

Ostracoda (Myodocopina)
of the SE Australian Continental
Slope, Part 1

LOUIS S. KORNIKER

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Louis S. Kornicker



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ABSTRACT

Kornicker, Louis S. Ostracoda (Myodocopina) of the SE Australian Continental Slope, Part 1. *Smithsonian Contributions to Zoology*, number 553, 200 pages, 111 figures, 4 tables, 1994.—Thirty-five species (32 new) of benthic Myodocopina in 16 genera (4 new) collected at depths of 204–2900 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 comparison of the sensory bristle of the male 1st antenna of species of *Rutiderma* and *Scleraner* in the Rutidermatidae indicates that the extent of coverage of the bristle by filaments may be useful in separating males of the two genera. A study of medial sclerites of the protopodites of second antennae indicates that the Cypridinidae and Cylindroleberididae fall into one group, and the Philomedidae, Sarsiellidae, and Rutidermatidae into a second group. Some information is given on eggs, juvenile morphology, parasitic copepods, and gut contents. Eye size is compared to depth. A new subfamily, Metaschismatinae in the Rutidermatidae, is proposed.

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Ostracoda (Myodocopina) of the SE Australian Continental Slope, Part 1

Louis S. Kornicker

Introduction

This work is a taxonomic report on some (35 species) of the Ostracoda in the suborder Myodocopina collected on the SE Australian continental slope during 1986 and 1988 by personnel of the Museum of Victoria and the Victorian Institute of Marine Sciences. The benthic material was collected in the Tasman Sea between Nowra, near Sydney, New South Wales (35°S), in the north, and the central eastern coast of Tasmania (42°S) in the south at depths of 204–2900 m. The distribution of species with depth is shown in Table 1. It is intended to publish descriptions of about 54 additional species in Parts 2 and 3. The arrangement of sclerites in the protopodite of the 2nd antenna are discussed herein based on all species in the collection; undescribed species are left in open nomenclature (each will be referred to in a synonymy when the species is later described and named).

STATIONS.—The sedimentology and hydrology of the area, as far as they are known, have been summarized in a paper in preparation by G.C.B. Poore, J. Just, and B. Cohen. The stations sampled were on four 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 off Eden, southern NSW; stations Slope 23–41 and Slope 65–72 off eastern Victoria in Bass Strait; and stations Slope 42–49 and Slope 73–85 off Freycinet Peninsula, eastern Tasmania (Table 2). The localities of those stations from which ostracodes have been identified herein are listed in an Appendix, "Station Data with Species in Samples."

SAMPLING.—A three-quarter sized WHOI epibenthic sled (opening 600 mm) with 1 mm mesh net was used for most samples. The sediment retained was washed through a 200 µm sieve on board ship with sea-water. Not all samples taken in the course of the two cruises have been processed for ostracodes. All specimens of the Philomedidae and Rutidermatidae were

removed from samples and identified. Specimens of Sarsiellidae and Cyllindroleberididae were also removed and identified from all samples, except for sample from Slope 40, in which they were abundant. Relatively few specimens of Cypridinidae (especially those of the genera *Metavargula* and *Paradoloria*) were removed from samples in which they were abundant. The many juveniles that could not be identified readily 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 (Appendix 2). Most holotypes have been placed in vials with alcohol because appendages mounted in glycerin dry out in time.

ABBREVIATIONS.—For definition of lettering system for appendage bristles see Skogsberg (1920:188) and Kornicker (1985a:2). Letters used in identifying sclerites of the protopodite of the 2nd antenna are explained in "Sclerites of the Protopodite of the Second Antenna." In the figures, Arabic numerals indicate limbs 1–7, as well as individual joints of each limb (the location of the numeral indicating whether a limb or joint is indicated). Roman numerals indicate the endites. Arrows on illustrations indicate anterior of valve.

The following abbreviations are used in 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
cox	coxale

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

Species	Depth (m)			
	201-500	501-1000	1001-2000	2001-3000
CYPRIDINIDAE				
<i>Pseudoloria plax</i>	X	X	XX	
<i>Vargula dentata</i>		XX		
<i>V. fugax</i>		XX		
<i>V. hex</i>	X	XX		
<i>V. matrix</i>			XX	
<i>V. psydrax</i>	X	X	XXX	X
<i>V. rapax</i>	X			
<i>V. straux</i>		XX		
<i>V. trifax</i>	XXXX			
<i>V. vertex</i>	X			
<i>V. vix</i>	X			
PHILOMEDIDAE				
<i>Philomedes fortax</i>		X		
<i>P. pseudolofthouse</i>			X	X
<i>P. ptyx</i>		X	X	
<i>P. sphinx</i>			X	
<i>P. thorax</i>		X		
<i>Pleoschisma mindax</i>	X			
<i>P. pnyx</i>	XXX	X		
<i>P. pseudoferax</i>	X			
<i>Pseudophilomedes fornix</i>		X		
RUTIDERMATIDAE				
<i>Metaschisma nex</i>	X			
<i>Scleraner trifax</i>	XXXX			
SARSIELLIDAE				
<i>Chelicopia pertinex</i>	XXX			
<i>C. triplex</i>	X			
<i>Dantya tryx</i>	X			
<i>Eusarsiella bex</i>		XXXX		
<i>E. edax</i>	XXX	X		
<i>E. fallomagna</i>	XXX			
<i>E. iayx</i>	XXXX	X		
<i>Nealella lux</i>	X			
<i>Parasarsiella poorei</i>	X			
CYLINDROLEBERIDIDAE				
<i>Asteropterygion magnum</i>	XXX			
<i>Leuroleberis mackenziei</i>	X			
<i>Macroasteropteron mindax</i>		X		
<i>Xenoleberis bex</i>		X		

cp	caudal process	le	lateral eye
dv	dorsal view	lft	left
c	valve edge	ll	lower lip
end	endopodite	lp	lamellar prolongation of selvage
epip	epipodite	lv	lateral view
esop	esophagus	me	medial eye
ex	exopodite	MLS	medial longitudinal sclerite
fu	furca	mnd	mandible
gen	genital organ	mo	mouth
gird	girdle	mv	medial view
hrt	heart	mx	maxilla
im	inner margin of infold	ov	outside view
inc	incisur	par	parasite
iv	inside view	precox	precoxale
L	left	prot	protopodite
lat	lateral process	pv	posterior view

TABLE 2.—Geographic distribution of species (X = a single sample; species arranged alphabetically in each family).

Species	Transect			
	Southern NSW		Victoria S of Point Hicks	Off eastern Tasmania
	Off Nowra	Off Eden		
CYPRIDINIDAE				
<i>Pseudoloria plax</i>			XX	
<i>Vargula dentata</i>	X		X	
<i>V. fugax</i>	X		X	
<i>V. hex</i>			XX	X
<i>V. matrix</i>			XX	
<i>V. psydrax</i>	XX		XXX	X
<i>V. rapax</i>				X
<i>V. stranx</i>			X	X
<i>V. trifax</i>	XX	X	X	
<i>V. vertex</i>		X		
<i>V. vix</i>			X	
PHILOMEDIDAE				
<i>Philomedes fortax</i>				X
<i>P. pseudolofthousae</i>			XX	
<i>P. ptyx</i>			XX	
<i>P. sphinx</i>			X	
<i>P. thorax</i>			X	
<i>Pleoschisma mindax</i>		X		
<i>P. pnyx</i>	X	XXX		
<i>P. pseudoferox</i>	X			
<i>Pseudophilomedes fornix</i>	X			
RUTIDERMATIDAE				
<i>Metaschisma nex</i>	X			
<i>Scleraner trifax</i>	X	XX		
SARSIELLIDAE				
<i>Chelicopia pertinex</i>	X	X	X	
<i>C. triplex</i>	X			
<i>Dantya tryx</i>	X			
<i>Eusarsiella bex</i>	X	X		X
<i>E. edax</i>	X	XX	X	
<i>E. fallomagna</i>	XX		X	
<i>E. iayx</i>	X	X	X	XXX
<i>Nealella lux</i>	X			
<i>Parasarsiella poorei</i>	X			
CYLINDROLEBERIDIDAE				
<i>Astropterygion magnum</i>	X	XX		
<i>Leuroleberis mackenziei</i>	X			
<i>Macroasteropteron mindax</i>	X			
<i>Xenoleberis bex</i>			X	

R	right
rt	right
sel	selvage
sens	sensory bristle of 5th joint of 1st antenna
sv	seminal vesicle
tes	testis
ul	upper lip
vv	ventral view
Y-scl	Y-sclerite

ACKNOWLEDGMENTS.—This project is part of a wide-ranging exploration of the continental slope of southeastern Australia by the Museum of Victoria, which has been supported by grants from the Australian Marine Science and Technolo-

gies Grants Scheme, an Australian Research Council grant, and by the Victorian Institute of Marine Sciences.

Initial correspondence concerning the ostracodes received from the Museum of Victoria was with Jean Just, who also removed the ostracodes from samples; 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 of species of *Vargula* were inked by Jack Schroeder, Jack Schroeder Associates; other inkings were by Molly Ryan, Smithsonian Institution, and two volunteers: Marsha Leaders

and Patricia Condit; Anne C. Cohen and an anonymous reviewer made many helpful suggestions that improved the paper, and Elizabeth Harrison-Nelson prepared the "Literature Cited" section, labeled figures, cataloged specimens, and helped in many other tasks. I also thank Don Fisher, Smithsonian Institution Press, for editing and preparing the manuscript.

Suborder MYODOCOPINA Sars, 1866

The Myodocopina include 5 families, all represented in the study area.

CYPRIDINIDAE Baird, 1850a

The Cypridinidae include 2 subfamilies, Cypridinidae and Azygocypridininae; both are represented in the study area, but only the first is treated herein.

CYPRIDININAE Baird, 1850a

The Cypridininae include 2 tribes, Gigantocypridinini (pelagic) and Cypridinini (benthic and pelagic); only the latter tribe is represented in the collection.

CYPRIDININI Baird, 1850a

The Cypridini are represented in the collection by 8 genera: *Cyprinodes*, *Paradoloria*, *Pseudodoloria* (new genus), *Metavargula*, *Pterocypridina*, *Rheina*, *Skogsbergia*, and *Vargula*, but only *Pseudodoloria* and *Vargula* are described herein.

Pseudodoloria, new genus

ETYMOLOGY.—From the Greek *pseudos* (lie) plus *Doloria*.

TYPE SPECIES.—*Pseudodoloria plax*, new species, herein.

COMPOSITION.—Known only from the type species.

DISTRIBUTION.—Victoria, S of Point Hicks. Known depth range 400–1500 m.

DIAGNOSIS.—The genus is defined on the following characters.

Second Antenna: Male endopodite formed as 3-jointed clasper. Female endopodite 3-jointed elongate with small terminal bristle on 2nd joint.

Furca: With many claws (11 or 12 on type species).

Upper Lip: Without long tusks.

COMPARISONS.—Previously proposed genera in the Cypridininae having a 3-jointed clasper on the male 2nd antenna are *Doloria* and *Codonocera*. Species of the latter have only 4 furcal claws compared to 11 or 12 on *Pseudodoloria*, and the endopodite of the female 2nd antenna lacks a bristle on the 2nd joint. The 2nd joint of the endopodite of the female 2nd antenna of species of *Doloria* lacks a bristle. *Pseudodoloria plax*, new species, has several characters that may prove to be of generic

value: 1, the 2nd joint of the 1st antenna bears a ventral bristle (not previously reported on members of the Cypridininae (Figure 5b)); 2, medial eye appears to have 2 parts (Figure 4b), and 3, the Bellonci organ has a short slender neck connecting it to the medial eye (Figure 4b).

Pseudodoloria plax, new species

FIGURES 1–5, 110a–d

ETYMOLOGY.—From the Greek *plax* (plate, tablet).

HOLOTYPE.—Ovigerous female (undissected) in alcohol, in collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 32, 38°21.90'S, 149°20.00'E, Victoria, S of Point Hicks; depth 1000 m.

PARATYPES.—Slope 27: USNM 193860, 1 partly dissected ovigerous female on slide and in alcohol. Slope 32: USNM 193832, 1 dissected ovigerous female on slide and in alcohol; USNM 193833, 1 partly dissected adult male on slide and in alcohol; 5 adult males, 4 adult females, and 7 specimens, all in alcohol. Slope 40: USNM 193980, 1 partly dissected adult female in alcohol. Slope 67: 1 partly dissected female, 1 partly dissected juvenile, and 5 undissected juveniles, all in alcohol.

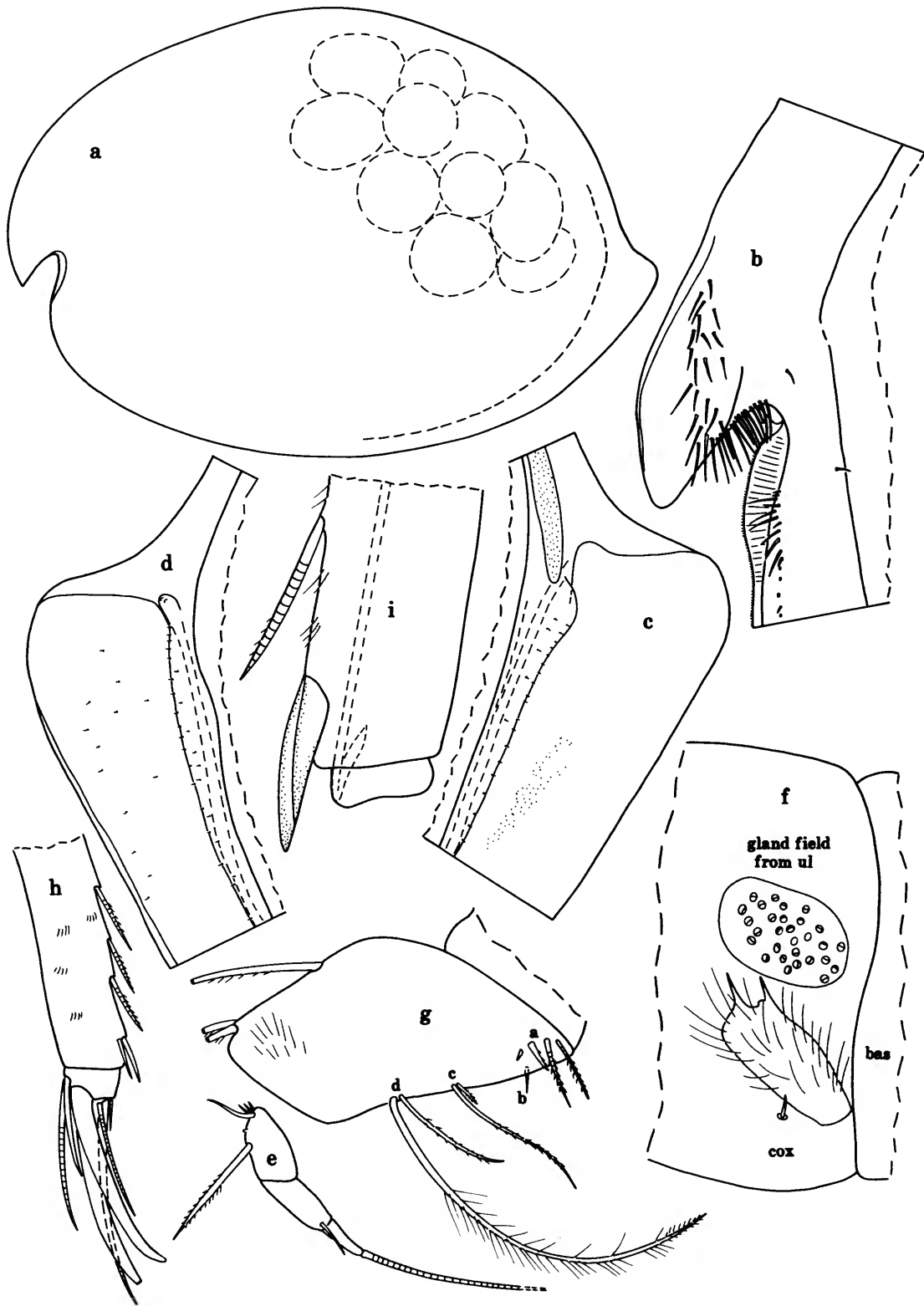
DISTRIBUTION.—Slope 27, 1500 m; slope 32, 1000 m. Slope 40: 400 m. Slope 67, 1277 m. Known depth range 400–1500 m.

DESCRIPTION OF ADULT FEMALE (Figures 1–5, 110a–c).—In lateral view ventral and dorsal margins broadly convex; incisur small at about valve midheight; rostrum without lateral processes and with pointed tip; ventral edge of valve slightly inset; small but distinct backward pointing caudal process with rounded or square posterior margin (Figures 1a,c,d 2b, 4g,j).

Ornamentation: Surface appearing smooth but at high magnification ($\times 150$ – $\times 300$ ($\times 10$ or $\times 20$ objective, $\times 15$ ocular)) indistinct striations visible in vicinity of incisur (Figure 2a) and caudal process (Figure 2b), and distinct minute scalloping observed on USNM 193860. Four or 5 minute bristles in row near incisur (Figure 2a). Very few additional bristles distributed on valve surface, some emerging from pore containing node.

Infold: Rostral infold with 35 fairly stout undivided bare bristles concentrated in distal part (Figure 1b); 1 small undivided bare bristle proximal to inner end of incisur. Anteroventral infold with 1 small undivided bare bristle near inner margin posterior to incisur, and near outer margin about 90 both short and long closely spaced undivided bare bristles in row (row extends along ventral margin to about $1/3$ valve length

FIGURE 1.—*Pseudodoloria plax*, new species, ovigerous female, paratype, USNM 193832: a, complete specimen from left side showing eggs within marsupium, length 5.5 mm; b, anterior, right valve, iv; c,d, caudal processes of right and left valves, respectively, iv; e, endopodite, right 2nd antenna, mv; f, coxale, left mandible, mv (glandular field is that of left side of upper lip that adhered to mandible when limb removed); g, basale, right mandible, mv; h, distal endopodite, right mandible, mv; i, distal endopodite, left mandible, mv.



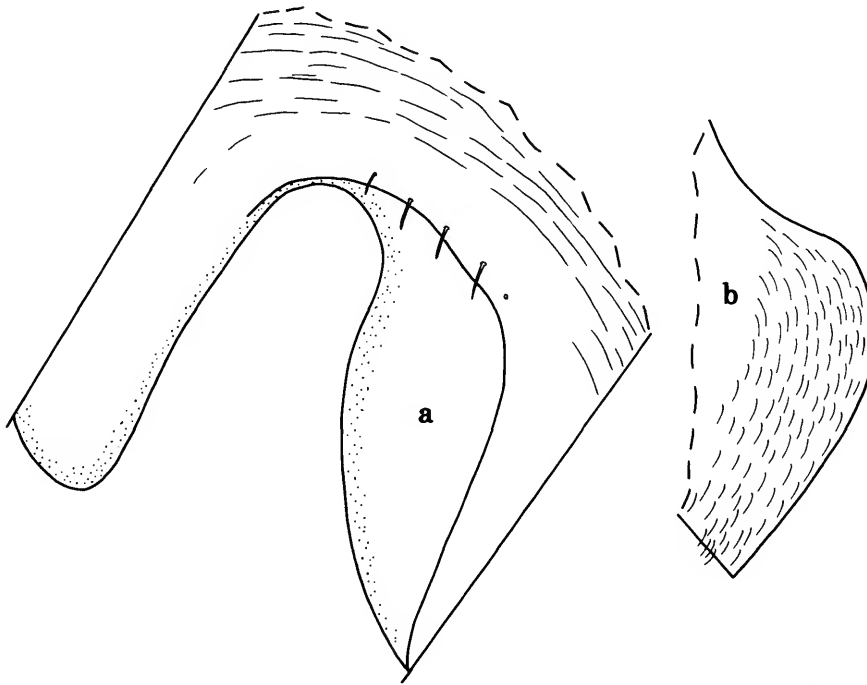


FIGURE 2.—*Pseudodoloria plax*, new species, ovigerous female, paratype, USNM 193832: *a, b*, incisur and tip of caudal process of left valve showing surface striations, *ov*.

measured from anterior end) (many bristles of USNM 193832 missing but prior presence indicated by empty sockets); long bristles with minute terminal papilla; short bristles narrower and with broadly rounded tips; some long bristles adjacent to each other, but generally 1 or 2 short bristles between each pair of long bristles; ventral infold posterior to row of anteroventral bristles with 12–20 widely spaced long undivided bare bristles in row on or just distal to narrow list. Narrow list with anterior end at about 12th bristle in anteroventral row continues along ventral margin and then broadens along anterior edge of infold of caudal process; list crenulate in anterior part of anteroventral infold. Posterior infold with broad list (with skirt) along anterior margin of caudal process (Figure 1*d, c*); minute spines emerging from pores along posterior edge of list and on flat surface of list; “pocket” extending from under skirt to valve edge present posterior to list; minute spines and pores in pocket but whether these are on or below surface not resolved with certainty. Right valve with sclerotized bar and left valve with knob dorsal to dorsal end of list (Figure 1*c*).

Selvae: Narrow lamellar prolongation with smooth outer edge present along anterior edge of rostrum (not shown), absent along dorsal edge of incisur, and represented by small flap at inner end of incisur (Figure 1*b*). Lamellar prolongation along ventral edge of incisur fairly broad, with closely spaced indistinct striations, and with fringe of minute spines along

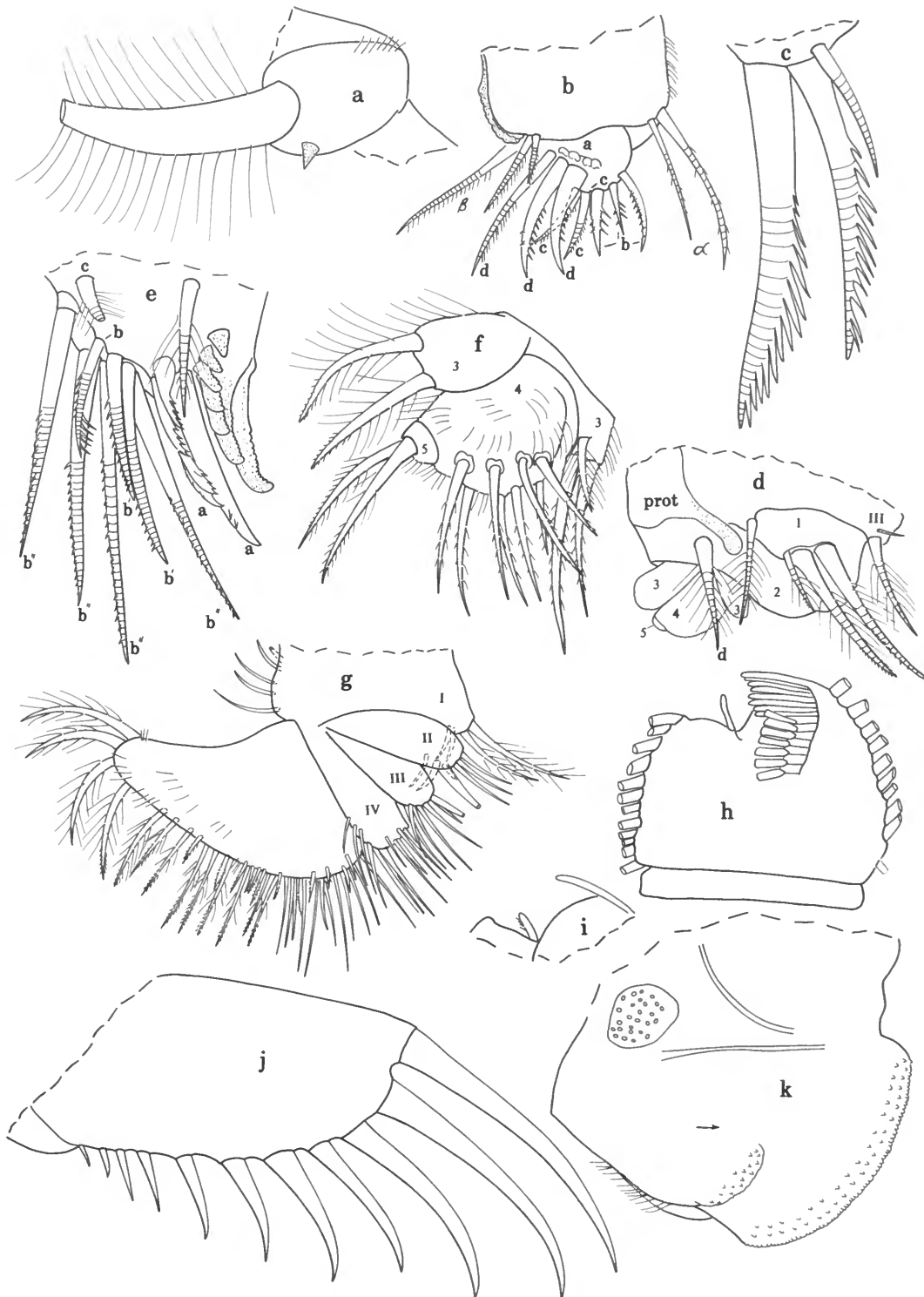
outer edge (Figure 1*b*). Lamellar prolongation along anteroventral and anterior half of ventral margin narrow and with minute spines along outer edge; lamellar prolongation along posterior half of ventral margin and along outer edge of caudal process narrow and with smooth outer edge.

Central Adductor Muscle Attachments (Figure 4*h*): Somewhat obscured, but comprising about 16 complex elongate and oval attachments.

Carapace Size (length, height in mm): Slope 27: USNM 193860, 6.8, 4.7. Slope 32: USNM 193832, 5.5, 3.9; 4 specimens: 5.9, 4.2 (holotype); 5.5, 4.0; 5.8, 4.1; 5.5, 3.9; 5.5, 4.0. Slope 40: USNM 193980, 5.6, 3.6. Length range 5.5–6.8 mm.

First Antenna: 1st joint with short distal lateral spines in rows near dorsal margin. 2nd joint spinous with 1 short spinous ventral bristle (3 specimens examined, left limb of USNM 193832 without bristle). 3rd joint with few small medial spines

FIGURE 3.—*Pseudodoloria plax*, new species, ovigerous female, paratype, USNM 193832: *a*, dorsal bristle and spine of coxale of left maxilla, *mv*; *b*, tip of right maxilla, *lv*; *c*, c-bristles of 2nd endopodial joint of left maxilla, *mv*; *d*, part of right 5th limb, *av* (only 2 bristles of endite III shown); *e*, part of left 5th limb, *pv*; *f*, exopodial joints 3–5 of left 5th limb, *pv*; *g*, right 6th limb, *lv*; *h*, tip of 7th limb; *i*, peg and middle tooth of comb of 7th limb opposite that shown in *h*; *j*, right lamella of furca (teeth not shown); *k*, upper lip from right side (anterior to right).



in row and 2 bristles (ventral subterminal, dorsal at midlength. 4th joint with 2 spinous terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 9 long proximal filaments (1 single followed by 2 pairs and 4 single), 3 short distal filaments, and bifurcate tip. 6th joint with short spinous medial bristle. 7th joint: a-bristle spinous, longer than bristle of 6th joint; b-bristle about 3 times length a-bristle, with 4 spinous marginal filaments; c-bristle long with about 9 spinous filaments and bifurcate tip. 8th joint: d- and e-bristles slightly shorter than b-bristle, bare with blunt tips; f-bristle long with spinous filaments; g-bristle long with 10 spinous marginal filaments and bifurcate tip.

Second Antenna: Protopodite with short spinous distal medial bristle (Figure 110a-c). Endopodite 3-jointed (Figure 1e): 1st joint with 4 proximal bristles (3 short, 1 longer) followed by small rounded peg and long spinous bristle at midlength; 2nd joint with short terminal bristle; 3rd joint with long filament (1.6 times length of joints 1-3). Exopodite: bristle of 2nd joint reaching past 9th joint, with numerous ventral spines; bristles of joints 3-8 long with natatory hairs; 9th joint with 4 bristles with natatory hairs; joints 3-8 with basal spines longer on distal joints; spine of 8th joint about twice length of 9th joint; lateral spine of 9th joint slightly shorter than basal spine of 8th joint; distal edges of joints without row of small spines.

Mandible: Coxale endite stout, spinous, with 2 stout terminal spines with minute peg between them; small unringed bristle near base of endite (Figure 1f). Basale (Figure 1g): ventral margin with 4 a-bristles (2 ringed, 2 unringed shorter unequal), 1 small b-bristle with base on lateral side, 2 slender ringed spinous c-bristles, and 2 ringed spinous d-bristles; dorsal margin with 3 spinous bristles (1 at midlength, 2 terminal); medial surface with long spines near distal dorsal corner. Exopodite about same length as dorsal margin of 1st endopodial joint, with pointed hirsute tip and 2 subterminal spinous bristles (distal slightly longer than midlength of proximal). 1st endopodial joint with 4 ventral bristles (1 long with long spines, 1 long with short spines, 1 short with short spines, 1 minute bare or with short spines). 2nd endopodial joint (Figure 1h, i): ventral margin with 2 (rarely 3) distal single ringed spinous bristles and 2 unringed sclerotized bare terminal bristles (lateral slightly longer and broader); dorsal margin with numerous long (1 reaches 3rd joint) and short bristles proximal to midlength (not shown); medial surface with spines in rows. 3rd endopodial joint with short slender dorsal claw, 2 long stout claws, and 4 ringed bristles (Figure 1h). (Glandular field on coxale of left limb of USNM 193832 is tentatively interpreted to be proximal lateral field of upper lip that adhered to mandible when it was removed from body (Figure 1f); a similar field is present in the same place on the right limb of an adult male (USNM 193833).)

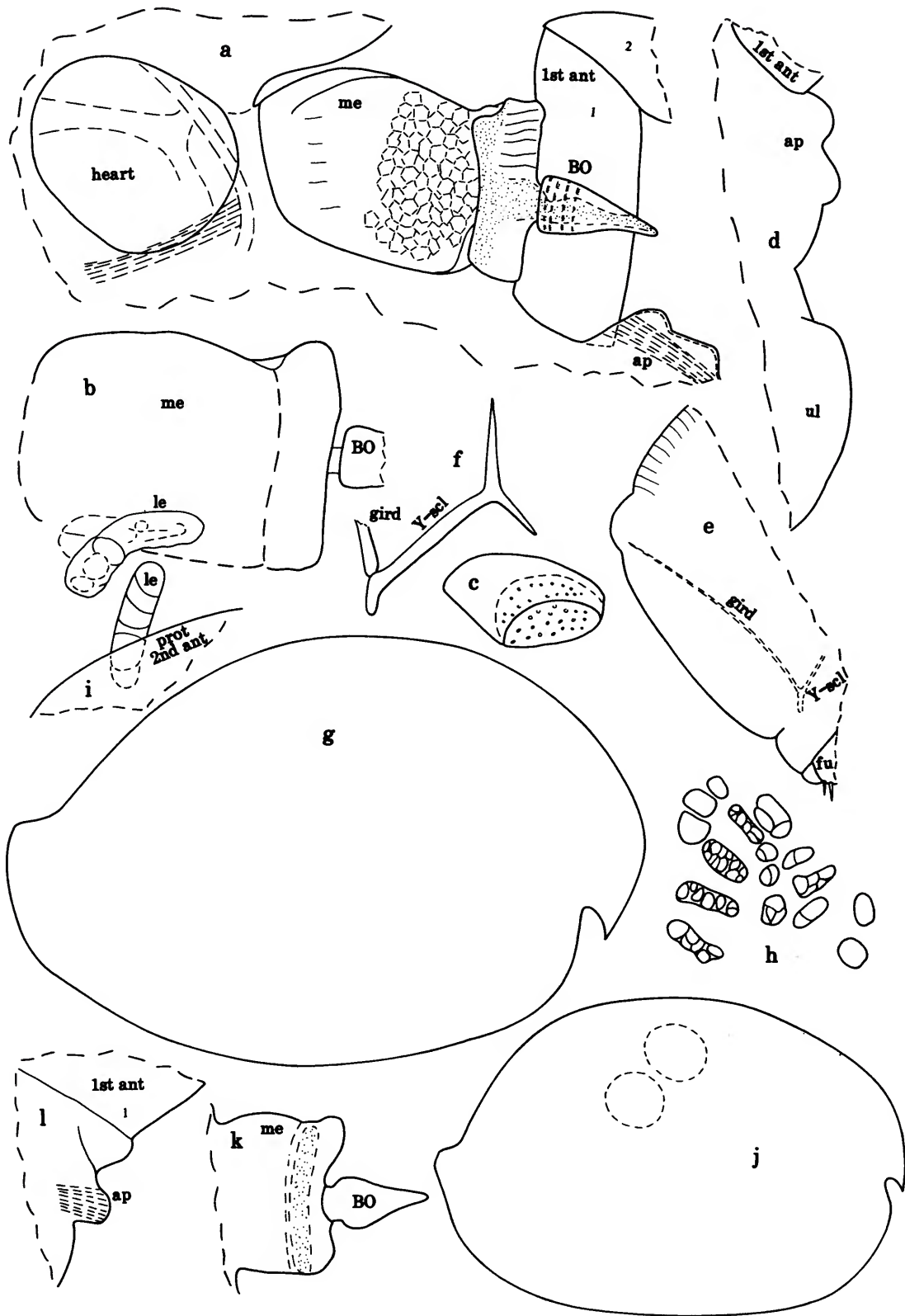
Maxilla: Coxale bristle missing on right limb of USNM 193832; bristle of left limb on small pedestal with small distal spine (Figure 3a). Endite I with 12 spinous bristles; endite II

with 7 spinous bristles; endite III with 7 spinous and pectinate bristles. Basale with long lateral spinous bristle near ventral margin and base of exopodite, and 1 short medial bristle on distal margin near ventral margin. Exopodite well developed with 3 bristles (proximal and outer terminal bristle with long spines; inner terminal bristle with short spines). 1st endopodial joint spinous, with 2 alpha-bristles with short spines, 3 beta bristles (outer 2 with stout spines, inner shorter with small spines), and undulate cutting tooth (Figure 3b). 2nd endopodial joint with 4 spinous a-bristles (only bases of a-bristles shown in Figure 3b), 3 pectinate b-bristles, 3 c-bristles (anterior small bare, outer 2 stout pectinate, Figure 3c), and 3 pectinate d-bristles (anterior 2 claw-like).

Fifth Limb: Protopodite with long slender anterior tooth (stippled in Figure 3d). Endite I with 5 spinous bristles; endite II with 5 spinous and pectinate bristles; endite III with 7 stout spinous and pectinate bristles and 1 small ringed anterior bristle (not all bristles shown in Figure 3d). 1st exopodial joint: main tooth with proximal triangular tooth followed by 6 cusped teeth (Figure 3e); 1 ringed bristle with long proximal spines proximal to triangular tooth; anterior side with 3 ringed bristles in row (outer pectinate distally) and 1 bristle (with long spines) near tooth of protopodite (Figure 3d). 2nd exopodial joint with 4 or 5 unringed pectinate (teeth stout) a-bristles, 3 ringed pectinate (teeth slender) b'-bristles, 4 ringed pectinate (teeth slender) b''-bristles, 1 posterior c-bristle with long proximal and short distal spines, and 1 anterior d-bristle with long proximal and short distal spines. 3rd exopodial joint hirsute (Figure 3f): inner lobe with 3 bristles (inner with long proximal and short distal hairs; 2 terminal longer with short spines); outer lobe with 2 bristles with long proximal and short distal hairs. 4th exopodial joint hirsute, with 8 bristles (with short spines) in 2 rows, each with 4 bristles (Figure 3f). 5th exopodial joint small, separated from 4th by well defined suture, hirsute, with 2 bristles with long proximal and short distal hairs (Figure 3f). (All bristles of joints 3-5 ringed (rings not shown).)

Sixth Limb (Figure 3g): With 5 bare epipodial bristles. Endite I with 4 spinous bristles (2 long terminal, 2 short medial); endite II with 7 spinous bristles (4 long terminal, 3 short medial); endite III with 7-9 long spinous terminal

FIGURE 4.—*Pseudodoloria plax*, new species, ovigerous female, paratype, USNM 193832: a, anterodorsal part of body from right side showing heart, medial eye, Bellonci organ, part of left 1st antenna, and anterior process; b, medial eye and right lateral eye, anterior to right; c, right genital organ, anterior to right; d, outline of anterior of body from right side, anterior to right; e, posterior of body from right side, anterior to right; f, right Y-sclerite, anterior to right. Adult female, paratype, USNM 193980: g, complete specimen from right side, length 5.6 mm; h, central adductor muscle attachments of left valve, anterior to left; i, right lateral eye and part of protopodite of right 2nd antenna. Ovigerous female, paratype, USNM 193860: j, complete specimen from right side showing 2 eggs in marsupium, length 6.8 mm; k, medial eye and Bellonci organ from right side, anterior to right; l, anterior of body showing anterior process, anterior to right.



bristles; endite IV with 12 spinous bristles. End joint with 38 spinous bristles (posterior 3 plumose). Endite IV and end joint hirsute.

Seventh Limb (Figure 3*h,i*): Each limb with 72 to 75 bristles (35–40 proximal (21–23 on peg side, 14–17 on comb side); 35–37 on terminal segment (17 on peg side, 18–20 on comb side)); each bristle with 1 to 8 bells. Comb: middle part with 12 elongate teeth with rounded tips; each side with 7 shorter teeth (14 total) with broad flat or very slightly rounded tips. Side opposite comb with slender elongate spinous peg (2 specimens examined, peg of 1 limb of USNM 193832 bare). Width of distal end of limb 1.14–1.63 times width of narrowest part.

Furca (Figure 3*j*): Each lamella with 11 claws; claw 4 slenderer than claw 5; claws with teeth forming medial and lateral row along posterior edge; distal medial teeth of claw 1 large, other teeth of claws fairly uniform; right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figure 4*a,h,k*): Separated from medial eye by narrow neck, then with broad base tapering to narrow tip; broad proximal part with 3 or 4 rows of indistinct minute spines.

Eyes: Lateral eye elongate, with amber-colored cells but without ommatidia (Figure 4*b,i*); stalk of eye intersects elongate eye near midlength forming T-like structure. Medial eye unusual, consisting of anterior and posterior parts: anterior (distal) part: narrow, rectangular in lateral view with straight distal margin with Bellonci organ at midheight (Figure 4*a,b,k*); posterior margin indicated by amber-colored band (stippled in Figure 4*a*); dorsal half with internal lineations perpendicular to anterior margin. Posterior (proximal) part: with area of light-amber pigment and with indistinct internal reticulations; posterior margin separated by narrow space from anterior margin of heart.

Upper Lip (Figure 3*k*): Long narrow unpaired with small glandular openings along distal margin (orientation shown in illustration); on each side proximal to posterior edge a short lobe with glandular openings directed anteroventrally; proximal paired lateral glandular fields with about 30 small glandular openings. (Figure 1*f* shows left lateral glandular field that adhered to coxale of left mandible when dissected.)

Genitalia (Figure 4*c*): Oval area on each side of body anterior to furca.

Anterior of Body (Figure 4*a,d,l*): With anterior process comprising 1 or 2 low rounded processes between medial eye and upper lip.

Posterior of Body (Figure 4*e*): Evenly rounded bare.

Y-Sclerite (Figure 4*f*): Typical of subfamily.

Number of Eggs: Slope 32: USNM 193832 with 21 eggs (single cluster) in marsupium (Figure 1*a*, not all eggs shown), length of typical egg 0.86 mm; unnumbered specimen, 25 well-developed eggs in marsupium (carapace length 5.8 mm). Slope 27: USNM 193860 with 32 eggs in marsupium (2 eggs shown in Figure 4*j*), length of typical egg 0.89 mm.

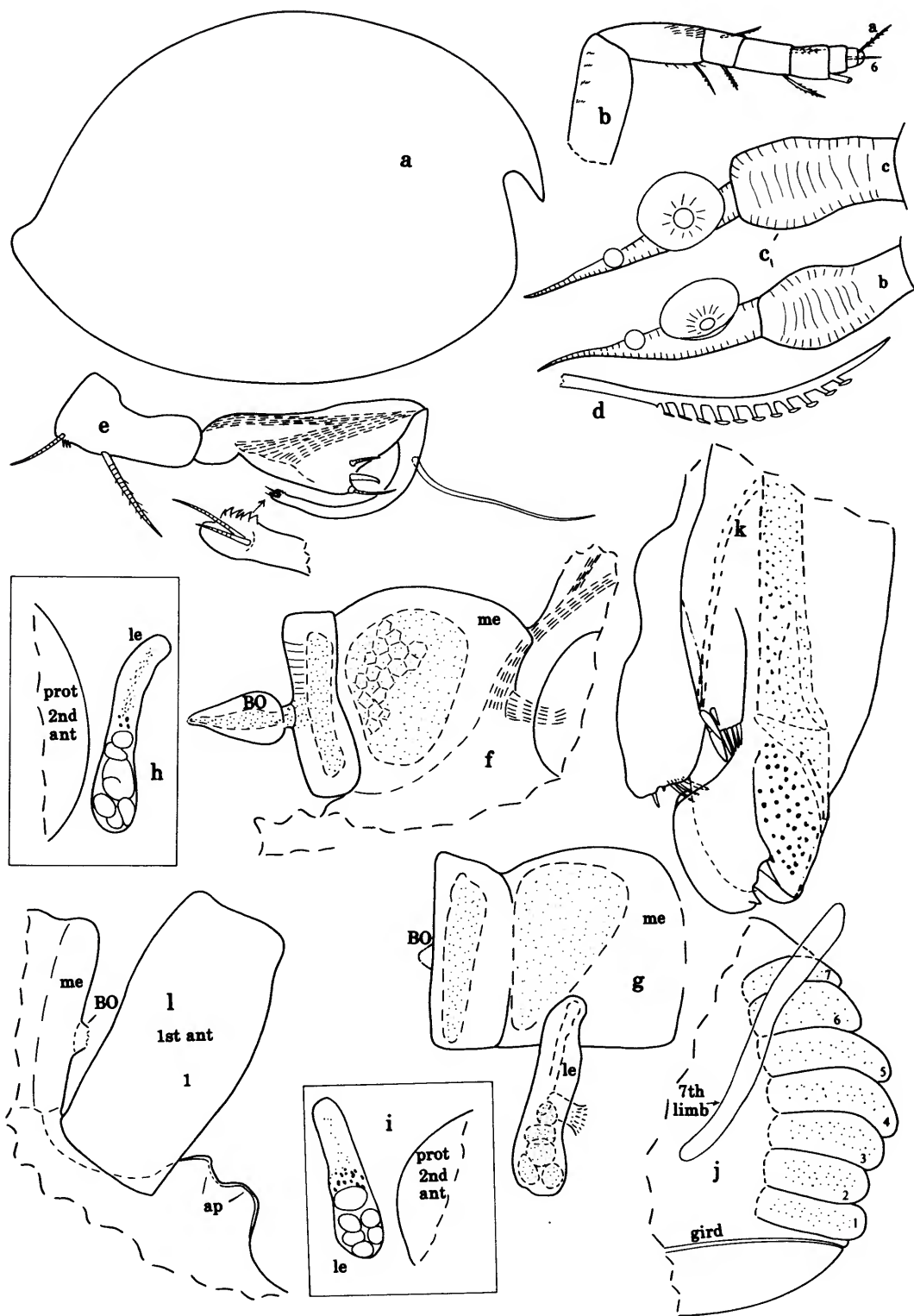
DESCRIPTION OF ADULT MALE (Figures 5, 110*d*).—Carapace shape similar to that of adult female but smaller (Figure 5*a*).

Carapace Size (length, height in mm): USNM 193833, 4.8, 3.5. Sta 32, 5 specimens: 4.9, 3.5; 4.4, 3.0; 4.5, 3.0; 4.3, 3.1; 4.7, 3.1. Range of lengths 4.3–4.9 mm.

First Antenna: 1st joint spinous. 2nd joint spinous with distal spinous ventral bristle (Figure 5*b*). 3rd joint with medial spines and 2 spinous bristles (1 ventral subterminal, 1 dorsal at midlength); 4th joint with 2 bristles (1 ventral subterminal, 1 dorsal terminal with base on medial side). Sensory bristle of 5th joint with 9 long proximal filaments (1 single followed by 3 paired and 2 single), 3 shorter distal filaments, and bifurcate tip. 6th joint with short spinous medial bristle similar to that of adult female. 7th joint: a-bristle spinous, longer than bristle of 6th joint; b-bristle about 3 times length of a-bristle with 4 filaments (proximal filament stout with bulbous proximal part followed by large sucker and small rounded peg and drawn-out pointed tip (Figure 5*c*); next 2 filaments slender each with 11 small suckers distal to minute triangular process (Figure 5*d*); next 2 filaments slender bare) and tip with terminal papilla; c-bristle about 3 times length of b-bristle with 8 filaments (proximal filament similar to that of b-bristle but with slightly larger sucker (sucker smaller than those in most other genera in subfamily) (Figure 5*c*); next filament slender with 10 small suckers distal to minute triangular process; next filament slender with 9 small suckers distal to indistinct triangular process; next 6 filaments narrow bare except for terminal papilla and bifurcate tip. 8th joint: d- and e-bristles about $\frac{2}{3}$ length of b-bristle, bare with blunt tips; f-bristle long with 10 filaments (some pectinate) and probably bifurcate tip (tips broken off on both limbs of USNM 193833); g-bristle long with 10 marginal filaments (some pectinate) and bifurcate tip; f- and g-bristles about same length as c-bristle.

Second Antenna: Protopodite and exopodite similar to those of adult female (exopodite with 4 bristles on 9th joint) (Figure 110*d*). Endopodite 3-jointed clasper (Figure 5*e*): 1st joint with 4 proximal bristles (1 long, 3 minute) and 1 longer spinous bristle near midlength; 2nd joint elongate, with proximal constriction, then broadening in distal $\frac{2}{3}$, with 3 bristles on distal edge of broad part (ringed proximal (dorsal) bristle on small pedestal, middle bristle unringed, claw-like with minute terminal spine or papilla (this bristle adjacent to

FIGURE 5.—*Pseudodoloria plax*, new species, adult male, paratype, USNM 193833: *a*, complete specimen from right side, length 4.8 mm; *b*, right 1st antenna, lv (not all bristles of joints 7 and 8 shown); *c*, proximal filaments of b- and c-bristles of left 1st antenna, mv; *d*, distal filament of b-bristle of left 1st antenna, mv; *e*, endopodite of right 2nd antenna, mv; *f*, medial eye and Bellonci organ from left side, anterior to left; *g*, medial eye and left lateral eye, anterior to left; *h*, *i*, left and right lateral eyes, each adjacent to part of protopodites of left and right 2nd antennae, respectively; *j*, posterior of body from left side (bristles and comb of 7th limb not shown); *k*, copulatory organ from right side, anterior to right; *l*, anterodorsal part of body from right side. (*c* and *d* drawn at same scale and 4 times scale of *b*.)



proximal bristle on left limb of USNM 193832 but not on illustrated right limb), distal bristle slender ringed); 3rd joint reflexed, with long proximal filament, 2 small terminal bristles, and tip with 6 ridges.

Mandible: Glandular field present on right limb of coxale of USNM 193833 similar to that on left limb of female described above (interpreted to be part of upper lip that adhered to mandible). Basale of right limb of USNM 193833 but not left limb with small c-bristle distal (not proximal as on adult female) to long c-bristle. Limb otherwise similar to that of adult female.

Maxilla: Endite bristles not counted but endites appearing similar to those of adult female. Basale, exopodite, and 1st endopodial joint similar to those of adult female. 2nd endopodite joint with only 2 c-bristles (small medial bristle present on adult female absent), otherwise joint similar to that of adult female. (Only right limb of USNM 193833 examined.)

Fifth Limb: Epipodite with 68 bristles. Endite bristles not counted. Tooth of protopodite, 1st, 3rd, and 5th exopodial joints similar to those of adult female. 2nd exopodial joint with 4 unringed a-bristles and 4 ringed b'-bristles, otherwise similar to that of adult female. 4th exopodial joint with 7 spinous bristles (3 bristles in posterior row, 4 along distal edge). (Only right limb of USNM 193833 examined.)

Sixth Limb: Not examined in detail but in general similar to that of adult female.

Seventh Limb (bristles not shown in Figure 5j): One limb examined, with 69 bristles (comb side with 16 proximal, 15 terminal; peg side with 20 proximal, 18 terminal). Comb with 12 elongate teeth with rounded tips and 14 short teeth with square tips (7 on each side of elongate teeth). Single elongate spinous peg similar to that of adult female. Width of distal part 1.10–1.34 times width of narrowest part.

Furca: Each lamella with 11 claws, all articulated; claw 4 slightly slenderer than 5th but longer; limb otherwise similar to that of adult female.

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

Eyes: Medial eye similar to that of adult female except pigment of posterior part slightly darker (Figure 5f,g). Lateral eye same type as on adult female but slightly longer (Figure 5g-i) (length of lateral eye of female equal to about $\frac{2}{3}$ height of medial eye; length of lateral eye of male equal to height of medial eye).

Upper Lip: Similar to that of adult female.

Genitalia (Figure 5k): Elongate with 3 lobes with terminal bristles and processes, on each side of body anterior to furca.

Anterior of Body (Figure 5l): Anterior process similar to that of adult female except upper process less rounded.

Posterior of Body (Figure 5j): With 7 lobate structures on each side; distal edge of lobe projects slightly past surface of body but segment then continues onto posterior of body and joins lobe on opposite side; long ventral and dorsal margins of each lobe slightly depressed but continuous with that of adjacent lobe, not free as are gills of the *Cylindroleberididae*.

Y-Sclerite: Similar to that of adult female.

Vargula Skogsberg, 1920

TYPE SPECIES.—*Cypridina* (*Vargula*) *norvegica* Baird, 1860.

COMPOSITION.—Thirteen species of *Vargula* are known from the vicinity of Australia, *V. puppis* Poulsen, 1962:186, *V. tubulata* Poulsen, 1962:198, *V. antarctica* (Müller, 1908) (Komicker (1975:155) questioned the identification; see "Remarks" following description below of *V. hex*), *V. dentata* Komicker, 1975:183, and nine new species described herein. Morphometrics and meristics for selected characters of females collected herein are presented in Table 3.

DISTRIBUTION.—This genus is widespread between latitudes of 80°N and 74°S and at depths of 0–3431 m (Komicker, 1984b:20).

REMARKS CONCERNING LATERAL EYES.—Poulsen (1962:189, 202) reported that *V. puppis* and *V. tubulata* have well-developed lateral eyes; both species were collected on the Australian shelf (0–200 m). All species of *Vargula* reported upon herein were collected either on the slope (200–2000 m) or upper abyssal zone (2000–2250 m). Four species from depths of 204–429 m have well-developed eyes with 13–15 ommatidia; 4 from depths of 500–1840 m have small eyes with 0–5 ommatidia; and 2 from depths of 429–2250 m are without eyes (Table 4). Eye size and depth are to some extent negatively correlated in *Myodocopa* (Komicker, 1992:4). The size of the eyes and their presence or absence are useful in separating species. Because most carapaces are translucent, pigmented eyes are usually visible without removing the body from the shell.

CORRECTION.—Komicker (1975, fig. 83) incorrectly plotted *V. stathme* in Bass Strait between Australia and Tasmania; it should have been in Cook Strait between North Island and South Island, New Zealand, as noted in the station list (1975:23).

TABLE 3.—Morphometrics and meristics for selected characters of females of species of *Vargula* from Australia (+ = present, - = absent).

Character	<i>Vargula</i>				
	<i>hex</i>	<i>fugax</i>	<i>stranx</i>	<i>trifax</i>	<i>matrix</i>
Carapace length (avg. mm)	2.71	3.5	2.28	5.13	2.98
Height as % of length (avg.)	63	63	66	68	70
Elongate caudal process (+, -)	-	+	-	+	-
List of caudal process with stout spines (+, -)	-	+	-	+	-
Bristles of rostral infold	22	27	72	29	13-25
Endop. 2nd ant., bristle of 2nd joint longer than 3rd joint (+, -)	+	+	-	+	+
Endop. 2nd ant., 3rd joint much shorter than 2nd (+, -)	+	+	-	+	+
Mandible, 3rd endop. joint, no. of claws/bristles	3/4	3/4*	3/4	3/4*	3/4
5th limb, no. pectinate cusps in main tooth	6	6	6	6	6
7th limb, number of bristles	19-26	29-30	11-13	46-47	22-25
7th limb, jaw opposite comb (+, -)	-	-	-	+	-
Furca, no. of claws	9	9	9	8-9	9
Furca, claws nonarticulated	2, 4	0	2, 4	2, 4, 5	2, 4
Lateral eye visible through shell (+, -)	+	-	+	+	-
Lateral eye large (l), small (s), absent (a)	s	s	s	l	s
Upper lip, tusks with proximal tooth (+, -)	-	+	-	+	-

Character	<i>Vargula</i>				
	<i>vix</i>	<i>psydrax</i>	<i>dentata</i>	<i>rapax</i>	<i>vertex</i>
Carapace length (avg. mm)	1.80	2.60	1.92	2.98	2.47
Height as % of length (avg.)	71	80	71	62	65
Elongate caudal process (+, -)	-	-	-	-	-
List of caudal process with stout spines (+, -)	-	-	-	-	-
Bristles of rostral infold	34-41	18	15-19	17-20	15
Endop. 2nd ant., bristle of 2nd joint longer than 3rd joint (+, -)	+	-	-	-	-
Endop. 2nd ant., 3rd joint much shorter than 2nd (+, -)	+	+	+	+	+
Mandible, 3rd endop. joint, no. of claws/bristles	4/2	3/4	3/4	3/4	3/4
5th limb, no. pectinate cusps in main tooth	4	6	5	6	6
7th limb, number of bristles	11	21-24	18-23	21	18-19
7th limb, jaw opposite comb (+, -)	-	-	-	-	-
Furca, no. of claws	9	8-9	8	9	9
Furca, claws nonarticulated	0	2, 4	2, 4	2, 4	0
Lateral eye visible through shell (+, -)	+	-	-	+	+
Lateral eye large (l), small (s), absent (a)	l	a	a	l	l
Upper lip, tusks with proximal tooth (+, -)	-	-	+	-	-

*Dorsal bristle could be interpreted as claw.

TABLE 4.—Distribution with depth of species of *Vargula* reported herein with large, small, and no lateral eyes (number of ommatidia and sex (F = female, M = male) in parenthesis).

Species	Depth range (m)	Median depth (m)
Large lateral eyes		
<i>V. trifax</i> (13; F, M)	204–429	316
<i>V. vertex</i> (15; F, M)	363	363
<i>V. vix</i> (13; F)	400	400
<i>V. rapax</i> (15; F)	400	400
Small lateral eyes		
<i>V. strax</i> (4 or 5; F)	600–720	660
<i>V. hex</i> (3 or 4; F, M)	500–1000	750
<i>V. fugax</i> (0; F, M)	996–1000	998
<i>V. matrix</i> (0; F, M)	1277–1840	1627
No lateral eyes		
<i>V. dentata</i> (F, M)	800–996 (Australia)	898
	429–1978 (elsewhere)	1203
<i>V. psydrax</i> (F, M)	429–2250	1340

Key to Species of *Vargula* in the Vicinity of SE Australia

(Adult females; excludes *V. antarctica*)

1. Claws 2, 4, and 5 of furca nonarticulated *V. trifax*, new species
 Claws 2 and 4 nonarticulated 2
 All furcal claws articulated 9
2. Carapace with elongate tubular caudal process; 7th limb with stout jaw opposite comb *V. tubulata*
 Carapace with nontubular caudal process; 7th limb with peg opposite comb . . . 3
3. Carapace with broad caudal process *V. puppis*
 Carapace with narrow caudal process 4
4. Carapace: height 78%–84% of length; anteroventral margin scalloped
 *V. psydrax*, new species
 Carapace: height less than 76% of length; anteroventral margin not scalloped . . 5
5. Lateral eye not visible through shell 6
 Lateral eye visible through shell 7
6. Carapace longer than 2.75 mm; tusks of upper lip without proximal tooth; main tooth of 5th limb with 6 pectinate teeth *V. matrix*, new species
 Carapace shorter than 2.45 mm; tusks of upper lip with proximal tooth; main tooth of 5th limb with 5 pectinate teeth *V. dentata*
7. Lateral eye large with 15 large ommatidia *V. rapax*, new species
 Lateral eye small with few ommatidia 8
8. Rostral infold with about 60 bristles; endopodite of 2nd antenna with 3rd joint about same length as 2nd; 7th limb with about 11 bristles . . . *V. strax*, new species
 Rostral infold with about 20 bristles; endopodite of 2nd antenna with 3rd joint shorter than 2nd; 7th limb with more than 18 bristles . . . *V. hex*, new species
9. Carapace longer than 3 mm and with elongate caudal process; lateral eyes minute *V. fugax*, new species
 Carapace shorter than 2.5 mm and without elongate caudal process; lateral eyes large 10
10. Carapace shorter than 2 mm, with broadly rounded posterodorsal margin; bristle of 2nd joint of endopodite of 2nd antenna longer than 3rd joint; main tooth of 5th limb with 4 pectinate teeth (always?) *V. vix*, new species
 Carapace longer than 2 mm, with sloping posterodorsal margin; bristle of 2nd joint of endopodite of 2nd antenna about 1/2 length of 3rd joint; main tooth of 5th limb with 6 pectinate teeth *V. vertex*, new species

Vargula hex, new species

FIGURES 6–10, 110k–m

ETYMOLOGY.—From the Greek *hex* (six).

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

TYPE LOCALITY.—Slope 32, 38°21.90'S, 149°20.00'E, Victoria, S of Point Hicks; depth 1000 m.

PARATYPES.—Slope 32: USNM 193835, ovigerous female on slide and in alcohol; 4 ovigerous females in alcohol; adult female with chionostomatid copepod in marsupium, in alcohol; adult nonovigerous female in alcohol; USNM 193850, adult male on slide and in alcohol. Slope 33, partly dissected ovigerous female in alcohol. Slope 47: ovigerous female on slide and in alcohol; USNM 194026, adult male on slide and in alcohol.

DISTRIBUTION.—Slope 32, 1000 m. Slope 33, 930 m. Slope 47, 500 m.

DESCRIPTION OF ADULT FEMALE (Figures 6, 7, 110k,l).—Caudal process projecting posteriorly either forming shallow concavity where joining posterior margin of valve just dorsal to process (Figure 6i), or evenly rounded (Figure 6a), both types may be present on opposing valves of same specimen (Figure 6l,n).

Infold: Rostral infold with 20 divided bristles (Figure 6j); 1 pair of unequal bristles near inner end of incisur; 3 or 4 minute bristles near lower edge of inner end of incisur. Infold extending from incisur to midlength of ventral margin with 45 to 50 double bristles; infold from midlength of ventral margin to anterior end of caudal process with 4 double bristles. List anterior to caudal process broad, with many pore canals along posterior edge of ventral $\frac{2}{3}$, about 25 of these projecting past posterior edge as minute processes, but edge appearing smooth at magnification of $\times 150$ ($\times 10$ objective, $\times 15$ ocular; Figure 6l–n, k), and 16–23 minute bristles (not all shown in Figure 6k) on medial surface near posterior edge.

Selvage: Outer margin of broad lamellar prolongation along ventral edge of incisur with minute spines; narrow anteroventral prolongation with minute crenulations (appearing like spines not extending past outer edge of selvage) along outer margin.

Central Adductor Muscle Attachments (Figure 6b): With about 19 ovoid attachments.

Carapace Size (length, height in mm): Slope 32: holotype, 2.84, 1.79. USNM 193835, 2.67, 1.69. Sta 32: 2.69, 1.70; 2.85, 1.73; 2.83, 1.79; 2.76, 1.73 (with parasite in marsupium). Slope 33: 2.65, 1.67. Slope 47: 2.40, 1.38. Length range 2.40–2.85 mm. Height 58%–63% of length.

First Antenna: 1st joint bare. 2nd joint with spines along ventral and dorsal margins and on medial and lateral surfaces. 3rd joint with short medial spines in 2 rows and 2 spinous bristles (1 ventral, 1 dorsal) (Figure 6o). 4th joint with 2 spinous bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 12 marginal filaments (some with a few proximal minute

spines) and bifurcate tip. Medial bristle of 6th joint spinous. 7th joint: a-bristle about $\frac{1}{3}$ longer than bristle of 6th joint, with short marginal spines; b-bristle about $\frac{1}{3}$ longer than a-bristle, with 4 or 5 short marginal filaments and few spines on stem following last filament and 2 minute terminal spines; c-bristle about 4 times length of a-bristle, with 9 or 10 marginal filaments (some with few teeth) and bifurcate tip. 8th joint: d- and e-bristles about twice length of b-bristle, shorter than c-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 9 marginal filaments (some with few minute spines) and bifurcate tip; g-bristle longer than f-bristle, about same length as c-bristle, with 10 or 11 marginal filaments (some with few minute spines) and with bifurcate tip.

Second Antenna: Protopodite with short medial bristle either bare or with short spines (Figure 110k,l). Endopodite 3-jointed (Figure 6p,q): 1st joint short with 4 bare proximal bristles (1 long, 3 short) and 1 long 1 spinous distal bristle; 2nd joint elongate with 1 bristle (with few indistinct short spines) reaching past distal end of 3rd joint; 3rd joint short with long terminal bristle. Exopodite: 1st joint with indistinct spines along dorsal edge; bristle of 2nd exopodial joint reaching distal end of 8th joint, with 7–9 ventral spines and slender dorsal spine at base of slender ringed terminal part; bristles of joints 3–8 long with natatory hairs, no spines; 9th joint with 3 long bristles with natatory hairs and 1 short dorsal bristle with few short spines; joints 3–8 with basal spines increasing in length on distal joints; basal spine of 8th joint reaching past distal end of 9th joint; lateral spine of 9th joint about $1\frac{1}{2}$ times length of 9th joint; joints 2–8 with short spines in row along distal edge; 2nd joint also with numerous minute indistinct ventral spines near midlength.

Mandible: Coxale endite spinous, with 2 stouter spines at tip; slender cylindrical process (about half length of stouter of 2 spines) with terminal nipple between terminal spines; minute bristle near base of endite. Basale: ventral margin with 2 a-bristles (longer bristle spinous), 1 short lateral b-bristle, 2 c-bristles (proximal small, distal long, both with indistinct short spines), and 2 d-bristles (proximal short with short spines, distal very long with long proximal and short distal spines); dorsal margin with 1 bristle distal to midlength and 2 terminal bristles with short spines; medial surface with numerous rows of spines. Exopodite hirsute, reaching just past distal end of dorsal margin of 1st endopodial joint, with 2 subterminal bristles (proximal bristle about twice length of distal bristle, both with short spines). 1st endopodial joint with few indistinct minute terminal spines on dorsal margin, and 4 ventral bristles (1 minute, 1 short, and 1 long, all with short spines, 1 long with long proximal and short distal spines). 2nd endopodial joint: ventral margin with spines and 4 distal bristles (2 single ringed then 2 subterminal paired (lateral ringed, medial unringed sclerotized, about twice width of lateral bristle but slightly shorter)) (Figure 6c,r); USNM 193835: dorsal margin with 11 to 14 short spinous cleaning bristles (1 with stout spines), 5 long spinous bristles (none reach 3rd joint), and 2 medium

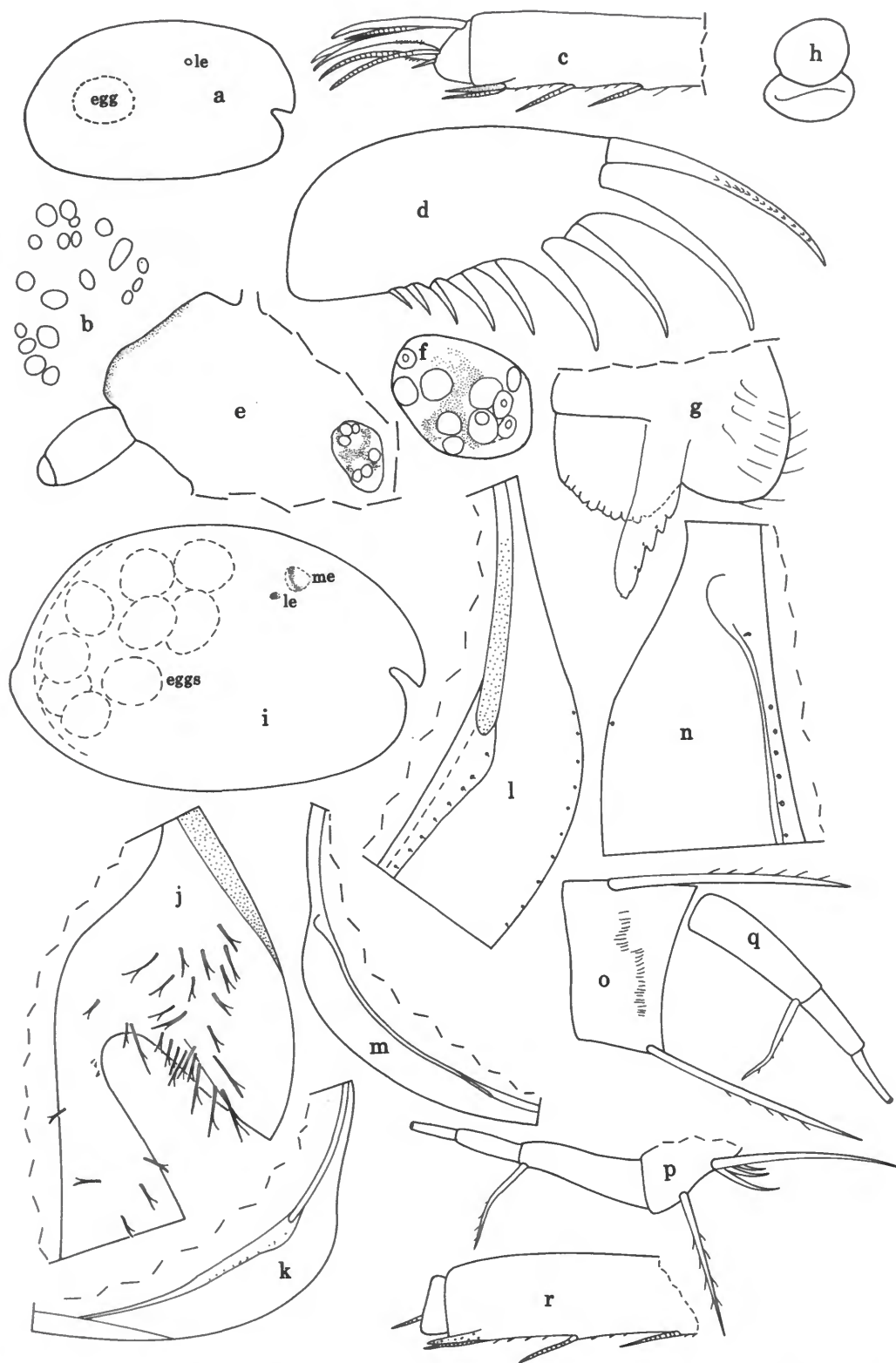


FIGURE 6.—*Vargula hex*, new species, ovigerous female, paratype: a, complete specimen from right side showing 1 egg and right lateral eye, length 2.40 mm; b, central adductor muscle attachments of right valve, anterior to right (body removed from carapace); c, distal endopodite of right mandible, mv; d, right lamella of furca, lv; e, left lateral eye, medial eye and Bellonci organ, anterior to left; f, right lateral eye; g, upper lip, anterior to left; h, right genital organ with attached spermatophore. Ovigerous female, paratype, USNM 193835; i,

complete specimen from right side showing medial eye, lateral eye, and eggs within marsupium, length 2.67 mm; j, anterior of left valve, lv; k, l, posterior of right valve, lv; m, n, posterior of left valve, lv; o, 3rd joint of left 1st antenna, mv; p, endopodite of left 2nd antenna, mv; q, joints 2 and 3 of endopodite of right 2nd antenna, mv; r, distal endopodite of right mandible, mv (only short bristle shown on 3rd joint).

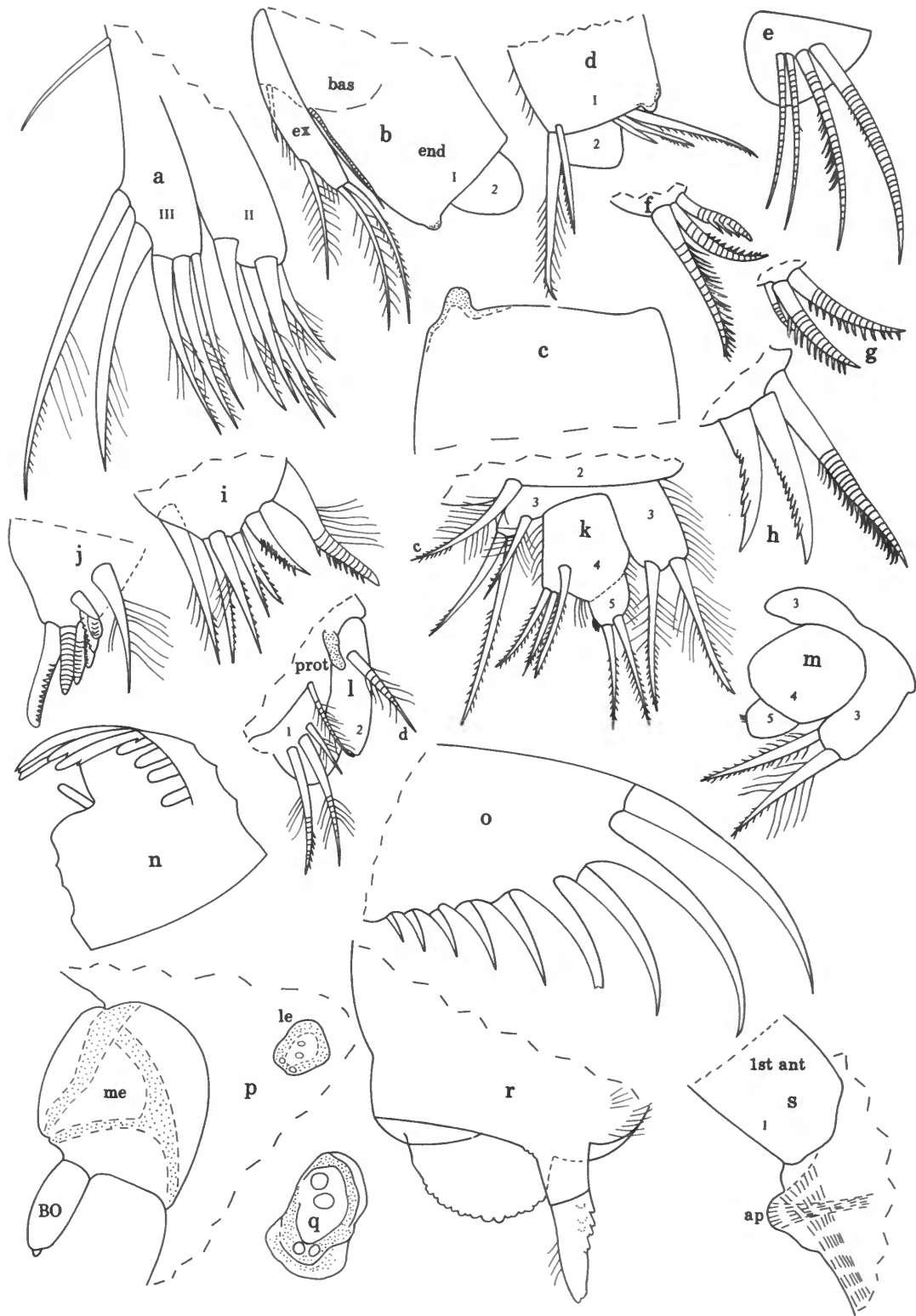


FIGURE 7.—*Vargula hex*, new species, ovigerous female, paratype, USNM 193835: *a*, endites II and III of left maxilla, lv; *b*, part of right maxilla, lv; *c*, cutting tooth of 1st endopodial joint of left maxilla, lv; *d*, alpha- and beta-bristles of left maxilla, lv; *e-h*, α -, β -, γ -, and δ -bristles respectively of left maxilla, lv; *i*, endite III of right 5th limb, pv; *j*, 1st exopodial joint of right 5th

limb, pv; *k*, exopodial joints 2 (part) and 3-5 of right 5th limb, pv; *l,m*, parts of left 5th limb, av; *n*, tip of 7th limb; *o*, right lamella of furca, lv; *p*, left lateral eye, medial eye and Bellonci organ, anterior to left; *q*, right lateral eye; *r*, distal upper lip, anterior to left; *s*, anterior process, anterior to left.

spinous bristles; 3rd endopodial joint with 3 short claws with proximal ventral teeth and 4 bristles (ventral bristle minute, remaining bristles about same length as claws (lateral bristle near ventral end of joint with basal part slightly broader than basal parts of other bristles; tip of dorsal bristle pointed)). Correction: lateral bristle of subterminal pair on ventral margin of 2nd endopodial joint also ringed on *V. ascensus* (bristle incorrectly called medial bristle in Kornicker (1979:18) but correct in his illustration (1979, fig. 6g)).

Maxilla: Dorsal margin of coxale with plumose dorsal bristle. Endite I broad with 10 or 11 spinous bristles; endite II narrow with 5 spinous bristles (Figure 7a); endite III narrow with 5 terminal bristles (4 with long spines) and 1 short proximal bare bristle (this bristle could be on basale) (Figure 7a). Basale with 1 long and 1 short bristle on distal ventral corner. Exopodite hirsute, with 1 plumose proximal bristle and 2 terminal bristles (bristle closest to proximal bristle plumose, other with short spines) (Figure 7b). 1st endopodial joint spinous with 2 alpha- and 3 beta-bristles (outer with slender teeth, middle with short spines, inner bare) (Figure 7d) and large squarish cutting tooth (Figure 7c). 2nd endopodial joint with 4 a-bristles (anterior bare, next with few minute spines, next with stout anterior spines, posterior with small anterior spines) (Figure 7e), 3 pectinate b-bristles (Figure 7f), 3 c-bristles (Figure 7g), and 3 pectinate d-bristles (2 unringed, claw-like) (Figure 7h).

Fifth Limb: Endite I with 6 spinous bristles; endite II with 5 spinous bristles (endite II fragmented on USNM 193835); endite III with 7 spinous and pectinate bristles (Figure 7i). Protopodite with long slender tooth (Figure 7l). Main tooth with triangular tooth (with few minute spines (not shown)) and 6 pectinate teeth (Figure 7j); stout bristle with long proximal spines proximal to smooth tooth. Anterior side of 1st exopodial joint with 3 bristles in row and 1 bristle between them and tooth of protopodite (Figure 7l). 2nd exopodial joint with 4 unringed pectinate a-bristles, 4 ringed pectinate b'-bristles, and 4 ringed pectinate b''-bristles, posterior c-bristle and anterior d-bristle (Figure 7k,l). Inner lobe of 3rd exopodial joint with 1 proximal bristle (with long proximal and short distal spines) and 2 longer terminal bristles with small spines (Figure 7k); outer lobe of 3rd joint with 2 bristles (inner bristle with only short spines (holotype) or long proximal and short distal spines (USNM 193835), outer bristle with long proximal and short distal spines (Figure 7k,m). 4th exopodial joint separated from 5th exopodial by suture better defined on anterior side than on posterior side, with 3 or 4 bristles with short spines (Figure 7k,m). 5th exopodial joint with 2 terminal bristles with short spines, and either with cluster of spines or a small process with spines on inner edge. 4th and 5th exopodial joints and outer lobe of 3rd exopodial joint hirsute.

Sixth Limb: With 4-6 epipodial bristles. Endite I with 3 spinous bristles (2 short medial, 1 long terminal); endite II with 5 spinous bristles (3 short medial, 2 long terminal; endite III with 4 bristles (1 medial, 3 terminal (shortest in middle));

endite IV with 3 or 4 bristles (1 medial, 2 or 3 terminal). End joint with 11-13 bristles (8-10 bristles with long proximal and short distal spines followed by space then stout bristle with long proximal and short distal spines and 2 stout plumose bristles). Medial surfaces of endites III and IV and end joint hirsute; lateral surface of end joint with stiff spines along ventral margin except near bases of 2 plumose bristles.

Seventh Limb: USNM 193835: limb with 26 bristles: distal group with 7 bristles on comb side and 6 on peg side. Proximal group with 6 bristles on comb side and 7 on peg side. Bristles with up to 5 bells. Comb with 15 teeth (7 long recurved alate midteeth, and 8 short truncate lateral teeth, 4 on each side) (not all teeth shown in Figure 7n). Single peg opposite comb. Nontype: each limb with 19-21 bristles: distal group with 4 to 6 bristles on comb side and 5 on peg side; proximal group with 4 or 5 bristles on comb side and 5 or 6 on peg side; bristles with 1-5 bells. Comb with 14 teeth (6 long recurved alate teeth and 8 short truncate teeth, 4 on each side). Single peg with minute terminal spines opposite comb. Limb not distally expanded.

Furca (Figure 7o): Each lamella with 9 claws; claws 2 and 4 nonarticulated; claw 3 slightly narrower than claw 4 at base; all claws with teeth along posterior edge (not shown); claw 1 also with row of medial teeth; right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figures 6e, 7p): Elongate (width 43%-52% of length) with small process at tip. Nontype: width about 59% of length.

Eyes: Medial eye with reddish brown pigment (Figures 6e, 7p). Lateral eye small, with reddish brown pigment around periphery, with 3 or 4 distinct amber-colored cells (Figure 7p,q) and also several unpigmented larger indistinct spheres (6e,f); eye visible through shell (Figure 6a,i).

Upper Lip (Figures 6g, 7r): Anterior unpaired part with fairly large glandular processes along distal margin. Each tusk with 4 step-like glandular processes along posterior edge, 3 medial processes near dorsal edge (Figure 7r), and 2 terminal; anterior edge of tusks with few long distal hairs (Figure 7r). Rounded lobe posterior to tusks hirsute.

Genitalia (Figure 6h): Small oval with attached spermatophore on each side of body anterior to furca.

Anterior of Body (Figure 7s): With rounded anterior process between medial eye and upper lip.

Posterior of Body: Evenly rounded, bare.

Y-Sclerite: With ventral branch typical for genus.

Number of Eggs: Slope 32: USNM 193835 with 15 eggs in marsupium; length of typical egg 0.54 mm. Holotype with 15 eggs in marsupium. Unnumbered specimen with about 19 eggs (counted through shell); length of 1 egg 0.40 mm. Slope 33: unnumbered specimen with 10 eggs in marsupium; length of typical egg 0.52 mm. Nontype, Slope 47: unnumbered specimen with 13 eggs in marsupium; length of 2 well-developed eggs, 0.46 mm, 0.48 mm.

Parasites: 1 adult nonovigerous female (length 2.76 mm, height 1.73 mm) from Slope 32 with female chonistomatid

copepod in marsupium.

DESCRIPTION OF ADULT MALE (Figures 8–10, 110m).—Carapace similar to that of adult female but smaller (Figures 8a, 10a).

Infold: Rostral infold with about 20 bristles, mostly divided (Figure 8b); usual pair of unequal bristles present just dorsal to inner end of incisur; 3 minute bristles just posterior to inner end of incisur. Infold extending from incisur to midlength of ventral margin with about 48 divided bristles, mostly along narrow list; infold from midlength of ventral margin to anterior end of caudal process with 4 bristles, all except last along narrow list. Broad list anterior to caudal process of left valve with row of 14 minute bristles at midwidth, and about 80 minute pore canals near posterior edge of ventral $\frac{2}{3}$, some project slightly past posterior edge on minute processes, but posterior edge of list generally smooth (dorsal part of list shown in Figure 8c). Broad list anterior to caudal process of right valve of USNM 194026 with about same number of bristles as left valve but very indistinct, and about 47 minute processes (each with pore) along posterior edge, many projecting slightly past edge creating less smooth margin than on left valve (possibly, visibility of unevenness affected by orientation of list) (only 25 pores and processes shown in Figure 8d). (Counts of bristles, pores and processes were made using a compound microscope ($\times 15$ ocular, $\times 40$ objective) on separated valves in glycerine in a depression slide and under a cover slip.)

Selvae: Proximal ridge of selvae along ventral edge of incisur with beaded row (Figure 8b). Anterior and anteroventral edge of rostrum with narrow lamellar prolongation with smooth outer margin; prolongation absent along dorsal edge of incisur; prolongation along ventral edge of incisur broad, striated, with minute spines along outer margin; prolongation along anteroventral and anterior $\frac{1}{4}$ of ventral edge of valve narrow, with closely spaced striations, and with minute serrations along outer margin; prolongation broad along posterior $\frac{3}{4}$ of ventral edge of valve and with smooth outer margin; selvae absent along edge of caudal process and posterior edge of valve dorsal to caudal process; selvae of ventral edge of right valve set well back from valve edge at ventral end of caudal process (Figure 8d). (Lamellar prolongation not shown.)

Carapace Size (length, height in mm): Slope 32: USNM 193850, 2.34, 1.61, height 69% of length. Slope 47: USNM 194026, 2.17, 1.37, height 63% of length.

First Antenna (Figures 8e,f, 10b,c): Joints 1–4 and 6 similar to those of adult female (Figures 8e, 10b). Sensory bristle of 5th joint with 11 or 12 long filaments (some with spines) and bifurcate tip. 7th joint: a-bristle similar to that of adult female; b-bristle about 3 times length of a-bristle, with 3 filaments (short stout proximal filament with bulbous base, large sucker and small triangular process; then 1 slender filament with minute spine and 4 or 5 small suckers, followed by 1 slender distal filament with minute spine and 4 or 5 small

suckers) (Figure 10c); c-bristle about twice length of b-bristle, with 9 filaments (stout proximal filament similar to proximal filament of b-bristle but with larger sucker with minutely serrate edge, then slender filament with spine and 4 small suckers, followed by slender filament (with spines) adjacent to longer slender filament with spine and 4 small suckers, followed by 5 slender filaments (some with spines)) and bifurcate tip. 8th joint: d- and e-bristles slightly shorter than b-bristle, bare with blunt tips (Figure 10c); f-bristle almost twice length of b-bristle, angled dorsally, with 8 short marginal filaments (some with spines) and bifurcate tip; g-bristle about $\frac{1}{4}$ longer than f-bristle, with 9 short marginal filaments (some with spines) and bifurcate tip.

Second Antenna (Figures 8g, 10d, 110m): Bristle of 2nd exopodial joint with 8–13 (8 on USNM 194026, 11–13 on USNM 193850) stout ventral spines and no dorsal spines. Limb otherwise similar to that of adult female.

Mandible (Figures 8h,i, 10e, f): Similar to that of adult female except in having stouter unringed sclerotized medial bristle in terminal pair on ventral margin of 2nd endopodial joint (Figures 8i, 10f).

Maxilla (Figure 9a–c): Endite I of specimen examined with 11 spinous bristles on 1 limb and 9 on other. Limb otherwise similar to that of adult female.

Fifth Limb (Figures 9d–f, 10g): Epipodite with 55 bristles. Endite I with 6 spinous bristles; endite II with 1 minute anterior bristle and 5 spinous terminal bristles; endite III with 7 spinous and pectinate bristles (Figure 9d). Limb otherwise similar to that of adult female.

Sixth Limb (Figure 9g): With 4 or 5 epipodial bristles, and 7–9 bristles in anterior group of end joint. Limb otherwise similar to that of adult female.

Seventh Limb: USNM 193850: 1 limb with 23 bristles (distal group with 6 bristles on comb side and 5 on peg side; proximal group with 6 bristles on comb side and 6 on peg side). Other limb with 21 bristles (distal group with 7 bristles on comb side and 5 on peg side; proximal group with 4 bristles on comb side and 5 on peg side). Bristles with 1–5 bells. Comb with 8 short truncate teeth, 4 on each side of about 6 long recurved alate teeth (with small triangular tooth between bases). Single peg opposite comb. USNM 194026 (Figure 9h): each limb with 19 or 20 bristles; distal group with 5 or 6 bristles on comb side and 5 on peg side; proximal group with 4 bristles on comb side and 5 on peg side. Bristles with 1–5 bells. Comb with 12 teeth (6 long recurved alate midteeth, and 6 short truncate lateral teeth, 3 on each side). Single peg with minute terminal spines opposite comb.

Furca (Figures 9i, 10h): 3rd claw about same width or very slightly narrower than claw 4. Furca otherwise similar to that of adult female.

Bellonci Organ: USNM 193850: width 43% of length (Figure 10i). USNM 194026: width about 75% of length (Figure 9j).

Eyes: Medial eye similar to that of adult female (Figures



FIGURE 8.—*Vargula hex*, new species, adult male, paratype, USNM 194026: *a*, complete specimen from left side showing locations of left lateral eye and central adductor muscle attachments, length 2.17 mm; *b,c*, anterior and posterior of left valve, iv; *d*, posterior of right valve, iv; *e*, part of left 1st antenna, iv; *f*, part of right 1st antenna, mv; *g*, protopodite and endopodite of right 2nd antenna, mv; *h*, part of right mandible (long d-bristle broken), mv; *i*, distal part of left mandible, mv.



FIGURE 9.—*Vargula hex*, new species, adult male, paratype, USNM 194026: *a*, endites of left maxilla, mv; *b*, part of right maxilla, lv; *c*, 2nd endopodial joint of right maxilla, lv (a-bristles not shown); *d*, endite III of right 5th limb, pv; *e*, part of left 5th limb, av; *f*, distal part of right 5th limb, pv; *g*, right 6th limb, mv; *h*, 7th limb; *i*, left lamella of furca; *j*, right lateral eye, medial eye and Bellonci organ, anterior to right; *k*, at left, left lateral eye (not under cover slip) and at right, right lateral eye (under cover slip); *l*, upper lip, anterior to left; *m*, posterior of body from right side, anterior to right.



FIGURE 10.—*Vargula hex*, new species, adult male, paratype, USNM 193850: *a*, complete specimen from right side showing locations of medial eye, right lateral eye and central adductor muscle attachments, length 2.34 mm; *b*, 3rd joint of right 1st antenna, mv; *c*, distal part of right 1st antenna, mv (not all bristles shown); *d*, protopodite and endopodite of right 2nd antenna, mv; *e*, part of basale of left mandible, mv; *f*, distal endopodite of left mandible, mv; *g*, exopodial joints 2 (part) and 3-5 of right 5th limb, pv; *h*, right lamella of furca, lv; *i*, right lateral eye, medial eye and Bellonci organ, anterior to right; *j*, upper lip, anterior to right; *k*, part of right lamella of furca and right copulatory organ, anterior to right; *l*, tip of left copulatory organ, anterior to left; *m*, anterior process, anterior to right; *n*, posterior of body, anterior to right.

9j, 10i). Lateral eye small, with reddish brown pigment, several small amber-colored cells, and about 4 indistinct unpigmented spheres (Figures 9j,k, 10i).

Upper Lip (Figures 9l, 10j) and *Anterior of body* (Figures 9l, 10m): Similar to those of adult female.

Genitalia (Figure 10k,l): Well-developed lobes on each side of body.

Posterior of Body: Posterodorsal margin slightly more undulate than that of adult female (Figures 9m, 10n). USNM 194026 with 5 weakly defined segments dorsal to girdle (Figure 9m).

VARIABILITY.—The male and female from Slope 47 are shorter and more elongate than those from Slopes 32 and 33. The posterior end of valves either has a caudal process with a slight concavity at its dorsal end, or is without a concavity. In some specimens a concavity is present on one valve but not on the other. The 3rd joint relative to the 2nd joint of the endopodite of the 2nd antenna is slightly longer on the specimens from Slope 47 than those from Slopes 32 and 33. The outer lobe of the 3rd exopodial joint of the 5th limb has an inner bristle with long proximal and short distal spines on USNM 193835, but has only short spines on other specimens examined (4 including holotype). The fused 4th and 5th exopodial joints of the 5th limb have a cluster of spines on the inner edge on USNM 193835, whereas the holotype has a cluster of spines on one limb and a small process bearing spines on the other, and the remaining specimens examined (3) have a spinous process on both limbs. The Bellonci organ in the adult male from Slope 47 is shorter than that of the female from that station as well as the females (3) and male from Slopes 32 and 33.

COMPARISONS.—*Vargula hex* is morphologically close to *V. ascensus* and *V. antarctica*. It differs from both species in having the bristle of the 2nd endopodial joint of the 2nd antenna longer than the 3rd joint; the bristle is shorter than the 3rd joint in *V. ascensus* and either shorter or the same length in *V. antarctica*. The carapace of *V. hex* (female length 2.40–2.85 mm) is much smaller than that of *V. antarctica* (female length 3.42–3.9 mm (excluding Poulsen's specimen from Australia discussed below)). Skogsberg (1920:268) reported that the main tooth of the 1st exopodial joint of the male 5th limb (1 limb examined) of *V. antarctica* bears 8 teeth. The main tooth of *V. hex* bears only 7 teeth, but I think it probable that most specimens of *V. antarctica* also have 7 teeth, which is the usual number possessed by members of the genus (Kornicker, 1991, table 2). The posterior edge of the upper lip of *V. hex* is more step-like than that of *V. antarctica* (Müller, 1908, pl. 4:13; Kornicker, 1979, fig. 8b,c).

Poulsen (1962:181) referred 2 specimens (1 adult female, 1 juvenile) collected at a depth of 70–100 m off the SE coast of Australia to *V. antarctica*, an identification that was questioned by Kornicker (1975:135). The adult female is only 3.0 mm long, smaller than specimens of *V. antarctica* from elsewhere (3.4–3.9 mm). Poulsen's female is slightly larger than females

of *V. hex* reported here (length 2.40–2.85 mm). Because of the difference in length as well as the quite different depths at which they were collected I have not referred Poulsen's specimens to *V. hex* herein, but they could be conspecific.

