopodial joint, left mandible, mv; *d*, endites I (right) and II (left), right maxilla; *e*, left maxilla, lv (endite bristles not shown); *f*, 5th limb; *g*, 6th limb; *h*, tip of 7th limb; *i*, right lamella of furca; *j,k*, lateral and ventral views of upper lip.

distal natatory hairs; 9th joint with 3 bristles (ventral with small proximal ventral spines and distal natatory hairs, middle short with small marginal spines, dorsal short bare and with base medial to middle bristle); joints 2–7 with row of minute spines along distal edges. USNM 193939 with some exopodial bristles broken (may have been broken during dissection).

**Mandible** (Figure 34*a–c*): Coxale similar to that of *S. crux*. Basale: dorsal margin with small unringed spine-like bristle

near midlength and 1 longer ringed spinous subterminal bristle; ventral margin with 7 bristles (Figure 34*a,b*). Exopodite absent. 1st endopodial joint (Figure 34*c*): dorsal margin with several slender terminal spines; ventral margin with minute spine at midlength, 2 stouter distal spines, and long terminal claw; medial surface with unringed spine-like bristle at base of ventral claw, and slender spines near distal edge. 2nd endopodial joint: dorsal margin with 2 fairly long unringed

spine-like subterminal bristles; medial surface with few spines near base of stout ventral claw. 3rd endopodial joint with long terminal claw, 2 short unringed ventral bristles, and 1 minute subterminal unringed dorsal bristle.

**Maxilla** (Figure 34d,e): Coxale with short dorsal bristle and fringe of long hairs. Endites I and III with 6 bristles; endite II with 4 bristles. Basale with short bristle near exopodite. Exopodite with 2 unequal bristles. Endopodite similar to that of *S. crux*.

**Fifth Limb** (Figure 34f): Similar to that of *S. crux*.

**Sixth Limb** (Figure 34g): Endite I with 3 short spinous bristles; endite II with 2 long spinous bristles. End joint with 14 or 15 spinous bristles followed by 2 plumose posterior bristles (1 limb of USNM 193939 with only 1 plumose posterior bristle (aberrancy)).

**Seventh Limb** (Figure 34h): Proximal group with 2 bristles, 1 on each side (1 on segment 9 and 1 on segment 10 counting from segment proximal to terminus), each with 5 bells; terminal group with 6 bristles, 3 on each side, each with 2–6 bells. Terminus with opposing combs, each with 9–12 elongate teeth with recurved bulbous tips; area between opposing combs mound-like.

**Furca** (Figure 34i): Each lamella with 7 claws; claw 1 nonarticulated; claw 3 about  $\frac{2}{3}$  length of claw 4; all claws with teeth along posterior edges.

**Bellonci Organ** (Figure 33i): Elongate, cylindrical, with 2 weak sutures near midlength, and triangular tip.

**Eyes**: Medial eye bare, with brown pigment (Figure 33i). Lateral eye unpigmented, smaller than medial eye, with 4 ommatidia.

**Genitalia**: Oval ring on each side of body anterior to furca.

**Upper Lip** (Figure 34j,k): Single hirsute lobe without stout anterior spines.

**Posterior of Body**: Evenly rounded, bare.

**Y-Sclerite** (Figure 33j): With ventral branch.

**Number of Eggs**: Holotype with 7 eggs (4 in posterodorsal bulge of right valve, and 3 in left), length of 1 egg 0.31 mm. USNM 193939 with unextruded eggs (this specimen has choniostomatid copepod and copepod egg sacs in marsupium).

**Parasites**: USNM 193939 with 1 female choniostomatid copepod and 3 copepod egg sacs (1 containing spherical eggs, 2 containing pyriform eggs) in marsupium (location of copepod and egg sac shown in Figure 33c). Both the female copepod and its egg sac mimic the ostracode egg in size (Figure 33k). A similar mimicry has been reported for copepods parasitizing the ostracode *Parasterope pollex* Kornicker (Bowman and Kornicker, 1967:1).

**Ectozoa**: USNM 193939 with round Foraminifera attached to outer surface of right valve near posterior end at midheight.

**COMPARISONS**.—*Spinacopia trox* is very close to *S. crux*. It differs in not having spines on either the protopodite or the 1st endopodial joint of the 2nd antenna, in having 9 or 10 rather than 2 or 3 teeth in the terminal combs of the 7th limb as well as a mound between combs, and in the carapace being much

larger (length 1.51–1.52 mm compared to 1.10 mm for *S. crux*). The terminal bristle of the endopodite of the 2nd antenna is shorter on *S. trox* than on *S. crux*, but the variability of this character is not known.

### *Spinacopia sandix*, new species

FIGURES 35–37

**ETYMOLOGY**.—From the Greek *sandix* (vermilion).

**HOLOTYPE**.—Partly dissected ovigerous female in alcohol in collection of the Museum of Victoria.

**TYPE LOCALITY**.—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden, depth 363 m.

**PARATYPES**.—Slope 1: USNM 193940, adult female on slide and in alcohol. Slope 22: USNM 194032, adult male on slide and in alcohol; adult female (with female choniostomatid copepod in marsupium) on slide and in alcohol.

**DISTRIBUTION**.—Slope 1, 204 m. Slope 22, 363 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 35, 36).—Carapace elongate in lateral view with straight posterior margin dorsal to posteriorly projecting caudal process (Figure 35a,b); incisure indicated by minute indentation in anterior margin of carapace dorsal to midheight but not by indentation in valve edge (Figure 35d). Caudal process projecting posteriorly and not ventrally, with pointed tip. Posterodorsal part of shell with large bulge (Figure 35a–c). Surface without gel-like coating.

**Ornamentation**: Surface with abundant small round fossae and 4 or 5 indistinct narrow low radial riblets extending outward from adductor muscle attachment area: 3 towards anterior margin of valve, none or 1 towards caudal process, and 1 onto posterodorsal bulge (Figure 35a,b). Valve appearing smooth but actually with abundant minute spines visible best along edges at high magnification ( $\times 15$  ocular,  $\times 20$  objective) (Figure 35d,e). A row of short and long bristles on inner side of anterior and ventral margins (long bristles longest along anteroventral margin; some long bristles stouter in proximal  $\frac{1}{2}$  or  $\frac{2}{3}$ ); very few short and long bristles (some with stout triangular basal part) on outer surface of valve.

**Infold**: Anteroventral infold with small bristle near inner margin (Figure 35d). Infold of caudal process with row of 9 spinous bristles on ridge anterior to pocket, 1–3 bristles in pocket close to ventral end of ridge, and several small bristles along inner margin of infold (Figure 35e).

**Selvage**: Wide lamellar prolongation with smooth outer edge along anterior, ventral, and posterior margins.

**Central Adductor Muscle Attachments** (Figure 35f): Comprising 17–21 attachments.

**Carapace Size** (mm): Slope 1: USNM 193940, length including caudal process 1.03, length excluding caudal process 0.97, height 0.75 (73% of length). Slope 22: holotype, length including caudal process 0.95, length excluding caudal process 0.89, height 0.54 (69% of length); paratype with choniosto-

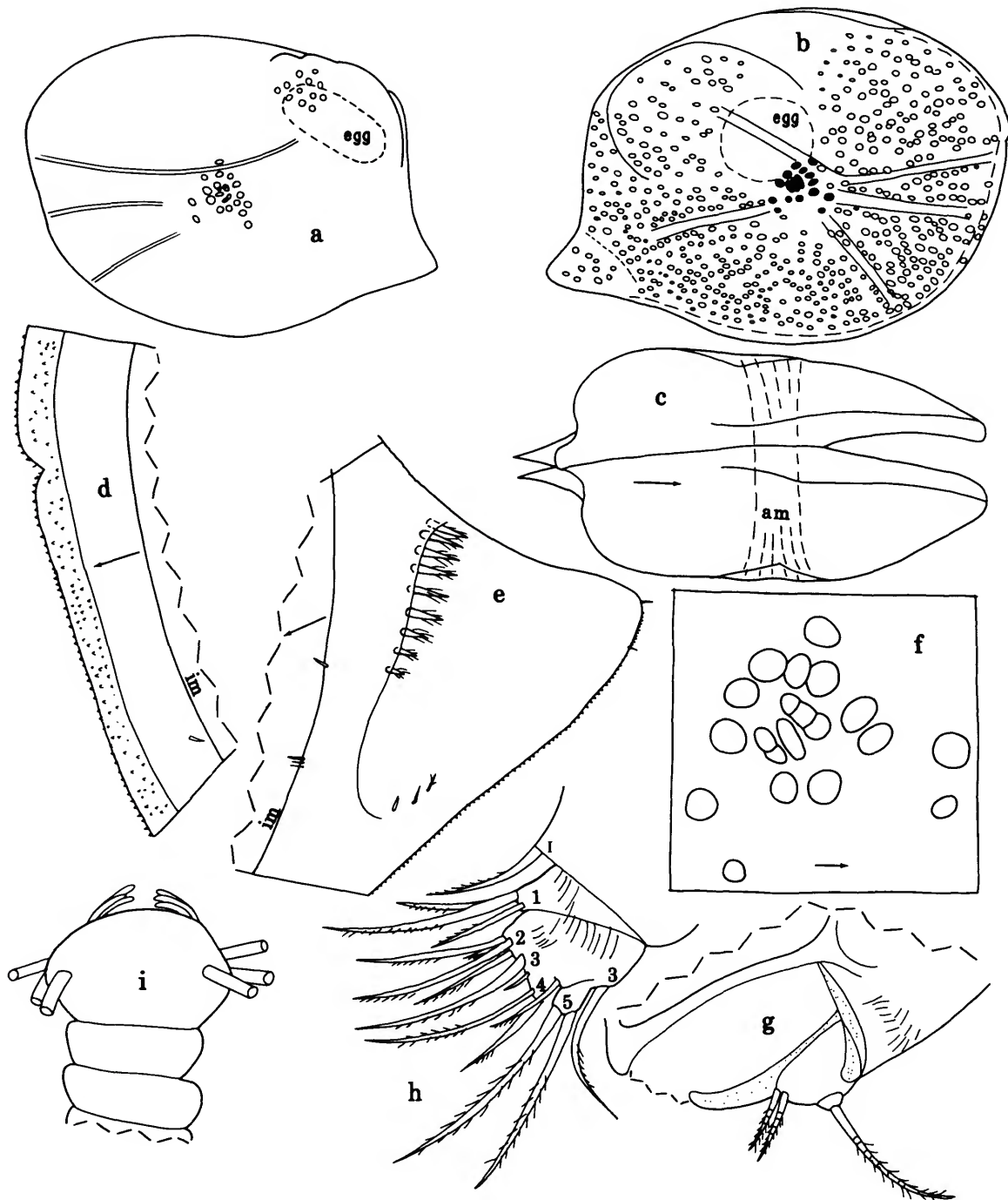


FIGURE 35.—*Spinacopia sandix*, new species, ovigerous female, holotype: *a*, complete specimen from left side showing location of 1 egg (dashed oval) and representative fossae, length 0.95 mm. Adult female, paratype, USNM 193940: *b*, complete specimen from right side showing location of 1 egg (dashed circle), length 1.03 mm; *c*, dorsal view of complete specimen, anterior to right (dashed lines show location of central adductor muscles); *d*, anterior, right valve, iv; *e*, caudal process, right valve, iv; *f*, central adductor muscle attachments, right valve, ov (anterior to right); *g*, protopodite and endopodite, right 2nd antenna, mv; *h*, 5th limb; *i*, tip of 7th limb.



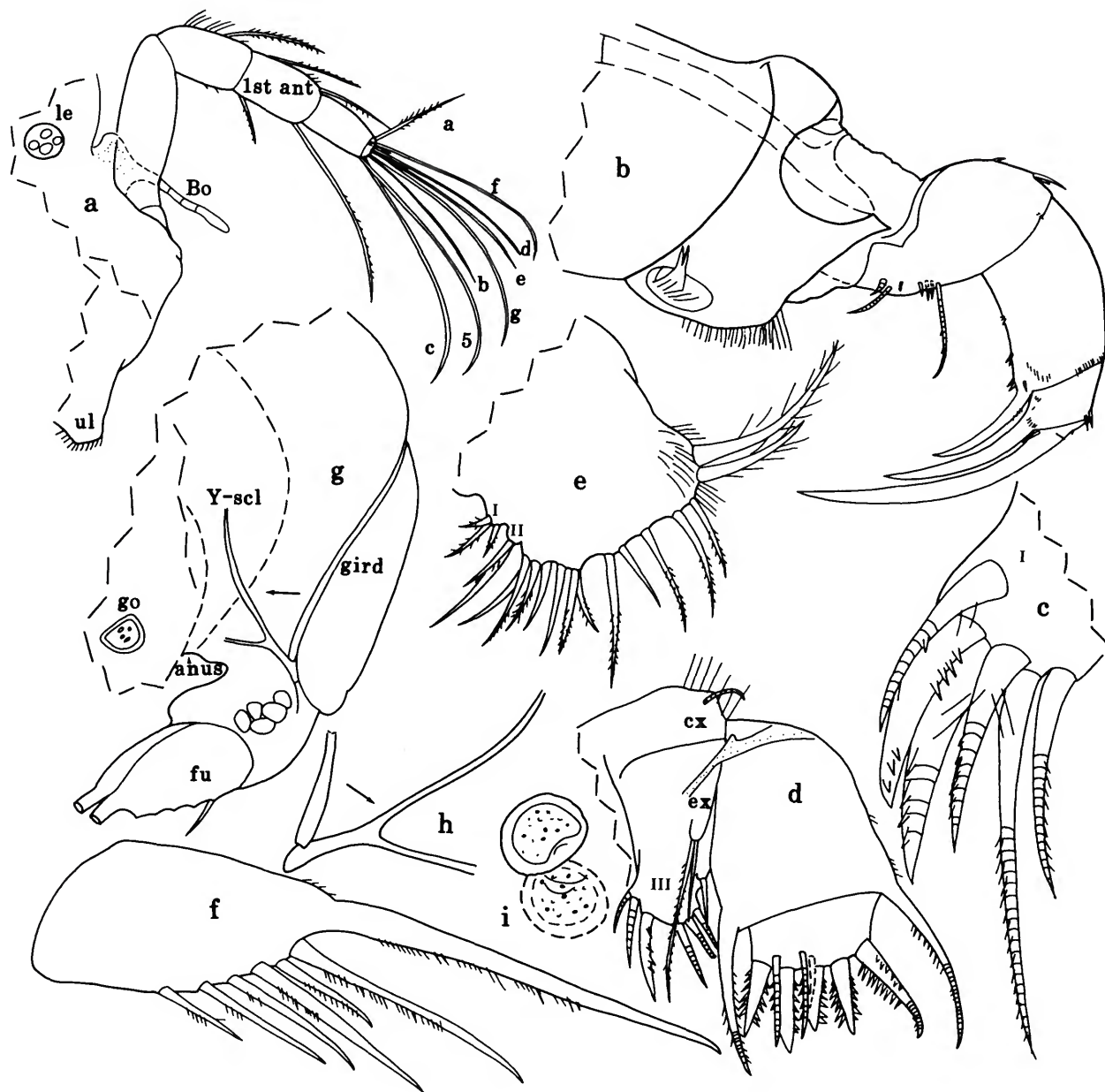


FIGURE 36.—*Spinacopia sandix*, new species, adult female, paratype, USNM 193940: *a*, anterior of body from right side and right 1st antenna; *b*, left mandible, mv; *c*, endite I, left maxilla, mv; *d*, right maxilla, lv (endites I and II not shown); *e*, 6th limb; *f*, right furcal lamella; *g*, posterior of body from left side showing internal sclerites, left genital organ, furca (without most claws), oval ends of 5 muscles proximal to furca, and outline of gut (dashed lines); *h*, right Y-sclerite; *i*, right and left (dashed) genital organs (anterior to right).

matid, length including caudal proces 0.98, length excluding caudal proces 0.91, height 0.68 (69% of length).

**First Antenna (Figure 36a):** 1st joint bare. 2nd joint with long spines on ventral margin, longer spines on dorsal margin, and dorsal bristle with short marginal spines. 3rd and 4th joint

fused; 3rd joint with 2 long spinous bristles (1 ventral, 1 dorsal); long 4th joint with dorsal spines and 2 long spinous bristles (1 ventral, 1 dorsal). Long 5th joint with long ventral bristle with 2 minute indistinct filaments (not shown), and spine at tip. 6th joint fused to 5th, with small spinous medial

bristle. 7th joint: a-bristle spinous, about half length of bristle of 5th joint, oriented dorsally on both limbs of USNM 193940; b-bristle about  $\frac{1}{4}$  longer than a-bristle; c-bristle slightly longer than bristle of 5th joint, bare except for spine at tip. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle slightly longer than e-bristle, bare except for spine at tip; g-bristle about same length as bristle of 5th joint, with 1 minute distal filament (not shown) and spine at tip. Marginal spines on bristles of joints 2–4 and 6 indistinct, but visible at high magnification ( $\times 15$  ocular,  $\times 100$  objective).

**Second Antenna:** Protopodite with few medial spines near endopodite (Figure 35g). Endopodite 2-jointed (Figure 35g): 1st joint with 2 slender spinous proximal bristles; 2nd joint small with long spinous terminal bristle. Exopodite: joint 1 with small recurved medial bristle; bristles of joints 2–8 with stout proximal ventral spines, a few proximal dorsal hairs, and distal natatory hairs; 9th joint with 2 bristles (ventral long with very slender proximal ventral marginal spines and distal natatory hairs, dorsal short with few small hairs); joints 2–8 with row of minute spines along distal edges.

**Mandible** (Figure 36b): Coxale and basale similar to those of *S. crux*, except lateral side of basale with 2 bristles near ventral margin instead of 2 or 3. Minute lateral spine on distal edge of basale near dorsal margin might represent exopodite. 1st endopodial joint: dorsal margin with several slender terminal spines; ventral margin with several minute spines at midlength, 3 small spines at distal  $\frac{1}{4}$ , and 2 larger spines just proximal to stout terminal claw (claw with indistinct proximal minute spines on dorsal edge); medial surface with row of slender spines on distal edge near dorsal margin, 1 small unringed spine-like bristle at base of ventral claw, and slender spines in distal ventral corner. 2nd endopodial joint: dorsal margin with 2 fairly long unringed spine-like subterminal bristles; ventral margin with long terminal claw; medial surface with small spines near ventral margin. 3rd endopodial joint with long terminal claw, 1 or 2 short unringed ventral bristles, and 1 minute, subterminal, unringed, spine-like dorsal bristle.

**Maxilla** (Figure 36c,d): Coxale with short dorsal bristle and dorsal fringe. Endites I and III each with 6 bristles (Figure 36c,d); endite II with 4 or 5 bristles. Basale with short bristle near exopodite. Exopodite small with 2 bristles (1 about half length of other; long bristle with spines) (Figure 36d). Endopodite similar to that of *S. crux*.

**Fifth Limb** (Figure 35h): With 30 epipodial bristles. Endite with 1 long spinous bristle. Exopodite similar to that of *S. crux*.

**Sixth Limb** (Figure 36e): Endite I with 3 or 4 short spinous bristles; endite II with 2 bristles. End joint with 12 slender bristles (either bare or with short spines) followed by 2 broad plumose posterior bristles.

**Seventh Limb:** Proximal group with 2 bristles either on same segment (segment 6 counting from segment proximal to terminus), or 1 on segment 6 and other on segment 7 or 8, 1 on each side, each with 4 bells; terminal group with 6 bristles, 3 on

each side, each with 2–5 bells. Terminus with opposing combs, each with 2 or 3 weak elongate teeth (Figure 35i).

**Furca** (Figure 36f): Each lamella with 6 or 7 claws; claw 1 nonarticulated; claw 3 about  $\frac{2}{3}$  length of claw 4; all claws with teeth along posterior edges, a few teeth longer and stouter than others; right lamella anterior to left by about  $\frac{3}{4}$  width of base of claw 1, and with small distal spines along anterior edge. (Right lamella of furca of paratype from Slope 22 with only 5 claws, all decreasing in length and width posteriorly along lamella, and interpreted to be aberrancy.)

**Bellonci Organ** (Figure 36a): Elongate with 3 indistinct sutures at midlength and rounded tip.

**Eyes:** Lateral eye small with 4 ommatidia (Figure 36a). Medial eye larger than lateral eye, bare, with brown pigment (Figure 36a).

**Upper Lip** (Figure 36a): Single hirsute lobe.

**Genitalia** (Figure 36g,i): Oval structure on each side of body anterior to furca, without attached spermatophore.

**Posterior of Body** (Figure 36g): Evenly rounded, bare.

**Y-Sclerite** (Figure 36g,h): With ventral branch and very long dorsal branch.

**Number of Eggs:** Slope 1: USNM 193940 with large unextruded eggs (outline of 1 egg shown in Figure 35b). Slope 22: holotype with 1 egg in marsupium, length of egg including velum 0.29 mm, length excluding velum 0.25 mm (outline of egg in place shown in Figure 35a).

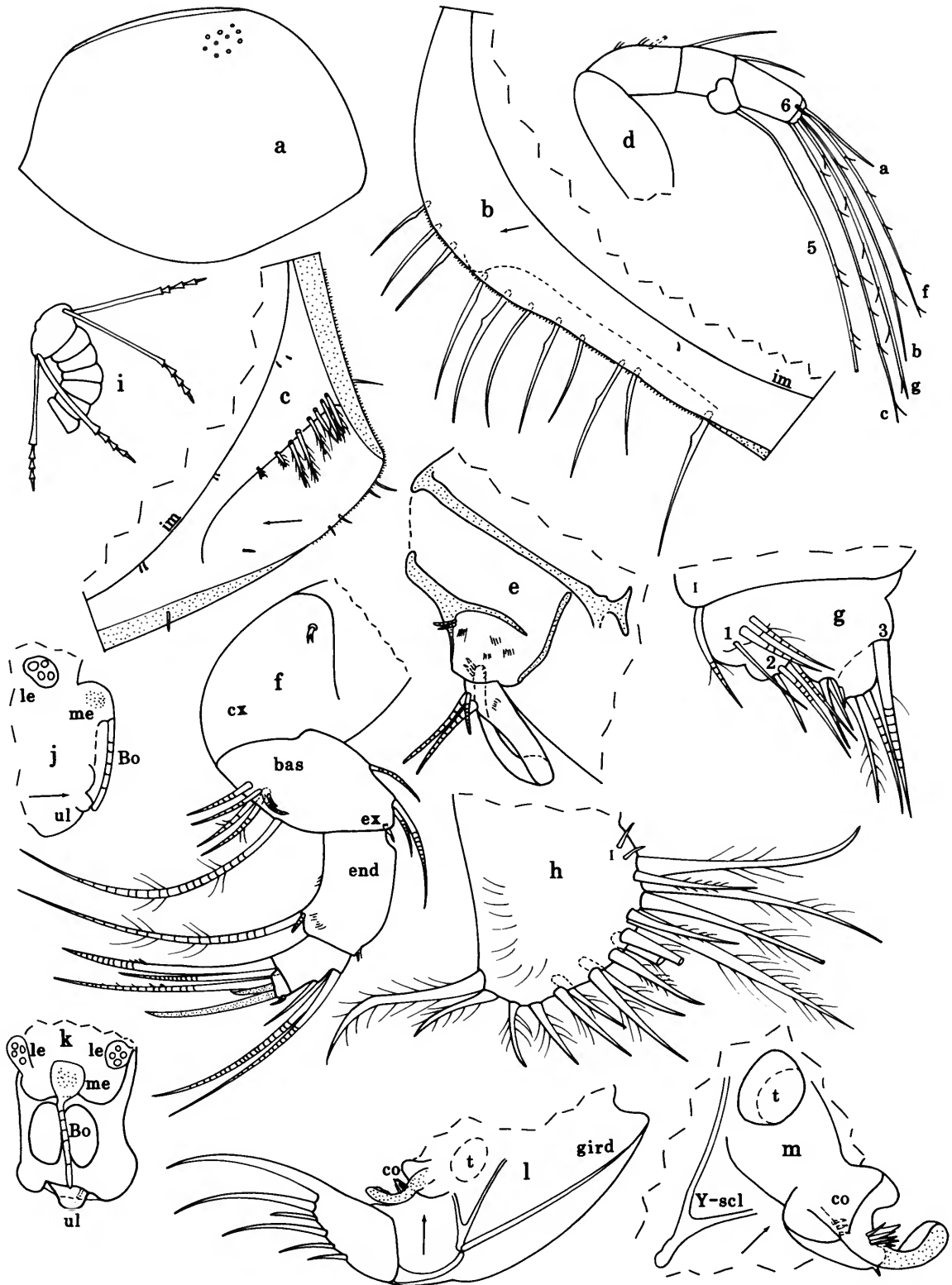
**Parasites:** Female paratype from Slope 22 with female chonistomatid copepod in marsupium.