Vargula fugax, new species

FIGURES 11–13, 110n

ETYMOLOGY.—From the Latin *fugax* (fleet, swift).

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

TYPE LOCALITY.—Slope 32, 38°21.90'S, 149°20.00'E, Victoria, S of Point Hicks; depth 1000 m.

PARATYPES.—Slope 53: adult male with cryptoniscid isopods, on slide and in alcohol; 3 undissected specimens in alcohol (1 adult male, 2 juveniles).

DISTRIBUTION.—Slope 32, 1000 m. Slope 53, 996 m.

DESCRIPTION OF ADULT FEMALE (Figures 11, 12, 110n).—Carapace with small incisor and narrow projecting caudal process near midheight (Figure 11a); ventral edge of incisor with minute triangular projection past valve edge (Figure 11f). Surface of carapace with widely spaced pits (Figure 11b,c).

Infold: Rostral infold with 23 bristles (mostly divided) forming row parallel to anterior and ventral edges of valve, 2 bristles near edge close to inner end of incisor, and 1 long divided bristle at midheight. 2 small bristles proximal to inner end of incisor (Figure 11f). Infold extending from incisor to about midlength of ventral margin with 40 bristles. List anterior to caudal process broad with broad flange with row of about 25 stout triangular spines (some bare, others with slender marginal spine) along posterior edge, 3 or 4 small spines at ventral end (Figure 11e,h), and about 15 minute triangular processes beneath flange (each of 13 processes shown as dots in Figure 11e, not shown in Figure 11h).

Selvage: Broad lamellar prolongation along anterior margin of rostrum and ventral edge of incisor, absent along dorsal margin of incisor (lamellar prolongation stippled in Figure 11g). Narrow lamellar prolongation along ventral margin of valve; selvage absent along posterior edge of caudal process. Lamellar prolongation along ventral edge of incisor and along ventral margin of valve with minute spines along distal edge (not shown).

Central Adductor Muscle Attachments: Central cluster with about 11 elongate and oval attachments (Figure 11d).

Carapace Size (length, height in mm): Holotype, 3.5, 2.2, height 63% of length.

First Antenna: 1st joint bare. 2nd joint spinous. 3rd joint with dorsal spines and 2 spinous bristles (1 dorsal at about $\frac{1}{3}$ joint length, 1 ventral, subterminal); length of ventral margin about $\frac{3}{4}$ that of dorsal margin. 4th joint with dorsal spines and 2 spinous bristles (1 dorsal, 1 ventral). 5th joint with dorsal spines at midlength; sensory bristle with 10 filaments (8 stout proximal, 2 slender distal) and bifurcate tip. Medial bristle of

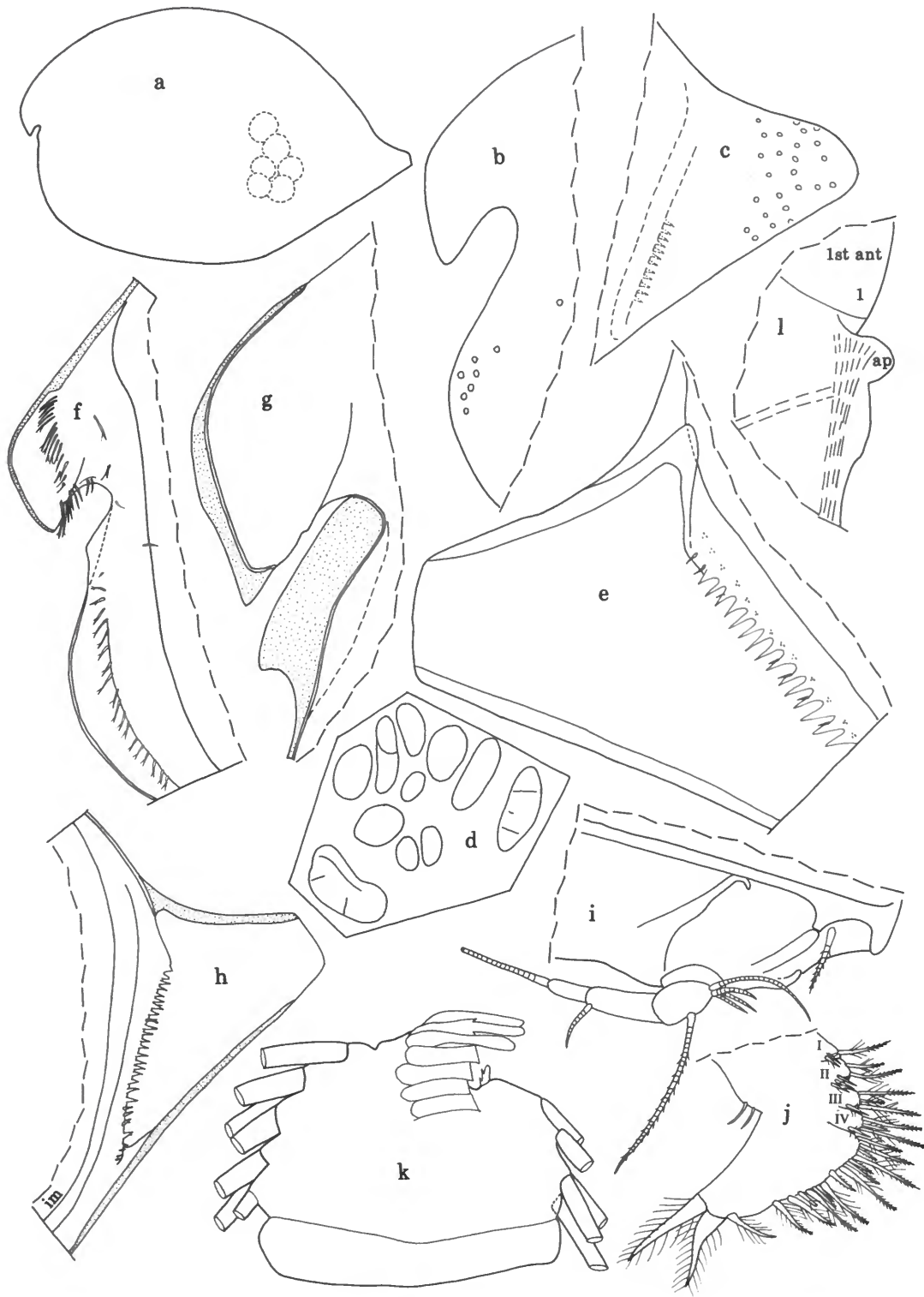


FIGURE 11.—*Vargula fugax*, new species, adult female, holotype: *a*, complete specimen from left side showing unextruded eggs, length 3.5 mm; *b, c*, anterior and posterior of left valve showing representative pits, *ov*; *d*, central adductor muscle attachments, right valve, anterior to right, *ov*; *e*, caudal process, left valve, *iv*; *f*, anterior, right valve, *iv*; *g*, anterior, right valve, *iv* (lamellar prolongation of selvage stippled); *h*, caudal process, right valve, *iv*; *i*, distal protopodite and endopodite of left 2nd antenna, *mv*; *j*, left 6th limb, *mv*; *k*, tip of 7th limb; *l*, anterior process.

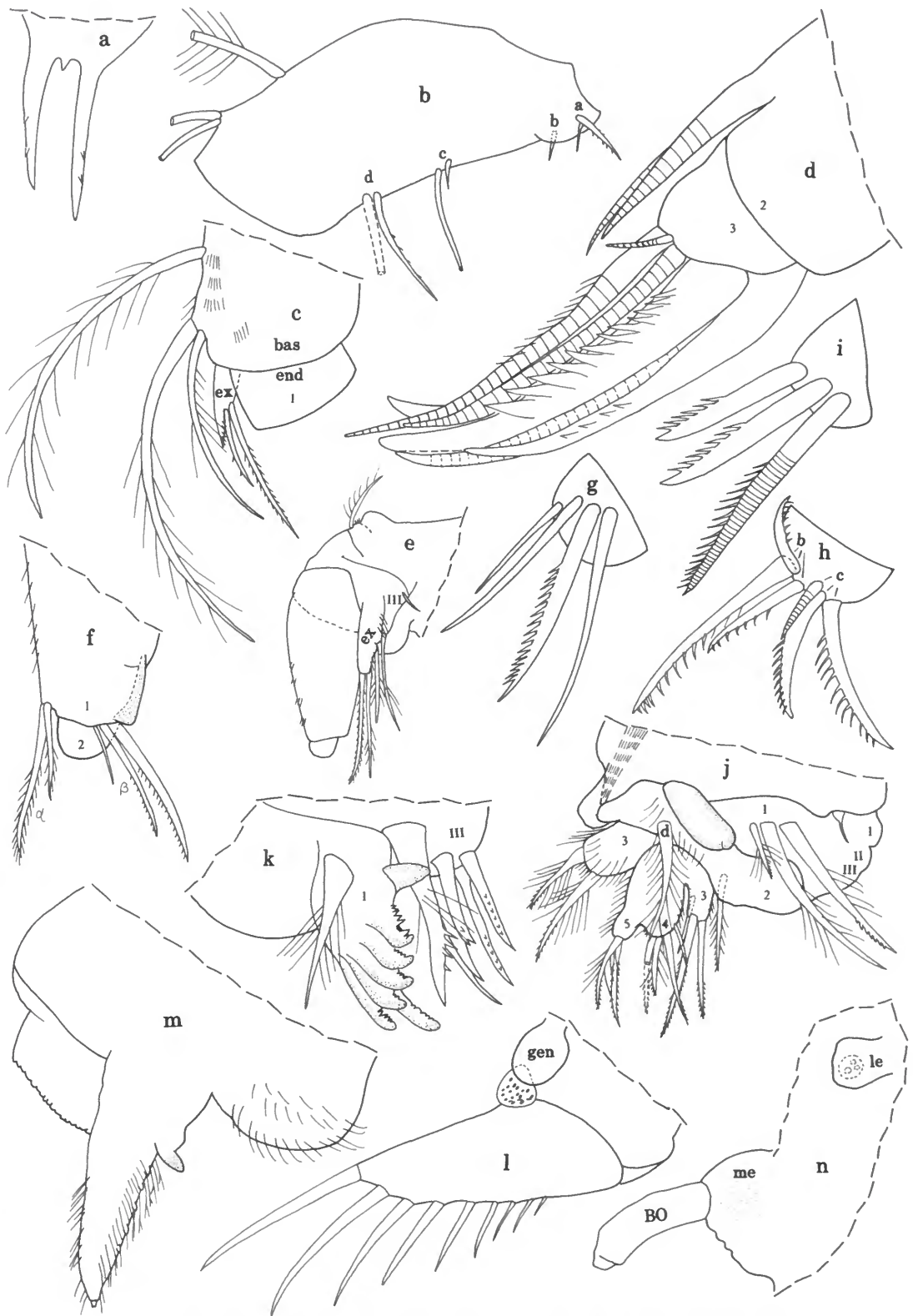


FIGURE 12.—*Vargula fugax*, new species, adult female, holotype: *a*, tip of coxale endite of right mandible; *b*, basale of right mandible, mv; *c*, part of right mandible, mv; *d*, tip of endopodite of left mandible, mv; *e*, left maxilla, lv (not all bristles shown); *f*, tip of left maxilla, lv (bristles of 2nd endopodial joint not shown); *g*, a-bristles of left maxilla, lv; *h*, b- and c-bristles of right maxilla, mv; *i*, d-bristles of left maxilla, lv; *j*, part of right 5th limb, pv; *k*, part of left 5th limb, pv; *l*, left lamella of furca and left genital organ with attached spermatophore; *m*, upper lip, anterior to left; *n*, left lateral eye, medial eye and Bellonci organ, anterior to left.

6th joint short spinous, with base near dorsal margin. 7th joint: a-bristle spinous, about $\frac{1}{3}$ longer than bristle of 6th joint; b-bristle about $2\frac{1}{2}$ times length of a-bristle, with 5 short marginal filaments, some with spines; c-bristle about 3 times length of b-bristle, with about 9 short marginal filaments (some with spines) and bifurcate tip. 8th joint: d- and e-bristles about same length as b-bristle, bare with blunt tips; f- and g-bristles similar to c-bristle (f-bristle slightly shorter).

Second Antenna: Protopodite with short spinous medial bristle (Figures 11i, 110n). Endopodite 3-jointed (Figure 11i): 1st joint with 4 proximal bristles (1 long, 3 short) and 1 long spinous distal bristle; 2nd joint elongate with 1 short terminal bristle; 3rd joint with long terminal filament about twice length of stem. Exopodite: bristle of 2nd joint reaching just past 9th joint, with 17 stout ventral spines and about 8 small hair-like dorsal spines; bristles of joints 3–8 long with natatory hairs, no spines; 9th joint with 4 bristles (2 long and 1 medium with natatory hairs, 1 short dorsal (observed on holotype)); joints 3–8 with basal spines longer on distal joints (spine of 8th joint slightly longer than 9th joint); lateral spine of 9th joint about same length as spine of 8th joint.

Mandible: Coxale endite with 2 terminal spines stouter but about same length as other spines, with minute peg between spines (Figure 12a); small bristle present at base of endite. Basale: medial surface with distal spines near dorsal margin (Figure 12c); ventral margin with 2 a-bristles, 1 b-bristle, 2 c-bristles (longer bristle twice length of shorter d-bristle), and 2 d-bristles (long d-bristle broken off both limbs of holotype) (all bristles ringed, rings not shown in Figure 12b); dorsal margin with 1 long distal bristle and 2 subterminal bristles, all with long spines (Figure 12b,c). Exopodite spinous, about same length as dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal shorter and with few spines, proximal with many spines) (Figure 12c). 1st endopodial joint with 4 ventral bristles (2 long with long spines, 1 short with short spines, 1 minute bare). 2nd endopodial joint: ventral margin with 2 single ringed bristles and 2 terminal, ringed, paired, pointed bristles (medial slightly shorter but about same width, bare; lateral with indistinct dorsal spines (spines not shown in Figure 12d); dorsal margin with 7 long bristles (longest just reaches 3rd endopodial joint) and about 16 short bristles, most with spines; medial and ventral surfaces spinous. 3rd endopodial joint with 3 claws (dorsal claw with few teeth, others with many stout teeth) and 4 bristles (lateral dorsal bristle stouter than lateral ventral bristle, weakly ringed, clawlike with pointed tip) (Figure 12d).

Maxilla: Endite bristles of holotype obscured; endite III with short proximal bristle near base of exopodite (Figure 12e). Dorsal margin of coxale with short hirsute fringe and stout bristle with few long hairs (Figure 12e). Basale with long ventral bristle. Exopodite well developed, hirsute, with plumose proximal bristle and 2 terminal bristles (bristle closest to proximal bristle with long spines, other with short spines) (Figure 12e). 1st endopodial joint tapered, with spines along

dorsal margin, narrow cutting tooth with single cusp, 2 ringed alpha-bristles (outer plumose, inner with few hairs) and 3 ringed beta-bristles (outer 2 pectinate) (Figure 12f). 2nd endopodial joint with 4 ringed a-bristles (3rd counted from anterior stout pectinate, others slender bare), 3 ringed pectinate b-bristles, 3 ringed c-bristles (smallest bare, others pectinate), and 3 pectinate d-bristles (posterior ringed, others unringed) (Figure 12g–i). Rings not shown on all ringed bristles.

Fifth Limb: With 51 exopodial bristles. Protopodial tooth elongate with rounded tip, tooth appearing sclerotized only along edge (Figure 12j). Endite I with 1 small proximal anterior bristle (Figure 12j) and 5 spinous terminal bristles; endite II with 7 spinous and pectinate bristles; endite III with 6 spinous and pectinate bristles (Figure 12k). 1st exopodial joint: main tooth with stout bare sclerotized triangular tooth and 6 pectinate teeth (largest tooth folded under in illustrated compressed left limb of USNM 193859 (Figure 12k)); stout bristle with long proximal spines proximal to triangular tooth (Figure 12k); anterior side with row of 3 bristles (with long proximal spines). 2nd exopodial joint with 4 ringed pectinate a-bristles, 4 ringed pectinate b'-bristles, 4 ringed pectinate b''-bristles, 1 posterior c-bristle with long proximal and short distal spines, and 1 anterior d-bristle with long proximal and short distal spines (Figure 12j). 3rd exopodial joint hirsute (Figure 12j): inner lobe with 1 proximal ringed bristle with long proximal spines and 2 terminal bristles with short spines (outer with spines confined to tip); outer lobe with 2 ringed terminal bristles with long proximal and short distal spines. 4th joint with 4 or 5 bristles (bristle on posterior side with long proximal spines and small distal teeth, others either bare or with short spines); few small spines but no process on edge of joint close to 5th joint (Figure 12j). 5th joint well developed but not separated from 4th joint by suture, with 2 ringed terminal bristles (1 with long proximal and short distal spines, other with only short spines) (Figure 12j). Joints 3–5 hirsute, but relatively few hairs on inner lobe of 3rd joint.

Sixth Limb (Figure 11j): With 2 epipodial bristles (bare or with short spines). Endite I with 2 spinous medial bristles and 1 spinous terminal bristle; endite II with 3 spinous medial bristles and 2 spinous terminal bristles; endites III and IV each with 1 spinous medial bristle and 3 terminal bristles (middle shorter). End joint with 15 or 16 spinous bristles (long bristles with long proximal and short distal spines; short bristles with short spines) followed by space and then 3 plumose bristles (anterior shorter, bare in distal part).

Seventh Limb: Holotype: one limb with 29 bristles (terminal group with 7 bristles on comb side and 5 on peg side (proximal ends shown in Figure 11k); proximal group with 7 bristles on comb side and 10 on peg side); other limb with 30 bristles (terminal group with 6 bristles on comb side and 6 on peg side; proximal group with 7 bristles on comb side and 11 on peg side). Each bristle with up to 7 bells. Comb with 4 short flat-tipped teeth on each side of 4 longer teeth with rounded tips (Figure 11k). Single peg with few indistinct spines opposite

comb. Limb not expanded distally.

Furca (Figure 12l): Each lamella with 9 articulated claws decreasing in length and width posteriorly along lamella; all claws with teeth along posterior edge (some slightly smaller than others); claw 1 with row of medial teeth only slightly stouter than teeth along posterior edge; claw 1 of right lamella anterior to claw 1 of left lamella by width of base.

Bellonci Organ (Figure 12n): Cylindrical with rounded tip.

Eyes: Lateral eye minute, indistinct, with few light amber-colored cells, but no ommatidia (eye could be easily overlooked) (Figure 12n). Medial eye with undulate ventral edge and amber-colored area near middle (Figure 12n).

Upper Lip (Figure 12m): Anterior unpaired part with short transparent tubes on glandular openings (not shown). Paired posterior part with 2 long tapering hairs (hairs in 3 rows: anterior, posterior, lateral) tusks with large sclerotized proximal tooth on posterior edge; tip of each tusk with small diaphanous process that may be on glandular opening; 5 or 6 small glandular openings present along posterior edge of each tusk.

Genitalia (Figure 12j): Holotype with elongate genitalia (each with attached spermatophore) on each side of body anterior to furca.

Anterior of Body (Figure 11i): Small rounded anterior process just ventral to attachments of 1st antennae.

Posterior of Body: Evenly rounded, bare.

Y-Sclerite: Typical for genus.

Eggs: Holotype with 20 unextruded eggs, 10 on each side (Figure 11a shows 6 eggs of left side as seen through shell). Diameter of typical egg 0.25 mm.

DESCRIPTION OF ADULT MALE (Figure 13).—Carapace smaller and less elongate than that of adult female (Figure 13a) and with similar surface pits (Figure 13b).

Infold: Not examined in detail but, in general, similar to that of adult female.

Central Adductor Muscle Attachments (Figure 13c,d): About 17 elongate and oval scars, some compound.

Carapace Size (length, height in mm): Slope 53: dissected paratype, 3.24, 2.23, height 69% of length; undissected paratype, 3.07, 2.05, height 67% of length.

First Antenna (Figure 13e): Joints 1–4 and 6 similar to those of adult female. 5th joint with dorsal spines at midlength (not shown); sensory bristle of 5th joint with 12 filaments (9 stout proximal, 3 slender distal) and bifurcate tip. 7th joint: a-bristle spinous (spines not shown), about twice length of bristle of 6th joint; b-bristle about twice length of a-bristle, with 5 filaments (proximal filament stout with round process followed by large diaphanous sucker (with marginal hairs) and minute node near pointed tip, next 4 filaments slender, bare except for terminal spine); c-bristle about 3 times length of b-bristle, with 9 filaments (proximal filament similar to that of proximal filament of b-bristle (paratype with large sucker of c-bristle of right limb slightly smaller than sucker of b-bristle, but opposite relationship on left limb), next 8 filaments slender,

bare or with few minute proximal spines) and bifurcate tip. 8th joint: d- and e-bristles slightly longer than b-bristle, bare with blunt tips; f-bristle slightly longer than c-bristle, with 9 filaments (most with few teeth) and bifurcate tip; g-bristle with about same number of filaments (most with few small teeth) as f-bristle (tip of bristle broken off on both limbs of paratype).

Second Antenna: Protopodite and endopodite similar to those of adult female. Exopodite: bristle of 2nd joint with about 12 ventral spines and few slender subterminal hair-like dorsal spines; all 4 bristles of 9th joint with natatory hairs; branch otherwise similar to that of adult female.

Mandible: Similar to that of adult female. Long d-bristle of basale with long proximal and short distal spines.

Maxilla: Endite I broad with about 11 spinous bristles; endite II small with about 6 bristles; endite III small, obscured, with about 5 bristles. Coxale with stout dorsal bristle with many long proximal and shorter distal spines. Remaining part of limb similar to that of adult female.

Fifth Limb: Epipodite fragmented and endite bristles not counted. Protopodial tooth similar to that of adult female. Except for 2nd joint having 5 rather than 4 ringed pectinate b'-bristles, exopodial joints 1–3 similar to those of adult female. 4th exopodial joint with 4 bristles (3 anterior with short spines, 1 posterior with long proximal and short distal spines); 5th exopodial joint well developed, fused to 4th joint, with 2 bristles (both bristles of left limb of paratype with long proximal and short distal spines; 1 of the bristles on right limb with only short spines).

Sixth Limb: With 2 small epipodial bristles (bare or with short spines). Endite I with 2 or 3 spinous medial bristles and 1 spinous terminal bristle; endite II with 2 or 3 spinous medial bristles and 2 spinous terminal bristles; endite III with 1 spinous medial bristle and 3 spinous terminal bristles; endite IV with 1 spinous medial bristle and 4 spinous terminal bristles. End joint with 15–17 spinous bristles (4 or 5 of short bristles with short spines, others with long proximal and short distal spines) and then 2 stout plumose bristles. Right limb of USNM 194009 with short space between anterior bristles and 3 posterior bristles; space absent on left limb).

Seventh Limb: Paratype: one limb with 23 bristles (terminal group with 7 on comb side and 5 on peg side; proximal group with 5 on comb side and 6 on peg side); other limb with 28 bristles (terminal group with 7 on comb side and 6 on peg side; proximal group with 7 on comb side and 8 on peg side). Each bristle with up to 7 bells. Comb with 5 short flat-tipped teeth on each side of 3 longer teeth with rounded tips. Single peg (bare or with few indistinct spines) opposite comb.

Furca: Similar to that of adult female.

Bellonci Organ (Figure 13f): Tapering slightly distally, with pointed tip; amber coloring where stippled in Figure 13f.

Eyes: Lateral eye minute indistinct with light amber cells (not ommatidia) (Figure 13f,g). Medial eye small but larger than lateral eye, with amber coloring (Figure 13f). (The lateral eyes of the species are difficult to see but are defined slightly

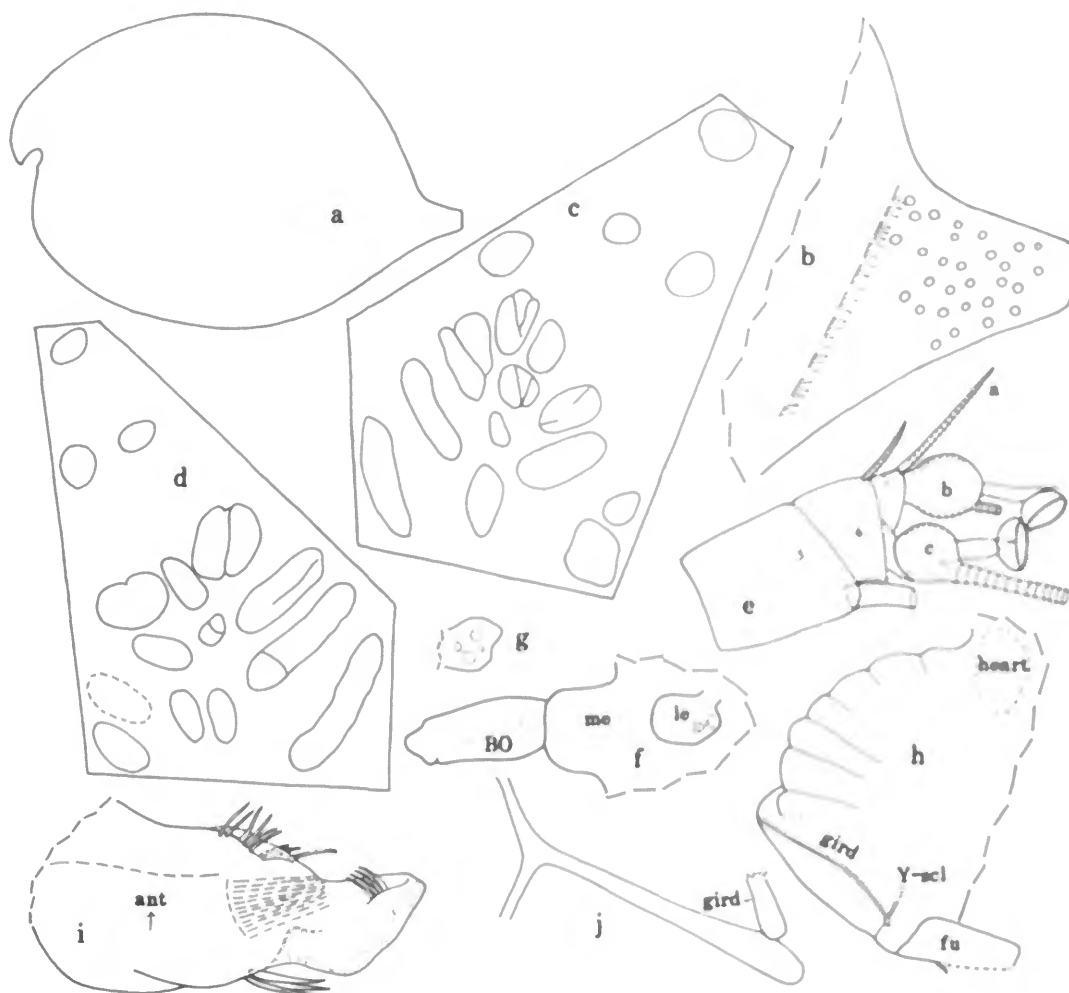


FIGURE 13.—*Vargula fugax*, new species, adult male, paratype: a, complete specimen from left side, length 3.24 mm; b, caudal process of left valve showing representative pits, ov; c, d, central adductor muscle attachments of left and right valves, respectively, ov; e, tip of left 1st antenna, mv (not under cover slip and not all bristles shown); f, left lateral eye, medial eye and Bellonci organ, anterior to left; g, right lateral eye; h, posterior of body from right side (only part of Y-sclerite shown); i, right copulatory limb, anterior to top; j, left Y-sclerite, anterior to left.

better in the male. The eyes are not visible through the shell.)

Upper Lip: Similar to that of adult female.

Genitalia (Figure 13i): Large copulatory limb with sclerotized triangular tip and small ringed bristles on each side of body anterior to furca (not all bristles shown).

Anterior of Body: Similar to that of adult female.

Posterior of Body (Figure 13h): Bare, with about 7 "segments" between dorsal end of girdle and heart.

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

Parasites: Dissected adult male paratype with 2 male or juvenile cryptoniscid isopods attached to right side of body posterior.

COMPARISONS.—The upper lip of *V. fugax* resembles that of *V. tubulata* Poulsen, 1962:198, but claws 2 and 4 of the furca of that species are nonarticulated, and the 7th limb bears a stout jaw rather than a cylindrical peg and, also, has bristles distal to the base of the jaw. The combination of a long caudal process near valve midheight, all furcal claws articulated, and a proximal tooth on the tusks of the upper lip is not present on previously described species of *Vargula*. The adult male of *V. fugax* is unusual in not having filaments with small suckers on the b- and c-bristles of the 7th joint of the 1st antennae. Only *Cypridinodes assymetrica* Brady, 1902, has been reported previously as not having filaments with small suckers (Poulsen,

1962:278). The present species has been referred to *Vargula* rather than *Cypridinodes* because of the lack of multiple serrations posterior to the tusks of the upper lip and lack of a jaw on tip of 7th limb.

Vargula straux, new species

FIGURES 14, 15, 110e

ETYMOLOGY.—From the Greek *straux* (something squeezed out, drop).

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

TYPE LOCALITY.—Slope 46, 42°00.20'S, 148°37.70', Tasmania, off Freycinet peninsula; depth 720 m.

PARATYPES.—Slope 39: 1 partly dissected ovigerous female in alcohol; 1 undissected adult female in alcohol. Slope 45: 2 adult females + 9 specimens, all undissected and in alcohol. Slope 46, USNM 193892, ovigerous female on slide and in alcohol.

DISTRIBUTION.—Slope 39, 600 m. Slope 45, 800 m. Slope 46, 720 m.

DESCRIPTION OF ADULT FEMALE (Figures 14, 15, 110e).—Carapace oval in lateral view, without distinct concavity where posterior edge of shell joins caudal process (Figure 14a,c,d). Incisur at about valve midheight.

Infold: Rostral infold with about 70 divided bristles (some represented by empty sockets in Figure 14b); 2 unequal divided bristles at inner end of incisur. Narrow list with anterior end just ventral to incisur (Figure 14b) continues along ventral margin, then broadens slightly to form anterior edge of caudal process (Figure 14c,d). About 100 divided bristles along anteroventral and ventral list to point near ventral end of caudal process. Broad list along anterior edge of caudal process with about 20 minute bristles emerging from flaring pores (7 bristles shown in Figure 14d). Anteroventral infold between list and inner margin with 18–24 divided bristles (not all shown in Figure 14b). Left valve of USNM 193892 with 3 bristles between list and valve edge just anterior to caudal process. Edge of valve posterior to caudal process with 20 minute pores (6 shown in Figure 14d).

Selvae: Narrow lamellar prolongation with smooth outer edge present along anterior edge of rostrum and anterior half of dorsal edge of incisur. Prolongation wide along ventral edge of incisur then narrows at point near anterior end of incisur; narrow prolongation along anteroventral margin of valve with minute spines along outer edge; prolongation along ventral margin of valve broad with indistinct striations or spines in inner half and with smooth or minutely denticulate outer edge; selvae terminates at ventral end of caudal process (Figure 14c); caudal process and posterior valve margin dorsal to caudal process without selvae. Space between ventral valve edge and base of selvae wider on right valve (at valve midlength base of selvae about midway between valve edge and list on right valve, but just within valve edge on left valve)

(posterior end of base of selvae of right valve shown in Figure 14c).

Central Adductor Muscle Attachments (Figure 14e): Comprising about 14 ovoid attachments.

Carapace Size (length, height in mm): Slope 39: 2.11, 1.38. Slope 45: 2 specimens, 2.33, 1.53. Slope 46: holotype, 2.30, 1.50; USNM 193892, 2.33, 1.58. Height 65%–68% of length.

First Antenna (Figure 14f): 1st joint bare; joints 2–4 with abundant spines. 3rd and 4th joints each with 2 spinous bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 11 or 12 filaments (10 stout proximal, 1 or 2 slender distal) and bifurcate tip. Medial bristle of 6th joint short bare with base near joint midwidth. 7th joint: a-bristle slightly longer than bristle of 6th joint, with few spines; b-bristle about $\frac{1}{3}$ longer than a-bristle, with small proximal filament; c-bristle about $\frac{1}{4}$ longer than sensory bristle of 5th joint, with 9 marginal filaments and bifurcate tip. 8th joint: d- and e-bristles about $\frac{1}{3}$ longer than b-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 9 filaments (some with spines) and bifurcate tip; g-bristle same length as c-bristle, with 9 marginal filaments (some with spines) and bifurcate tip.

Second Antenna (Figure 14g-i): Protopodite with short spinous medial bristle (Figure 14g,h, 110e). Endopodite 3-jointed (Figure 14h): 1st joint with 4 bare proximal bristles (1 long, 3 short) and 1 long spinous distal bristle; 2nd joint elongate with distal bristle about same length as 3rd joint; 3rd joint about same length as 2nd, with long terminal filament about twice length of stem (only small proximal part shown in Figure 14h). Exopodite: 1st joint with few spines along concave dorsal margin; 2nd joint with spines on ventral and dorsal margins and distal dorsal corner (Figure 14i); bristle of 2nd joint reaching 9th joint, with 14 stout ventral spines; bristle of 3rd joint with about 27 proximal slender hair-like ventral spines and distal natatory hairs; bristles of joints 4–8 with natatory hairs, no spines; 9th joint with 3 bristles (1 long and 1 medium with natatory hairs, 1 short with short spines); joints 3–8 with basal spines increasing in length on distal joints; spine of 8th joint longer than 9th joint; lateral spine of 9th joint about $1\frac{1}{2}$ times length of joint; joints 2–8 with minute spines in row along distal dorsal corner.

Mandible (Figure 15a,b): Coxale endite with 2 terminal spines stouter than other spines, but about same length; minute peg between terminal spines; small unringed bristle present at base of endite (Figure 15a). Basale: medial surface with abundant spines; ventral margin with 2 small a-bristles, 1 b-bristle, 2 c-bristles, and 2 d-bristles (longer with long proximal and short distal spines) (Figure 15a); dorsal margin with 1 bristle near midlength and 2 subterminal, all with short spines. Exopodite spinous, about same length as dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal shorter) (Figure 15a). 1st endopodial joint with 4 ventral bristles (1 long with long proximal and short distal spines, 1 long and 1 short with short spines, 1 minute) and few terminal

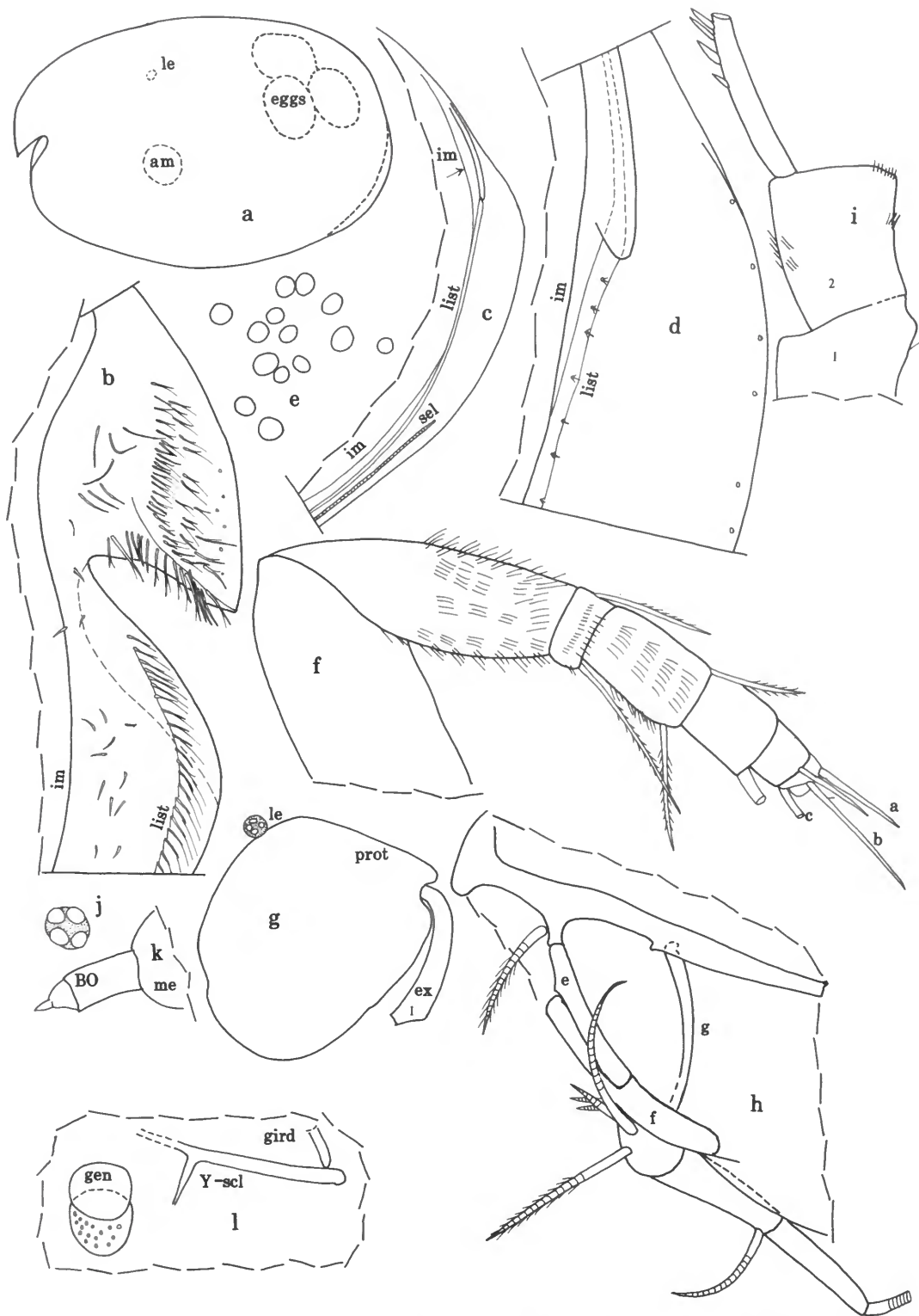


FIGURE 14.—*Vargula strax*, new species, ovigerous female, paratype, USNM 193892: *a*, complete specimen from left side showing locations of left lateral eye, central adductor muscle attachments, and 3 eggs; *b*, anterior, left valve, *iv*; *c*, posterior, right valve, *iv* (bristles not shown); *d*, detail from *c*; *e*, central adductor muscle attachments of right valve, *ov*, anterior to right; *f*, left 1st antenna, *mv* (bristles of 8th joint not shown); *g*, left lateral eye and part of left 2nd antenna, *mv*; *h*, protopodite and endopodite of right 2nd antenna, *mv*; *i*, part of exopodite of left 2nd antenna, *mv*; *j*, right lateral eye; *k*, medial eye and Bellonci organ; *l*, left Y-sclerite and left genital organ with attached spermatophore.



FIGURE 15.—*Vargula straux*, new species, ovigerous female, paratype, USNM 193892: *a*, right mandible, mv (bristles of 3rd endopodial joint not shown); *b*, tip of right mandible, mv; *c*, right maxilla, mv (endopodite twisted; not all bristles shown); *d*, part of right 5th limb, av; *e*, part of left 5th limb, pv; *f*, left 6th limb, mv; *g*, 7th limb; *h*, upper lip and anterior process (arrow indicates anterior). *i*, ovigerous female, holotype, right lamella of furca.

dorsal spines. 2nd endopodial joint: ventral margin with 2 single ringed bristles and 2 terminal ringed paired pointed bristles of similar length and width; dorsal margin with 5 long spinous bristles and 9 or 10 short bristles (short bristle near 2nd long bristle with stout spines) (Figure 15a); medial and ventral surfaces spinous. 3rd endopodial joint with 3 claws (dorsal claw bare, others with proximal teeth) and 4 ringed bristles (dorsal lateral bristle with pointed tip) (Figure 15b).

Maxilla (Figure 15c): Endite I with 10 or 11 spinous bristles; endite II with 5 spinous bristles; endite III with 1 bare proximal bristle (Figure 15c) and 5 spinous terminal bristles (1 slender ringed, others stout). Coxale with spinous dorsal bristle. Basale with 2 bristles (1 short ventral, 1 longer closer to midwidth) (Figure 15c). Exopodite well developed, with 1 proximal spinous bristles and 2 terminal bristles (inner with stout base and long marginal hairs, outer slender with short spines) (Figure 15c). 1st endopodial joint spinous, with 1 long alpha-bristle with long spines, 2 beta-bristles (longer pectinate, shorter bare), and narrow cutting tooth with single cusp (in Figure 15c the endopodite is twisted resulting in cutting tooth appearing to be on anterior rather than posterior corner). 3rd endopodial joint obscured, with 4 slender bare ringed a-bristles and about 2 ringed b-bristles, 3 ringed c-bristles, and 3 d-bristles (1 ringed, 2 unringed claw-like pectinate).

Fifth Limb (Figure 15d,e): Three endites very close together (bristles could not be counted). Protopodial tooth short slender (Figure 15d). 1st exopodial joint: main tooth with small bare tooth and 6 pectinate teeth (Figure 15e); stout bare bristle proximal to small bare tooth; anterior side with row of 3 bristles with long proximal hairs (2 longer bristles pectinate distally), and 1 bristle (with long proximal spines) closer to protopodial tooth. 2nd exopodial joint with 4 pectinate unringed a-bristles, 3 ringed pectinate b'-bristles, 4 ringed pectinate b''-bristles, 1 posterior c-bristle with long proximal hairs and short distal spines, and 1 anterior d-bristle with long proximal spines. 3rd exopodial joint hirsute (Figure 15e): inner lobe with 1 proximal bristle with long proximal hairs and short distal spines and 1 terminal bristle with short spines; outer lobe with 2 terminal bristles (outer with long proximal and short distal spines, inner with short spines). 4th and 5th exopodial joints hirsute, fused, with stout spinous process between joints (detail in Figure 15e); 4th joint with 1 spinous bristle, 5th joint with 2. Note: inner lobe of 3rd joint of USNM 193892 unusual for genus in having 2 rather than 3 bristles; whether this is aberration or typical for species must await study of additional specimens.

Sixth Limb (Figure 15f): With 3 or 4 fairly long bare epipodial bristles. Endite I with 0-2 small spinous medial bristles and 1 long spinous terminal bristle; endite II with 3 or 4 small spinous medial bristles and 2 long spinous terminal bristles; endite III with 3 spinous terminal bristles (middle shorter); endite IV with 1 spinous medial bristle and 1 longer spinous terminal bristle. End joint with 7 spinous bristles followed by space and then 3 plumose bristles (anterior of 3 with small spines distally). Limb hirsute.

Seventh Limb (Figure 15g): USNM 193892: one limb with 11 bristles (terminal group with 3 bristles on peg side and 2 on comb side, each with 3-5 bells; proximal group with 4 bristles on peg side and 2 on comb side, each with 3 bells); other limb with 11 bristles (terminal group with 3 bristles on each side, each with 3-5 bells (1 bristle on each side longer and with 5 bells); proximal group with 3 on peg side and 2 on comb side, each with 3 bells). Comb with 2 short flat-tipped teeth on each side of 5 longer teeth with rounded tips. Single spinous peg opposite comb. Right limb of specimen from Slope 39 with 11 bristles (terminal group with 3 bristles on peg side and 4 on comb side, each with 3-5 bells; proximal group with 2 bristles on each side, each with 3 bells). Right limb of specimen from Slope 45 with 13 bristles (terminal group with 3 bristles on each side; proximal group with 4 bristles on peg side and 3 on comb side).

Furca (Figure 15i): Each lamella with 9 claws; claws 2 and 4 nonarticulated; claw 3 slenderer than claw 4; all claws with teeth along posterior edge; claw 1 with teeth in medial row larger distally, stouter than distal teeth of lateral row along posterior edge; right lamella anterior to left by width of base of claw 1; anterior margin of lamellae with slender spines.

Bellonci Organ (Figure 14k): Cylindrical with pointed process at tip.

Eyes: Lateral eyes small but distinct and visible through shell, with 4 or 5 large divided ommatidia and scattered brown pigment between ommatidia (Figure 14a,g,j). Medial eye indistinct, unpigmented (Figure 14i).

Upper Lip (Figure 15h): Anterior part oriented anteroventrally, with large widely separated glandular openings. Paired posterior part with 2 fairly short tusks, each with 4 or 5 distal glandular openings and without hairs; a thin suture (better developed on inner side) divides each tusk into slightly broader proximal part and longer distal part (suture indicated by dashed line in Figure 15h).

Genitalia (Figure 14l): Oval with attached spermatophore on each side of body near Y-sclerite.

Anterior of Body (Figure 15h): With rounded anterior process dorsal to upper lip.

Posterior of Body: Evenly rounded, bare.

Y-Sclerite (Figure 14l): Typical for genus.

Number of Eggs: Slope 39: specimen with 11 eggs in marsupium (length of 1 egg 0.38 mm) and much smaller unextruded eggs. Slope 46: USNM 193892 with 17 eggs in marsupium (length of 2 typical eggs, 0.40 mm, 0.42 mm) (3 eggs within carapace shown in Figure 14a).

COMPARISONS.—*Vargula straux* is compared below with other species of *Vargula* having small lateral eyes with fewer than 5 ommatidia. The carapace of *V. straux* does not have a slight concavity dorsal to the caudal process present on the carapaces of many but not all *V. hex*. The rostral infold of *V. straux* has about 70 bristles compared to about 22 for *V. hex* and 15 or 16 for *V. ascensus*. The tusks of the upper lip of *V. hex*, *V. antarctica*, and *V. ascensus* are much longer than those of *V.*

stranx. The 7th limbs of *V. hex*, *V. antarctica*, and *V. ascensus* bear 24–30 bristles compared to only 11 on *V. stranx*. The medial bristle of the subterminal pair on the ventral margin of the 2nd endopodial joint of the mandible of *V. stranx* differs from those of *V. hex* and *V. ascensus* in being ringed and not broader than the lateral bristle. The carapace of *V. stranx* resembles that of *V. stathme* except for being slightly larger (2.11–2.33 mm compared to 1.95 mm). The 7th limb of *V. stathme* has 19 or 20 bristles compared to 11 on *V. stranx*. *Vargula stathme* also differs from *V. stranx* in having fewer bristles (16, not about 70) on the rostral infold and shorter epipodial bristles on the 6th limb. *Vargula stranx* differs from many species of the genus in having an unusually long 3rd joint relative to the length of the 2nd joint on the endopodite of the 2nd antenna (the 3rd joint is about the same length as the 2nd in *V. stranx* and shorter than the 2nd in many other species of the genus).

Vargula trifax, new species

FIGURES 16–20, 110*o,p*

ETYMOLOGY.—From the Latin *trifax* (a kind of spear).

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

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

PARATYPES.—Slope 1: USNM 193905, ovigerous female on slide and in alcohol; 2 ovigerous females and 1 adult female (with female chonistomatid copepod and 2 chonistomatid ovisacs in marsupium) in alcohol; 3 adult females without eggs and 9 specimens (mostly juveniles) in alcohol. Slope 22: adult male in alcohol. Slope 40, 40 specimens (mostly juveniles but including 3 ovigerous females) in alcohol. Slope 56, USNM 193948, 1 adult male on slide and in alcohol; 4 specimens in alcohol.

DISTRIBUTION.—Slope 1, 204 m. Slope 22, 363 m. Slope 40, 400 m. Slope 56, 429 m. Known depth range 204–429 m.

DESCRIPTION OF ADULT FEMALE (Figures 16–19*a–e*, 110*o*).—Carapace with small rostrum with lateral bulge (Figure 16*a,b*) and tubular caudal process. Height about 70% of length.

Infold: Rostral infold with 9–12 divided bristles forming row parallel to anterior edge of rostrum, about 6 divided bristles on or ventral to list, 8 smaller divided bristles posterior to row of longer bristles, and 2 long divided bristles posterior to smaller bristles; inner end of incisur with a pair of divided bristles (Figure 16*b*). Anteroventral infold with 1–3 small bristles near incisur, 1 small bristle near inner margin of infold, and on right valve about 38 divided spinous bristles forming row extending along anterior $\frac{1}{3}$ of valve (posterior 23 of these along subdued indistinct wavy list), and on left valve about 82 bristles in row extending full length of ventral margin (bristles more widely separated in posterior half of row; along anterior

$\frac{1}{3}$ of valve most bristles along subdued indistinct wavy list); 2 bristles present dorsal to row of bristles in vicinity of bristles number 8 to 12 counting from anterior end of row. Broad sclerotized ridge along inner margin of posteroventral and posterior infold with 34 stout spines, some bifurcate; ridge narrows ventrally and continues along ventral margin of valve as bare narrow ridge along inner edge of infold. Ventral end of spinous part of ridge without closure as on *V. trifax* (Figure 11*h*) and is similar to ridge of *V. tubulata* (Poulsen, 1962, fig. 98*c*); dorsal end of ridge broad, triangular, with few small spines, and left valve with lip absent on right valve (Figures 16*c*, 17*a*). Infold of caudal process posterior to list with straight line and numerous minute pores (not all shown); 6–8 minute bristles just within posterior edge of caudal process. On left valve only list along middle $\frac{2}{3}$ of ventral margin strongly crenulate; and in this area bristles not on list but about midway between list and valve edge (Figure 16*d*).

Carapace Size (length, height in mm): Slope 1: USNM 193905, 5.2, 3.7; 5 specimens: 5.3, 3.7; 5.2, 3.5; 5.1, 3.5; 5.0, 3.6; length only, 5.2. Slope 40: 5.0, 3.2 (holotype). Height 67%–72% of length.

First Antenna (Figure 16*e*): 1st joint bare. 2nd joint with ventral, dorsal, medial, and lateral spines. 3rd joint with 2 bristles (ventral subterminal or terminal, dorsal $\frac{1}{4}$ to $\frac{1}{3}$ joint length from proximal end) with short spines, neither bristle reaching distal edge of 4th joint. 4th joint with 2 terminal bristles (dorsal bristle reaching middle of 6th joint, ventral about twice as long) with short spines. Sensory bristle of 5th joint with 9 stout proximal filaments, 3 slender distal filaments, and bifurcate tip. Medial bristle of 6th joint with short spines. 7th joint: a-bristle longer than bristle of 6th joint, with short spines; b-bristle with 3 or 4 filaments; c-bristle with 10 marginal filaments (most with spines) and bifurcate tip. 8th joint with minute papilla proximal to base of d-bristle; d- and e-bristles about same length as b-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with 9 marginal filaments (most with spines) and bifurcate tip; g-bristle slightly longer than c-bristle, with 10 marginal filaments (most with spines) and bifurcate tip.

Second Antenna: Medial bristle of protopodite short with few indistinct spines (Figure 110*o*). Endopodite 3-jointed (Figure 17*b*): 1st joint with 4 bare proximal bristles (1 long, 3 short) and 1 long spinous distal bristle; 2nd joint with terminal bristle shorter than length of joint; 3rd joint with long terminal filament. Exopodite: bristle of 2nd joint reaching past 9th joint, with 13 stout ventral spines; bristles of joints 3–8 and 4 bristles (3 long, 1 short) of 9th joint with natatory hairs, no spines; joints 2–8 with basal spines stouter on distal joints; spine of 8th joint reaching past end of 9th joint; lateral spine of 9th joint about $\frac{1}{3}$ longer than joint.

Mandible: Coxale endite with abundant slender spines and 2 slightly stouter terminal spines with small marginal spines; fairly long bare ringed bristle present near base of endite (about same length as longest of spines). Basale (Figure 17*c*): ventral

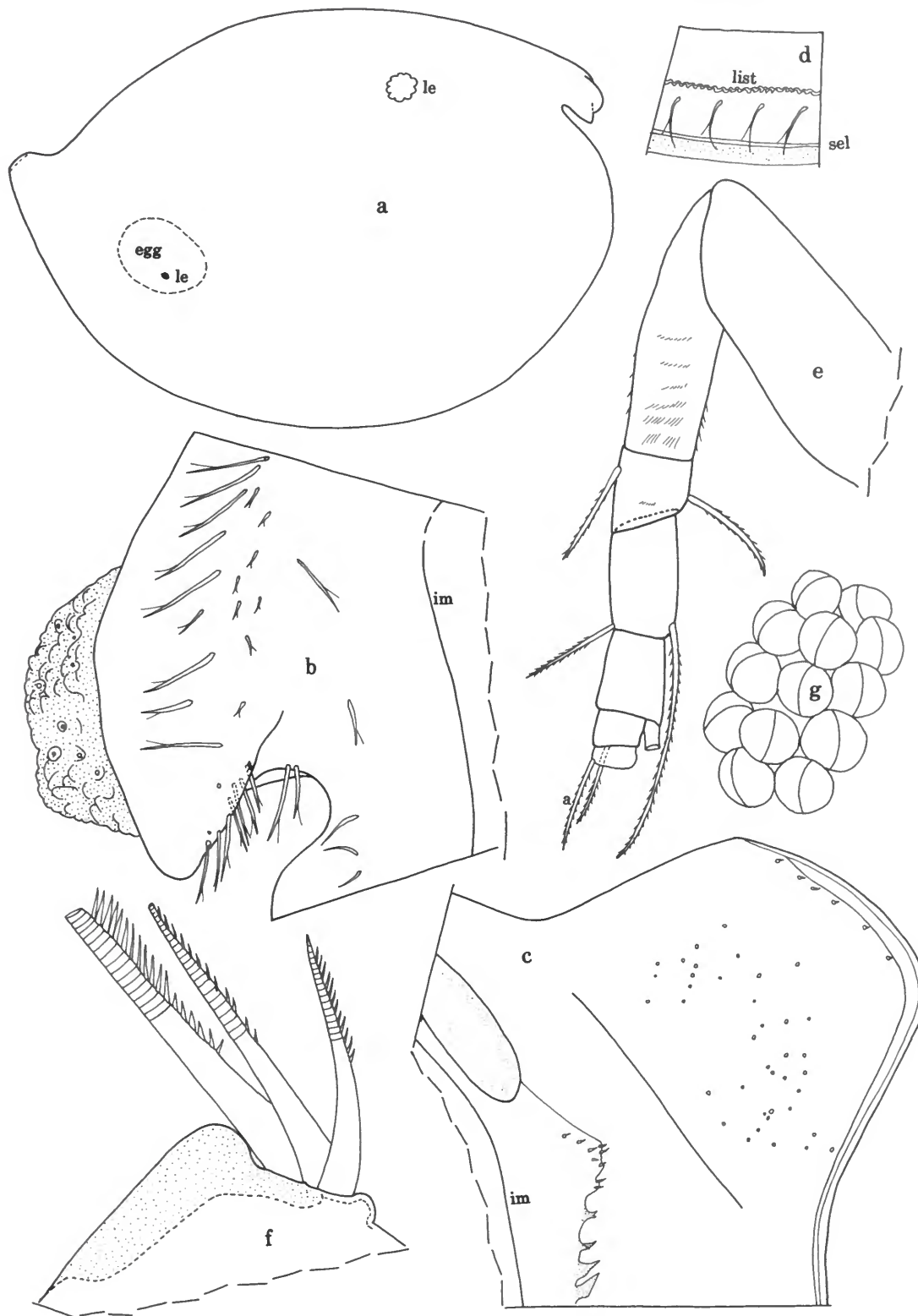


FIGURE 16.—*Vargula trifax*, new species, ovigerous female, paratype, USNM 193905: *a*, complete specimen from right side showing locations of right lateral eye and 1 egg having lateral eyes, length 5.2 mm; *b*, anterior, right valve, iv; *c*, caudal process, right valve, iv; *d*, part of ventral margin near midlength, iv; *e*, left 1st antenna, iv (not all bristles shown); *f*, beta-bristles and cutting tooth of 2nd endopodial joint of maxilla; *g*, right lateral eye, anterior to right.

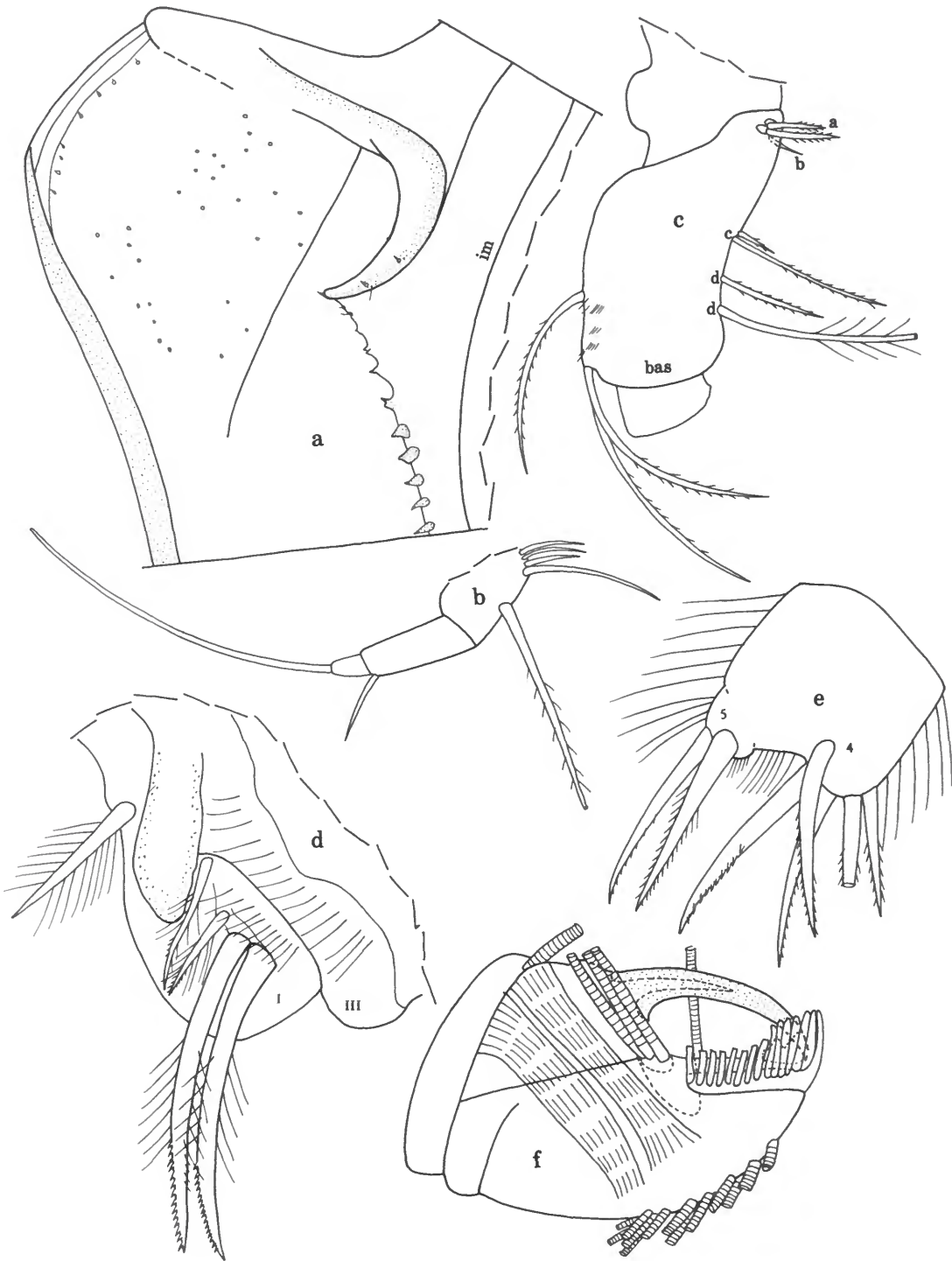


FIGURE 17.—*Vargula trifax*, new species, ovigerous female, paratype, USNM 193905: *a*, caudal process, left valve, iv; *b*, endopodite, left 2nd antenna, mv; *c*, part of right mandible, mv; *d*, part of right 5th limb, av; *e*, part of exopodite of left 5th limb, pv; *f*, tip of 7th limb.

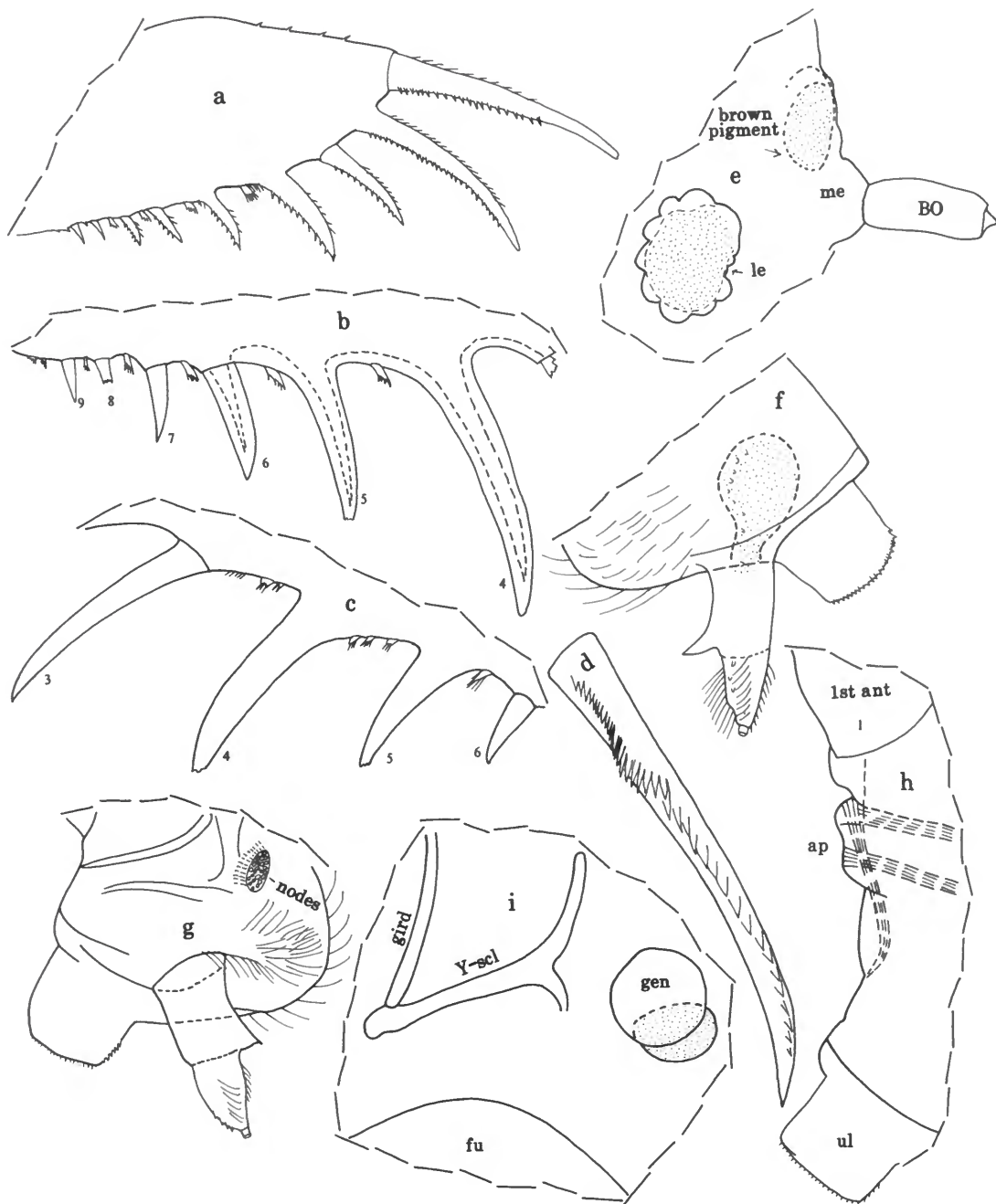


FIGURE 18.—*Vargula trifax*, new species, ovigerous female, paratype, USNM 193905: *a*, right lamella of furca, lv; *b*, detail from *a*; *c*, part of left lamella of furca, lv; *d*, claw 1 of left lamella of furca, mv; *e*, right lateral eye, medial eye and Bellonci organ, anterior to right; *f, g*, right and left views of upper lip; *h*, anterior of body from left side (tusks of upper lip not shown); *i*, part of posterior of body from right side.

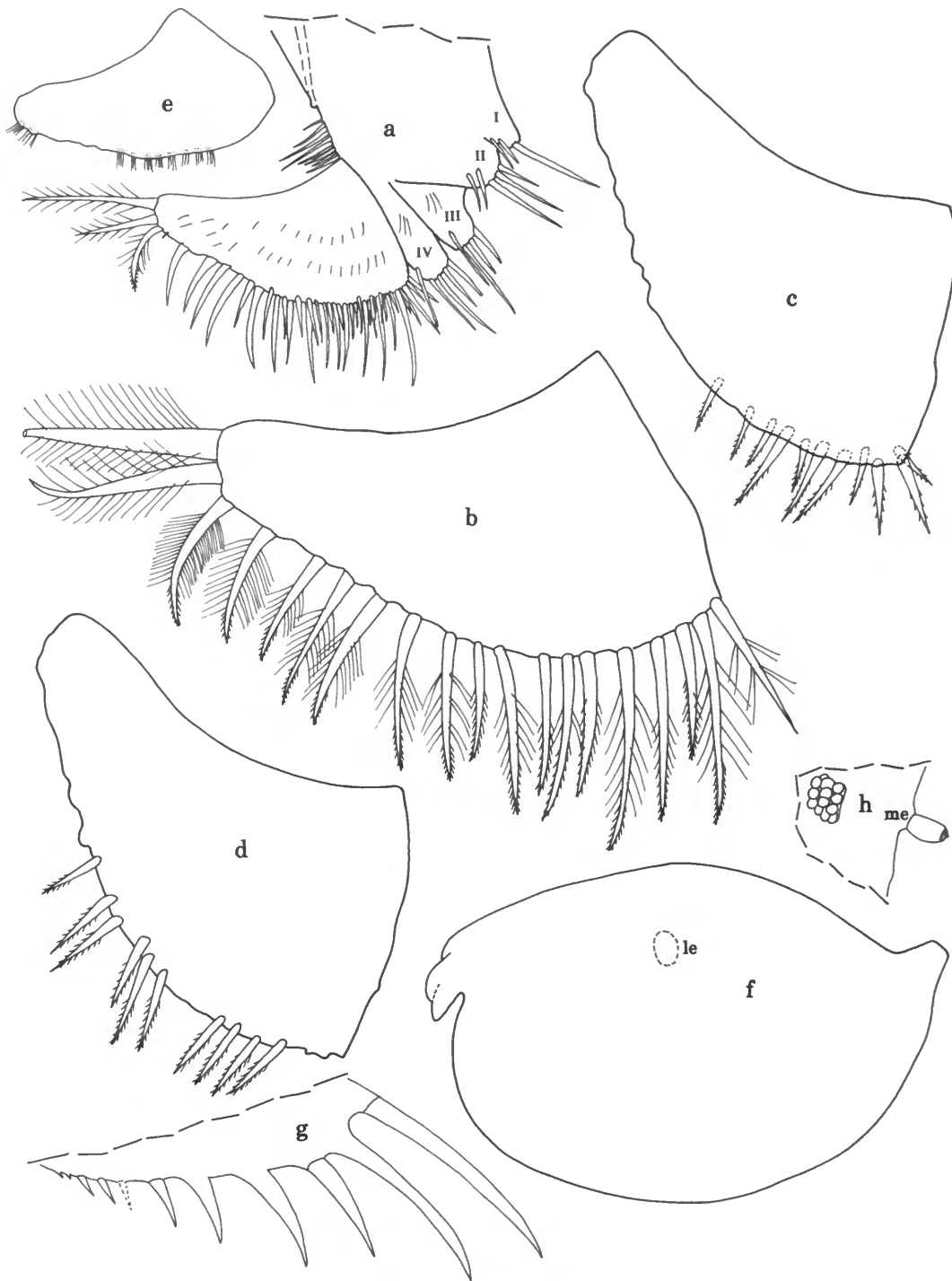


FIGURE 19.—*Vargula trifax*, new species, ovigerous female, paratype, USNM 193905: *a*, left 6th limb, mv; *b–e*: bristles of end joint of 6th limb shown in *a*; *b*, marginal bristles; *c*, short lateral bristles; *d*, short medial bristles; *e*, lateral spines along edge. Adult male, paratype, USNM 193948: *f*, complete specimen from left side showing location of left lateral eye, length 4.1 mm; *g*, right lamella of furca; *h*, right lateral eye, medial eye and Bellonci organ, anterior to right.

margin with 2 ringed spinous a-bristles, 1 small ringed bare b-bristle close to a-bristles but with lateral base, 2 spinous c-bristles, and 2 spinous d-bristles (bases widely spaced; longer bristle with long proximal and short distal spines); dorsal margin with usual 3 bristles with short spines; medial surface with few distal rows of spines near dorsal margin. Exopodite slightly longer than length of dorsal margin of 1st endopodial joint, hirsute, with 2 subterminal bristles (distal $\frac{1}{3}$ length of other) with short spines. 1st endopodial joint with 4 ventral bristles (1 minute bare, 1 short and 1 long with short spines, longest with short spines except for ring of long spines at distal $\frac{1}{4}$). 2nd endopodial joint: ventral margin with 4 distal pointed bristles (2 single, 2 paired); medial of distal pair slightly longer and almost twice width of lateral; dorsal margin with 6 long bristles, 1 medium distal bristle, and 11 short bristles (most medial), none coarsely pectinate; ventral margin and medial surface spinous. 3rd endopodial joint with 3 stout claws (lateral with 5 proximal teeth (distal teeth stouter), others bare; dorsal claw about half length of longest claw), a stout dorsal claw-like bristle (with pointed tip) about $\frac{2}{3}$ length of longest claw, and 3 ventral bristles (lateral bristle fairly stout proximally but not bulbous and no spines observed). Endopodite of left limb aberrant with few dorsal bristles on 2nd joint. Right limb with about half number of short bristles present on male mandible and may also be aberrant.

Maxilla: Dorsal bristle of coxale plumose in proximal half and with minute spines on distal half. Endite I with 10 spinous bristles; endite II with 7 spinous bristles; endite III with 5 terminal bristles (4 stout spinous, 1 short, slender, bare). Basale with 1 short, slender, bare, lateral bristle near base of exopodite, 1 slender ventral bristle (with wreath of long spines) reaching 2nd endopodial joint, and 1 small medial bristle near long ventral bristle. Exopodite well developed, hirsute, with 3 equilength bristles (proximal and middle bristle with long hairs, other with few indistinct small spines). 1st endopodial joint with dorsal spines, few medial hairs near cutting tooth, 2 alpha-bristles (outer with abundant short hairs, inner with few indistinct minute hairs), and 3 pectinate beta-bristles; cutting tooth smoothly rounded (Figure 16f). 2nd endopodial joint with 4 a-bristles (anterior bare, next with slender teeth, 3rd stout with strong teeth and narrow blunt tip, 4th with slender teeth), 3 pectinate ringed b-bristles, 3 pectinate ringed c-bristles (2 shorter than b-bristles), and 3 pectinate d-bristles (anterior 2 unringed, other ringed).

Fifth Limb: Epipodite with 71 bristles. Endite I with 6 spinous bristles; endite II with 4 spinous and pectinate bristles; endite III with 6 spinous and pectinate bristles. Protopodite with abundant anterior hairs and very large tooth (Figure 17d). 1st endopodial joint: anterior side hirsute, with 3 bristles (all with long spines) in row, and 1 bristle (with long spines) closer to protopodial tooth (Figure 17d); main tooth with smooth proximal peg, 6 pectinate teeth, and 1 bristle (with long proximal spines) proximal to peg. 2nd endopodial joint with 4 unringed pectinate a-bristles, 4 ringed pectinate b'-bristles, 4

ringed pectinate b"-bristles, 1 stout posterior c-bristle, and 1 anterior d-bristle with long hairs. 3rd endopodial joint: inner lobe with proximal plumose bristle and 2 terminal pectinate bristles (marginal teeth minute, not long like those of b"-bristles); outer lobe with 2 terminal bristles with long hairs or spines in proximal half and small distal spines. 4th and 5th joints hirsute, fused but location of boundary between them indicated by indentation in margin; 4th joint with 5 spinous bristles; 5th joint with 2 spinous bristles (neither with long spines) and small hirsute bulge near their bases (Figure 17e).

Sixth Limb (Figure 19a-e): With 8 epipodial bristles (Figure 19a). Endite I with 2 or 3 medial bristles and 1 terminal bristle; endite II with 2 or 3 medial bristles and 3 terminal bristles; endite III with 1 medial bristle and 3 terminal bristles; endite IV with 1 medial bristle and 4 terminal bristles. End joint with 39 or 40 bristles (19 or 20 long bristles along edge (posterior 2 with only long hairs, 3 or 4 with only short spines, others with long proximal hairs or spines and short distal spines) (Figure 19b); 9-11 short bristles medial to edge with short spines (Figure 19d); and 8-11 short bristles lateral to edge with short spines (Figure 19c)). Medial side of limb hirsute; middle and posterior parts of distal edge of end joint with short rows of long spines (Figure 19e).

Seventh Limb (Figure 17f): USNM 193905: one limb with 48 bristles: terminal segment with 13 bristles on ventral edge of comb and 4 (3 on 1 side, 1 on other) at proximal end of comb; proximal segments with 11 bristles on comb side and 20 on jaw side. Other limb with 47 bristles: terminal segment with 13 bristles on ventral edge of comb and 4 (2 on each side) at proximal end of comb; proximal segments with 14 bristles on comb side and 16 on jaw side. Each bristle with up to 7 bells. Terminal comb with 8 flat-tipped teeth on each side of 11 or 12 longer alate teeth with rounded tips. Sclerotized ridge inside arc of comb with 2 stout distal teeth. Stout smooth claw-like jaw opposite comb.

Furca (Figure 18a-d): Each lamella with 8 or 9 claws; claws 2, 4, and 5 nonarticulated; claw 3 slenderer than claw 4 but about same length; 1-3 small indistinct spinous processes between each pair of claws except between claws 1 and 2 and 2 and 3; 2 similar processes on lamella following last claw. Each claw with slender teeth along posterior edge; medial row of teeth of claw 1 close to posterior edge in proximal $\frac{1}{4}$ then it bends anteriorly and continues distally closer to anterior edge (Figure 18d); most claws with spines along anterior edge; anterior edge of lamellae with few minute spines; right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figure 18e): Cylindrical with triangular tip.

Eyes: Lateral eye well developed with 13 large ommatidia and dark brown pigment (Figures 16g, 18e), visible through shell (Figure 16a). Medial eye short unpigmented (Figure 18e).

Upper Lip (Figure 18f,g): Anterior unpaired part a narrow ridge with very small glandular openings. Paired tusks hirsute (rows of anterior, posterior, and stouter lateral hairs), each with

proximal triangular tooth and large terminal glandular process. Proximally on each side of lip a field of minute nodes (Figure 18g).

Genitalia (Figure 18i): Ring with attached spermatophore on each side of body anterior to furca.

Anterior of Body: A broad low anterior process ventral to 1st antenna (Figure 18h). Brown pigmented area dorsal to medial eye (not part of eye) (Figure 18e).

Posterior of Body: Evenly rounded, bare.

Y-Sclerite (Figure 18i): Typical for genus.

Number of Eggs: USNM 193905 with 34 eggs, each with black lateral eyes (1 egg inside of carapace shown in Figure 16a); length of 2 eggs 0.97 mm, 0.94 mm. Holotype: length of 2 eggs, each with lateral eyes: 0.66 mm, 0.68 mm.

Parasites: Marsupium of adult female from Slope 1 with female chionostomatid copepod and 2 chionostomatid ovisacs.

DESCRIPTION OF ADULT MALE (Figures 19f-h, 20, 110p).—Carapace similar in shape to that of adult female but smaller (Figure 19f).

Carapace Size (length, height in mm): Slope 56: USNM 193948, 4.1, 2.8, height 68% of length. Slope 22: 4.5, 3.0, height 67% of length.

First Antenna (Figure 20a-c,e): Joints 1-5 similar to those of adult female (right limb of USNM 193948 aberrant in having unusually long 3rd joint (Figure 20a)). 7th joint: a-bristle longer than bristle of 6th joint, with marginal spines; b-bristle with stout proximal filament (with large diaphanous sucker with concentric rings and marginal fringe, small distal node, and pointed tip) (Figure 20c), followed by slender filament with about 14 minute suckers, then group of 3 filaments (2 short bare, 1 long with about 14 minute suckers); c-bristle longer than b-bristle, with stout proximal filament with large sucker similar to that of b-bristle (Figure 20c), followed by 2 long filaments each with 14 or 15 minute suckers preceded by minute tooth, then 6 bare filaments and bifurcate tip (proximal bare filament close to 2nd filament with suckers). 8th joint: d- and e-bristles about half length of c-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with 9 filaments (most with spines) and bifurcate tip; g-bristle about same length as c-bristle, with 10 filaments (most with spines) and bifurcate tip.

Second Antenna (Figure 110p): Similar to that of adult female.

Mandible (Figure 20d): 2nd endopodial joint: dorsal margin of 2nd endopodial joint with 6 long spinous bristles, 4 medium distal bristles, and 23 short bristles (most medial; 3 or 4 coarsely pectinate); medial bristle of terminal pair on ventral margin appearing more strongly sclerotized than that of adult female (Figure 20d). Limb otherwise similar to that of adult female.

Maxilla: Endite I with 11 spinous bristles. Small medial bristle of basale near midwidth. Anterior 2 of 4 a-bristles of 2nd endopodial joint bare. Limb otherwise similar to that of adult female.

Fifth limb: Epipodial and endite bristles not counted. Protopodial tooth and exopodite similar to those of adult female.

Sixth Limb: With 7 epipodial bristles. Endite I with 3 bristles (2 short medial, 1 long terminal); endite II with 3 short medial and 2 long terminal bristles; endite III with 1 medial and 3 terminal bristles (middle bristle short); endite IV with 1 medial and 4 terminal bristles. End joint with 27-30 bristles (posterior 2 with only long hairs, others with either long proximal and short distal spines or only short spines). Hairs and spines of end joint similar to those of adult female.

Seventh limb: USNM 192948: one limb with 41 bristles: terminal segment not expanded in size, with 11 bristles on ventral edge of comb and 3 at proximal end of comb (2 on 1 side, 1 on other); proximal segments with 11 bristles on comb side and 16 on jaw side. Other limb also with 41 bristles: terminal segment with 13 bristles on ventral edge of comb and 3 at proximal end of comb (2 on 1 side, 1 on other); proximal segments with 10 bristles on comb side and 15 on jaw side. Each bristle with up to 6 bells. Terminal comb with 5 or 6 flat-tipped teeth on each side of about 13 longer alate teeth with rounded tips. Sclerotized ridge inside arc of comb and stout jaw opposite comb similar to those of adult female.

Furca (Figure 19g): Similar to that of adult female except 3rd claw only very slightly narrower than claw 4 and spinous processes between claws not observed.

Bellonci Organ (Figures 19h, 20e): Similar to that of adult female.

Eyes: Lateral eye (Figure 19f,h) and medial eye (Figure 19h) similar to those of adult female. Lateral eye same length as that of female but smaller relative to size of carapace, which is smaller in male.

Upper Lip (Figure 20f): Similar to that of adult female (proximal field of minute nodes present but not shown in Figure 20f). (Tip of both tusks of USNM 193948 with glob that could have been extruded, but may be debris (dashed in Figure 20f).)

Genitalia (Figure 20g): Small copulatory organ on each side of body anterior to furca (not studied in detail).

Anterior of Body (Figure 20e), **Y-Sclerite:** Similar to those of adult female.

Posterior of Body (Figure 20h, i): With 7 segments on each side continuous across posterior of body where each segments bends ventrally (Figure 20h); rounded posterior end of each segment viewed posteriorly forms visible edge (Figure 20i).

COMPARISONS.—The female *V. trifax* shares many characters with, and differs from the female *V. tubulata* Poulsen, 1962:198, mainly in the furca (5th claw articulated in *tubulata*, nonarticulated in *trifax*). The length of the carapace of the female *tubulata* is 4.17 mm, shorter than *trifax*, which is 5.0-5.3 mm in length. (Dr. Anne C. Cohen has reexamined the holotype of *V. tubulata* and verified that the 5th claw of the furca is articulated (in lit. 1990).)



FIGURE 20.—*Vargula trifax*, new species, adult male, paratype, USNM 193948: *a, b*, right (lv) and left (mv) 1st antennae, respectively (not all bristles shown); *c*, tip of left 1st antenna (not all bristles shown); *d*, part of endopodite of left mandible, mv; *e*, portion of dorsal part of anterior of body from right side; *f*, upper lip, anterior to right; *g*, part of body showing left copulatory organ, anterior to top; *h*, posterior of body from right side, anterior to right; *i*, posterior view of 3 segments shown in *h*.

Vargula matrix, new species

FIGURES 21–24, 110j

ETYMOLOGY.—From the Latin *matrix* (mother, womb, source).

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

TYPE LOCALITY.—Slope 69, 38°29.33'S, 149°19.98'E, Victoria, 76 km S of Point Hicks; depth 1840 m.

PARATYPES.—Slope 67: USNM 194003, ovigerous female on slide and in alcohol; USNM 194004, adult male on slide and in alcohol. Slope 69: USNM 193970, adult female with cryptoniscid isopods, on slide and in alcohol.

DISTRIBUTION.—Slope 67: 1277 m. Slope 69, 1840 m.

DESCRIPTION OF ADULT FEMALE (Figures 21–23, 110j).—Carapace oval in lateral view with caudal process blending smoothly with posterior margin of valve dorsal to process (Figures 20a,c,d, 23e). Incisur small at about valve midheight. Anterior edge of rostrum and anteroventral margin smooth.

Infold: Rostral infold of holotype and USNM 193970 with 11–17 bristles (Figure 21b), of USNM 194003 with 22 or 23 bristles (most divided); paired bristles at inner end of incisur (Figure 21b); 3 small bristles near inner end of incisur. Narrow list with anterior end ventral to incisur continuing along ventral margin, then broadening to form anterior edge of caudal process (Figure 21c–e). Each valve with 36–44 divided bristles along anteroventral list and anterior half of ventral list, 5–10 widely separated bristles along posterior half of ventral list, and 3–6 bristles between list and inner margin of anteroventral infold; left valve only with 2 bristles between list and valve edge near caudal process. Broad list of caudal process with 15–18 minute spines emerging from pores near anterior edge (Figure 21c,d) and numerous pores along posterior edge, some emerging on minute nodes (not shown). Posterior edge of valve at caudal process with 9–16 minute pores (Figure 21c–e).

Selvage: Narrow ridge of selvage along ventral edge of incisur segmented (segments are in area where lamellar prolongation is striated, and segments of ridge coincide with striae of lamellar prolongation) (Figure 21b). Narrow lamellar prolongation with smooth outer edge along anterior margin of rostrum. Lamellar prolongation not observed along dorsal edge of incisur. Prolongation wide and striated along ventral edge of incisur (not shown), then narrows and is without striae at point near anterior end of incisur; narrow prolongation along anteroventral margin of valve with minute spines along outer edge; prolongation slightly broader along ventral margin of valve and with smooth outer edge; selvage terminates at ventral end of caudal process. On ventral margin of right valve ridge of selvage located inward from outer edge of valve (Figure 21e shows ridge where it terminates at caudal process).

Carapace Size (length, height in mm): Slope 67: USNM 194003, 3.10, 2.19, height 71% of length. Slope 69: holotype, 2.92, 2.07, height 71% of length. USNM 193970, 2.92, 1.98, height 68% of length.

First Antenna (Figure 21f,g, 23b): Lateral side of 1st joint with few oblique rows of short spines near dorsal margin (not shown). 2nd joint with many ventral, dorsal, and medial spines (Figure 21f). 3rd and 4th joints each with 2 spinous bristles (1 ventral, 1 dorsal) (Figure 21f,g); 3rd joint with medial spines (Figure 21f). Sensory bristle of 5th joint with 9 or 10 long stout proximal filaments (some with small proximal spines), 2 long slender distal filaments, and bifurcate tip. Medial bristle of 6th joint with few marginal spines (right limb of USNM 194003 aberrant in having bristle normally on 6th joint on 7th joint). 7th joint: a-bristle broader and about $\frac{1}{3}$ longer than bristle of 6th joint, with short widely spaced marginal spines; b-bristle same length as a-bristle, with 4 or 5 short proximal filaments (some with few spines) and with few marginal spines on stem distal to filaments; c-bristle almost twice length of sensory bristle of 5th joint, with 9 bare filaments and bifurcate tip. 8th joint: d- and e-bristles well developed, bare; f-bristle about $\frac{3}{4}$ length of c-bristle, with 9 filaments (most with spines) and bifurcate tip; g-bristle with tip broken off on both limbs of USNM 193970, with 10 filaments (most with spines) on remaining part.

Second Antenna: Protopodite with medial bristle (with minute indistinct spines) about same length as longest proximal bristle of 1st endopodial joint (Figure 21h, 110j). Endopodite 3-jointed (Figure 21h): 1st joint with 4 bare proximal bristles (1 long, 3 short) and 1 long spinous bristle at midlength; 2nd joint elongate with distal bristle (bare or with few indistinct marginal spines) longer than 3rd joint; 3rd joint $\frac{2}{3}$ to $\frac{3}{4}$ length of 2nd, with long terminal filament. Exopodite: bristle of 2nd joint reaching 9th joint, with 9 or 10 ventral spines; bristle of 3rd joint with proximal ventral hairs stouter and shorter than dorsal hairs; bristles of joints 4–8 with thin natatory hairs; 9th joint with 4 bristles (2 long and 1 medium with natatory hairs, 1 (dorsal) short with few widely separated small spines); joints 3–8 with basal spines increasing in length on distal joints; spine of 8th joint and lateral spine of 9th joint about same length as 9th joint; joints 2–8 with row of minute spines along distal edge on lateral side and dorsal margin; joint 2 with medial row of spines at midlength near ventral margin.

Mandible: Coxale endite spinous with 2 terminal spines stouter than others but about same length; minute peg between terminal spines; small bristle present at base of endite. Basale (Figure 21i): ventral margin with 2 small a-bristles, 1 small lateral b-bristle, 2 c-bristles (proximal short, distal long), and 2 d-bristles (distal with long proximal and short distal spines) (left limb of USNM 194003 aberrant in having 3 d-bristles (2 distal long spinous)); dorsal margin with 1 bristle (with indistinct short spines) at distal $\frac{3}{4}$, and 2 subterminal with short spines; medial surface with indistinct distal hairs near dorsal margin. Exopodite spinous, slightly longer than dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal about half length of proximal) with short spines. 1st endopodial joint with 4 ventral bristles (1 long with long proximal and short distal spines, 1 long and 1 short with short



FIGURE 21.—*Vargula matrix*, new species, adult female, paratype, USNM 193970: *a*, complete specimen from right side showing 2 choniostomatids (female and either male or juvenile) in marsupium, length 2.92 mm; *b, c*, anterior and posterior of left valve, respectively, iv; *d*, detail from *c*; *e*, posteroventral corner of right valve, iv; *f*, joints 2 and 3 of right 1st antenna, mv; *g*, joint 3 of left 1st antenna, lv; *h*, protopodite and endopodite of left 2nd antenna, mv; *i*, basale of right mandible, mv; *j*, distal end of endopodite of left mandible, mv.

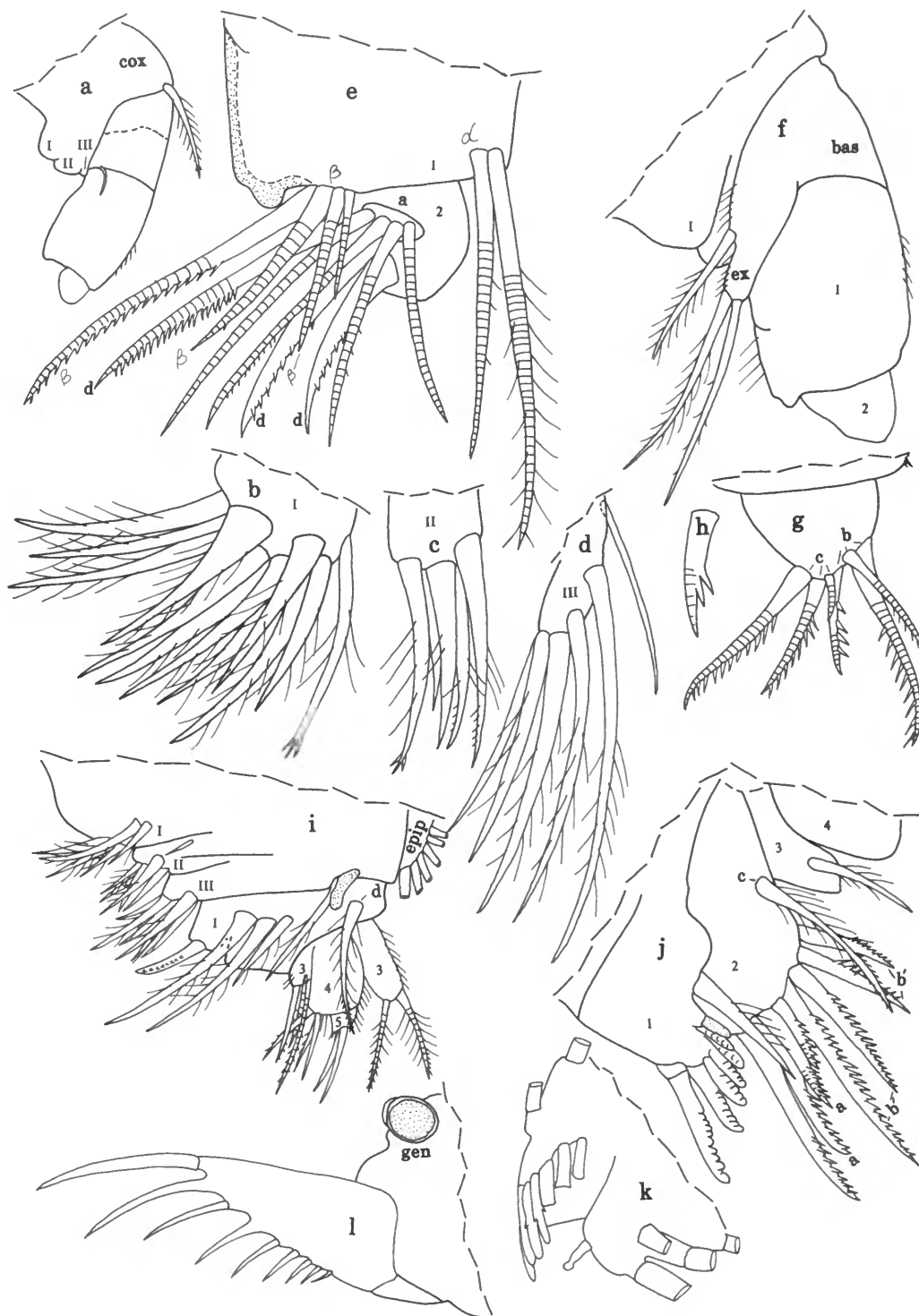


FIGURE 22.—*Vargula matrix*, new species, adult female, paratype, USNM 193970: *a*, left maxilla, mv (not all bristles shown); *b, c*, endites I and II of left maxilla, mv; *d*, endite III of right maxilla, lv; *e*, distal end of endopodite of right maxilla, lv (not all bristles shown); *f*, right maxilla, lv (not all bristles shown); *g*, *b*- and *c*-bristles of left maxilla, mv; *h*, posterior *b*-bristle of right maxilla, lv; *i*, part of left 5th limb, av; *j*, part of right 5th limb, pv (4 *b*" bristles not shown); *k*, tip of 7th limb; *l*, left lamella of furca and left copulatory organ with attached spermatophore.

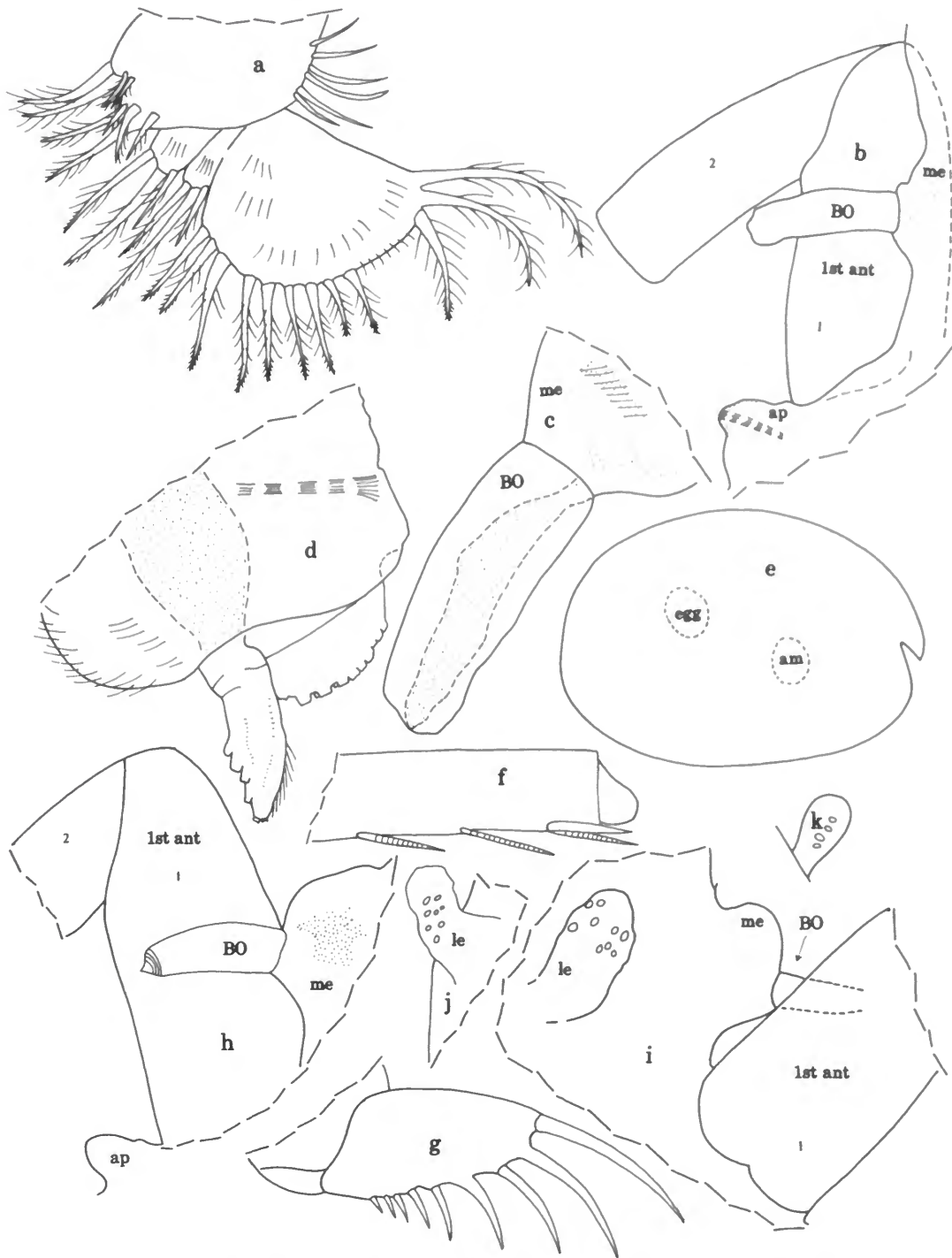


FIGURE 23.—*Vargula matrix*, new species, adult female, paratype, USNM 193970: *a*, right 6th limb, mv; *b*, dorsal part of anterior of body, anterior to left; *c*, medial eye and Bellonci organ; *d*, upper lip, anterior to right. Ovigerous female, paratype, USNM 194003: *e*, complete specimen from right side showing locations of 1 egg and central adductor muscle attachments, length 3.10 mm; *f*, ventral bristles of 2nd endopodial joint of left mandible, mv; *g*, right lamella of furca, lv; *h*, *i*, dorsal part of anterior of body from left side and right sides, respectively; *j*, left lateral eye. *k*, ovigerous female, holotype, right lateral eye.

spines, and 1 minute bare). 2nd endopodial joint (Figures 21j, 23f): ventral margin with 2 single ringed bristles and 2 terminal paired bristles (lateral ringed, medial unringed, slightly broader and shorter; tip of medial bristle broken off on illustrated limb, Figure 21j) (right limb of USNM 193970 aberrant, with only 1 single proximal bristle and lacking lateral terminal bristle); dorsal margin with 17–20 spinous bristles (5 long, 2 medium, and 10–13 short (spines on 1 short bristle slightly stouter than spines on other short bristles)); medial and ventral surfaces spinous. 3rd endopodial joint with 3 claws (dorsal bare, others with proximal teeth) and 4 bristles (Figure 21j).

Maxilla: Endite I with 12 spinous bristles (Figure 22b); endite II with 5 spinous bristles (Figure 22c); endite III with 1 slender proximal bristle and 5 stout spinous terminal bristles (Figure 22d). Coxale with long dorsal bristle with long proximal and short distal hairs (Figure 22a). Basale with small distal bristle near ventral margin (Figure 22a). Exopodite well developed, with 1 proximal plumose bristle and 2 terminal bristles (outer with long hairs along proximal $\frac{3}{4}$, inner with few minute indistinct spines) (Figure 22f). 1st endopodial joint with long hairs on medial side and along dorsal margin, 2 alpha-bristles (inner bare or with short spines; outer longer, plumose), 3 or 4 beta-bristles (outer pectinate, next either bare or with short spines, others bare) (4 beta-bristles on only 1 of 4 limbs examined and probably an aberrancy), and rounded cutting tooth (Figure 22e). 3rd endopodial joint with row of 4 a-bristles (posterior either bare or with short spines, next with many short spines, others bare) (Figure 22e), 3 pectinate b-bristles (posterior mostly unringed claw-like with 2–4 stout teeth, others ringed (Figure 22g,h)), 3 ringed c-bristles (anterior small bare, middle with 13 teeth and posterior with 15–18 teeth (not all teeth shown)) (Figure 22g), and 3 pectinate d-bristles (anterior unringed claw-like with 5 or 6 teeth; middle unringed claw-like with 8 or 9 teeth; posterior ringed longer with 21–27 teeth (not all teeth shown)) (Figure 22e).

Fifth Limb: Endite I with 7 spinous bristles; endite II with 1 small anterior bristle and 5 spinous terminal bristles; endite III with 8 spinous bristles (not all bristles shown in Figure 22i,j). Protopodial tooth short (Figure 22i). 1st exopodial joint: main tooth with bare proximal tooth and 6 pectinate teeth (Figure 22j); stout bristle (with long spines) proximal to bare tooth; anterior side with row of 3 bristles with long proximal spines, and 1 plumose bristle close to protopodial tooth (Figure 22i). 2nd exopodial joint with 4 pectinate a-bristles (2 smaller bristles either unringed or with few distal rings, others unringed), 4 ringed pectinate b'-bristles, 3 or 4 ringed pectinate b''-bristles (not shown), 1 posterior c-bristle with long proximal hairs and short distal spines (Figure 22j), and 1 anterior d-bristle with long hairs along proximal $\frac{2}{3}$ and short distal spines (Figure 22i). 3rd exopodial joint hirsute (especially outer lobe): inner lobe with 1 proximal bristle (with long proximal hairs and short distal spines) and 2 terminal bristles (inner ringed, outer either unringed or weakly ringed) with short spines; outer lobe with 2 ringed terminal bristles with long

proximal and short distal spines (Figure 22i). 4th joint separated from 5th by distinct suture; 4th joint of USNM 193970 with 3 ringed bristles with short spines, of USNM 194003 with 4 on left limb and 5 on right limb; 5th joint of USNM 193970 and left limb of USNM 194003 with 2 ringed bristles with short spines (right limb of USNM 194003 with 1 ringed bristle long proximal and short distal spines); joint with small process with short stout spines on distal inner corner; 4th and 5th joints hirsute. Rings not shown on all bristles.

Sixth Limb (Figure 23a): With 5 or 6 bare exopodial bristles. Endite I with 2–4 spinous bristles (1 or 2 small medial and 1 or 2 longer terminal); endite II with 5 or 6 spinous bristles (3 small medial and 2 or 3 longer terminal); endites III with 1 spinous distal medial bristle and 2 or 3 longer spinous terminal bristles; endite IV with 1 distal spinous medial bristle and 2 longer spinous terminal bristles. End joint with 9 or 10 bristles (with long proximal and short distal spines) followed by space and then 3 (usual) or 4 plumose bristles (anterior 1 or 2 with small spines near tip, posterior 2 plumose to tip). Medial side of endites III and IV and end joint hirsute; lateral side of end joint with spines along ventral edge.

Seventh Limb (Figure 22k): USNM 193970 with 24 or 25 bristles (distal group with 6 bristles on peg side and 7 on comb side, each with up to 5 bells; proximal group with 6 or 7 bristles on peg side and 5 on comb side, each with 2 (rare) or 3 bells); comb with 14 teeth (3 or 4 short flat-tipped teeth on each side of 7 longer alate teeth with rounded tips) (not all bristles shown in Figure 22k). Single peg opposite comb. USNM 194003 with 22–24 bristles (distal group with 5 bristles on peg side and 6 or 7 on comb side, each with up to 6 bells; proximal group with 5–8 bristles on peg side and 6 on comb side, each with 3 bells); comb with 11 or 12 teeth (3 or 4 short flat-tipped teeth on each side of 4 or 5 longer alate teeth with rounded tips); single peg with terminal spines opposite comb (note: spines not present on peg of USNM 193970).

Furca (Figures 22l, 23g): Each lamella with 9 claws; claws 2 and 4 nonarticulated; claw 3 longer but not as broad as claw 4; all claws with small teeth along posterior edge (not shown); claw 1 with distal teeth in medial row larger (not shown); right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figure 23b,c,h,i): Cylindrical with convex or pointed tip.

Eyes: Lateral eyes unpigmented, indistinct, with minute light amber-colored cells (Figure 23i–k) (eye not well defined and extremely difficult to see, and not visible through shell). Medial eye small, amber-colored except for small brownish area (Figure 23b,c,h,i) (brown area striated and amber-colored area stippled in Figure 23c).

Upper Lip (Figure 23d): Anterior part with fairly broad field with large widely separated glandular openings. Paired posterior part with 2 long tusks, each with 4 large step-like glandular openings along posterior edge and 2 or 3 glandular openings at tip; anterior edge of tusks with indistinct long hairs.

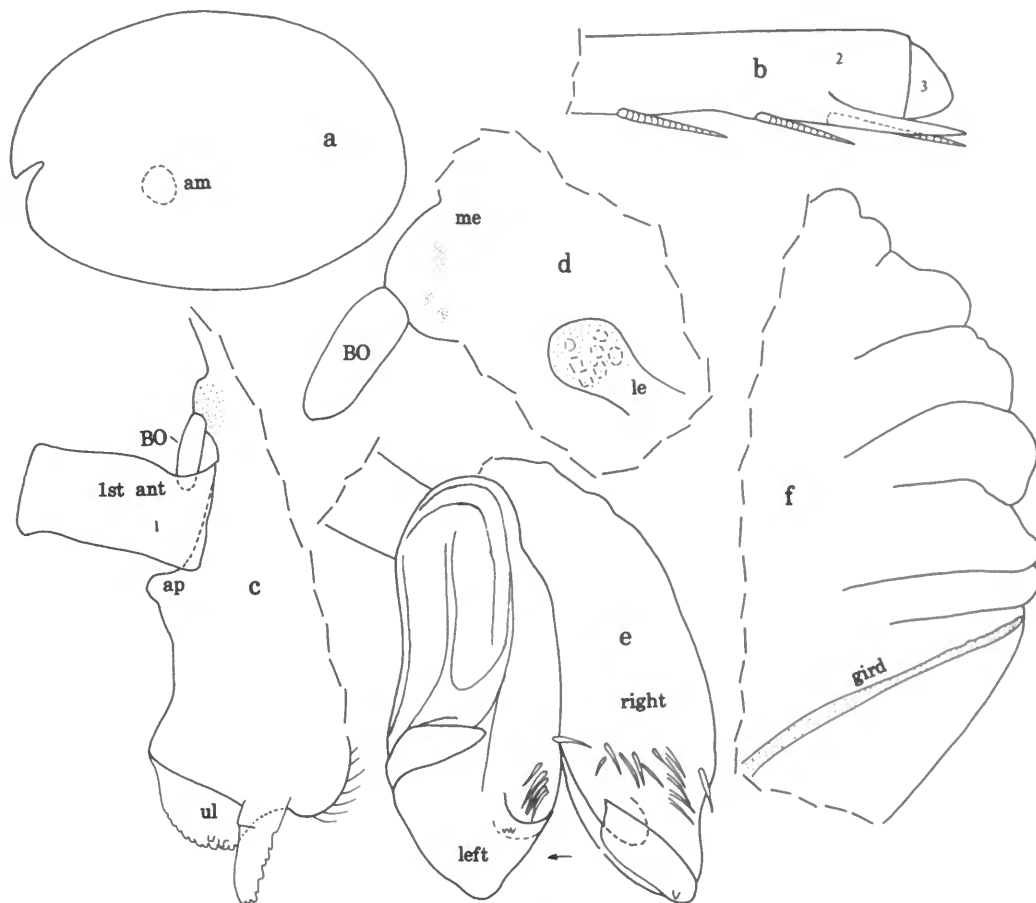


FIGURE 24.—*Vargula matrix*, new species, adult male, paratype, USNM 194004: *a*, complete specimen from left side showing location of central adductor muscle attachments, length 2.91 mm; *b*, ventral bristles of 2nd endopodial joint of left mandible, mv; *c*, anterior of body from left side, anterior to left; *d*, left lateral eye, medial eye and Bellonci organ, anterior to left; *e*, copulatory limbs; *f*, posterior of body from left side, anterior to left.

Genitalia (Figure 22*l*): Oval on each side of body anterior to furca.

Anterior of Body (Figure 23*h*): With rounded anterior process just ventral to bases of 1st antennae.

Posterior of Body: Dorsal corner near end of girdle with small spines.

Y-Sclerite: Typical for genus.

Number of Eggs: Slope 67: USNM 194003 with 17 eggs, length of typical egg 0.40 mm (1 egg within carapace shown in Figure 23*e*). Slope 69: holotype with 7 eggs in marsupium, length of typical egg 0.48 mm.

Parasites (Figure 21*a*): USNM 193970 with cryptoniscid isopods (1 female + 2 males or larvae) in marsupium.

DESCRIPTION OF ADULT MALE (Figure 24).—Carapace (Figure 24*a*) similar in shape to that of adult female.

Infold and Selvage: Not examined in detail.

Carapace Size (length, height in mm): USNM 194004, 2.91, 2.04, height 70% of length.

First Antenna: Joints 1–6 similar to those of adult female. 7th joint: a-bristle similar to that of adult female; b-bristle with distal part broken off on both limbs of USNM 194004, with 2 filaments on remaining part (proximal filament short stout with broad base, large transparent sucker, small triangular subterminal process, and pointed tip; next filament with minute triangular process followed by 4 small suckers); c-bristle about $\frac{1}{4}$ longer than bristle of 5th joint, with stout proximal filament (with broad base, large transparent sucker (larger than sucker of b-bristle), small button-like subterminal process, and pointed tip), followed by 2 slender filaments (each with small triangular process and 4 small suckers), followed by 6 slender bare filaments and bifurcate tip. 8th joint: d- and e-bristles about $\frac{3}{4}$ length of sensory bristle of 5th joint, bare with blunt tips;

f-bristle about same length as c-bristle, with 9 marginal filaments (some pectinate) and bifurcate tip; g-bristle about same length as c-bristle, with 10 marginal filaments (some pectinate) (tip of bristle missing on USNM 194004).

Second Antenna: Distal medial bristle about $\frac{3}{4}$ length of long proximal bristle of 1st endopodial joint; otherwise protopodite similar to that of adult female. Endopodite: longest proximal bristle of 1st joint same length as distal bristle; bristle of 2nd joint about twice length of 3rd joint; 3rd joint about $\frac{1}{2}$ length of 2nd; otherwise branch similar to that of adult female. Exopodite: bristle of 2nd joint with 13 stout ventral spines; ventral hairs of bristle of 3rd joint about same thickness as dorsal hairs; small dorsal bristle of 8th joint bare; branch otherwise similar to that of adult female.

Mandible (Figure 24b): Medial bristle of terminal pair on ventral margin of 2nd endopodial joint broader than that of female; limb otherwise similar to that of adult female.

Maxilla: Endite bristles not counted. 1st endopodial joint: inner alpha-bristle with short spines; with 3 beta-bristles (middle bristle with short spines). 2nd endopodial joint: middle c-bristle with 15 teeth; outer c-bristle with 20 teeth; anterior d-bristle with 8 teeth; middle d-bristle with 9 teeth; posterior d-bristle with 33 teeth. Limb otherwise similar to that of adult female.

Fifth Limb: Endite bristles not counted. Protopodial tooth and 1st exopodial joint similar to those of adult female. 2nd exopodial joint with 4 unringed a-bristles, 4 b'-bristles, 4 b"-bristles, and 1 c- and 1 d-bristle. 3rd exopodial joint: inner lobe with 3 bristles; outer lobe with 2 or 3 bristles with long spines. 4th exopodial joint with 3 or 4 bristles. 5th exopodial joint with 3 or 4 bristles and small spinous process.

Sixth Limb: With 5 bare epipodial bristles. Endite I with 2 spinous medial bristles and 1 longer spinous terminal bristle; endite II with 3 spinous medial bristles and 2 longer spinous terminal bristles; endite III with 1 distal spinous medial bristle and 3 spinous terminal bristles (middle bristle shorter); endite IV with 1 distal spinous medial bristle and 2 spinous terminal bristles. End joint (USNM 194004): left limb with 9 bristles (with long proximal and short distal spines) followed by space and then 4 plumose bristles (anterior bristle with small spines near tip, posterior 3 bristles plumose to tip); right limb with 10 spinous bristle followed by space with short partly extruded bristle at midlength of space, then 4 plumose bristles (anterior 2 bristles with small spines near tip, posterior 2 plumose to tip). Hairs and spines on limb similar to those of adult female.

Seventh Limb: USNM 194004 with 25 bristles (distal group with 5 bristles on peg side and 6 on comb side, each with up to 8 bells, but most with less); proximal group with 7 bristles on peg side and same on comb side, each with 3-5 bells (usually 3 or 4). Comb with 12 teeth (3 or 4 short flat-tipped teeth on each side of 5 or 6 longer alate teeth with rounded tips). Single peg with terminal spines opposite comb.

Furca, Bellonci Organ (Figure 24c,d), Eyes (Figure 24d), Anterior of Body (Figure 24c), and Y-Sclerite: Similar to

those of adult female.

Upper Lip (Figure 24c): Similar to that of adult female except each tusk with 5 instead of 4 step-like glandular openings along posterior edge.

Genitalia (Figure 24e): Two complex copulatory limbs anterior to furca.

Posterior of Body (Figure 24f): Margin dorsal to dorsal end of girdle with large undulations.

COMPARISONS.—The lateral eye of *V. matrix* is extremely difficult to see and the species could easily be interpreted to be without lateral eyes. Two species of *Vargula* without lateral eyes and having claws 2 and 4 of the furca nonarticulated are *V. dentata* Kornicker, 1975:183, and *V. lusca* Kornicker, 1975:190; and *V. psydrax* (herein) has minute eyes difficult to identify. The upper lip of *V. dentata* differs from that of *V. matrix* in having a proximal tooth on the tusks of the upper lip. The carapace of *V. psydrax* differs from that of *V. matrix* in being higher relative to length (height as percent of length 78%-84% for *V. psydrax*, 68%-71% for *V. matrix*) and in having distinct scalloping along anteroventral edge. The female *V. matrix* is only slightly larger than that of *V. lusca* (length 2.92-3.10 mm compared to 2.79 mm), the concavity formed between the upper end of the caudal process and the posterior margin of the left valve dorsal to caudal process is deeper on *V. lusca* than it is on *V. matrix*; the 6th limb of *V. matrix* has 5 or 6 epipodial bristles compared to 4 on *V. lusca*, but the intraspecific variability of that character is unknown. The lateral eye of *V. matrix* is small, unpigmented, and not visible through the shell, whereas those of *V. hex* and *V. straux*, although also small, are pigmented and easily visible through the shell. The lateral eye of *V. vix* is large and pigmented. The carapaces of *V. fugax* and *V. trifax* each have a much larger caudal process than the carapace of *V. matrix*.

Vargula vix, new species

FIGURES 25-27, 110i

ETYMOLOGY.—From the Latin *vix* (with difficulty, barely).

HOLOTYPE.—Ovigerous female on slide and in alcohol in 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: 1 partly dissected unnumbered adult female on slide and in alcohol; 4 undissected unnumbered females in alcohol (1 ovigerous female, 2 adult females, 1 adult female with chonistomatid copepods (1 juvenile, 2 egg sacs)).

DISTRIBUTION.—Slope 40, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 25-27, 110i).—Carapace oval in lateral view with narrow very slightly projecting caudal process (Figure 25a,c); incisur small at about midheight; surface with indistinct scalloping reflected by unevenness along anteroventral valve edge (Figure 25d).

Infold: Rostral infold with row of 12 or 13 divided bristles

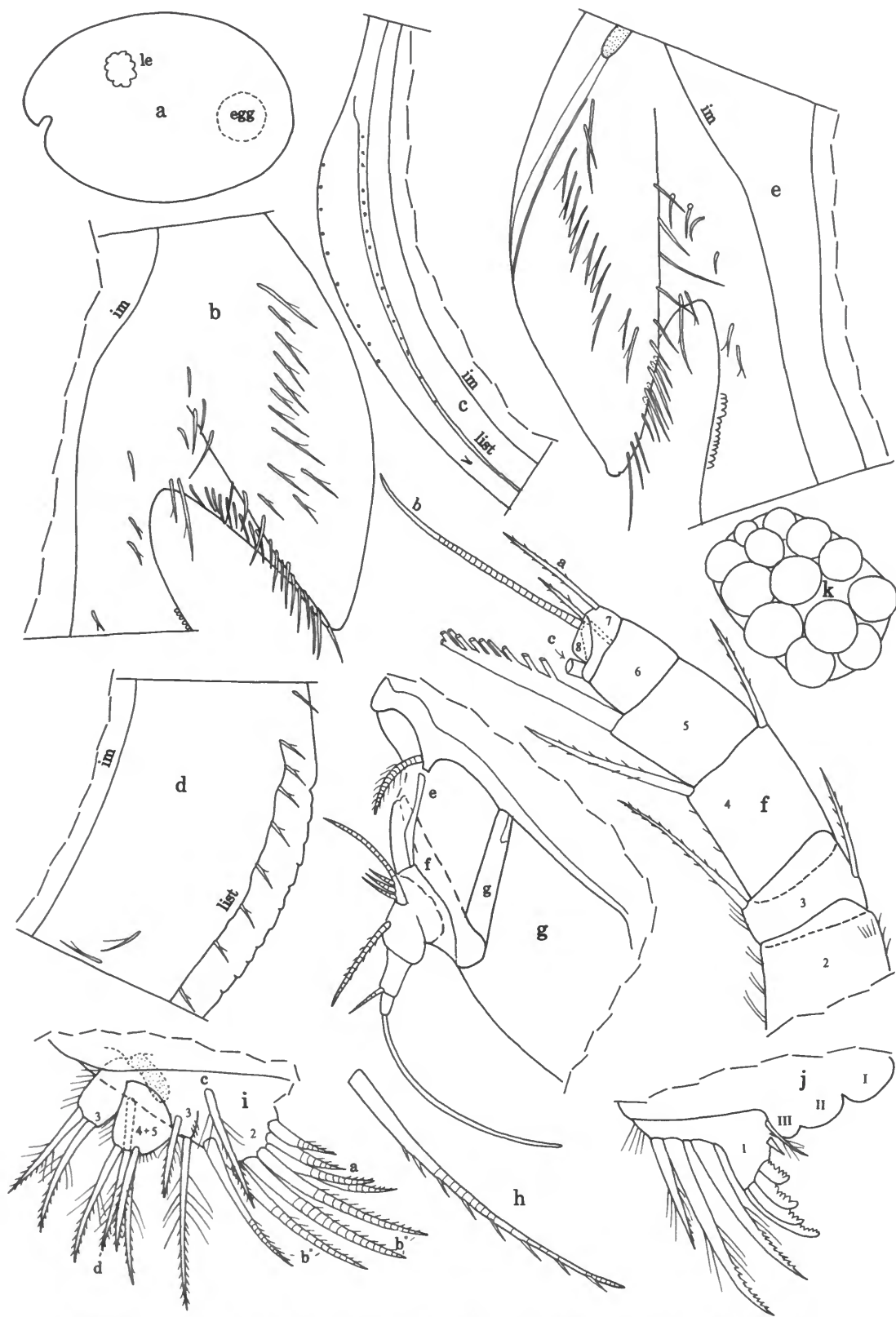


FIGURE 25.—*Vargula vix*, new species, ovigerous female, holotype: *a*, complete specimen from left side showing locations of left lateral eye and 1 egg, length 1.77 mm; *b,c*, anterior and posterior, respectively, of left valve, iv; *d*, part of anteroventral margin, left valve, iv; *e*, anterior, right valve, iv; *f*, part of left 1st antenna, 1v (not all bristles shown); *g*, part of protopodite and endopodite of right 2nd antenna, 2v; *h*, bristle of 2nd joint of exopodite of left 2nd antenna, 1v; *i*, part of left 5th limb, 5v (3 b'-bristles not shown); *j*, part of left 5th limb, 5v (endite bristles and 2nd-5th joints not shown); *k*, left lateral eye, anterior to left.



FIGURE 26.—*Vargula vix*, new species, ovigerous female, holotype: a, part of left mandible, mv; b,c, tips of left and right mandibles, respectively, mv; d, endopodite of right maxilla, lv (bristles not shown); e, a-bristles of right maxilla, lv; f, part of left maxilla, mv (not all bristles shown); g, bristles of 2nd endopodial joint of left maxilla, mv (a-bristles not shown); h, left 6th limb, mv; i, tip of 7th limb; j, left lamella of furca, left genital organ with attached spermatophore, and left Y-sclerite.



FIGURE 27.—*Vargula vix*, new species, ovigerous female, holotype: a, anterior of body from right side, anterior to right; b, upper lip, anterior to left; c, posterior of body showing unextruded eggs, anterior to right.

parallel to anterior edge of valve (Figure 25b,e). List of rostrum well defined, with numerous bristles along list and between list and incisur: holotype with about 19 bristles on right valve (Figure 25e) and about 27 bristles on left valve (Figure 25e). Inner end of incisur with 2 (anterior longer) divided bristles, and 1 short bristle inward from them. Anteroventral infold with 2 divided bristles just ventral to inner end of incisur (Figure 25b,e). Narrow list with anterior end ventral to incisur continues along ventral margin, then broadens to form anterior edge of caudal process; list crenulate and close to outer edge of infold along anteroventral margin, and straight and at midwidth of infold in vicinity of caudal process; about 27 divided bristles along anteroventral list and anterior half of ventral list (8 anterior bristles shown in Figure 25d, which also shows single bristle anterior to end of list), 1 or 2 bristles along posterior half of ventral list, and 2 divided bristles between list and inner margin of anteroventral infold (Figure 25d; left valve only with 2 paired bristles between list and outer margin of infold just anterior to ventral edge of caudal process (shown in Figure 25c). Broad list along anterior edge of caudal process with about 16 minute pores (Figure 25c). Posterior edge of caudal process with row of about 10 minute pores (Figure 25c).

Selvage: Narrow lamellar prolongation with smooth outer edge along anterior margin of rostrum. Lamellar prolongation not observed along dorsal edge of incisur. Prolongation wide and striated along ventral edge of incisur, and narrow and without striae at point near anterior end of incisur; prolongation narrow, without striae, and with smooth outer edge along

anteroventral margin of valve; prolongation similar along ventral margin except broader; selvage terminates at ventral end of caudal process. On ventral margin of right valve proximal ridge of selvage located inward from outer edge of valve.

Carapace Size (length, height in mm): Slope 40: holotype, 1.77, 1.26, height 71% of length; partly dissected specimen, 1.83, 1.30, height 71% of length; undissected specimen with small unextruded eggs, 1.84, 1.31, height 71% of length; undissected specimen with chionostomatid parasites, 1.74, 1.22, height 70% of length.

First Antenna (Figure 25f): 1st joint bare. 2nd joint with many ventral, dorsal, and medial hairs, and fewer rows of lateral hairs near ventral margin. 3rd joint with ventral and medial spines and 2 spinous bristles (1 ventral, 1 dorsal). 4th joint with ventral spines and 2 spinous bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 10 long stout proximal filaments, 2 long slender distal filaments, and bifurcate tip. Medial bristle of 6th joint almost twice length of joint, with few indistinct marginal spines. 7th joint: a-bristle spinous, about $\frac{1}{4}$ longer than bristle of 6th joint; b-bristle about twice length of a-bristle, ringed in proximal $\frac{2}{3}$, bare except for spine at tip; c-bristle almost twice length of sensory bristle of 5th joint, with 9 filaments (some with spines) and bifurcate tip. 8th joint: d- and e-bristles well developed bare; f-bristle slightly shorter than c-bristle, with 9 filaments (most with spines) and bifurcate tip; g-bristle about same length as c-bristle, with about 11 filaments (most with spines) and bifurcate tip.

Second Antenna: Protopodite with medial bristle (with slender spines) shorter than long proximal bristle of 1st endopodial joint (Figures 25g, 110i). Endopodite 3-jointed (Figure 25g): 1st joint with 4 bare proximal bristles (1 long, 3 short) and 1 long distal bristle with minute indistinct spines; 2nd joint with bare distal bristle longer than 3rd joint; 3rd joint with long terminal filament. Exopodite: bristle of 2nd joint with 8 or 9 ventral spines (Figure 25h); bristle of 3rd joint with short slender hair-like proximal ventral spines and long natatory hairs; bristles of joints 4–8 with long natatory hairs; 9th joint with 3 bristles (1 long and 1 medium with natatory hairs, 1 short (dorsal) with short hair-like spines); joints 3–8 with basal spines increasing in length on distal joints; spine of 8th joint either same length or about $\frac{1}{4}$ longer than 9th joint; lateral spine of 9th joint about $\frac{1}{4}$ longer than joint; joints 2–8 with minute spines along distal edge on lateral side and dorsal corner; joint 2 with row of ventral and medial spines at midlength.

Mandible (Figure 26a–c): Coxale endite spinous with 2 terminal spines stouter than others but about same length; no peg between terminal spines; small bristle present at base of endite. Basale (Figure 26a): ventral margin with 2 a-bristles (1 short with few indistinct spines, 1 longer spinous), 1 small lateral b-bristle, 2 spinous c-bristles (proximal short, distal about twice length of long a-bristle), and 2 spinous d-bristles (proximal slender with short spines, distal stout, very long, with long proximal and short distal spines); dorsal margin with 1 bristle (with indistinct spines) at distal $\frac{3}{4}$, and 2 subterminal with short spines; medial surface with indistinct distal hairs near dorsal margin. Exopodite spinous, slightly longer than dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal about $\frac{1}{2}$ length of proximal). 1st endopodial joint with 4 bristles (1 long with long proximal and short distal spines, 1 long and 1 short with short spines, and 1 minute bare). 2nd endopodial joint: ventral margin with 4 ringed spinous bristles (right limb of holotype with 2 single and 2 terminal paired (Figure 26c); left limb aberrant in having 2 sets of paired bristles (Figure 26b)); dorsal margin with 11 spinous bristles (5 long, 1 medium (distal), and 5 short (spines on 2 stouter than spines on others)); medial surface and ventral margin spinous. 3rd endopodial joint with 4 spinous pointed claws (with incomplete rings (rings not shown)) and 2 ringed spinous ventral bristles (Figure 26b,c).

Maxilla: Endite I spinous, with 8 spinous bristles; endite II spinous, with 4 or 5 spinous bristles; endite III with 1 slender proximal bristle and 4 stout spinous terminal bristles (only 1 shown in Figure 26f). Coxale with plumose dorsal bristle (not shown). Basale with long slender ventral bristle and short medial bristle at midwidth (Figure 26f). Exopodite well developed, with 1 proximal and 2 terminal bristles, all with long hairs (Figure 26f). 1st endopodial joint with long dorsal hairs, 1 alpha-bristle with long proximal hairs, 2 beta-bristles (outer pectinate, inner smaller with long proximal hairs), and unusual cutting tooth extending along distal $\frac{1}{3}$ to $\frac{1}{2}$ length of

joint, with 4 cusps (proximal cusp low, others well developed, triangular) (Figure 26f). 2nd endopodial joint with 4 ringed pectinate a-bristles (Figure 26e), a total of 6 b- and c-bristles, and 3 pectinate d-bristles (anterior unringed claw-like, others ringed) (Figure 26g).

Fifth Limb (Figure 25i,j): Endites I, II, and III each with about 6 spinous bristles (not shown). Protopodial tooth elongate (dashed in Figure 25i). 1st exopodial joint: main tooth with bare pointed proximal tooth and 4 pectinate teeth (Figure 25j); slender ringed bristle with long spines proximal to bare tooth; anterior side with row of 3 bristles with long proximal spines (inner and middle bristle pectinate distally, other with slender distal spines) (Figure 25j). 2nd exopodial joint with 4 pectinate ringed a-bristles, 3 pectinate ringed b'-bristles (not shown in Figure 25i), 4 pectinate ringed b"-bristles, 1 posterior c-bristle with long proximal and short distal spines, and 1 anterior d-bristle with long proximal and short distal spines (Figure 25i). 3rd exopodial joint hirsute: inner lobe with 2 bristles (1 proximal, 1 terminal), both ringed and with long proximal and short distal spines; outer lobe with 2 ringed terminal bristles with long proximal and short distal spines. 4th and 5th joints fused, hirsute, with 3 ringed bristles (shortest with short marginal spines, others with long proximal and short distal spines); minute process (with short spines) on distal inner corner. Rings not shown on all bristles.

Sixth Limb (Figure 26h): With 4 bare epipodial bristles. Endite I with 2 small spinous medial bristles and 1 stout spinous terminal bristle; endite II with 3 small spinous medial bristles and 2 long spinous terminal bristles; endite III with 2 stout spinous terminal bristles; endite IV with 1 stout spinous terminal bristle. End joint with 9 or 10 bristles (with long proximal and short distal spines) followed by small space, then 1 bristle with long proximal and short distal spines and 2 plumose bristles. Endites III and IV and end joint with abundant long medial hairs; end joint with stout lateral spines along ventral edge (spines absent in vicinity of 2 posterior plumose bristles). Limb with pigment appearing brown in transmitted light.

Seventh Limb: With 11 bristles (distal group with 6 bristles (3 on each side), each with 3–5 bells; proximal group with 5 bristles (2 on comb side, 3 on peg side), each with 3 bells. Comb with about 9 alate teeth (2 short teeth on each side of 5 longer teeth) (Figure 26i). Single spinous peg opposite comb.

Furca (Figure 26j): Each lamella with 9 claws, all articulated; claw 4 broader than claw 3 but about same length; all claws with small teeth along posterior edge (not shown); claw 1 with fairly large teeth in medial row (not shown); right lamella with few distal spines along anterior edge; ventral edge of each lamella with small spines following claw 9; right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figure 27a): Elliptical with small terminal process.

Eyes: Lateral eye large, with 13 brownish ommatidia, and darker brown pigment between ommatidia (Figure 25a,k).

Medial eye about half size of lateral eye, unpigmented, bare (Figure 27a).

Upper Lip (Figure 27a,b): Anterior unpaired part with about 5 rows of fairly large glandular openings anteriorly directed. Tusks of posterior paired part fairly short, each with 2 fairly large proximal glandular openings and 2 smaller distal openings along anterior edge, and tip with 1 small glandular opening.

Genitalia: USNM 193981 with oval ring with attached spermatophore on each side of body anterior to furca (Figure 26j).

Anterior of Body (Figure 27a): With rounded anterior process just ventral to bases of 1st antennae.

Posterior of Body (Figure 27c): Evenly rounded bare.

Y-Sclerite (Figures 26j, 27c): Typical for genus.

Number of Eggs: Holotype with 9 eggs in marsupium (length of typical egg 0.36 mm; 1 egg shown in Figure 25a) and single cluster of smaller unextruded eggs (about 6 large and 4 small; length of largest egg 0.18 mm) (Figure 27c).

Parasites: Adult female from Slope 40 with chonistomatid copepods (1 juvenile + 2 egg sacs) in marsupium.

COMPARISONS.—The carapace of *V. vix* is smaller than those of other species of *Vargula* described previously herein (length of adult female *V. vix* 1.74–1.84 mm; range of lengths of other species 2.11–5.3 mm (*V. fugax* 3.5 mm, *V. hex* 2.65–2.85 mm, *V. matrix* 2.92–3.10 mm, *V. psydrax* 2.66–2.83 mm, *V. straux* 2.11–2.33 mm, and *V. trifax* 5.0–5.3 mm). The cutting tooth of the maxilla of *V. vix* differs from those of previously described species in covering $\frac{1}{3}$ to $\frac{1}{2}$ the length of the 2nd endopodial joint. The 5th limb of *V. vix* is unusual in having only 4 pectinate teeth on the main tooth of the 1st exopodial joint (on both limbs of 2 specimens examined). The upper lip of *V. vix* has fairly short tusks, and unlike those of other species of the genus the glandular openings are close to the anterior rather than the posterior edge. All claws of the furcae of *V. vix* and *V. fugax* are articulated; the carapace of the latter species has a long projecting caudal process absent on *V. vix*. *Vargula vix* differs from *V. sutura* Kornicker, 1975:167, which also has all furcal claws articulated, in having lateral eyes. *Vargula vix* differs from *V. dentata* Kornicker, 1975:183 in having all furcal claws articulated and in having lateral eyes, as well as not having a proximal tooth on the tusks of the upper lip.

Vargula psydrax, new species

FIGURES 28–31, 110f,g

ETYMOLOGY.—From the Greek *psydrax* (blister).

HOLOTYPE.—One undissected ovigerous female in alcohol in the Museum of Victoria.

TYPE LOCALITY.—Slope 69, 28°29.33'S, 149°19.98'E, Victoria, 76 km S of Point Hicks; depth 1840 m.

PARATYPES.—Slope 17: juvenile in alcohol; USNM 194000, adult male on slide and in alcohol. Slope 25: USNM 193900,

ovigerous female on slide and in alcohol. Slope 53: 27 undissected specimens in alcohol (7 ovigerous females, 6 adult females, 5 adult males, 9 juveniles). Slope 56: USNM 193995, ovigerous female on slide and in alcohol. Slope 67: 1 undissected ovigerous female, 1 partly dissected and 1 undissected adult male in alcohol. Slope 69: USNM 193969, partly dissected ovigerous female on slide (7th limbs) and in alcohol; 1 adult female (without eggs) with cryptoniscid isopods in alcohol. Slope 81: juvenile in alcohol.

DISTRIBUTION.—Slope 17, 2250 m. Slope 25, 1850 m. Slope 53, 996 m. Slope 56, 429 m. Slope 67, 1277 m. Slope 69, 1840 m. Slope 81, 1264 m. Known depth range 429–2250 m.

DESCRIPTION OF ADULT FEMALE (Figures 28–31a, 110f,g).—Carapace oval in lateral view with small but distinct angle where posterior edge of shell joins caudal process (Figures 28a, 30f). Incisur small and at about valve midheight. Surface of shell with minute closely spaced pustules appearing as crescent-like ridges in rows (Figure 28c) (not always visible on decalcified shells). Anterior edge of rostrum with slight scalloping, and anteroventral margin ventral to incisur with distinct scalloping (Figure 28b).

Infold: Rostral infold with about 16 divided bristles plus paired bristles at inner end of incisur (longer bristle divided) (Figure 28d); anteroventral infold with 3 small divided bristles near incisur. Narrow list with anterior end ventral to incisur continues along ventral margin (Figure 28d), then broadens to form anterior edge of caudal process (Figure 28e–g). Left valve of USNM 193900 with 53 divided bristles along anteroventral and ventral list to point near ventral end of caudal process; right valve with only about 40; left valve of USNM 193995 with about 54 bristles; right valve with about 35 bristles. Broad list along anterior edge of caudal process with about 15 minute bristles emerging from pores (some pores shown in Figure 28g). Anteroventral infold between list and inner margin with 2 divided bristles (Figure 28d). Left valves of both USNM 193900 and 193995 with 3 or 4 bristles between list and valve edge just anterior to caudal process. Posterior edge of caudal process with 10–13 minute pores (5 pores shown in Figure 28g).

Selvae: Narrow ridge of selvae along ventral edge of incisur segmented (segments are in area where lamellar prolongation is striated, and segments of ridge appear to coincide with striae of lamellar prolongation) (Figure 28d). Narrow lamellar prolongation with smooth outer edge along anterior margin of rostrum. Lamellar prolongation not observed along upper edge of incisur. Prolongation wide and striated along ventral edge of incisur then narrows and is without striae at point near anterior end of incisur; narrow prolongation along anteroventral margin of valve with minute spines along outer edge; prolongation slightly broader along ventral margin of valve and with smooth outer edge; selvae terminates at ventral end of caudal process (Figure 28e–g).

Central Adductor Muscle Attachments (Figure 28h,i): Comprising numerous ovoid attachments, some coa-

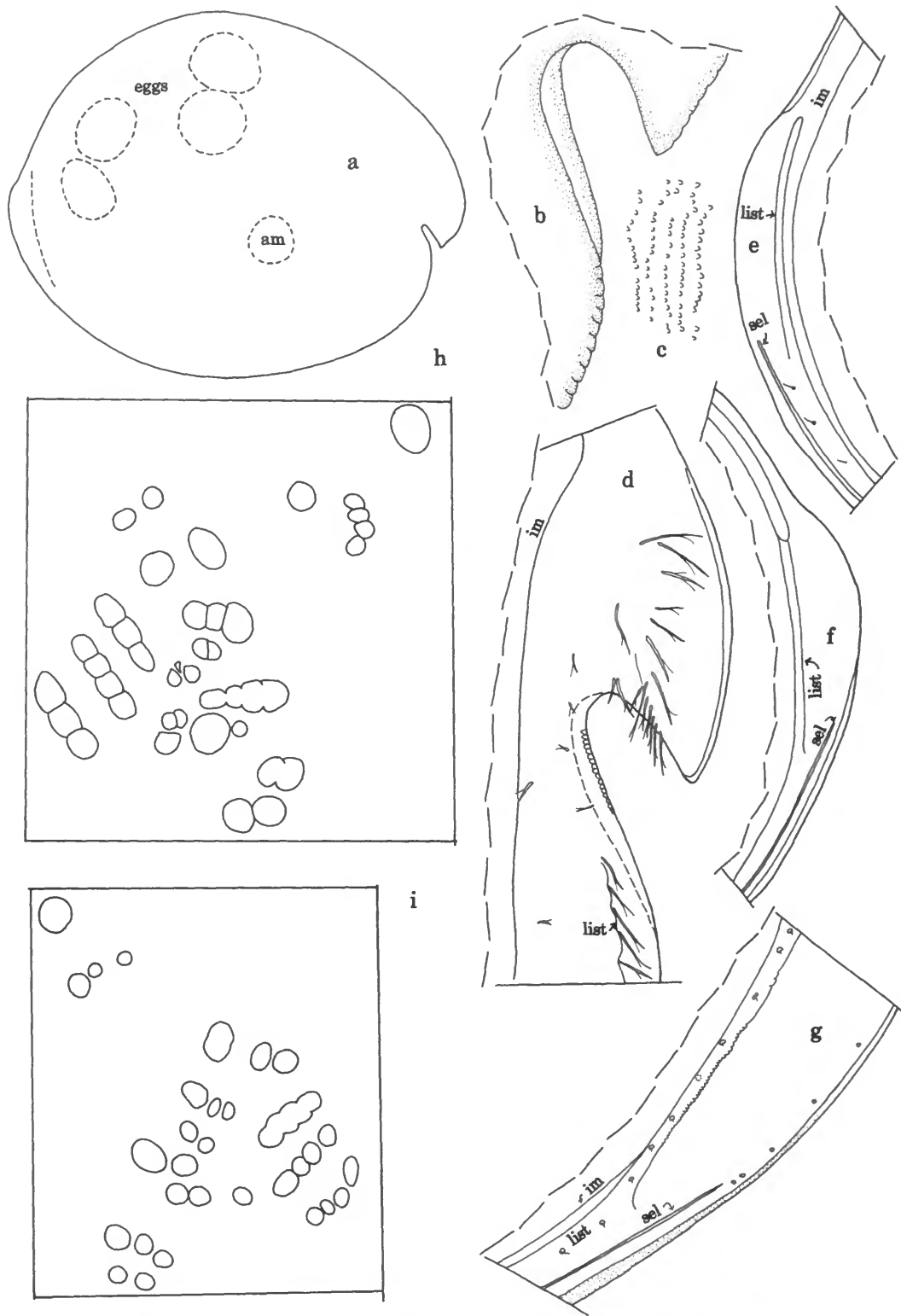


FIGURE 28.—*Vargula psydrax*, new species, ovigerous female, paratype, USNM 193900: *a*, complete specimen from right side showing locations of eggs and central adductor muscle attachments, length 2.83 mm; *b*, anterior, right valve, ov; *c*, lineation of surface pustles near posterior end of right valve; *d*, anterior, left valve, iv; *e, f*, posterior of left and right valves, respectively, iv; *g*, detail from *f*; *h, i*, central adductor muscle attachments of left and right valves, respectively, ov.

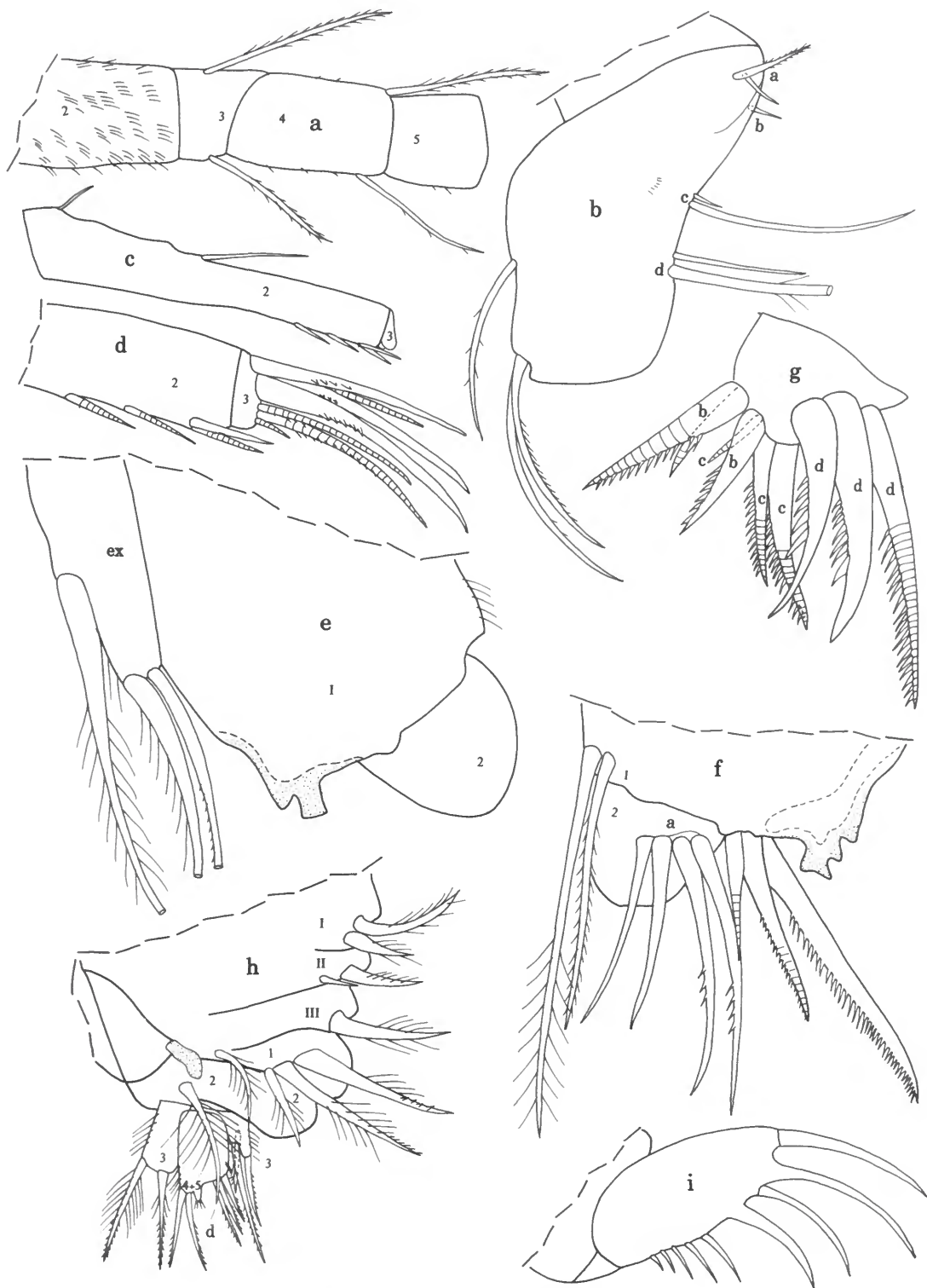


FIGURE 29.—*Vargula psyrax*, new species, ovigerous female, paratype, USNM 193900: *a*, part of left 1st antenna, mv; *b*, basale, right mandible, mv; *c,d*, parts of endopodite of left mandible, mv; *e*, part of right maxilla, lv (not all bristles shown); *f*, part of endopodite of left maxilla, lv (most bristles not shown); *g*, 2nd endopodial joint of left maxilla, lv (a-bristles not shown); *h*, part of right 5th limb, av (not all bristles shown); *i*, right lamella of furca.



FIGURE 30.—*Vargula psydrax*, new species, ovigerous female, paratype, USNM 193900: a, part of left 5th limb, pv (b' and b"-bristles not shown); b, right 6th limb, mv; c, 7th limb; d, detail from c; e, medial eye and Bellonci organ; f, anterior of body from left side, anterior to left; g, posterior of body from left side, anterior to left; h, left genital organ and attached spermatophore, anterior to left. Ovigerous female, paratype, USNM 193995: i, complete specimen from right side showing locations of eggs and central adductor muscle attachments, length 2.32 mm; j, bristles of 2nd exopodial joint, left 5th limb, pv; k, anterior of body from right side, anterior to right.

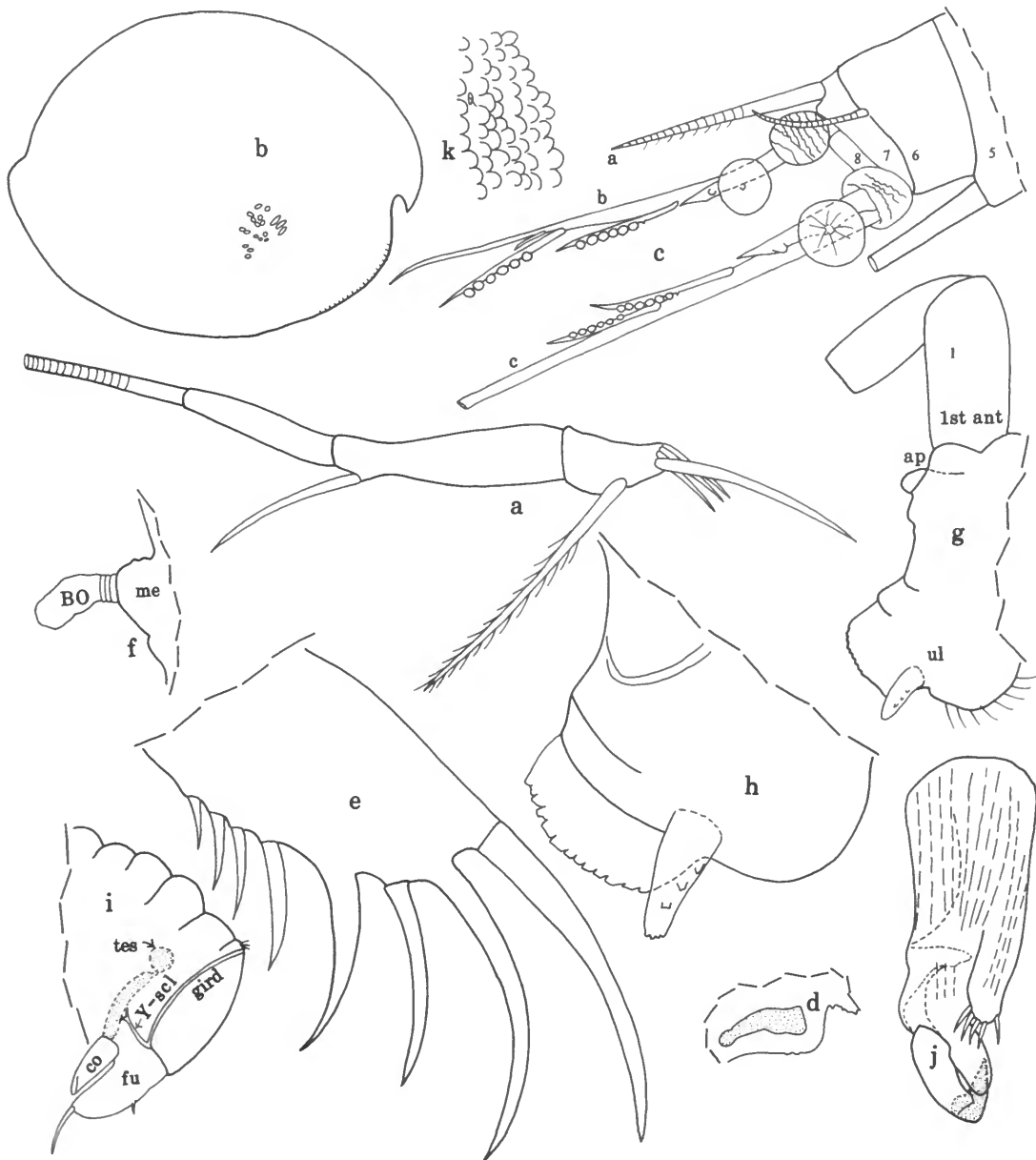


FIGURE 31.—*Vargula psydrax*, new species: *a*, ovigerous female, paratype, USNM 193900, endopodite of left 2nd antenna, mv. Adult male, paratype, USNM 194000: *b*, complete specimen from right side showing central adductor muscle attachments, length 2.38 mm; *c*, tip of right 1st antenna, mv (not all bristles shown); *d*, anterior tooth of protopodite of left 5th limb; *e*, right lamella of furca; *f*, medial eye and Bellonci organ; *g*, anterior of body from left side, anterior to left; *h*, upper lip, anterior to left; *i*, posterior of body from left side, anterior to left; *j*, left copulatory organ, anterior to left. *k*, adult male from Slope 53, crescentic ridges on surface of right valve near midheight and about $\frac{3}{4}$ valve length.

lescing to form elongate attachments.

Carapace Size (length, height in mm): Slope 25: USNM 193900, 2.83, 2.28, height 81% of length. Slope 53: unnumbered specimen, 2.30, 1.78, height 78% of length. Slope 56: USNM 193995, 2.32, 1.80, height 78% of length. Slope 67: unnumbered specimen, 2.63, 2.20, height 84% of length. Slope 69: holotype, 2.66, 2.13, height 80% of length; USNM 193969, 2.70, 2.18, height 81% of length; adult female without eggs, 2.76, 2.25, height 82% of length. Length range 2.30–2.83; range of height as percent of length 78–84. Note unusually large size range for species.

First Antenna (Figure 29a): 1st joint bare. 2nd joint with many ventral, dorsal, and medial spines, and few distal lateral spines. 3rd and 4th joints each with 2 spinous bristles (1 ventral, 1 dorsal); 4th joint with few ventral and dorsal spines. Sensory bristle of 5th joint with 9 or 10 long stout proximal filaments, 2 long slender distal filaments, and bifurcate tip; joint with few ventral spines. Medial bristle of 6th joint short with few minute spines. 7th joint: a-bristle about $\frac{1}{3}$ longer than bristle of 6th joint, with short marginal spines; b-bristle about $\frac{1}{5}$ longer than a-bristle, with 5 short proximal filaments; c-bristle about $\frac{1}{2}$ longer than sensory bristle of 5th joint, with 9 bare proximal filaments and bifurcate tip. 8th joint: d- and e-bristles about twice length of b-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 9 proximal filaments (most with spines) and bifurcate tip; g-bristle about same length as c-bristle, with 10 or 11 filaments and bifurcate tip.

Second Antenna: Protopodite with spinous medial bristle about same length as long proximal bristle of 1st endopodial joint (Figure 110f,g). Endopodite 3 jointed (Figure 31a): 1st joint with 4 bare proximal bristles (1 long, 3 short) and 1 long spinous distal bristle; 2nd joint elongate with distal bristle about same length as 3rd joint; 3rd joint about $\frac{3}{4}$ length of 2nd, with long terminal filament about twice length of stem (only proximal part shown in Figure 31a). Exopodite: 1st joint with indistinct spines along concave dorsal margin; bristle of 2nd joint reaching 9th joint, with 0–3 small proximal ventral spines followed by 10–13 stouter ventral spines and small spine at tip; bristle of 3rd joint with numerous slender ventral spines and distal natatory hairs; bristles of joints 4–8 with natatory hairs, no spines; 9th joint with 4 bristles (2 long and 1 medium with natatory hairs, 1 short, bare); joints 3 to 8 with basal spines increasing in length on distal joints; spine of 8th joint slightly longer than 9th joint; lateral spine of 9th joint about $\frac{1}{4}$ times length of joint; 2nd joint with few ventral and dorsal spines, and minute indistinct spines along middle of distal margin of lateral side; joints 3–8 with few indistinct minute spines on distal dorsal corner; joints 3 and 4 with minute spines along middle of distal edge of lateral side.

Mandible: Coxale endite spinous with 2 small terminal spines stouter than others but about same length; minute peg between terminal spines; small bristle present at base of endite. Basale (Figure 29b): medial surface with few spines; ventral

margin with 2 small a-bristles, 1 b-bristle, 2 c-bristles, and 2 d-bristles (longer with long proximal and short distal spines) (left limb of USNM 193900 aberrant in having 3 d-bristles (2 very long, 1 short)); dorsal margin with 1 bristle near midlength and 2 subterminal, all with short spines. Exopodite spinous, about same length as dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal shorter bare, or with few minute spines, other with short spines). 1st endopodial joint with 4 ventral bristles (1 long with long proximal and short distal spines, 1 long, 1 short, and 1 minute with short spines). 2nd endopodial joint (Figure 29c,d): ventral margin with 2 single ringed bristles and 2 terminal, bare, pointed, paired bristles (lateral ringed, medial unringed, slightly wider and longer) (right limb of USNM 193900 aberrant in having paired ringed bristles in place of single proximal bristle); dorsal margin with 14 bristles (5 long, 2 medium, and 7 short (none of the short bristles with stout spines)); medial and ventral surfaces spinous. 3rd endopodial joint with 3 claws (with proximal teeth) and 4 bristles (Figure 29d).

Maxilla: Endite I with 11 spinous bristles; endite II with 5 spinous bristles; endite III with 7 spinous bristles (1 proximal and 6 terminal). Coxale with long dorsal bristle with long proximal hairs and short distal spines. Basale with small medial bristle near midwidth of distal margin and 1 long ventral bristle. Exopodite well developed, with 1 proximal spinous bristle and 2 terminal bristles (outer with long proximal hairs and short distal spines; inner with short spines) (Figure 29e). 1st endopodial joint with dorsal spines, 2 ringed alpha-bristles (inner short with short hairs; outer long with long hairs), 3 ringed beta-bristles (middle and outer pectinate, inner bare), and cutting tooth with large squarish distal cusp and 1 or 2 triangular proximal cusps (Figure 29e,f). 3rd endopodial joint with 4 ringed a-bristles (posterior 2 spinous, others either bare or with few spines) (Figure 29f), 3 pectinate b-bristles (inner unringed or with poorly developed rings), 3 ringed c-bristles (1 small either bare or with few spines, others pectinate), and 3 pectinate d-bristles (2 unringed claw-like) (Figure 29g). (Rings not shown on all ringed bristles.)

Fifth Limb (Figures 29h, 30a,j): Epipodite with 60 plumose bristles. Endites I to III each with 6 or 7 bristles (not all shown in Figure 29h). Protopodial tooth short (Figure 29h). 1st exopodial joint: main tooth with fairly large proximal tooth (with few minute spines at tip) and 6 pectinate teeth (Figure 30a); stout bristle with long spines proximal to bare tooth; anterior side with row of 3 bristles with long proximal hairs (2 longer bristles pectinate distally) and 1 bristle with long proximal hairs closer to protopodial tooth. 2nd exopodial joint with 4 unringed pectinate a-bristles (Figure 30a,j), 3 ringed pectinate b'-bristles, 4 ringed pectinate b"-bristles, 1 posterior c-bristle with long proximal hairs and short distal spines, and 1 anterior d-bristle with long proximal and short distal hairs (Figure 30a,j). 3rd exopodial joint hirsute (Figure 29h): inner lobe with 1 proximal bristle with long proximal hairs and short distal spines and 2 terminal bristles (inner ringed, outer

unringed) with short spines; outer lobe with 2 ringed terminal bristles (outer with long proximal and short distal spines, inner with a few long proximal spines and many short distal spines). 4th and 5th exopodial joints fused, hirsute, with stout spinous process on inner corner of 5th joint; 4th joint with 3 (USNM 193900) or 4 bristles (USNM 193995) with small spines; 5th joint with 2 bristles with short spines. Rings not shown on all bristles.

Sixth Limb (Figure 30b): With 4 bare epipodial bristles (longest bristle of right limb of USNM 193900 about $\frac{1}{4}$ longer than longest bristle of left limb). Endite I with 2 small spinous medial bristles and 1 long spinous terminal bristle; endite II with 3 small spinous medial bristles and 2 longer spinous terminal bristles; endite III with 1 distal spinous medial bristle and 3 spinous terminal bristles; endite IV with 1 distal spinous medial bristle and 2 spinous terminal bristles. End joint with 7 spinous bristles followed by space and then 3 plumose bristles (anterior of 3 with small spines near tip). Limb hirsute.

Seventh Limb (Figure 30c,d): USNM 193900: each limb with 21 bristles (distal group with 5 bristles on peg side and 6 on comb side, each with up to 7 bells; proximal group with 6 bristles on peg side and 4 on comb side (0 or 1 segment with 2 bristles), each bristle with 3 or rarely 4 bells); comb with 2 or 3 short flat-tipped teeth on each side of 7–10 longer alate teeth with rounded tips (Figure 30d); single spinous peg opposite comb. USNM 193969: each limb with 24 bristles (distal group with 7 bristles on peg side and 6 on comb side, each with up to 6 bells; proximal group with 5 bristles on peg side and 6 on comb side (3 segments on each limb with 2 bristles, 1 on each side); each bristle with 3 bells); comb and peg similar to those of USNM 193900. USNM 193995: each limb with 21 bristles (distal group with 5 bristles on peg side and 6 on comb side, each with up to 5 bells; proximal group with 10 bristles (5 or 6 bristles on peg side and 4 or 5 on comb side; 3–5 segments with 2 bristles, 1 on each side), each bristle with 3 or rarely 4 bells); comb and peg similar to those of USNM 193900.

Furca (Figure 29i): Each lamella with 8 or 9 claws; claws 2 and 4 nonarticulated; claw 3 slenderer than claw 4; all claws with teeth along posterior edge (not shown); claw 1 with teeth in medial row larger distally, stouter than distal teeth in lateral row; right lamellar anterior to left by width of base of claw 1; anterior margin of lamella with few minute spines. On right lamella of both USNM 193900, 193969, and 193995 broad space between claws 4 and 5.

Bellonci Organ (Figure 30e,k): Cylindrical with constricted proximal part and rounded tip.

Eyes: Lateral eyes absent. Medial eye small unpigmented (Figure 30e,k).

Upper Lip (Figure 30f): Anterior part with narrow ridge-like field with large widely separated glandular openings. Paired posterior part with 2 long tusks, each with 3 small distal glandular openings near or on posterior edge and 2 or 3 small terminal glandular openings.

Genitalia (Figure 30h): Oval with attached spermatophore

on each side of body anterior to furca.

Anterior of Body (Figure 30f,k): With rounded anterior process dorsal to upper lip.

Posterior of Body: Dorsal corner just dorsal to end of girdle with spines (Figure 30g).

Y-Sclerite: Typical for genus.

Number of Eggs: Holotype with 9 eggs in marsupium. USNM 193900 with 12 eggs in marsupium; length of typical egg 0.41 mm (4 eggs shown in Figure 28a). USNM 193969 with 15 eggs in marsupium; length of typical egg 0.50 mm. USNM 193995 with 5 eggs in marsupium and about 8 smaller unextruded eggs; length of typical extruded egg 0.48 mm; length of largest unextruded egg 0.06 mm (2 eggs in marsupium shown in Figure 30i). Specimen from Slope 53 with 9 eggs in marsupium, length of typical egg 0.49 mm.

Parasites: Adult female (nonovigerous) from Slope 69 with 2 either juvenile or male cryptoniscid isopods within posterior end of carapace (seen through shell).

DESCRIPTION OF ADULT MALE (Figure 31b–k).—Carapace similar in shape to that of adult female except for having smaller caudal process (Figure 31b); anteroventral margin ventral to incisur with distinct scalloping; shell surface with small crescent-like ridges (Figure 31k) (ridges not visible on decalcified specimens (most specimens in collection) except for minute ridges near caudal process).

Infold: In general similar to that of adult female but bristles not counted.

Selva: Narrow ridge of selva along ventral edge of incisur segmented similar to that of female.

Central Adductor Muscle Attachments (Figure 31b): In general similar to those of adult female.

Carapace Size (length, height in mm): Slope 17: USNM 194000, 2.38, 1.88, height 79% of length. Slope 53: 2.17, 1.63, height 75% of length. Slope 67: 2.36, 1.87, height 79% of length.

First Antenna (Figure 31c): Joints 1–4 similar to those of adult female, except no dorsal spines on 4th joint. Sensory bristle of 5th joint with 10 long stout proximal filaments, 2 long slender distal filaments, and bifurcate tip. Medial bristle of 6th joint short bare. 7th joint: a-bristle about twice length of bristle of 6th joint, with short spines; b-bristle about twice length of a-bristle, with short stout proximal filament (with broad base, large transparent sucker, small button-like distal process, and pointed tip) followed by 2 short slender filaments (each with 6 small suckers) and then 1 or 2 minute bare filaments just distal to base of filament with suckers; c-bristle about $\frac{1}{4}$ longer than sensory bristle of 5th joint, with short stout proximal filament (with broad base, large transparent sucker (larger than sucker of proximal filament of b-bristle), small button-like distal process and pointed tip) followed by 2 slender filaments (each with 6 small suckers), 6 long slender bare filaments, and bifurcate tip. 8th joint: d- and e-bristles about $\frac{1}{3}$ longer than b-bristle, bare with blunt tips; f-bristle about twice length of b-bristle, with 10 marginal filaments (some pectinate) and bifurcate tip; g-bristle

only slightly shorter than c-bristle, with 10 filaments (some pectinate) and bifurcate tip.

Second Antenna: Protopodite similar to that of adult female. Endopodite similar to that of adult female except bristle of 2nd joint only about $\frac{3}{4}$ length of 3rd joint. Exopodite: 1st joint with indistinct spines along concave margin; bristle of 2nd joint reaching just past 9th joint, with 1 small ventral spine followed by 11 or 12 stout spines and small terminal spine; basal spines of joints 3–8 and lateral spine and bristles of 9th joint similar to those of adult female; joints 2–8 with lateral spines along distal edges.

Mandible: Similar to that of adult female.

Maxilla: Except for all 3 c-bristles of 2nd endopodial joint being pectinate, limb similar to that of adult female.

Fifth Limb (Figure 31d): Epipodial bristles not counted. 1st exopodial joint: main tooth of 5th joint with small triangular tooth (with 2 small subterminal pointed cusps) and 6 pectinate teeth; 4th bristle on anterior side closer to row of 3 bristles than on adult female. Limb otherwise similar to that of adult female.

Sixth Limb: With 4 or 5 epipodial bristles. Endite I with 1 or 2 small spinous medial bristles and 1 longer spinous terminal bristle; endite II with 4 spinous medial bristles and 2 longer spinous terminal bristles; endite III with 1 spinous distal medial bristle and 2 or 3 spinous terminal bristles; endite IV with 2 spinous distal medial bristles and 2 spinous terminal bristles. End joint with 8 spinous bristles followed by space and then 3 plumose bristles (anterior of 3 with small spines near tip). Limb hirsute. Spinosity of bristles similar to those of adult female.

Seventh Limb: Each limb with 19 or 20 bristles (distal group similar to those of adult female, except 1 bristle on 1 limb with 8 bells, others with up to 7; proximal group with 2 or 3 bristles on comb side and 6 or 7 on peg side, each bristle with up to 4 bells, but all except 1 on 1 limb with 3. Comb and peg similar to those of adult female.

Furca (Figure 31e): Each lamella of USNM 194000 with 8 or 9 claws similar to those of adult female.

Bellonci Organ (Figure 31f), Medial Eye (Figure 31f), Upper Lip (Figure 31g,h), Anterior of Body (Figure 31g), and Y-Sclerite (Figure 31i): Similar to those of adult female. Lateral eye absent.

Posterior of Body (Figure 31i): Margin dorsal to dorsal end of girdle with folds; spines on dorsal corner similar to those of adult female.

Genitalia (Figure 31i,j): Outer lobe with stout terminal tooth folding onto inner lobe; central lobe shorter and with terminal bristles.

COMPARISONS.—*Vargula psydrax* differs from other species of *Vargula* described previously herein in having the following combination of characters: a higher carapace relative to length (height 78%–84% of length), minute scalloping along anteroventral margin of valve, a large square cutting tooth on the maxilla, and in not having lateral eyes. The lateral eyes of *V. hex* and *V. strax* although small, are visible through the shell.

The furca of *V. trifax* has claws 2, 4, and 5 nonarticulated and

has large lateral eyes. The lateral eye of *V. vix* is large and the 5th limb bears only 4 pectinate teeth on the main tooth. The 7th limb of *V. psydrax* bears 19–24 bristles compared to 11 for *V. strax* and more than 40 for *V. trifax*. The carapace of *V. psydrax* is without the projecting caudal process of *V. fugax*. Two species of *Vargula* without lateral eyes and having furcal claws 2 and 4 nonarticulated have been described previously: *V. dentata* Kornicker, 1975:183, and *V. lusca* Kornicker, 1975:190. The carapaces of both species differ from that of *V. psydrax* in not having distinct scalloping on the anteroventral margin. *Vargula dentata* also differs in having a proximal tooth on the tusks of the upper lip. *Vargula lusca* also differs in having a more elongate carapace (height 63% of length) and a 5th limb with the 4th and 5th exopodial joints separated by a suture. In general, the appendages of *V. psydrax* indicate close affinity with *V. lusca* and *V. hex*.

Vargula dentata Kornicker, 1975

FIGURES 32, 33

Vargula dentata Kornicker, 1975:183, figs. 100–103.

HOLOTYPE.—USNM 127968, adult male on slide and in alcohol in collection of Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution.

TYPE LOCALITY.—*Eltanin* Cruise 6, station 340, Scotia Sea, Subantarctic; depth 578–567 m (Kornicker, 1975:10, 183).

MATERIAL.—Slope 34: ovigerous female on slide and in alcohol. Slope 53: USNM 194010, ovigerous female on slide and in alcohol (carapace and upper lip lost).

DISTRIBUTION.—Previously collected in American Quadrant of Subantarctic Region at bathyal depths (429–1978 m) (Kornicker, 1975:190). Australia: Slope 34, 800 m. Slope 53, 996 m.

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figures 32, 33).—Carapace oval in lateral view with dorsal end of caudal process forming very small angle with posterior margin of valve dorsal to caudal process; incisur at valve midheight; distinct narrow ridge extending from inner end of incisur to anteroventral edge of valve (Figures 32a, 33g).

INFOLD.—Rostral infold with 15–19 bristles including pair at inner end of incisur.

Central Adductor Muscle Attachments: About 20 attachments (patterns of specimen from Slope 34 (Figure 33h) and USNM 194010 (Figure 32b) appear somewhat different).

Carapace Size (length, height in mm): Slope 34: unnumbered specimen, 1.80, 1.30, height 72% of length. Slope 53: USNM 194010, 2.04, 1.42, height 69% of length.

First Antenna (Figure 32c): 1st joint bare. 2nd joint spinous. 3rd joint with medial spines and 2 bristles (1 ventral, 1 dorsal). 4th joint with 2 bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 8 long stout proximal filaments, 2 long slender distal filaments, and bifurcate tip. 6th joint with short



FIGURE 32.—*Vargula dentata* Kornicker, 1975, ovigerous female, USNM 194010: a, complete specimen from left side showing locations of egg and central adductor muscle attachments, length 2.04 mm; b, central adductor muscle attachments of left valve, ov, anterior to left; c, left 1st antenna, lv (not all bristles shown); d, endopodite, left 2nd antenna, mv; e, f, parts of left mandible, mv; g, part of left maxilla, lv; h, a-bristles of left maxilla, lv; i, bristles of 2nd exopodial joint of right maxilla, mv (a-bristles not shown); j, part of right 5th limb, av (not all bristles shown); k, part of left 5th limb, pv (not all bristles shown); l, upper lip, anterior to left.



FIGURE 33.—*Vargula dentata* Kornicker, 1975, ovigerous female, USNM 194010: a, right 6th limb, mv; b, 7th limb; c, left lamella of furca; d, posterior of body showing unextruded eggs and left genital organ; e, part of body showing right Y-sclerite and dashed outline of genital organ; f, outline of egg from marsupium. Ovigerous female from Slope 34: g, complete specimen from left side showing locations of egg and central adductor muscle attachments, length 1.80 mm; h, central adductor muscle attachments of left valve, ov, anterior to left; i, left lamella of furca; j, anterior of body from left side, anterior to left; k, upper lip, anterior to left.

slender spinous medial bristle. 7th joint: a-bristle slightly longer than bristle of 6th joint, with short spines; b-bristle almost twice length of a-bristle, with 4 short filaments with 1 or 2 proximal teeth; c-bristle about $\frac{1}{5}$ longer than sensory bristle of 5th joint, with about 8 filaments and bifurcate tip. 8th joint: d- and e-bristles about $\frac{1}{3}$ longer than b-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 8 filaments (some with proximal tooth) and bifurcate tip; g-bristle same length as c-bristle, with 8 filaments (some with minute proximal teeth) and bifurcate tip (f- and g-bristles not shown).

Second Antenna: Protopodite with slender distal medial bristle (about $\frac{3}{4}$ length of longest of proximal group of bristles on 1st endopodial joint). Endopodite 3-jointed (Figure 32d): 1st joint with 3 proximal and 1 distal bristles; 2nd joint very long, with terminal bristle shorter than 3rd joint; 3rd joint with terminal filament about $\frac{1}{3}$ longer than stem. Exopodite: bristle of 2nd joint reaching 9th joint, with 14 stout ventral spines and 2 minute proximal dorsal spines; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (2 long and 1 medium with natatory hairs, 1 short, dorsal, with short, widely separated hairs); joints 3–8 with basal spines increasing very slightly on distal joints; spine of 8th joint about $1\frac{1}{4}$ times length of 9th joint; lateral spine of 9th joint about twice length of 9th joint; joint 1 with few minute spines on concave dorsal margin; joints 2–8 with minute spines along distal edge; joint 2 also with row of minute spines at midlength.

Mandible (Figure 32e,f): Coxale endite spinous with 2 stout terminal spines about same length as others, with minute peg between them; small bristle present at base of endite. Basale: ventral margin with 2 a-bristles, 1 small lateral b-bristle, 2 c-bristles, and 2 d-bristles (longer with long proximal and short distal spines); dorsal margin with bristle at distal $\frac{2}{3}$ and 2 subterminal bristles; medial surface spinous. Exopodite spinous, about same length as dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal about $\frac{1}{2}$ length of proximal). 1st endopodial joint with 4 ventral bristles (1 long with long proximal and short distal spines, 1 long and 1 short with short spines, and 1 minute bare); dorsal margin with row of minute terminal spines. 2nd endopodial joint: ventral margin with 2 single ringed bristles and 2 terminal paired bristles (medial unringed bristle about same length but slightly broader than ringed lateral bristle) (Figure 32f); dorsal margin with 12–15 bristles (4 or 5 long, 1 medium, and 7–9 short (spines similar on all short bristles)) (not shown); medial and ventral surfaces spinous. 3rd endopodial joint with 3 claws (with partly formed rings (not shown) and with few proximal teeth (dorsal claw with teeth on only 1 of 4 limbs examined)) and 4 ringed bristles (longest ventral bristle with ventral spines generally restricted to proximal half).

Maxilla: Basale with 1 short medial bristle near ventral margin, and 1 short lateral bristle near base of exopodite (bristle could be interpreted to be proximal on endite) (Figure 32g). Exopodite well developed, with 1 proximal bristle with long hairs and 2 terminal bristles (inner with long hairs, outer with

short spines) (Figure 32g). 1st endopodial joint with dorsal spines, 2 alpha-bristles (inner short bare, outer plumose), 3 beta-bristles (outer and middle pectinate, other either bare or with few short spines), and cutting tooth with 2 low cusps (Figure 32g, h). 2nd endopodial joint with row of 4 a-bristles (2 anterior bare, 2 posterior pectinate) (Figure 32h), 3 pectinate b-bristles (posterior with 3 stout teeth and weak distal rings; others with rings and many teeth), 3 ringed c-bristles (anterior small bare, others pectinate), and 3 d-bristles (2 anterior unringed, claw-like, with 8 or 9 teeth; posterior ringed, with about 25 teeth (not all shown)) (Figure 32i).

Fifth Limb: Endite I with 8 spinous bristles; endite II with 1 small anterior bristle and 5 stout spinous and pectinate bristles; endite III with 7 or 8 spinous and pectinate bristles (not all bristles shown). Protopodial tooth short (Figure 32j). 1st exopodial joint: main tooth with bare proximal tooth and 5 pectinate teeth (Figure 32k); stout bristle with long spines proximal to bare tooth; anterior side with row of 3 bristles with long proximal spines, and 1 bristle (with long proximal hairs) close to protopodial tooth (Figure 32j). 2nd exopodial joint with 4 pectinate unringed a-bristles (Figure 32j), 3 ringed pectinate b'-bristles, 4 ringed pectinate b"-bristles, 1 posterior c-bristle with long proximal hairs and short distal spines, and 1 anterior d-bristle with long proximal hairs. 3rd exopodial joint (Figure 32j): inner lobe with 1 proximal bristle with long proximal hairs and short distal spines and 2 terminal bristles (inner ringed with marginal spines, outer either unringed or with weak rings and with widely spaced marginal spines); outer lobe hirsute, with 2 ringed bristles (outer slightly subterminal) with long proximal and short distal spines. 4th joint hirsute, separated from 5th by suture, with 3 ringed bristles with short spines. 5th joint with minute process with short stiff spines on distal inner corner, and 2 ringed terminal bristles with short spines. Rings not shown on all bristles.

Sixth Limb (Figure 33a): With 3 or 4 bare epipodial bristles. Endite I with 3 or 4 spinous bristles (2 or 3 small medial, 1 long stout terminal); endite II with 5 or 6 spinous bristles (3 medial, 2 or 3 terminal) endite III with 4 or 5 spinous bristles (1 or 2 distal medial, 3 terminal); endite IV with 2 or 3 spinous bristles (1 distal medial, 1 or 2 terminal). End Joint with 7–9 bristles (with long proximal and short distal spines) followed by short space and then 3 (rarely 4) bristles (1 (rarely 2) anterior with long proximal and short distal spines, 2 posterior plumose); Medial sides of endites II–IV and end joint hirsute; lateral side of end joint with spines along ventral edge. Not all spines and hairs shown.

Seventh Limb (Figure 33b): With 18–23 bristles (distal group with 9–11 bristles (4 or 5 on peg side and 5 or 6 on comb side, each with 1–4 bells; proximal group with 9–12 bristles (5–7 on peg side and 4 or 5 on comb side, each with 1–3 bells); comb with 12–14 teeth (2 short flat-tipped teeth on each side of 8–10 longer alate teeth with rounded tips). Single peg (with indistinct terminal spines) opposite comb.

Furca (Figure 33i): Each lamella with 8 claws; claws 2 and

4 nonarticulated, claw 3 longer but thinner than claw 4; all claws with small teeth along posterior edge (not shown); claw 1 with row of larger medial teeth (not shown); right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figure 33j): Long cylindrical. (Organ of USNM 194010 not observed (probably fragmented).)

Eyes: Lateral eyes absent. Medial eye not well defined, small, unpigmented (Figure 33j).

Upper Lip (Figures 32l, 33k): Each tusk with broad basal part with tooth-like sclerotized distal posterior corner; posterior edge of tusk with 2 minute glandular processes; terminal end with 2 small glandular processes; anterior and posterior hairs present on tusks.

Genitalia (Figure 33d,e): Oval structure on each side of body anterior to furca.

Anterior of Body (Figure 33j): With rounded projecting anterior process.

Posterior of Body (Figure 33d): Dorsal corner near dorsal end of girdle of USNM 194010 with small spines not observed on holotype.

Y-Sclerite (Figure 33e): Unusually long.

Number of Eggs: USNM 194010 with 6 well-developed eggs in marsupium (Figure 32a, 33f) (length of typical egg 0.36 mm), and also eggs in ovaries (Figure 33d) (length of an egg 0.044 mm). Slope 34, unnumbered specimen with 7 well-developed eggs in marsupium (Figure 33g) (length of typical egg 0.34 mm), and also minute unextruded eggs (7 on each side) in ovaries.

REMARKS.—Although some small differences occur between the Australian specimens and specimens collected previously at bathyal depths in the American Quadrant of the Subantarctic region (Kornicker, 1975:190), none warrant proposal of a new species for the Australian specimens. The Australian specimens differ in that the tooth at the base of tusks of the upper lips appears to be less well developed (see Kornicker, 1975, fig. 103c). Also, the 7th limb of the previously described female has 30 bristles compared to 18–23 bristles for the Australian female. Like the previously described specimens, the Australian specimens have only 5 pectinate teeth in the main tooth of the 5th limb (both limbs of 2 Australian females). The 2 Australian females are 1.80 and 2.04 mm long, whereas the 2 previously described females have lengths of 1.91 and 2.26 mm.

Vargula rapax, new species

FIGURES 34–36

ETYMOLOGY.—From the Latin *rapax* (grasping, greedy).

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

TYPE LOCALITY.—Slope 48, 41°57.50'S, 148°37.90'E, Tasmania, off Freycinet Peninsula; depth 400 m.

PARATYPES.—Slope 48: USNM 194020, ovigerous female

on slide and in alcohol; 4 undissected adult females and 2 juveniles in alcohol.

DISTRIBUTION.—Slope 48, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 34–36).—Carapace oval in lateral view with well-defined concavity between dorsal end of short caudal process and edge of valve dorsal to process (Figure 34a); incisur small at about midheight (Figure 34a,b). Thin thread-like bristles sparsely distributed along inner side of anteroventral and ventral margins (5 shown in Figure 34b).

Infold: List of rostrum well defined; rostral infold with 9 bristles (mostly divided) in row dorsal to list and 6–8 bristles on or ventral to list (Figure 34b); 1 longer bristle near midheight of rostrum and posterior to row of bristles (bristle on left but not right valve of USNM 194020) (Figure 34b); 2 bristles at inner end of rostrum and 1 smaller bristle dorsal to them. One fairly long divided bristle near valve edge just ventral to inner end of incisur. Narrow list with anterior end ventral to inner end of incisur continues along ventral margin, then broadens to form anterior edge of caudal process; row of about 40 short bristles along anteroventral list and anterior half of ventral list (bristles more closely spaced along anterior 1/4 of ventral infold) (anterior 14 shown in Figure 34b); 4 bristles along posterior half of ventral list anterior to caudal process; anteroventral infold with 5 bristles between list and inner margin of infold (Figure 34b); left valve with 2 bristles between list and outer edge of infold just anterior to ventral end of caudal process. Broad list along anterior edge of caudal process of left valve of USNM 194020 with row of 17 minute bristles emerging from pores (15 shown in Figure 34c), and about 10 on right valve. Posterior edge of caudal process with row of about 12 minute pores (10 shown in Figure 34c). Few minute pores between broad list and outer margin of infold, but whether these intersect surface of infold not resolved (Figure 34c).

Selvae: Narrow lamellar prolongation with smooth outer edge along anterior margin of rostrum; prolongation absent along dorsal edge of incisur, wide and with striae along ventral edge of incisur, and narrow without striae at point near anterior end of incisur; prolongation narrow and with indistinct closely spaced striae along anteroventral and ventral margin of valve; selvae terminates at ventral end of caudal process; posterior edge of valve dorsal to caudal process without prolongation. On ventral margin of right valve proximal ridge of selvae located farther inward from outer edge than on left valve.

Carapace Size (length, height in mm): Slope 48: holotype, 3.02, 1.89, height 63% of length; USNM 194020, 3.04, 1.88, height 62% of length; 4 specimens without eggs: 3.08, 1.86, height 60% of length; 2.91, 1.88, height 65% of length; 2.94, 1.83, height 62% of length; 2.87, 1.82, height 63% of length. Length range 2.87–3.08 mm; height range 1.82–1.89.

First Antenna (Figure 34d): 1st joint bare. 2nd joint spinous. 3rd joint with row of medial spines and 2 spinous bristles (1 ventral, 1 dorsal). 4th joint with ventral spines and 2



FIGURE 34.—*Vargula rapax*, new species, ovigerous female, paratype, USNM 194020: *a*, complete specimen from left side showing locations of lateral eye, central adductor muscle attachments, and 1 egg, length 3.04 mm; *b*, anterior of left valve, iv; *c*, posterior of left valve, iv; *d*, right 1st antenna, mv (not all bristles shown); *e*, protopodite (not all sclerites shown) and endopodite of left 2nd antenna, mv; *f*, joints 8 and 9 of exopodite of right 2nd antenna, mv (bristles not shown); *g*, right mandible, mv; *h*, part of left mandible, mv; *i*, part of endopodite of right mandible, mv (sclerotized parts stippled); *j*, anterior of body from left side, anterior to left; *k*, medial eye and Bellonci organ; *l*, right lateral eye, anterior to right.