**DESCRIPTION OF ADULT MALE** (Figure 37).—Carapace with very slight concavity along anteroventral margin and small projecting caudal process (Figure 37a–c). Surface without gel-like coating.

**Ornamentation:** Surface with abundant round fossae similar to those of adult female (Figure 37a), but without indistinct radial riblets of the female. Surface appearing smooth but with abundant minute spines similar to those of adult female. Long bristles along anterior and anteroventral margin, sparse elsewhere (Figure 37b,c).

**Infold:** Anteroventral margin with minute bristle near inner margin (Figure 37b). Infold of caudal process with row of 8 or 9 spinous bristles on ridge anterior to pocket, 1 small bristle near ventral end of pocket, several small bristles along inner

FIGURE 37.—*Spinacopia sandix*, new species, adult male, paratype, USNM 194032: a, complete specimen from right side showing representative fossae, length 0.85 mm; b, anterior, right valve, iv; c, caudal process, right valve, iv; d, left 1st antenna, mv (d- and e-bristles of 8th joint not shown); e, protopodite and endopodite of right 2nd antenna, mv; f, left mandible, mv; g, 5th limb (not all hairs on bristles shown); h, 6th limb; i, 7th limb; j, anterior of body from right side showing right lateral eye, medial eye, Bellonci organ, and upper lip at bottom; k, anterior view of anterior of body showing lateral eyes, medial eye, Bellonci organ, and upper lip at bottom; l, posterior of body from left side (sclerotized part of copulatory organ stippled); m, right copulatory organ and Y-sclerite.



edge of infold, and 4 small bristles along posterior edge of process (Figure 37c).

*Selvage*: Similar to that of adult female.

*Carapace Size* (length, height in mm): USNM 194032, 0.85, 0.77.

*First Antenna* (Figure 37d): 1st joint bare. 2nd joint with dorsal spines and 1 dorsal bristle (bristle broken off on both limbs of USNM 194032 but empty socket present). 3rd and 4th joints fused, each with 1 dorsal bristle. 5th joint wedged ventrally between 4th and 6th joints; bristle with stout proximal process with abundant thin filaments and long stem with several marginal filaments (tip broken on both limbs of USNM 194032, with 4 filaments on remaining part). 6th joint with small medial bristle. 7th joint: a-bristle about same length or slightly longer than dorsal margin of 6th joint; b-bristle about 3 times length of a-bristle, with 2 short marginal filaments; c-bristle almost 4 times length of a-bristle, with 6 short marginal filaments. 8th joint: d- and e-bristles long bare with blunt tips (not shown); f-bristle slightly shorter than b-bristle, with 5 short marginal filaments; g-bristle almost as long as c-bristle, with 6 short marginal filaments.

*Second Antenna*: Protopodite bare. Endopodite 3-jointed (Figure 37e): 1st joint short with 2 small bristles and indistinct rows of medial spines; 2nd joint elongate with 3 bristles (1 short, 2 long), and indistinct medial row of proximal spines; 3rd joint elongate with terminal ridges and 2 small terminal bristles. Exopodite: 1st joint with minute medial terminal bristle; bristles of joints 2–5 with proximal hairs followed by few ventral spines and distal natatory hairs; bristles of joints 6–8 with natatory hairs, no spines; 9th joint with 3 bristles (1 long and 1 short with natatory hairs, 1 small bare); joints 2–8 with row of small spines along distal edges.

*Mandible* (Figure 37f): Coxale endite minute, bifurcate. Basale with 4 bare ringed medial bristles near ventral margin, 1 long spinous ringed ventral bristle, and 2 spinous ringed lateral bristles near ventral margin; dorsal margin with 3 bare ringed bristles (1 at midlength, 2 subterminal). Exopodite small with short ringed terminal bristle. 1st endopodial joint: dorsal margin with proximal indentation and row of terminal spines; ventral margin with few weak spines at midlength and 2 ringed subterminal bristles (1 long, 1 minute medial); medial surface with few small distal spines. 2nd endopodial joint: dorsal margin with 3 bare ringed bristles (2 long, 1 short) near midlength; terminal edge with 2 long bristles at ventral end (ventral of these with proximal  $\frac{2}{3}$  claw-like unringed and distal  $\frac{1}{3}$  ringed bristle-like, and ringed with indistinct ventral hairs; other bristle bare, ringed, bristle-like). 3rd endopodial joint with 2 claws (1 long lateral, 1 short medial), 1 minute ringed medial bristle near dorsal margin, and 1 long ringed bristle (with indistinct ventral spines) near ventral margin. Tips of bristles unringed, sharply pointed.

*Maxilla*: Limb minute. Coxale with ringed dorsal bristle. Exopodite with 2 long ringed bristles. Bristles of endites and endopodite indistinct and difficult to resolve.

*Fifth Limb* (Figure 37g): Exopodite minute. (Bristles

difficult to resolve and some bristles may be missing in Figure 37g, which was drawn under oil immersion ( $\times 15$  ocular,  $\times 100$  objective).)

*Sixth Limb* (Figure 37h): Endites less well defined than on adult female. Endite I with 2 or 3 small bristles; remaining endites and end joint with total of 16 or 17 spinous and hirsute bristles.

*Seventh Limb* (Figure 37i): Limb well developed with 47 segments including terminus, but without proximal bristles and terminal comb. Terminal group with 4 bristles, 2 on each side, each with 4 bells.

*Furca* (Figure 37l): Each lamella with 6 claws; claw 3 shorter and slenderer than claw 4; all claws with teeth along posterior edges (not shown); a few teeth longer and stouter than others; right lamella anterior to left by about width of base of claw 1, and with few minute spines along anterior edge.

*Bellonci Organ* (Figure 37j,k), *Eyes* (Figure 37j,k), *Posterior of Body* (Figure 37l), and *Y-Sclerite* (Figure 37l,m): Similar to those of adult female.

*Upper Lip* (Figure 37j,k): Broadly rounded in lateral view.

*Genitalia* (Figure 37l,m): 3 lobes on each side of body: 2 short lobes with several small bristles, 1 long lobe with sclerotized hook-like tip with triangular tooth and several bristles at midlength; tip of hook with indistinct transparent velum.

**COMPARISONS.**—The female *S. sandix* is very close to the female *S. crux*. They differ mainly in the carapace. The carapace of *S. sandix* is more elongate (height 69%–73% of length compared to 86% for *S. crux*) and the caudal process projects posteriorly and has a pointed tip; whereas, the caudal process of *S. crux* projects posteroventrally and has a more rounded tip. The protopodite of the 2nd antenna of *S. sandix* has a few short medial spines near the endopodite; whereas, that of *S. crux* has many long hairs. Also, the 1st endopodial joint of the 2nd antenna of the *S. sandix* is bare, whereas it bears rows of short spines on *S. crux*. *Spinacopia sandix* is also close to *S. trox* but is much smaller (carapace length 0.89–1.03 mm compared to 1.51–1.52 mm for *S. trox*), and the shape of *S. trox* is closer to *S. crux* than it is to *S. sandix*. The 2nd joints of the 1st antennae of both *S. crux* and *S. trox* bear hairs that are longer on the ventral margin than on the dorsal; whereas, on the 2nd joint of *S. sandix* the hairs are longer on the dorsal margin.

### *Spinacopia syrinx*, new species

FIGURES 38, 39

**ETYMOLOGY.**—From the Greek *syrinx* (pipe).

**HOLOTYPE.**—Undissected ovigerous female in alcohol in collection of the the Museum of Victoria.

**TYPE LOCALITY.**—Slope 40, 38°17.70'S, 149°11.30'E, Victoria, S of Point Hicks, depth 400 m.

**PARATYPES.**—Slope 40: USNM 193990, ovigerous female on slide and in alcohol; 3 undissected ovigerous females in alcohol.

DISTRIBUTION.—Slope 40, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 38, 39).—Carapace oval in lateral view with greatest height just posterior to midlength (Figure 38a); anterior margin with minute step dorsal to midheight marking incisur (Figure 38a,c); posterior with short caudal process with rounded tip; adult female with low posterodorsal bulge (Figure 38a,b). Surface without gel-like coating.

*Ornamentation:* Surface smooth without fossae. Long, medium, and short hairs with enlargement (either proximal or at about  $1/3$  length) common along valve edge and sparse on lateral surface (Figure 38a,c); short slender tapering hairs sparsely distributed near valve edge and on lateral surface (Figure 38a); minute spines along anterior and ventral edges of valve visible at high magnification ( $\times 15$  ocular,  $\times 20$  objective) (not shown); 4 minute spines along distal edge of caudal process (Figure 38a).

*Infold:* Anterior infold ventral to minute incisur with small bristle near midheight (Figure 38c). Infold of caudal process with row of 7 spinous bristles (Figure 38d). Small bristles along inner margin of infold anterior to caudal process.

*Central Adductor Muscle Attachments* (Figure 38a): Comprising about 19 oval attachments.

*Carapace Size* (length (including caudal process), height in mm): Slope 40: USNM 193990 and holotype, 0.87, 0.75; 3 unnumbered paratypes: 0.98, 0.79; 0.87, 0.85; 0.77, 0.72.

*First Antenna* (Figure 39a,b): 1st joint bare. 2nd joint with long equilength spines on ventral and dorsal margins, rows of shorter lateral and medial spines near dorsal margin, rows of fairly long medial spines near ventral margin, and 1 bare dorsal bristle. 3rd joint fused to 4th, with 2 long bristles (1 dorsal bare, 1 ventral with indistinct short spines). 4th joint with dorsal spines, indistinct medial hairs near ventral margin, and 2 bristles (1 dorsal bare, 1 longer ventral with indistinct short spines). 5th joint with dorsal spines, and sensory bristle with small proximal filament, 1 distal spine, and terminal papilla. 6th joint fused to 5th, with small ringed spinous medial bristle. 7th joint: a-bristle oriented dorsally, about half length of sensory bristle of 5th joint, with indistinct short spines; b-bristle about  $2/3$  length of sensory bristle, bare except for terminal papilla; c-bristle about same length as sensory bristle of 5th joint, with 2 or 3 minute spines and terminal papilla. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle shorter than sensory bristle of 5th joint, with 1 small proximal filament, 1 minute spine near midlength, and terminal papilla; g-bristle about same length as sensory bristle of 5th joint, with 1 small proximal filament, 1 minute spine near midlength, and terminal papilla.

*Second Antenna:* Protopodite with long lateral and medial spines along ventral margin near endopodite (Figure 38e). Endopodite 2-jointed (Figure 38e): 1st joint with 2 small bare proximal bristles; 2nd joint small with spinous terminal bristle about twice length of longer bristle of 1st joint. Exopodite: joint 1 with small fairly straight medial terminal bristle; bristle of joint 2 with proximal dorsal hairs, then 8 slender ventral spines

followed by natatory hairs; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 3 bristles (1 long (ventral) with natatory hairs; 1 short (dorsal) and 1 medium (about 5 times length of short bristle) with small marginal spines (base of short bristle medial to base of medium bristle)); joints 2–8 with row of minute spines along distal edges.

*Mandible* (Figure 39c): Coxale endite with 2 stout terminal spines (with few small marginal spines) and long slender proximal spines. Ventral margin of basale with long spines (distal spines longer). Basale: dorsal margin with small unringed spine-like bristle near midlength and 2 small subterminal bristles; medial surface with 5 bristles (including 1 very long bristle with indistinct spines) near ventral margin; lateral surface with 2 small ringed bristles near ventral margin, and minute unringed bristle on distal edge near dorsal margin (possibly vestigial exopodite). 1st endopodial joint: dorsal margin with several slender terminal spines; ventral margin with several small spines, and long slender terminal claw with indistinct minute proximal spines along ventral and dorsal edges; medial surface with 1 small spine-like bristle at base of ventral claw and spines forming row along distal margin. 2nd endopodial joint with 2 unringed, spine-like, subterminal, dorsal bristles and long ventral claw. 3rd endopodial joint with long terminal claw, 2 short, unringed, terminal, ventral bristles, and 1 minute, subterminal, unringed, dorsal bristle.

*Maxilla:* Coxale with short dorsal bristle with short marginal spines (Figure 39f). Endites I, II, and III each with 6 bristles (1 bristle of endite III unusually short) (Figure 39d,e). Basale with ventral bristle distal to exopodite (Figure 39f). Exopodite small with 2 bristles (1 long, 1 about  $2/3$  its length and spinous). 1st endopodial joint with spines along anterior margin, 1 spinous alpha-bristle and 1 spinous beta-bristle. 2nd endopodial joint with 2 spinous a-bristles, 1 spinous c-bristle, and 5 pectinate end bristles (anterior bristle ringed distally; middle bristle shortest).

*Fifth Limb* (Figure 39g): Epipodite with 32 bristles. Single endite with 1 long spinous bristle. Exopodite: 1st joint with 3 spinous bristles; 2nd joint with 5 spinous bristles; 3rd joint with 4 spinous bristles on inner and 1 bristle (with few indistinct spines) on outer lobe; fused 4th and 5th joints with total of 2 spinous bristles; exopodial joints 1–3 hirsute. All bristles ringed (rings not shown).

*Sixth Limb* (Figure 38f): Endite I with 3 short spinous bristles; endite II with 2 spinous bristles. End joint with 12 or 13 bristles with short spines followed by 2 long posterior plumose bristles; limb hirsute.

*Seventh Limb:* Proximal group with 2 bristles on same segment (segment 7 counting from segment proximal to terminus) or on adjacent segments (segments 7 and 8), 1 bristle on each side, each with 2 or 3 bells; terminal group with 6 bristles, 3 on each side, each with 2–5 bells. Terminus with opposing combs, each with 3 (2 short, 1 longer) weak teeth (Figure 38g).

*Furca* (Figure 38h): Each lamella with 6 claws; claw 1 nonarticulated; claw 3 about half length of claw 4; claws 1, 2,

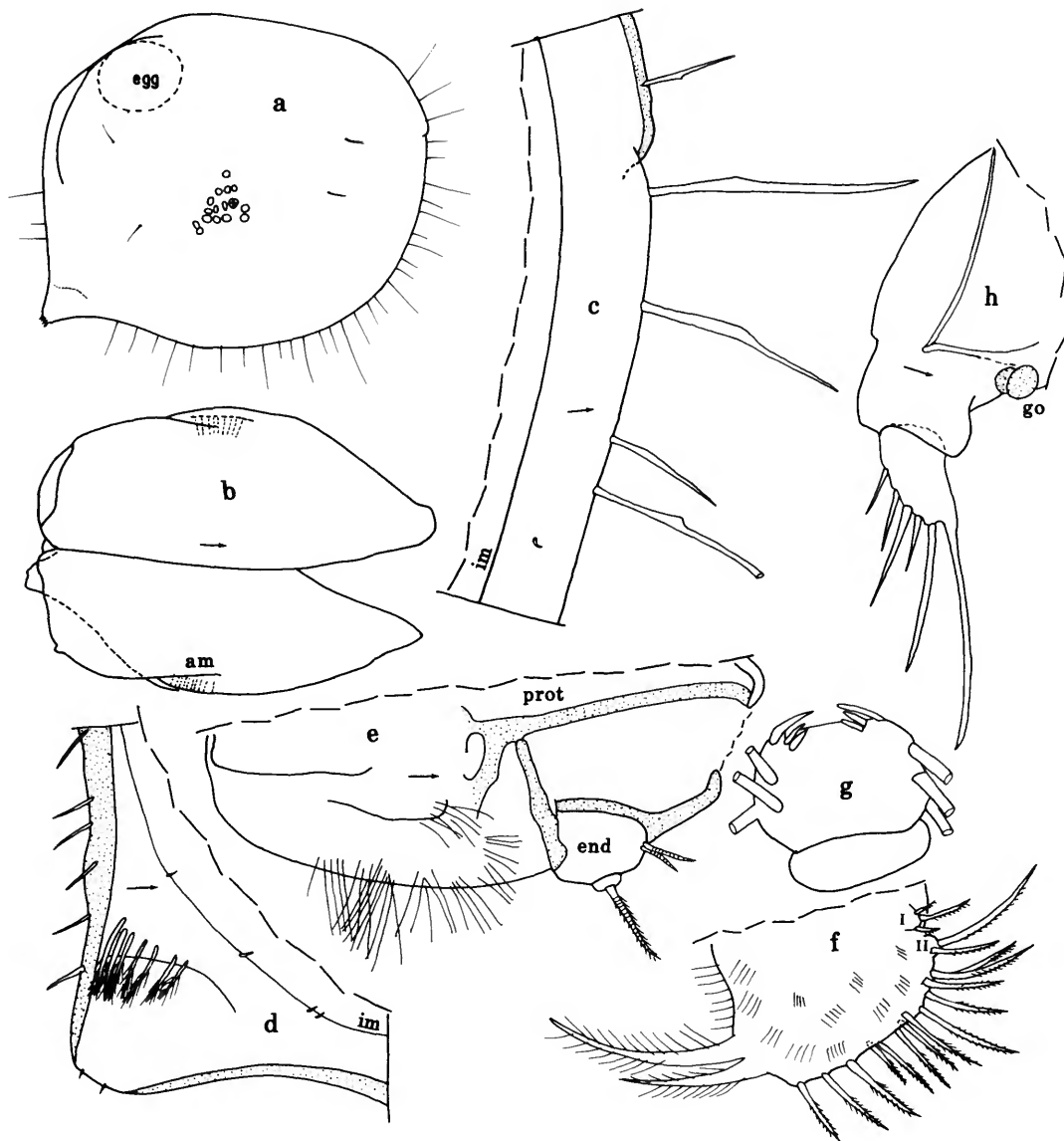


FIGURE 38.—*Spinacopia syrinx*, new species, ovigerous female, paratype, USNM 193990: *a*, Complete specimen from right side showing location of 1 egg (dashed oval), length 0.87 mm; *b*, dorsal view of complete specimen showing ends of central adductor muscles (dashed lines) (anterior to right); *c*, anterior, left valve, iv; *d*, caudal process, left valve, iv; *e*, prodopodite and endopodite, left 2nd antenna, mv; *f*, left 6th limb, mv; *g*, tip of 7th limb; *h*, posterior of body from right side showing right furcal lamella, internal sclerites, and right genital organ.

4, and 5 with teeth along posterior edge (a few longer and stouter than others) claws 3 and 6 with a few proximal teeth along posterior edge; right lamella anterior to left by width of base of claw 1.

**Bellonci Organ** (Figure 39h): Elongate, cylindrical, with 2 sutures (distal suture weakly defined) near midlength, and rounded tip.

**Eyes:** Lateral eyes absent. Medial eye unpigmented, containing 3 amber-colored ovals (Figure 39h).

**Upper Lip** (Figure 39i): Hirsute lobe with narrow, elongate, hirsute, weakly defined process on each side.

**Genitalia** (Figure 38h): Oval on each side of body with attached round spermatophore.

**Anterior of Body** (Figure 39h,i): Triangular process on each side ventral to insertion of 1st antenna.

**Posterior of Body** (Figure 38h): Evenly rounded, bare.

**Y-Sclerite** (Figure 38h): Ventral branch obscured.

**Number of Eggs:** Holotype with 1 egg in marsupium.



FIGURE 39.—*Spinacopia syrinx*, new species, ovigerous female, paratype, USNM 193990: *a*, joints 1–4 and proximal part of 5th joint, left 1st antenna, lv; *b*, joints 4–8, left 1st antenna, lv; *c*, right mandible, mv; *d*, endites I (right) and II (left), right maxilla, mv; *e*, endite III, right maxilla, lv; *f*, left maxilla, lv (endite bristles not shown); *g*, 5th limb; *h*, anterior of body from left side showing proximal part of 1st joint of left 1st antenna, medial eye (dashed), Bellonci organ, triangular anterior process (stippled at midheight), and dorsal edge of proximal part of mandible; *i*, anterior of body from right side showing upper lip (bottom) and part of socket of mandible (dorsal end stippled).

USNM 193990 with 2 eggs in marsupium and 2 unextruded eggs; length of egg in marsupium 0.27 mm, length of unextruded egg 0.19 mm; outline of egg in marsupium shown in Figure 38a. 2 unnumbered specimens with 1 and 2 eggs in marsupium and also with unextruded eggs: length of 1 egg in each marsupium 0.21 mm.

**COMPARISONS.**—The carapace of *S. syrix* resembles that of *S. crux* except for being smaller (length 0.77–0.98 mm (average 0.87 mm) compared to 1.10 mm). The 2nd antenna of *S. syrix* differs from that of *S. crux* in having a shorter terminal bristle on the endopodite and in lacking proximal spines on bristles of joints 3–8 of the exopodite. The 1st endopodial joint of the mandible of *S. syrix* is without the 2 or 3 stout ventral spines present on *S. crux* and *S. trox*. The 7th limb of *S. syrix* bears 3 short teeth in each terminal comb compared to 10–12 long teeth in each terminal comb of *S. trox*. The carapace of *S. syrix* is much smaller than those of *S. trox* (length 1.51–1.52 mm) and *S. rex* (length 1.77–1.94 mm). The carapace of *S. syrix* is without the lateral ribs present on the carapace of *S. sandix*, which also has a different shape.

### *Spinacopia illex*, new species

FIGURES 40, 41

**ETYMOLOGY.**—From the Latin *illex* (contrary to law).

**HOLOTYPE.**—Ovigerous female on slide and in alcohol in the collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden, depth 363 m.

**PARATYPES.**—None.

**DISTRIBUTION.**—Slope 22, 363 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 40, 41).—In lateral view carapace oval except for concavities anterior and dorsal to caudal process, and with posterodorsal bulge (Figure 40a). Anterior margin evenly rounded, with minute indentation dorsal to midheight visible when valve viewed from inside, but no indentation in valve edge (Figure 40b). Caudal process oriented posteroventrally, with broad flat or slightly rounded tip (Figure 40a,c). Surface without gel-like coating.

**Ornamentation:** Surface with abundant distinct, small, fairly deep, round fossae, no riblets (representative fossae shown in Figure 40a). Valve appearing smooth but with abundant minute spines visible along edges and along boundaries of indistinct reticulations (spines visible at high magnification ( $\times 15$  ocular,  $\times 20$  objective)) (Figure 40b). A row of short and long bristles on inner side of anterior (Figure 40b) and ventral margins (long bristles longest along anteroventral margin; most long bristles stouter in proximal  $1/3$  or  $1/2$ ); very few short and long bristles (some with stout triangular basal part) on outer surface of valve.

**Infold:** Anteroventral infold with small bristle near inner margin (Figure 40b). Infold of caudal process with row of 8 spinous bristles on ridge anterior to pocket and several small bristles near inner margin of infold (Figure 40c).

**Central Adductor Muscle Attachments** (Figure 40d): Comprising 15 ovoid attachments.

**Carapace Size** (mm): Holotype, length including caudal process 1.02, height 0.85 (height 83% of length).

**First Antenna** (Figure 40e,f): 1st joint bare. 2nd joint with no spines on ventral margin, short spines on dorsal margin, and bare dorsal bristle. 3rd and 4th joints fused; 3rd joint with 2 long bristles (1 ventral, 1 dorsal, both with small indistinct spines); 4th joint with dorsal spines and 2 long bristles (1 ventral, 1 dorsal). Long 5th joint with few dorsal spines and long ventral bristle with small proximal filament, 2 minute filaments or spines at midlength, and 1 terminal spine. 6th joint fused to 5th, with small medial bristle. 7th joint: a-bristle (with few spines) less than half length of bristle of 5th joint; b-bristle about  $1/4$  or  $1/3$  longer than a-bristle, bare or with minute spine at midlength; c-bristle reaching slightly past tip of bristle of 5th joint, with small proximal filament, 1 or 2 minute filaments or spines at midlength, 1 minute subterminal filament or spine, and terminal spine. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with minute subterminal filament or spine and terminal spine; g-bristle about same length as bristle of 5th joint, with 2 minute marginal filaments or spines (1 near midlength, 1 subterminal) and 1 terminal spine.

**Second Antenna:** Protopodite bare (Figure 40g). Endopodite 2-jointed (Figure 40g): 1st joint with 2 slender bare proximal bristles; 2nd joint small with fairly long spinous terminal bristle. Exopodite: joint 1 with small recurved tubular medial bristle; bristles of joints 2 and 3 with few stout proximal ventral spines, a few proximal dorsal hairs, and distal natatory hairs; bristles of joints 4–8 of right limb with natatory hairs, no spines; bristles of joints 4–8 of left limb with ventral spines in addition to natatory hairs; 9th joint with 3 bristles (ventral long with natatory hairs, 2 dorsal short (medial about  $1/5$  length of lateral) with slender spines); joints 2–7 with row of minute spines along distal edges.

**Mandible** (Figure 41a): Coxale endite bifurcate dentate, with stout spines near base. Ventral margin of coxale with long spines (distal spines longer). Basale: dorsal margin with 1 small unringed spine-like bristle near midlength and 2 subterminal (shorter indistinct, longer ringed spinous); medial surface with 5 ringed bristles (distal very long) near ventral margin; lateral surface with 2 small ringed bristles near ventral margin, and 1 small process (?exopodite) on distal edge near dorsal margin (not shown). 1st endopodial joint: dorsal margin with several slender terminal spines; ventral margin with 2 slender spines just proximal to stout terminal claw; dorsal margin of terminal claw with minute proximal spines; medial surface with row of slender spines on distal edge near dorsal margin, 1 fairly stout spine medial to base of stout terminal claw, and 8–10 slender spines at distal ventral corner. 2nd endopodial joint: dorsal margin with 2 fairly long unringed spine-like subterminal bristles; ventral margin with stout terminal claw. 3rd endopodial joint with long terminal claw, 2 short unringed ventral



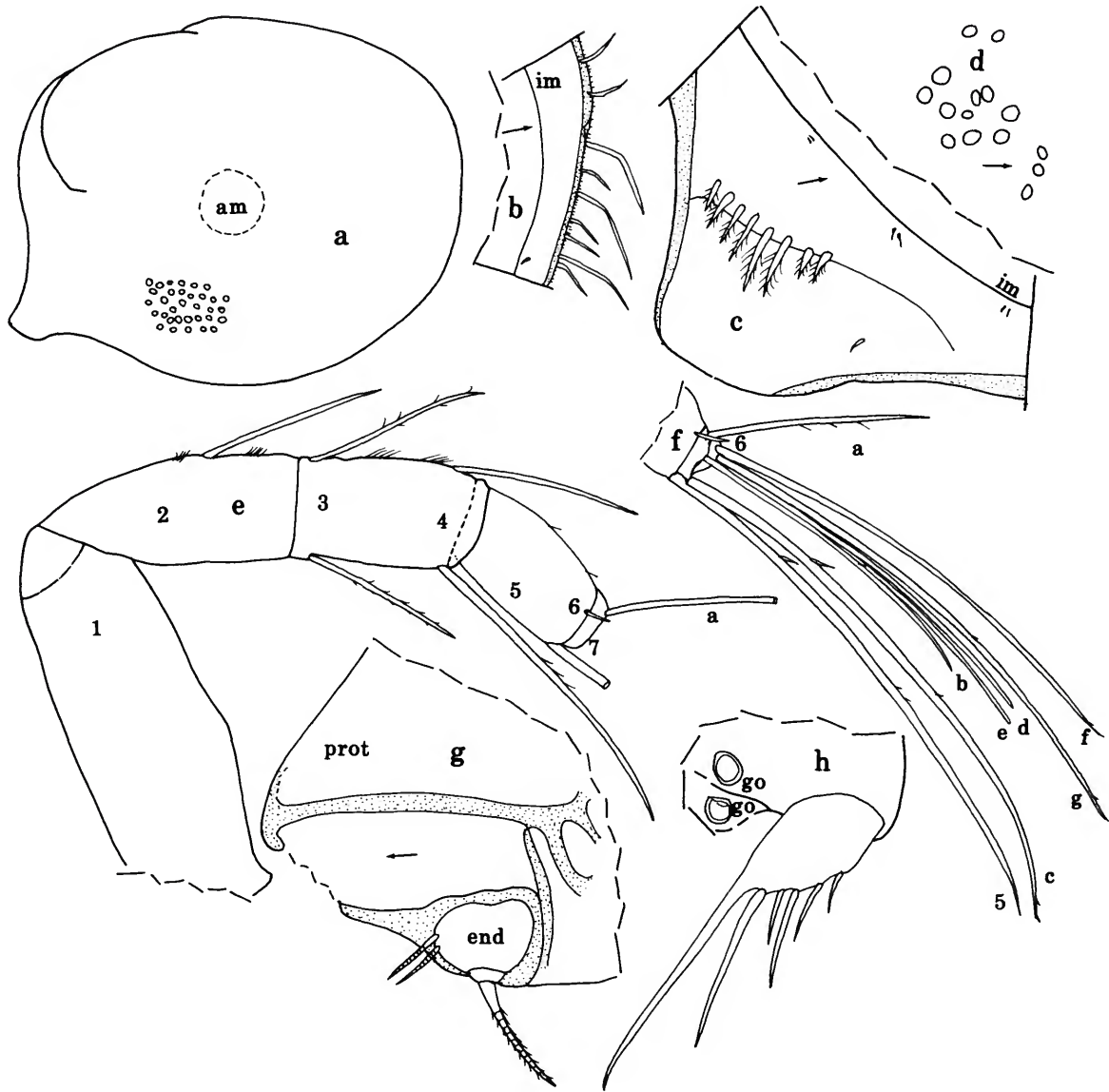


FIGURE 40.—*Spinacopia illex*, new species, ovigerous female, holotype: a, complete specimen from right side showing location of central adductor muscle attachments (dashed oval) and representative fossae, length 1.02 mm; b, anterior, left valve, iv; c, caudal process, left valve, iv; d, central adductor muscles, right valve, ov (anterior to right); e, left 1st antenna, mv (only a-bristle of 7th joint and no bristles of 8th joint shown); f, joints 5-8, left 1st antenna, mv; g, protopodite and endopodite, right 2nd antenna, mv; h, ventral part of posterior of body from left side showing left furcal lamella and left (upper) and right (lower) genital organs.

bristles, and 1 minute subterminal unringed spine-like dorsal bristle.

**Maxilla** (Figure 41b): Coxale with short dorsal bristle. Endites I and III each with 6 bristles; endite II with 4 bristles. Basale with short bristle near exopodite. Exopodite small with 2 subequal bristles (longest with indistinct short spines). Endopodite similar to that of *S. crux*.

**Fifth Limb** (Figure 41c): Single endite with 1 long spinous bristle. Exopodite: 1st joint with 3 spinous bristles. 2nd joint and inner lobe of 3rd joints fused, with total of 9 spinous bristles; outer lobe of 3rd joint with 1 spinous bristle. Fused 4th and 5th joints with total of 3 spinous bristles.

**Sixth Limb** (Figure 41d): Endite I with 3 short spinous bristles; endite II with 2 spinous bristles. End joint with 13

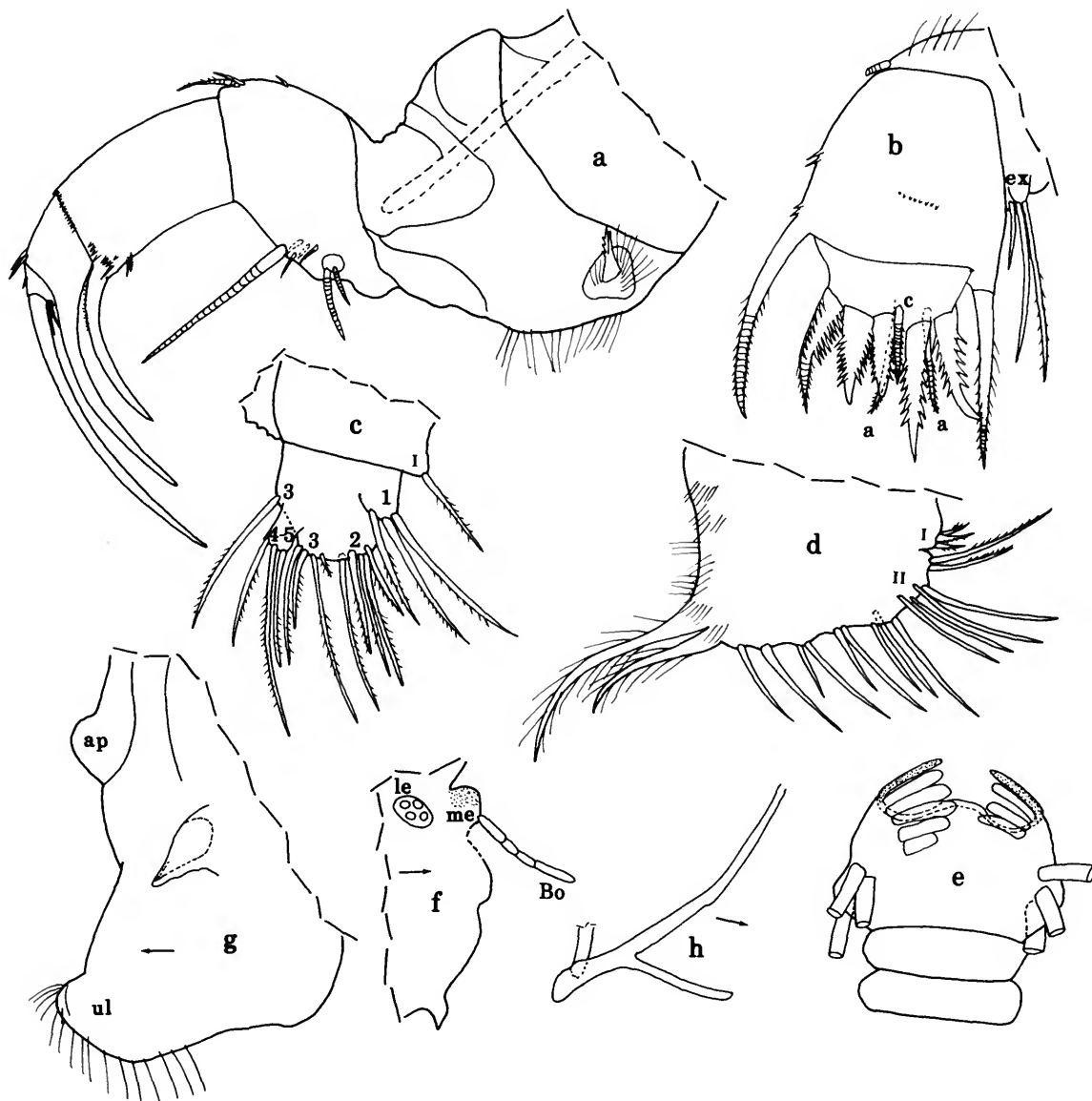


FIGURE 41.—*Spinacopia illex*, new species, ovigerous female, holotype: a, right mandible, mv; b, right maxilla, mv (endites not shown); c, 5th limb; d, 6th limb; e, tip of 7th limb; f, anterior of body from right side showing right lateral eye, medial eye, and Bellonci organ (area of brown pigment stippled); g, anterior of body from left side showing rounded anterior process, lateral triangular process, and upper lip (bottom); h, right Y-sclerite.

slender bristles with short spines (spines not shown) followed by 2 broad plumose posterior bristles; long hairs near posterior edge of limb.

**Seventh Limb:** Proximal group with 2 bristles (1 on segment 7, other on segment 9 or 10 counting from segment proximal to terminus), 1 on each side, each with 3 or 4 bells; terminal group with 6 bristles, 3 on each side, each with 2-4 bells. Terminus with opposing combs, each with about 8

elongate teeth (middle tooth sclerotized, others indistinct, weakly developed); area between opposing combs mound-like (Figure 41e).

**Furca** (Figure 40h): Each lamella with 6 claws; claw 1 nonarticulated; claw 3 about  $\frac{1}{2}$  length of claw 4; teeth on claws not shown but similar to those of *S. crux*.

**Bellonci Organ** (Figure 41f): Elongate with 2 or 3 indistinct sutures near midlength and rounded tip.

*Eyes:* Lateral eye small, distinct, with 4 amber-colored ommatidia (Figure 41f). Medial eye slightly larger than lateral eye, bare with brown pigment (Figure 41f).

*Upper Lip* (Figure 41g): Single hirsute lobe; some anteroventral hairs slightly stouter than others, spine-like.

*Genitalia* (Figure 40h): Sclerotized ring on each side of body anterior to furca.

*Anterior of Body* (Figure 41f,g): Triangular process on each side of body just lateral to insertion of mandible.

*Posterior of Body:* Evenly rounded, bare.

*Y-Sclerite* (Figure 41h): With short ventral and very long dorsal branches.

*Number of Eggs:* Holotype with 3 eggs in marsupium; length of 1 egg 0.25 mm.

**COMPARISONS.**—The shape of the carapace of *S. illex* resembles that of *S. crux* in having a broadly rounded posteroventral caudal process. The appendages of *S. illex* differ from those of *S. crux* as follows: 1st antenna without ventral spines on 2nd and 4th joints; 2nd antenna without medial spines on protopodite and 1st endopodial joint; mandible without 3 stout ventral spines on 1st endopodial joint and without medial spines on 2nd endopodial joint; and 7th joint with mound-like process between combs of 7th limb and with more teeth in combs. The caudal process of *S. sandix* differs from that of *S. illex* in being oriented posteriorly, and in *S. sandix* the ventral margin of the 1st endopodial joint of the mandible has stout spines. The valves of *S. sandix* also differ in having ribs. *Spinacopia syrinx* differs from *S. illex* in having long ventral spines on the 2nd joint of the 1st antenna, medial spines on the protopodite of the 2nd antenna, and in lacking lateral eyes. The carapace of *S. trox* is much larger than that of *S. illex* (length of female *S. trox* 1.51 mm, length of female *S. illex* 1.02 mm), and the 1st antenna has long ventral spines on the 2nd joint. The shape of the carapace of *S. illex* differs considerably from the much larger *S. rex*. The round fossae on the surface of the carapace of *S. illex* are much more distinct than on others species of *Spinacopia* in the collection, but it is possible that this could be the result of better preservation.

### *Cymbicopia* Kornicker, 1975

*Cymbicopia* Kornicker, 1975:608; 1986:40 [emended].

**TYPE SPECIES.**—*Sarsiella hanseni* Brady, 1898.

**COMPOSITION.**—This genus includes two species from New Zealand, *C. hanseni* (Brady, 1898:438) and *C. brevicosta* Kornicker, 1975:633, and two new species from the vicinity of Australia.

**DISTRIBUTION.**—New Zealand at a depth of 15 m and less, and off Australia at a depth of 363–400 m.

**REMARKS CONCERNING BRISTLE OF 6TH JOINT OF 1ST ANTENNA.**—Members of the Sarsiellidae generally have a small medial bristle on the 6th joint of the 1st antenna. The bristle is lacking on known species of *Cymbicopia*: *C. hanseni*

(Kornicker, 1975:615, 618), *C. brevicosta* (Kornicker, 1975:637, 639), and *C. cervix* and *C. climax*, both new species herein. It is also lacking on two species of *Neomuelleriella* (Kornicker, 1986:40), *N. zealandica* (Poulsen, 1965:60), and *N. hispida* (Kornicker, 1975:625, 627), but is present on *N. nex* and *N. klomax*, both new species, herein. It is also lacking in two new species of *Alphasarsiella*, new genus, herein. The bristle is lacking on both males and females of species where both sexes are known.

### *Cymbicopia cervix*, new species

FIGURES 42, 43

**ETYMOLOGY.**—From the Latin *cervix* (neck).

**HOLOTYPE.**—Ovigerous female with body separated from carapace in alcohol in the collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden, depth 363 m.

**PARATYPES.**—Slope 22: 1 undissected adult female (carapace disorted) in alcohol. Slope 40: USNM 193991, adult female on slide and in alcohol; 2 ovigerous females in alcohol.

**DISTRIBUTION.**—Slope 22, 363 m. Slope 40, 400 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 42, 43).—Carapace elongate in lateral view with prominent rostrum, shallow incisur, and short posterodorsal caudal process (Figure 42a). Lateral overhang of valve edge at rostrum (Figure 42c) and ventral margin. Edge of valve at dorsal end of rostrum forming sharp angle (Figure 42c). Surface of carapace with gel-like coating as thick as lengths of long bulbous bristles (not shown).

**Ornamentation:** Surface with abundant short bristles with bulbous tips (Figure 42b; not shown in Figure 42a); and longer bristles with bulbous tips along valve margins (except in vicinity of incisur) (Figure 42c,e), and forming 3 rows (Figure 42a (bulbous tips of long bristles not shown)): 1 short horizontal row posterior to rostrum, 1 long row angling from anteroventral margin to posterodorsal margin, and 1 short row ventral to central adductor muscle attachments. Outer surface of valves with few long and short bristles tapering to point (some long bristles with proximal enlargement); long slender bristles tapering to point present on inner side of lateral overlap of rostrum (Figure 42c) and ventral margin. Surface with indistinct round fossae without spines.

**Infold:** Anterior infold with small bristle near inner margin ventral to rostrum (Figure 42c). Infold of caudal process with row of 13 broad translucent spinous bristles tapering to needle-like tip (Figure 42d,e) (spines of bristles indistinct and were barely resolved on a few bristles). Inner edge of infold in vicinity of caudal process with 6 small bristles in 3 groups, each with 1–3 bristles (Figure 42d).

**Selvae:** Inner part of selvae broad in vicinity of rostrum (striated in Figure 42c); broad transparent lamellar prolongation with smooth outer edge present along free margin of each

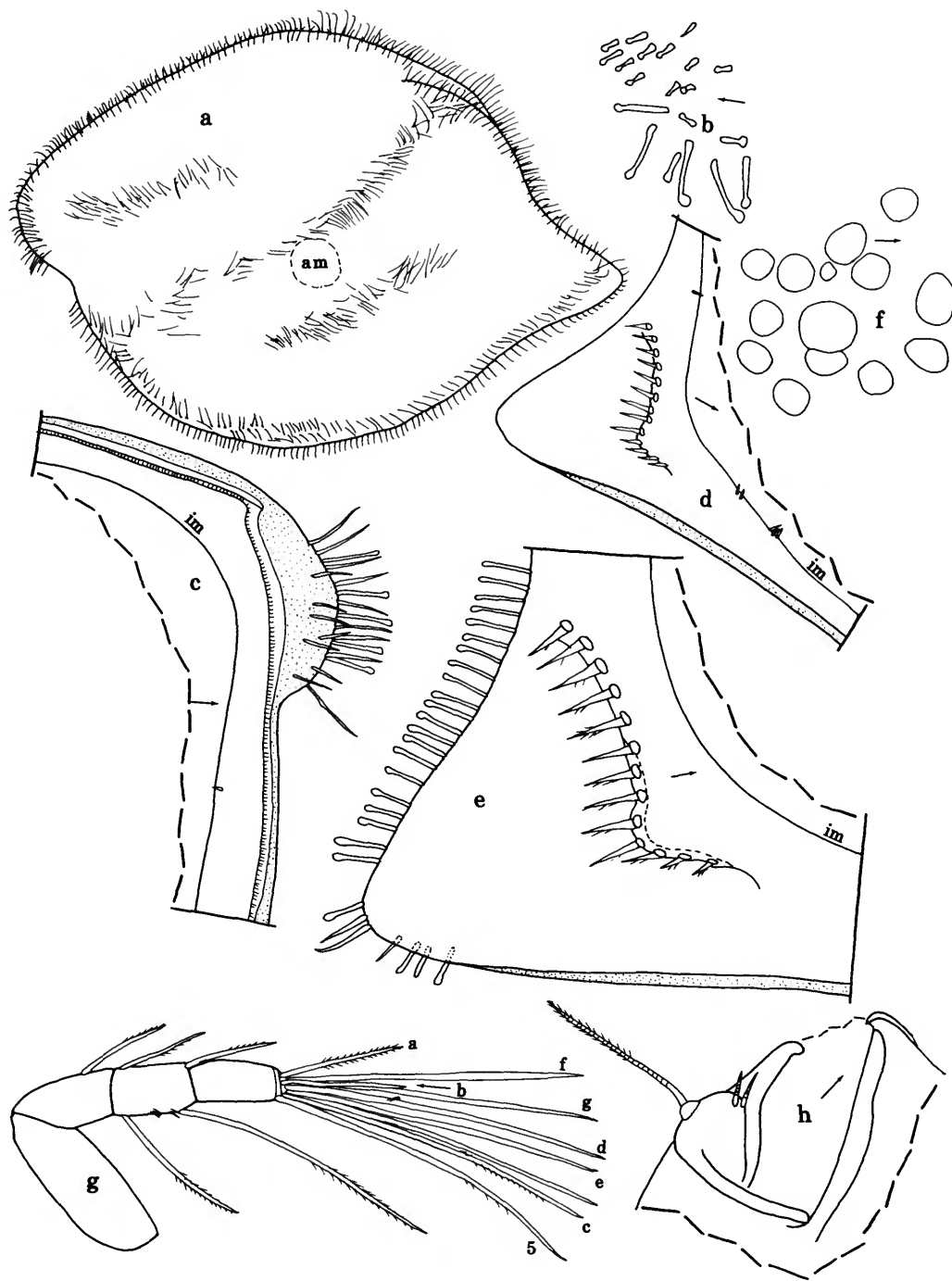


FIGURE 42.—*Cymbicopia cervix*, new species, adult female, paratype, USNM 193991: *a*, complete carapace from left side (body removed), length 1.48 mm (location of central adductor muscle attachments shown by dashed oval); *b*, surface bristles near valve middle of left valve, ov (anterior of valve to left); *c*, anterior, left valve, iv; *d*, caudal process, left valve, iv (spines of bristles not shown); *e*, caudal process, left valve, iv (not all bristles on outer surface shown); *f*, central adductor muscles, right valve, ov (anterior to right); *g*, left 1st antenna, mv; *h*, protodipite and endopodite, right 2nd antenna, mv.

valve and undivided in vicinity of rostrum (prolongation not shown).