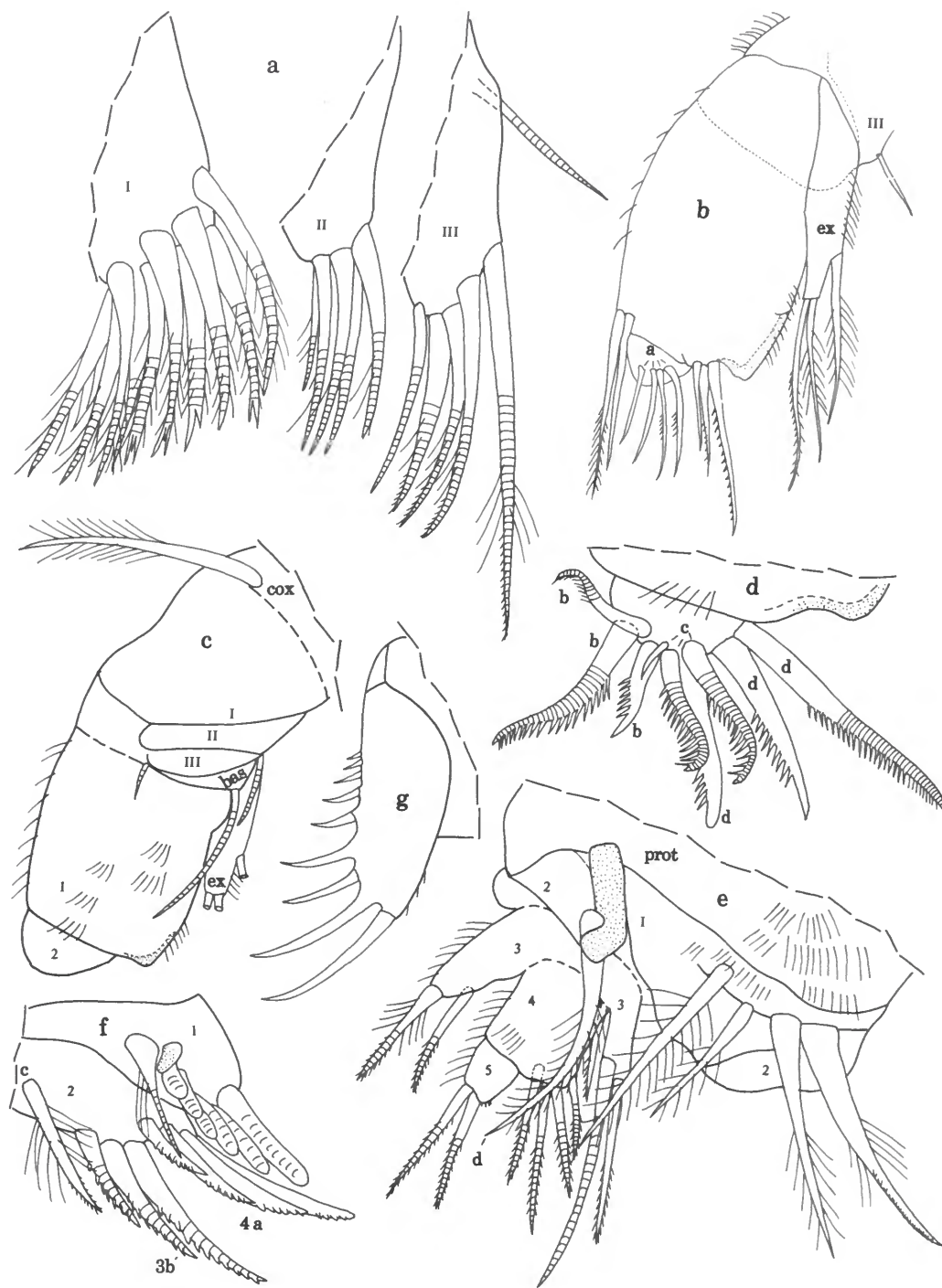


FIGURE 35.—*Vargula rapax*, new species, ovigerous female, paratype, USNM 194020: *a*, endites of left maxilla, mv; *b*, part of left maxilla, lv (not all bristles shown); *c*, part of right maxilla, mv (not all bristles shown); *d*, bristles of 2nd endopodial joint of right maxilla, mv (a-bristles not shown); *e*, part of right 5th limb, av (not all bristles shown); *f*, part of left 5th limb, pv (not all bristles shown); *g*, right lamella of furca.

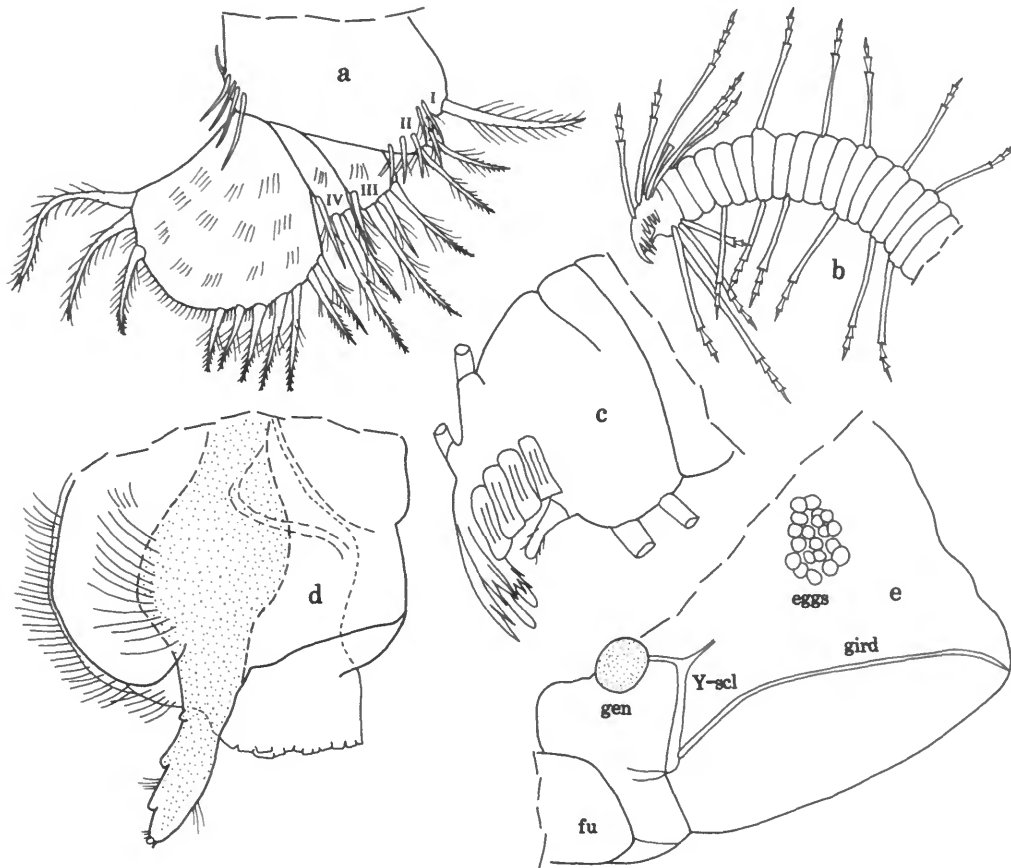


FIGURE 36.—*Vargula rapax*, new species, ovigerous female, paratype, USNM 194020: a, left 6th limb, mv; b, 7th limb; c, detail from b; d, upper lip, anterior to right; e, posterior of body showing unextruded eggs and left genital organ.

spinous bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 9 or 10 long stout proximal filaments, 2 slender distal filaments, and bifurcate tip. 6th joint with few small lateral spines, and medial bristle (with few indistinct spines) near dorsal margin. 7th joint: a-bristle spinous, about $\frac{1}{3}$ longer than bristle of 6th joint; b-bristle about $\frac{1}{3}$ longer than a-bristle, ringed proximal half with 3 short filaments; c-bristle about $\frac{1}{3}$ longer than sensory bristle of 5th joint, with 9 filaments (some with spines) and bifurcate tip. 8th joint: d- and e-bristles about twice length of b-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 9 filaments (some with spines) and bifurcate tip; g-bristle slightly longer than c-bristle, with 10 filaments (some with spines) and bifurcate tip. (Not all bristles of 7th and 8th joints shown in Figure 34d.)

Second Antenna: Protopodite with distal medial bristle (with few indistinct spines) shorter than longest proximal bristle of 1st endopodial joint (Figure 34e). Endopodite 3-jointed (Figure 34e): 1st joint short, with 4 bare proximal

bristles (1 long, 3 short) and 1 long distal bristle with indistinct spines; 2nd joint long, with bare distal bristle about same length as 3rd joint; 3rd joint long, about 70% length of 2nd joint, with long terminal filament about 1.4 times length of stem. Exopodite: bristle of 2nd joint reaching 9th joint, with 9 ventral spines; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 3 bristles (2 long with natatory hairs, 1 short bare); joints 3–8 with basal spines increasing in length on distal joints; spine of 8th joint about $\frac{1}{3}$ longer than 9th joint (Figure 34f); lateral spine of 9th joint about twice length of joint; joints 2–8 with minute spines near distal margin.

Mandible (Figure 34g–i): Coxale endite spinous with 2 stouter terminal spines with elongate peg between them; small bristle present at base of endite (Figure 34h). Basale: ventral margin with 2 a-bristles (1 short with short spines, 1 longer with long proximal and short distal spines) (Figure 34g,h), 1 small bare lateral b-bristle, 2 c-bristles (proximal short bare, distal about twice length of long a-bristle, with short spines),

and 2 spinous d-bristles (proximal slender with indistinct short spines, distal stout, very long, with long proximal and short distal spines); dorsal margin with 1 bristle (with short spines) near midlength, and 2 subterminal with short spines; medial surface with rows of spines; left but not right limb of USNM 194020 with long hairs in proximal ventral corner (Figure 34h); lateral surface with row of spines near proximal $\frac{1}{4}$ of dorsal margin (spines extend past edge of joint (Figure 34g)). Exopodite spinous, about same length as dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal about half length of proximal) with short spines. 1st endopodial joint with few terminal spines on dorsal margin, and 4 ventral bristles (1 long with long and short proximal spines and short distal spines, 1 long and 1 short with short spines, 1 minute bare). 2nd endopodial joint: ventral margin with 2 single ringed bare bristles and 2 terminal paired bare bristles; medial of terminal pair unringed (knife-like) slightly wider but about same length as lateral ringed bristle (Figure 34i); dorsal margin with 18 spinous bristles (5 long, 1 medium (distal), and 12 short (spines on 1 short bristle stouter than spines on others)) (not all bristles shown in Figure 34g); medial surface and ventral margin spinous. 3rd endopodial joint with 3 stout spinous claws (dorsal claw slightly shorter) and 4 ringed bristles (long lateral ventral bristle slightly stouter in proximal part (Figure 34i); long lateral dorsal bristle with short unringed knife-like tip).

Maxilla: Mounted endites of USNM 194020 somewhat obscured so that number of bristles approximate: endites I-III with 10, 5, and 6 (1 proximal (could be on basale), 5 terminal) bristles, respectively (Figure 35a). Coxale with long plumose dorsal bristle (Figure 35c). Basale with long slender ventral bristle and short medial bristle at midwidth (Figure 35c). Exopodite well developed, hirsute, with 3 long bristles (proximal and outer of terminal bristles with long hairs; inner terminal bristle with short hairs) (Figure 35b,c). 1st endopodial joint with long medial and dorsal hairs, 2 alpha-bristles (longest with long hairs, other bare), 3 beta-bristles (outer longest pectinate, middle either bare or pectinate, inner shortest bare), and cutting tooth with single rounded cusp and proximal ventral hairs (Figure 35b-d). 2nd endopodial joint with 4 ringed a-bristles (posterior 2 equally pectinate at midlength, others bare) (Figure 35b), 3 pectinate b-bristles, 3 c-bristles (1 small bare, others stout pectinate), and 3 pectinate d-bristles (posterior ringed, others unringed claw-like) (Figure 35d).

Fifth Limb: Endites I, II, and III each with 5 or 6 spinous bristles. Protopodial tooth well developed (Figure 35e). 1st exopodial joint: main tooth with bare triangular proximal tooth and 6 pectinate teeth (Figure 35f); bristle proximal to triangular tooth with long proximal spines; anterior side with row of 3 bristles (outer with long proximal spines and pectinate distally, others with long spines) and 1 long spinous bristle closer to protopodial tooth (Figure 35e). 2nd exopodial joint with 4 unringed pectinate a-bristles, 3 ringed pectinate b'-bristles, 4 ringed pectinate b''-bristles (not shown), 1 c-bristle with long proximal and short distal spines, and 1 d-bristle with long

spines (Figure 35e,f). 3rd exopodial joint: inner lobe narrow, with indistinct long hairs and 3 bristles (proximal ringed, with long proximal and short distal spines; outer terminal unringed pectinate; inner terminal ringed, with short indistinct spines) (Figure 35e); outer lobe hirsute, with 2 ringed bristles (inner subterminal with short spines, outer terminal with long proximal and short distal spines). 4th exopodial joint separated from 5th by distinct suture, both joints hirsute; 4th joint with 3 or 4 ringed bristles with short spines; 5th joint with 2 ringed terminal bristles (with short spines) and small but distinct spines on sclerotized inner distal corner (Figure 35e).

Sixth Limb (Figure 36a): With 5 bare epipodial bristles (on both limbs of USNM 194020, proximal bristle with base on edge and bristle oriented dorsally; whereas, 4 distal bristles with bases medial and set back from edge, and bristles oriented ventrally). Endite I with 2 small, spinous, proximal, medial bristles and 1 long terminal bristle with long spines; endite II with 3 or 4 small, spinous, proximal, medial bristles and 2 long terminal bristles with long proximal and short distal spines; endite III with 1 spinous proximal medial bristle and 3 spinous terminal bristles (middle bristle short); endite IV with 1 spinous proximal medial bristle and 2 spinous terminal bristles. End joint with 6 or 7 bristles (with long proximal and short distal spines) followed by space, then 1 spinous bristle with long proximal and short distal spines and 2 plumose bristles. Endites III and IV and end joint with long medial hairs; end joint with stout lateral spines along ventral edge (spines absent in vicinity of 2 anterior and 2 posterior bristles). Limb with small amount of brown pigment (not shown).

Seventh Limb (Figure 36b,c): With 21 bristles (distal group with 11 bristles (6 on comb side, 4 on peg side), each with 2-5 bells; proximal group with 11 bristles (5 on comb side, 6 on peg side), each with 3 bells. Comb with 13 teeth (4 short flat-tipped teeth on each side of 5 long alate teeth). Single spinous peg opposite comb (Figure 36c).

Furca (Figure 35g): Each lamella with 9 claws; claws 2 and 4 nonarticulated; claw 3 slenderer but about same length as claw 4; all claws with small teeth along posterior edge (not shown); claw 1 with fairly large medial row of teeth extending almost to tip (not shown); right lamella with few spines along anterior edge, and anterior to left lamella by width of base of claw 1.

Bellonci Organ (Figure 34j,k): Elongate with small process at tip.

Eyes: Lateral eye large with 15 ommatidia and brown pigment between ommatidia (Figure 34a,j,l). Medial eye smaller than lateral eye, with brown pigment, bare (Figure 34j,k).

Upper Lip (Figures 34j, 36d): Anterior unpaired part narrow ridge-like, with fairly large glandular openings. Tusks of paired part long with anterior proximal end terminating on ridge intersecting anterior edge of lip; each tusk with 3 widely separated glandular processes along posterior edge and 1 at tip, and few long indistinct hairs; in transmitted light brown

pigment extending into tusks (stippled in Figure 36d).

Genitalia (Figure 36e): USNM 194020 with brownish oval (without spermatophore attached) on each side of body anterior to furca.

Anterior of Body (Figure 34j): With projecting rounded anterior process just ventral to bases of 1st antennae.

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

Y-Sclerite (Figure 36e): Typical for genus.

Number of Eggs: USNM 194020 with 26 eggs in marsupium, length of typical egg 0.38 mm (1 shown within carapace in Figure 34a), and many smaller unextruded eggs (Figure 36e). Holotype with 8 eggs in marsupium, length of 1 egg 0.36 mm.

COMPARISONS.—The only other species of *Vargula* described previously herein having a large lateral eye is *V. vix* and *V. trifax*. The length of an adult female of *V. vix* is 1.74–1.84 mm compared to 2.87–3.08 mm for *V. rapax*. The furca of *V. rapax* has claws 2 and 4 nonarticulated, whereas all furcal claws of *V. vix* are articulated. The length range of the adult female *V. trifax* is 5.0–5.3 mm, and furcal claws 2, 4, and 5 are nonarticulate. The female *V. rapax* is very close to the female *V. subantarctica* Kornicker, 1975:171; they differ in that the carapaces of female *V. rapax* are more elongate than those of the female *V. subantarctica* (height 60%–65% of length for *V. rapax* (6 specimens), and 67%–73% of length for *V. subantarctica* (4 specimens)); also, the tusks of *V. subantarctica* have many more glandular openings. The carapace of *V. puppis* Poulsen, 1962:186, differs from that of *V. rapax* in having a much broader caudal process.

Vargula vertex, new species

FIGURES 37–39

ETYMOLOGY.—From the Latin *vertex* (top, peak, pole of the heavens, whirl, eddy).

HOLOTYPE.—Adult male on slide and 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: USNM 194036, ovigerous female on slide and in alcohol; partly dissected A-1 male in alcohol.

DISTRIBUTION.—Slope 22, 363 m.

DESCRIPTION OF ADULT FEMALE (Figure 37).—Carapace elongate with oblique straight posterodorsal margin in lateral view (Figure 37a); small incisur at about midheight; surface smooth.

Infold: Rostral infold with 12 divided bristles (Figure 37b); inner end of incisur with paired bristles (anterior longer); 1 short bristle inward from paired bristles; list on rostrum well-defined, sclerotized. Anteroventral infold with 3 short bristles just ventral to inner end of incisur and 1 divided bristle near inner margin of infold (Figure 37b). Narrow list with anterior end ventral to incisur continues along ventral

margin, then broadens to form anterior edge of caudal process. Anteroventral infold including anterior $\frac{1}{4}$ of ventral margin with 36 divided bristles. Broad list along anterior edge of caudal process with numerous minute pore canals (not shown) and row of minute bristles along posterior edge (4 bristles shown in Figure 37d), which is detail of Figure 37c).

Selvage: Narrow lamellar prolongation with smooth outer edge along anterior margin of rostrum. Lamellar prolongation not observed along dorsal edge of incisur. Prolongation wide and segmented along ventral edge of incisur, and narrow and unsegmented at point near anterior end of ventral edge of incisur; prolongation along ventral margin with smooth outer edge; selvage along ventral margin terminates near caudal process. On ventral margin of right valve proximal ridge of selvage located inward from outer edge of valve.

Central Adductor Muscle Attachments (Figure 37e): Comprising about 18 ovoid attachments.

Carapace Size (length, height in mm): USNM 194036, 2.47, 1.35; height 55% of length.

First Antenna: 1st joint bare. 2nd joint with few indistinct ventral, dorsal, and medial hairs. 3rd joint with 2 spinous bristles (1 ventral terminal, 1 dorsal proximal). 4th joint with 2 terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 10 long stout proximal filaments, 2 long slender distal filaments, and bifurcate tip. Medial bristle of 6th joint about $1\frac{1}{2}$ times length of joint, bare. 7th joint: a-bristle spinous, only slightly longer than bristle of 6th joint; b-bristle about $2\frac{1}{2}$ times length of a-bristle, with 5 short marginal filaments and minute spine at tip; c-bristle about $1\frac{1}{3}$ times length of sensory bristle of 5th joint, with 9 filaments (some with spines) and bifurcate tip. 8th joint: d- and e-bristles well developed, bare with blunt tips; f-bristle shorter than c-bristle, with 9 filaments (some with spines) and bifurcate tip; g-bristle about same length as c-bristle, with 10 filaments (some with spines) and bifurcate tip.

Second Antenna: Protopodite with short bare medial bristle. Endopodite 3-jointed (Figure 37f): 1st joint with 4 bare bristles (1 long, 3 short) and 1 long distal bristle with few indistinct spines; 2nd joint long, with bare terminal bristle about half length of 3rd joint; 3rd joint more than half length of 2nd joint, with long terminal filament. Exopodite: bristle of 2nd joint with 14 ventral spines; bristle of 3rd joint with slender hair-like proximal ventral spines and distal natatory hairs; bristles of joints 4–8 with natatory hairs; 9th joint with 3 bristles (1 short (dorsal) with short indistinct hairs; 2 long with natatory hairs); joints 3–8 with basal spines increasing in length on distal joints; basal spine of 8th joint about $\frac{1}{4}$ longer than 9th joint; lateral spine of 9th joint slightly shorter than basal spine of 8th joint, with a small tooth on each side of tip of spine; joints 2–8 with minute spines at distal dorsal corner.

Mandible (Figure 37g): Coxale endite spinous with 2 terminal spines stouter than others but about same length; no peg between terminal spines; small bristle present at base of endite. Basale: ventral margin with 2 a-bristles (1 short with

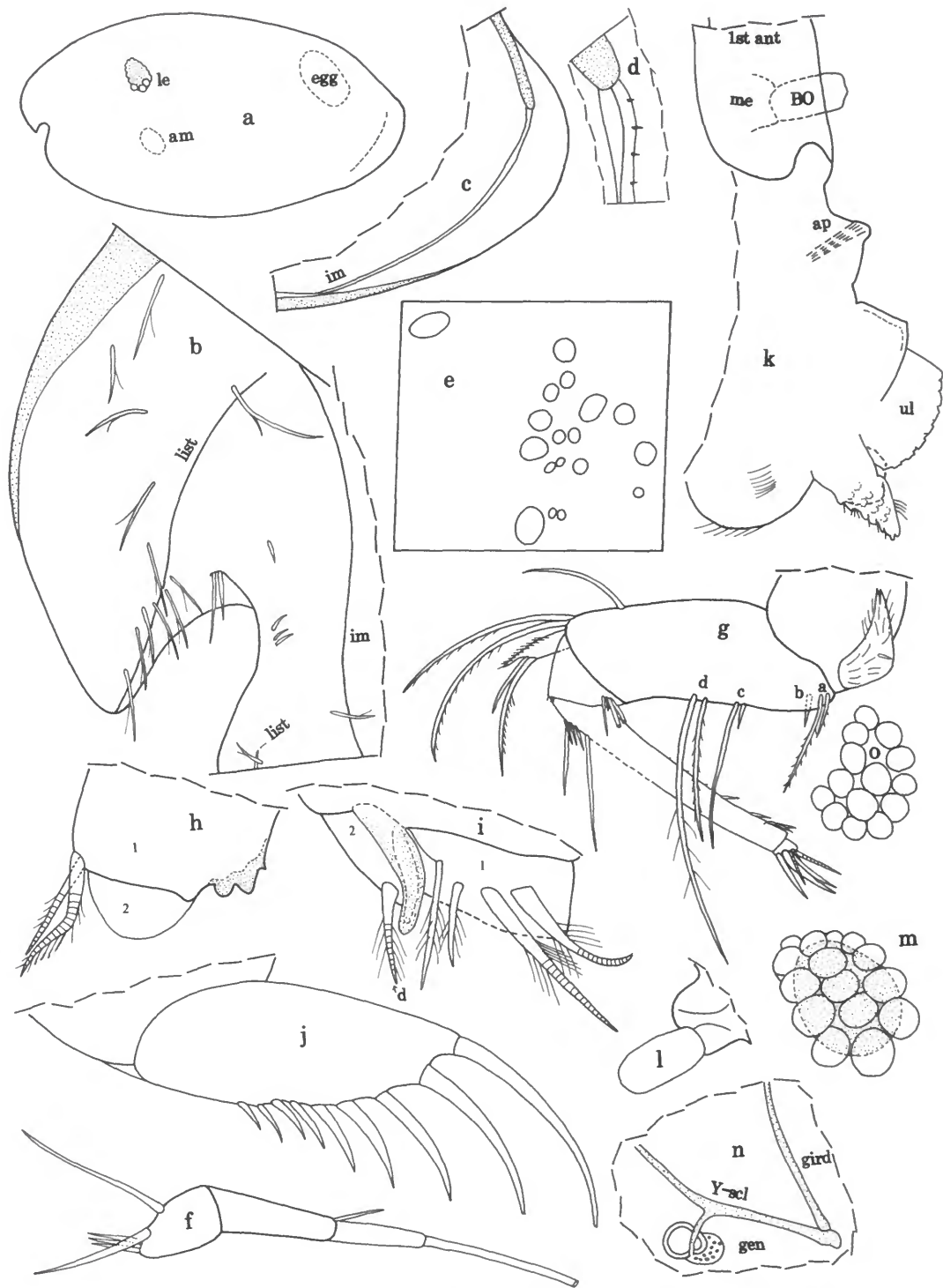


FIGURE 37.—*Vargula vertex*, new species, ovigerous female, paratype, USNM 194036: a, complete specimen from left side showing locations of lateral eye, central adductor muscle attachments, and 1 egg, length 2.23 mm; b, c, anterior and posterior, respectively, of right valve, iv; d, detail from c; e, central adductor muscle attachments of right valve, ov, anterior to right; f, endopodite, left 2nd antenna, mv; g, right mandible, mv (not all bristles shown); h, part of endopodite of right maxilla, mv (not all bristles shown); i, part of right 5th limb, av (not all bristles shown); j, right lamella of furca; k, anterior of body from right side, anterior to right (diaphanous membrane covering part of tusk of upper lip dashed); l, medial eye and Bellonci organ; m, left lateral eye, anterior to left; n, left genital organ and left Y-sclerite, anterior to left; o, unextruded eggs on left side of body, anterior to left.

few spines, 1 longer spinous), 1 small lateral b-bristle close to a-bristles, 2 c-bristles (proximal short bare, distal long with indistinct spines (not shown)) and 2 long spinous d-bristles (longer bristle with long spines, and bare in distal $1/5$) (left limb of USNM 194036 aberrant in having 3 d-bristles); dorsal margin with 1 bare bristle at distal $3/4$, and 2 subterminal with indistinct spines. Exopodite spinous, slightly longer than dorsal margin of 1st endopodial joint, with 2 subterminal bristles (distal about $1/2$ length of proximal). 1st endopodial joint with 4 ventral bristles (1 long with long spines, 1 long with short spines, 1 short and 1 minute bare) and short terminal spines on dorsal margin. 2nd endopodial joint: ventral margin with 4 distal bristles (2 proximal single ringed, 2 subterminal paired (medial unringed, very slightly broader but about same length as lateral; lateral may be ringed but partly obscured); dorsal margin with 12 or 13 bristles (5 long spinous, 1 medium (distal), 6 or 7 short spinous (1 with spines stouter than on others)); ventral margin with spines. 3rd endopodial joint with 3 stout bare unringed claws and 4 ringed bristles (3 ventral with tubular tips, 1 lateral dorsal (bristle obscured but appearing to have small unringed spine emerging from tip of ringed tubular bristle); lateral bristle missing on illustrated right limb but present on left limb of same specimen).

Maxilla: With 3 endites. Coxale with plumose dorsal bristle. Basale with long slender ventral bristle and short medial bristle at midwidth. Exopodite well developed, with 1 proximal and 2 terminal bristles (proximal and middle bristle with long hairs). 1st endopodial joint with long dorsal hairs, 2 alpha-bristles (shorter with short hairs, longer with long hairs) (beta-bristles missing from USNM 194036), and cutting tooth with 3 cusps (Figure 37h). 2nd endopodial joint similar to that of adult male (Figure 38i, j).

Fifth Limb: With 3 endites. Protopodial tooth long curved (Figure 37i). 1st exopodial joint: main tooth with bare pointed proximal tooth and 6 pectinate teeth; slender ringed bristle with long spines proximal to bare tooth; anterior side with 4 bristles (Figure 37i). 2nd exopodial joint: a-bristles unringed, b'- and b''-bristles ringed (number of bristles obscured on USNM 194036); c- and d-bristles plumose. 3rd exopodial joint: inner lobe with 3 ringed bristles (1 proximal, 2 terminal); outer lobe hirsute, with 2 ringed terminal bristles. 4th and 5th exopodial joints fused, hirsute, with 3 ringed terminal bristles, and without spinous process.

Sixth Limb: With 5 bare epipodial bristles. Endite I with 2 or 3 short proximal medial bristles and 1 stout terminal spinous bristle. endite II with 3 small spinous medial bristles and 2 long spinous terminal bristles; endite III with 1 spinous medial bristle and 3 spinous terminal bristles (2 long, 1 shorter); endite IV with 1 spinous medial bristle and 2 spinous terminal bristles. End joint with 5 or 6 bristles (with long proximal and short distal spines) followed by long space, then 1 bristle with long proximal and short distal spines and 2 plumose bristles.

Seventh Limb: With 18 or 19 bristles (distal group with 9 bristles (6 on comb side and 3 on peg side), each with 1-5

bells; proximal group with 9 or 10 bristles (4 or 5 on comb side, 5 on peg side), each with 3 bells. Comb with about 12 teeth (3 short flat-tipped teeth on each side of 6 longer teeth). Single spinous peg opposite comb.

Furca (Figure 37j): Each lamella with 9 claws, all articulated; claw 3 about same width at base as claw 4 but longer; all claws with small teeth along posterior edge (not shown); claw 1 with medial row of teeth (not shown); right lamella with few small distal spines along anterior edge (not shown); right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figure 37k, l): Short cylindrical, with small terminal process.

Eyes: Lateral eye large with 15 amber-colored ommatidia and black pigment between ommatidia (Figure 37a, m). Medial eye small, about half size of lateral eye, unpigmented, bare (Figure 37k, l).

Upper Lip (Figure 37k): Anterior broad unpaired part with fairly large glandular openings. Tusks of posterior paired part fairly short, triangular in lateral view, each with 5 stepped glandular processes along posterior edge, 1 or 2 terminal, and 8 medial; each tusk with long anterior and posterior hairs. Diaphanous membrane covers proximal lateral and anterior parts of tusk (dashed in Figure 37k).

Genitalia (Figure 37n): USNM 194036 with oval ring with attached spermatophore on each side of body anterior to furca.

Anterior of Body (Figure 37k): With triangular anterior process just ventral to bases of 1st antennae.

Posterior of Body: Evenly rounded bare.

Y-Sclerite (Figure 37n): Typical for genus.

Number of Eggs: USNM 194036 with 5 eggs in marsupium (lengths of 2 eggs 0.32 mm, 0.35 mm) and 26 small unextruded eggs (12 on right side, 14 on left (Figure 37o); length of 1 egg 0.045 mm) (location of 1 egg within marsupium is shown in Figure 37a).

DESCRIPTION OF ADULT MALE (Figure 38).—Carapace (Figure 38a) similar in shape to that of adult female.

Infold: Not examined.

Carapace Size (length, height in mm): Holotype, 2.19,

FIGURE 38.—*Vargula vertex*, new species, adult male, holotype, USNM 194037: a, complete specimen from left side showing locations of lateral eye, central adductor muscle attachments, and dashed outline of posterior of body, length 2.19 mm; b, distal part of left 1st antenna, mv (not all bristles shown); c, d, suckers of 2nd and 3rd filaments, respectively, of b-bristle of left 1st antenna; e, suckers on distal sucker-bearing filament of c-bristle of left 1st antenna; f, distal protopodite and whole endopodite of left 2nd antenna, mv; g, endites of right maxilla, mv; h, part of right maxilla, lv (not all bristles shown); i, a-bristles of 2nd endopodial joint of right maxilla, lv; j, bristles of 2nd endopodial joint of left maxilla, mv (a-bristles not shown); k, part of left 5th limb, av (not all bristles shown); l, part of right 5th limb, pv (not all bristles shown); m, left 6th limb, mv; n, medial eye and Bellonci organ; o, right lateral eye, anterior to lower right; p, upper lip and anterior process, anterior to upper left (diaphanous membrane covering proximal part of tusk dashed); q, left copulatory organ and left Y-sclerite, anterior to left; r, posterior of body from right side, anterior to right.



1.18, height 54% of length.

First Antenna (Figure 38b-e): Joints 1-6 similar to those of adult female. 7th joint: a-bristle about same length as bristle of 6th joint; b-bristle reaching just past distal end of sensory bristle of 5th joint, with 3 filaments (short stout proximal filament with round sucker, 2 distal slender filaments, each with small spine and 2 small suckers (Figure 38b-d); distal of the 2 slender filament extends well past tip of stem); c-bristle longer than b-bristle, with 9 filaments (short stout proximal filament with sucker about twice diameter of proximal sucker of b-bristle (Figure 38b), followed by slender filament with small spine and 2 small suckers, then 2 shorter slender bare filaments, 1 stouter long filament with spine and 2 small suckers (Figure 38e), and 4 slender bare filaments) and bifurcate tip; small suckers of filaments of b- and c-bristles with slightly convex distal edge (Figure 38c,e). 8th joint: d- and e-bristles well developed, bare with blunt tips; f-bristle only slightly longer than b-bristle, with 9 marginal filaments (some with spines) and bifurcate tip; g-bristle about same length as c-bristle, with 10 marginal filaments (some with spines) and bifurcate tip.

Second Antenna: Protopodite and endopodite similar to those of adult female (Figure 38f). Exopodite similar to that of adult female (spines on bristle of 2nd joint not counted); 9th joint with 3 bristles.

Mandible: Dorsal margin of 2nd endopodial joint with 5 long bristles, 1 medium bristle (distal), and 7 or 8 short bristles (proximal short bristle of left limb of holotype bare, other short bristles spinous (1 or 2 bristles with spines stouter than others). Limb otherwise similar to that of adult female.

Maxilla: Endite I with 10 spinous bristles; endite II with 4 spinous bristles; endite III with 1 slender proximal bristle and 4 stout spinous terminal bristles (Figure 38g). Coxale with plumose dorsal bristle. Basale with long slender ventral bristle and short medial bristle at midwidth. Exopodite well developed, hirsute, with 1 proximal and 2 terminal bristles (proximal and middle bristle with long hairs) (Figure 38h). 1st endopodial joint with long dorsal and medial hairs, 2 ringed alpha-bristles (shorter with short hairs, longer with long hairs), 2 ringed beta-bristles (1 short bare, other long stout pectinate), and cutting tooth with 3 cusps (Figure 38h). 2nd endopodial joint with 4 ringed pectinate a-bristles (anterior bristle with posterior teeth, others with anterior teeth, all bristles with pointed tips) (Figure 38i), 3 pectinate b-bristles (2 ringed, 1 unringed claw-like), 3 c-bristles (1 minute, 2 stout ringed pectinate), and 3 stout pectinate d-bristles (posterior ringed, others unringed claw-like) (Figure 38j).

Fifth Limb (Figure 38k,l): With 3 endites. Protopodial tooth long curved (Figure 38k). 1st exopodial joint: main tooth with bare pointed tooth and 6 pectinate teeth (Figure 38l); slender ringed bristle with long spines proximal to bare tooth; anterior side with 5 hirsute and spinous bristles (1 close to protopodial tooth could be on protopodite) (Figure 38k). 2nd exopodial joint with 4 a-bristles (posterior ringed, others

unringed or weakly ringed), about 9 b'- + b''-bristles (a- and b-bristles not shown), 1 posterior c-bristle with long proximal hairs and short distal spines (Figure 38l), and 1 anterior plumose d-bristle (Figure 38k). 3rd exopodial joint (Figure 38l): inner lobe with 3 bare ringed bristles (1 proximal, 2 terminal); outer lobe hirsute, with 2 bare ringed terminal bristles (bristles more widely separated than on female). 4th and 5th exopodial joint fused, hirsute, with 3 bare or hirsute bristles, and without spinous process (joints but not bristles shown in Figure 38k).

Sixth Limb (Figure 38m): With 5 bare epipodial bristles. Endite I with 2 small spinous medial bristles and 1 long spinous terminal bristle; endite II with 3 small spinous medial bristles and 2 spinous terminal bristles; endite III with 1 spinous medial bristle and 3 spinous terminal bristles (1 short); endite IV with 1 spinous medial bristle and 2 spinous terminal bristles. End joint with 6 anterior bristles with long proximal and short distal spines followed by long space, 1 bristle with long proximal and short distal spines and 2 plumose bristles (hairs and spines not shown on all bristles in Figure 38m). Endites III and IV and end joint with abundant long medial hairs; end joint with stout lateral spines along ventral edge (spines absent in vicinity of 2 posterior plumose bristles).

Seventh Limb: With 15 or 16 bristles (distal group with 8 or 9 bristles (6 on comb side, 2 or 3 on peg side), each with 1-5 bells; proximal group with 7 bristles (3 on comb side, 4 on peg side), each with 3 bells). Comb with 10-12 teeth (2 or 3 short flat-tipped teeth on each side of 6 or 7 longer teeth with rounded tips). Single spinous peg opposite comb.

Furca: Similar to that of adult female except 3rd claw slightly narrower at base than 4th claw.

Bellonci Organ (Figure 38n): Similar to that of adult female.

Eyes: Lateral eye large with 15 amber-colored ommatidia and black pigment between ommatidia (Figure 38a,o). Medial eye similar to that of adult female (Figure 38n).

Upper Lip (Figure 38p) and **Y-Sclerite** (Figure 38q): Similar to those of adult female.

Genitalia (Figure 38q): Copulatory lobe on each side of body anterior to furca.

Anterior of Body (Figure 38p): With anterior process similar to that of adult female.

Posterior of Body (Figure 38r): Body dorsal to dorsal end of girdle with 6 projecting processes (not paired); the processes continue anteriorly on each side of body as "segments" containing large round cells (cells shown in 1 segment in Figure 38r).

DESCRIPTION OF A-1 MALE (Figure 39).—Carapace similar in shape to that of adult male (Figure 39a).

Carapace Size (length, height in mm): 1.84, 0.98; height 53% of length.

Furca: Each lamella with 8 claws, all articulated; claw 3 very slightly narrower at base than claw 4 but longer.

Posterior of Body (Figure 39b): Body dorsal to dorsal end

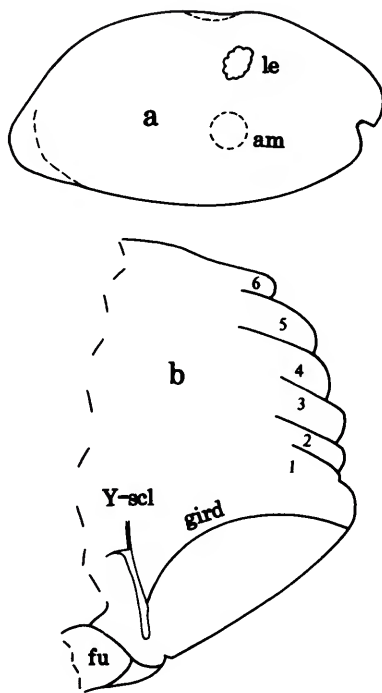


FIGURE 39.—*Vargula vertex*, new species, A-1 male, paratype: a, complete specimen showing locations of lateral eye and central adductor muscle attachments, length 1.84 mm; b, posterior of body from left side, anterior to left.

of girdle with 6 projecting processes; each segment containing large round cells similar to those of adult male (cells not shown).

COMPARISONS.—Only 2 additional species from Australia have all furcal claws articulated: *V. vix* and *V. fugax*. *Vargula*

fugax differs from *V. vertex* in having a carapace with an elongate caudal process and in having a minute lateral eye. The carapace of *V. vertex* differs from that of *V. vix* in having a sloping instead of a broadly rounded posterodorsal margin in lateral view, and in being larger (length of female *V. vix* 1.74–1.84 mm; length of female *V. vertex* 2.47 mm). *Vargula vix* also differs from *V. vertex* in having fewer main teeth on the 1st exopodial joint of the 5th limb and fewer bristles on the 7th limb. *Vargula vertex* differs from *V. sutura* Kornicker, 1975:167, in having lateral eyes and a carapace with a sloping posterodorsal margin.

PHILOMEDIDAE Müller, 1906

The Philomedidae include the 2 subfamilies Philomedinae and Pseudophilomedinae; both are represented in the collection.

PHILOMEDINAE Müller, 1906

The Philomedinae are represented in the collection by 5 genera: *Euphilomedes*, *Igene*, *Philomedes*, *Pleoschisma*, and *Scleroconcha*, but only *Philomedes* and *Pleoschisma* are described herein.

***Philomedes* Liljeborg, 1853**

TYPE SPECIES.—*Philomedes longicornis* Liljeborg, 1853:176 (= *Cypridina Brenda* Baird, 1850a).

COMPOSITION.—Five species (all new) of *Philomedes* are known from the vicinity of Australia: *P. fortax*, *P. pseudolofthousae*, *P. ptyx*, *P. sphinx*, and *P. thorax*.

DISTRIBUTION.—The genus is cosmopolitan including the Arctic and Antarctic with a known depth range of intertidal to 3382 m (Kornicker, 1984a:13).

Key to Species of *Philomedes* in the Vicinity of SE Australia

(Adult female)

1. Tip of projecting caudal process forming sharp angle with valve edge dorsal to caudal process 2
 Tip of projecting caudal process smoothly joining valve edge dorsal to caudal process or with broadly rounded caudal process 3
2. Carapace shorter than 2.2 mm; 2nd endopodial joint of 2nd antenna with 2 ventral bristles; 7th limb with 9 bristles, and tip with about 14 undivided pegs *P. fortax*, new species
 Carapace longer than 2.4 mm; 2nd endopodial joint of 2nd antenna with 1 ventral bristle; 7th limb with 18–22 bristles, and tip with 6 or 7 pegs, mostly bifurcate *P. ptyx*, new species
3. Carapace with broadly rounded caudal process; mandibular basale with 3 dorsal bristles; Bellonci organ very short (less than width of 1st joint of 1st antenna) *P. sphinx*, new species
 Carapace with truncate caudal process; mandibular basale with 4 or 5 dorsal bristles;

- Bellonci organ long 4
4. Carapace shorter than 1.8 mm; 2nd joint of 1st antenna with 3 bristles; 7th limb with 9 bristles *P. thorax*, new species
- Carapace longer than 2.2 mm; 2nd joint of 1st antenna with 5 or 6 bristles; 7th limb with 25 bristles *P. pseudolofthousae*, new species

Philomedes fortax, new species

FIGURES 40, 41

ETYMOLOGY.—From the Latin *fortax* (carrier, bearer).

HOLOTYPE.—Ovigerous female on slide and 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.—None.

DISTRIBUTION.—Slope 46, 720 m.

DESCRIPTION OF ADULT FEMALE (Figures 40, 41).—Carapace oval in lateral view with prominent rostrum (with minute anterior process on inferior corner) and small but distinct posterior protuberance of caudal process (Figure 40*a,b,d-f*). Lateral surface with abundant short spines and few long bristles, some with stout base; long bristles along anterior and ventral margins including caudal process; a long bristle with stout base on dorsal tip of caudal process (Figure 40*a,d,f*). Posterior edge of caudal process without digitations.

Infold: Rostral infold with row of about 21 bristles (mostly divided) near dorsal, anterior, and ventral valve margins (Figure 40*b*); a small bristle posterior to inner end of incisur (Figure 40*b*). Anteroventral margin with about 11 concentric ridges of which outermost forms list (Figure 40*c*); row of 13 short spinous bristles near list (Figure 40*c*). Narrow list at about infold midheight along ventral valve margin and closer to inner margin of infold along posterior valve margin. Ventral infold along middle part of valve bare; posterior $\frac{1}{3}$ of ventral infold plus posterior infold with about 14 groups of 1–4 bristles along list; infold dorsal to caudal process with 4 longer single bristles with bases between list and valve edge (Figure 40*e*). Infold of caudal process with narrow flange along anterior edge of "pocket" with row of 7 or 8 small bristles (Figure 40*e,f*).

Selvae: Lamellar prolongation along anterior and ventral edges of rostrum with narrow segments and marginal fringe; prolongation along ventral edge of incisur very broad, segmented, with marginal fringe; long hairs with bases at midwidth of prolongation along anteroventral corner of valve; prolongation along anterior half of ventral margin narrow, becoming broader along posterior half (both halves with marginal fringe); posterior tip of caudal process without lamellar prolongation.

Central Adductor Muscle Attachments (Figure 40*a,g,h*): Comprising about 25 ovoid attachments (Figure 40*g*). (In lateral view of valves some muscle attachments give impression of being elongate but are attached actually only at outer end. The erroneous elongate muscle attachments of

right side drawn with body of animal inside shell are shown in Figure 40*h*, whereas the muscles projecting from the left side of body after shell is removed are shown in Figure 40*g*. The major differences between the 2 illustrations reflect the difficulty in obtaining accurate illustrations of muscle attachments of some myodocopids.)

Carapace Size (length, height in mm): Holotype 1.87, 1.35; height 72% of length.

First Antenna (Figure 40*i*): 1st joint with very few indistinct medial spines near ventral margin. 2nd joint with rows of medial spines on and near proximal part of dorsal margin, 1 row of medial spines near proximal part of ventral margin, several distal rows of lateral spines near ventral margin, 1 distal row of lateral spines near dorsal corner, and 3 bristles (1 ventral, 1 dorsal, 1 lateral) with long proximal and short distal spines (surface spines of 2nd joint not shown). 3rd joint with 5 bristles (1 ventral, 4 dorsal) with bases on medial surface and with short marginal spines. 4th joint with 5 bristles (4 ventral, 1 dorsal) with long proximal and short distal spines. Sensory bristle of 5th joint with 4 short slender proximal and 4 terminal filaments. Medial bristle of 6th joint with long proximal and short distal spines. 7th joint: a-bristle longer than bristle of 6th joint, with long proximal and short distal spines; b-bristle about twice length of a-bristle, with 1 short proximal and 5 terminal filaments; c-bristle with 5 short proximal and 5 longer terminal filaments. 8th joint: d- and e-bristles long bare with blunt tips; f-bristle with 4 short proximal and 5 longer terminal filaments; g-bristle with 3 short proximal and 5 longer terminal filaments; all bristles either of similar length or subequal.

Second Antenna: Protopodite bare. Endopodite 2-jointed: 1st joint with 6 bare bristles (right limb of holotype with 5 proximal, 1 distal (Figure 41*b*); left limb with bristles together (Figure 41*a*)); 2nd joint with 2 ventral bristles (proximal with long proximal and short distal spines; distal shorter with few indistinct marginal spines) and 1 recurved bare terminal bristle. Exopodite: 1st joint with minute straight tubular medial bristle;

FIGURE 40.—*Philomedes fortax*, new species, ovigerous female, paratype: *a*, complete specimen from right side showing locations of eggs and central adductor muscle attachments, length 1.87 mm; *b*, anterior, left valve, iv; *c*, anteroventral infold, left valve, iv; *d*, caudal processes, left valve, iv; *e*, detail from *d*; *f*, caudal process, right valve, iv; *g*, central adductor muscles projecting from left side of body, anterior to left (with body removed from shell); *h*, apparent central adductor muscle attachments of right valve, ov, anterior to right (complete specimen); *i*, part of right 1st antenna (not all bristles shown); *j*, right lamella of furca; *k*, 7th limb; *l*, pegs on 7th limb opposite limb shown in *k*.

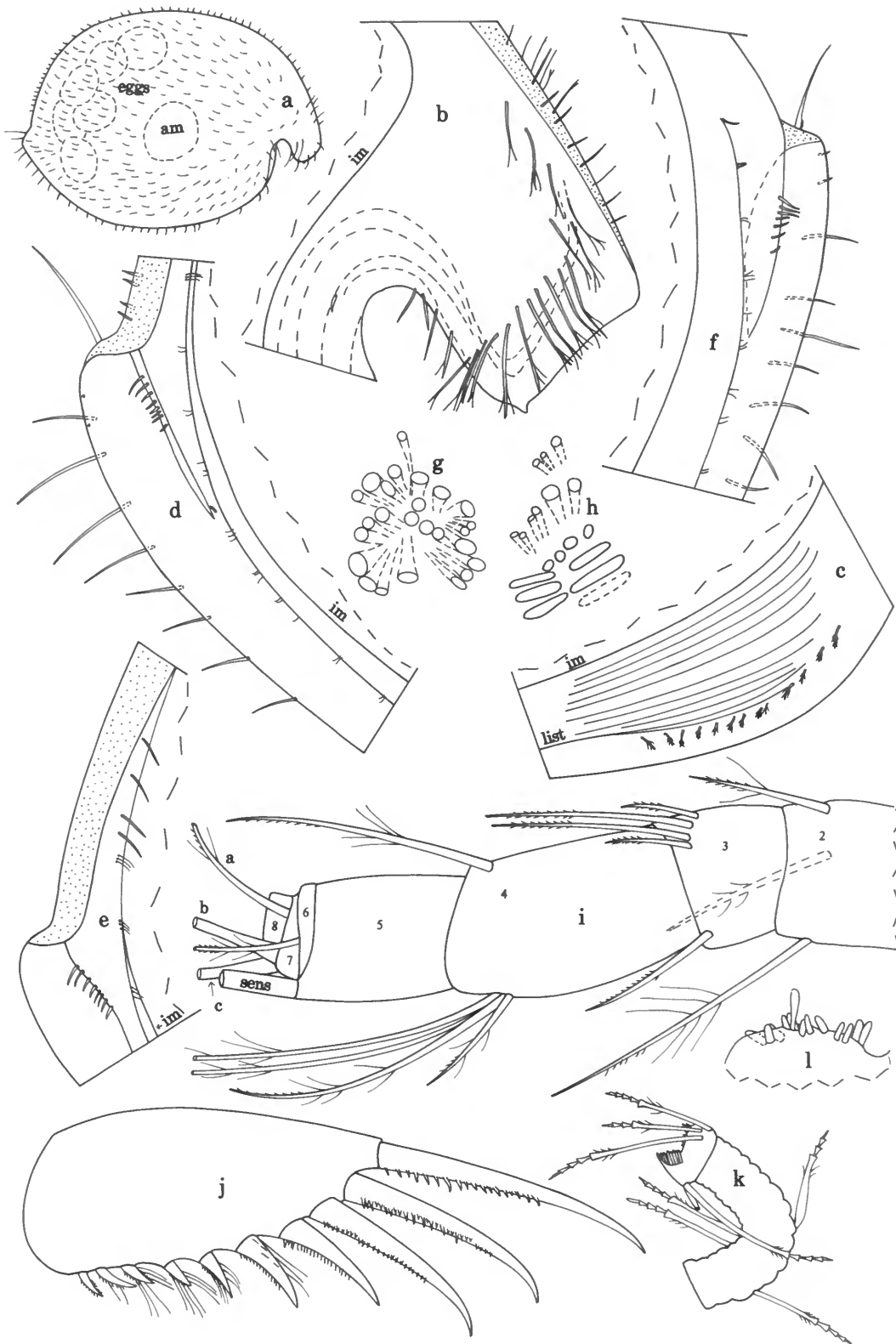




FIGURE 41.—*Philomedes fortax*, new species, ovigerous female, holotype: *a*, endopodite, left 2nd antenna, mv; *b*, bristles of joint 1 of endopodite, right 2nd antenna, mv; *c*, left mandible, mv; *d*, right maxilla, lv (not all bristles shown); *e*, left 5th limb, pv (4 pectinate teeth of main tooth and edge of 2nd joint stippled; not all bristles shown); *f*, right 5th limb, av (not all bristles shown); *g*, right 6th limb, mv; *h*, tip of 7th limb shown in Figure 40*k*; *i*, anterior of body from right side, anterior to right; *j*, part of anterior of body from left side, anterior to left; *k*, right Y-sclerite, anterior to right.

bristles of joints 2–5 fairly short, bare, with pointed tips; bristles of joints 6–8 broken near base on both limbs of holotype (stumps with natatory hairs); 9th joint with 4 long terminal bristles (broken off on both limbs of holotype (stumps with natatory hairs)), 1 short medial bristle with long proximal and short distal spines, and 1 smaller medial bristle with short marginal spines. Joints 4–8 with small basal spines (spines of joints 2 and 3 not seen with certainty); basal spine of 8th joint about $\frac{3}{4}$ length of 9th joint; joints 2–8 with row of slender spines along distal edge. (Broken bristles on exopodite suggest that the ovigerous female is unable to swim, but could be sampling artifact.)

Mandible (Figure 41c): Coxale endite bifurcate, spinous, with small ringed bristle near base; coxale with rows of medial spines near endite (not shown). Basale: dorsal margin with spines, 3 bristles distal to midlength (proximal bristle on right limb of holotype with long proximal spines, otherwise bristles bare) and 2 terminal (medial with long proximal and short distal spines; lateral about half length of medial, bare); ventral margin with 7 bristles (1 proximal and 2 distal with bases on medial side or on margin; 4 with bases on lateral side) with long proximal and short distal spines; medial surface with 6 proximal bristles (3 stout unringed pectinate, 3 slender ringed spinous) and rows of long spines. Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, with small distal spines, minute spinous terminal process, and 2 distal bristles (proximal longer, with long proximal and short distal spines; distal with only short spines). 1st endopodial joint: ventral margin with 4 bristles (3 long, 1 short (1 of 3 long bristles missing (broken off?) on illustrated left limb of holotype and only proximal part of 2 bristles shown) with long spines (not shown); medial surface with spines at dorsal margin. 2nd endopodial joint: ventral margin with 6 distal bristles forming 2 groups, each with 3 spinous bristles; dorsal margin with 8–10 bristles forming 2 groups (proximal group with 3–5 short bristles (bare or with short spines), distal group with 5 long bristles with long proximal and short distal spines); medial surface with rows of spines. 3rd endopodial joint with 3 claws and 4 bristles (1 of the latter (lateral) obscured on holotype and not seen with certainty).

Maxilla (Figure 41d): Endite I broad with 10 spinous and pectinate bristles; endite II narrow with 6 spinous and pectinate bristles; endite III long, narrow, with 1 proximal bristle (with short indistinct marginal spines) and 10 distal spinous and pectinate bristles (endite bristles not shown). Precoxale and coxale with dorsal fringe of long hairs; coxale with plumose dorsal bristle. Basale with 4 distal bristles: 2 paired dorsal (these appear as dashed medial lines on illustrated compressed right limb of holotype), and 2 long ventral (1 lateral, 1 medial). Exopodite with 3 bristles (1 short bare and slightly proximal, 2 long terminal with wreaths of long hairs and short distal spines). 1st endopodial joint with long spinous alpha-bristle; beta-bristles obscured on holotype. 2nd endopodial joint obscured but with 3 stout unringed claw-like bristles and

several ringed bristles. (Endopodial bristles not shown.)

Fifth Limb: Endite I with 5 spinous bristles; endite II with about 8 spinous bristles; endite III with about 9 bristles (including 2 or 3 claw-like). 1st exopodial joint with 4 pectinate teeth (distal tooth bifurcate with large smooth anterior cusp (Figure 41f) and stout square-tipped pectinate posterior cusp) (Figure 41e); bristle proximal to teeth with short marginal spines; anterior side of joint with 2 spinous bristles at midwidth, and on outer corner a small lobe with a short stout spinous bristle; small spinous flap near lobe (Figure 41f). 2nd exopodial joint (Figure 41e,f): inner curvature of large flat triangular tooth without nodes but uneven, suggesting that nodes may have broken off; posterior of joint with group of 3 bristles (long bristle with small bristle on each side) (Figure 41e); c-bristle stout with few distal teeth; outer corner of large tooth without small bristle. 3rd exopodial joint with 3 bristles on inner lobe and 2 bristles with long spines on outer lobe. 4th and 5th exopodial joints fused, hirsute, with 6 spinous and pectinate bristles (Figure 41e).

Sixth Limb (Figure 41g): Epipodite represented by 3 small hirsute bristles. Endite I small (medial to endite II on both limbs of holotype) with 3 spinous bristles (2 medial, 1 terminal); endite II small, with 1 medial and 2 or 3 terminal spinous bristles; endite III long, with 1 medial and 7 terminal spinous bristles; endite IV long, with 1 medial and 8 spinous terminal bristles. End joint with 27–31 spinous bristles. (Spines and hairs of bristles not shown.)

Seventh Limb (Figures 40k,l, 41h): With 9 bristles: proximal group with 4 bristles, 2 on each side, each with 3 or 4 bells; terminal group with 3 bristles on peg side, each with 3 or 4 bells, and 2 bristles on comb side, each with 4 bells; all bristles with distal marginal spines proximal to bells. Comb with 16 teeth, each with central part with rounded tip and alar projection on each side. Pegs opposite comb somewhat obscured on both limbs of holotype, with about 14 pegs (1 about twice length of others; remaining pegs elongate but some shorter than others).

Furca (Figure 40j): Each lamella with 10 claws decreasing in length along lamella; claws 1–8 or 9 with long spines forming medial row near base (not all shown); claw 1 of right lamella anterior to claw 1 of left lamella by width of claw base; claw 1 with lateral and medial row of teeth (distal medial teeth larger) and claws 2–10 with single row near posterior edge (teeth on claws 8–10 minute); claws 8–10 with minute spines along anterior edge; few hairs observed on lamella between claws 8–10 and following claws, but hairs absent between claws 1–7.

Bellonci Organ (Figure 41i): Elongate with distinct suture at midlength and rounded tip.

Eyes: Lateral eyes absent. Medial eye with brown elliptical area (stippled in Figure 41i).

Upper Lip (Figure 41i,j): Hirsute with several minute glandular processes at tip.

Anterior of Body (Figure 41i,j): Rounded anterior process

between medial eye and upper lip.

Posterior of Body: With few hairs near furca, otherwise bare.

Y-Sclerite (Figure 41k): Typical for genus.

Number of Eggs: Holotype with 16 eggs in marsupium (some eggs shown in Figure 40a). Length of typical egg 0.34 mm.

COMPARISONS.—Species of *Philomedes* with many terminal pegs on the 7th limb may be divided into those with long pegs (pegs 3 or 4 times width) and those with short pegs. I consider the pegs on the 7th limb of *P. fortax* to be the former but recognize that some are shorter than usual. In the key to species of *Philomedes* with long pegs on the 7th limb presented in Kornicker (1987:877), *P. fortax* keys out to *P. lilljeborgii* (Sars, 1865). The carapace of *P. fortax* differs from that species in being smaller (1.87 mm compared to 1.99–2.6 mm (Kornicker, 1987:884)); the 7th limb differs in having 1 peg about twice the length of others rather than all being the same length. The 2nd joint of the endopodite of the female 2nd antenna of *P. fortax* bears 2 ventral bristles, whereas *P. lilljeborgii* usually has 3 or 4, rarely 2 (Kornicker, 1987:883). The female *P. fortax* is without lateral eyes whereas *P. lilljeborgii* has minute lateral eyes. *Philomedes fortax* differs from *P. horikoshii* Hiruta, 1987, in being smaller (1.87 mm compared to 2.20 mm) and in having fewer proximal bristles on the 7th limb (4 compared to 11).

Philomedes ptyx, new species

FIGURES 42–44a, 109e

ETYMOLOGY.—From the Greek *ptyx* (fold, leaf, layer, plate).

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

TYPE LOCALITY.—Slope 32, 38°21.90'S, 149°20.00'E, Victoria, S of Point Hicks; depth 1000 m.

PARATYPES.—Slope 69: 1 adult female on slide and in alcohol.

DISTRIBUTION.—Slope 32, 1000 m. Slope 69, 1840 m.

DESCRIPTION OF ADULT FEMALE (Figures 42–44a, 109e).—Carapace oval in lateral view, with broad rostrum with straight anterior margin with angular anterior and inferior corners and minute process on inferior corner, small incisur, and small but distinctly projecting caudal process (Figure 42a,c,d). Surface with abundant short pointed bristles (Figure 42b) and scattered longer bristles, some with broad base.

Infold: Rostral infold with 33–35 bristles forming row along dorsal and anterior margins and 2 bristles along ventral margin (Figure 42d); 1 small bristle below inner end of incisur; anteroventral infold with 14 or 15 striae (outermost stria forms list) and 27 or 28 bristles in row (posterior half of row along list); bristles absent along middle part of ventral infold; posteroventral and posterior infold with about 70 small slender bristles along inner margin in groups of 1 to 6 bristles (some

shown in Figure 42c); infold of caudal process with anterior flap with 7–10 small bristles along posterior edge (Figure 42c); 3 small bristles just within outer edge of caudal process near dorsal end (Figure 42c).

Carapace Size (length, height in mm): Holotype, 2.86, 1.95, height 68% of length; specimen from Slope 69, 2.90, 2.08, height 72% of length.

First Antenna: 1st joint with slender spines along ventral margin and stouter distal medial spines. 2nd joint with dorsal and ventral spines, medial spines near margins, and 3 bristles (1 ventral, 1 dorsal, 1 lateral) with long spines near midlength. 3rd joint with 1 ventral bristle and 2 dorsal bristles (shortest about $\frac{1}{5}$ length of longest) (Figure 44a). 4th joint with 5 bristles (1 dorsal, 4 ventral). Sensory bristle of 5th joint with 5 proximal and 5 terminal filaments. Medial bristle of 6th joint short, with long proximal and short distal spines. 7th joint: a-bristle broken off both limbs of holotype; remaining bristles typical for genus (bristles missing from right limb, probably due to injury).

Second Antenna: Protopodite bare (Figure 109e). Endopodite 2 jointed (Figure 42e): 1st joint with 6 bare bristles (5 proximal, 1 distal); 2nd joint with 1 ventral bristle with wreaths of long hairs and 1 terminal recurved bare bristle. Exopodite: 1st joint with minute medial terminal bristle; bare bristle of 2nd joint reaching well past 9th joint; bristles of joints 2–5 bare (on holotype bristle of 4th joint broken on left limb and bristles of joint 4 and 5 broken on right limb); bristles of joints 6–8 and 5 (4 long, 1 medium) of 7 bristles on 9th joint broken on both limbs of holotype; longer of 2 short bristles of 9th joint with long spines, shorter with few short spines; joints 3–8 with small basal spines; joints 2–8 with spines on distal dorsal corner (spines of 8th joint long, others minute).

Mandible: Coxale endite large spinous with bifurcate pectinate tip; minute ringed bristle near base of endite. Basale (Figure 42f): medial surface spinous, with 5 proximal bristles (3 pectinate, 2 spinous) and 1 spinous bristle closer to midlength; lateral surface with 5 short spinous bristles (proximal of these actually on ventral margin) (right limb of holotype aberrant in lacking lateral bristles); ventral margin spinous, with 3 distal spinous bristles; dorsal margin with 3 spinous bristles (1 just distal to midlength, 2 terminal). Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, spinous distally, with 2 subterminal bristles (distal slightly shorter) with long spines at midlength. 1st endopodial joint with 4 ventral bristles (1 short, 3 long, all with long spines) and minute spines on distal dorsal corner. 2nd endopodial joint: dorsal margin with 11 bristles forming roughly 2 groups (5 in proximal group, 6 in distal); ventral margin with 6 short spinous distal bristles in 2 groups, each with 3 bristles; medial surface spinous. 3rd endopodial joint with 4 spinous bristles and 3 bare claws (dorsal claw $\frac{1}{2}$ length of longest claw).

Maxilla: Endite I with 9 bristles; endite II with 6 bristles; endite III long slender with 1 proximal and about 8 terminal bristles. Precoxale and coxale with dorsal fringe of long hairs;

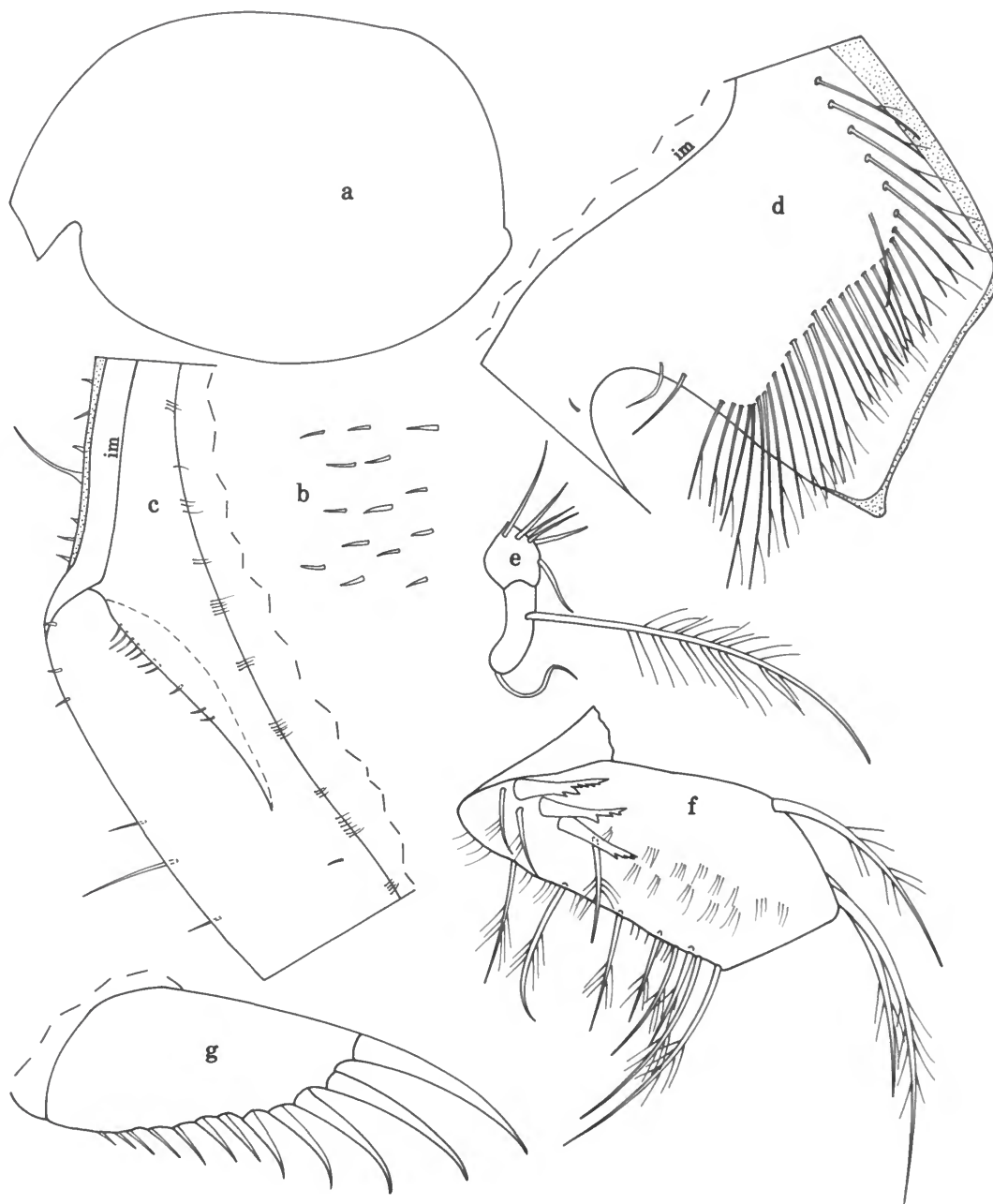


FIGURE 42.—*Philomedes ptyx*, new species, adult female, holotype: *a*, complete specimen from left side, length 2.86 mm; *b*, bristles on outer surface of shell, anterior to right; *c*, caudal process, left valve, iv; *d*, rostrum, left valve, iv; *e*, endopodite, left 2nd antenna, mv; *f*, basale, left mandible, mv; *g*, right lamella of furca.

coxale with stout plumose dorsal bristle. Basale with 3 long bristles on distal margin. Exopodite short with 3 bristles (1 short slightly proximal, 2 long terminal). 1st endopodial joint with dorsal spines and 1 alpha-bristle with long spines;

beta-bristles obscured on both limbs of holotype. 2d endopodial joint obscured on both limbs of holotype but with 3 stout unringed claw-like bristles and additional ringed bristles.

Fifth Limb: Endite I with about 5 bristles; endite II with

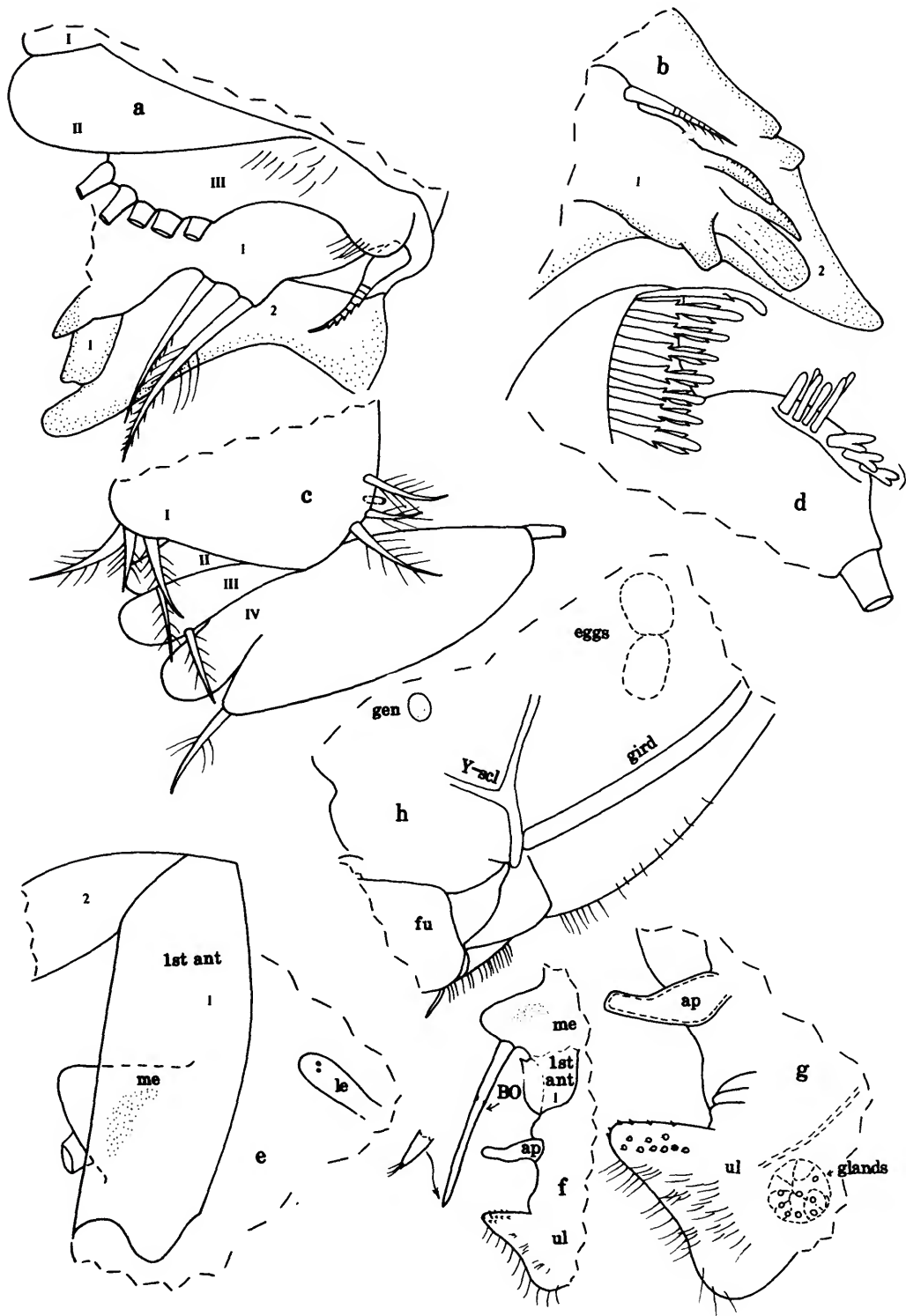


FIGURE 43.—*Philomedes pyx*, new species, adult female, holotype: a, part of left 5th limb, av (not all bristles shown); b, part of right 5th limb, pv (not all bristles shown); c, right 6th limb, mv (not all bristles shown); d, tip of 7th limb; e, part of anterior of body from left side, anterior to left; f, anterior of body from left side, anterior to left; g, detail from f; h, posterior of body from left side, anterior to left.

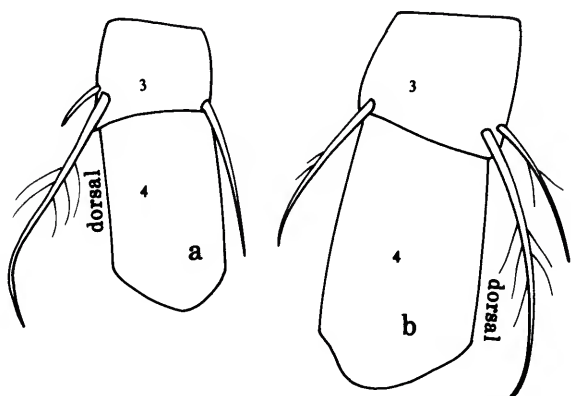


FIGURE 44.—*Philomedes ptyx*, new species: a, adult female, holotype, joints 3 and 4 of right 1st antenna, dorsal margin at left, mv. *Philomedes ramus* Kornicker, 1975: b, adult female, holotype, USNM 135047, joints 3 and 4 of left 1st antenna, dorsal margin at right, mv.

about 8 bristles; endite III with about 9 bristles. 1st exopodial joint: anterior side with 2 spinous bristles at midwidth and 1 short stout bristle at outer corner (Figure 43a); main tooth with proximal bristle and 4 teeth (distal stouter and with anterior prong; smallest broken off in Figure 43b) (Figure 43a,b). 2nd exopodial joint: inner curvature of large quadrate tooth with 2 small processes (Figure 43b); bristles obscured. 3rd exopodial joint with 3 spinous bristles on inner lobe and 2 with long spines on outer lobe. 4th and 5th exopodial joints fused, with 6 spinous bristles.

Sixth Limb (Figure 43c): With 4 spinous epipodial bristles. Endite I with 3 spinous bristles (2 medial, 1 terminal); endite II with 4 spinous bristles (1 medial, 3 terminal); endite III with 9 spinous bristles (1 medial, 8 terminal); endite IV with 9 or 10 spinous bristles (1 medial, 8 or 9 terminal). End joint prolonged posteriorly, with 25 spinous and hirsute bristles. Lateral and medial surfaces of end joint hirsute; lateral surfaces of endites II–IV with long spines. (Most bristles not shown.)

Seventh Limb: Each limb with 18 bristles (terminal group with 2 on comb side and 3 on peg side; proximal group with 6 on comb side and 7 on peg side); each bristle with up to 7 bells. Terminal comb with 15 alate teeth; side opposite comb with 1 undivided inner peg, 0 or 1 additional undivided peg, and 5 bifurcate pegs (Figure 43d).

Furca (Figure 42g): Each lamella with 12 claws decreasing in length and width and becoming straighter posteriorly along lamella. Claw 1 with stout lateral and medial teeth in rows (several teeth at midlength in lateral row stouter than others; distal medial teeth stouter than lateral teeth); teeth of claws 1–6 markedly stouter than teeth of other claws; claws 6–12 with slender spine-like teeth on anterior and posterior margins near tips. Lamellae near medial side of bases of claws and following claws with long spines; row of long spines on claws near bases. Right lamella anterior to left by width of base of claw 1;

anterior margin of right lamella with small spines; medial surface of right lamella near anterior margin with rows of long hairs.

Bellonci Organ (Figure 43f): Elongate with slight indentation just proximal to midlength but suture not evident; tip tapering to small terminal spine; several hairs on tip.

Eyes: Lateral eye minute, barely visible, bare; left eye of USNM 193899 with 2 minute indistinct cells (Figure 43e), but cells not observed in right eye. Medial eye well developed with brown pigment, without long hairs (Figure 43f).

Upper Lip (Figure 43f,g): Hirsute, with 4 minute spines along upper anterior edge, and many glandular openings laterally on anterior projecting part. Proximal lateral glandular field on each side with about 8 small glandular openings; large glandular bodies visible beneath openings in transmitted light (dashed in Figure 43g).

Genitalia (Figure 43h): Small amber-colored round disk on each side anterior to furca.

Anterior of Body (Figure 43f,g): With stout anterior process with blunt tip.

Posterior of Body (Figure 43h): Evenly rounded with hairs along ventral part.

Y-Sclerite (Figure 43h): Typical for genus.

Eggs: Holotype with many fairly large unextruded eggs (2 shown as dashed ovals in Figure 43h).

COMPARISONS.—Only one other species having bifurcate pegs on the 7th lip has been described, *P. ramus* Kornicker, 1975:277, which is known from a single adult female collected in the Pacific Ocean west of Chile at a depth of 3219 m. The proximal dorsal bristle on the 3rd joint of the 1st antenna is about 1/2 the length of the joint on *P. ptyx* (Figure 44a) and longer than the joint on *P. ramus* (Figure 44b); also, the 7th limb of *P. ptyx* bears 6 or 7 terminal pegs compared to only 4 for *P. ramus*. Some additional differences are tabulated below, but variability within each species is unknown.

	<i>P. ramus</i>	<i>P. ptyx</i>
Carapace length (mm)	3.21	2.86–2.90
Bristles on rostral infold	21	35–37
Bristles on end joint of 6th limb	33	25
Furcal claws	11	12

Philomedes pseudolofthousae, new species

FIGURES 45, 46

ETYMOLOGY.—From the Greek *Pseudos* (lie) plus *lofthousae*; so named because the species closely resembles *P. lofthousae* Kornicker, 1975.

HOLOTYPE.—1 partly dissected adult female in alcohol in collection of the Museum of Victoria.

TYPE LOCALITY.—Slope 69, 76 km south of Point Hicks, Victoria, 38°29.33'S, 149°19.98'E; depth 1840 m.

PARATYPES.—Slope 66: USNM 193976, 1 partly dissected adult female in alcohol. Slope 69: USNM 193946, 1 adult female on slide and in alcohol; 1 undissected adult female, 1

partly dissected A-1 male, and 5 undissected juveniles, all in alcohol.

DISTRIBUTION.—Slope 66, 2900 m. Slope 69, 1840 m.

DESCRIPTION OF ADULT FEMALE (Figures 45, 46).—Carapace with prominent rostrum with minute protuberance at tip, broad incisur, and truncate posterior (Figure 45a,b,d).

Ornamentation: Carapace smooth with scattered single bristles more abundant along anterior and ventral margins; internal reticulations indistinctly visible with transmitted light (Figure 45d).

Infold: Infold of rostrum of left valve of USNM 193946 with 26 bristles forming row (Figure 45b); right valve with 5 additional bristles along dorsal edge; 1 small bristle on infold posterior to inner end of incisur; anteroventral infold with 14 striae proximal and parallel to narrow list, and 14 bristles along list; middle part of ventral list without bristles; list extending along posterior $\frac{1}{3}$ of ventral infold and onto infold of caudal process, and with numerous bristles (anterior 6 bristles single, remaining bristles in groups of 1 to 5); infold of caudal process with 7 or 8 short bristles forming row between list and valve edge, and 4 small bristles along outer edge (Figure 45c).

Selvage: Lamellar prolongation with marginal fringe present along anterior, ventral, and posterior margins, but absent, or very narrow, along posterior edge of caudal process; prolongation with typical segmentation along rostrum and incisur; prolongation along anteroventral margin with long proximal threads extending well past outer edge of prolongation.

Carapace Size (length, height in mm): Slope 69: holotype, 2.34, 1.47, height 63% of length; paratypes: 2.36, 1.60, height 68% of length; USNM 193946, 2.35, 1.56 height 66% of length. Slope 66: USNM 193976, 2.41, 1.62, height 67% of length.

First Antenna (Figure 45e): 1st joint with long ventral spines. 2nd joint with ventral, dorsal, lateral, and medial rows of long spines and 5 or 6 bristles (both limbs of USNM 193946 with 6 bristles (2 ventral, 2 dorsal, 2 lateral); holotype similar except with only 5 bristles (only 1 dorsal bristle on left limb and 1 lateral bristle on right limb)) with long proximal and short distal spines. 3rd joint with row of medial spines and 3 spinous bristles (1 ventral, 2 dorsal). 4th joint with minute distal medial pore at midheight (shown dotted in Figure 45e) and 5 spinous bristles (4 ventral, 1 dorsal). Sensory bristle of 5th joint with 5 short marginal filaments and tip with 5 filaments. 6th joint fused to 5th; medial bristle about half length of bristle of 5th joint, with long proximal and short distal spines (not shown). 7th joint (bristles not shown): a-bristle more than half length of bristle of 5th joint, with short marginal spines; b-bristle about $\frac{2}{3}$ length of bristle of 5th joint, with 1 proximal and 4 terminal filaments; c-bristle about same length as bristle of 5th joint, with 5 marginal and 4 terminal filaments. 8th joint (bristles not shown): d- and e-bristles same length as c-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 4 marginal and 5 terminal filaments; g-bristle same length as c-bristle, with 3

marginal and 5 terminal filaments.

Second Antenna: Protopodite with long spines along distal dorsal margin. Endopodite 2-jointed (Figure 45f): 1st joint with 6 short bare bristles (5 proximal, 1 subterminal); 2nd joint elongate with 3 spinous ventral bristles (proximal long with long proximal and short distal spines, others shorter and with short spines) and recurved terminal bristle. Exopodite: 1st joint with short tubular medial terminal bristle; bristle of 2nd joint reaching well past 9th joint, with 14 ventral spines; bristles of joints 3–5 with ventral spines and no natatory hairs; bristles of joint 6–8 with natatory hairs (some bristles broken); 9th joint with 7 bristles (4 long with natatory hairs (some bristles broken), 3 short with small slender marginal spines); joints 2–8 with slender spines along distal edges; joints 2–7 with row of medial spines at midlength; slender basal spines on joints 7 and 8, possibly others (obscured).

Mandible (Figure 46a): Coxale with long medial spines; endite with long proximal spines and teeth on bifurcate tip; small ringed bristle near base of endite. Basale: dorsal margin with 4 or 5 bristles (USNM 193946 with 5 bristles on both limbs; holotype and USNM 193976 with 4 on left limb and 5 on right), including 2 or 3 placed distal to midlength and 2 terminal; medial side with rows of spines and 6 proximal bristles (3 stout unringed pectinate, 3 slender ringed spinous) near ventral margin; ventral margin with 3 distal spinous bristles; lateral side near ventral margin with 5 spinous bristles. Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, hirsute distally, with 2 subterminal bristles (proximal very slightly longer) with long proximal and short distal spines. 1st endopodial joint with 4 long ventral terminal spinous bristles (not shown) and row of terminal spines on dorsal margin. 2nd endopodial joint: dorsal margin with proximal spines and 9 spinous bristles (3 in proximal group, 6 in distal group); ventral margin with 2 groups of spinous bristles, each with 3 bristles; medial surface with rows of spines. 2nd endopodial joint with 3 claws (dorsal claw about half length of longest claw; long medial claw slightly shorter than lateral claw; all claws with spines along middle of ventral margin) and 4 spinous bristles.

Maxilla (Figure 45g): Endite I with 10 spinous bristles; endite II with 6 spinous bristles; endite III with 1 spinous proximal bristle and about 8 spinous terminal bristles. Coxale with plumose dorsal bristle. Basale with 4 bristles (2 dorsal, 1 medial, 1 ventral; on USNM 193946 1 dorsal bristle about half length of other (Figure 45g); on holotype bristles of similar length (both long). Exopodite with 3 bristles (1 short proximal, 2 long terminal). 1st endopodial joint with dorsal spines, 1 long alpha-bristle with long proximal spines, and 4 shorter beta-bristles with few spines. 2nd endopodial joint with 3 stout unringed pectinate claws and about 5 ringed bristles. (Not all bristles shown.)

Fifth Limb: 1st exopodial joint with 2 long anterior bristles and 1 short spinous bristle at outer corner; main tooth with bilobed anterior tooth, 3 pectinate teeth, and 1 proximal bare



FIGURE 45.—*Philomedes pseudolofthousae*, new species, adult female, paratype, USNM 193946: *a*, complete specimen from left side, length 2.35 mm; *b*, rostrum, left valve, iv; *c*, caudal process, left valve, iv; *d*, rostrum, left valve, ov; *e*, anterior of body from left side, anterior to left (not all bristles shown on 1st antenna); *f*, protopodite and endopodite of right 2nd antenna, mv; *g*, left maxilla, iv (not all bristles shown); *h*, right lateral eye, anterior to right; *i*, medial eye and Bellonci organ.

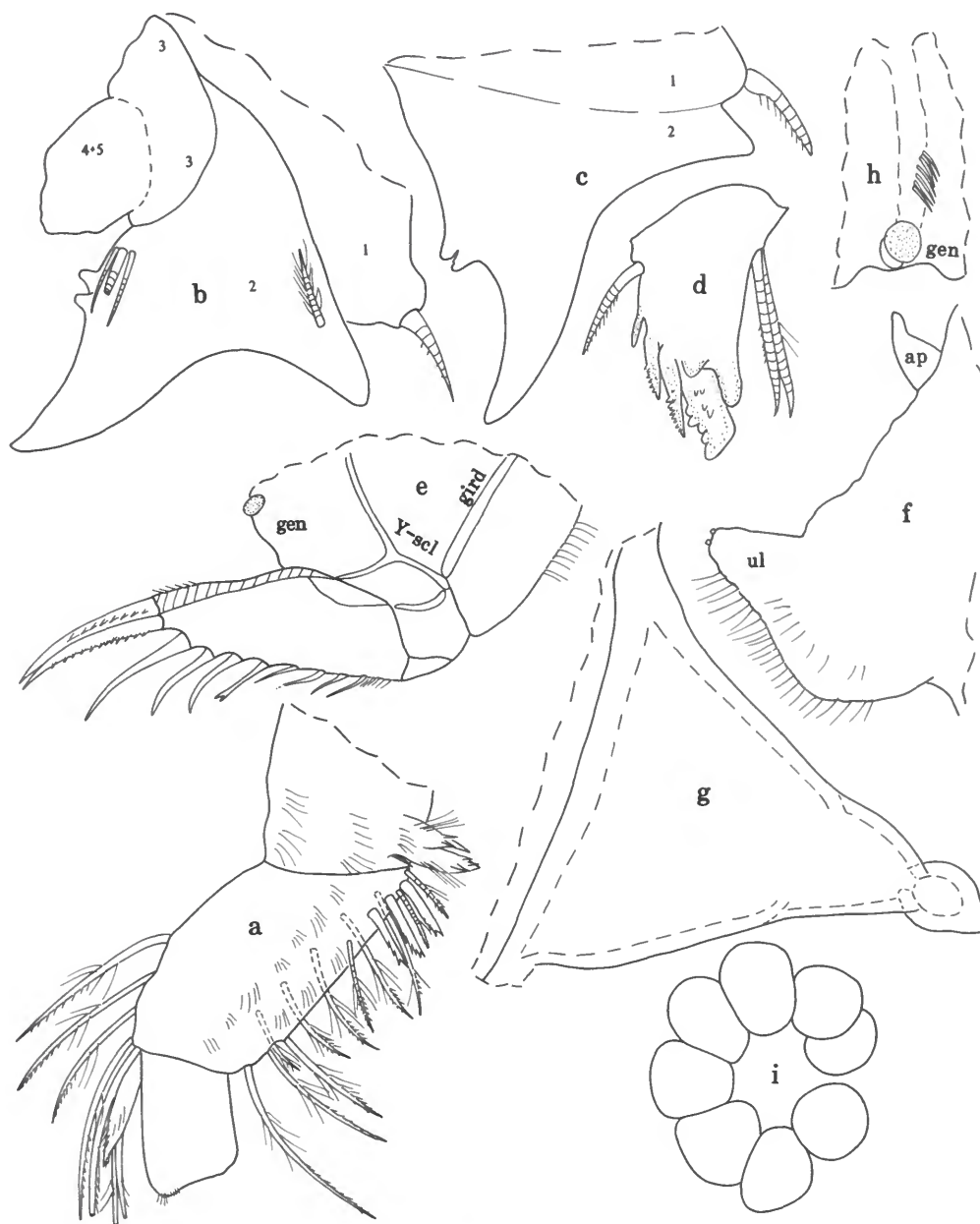


FIGURE 46.—*Philomedes pseudolofthousae*, new species, adult female, paratype, USNM 193946: *a*, part of right mandible, mv (not all bristles shown); *b*, part of right 5th limb, pv (not all bristles shown); *c*, part of left 5th limb, av (not all bristles shown); *d*, 1st exopodial joint, left 5th limb, av; *e*, posterior of body from left side (right furcal lamella striated); *f*, upper lip and anterior process from left side, anterior to left; *g*, anterior process, ventral view; *h*, right copulatory organ and right brush-like organ, anterior to right; *i*, unextruded eggs on left side of body, anterior to left.

tooth (Figure 46*d*); ringed bristle with short spines present proximal to smooth tooth. 2nd exopodial joint with 2 protuberances on inner margin of large flat triangular tooth (Figure 46*b,c*); small slender posterior plumose bristle near distal outer corner of tooth (Figure 46*b*); posterior c-bristle

observed on USNM 193946 but row of 3 bristles shown in Figure 46*b*). 3rd exopodial joint with 3 spinous bristles on inner lobe and 2 plumose bristles on hirsute outer lobe. 4th and 5th exopodial joints fused, hirsute, with total of 6 spinous bristles. (Not all bristles shown.)

Sixth Limb: With 3 short plumose epipodial bristles. Endite I with 3 spinous bristles (2 short medial, 1 long terminal); endite II with 4 spinous bristles (1 short medial, 3 long terminal); endite III with 9 or 10 spinous bristles (1 short medial, 8 or 9 long terminal); endite IV with 7 or 8 spinous bristles (1 short medial, 6 or 7 long terminal). End joint with 19 spinous bristles; limb hirsute.

Seventh Limb: Limb with 25 bristles: 20 in proximal group (13 or 14 on peg side, 11 or 12 on comb side), each with 4–6 bells (most with 5); and 5 in terminal group (3 on peg side, 2 on comb side), each with 4–7 bells. Terminus with comb of 15 alate teeth opposite 2 straight pegs with rounded tips.

Furca (Figure 46e): Each lamella with 9 or 10 claws decreasing in length posteriorly along lamella but posterior 4 or 5 claws fairly similar in length; all claws with teeth along posterior edges; claw 1 also with row of stout medial teeth; hairs present on lamella medial to bases of claws and following posterior claw; right lamella anterior to left by width of base of claw 1 and with spines along anterior edge; 5th claw of illustrated left lamella aberrant in having bifurcate tip.

Bellonci Organ (Figure 45e,i): Elongate with indistinct suture at midlength and rounded tip.

Eyes: Lateral eye small, unpigmented, with 2 ommatidia (Figure 45e,h). Medial eye large with small area with brown pigment (Figure 45e,i).

Upper Lip (Figures 45e, 46f): Hirsute ventrally and with 2 small diaphanous processes at anterior tip.

Genitalia (Figure 46e,h): Small amber-colored oval on each side of body anterior to furca.

Brush-like Organ (Figure 46h): Organ comprising about 7 minute bristles on each side dorsal to genitalia.

Anterior of Body (Figures 45e, 46f,g): With elongate tapering anterior process with knob-like tip.

Posterior of Body (Figure 46e): With long hairs along ventral $\frac{1}{3}$, and few rows of indistinct spines on rounded posterodorsal corner.

Y-Sclerite (Figure 46e): Typical for genus.