*Central Adductor Muscle Attachments* (Figure 42f): Comprising about 14 ovoid attachments.

*Carapace Size* (mm): Slope 22: holotype, length with caudal process 1.32, length without caudal process 1.20, height 1.07. Slope 40: USNM 193991, length with caudal process 1.48, length without caudal process 1.38, height 1.05; 2 paratypes: length with caudal process 1.32, height 0.97; length with caudal process 1.30, height 0.99.

*First Antenna* (Figure 42g): 1st joint bare. 2nd joint with dorsal bristle with indistinct short distal spines. 3rd joint fused to 4th, with 2 bristles (1 ventral, 1 dorsal) with indistinct short spines. 4th joint with few ventral spines and 2 or 3 bristles (1 or 2 ventral (1 very long), 1 dorsal) with indistinct short spines. Sensory bristle of 5th joint with few indistinct distal spines and terminal papilla. 6th joint fused to 5th, without medial bristle. 7th joint: a-bristle with short marginal spines; b-bristle same length as a-bristle, bare except for terminal papilla; c-bristle about same length as sensory bristle of 5th joint, with indistinct small distal spines and terminal papilla. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, bare except for terminal papilla; g-bristle same length as c-bristle, with 1 or 2 small proximal filaments and terminal papilla.

*Second Antenna*: Protopodite bare. Endopodite 2-jointed (Figure 42h): 1st joint with 2 small proximal bristles; 2nd joint small with long terminal bristle with short spines. Exopodite: 1st joint with small terminal tubular medial bristle; bristle of 2nd joint with 14–16 stout ventral spines followed by natatory hairs; bristles of joints 3–8 with 9–14 ventral spines followed by natatory hairs; 9th joint with 2 bristles (ventral with 7–12 slender ventral spines followed by natatory hairs; dorsal short with small hair-like spines); joints 3–7 with indistinct minute lateral row of spines along distal edges.

*Mandible* (Figure 43a): Coxale endite represented by stout spine with minute marginal spine at midlength; coxale with long ventral hairs. Basale: dorsal margin with or without indistinct minute spine at distal  $\frac{2}{3}$  (not present on left limb of USNM 193991), and 1 or 2 indistinct minute subterminal spines; ventral margin with 2 small lateral bristles and 5 medial bristles (3 short unringed, 1 longer ringed, 1 longest unringed knife-like with few spines (see detail in Figure 43a)). Exopodite represented by minute digitate process (dotted outline in Figure 43a). Endopodite: 1st joint with rows of medial spines near distal edge, 1 small medial spine-like dorsal bristle at base of stout ventral claw; 2nd joint with small spine-like subterminal dorsal bristle and stout ventral claw; 3rd joint with stout terminal claw and 2 small ventral spine-like bristles; tips of claws of joints 1–3 narrowly rounded.

*Maxilla*: Coxale with short dorsal bristle. Endites I, II, and III with 6, 5, and 6 bristles, respectively (Figure 43b). Basale with short ventral bristle distal to exopodite (Figure 43c). Exopodite small with 3 long bare bristles. 1st endopodial joint

with few anterior spines and spinous alpha- and beta-bristles. 2nd endopodial joint with 2 spinous a-bristles, 1 bare c-bristle, and 5 pectinate end bristles (middle bristle shorter than others).

*Fifth Limb* (Figure 43d): Single endite with small bare bristle. Exopodite: 1st joint with 3 spinous bristles; 2nd joint with 3 long spinous terminal bristles and 1 short bare bristle near inner lobe of 3rd joint; 3rd joint with 3 bristles (2 long spinous, 1 short bare) on inner lobe and 1 bare bristle on outer lobe; fused 4th and 5th joints with total of 3 spinous bristles. Joints 1 and 2 hirsute.

*Sixth Limb* (Figure 43e): Endite I with 3 short bristles with few short spines; endite II with 1 long bristle with short spines; endite III with 4 long bristles with short spines; endite IV with lateral hairs and 3 long bristles with short spines. End joint with 7 or 8 bristles (3 or 4 anterior and 2 at midwidth with short spines, 2 posterior plumose); posterior half of joint with lateral and medial hairs. (On USNM 193991 endite II of the right limb is more clearly separated from endite III than on the illustrated left limb.)

*Seventh Limb* (Figure 43f,g): Proximal group with 4 bristles, 2 on each side, each with 4 bells; terminal group with 6 bristles, 3 on each side, each with 3–7 bells (a short terminal bristle missing on illustrated limb but empty socket visible). Terminus with opposing combs, each with sclerotized tooth at midwidth and a translucent tooth (with proximal teeth and broadly rounded tip) on each side (Figure 43g).

*Furca* (Figure 43k): Each lamella with 5 or 6 claws decreasing in length along lamella (holotype and USNM 193991 with 6 claws on left lamella and 5 on right); claws 1 and 2 nonarticulated; claw 1 with small and large teeth (4 or 5 distal stouter than others) along posterior edge and row of long medial hairs at base; claw 2 with small teeth along posterior edge, a few slightly stouter than others, and few indistinct distal short hairs along anterior edge; claws 3–6 with minute teeth along posterior edge and few indistinct short hairs along anterior edge; claw 1 with narrowly rounded tip (worn?); claws 3–6 with pointed tips; left lamella with few long hairs following posterior claw; right lamella with few short hairs along anterior edge proximal to claw 1; right lamella anterior to left by width of base of claw 1.

*Bellonci Organ* (Figure 43h): Elongate with rounded tip.

*Eyes*: Lateral eye unpigmented, with 2 well-developed ommatidia (Figure 43j). Medial eye about twice size of lateral eye, with brown pigment (Figure 43h,i).

*Upper Lip* (Figure 43i): Evenly rounded.

*Genitalia* (Figure 43k): Oval with attached spermatophore on each side of body anterior to furca.

*Anterior of Body* (Figure 43i): With triangular process dorsal to upper lip.

*Posterior of Body*: Evenly rounded bare.

*Y-Sclerite* (Figure 43k): With ventral branch.

*Number of Eggs*: Holotype with 2 eggs in marsupium and also 2 unextruded egg; lengths of 2 extruded eggs, 0.30, 0.33; length of 1 unextruded egg 0.23; 1 unnumbered paratype with

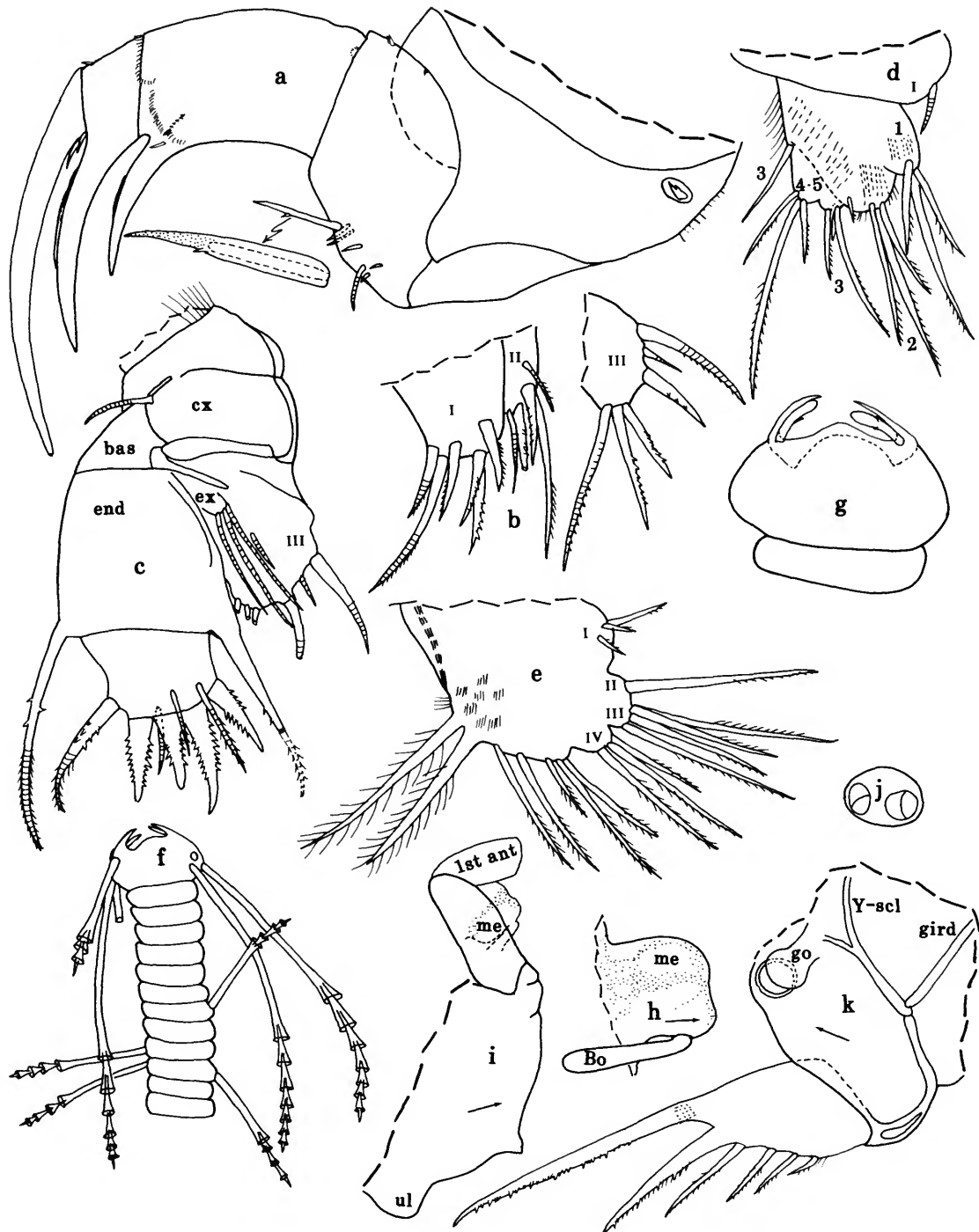


FIGURE 43.—*Cymbicopia cervix*, new species, adult female, paratype, USNM 193991: *a*, right mandible, mv; *b*, endites I (left), II (middle) and III (right) of right maxilla, mv; *c*, left maxilla, lv (endites I and II not shown); *d*, 5th limb; *e*, 6th limb; *f*, 7th limb (1 terminal bristle represented by socket); *g*, detail from *f*; *h*, medial eye (area of brown pigment stippled) and Bellonci organ; *i*, anterior of body from right side showing joints 1 and 2 of right 1st antenna, medial eye (area of brown pigment stippled), proximal part of Bellonci organ (2 parallel dashed lines), and upper lip (bottom); *j*, left lateral eye (anterior to left); *k*, posterior of body from left side showing internal sclerites, left furcal lamella, and genital organ.

2 eggs in marsupium (length of 1 egg 0.35 mm); 1 unnumbered paratype with 3 eggs in marsupium (length of 1 egg 0.31 mm).

COMPARISONS.—The carapace of *C. cervix* differs from that of *C. hanseni* and *C. brevicosta* in being larger (length of *cervix* 1.32–1.48 mm; length of *hanseni* 0.98–1.06 mm; length of *brevicosta* 1.02–1.10 mm), and in having more bristles on the ridge inside the caudal process (*cervix* 13; *hanseni* 7 or 8; *brevicosta* 8). The mandibular basale of *C. cervix* differs from that of *C. hanseni* in the longest bristle on the ventral margin being shorter. The 7th limb of *C. cervix* differs from that of *C. hanseni* and *C. brevicosta* in having 4 bristles rather than 2 in the proximal group and fewer teeth in terminal combs. The furca of *C. cervix* differs from that of *C. hanseni* in having more furcal claws on each lamella (*cervix* 5 or 6; *hanseni* 4 (rarely 5).

### *Cymbicopia climax*, new species

FIGURES 44–46

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

HOLOTYPE.—Undissected ovigerous female in alcohol in the collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden, depth 363 m.

PARATYPES.—Slope 19: 1 partly dissected ovigerous female in alcohol. Slope 22: USNM 194034, ovigerous female on slide and in alcohol; 1 undissected ovigerous female in alcohol; 1 undissected adult female in alcohol; USNM 194035, adult male on slide and in alcohol.

NONTYPES.—Slope 22: 2 undissected late instars in alcohol.

DISTRIBUTION.—Slope 19, 520 m. Slope 22, 363 m.

DESCRIPTION OF ADULT FEMALE (Figure 44).—Carapace similar in shape to that of *C. cervix* but slightly smaller (Figure 44a,b). Surface of carapace with gel-like coating over bristles.

*Ornamentation:* Lateral surface with abundant short bristles with rounded tips and relatively few longer bristles with rounded or slightly bulbous tips (Figure 44c,d); some longer bristles forming irregular clusters but none forming distinct rows as on *C. cervix*. Edges of valves and distal part of caudal process with pointed bristles (Figure 44d,e). Very long bristles with pointed tips (some with proximal enlargement) sparsely distributed on lateral surface and more numerous along anterior and ventral margins.

*Infold:* Anterior infold with small bristle near inner margin ventral to rostrum (Figure 44d). Infold of caudal process with row of 12 bristles similar to those of *C. cervix* (Figure 44e). Inner edge of infold in vicinity of caudal process with 6 bristles in 3 groups, each with 1–3 bristles (Figure 44e).

*Selvage:* Similar to that of *C. cervix*.

*Central Adductor Muscle Attachments* (Figure 44f): Comprising 16 or 17 ovoid attachments.

*Carapace Size* (mm): Slope 19: length with caudal process 1.10, height 0.93. Slope 22: holotype, length with caudal process 1.12, length without caudal process 1.11, height 0.91; USNM 194034, maximum length (includes caudal process

which does not extend past valve edge dorsal to process) 1.20, height 0.98; 2 unnumbered specimens: length with caudal process 1.18, length without caudal process 1.13, height 0.95; length with caudal process 1.12, length without caudal process 1.11, height 0.95. Range of length including caudal process 1.10–1.20.

*First Antenna:* 1st joint bare. 2nd joint with dorsal bristle with few spines. 3rd joint fused to 4th, with 2 bristles (ventral bristle reaching 7th joint, dorsal bristle reaching middle of 5th joint) with indistinct marginal spines. 4th joint with few ventral spines and 3 bristles (2 ventral (1 very long bare, other reaching 8th joint, spinous); 1 dorsal reaching 7th joint). Sensory bristle of 5th joint with small spine at midlength and terminal papilla. 6th joint without medial bristle. 7th joint: a-bristle with few spines; b-bristle longer than a-bristle, bare except for terminal papilla; c-bristle about same length as sensory bristle of 5th joint, with terminal papilla. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with small spine near midlength and terminal papilla; g-bristle same length as c-bristle, with 2 minute marginal filaments (1 at about 1/4 length, other at about midlength) and terminal papilla. Relative lengths of joints similar to those of *C. cervix*.

*Second Antenna:* Protopodite bare. Endopodite 2 jointed: 1st joint with 1 or 2 small proximal bristles; 2nd joint small (similar to that of *C. cervix*) with long spinous terminal bristle. Exopodite similar to that of *C. cervix*.

*Mandible:* Differs from that of *C. cervix* as follows: basale with row of 3 instead of 2 small lateral bristles near ventral margin; 1st endopodial joint with medial spines near midlength in addition to distal spines (Figure 44g); minute exopodite obscured but may not have digitations.

*Maxilla:* Coxale with short dorsal bristle. Endites I, II, and III with 6, 5, and 6 bristles respectively. Basale with short bristle distal to exopodite. Exopodite with 1 short and 2 longer bristles (Figure 44h). Endopodite similar to that of *C. cervix*.

*Fifth Limb* (Figure 44i): Single endite with small bare bristle. Exopodite: 1st joint with 2 bristles; 2nd joint with 3 terminal bristles and 1 short bristle near inner lobe of 3rd joint; 3rd joint with 2 bristles on inner lobe and 1 bare bristle on outer lobe; fused 4th and 5th joints with total of 3 bristles. Joints 1 and 2 hirsute. Epipodite with 35 plumose bristles.

*Sixth Limb* (Figure 44j): Endite I with 3 short bristles; endite II small with 1 long bristle; endite III with 4 bristles; endite IV with 3 bristles. End joint with 7 bristles (4 anterior, 1 at midwidth, 2 posterior plumose).

*Seventh Limb:* Similar to that of *C. cervix* except terminal bristles with 3–6 rather than 3–7 bells.

*Furca* (Figure 44k): Each lamella with 6 claws decreasing in length along lamella; claws 1 and 2 nonarticulated; claw 1 with small and large teeth, and row of long medial hairs at base; claws 2 and 3 with small teeth along posterior edge, a few slightly stouter than others; claws 4–6 with minute teeth along posterior edge. Claw 1 of left lamella of USNM 194034 with narrowly rounded tip (worn?), other claws with pointed tips.

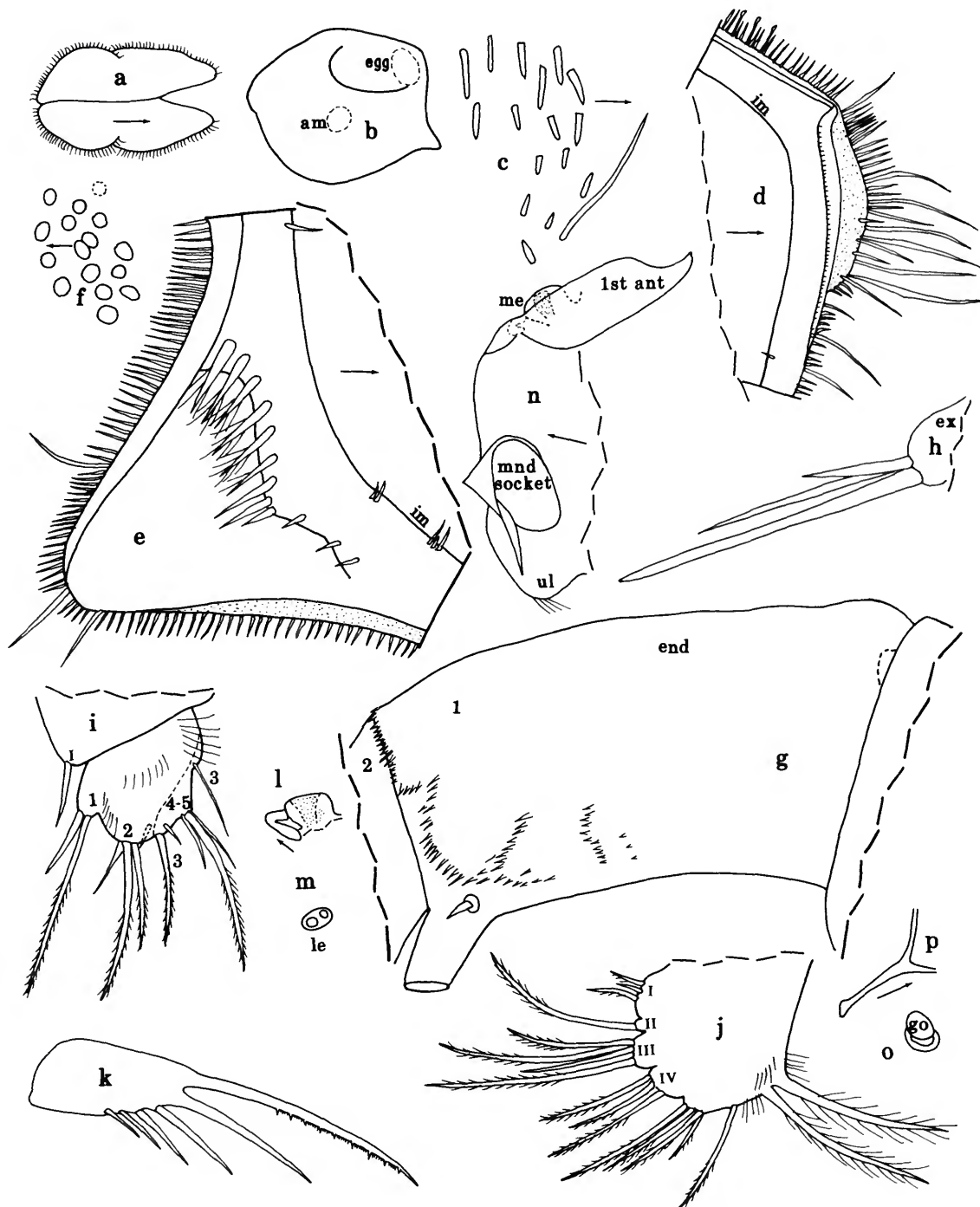


FIGURE 44.—*Cymbicopia climax*, new species, ovigerous female, holotype: *a*, dorsal view of complete specimen, length 1.12 mm. Ovigerous female, paratype, USNM 194034: *b*, complete specimen from left side showing location of central adductor muscle attachments (lower dashed oval) and 1 egg (upper dashed oval), length 1.20 mm; *c*, surface bristles near ventral edge of posterodorsal bulge of right valve, ov (anterior to right); *d*, anterior, left valve, iv; *e*, caudal process, left valve, iv; *f*, central adductor muscle attachments, left

valve, ov (anterior to left); *g*, 1st endopodial joint, and small process in vicinity of exopodite (dashed), right mandible, mv; *h*, exopodite, maxilla; *i*, 5th limb; *j*, right 6th limb; mv; *k*, right lamella of furca; *l*, medial eye and Bellonci organ; *m*, right lateral eye; *n*, anterior of body from left side showing 1st joint of left 1st antenna, medial eye (partly dashed), Bellonci organ (dashed), mandibular socket, and upper lip (bottom); *o*, left genital organ (anterior to left); *p*, right Y-sclerite, anterior to right.



*Bellonci Organ* (Figure 44l,n), *Lateral Eye* (Figure 44m), *Medial Eye* (Figure 44l,n), *Upper Lip* (Figure 44n), *Genitalia* (Figure 44o), *Anterior of Body* (Figure 44n), *Posterior of Body*, and *Y-Sclerite* (Figure 44p): Similar to those of *C. cervix*.