Number of Eggs: USNM 193946 with about 8 unextruded eggs of similar size on each side of body near brush-like organ (Figure 46i); length of longest egg 0.104 mm.

DESCRIPTION OF A-1 MALE.—Posterodorsal corner and posterior of carapace more oblique than that of adult female.

Carapace Size (length, height in mm): Slope 69, 1.97, 1.19.

First Antenna: 2nd joint of specimen from Slope 69 with 4 bristles (2 dorsal, 1 ventral, 1 lateral) on each limb; 4th joint with 1 dorsal and 3 ventral bristles; limb otherwise similar to that of adult female, but filaments of bristles of 5th, 7th, and 8th joints not counted.

Second Antenna: Protopodite with long distal dorsal hairs. Endopodite 3-jointed: 1st joint short with 6 small bristles (5 proximal, 1 distal); 2nd joint elongate with 3 ventral bristles (proximal long with long proximal and short distal spines, others shorter); 3rd joint elongate with long proximal dorsal bristle and 2 small terminal bristles. Exopodite 9-jointed; all

bristles fairly short, none with natatory hairs, most with spines; 9th joint with 6 bristles (4 stout, 2 small); joints 5–8, possibly others (obscured), with basal spines.

Mandible: Dorsal margin of basale of specimen from slope 69 with 5 bristles on each limb. Limb not studied in detail but appearing similar to that of adult female.

Maxilla: Basale with 2 long dorsal bristles. Remaining part of limb not studied.

Seventh Limb: Limb with 18 bristles: 13 in proximal group (6 on comb side, 7 on peg side), each with 3 or 4 bells; 5 in terminal group (2 on comb side, 3 on peg side), each with 2–5 bells; all bristles tapering distally (juvenile character). Terminus with comb of about 6 teeth opposite 2 straight pegs.

Furca: Each lamella with 10 claws; teeth of claws similar to those of adult female.

Bellonci Organ: Similar to that of adult female except without suture at midlength.

Eyes: Lateral eye fairly large with numerous minute ommatidia, unpigmented. Medial eye not examined.

Genitalia: Obscured, if present.

Anterior of Body: Anterior process similar to that of adult female.

Posterior of Body: Similar to that of adult female (long hairs on posterior edge and spines on posterodorsal corner).

Y-Sclerite: Similar to that of adult female.

COMPARISONS.—The only other known species of *Philomedes* having 5 or 6 bristles (including 2 ventral bristles) on the 2nd joint of the 1st antenna of the adult female is *P. lofthousae* Kornicker, 1975:281. The maxilla of *P. pseudolofthousae* differs from that of *P. lofthousae* in having 2 rather than 1 bristle on the dorsal margin of the basale. An A-1 male of *P. pseudolofthousae* studied herein also has 2 dorsal bristles on the basale of the maxilla. *Philomedes lofthousae* was collected in the vicinity of the Kerguelen Islands at depths of 25–55 m (Kornicker, 1975:289). *Philomedes pseudolofthousae* was collected on the southern Australian slope at a depth of 1840 m. The 2 species are closely related.

REMARKS CONCERNING *Philomedes lofthousae*.—A maxilla of an A-1 female (length of empty carapace 2.15 mm, height 1.40 mm) paratype of *P. lofthousae* (USNM 139853) was examined and found to have 3 bristles on the basale (1 dorsal, 1 medial, 1 ventral); the ventral bristle was overlooked on the adult female described by Kornicker (1975:285). In the diagnosis of the species Kornicker (1975:283) incorrectly gave the number of dorsal bristles on the mandibular basale of the adult female as 6; it should have been 4 as stated in the description of the species (1975:285) and as shown in the illustration of the mandible (1975, fig. 172g).

Philomedes sphinx, new species

FIGURES 47–49

ETYMOLOGY.—From the Greek *Sphinx* (female monster of Thebes who asked riddles).

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

TYPE LOCALITY.—Slope 25, 38°25'54"S, 148°58'36"E, Victoria, south of Point Hicks; depth 1850 m.

PARATYPES.—None.

DISTRIBUTION.—Slope 25, 1850 m.

DESCRIPTION OF ADULT FEMALE (Figures 47–49).—Carapace oval in lateral view with prominent rostrum and evenly rounded caudal process (Figure 47a); anterior margin of rostrum slightly concave in lateral or medial views (Figure 47a,c); lateral projection extending past valve edge just ventral to incisor (stippled area in Figure 47c) (projection not apparent when valve slightly compressed under cover slip (Figure 47d)). Carapace surface with few small widely scattered bristles; about 9 short bristles forming row paralleling outer edge of caudal process (Figure 47b), and 2 or 3 bristles at edge of caudal process (lateral to narrow lamellar prolongation of selvage) (Figure 47e).

Infold: Rostral infold with 1 bristle near dorsal edge separated by space from 7 bristles in row slightly oblique to anterior edge (Figure 47c); 2 bristles along ventral edge, and 1 posterior to inner end of incisor (Figure 47c). Anteroventral selvage with about 12 parallel ridges near posterior end but without bristles (Figure 47d). Narrow list with anterior end near outer of the ridges continues along ventral margin then bends dorsally coming closer to inner margin of infold along caudal process (Figure 47e); list in vicinity of caudal process with total of about 35 very slender ungrouped bristles (23 shown in Figure 47e). Infold of caudal process with 12–14 small bristles (Figure 47e). Each valve with 4 clusters of spines on vestment close to inner margin of anteroventral infold in vicinity of concentric ridges (Figure 47d).

Selvage: Lamellar prolongation along anterior and ventral edges of rostrum with narrow segments and marginal fringe; prolongation along ventral edge of incisor very broad, segmented, with marginal fringe; long hairs with bases at midwidth of prolongation along anteroventral corner of valve; prolongation along ventral selvage broad with marginal fringe, and strongly segmented on left valve only (Figure 47d); prolongation along caudal process narrow with smooth edge; prolongation dorsal to caudal process broader and with marginal fringe.

Carapace Size (length, height in mm): Holotype, 1.59, 1.07, height 67% of length.

First Antenna (Figure 47f): 1st joint with few distal medial rows of small spines (not shown). 2nd joint with rows of medial spines on and near dorsal margin, a few distal spines on ventral margin (not shown), lateral spines forming row along distal margin, and 2 bristles (1 dorsal, 1 lateral) with short spines. 3rd joint with 2 rows of medial spines and 3 bristles (1 ventral, 2 dorsal) with short marginal spines. 4th joint with medial spines and 3 ventral bristles (2 with long and short spines, 1 (shortest) with only short spines) and 1 dorsal bristle with short spines. 5th joint with medial, lateral, and dorsal spines; sensory bristle

with 3 short slender proximal filaments and 4 terminal filaments (2 long stout (on right limb only of holotype, 1 of the long filaments with forked tip, Figure 47g), 2 short slender). Medial bristle of 6th joint with long proximal and short distal spines. 7th joint: a-bristle about twice length of bristle of 6th joint, with short marginal spines; b-bristle almost twice length of a-bristle, with 3 or 4 terminal filaments; c-bristle about same length as sensory bristle, with 3 short slender proximal filaments and 4 terminal filaments (2 long stout, 2 short slender). 8th joint: d- and e-bristles almost same length as c-bristle, bare with blunt tips; f-bristle almost as long as c-bristle, with 2 short slender proximal filaments and 4 terminal filaments (2 long, 2 short); g-bristle same length as c-bristle, with 3 short slender proximal filaments and 4 terminal filaments (2 long stout, 2 short slender).

Second Antenna: Protopodite bare. Endopodite 2-jointed (Figure 47h,i): 1st joint with 4 short bare bristles; 2nd joint with 1 long bristle with long spines except for short spines near tip; right limb only with additional short spinous bristle (Figure 47i). Exopodite (Figure 47j): 1st joint with minute straight tubular medial bristle on distal edge; bristles of joints 3–8 bare except for minute hook-like tips (detail in Figure 47j); 9th joint with 6 bristles (3 similar to bristles of joints 3–8, 3 short with short spines); joints 2–8 with fairly long spines near distal edge, but no basal spines. (Absence of natatory hairs on bristles of exopodite suggests that female is unable to swim.)

Mandible: Coxale endite bifurcate, spinous, with small ringed bristle near base (Figure 48a). Basale (Figure 48a): dorsal margin with 1 bristle (with short spines) at distal $\frac{3}{4}$ and 2 terminal with long proximal and short distal spines (proximal terminal bristle also lateral, about $\frac{3}{4}$ length of terminal medial bristle); ventral margin with 6 or 7 bristles (2 distal with bases on margin, others with bases lateral (3 of latter with bases farther from margin than others)) with long proximal and short distal spines; medial surface with rows of long spines and 6 proximal bristles (3 stout unringed pectinate, 3 slender ringed spinous). Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, with distal spines, minute spinous distal process, and 2 distal bristles (proximal longer and with long proximal and short distal spines; distal bare or with indistinct short spines). 1st endopodial joint with 3 bristles with long proximal and short distal spines. 2nd endopodial joint: ventral margin with 5 distal bristles forming 2 groups (proximal group with 2 spinous bristles, distal group terminal with 3 bristles, either bare or with few spines (Figure 48b)); dorsal margin with 9 spinous bristles forming roughly 3 groups (2 in proximal group, 1 in middle group, and 6 in distal group); medial surface with numerous rows of spines in proximal half. 3rd endopodial joint with 3 bare claws and 3 ringed bristles (Figure 48c).

Maxilla: Endite I broad with 8 spinous and pectinate bristles (Figure 48d); endite II narrow with 6 spinous and pectinate bristles (bristles not shown); endite III narrow, longer than endite II, with 1 proximal and 9 terminal spinous and



FIGURE 47.—*Philomedes sphinx*, new species, adult female, holotype: *a*, complete specimen from right side, length 1.59 mm; *b*, posterior, right valve, ov; *c*, anterior, left valve, iv; *d*, anteroventral infold, left valve, iv; *e*, posterior, left valve, iv; *f*, medial eye (stippled), Bellonci organ, 2 muscle bands, and part of right 1st antenna; *g*, tip of sensory bristle of 5th joint of right 1st antenna, mv; *h*, endopodite, left 2nd antenna, mv; *i*, endopodite, right 2nd antenna, mv; *j*, exopodite, left 2nd antenna, mv; *k*, anterior of body from right side, anterior to right.



FIGURE 48.—*Philomedes sphinx*, new species, adult female, holotype: *a*, part of right mandible, mv; *b*, part of 2nd endopodial joint, right mandible, mv; *c*, bristles of 3rd endopodial joint, right mandible, mv; *d*, right maxilla, mv (not all bristles shown); *e*, left maxilla (limb twisted, medial view of endopodite; not all bristles shown); *f*, beta-bristles, left maxilla, lv; *g*, a-bristles, left maxilla, lv; *h*, bristles of 2nd endopodial joint, left maxilla, lv (a-bristles not shown); *i*, right lamella of furca.

pectinate bristles (Figure 48*e*). Precoxale and coxale with dorsal fringe of long hairs; coxale with plumose dorsal bristle (Figure 48*d*). Basale with 3 long spinous terminal bristles (1 dorsal, 2 ventral (1 medial, 1 lateral)) (Figure 48*d*). Exopodite

small, with 3 bristles (1 short and slightly proximal, 2 long terminal) (Figure 48*e*). 1st endopodial joint with distal hairs along anterior margin, 1 long spinous alpha-bristle (Figure 48*d,e*) and 3 fairly straight bare beta-bristles (Figure 48*e,f*).

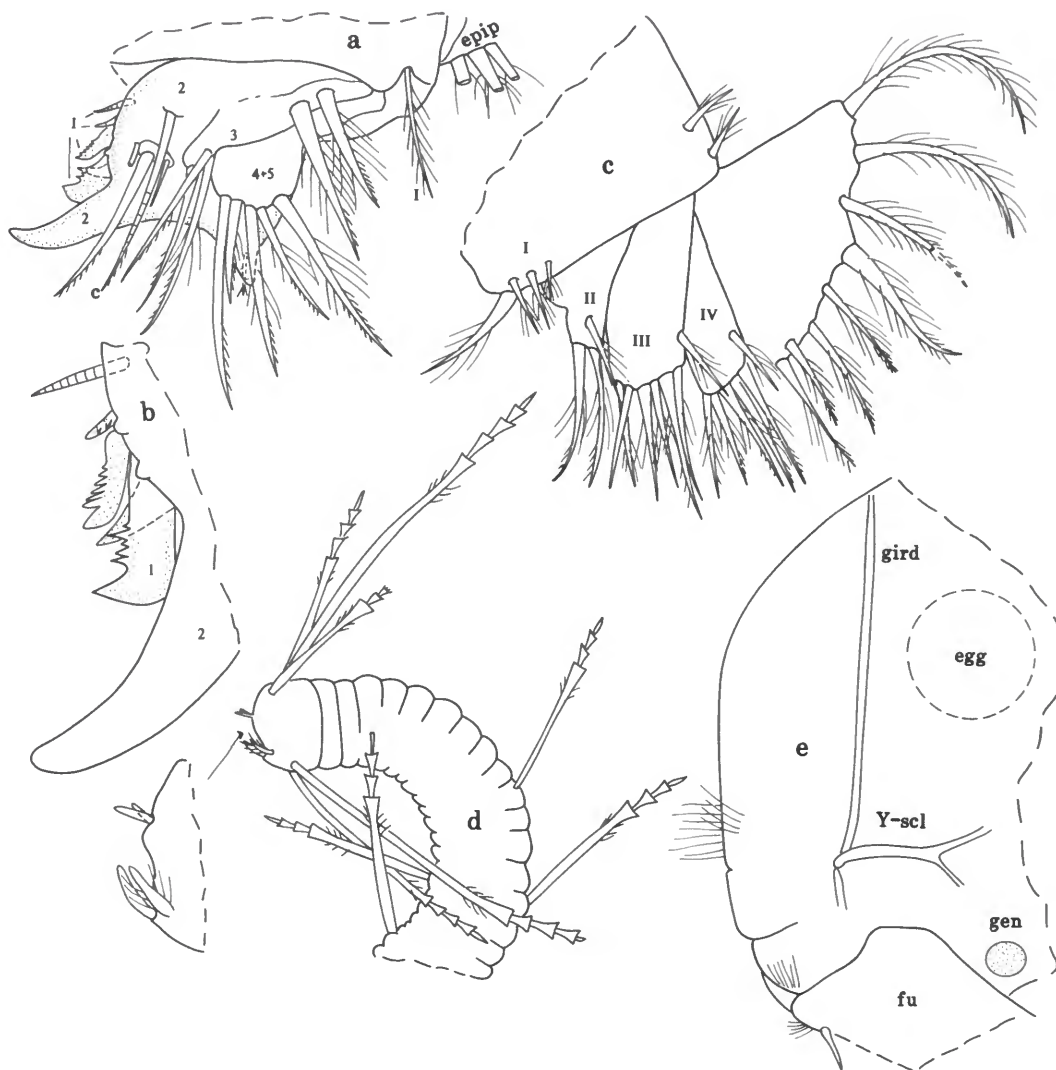


FIGURE 49.—*Philomedes sphinx*, new species, adult female, holotype: a, right 5th limb, pv; b, detail from a; c, right 6th limb, mv; d, 7th limb; e, posterior of body from right side, anterior to right.

2nd endopodial joint with 3 bare a-bristles (Figure 48g), 2 b-bristles (shorter ringed pectinate; longer claw-like, almost bare), 2 ringed c-bristles (bare or with few indistinct spines), and 3 d-bristles (outer ringed spinous, others claw-like bare) (Figure 48h).

Fifth limb (Figure 49a,b): Epipodite with 40 plumose bristles. Three endites with bristles present but obscured. 1st exopodial joint with 3 pectinate teeth; distal tooth bifurcate with smooth triangular anterior cusp; ringed bristle proximal to teeth; anterior side of joint with 2 spinous bristles at midwidth of distal margin (not shown); small spinous bristle present near epipodite. 2nd exopodial joint: inner curvature of large flat triangular tooth with 2 minute nodes; posterior side of tooth with 3 bristles (long bristle with small bristle on each side);

c-bristle stout with few distal teeth; outer corner of large tooth with small anterior bristle with long hairs. 3rd endopodial joint with 3 bristles on inner lobe and 2 bristles with long proximal and short distal spines on outer lobe. 4th and 5th joints fused, with 5 spinous and pectinate bristles.

Sixth Limb (Figure 49c): Epipodite with 2 small hirsute bristles. Endite I small, with 2–4 spinous bristles (1–3 medial, 1 terminal); endite II small with 3 spinous bristles (1 medial, 2 terminal); endite III long and wide, with 7 spinous bristles (1 medial, 6 terminal); endite IV narrower than endite III, with 6 spinous bristles (1 medial, 5 terminal). End joint with 8 bristles (posterior 2 plumose, others with long hairs or spines except for short spines near tip). Limb hirsute.

Seventh Limb (Figure 49d): With 9 bristles: proximal

group with 4 bristles, 2 on each side, each with 3 bells; terminal group with 3 bristles on peg side, each with 1–5 bells, and 2 on comb side, each with 4 bells; all bristles with few indistinct distal spines. Comb with 3 teeth (1 tooth with long proximal spines on each side of longer tooth without long spines); 2 subequal smooth pegs opposite comb.

Furca (Figure 48i): Each lamella with 9 claws; claws 1 and 2 about same length but claw 1 slightly wider; remaining claws decrease in length and width posteriorly along lamella, but decrease greater between claws 1–5 and claws 6–9; claws 1–8 with long medial spines near bases (not shown); hairs on lamellae following claws; right lamella anterior to left by width of base of claw 1; claw 1 with medial and lateral row of similar teeth (some smaller than others); claws 2–9 with row of teeth along posterior edge (teeth on claws 7–9 minute); claws 3–7 with few and claws 8 and 9 with many spines along anterior edge.

Bellonci Organ (Figure 47f): Small (length less than width of 1st joint of 1st antenna), cylindrical, unsegmented, with tapered tip.

Eyes: Lateral eyes absent. Medial eye small with brown pigment (Figure 47f).

Upper Lip (Figure 47k): With broadly rounded anterior tip with few spines; long hairs along ventral surface.

Genitalia (Figure 49e): Small oval with amber pigment on each side of body anterior to furca.

Anterior of Body (Figure 47k): Rounded anterior process between medial eye and upper lip.

Posterior of Body (Figure 49e): With long hairs at about midheight.

Y-Sclerite (Figure 49e): With ventral branch typical for genus.

Eggs: Holotype with fairly large unextruded eggs (1 shown in Figure 49e).

COMPARISONS.—*Philomedes sphinx* differs from species previously referred to the genus in having a much smaller Bellonci organ, only 3 teeth in the comb of the 7th limb, and in not having a ventral bristle on the 2nd joint of the 1st antenna.

The species could have been referred to *Igene* Kornicker, 1975:367, which it resembles in many characters. Its Bellonci organ (Figure 47f) is small like that of *Igene* but is cylindrical rather than conical, and for that reason the species has been referred to *Philomedes*. Many members of the Pseudophilomedinae have small cylindrical Bellonci organs similar to that of *P. sphinx*, but the posterior projection of the end joint of the 6th limb (Figure 49c) of *P. sphinx* indicates that it belongs in the Philomedinae.

Philomedes thorax, new species

FIGURES 50–52

ETYMOLOGY.—From the Greek *thorax* (breastplate, cuirasse).

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

TYPE LOCALITY.—Slope 34, 38°16.40'S, 149°27.60'E, Victoria, S of Point Hicks; depth 800 m.

PARATYPES.—Slope 34: 1 adult male, 1 juvenile.

DISTRIBUTION.—Slope 34, 800 m.

DESCRIPTION OF ADULT FEMALE (Figures 50, 51).—Carapace with prominent rostrum with minute protuberance at tip, broad incisor, and truncate posterior (Figure 50a,b).

Ornamentation: Carapace smooth except for indistinct shallow fossae observed in vicinity of rostrum of holotype (Figure 50b); scattered undivided bristles present on lateral surface, more abundant along anterior and ventral margins and ventral edge of caudal process.

Infold: Infold of rostrum with row of 28–30 divided bristles (Figure 50c) (divisions not shown); 1 small bristle on infold posterior to inner end of incisor; anteroventral infold with 14 striae proximal and parallel to narrow list, 14 bristles along list, and 6 additional bristles in row anterior to anterior end of list; middle part of ventral list without bristles; list extending along posterior 1/3 of ventral list and onto infold of caudal process with numerous bristles in groups of 1 to 4 (Figure 50d); infold of caudal process with 7 short bristles in irregular row between list and outer edge of valve, and 8 short bristles along outer edge (Figure 50d).

Selvage: Lamellar prolongation with marginal fringe present along anterior, ventral, and posterior margins, but absent, or very narrow, along posterior edge of caudal process; prolongation with typical segmentation along rostrum and incisor; prolongation along anteroventral margin with long proximal threads extending well past outer edge of prolongation; more widely separated, shorter and slenderer threads along ventral margin.

Central Adductor Muscle Attachments (Figure 50e): Comprising about 19 ovoid attachments.

Carapace Size (length, height in mm): Holotype, 1.80, 1.08; height 60% of length.

First Antenna (Figure 50f): 1st joint with long ventral and distal medial spines. 2nd joint with ventral, dorsal, lateral and medial rows of long spines and 3 bristles (1 ventral, 1 dorsal, 1 lateral). 3rd joint with 3 bristles (1 ventral, 2 dorsal), 4th joint with 5 bristles (4 ventral, 1 dorsal). Sensory bristle of 5th joint with 5 short marginal and 5 terminal filaments. 6th joint fused to 5th; medial bristle about half length of bristle of 5th joint, with long proximal and short distal spines. 7th joint: a-bristle longer than bristle of 6th joint, with short marginal spines; b-bristle about 3/4 length of bristle of 5th joint, with 1 proximal and 4 terminal filaments; c-bristle about same length as bristle of 5th joint, with 5 marginal and 5 terminal filaments. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; minute medial papilla just proximal to base of d- and e-bristles; f-bristle same length as c-bristle, with 4 or 5 marginal and 4 or 5 terminal filaments; g-bristle same length as c-bristle, with 3 marginal and 5 terminal filaments.



FIGURE 50.—*Philomedes thorax*, new species, ovigerous female, holotype: *a*, complete specimen from left side, length 1.80 mm; *b*, rostrum, right valve, ov; *c*, anterior, right valve, iv; *d*, posterior, right valve, iv; *e*, central adductor muscle attachments, left valve, ov, anterior to left; *f*, left 1st antenna, mv (not all bristles shown); *g*, endopodite and part of protopodite, left 2nd antenna, mv; *h*, right mandible, mv (not all bristles shown); *i*, bristles of 3rd endopodial joint, right mandible, mv; *j*, right maxilla, lv (not all bristles shown); *k*, medial eye and Bellonci organ; *l*, right lateral eye, anterior to right.

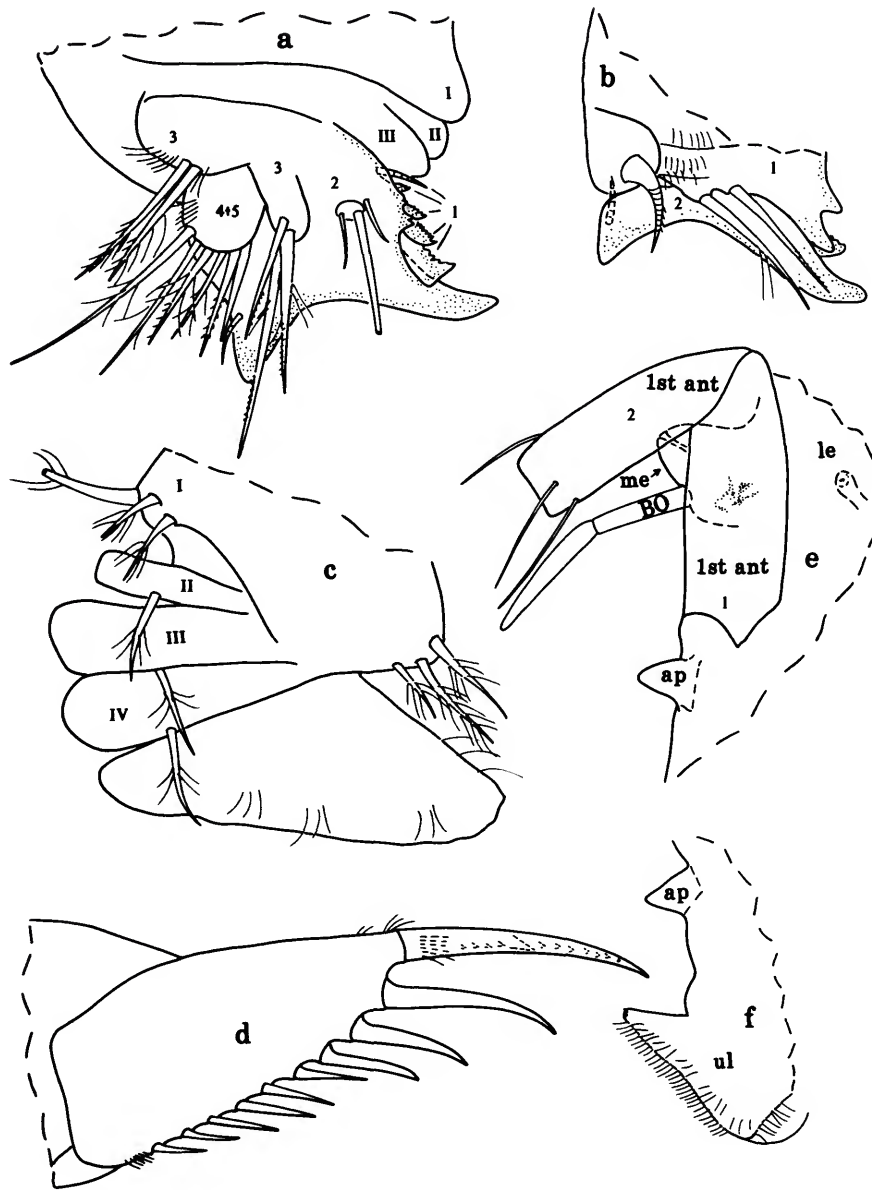


FIGURE 51.—*Philomedes thorax*, new species, ovigerous female, holotype: a, left 5th limb, pv (endite bristles not shown); b, part of right 5th limb, av; c, right 6th limb, mv (not all bristles shown); d, right lamella of furca; e, anterior of body from left side, anterior to left; f, upper lip and anterior process from left side, anterior to left.

Second Antenna: Prodopodite with long spines along distal dorsal margin (not shown) and few on distal medial surface (Figure 50g). Endopodite 2-jointed (Figure 50g): 1st joint with 6 short bare bristles (5 proximal, 1 distal); 2nd joint elongate with 2 ventral bristles (proximal long with long spines, other shorter bare) and recurved bare terminal bristle. Exopodite: 1st joint with short, tubular, medial, terminal bristle; bristle of 2nd

joint reaching well past 9th joint, with 15 proximal ventral spines; bristles of joint 3–5 with ventral spines and no natatory hairs; bristles of joints 6–8 with natatory hairs (no bristles broken); 9th joint with 7 bristles (4 long with natatory hairs (none broken), 3 short with either slender spines or bare); joints 2–8 with fairly long slender spines along distal edges and row of shorter medial spines near midlength.

Mandible (Figure 50*h,i*): With 3 endites: endite I with 6 bristles; bristles of endites II and III obscured. Coxale with long medial spines; endite with long spines, and teeth on bifurcate tip; small ringed bristle near base of endite (dashed in Figure 50*h*). Basale (Figure 50*h*): dorsal margin with 5 bristles (3 single distal to midlength, 2 paired terminal); medial side with rows of spines and 6 proximal bristles (3 stout unringed pectinate, 3 slender ringed spinous) near ventral margin; ventral margin with 3 distal spinous bristles; lateral side near ventral margin with 5 spinous bristles. Exopodite about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, hirsute distally, with 2 subequal subterminal bristles (proximal with long spines near midlength, other bare). 1st endopodial joint with 4 long ventral bristles (only stumps shown in Figure) and row of minute terminal spines on dorsal margin. 2nd endopodial joint: dorsal margin with proximal spines and 9 bristles (3 in proximal group, 6 in distal group); ventral margin with 2 groups of spinous bristles, each with 3 bristles; medial surface with rows of spines. 2nd endopodial joint with 3 claws (dorsal claw about half length of longest claw; long medial claw slightly shorter than lateral claw) with proximal spines and 4 ringed bristles with slender pointed talon-like tips (Figure 50*i*).

Maxilla (Figure 50*j*): Endite I with 10 spinous bristles; endite II with 6 spinous bristles; endite III with 1 proximal bristle and about 8 spinous terminal bristles. Coxale with plumose dorsal bristle. Basale with 3 bristles (1 short dorsal, 1 long medial, 1 long ventral. Exopodite with 3 bristles (1 short proximal bare, 2 long terminal (anterior with short spines, other with long proximal and short distal spines). 1st endopodial joint with 1 ringed alpha-bristle with long proximal and short distal spines, and 4 shorter ringed beta-bristles with short spines or bare. 2nd endopodial joint with 3 bare-ringed a-bristles, 2 pectinate b-bristles (shorter ringed, longer unringed claw-like), 3 ringed c-bristles, and 3 d-bristles (outer ringed spinous, others unringed pectinate claw-like (not shown).

Fifth Limb: 1st exopodial joint with 2 long spinous anterior bristles and 1 short spinous bristle at outer corner (Figure 51*b*); main tooth with bilobed anterior tooth and 4 pectinate teeth (smallest pectinate tooth appears to be in place of usual smooth tooth, which if present on holotype is obscured); ringed bristle proximal to smallest tooth (Figure 51*a*). 2nd exopodial joint with 3 small protuberances on inner margin of large flat triangular tooth, 1 small indistinct posterior bristle near outer distal corner of joint, and row of 3 posterior bristles (long stout bristle with 1 small bristle on each side) (Figure 51*a*). 3rd exopodial joint with 3 spinous bristles on inner lobe and 2 plumose bristles on hirsute outer lobe (Figure 51*a*). 4th and 5th exopodial joints fused, hirsute, with total of 6 spinous bristles.

Sixth Limb (Figure 51*c* (not all bristles shown)): With 3 short plumose epipodial bristles. Endite I with 3 spinous bristles (2 short medial, 1 long terminal); endite II with 4 spinous bristles (1 short medial, 3 long terminal); endites III and IV each with 9 spinous bristles (1 short medial, 8 long

terminal). End joint with 16–18 spinous bristles; limb hirsute.

Seventh Limb: Limb with 9 bristles: 4 in proximal group, 2 on each side, each with 4 or 5 bells; and 5 in terminal group, 3 on peg side, 2 on comb side, each with 4–6 bells. Terminus with comb of 13 alate teeth opposite 2 straight pegs with rounded tips.

Furca (Figure 51*d*): Each lamella with 10 claws decreasing in length along lamella, but posterior 5 or 6 claws fairly similar in length; all claws with teeth along posterior edges (not shown); claw 1 also with row of stout medial teeth (tooth at midlength longer than others (Figure 51*d*)); claws 2 and 3 with few proximal medial teeth (not shown); claws 1–5 with few spines along anterior edges (not shown); claws 6–10 with slender teeth along anterior edges only slightly slenderer than those along posterior edges (not shown); hairs present medial to bases of claws and just posterior to posterior claw (not all shown); right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figures 50*k*, 51*e*): Elongate with suture near midlength and rounded tip.

Eyes: Lateral eye minute with black pigment but no ommatidia (it is possible that the species lacks lateral eyes, but the black pigment spot interpreted to be a lateral eye was observed on both sides of holotype (Figures 50*l*, 51*e*); eye not visible through shell. Medial eye large with small area of brown pigment (Figures 50*k*, 51*e*).

Upper Lip (Figure 51*f*): Hirsute ventrally and with 2 or 3 small diaphanous processes at anterior tip.

Genitalia: Brown poorly defined oval on each side anterior to furca.

Anterior of Body (Figure 51*e,f*): With triangular anterior process.

Posterior of Body: Evenly rounded, with indistinct hairs.

Y-Sclerite: Typical for genus.

Number of Eggs: Holotype with 11 eggs in marsupium (length of typical egg 0.32 mm).

DESCRIPTION OF ADULT MALE (Figure 52).—Carapace more elongate than that of adult female. In lateral view of whole specimen incisure appears shallow (Figure 52*a*), but when valve viewed from inside incisure forms right angle (Figure 52*b*).

Infold: Rostral infold with 23 bristles (Figure 52*b*). Remainder of infold not examined.

Central Adductor Muscle Attachments (Figure 52*c*): Comprising about 20 ovoid attachments arranged in a pattern similar to those of adult female.

Carapace Size (length, height in mm): Slope 34: 1.90, 0.92; height 48% of length.

First Antenna (Figure 52*d*): 1st joint bare. 2nd joint very long, with distal ventral and lateral spines and 3 bristles (1 ventral, 1 dorsal (short), 1 lateral). 3rd joint short, with 3 bristles (2 dorsal, 1 medial); distal end of joint with triangular prolongation (with rows of minute spines) on lateral side extends well past edge of joint on medial side. 4th joint with 5 bristles (4 ventral, 1 dorsal). 5th joint wedged medially between



FIGURE 52.—*Philomedes thorax*, new species, adult male, paratype: *a*, complete specimen from left side showing locations of lateral eye and central adductor muscle attachments, length 1.90 mm; *b*, anterior, right valve, iv; *c*, central adductor muscle attachments, right valve, ov, anterior to right; *d*, right 1st antenna, lv (not all bristles shown); *e*, endopodite and part of protopodite, left 2nd antenna, mv; *f*, right mandible, mv (not all bristles shown); *g*, bristles of 3rd endopodial joint, right mandible, mv; *h*, right maxilla, lateral view, except endopodite twisted and in medial view; *i*, left maxilla, mv (1st endopodial joint twisted); *j*, 5th limb; *k*, medial eye and Bellonci organ; *l*, left lateral eye, anterior to left; *m*, anterior of body from right side showing anterior process and upper lip; *n*, part of body from right side showing copulatory organs and right Y-sclerite, anterior to right; *o*, outline of heart, anterior to left.

4th and 6th joints near ventral edges; sensory bristle with abundant sensory filaments in broad proximal half (only 7 filaments shown) and 5 shorter terminal filaments. 6th joint with slender medial bristle near dorsal edge. 7th joint: a-bristle about same length as bristle of 6th joint; b-bristle not reaching tip of bristle of 5th joint, with 3 short marginal and about 4 short terminal filaments; c-bristle extremely long with 14 short marginal filaments. 8th joint: d- and e-bristles reaching past tip of bristle of 5th joint, bare with blunt tips; f-bristle long, similar to c-bristle, with 12 short marginal filaments; g-bristle same length as d-bristle, with 3 short marginal and 5 terminal filaments.

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 52e): 1st joint short with 6 short bristles (5 proximal, 1 distal); 2nd joint elongate with 3 ventral bristles; 3rd joint reflexed on 2nd, with long proximal filament, 2 small terminal bristles, and terminal ridges. Exopodite: 1st joint with minute medial terminal bristle; bristle of 2nd joint reaching 5th joint, with 9 ventral spines; 3rd joint about twice length of 2nd joint; bristles of joints 3–8 with natatory hairs; 9th joint with 6 bristles (4 long and 2 short; all with natatory hairs); joints 3–8 each with small basal spine (spine of 8th joint about half length of 9th joint); joints 3–8 with row of few minute spines at distal corner.

Mandible (Figure 52 f,g): Coxale endite small, bare, bifurcate, with small adjacent bristle. Basale: dorsal margin with 5 bristles (3 single distal to midlength, 2 paired terminal (medial more than twice length of lateral)); medial side with 6 slender bristles (3 unringed bare, 3 ringed (1 bare, 2 with spines (not shown)) near ventral margin; ventral margin with 1 proximal plumose bristle (this bristle equivalent to proximal lateral bristle of adult female, and present only on right limb of examined male), and 3 plumose distal bristles; lateral side with 3 plumose bristles near ventral margin. Exopodite about half length of dorsal margin of 1st endopodial joint, hirsute distally, with 2 subequal subterminal bristles. 1st endopodial joint with 4 long ventral bristles (stumps shown) and few minute spines at distal dorsal corner. 2nd endopodial joint: dorsal margin with proximal spines and 9 bristles (4 short proximal, 5 long distal); ventral margin with 2 groups of spinous bristles, each with 3 bristles; medial surface with rows of spines. 2nd endopodial joint with 3 claws (dorsal claw about $\frac{1}{3}$ length of longest claw; long medial claw about $\frac{2}{3}$ length of lateral claw; longest claw with few ventral teeth at midlength and few distal dorsal spines) and 4 ringed bristles.

Maxilla (Figure 52h,i): Reduced, with 3 endites with terminal bristles weakly developed (not counted); endite III with 1 proximal bristle. Bristles of coxale and basale similar to those of adult female. Exopodite similar to that of adult female except all bristles hirsute (Figure 52h). 1st endopodial joint with long alpha-bristle (with long hairs (not shown)) and 3 weak beta-bristles (Figure 52h). 2nd endopodial joint with 2 fairly well-defined weakly ringed bristles, but other bristles unringed and weakly developed.

Fifth Limb (Figure 52j): Reduced, with 3 endites (bristles not counted). Exopodite (Figure 52j): 1st and 2nd joints each with 2 or 3 broad unringed finger-like bristles and few additional slender bristles; 3rd joint with 3 bristles on inner lobe and 2 long stout plumose bristles (ringed distally) on outer lobe; 4th and 5th joints fused with total of 5 or 6 ringed bare bristles.

Sixth Limb: With 3 short plumose epipodial bristles. Endite I fragmented; endite II with 1 proximal medial bristle and 2 or 3 terminal bristles; endite III with 1 proximal medial bristle and 7 terminal bristles; endite IV with 1 proximal medial bristle and 9 terminal bristles. End joint with 12–14 bristles; limb hirsute.

Seventh Limb: Similar to that of adult female.

Furca: Each lamella with 9 claws distributed as on furca of adult female. Furca differs from that of female in having only small teeth in medial row on claw 1, and in claws 1 and 2 being longer and slenderer.

Bellonci Organ (Figure 52k): Similar to that of adult female.

Eyes: Medial eye similar to that of adult female (Figure 52k). Lateral eye well developed, about same size as medial eye, with 29 amber-colored ommatidia and black pigment between ommatidia (Figure 52l).

Upper Lip (Figure 52m), **Anterior of Body** (Figure 52m); **Posterior of Body**, and **Y-Sclerite** (Figure 52n): Similar to those of adult female.

Genitalia (Figure 52n): Elongate copulatory organs on each side of body anterior to furca.

Heart (Figure 52o): Well developed.

COMPARISONS.—In lateral view *P. thorax* resembles *P. pseudolothousae*, but is smaller (length of female *P. thorax* 1.80 mm; length of female *P. pseudophilomedes* 2.34–2.41 mm) and the caudal process is more pointed. Also, the appendages of the female *P. thorax* differ from those of the female *P. pseudophilomedes* in having fewer bristles on the 2nd joint of the 1st antenna, fewer bristles on the dorsal margin of the basale of the maxilla, and fewer bristles on the 7th limb. The female *P. thorax* is easily separated from females of other species of the genus in the present collection because of the truncate shape of the caudal process viewed laterally. The caudal processes of both *P. fortax* and *P. ptyx* are sharply delimited from the shell dorsal to the protuberance, unlike that of *P. thorax*, which forms a smooth curve. The caudal process of *P. sphinx* is broadly rounded. In the key to species of Subantarctic and Antarctic species of *Philomedes* presented by Kormicker (1975:229), *P. thorax* keys to *P. eugeniae* Skogsberg, 1920:410. They differ in that the 7th limb of the female *P. thorax* bears 4 proximal bristles compared to 9–13 on the limb of the female *P. eugeniae*. Also, the lateral eye of the female *P. eugeniae* bears 2 ommatidia whereas, the lateral eye of the female *P. thorax* is represented by a black spot.

***Pleoschisma* Brady, 1890**

TYPE SPECIES.—*Pleoschisma moroides* Brady, 1890, by subsequent designation (Sylvester-Bradley, 1961:Q399).

COMPOSITION.—Four species are known from the vicinity of Australia: *P. ferox* (Poulsen, 1962:391), and 3 new species described herein: *P. pnyx*, *P. pseudoferox*, and *P. mindax*.

DISTRIBUTION.—*Pleoschisma moroides* is known from the Fiji Islands at shallow depths; *P. agilis* (Thomson, 1879:257) is known from New Zealand at shallow depths and has been reported from New Caledonia (surface) (Poulsen, 1962:388); *P. ferox*, *P. pnyx*, *P. pseudoferox*, and *P. mindax* are from the vicinity of Australia at depths of 70–520 m.

Key to Species of *Pleoschisma*

(Adult females and late juveniles)

1. Exopodite of mandible $\frac{1}{4}$ length of dorsal margin of 1st endopodial joint *P. mindax*, new species
Exopodite of mandible $\frac{1}{2}$ to $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint 2
2. 5th limb with 1 large fang-like tooth on 1st exopodial joint 3
5th limb with 2 large fang-like teeth on 1st exopodial joint 5
3. Incisur negligible 4
Incisur fairly well developed *P. agilis*
4. Fang-like tooth of 1st exopodial joint of 5th limb with 4–6 stout teeth along inner margin *P. moroides*
Fang-like tooth of 1st exopodial joint of 5th limb with 12 stout teeth along inner margin *P. pseudoferox*, new species
5. Carapace longer than 1.8 mm; smaller fang-like tooth of 1st exopodial joint of 5th limb with 3 small teeth at base *P. ferox*
Carapace shorter than 1.4 mm; smaller fang-like tooth of 1st exopodial joint of 5th limb with no teeth at base *P. pnyx*, new species

***Pleoschisma pnyx*, new species**

FIGURES 53–57, 109c

ETYMOLOGY.—From the Greek *pnyx* (place for public assembly in Athens).

HOLOTYPE.—Partly dissected adult female on slide and 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 193928, ovigerous female on slide and in alcohol; 5 adult females, 5 instar V, 1 instar IV, all in alcohol. Slope 19: 1 partly dissected juvenile female in alcohol. Slope 21: USNM 194025, adult male on slide and in alcohol; 1 undissected instar IV in alcohol (length 0.92 mm, height 0.73 mm). Slope 22: 2 adult females, 2 juveniles, all undissected and in alcohol.

DISTRIBUTION.—Slope 1, 204 m. Slope 19, 520 m. Slope 21, 220 m. Slope 22, 363 m. Known depth range 204–520 m.

DESCRIPTION OF ADULT FEMALE (Figures 53–55, 57a, 109c).—Carapace oval in lateral view with slight or no incisur visible (Figure 53a,i,j), but small rostrum and shallow incisur visible in medial view (Figure 53b,d,e); posterior evenly rounded (without projecting caudal process) (Figure 53a,b,g).

Outer edge of valve folded inward on all margins (Figure 53b).

Ornamentation: With abundant distinct round fossae except for large irregular platelets in vicinity of adductor muscle attachments (Figures 53a,c, 57a); 2 or 3 similar platelets at bases of some long bristles. Surface with widely scattered long and short undivided bristles; some long bristles with stout triangular base. In medial view ventral margin of rostrum with elliptical structure with indistinctly striated surface (structure part of outer surface of shell, not infold (Figure 53 d,e)).

Infold: USNM 193928: rostral infold of left valve with row of 5 broken bristles (2 stumps divided) (divisions not shown in Figure 53e); right valve with vertical row of 2 or 3 bristles and 7 bristles along inner side of dorsal edge (all bristles undivided) (Figure 53d); anteroventral infold striate, with 1 bristle at valve midheight (not shown); posteroventral infold with 17–20 bristles; posterior infold of right valve with several hairs or hair-like bristles (Figure 53g,h). Holotype: rostral infold of left valve with vertical row of 8 bristles; right valve with vertical row of 8 bristles and row of 6 bristles along inner side of dorsal edge; all bristles undivided and appearing bare.

Central Adductor Muscle Attachments: Surface of shell in vicinity of muscle attachments with large platelets, at least

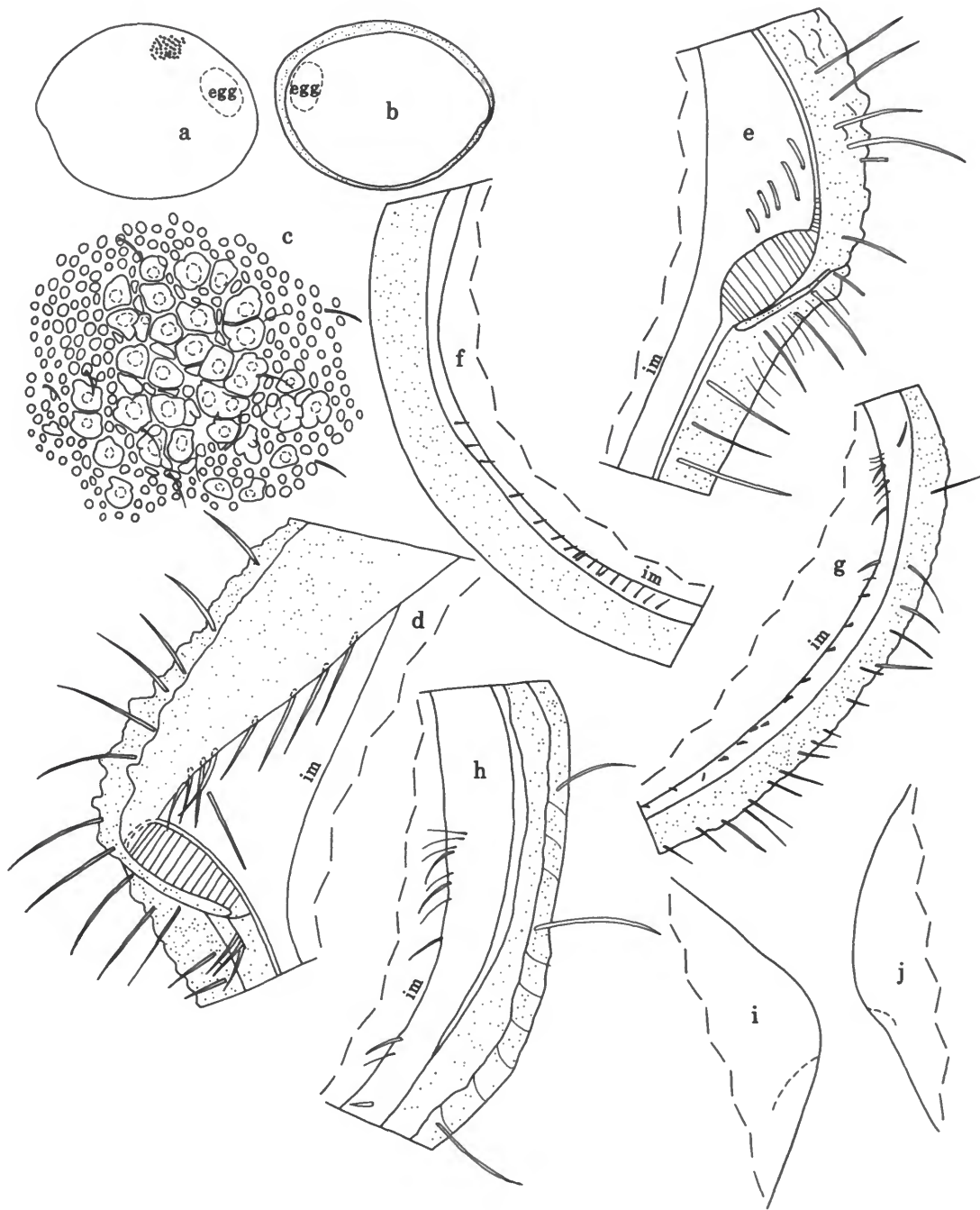


FIGURE 53.—*Pleoschisma pnyx*, new species, ovigerous female, paratype, USNM 193928: *a*, complete specimen from left side showing representative fossae and location of 1 egg, length 1.36 mm, ov; *b*, left valve, iv; *c*, structures on left valve in vicinity of central adductor muscle attachments, ov; *d, e*, anteriors of right and left valves, respectively, iv; *f, g*, posteriors of left and right valves, respectively, iv; *h*, detail from *g*; *i, j*, right and left valves, respectively, in area of incisur (dashed), ov.

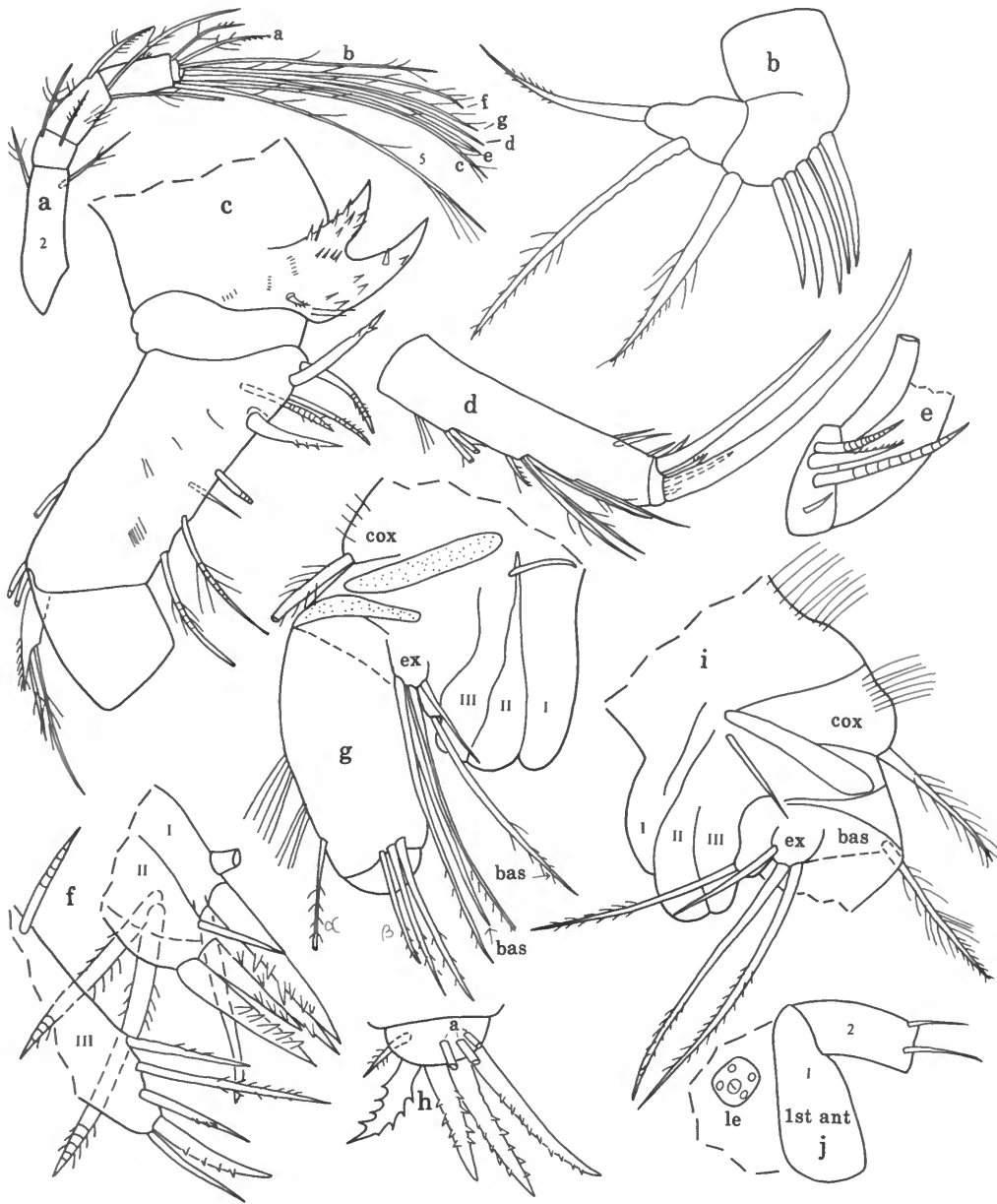


FIGURE 54.—*Pleoschisma pnyx*, new species, ovigerous female, paratype, USNM 193928: *a*, part of left 1st antenna, mv; *b*, endopodite, left 2nd antenna, mv; *c*, proximal part of right mandible, mv (not all bristles shown); *d*, distal part of endopodite of left mandible, lv; *e*, bristles of 3rd endopodial joint, right mandible, mv; *f*, endites of left maxilla, lv (not all bristles shown); *g*, left maxilla, lv (not all bristles shown); *h*, bristles of 2nd endopodial joint, left maxilla, lv; *i*, part of right maxilla, lv; *j*, right lateral eye and joints 1 and 2 of right 2nd antenna, anterior to right.

some coincide with individual muscle attachments (Figure 53c).

Carapace Size (length, height in mm): Slope 1: holotype, 1.35, 1.08; USNM 193928, 1.36, 1.07; 5 specimens: 1.32, 1.05;

1.33, 1.04; 1.33, 1.00; 1.32, 1.07; 1.30, 1.02. Slope 22: 1.33, 1.0. Range: length 1.30–1.36 mm, height 1.00–1.08 mm.

First Antenna (Figure 54*a,j*): 1st joint bare. 2nd joint with 2 spinous bristles (1 dorsal, 1 lateral near midwidth or closer to

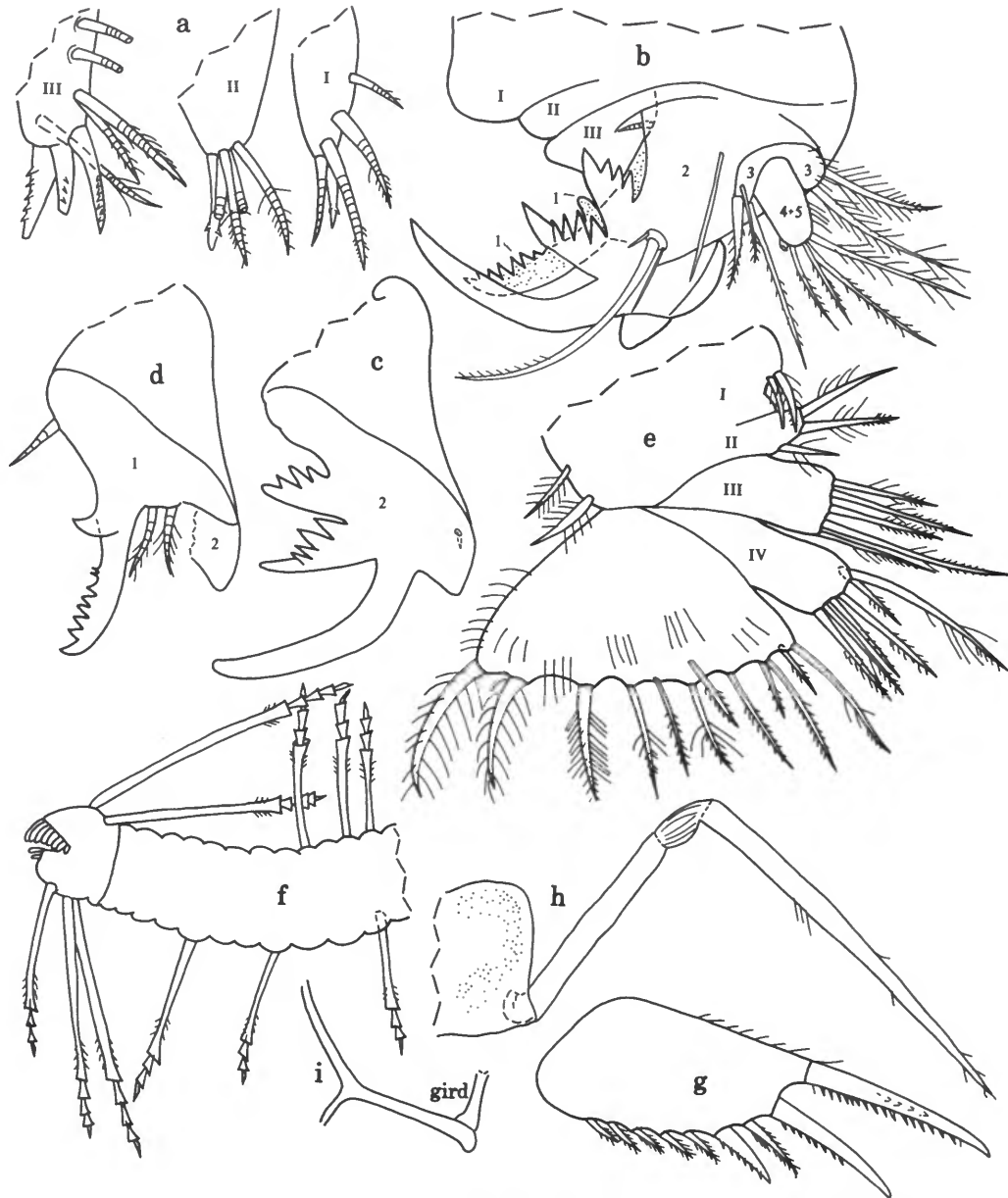


FIGURE 55.—*Pleoschisma pnyx*, new species, ovigerous female, paratype, USNM 193928: a, endites of left 5th limb, av; b, right 5th limb, pv (not all bristles shown); c, 2nd exopodial joint, left 5th limb, av; d, 1st exopodial joint, left 5th limb, av; e, left 6th limb, mv; f, 7th limb; g, right lamella of furca; h, medial eye and Bellonci organ; i, left Y-sclerite, anterior to left.

ventral margin). 3rd joint with 2 bristles (1 dorsal, 1 medial). 4th joint spinous, with 3 bristles (1 dorsal, 2 ventral). 5th joint with dorsal spines, and long ventral bristle with 4 proximal and about 4 terminal filaments. 6th joint fused to 5th, with short spinous medial bristle near dorsal margin. 7th joint: a-bristle longer than bristle of 6th joint, with long and short spines;

b-bristle with 1 filament at midlength and 4 at tip; c-bristle about same length as bristle of 5th joint, with 4 proximal filaments and 5 near tip (including stem). 8th joint: d- and e-bristles long bare with blunt tips; f-bristle with 4 marginal and about 4 terminal filaments; g-bristle with 3 proximal and about 4 terminal filaments.

Second Antenna: Protopodite bare (Figure 109c). Endopodite 2-jointed (Figure 54b): 1st joint with 5 short bare proximal bristles and 1 long spinous distal bristle; 2nd joint elongate, with 1 long spinous ventral bristle at midlength and 1 shorter terminal bristle with indistinct spines. Exopodite: 1st joint with minute straight terminal medial bristle; bristles of joints 2-5 short with 10-13 ventral spines and spine-like terminal segment; bristles of joints 6-8 long with natatory hairs, no spines; 9th joint with 7 bristles (4 long with natatory hairs, 2 short with long hairs, 1 minute bare); joints 3-8 with basal spines increasing in length on distal joints; spine of 8th joint same length as 9th joint; joints 3-8 with row of fairly long spines along distal edge.

Mandible (Figure 54c-e): Coxale endite bifurcate with several spines, 2 long proximal hairs, and small spinous bristle near base. Basale with 4 bristles in proximal ventral corner (2 stout unringed pectinate, 2 slender ringed spinous), 2 slender ringed bristles on lateral surface near ventral margin, 3 slender ringed bristles on ventral margin (1 near midlength, 2 distal with long proximal and short distal spines), 3 dorsal bristles (1 near midlength, 2 terminal), and few rows of hairs on medial surface. Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, hirsute with 2 subterminal bristles. 1st endopodial joint with 4 ringed terminal ventral bristles (2 long with long proximal and short distal spines, 2 short). 2nd endopodial joint: ventral margin with 3 or 4 short indistinctly ringed bristles (2 subterminal, 1 or 2 terminal); dorsal margin with 1 short bristle with long spines and 6 long bristles. 3rd endopodial joint with 1 long stout dorsal claw, 1 shorter and slenderer ventral bristle-like claw, and 4 short medial bristles (1 with marginal spines and unringed could be interpreted to be a claw). (Rings not shown on all illustrated bristles.)

Maxilla: Endite I obscured but with 2 long spinous bristles, 2 stout pectinate claw-like bristles, plus other bristles; endite II obscured but with 2 stout pectinate claw-like bristles plus other bristles; endite III with 1 slender proximal bristle and 5 terminal bristles (1 pectinate, claw-like, others slender ringed) (Figure 54f). Precoxale and coxale with dorsal fringe of long hairs. Coxale with stout plumose dorsal bristle. Basale with 3 long bristles (2 ventral, 1 dorsal (dorsal bristle missing on illustrated left limb, (Figure 54g))). Exopodite with 1 short proximal bristle and 2 long terminal bristles with short spines (Figure 54g,i). 1st endopodial joint with anterior spines, 1 spinous alpha-bristle, and 3 slender beta-bristles with short widely separated marginal spines (Figure 54g). 2nd endopodial joint obscured (with 3 a-bristles, 4 stout pectinate claw-like bristles, plus others) (Figure 54h). (Not all bristles shown.)

Fifth Limb: Endite I with 5 bristles including 1 short and unringed with few small marginal teeth; endite II with 5 bristles including 1 unringed, claw-like, pectinate; endite III with 8 bristles including 3 unringed, claw-like, pectinate (Figure 55a). 1st exopodial joint with long tooth with 5 or 6 large distal cusps and 2 minute proximal cusps on inner edge and stout smooth proximal tooth (Figure 55d); 1 bristle on edge proximal to

smooth tooth; anterior side with 2 short hirsute bristles at midwidth. 2nd exopodial joint with 3 teeth along inner edge (Figure 55b,c): distal tooth longest smooth; middle tooth stout with 4 pointed cusps along inner edge; proximal tooth stout with 3 cusps along inner edge; posterior side with row of 3 bristles (long middle bristle with 1 short bristle on each side), and 1 long proximal bristle. 3rd exopodial joint with 3 spinous bristles on inner lobe and 2 long spinous and hirsute bristles on hirsute outer lobe (Figure 55b). 4th and 5th exopodial joints fused, with total of 5 spinous bristles.

Sixth Limb (Figure 55e): With 2 epipodial bristles. Endite I with 2 short spinous bristles; endite II with 1 short medial spinous bristle and 2 or 3 longer spinous terminal bristles; endite III with 5 spinous bristles (either 1 medial and 4 terminal or all 5 terminal); endite IV with 6 spinous terminal bristles. End joint of right limb of USNM 193928 [left limb with some bristles missing] triangular, hirsute, with 12 bristles (6 shorter bristles near anterior end with short marginal spines; 3 longer with long proximal and short distal spines; 3rd from posterior end with abundant long proximal hairs and short distal spines; 2 posterior plumose to tip).

Seventh Limb (Figure 55f): Six or 7 bristles in proximal group, 3 or 4 on each side, each with indistinct distal spines and 3 bells. Terminal group with 5 bristles, 2 on comb side and 3 on peg side, each with indistinct distal spines and 3 or 4 bells. Terminus with comb of 13 or 14 alate teeth with rounded tips opposite 2 pegs (inner peg longer); comb teeth increase in length towards middle but middle tooth only slightly longer (unlike *P. ferox*).

Furca (Figure 55g): Each lamella with 9 or 10 claws; claws 1, 2, and 4 primary; claw 3 slenderer than claw 4 but about same length; primary claws with stout teeth along posterior edges; secondary claws feather-like with slender teeth along anterior and posterior edges; claw 1 with row of medial teeth stouter than teeth in lateral row along posterior edge, and with medial row of long hairs proximal to teeth (not shown); right lamella anterior to left by width of base of claw 1 and with hairs along anterior edge proximal to claws; lamellae following claws with very few long hairs (not shown).

Bellonci Organ (Figure 55h): Very long with distal half tapering to point and with few long marginal hairs; small segment at midlength with indistinct striations (short middle segment may be separated from long proximal and distal segments by indistinct sutures).

Eyes: Medial eye bare with brown pigment (Figure 55h). Lateral eye small with 5 minute ommatidia and specs of brown pigment (pigment not present in lateral eyes of USNM 193928 but observed in eyes of holotype) (Figure 54j).

Genitalia: Small light amber-colored oval on each side anterior to furca.

Posterior of Body: Evenly rounded, with minute lateral spines.

Y-Sclerite (Figure 55i): With ventral branch.

Number of Eggs: USNM 193928 with single fairly round

egg in marsupium (location of egg shown in Figure 53a,b); length 0.28 mm.

DESCRIPTION OF ADULT MALE (Figure 56).—Carapace more elongate than that of adult female and with broad blunt rostrum (Figure 56a).

Ornamentation: With abundant reticulations (Figure 56a,b) [without round fossae present on adult female].

Infold: Not examined.

Central Adductor Muscle Attachments (Figure 56c): Comprising about 25 ovoid scars at valve midlength and midheight.

Carapace Size (length, height in mm): USNM 194025, 1.41, 0.83.

First Antenna (Figure 56d,m): 1st joint bare. 2nd joint with 3 spinous bristles (1 ventral [twice length of other bristles], 1 dorsal, 1 lateral) (on illustrated left limb ventral bristles of both 2nd and 3rd joints are medial, but on right limb they are ventral) (Figure 56m) [adult female with only 2 bristles]. 3rd joint with 2 spinous bristles (1 ventral, 1 dorsal). 4th joint with 5 bristles (1 dorsal, 4 ventral [adult female with 2 ventral]). Sensory bristle of 5th joint with base medial to distal part of 4th joint, with numerous long filaments (not shown) along distal $1/2$ – $3/4$ of stout proximal part and 5 or 6 short filaments along distal slender part. Long 6th joint with spinous medial bristle with base near dorsal margin. 7th joint: a-bristle about same size as bristle of 6th joint, with short spines; b-bristle about 3 times length of a-bristle, with 3 proximal and 4 terminal filaments including stem; c-bristle very long, stout, with many short filaments. 8th joint: d- and e-bristles long, bare, with blunt tips; f-bristle similar to c-bristle; g-bristle about same length as d-bristle, with 3 proximal and 5 terminal filaments including stem (not shown).

Second Antenna: Protopodite bare (Figure 56e). Endopodite 3-jointed (Figure 56e,f): 1st joint short with 5 short bare proximal bristles and 1 longer spinous distal bristle; 2nd joint long with 2 ventral bristles near midlength; 3rd joint long, reflexed on 2nd, with 3 bristles (1 proximal, 2 subterminal), 4 small dorsal protuberances near midlength, and several ridges at tip. Exopodite: 1st joint with minute straight terminal medial bristle; 3rd joint about twice length of 2nd joint; bristle on 2nd joint reaching 5th joint, with ventral spines; bristles of joints 3–8 long, with natatory hairs, no spines; 9th joint with 4 long and 2 short bristles, all with hairs, no spines; joints 3–8 with small basal spines; spine of 8th joint reaching middle of 9th joint; joint 2 with long slender lateral spines along distal edge; joints 3–8 with short lateral spines along distal edge.

Mandible (Figure 56g): Coxale endite minute, diaphanous, bifurcate, with adjacent minute ringed bristle. Basale with 4 small medial bristles along medial ridge near ventral margin, 5 long spinous bristles on or near ventral margin, and 3 dorsal bristles (1 near midlength, 2 terminal), and rows of hairs on medial surface. Exopodite about $1/2$ length of dorsal margin of 1st endopodial joint, with short spinous terminal process and 2 subterminal bristles. 1st endopodial joint with rows of medial spines and 4 ventral bristles with short spines. 2nd endopodial

joint: ventral margin with spines and 3 or 4 bristles (2 subterminal, 1 or 2 terminal); dorsal margin with 1 short bristle with short spines and 6 long bristles; medial surface spinous. 3rd endopodial joint with 1 long stout dorsal claw and 5 bristles. (Not all spines or rings shown on bristles.)

Maxilla (Figure 56h,i): Limb reduced. Precoxale and coxale with fringe of dorsal hairs; coxale with stout plumose dorsal bristle. Bristles of endite I weakly developed, unringed; some bristles of endites II and III ringed; endite III with proximal bristle in addition to terminal bristles. Basale with 3 long ringed bristles (1 dorsal, 2 ventral). Exopodite with 3 stout plumose ringed bristles (1 proximal shorter, 2 terminal). 1st endopodial joint with 1 slender ringed alpha-bristle and 3 slender ringed beta-bristles. 2nd endopodial joint with about 8 weakly developed ringed and unringed bristles (Figure 56i). (Rings not shown on all bristles.)

Fifth Limb (Figure 56j): Limb reduced. Epipodite with about 50 bristles. Endites I and II each with 5 short ringed and unringed bristles; endite III with 1 long ringed bristle and about 7 shorter ringed and unringed bristles. 1st exopodial joint minute with ringed proximal bristle and short unringed broad terminal bristle. 2nd exopodial joint with 2 lobes: proximal lobe with 3 unringed broad bristles (1 long with minute pustules near tip, 2 short); distal lobe with 2 ringed bristles. 3rd exopodial joint with 3 slender ringed bristles on inner lobe and 2 stout plumose bristles on outer lobe. 4th and 5th joints fused, hirsute, with total of 5 slender ringed bristles. (Bristles on endites II and III not shown; not all rings shown on bristles; bristles of endites and 1st and 2nd exopodial joints difficult to resolve and above interpretation may be incorrect.)

Sixth Limb: Similar in shape to that of adult female. With 2 hirsute epipodial bristles. Endite I with 2 bristles; endite II with 3 or 4 bristles; endites III and IV each with 6 bristles. End joint with 14 hirsute and spinous bristles.

Seventh Limb: Six bristles in proximal group, 3 on each side, each with 3 bells. Terminal group with 5 bristles, 2 on comb side, 3 on peg side, each with 3 or 4 bells; all bristles with indistinct distal spines. Terminus with comb of about 11 alate teeth with rounded tips opposite 2 pegs (inner peg slightly longer and stouter); comb teeth increase in length towards middle but middle tooth about same length as flanking teeth.

Furca (Figure 56k): Distribution of claws similar to those of adult female. USNM 194025 with 9 claws on left lamella and 10 on right. (Teeth not shown on claws of illustrated limb.)

Bellonci Organ (Figure 56l,m): With 1 suture proximal to middle, then tapering to narrow point.

Eyes: Medial eye bare with brown pigment (Figure 56l,m). Lateral eye well developed, about twice size of medial eye, with black pigment and about 24 amber-colored ommatidia (exact number uncertain because of black pigment) (Figure 56a,l).

Genitalia (Figure 56n): Small copulatory lobes on each side of body anterior to furca.

Posterior of Body (Figure 56n): With 2 short sutures

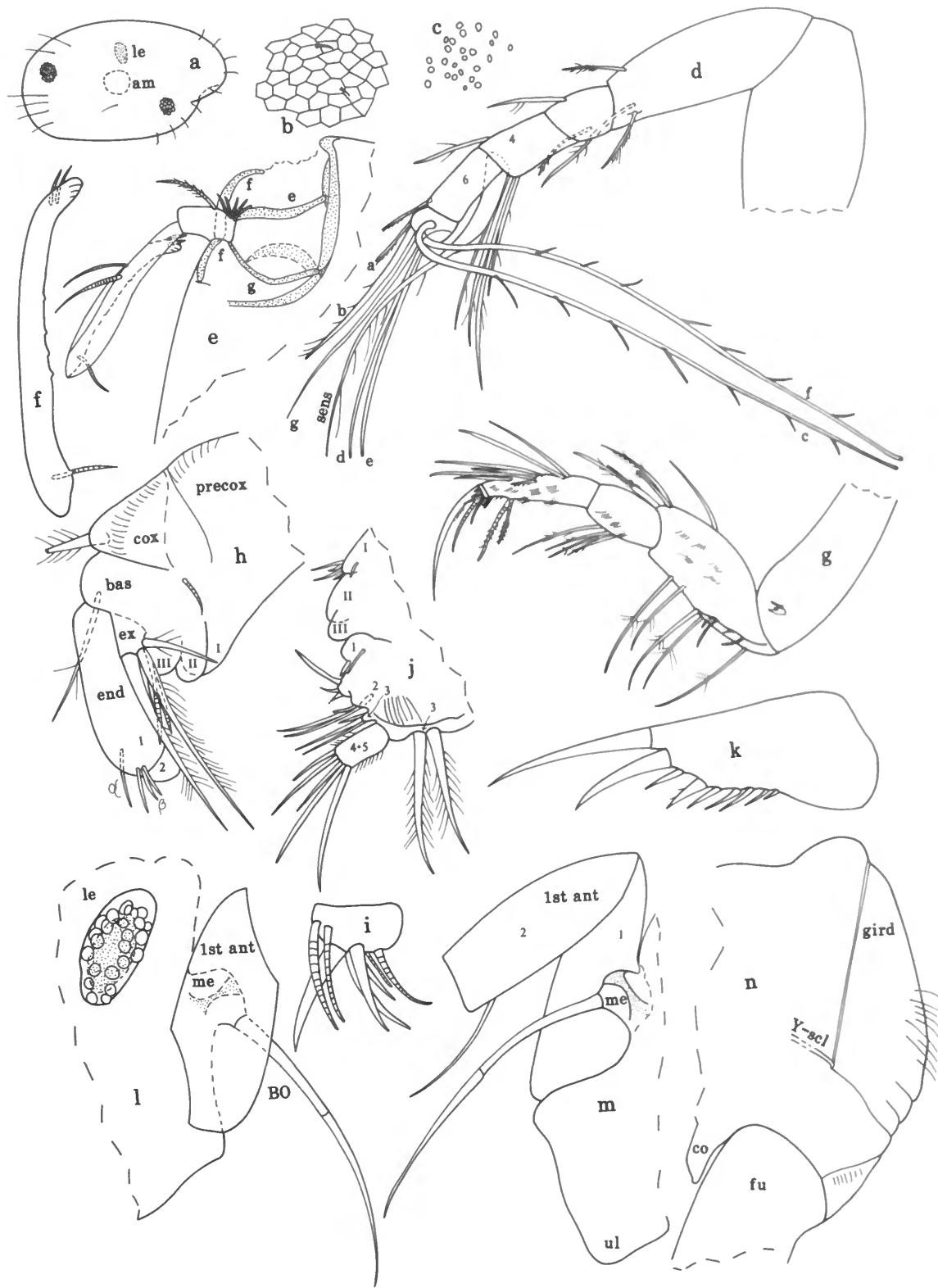


FIGURE 56.—*Pleoschisma pnyx*, new species, adult male, paratype, USNM 194025: *a*, complete specimen from right side showing 2 areas of representative reticulations and locations of lateral eye (stippled) and central adductor muscle attachments; *b*, 2 bristles and reticulations on left valve anterior to central adductor muscle attachments, *ov*; *c*, central adductor muscle attachments of right valve, anterior to right; *d*, left 1st antenna, *lv*; *e*, protopodite and

endopodite, right 2nd antenna (sclerites stippled; more deeply embedded sclerite dashed (muscles attached to concave margin of this sclerite not shown)) *mv*; *f*, detail of 3rd endopodial joint in *e*; *g*, right mandible, *mv*; *h*, left maxilla, *lv* (not all bristles shown); *i*, bristles of 2nd endopodial joint of left maxilla, *lv*; *j*, 5th limb; *k*, left lamella of furca; *l, m*, anterior of body from right and left sides, respectively; *n*, posterior of body from left side.

posterior to ventral end of girdle, and long hairs near midheight.

Y-Sclerite.—Similar to that of adult female (only posterior end shown in Figure 56n).

COMPARISONS.—The adult female *P. pnyx* differs from that of the A-1 female *Pleoschisma ferox* in not having 3 small teeth in the vicinity of the large smooth proximal tooth on the 1st exopodial joint of the 5th limb, in having 12 instead of 27 bristles on the end joint of the 6th limb, and 6 or 7 bristles instead of 16 in the proximal group of the 7th limb, and in being smaller (length of female *P. pnyx* 1.30–1.36 mm; length of A-1 female *P. ferox* 2.00 mm). *Pleoschisma pnyx* differs from *P. moroides* and *P. agilis* in having 2 large teeth instead of only 1 on the 1st exopodial joint of the 5th limb. The incisur on the carapace of *P. agilis* is deeper than that of *P. pnyx* (Kornicker, 1981a:3).

DEVELOPMENT.—In the sample from Slope 1 are 6 juveniles (sex not determined): 5 (with carapace lengths of 1.13–1.17 mm) are estimated to be 5th (A-1) instars, and 1 (with a carapace length of 0.87 mm) is estimated to be a 4th (A-2) instar (the specimen has a 7th limb with tapered bristles indicating that it is at minimum a 4th instar). The carapaces of the juveniles differ from the adult females in being lighter in color (tan rather than brown) and in the surface being reticulate (Figure 57b) instead of having the round fossae present on the adult female (Figure 57a) (adult females have polygonal platelets in the vicinity of adductor muscle attachments but reticulations are absent elsewhere (Figure 53c)). The carapaces of a few 5th instars, although mostly reticulate, have a few small areas with round fossae. The fossae are not within reticulations but appear to replace them; fossae are about half the diameter of reticulations. Apparently, the polygonal areas within reticulations of juveniles become round fossae in adult females and the reticulate structure is resorbed. The adult male has surface reticulations similar to those of the juvenile.

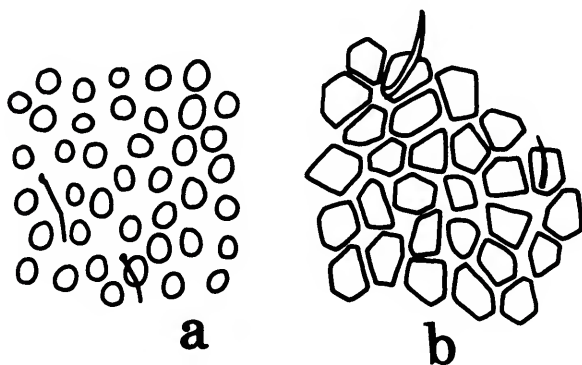


FIGURE 57.—*Pleoschisma pnyx*, new species, surface microstructures near center of valves but away from central adductor muscle attachments, drawn at same scale: a, adult female, holotype; b, juvenile instar V from Slope 1.

REMARKS.—The adult female bears 2 ventral bristles on the 4th joint of the 1st antenna compared to 4 on the adult male suggesting that the male and female might not be conspecific. The female of *Pleoschisma mindax*, which was collected in the same sample as the male *P. pnyx*, has 3 or 4 ventral bristles on the 4th joint. The male is referred to *P. pnyx* rather than *P. mindax* because of similarity in carapace size and length of exopodite of the mandible.

Pleoschisma pseudoferox, new species

FIGURE 58

ETYMOLOGY.—From the Greek *pseudos* (lie) plus *ferox*.

HOLOTYPE.—Late larval stage female (A-1 or A-2) on slide and 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.—None.

DISTRIBUTION.—Slope 1, 204 m.

REMARKS.—In the description below, mainly differences between the juvenile female in the present collection and that of *P. ferox* described by Poulsen (1962:391) are noted, and some details not included in the description by Poulsen are added. The present specimen is probably a 5th instar (A-1) but could be a 4th instar (A-2).

DESCRIPTION OF JUVENILE FEMALE (Figure 58).—Incisur indicated by very slight indentation below rostrum when valve viewed from inside and not visible from outside (Figure 58a).

Ornamentation: Surface with minute polygons with small spines along edges. Scattered undivided slender bristles on valve surface, some with broad base; some of the bristles with base at intersection of 4–6 polygons; polygons absent over central adductor muscle attachments.

Infold: Rostral infold of right valve with vertical row of 8 undivided bristles near anterior edge of infold and 8 along inner side of dorsal edge; rostral infold of left valve with vertical row of 9 undivided bristles near anterior edge of infold and none along dorsal edge. Infold of caudal process with 5 or 6 hairy bristles more widely spaced than those on specimen of *P. ferox* illustrated by Poulsen (1962, fig. 171b). Infold of ventral margin with about 7 striations parallel to valve edge.

Central Adductor Muscle Attachment (Figure 58b): Including about 16 oval and elongate attachments.

Carapace Size (length, height in mm): Holotype, 1.85, 1.45.

First Antenna: Ventral bristle of 3rd joint reaching 5th joint and with wreath of long spines. Dorsal margin of 4th joint with 2 bristles, both reaching past distal end of joint and with wreaths of long spines.

Second Antenna: 2nd endopodial joint of right limb with ventral bristle proximal (Figure 58c); on left limb both bristles closer to distal edge. 9th exopodial joint with 5 bristles



FIGURE 58.—*Pleoschisma pseudoferax*, new species, late larval stage female (A-1 or A-2), holotype: *a*, complete specimen from left side showing location of central adductor muscle attachments, length 1.85 mm; *b*, central adductor muscle attachments, left valve, ov, anterior to left; *c*, endopodite, right 2nd antenna, mv; *d*, bristles of 3rd endopodial joint, right mandible, mv; *e*, part of left 5th limb, av; *f*, 2nd exopodial joint, right 5th limb, pv; *g*, left 6th limb, mv (not all bristles shown); *h*, tip of 7th limb; *i*, medial eye and Bellonci organ; *j*, right lateral eye and part of right 1st antenna; *k*, left Y-sclerite, anterior to left.

(shortest bare, next with minute spines, others with stout spines).

Mandible: Basale: Proximal ventral corner with 5 medial bristles (1 stout without rings and with a few minute teeth; 1 stout, ringed distally and with short distal spines; 3 slender completely ringed and either bare or with indistinct short spines); of 5 distal bristles near ventral margin only 2 significantly longer than proximal bristles. Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint. 1st endopodial joint with 3 or 4 ventral bristles (1 long, 1 medium, 1 or 2 short). 2nd endopodial joint: dorsal margin with proximal spines and 3 groups of bristles (proximal group with 2 long bristles with wreath of long spines; middle group with 1 short bristle with long spines and 2 long bristles with wreath of long spines; distal group with 1 long bristle with wreath of long spines); ventral margin with long spines, and bristles forming 2 distal groups (2 bristles in proximal group, 3 in terminal group); medial surface with rows of long spines. 3rd endopodial joint with 1 long stout dorsal claw, 1 long bristle-like ventral claw, and 4 short medial bristles (longest claw-like, unringed, with ventral spines; shortest, dorsal, claw-like unringed; others ringed bristle-like) (Figure 58d).

Fifth Limb: 1st exopodial joint (Figure 58e): with 1 long tooth with about 12 cusps along inner edge and 4 proximal teeth (2 rounded, 2 pointed); anterior side with 3 bristles along distal edge and 1 small bristle on lobe near outer edge. 2nd exopodial joint (Figure 58f): posterior side with row of 3 bristles (long bristle with small bristle on each side), 1 long bristle proximal to row and 1 minute indistinct bristle near outer corner; inner edge of sclerotized joint with 3 teeth along inner edge: proximal with 2 or 3 cusps, middle with 4 cusps, and terminal long slender without cusps. Fused 4th and 5th exopodial joints with 5 bristles with wreaths of long spines. (The proximal fang-like tooth of the 2nd exopodial joint of the right 5th limb of the holotype bears 3 cusps (Figure 58f) whereas the left limb bears only 2 indicating variability in the number of cusps.)

Sixth Limb (Figure 58g): Endite III with 1 medial and 7 terminal bristles; endite IV with 1 medial and 6 terminal bristles. End joint with 19 bristles (6 medial, 2 lateral, 11 marginal). (Not all bristles shown.)

Seventh Limb: Each limb with 24 or 25 bristles. Peg (dorsal) side with 12 or 13 tapered proximal bristles with 2 or 3 bells, and 2 terminal bristles with 3 bells; comb (ventral) side with 7-9 tapered proximal bristles with 2 or 3 bells, and 2 terminal bristles with 2 or 3 bells; some bristles with minute indistinct distal marginal spines. Terminus with comb of 17 teeth (teeth increase in length towards middle, but middle tooth only slightly longer than others); side opposite comb with 2 pegs (1 very short) (Figure 58h).

Furca: Main claws 1, 2, and 4 with medial and lateral rows of teeth; medial teeth of claw 1 about same size as lateral teeth; lamellae following posterior secondary claw with long hairs; right lamella anterior to left by width of base of claw 1 and with

few spines along anterior margin.

Bellonci Organ (Figure 58i): Short segment proximal to middle with indistinct striations; part distal to segment with marginal and terminal hairs.

Eyes: Lateral eye small, with dark brown pigment and 3 or 4 small ommatidia (Figure 58j). Medial eye almost twice as long as lateral eye, with dark brown pigment (Figure 58i).

Posterior of Body: Evenly rounded with hairs at midheight.

Y-Sclerite (Figure 58k): With posterior end forming long ventral leg at right angle to long middle segment.

COMPARISONS.—*Pleoschisma pseudoferox* differs in many characters from the description of *P. ferox* Poulsen (1962:391): *P. ferox* is without a lateral eye, whereas *P. pseudoferox* has a small lateral eye with dark brown pigment; *P. ferox* has 5 dorsal bristles on the terminal segment of the 7th limb, whereas *P. pseudoferox* has only 2, but the main difference is that the 1st exopodial joint of the 5th limb of *P. ferox* bears 2 stout teeth, whereas *P. pseudoferox* has only 1. The juvenile female *P. pseudoferox* is larger than the adult female *P. pnyx* and also bears 4 small proximal teeth at the base of the stout fang-like tooth of the 1st exopodial joint of the 5th limb compared to only 1 tooth on *P. pnyx*.

Pleoschisma mindax, new species

FIGURES 59-61

ETYMOLOGY.—From the Greek *mindax* (a Persian incense).

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

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

PARATYPES.—Partly dissected A-1 male on slide (2nd antenna, mandible, 5th limb), and in alcohol.

DISTRIBUTION.—Slope 21, 220 m.

DESCRIPTION OF ADULT FEMALE (Figures 59-61a-h).—Carapace oval in lateral view with small but distinct indentation ventral to rostrum (Figure 59a,b); posterior evenly rounded (without projecting caudal process) (Figure 59a,c). Edge of valve folded inward on all margins.

Ornamentation: Surface with abundant round fossae (some shown as crescents in Figure 59a), many with a slender bristle in center; no bristles with broad base. Reticulations observable with transmitted light (Figure 59e).

Infold: Rostral infold of right valve with 3 bristles near anterior edge, and 9 or 10 along inner side of dorsal edge (2 bristles represented by sockets in Figure 59b); rostral infold of left valve with 3 bristles near anterior edge and none along dorsal edge. Infold of caudal process of right valve with 8 closely spaced bare bristles near dorsal end and close to inner edge of infold, and 2 bristles closer to midwidth ventral to the closely spaced bristles; narrow lisp near outer edge of infold extending from ventral end of rostrum (not shown in Figure

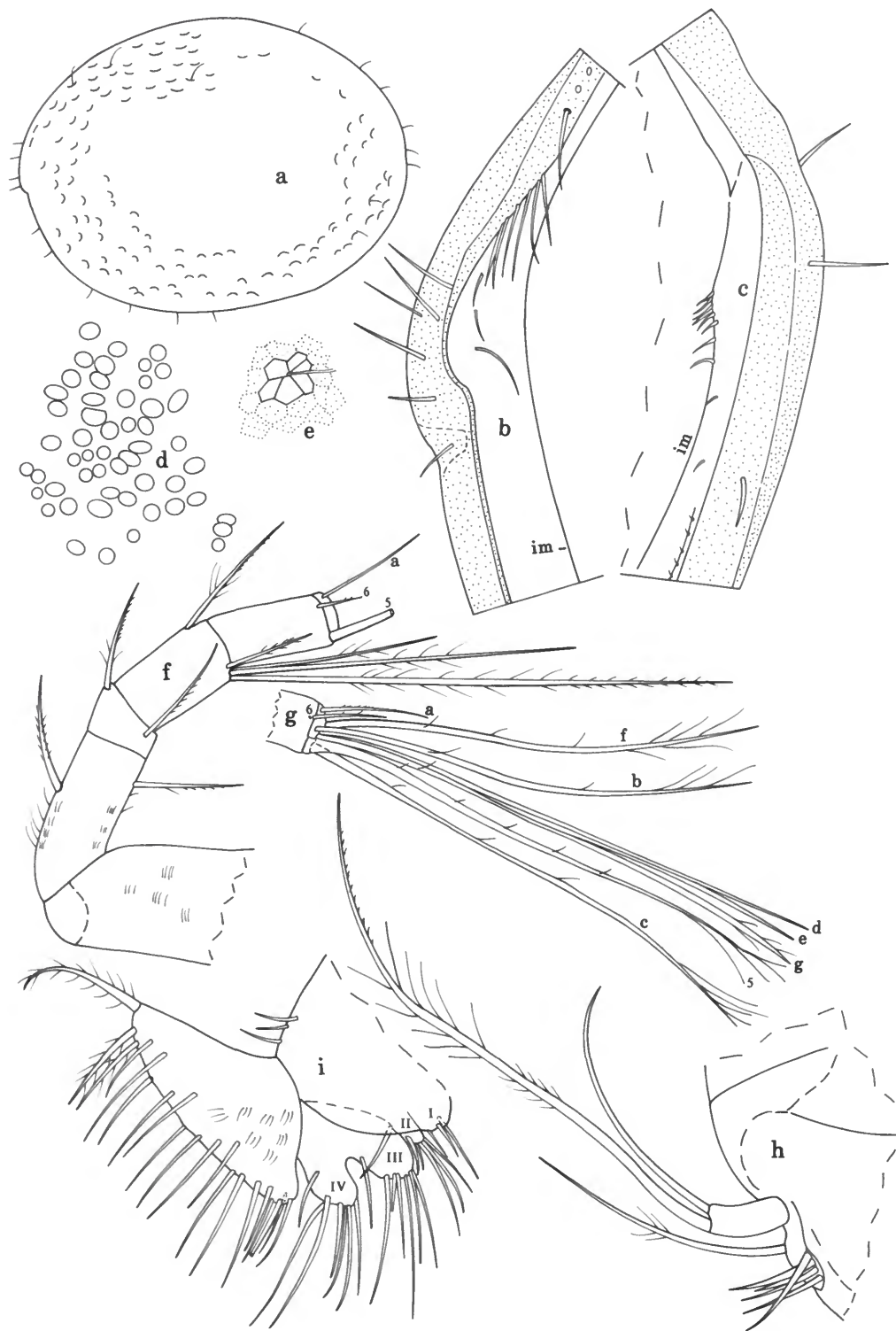


FIGURE 59.—*Pleoschisma mindax*, new species, adult female, holotype: *a*, complete specimen from left side, length 2.38 mm; *b, c*, anterior and posterior, respectively, right valve, iv; *d*, central adductor muscle attachments, right valve, ov, anterior to right; *e*, reticulations in vicinity of a bristle on right valve, ov; *f, g*, right 1st antenna, mv; *h*, distal protopodite and endopodite, left 2nd antenna, mv; *i*, left 6th limb, mv.