*Number of Eggs*: USNM 194034 with 3 eggs in marsupium, length of 1 egg including velum 0.31 mm, length excluding velum 0.24 mm. Holotype with 3 eggs in marsupium, length of 1 egg 0.37 mm. Unnumbered specimen from Slope 22 with 1 larva in marsupium with valves developed and slightly open, length 0.37 mm. Specimen from Slope 19 with 4 eggs in marsupium. Location in carapace of 1 egg shown in Figure 44b.

**DESCRIPTION OF ADULT MALE** (Figures 45, 46).—Carapace smaller and more elongate than that of adult female; also with larger rostrum and straighter posterior margin (Figure 45a).

*Ornamentation*: With abundant bristles with rounded tips on lateral surface and pointed bristles along margins, similar to those of adult female (Figure 45b–d); carapace similar to adult female in lacking rows of bristles.

*Infold*: Anterior infold with small bristle near inner margin ventral to rostrum (Figure 45c); infold of caudal process with row of 10 or 11 bristles of same type as on adult female (Figure 45d). Inner edge of infold in vicinity of caudal process with 6 bristles in 3 groups of 1–3 bristles (Figure 45d).

*Selvage*: Similar to that of adult female.

*Carapace Size* (mm): USNM 194035, length with caudal process 1.04, length without caudal process 0.98, height 0.72.

*First Antenna* (Figure 45e): 1st joint bare. 2nd joint with dorsal bristle with long proximal hairs. 3rd and 4th joints fused; 3rd joint with 2 bristles (1 long dorsal, 1 short ventral). 4th joint with 3 bristles (1 long dorsal, 2 short ventral). 5th joint wedged ventrally between 4th and 6th joints; sensory bristle with stout proximal part with abundant thin filaments and stem with 3 distal filaments and bifurcate tip. 6th joint without medial bristle. 7th joint: a-bristle bare, slightly longer than dorsal margin of 6th joint; b-bristle twice length of a-bristle, with 2 long marginal filaments and minute terminal papilla; c-bristle reaching past tip of sensory bristle of 5th joint, with 5 marginal filaments and bifurcate tip. 8th joint: d- and e-bristles long, bare, with blunt tips; f-bristle shorter than c-bristle, with 5 marginal filaments and bifurcate tip; g-bristle almost as long as c-bristle, with 5 marginal filaments and bifurcate tip. Marginal filaments and 2 minute terminal branches of sensory bristle of 5th joint and bristles of 7th and 8th joints with minute terminal papilla.

*Second Antenna*: Protopodite bare. Endopodite 3-jointed (Figure 45f): 1st joint short, with 2 small proximal ringed bristles, and broad medial spines along distal edge; 2nd joint elongate with 3 proximal bristles (2 bristles of illustrated limb aberrant in being fused proximally); 3rd joint elongate, reflexed, with 2 minute terminal bristles and 8–10 ridges along distal half of inner edge. Exopodite: 1st joint with minute medial bristle on distal edge; bristle of 2nd joint with 1 or 2 proximal long dorsal hairs followed by 13–16 slender ventral spines, then natatory hairs; bristles of joints 3 and 4 with few

proximal hairs followed by slender ventral spines, then natatory hairs; bristles of joints 5–8 with natatory hairs, no spines; 9th joint with 2 bristles (1 short bare dorsal; 1 long ventral, with few proximal ventral or dorsal spines and distal natatory hairs).

*Mandible* (Figure 46a): Coxale endite represented by weakly-developed spine with terminal papilla. Basale: ventral margin with 4 small ringed medial bristles (3 proximal, 1 distal), row of 3 longer ringed lateral bristles, and 1 very long ringed bristle with base on margin; dorsal margin with 3 ringed bristles (1 near midlength, 2 subterminal); medial surface with few long proximal hairs near dorsal margin. Exopodite small, bare. 1st endopodial joint: ventral margin with 2 subterminal ringed bristles (1 small bare medial, 1 long plumose on margin); dorsal margin with proximal indentation in vicinity of exopodite and row of terminal spines; medial surface with row of distal spines. 2nd endopodial joint: dorsal margin with 2 ringed bristles near midlength; distal edge with 2 long bristles (1 unringed, claw-like, with short marginal spines; 1 longer, ringed, with base on lateral side, and with very indistinct short spines) near ventral edge; medial surface with row of spines along distal edge. 3rd endopodial joint with 1 ringed bristle (with short spines) with base near ventral end, and 3 unringed claws (1 minute dorsal, with base medial (claw could be interpreted to be bristle); 1 short at joint midwidth with base medial, and with ventral spines; 1 long, terminal, with distal indistinct ventral spines). (Dorsal bristles of 2nd endopodial joint were broken off both limbs of USNM 194035 during dissection, but 2 joined bristles on slide were interpreted to be the bristles and were drawn in proper place in Figure.)

*Maxilla* (Figure 46b): Minute (illustrated limb drawn under oil immersion (ocular  $\times 15$ , objective  $\times 100$ ); endite bristles and many endopodial bristles not shown). Coxale with ringed dorsal bristle. Exopodite with 3 ringed unequal bristles. Bristles of endites and endopodite indistinct.

*Fifth Limb* (Figure 46c): Exopodite minute. Single endite with 1 bristle. Exopodite: 1st joint with 2 bristles; 2nd joint with 3 bristles; 3rd joint with 2 bristles on inner and 1 bristle on outer lobe; fused 4th and 5th joints with total of 3 bristles.

*Sixth Limb* (Figure 46d): Endite I with 3 short bristles. Remaining endites and end joint fused, with total of 14 bristles (most bristles plumose). Limb hirsute (not shown).

*Seventh Limb* (Figure 46e): Proximal group with 2 bristles, 1 on each side, each with 4 bells. Terminal group with 4 bristles, 2 on each side, each with 6 bells. Terminus without combs.

*Furca* (Figure 45g): Each lamella with 6 claws decreasing in length along lamella; claws 1 and 2 nonarticulated, with small and large teeth, but large teeth slenderer than those of adult female; claws 3 and 4 with a few teeth longer than others; claws 5 and 6 with minute teeth; all claws pointed; right lamella anterior to left by width of base of claw 1, and with few minute spines along anterior edge near claw 1. (Teeth of claws not shown.)

*Bellonci Organ* (Figure 45h), *Lateral Eye* (Figure 45i), *Medial Eye* (Figure 45h): Similar to those of adult female.

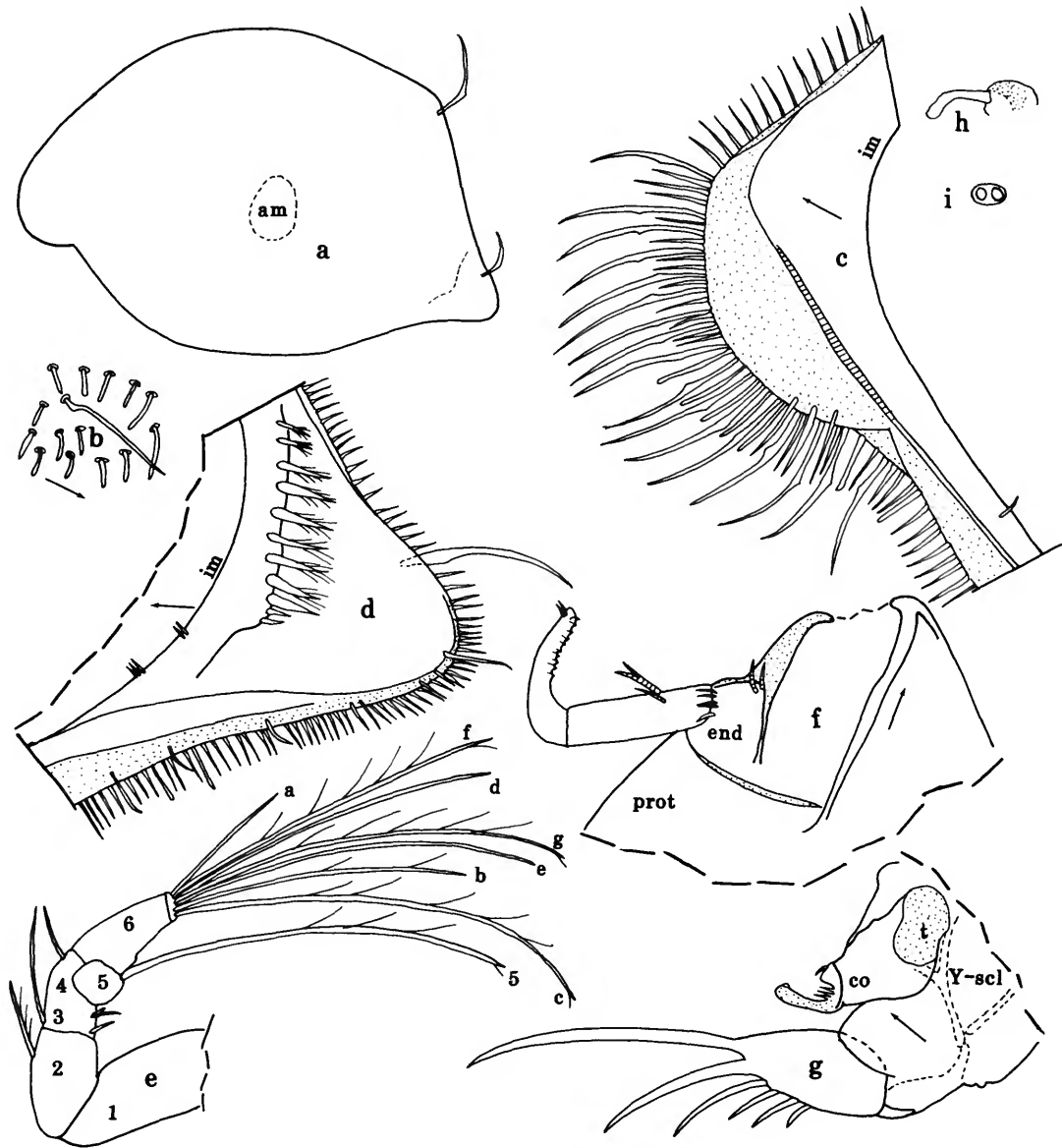


FIGURE 45.—*Cymbicopia climax*, new species, adult male, paratype, USNM 194035: a, complete specimen from left side showing location of central adductor muscle attachments (dashed oval), length 1.04 mm; b, surface bristles near middle of right valve (small circle around base of each bristle); c, anterior, right valve, iv; d, caudal process, right valve, iv; e, left 1st antenna, mv; f, prodopodite and endopodite, right 2nd antenna, mv; g, posterior of body from left side showing internal sclerites (dashed lines), left furcal lamella, and left copulatory organ; h, left furcal lamella; i, left lateral eye (anterior to left).

**Genitalia** (Figure 45g): With 2 or 3 lobes on each side of body, some with bristles; longest lobe with elongate sclerotized process with broadly rounded tip.

**Posterior of Body, and Y-Sclerite** (Figure 45g): Similar to those of adult female.

**COMPARISONS.**—The carapace of *C. climax* differs from that of *C. cervix* in the type of bristles: most bristles on *C. cervix*

have bulbous tips, which are rare on bristles of *C. climax*; also, on *C. cervix* long bulbous bristles form 3 distinct rows which are absent on *C. climax*. The carapaces of female *C. climax* (length 1.10–1.20 mm) in the collection are smaller than those of *C. cervix* (length 1.32–1.48 mm). Although small differences in the distribution of bristles on the mandible, exopodite of the maxilla, and on the 5th and 6th limbs were observed on

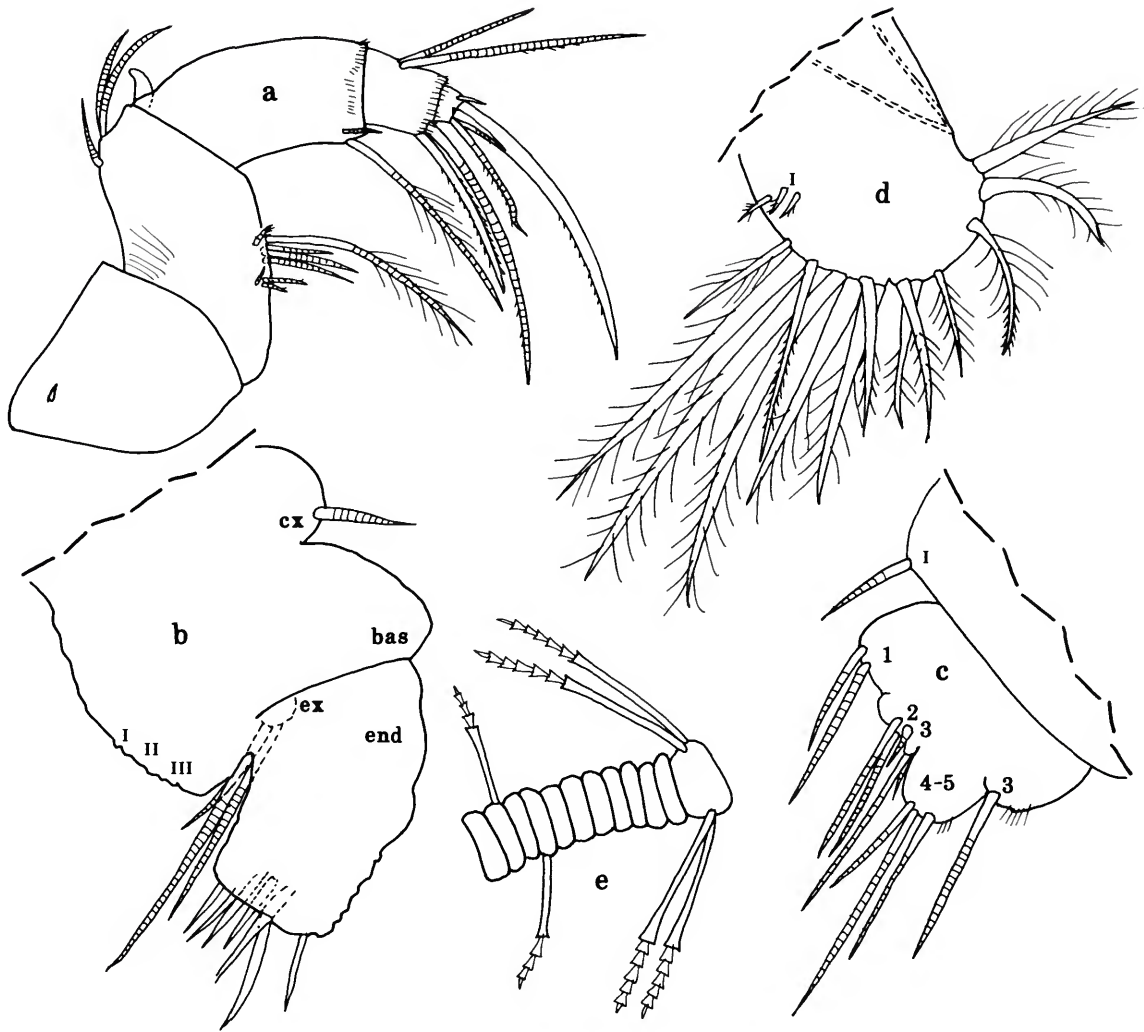


FIGURE 46.—*Cymbicopia climax*, new species, adult male, paratype, USNM 194035: a, left mandible, mv; b, maxilla (no endite bristles and not all endopodite bristles shown); c, 5th limb; d, left 6th limb, mv; e, 7th limb.

females of the two species, they are interpreted to be insignificant. The carapace of *C. climax* differs from those of *C. brevicosta* and *C. hanseni* in lacking both abundant bristles with bulbous tips and rows of bristles. The appendages of *C. climax* differ from those of *C. brevicosta* and *C. hanseni* in the same characters listed for *C. cervix* in the comparison paragraph of *C. cervix*.

***Neomuelleriella* Kornicker, 1986**

**TYPE SPECIES.**—*Muelleriella zealandica* Poulsen, 1965:58, by subsequent designation in Cohen and Kornicker (1975, table 1).

**COMPOSITION.**—The genus includes four species: *N. zealandica* (Poulsen, 1965:58), *N. hispida* (Brady, 1898:439), and two

new species described herein: *N. nex* and *N. klomax*.

**DISTRIBUTION.**—*Neomuelleriella hispida* and *N. zealandica* from New Zealand at depths of 2–9 m, and 10–15 m, respectively; and from the vicinity of Australia, *N. nex* from 363–400 m, and *N. klomax* from 520 m.

***Neomuelleriella nex*, new species**

FIGURES 47, 48

**ETYMOLOGY.**—From the Latin *nex* (violent death).

**HOLOTYPE.**—Undissected ovigerous female in alcohol in collection of the Museum of Victoria.

**TYPE LOCALITY.**—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden, depth 363 m.

**PARATYPES.**—Slope 22: 8 specimens (1 ovigerous female in alcohol + 1 adult female with choniostomatid copepods (female, male, and egg sac) + 3 adult females without eggs + 1 juvenile male + 2 specimens) in alcohol. Slope 40: USNM 193992, adult female on slide and in alcohol.

**DISTRIBUTION.**—Slope 22, 363 m. Slope 40, 400 m.

**DESCRIPTION OF ADULT FEMALE** (Figures 47, 48a–j).—Subround in lateral view, without projecting caudal process; posterodorsal margin less convex than anterior and ventral margins. Surface without gel-like coating.

**Ornamentation** (Figure 47a,b): Surface with numerous long stout bristles with sides parallel almost to tip (bristles shorter (many bent) on anterior half of valve), and fewer long and short bristles with or without proximal swelling (these more abundant on or near valve margins (Figure 47b); valve surface with abundant minute spines (more easily visible along valve edges) (not shown). Surface bristles only slightly denser in caudal area (Figure 47a).

**Infold:** Anterior infold with 1 small bristle near inner margin (Figure 47b). Infold of caudal region with row of 11 or 12 short bristles near midwidth and several minute bristles along inner margin; 2 setal bristles dorsal to caudal area (Figure 47c).

**Central Adductor Muscle Attachments** (Figure 47d): Comprising about 20 individual ovoid scars.

**Carapace Size** (length, height in mm): Slope 22: holotype, 0.91, 0.83. 2 specimens with choniostomatids: 0.83, 0.73; 0.88, 0.73. 2 specimens without eggs: 0.85, 0.78; 0.81, 0.75. 1 specimen with 3 eggs, 0.82, 0.76. Slope 40: USNM 193992, 0.90, 0.76.

**First Antenna** (Figure 47e): 1st joint bare. 2nd joint with proximal dorsal spines, row of lateral spines along distal edge, and 1 dorsal bristle with long proximal and short distal spines. 3rd joint fused to 4th, with 2 spinous bristles (1 dorsal, 1 ventral). 4th joint with 2 bristles (1 ventral long, 1 dorsal short) with indistinct short spines. Sensory bristle of 5th joint with 2 proximal filaments and 1 minute subterminal spine. 6th joint with small medial bristle with short spines (spines not shown). 7th joint: a-bristle with short marginal spines; b-bristle slightly longer than a-bristle, bare; c-bristle slightly longer than bristle of 5th joint, with 3 minute filaments along middle part and 2 minute spines near tip. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle with 1 minute proximal filament and 1 minute spine at midlength (tip of bristle missing); g-bristle with minute proximal filament and 1 minute spine near tip.

**Second Antenna:** Protopodite with long medial hairs near endopodite (Figure 47f,g). Endopodite either 2-jointed (1st joint with small proximal bristle; 2nd joint short bare) (Figure 47g), or 3-jointed (1st joint with small proximal bristle; 2nd joint elongate bare; 3rd joint short with small terminal ringed bristle) (Figure 47f). Exopodite: 1st joint with small curved tubular medial bristle on distal edge; bristles of joints 2–8 with slender ventral spines followed by natatory hairs; 9th joint with 2 bristles (1 long ventral with slender ventral spines followed

by natatory hairs, 1 short dorsal, either bare or with few indistinct hair-like spines); joints 3–8 with row of minute spines along distal edges.

**Mandible** (Figure 48a,b): Coxale endite stout spine-like; coxale with rows of ventral hairs. Basale: dorsal margin with 1 minute spine distal to midlength and 1 short subterminal spine-like bristle; ventral margin with 3 small medial bristles and 1 small lateral bristle. Exopodite represented by small process with terminal spine (Figure 48b). 1st endopodial joint with few medial spines along distal edge, few terminal dorsal spines, and 1 medial spine-like bristle near base of stout ventral claw. 2nd endopodial joint with 2 small, spine-like, subterminal, dorsal bristles and stout terminal ventral claw. 3rd endopodial joint with stout terminal claw with 2 small indistinct bristles near base (1 ventral, 1 dorsal).

**Maxilla:** Endites I–III each with 5 or 6 bristles. Coxale with short dorsal bristle (Figure 48c). Basale with ventral bristle near exopodite. Exopodite small with 2 bristles (Figure 48c,d). 1st endopodial joint with few anterior spines and spinous alpha- and beta-bristles. 2nd endopodial joint with 2 a-bristles (not shown), 1 c-bristle (shorter than a-bristles), and 5 pectinate end bristles.

**Fifth Limb** (Figure 48e): Epipodite with 31 bristles. Single endite with small bare bristle. Exopodite: 1st joint with 2 spinous bristles; 2nd joint with 3 spinous bristles; 3rd joint with 1 spinous bristle on outer lobe and 3 on inner lobe; fused 4th and 5th joints close to inner lobe of 3rd joint, with total of 2 spinous bristles (limb could be interpreted as having inner lobe of 3rd joint fused to 4th and 5th joints). Limb hirsute.

**Sixth Limb** (Figure 48f): Endite I with 3 short bristles; endite II with 5 long spinous bristles. End joint with 9 bristles with short spines followed by 2 posterior plumose bristles (plumose bristles broken on illustrated limb; 1 bristle near anterior of end joint of illustrated limb only partly extruded (dashed)).

**Seventh Limb** (Figure 48g): Proximal group with 4 bristles (2 on each side with 3 (rarely 4) bells; terminal group with 6 bristles (3 on each side with 2–6 bells). Terminus with comb of about 9 teeth opposite 2 small pegs.

**Furca** (Figure 48h,i): Each lamella with 6 claws; only claw 1 nonarticulated; claw 3 shorter and slenderer than claw 4; all claws with teeth along posterior edge (not all shown); edge of lamellae following claws with spines (more spines on left lamella); right lamella with spines along anterior edge, and rows of long medial hairs near anterior edge and at base of claw 1.

**Bellonci Organ** (Figure 47h,i): Elongate with 2 weakly developed sutures near midlength and minute process at tip.

**Eyes:** Lateral eye minute, with brown pigment and about 5 amber-colored cells (ommatidia ?) (Figure 47h). Medial eye with brown pigment, bare, much larger than lateral eye (Figure 47h,i).

**Upper Lip** (Figure 47h): Evenly rounded.

**Genitalia** (Figure 48j): Oval genitalia with attached spermatophore.

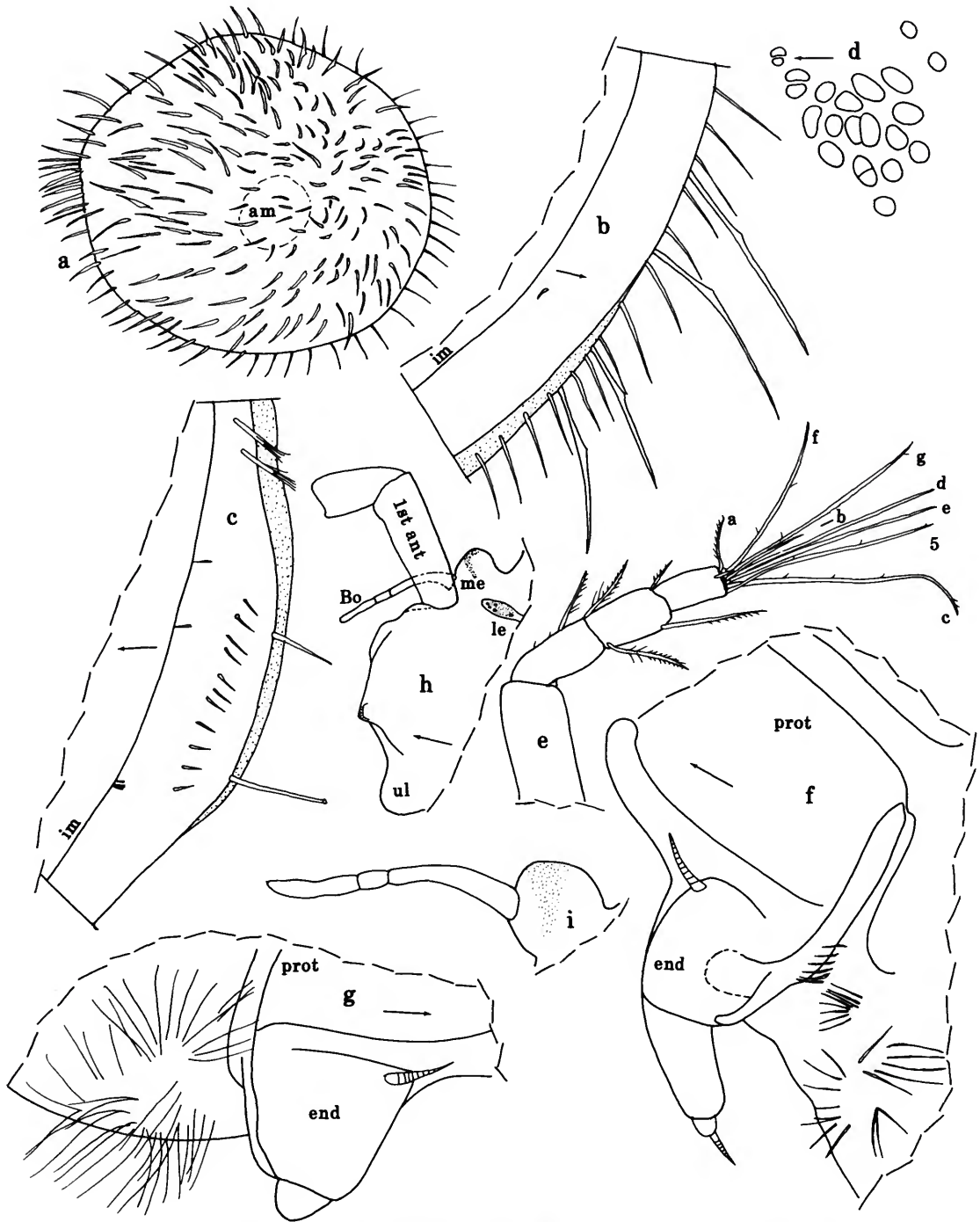


FIGURE 47.—*Neomuelleriella nex*, new species, adult female, paratype, USNM 193992: a, complete specimen from right side showing location of central adductor muscle attachments (dashed oval), length 0.90 mm; b, anterior, left valve, iv; c, posterior, right valve, iv; d, central adductor muscle attachments, left valve, ov (anterior to left); e, left 1st antenna, mv; f, g, protopodite and endopodite of right and left 2nd antenna, respectively, mv; h, anterior of body from left side showing left lateral eye (area of brown pigment stippled), medial eye (area of brown pigment stippled), Bellonci organ, 1st and 2nd joints of right 1st antenna (bristles not shown), triangular projection at dorsal end of mandibular socket (near midheight) and upper lip; i, medial eye (area of brown pigment stippled), and Bellonci organ.

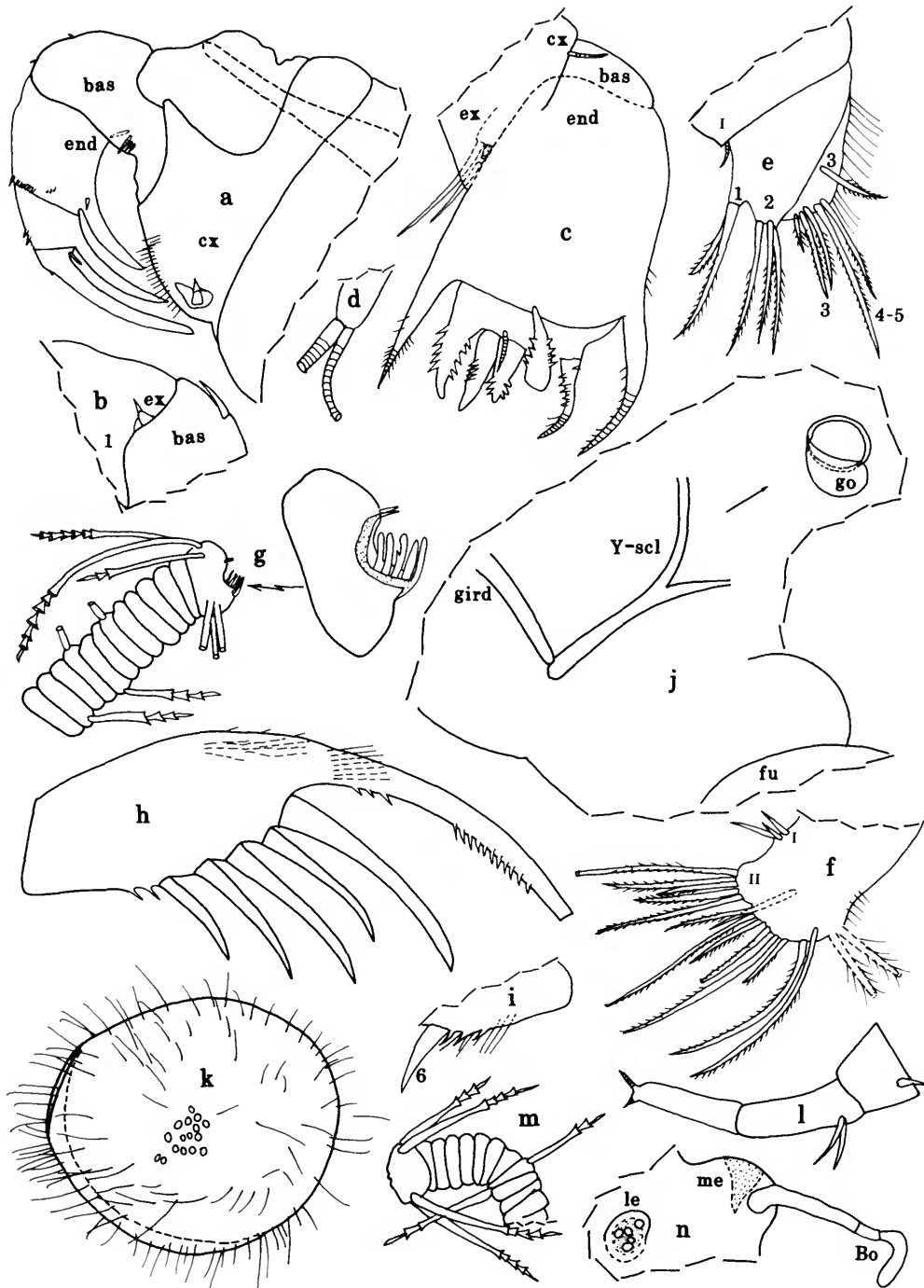


FIGURE 48.—*Neomuelleriella nex*, adult female, paratype: USNM 193992: *a*, right mandible, mv; *b*, distal part of basale (lower right), exopodite, proximal part of 1st endopodial joint, left mandible, lv; *c*, left maxilla, mv (endites and a-bristles of 2nd endopodial joint not shown); *d*, exopodite (bristles broken), right maxilla, lv; *e*, 5th limb; *f*, right 6th limb (dashed bristle partly unextruded), mv; *g*, 7th limb; *h*, right furcal lamella; *i*, proximal claw and 3 spines of left furcal lamella, lv; *j*, posterior of body from right side showing internal sclerites and right genital organ. A—1 male, paratype: *k*, complete specimen from right side, length 0.73 mm (not all surface bristles shown); *l*, endopodite, left 2nd antenna, mv; *m*, 7th limb; *n*, right lateral eye (area of brown pigment stippled), medial eye (area of brown pigment stippled), and Bellonci organ.

*Anterior of Body* (Figure 47h): With small triangular process on each side dorsal to upper lip.

*Posterior of Body*: Evenly rounded, bare.

*Y-Sclerite* (Figure 48j): With ventral branch.

*Number of Eggs*: Slope 22: holotype with 3 eggs in marsupium, length of 1 egg 0.25 mm; unnumbered specimen with 3 eggs, length of 1 egg 0.25 mm.

*Parasites*: Adult female from Slope 22 with chonistomatids (female, male, egg sac) within marsupium.

DESCRIPTION OF A-1 MALE (Figure 48k-n).—Shape of carapace similar to that of adult female (Figure 48k).

*Ornamentation* (Figure 48k): Without parallel-sided bristles present on adult female; most bristles taper to slender tip; some bristles with swelling at proximal  $2/3$ .

*Infold*: Not examined.

*Central Adductor Muscle Attachments* (Figure 48k): Comprising at least 16 ovoid scars.

*Carapace Size* (length, height in mm): Specimen from Slope 22: 0.73, 0.64.

*First Antenna*: Distribution of bristles similar to that of adult female.

*Second Antenna*: Protopodite with long medial hairs and skeletal structure similar to those of adult female. Endopodite 3-jointed (Figure 48l): 1st joint short with short proximal ventral bristle; 2nd joint elongate with 2 short proximal ventral bristles; 3rd joint elongate with 2 small terminal bristles. Exopodite: bristles of similar length to those of adult female and with similar spines and natatory hairs; joints with spines similar to those of adult female.

*Maxilla*: Exopodite and endopodite similar to those of adult female; remaining part of limb not examined.

*Seventh Limb* (Figure 48m): Well developed; proximal group with 2 tapered bristles (1 on each side, each with 2 bells); terminal group with 4 tapered bristles (2 on each side, each with 3 or 4 bells); "clapper" of each terminal bell relatively longer than those of adult female. Terminus without comb or pegs.

*Furca and Eyes* (Figure 48n): Similar to those of adult female.

*Bellonci Organ* (Figure 48n): Similar to that of adult female except for having rounded tip.

COMPARISONS.—The carapace of *N. nex* differs from those of *N. zealandica* and *N. hispida* in not having a projecting caudal process. Except for being smaller the carapace of *N. nex* resembles *Chelicopia pertinax* Kornicker, 1994, but the furca of that species has claws 2 and 4 on each lamella of the furca nonarticulated.

### *Neomuelleriella klomax*, new species

FIGURES 49, 50

ETYMOLOGY.—From the Greek *klomax* (heap of stones).

HOLOTYPE.—Adult female on slide and in alcohol in the collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 19, 37°07.30'S, 150°20.20'E, New South Wales, off Eden, depth 520 m.

PARATYPES.—None.

DISTRIBUTION.—Slope 19, 520 m.

REMARKS.—In parts of the description below the new species is compared with *N. nex*.

DESCRIPTION OF ADULT FEMALE (Figures 49, 50).—Carapace differs in form from that of *N. nex* in having a projecting caudal process (Figure 49a). Surface without gel-like coating.

*Ornamentation* (Figure 49a,b): Surface and margins with abundant long bristles tapering gradually to slender point (right bristle in Figure 49b), sparse longer bristles with broad part at midlength and very slender distal part (longest bristle in Figure 49b), and sparse short bristles of varying lengths (3 bristles on left in Figure 49b).

*Infold*: Anterior infold with small bristle near inner margin. Infold of caudal process with row of about 7 bristles near midwidth and 1 bristle of similar type near inner margin; 2 setal bristles dorsal to caudal area (Figure 49c).

*Carapace Size* (length including caudal process, height in mm): Holotype, 0.94, 0.84.

*First Antenna* (Figure 49d,e): 1st joint bare. 2nd joint with few indistinct dorsal spines and 1 spinous dorsal bristle. 3rd joint fused to 4th, with 2 bristles (1 ventral bare and longer than that of *N. nex*, 1 dorsal with indistinct spines). 4th joint with 3 terminal bristles (2 ventral, 1 dorsal). Sensory bristle of 5th joint with 2 small proximal filaments and 1 minute subterminal spine. 6th joint with small bare medial bristle. 7th joint: a-bristle spinous; b-bristle only slightly longer than a-bristle, bare; c-bristle same length as sensory bristle of 5th joint, with 2 minute proximal filaments and minute subterminal spine. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle with 1 small proximal filament and 1 minute subterminal spine; g-bristle with 3 small proximal filaments and 1 minute subterminal spine.

*Second Antenna*: Protopodite bare (Figure 49f). Endopodite 1-jointed with small proximal bristle (Figure 49f,g); endopodite of left limb of holotype with minute terminal swelling (Figure 49g). Exopodite: 1st joint with small curved tubular medial bristle on distal edges; bristles of joints 2-9 bare; 9th joint with 2 bristles (1 long, 1 short (dorsal)); joints 2-7 or 8 with row of minute spines along distal edge; long bristles of joints 2-8 relatively short and about same length, about equal to combined lengths of joints 1-3. (Bare exopodial bristles not previously reported in the Sarsiellidae.)

*Mandible* (Figure 49h,i): Coxale endite stout spine-like, bifurcate, with slender spine or unringed bristle near base; coxale with rows of ventral hairs. Basale: dorsal margin with 1 short subterminal spine-like bristle; ventral margin with 4 small medial bristles and 1 either lateral or along ventral edge. Exopodite indistinct but appearing as very short process (Figure 49i). 1st endopodial joint with small spines along distal edge and at terminal dorsal margin, and 2 small spine-like medial bristles near base of stout ventral claw. 2nd endopodial

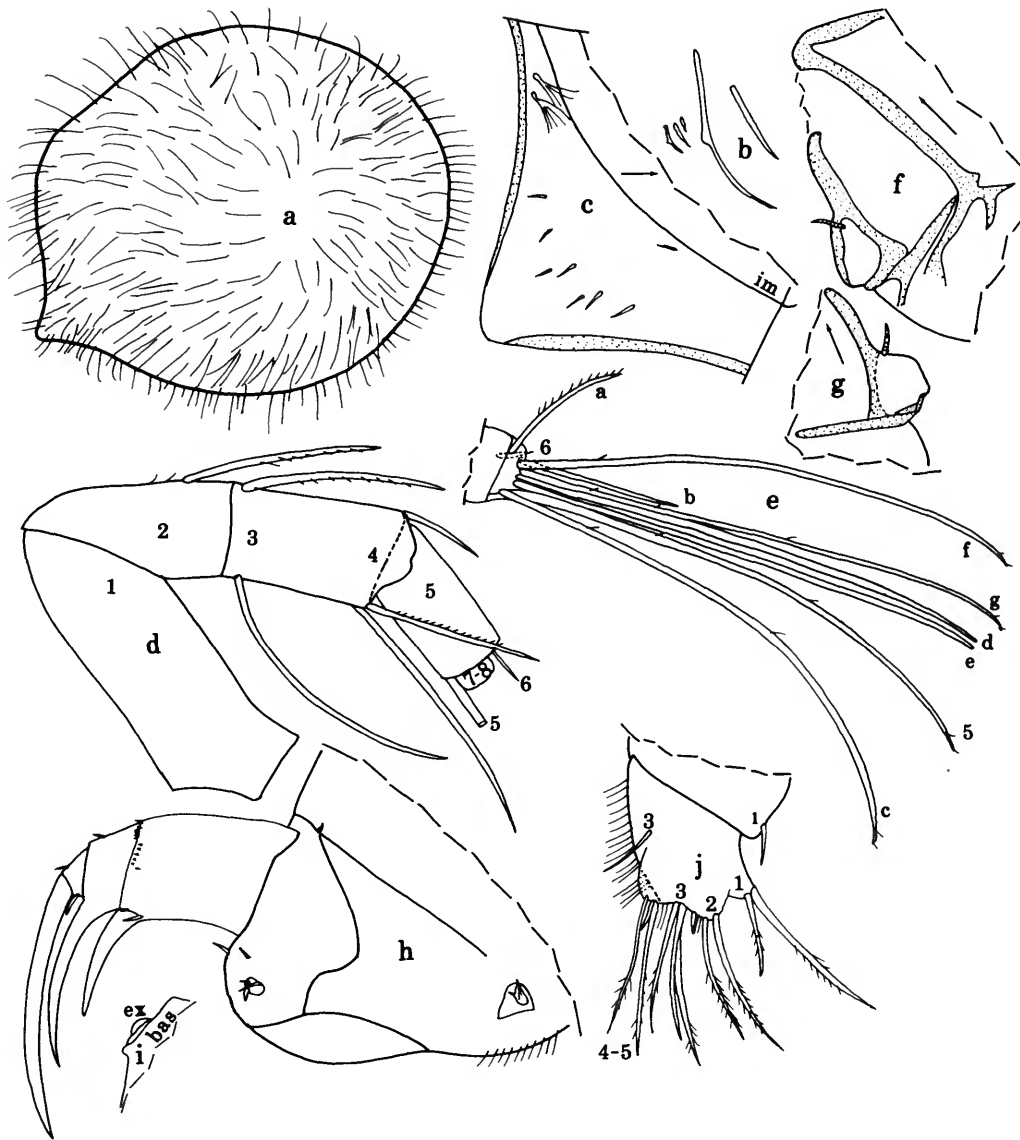


FIGURE 49.—*Neomuelleriella klomax*, new species, adult female, holotype: *a*, complete specimen from right side, length 0.94 mm; *b*, typical surface bristles on carapace, ov; *c*, posterior, left valve, iv; *d*, left 1st antenna, mv (bristles of joints 7 and 8 not shown); *e*, bristles of joints 5–8 of right 1st antenna, lv; *f, g*, protopodite and endopodite of right and left 2nd antenna, mv; *h*, right mandible, mv; *i*, left mandible showing small exopodite on distal margin of basale, lv; *j*, 5th limb.

joint with 1 small spine-like subterminal dorsal bristle and stout terminal ventral claw. 3rd endopodial joint with stout terminal claw, 1 minute subterminal spine-like dorsal bristle, and 1 fairly long spine-like ventral bristle. Endopodial claws taper to point.

**Maxilla:** Endites I and III each with 6 bristles; endite II with 4 bristles (Figure 50*a*). Coxale with lateral hairs near dorsal margin (not shown) and 1 dorsal bristle (this bristle

displaced distally (because of torn limb) on mounted right limb of holotype (Figure 50*b*) and absent on left limb). Basale with 1 bristle near exopodite. Exopodite small with 2 bristles (Figure 50*b*). 1st endopodial joint with few distal anterior spines and spinous alpha- and beta-bristles. 2nd endopodial joint with 2 a-bristles (posterior longer), 1 c-bristle, and 5 pectinate end bristles.

**Fifth Limb (Figure 49*j*):** Single endite with small bare



bristle. Exopodite: 1st joint with 2 spinous bristles. 2nd joint with 1 short and 2 long bristles; 3rd joint with 1 bristle on outer lobe and 3 on inner lobe; fused 4th and 5th joints close to inner lobe of 3rd joint, with total of 3 bristles (1 short, 2 long) (limb could be interpreted as having 3rd joint fused to 4th and 5th joints). Limb hirsute.

*Sixth Limb* (Figure 50c): Endite I with 3 short bare bristles; endite II with 4 long spinous bristles. End joint with 7 bristles with short spines followed by 2 more weakly developed plumose bristles.

*Seventh Limb* (Figure 50d): Proximal group with 4 bristles (2 on each side with 3 (rarely 2) bells); terminal group with 6 bristles (3 on each side with 2-5 bells); all bristles cylindrical. Terminus with comb of 6 teeth opposite 2 small pegs.

*Furca* (Figure 50e): Similar to that of *N. nex*.

*Bellonci Organ* (Figure 50f): Elongate with 2 sutures at midlength and rounded tip.

*Eyes*: Lateral eyes absent. Medial eye well developed, unpigmented (Figure 50f).

*Upper Lip* (Figure 50g,h): Comprising 2 lobes with saddle between them.

*Genitalia* (Figure 50i): Oval genital organ with attached spermatophore observed on only right side of body.

*Posterior of Body* (Figure 50e): Bare.

*Y-Sclerite* (Figure 50e,j): With ventral branch.

COMPARISONS.—The carapace of *N. klomax* differs from that of *N. nex* in having a projecting caudal process. Exopodial bristles of joints 3-8 of the 2nd antenna of the female *N. klomax* are without natatory hairs; all previously described 2nd antennae of sarsiellids have them.