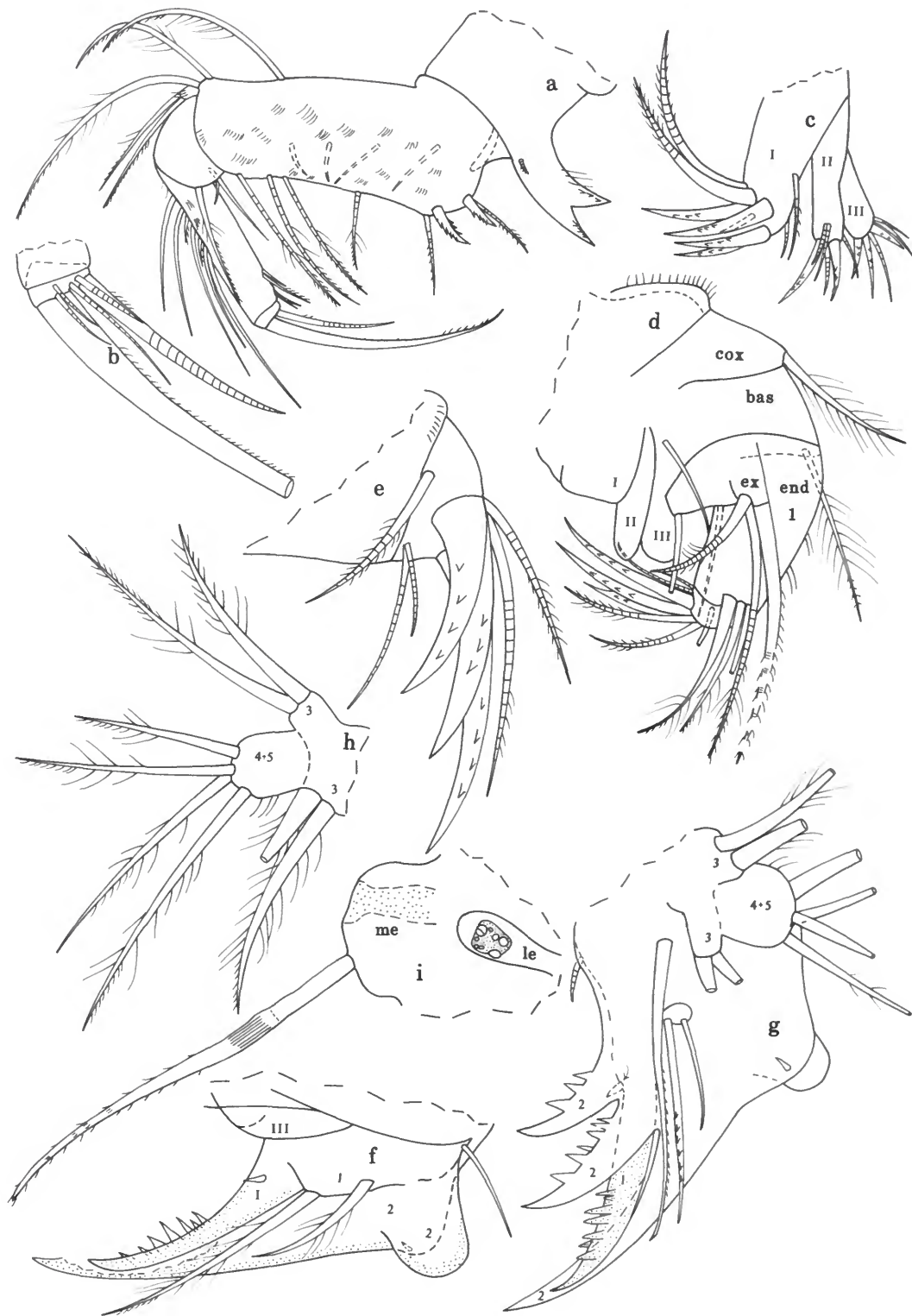


FIGURE 60.—*Pleoschisma mindax*, new species, adult female, holotype: a, right mandible, mv (not all bristles shown); b, bristles of 3rd endopodial joint, right mandible, mv; c, endites, left maxilla, mv; d, right maxilla, lv (not all bristles shown); e, bristles of 2nd endopodial joint, left maxilla, mv; f, part of left 5th limb, av (not all bristles shown); g, right 5th limb, pv (endite bristles not shown); h, part of exopodite, right 5th limb, pv; i, left lateral eye, medial eye, and Bellonci organ.

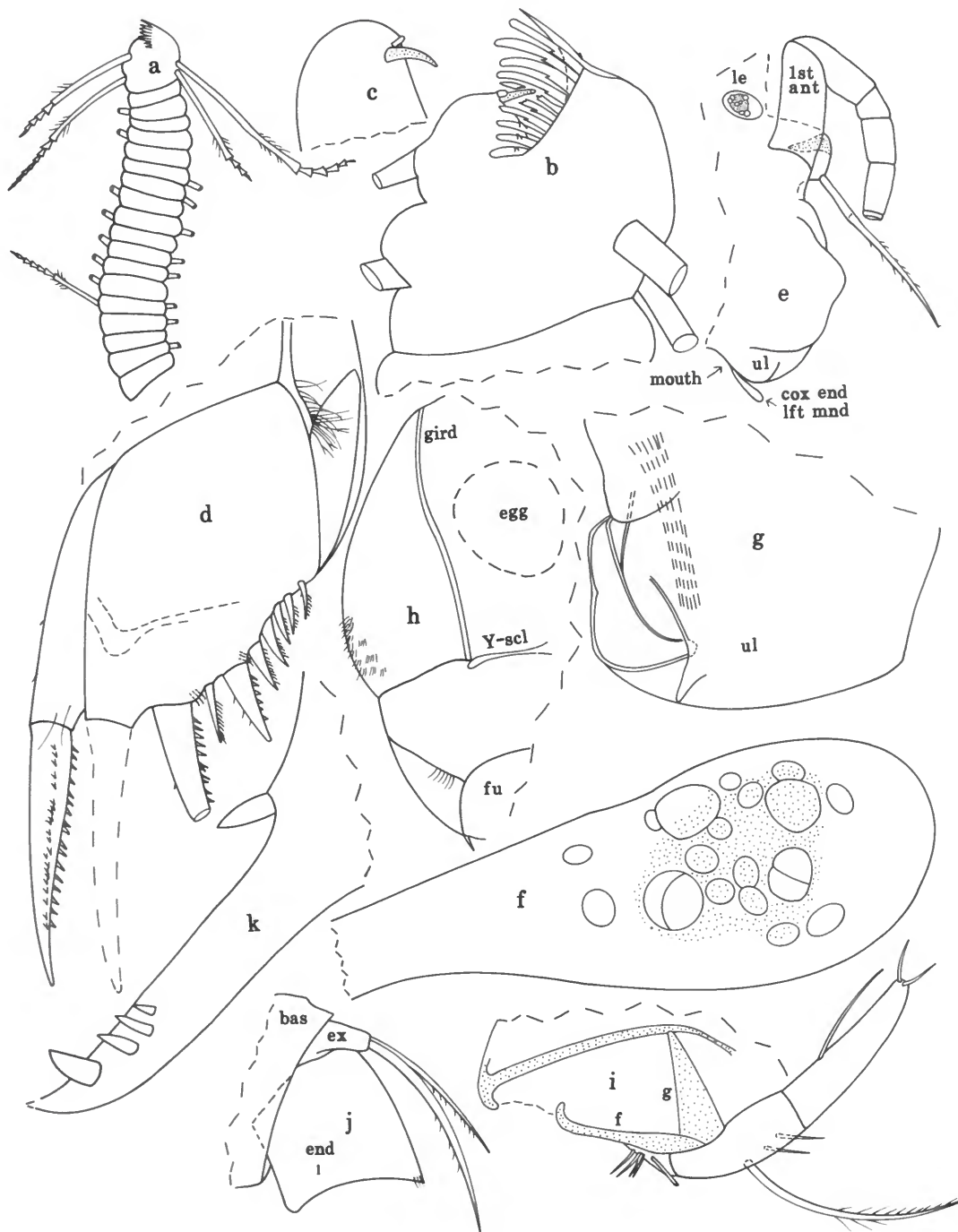


FIGURE 61.—*Pleoschisma mindax*, new species, adult female, holotype: a, 7th limb; b, detail from a; c, pegs on tip of 7th limb opposite limb shown in a; d, caudal furca (missing claw 1 of left lamella dashed; only claw 1 of right lamella shown); e, anterior of body showing coxale endite of left mandible in natural position near mouth region; f, lateral eye at high magnification ($\times 15$ ocular, $\times 100$ objective); g, upper lip from left side, anterior to left; h, posterior of body from right side showing unextruded egg, anterior to right. A-1 male, paratype: i, distal protopodite and endopodite, right 2nd antenna, mv; j, part of right mandible, lv (not all bristles shown); k, tooth of 2nd exopodial joint of right 5th limb, pv.

59b) to ventral end of caudal process, with row of minute bristles more closely spaced near caudal process (5 shown near bottom of Figure 59c). Infold of caudal process of left valve without closely spaced bristles present on right valve.

Central Adductor Muscle Attachments (Figure 59d): Including about 52 oval scars.

Carapace Size (length, height in mm): Holotype, 2.38, 1.85.

First Antenna: 1st joint with medial spines (Figure 59f). 2nd joint spinous, with 2 spinous bristles (1 ventral, 1 dorsal). 3rd joint with 2 spinous bristles (1 dorsal, 1 medial near ventral margin). 4th joint with 4 or 5 spinous bristles (3 or 4 ventral, 1 dorsal). Sensory bristle of 5th joint with about 5 proximal and 4 terminal filaments. 5th and 6th joints fused; medial bristle of 6th joint short with indistinct spines. 7th joint (Figure 59g): a-bristle longer than bristle of 6th joint, with indistinct short spines; b-bristle with 2 proximal and 4 terminal filaments; c-bristle about same length as bristle of 5th joint, with 3 or 4 proximal and 5 terminal filaments. 8th joint: d- and e-bristles long, bare, with blunt tips; f-bristles with 2 or 3 proximal filaments and 5 to 7 near tip; g-bristle with 1 or 2 proximal and 5 terminal filaments.

Second Antenna: Protopodite bare. Endopodite 2-jointed (Figure 59h): 1st joint with 5 short proximal bristles and 1 long spinous distal bristle; 2nd joint elongate, with very long spinous slightly subterminal bristle and shorter terminal bristle. Exopodite: 1st joint with minute straight terminal medial bristle; bristles of joints 2–5 short with stout ventral spines; bristles of joints 6–8 long with natatory hairs, no spines; bristles of 9th joint broken off on both limbs of holotype; joints 3–8 with stout basal spine increasing in size on distal joints; spine of 8th joint reaching past 9th joint; joints 4–8 with indistinct spines along distal edge.

Mandible: Coxale endite bifurcate with teeth on each branch, few long spines proximal to branches, and small ringed bristle near base (Figure 60a). Basale with 4 bristles in proximal ventral corner (2 stout unringed pectinate, 2 slender ringed spinous), 4 lateral bristles near midwidth, 4 slender bristles on ventral margin (1 near midlength, 3 distal), 3 dorsal bristles (1 at distal $\frac{3}{4}$, 2 terminal), and medial rows of long and short spines. Exopodite about $\frac{1}{4}$ length of dorsal margin of 1st endopodial joint, bare or with few hairs, with 2 spinous terminal bristles. 1st endopodial joint with 3 ventral bristles (2 long (1 with long proximal and short distal spines), 1 short). 2nd endopodial joint: ventral margin with 3 or 4 short bristles (2 subterminal, 1 or 2 terminal); dorsal margin with 1 or 2 short bristles with long spines and 4 or 5 long bristles; medial surface and dorsal margin with rows of spines. 3rd endopodial joint with 1 long stout dorsal pectinate claw, 1 long slender ventral ringed spinous bristle, and 3 or 4 slender ringed shorter medial bristles (Figure 60b; not all shown in Figure 60a).

Maxilla: Coxale with plumose dorsal bristle. Endite I with 9 bristles (2 long ringed posterior, 2 shorter ringed anterior, 1 small ringed lateral, 4 stout pectinate claw-like terminal);

endite II with 2 claws and 4 ringed bristles; endite III with 1 proximal bristle (Figure 60d), 3 terminal claws and 3 terminal ringed bristles (Figure 60c). Basale with 3 terminal bristles (anterior with long proximal and short distal spines). Exopodite short with 3 stout bristles (proximal shortest and with long hairs; middle slenderest with short spines and distal ring of long spines; outer stoutest and with short spines) (Figure 60d). 1st endopodial joint with dorsal spines and 3 stout medial bristles on distal edge near dorsal margin (?alpha-bristles) (Figure 60d). 2nd endopodial joint with 2 slender ventral bristles, 2 slender dorsal bristles, 1 slender proximal medial bristle, and 3 stout unringed pectinate terminal claws (Figure 60e).

Fifth Limb: With 3 endites (bristles obscured on holotype). 1st exopodial joint with long fang-like tooth with 1 pointed proximal cusp and 7 pointed distal cusps (Figure 60f,g); anterior side with 2 hirsute bristles at midwidth and small bristle at outer corner (Figure 60f). 2nd exopodial joint with 3 long stout fang-like teeth along inner edge: distal tooth longest smooth; middle tooth with 6 cusps along inner edge; proximal tooth with 3 cusps along inner edge; posterior side of joint with 2 adjacent bristles (a minute 3rd bristle may be present but obscured on mounted slide of holotype), 1 long proximal bristle, and 1 minute bristle near outer distal corner (Figure 60g). 3rd exopodial joint with 2 spinous bristles on inner lobe and 2 stouter spinous bristles on outer lobe (Figure 60g,h). 4th and 5th exopodial joints fused, with total of 4 spinous bristles.

Sixth Limb (Figure 59i): With 3 bare epipodial bristles. Endite I with 3 spinous bristles (2 short, 1 long); endite II with 1 short medial spinous proximal bristle and 5 spinous terminal bristles; endite III with 1 short medial spinous proximal bristle and 6 spinous terminal bristles; endite IV with 1 medial spinous proximal bristle and 6 spinous terminal bristles. End joint triangular, hirsute, with 18–20 bristles (2 posterior plumose to tip, others with long proximal and short distal spines (spines not shown)).

Seventh Limb (Figure 61a–c): Each limb with 20 or 21 bristles: 16 bristles in proximal group, 8 on each side, with distal spines and 6 bells (Figure 61a). Terminal group with 4 or 5 bristles (2 on comb side, 2 or 3 on peg side), each with distal spines and 3–8 bells. Terminus with comb of 20 or 21 alate teeth with rounded tips opposite 2 pegs (1 long, 1 short indistinct and with blunt tip) (Figure 61b,c). Middle tooth of comb about same length as tooth on each side.

Furca (Figure 61d): Each lamella with 9 claws; claws 1, 2, and 4 primary; claw 3 slenderer and shorter than claw 4; all claws with teeth along posterior edge and few minute spines along anterior edge (not all shown); claw 1 with row of medial teeth in addition to posterior teeth, and with few long medial hairs proximal to claw; rows of medial hairs also proximal to claws 2–4; right lamella anterior to left by width of claw 1, and with few minute spines along anterior edge.

Bellonci Organ (Figure 61e): Very long with small broad part (with indistinct striations) at $\frac{1}{3}$ length; part distal to broad part tapers to point and bears spines on surface and tip.

Eyes: Medial eye bare with brown pigment (Figure 61e). Lateral eye small, with brown pigment, 4 ommatidia, and many smaller amber-colored cells (Figure 61e,f).

Upper Lip (Figure 61e,g): Broadly rounded, without glandular processes, spines, or hairs.

Anterior of Body (Figure 61e): Broadly convex.

Posterior of Body: With short row of long spines on each side just dorsal to posterior dorsal corner of furca (Figure), and many spines at midheight (Figure 61h).

Y-Sclerite: With ventral branch (only posterior end of sclerite shown in Figure 61h).

Gut Content: Holotype with minute sclerotized black polychaete jaws (identified by Marian Pettibone, Smithsonian Institution).

Number of Eggs: Holotype with 10 large unextruded eggs (1 shown in Figure 61h), length of 1 egg 0.27 mm.

DESCRIPTION OF A-1 MALE (Figure 61i-k).—Carapace similar to that of adult female.

Infold: Not examined.

Carapace Size (length, height in mm): Paratype, 2.02, 1.65.

Second Antenna: Endopodite 3-jointed (Figure 61i): 1st joint short with 5 bristles (4 short, 1 longer (broken on illustrated limb)); 2nd joint long with 3 bristles (1 long, 2 short); 3rd joint long with 1 long proximal and 2 short terminal bristles. Exopodite: 1st joint with minute straight terminal medial bristle; bristles of joints 2–8 short with stout ventral spines, no hairs; 9th joint with 6 bristles (3 short stout with ventral spines, no hairs; 3 shorter near dorsal end of joint (longest with ventral spines, others minute bare); joints 3–8 with small basal spines similar to those of adult female, and minute spines along distal edges.

Mandible: In general, similar to that of adult female. Exopodite about $\frac{1}{4}$ length of dorsal margin of 1st endopodial joint (Figure 61j).

Fifth Limb: Tooth of 1st exopodial joint with stout proximal cusp and 4 distal cusps (Figure 61k). Teeth of 2nd exopodial joint similar to those of adult female but cusps not counted. Remainder of limb not examined in detail but, in general, similar to that of adult female.

Furca: Similar to that of adult female.

Eyes: Medial eye similar to that of adult female. Lateral eye larger than that of adult female, with brown pigment and indistinct ommatidia.

COMPARISONS.—The mandible of *P. mindax* differs from those of previously described species in having a shorter exopodite: the exopodite is about $\frac{1}{4}$ the length of the dorsal margin of the 1st endopodial joint compared to $\frac{1}{3}$ to $\frac{3}{4}$ for other species. The teeth of the 1st exopodial joint of the adult female and late juvenile 5th limb of *P. mindax* differ from those of previously described species. The carapace of *P. mindax* (length 2.38 mm) is larger than that of *P. pnyx* (length 1.30–1.36 mm) and surface fossae are less distinct.

PSEUDOPHILOMEDINAE Kornicker, 1967

This family is represented in the collection by 2 genera, *Harbansus* and *Pseudophilomedes*, but only the latter is described herein.

Pseudophilomedes Müller, 1893

TYPE SPECIES.—*Pseudophilomedes foveolatus* Müller, 1894.

COMPOSITION.—Only 1 species (new), *P. fornix*, is known from the vicinity of Australia.

DISTRIBUTION.—Members of the genus have been reported from the Gulf of Naples, the Great Bahama Bank, the Atlantic Shelf off Georgia and North Carolina, the Gulf of Mexico, Bermuda (in caves), off Spanish Sahara and Mauritania, at depths of 0–534 m (Kornicker, 1984a:33; Kornicker and Iliffe, 1989b:9). The genus has not been reported previously in the southern hemisphere. In the present collection from off Australia at a depth of 996 m.

Pseudophilomedes fornix, new species

FIGURES 62, 63

ETYMOLOGY.—From the Latin *fornix* (arch, vault).

HOLOTYPE.—Ovigerous female on slide and 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.—None.

DISTRIBUTION.—Slope 53, 996 m.

DESCRIPTION OF ADULT FEMALE (Figures 62, 63).—Carapace elongate with straight posterodorsal hinge, shallow incisur, straight oblique posterior margin, and rounded posteroventral corner (caudal process) (Figure 62a–c). Scattered bristles more abundant along edges of valve (Figure 62b,c). Surface appearing smooth but at high magnification ($\times 15$ ocular, $\times 20$ objective) minute spines and punctae visible along ventral edge of valves. Posterior edge of left valve folded inward forming narrow lip (Figure 62e).

Infold: Rostral infold with row of 4 spinous undivided bristles (Figure 62d). Anteroventral infold with short bristle near inner end of incisur (Figure 62d), and about 6 ridges parallel to valve edge. Infold of caudal process with row of 5 spinous bristles near upper end (Figure 62e). Five bristles present along inner margin of infold in vicinity of caudal process (only posterior 4 shown in Figure 62e).

Selvage: Fairly broad unsegmented lamellar prolongation with long marginal hairs along anterodorsal, anterior, anteroventral, ventral, and posterior margins but not observed along edge of caudal process; selvage divided at inner end of incisur (Figure 62d).

Central Adductor Muscle Attachments (Figure 62f): About 22 individual scars.

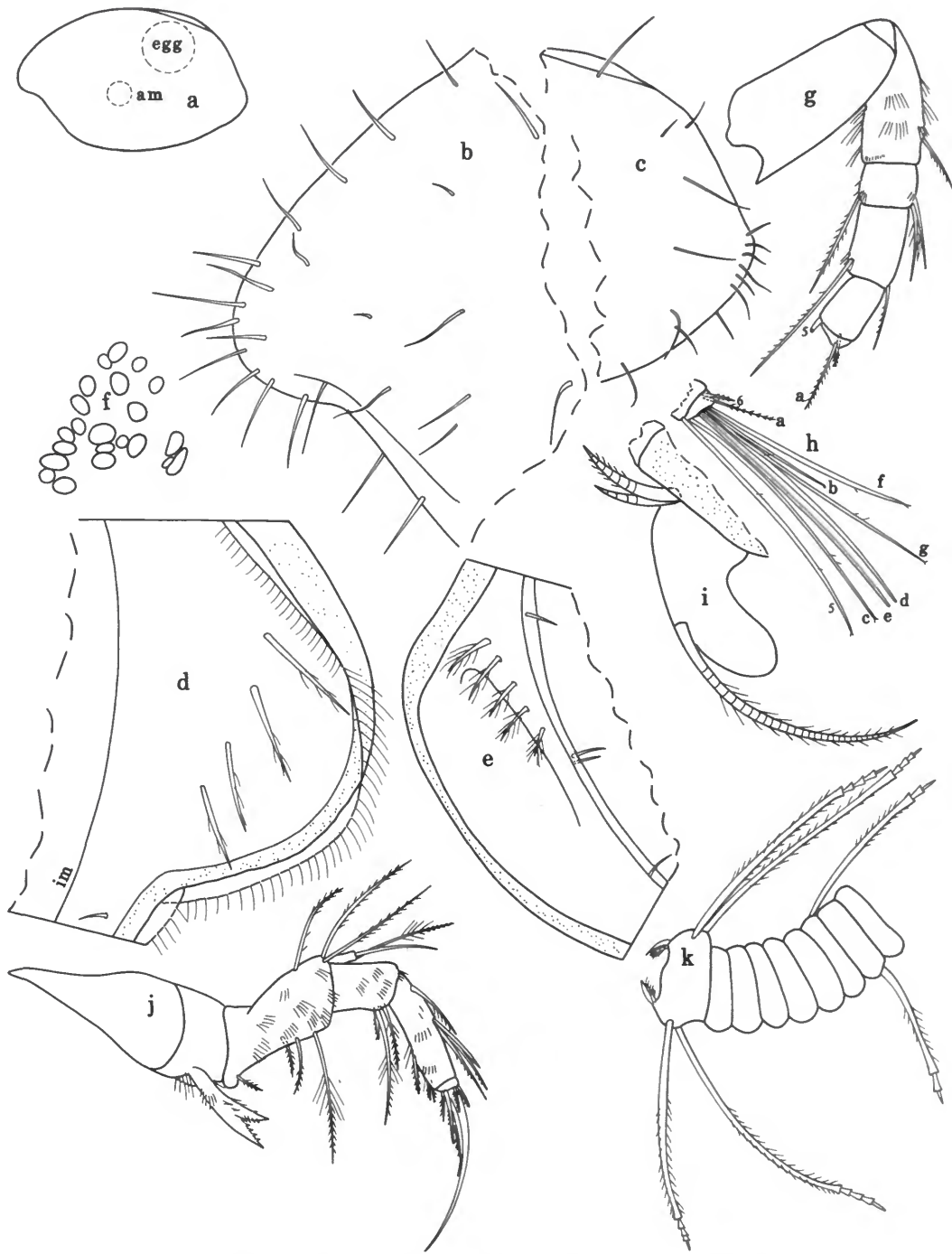


FIGURE 62.—*Pseudophilomedes fornix*, new species, ovigerous female, holotype: *a*, complete specimen from left side showing locations of central adductor muscle attachments and 1 egg, length 1.41 mm; *b, c*, anterior and posterior, respectively, of left valve, ov; *d, e*, anterior and posterior, respectively, of left valve, iv; *f*, central adductor muscle attachments, right valve, ov, anterior to right; *g, h*, right 1st antenna, lv; *i*, endopodite, right 2nd antenna, mv; *j*, left mandible, mv; *k*, 7th limb.



FIGURE 63.—*Pseudophilomedes fornix*, new species, ovigerous female, holotype: *a, b*, maxillae; *c*, right 5th limb, pv; *d*, 1st exopodial joint of 5th limb shown in *e*, av (view through 2nd joint); *e*, left 5th limb, av; *f*, left 6th limb, medial view; *g*, right lamella of furca; *h*, anterior of body from right side, anterior to right; *i*, medial eye and Bellonci organ; *j*, posterior of body from right side, anterior to right.

Carapace Size (length, height in mm): Holotype, 1.41, 0.87.

First Antenna: 1st joint bare. 2nd joint with dorsal, ventral, medial, and lateral spines, and dorsal bristle with short spines (Figure 62g). 3rd joint with few dorsal, ventral, and lateral spines, 2 dorsal bristles with short or long spines, and 1 ventral bristle with short spines. 4th joint with distal ventral spines, distal lateral spines near ventral margin, distal medial spines, and 2 bristles (1 ventral, 1 dorsal) with short spines. Sensory bristle of long 5th joint with small proximal filament, minute distal filament, and 2 minute terminal filaments. 6th joint fused to 5th, with short medial bristle (with short spines) near dorsal margin. 7th joint (Figure 62h): a-bristle (with short marginal spines) twice length of bristle of 6th joint; b-bristle about twice length of a-bristle, bare except for minute terminal filament; c-bristle about twice length of b-bristle and same length as bristle of 5th joint, with 2 minute distal filaments and 2 minute terminal filaments. 8th joint: d- and e-bristles almost same length as c-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with minute distal filament and 2 minute terminal filaments; g-bristle same length as c-bristle, with small proximal filament, 2 minute distal filaments, and 2 minute terminal filaments.

Second Antenna: Protopodite bare or with few indistinct spines and hairs near endopodite. Endopodite elongate, either 1- or 2-jointed, with broadly rounded tip, with 2 small proximal bristles and 1 long spinous ventral bristle near midlength (Figure 62i). (Endopodite obscured on both mounted limbs of holotype, and the number of joints could not be determined.) Exopodite: 1st joint with small recurved tubular medial bristle on terminal margin; bristle of 2nd joint reaching past 9th joint, with proximal dorsal hairs, then slender ventral spines followed by ventral and dorsal natatory hairs; bristles of joints 3–8 longer but with similar distribution of hairs and spines; 9th joint with 3 bristles (ventral bristle long with proximal ventral spines and distal natatory hairs, middle bristle shorter, with small ventral and dorsal spines; dorsal bristle small, with small indistinct marginal spines); joint 2 with dorsal row of spines at midlength; joints 2–8 with row of spines along distal margin.

Mandible (Figure 62j): Coxale endite elongate, bifurcate, with proximal spines, and marginal teeth on both prongs. Basale: medial and lateral surfaces with abundant rows of long spines; dorsal margin with 3 bristles (1 at distal $\frac{2}{3}$, 2 terminal), all with short spines; ventral margin with 2 bristles (with short spines) with bases on medial side, and 1 distal bristle (with long proximal and short distal spines) with base on margin; lateral side with 1 bristle (with short spines) at midlength near ventral margin. Exopodite not reaching midlength of dorsal margin of 1st endopodial joint, with 2 subequal terminal bristles (medial either bare or with long proximal and short distal spines, lateral with long proximal and short distal spines). 1st endopodial joint with medial rows of spines and 3 ventral bristles (2 longer bristles with long proximal and short distal spines, 1 small bristle with short marginal spines). 2nd endopodial joint:

ventral margin with spines and 3 short bristles (1 just distal to midlength, 2 subterminal) with short marginal spines; dorsal margin with 4 bristles (1 proximal, 3 at midlength) with short spines. 3rd endopodial joint with 1 long terminal bare curved claw, 1 short medial dorsal claw with ventral spines, 1 longer medial claw (with short ventral spines) just ventral to long curved claw, and 3 ringed bristles with short spines.

Maxilla (Figure 63a,b): Precoxale, coxale, basale, and 1st endopodial joint with hairs near and on dorsal margin. Endite I broad, with 1 short slender ringed distal bristle and 4 stout terminal bristles (3 ringed spinous or pectinate, 1 unringed pectinate); endite II narrow, with 3 terminal bristles (2 unringed pectinate, 1 ringed, with short spines); endite III broader than endite II, with 5 spinous ringed terminal bristles. Basale with 2 long ringed ventral bristles with short spines and 1 shorter ringed bristle (with short spines) near dorsal margin. 1st endopodial joint with 1 proximal bristle (exopodite?) and 1 terminal bristle, both ringed and with short spines. 2nd endopodial joint with 2 terminal bristles (1 stout with narrowly rounded tip (with long ventral spines along proximal unringed $\frac{2}{3}$, and short closely spaced spines along distal ringed $\frac{1}{3}$; 1 shorter, slender, ringed, with short spines). (Dorsal bristle usually present on coxale of other known members of genus absent on both limbs of holotype.)

Fifth Limb (Figure 63c–e): Single endite with 1 small bristle. Sclerotized 1st exopodial joint with long fang-like tooth with 4 proximal bristles (1 short stout spinous, 1 minute, 2 slender (1 of latter could be on 2nd joint), many minute spines, and 3 distal pectinate prongs (Figure 63d). 2nd exopodial joint with long fang-like tooth with 2 adjacent spinous bristles at $\frac{1}{3}$ length and 3 teeth along inner margin (proximal tooth with 4 marginal cusps, next tooth with 3 marginal cusps; distal tooth without marginal cusps) (Figure 63e). 3rd exopodial joint with 1 spinous bristle on inner lobe and 2 spinous bristles on outer lobe. 4th and 5th exopodial joints fused, with long hairs and a total of 4 spinous bristles (Figure 63c,e).

Sixth Limb (Figure 63f): With 1 small spinous epipodial bristle. Endite I with 2 small spinous bristles; endite II with 2 bristles (long bristle with long proximal and short distal spines, short bristle with short spines); endite III with 4 bristles (2 long with long proximal and short distal spines, 2 short with short spines); endite IV with 4 bristles (2 with long proximal and short distal spines, 2 with short spines). End joint narrow, with 7 marginal bristles (5 anterior with long proximal and short distal spines, 2 posterior longer, plumose). Limb hirsute (not all hairs shown).

Seventh Limb (Figure 62k): Proximal group with 2 bristles (1 on each side) with distal spines and 2 bells; terminal group with 4 bristles (2 on each side) with distal spines and 2–4 bells. Terminus with opposing combs, each with 3 or 4 teeth (lateral teeth with long spines).

Furca (Figure 63g): Each lamella with 8 claws; claw 3 thinner and shorter than claw 4; claws 1–5 with teeth along posterior margin and hairs along anterior margin (claws 1 and

2 with some teeth stouter than others); claws 6–8 with spines along both margins; claw 1 without stout medial teeth; long hairs present along lamella posterior to claw 8; anterior margin of lamella with spines; right lamella anterior to left by width of base of claw 1. (Teeth and spines not shown on most claws.)

Bellonci Organ (Figure 63*h,i*): Elongate with about 6 indistinct sutures in proximal $2/3$; segment distal to last suture broad with rounded tip; organ bare except for 2 minute spines at tip.

Eyes: Medial eye small, unpigmented, bare (Figure 63*i*). Lateral eyes absent.

Upper Lip (Figure 63*h*): Rounded, hirsute.

Genitalia (Figure 63*j*): Round sclerotized ring enclosing minute globules on each side of body anterior to furca.

Posterior of Body (Figure 63*j*): Posterior dorsal corner with spines.

Y-Sclerite (Figure 63*j*): With ventral branch more translucent than dorsal branch.

Number of Eggs: Holotype with 3 eggs in marsupium; length of typical egg 0.37 mm (1 egg shown in Figure 62*a*).

COMPARISONS.—The 3rd endite of the maxilla of *P. fornix* is better developed than in previously described species of the genus, and the 2nd endopodial joint bears only 2 bristles compared to at least 3 in previously described species. In previously described species the 1st exopodial joint of the 5th limb has 2 segments each with 2 or 3 teeth, whereas *P. fornix* has only 1 segment with 3 teeth.

RUTIDERMATIDAE Brady and Norman, 1896

This family contains 2 subfamilies: Rutidermatinae Brady and Norman, 1896, and Metaschismatinae, new subfamily.

RUTIDERMATINAE Brady and Norman, 1896

This subfamily contains 3 genera: *Rutiderma* Brady and Norman, 1896, *Alternochelata* Kornicker, 1958, and *Scleraner* Kornicker, 1975. The first two have been reported in shallow near shore water of Australia (Kornicker, 1982:793). *Scleraner* is represented in the present collection by 1 new species.

SENSORY BRISTLE OF THE 5TH JOINT OF THE 1ST ANTENNA OF THE ADULT MALE.—The genera *Rutiderma* and *Scleraner* differ mainly in the endopodite of the 2nd antenna of the female; the endopodite is 1-jointed in *Rutiderma* and 2-jointed in *Scleraner*. While describing the adult male of *Scleraner trifax*, new species, herein (the male of the genus was previously unknown), it was noted that the filaments of the sensory bristle of the 5th joint of the 1st antenna covered the distal $3/4$ of the broad proximal part of the bristle. Because on male *Rutiderma* the filaments are restricted to about the distal $1/3$ of the broad proximal part of the bristle, the difference in extent of coverage by filaments suggested that this character might be useful in separating males of the 2 genera. Therefore, the sensory bristle of males of *Rutiderma*, *Scleraner*, and also *Alternochelata* (the male of the new genus *Metaschisma* is

unknown), of selected species, of which both the male and female are known, were studied either from descriptions in the literature or from specimens in the collection of this museum (listed below). The 15 species of *Rutiderma* studied all have filaments of the broad proximal part restricted to the distal $1/3$ or less (2 typical sensory bristles are shown in Figure 64*a,b*); whereas, the 2 species of *Alternata* have the filaments restricted to about the distal $1/2$ to $2/3$ (Figure 64*c,d*), and the single species of *Scleraner* has the filaments on the distal $3/4$ (Figure 64*e*). *Alternochelata* and *Metaschisma* have on the furca secondary furcal claws between main claws, and therefore, are easily separated from *Rutiderma* and *Scleraner*, which do not have secondary claws between main claws. The data suggest that the extent of coverage of the broad proximal part of the sensory bristle by filaments is useful in separating males of *Rutiderma* and *Scleraner*. Because the male is known for only 1 species of *Scleraner*, the variability of the character is unknown; however, because all 15 species of *Rutiderma* studied have the filaments restricted to the distal $1/3$ or less, it seems likely that the character will hold for other species of *Scleraner*, when they become known. In the list below, species followed by a USNM number are those reexamined herein. Some species have been described of which only the male is known. Based on the distribution of filaments on the sensory bristle of some of them, it is now possible to conclude, at least tentatively, that *Rutiderma* species B (Kornicker, 1975:675) (USNM 138667), *Rutiderma* species B (Kornicker, 1983a:80) (USNM 159042), *R. mortenseni* Poulsen, 1965, and less certainly *R. lusca* Poulsen, 1965, have been correctly referred to *Rutiderma*. Not all filaments of sensory bristles are shown in Figure 64.

Filaments restricted to distal $1/3$ or less

Rutiderma arx Kornicker, in press (USNM 193409)
Rutiderma darbyi Kornicker, 1983a (USNM 152851)
Rutiderma gyre Kornicker, 1983a (USNM 157993)
Rutiderma hartmanni Poulsen 1965 (USNM 158218)
Rutiderma judayi McKenzie, 1965 (USNM 158220)
Rutiderma kalkei Kornicker, 1983a (USNM 159069B)
Rutiderma licinum Kornicker, 1983a (USNM 157878)
Rutiderma lomae (Juday, 1907) (USNM 158260)
Rutiderma mollitum Darby, 1965 (USNM 158209)
Rutiderma normani Poulsen, 1965
Rutiderma ovata Kornicker, 1975 (USNM 137685)
Rutiderma rostratum Juday, 1907 (USNM 158228)
Rutiderma rotundum Poulsen, 1965 (USNM 158215)
Rutiderma sterreri Kornicker, 1981b (USNM 158573)
Rutiderma vox Kornicker, 1991a (USNM 158316)

Filaments restricted to distal $1/2$ to $2/3$

Alternochelata lizardensis Kornicker, 1982 (USNM 158487)
Alternochelata sikorai Kornicker, 1983b (USNM 158935)

Filaments restricted to distal $3/4$

Scleraner trifax, new species (USNM 194019)

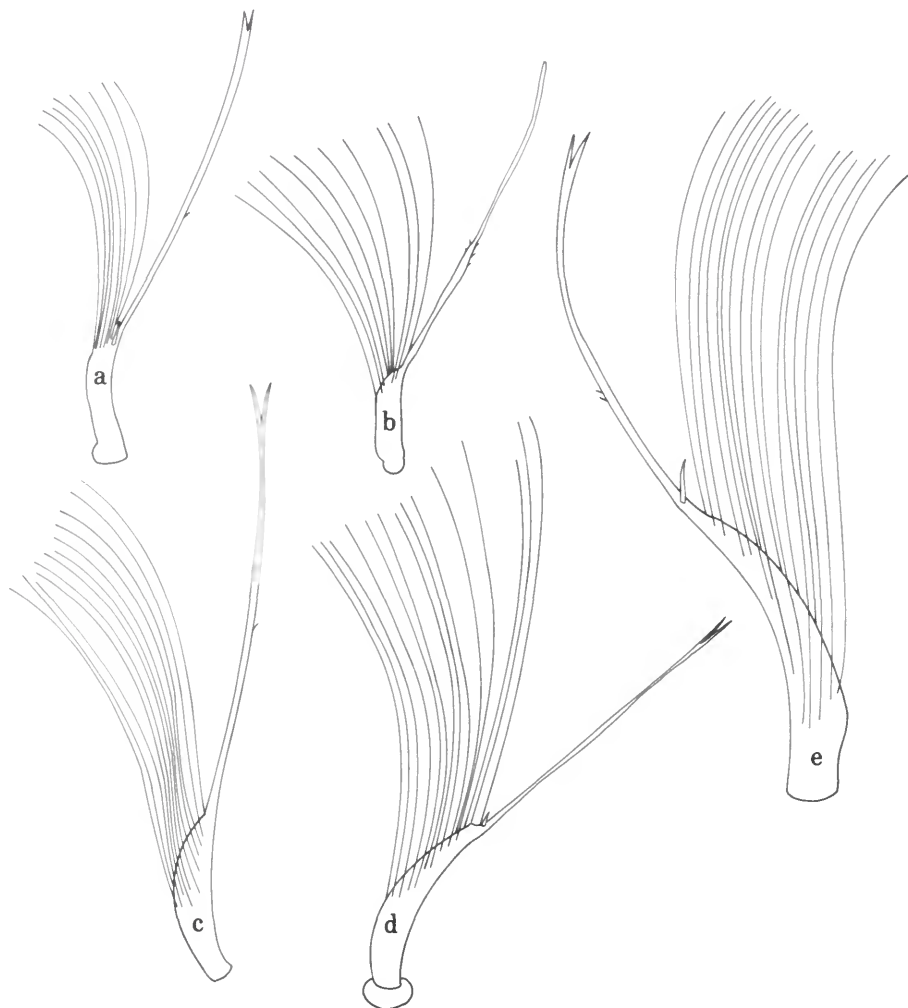


FIGURE 64.—Sensory bristles of 5th joints of 1st antennae of male Rutidermatidae (all drawn at same magnification: $\times 15$ ocular, $\times 40$ objective): a, *Rutiderma* species B, USNM 159042 (Kornicker, 1983:80), from left limb, mv; b, *R. vox* Kornicker, 1991a:78, paratype, USNM 158316, from right limb, mv; c, *Alternochelata lizardensis* Kornicker, 1982:793, paratype, USNM 158487, from left limb, lv; d, *A. sikorai* Kornicker, 1983:17, paratype, USNM 158935, from right limb, mv; e, *Scleraner trifax*, new species, paratype, USNM 194019, from left limb, mv.

Scleraner Kornicker, 1975

TYPE SPECIES.—*Scleraner chacaoi* (Hartmann) (in Hartmann-Schröder and Hartmann, 1965:328) by Kornicker, 1975:678.

COMPOSITION.—This genus includes 2 species, *S. chacaoi* and *S. trifax*, new species.

DISTRIBUTION.—Previously known from the Pacific coast of Chile at depths of 30–240 m. In the present collection from off Australia at a depth of 204–400 m.

Scleraner trifax, new species

FIGURES 64e, 65–68

ETYMOLOGY.—From the Latin *trifax* (a kind of spear).

HOLOTYPE.—Ovigerous female, partly dissected, 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 193922, 1 ovigerous female on slide and in alcohol; 1 A-1 male partly dissected and in separate vial of alcohol; 3 ovigerous females + 1 adult female with unextruded eggs + 15 specimens (mostly juveniles, no adult males), all in same vial of alcohol. Slope 21: 1 partly dissected ovigerous female + 1 juvenile in alcohol. Slope 22: 1 ovigerous female + 2 adult females + 17 juveniles in alcohol. Slope 48: 1 A-1 male in alcohol; USNM 194019, 1 adult male on slide and in alcohol.

DISTRIBUTION.—Slope 1, 204 m. Slope 21, 220 m. Slope 22, 363 m. Slope 48, 400 m. Known depth range 204–400 m.

DESCRIPTION OF ADULT FEMALE (Figures 65, 66).—Carapace oval in lateral view with slightly overhanging rostrum and projecting caudal process (Figure 65a).

Ornamentation: Alar lateral process on each valve with uneven posterior edge (Figure 65a,b); posterodorsal corner of process extending to, or just past, posterior edge of shell; 4 or 5 indistinct narrow low riblets extending from anterior end of process just anterior to central adductor muscle attachments to anterior margin of valve (Figure 65a) (riblets generally not visible in transmitted light); surface of valves with abundant minute well defined fairly deep fossae with ring of small inward pointing spines or papillae (size and spacing of representative fossae shown in Figure 65a,b). Anterior edge of valve in vicinity of incisur broadly concave; rostrum formed by lateral overhang of shell (Figure 65a,c); lateral overhang also along anteroventral margin of shell (Figure 65c); straight posterodorsal margin of each valve with small triangular process generally larger on right valve; anterodorsal and ventral margins of shell scalloped (Figure 65a); bristles present along anterior and ventral margins and sparsely distributed over valve surface.

Infold: Rostral infold with 15 bristles forming row parallel to valve edge (Figure 65c); 2 bristles near edge at inner end of incisur; anteroventral infold with 15 bristles forming row (not all shown in Figure 65c), and about 7 narrow ridges; a row of about 18 small bristles forming row near inner margin of infold beginning just anterior to caudal process and extending along caudal process (Figure 65d,e); caudal process with 6–8 additional small widely scattered bristles but most near tip; infold of caudal process similar on both valves and without ridges or “pocket” present on many other rutidermatids.

Selvae: Divided at inner end of incisur.

Central Adductor Muscle Attachments (Figure 65f): With about 31 individual attachments.

Carapace Size (length, height in mm): Slope 1: USNM 193922, 1.77, 1.28; 5 specimens: 1.77, 1.26; 1.77, 1.25; 1.85, 1.25; 1.86, 1.28; 1.84, 1.24. Slope 21: 1.69, 1.26. Slope 22: 3 specimens: 1.91, 1.37; 1.85, 1.42; 1.89, 1.47. Length range 1.69–1.91 mm.

First Antenna (Figure 65g): 1st joint bare. 2nd joint with long dorsal and medial spines, short lateral spines in row along dorsal half of distal margin, and 2 spinous bristles (1 dorsal, 1 lateral). 3rd and 4th joints fused on lateral side but with fairly well-defined suture on medial side (not as well defined as sutures between 2nd and 3rd or 4th and 5th joints); 3rd joint about $\frac{1}{3}$ length of 4th joint, with 3 short spinous bristles (1 ventral, 2 dorsal); 4th joint with 2 spinous dorsal bristles (1 at $\frac{1}{2}$ length, 1 longer, terminal) and 2 very long, spinous, terminal, ventral bristles. Sensory bristle of 5th joint with 2 short proximal filaments and 2 distal minute marginal spines; ventral margin of joint with small spine near base of bristle. 6th joint minute fused to 5th, with short spinous medial bristle. 7th

joint: a-bristle longer than bristle of 6th joint, spinous; b-bristle longer than a-bristle, bare; c-bristle longer than sensory bristle of 5th joint, with 3 short marginal filaments followed by small distal marginal spine, 1 subterminal spine, and 2 papillae at tip. 8th joint: d- and e-bristles (not shown) almost as long as c-bristle, bare with blunt tips; f-bristle about twice length of a-bristle, with 2 short proximal filaments and 2 papillae at tip; g-bristle about same length as c-bristle, with 2 short proximal filaments followed by minute marginal spine and 2 papillae at tip. (Not all spines of joints and bristles shown.) (The presence of a proximal dorsal bristle on the 4th joint is unusual.)

Second Antenna: Protopodite bare. Endopodite 2-jointed (Figure 65h,i): 1st joint with 5 bristles (4 proximal, 1 at about midlength); 2nd joint elongate with short terminal bristle. Exopodite: 1st joint with minute distal medial bristle; bristle of 2nd joint reaching 9th joint, with minute pointed spines along ventral margin and without hooked tip; bristles of joints 3–5 short with row of blunt ventral spines and without hooked tips; bristles of joints 6–8 long with natatory hairs, no spines; 9th joint with 5 bristles (3 long and 1 medium with natatory hairs, 1 short with few short hairs or spines).

Mandible (Figure 66a–c): Coxale endite bifurcate; proximal prong with long proximal spines and short distal teeth; distal prong with small teeth. Basale: dorsal margin with 3 distal bristles in 2 groups (1 short in proximal group, 1 short and 1 long in distal group); medial surface near ventral margin with 8 bristles (5 bristles in proximal corner (3 unringed pectinate, 2 ringed spinous); 1 short stout pectinate ringed bristle proximal to midlength; 2 distal ringed fairly long bristles near midlength with fairly long spines). Exopodite represented by minute slender bristle on lateral side of distal margin of basale at about midwidth (dashed in Figure 66a). 1st endopodial joint with 3 small ventral bristles (dashed in Figure 66a); medial surface with abundant spines. 2nd endopodial joint: dorsal margin with 7 bristle (including 2 small bristles medial and with long marginal spines); ventral margin with 2 small a-bristles; medial surface with abundant spines and small terminal ringed b-bristle on small sclerotized base (Figure 66b); terminal c-bristle claw-like, with small dorsal teeth and long slender tip terminating in small bulb, but without proximal dorsal tooth-like process present on many rutidermatids; lateral surface with 2 terminal d-bristles (outer bristle unusual, spine-like with stout sclerotized base) (Figure 66c). 3rd endopodial joint with 3 slender medial a-bristles, long terminal b-bristle with minutely serrate ventral margin, and stout terminal claw-like c-bristle with minutely serrate ventral margin. (Lettering used for bristles of 2nd and 3rd endopodial joints from Kornicker (1985:2).)

Maxilla (Figure 66d): Precoxale and coxale with dorsal fringe of long hairs; coxale with dorsal bristle. 3 endites each with 2 or 3 short stout pectinate claw-like bristles in addition to a few slender bristles; endite III also with slender proximal bristle. Basale with 2 or 3 bristles. Exopodite with 3 bristles (2 short, 1 long). 1st endopodial joint with 1 alpha-bristle and 1 or

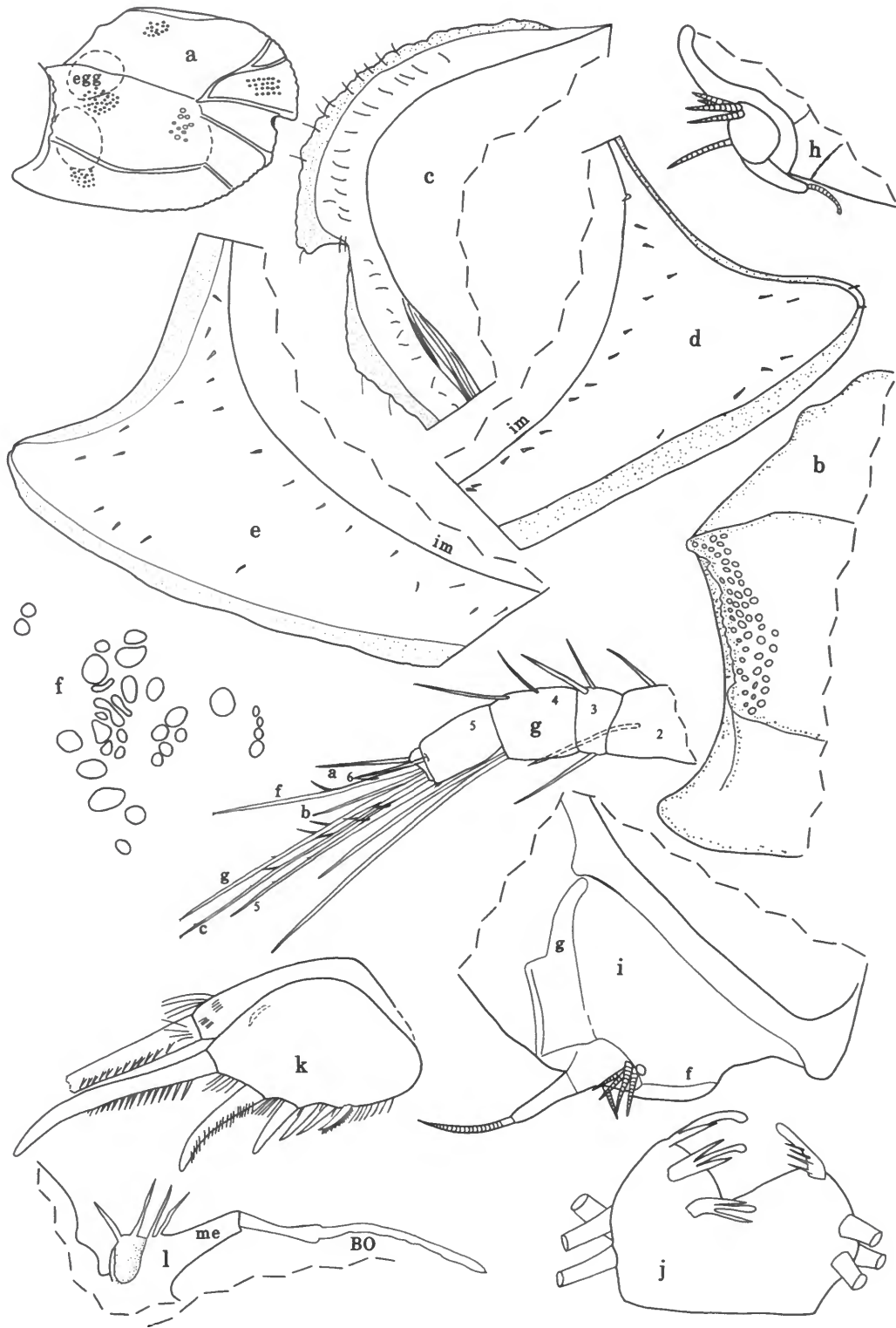


FIGURE 65.—*Scleraner trifax*, new species, ovigerous female, paratype, USNM 193922: a, complete specimen from right side showing representative fossae and location of 2 eggs, length 1.77 mm; b, posterior of right valve showing representative fossae; c, anterior, right valve, iv; d, e, caudal processes of right and left valves, respectively, iv; f, central adductor muscle attachments, left valve, ov, anterior to right; g, part of right 1st antenna, mv (neither d- and e-bristles nor marginal spines of bristles shown); h, i, endopodites of right and left 2nd antennae, respectively, mv; j, tip of 7th limb (not all comb teeth shown); k, furca (only claw 1 of right lamella shown; teeth not shown on all claws); l, medial eye and Bellonci organ.



FIGURE 66.—*Scleraner trifax*, new species, ovigerous female, paratype, USNM 193922: *a*, right mandible, mv; *b*, detail of b-bristle of 2nd endopodial joint of mandible shown in *a*; *c*, part of left mandible, lv; *d*, left maxilla, lv (not all bristles shown); *e*, endites of 5th limb; *f*, 1st exopodial joint, 5th limb, av; *g, h*, 2nd exopodial joint, 5th limb, posterior and anterior views, respectively; *i*, 3rd-5th exopodial joints, 5th limb, av; *j*, left 6th limb, lv; *k*, part of anterior of body from left side, anterior to left; *l, m* anterior and posterior of body, respectively, from right side, anterior to right.

2 beta-bristles (on specimen examined, 2 on left limb, 1 on right). 2nd endopodial joint with 2 stout pectinate claws, 1 slender pectinate claw, and several bristles.

Fifth Limb (Figure 66e-i): Endites I, II, and III with 3, 5, and 7 bristles, respectively (Figure 66e) Tooth of 1st exopodial joint with 4 stout prongs, all except proximal with cusps (Figure 66f); 1 short stout ringed bristle proximal to bare prong, and 2 ringed bristles on edge proximal to largest prong. 2nd exopodial joint a large flat tooth with 3 prongs along inner edge (Figure 66g,h); distal prong with 2 small cusps on or near inner edge, proximal 2 prongs with cusp near tip; inner edge of joint with proximal spinous bristle (Figure 66h); posterior side of joint with 3 bristles near base of proximal prong (Figure 66g,h). Inner lobe of 3rd exopodial joint with 3 bristles (shortest bare, widest pectinate, longest with indistinct spines, all weakly ringed), outer lobe with 2 strongly ringed bristles with slender marginal hairs; 4th and 5th joints fused, with total of 4 bristles (1 with long proximal hairs and short distal spines, others with only short spines, all bristles weakly ringed) (Figure 66i); all joints without hairs. (Not all rings and spines shown on bristles.)

Sixth Limb (Figure 66j): With 2 spinous epipodial bristles. Endite I with 3 bristles; endite II with 2 bristles; endite III with 4 bristles; endite IV with 3 bristles. End joint with 4 or 5 anterior bristles on projection, then 3 stouter bristles (2 posterior bristles plumose to tip).

Seventh Limb (Figure 65j): Each limb with 10 bristles (4 proximal, 2 on each side, each with 4 or 5 bells; 6 terminal, 3 on each side, each with 3-7 bells). Terminus with comb of 9 alate teeth opposite comb with 2 spinous teeth (not all comb teeth shown).

Furca (Figure 65k): Each lamella with 3 stout primary claws with rounded tips followed by 3 short secondary claws with pointed tips. Lateral and medial rows of teeth of claw 1 considerably stouter than lateral and medial rows of teeth of claws 2 and 3; secondary claws with hair-like spines along posterior edge. Inner side of claws 1-3 with row of long spines near base; long spines on lamella between claws, following claws, and on distal anterior edge of right lamella; right lamella anterior to left by about width of base of claw 1.

Bellonci Organ (Figures 65l, 66k): Long, with broad part at proximal $\frac{1}{3}$, and with narrow tip with triangular terminal spine.

Eyes: Medial eye elongate with area of brown pigment and slender filaments on dorsal margin (Figure 65l). Lateral eye small, unpigmented, with about 5 minute ommatidia (Figure 66k); eye not visible through shell.

Upper Lip (Figure 66l): Simple, rounded.

Genitalia: Small oval (with light amber color) on each side anterior to furca.

Anterior of Body (Figure 66k,l): With rounded anterior process at midheight. An additional small rounded process present on each side of body just dorsal to insertion of mandible (Figure 66k).

Posterior of Body (Figure 66m): Part at midheight hirsute. *Y-Sclerite* (Figure 66m): Typical for family.

Number of Eggs: Slope 1: USNM 193922, 2 eggs in marsupium (outlines shown in Figure 65a), length of 1 egg 0.36 mm; 4 additional specimens with 2 eggs, and 1 with 3. Slope 26: 1 specimen with 3 eggs in marsupium, length of 1 egg 0.35 mm, length of an embryo with valves separated 0.42 mm. Slope 22: 1 specimen with 3 eggs, length of 1 egg 0.38 mm.

DESCRIPTION OF ADULT MALE (Figures 64e, 67-68a-j).—Carapace more elongate than that of adult female (Figure 67a), and tip of rostrum more rounded (Figure 67a,b).

Ornamentation: Short lateral alar process near posterior edge of valve (Figure 67a); posterodorsal corner of process with short knob; additional posterodorsal knob closer to valve edge (Figure 67c); surface of valve without anterior riblets present on adult female. Valve surface with abundant minute well defined deep fossae (with minute spines along periphery) similar to those of adult female (representative fossae shown in Figure 67a, but spines not shown). Rostrum formed mostly by lateral overhang of valve edge as on adult female; lateral overhang of valve edge also along ventral margin of valve (Figure 67b). Anterior margin of rostrum scalloped. Undivided bristles present along anterior and ventral margins and sparsely distributed over valve surface (Figure 67b,d).

Infold: Rostral infold plus anterodorsal infold with row of 12 bristles (only 9 shown in Figure 67b) with indistinct marginal hairs; 2 bristles near inner end of incisur; anteroventral infold with row of 10-14 bristles (only anterior 3 shown in Figure 67b); anteroventral ridges present on female absent on male; ventral infold anterior to caudal process with 11 short bristles; infold of caudal process with 5 small bristles (Figure 67d); infold dorsal to caudal process with row of 6 short slender bristles; infold of caudal process similar to that of adult female in not having ridges, list, or pocket.

Selvage: Divided at inner end of incisur; lamellar prolongation along rostrum and anteroventral margin narrowly striate and with marginal fringe; lamellar prolongation along ventral margin with striations confined to proximal $\frac{1}{3}$ and with short marginal fringe; lamellar prolongation along caudal process and posterior infold striate but without fringe; outer edge of lamellar prolongation at tip of caudal process with deep indentation in vicinity of spine-like bristle (detail in Figure 67d).

Central Adductor Muscle Attachments (Figure 67e): With about 23 individual scars.

Carapace Size (length, height in mm): USNM 194019, 1.96, 1.23.

First Antenna (Figures 64e, 67f): 1st joint bare. 2nd joint with medial, ventral, and lateral spines and 2 spinous bristles (1 dorsal, 1 lateral). 3rd joint shorter on medial side than on dorsal side but with distal margin well defined on both sides, with few medial and lateral spines and 3 spinous bristles (1 ventral, 2 dorsal). 4th joint with few lateral spines near ventral margin,

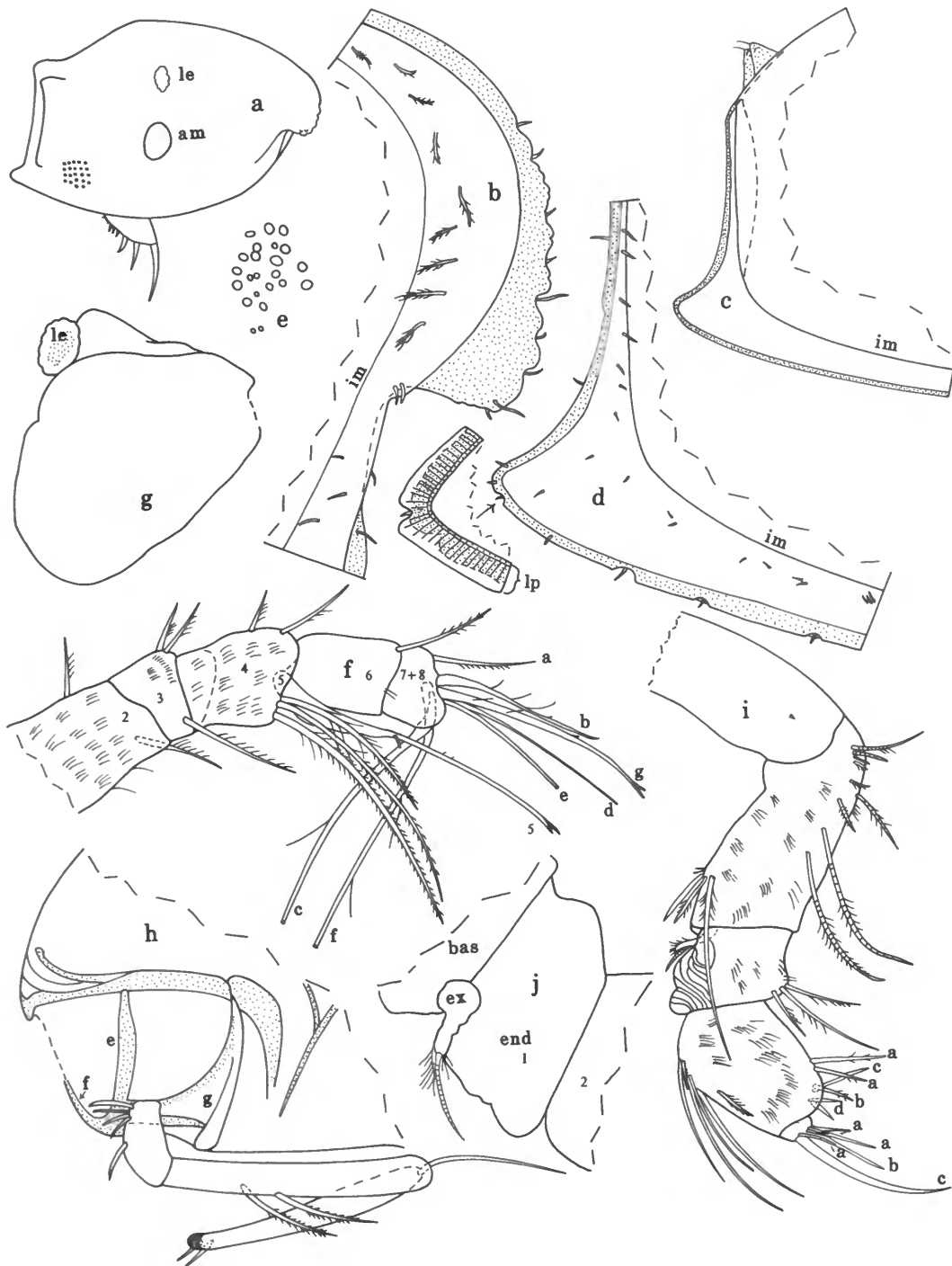


FIGURE 67.—*Scleraner trifax*, new species, adult male, paratype, USNM 194019: *a*, complete specimen from right side showing projecting furca, representative fossae on shell, and locations of lateral eye and central adductor muscle attachments, length 1.96 mm; *b*, anterior of left valve, iv; *c*, posterior of left valve, iv (bristles not shown); *d*, detail from *c*; *e*, central adductor muscle attachments of right valve, lv, anterior to right; *f*, part of left 1st antenna, mv; *g*, right lateral eye (stippled) and protopodite of right 2nd antenna, anterior to right; *h*, endopodite and part of protopodite, right 2nd antenna, mv; *i*, right mandible, mv; *j*, exopodite, left mandible, lv.

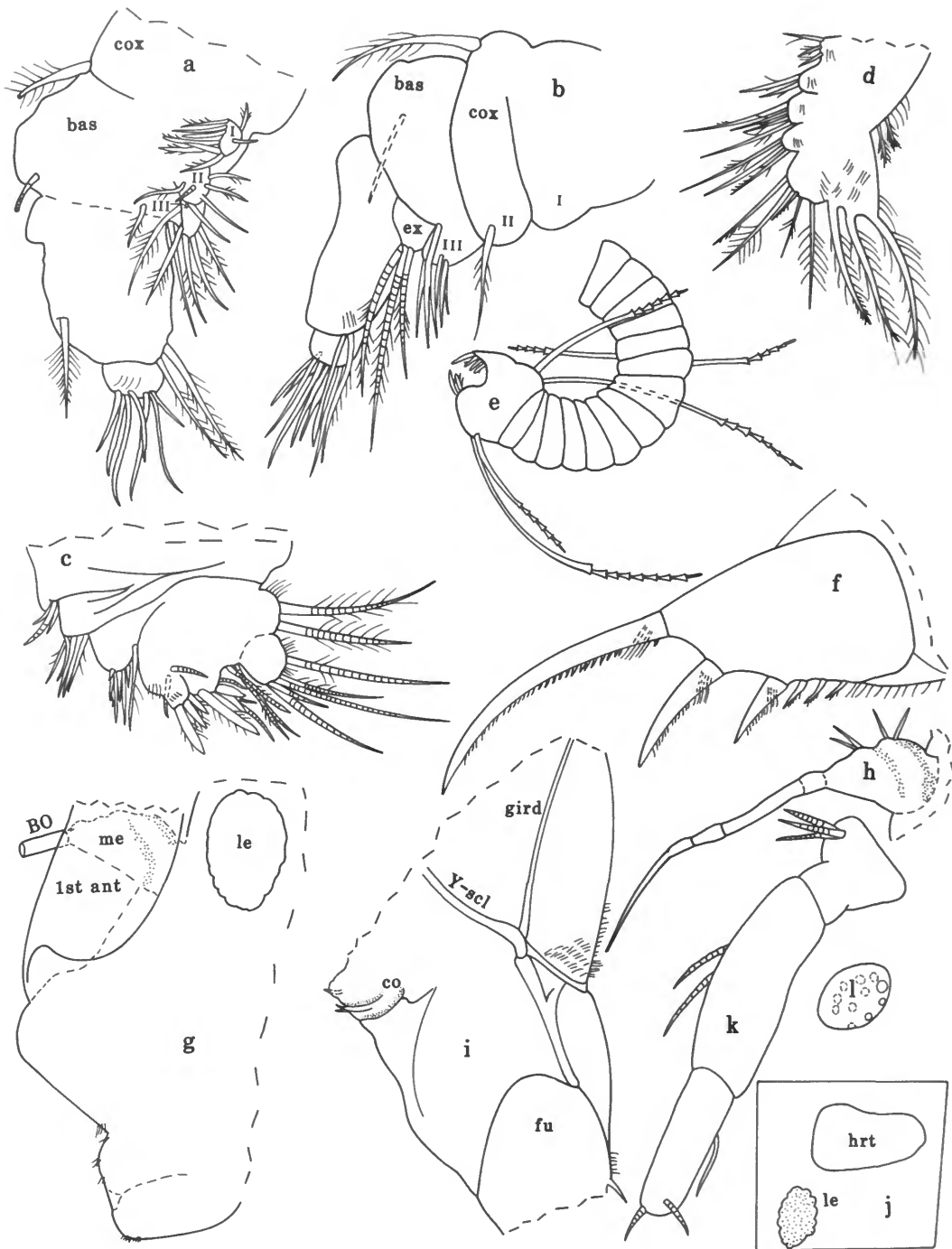


FIGURE 68.—*Scleraner trifax*, new species, adult male, paratype, USNM 194019: *a*, right maxilla, *mv* (exopodite not shown); *b*, left maxilla, *lv* (not all endite or basale bristles shown); *c*, 5th limb; *d*, right 6th limb, *mv*; *e*, 7th limb; *f*, left lamella of furca; *g*, anterior of body from left side, anterior to left; *h*, medial eye and Bellonci organ; *i*, posterior of body with left copulatory organ; *j*, left lateral eye and heart from left side, anterior to left. A-1 male, paratype: *k*, endopodite, right 2nd antenna, *mv*; *l*, right lateral eye.

abundant medial spines, 2 separated spinous dorsal bristles, and 3 very long, spinous, terminal, ventral bristles. Sensory bristle of minute 5th joint with broad proximal part reaching past proximal edge of 6th joint and with abundant thin filaments (few filaments shown in Figure 64e; none shown in Figure 67f); stem with short pointed filament just distal to broad proximal part, 2 minute dorsal spines at midlength, and bifurcate tip. 6th joint with 2 medial spines near distal edge, row of lateral spines near distal dorsal corner, and short spinous medial bristle near dorsal edge. 7th joint: a-bristle about same length as bristle of 6th joint, ringed, spinous; b-bristle about twice length of a-bristle, with 3 short proximal filaments, 1 minute distal dorsal spine, and 2 papillae at tip; c-bristle broken on both limbs of USNM 194019, with 5 filaments on stump. 8th joint: d-bristle longer than b-bristle, bare with blunt tip; e-bristle similar to d-bristle but broken on both limbs of USNM 194019; f-bristle similar to c-bristle (broken on both limbs of USNM 194019) but with 6 filaments on stump; g-bristle about $\frac{1}{4}$ longer than b-bristle and about same length as d-bristle, with 2 short proximal filaments, 1 minute distal dorsal spine, and bifurcate tip.

Second Antenna: Protopodite triangular, bare (Figure 67g). Endopodite 3-jointed (Figure 67h): 1st joint short with 5 bare bristles (4 proximal, 1 at midlength); 2nd joint elongate with 2 spinous bristles at midlength; 3rd joint elongate, reflexed on 2nd joint, with 1 long bare proximal bristle, 2 small subterminal bristles, and 5 serrate ridges at tip. Exopodite: 1st joint long, with distal ventral spines and minute medial terminal bristle; 2nd joint short, $\frac{3}{5}$ length of 3rd joint; joints 4–9 short, decreasing in length distally; bristle of joint 2 reaching to about 6th joint, with minute ventral spines (about 8 sets decreasing in length towards tip of bristle); bristles of joints 3–9 with natatory hairs, no spines; 9th joint with 5 bristles with natatory hairs (3 long, 1 medium dorsal, 1 minute dorsal); joints 3–8 with minute spines along distal margins, but no basal spines.

Mandible (Figure 67i,j): Coxale endite minute, indistinct, with pointed tip. Basale: with medial, lateral, ventral, and dorsal spines; dorsal margin with row of 3 bristles (1 long, 2 short); medial surface near ventral margin with 9 bristles (only 1 of short bristles in proximal ventral corner unringed). Exopodite finger-like, with distal hairs, and long subterminal ringed bristle (Figure 67i,j). 1st endopodial joint crinkled near dorsal margin, with medial spines and 3 spinous ventral bristles. 2nd endopodial joint: dorsal margin with 6 bristles (2 small bristles medial and with short spines); ventral margin with 2 a-bristles, 1 b-bristle, 1 c-bristle, and 2 d-bristles. 3rd endopodial joint with 5 a-bristles (not 3 as on female), 1 b-bristle, and claw-like c-bristle.

Maxilla (Figure 68a,b): Limb reduced. Coxale with plumose dorsal bristle. 3 endites with weakly developed hairs: endite I with about 9 bristles; endite II with about 6 bristles; endite III with about 5 bristles (Figure 68a). Basale with 3 bristles (Figure 68a). Exopodite small, with 3

well-developed long ringed bristles (Figure 68b). 1st endopodial joint with 1 alpha-bristle with long proximal and short distal hairs, and 2 beta-bristles (Figure 68a). 2nd endopodial joint hairs, with about 7 weak bristles.

Fifth Limb (Figure 68c): Limb reduced. 3 endites with weakly developed bristles with spines or hairs: endite I with 3 or 4 bristles; endite II with 5 bristles; endite III with about 8 bristles. 1st exopodial joint with 3 unringed finger-like spinous bristles and 2 ringed proximal bristles. 2nd exopodial joint with 3 unringed finger-like spinous bristles and 3 ringed bristles. 3rd exopodial joint with 3 ringed bristles on inner lobe, and 2 long stout ringed plumose bristles on hairs outer lobe. 4th and 5th exopodial joints fused, hairs, with total of 5 ringed bristles.

Sixth Limb (Figure 68d): With 2 spinous epipodial bristles. Endite I with 3 bristles; endite II with 2 bristles; endite III with 4 bristles; endite IV with 3 bristles. End joint with 4 or 5 anterior bristles on projection, then 3 stouter bristles (2 posterior bristles plumose to tip); limb hairs.

Seventh Limb (Figure 68e): Each limb with 6 bristles (2 proximal, 1 on each side, each with 4 or 5 bells; 4 terminal, 2 on each side, each with 6–8 bells). Terminus with comb of 7 alate teeth opposite comb with 2 spinous teeth.

Furca (Figure 68f): Similar to that of adult female except for claw 1 being slenderer and having smaller teeth along posterior edge.

Bellonci Organ (Figure 68h): With small segment at midlength and tapering to point.

Eyes: Medial eye similar to that of adult female (Figure 68h). Lateral eye well developed, with many ommatidia but could not determine number because of black pigment (Figure 68g,j).

Upper Lip (Figure 68g): Similar to that of adult female.

Genitalia (Figure 68i): 1 short lobe (with few spines) on each side anterior to base of furca; on USNM 194019 both lobes on left side.

Anterior of Body (Figure 68g): With broad anterior projection at midheight.

Posterior of Body: With spines on surface near posterior end of Y-sclerite (Figure 68i) (part with spines shorter than on adult female); 2 rows of spines on rounded posterodorsal corner (not shown).

Y-Sclerite (Figure 68k): Ventral branch may be absent on USNM 194019.

Heart (Figure 68j): Well developed.

DESCRIPTION OF A-1 MALE (Figure 68k,l).—Carapace similar in shape and ornamentation to that of adult female.

Carapace Size (length, height in mm): Slope 1: 1.67, 1.13.

First Antenna: Same number of bristles as that of adult female including proximal and terminal dorsal bristles on 4th joint. Filaments on bristles of joints 5, 7, and 8 not counted.

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 68k): 1st joint with 3 small proximal ventral bristles and 0 or 1 small distal ventral bristle; elongate 2nd joint with 2 short ventral bristles; elongate 3rd joint with proximal dorsal

bristle and 2 small terminal bristles. Exopodite: bristles of joints 2-9 short, none with natatory hairs; 9th joint with 5 bristles.

Mandible, Maxilla, Fifth to Seventh Limbs: Bristles not counted but limbs similar type as those of adult female. End joint of 6th limb with 7 bristles as on adult female.

Furca: Similar to that of adult female, with 3 primary claws followed by 3 secondary claws.

Bellonci Organ: Similar to that of adult female.

Eyes: Medial eye slender like that of adult female, but dorsal edge covered by debris and I could not determine presence or absence of filaments. Lateral eye twice size of that of adult female, with more ommatidia, but also unpigmented (Figure 68*l*) and not visible through shell.

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

Posterior of Body: With hairs similar to those of adult female.

COMPARISONS.—The carapace of *S. trifax* differs from that of *S. chacaoi* in having lateral ribs. The 2nd joint of the endopodite of the female 2nd antenna differs in having 1 instead of 2 bristles. Each lamella of the furca of *S. trifax* has 3 primary claws followed by 3 secondary claws; that of *S. chacaoi* has 4 primary claws followed by 5 secondary.

METASCHISMATINAE, new subfamily

This new subfamily is proposed for the new genus *Metaschisma*.

DIAGNOSIS.—Same as for diagnosis of genus.

COMPARISONS.—Unlike all known species of the Sarsiellidae the furcae of the Rutidermatidae have claw 1 articulated. However, the mandibles of some species of *Dantya* resemble the mandible of *Metaschisma nex*, suggesting a possible relationship between those two probably primitive genera. The 5th limb of *M. nex* bears some resemblance to those of some members of the Philomedidae, e.g., *Pleoschisma* herein. A phylogenetic analysis of the families may be of value in demonstrating the relationship between *Metaschisma* and other groups, but is beyond the scope of the present paper.

Metaschisma, new genus

ETYMOLOGY.—From the Greek *meta* (between, among, near) plus the Greek *schisma* (a split).

TYPE SPECIES.—*Metaschisma nex*, new species herein.

COMPOSITION.—Monotypic.

DISTRIBUTION.—Slope 1, off Nowra, New South Wales, 204 m.

DIAGNOSIS.—The new genus *Metaschisma* is proposed because of the morphology of the mandible (Figure 70*a*), which differs considerably from that of known Rutidermatidae: basale wider than long, and shorter than dorsal edge of 1st endopodial joint; 2nd endopodial joint broad (length of

proximal edge greater than length of ventral edge), tapering distally, with 2 stout terminal ventral claws; 3rd endopodial joint with stout terminal claw with right-angle bend near base, and a shorter pointed ventral bristle with several stout ventral teeth near base and distal rings; exopodite a minute node with small terminal bristle.

A combination of the following characters of other appendages of *M. nex* may be diagnostic for the genus: The suture separating the 3rd and 4th joints of the 1st antenna, the 2-jointed endopodite on the female 2nd antenna, the 2 stout bristles representing the exopodite on the maxilla, the teeth on the 1st and 2nd exopodial joints of the female 5th limb, and the furca with claws 1, 2, 4, and 6 primary. The adult male is unknown.

DISCUSSION.—It is possible to relate most bristles on the 1st and 2nd endopodial joints of the mandible to those of *Rutiderma* using the lettering system proposed in Kornicker (1985a:2). Although the female mandibles of *Metaschisma* and *Rutiderma* appear to be quite different, the main differences are that the minute spine-like b-bristle of the 2nd endopodial joint of *Rutiderma* is a stout claw on *Metaschisma*, the claw-like c-bristle of the 2nd endopodial joint is shorter on *Metaschisma*, and the claw-like c-bristle of the 3rd joint is much longer on *Metaschisma*. The presence of a suture between the 3rd and 4th joints of the 1st antenna, of secondary claws between primary claws on the furca, and the complex teeth on the 5th limb suggest that *Metaschisma* might be more closely related to *Alternochelata* than to *Rutiderma* or *Scleraner*.

Metaschisma nex, new species

FIGURES 69-71, 111*b*

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

HOLOTYPE.—Undissected ovigerous female 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 193930, adult female on slide and in alcohol; USNM 193931, ovigerous female on slide and in alcohol; USNM 193932, A-1 male on slide and in alcohol; 15 specimens (adult females (at least 1 ovigerous) plus late juveniles).

DISTRIBUTION.—Slope 1, 204 m.

DESCRIPTION OF ADULT FEMALE (Figures 69-71, 111*b*).—Carapace oval in lateral view with broad rostrum and small indented incisur (Figure 69*a*). Posterior margin without projecting caudal process.

Ornamentation: Surface reticulate with borders of reticulations formed by rows of minute spine-like papillae with pointed or blunt tips (Figure 69*b*); papillae especially visible along valve edges (Figure 69*c,d*). Bristles of 2 types present: 1, long slender bristles with triangular base; 2, more abundant shorter and stouter bristles, some tapering from base to tip, others with

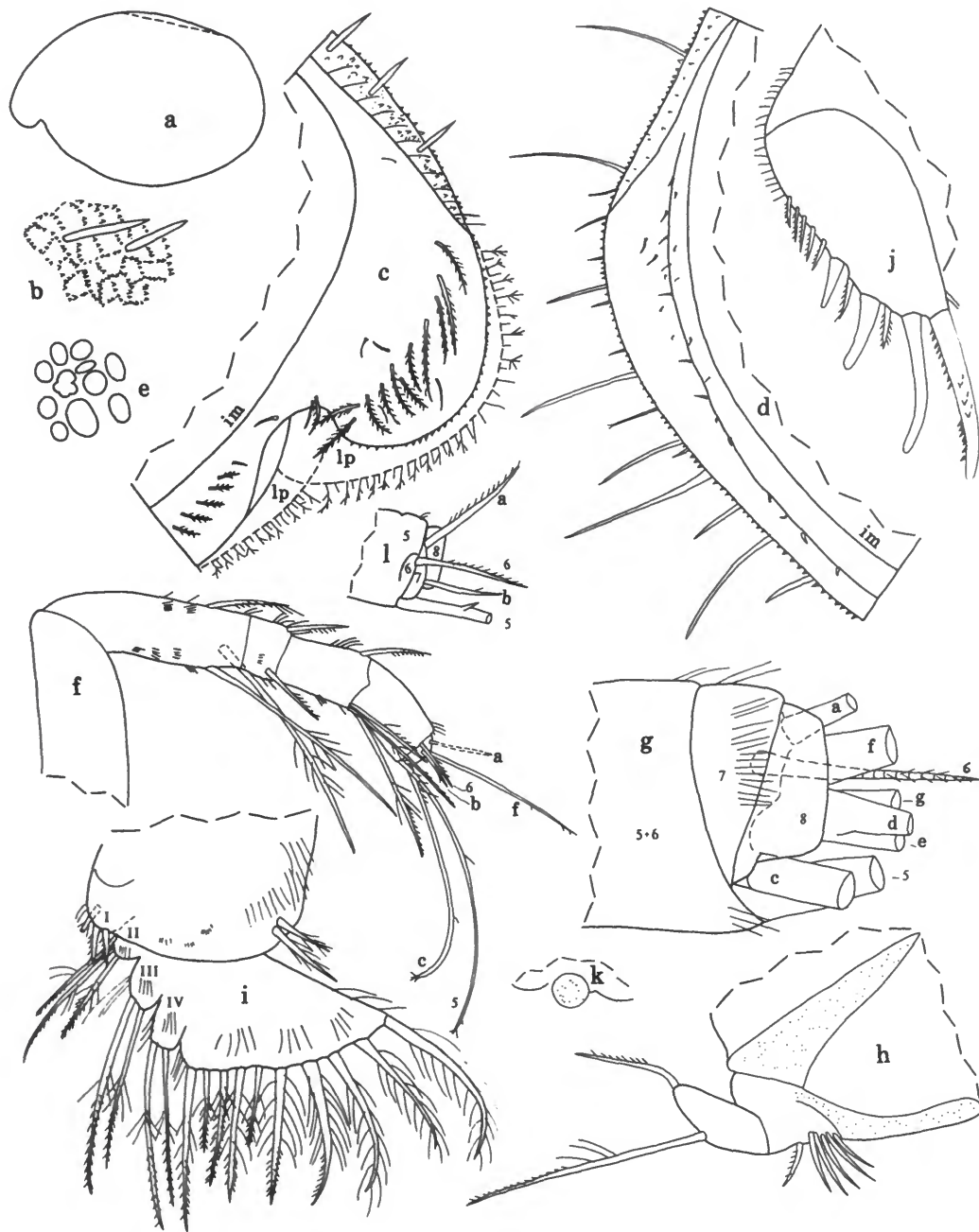


FIGURE 69.—*Metaschisma nex*, new species, adult female, paratype, USNM 193930: *a*, complete specimen from left side (hinge-line dashed), length 1.49 mm; *b*, detail of surface ornamentation and bristles, left valve, lv; *c,d*, anterior and posterior of left valve, respectively; *e*, central adductor muscle attachments, left valve, anterior to left; *f*, left 1st antenna, mv (not all bristles shown); *g*, location of bristles of joints 5–8, right 1st antenna, lv (*b*-bristle not shown); *h*, endopodite and part of protopodite, left 2nd antenna, mv; *i*, right 6th limb, mv; *j*, right lamella of furca; *k*, right genital organ, lv. Ovigerous female, paratype, USNM 193931: *l*, tip of left 1st antenna, mv (not all bristles shown).

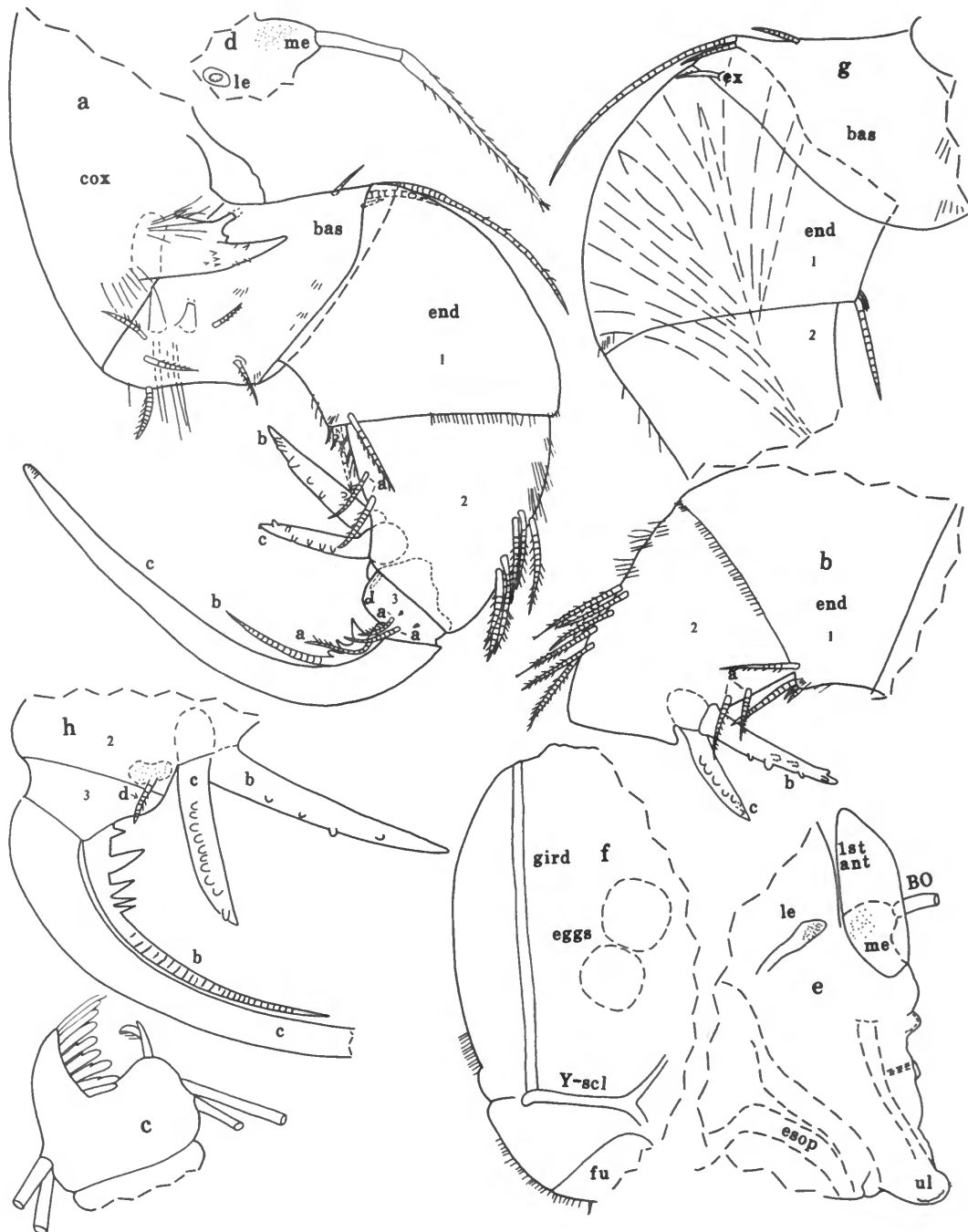


FIGURE 70.—*Metaschisma nex*, new species, adult female, paratype, USNM 193930: *a*, left mandible, mv; *b*, endopodite, right mandible, mv; *c*, tip of 7th limb; *d*, Bellonci organ, lateral and medial eyes; *e*, anterior of body from right side, anterior to right; *f*, posterior of body from right side showing location of 2 unextruded eggs, anterior to right. Ovigerous female, paratype, USNM 193931: *g*, part of left mandible showing locations of internal muscles, lv (not all bristles shown); *h*, tip of left mandible, lv (not all bristles shown).



FIGURE 71.—*Metaschisma nex*, new species, adult female, paratype, USNM 193930: a, left maxilla, lv; b, 1st exopodial joint of right 5th limb as seen through 2nd joint, pv c, part of right 5th limb, pv (not all bristles shown); d, part of left 5th limb, pv (not all bristles or teeth shown). e, ovigerous female, paratype, USNM 193931, part of left maxilla, mv (not all bristles shown). A-1 male, paratype, USNM 193932: f, endopodite and part of protopodite, right 2nd antenna, mv; g, part of dorsal part of anterior of body from left side, anterior to left; h, right lateral eye.

fairly parallel sides except for tapering tip (Figure 69b); bristles with parallel sides longer near posterior margin.

Infold: Rostral infold with 11 or 12 long spinous bristles and 5–8 short thread-like bristles (Figure 69c); paired bristles present at inner end of incisur. Anteroventral infold with 1 short bristle just ventral to inner end of incisur followed by space, 1 thin bristle, and 5 or 6 spinous bristles; about 9 striations parallel to valve edge in vicinity of bristles (not shown). Broad infold in posteroventral corner with about 10 short bare bristles either on or distal to list and several thread-like bristles proximal to list near inner margin of infold (Figure 69d); a few

additional bristles along list just anterior to posteroventral corner.

Selvae: Broad lamellar prolongation along anterior, anteroventral, and ventral margins with fringe of long and short filaments (Figure 69c); many long filaments with thin marginal hairs; prolongation divided at inner end of incisur; prolongation narrower and without long filaments in immediate vicinity of posteroventral corner.

Central Adductor Muscle Attachments (Figure 69e): Including about 11 ovoid attachments.

Carapace Size (length, height in mm): Slope 1: holotype,

1.49, 1.00; USNM 193930, 1.49, 1.02; USNM 193931, 1.47, 1.04; 2 unnumbered paratypes: 1.47, 0.99; 1.46, 0.99.