REMARKS.—The unique holotype is without either unextruded or extruded eggs, but the genital organ with attached spermatophore was observed on the right side of the body, and the bristles of the 7th limb are cylindrical. I have concluded that the specimen is adult, but the shortness of the exopodial bristles

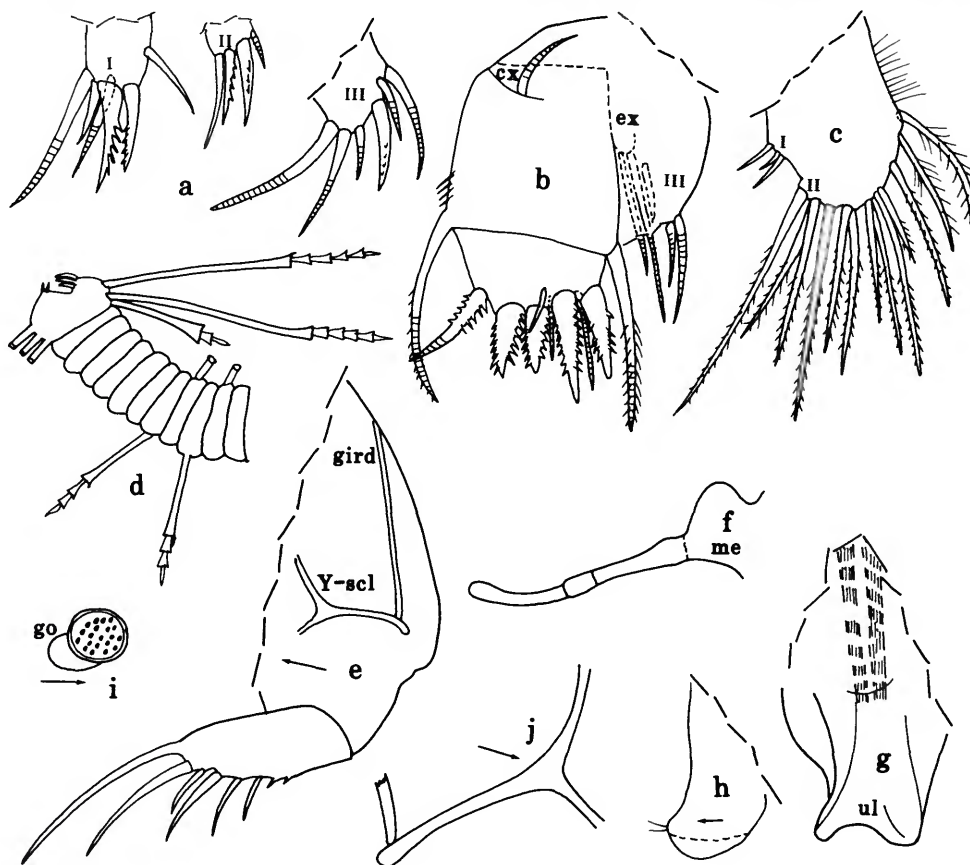


FIGURE 50.—*Neomuelleriella klomax*, new species, adult female, holotype: a, endites I (left), II (middle), and III (right), left maxilla, lv; b, right maxilla, mv (endites I and II and only 2 bristles of endite III shown); c, 6th limb; d, 7th limb; e, posterior of body from left side showing internal sclerites and left furcal lamella; f, medial eye and Bellonci organ; g, anterior view of body showing internal muscles (dashed lines) and upper lip (bottom); h, upper lip from left side; i, right genital organ, anterior to right.

of the 2nd antenna as well as the absence of natatory hairs on them raised the possibility that it is an A-1 juvenile, because those characters are typical of most juvenile Philomedidae. Previously described 2nd antennae of juvenile sarsiellids have natatory hairs on most bristles, but the relative lengths of the bristles compared to adults have not been mentioned, except for statements that they are similar to those of the adult. Therefore, an A-1 male of *Neomuelleriella nex* was examined; the exopodial bristles of the 2nd antenna were observed to be very long, similar in length to those of the adult female, and to have natatory hairs. This supports the conclusion that the holotype of *N. klomax* is an adult, and that the short exopodial bristles and lack of natatory hairs on them is characteristic of the species. The absence of natatory hairs indicates that *N. klomax* either cannot swim or, at best, is a poor swimmer.

### *Alphasarsiella*, new genus

ETYMOLOGY.—From the first letter of the Greek alphabet and *Sarsiella*.

TYPE SPECIES.—*Alphasarsiella altrix*, new species. Gender feminine.

COMPOSITION.—With two species described herein.

DISTRIBUTION.—Off Australia, 363–400 m.

DIAGNOSIS (adult female).—Caudal process of carapace with inner row of broad spinous bristles along list. 1st antenna: medial bristle of 6th joint absent; c-, f-, and g-bristles not claw-like; and d-bristle present. Tip of 7th limb with teeth. Each lamella of furca with 6 claws, without secondary claws between primary claws, and only claw 1 nonarticulated. Genus based mainly on inner bristles of caudal process and distribution of furcal claws.

COMPARISONS.—Only two previous genera have a row of broad spinous bristles along list of caudal process: *Cymbicopia* and *Spinacopia*. The furca of *Alphasarsiella* differs from that of *Cymbicopia* in having claw 1 rather than claws 1 and 2 nonarticulated, and from *Spinacopia* in having no secondary claws between main claws. Some species of the genus *Parasarsiella* Poulsen, 1965:70 have a furca similar to that of *Alphasarsiella*, but the carapace is without the row of broad spinous bristles along the list of the caudal process. In *A. altrix* and *A. anax* the row of bristles on the list extends from the dorsal to ventral margins of the caudal process; whereas, on known species of *Spinacopia* most bristles are in the dorsal part. A medial bristle is absent on the 6th joint of the 1st antennae of *Cymbicopia*, *Alphasarsiella*, and some species of *Neomuelleriella*, but is present on other genera.

### *Alphasarsiella altrix*, new species

FIGURES 51, 52

ETYMOLOGY.—From the Latin *altrix* (nourisher).

HOLOTYPE.—Adult female on slide and in alcohol in collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 40, 38°17.70'S, 149°11.30'E, Victoria, S of Point Hicks, depth 400 m.

PARATYPES.—Slope 40: 4 undissected ovigerous females.

DISTRIBUTION.—Slope 40, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 51, 52).—Carapace in lateral view with minute anterior incisure, narrow high rostrum dorsal to incisure, projecting posteroventral caudal process, and large posterodorsal bulge (Figure 51a). Surface without gel-like coating.

*Ornamentation*: Surface with abundant short stout pointed spines longer along outer margin and absent at bottoms of round surface fossae (Figure 51b,c); 2 indistinct low spine-covered ribs extend anteriorly from area of adductor muscle attachments (Figure 51a,b). Long bristles with broad bases sparsely distributed on valve surface; long and short bristles, some with broad part in proximal third, numerous along valve margins (Figure 51d).

*Infold*: Anterior infold with small bristle near inner margin ventral to incisure (Figure 51d). Infold of caudal process with a few small bristles along inner edge of infold, and row of 9 broad spinous bristles along list (row extends from dorsal to ventral edge of caudal process) (Figure 51e).

*Central Adductor Muscle Attachments* (Figure 51f): Comprising about 17 ovoid attachments.

*Carapace Size* (length, including caudal process, height in mm): Slope 40: holotype, 0.96, 0.78; 4 unnumbered paratypes: 0.96, 0.78; 0.91, 0.75; 0.98, 0.76; 0.90, 0.74.

*First Antenna* (Figure 51g): 1st joint bare. 2nd joint with rows of medial spines near ventral margin and 1 dorsal bristle with short spines. 3rd joint fused to 4th, with 2 spinous bristles (1 long ventral, 1 shorter dorsal). 4th joint with 3 spinous bristles (2 long ventral, 1 shorter dorsal). Long sensory bristle of 5th joint with 1 or 2 distal spines and terminal papilla. 6th joint fused to 5th, without medial bristle. 7th joint: a-bristle spinous; b-bristle longer than a-bristle, with minute terminal papilla; c-bristle about same length as sensory bristle, with minute proximal filament and 2 minute distal spines. 8th joint: d- and e-bristles long bare with blunt tips; f- and g-bristles with minute filament at midlength. (Most spines and filaments of bristles of joints 5–8 not shown.)

*Second Antenna*: Protopodite bare. Endopodite 2-jointed (Figure 51h): 1st joint with 2 short bare proximal anterior ringed bristles; 2nd joint small, with very long terminal ringed bristle with short spines. Exopodite: 1st joint with minute, bare, tubular, terminal, medial bristle; bristle of 2nd joint with about 12 slender hair-like proximal ventral spines followed by natatory hairs; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 2 bristles (1 long ventral with natatory hairs, 1 short dorsal with short hairs); joints 2–8 with row of spines along distal edges.

*Mandible* (Figure 52a,b): Coxale endite represented by bifurcate process with few marginal spines; coxale with long hairs along ventral margin. Basale: ventral margin with 8 or 9 bristles (including 3 or 4 with bases on lateral side); dorsal margin with 1 small subterminal spine-like bristle. Exopodite

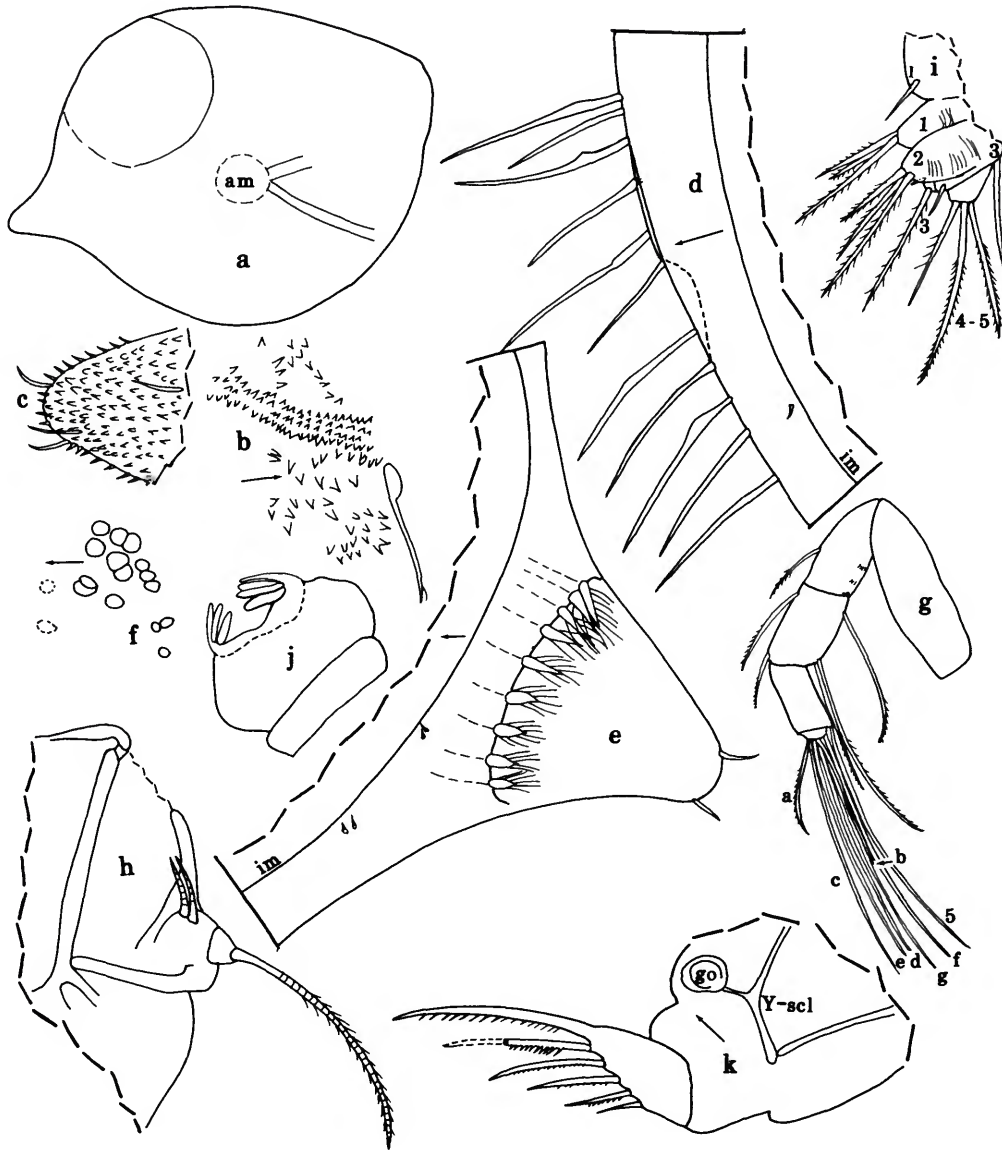


FIGURE 51.—*Alphasarsiella altrix*, new species, adult female, holotype: *a*, complete specimen from right side showing location of central adductor muscle attachments (dashed oval near midlength), length 0.96 mm; *b*, surface spines and bristle on, and adjacent to, anterior rib near central adductor muscle attachments, right valve, ov; *c*, surface spines and bristles of caudal process, right valve, ov; *d*, anterior, right valve, iv; *e*, caudal process, right valve, iv; *f*, central adductor muscle attachments, left valve, ov (anterior to left); *g*, right 1st antenna, mv; *h*, protopodite and endopodite, left 2nd antenna, mv; *i*, 5th limb; *j*, tip of 7th limb (bristles not shown); *k*, posterior of body from left side showing internal sclerites, left furcal lamella, and left genital organ (oval).

well developed, with few spines and slender subterminal bristle. 1st endopodial joint with row of medial spines along distal edge, 1 small medial spine-like bristle at base of stout terminal ventral claw, and few small terminal spines on dorsal margin. 2nd endopodial joint with small subterminal spine-like dorsal bristle and stout ventral claw with a few minute proximal ventral teeth. 3rd endopodial joint with terminal claw and 2

small spine-like ventral bristles. Left limb of holotype aberrant in having stout dorsal bristle on 2nd endopodial joint, and on 3rd joint 1 medial as well as 1 ventral bristle at base of terminal claw (Figure 52*b*).

*Maxilla*: Protopodite with transparent thumb-like process (Figure 52*e*). Coxale with fairly long dorsal bristle. Endites I, II, and III with 5, 4, and 6 bristles, respectively (Figure 52*d*).

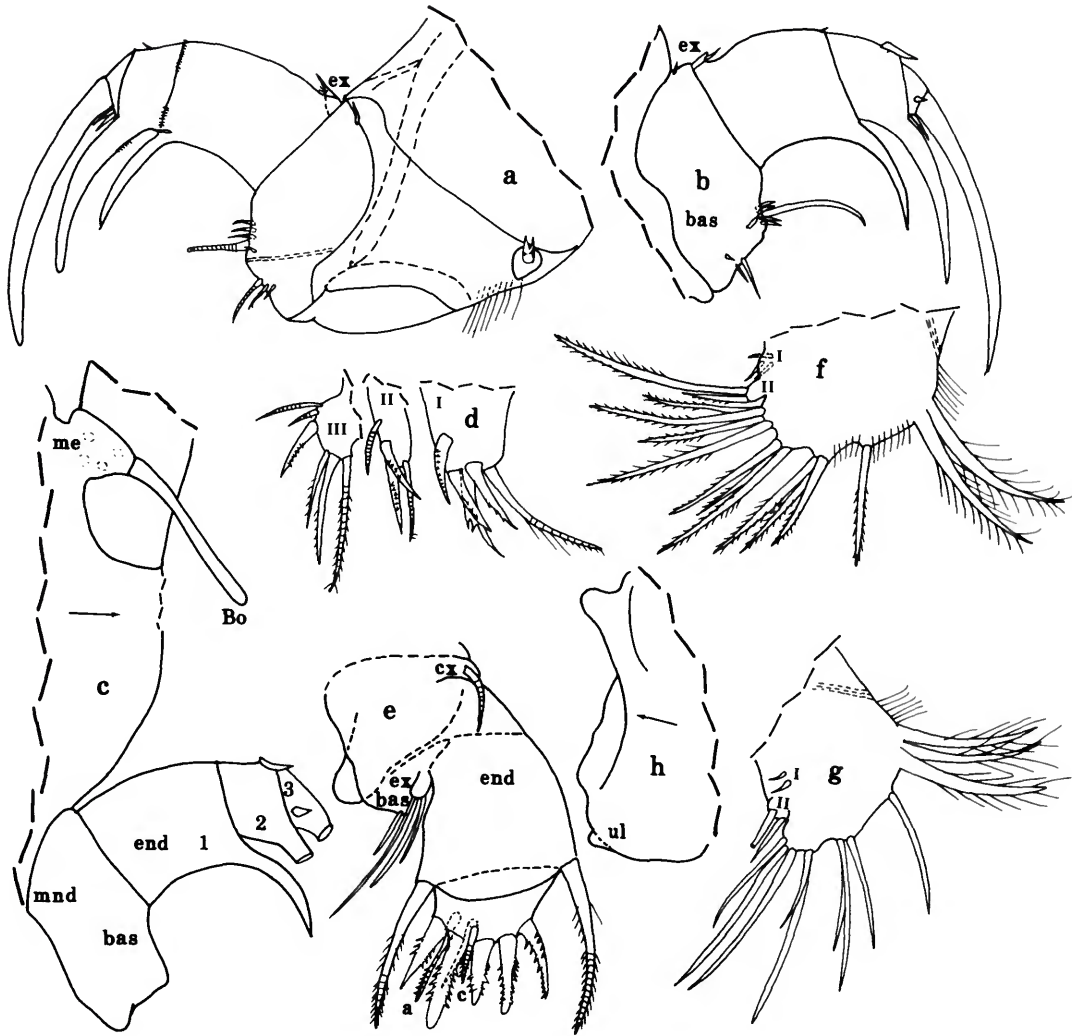


FIGURE 52.—*Alphasarsiella altrix*, new species, adult female, holotype: *a*, right mandible, mv; *b*, left mandible, mv (coxale not shown); *c*, anterior showing proximal part of 1st joint of left 1st antenna, medial eye (amber-colored cells dashed), Bellonci organ, and part of right mandible; *d*, endites I (right), II (middle), and III (left), left maxilla, mv; *e*, left maxilla, mv (endites not shown); *f*, left 6th limb, lv; *g*, right 6th limb, mv (spines on most bristles not shown); *h*, anterior of body from left side showing protuberance just dorsal to mandible, and upper lip (bottom).

Basale with short ventral bristle near exopodite. Exopodite with 3 unequal bristles. 1st endopodial joint with spinous alpha- and beta-bristles. 2nd endopodial joint with 2 spinous a-bristles, 1 shorter spinous c-bristle, and 5 pectinate end bristles.

**Fifth Limb** (Figure 51i): Single endite with 1 bare bristle. Exopodite: 1st and 2nd joints each with 3 spinous bristles; inner lobe of 3rd joint with 3 bristles (1 long, 2 short); outer lobe of 3rd joint with 1 long bare bristle; fused 4th and 5th joints with total of 3 spinous bristles; 1st and 2nd joints hirsute.

**Sixth Limb:** With 2 endites: endite I with 2 or 3 small bristles; endite II with 2 spinous bristles (1 long, 1 short). End

joint of left limb of holotype with 11 bristles with short spines followed by 2 posterior plumose bristles (Figure 52f); end joint of right limb with 9 bristles with short spines followed by 3 posterior plumose bristles (3 bristles probably aberrant as 2 are usual) (Figure 52g). Limb hirsute. (Limb could be interpreted as having more than 2 endites.)

**Seventh Limb** (Figure 51j): 4 bristles in proximal group, 2 on each side with 2 or 3 bells; 6 bristles in terminal group, 3 on each side with 2–5 bells. Terminus with opposing combs, each with 5–7 broad teeth (not all shown).

**Furca** (Figure 51k): Each lamella with 6 claws decreasing

in length posteriorly along lamella; only claw 1 nonarticulated; claws 1 and 2 with long slender teeth and claws 3–5 with short slender teeth along posterior edges; edge of lamellae following claws bare.

*Bellonci Organ* (Figure 52c): Elongate, unsegmented, with rounded tip.

*Eyes*: Lateral eyes absent. Medial eye unpigmented, with several light amber-colored cells (Figure 52c).

*Upper Lip* (Figure 52h): With straight ventral margin in lateral view and without spines or hairs.

*Genitalia* (Figure 51k): Ovoid with attached oval spermatophore on each side of body anterior to furca.

*Anterior of Body* (Figure 52c,h): Typical for subfamily.

*Posterior of Body*: Evenly rounded with few long hairs at posterodorsal corner.

*Y-Sclerite* (Figure 51k): With ventral branch.

*Number of Eggs*: Slope 40: holotype with few unextruded eggs; each of 3 paratypes with 2 eggs in marsupium (length of 1 egg in 2 specimens 0.25 mm, 0.26 mm).

#### *Alphasarsiella anax*, new species

FIGURE 53

ETYMOLOGY.—From the Greek *anax* (lord, master, king).

HOLOTYPE.—Ovigerous female on slide and in alcohol in the collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 22, 37°0.60'S, 150°20.70'E, New South Wales, off Eden, depth 363 m.

PARATYPES.—None.

DISTRIBUTION.—Slope 22, 363 m.

DESCRIPTION OF ADULT FEMALE (Figure 53).—Carapace similar in shape to that of *A. altrix* (Figure 53a).

*Ornamentation*: Carapace with 2 ribs extending anteriorly from vicinity of central adductor muscle attachments and several additional less well-defined ribs (Figure 53a). Surface with pointed spines, but also with abundant spines with blunt and globose tips along margins and ribs (Figure 53b).

*Infold*: Anterior infold with small bristle near inner margin ventral to incisur. Infold of caudal process with a few small bristles along inner edge of infold, and row of 9 broad spinous bristles along list (row extends from dorsal to ventral edge of caudal process (Figure 53d) (right valve of holotype interpreted to be aberrant in having 3 bristles, an empty socket of additional bristle, and 3 stumps in place of bristles).

*Central Adductor Muscle Attachments* (Figure 53c): Comprising about 21 attachments.

*Carapace Size* (mm): Holotype, length including caudal process 0.92, length excluding caudal process 0.85, height 0.72.

*First Antenna, Second Antenna, Mandible* (Figure 53e), *Maxilla, Fifth Limb, Sixth Limb, Seventh Limb, Furca* (Figure 53f), and *Bellonci Organ* (Figure 53g): Similar to those of *A. altrix*.

*Eyes*: Lateral eyes absent. Medial eye with brown pigment and several light amber-colored cells (Figure 53g).

*Upper Lip* (Figure 53h), *Genitalia* (Figure 53f), *Anterior of Body* (Figure 53e,h), *Posterior of Body* (Figure 53f), and *Y-Sclerite* (Figure 53f): Similar to those of *A. altrix*.

*Number of Eggs*: Holotype with small unextruded eggs and 2 eggs in marsupium (1 shown in place in Figure 53a); lengths of 2 extruded eggs 0.27 mm, 0.29 mm; length of 1 unextruded egg 0.17 mm.

*Gut Content*: Holotype with worm fragments in gut.

COMPARISONS.—*Alphasarsiella anax* is very close to *A. altrix*. The carapaces differ in that all surface spines on *A. altrix* are pointed, whereas, many along the margins and ridges of *A. anax* have blunt or globose tips. The medial eye of *A. altrix* is unpigmented, whereas, that of *A. anax* has brown pigment; however, that could be the result of differential preservation.

#### Egg Size

Kornicker (1975:49, figs. 25–28; 1981:35, fig. 6; 1986:174, fig. 112) presented data indicating that clutch size is, in part, a function of carapace size in the families Cypridinidae, Philomedidae, Cylindroleberididae, and Sarsiellidae. In the present study one or more eggs in the marsupium were measured. Some eggs are spherical whereas others are elliptical; for the latter shape the greatest length was measured. Eggs probably become more elliptical and larger with brooding development time. The eggs have an outer membrane which on some eggs is separated by a space from the amber-colored dense central part. The length of some eggs with and without the separated membrane are given in the text, but the length with the membrane is used in Appendix 2. According to Cohen (1983:244) the membrane around eggs of *Skogsbergia lernerii* (Kornicker, 1958) is discarded immediately after the embryo is released from the marsupium. The term egg is used herein without regard for degree of development, but it may be mentioned in the text. The size of eggs is, in part, a function of carapace size in the Cypridinidae (Figure 54a), and probably also in the Cylindroleberididae (Figure 54b) and Sarsiellinae (Figure 54d), and possibly in the Philomedidae (Figure 54c), but additional data are necessary to establish the trends. Insufficient data are available to approximate a trend in the Rutidermatidae (Figure 54e). Trend lines in Figure 54 are drawn by eye.

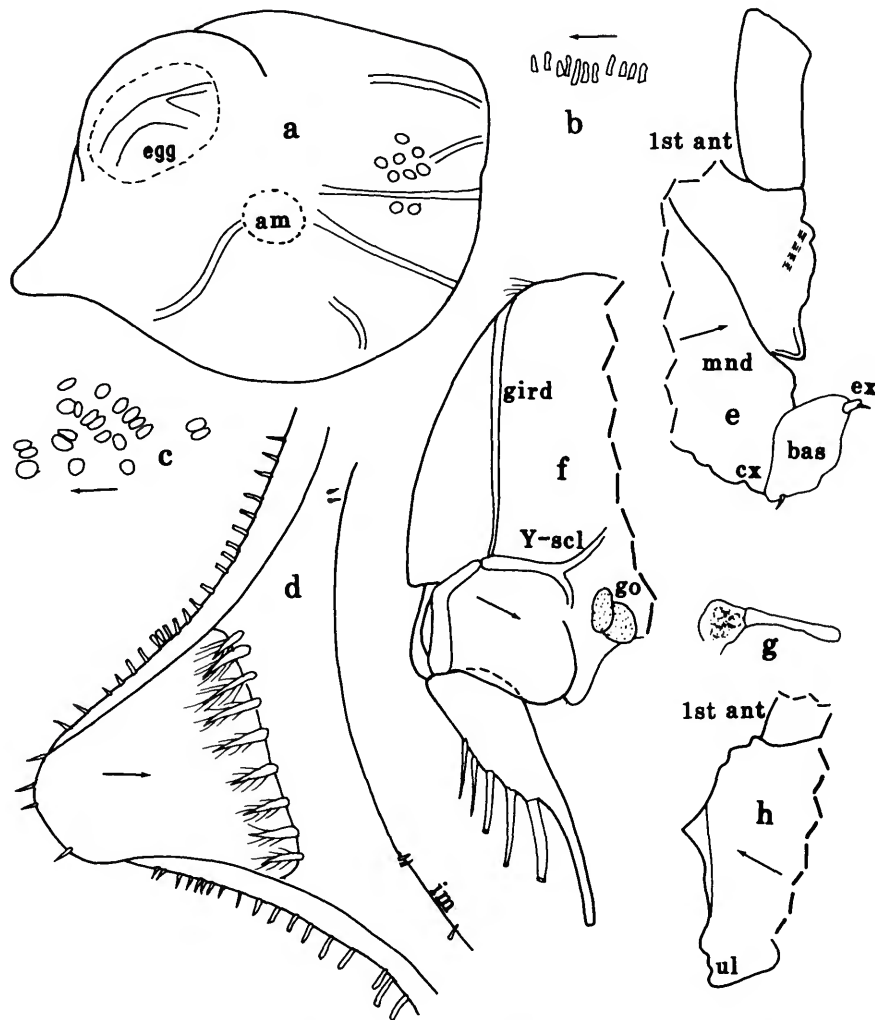


FIGURE 53.—*Alphasarsiella anax*, new species, ovigerous female, holotype: *a*, complete specimen from right side showing location of central adductor muscle attachments (anterior dashed oval) and 1 egg (posterior dashed oval), length 0.92 mm; *b*, bristles along upper edge of right valve, ov (anterior to right); *c*, central adductor muscle attachments, left valve, ov (anterior to left); *d*, caudal process, left valve, iv; *e*, anterior of body from right side showing 1st joint of right 1st antenna, triangular process just dorsal to mandible, and part of mandible showing exopodite; *f*, posterior of body from right side showing internal sclerites, right furcal lamella, and right genital organ; *g*, medial eye (area of brown pigment stippled), and Bellonci organ; *h*, anterior of body from left side showing proximal part of left 1st antenna, triangular process just dorsal to mandible, and upper lip (bottom).

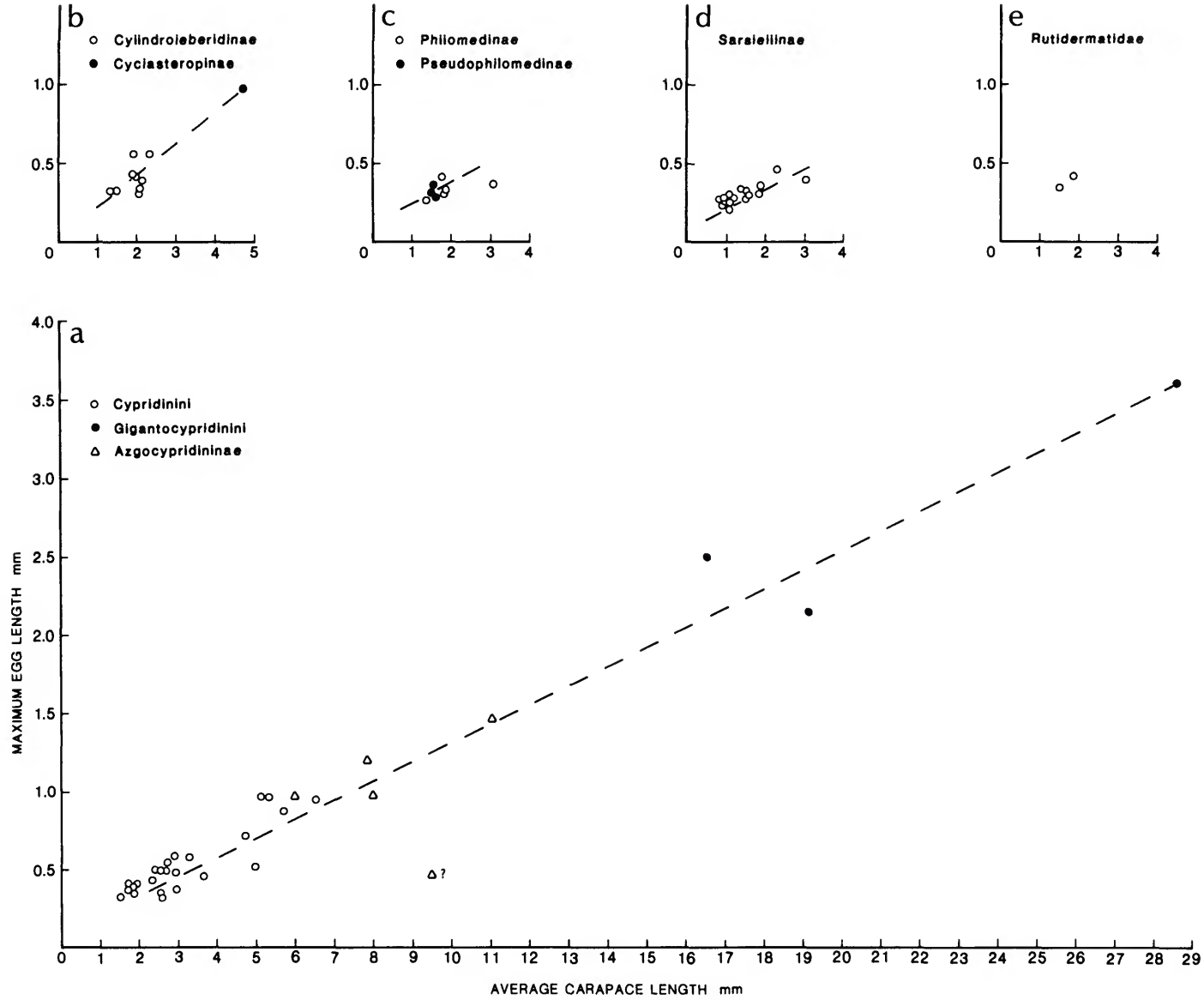


FIGURE 54.—Relationship of average carapace length and maximum egg length of species of Myodocopina (includes species from Australia plus those from elsewhere reported in the literature) (from Appendix 2).

# Appendix 1

## Station Data with Species in Samples

(All samples taken aboard ORV *Franklin* with WHOI epibenthic sled by Gary C.B. Poore et al.)

Slope 1: New South Wales off Nowra (34°59.52'S, 151°5.94'E), 204 m, coarse shell, 14 Jul 1986.

*Harbansus vatrax*; *H. felix*; *Spinacopia crux*; *S. sandix*; *S. trox*.

Slope 6: New South Wales off Nowra (34°51.90'S, 151°12.60'E), 770 m, crinoid dominated, 15 Jul 1986.

*Igene illex*.

Slope 19: New South Wales off Eden (37°07.30'S, 150°20.20'E), 520 m, grey coarse shell, 20 Jul 1986.

*Cymbicopia climax*; *Neomuelleriella klomax*.

Slope 21: New South Wales off Eden (36°57.40'S, 150°18.80'E), 220 m, muddy shell, 20 Jul 1986.

*Euphilomedes ernyx*.

Slope 22: New South Wales off Eden (37°0.60'S, 150°20.70'E), 363 m, coarse shell, 21 Jul 1986.

*Harbansus vortex*; *Spinacopia illex*; *S. sandix*; *Cymbicopia cervix*; *C. climax*; *Neomuelleriella nex*; *Alphasarsiella anax*.

Slope 25: Victoria S of Point Hicks (38°25.90'S, 148°58.60'E), 1850 m, muddy, sandstone, 22 Jul 1986.

*Spinacopia rex*.

Slope 27: Victoria S of Point Hicks (38°25.00'S, 149°0.00'E), 1500 m, compacted clay, 22 Jul 1986.

*Spinacopia rex*.

Slope 32: Victoria S of Point Hicks (38°21.90'S, 149°20.00'E), 1000 m, 23 Jul 1986.

*Spinacopia rex*.

Slope 39: Victoria S of Point Hicks (38°19.10'S, 149°14.30'E), 600 m, coarse sand, 24 Jul 1986.

*Scleroconcha solox*.

Slope 40: Victoria S of Point Hicks (38°17.70'S, 149°11.30'E), 400 m, coarse sand, gravel, mud, many sponges, 24 Jul 1986.

*Harbansus felix*; *H. tenax*; *Spinacopia syrinx*; *Cymbicopia cervix*; *Neomuelleriella nex*; *Alphasarsiella altrix*.

Slope 45: Tasmania off Freycinet Peninsula (42°2.20'S, 148°38.70'E), 800 m, coarse shelly sand, 27 Jul 1986.

*Scleroconcha solox*.

Slope 46: Tasmania off Freycinet Peninsula (42°0.20'S, 148°37.70'E), 720 m, coarse shelly sand, 27 Jul 1986.

*Scleroconcha solox*.

Slope 53: New South Wales 54 km ESE of Nowra (34°52.72'S, 151°15.04'E, 996 m, to 34°54.3'S, 151°19.5'E, 990 m), mud, fine sand, fine shell, 22 Oct 1988.

*Igene illex*; *Harbansus hapax*.

Slope 56: New South Wales 44 km E of Nowra (34°55.79'S, 151°08.06'E), 429 m, muddy coarse shell, 22 Oct 1988.

*Scleroconcha solox*; *Harbansus hapax*.



Slope 67: Victoria 67 km S of Point Hicks (38°23.95'S, 149°17.02'E), 1277 m, fine mud, 25 Oct 1988.

*Spinacopia rex*.

Slope 69: Victoria 76 km S of Point Hicks (38°29.33'S, 149°19.98'E), 1840 m, sandy mud, fine shell, 26 Oct 1988.

*Spinacopia rex*.

Slope 81: Tasmania 48 km ENE of Cape Tourville (42°00.25'S, 148°43.55'E, 1264 m, to 41°57.77'S, 148°42.08'E, 1130 m), gravel with lumps of sandy aggregate, 30 Oct 1988.

*Scleroconcha solox*; *Spinacopia rex*.

Slope 82: Tasmania 54 km ENE of Cape Tourville (41°57.30'S, 148°58.54'E), 1770 m, coarse biogenic rubble, 30 Oct 1988.

*Spinacopia rex*.

## Appendix 2

### Material from Museum of Victoria "Crustacea" Database

#### PHILOMEDIDAE

##### *Euphilomedes ernyx*

- holotype stn SLOPE 21, NMV J36842, (1 female)
- paratype stn SLOPE 21, NMV J36829, (1 female)
- paratype stn SLOPE 21, NMV J36830, (2 juveniles)

##### *Igene illex*

- holotype stn SLOPE 6, NMV J36845, (1 female)
- paratype stn SLOPE 53, NMV J36826, (2 late instars)
- paratype stn SLOPE 53, NMV J36827, (1 instar I)
- paratype stn SLOPE 6, NMV J36844, (1 ovigerous female, 1 slide)

##### *Scleroconcha solox*

- holotype stn SLOPE 46, NMV J36837, (A-1 male)
- paratype stn SLOPE 46, NMV J36821, (2 A-2 instars)
- paratype stn SLOPE 81, NMV J36820, (8 juveniles)
- paratype stn SLOPE 45, NMV J36825, (6 juveniles)

#### PSEUDOPHILOMEDINAE

##### *Harbansus felix*

- holotype stn SLOPE 1, NMV J36851, (1 adult female)
- paratype stn SLOPE 1, NMV J36852, (1 adult female)
- paratype stn SLOPE 40, NMV J36853, (1 adult female)

##### *Harbansus hapax*

- holotype stn SLOPE 53, NMV J36862, (1 ovigerous female)

##### *Harbansus tenax*

- holotype stn SLOPE 40, NMV J36849, (1 adult female)
- paratypes stn SLOPE 40, NMV J36850 (20, including ovigerous females, adult females, and juveniles)

##### *Harbansus vatrax*

- holotype stn SLOPE 1, NMV J36860, (1 ovigerous female)
- paratype stn SLOPE 1, NMV J36861, (1 male instar III, and 26, including females and juveniles)

##### *Harbansus vortex*

- holotype stn SLOPE 22, NMV J36847, (1 adult female, 1 slide)
- paratype stn SLOPE 22, NMV J36848 (3)

##### *Harbansus* sp. indet.

- Other material stn SLOPE 40, NMV J36866 (1, this specimen was not included in text)

#### SARSIELLIDAE

##### *Alphasarsiella altrix*

- holotype stn SLOPE 40, NMV J36869, (1 adult female, 1 slide)

- paratype stn SLOPE 40, NMV J36863, (4 ovigerous females)

##### *Alphasarsiella anax*

- holotype stn SLOPE 22, NMV J36864, (1 ovigerous female, 1 slide)

##### *Cymbicopia cervix*

- holotype stn SLOPE 22, NMV J36858, (1 adult female)
- paratype stn SLOPE 22, NMV J36859, (1 adult female)
- paratype stn SLOPE 40, NMV J36865, (2 ovigerous females)

##### *Cymbicopia climax*

- holotype stn SLOPE 22, NMV J36857, (1 ovigerous female)
- paratype stn SLOPE 19, NMV J36854, (1 ovigerous female)
- paratype stn SLOPE 22, NMV J36855, (1 adult female and 1 ovigerous female)
- Other material stn SLOPE 22, NMV J36856, (2)

##### *Neomuelleriella klomax*

- holotype stn SLOPE 19, NMV J36819, (1 female, 1 slide)

##### *Neomuelleriella nex*

- holotype stn SLOPE 22, NMV J36834, (1 ovigerous female)
- paratype stn SLOPE 22, NMV J36868, (8)

##### *Spinacopia crux*

- holotype stn SLOPE 1, NMV J36823, (1 ovigerous female, 1 slide)

##### *Spinacopia illex*

- holotype stn SLOPE 22, NMV J36846, (1 ovigerous female, 1 slide)

##### *Spinacopia rex*

- holotype stn SLOPE 27, NMV J36822, (1 undissected adult female)
- paratype stn SLOPE 82, NMV J36840, (2 adult females (1 ovigerous) and 4 juveniles)
- paratype stn SLOPE 81, NMV J36870, (2 females, 2 juveniles)
- paratype stn SLOPE 25, NMV J36833, (4)
- paratype stn SLOPE 27, NMV J36835, (4, including adult females and juveniles)
- paratype stn SLOPE 32, NMV J36838, (12, including adult females and juveniles)
- paratype stn SLOPE 67, NMV J36839, (4)
- paratype stn SLOPE 69, NMV J36841, (12, including adult females and juveniles)

##### *Spinacopia sandix*

- holotype stn SLOPE 22, NMV J36828, (1 ovigerous female)
- paratype stn SLOPE 22, NMV J36843, (1 adult female, 1 slide)

*Spinacopia syrinx*

holotype stn SLOPE 40, NMV J36831, (1 ovigerous female)

paratype stn SLOPE 40, NMV J36836, (3 ovigerous females)

*Spinacopia trox*

holotype stn SLOPE 1, NMV J36832, (1 ovigerous female)

*Spinacopia* sp. indet.

Other material stn SLOPE 22, NMV J36824, (1 juvenile female, this specimen not mentioned in text)

Other material stn SLOPE 1, NMV J36867, (1 male, this specimen not mentioned in text)

## Appendix 3

### Comparison of Carapace Length, Number of Eggs in Marsupium, and Egg Length

(Includes species from Australia in the present collection plus those from elsewhere reported in the literature;  
nd = no data; \* = nomen nudem.)

Species	Carapace length (avg. mm)	Number of eggs	Length of selected eggs (mm)
<b>CYPRIDINIDAE</b>			
<b>CYPRIDININAE</b>			
<b>CYPRIDININI</b>			
<i>Cypridinodes wyvillethomsoni</i>	5.25	1-6	0.85-0.97
<i>Macrocypridina castanea</i> <sup>a</sup>	6.55	46-75 <sup>bc</sup>	0.42-0.9
<i>Metavargula apex</i> *	2.90	5-9	0.33-0.60
<i>Metavargula currax</i> *	5.00	32-42	0.52
<i>Metavargula spadix</i> *	3.61	16	0.35-0.46
<i>Paradoloria fax</i> *	2.67	1-10	0.36-0.50
<i>Paradoloria mordax</i> *	3.22	13-16	0.58
<i>Paradoloria pugnax</i> *	2.58	10	0.52
<i>Paradoloria tryx</i> *	4.65	6	0.71
<i>Pseudodoloria plax</i>	5.76	21-32	0.86-0.89
<i>Pterocypridina appendix</i> *	1.72	2-10	0.31-0.38
<i>Pterocypridina tressleri</i> *	1.78	10-14	0.41
<i>Rheina relax</i> *	1.53	1-8	0.29-0.33
<i>Vargula dentata</i>	1.92	6-7	0.36
<i>Vargula hex</i>	2.71	10-19	0.40-0.54
<i>Vargula matrix</i>	2.98	7-17	0.40-0.48
<i>Vargula psydrax</i>	2.60	5-15	0.41-0.50
<i>Vargula rapax</i>	2.98	8-26	0.36-0.38
<i>Vargula straux</i>	2.25	11-17	0.38-0.42
<i>Vargula trifax</i>	5.13	34	0.66-0.97
<i>Vargula vertex</i>	2.23	5 <sup>d</sup>	0.32-0.35
<i>Vargula vix</i>	1.77	9	0.36
<i>Skogsbergia lerner</i> <sup>e</sup>	1.96	10-22	0.4
<i>Skogsbergia vivax</i> *	2.59	18	0.35
<b>GIGANTOCYPRIDININI</b>			
<i>Gigantocypris agassiz</i> <sup>f</sup>	28.5	nd	1.3-3.6
<i>Gigantocypris danae</i> <sup>c</sup>	19.2	nd	0.9-2.3
<i>Gigantocypris muelleri</i> <sup>a</sup>	16.5	20-85 <sup>b</sup>	1-2.4
<b>AZYGOCYPRIDININAE</b>			
<i>Azygocypridina imperialis</i> <sup>f</sup>	9.48	31-65	0.45
<i>Azygocypridina lowry</i> <sup>g</sup>	11.0	nd	1.47
<i>Azygocypridina ohtai</i> <sup>h</sup>	7.8	43	1-1.2
<i>Isocypridina fallax</i> *	6.0	8-17	0.93
<i>Isocypridina quatuorsetae</i> <sup>i</sup>	8.0	2-27	0.93
<b>PHILOMEDIDAE</b>			
<b>PHILOMEDINAE</b>			
<i>Igene illex</i>	1.74	5	0.42
<i>Philomedes fortax</i>	1.87	16	0.34
<i>Philomedes thorax</i>	1.80	11	0.32
<i>Pleoschisma pnyx</i>	1.33	1	0.28
<i>Scleroconcha solox</i>	3.03	16	0.36

Species	Carapace length (avg. mm)	Number of eggs	Length of selected eggs (mm)
<b>PSEUDOPHILOMEDINAE</b>			
<i>Harbansus hapax</i>	1.43	2	0.32
<i>Harbansus vatrax</i>	1.54	4	0.33
<i>Pseudophilomedes fornix</i>	1.47	3	0.37
<b>SARSIELLIDAE</b>			
<b>SARSIELLINAE</b>			
<i>Alphasarsiella atrix</i>	0.94	2	0.25-0.26
<i>Alphasarsiella anax</i>	0.92	2	0.27-0.29
<i>Chelicopia pertinex</i>	1.19	1-4	0.28-0.30
<i>Cymbicopia cervix</i>	0.94	2-3	0.30-0.35
<i>Cymbicopia climax</i>	1.15	1-3	0.31-0.37
<i>Eusarsiella bex</i>	1.54	2-6	0.23-0.30
<i>Eusarsiella edax</i>	1.80	5-8	0.24-0.31
<i>Eusarsiella fallomagna</i>	2.29	9	0.46
<i>Eusarsiella iayx</i>	1.53	3-5	0.21-0.29
<i>Neomuelleriella nex</i>	0.86	3	0.25
<i>Parasarsiella poorei</i>	3.07	7-11	0.36-0.41
<i>Spinacopia crux</i>	1.10	5	0.25
<i>Spinacopia illex</i>	1.02	3	0.25
<i>Spinacopia rex</i>	1.85	4	0.37
<i>Spinacopia sandix</i>	0.99	1	0.29
<i>Spinacopia syrinx</i>	0.87	1-2	0.21-0.27
<i>Spinacopia trox</i>	1.52	7	0.31
<b>DANTYINAE</b>			
<i>Dantya tryx</i>	1.38	1?-2	0.29-0.42?
<b>RUTIDERMATIDAE</b>			
<i>Metaschisma nex</i>	1.48	3-6	0.35
<i>Scleraner trifax</i>	1.82	2-3	0.35-0.42
<b>CYLINDROLEBERIDIDAE</b>			
<b>CYLINDROLEBERIDINAE</b>			
<i>Archasterope apex*</i>	2.13	13	0.33-0.34
<i>Archasterope efficax*</i>	2.08	17-19	0.30-32
<i>Homasterope trebax*</i>	1.39	6	0.35
<i>Parasterope lux*</i>	1.97	14	0.41
<i>Parasterope physinx*</i>	1.44	9	0.34
<i>Parasterope sequax*</i>	1.99	6-10	0.37-0.43
<i>Xandarasterope storthynx*</i>	2.38	10	0.55
<i>Xandarasterope trux*</i>	1.96	6-10	0.42-0.56
<i>Xenoleberis bex</i>	2.13	13	0.38
<b>CYCLASTEROPINAE</b>			
<i>Leuroleberis zealandica<sup>†</sup></i>	4.62	2-47	0.74-0.99

\*Data from Poulsen (1962).

<sup>b</sup>Data, in part, from Skogsberg (1920:294).

<sup>c</sup>Data, in part, from Kornicker et al. (1976:11).

<sup>d</sup>Specimen also with 26 smaller unextruded eggs.

<sup>e</sup>Data from Cohen (1983:235).

<sup>f</sup>Data from Athersuch (1980:139).

<sup>g</sup>Data from Kornicker (1985:698).

<sup>h</sup>Data from Hiruta (1981:49).

<sup>i</sup>Egg measured in present study, other data from Kornicker (1975:208).

<sup>j</sup>Data from Fenwick (1984:255).

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