First Antenna: 1st joint bare. 2nd joint with ventral, dorsal, and medial spines, lateral spines along distal edge, and 3 spinous bristles (1 ventral, 1 dorsal, 1 lateral) (Figure 69f). 3rd joint with few short ventral and medial spines, numerous long dorsal and lateral hairs, and 2 short spinous bristles (1 ventral, 1 dorsal). 4th joint with ventral and dorsal hairs and 4 bristles (1 dorsal with short spines, 3 ventral with long and short spines). 5th joint with spines on distal corners (Figure 69f), and long ventral bristle with 4 short proximal filaments and several short terminal filaments. 6th joint fused to 5th, with short spinous medial bristle. 7th joint (Figure 69f,g,l): a-bristle about same length as bristle of 6th joint; b-bristle small, slightly shorter than a-bristle, with minute distal filament; c-bristle long, with 3 very small proximal filaments, 1 very short distal filament, and 4 short terminal filaments including stem; joint with row of lateral hairs (the hairs could be interpreted to be on 6th joint) (Figure 69g). 8th joint (Figure 69g): d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle about $\frac{3}{4}$ length of c-bristle, with 1 minute distal filament and several minute terminal filaments; g-bristle about same length as bristle of 5th joint, slightly longer than c-bristle, with 2 minute proximal filaments, 1 minute distal filament, and several minute filaments at tip.

Second Antenna: Protopodite bare (Figure 111b). Endopodite 2-jointed (Figure 69h): 1st joint with 5 short bare proximal bristles and 1 spinous distal bristle of similar length; 2nd joint elongate with 1 long bristle (with long and short spines) at midlength, and 1 shorter terminal bristle with short spines. Exopodite: 1st joint with minute terminal medial tubular bristle; bristles of joints 2–5 short bare; on both limbs of USNM 193930 and 193931 bristles of joints 6–8 broken off near base, without spines or hairs on stumps; 9th joint with 6 or 7 bristles (4 stout, 2 or 3 short slender), all except a short slender bristle (on USNM 193931) broken off near base (1 slender bristle with short spines on stump, others without spines or hairs on stumps).

Mandible (Figure 70a,b,g,h): Coxale with long spines near endite; endite bifurcate (tip of 1 prong broken off on USNM 193930), with long proximal spines and short distal teeth; minute peg between prongs. Basale: unusually short; medial side with few distal spines, 4 proximal bristles (2 stout unringed, 2 slender ringed spinous), 1 short, slender, ringed, spinous bristle at midlength, and 1 slender, ringed, spinous, distal bristle near ventral margin; ventral margin with 1 short, slender, ringed, spinous, proximal bristle; lateral side with long proximal hairs near ventral margin; dorsal margin with 1 short ringed bristle at distal $\frac{3}{4}$, and 2 subterminal bristles (1 short ringed, 1 long ringed with few marginal hairs). Exopodite a minute node with single terminal bristle with few short spines (Figure 70g). 1st endopodial joint: medial side with spines forming row along distal edge and 1 short spinous ringed distal bristle near ventral margin; ventral margin with spines, 2

minute ringed distal bristles with short marginal spines, and 1 short ringed bristle (missing on illustrated left limb of USNM 193930, interpreted to be broken off); dorsal margin with terminal row of short spines; broad internal promotor muscles extend from 1st joint to sclerite attached to ventral terminal corner of 3rd joint (Figure 70g). 2nd endopodial joint: short stout, tapering distally; dorsal margin with proximal spines and 6 short ringed spinous bristles at about midlength; medial surface with 2 short ringed spinous a-bristles near ventral margin; ventral margin with proximal spines and 1 stout claw-like b-bristle (with marginal teeth) distal to a-bristles, and 1 stout terminal claw-like c-bristle with marginal teeth; lateral side with few rows of spines and minute ringed terminal d-bristle near ventral margin (Figure 70h). 3rd endopodial joint with 2 minute medial spine-like bristles at joint midlength, 3 short slender ringed a-bristles with bases medial to terminal claws, 1 fairly long pointed ventral b-bristle with 3–5 stout proximal ventral teeth and distal rings, and 1 long stout bare terminal claw-like c-bristle with right-angle bend near base, indistinct minute proximal ventral spines (not shown), and few transverse grooves or ridges near tip (Figure 70a,h). (Letters used to designate bristles of 2nd and 3rd endopodial joints explained in Kornicker (1985a:2).)

Maxilla (Figure 71a,e): Precoxale and coxale with dorsal fringe. Coxale with stout plumose dorsal bristle. Endite I broad spinous with 6 bristles (1 small, 3 claw-like, 2 long stout); endite II narrow with 5 bristles (3 slender spinous, 2 claw-like pectinate); endite III small with 3 bristles (1 or 2 claw-like). Basale with 2 slender spinous bristles (1 ventral). Exopodite represented by 2 stout plumose bristles with bases on slight rise, but without usual lobe. 1st endopodial joint with 1 spinous alpha-bristle and 1 spinous beta-bristle of similar length (joint folded in illustrated mounted limb of USNM 192930 and only stump of beta-bristle present). 2nd endopodial joint with 6 bristles (3 claw-like unringed pectinate, 3 shorter slender ringed spinous).

Fifth Limb: Endite I with 2 bristles; endite II with small triangular tooth and 2 bristles; endite III with small triangular tooth, 1 small unringed bristle (with 1 tooth) adjacent to triangular tooth, and 3 bristles (1 claw-like) (Figure 71d). 1st exopodial joint: with long fang-like tooth with 3–5 cusps (excluding tip of tooth) along distal inner edge (Figure 71b); anterior side of joint with 1 short bristle at midwidth of distal edge (Figure 71b); posterior side of joint with 1 proximal bristle near inner edge of fang-like tooth (Figure 71d). 2nd exopodial joint with 3 teeth along inner edge (Figure 71c): distal tooth fang-like with 6–9 small pointed cusps along inner margin (limbs of USNM 193931 with row of 6 cusps on posterior side and row of 2 or 3 on anterior side); middle tooth with 5 pointed cusps along inner edge (including tip of tooth); proximal tooth with 3 or 4 pointed cusps along inner edge (including tip of tooth) (Figure 71c); posterior side of joint with long spinous bristle at midwidth (Figure 71c). 3rd exopodial joint without inner lobe but with 1 spinous bristle in usual place

of inner lobe (this could be interpreted to be on 2nd joint), and 2 stout bristles (with abundant long proximal hairs and short distal spines) on outer lobe. 4th and 5th exopodial joints fused hirsute, with total of 4 spinous and pectinate bristles (1 claw-like) (Figure 71c).

Sixth Limb (Figure 69i): With 2 short plumose epipodial bristles. Endite I with 3 spinous bristles (2 short, 1 longer); endite II spinous, with 2 or 3 long spinous terminal bristles; endite III spinous, with 2 or 3 long spinous terminal bristles; endite IV spinous, with 2 long spinous terminal bristles. End joint spinous, with 10 bristles (posterior 3 plumose, remaining bristles with long proximal spines or hairs and short distal spines).

Seventh Limb (Figure 70c): Proximal group with 4 cylindrical bristles, 2 on each side with distal spines and 1 or 2 minute bells; terminal segment with 4 cylindrical bristles (longer than those of proximal group), 2 on each side with distal spines and 2 or 3 minute bells. Terminus with comb of about 17 alate teeth opposite 2 pegs (longest peg with marginal spines).

Furca (Figure 69j): Each lamella with 11 articulated claws; claws 1, 2, 4, 6 primary; most lateral teeth broken off primary claws of USNM 193930 except proximally and distally on claw 1, and proximally on claw 2 of left lamella; claw 1 with 3 large medial teeth in row; right lamella anterior to left by width of base of claw 1 and with few long spines along anterior edge; lamellae following claws with abundant long hairs.

Bellonci Organ (Figure 70d): Elongate with weak suture at proximal $\frac{1}{3}$; part distal to suture hirsute and tapers to point.

Eyes: Lateral eye small, with brown pigment but no ommatidia (Figure 70d,e). Medial eye larger than lateral eye, with brown pigment (Figure 70d,e).

Upper Lip (Figure 70e): Rounded with 2 minute anterior spines (no glandular processes observed).

Genitalia (Figure 69k): Small amber-colored oval on each side of body anterior to furca.

Anterior of Body (Figure 70e): 1 or 2 small rounded processes at midheight.

Posterior of Body (Figure 70f): Evenly rounded with spines ventral to midheight.

Y-Sclerite (Figure 70f): With ventral branch, and posterior end bent ventrally.

Eggs: Slope 1: holotype with 5 eggs in marsupium; USNM 193930 with 2 fairly large unextruded eggs on each side of body (Figure 70f); USNM 193931 with 3 eggs in marsupium, length of typical egg 0.35 mm; unnumbered paratype with 6 eggs in marsupium.

DESCRIPTION OF A-1 MALE (Figure 71f-h).—Carapace similar in shape and ornamentation to that of adult female. Infold not examined.

Carapace Size (length, height in mm): USNM 193932 (valves slightly distorted) 1.33, 0.84.

First Antenna: Joints with same number of bristles as on

adult female. 7th joint: b-bristle distinct, ringed, about same length as a-bristle, with 3 filaments (1 small at midlength, 1 small at distal $\frac{3}{4}$, and 1 minute subterminal).

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 71f): 1st joint with 4 or 5 short ventral bristles (3 or 4 proximal, 1 distal); 2nd joint elongate with 3 (1 long, 2 short) spinous ventral bristles; 3rd joint elongate with 1 slender dorsal bristle at $\frac{1}{4}$ length and 2 short terminal bristles. Exopodite: 1st joint with minute terminal tubular medial bristle; bristles of joints 2-8 short bare; 9th joint with 6 bare bristles (3 short stout, 1 short slender, 2 minute); joints 2-8 with row of minute spines along distal edge.

Mandible: Coxale and basale similar to that of adult female. 1st endopodial joint: only 2 long bristles observed on or near ventral margin (2 small bristles present on adult female not observed, possibly obscured). 2nd endopodial joint: dorsal margin with 4 or 5 bristles; joint otherwise similar to that of adult female. 3rd endopodial joint: ventral pointed b-bristle with 4 proximal ventral teeth; joint otherwise similar to that of adult female.

Maxilla: Similar to that of adult female.

Fifth Limb: Epipodite with 46 bristles. Limb similar to that of adult female.

Sixth Limb: With 2 epipodial bristles. Endites I, II, and IV with 2 bristles; endite III with 3 bristles. End joint with 7 bristles.

Seventh Limb: Distribution of bristles similar to those of adult female but bristles tapered (juvenile character); all bristles with distal spines; proximal bristles with 1 or 2 bells, terminal bristles with 2 bells. Terminal comb with 11 teeth opposite 2 elongate curved pegs (inner peg longer spinous).

Furca: Each lamella with 10 claws; claws 1, 2, 4, and 6 primary claws.

Bellonci Organ: Similar to that of adult male but without suture.

Eyes: Medial eye similar to that of adult female. Lateral eye about same size as medial eye, about twice size of lateral eye of adult female, with black pigment and many small cells, but no ommatidia apparent (Figure 71g,h).

SARSIELLIDAE Brady and Norman, 1896

The Sarsiellidae include the two subfamilies Sarsiellinae and Dantyninae, both are represented in the collection.

SARSIELLINAE Brady and Norman, 1896

The Sarsiellinae are represented in the collection by seven genera: *Eusarsiella*, *Chelicopia*, *Cymbicopia*, *Neomuelleriella*, *Parasarsiella*, *Spinacopia*, and an undescribed genus, but only *Chelicopia*, *Eusarsiella*, and *Parasarsiella* are described herein.

Eusarsiella Cohen and Kornicker, 1975

TYPE SPECIES.—*Sarsiella tumida* Scott, 1905, by subsequent designation in Cohen and Kornicker (1975, table 1).

COMPOSITION.—Poulsen (1965:89) described *E. magna* Poulsen from off SE Australia at a depth of 70–100 m, and Hall (1987:738–760) described five species (*E. claviformis* (Hall),

E. serrata (Hall), *E. springthorpei* (Hall), *E. reticulata* (Hall), and *E. asciformis* (Hall)) from shallow water (0–4.5 m) in the vicinity of Lizard Island, Australia. Four new species are described herein from depths of 204–720 m.

DISTRIBUTION.—Cosmopolitan between latitudes of about 63°N and 37°S. Known depth range is intertidal to 1120 m (Kornicker, 1986:41).

Key to Species of *Eusarsiella* in Collection

(Adult females)

1. Carapace longer than 2 mm *E. fallomagna*, new species
Carapace shorter than 1.8 mm 2
2. Carapace with divided bristles on lateral surface *E. iayx*, new species
Carapace with undivided bristles on lateral surface 3
3. Posterodorsal bulge with 2 subparallel ribs at midheight . . . *E. edax*, new species
Posterodorsal bulge without 2 subparallel ribs at midheight . . *E. bex*, new species

Eusarsiella bex, new species

FIGURES 72–75

ETYMOLOGY.—From the Greek *bex* (cough).

HOLOTYPE.—Ovigerous female with body separated from shell in alcohol (with 2 eggs, 1 female chonistomatid copepod and 6 chonistomatid ovisacs that were in marsupium) 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 2: 5 adult females including 4 ovigerous, all in alcohol. Slope 19: 4 ovigerous females + 2 adult females in alcohol. Slope 46: USNM 193867, ovigerous female + 2 adult females in alcohol; USNM 193866, ovigerous female on slide and in alcohol; unnumbered, ovigerous female in alcohol. Slope 56, 2 ovigerous females in alcohol.

NONTYPES.—Slope 56: USNM 193947, 1 adult male on slide and in alcohol.

DISTRIBUTION.—Slope 2: 503 m. Slope 19: 520 m. Slope 46, 720 m. Slope 56, 429 m. Known depth range 429–720 m.

DESCRIPTION OF ADULT FEMALE (Figures 72–74).—Carapace round in lateral view and with long slender posteroventral caudal process and posterodorsal bulge appearing fairly flat in lateral view in transmitted light and slightly convex in dorsal view (Figure 74*b,d*); posterior end of bulge with very small posterior projection on some specimens (Figure 74*b,d*); dorsal and ventral edges of bulge well defined, rib-like on some specimens, forming right angle with apex at posterior end of bulge (Figures 72*a,b*, 74*a*).

Ornamentation: Long bristle just medial to tip of posterodorsal bulge (Figures 72*b*, 74*b,d*). Surface of valves with widely separated dish-like shallow fossae on most specimens (Figure 72*b*), and closely spaced minute spines along shell

edges (Figure 72*c,e*). Long undivided bristles very sparsely distributed on lateral surface of valves, more abundant along anterior and ventral margins, most with broad triangular base (Figure 72*c*). Minute processes observed on inner side of posterodorsal edge of left valve of USNM 193866; pore canals lead from processes to inside of valve (Figure 72*d,f*). Outer surface of valves without gel-like coating.

Infold: Anterior infold with small bristle near inner margin (Figure 72*c*). Infold anterior to caudal process with several minute bristles near inner edge (Figure 72*d,e*); infold of caudal process with 3–5 small proximal bristles and 2 small distal bristles (Figure 72*d,e*); infold dorsal to caudal process with 2 setal bristles (Figure 72*d*).

Central Adductor Muscle Attachments (Figure 72*b*): Comprising about 16 individual ovoid attachments.

Carapace Size (mm): Slope 19: length and height 1.60, 1.48. Slope 46: holotype, length and height 1.57, 1.42; USNM 193866, length without caudal process 1.49, length with caudal process 1.56, height 1.45; USNM 193867 (2 specimens), length without caudal process 1.49, length with caudal process 1.51, height 1.45; length and height 1.47, 1.35. Slope 56 (3 specimens): length 1.64, height without caudal process 1.47, height with caudal process 1.60; length and height 1.58, 1.46; length 1.52, height with caudal process 1.39, height without caudal process 1.32. Length range without caudal process 1.47–1.64. (If a measurement is given above not mentioning caudal process, the caudal process did not extend past valve edge measured.) (Note that in some specimens caudal process extends past valve edge posteriorly and in others ventrally.)

First Antenna (Figure 72*g,h*): 1st joint long, bare. 2nd joint with few dorsal spines and spinous dorsal bristle. 3rd and 4th joints fused; 3rd joint with long dorsal bristle and ventral bristle about half as long, both with few indistinct hairs. 4th

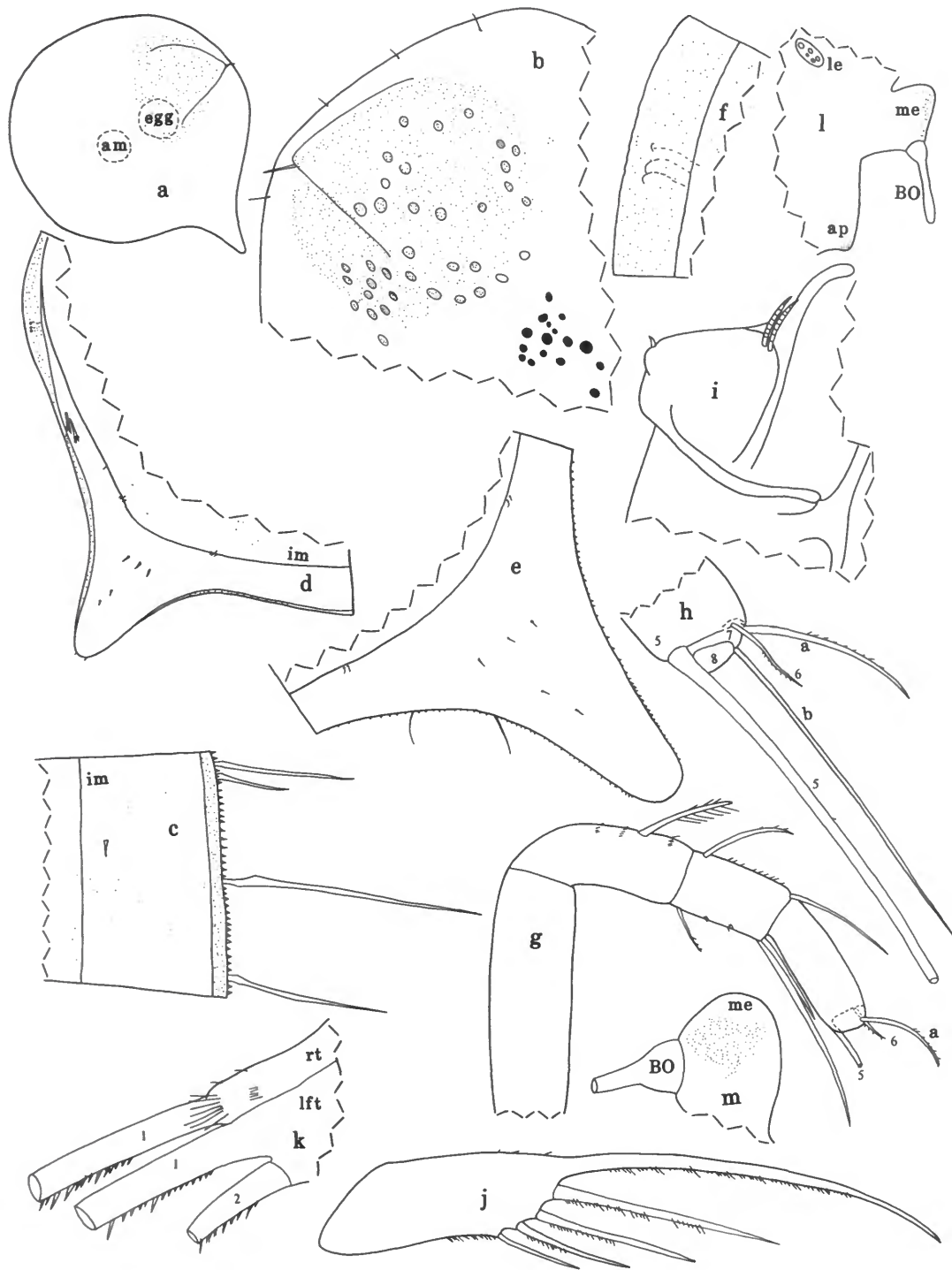


FIGURE 72.—*Eusarsiella bex*, new species, ovigerous female, paratype, USNM 193866: *a*, complete specimen from left side, length without caudal process 1.49 mm, ov (bulge stippled); *b*, posterodorsal corner, right valve, ov (bulge stippled; fossae represented by open circles; central adductor muscle attachments represented by filled-in circles); *c*, anterior, left valve near midheight, iv (not all marginal bristles shown); *d*, posterior, left valve, iv; *e*, caudal process, right valve, iv; *f*, 3 processes and pore canals (dashed) on inner posterior edge, left valve, iv (detail from *d*); *g*, right 1st antenna, lv (not all bristles shown); *h*, tip of left 1st antenna, mv (not all bristles shown); *i*, endopodite and part of protopodite, right 2nd antenna, mv; *j*, right lamella of furca; *k*, furca (proximal parts of claws 1 and 2 of left lamella and claw 1 or right lamella); *l*, dorsal part of anterior of body from right side, anterior to right; *m*, medial eye and proximal part of Bellonci organ from left side, anterior to left (area of brown pigment stippled).

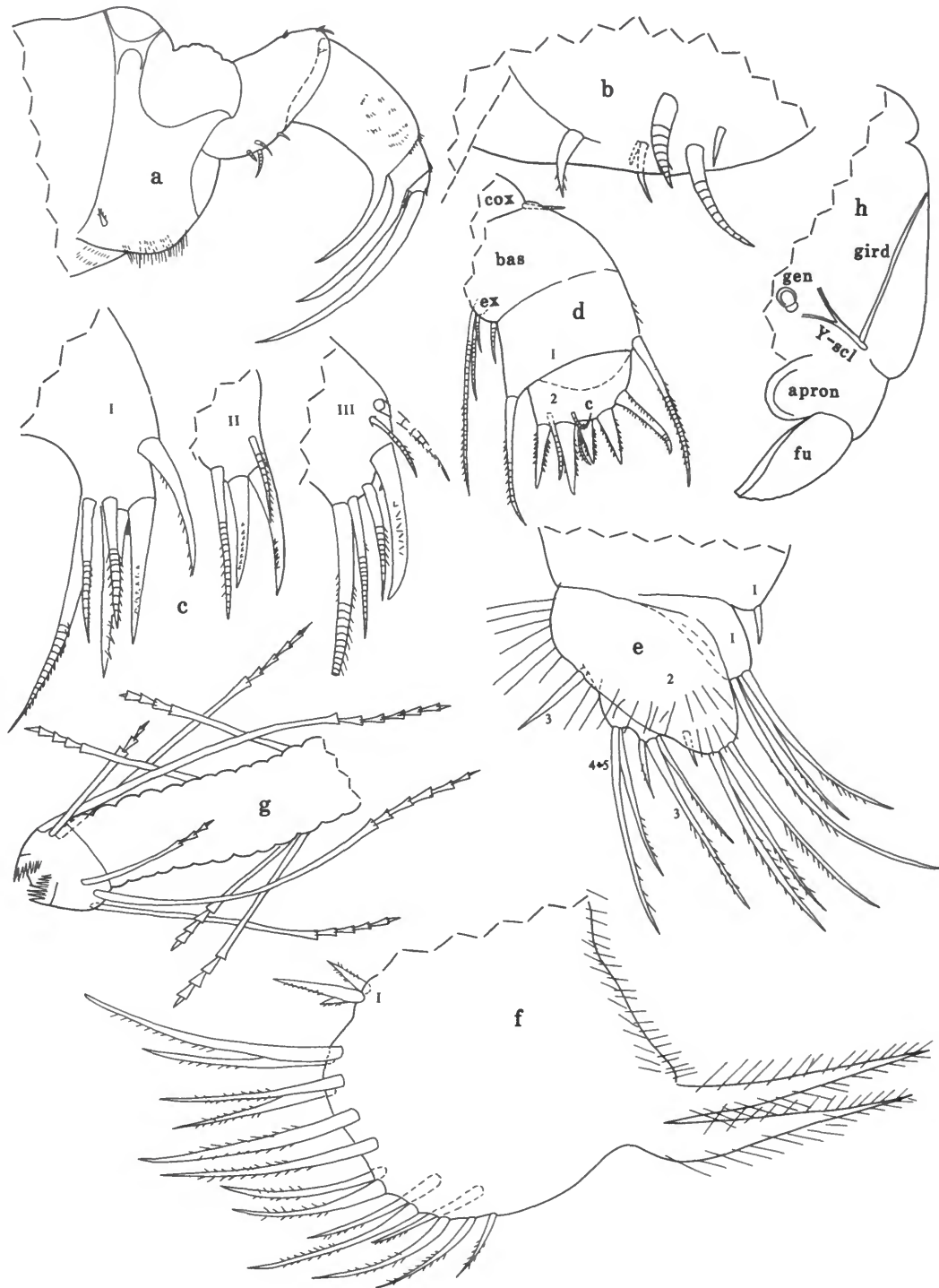


FIGURE 73.—*Eusarsiella bex*, new species, ovigerous female, paratype, USNM 193866: a, left mandible, mv; b, ventral part of basale, right mandible, mv, anterior to left; c, endites, left maxilla, mv; d, left maxilla, mv (endites not shown); e, 5th limb; f, left 6th limb, lv; g, 7th limb; h, posterior of body from left side, anterior to left.

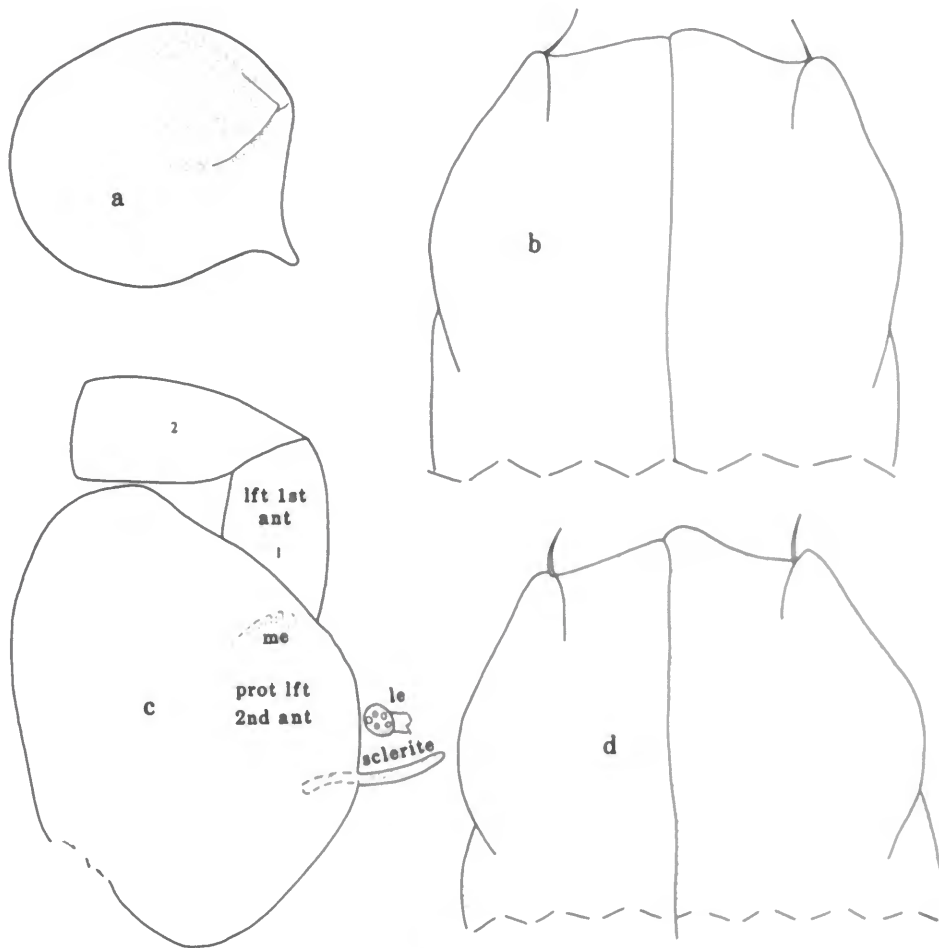


FIGURE 74.—*Eusarsiella bex*, new species, ovigerous female, holotype: *a*, complete specimen from left side, length without caudal process 1.57 mm ov (bulge stippled); *b*, dorsal view of posterior end of complete specimen, anterior to bottom, ov; *c*, dorsal part of anterior of body from left side, anterior to left. Ovigerous female, paratype, USNM 193867; *d*, dorsal view of posterior of complete specimen, anterior to bottom.

joint with numerous minute dorsal spines, 2 rows of indistinct ventral spines and 3 or 4 bare bristles (2 or 3 ventral, 1 dorsal). Sensory bristle of 5th joint with 1 minute filament at about $\frac{1}{3}$ length (Figure 72*h*). 6th joint fused to 5th, with small spinous medial bristle near dorsal margin. 7th joint (Figure 72*h*): a-bristle about twice length of bristle of 6th joint, with short marginal spines; b-bristle slender, bare, about twice length of a-bristle; c-bristle slightly shorter than sensory bristle of 5th joint, with minute filament at about $\frac{1}{3}$ length. 8th joint: d- and e-bristles slightly shorter than c-bristle, and d-bristle slightly longer than e-bristle, both bare with blunt tips; f- and g-bristles same length as sensory bristle of 5th joint, with minute filament at $\frac{1}{3}$ to $\frac{1}{2}$ length. Sensory bristle of 5th joint and b-, c-, f-, and g-bristles with minute filament at tip.

Second Antenna: Protopodite bare (Figures 72*i*, 74*c*). Endopodite with 2 slender bare proximal bristles and 1 minute unringed bristle on a small terminal node (Figure 72*i*). Exopodite: 1st joint with small terminal medial recurved tubular bristle; bristle of 2nd joint with slender proximal ventral spines and distal natatory hairs; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 2 bristles (1 short dorsal, bare or with few short hairs, 1 long ventral with natatory hairs).

Mandible (Figure 73*a,b*): Coxale endite single stout pectinate; ventral margin of coxale with long slender spines; longer and slenderer spines on lateral side near ventral margin. Basale (Figure 73*a,b*): ventral margin with 4–6 short bristles; dorsal margin with small bristle at midlength and 2 terminal;

lateral surface with minute bristle on distal edge near dorsal margin (?exopodite) (dashed in Figure 73a). 1st endopodial joint with medial spines and spines on distal dorsal corner; ventral claw slender. 2nd endopodial joint with minute indistinct bristle on dorsal margin; ventral claw slender. 3rd endopodial joint with slender terminal claw and 3 minute bristles (2 ventral, 1 dorsal).

Maxilla: Precoxae with dorsal hairs. Coxale with short bare dorsal bristle (Figure 73d). Endite 1 with 3 pectinate unringed claws and 3 ringed bristles with spines or minute teeth; endite 11 with 2 pectinate unringed claws and 2 ringed bristles with short spines; endite 111 with 1 pectinate unringed claw and 5 ringed bristles with marginal spines (Figure 73c). Basale with short bare bristle near exopodite (Figure 73d). Exopodite with 3 bristles (1 long spinous, 2 shorter bare (one $1/2$ and other $1/4$ length of long bristle)). 1st endopodial joint with spinous alpha- and beta-bristles. 2nd endopodial joint with 2 lateral spinous a-bristles, 1 medial spinous c-bristle, and 5 pectinate end bristles (middle bristle shorter, anterior bristle ringed distally, other stout unringed claw-like).

Fifth Limb (Figure 73e): Epipodite with 38 plumose bristles. Single endite with small bare bristle. Exopodite: 1st joint with 3 bristles; 2nd joint hirsute, with 4 bristles (1 small); joints 3–5 fused, with total of 6 bristles (1 small); joints 3–5 could be interpreted as having 1 bristle on outer lobe of 3rd joint and 3 bristles on inner lobe, and 4th plus 5th joints with 2 bristles. (Rings of bristles not shown.)

Sixth limb (Figure 73f): Single endite with 3 bristles (2 medial, 1 longer terminal). End joint with 14 bristles followed by space and 2 long plumose bristles; posterior edge and medial and lateral sides near edge hirsute (not all shown). (Rings of bristles not shown.)

Seventh Limb (Figure 73g): Proximal group with 4 or 5 bristles (2 or 3 on each side), each with 4 bells; terminal group with 6 bristles (3 on each side), each with 2–6 bells. Terminus with opposing combs, each with about 13 alate teeth.

Furca: Each lamella with 5 claws (Figure 72j); claw 1 nonarticulated; claws with long and short teeth along posterior edges; right lamella anterior to left by width of base of claw 1, with row of long hairs just proximal to base of claw 1 and with few indistinct spines along leading edge (Figure 72k); each lamella with numerous spines along margin following claws.

Bellonci Organ (Figure 72l,m): Broad proximal part tapering to cylinder with broadly rounded tip.

Eyes: Medial eye bare with scattered brown pigment (Figure 72l,m). Lateral eye smaller than medial eye, with 5 or 6 minute amber-colored cells; small amount of brown pigment in lateral eye of holotype (Figure 74c) and specimen from Slope 56, but not in eye of USNM 193866 (Figure 72l); eye visible through shell of 2 specimens from Slope 56.

Upper Lip: Not examined.

Genitalia (Figure 73h): Small sclerotized ring with attached spermatophore on each side of body anterior to furca of USNM 193866.

Anterior of Body (Figure 72l): With small rounded anterior process between medial eye and upper lip.

Posterior of Body (Figure 73h): Bare.

Y-Sclerite (Figure 73h): Typical for genus.

Number of eggs: Holotype with 2 eggs in marsupium (also 1 female choniostomatid copepod and 6 choniostomatid ovisacs); length of typical egg 0.30 mm; USNM 193866 with 3 eggs in marsupium (1 egg shown inside shell in Figure 72a); length of typical egg 0.29 mm. USNM 193867 and unnumbered specimen from Slope 46 with 5 eggs in marsupium. Specimen from Slope 56 with 6 eggs in marsupium; length of typical egg 0.23 mm.

Parasites: Holotype with 1 female choniostomatid copepod and 6 choniostomatid ovisacs in marsupium; range of lengths of 3 choniostomatid ovisacs: 0.30–0.33 mm.

Epizoa: Ovipigerous female from slope 56 with small foraminifera cemented to outer surface of right valve near caudal process.

DESCRIPTION OF ADULT MALE (Figure 75).—Carapace more elongate than that of female; anteroventral edge oblique in lateral view (edge of valve shown dashed in Figure 75a). Outer surface without jell-like coating.

Ornamentation: Broad flange-like lateral overhang extending past valve edge; flange broadest along anterior and ventral margins and absent in vicinity of incisur (Figure 75a); small lateral posterodorsal process extending past valve edge. Narrow low horizontal rib present in vicinity of central adductor muscle attachments. Long bristles (some with broad bases) along edge of valve and on inner side of marginal flange as well as sparsely distributed on valve surface (some bristles shown in Figure 75a).

Infold: Small bristle at inner edge of anteroventral infold posterior to incisur; infold of caudal process with 5 or 6 minute bristles (similar to pattern in female); 2 setal bristles on posterior infold dorsal to caudal process; posterior edge of caudal process with 4 minute bristles (Figure 75a).

Carapace Size (length (including caudal process), height in mm): USNM 193947, 1.44, 1.01.

First Antenna (Figure 75b,c): 1st joint bare. 2nd joint with dorsal bristle with long stout proximal and short slender distal spines. 3rd and 4th joints fused; 3rd joint with 2 bristles (1 short ventral, 1 longer dorsal); 4th joint with 3 bristles (2 long slender ventral, 1 shorter, stouter, dorsal). 5th joint wedged ventrally between 4th and 6th joints; sensory bristle long with 4 short distal filaments, bifurcate tip, and proximal cup with abundant thin filaments (filaments not shown). Medial bristle of 6th joint short with few widely spaced spines. 7th joint: a-bristle about twice length of bristle of 6th joint, with short spines; b-bristle long, with small distal filament and terminal spine; c-bristle reaching slightly past sensory bristle of 5th joint, with 1 small proximal filament, 4 small distal filaments, and bifurcate tip. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle about same length as e-bristle, with 1 small proximal filament, 3 small distal filaments, and bifurcate tip;

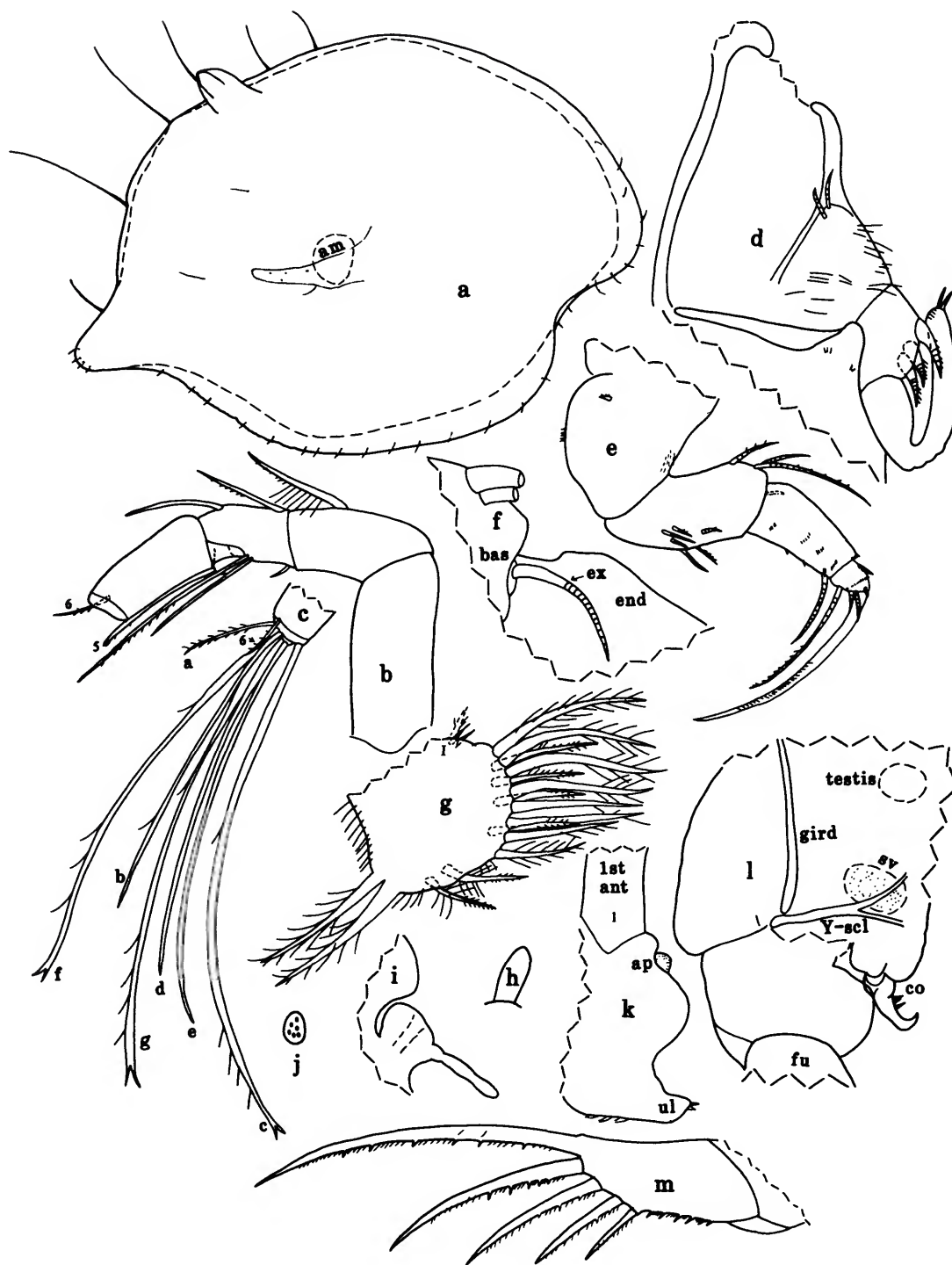


FIGURE 75.—*Eusarsiella bex*, new species, adult male, nontype, USNM 193947: *a*, complete specimen from right side, length including caudal process 1.44 mm; *b*, part of left 1st antenna, lv (not all bristles shown); *c*, tip of right 1st antenna, mv; *d*, endopodite and part of protopodite, left 2nd antenna, mv; *e*, left mandible, mv; *f*, part of right mandible, lv; *g*, right 6th limb, lv; *h*, right 7th limb, lv; *i*, medial eye and Bellonci organ from right side; *j*, left lateral eye; *k*, *l*, anterior and posterior of body, respectively, from right side, anterior to right; *m*, left lamella of furca.

g-bristle longer than f-bristle, with 1 small proximal filament, 4 small distal filaments, and bifurcate tip. Each branch of bifurcate tips of bristles on 7th and 8th joints with minute terminal spine (not shown).

Second Antenna: Protopodite with few minute medial spines near endopodite. Endopodite 3-jointed (Figure 75d): 1st joint with 2 small proximal bristles and long medial spines; 2nd joint with 3 spinous ventral bristles; 3rd joint elongate, reflexed, with 2 small bristles and several ridges at tip. Exopodite: 1st joint with small, curved, tubular, medial, terminal bristle; bristle of 2nd joint long with slender proximal ventral spines and distal natatory hairs; bristles of joints 3–8 long, with natatory hairs, no spines; 9th joint with 2 bristles (1 long with natatory hairs, 1 short, dorsal, with slender marginal spines); joints 2–8 with few minute indistinct spines along distal edges.

Mandible (Figure 75e,f): Coxale endite represented by small stout spine-like bristle with few marginal spines (Figure 75e); coxale with hairs along ventral margin and long distal lateral spines near dorsal margin. Basale with 5 or 6 ringed bristles near ventral margin (4 medial, 1 or 2 ventral or lateral), and 3 ringed dorsal bristles; lateral side with few rows of minute spines. Exopodite represented by small node with single ringed bristle (Figure 75f). 1st endopodial joint: ventral margin with marginal spines and 1 long ringed terminal bristle; medial surface with minute spine-like bristle near terminal ventral bristle and rows of indistinct minute spines; dorsal margin with row of minute terminal spines. 2nd endopodial joint: ventral margin with long, ringed, terminal bristle with indistinct distal spines; dorsal margin with row of minute, dorsal, terminal spines, and 1 small spine-like bristle (with base on lateral side) at midlength. 3rd endopodial joint with stout terminal claw with indistinct spines; medial side of joint with 2 small ringed bristles near ventral margin and 1 smaller spine-like bristle near dorsal margin.

Maxilla and Fifth Limb: Reduced, not examined in detail. Epipodite of 5th limb with 31 bristles.

Sixth Limb (Figure 75g): Single endite with 3 bristles (2 short medial, 1 longer terminal). End joint with 14 bristles followed by space and 2 long plumose bristles; posterior edge and medial and lateral surfaces near edge hirsute; bristles along anterior part of end joint with more marginal hairs than those of adult female.

Seventh Limb (Figure 75h): Small bare.

Furca (Figure 75m), Bellonci Organ (Figure 75i): Similar to those of adult female.

Eyes: Medial eye unpigmented (Figure 75i). Lateral eye minute with about 6 cells (Figure 75j). (Figure 75i and j are drawn at same magnification.)

Upper Lip (Figure 75k): With anterior projection with 2 spines.

Genitalia (Figure 75l): Copulatory organ on each side of body with hook-like terminal process on lobe; organ not examined in detail.

Anterior of Body (Figure 75k), Posterior of Body (Figure 75l), Y-Sclerite (Figure 75l): Similar to those of adult female.

Remarks: The male from Slope 56 is not identified as *E. bex* with a high degree of certainty, and therefore, is considered a non-type. Two additional males from Slope 56 are identified herein as *E. edax*.

COMPARISONS.—The carapace of the female *E. bex* strongly resembles that of *E. vema* Kornicker, 1986:154, but is larger (length 1.45–1.64 mm for *E. bex* and 1.27–1.28 mm for *E. vema*). Also, the 3rd joint of the 1st antenna of *E. bex* bears a fairly long ventral bristle which is absent on *E. vema*, and the 1st exopodial joint of the 5th limb bears 3 bristles on *E. bex* and only 2 on *E. vema*. The 7th limb of *E. bex* bears 10 bristles compared to 8 on *E. vema*, and the lateral eye is larger on *E. vema*. The carapace of *E. bex* resembles that of *E. magna* Poulsen, 1965:89, which had been collected off SE Australia at a depth of 70–100 m, but the posterodorsal bulge of *E. magna*, according to the drawing of the shell by Poulsen (1965, fig. 25a), does not have the intersecting ribs present on *E. bex* (Figure???) and *E. magna* is larger (length 2.2 mm). The 7th limb of *E. magna* has 20 bristles compared to only 10 or 11 for *E. bex*.

Eusarsiella fallomagna, new species

FIGURES 76–78

ETYMOLOGY.—From the Latin *fallo* (lie, deceive) plus the Latin *magnus* (large, great). So named because of the similarity of the species to *E. magna* Poulsen, 1965.

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 193944, adult female on slide and in alcohol; 2 undissected ovigerous females in alcohol (1 with bryozoan on shell). Slope 40: USNM 193989, 1 partly dissected adult nonovigerous female in alcohol; 1 undissected adult female in alcohol. Slope 56: 7 adult females (6 ovigerous) in alcohol.

DISTRIBUTION.—Slope 1, 204 m. Slope 40, 400 m. Slope 56, 429 m.

DESCRIPTION OF ADULT FEMALE (Figures 76–78).—Carapace round in lateral view with ovoid posterodorsal processes large in some specimens (Figures 76a, 78c,d, and smaller in others (Figure 78f), and a paratype from slope 1 with bulge only on right valve (Figure 78e); posteroventral caudal process with rounded tip (Figure 76d,e). Some specimens with many large secondary calcareous concretions.

Ornamentation: Surface with widely separated oval fossae with short stout spines (Figure 76b) and minute spines between fossae (Figure 76c,e). Short and long undivided bristles, some with broad bases, very sparsely distributed on lateral surface

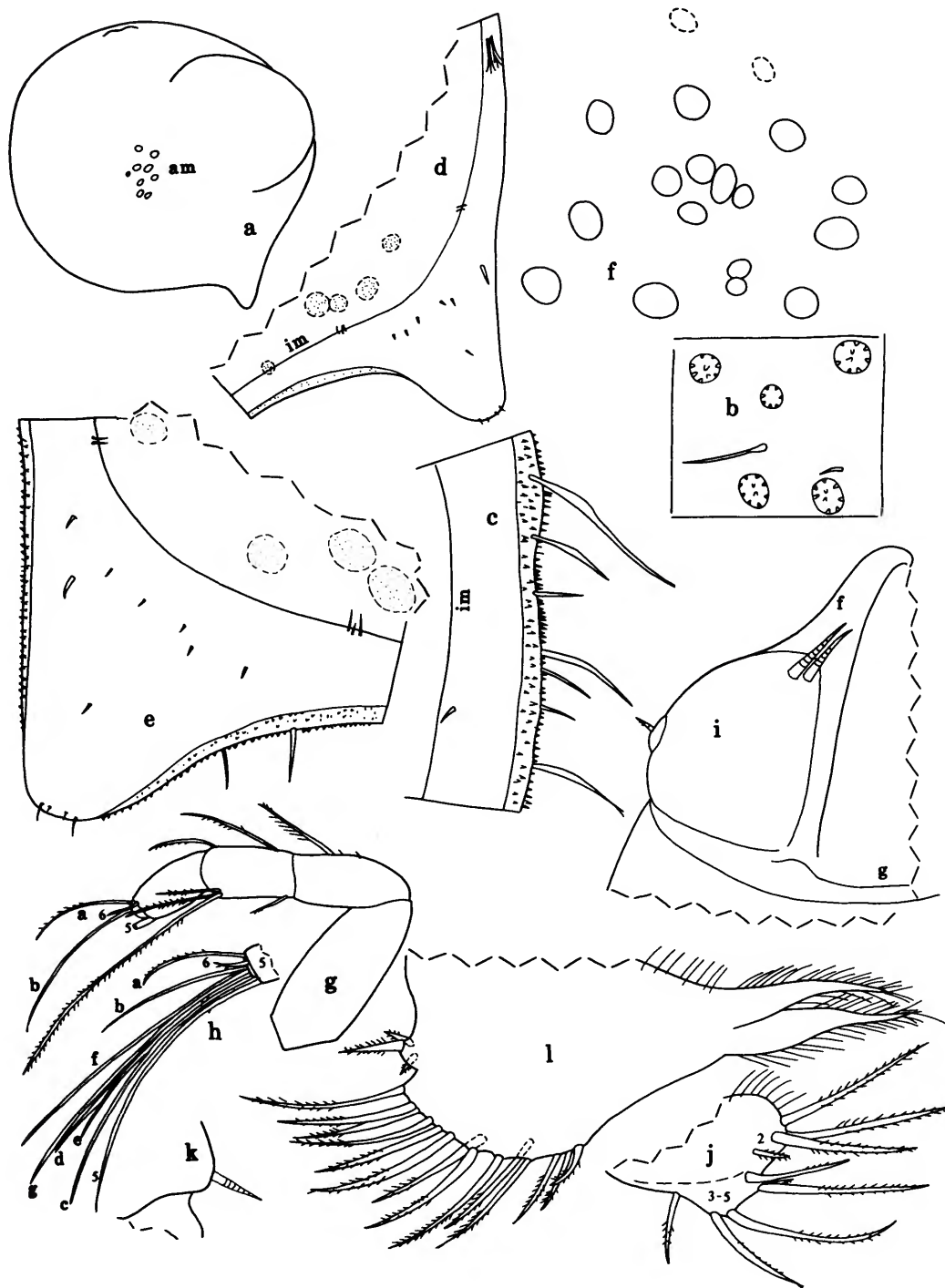


FIGURE 76.—*Eusarsiella fallomagna*, new species, adult female, paratype, USNM 193944: *a*, complete specimen from left side, length including caudal process 2.3 mm (not all central adductor muscle attachments shown); *b*, representative fossae and bristles (minute spines between fossae not shown); *c*, anterior of left valve near midlength, iv; *d*, posterior, right valve, iv; *e*, caudal process, left valve, iv; *f*, central adductor muscle attachments, left valve, anterior to left; *g*, right 1st antenna, mv (not all bristles shown); *h*, tip of right 1st antenna, mv; *i*, endopodite and part of protopodite, right 2nd antenna, mv; *j*, 5th limb; *k*, endite, 5th limb; *l*, left 6th limb, lv.

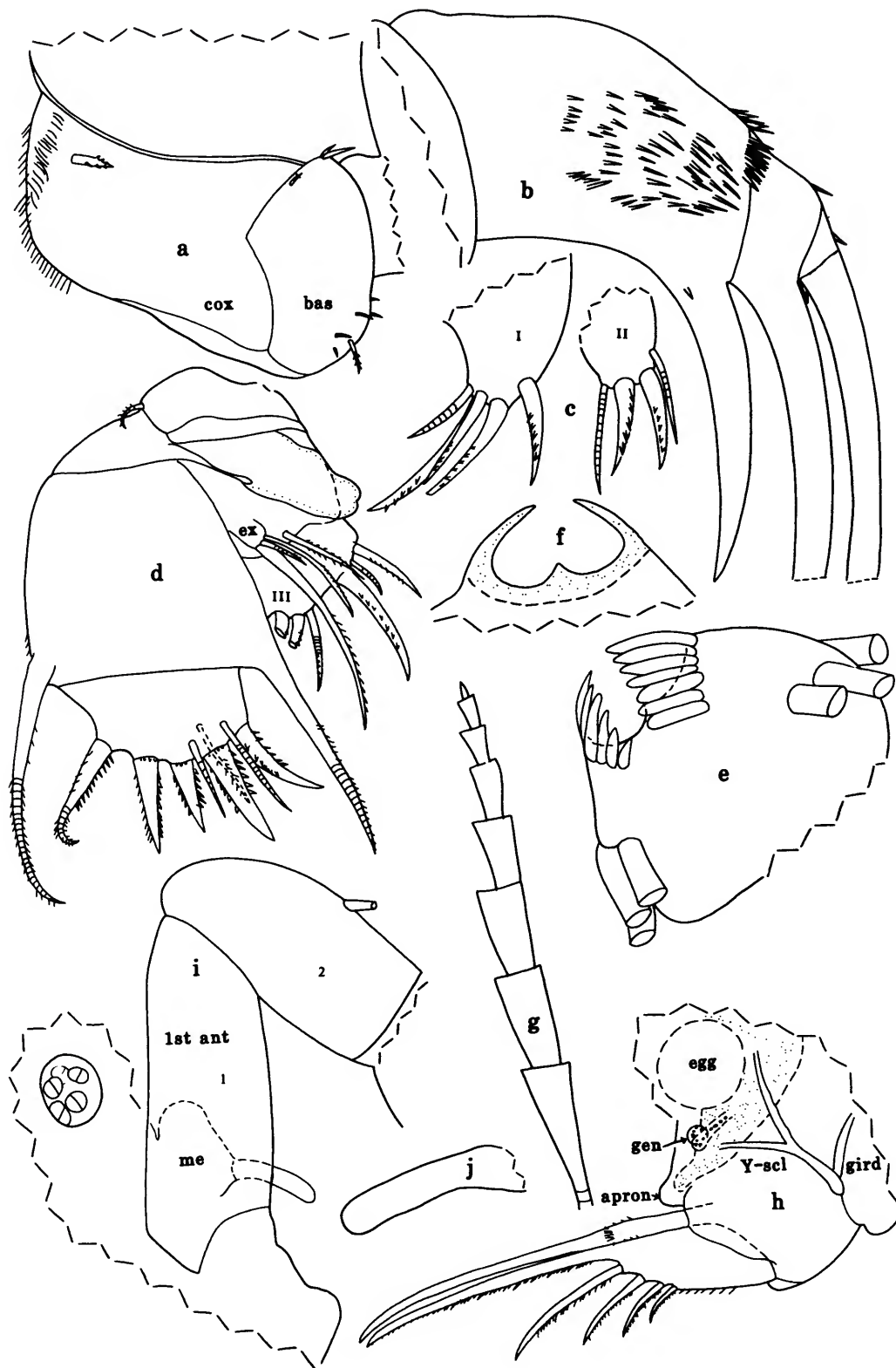


FIGURE 77.—*Eusarsiella fallomagna*, new species, adult female, paratype, USNM 193944: *a*, coxale and basale, left mandible, mv; *b*, endopodite, left mandible, mv; *c*, endites I and II, right maxilla, mv; *d*, left maxilla, lv; *e*, tip of 7th limb; *f*, detail from *e* showing only middle tooth of each comb; *g*, tip of bristle of 7th limb; *h*, posterior of body from left side, anterior to left (gut stippled; only claw 1 of right lamella shown); *i*, dorsal part of anterior of body from right side, anterior to right; *j*, Bellonci organ.

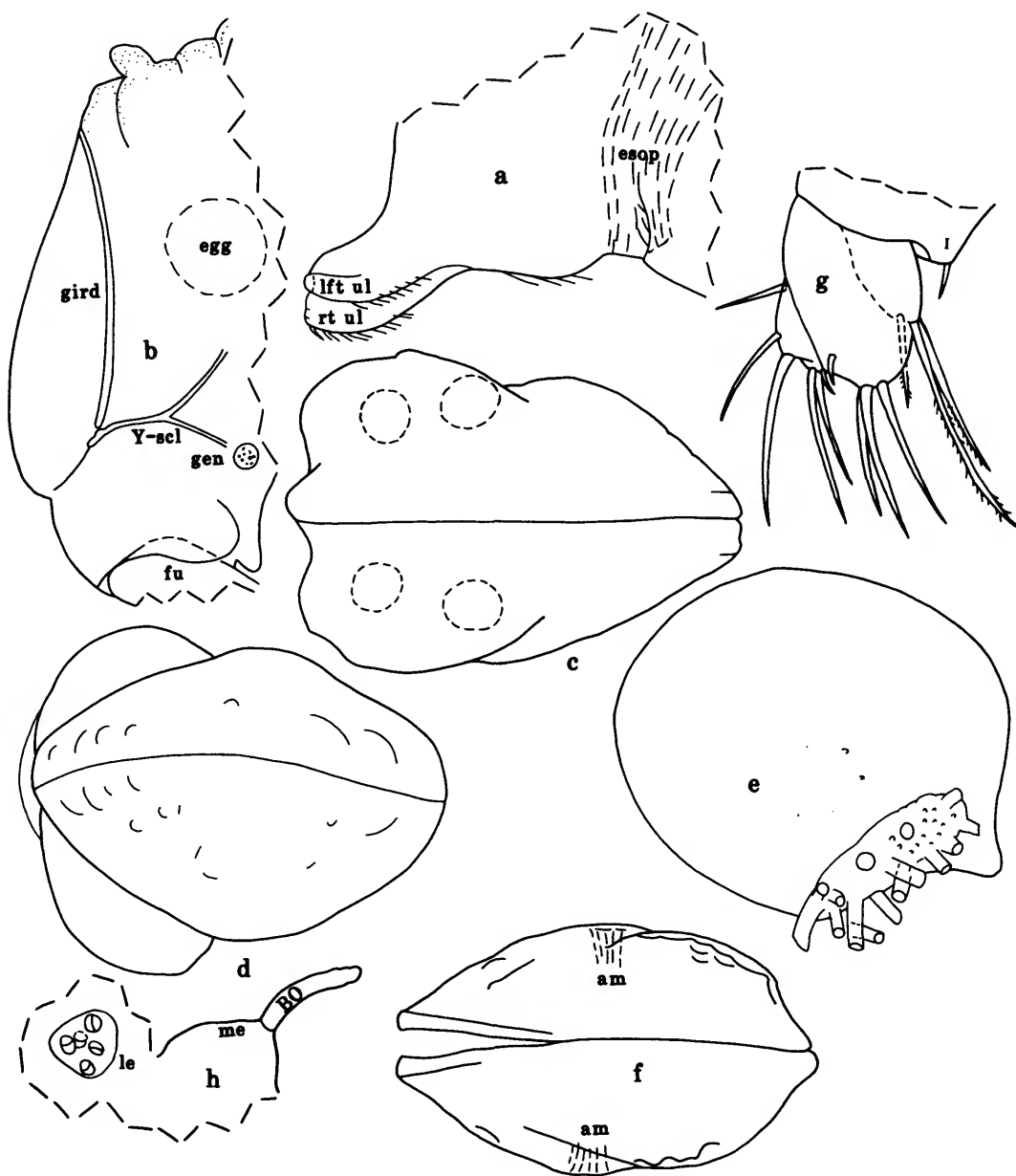


FIGURE 78.—*Eusarsiella fallomagna*, new species, adult female, paratype, USNM 193944: *a*, upper lip and esophagus, anterior to left; *b*, posterior of body from right side, anterior to right. Ovigerous female, holotype: *c*, dorsal view of complete specimen showing 4 eggs in marsupium, length 2.2 mm, anterior to right; *d*, anterior view of complete specimen, ventral to right (slightly oblique view). *e*, ovigerous female, paratype, complete specimen from left side with bryozoan attached to left valve, length including caudal process 2.2 mm. Adult female, paratype, USNM 193989: *f*, dorsal view of complete specimen, length including caudal process 2.53 mm, anterior to left; *g*, 5th limb; *h*, dorsal part of anterior of body.

but more abundant along anterior and ventral margins (Figure 76*c,e*). Outer surface without gel-like coating.

Infold: Anterior infold with minute bristle near inner margin (Figure 76*c*). Infold of caudal process with 7 or 8

bristles; few small bristles along inner margin of infold in vicinity of caudal process (Figure 76*d,e*). Posterior infold with 2 setal bristles at about midheight (Figure 76*d*); 4 darker unevenly spaced ovoid areas just anterior to infold of caudal

process (Figure 76d,e).

Central Adductor Muscle Attachments (Figure 76f): Comprising 18–20 ovoid attachments.

Carapace Size (length including caudal process, height in mm): Slope 1: holotype, 2.2, 2.1, width 1.6; USNM 193944, 2.3, 2.0; 2 unnumbered specimens: 2.1, 1.9; 2.2, 1.9 (specimen with bryozoan on shell). Slope 40, USNM 193989, 2.53, 2.10. Slope 56, unnumbered specimen, 2.38, 2.08. (Note considerable variation in size.)

First Antenna (Figure 76g,h): 1st joint bare. 2nd joint with few proximal dorsal spines and plumose dorsal bristle. 3rd joint fused to 4th, with ventral bristle about half length of dorsal bristle; 4th joint with 4 spinous bristles (3 ventral, 1 dorsal). Ventral bristle of 5th joint with 1 minute proximal filament and 1 terminal filament. 6th joint fused to 5th, with small spinous medial bristle. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with short marginal spines; b-bristle about $\frac{1}{3}$ longer than a-bristle, with pointed tip; c-bristle about same length as bristle of 5th joint, with minute terminal filament. 8th joint: d- and e-bristles shorter than c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with minute terminal filament; g-bristle same length as c-bristle, with 2 minute proximal filaments and minute terminal filament.

Second Antenna: Protopodite bare. Endopodite with 2 bare proximal bristles and 1 minute spinous terminal bristle (about $\frac{1}{3}$ length of proximal bristles) on small terminal node (Figure 76i). Exopodite: 1st joint with small, terminal, medial, straight, tubular bristle; bristles of joints 2–8 and long bristle of 9th joint with natatory hairs, no ventral spines; short bristle of 9th joint with slender hair-like spines; some joints with few minute spines along distal edges.

Mandible: Coxale endite single, stout, pectinate (Figure 77a); ventral margin of coxale with long slender spines. Basale: ventral margin with 6 short bristles; dorsal margin with small bristle near midlength and 2 terminal bristles (Figure 77a). 1st endopodial joint with medial spines, spines on distal dorsal corner, and stout ventral claw (Figure 77b). 2nd endopodial joint with minute dorsal bristle and stout ventral claw. 3rd endopodial joint with stout terminal claw and 2 or 3 small bristles (1 or 2 ventral, 1 dorsal).

Maxilla: Coxale with dorsal bristle with few short spines. Diaphanous lobe near coxale (edge of lobe stippled in Figure 77d). Endite I with 5 bristles (Figure 77c); endite II with 4 bristles (Figure 77c); endite III with 6 bristles (Figure 77d). Basale with spinous bristle near exopodite. Exopodite with 3 spinous bristles (1 short, 1 medium, 1 long). 1st endopodial joint with slender pectinate ringed alpha- and beta-bristles. 2nd endopodial joint with 2 slender ringed a-bristles, 1 slender ringed spinous c-bristle, and 5 pectinate end bristles (middle bristle shorter, anterior bristle ringed distally, others unringed claw-like).

Fifth Limb: Epipodite with 43 bristles. Single endite with 1 short bristle (Figures 76k, 78g). Exopodite (Figures 76j, 78g): 1st joint with 3 bristles; joints 2–5 fused: 2nd joint with 4 bristles; joints 3–5 with total of 6 bristles.

Sixth Limb (Figure 76l): Single endite with 3 short bristles. End joint with considerable posterior extension, 14 or 15 bristles (with short spines) followed by long space, then 2 broad bristles with abundant thin hairs; posterior margin hirsute.

Seventh Limb: USNM 193944: proximal group with 11 bristles (5 or 6 on each side), each bristle with 4 or 5 bells; terminal group with 6 bristles (3 on each side) (Figure 77e), each bristle with 4–7 bells (terminal bell minute; Figure 77g). Terminus with opposing combs, each with 11–13 teeth (24 total) (Figure 77e). Illustrated limb of USNM 193944 with small triangular process between combs (Figure 77e,f), but process not present on opposite limb. USNM 193989: proximal group with 14 or 15 bristles (6–8 on each side).

Furca (Figure 77h): Each lamella with 5 claws; claw 1 nonarticulated; all claws with long and short teeth along posterior edges and bare along anterior edges; claw 1 with row of transverse spines near base; minute spines on lamellae following claws; right lamella anterior to left by width of base of claw 1; anterior edges of lamellae with minute spines.

Bellonci Organ (Figures 77i,j, 78h): Short, cylindrical, with rounded tip.

Eyes (Figures 77i, 78h): Medial eye bare, unpigmented. Lateral eye smaller than medial eye, unpigmented with 5 (4 well developed lateral, 1 poorly developed medial) ommatidia.

Upper Lip (Figure 78a): With 2 elongate anterior projections.

Genitalia (Figures 77h, 78b): USNM 193944 with small sclerotized ring without spermatophore on each side of body anterior to furca.

Posterior of Body: Evenly rounded, bare; USNM 194944 with small unpaired process near posterodorsal corner (Figure 78b) (not present on USNM 193989).

Y-Sclerite (Figures 77h, 78b): Typical for genus.

Number of Eggs: Holotype with 9 eggs in marsupium; lengths of 2 eggs measured through shell 0.36 mm, 0.46 mm (outlines of 4 eggs shown in Figure 78c). USNM 193944 with about 7 unextruded eggs; length of largest egg 0.26 mm (1 egg shown in Figure 77h, another in Figure 78b).

Epizoa: Ovigerous female from Slope 1 with bryozoan (without soft parts) on left shell (Figure 78e) (identified as bryozoan by Alan H. Cheetham).

COMPARISONS.—Externally the carapace of *E. fallomagna* resembles *E. magna* Poulsen (1965, fig. 25a). Viewed internally the valves of both species have 4 dark ovoids anterior to the caudal process, but they are evenly spaced in *magna* and unevenly spaced in *fallomagna* (Figure 76d,e). Appendages of *E. fallomagna* also differ from *E. magna* in having a 1st antenna with no spines on the ventral margin of the 2nd joint, and an extremely long ventral bristle (about 3 times the length of the 5th joint) on the 4th joint, an endopodite of the 2nd antenna with a terminal node and proximal bristles much stouter than the terminal bristle, a mandible with numerous medial spines on the 1st endopodial joint, and terminal combs of the 7th limb with a total of about 24 teeth (40 on *E. magna*).

Eusarsiella edax, new species

FIGURES 79–81

ETYMOLOGY.—From the Latin *edax* (greedy, gluttonous).

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 22: 3 ovigerous females + 2 adult females + 1 juvenile, all in alcohol; Slope 40: USNM 193985, 1 ovigerous female on slide and in alcohol; 2 unnumbered ovigerous females in alcohol.

NONTYPES.—Slope 19: 1 juvenile in alcohol. Slope 40: USNM 193987, 1 adult male on slide and in alcohol. Slope 56: USNM 193994, 1 adult male in alcohol; 1 unnumbered adult male in alcohol.

DISTRIBUTION.—Slope 19, 520 m. Slope 22, 363 m. Slope 40, 400 m. Slope 56, 429 m. Known depth range 363–520 m.

DESCRIPTION OF ADULT FEMALE (Figures 79, 80).—Carapace oval in lateral view with elongate caudal process and globose posterodorsal bulge with triangular projection extending past posterodorsal edge of valve (Figures 79*a,b*, 80*i,j*).

Ornamentation: Two narrow subparallel ribs at midheight of posterodorsal projection, and indistinct horizontal rib in vicinity of central adductor muscle attachments (Figure 79*a*, 80*i*). Anterior and ventral edges of both valves as well as posterior edge of right valve with minute spines (Figure 79*c,d*). Anterior and ventral margins of valves with long and short bristles; most long bristles with broad section either proximal or at midlength; few bristles present on either lateral surface or along posterior margin. Outer surface without gel-like coating.

Infold: Anterior infold with small bristle near inner margin (Figure 79*c*). Infold anterior to caudal process with 10–14 small bristles (some taper gradually from base to tip, others with parallel edges on broad proximal half and slender tapered distal half), and 7 small bristles along inner margin (Figure 79*e*); infold dorsal to caudal process with 2 setal bristles, and 1 slender bare bristle on inner margin dorsal to setal bristles (Figure 79*f*).

Central Adductor Muscle Attachments (Figure 79*g*): Comprising about 22 ovoid attachments.

Carapace Size (mm): Slope 22: holotype, length with caudal process 1.71, height 1.55; 3 ovigerous females (length including caudal process, height): 1.81, 1.56; 1.88, 1.60; 1.83, 1.56. Slope 40: USNM 193985, length with caudal process 1.75, length without caudal process 1.67, height 1.50. Length range including caudal process 1.71–1.88.

First Antenna (Figure 79*h*): 1st joint long, bare. 2nd joint with few proximal dorsal spines, indistinct row of lateral hairs at distal edge near dorsal margin, and spinous dorsal bristle. 3rd joint fused to 4th, with long dorsal bristle and ventral bristle about half as long, both with indistinct hairs. 4th joint without dorsal hairs present on *E. bex*, with 4 bristles (1 dorsal, 3 ventral). Sensory bristle of 5th joint with 1 minute filament at

about $\frac{1}{3}$ length (tip of sensory bristle broken off). 6th joint fused to 5th, with small medial bristle near dorsal margin. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with indistinct marginal hairs; b-bristle slender, bare, about twice length of a-bristle (tip obscured); c-bristle probably about same length as sensory bristle of 5th joint (tip of sensory bristle broken off), with minute spine at about $\frac{2}{3}$ length. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with minute filament at $\frac{2}{3}$ length; g-bristle about same length as c-bristle, bare; c-, f- and g-bristles with minute filament at tip.

Second Antenna: Protopodite bare. Endopodite with 2 slender proximal bristles with indistinct spines and 1 minute unringed bristle (with few spines) on a small terminal node (Figure 79*i*). Exopodite: 1st joint with terminal, medial, recurved, tubular bristle; bristles of joints 2–8 with natatory hairs, no spines; 9th joint with 2 bristles (1 short (dorsal) and 1 long, both with natatory hairs; joints 2–7 with minute spines along part of distal margins.

Mandible (Figure 80*a-c*): Coxale endite single, stout, pectinate; ventral margin of coxale with long slender spines. Basale: ventral margin with 6 short bristles (some unringed); dorsal margin with small bristle at midlength and 2 terminal. Exopodite represented by minute bristle and process on lateral side of basale set back from dorsal edge (dashed in Figure 80*c*). 1st endopodial joint with medial spines and spines on distal dorsal corner; ventral claw with rounded tip and narrow proximal translucent flange along dorsal edge (flange with perpendicular lines, some projecting slightly at outer edge forming spines); dorsal margin of joint uneven (Figure 80*a*). 2nd endopodial joint with small distal bristle on dorsal margin, and ventral claw with rounded tip and narrow proximal translucent flanges along both ventral and dorsal margins. 3rd endopodial joint with terminal claw with rounded tip, and 3 small bristles (1 dorsal, 2 ventral); ventral edge of claw with few indistinct teeth near midlength.

Maxilla: Coxale with short dorsal bristle (not shown) and diaphanous thin flap with rounded tip (Figure 79*k*). Endites I, II, and III with 6, 4, and 6 bristles, respectively (Figure 79*j*). Basale with slender bare bristle near exopodite (Figure 79*k*). Exopodite with 3 ringed (rings not shown) bristles (1 long spinous, 2 shorter bare (one about $\frac{1}{2}$ and other about $\frac{1}{4}$ length of long bristle)). 1st endopodial joint with distal dorsal spines and spinous alpha- and beta-bristles. 2nd endopodial joint with 2 a-bristles, 1 c-bristle, and 5 pectinate end bristles (middle shorter, anterior ringed distally, others unringed claw-like).

Fifth Limb (Figure 79*l*): Single endite with small bare bristle. Exopodite: 1st joint with 3 bristles; 2nd joint hirsute, with 4 bristles (1 small), 3rd to 5th joints fused, with total of 6 bristles; joints 3–5 could be interpreted as having 1 bristle on outer lobe of 3rd joint and 3 bristles on inner lobe, and 4th plus 5th joints with 2 bristles.

Sixth Limb (Figure 79*m*): Single endite with 3 bristles (2 medial, 1 longer terminal). End joint with 15 spinous bristles



FIGURE 79.—*Eusarsiella edax*, new species, ovigerous female, paratype, USNM 193985: *a*, complete specimen from left side, length with caudal process 1.75 mm; *b*, dorsal view of complete specimen, anterior to left; *c*, anterior margin of left valve near midheight, *iv* (marginal bristles not shown); *d*, anterior margin just dorsal to infold bristle shown in *c*, *iv*; *e*, posterior of right valve, *iv*; *f*, setal bristles of posterior of right valve, *iv*; *g*, central adductor muscle attachments, right valve, *ov*, anterior to right; *h*, right 1st antenna, *lv* (not all bristles shown); *i*, endopodite and part of protopodite, right 2nd antenna, *mv*; *j*, endites, right maxilla, *mv* (not all spines or teeth shown on bristles); *k*, left maxilla, *lv* (not all endite bristles shown); *l*, 5th limb, *mv*; *m*, left 6th limb; *n*, medial eye and Bellonci organ (area of brown pigment stippled); *o*, left lateral eye (area of brown pigment stippled).

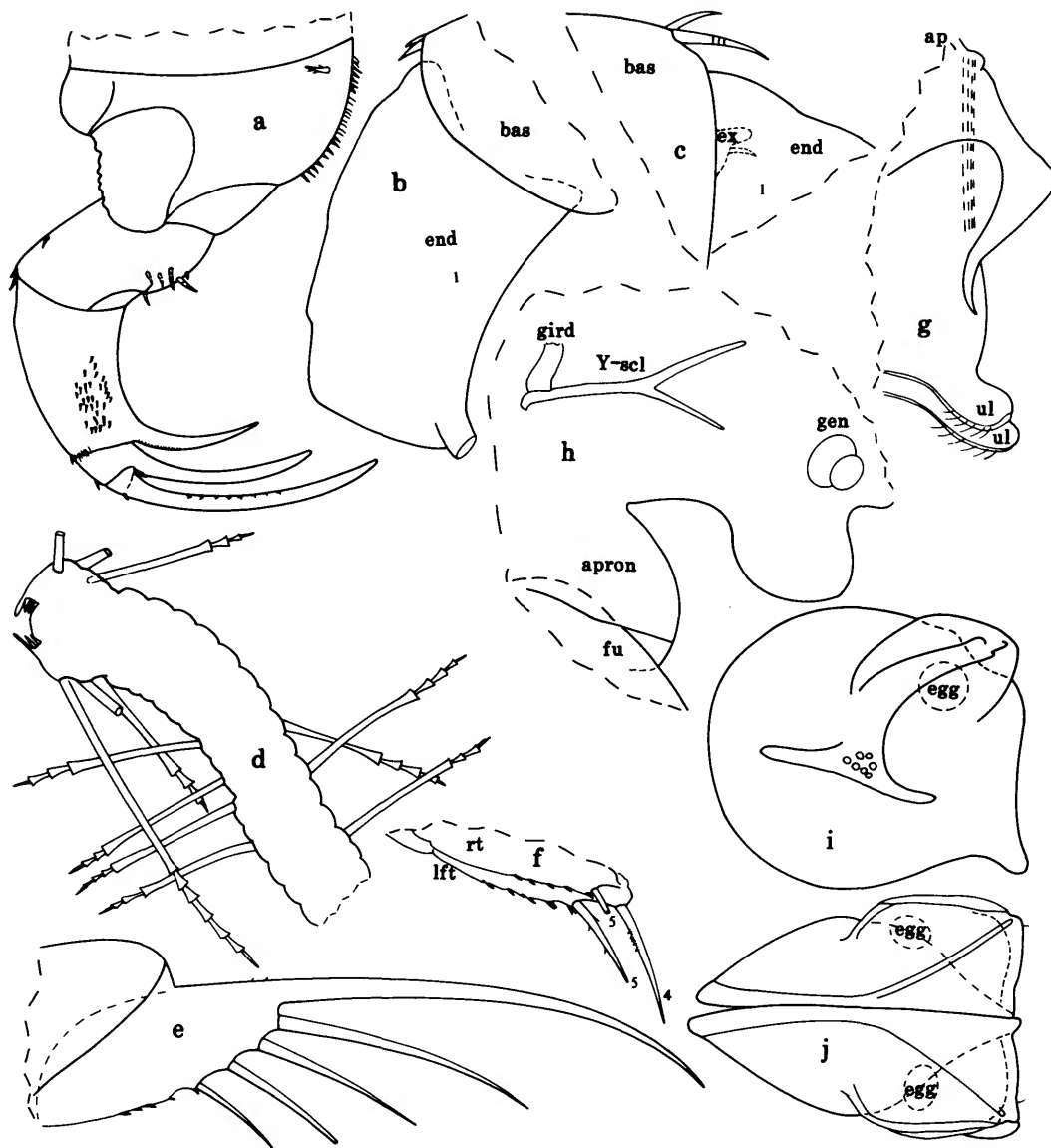


FIGURE 80.—*Eusarsiella edax*, new species, ovigerous female, paratype, USNM 193985: *a*, right mandible, mv; *b*, joint 1 of endopodite of right mandible showing undulations along dorsal margin, mv; *c*, left mandible showing exopodite (dashed), mv; *d*, 7th limb; *e*, right lamella of furca; *f*, ventral edge of proximal (posterior) end of lamellae of furca; *g*, anterior of body from right side, anterior to right; *h*, part of posterior of body from right side, anterior to right. Ovigerous female, holotype: *i*, complete specimen from left side, length with caudal process 1.71 mm; *j*, dorsal view of complete specimen, anterior to left.

followed by space and 2 long plumose bristles; limb hirsute in posterior half, especially on medial surface.

Seventh Limb (Figure 80d): Proximal group with 7 or 8 bristles (3 or 4 on each side), each with 3 or 4 bells; terminal group with 6 bristles (3 on each side), each with 3–6 bells. Terminus with opposing combs, each with about 9 indistinct

teeth.

Furca (Figure 80e,f): Similar to that of *E. bex*.

Bellonci Organ (Figure 79n): Cylindrical with broadly rounded tip with 2 minute nodes.

Eyes: Medial eye with scattered brown pigment (Figure 79n). Lateral eye almost as large as medial eye, with 5

well-developed divided amber-colored ommatidia, with light-brown pigment between ommatidia (Figure 79o). (Figure 79n and o drawn at same magnification.)

Upper Lip (Figure 80g): Paired projecting processes rounded at anterior end in lateral view, each with thin sclerotized rim and ventral hairs.

Genitalia (Figure 80h): Small sclerotized ring with attached spermatopore on each side of body anterior to furca.

Anterior of Body (Figure 80g): Small rounded anterior process just ventral to medial eye. Broad triangular projection ventral to anterior process on each side of body in vicinity of proximal end of coxale of mandible.

Posterior of Body: Bare.

Y-Sclerite (Figure 80h): Typical for genus.

Number of Eggs: Slope 22: holotype with 5 eggs; length of 1 egg, 0.24 mm. Slope 40: USNM 193985 with 5 well-developed eggs in marsupium, length of typical egg 0.31 mm; 3 specimens with 6, 6, and 8 eggs (also with smaller unextruded eggs) in marsupium. Location of some eggs within marsupium shown in Figures 79b and 80i, j.

DESCRIPTION OF ADULT MALE (Figure 81).—Carapace larger and more elongate than that of female, with prominent rostrum, anteroventral concavity ventral to rostrum, and narrow projecting posteroventral caudal process (Figure 81a,b). Outer surface without gel-like coating.

Ornamentation (Figure 81a,b): Broad flange along anterior and ventral margins; ventral flange lobate with small spines on lobes; spines also present on tip of rostrum and on low processes along dorsal margin of valve. Elongate posterodorsal process extending past posterodorsal edge of valve; narrow low horizontal rib present in vicinity of central adductor muscle attachments; 2 processes with terminal spines on posterior margin dorsal to caudal process. Long bristles (some with broad bases) along margins, sparsely distributed on lateral surface, and at terminal ends of processes (not all bristles shown).

Infold: Infold of caudal process with 4 small pointed bristles (3 anterior, 1 posterior) in addition to 6 bristles along the inner margin of the infold.

Carapace Size (length (with caudal process), height in mm): Slope 40: USNM 193987, 1.90, 1.44. Slope 56: USNM 193994, 1.87, 1.45; unnumbered specimen, 1.91, 1.52.

First Antenna (Figure 81c): 1st joint bare. 2nd joint with dorsal bristle with long proximal and short distal spines. 3rd and 4th joints fused; 3rd joint with 2 short bristles (1 ventral, 1 dorsal). 4th joint with 3 bristles (2 long ventral, 1 short dorsal). 5th joint wedged ventrally between 4th and 6th joints; sensory bristle long with 3 short distal filaments and bifurcate tip, and proximal cup with abundant thin filaments (filaments not shown). Medial bristle of 6th joint short, with marginal spines. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with short spines; b-bristle long, with short distal filament and terminal spine; c-bristle reaching slightly past tip of sensory bristle of 5th joint, with 5 distal filaments and bifurcate tip. 8th

joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle about same length as e-bristle, with 1 short proximal filament, 3 distal filaments, and bifurcate tip; g-bristle longer than f-bristle, with 5 short distal filaments and bifurcate tip. All filaments of bristles not shown.

Second Antenna: Protopodite and endopodite (Figure 81d) similar to those of *E. bex*. Exopodite: 1st joint with small, straight, tubular, medial, terminal bristle; bristle of 2nd joint with proximal natatory hairs, then 7–15 slender ventral spines and more natatory hairs; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 2 bristles (1 long stout with natatory hairs, 1 short (dorsal) with small slender spines); joints 3–8 with row of minute spines along distal edges.

Mandible (Figure 81e,f): Coxale endite represented by small ringed bristle with few marginal spines; ventral margin of coxale as well as medial surface near ventral margin with spines and hairs. Basale with 6 ringed bristles near ventral margin (4 medial, 2 closely spaced ventral), and 3 ringed dorsal bristles. Exopodite represented by long spinous rod-like process and 1 ringed (rings not shown) bristle (Figure 81e,f). 1st endopodial joint: medial surface with rows of spines; ventral margin with long subterminal bristle ringed except at pointed tip; dorsal margin with minute terminal spines. 2nd endopodial joint: medial surface with rows of spines; ventral margin with long terminal bristle ringed except at pointed tip, and 1 minute unringed spine-like bristle; dorsal margin with 1 small ringed bristle at midlength. 3rd endopodial joint with stout terminal claw with proximal ventral spines; medial side with 2 small ringed bristles near ventral margin, and 1 smaller spine-like bristle near dorsal margin.

Maxilla and Fifth Limb: Reduced, not examined in detail. Epipodite of 5th limb with 40 bristles.

Sixth Limb (Figure 81g): Single endite with 3 bristles (2 short medial, 1 longer terminal). End joint with 16 bristles followed by space and 2 long plumose bristles; bristles along anterior and ventral edge of end joint hairier than those of female (hairs not shown on all bristles); medial and lateral surfaces and posterior edge of end joint hirsute.

Seventh Limb (Figure 81h): Small bare.

Furca (Figure 81i): Similar to that of adult female.

Eyes (Figure 81j): Medial eye unpigmented. Lateral eye unpigmented, smaller than medial eye, with 5 well-defined ommatidia.

Upper Lip (Figure 81k): With anterior hirsute anterior projection.

Genitalia (Figure 81h): Copulatory organ on each side of body with lobe with hook-like terminal process, proximal node, and 2 proximal bristles, and at least 2 small bristles on 2nd lobe; organ not studied in detail.

Anterior of Body (Figure 81k), *Posterior of Body*, and *Y-Sclerite* (Figure 81h): In general, similar to those of adult female.

Remarks: The adult males are identified as *E. edax* without a high degree of certainty, and therefore, are designated

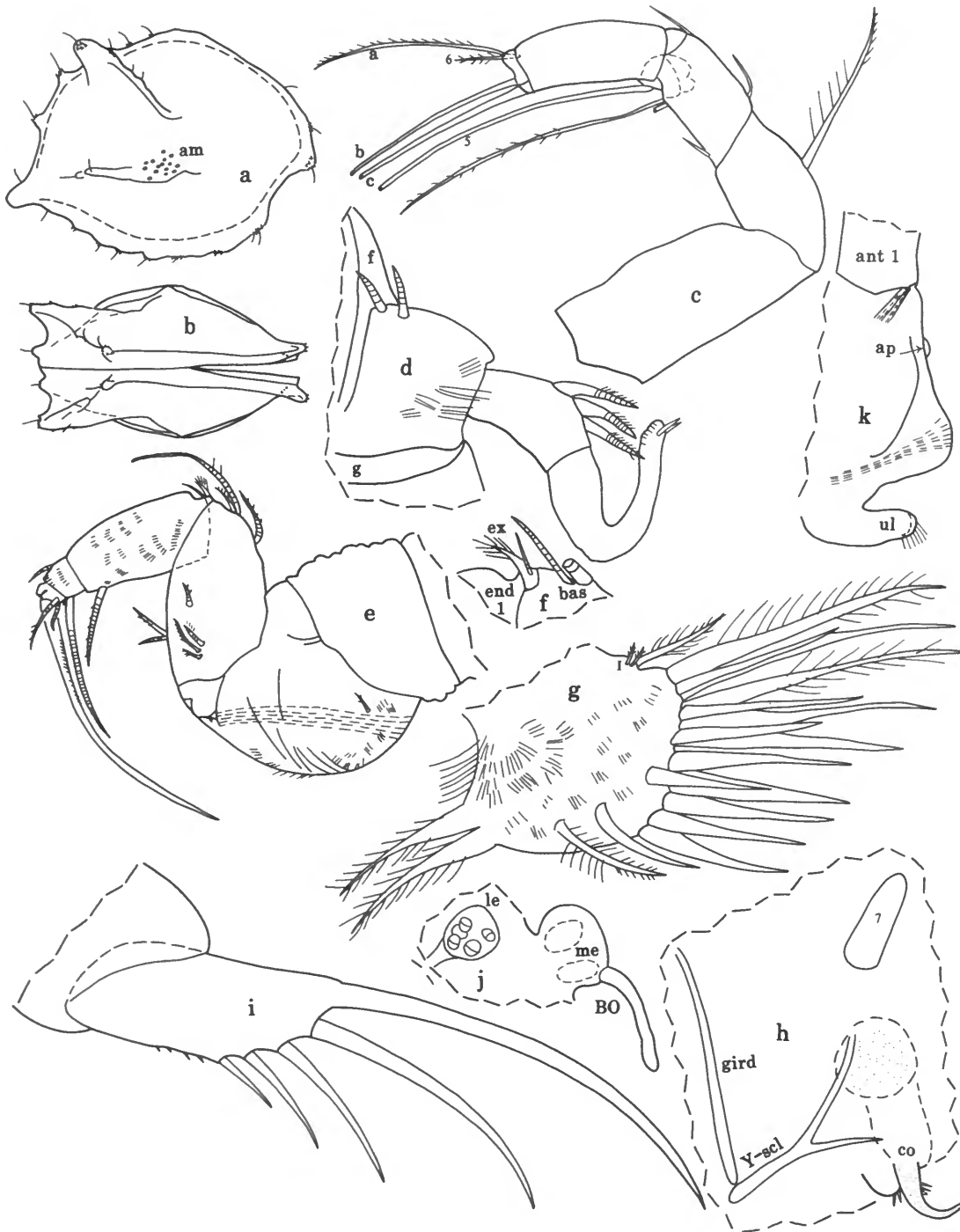


FIGURE 81.—*Eusarsiella edax*, new species, adult male, nontype, USNM 193987: *a*, complete specimen from right side, length with caudal process 1.90 mm; *b*, dorsal view of complete specimen; *c*, left 1st antenna, lv (not all bristles shown); *d*, endopodite and part of protopodite of left 2nd antenna, mv; *e*, right mandible, mv; *f*, exopodite, left mandible, lv; *g*, right 6th limb, mv; *h*, part of posterior of body from right side, anterior to right; *i*, right lamella of furca; *j*, anterior of body near dorsal end, anterior to right; *k*, anterior of body from right side, anterior to right.

nontypes. They are referred to *E. edax* because of the horizontal rib at midheight and well-developed posterodorsal process, but the infold of the caudal process contains less than half the number of bristles present in the female, and no bristle is present on posterior infold dorsal to setal bristles.

COMPARISONS.—The carapace of the female *E. edax* differs from that of *E. bex* in that the posterodorsal process projects past the posterodorsal edge of valve, is much broader in dorsal view, and bears 2 subparallel ribs near midheight. The dorsal margin of the 4th joint of the 1st antenna of the female *E. bex* bears numerous minute spines absent on *E. edax*. The bristle of the 2nd joint of the exopodite of the 2nd antenna of the female *E. bex* bears slender proximal ventral spines absent on *E. edax*. The 7th limb of the female *E. edax* bears 7 or 8 bristles in the proximal group compared to 4 or 5 on the limb of *E. bex*. The lateral eyes of the female *E. edax* have 5 well-developed divided ommatidia; whereas, the lateral eyes of *E. bex* are smaller and have about 5 or 6 minute cells that may represent ommatidia. The carapace of the female *E. edax* is smaller than that of *E. magna* Poulsen, 1962:89, and has a longer posterodorsal process. The endopodite of the 2nd antenna of the female *E. edax* has a terminal node absent on *E. magna*. The carapace of *E. edax* resembles that of *E. springthorpei* (Hall, 1987:747), which was reported from the vicinity of Lizard Island, North Queensland; however, the posterodorsal process of that species does not have 2 ribs near midheight and the 7th limb bears 10 proximal bristles; also, the terminal claw of the 3rd endopodial joint of the mandible is broader distally (according to illustration by Hall (1987, fig. 6F) than that of *E. edax*.

The carapace of the adult male *E. edax* is larger than that of *E. bex*, has a lobate spinous ventral margin, and 2 spinous processes on the posterior margin dorsal to the caudal process. The mandible of *E. edax* has a rod-like branch on the exopodite not present on *E. bex*.

Eusarsiella iayx, new species

FIGURES 82–85

ETYMOLOGY.—From the Greek *iayx* (northwest wind).

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

TYPE LOCALITY.—Slope 48, 41°57.50'S, 148°37.90'E, Tasmania, off Freycinet Peninsula; depth 400 m.

PARATYPES.—Slope 22: USNM 194044, 1 ovigerous female on slide and in alcohol; 1 ovigerous female + 4 adult females in alcohol. Slope 40: USNM 193986, 1 ovigerous female on slide and in alcohol; 11 adult females (10 ovigerous) in alcohol. Slope 46: 1 late instar in alcohol. Slope 47: 1 adult female with chonistomatid copepods (1 female, 1 male, 1 egg sac containing well developed copepodites) in marsupium. Slope 48: USNM 194021, ovigerous female on slide and in alcohol; USNM 194022, partly dissected ovigerous female in alcohol;

unnumbered specimens: 3 ovigerous female + 3 adult females + 3 juveniles, all in alcohol.

NOTYPE.—Slope 40: USNM 193988, 1 adult male on slide and in alcohol.

DISTRIBUTION.—Slope 22, 363 m. Slope 40, 400 m. Slope 46, 720 m. Slope 47, 500 m. Slope 48, 400 m. Known depth range 363–720 m.

DESCRIPTION OF ADULT FEMALE (Figures 82–84).—Carapace with bulbous posterodorsal bulge on each valve and moderate size caudal process (Figures 82a–c, 84a,b).

Ornamentation: On some specimens posterodorsal bulge bearing thin rib (Figure 82a,b), but on others (including holotype) ridge absent (Figure 84a). Surface with minute spines along edges (Figures 82e, 84c), and with more lateral bristles than on either *E. bex* or *E. edax*, but not abundant. Bristles of 3 types: (1) bristles with stout triangular base, or thicker in proximal 1/3 or 1/2 and with angular bend just distal to stout part; (2) undivided slender bristles (sparse); (3) divided slender bristles slightly broader at base and with 1 branch much shorter than other (Figure 84c) (the divided bristles characterize the species); divided bristles absent along edges of valve. Outer surface without jell-like coating.

Infold: Anterior infold with 1 small bristle near inner margin ventral to midheight (Figure 82e). Infold anterior to caudal process with 3–6 small bristles plus 5 bristles along inner margin (Figures 82d, 84d). Dorsal to caudal process 2 setal bristles, and 1 slender bristle on inner margin dorsal to setal bristles (Figures 82d, 84d).

Central Adductor Muscle Attachments (Figure 82f): Comprising about 20 ovoid attachments.

Carapace Size (mm): Slope 22: USNM 194044, length with caudal process 1.27; height without caudal process 1.21. Slope 40: USNM 193986, length with caudal process 1.43, length without caudal process 1.40. height without caudal process 1.24. Slope 47: unnumbered specimen, length with caudal process 1.69, length without caudal process 3.61, height without caudal process 1.43. Slope 48: holotype, length with caudal process 1.77, length without caudal process 1.71, height without caudal process 1.53; USNM 194021, length with caudal process 1.68, length without caudal process 1.55, height without caudal process 1.43; USNM 194022, length with caudal process 1.48, length without caudal process 1.44, height without caudal process 1.53. Range of length considerable (with caudal process) 1.27–1.77 mm.

First Antenna (Figure 82g): 1st joint long, bare. 2nd joint with proximal dorsal spines, spinous dorsal bristle, and row of few indistinct short lateral hairs on distal edge near dorsal margin. 3rd joint fused with 4th, with 2 spinous bristles (1 ventral, 1 dorsal). 4th joint without dorsal hairs, with 3 or 4 spinous bristles (2 or 3 ventral (on USNM 193986 both bristles short, but on holotype and USNM 194044 one bristle extends past 8th joint), 1 dorsal). Sensory bristle of 5th joint with 2 single closely spaced minute spines at midlength (not shown). 6th joint fused to 5th, with small medial bristle near dorsal

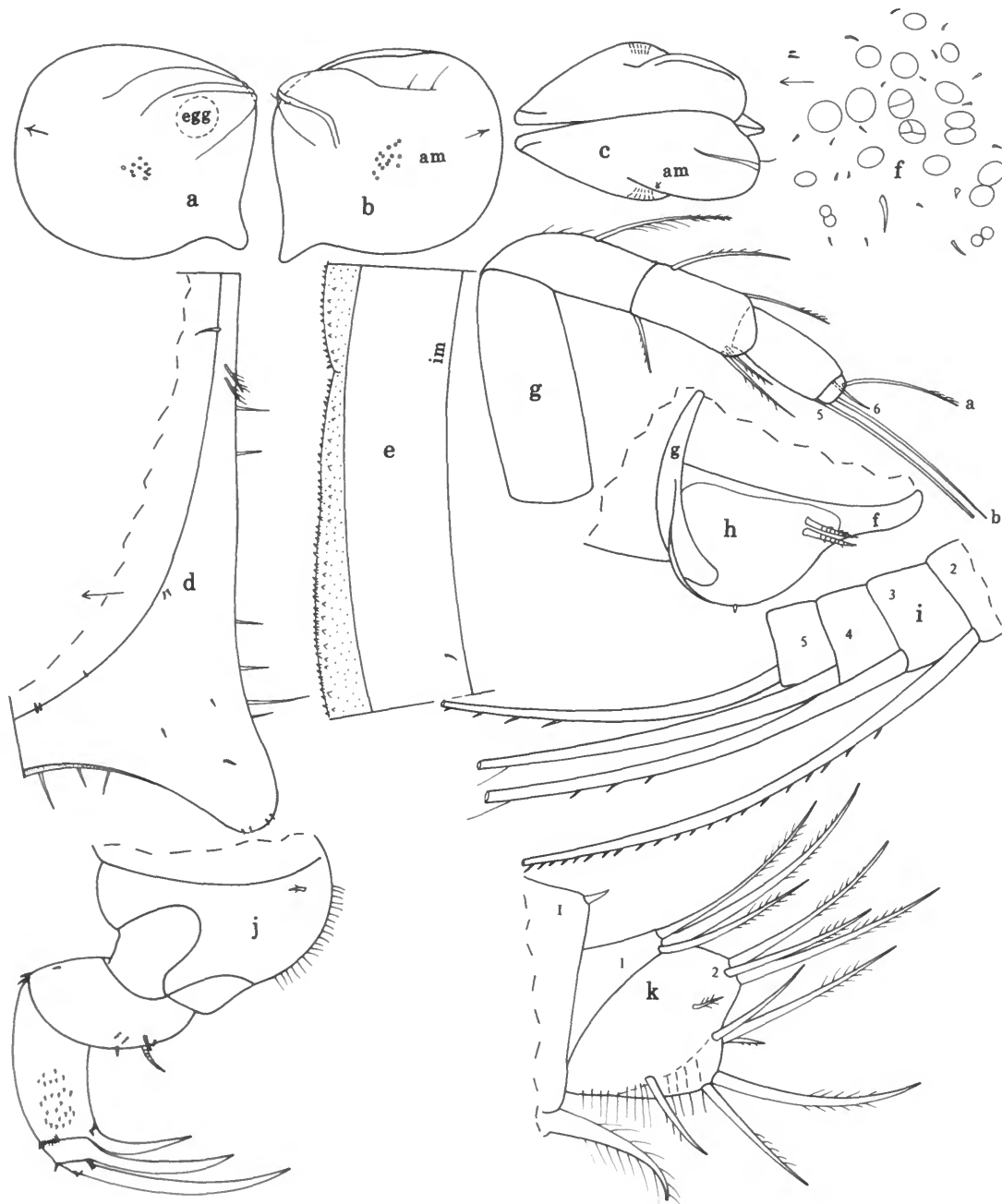


FIGURE 82.—*Eusarsiella iayx*, new species, ovigerous female, paratype, USNM 193986: *a, b*, complete specimen from left and right sides, respectively, length with caudal process 1.43 mm (neither bristles nor all central adductor muscle attachments shown); *c*, dorsal view of complete specimen (not all bristles shown); *d, e*, posterior and anterior, respectively, of right valve, *iv*; *f*, central adductor muscle attachments, left valve, anterior to left; *g*, right 1st antenna, *lv* (not all bristles shown); *h*, endopodite and part of protopodite, left 2nd antenna, *mv*; *i*, part of exopodite of left 2nd antenna, *mv*; *j*, right mandible, *mv*; *k*, 5th limb.

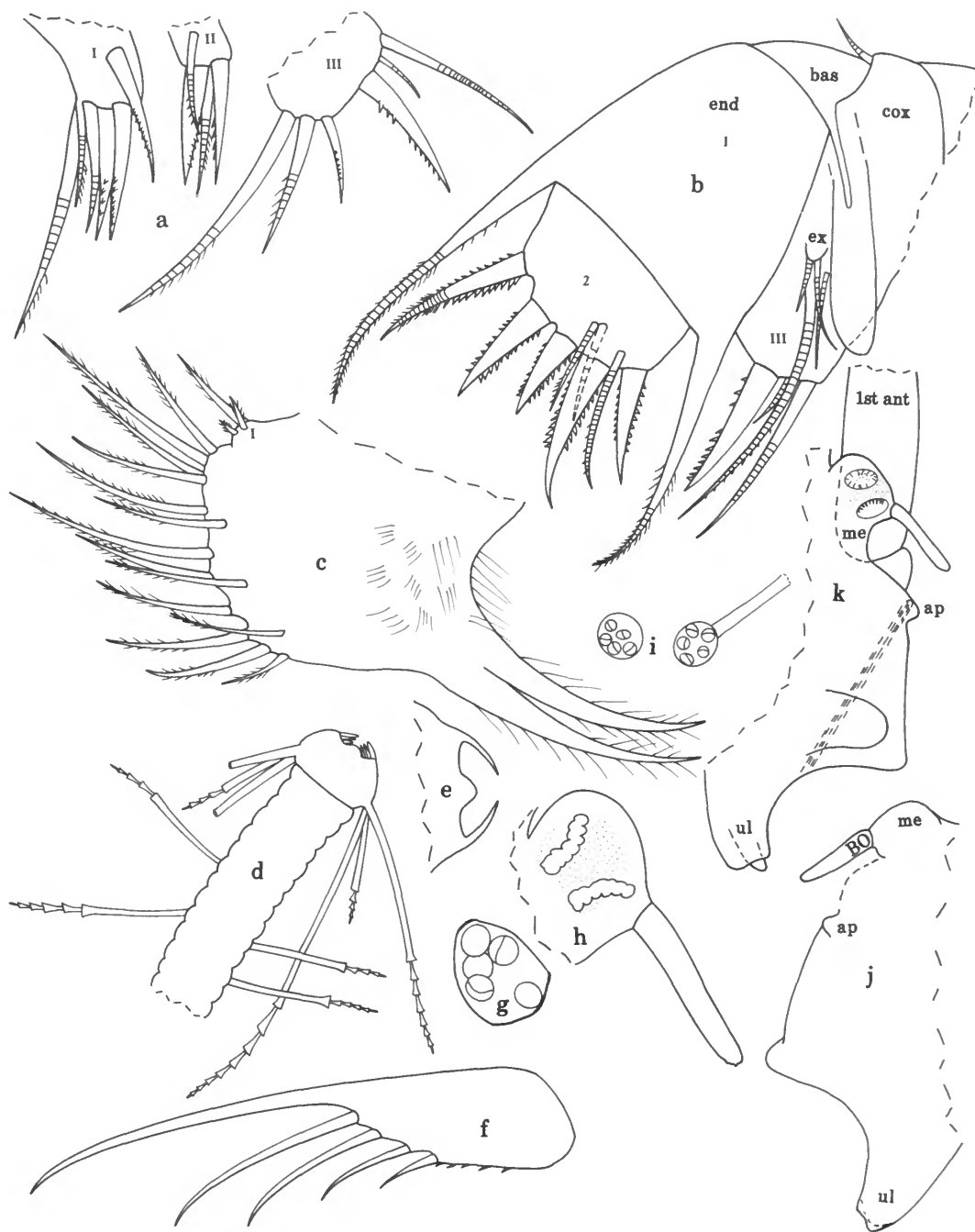


FIGURE 83.—*Eusarsiella iayx*, new species, ovigerous female, paratype, USNM 193986: a, endites I-III, right maxilla; b, left maxilla, lv; c, right 6th limb, mv; d, 7th limb; e, tip of 7th limb opposite that shown in d (only middle tooth of combs shown); f, left lamella of furca; g, right lateral eye; h, medial eye and Bellonci organ (same magnification as g; i, right and left lateral eyes; j, anterior of body from left side, anterior to left; k, anterior of body from right side, anterior to right.

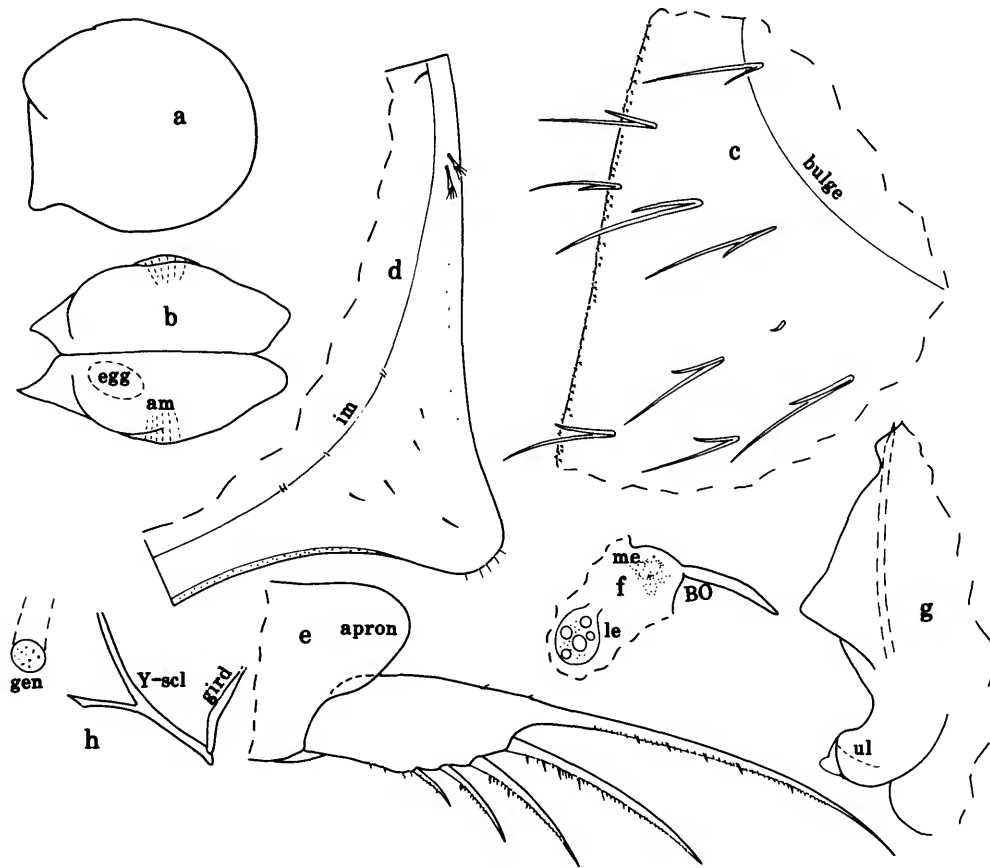


FIGURE 84.—*Eusarsiella iayx*, new species, ovigerous female, paratype, USNM 194044: *a*, outline of complete specimen from right side, length with caudal process 1.27 mm; *b*, dorsal view of complete specimen, anterior to right; *c*, divided bristles on posterodorsal surface of right valve (curved line represents edge of bulge), anterior to right, ov; *d*, posterior of right valve, iv; *e*, right lamella of furca; *f*, dorsal part of anterior of margin, anterior to right; *g*, anterior of body from left side, anterior to left; *h*, genital organ and Y-sclerite of left side of body, anterior to left.

margin. 7th joint: a-bristle 3–5 times length of bristle of 6th joint, with few distal spines; b-bristle almost twice length of a-bristle or longer, bare; c-bristle same length as sensory bristle of 5th joint, with minute filament at $\frac{1}{3}$ length, and 2 single minute closely spaced spines at midlength. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle about same length as d-bristle, bare; g-bristle about same length as c-bristle, with 1 or 2 minute spines at midlength; sensory bristle of 5th joint, and b-, c-, f-, and g-bristles of 7th and 8th joints with minute spine or filament at tip.

Second Antenna: Protopodite bare. Endopodite with 2 slender proximal bristles with few small spines, and 1 minute unringed terminal bristle (on USNM 193986 bristle is not on node (Figure 82*h*), but node present on holotype, USNM 194021, USNM 194044, and USNM 194022). Exopodite

(USNM 193986): left limb (Figure 82*i*): 1st joint with small terminal medial fairly straight tubular bristle; bristle of 2nd joint long with about 21 proximal ventral spines and distal natatory hairs; bristle of 3rd joint with 3 proximal ventral spines and distal natatory hairs; bristle of 4th joint with natatory hairs, no spines; bristle of 5th joint with 4 proximal ventral spines and distal natatory hairs; bristle of 6th joint with few proximal ventral hairs then 6 ventral spines and distal natatory hairs; bristle of 7th joint with 12 proximal ventral spines and distal natatory hairs; bristle of 8th joint with few proximal ventral hairs, then 11 ventral spines and distal natatory hairs; 9th joint with 2 bristles (1 long with natatory hairs, 1 short (dorsal) with short hairs); joints 2–8 with few minute spines along distal edge. Exopodite of right limb: bristle of 2nd joint with 20 proximal ventral spines and distal natatory hairs;

bristles of joints 3 and 4 with natatory hairs, no spines; bristles of joints 5–8 with proximal ventral spines (not counted) and distal natatory hairs; 9th joint similar to that of left limb. Exopodite (holotype): bristle of 2nd joint with only 5 proximal ventral spines, some other bristles with few spines but these not counted.

Mandible (Figure 82j): Similar to that of *E. edax* except for small medial spine-like bristle near base of claw of 1st endopodial joint (examined 3 specimens but not holotype), no ventral teeth on claw of 3rd endopodial joint, and no exopodite.

Maxilla (Figure 83a,b) and **Fifth Limb** (Figure 82k): In general, similar to those of *E. edax*.

Sixth Limb (Figure 83c): Single endite with 3 bristles (2 medial, 1 longer terminal). End joint with 14–16 spinous bristles followed by space and 2 long plumose bristles; limb hirsute along proximal posterior edge and medially on posterior half.

Seventh Limb (Figure 83d,e): Proximal group usually with 4 bristles (2 on each side), but one limb of holotype with 5 bristles, and one limb of USNM 194021 with 7; each bristle with 4 or 5 bells; terminal group with 6 bristles (3 on each side), each with 4–7 bells. Terminus with opposing combs, each with about 8 indistinct teeth; prominent node present at midpoint of terminus (Figure 83e (only middle tooth of each comb shown)).

Furca (Figures 83f, 84e), **Bellonci Organ** (Figures 83 h,j, 84f), **Eyes** (Figures 83g–k, 84f), **Genitalia** (Figure 84h), **Anterior of Body** (Figures 83j,k, 84g), **Posterior of Body**, and **Y-Sclerite** (Figure 84h): Similar to those of *E. edax*, except Bellonci organ of USNM 194044 with thinner and more tapered tip.

Upper Lip (Figures 83j,k, 84g): Comprising 2 adjacent bare lobes projecting anteriorly; left lobe usually longer.

Number of Eggs: Slope 22: USNM 194044 with 4 well-developed eggs in marsupium (length of typical egg 0.37 mm) and 1 unextruded egg (length 0.21 mm) (location of 1 egg in marsupium shown in Figure 84b). Slope 40: USNM 193986 with 4 eggs in marsupium (length of typical egg 0.25 mm) (location of 1 egg shown in Figure 83a). Slope 48: holotype with 3 eggs (all in posterodorsal bulge of left valve) (length of typical egg 0.28 mm). Slope 48: USNM 194021 with 5 eggs in marsupium (length of 1 egg including transparent sac 0.29 mm (length excluding transparent sac 0.22 mm); USNM 194022 with 4 eggs in marsupium (length of 1 egg 0.22 mm).

Parasites: Female from Slope 47 with chionistomatid copepods (1 female, 1 male, 2 egg sacs with well-developed copepodites (length of 1 sac 0.29 mm), 1 egg sac with round eggs (length 0.18 mm)).

DESCRIPTION OF ADULT MALE (Figure 85).—Carapace similar to that of *E. bex* (Figure 85a,b).

Ornamentation: With fewer bristles than on adult female and without divided bristles.

Infold: Infold of caudal process with 4 small bristles (3 anterior, 1 posterior) and 3 small bristles along inner margin of

infold. No bristle present dorsal to 2 setal bristles on posterior infold.

Carapace Size (length (including caudal process), height in mm): USNM 193988, 1.39, 1.03.

First Antenna (Figure 85c) and **Mandible** (Figure 85e,f): Similar to those of *E. bex*.

Second Antenna: Protopodite differs from that of *E. bex* in having more medial spines near endopodite (Figure 85d). Endopodite (Figure 85d) and exopodite similar to those of *E. bex*.

Maxilla and Fifth Limb: Reduced (not examined in detail).

Sixth Limb (Figure 85g), **Seventh Limb** (Figure 85h), **Furca** (Figure 85i), **Bellonci Organ** (Figure 85j–l), and **Eyes** (Figure 85a,j–l): Similar to those of *E. bex*.

Upper Lip (Figure 85l,m): With anterior projection with small process on each side, each with 2 or 3 small spines.

Genitalia (Figure 85i), **Anterior of Body** (Figure 85l,m), and **Posterior of Body:** Similar to those of *E. bex*.

Remarks: Females referred to this species are quite variable in size of carapace, and it is possible that more than one species has been included. Seventh limbs of five specimens examined (holotype, USNM 194021, USNM 194022, USNM 194044, and unnumbered specimen from Slope 47) have a large node between the opposing terminal combs, which is uncommon among species of the genus. Only specimens having divided bristles on the lateral surface of the carapace are referred to the species. Divided bristles were observed on adult females and on the A-1 and A-2 instars, but not on the adult male. The adult male identified as *E. iayx* is not referred to the species with a high degree of certainty, and therefore, is designated a nontype. Carapaces of juveniles are without a posterodorsal bulge.

COMPARISONS.—The shape of the carapace of the female *E. iayx* is similar to that of *E. edax*, but the posterodorsal bulge of *E. iayx* does not have the 2 ribs present on *E. edax*. The carapace of *E. iayx* bears divided bristles absent on both *E. edax* and *E. bex*. The 7th limb of *E. iayx* usually bears 4 proximal bristles compared to seven or eight on *E. edax*, and a prominent node present at the midpoint of the terminal end of the limb is absent on *E. edax* (a node present on some limbs of *E. fallomagna* (Figure 77f)). The bristle of the 2nd exopodial joint of the 2nd antenna of *E. iayx* bears proximal ventral spines absent on *E. edax*.

The posterodorsal process on the carapace of *E. bex* is less globose than that of *E. iayx*, and the dorsal margin of the 4th joint of the 1st antenna of the female *E. bex* bears minute spines absent on *E. iayx*. No large differences were observed between the adult males *E. iayx* and *E. bex*, and they may be conspecific; however, they are interpreted to be different species because each occurred in a sample with females of the two different species to which they have been referred to herein, and because males of closely related sarsiellids are often more similar to each other than are females.



FIGURE 85.—*Eusarsiella iayx*, new species, adult male, nontype, USNM 193988: *a, b*, complete specimen from left and right sides, length with caudal process 1.39 mm; *c*, right 1st antenna, lv (not all bristles shown); *d*, endopodite and part of protopodite, left 2nd antenna, mv; *e*, left mandible, mv; *f*, exopodite, right mandible, lv; *g*, right 6th limb, mv; *h*, right and left 7th limbs; *i*, right copulatory organ, right lamella and part of left lamella (striated) of furca; *j, k*, dorsal part of anterior of body from left and right sides, respectively; *l*, anterior of body from left side; *m*, anterior of body from right side (inner surface of left side striated).

Chelicopia Kornicker, 1958

TYPE SPECIES.—*Chelicopia arostrata* Kornicker, 1958:253, monotypy.

COMPOSITION.—Two species have been described previously from shallow water in the vicinity of the Great Barrier

Reef (Hall, 1985:505, 513) and two new species are described herein.

DISTRIBUTION.—Bahama Islands, Pacific coast off El Salvador; Scammon Lagoon, Baja California, Mexico; the Tasman Sea off west coast of South Island, New Zealand; Indian Ocean, and in the vicinity of Australia (Kornicker, 1986:29; in press). Known depth range 1–768 m.

Key to Species of *Chelicopia*

1. Surface of carapace with minute plates *C. lorica*
Surface of carapace without minute plates 2
2. Surface of carapace with bristles with digitate tips 3
Surface of carapace with only slender non-digitate bristles 4
3. Digitations at tip of surface bristles on diaphanous flare; claw of 1st endopodial joint of female and late juvenile mandible with 2 proximal prongs . . . *C. radix*
Digitations at tip of surface bristles not on diaphanous flare; claw of 1st endopodial joint of female and late juvenile mandible without proximal prongs *C. triplex*, new species
4. Furca with 6 claws 5
Furca with 7 or 8 claws 7
5. Endopodite of 1st joint of female 2nd antenna with 2 bristles . . . *C. tasmanensis*
Endopodite of 1st joint of female 2nd antenna with 1 bristle 6
6. Length of female carapace 1.43–1.53 mm; many surface bristles bent at right angle; Bellonci organ with hairs and ?short *C. squameospinosa*
Length of female carapace 1.02–1.35; no surface bristles bent at right angles; Bellonci organ without hairs and long *C. pertinex*, new species
7. Carapace with projecting caudal process *C. obex*
Carapace without projecting caudal process
. *C. arostrata*, *C. rotunda*, *C. kornickeri*

Chelicopia pertinex, new species

FIGURES 86–89, 111c

ETYMOLOGY.—From the Latin *pertinex* (firm, persistent, obstinate).

HOLOTYPE.—Adult undissected 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 193933, 1 adult female (with male and female choniostomatid copepod in marsupium) on slide and in alcohol; USNM 193934, 1 partly dissected ovigerous female in alcohol; 3 unopened females in alcohol. Slope 22: 2 partly dissected ovigerous females + 10 specimens (6 adult females + 4 specimens (1 with choniostomatid copepods in marsupium)) in alcohol (7 lost); USNM 194031, 1 adult male on slide and in alcohol. Slope 40: 1 adult female with body removed from shell in alcohol.

DISTRIBUTION.—Slope 1, 204 m. Slope 22, 363 m. Slope 40, 400 m.

DESCRIPTION OF ADULT FEMALE (Figures 86–88a–c,

111c).—Carapace oval in lateral view with posterior margin of caudal process slightly concave (seen best when viewed from inside) (Figure 86a,d). In dorsal view valves broadest at about midlength (Figure 86i).

Ornamentation: Surface of all specimens from Slope 1 with abundant debris, but without gelatinous coating. Long and short bristles abundant (Figure 86j); short bristles in central part of valves and longer bristles along margins (Figure 86b), especially ventral and posterior margins; bristles also more abundant in vicinity of concave posterior edge of caudal process (Figure 86d); some long slender bristles along margins broad in proximal half then bend at angle at about midlength, other long slender bristles broaden at distal $\frac{3}{4}$ then bend slightly, but most long and all short bristles taper from base to tip and are straight (Figure 86b,d,j); surface between bristles with abundant minute spines (visible only where surface cleaned of debris) (dots in Figure 86b). Surface without gel-like coating

Infold: Anterior infold with 1 small bristle just ventral to valve midheight (Figure 86c): infold of caudal process with row of short bristles at about midwidth and several smaller

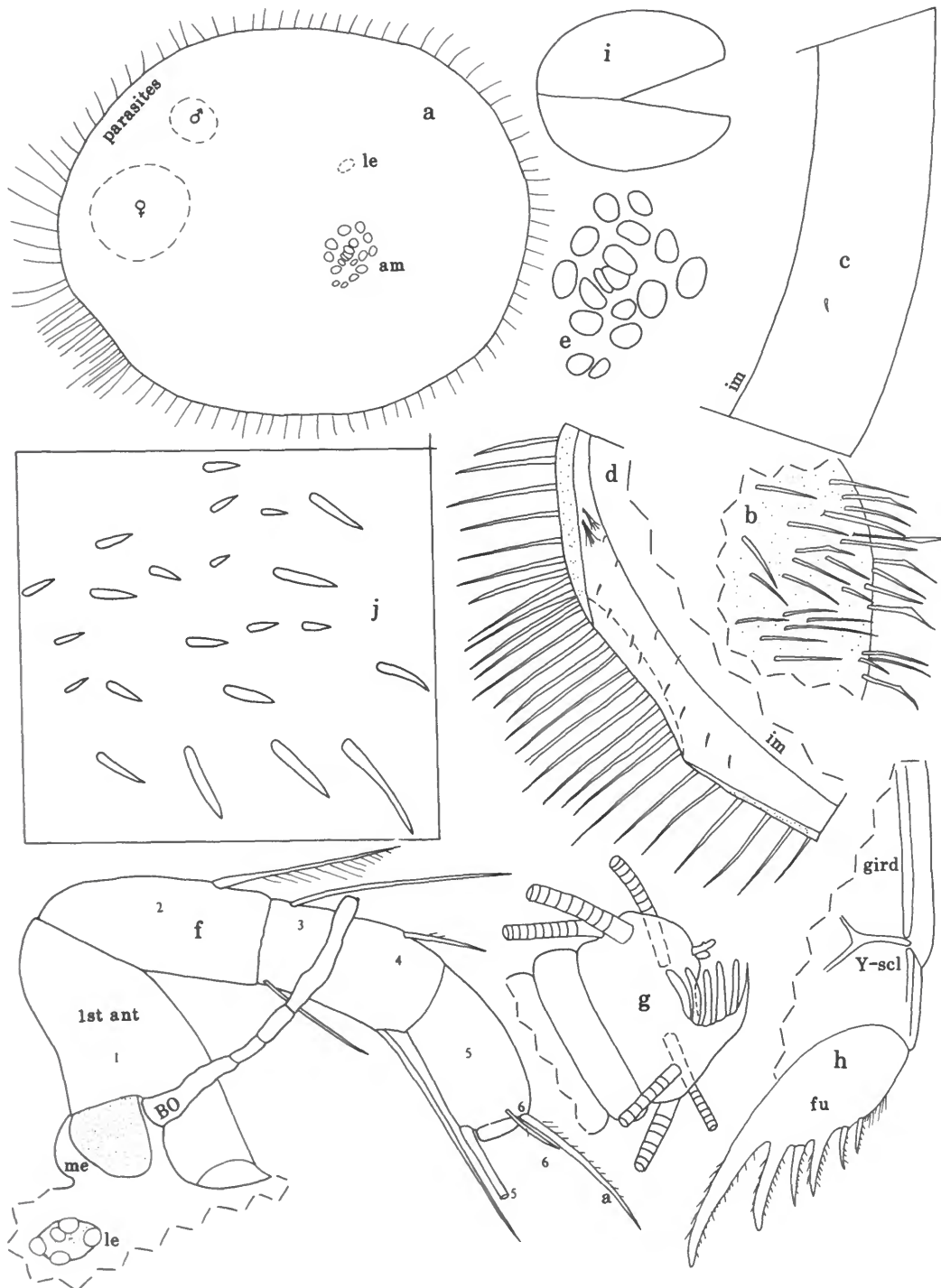


FIGURE 86.—*Chelicopia pertinex*, new species, adult female, paratype, USNM 193933: *a*, complete specimen from right side with 1 male and 1 female choniostomatid copepod in marsupium, length 1.14 mm; *b*, bristles on anterior surface of right valve near midheight, anterior to right; *c*, anterior of left valve near midheight, iv, anterior to right; *d*, posteroventral part of left valve, iv, anterior to right; *e*, central adductor muscle attachments, right valve, anterior to right; *f*, dorsal part of anterior of body from right side, anterior to right (not all bristles of 1st antenna shown); *g*, tip of 7th limb; *h*, posterior of body from left side, anterior to left (only left lamella of furca shown). Oviparous female, paratype, USNM 193934: *i*, dorsal view of valves of complete specimen, anterior to right, length 1.20 mm; *j*, detail of surface bristles of left valve at about $\frac{3}{4}$ valve length near midheight.



FIGURE 87.—*Chelicopia pertinex*, new species, adult female, paratype, USNM 193933: *a*, endopodite and part of propodite, left 2nd antenna, mv; *b*, left mandible, mv; *c, d*, endites I, and II and III, respectively, right maxilla, lv; *e*, right maxilla, lv (endite bristles not shown); *f*, 5th limb; *g*, 6th limb.

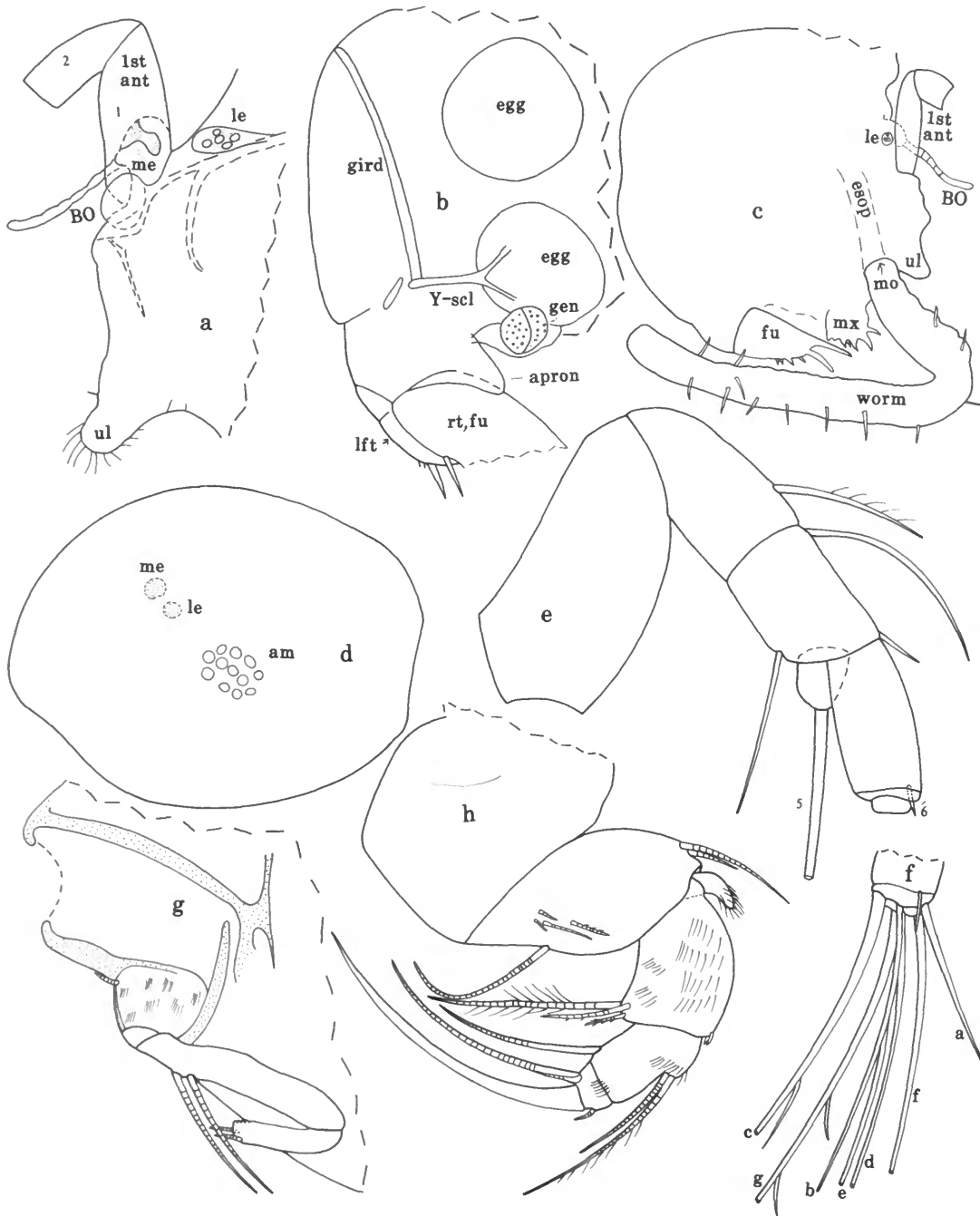


FIGURE 88.—*Chelicopia pertinex*, new species, adult female, paratype, USNM 193933: *a*, anterior of body from left side, anterior to left (bristles of 1st antenna not shown); *b*, posterior of body from right side, anterior to right. *c*, body of unnumbered ovigerous female paratype from Slope 22 drawn from right side with large worm protruding from mouth (not nematode or polychaete). Adult male, paratype, USNM 194031: *d*, complete specimen from left side, length 1.02 mm; *e*, right 1st antenna, lv (not all bristles shown); *f*, tip of left 1st antenna, mv; *g*, endopodite and part of protopodite of right 2nd antenna, mv; *h*, left mandible, mv.

bristles along inner margin; 2 setal bristles present dorsal to caudal process (Figure 86d).

Central Adductor Muscle Attachments (Figure 86a,e): Comprising about 17 ovoid attachments.

Carapace Size (length, height in mm): Slope 1: holotype, 1.17, 0.99; USNM 193933, 1.14, 0.94; USNM 193934, 1.20, 1.00; 3 unnumbered specimens: 1.13, 0.89; 1.11, 0.93; 1.08, 0.89. Slope 22: 5 specimens: 1.26, 1.01; 1.35, 1.04; 1.26, 1.11; 1.26, 1.06; 1.30, 1.05. Slope 40: 1.02, 0.85. Length range 1.02–1.35.

First Antenna (Figure 86f): 1st joint bare. 2nd joint with plumose dorsal bristle. 3rd joint fused to 4th, with 1 ventral bristle and 1 longer dorsal bristle (both bare); 4th joint with 1 ventral bristle and 1 shorter dorsal bristle (both with few indistinct short spines). 5th joint with long ventral bristle with 2 minute filaments. 6th joint with short medial bristle with few small spines. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with short spines; b-bristle about twice length of a-bristle, narrower in distal half; c-bristle slightly longer than bristle of 5th joint, with 3 minute filaments. 8th joint: d- and e-bristles slightly shorter than bristle of 5th joint, bare with blunt tips; f-bristle slightly shorter than d-bristle, with 1 minute proximal filament; g-bristle almost as long a c-bristle, with 3 minute filaments.

Second Antenna: Protopodite bare (Figure 111c). Endopodite 1 jointed with 1 proximal anterior bristle and minute terminal process (Figure 87a). Exopodite: 1st joint with minute, recurved, terminal, medial bristle; bristle of 2nd joint long with about 23 stout proximal ventral spines and distal natatory hairs; bristles of joints 3–8 long, with stout proximal ventral spines and distal natatory hairs; 9th joint with 2 bristles (1 ventral stout with slender proximal ventral spines and distal natatory hairs; 1 small dorsal, with short slender hair-like spines); joints 2–8 with row of minute spines along distal edge.

Mandible (Figure 87b): Coxale endite represented by stout pointed spine with slender spines at base. Coxale with long spines along ventral margin. Basale: ventral margin with 5 or 6 small bristles; dorsal margin with 2 small spine-like bristles (1 near midlength, 1 at distal $\frac{3}{4}$). Exopodite absent. 1st endopodial joint: medial side with distal spines and 2 spine-like bristles at base of stout ventral claw; lateral side with row of spines along dorsal half of distal edge. 2nd endopodial joint with stout ventral claw and 2 small dorsal spine-like bristles (1 at midlength and 1 at distal $\frac{3}{4}$); lateral side with row of minute spines at base of 3rd joint (not shown). 3rd endopodial joint with stout terminal claw, 1 small spine-like ventral bristle (lateral to claw of joint 2) and 1 minute spine-like lateral bristle at base of claw (dotted in Figure 87b). Ventral claws of endopodial joints 1 and 2 with bases as wide or slightly wider than terminal claw of 3rd joint and taper to pointed tips.

Maxilla (Figure 87c–e): Diaphanous thumb-like process visible near base of exopodite but probably with base on protopodite (Figure 87e). Protopodite with short dorsal bristle and fringe of long dorsal hairs. Endite I with 6 bristles (Figure

87c); endite II with 3 bristles (Figure 87d); endite III with 6 bristles (Figure 87d). Basale with short bristle near base of exopodite (Figure 87e). Exopodite with 1 short bristle with few spines and 1 long bristle with many short spines. 1st endopodial joint with spinous alpha- and beta-bristles, each ringed distally. 2nd endopodial joint with 2 slender ringed a-bristles, 1 slender ringed c-bristle, and 5 pectinate end bristles (middle bristle shorter, anterior bristle ringed distally, others unringed and claw-like).

Fifth Limb (Figure 87f): All bristles ringed (rings not shown). Single endite with small bare bristle. 1st exopodial joint with 2 spinous bristles. Exopodial joints 2–5 fused, with total of 10 bristles.

Sixth Limb (Figure 87h): With 2 endites; endite I (with 3 short bristles) separated by space from endite II (with 5 long bristles). End joint with 11 bristles (2 posterior bristles plumose, others either bare or with short spines).

Seventh Limb (Figure 86h): Each limb with 4 proximal bristles, 2 on each side, each with 4 bells; terminal group with 6 bristles (each side with 1 short bristle with 3 bells of similar size and 2 long bristles with 6 bells decreasing slightly in size distally). Terminus with comb of 11 teeth opposite 2 pegs (1 longer than other). Limb with 64 segments including terminal segment.

Furca (Figures 86h, 88c): Each lamella with 6 claws; claws 1, 2, and 4 nonarticulated; all claws with teeth along posterior edge (some teeth longer than others); nonarticulated claws with spines along anterior edge; right lamella anterior to left, with long medial spines just within anterior edge, and spines along anterior edge; long and short spines on each lamella following posterior claw. Right lamella of specimen from Slope 40 aberrant in having total of 5 claws with claws 1, 2, and 3 nonarticulated, but left lamella normal.

Bellonci Organ (Figures 86f, 88a,c): Cylindrical, bare, with 3–6 proximal sutures and rounded tip with or without minute triangular terminal process.

Eyes: Medial eye well developed, bare, with dark brown pigment, larger than lateral eye (Figures 86f, 88a,c). Lateral eye with dark brown pigment and 5 amber-colored ommatidia (Figures 86f, 88a,c).

Upper Lip (Figure 88a,c): Evenly rounded hirsute. Small spine may be present on anterior margin just proximal to upper lip (Figure 88a) (observed before but not after dissection of USNM 193933).

Genitalia (Figure 88b): Amber-colored oval on each side of body anterior to furca.

Posterior of Body (Figure 88b): Evenly rounded, bare.

Y-Sclerite (Figures 86h, 88b): With ventral branch.

Number of Eggs: Slope 1: USNM 193934 with 1 elliptical egg in marsupium, length of egg 0.30 mm; USNM 193933 with 4 round unextruded ostracode eggs (2 shown in Figure 88b), length of 1 egg 0.19 mm. Slope 22: 2 specimens each with 1 egg in marsupium having length of 0.28 mm; 1 of the

specimens with 3 unextruded eggs (1 egg with length of 0.20 m).

Parasites: USNM 193933 with an adult male and female chonistomatid copepode in marsupium (location shown in Figure 86a) (note: ostracode also has 4 unextruded eggs (2 shown in Figure 88b)). One specimen from Slope 22 with chonistomatids (female, male, and 1 ovisac) in marsupium.

Food: An unnumbered specimen from Slope 1 with anterior end of large worm in mouth (Figure 88c) (the worm was examined by Duane Hope and Marian Pettibone, Smithsonian Institution, who determined that it was neither a nematode nor polychaete, but could not with certainty identify it further without detailed study).

Remarks: Adult females from Slope 1 are smaller (length 1.08–1.20 mm) than those from Slope 22 (length 1.26–1.35 mm). The single female from Slope 40 has a length of 1.02 mm. This suggests that the specimens from Slope 22 might not be conspecific with those from Slope 1 and 40, but I could find no differences that would warrant their separation. One observed difference is that the segments of the Bellonci organ of the 2 specimens that were examined from Slope 22 broaden distally, whereas segments of the examined specimens from the other 2 stations are cylindrical.

DESCRIPTION OF ADULT MALE (Figures 88d–h).—Carapace more elongate and smaller than most adult females, with shallow incisure; distal end of caudal process slightly concave in lateral view (Figure 88d).

Ornamentation: With numerous bristles similar to those of adult female (not shown). Surface without gel-like coating.

Infold: Not examined.

Carapace Size (length, height in mm): USNM 194031, 1.02, 0.79.

First Antenna (Figure 88e,f): 1st joint bare. 2nd joint with dorsal bristle with few long spines. 3rd joint fused to 4th, with long dorsal bristle and without ventral bristle. 4th joint with long slender ventral bristle and short dorsal bristle. 5th joint small, wedged ventrally between 4th and 6th joints; bristle with stout proximal part with abundant filaments (not shown), and stem with several short distal filaments. 6th joint with small medial bristle near dorsal margin. 7th joint: a-bristle about same length as dorsal margin of 6th joint; b-bristle about 1½ times length of a-bristle, bare; c-bristle reaching past tip of sensory bristle of 5th joint, about 4 times length of b-bristle, with 6 short marginal filaments. 8th joint: d- and e-bristles reaching tip of sensory bristle of 5th joint, bare with blunt tips; f-bristle about twice length of b-bristle, with 5 short marginal filaments; g-bristle same length as c-bristle, with 6 short marginal filaments.

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 88h): 1st joint short with 1 short proximal bristle and indistinct rows of medial spines; 2nd joint elongate, with 2 long bristles at about 1/3 length; 3rd joint elongate, reflexed, with 2 small terminal bristles and few ridges along distal inner edge. Exopodite: 1st joint with minute, slightly curved, medial,

terminal bristle; bristle of 2nd joint long, with few long proximal hairs (4 on dorsal margin, 1 on ventral margin) followed by 8 slender ventral spines, then natatory hairs; bristles of joints 3–5 or 3–6 with proximal natatory hairs, followed by few slender ventral spines, then more natatory hairs; bristles of joints 6–8 or 7–8 with natatory hairs, no spines; 9th joint with 2 bristles (dorsal small bare; ventral long with natatory hairs); joints 2–7 with row of minute spines along distal margins.

Mandible (Figure 88h): Coxale endite not observed with certainty (fragmented on illustrated limb of USNM 194031 and obscured on other limb). Basale: ventral margin with long bare bristle at midlength; medial side with 4 bristles near ventral margin; dorsal margin with 2 subterminal bristles. Exopodite short, hirsute. 1st endopodial joint: ventral margin with 3 terminal bristles (2 short with few short spines; 1 long, plumose except along proximal and distal fourths); dorsal margin with row of short terminal spines; medial and lateral surfaces hirsute. 2nd endopodial joint: ventral margin with long bare distal bristle; dorsal margin with 2 bristles just proximal to midlength; medial surface with 2 rows of hairs (1 extending onto dorsal margin just proximal to dorsal bristles, and 1 terminal). 3rd endopodial joint with long bare terminal claw, 1 small bare dorsal bristle, and 2 bare ventral bristles (1 short, 1 long).

Maxilla (Figure 89a): Limb minute (illustrated limb drawn with oil immersion lens (×100 objective, ×15 ocular)). Endites with weak bristles (not shown). Coxale with dorsal bristle. Exopodite with 2 bristles (broken in illustrated limb). Basale and 1st and 2nd endopodial joints appear fused with most bristles weakly developed (indistinct) (not all shown).

Fifth Limb (Figure 89b): Exopodite minute (illustrated limb drawn with oil immersion lens (×100 objective, ×15 ocular)). Single endite with 1 short bristle. 1st exopodial joint with 2 spinous bristles. Exopodial joints 2–5 fused, with total of 10 bristles.

Sixth Limb (Figure 89c): Single endite with 3 short bristles. End joint with 14 plumose bristles. Limb hirsute. (Endite II present on adult female fused with end joint on adult male.)

Seventh Limb (Figure 89d): Each limb with 2 proximal bristles, 1 on each side, each with 3 or 4 bells; terminal group with 4 bristles (each side with 1 short bristle with 5 or 6 bells and 1 longer bristle with 6 bells). Terminus with comb of about 8 teeth opposite 1 or 2 short pegs.

Furca (Figure 89e,f): Similar to that of adult female, except claws are slenderer.

Bellonci Organ (Figure 89g,h): Long, cylindrical, with 4 proximal sutures and rounded tip.

Eyes: Medial eye well developed, bare, with dark brown pigment (Figures 88d, 89g,h). Lateral eye about same size as medial eye, with dark brown pigment and 5 amber-colored ommatidia (Figures 88d, 89i).

Genitalia (Figure 89f,j,k): Two or 3 lobes on each side of body anterior to furca; longest lobe with sclerotized hook

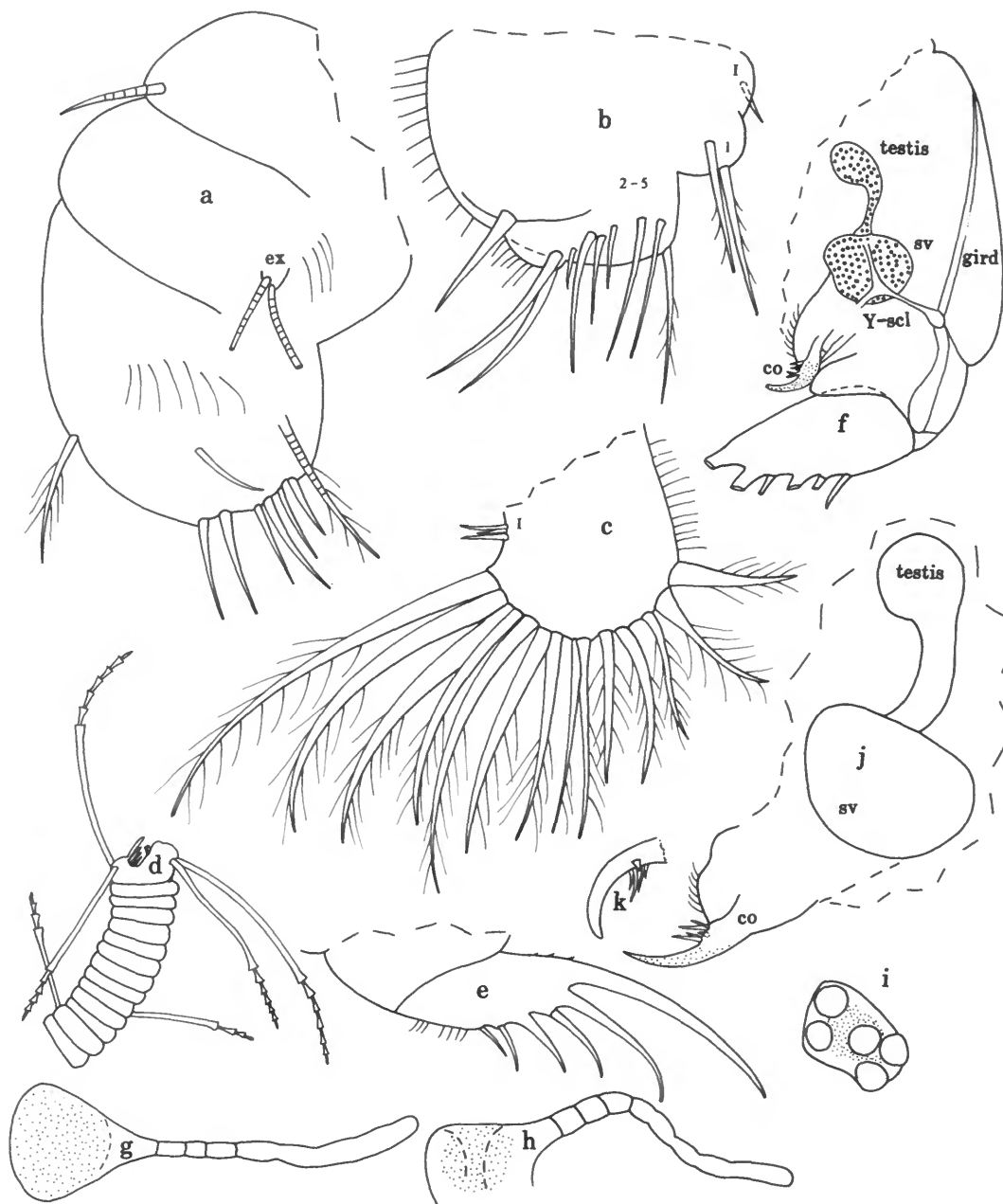


FIGURE 89.—*Chelicopia pertinex*, new species, adult male, paratype, USNM 194031: *a*, maxilla (not all bristles shown); *b*, 5th limb (not all bristles shown); *c*, 6th limb; *d*, 7th limb; *e*, right lamella of furca (teeth on claws not shown); *f*, posterior of body from left side, anterior to left (only left lamella of furca shown, and only proximal parts of most claws); *g*, *h*, dorsal or ventral view, and lateral view, respectively, of medial eye and Bellonci organ (area of black pigment stippled); *i*, lateral eye (area of black pigment stippled); *j*, left copulatory apparatus from left side, anterior to left; *k*, inside view of tip of copulatory organ shown in *j*.

having small triangular tooth and 4 bristles proximally on concave edge.

Posterior of Body (Figure 89f), and *Y-Sclerite* (Figure 89f): Similar to those of adult female.

COMPARISONS.—The carapace of the adult female *C. pertinax* is smaller (length 1.02–1.35 mm) than that of *C. squameospinosa* Hall, 1985:513 (length 1.43–1.53 mm), and does not have the bent surface bristles that characterize that species (Hall, 1985, fig. 11B). If the Bellonci organ of *C. squamosa* illustrated by Hall (1985, fig. 9C) represents an unbroken organ, it is much shorter than that of *C. pertinax*. Also, hairs are present on the Bellonci organ of *C. squamosa*, but are absent on that of *C. pertinax*. The bristles on the carapace of *C. pertinax* appear to be similar to those of *C. arastrata* Kornicker, 1958 (Kornicker, 1986, fig. 9a) except some long bristles of that species have a minute bulb at tip (Kornicker, 1986, fig. 9e), and *C. tasmanensis* Kornicker, 1981d:386. Both species differ from *C. pertinax* in having 2 rather than 1 proximal bristle on the endopodite of the 2nd antenna. *Chelicopia arastrata* also has a terminal bristle on the endopodite of the female 2nd antenna that is absent on *C. pertinax*.

Chelicopia triplex, new species

FIGURES 90, 91

ETYMOLOGY.—From the Latin *triplex* (threefold).

HOLOTYPE.—Undissected adult 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 193935, adult female on slide and in alcohol; 5 unopened adult females in alcohol (7th limb with cylindrical bristles (visible through shell) indicating specimens are adults).

DISTRIBUTION.—Slope 1, 204 m.

DESCRIPTION OF ADULT FEMALE (Figures 90, 91).—Carapace round in lateral view, without incisur (Figure 90b); carapace in dorsal view broader in posterior half (Figure 90a).

Posterior edge of caudal process slightly concave (Figure 90e,f), but concavity not reflected in convex outline of valve which extends past concavity.

Ornamentation: Surface with abundant short bristles with digitate (serrate) tips (Figure 90c,d). Longer bristles, most with rounded tips, present in vicinity of posterior edge of caudal process (Figure 90f). Long slender bristles stouter in proximal half and with pointed tips sparsely distributed along valve edges, especially along anterior (Figure 90d) and ventral edges. Slender bristles, some with broad triangular base, sparsely distributed on outer surface and near edges, more abundant in vicinity of posterior edge of caudal process; a few bristles with short broad part near tip; concave edge of caudal process with 1 or 2 straight pointed bristles on ventral and dorsal ends

(Figure 90e). Surface without gel-like coating.

Infold: Anterior infold with 1 small bristle ventral to midheight of valve (Figure 90d). Infold of caudal process with row of 5 or 6 bristles along narrow list and several slenderer bristles along inner margin of infold (Figure 90f). Posterior infold with 2 setal bristles dorsal to caudal process (Figure 90f).

Selva: Broad continuous lamellar prolongation along anterior, ventral and posterior margins of valve; long fringe of hairs observed on edge of prolongation along anterior margin of left valve of USNM 193935 but not on right.

Carapace Size (length, height in mm): Slope 1: holotype, 0.86, 0.73; USNM 193935, 0.87, 0.78; 5 specimens: 0.86, 0.73; 0.84, 0.71; 0.78, 0.72; 0.81, 0.77; 0.81, 0.69. Length range 0.78–0.87.

First Antenna (Figure 90g,h): 1st joint bare. 2nd joint with 1 dorsal bristle with long hairs. 3rd and 4th joints fused; 3rd joint with 2 equilateral bare bristles (1 dorsal, 1 ventral); 4th joint with 2 bristles (1 short dorsal with few indistinct short spines, 1 long spinous ventral). 5th joint with long ventral bristle with 1 minute filament. Medial bristle of 6th joint short with few indistinct spines. 7th joint: a-bristle about 3 times length of bristle of 6th joint with few indistinct spines; b-bristle about twice length of a-bristle, bare except for terminal spine; c-bristle longer than bristle of 5th joint, with 2 small proximal filaments and 1 minute spine-like distal filament. 8th joint: d- and e-bristles very slightly shorter than bristle of 5th joint, bare with blunt tips; f-bristle about same length as e-bristle, with 2 small proximal filaments and 1 minute spine-like distal filament; g-bristle about same length as bristle of 5th joint, with 2 small proximal filaments and 1 minute spine-like distal filament. (Filaments on bristles of 7th and 8th joints not shown.)

Second Antenna: Protopodite bare. Endopodite 1-jointed with 1 proximal bristle and very low terminal bulge (Figure 90i). Exopodite: 1st joint with small bent medial terminal bristle; bristle of 2nd joint long with 21 slender proximal ventral spines and distal natatory hairs; bristles of joints 3–8 long with proximal ventral spines and distal natatory hairs; 9th joint with 2 bristles (ventral long with proximal ventral spines and distal natatory hairs; dorsal short with small hairs); joints 2–7 with row of minute spines along distal margins.

Mandible (Figure 90j): Coxale with ventral spines and endite represented by stout spine (not shown). Basale with 4 short ventral bristles, 1 lateral bristles at joint midheight, and 1 distal dorsal bristle. Exopodite represented by slender spine. 1st endopodial joint: medial surface with few distal spines, row of spines along dorsal $\frac{1}{3}$ of distal margin, and 2 spine-like bristles at base of stout ventral claw; lateral surface with spines along dorsal half of distal margin. 2nd endopodial joint with 2 distal spine-like dorsal bristles, lateral spines near base of 3rd endopodial joint, and stout ventral claw. 3rd endopodial joint with 2 small spine-like bristles (1 ventral, 1 dorsal) at base of stout terminal claw.

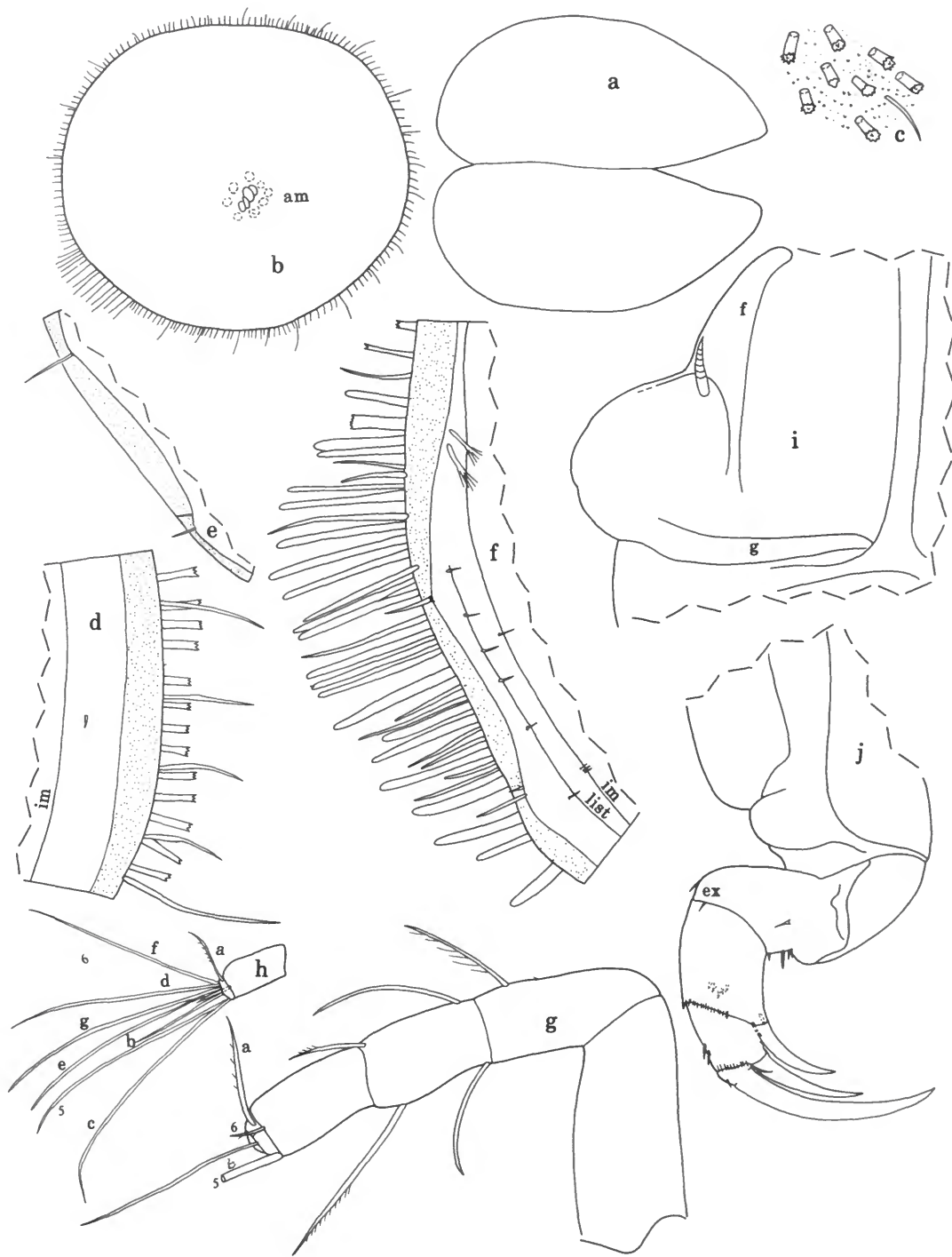


FIGURE 90.—*Chelicopia triplex*, new species, adult female, unnumbered paratype: *a*, dorsal view of complete carapace, anterior to right (valves open about 30°), length 0.86 mm. Adult female, paratype, USNM 193935: *b*, complete specimen from right side, length 0.87 mm (only marginal bristles shown); *c*, detail of carapace bristles dorsal to central adductor muscle attachments; *d*, anterior of left valve, iv; *e*, caudal process of left valve showing 3 bristles along valve edge, iv; *f*, posteroventral corner of left valve, iv; *g*, right 1st antenna, mv (not all bristles shown); *h*, tip of left 1st antenna, lv; *i*, endopodite and part of protopodite, right 2nd antenna, mv; *j*, left mandible, lv.

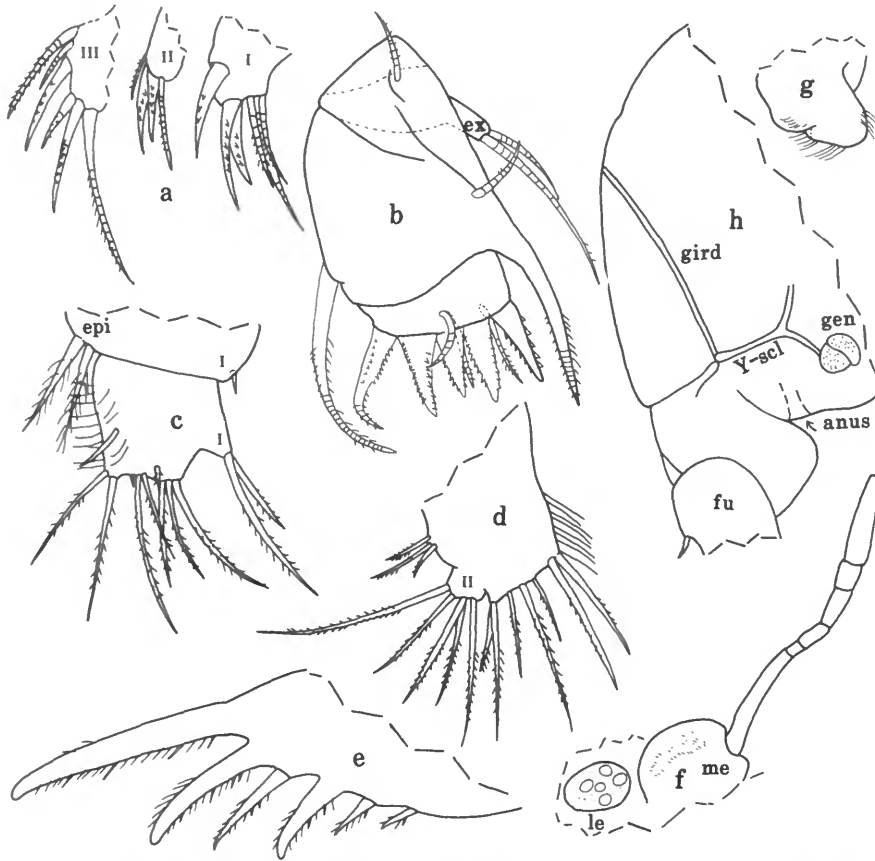


FIGURE 91.—*Chelicopia triplex*, new species, adult female, paratype, USNM 193935: a, endites of maxilla; b, right maxilla, mv (endites not shown); c, 5th limb; d, 6th limb; e, left lamella of furca; f, dorsal part of anterior of body from right side, anterior to right; g, upper lip from right side, anterior to right; h, posterior of body from right side, anterior to right.

Maxilla: Protopodite with single spinous dorsal bristle (bristle displaced in Figure 91b), fringe of dorsal hairs, and diaphanous thumb like process (latter observed on only 1 limb) (fringe and diaphanous process not shown in Figure 90b). Endite I with 6 bristles; endite II with 4 bristles; endite III with 6 bristles (Figure 91a). Basale with short bristle near base of exopodite (bristle displaced in Figure 91b). Exopodite with 2 bristles. 1st and 2nd endopodial joints typical (Figure 91b).

Fifth Limb (Figure 91c): Single endite with 1 small bristle. 1st exopodial joint with 2 bristles. Exopodial joints 2–5 fused, with total of 10 bristles.

Sixth Limb (Figure 91d): Rather rectangular in shape, with 2 endites: endite I with 3 small spinous bristles; endite II separated by space from endite I, with 4 or 5 long spinous terminal bristles. End joint with 7–9 bristles with short spines (spines on 2 posterior bristles similar to those on others).

Seventh Limb: Proximal group with 4 bristles, 2 on each

side, each with 4 bells. Terminal group with 6 bristles, 3 on each side (1 short with 3 bells, 2 long with 5 or 6 bells). Terminal comb with 4 or 5 curved teeth opposite 2 small curved pegs.

Furca (Figure 91e): Each lamella with 6 claws, all with teeth along posterior edges and spines along anterior edges; claw 1, 2, and 4 nonarticulated. Right lamella anterior to left by width of base of claw 1, with medial spines near anterior edge and spines along anterior edge, and with few long spines following posterior claw (not shown).

Bellonci Organ (Figure 91f): Elongate, bare, with 5 weak sutures in middle part and broadly rounded tip.

Eyes (Figure 91f): Lateral eye with 5 ommatidia and dark brown pigment between ommatidia. Medial eye larger than lateral eye, bare, with dark brown pigment.

Upper Lip (Figure 91g): Evenly rounded, hirsute, with few anterior hairs but no thickened spines.

Genitalia (Figure 91h): Oval (with attached oval spermatophore) on each side of body anterior to furca.

Posterior of Body (Figure 91h): Evenly rounded bare.

Y-Sclerite (Figure 91h): With ventral branch.

Eggs: USNM 193935 with 2 large unextruded eggs, length of 1 egg 0.19 mm.

COMPARISONS.—The digitate (serrate) bristles on the carapace of *C. triplex* are similar to those of *C. radix* Kornicker (1992, fig. 87a,d) except in that species the digitations are on a diaphanous flare at the tip of the bristles. The mandible of *C. radix* differs from that of *C. triplex* in having 2 proximal prongs on the ventral claw of the 1st endopodial joint.

Parasarsiella Poulsen, 1965

Parasarsiella Poulsen, 1965:70.—Kornicker, 1986:38.

Metasarsiella Kornicker, 1991:104.

TYPE SPECIES.—*Sarsiella globulus* Brady and Norman, 1887, by monotypy.

COMPOSITION.—Four species are referred to this genus: *P. benthedi* (Kornicker, 1992:166), *P. globulus*, *P. vibex* (Kornicker, 1992:105), and *P. poorei*, new species herein.

DISTRIBUTION.—*Parasarsiella benthedi* from western Indian Ocean, depth 50–150 m, *P. globulus* from between the Canary Islands and Cape Verde Islands at depths of 932–2333 m, and off Frederiksted, St. Croix, U.S. Virgin Islands at unknown depth, *P. vibex* from Enewetak lagoon, depth 2–7 m, and *P. poorei* from Slope 1, depth 204 m.

REVISED DIAGNOSIS.—Furca with only claw 1 nonarticulated, claws decreasing in length and width along lamella, with either 7 claws on each lamella, or 6–8 on left lamella and 5 or 6 on right lamella, and more claws on left lamella than on right, or with 6 claws on each lamella and claw 3 about same length and width as claw 4. Sixth limb with 1 or 2 endites.

REMARKS.—Poulsen (1965:71) described an A-1 male of the type species and proposed the monotypic genus *Parasarsiella* and gave a comprehensive diagnosis of the genus. Kornicker (1986:38) gave a shortened diagnosis for the genus based on the furca having more than 5 claws, with only claw 1 nonarticulated, and claw 3 longer and stouter than claw 4. Kornicker (1991a:104) proposed a new genus *Metasarsiella* having a furca with 6 claws, with claw 3 about same width and length as claw 4, and noted that the furca of *Parasarsiella* (sensu Poulsen, 1965:70) has 7 claws. The furca of the new species *P. poorei* appears to bridge *Parasarsiella* and *Metasarsiella*, and therefore, the 2 genera are synonymized herein. The diagnosis of *Parasarsiella* has been revised above. Note: The type species of *Parasarsiella*, *P. globulus*, differs from the 3 additional species referred to the genus in having a bifurcate coxale endite on the mandible, and 2 rather than 1 endite on the 6th limb. It is probable that the genus will eventually be split.

Parasarsiella poorei, new species

FIGURES 92–95

ETYMOLOGY.—The species is named for Dr. Gary C.B. Poore, Museum of Victoria, who supplied the specimens upon which this study is based.

HOLOTYPE.—Ovigerous female separated from carapace, 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 193937, partly dissected ovigerous female in alcohol; USNM 193938, adult female on 2 slides and in alcohol; USNM 193936, adult male on slide and in alcohol; 9 unnumbered specimens (including 1 late juvenile, 1 adult female, 1 adult male, and 1 ovigerous female with bryozoan on left shell) in alcohol.

NONTYPES.—Slope 1: 1 early juvenile in alcohol (a Foraminifera cemented to carapace).

DISTRIBUTION.—Slope 1, 204 m.

DESCRIPTION OF ADULT FEMALE (Figures 92, 93a–g).—Carapace round in lateral view except for straight posterior margin and rather short projecting caudal process (Figure 92a,d); incisur and rostrum absent; each valve with well-developed posterodorsal wing-like projection with pointed posterior end reaching to, or extending just past, posterior edge of valve; anterior end of projection joins valve dorsal to central adductor muscles; in dorsal view posterior end of projection forms slightly less than right angle with plane of valve (Figure 92b); tip of caudal process narrowly rounded in lateral view. All specimens with large secondary calcareous nodules.

Ornamentation: Alar projection described above. Surface appearing smooth at low magnification, but at high magnification ($\times 20$ objective, $\times 15$ ocular) abundant minute spines visible (seen best in profile along edge) (Figure 92e); clusters of slightly larger spines scattered over valve surface appear light brown in transmitted light. Bristles of various length, some with broad base, very sparsely distributed on outside surface and along margins. Carapace without gel-like coating.

Infold: Anterior infold with 1 small bristle near midheight. Infold of caudal process with about 16 unringed bristles plus several bristles near inner margin (Figure 92e). Posterior infold with 2 setal bristles close to dorsal margin of valve (Figure 92f). Four small, oval, slightly dark areas present between vestment and shell just anterior to infold of caudal process (Figure 92c) (these resemble those described by Poulsen (1965:89; fig. 25b) for *Eusarsiella magna* but are spaced differently).

Central Adductor Muscle Attachments (Figure 92a): Comprising about 17 small ovoid attachments.

Carapace Size (length, height in mm): Slope 1: holotype, 3.2, 2.7; USNM 193937, 3.18, 2.72; USNM 193938, 3.2, 2.8; unnumbered specimen, 2.7, 2.2 (specimen with bryozoan on left shell).

First Antenna (Figure 92g): 1st joint bare. 2nd joint with



FIGURE 92.—*Parasarsiella poorei*, new species, ovigerous female, paratype, USNM 193937: *a*, complete specimen from right side showing 5 eggs and central adductor muscle attachments, length 3.18 mm; *b*, dorsal view of complete specimen, anterior to right; *c*, caudal process of left valve showing 4 oval dark areas (stippled) anterior to infold, ov. *d*, ovigerous female, paratype, unnumbered specimen, complete specimen from left side showing attached bryozoan, length 2.7 mm. Adult female, paratype, USNM 193938, length 3.2 mm: *e*, caudal process, left valve, iv; *f*, posterior of right valve showing location of 2 setal bristles, iv; *g*, medial eye, Bellonci organ, and right 1st antenna (d-, e-, and g-bristles not shown); *h*, right lamella of furca (teeth not shown); *i*, right lateral eye, anterior to right; *j*, medial eye and Bellonci organ.



FIGURE 93.—*Parasarsiella poorei*, new species, adult female, paratype, USNM 193938: *a*, endopodite, left 2nd antenna, mv; *b*, right mandible, mv; *c*, endites left maxilla, mv; *d*, right maxilla, lv (endite bristles not shown); *e*, 5th limb; *f*, 6th limb; *g*, posterior of body from left side, anterior to left. Adult male, paratype, USNM 193936: *h*, posterior of body from left side, anterior to left.

plumose dorsal bristle. 3rd joint fused to 4th, with 2 spinous bristles (1 ventral, 1 dorsal); 4th joint with 4 spinous terminal bristles (3 ventral (1 unusually long), 1 dorsal). 5th joint with long ventral bristle with minute proximal filament and minute terminal spine. 6th joint with small medial bristle with short spines. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with short marginal spines; b-bristle longer than a-bristle; c-bristle about same length as bristle of 5th joint, with minute terminal spine. 8th joint: d- and e-bristles slightly shorter than f-bristle, bare with blunt tips (not shown); f-bristle slightly shorter than c-bristle, with minute proximal filament and terminal spine; g-bristle about same length as c-bristle, with 2 minute proximal filaments and terminal spine (not shown). (Filaments on bristles of joints 7 and 8 not shown.)

Second Antenna: Protopodite bare. Endopodite with 2 short spinous proximal bristles and terminal node (node could be interpreted to be 2nd joint) with short spinous bristle (Figure 93a). Exopodite: 1st joint with minute terminal medial bristle; bristle of 2nd joint long, with 0 or 2 proximal ventral spines, a few long proximal hairs near spines, and distal natatory hairs; bristles of joints 3–8 long, with natatory hairs, no spines; 9th joint with 2 bristles (ventral long, dorsal medium) with natatory hairs, no spines; joints 3–8 with minute spines along distal edges.

Mandible (Figure 93b): Coxale with ventral spines; coxale endite a stout spine with short marginal spines. Basale: 6 bristles near ventral margin (4 medial, 2 lateral); dorsal margin with 3 spine-like bristles (1 near midlength, 2 subterminal). Exopodite absent. 1st endopodial joint: medial surface with about 80 small spines at midwidth, about 20 small spines along dorsal half of distal edge (not all spines shown), and short spine-like bristle at base of stout ventral claw; dorsal margin with row of terminal spines. 2nd endopodial joint with stout ventral claw and minute indistinct spine-like dorsal bristle. 3rd endopodial joint with stout terminal claw with 3 small spine-like bristles at base (2 ventral, 1 dorsal).

Maxilla: Protopodite with short diaphanous lobe, dorsal fringe, and short dorsal bristle (Figure 93d). Endite I with 6 bristles; endite II with 4 bristles; endite III with 6 bristles (Figure 93c). Basale with bristle with short spines near exopodite. Exopodite with 3 bristles (1 long, 2 short) with short spines (Figure 93d). 1st endopodial joint with medial spines near and on anterior margin and spinous alpha- and beta-bristles. 2nd endopodial joint with 2 lateral a-bristles (posterior longer) with short spines, 1 medial c-bristle about same length as anterior a-bristle, and 5 stout pectinate terminal bristles (anterior bristle ringed distally, others unringed claw-like; middle bristle shorter than others).

Fifth Limb (Figure 93e): Epipodite with 50 bristles. Single endite with short bristle. 1st endopodial joint with 3 spinous bristles. Endopodial joints 2–5 fused, with total of 10 spinous bristles (2 small).

Sixth Limb (Figure 93f): Single endite with 3 short bristles with short spines. Anterior half of end joint with 14 or 15

bristles with short spines; posterior end projecting posteriorly, with 2 broad plumose bristles. Hairs present along posterior margin of limb and proximally in posterior half.

Seventh Limb: 1 limb of USNM 193938 With 26 proximal bristles (11–15 on each side), each with 4 or rarely 5 bells, and 6 terminal bristles (3 on each side; 1 of these missing), each with 4–8 bells; other limb of USNM 193938 broken, with 20 proximal (some lost?) and 6 terminal bristles. Terminus with opposing combs, each with 10 or 11 teeth.

Furca (Figure 92h): Claw 1 nonarticulated, others articulated; claws decreasing in length and width posteriorly along lamella, and with teeth along posterior edges (some teeth longer than others); left lamella with 7 or 8 clusters of spines following posterior claw and may have spines between 2 posterior claws, right lamella with fewer clusters following posterior claw; right lamella with minute spines along anterior margin and medially near anterior margin, including spines near base of claw 1; right lamella anterior to left by about width of base of claw 1. Furca (4 specimens) with total of 11–14 claws; each lamella with 5–8 claws; left lamella with 1–3 claws more than right lamella. The numbers of claws on 4 specimens are tabulated below.

Specimen	Number of Claws	
	Right lamella	Left lamella
Holotype	5	8
USNM 193837	5	6
USNM 193938	6	7
Specimen with bryozoan	6	8

Bellonci Organ (Figure 92g,j): Short, elongate, bare, cylindrical, with uneven tip.

Eyes: Medial eye bare with dark brown pigment (Figure 92g,j). Lateral eye smaller than medial eye, amber colored or with brown pigment, with 5 distinct ommatidia (Figure 92i).

Genitalia: Small amber-colored oval with attached spermatophore on each side of body anterior to furca.

Posterior of Body (Figure 93g): With spines at midheight.

Y-Sclerite (Figure 93g): With ventral branch.

Number of Eggs: Holotype with 10 eggs (5 inside each wing-like process) and about 13 fairly large unextruded eggs (6 or 7 on each side); length of extruded egg 0.38 mm, length of unextruded egg 0.27 mm. USNM 193937 with 11 eggs in marsupium (5 or 6 inside each wing-like process (Figure 92a)) and about 14 small unextruded eggs (7 on each side), length of 5 extruded eggs (mm): 0.39, 0.37, and 3 eggs at 0.36; length of unextruded egg 0.19 mm. Specimen with bryozoan on left shell with 7 eggs in marsupium (length of 1 egg 0.41 mm) and many small unextruded eggs (length of 1 egg 0.12 mm).

Epizoa: Ovigerous female from Slope 1 with bryozoan on left shell (Figure 92d) (bryozoan identified by Dr. Alan H. Cheetham). An early juvenile from Slope 1 has a foraminiferan cemented to shell.

DESCRIPTION OF ADULT MALE (Figures 93h–95).—Carapace oval in lateral view with projecting caudal process, anterior concavity, and wing-like posterodorsal process extending past valve margin (Figure 94a,b). Anterior and ventral

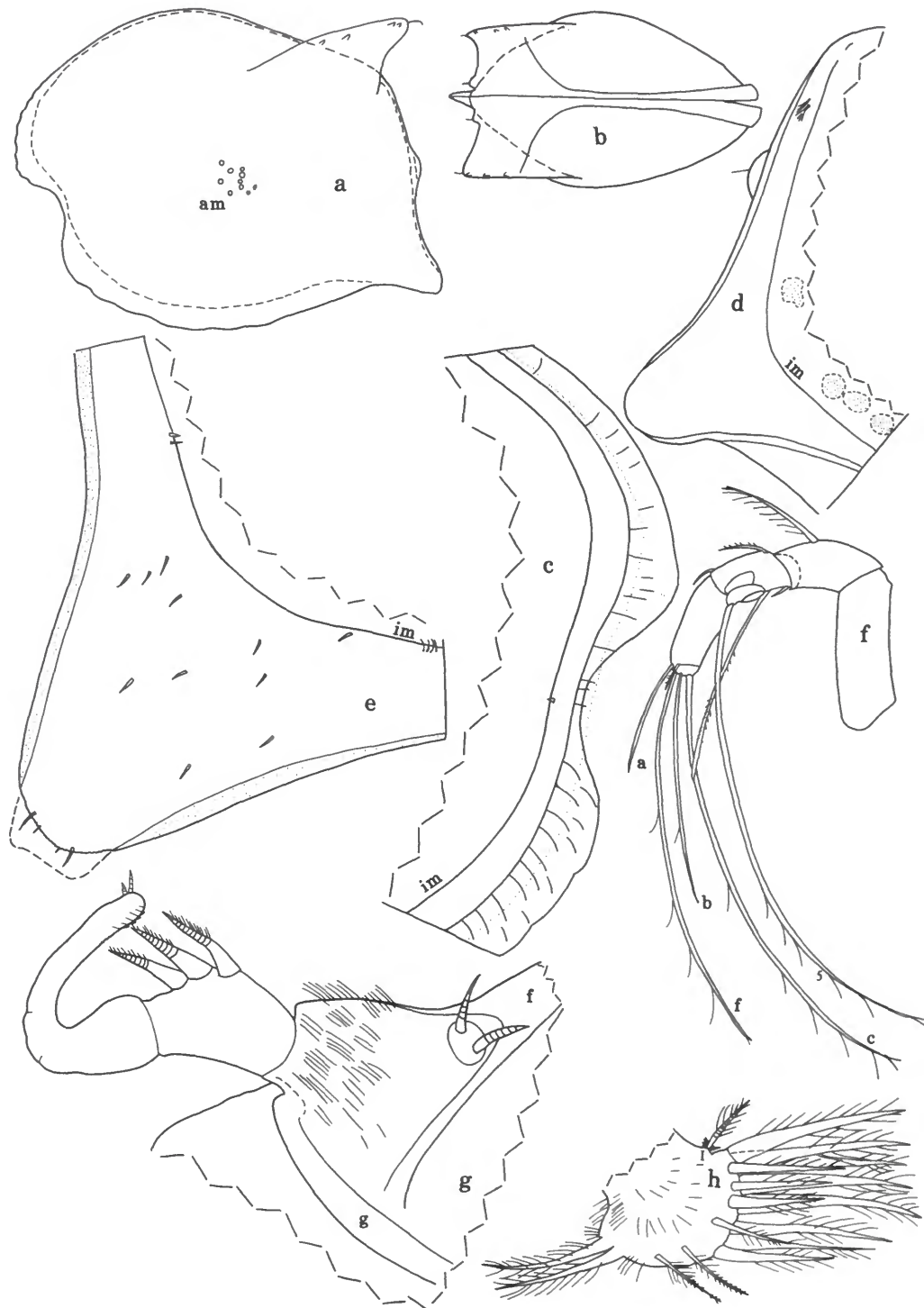


FIGURE 94.—*Parasarsiella poorei*, new species, adult male, paratype, USNM 193936: *a*, complete specimen from left side showing location of central adductor muscle attachments, length including caudal process 2.70 mm; *b*, complete specimen, dorsal view, anterior to right; *c*, anterior of left valve, iv; *d*, posterior of left valve, iv (only setal bristles shown); *e*, caudal process, left valve, iv; *f*, right 1st antenna, mv (d-, e-, and g-bristles not shown); *g*, endopodite, right 2nd antenna, mv; *h*, left 6th limb, mv.



FIGURE 95.—*Parasarsiella poorei*, new species, adult male, paratype, USNM 193936: *a*, right mandible, mv, *b*, maxilla (not all bristles shown); *c*, 5th limb; *d*, left lamella of furca (teeth not shown); *e*, anterior of body (only terminal claw shown on mandible); *f*, lateral eye; *g*, medial eye and Bellonci organ.

margins with wide thin flange-like overhang with anterior concavity (Figure 94*a,c*); inner edge of flange coincides with outer edge of valve (dashed line in Figure 94*a*).

Ornamentation: Outer lateral edge of posterodorsal process with 3 or 4 small nodes (Figure 94*a,b*); posterior edge of process (where it joins valve) with small protuberance bearing

a bristle (Figure 94*b*). Long bristles very sparse on lateral surface but numerous along anterior and ventral margins medial to wide flange. Surface appearing smooth but with closely packed minute spines visible best along valve edges in transmitted light at high magnification ($\times 20$ objective, $\times 15$ ocular). A small node bearing a long bristle present at

midheight of posterior edge of each valve (Figure 94d). All specimens with large secondary calcareous concretions and without gel-like coating.

Infold: Anterior infold with minute bristle ventral to valve midheight and posterior to concavity of flange (Figure 94c). Infold of caudal process with about 10 bristles and also several bristles along inner margin of infold (Figure 94e). Four oval slightly dark areas between vestment and shell just anterior to inner margin of infold of caudal process (3 anterior ovals separated by space from posterior oval) (Figure 94d) (similar ovals in female shell). Two setal bristles dorsal to caudal process.

Selvage: Wide lamellar prolongation (with smooth outer edge) along anterior and ventral shell margins; prolongation projects past tip of caudal process and with square tip (Figure 94e).

Carapace Size (length, height in mm): Slope 1: USNM 193936, length including caudal process 2.70, length without caudal process 2.39, height 1.90; unnumbered specimen, length including caudal process 2.32, height 1.65.

First Antenna (Figure 94f): 1st joint bare. 2nd joint with plumose dorsal bristle. 3rd joint fused to 4th, with 2 bristles (1 ventral, 1 dorsal); 4th joint with 2 bristles (1 long ventral, 1 short dorsal). 5th joint small, wedged ventrally between 4th and 6th joints; sensory bristle with proximal cup with abundant thin filaments (not shown) and stem with 5 distal filaments and bifurcate tip. 6th joint long, with short spinous medial bristle near dorsal margin. 7th joint: a-bristle spinous, 3 or 4 times length of bristle of 6th joint; b-bristle 2 or 3 times length of a-bristle, with distal filament and minute spine at tip; c-bristle reaching tip of sensory bristle of 5th joint, with 5 distal filaments and bifurcate tip. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips (not shown); f-bristle shorter than c-bristle, with 4 marginal filaments and bifurcate tip; g-bristle with tip broken, with 4 distal filaments on remaining part (not shown).

Second Antenna: Protopodite bare. Endopodite 3 jointed (Figure 94g): 1st joint with 2 proximal bare bristles and long medial spines; 2nd joint with 3 short spinous bristles; 3rd joint recurved, with 2 small terminal bristles and 6 small ridges near tip of inner end; outer edge of curved part of joint unevenly scalloped. Exopodite: bristle of 2nd joint with 13 ventral spines and both proximal and distal natatory hairs; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 2 bristles (ventral bristle stout with natatory hairs; dorsal bristle medium with few proximal dorsal spines and distal natatory hairs); joints 3–7 with small spines along distal edges.

Mandible (Figure 95a): Coxale endite represented by small spine with small marginal spines. Basale: with 6 ringed bristles near ventral margin, most with short spines; dorsal margin with 3 long spinous bristles (1 distal to midlength, 2 subterminal). Exopodite short, spinous, with ringed bristle with base at proximal 1/4 of exopodite; exopodite lateral relative to 1st endopodial joint (does not overlap medial side of joint as on

some other male sarsiellids). 1st endopodial joint: medial side with abundant rows of minute spines; ventral margin with 2 spinous ringed terminal bristles (medial short, lateral long); dorsal margin with small indentation in vicinity of exopodite, and row of terminal spines. 2nd endopodial joint: medial surface with few rows of minute spines; ventral margin with long ringed bare bristle; dorsal margin with short spinous ringed bristle at midlength, and rows of distal spines. 3rd endopodial joint with extremely long stout terminal claw with minute proximal medial spines and indistinct dorsal hairs, 1 small indistinct ringed dorsal bristle, and 2 ventral bristles (shorter ringed; longer weakly ringed, with ventral spines).

Maxilla (Figure 95b): Extremely small, with weakly developed bristles. Precoxale and coxale with dorsal fringe; coxale with dorsal bristle. Exopodite with 1 long and 2 shorter bristles (these 3 bristles stronger than others on limb). Some weakly developed bristles of 2nd exopodial joint with long hairs (not shown).

Fifth Limb (Figure 95c): Epipodite with 50 bristles (same number as on adult female). Single endite with 1 bristle. Exopodite extremely small: 1st joint with 3 plumose weakly developed bristles; joints 2–5 fused, hirsute, with total of about 8 bristles (2 ringed, others unringed and weakly developed).

Sixth Limb (Figure 94h): Single endite with 3 bristles (2 small with short spines, 1 longer with long hairs). End joint with medial row of 6 bristles with either long spines, or both long and short spines, and edge row of 8 or 9 broad plumose bristles followed by space and 2 broad plumose posterior bristles. Limb hirsute.

Seventh Limb (Figure 93h): Short bare.

Furca (Figure 95d): Furca of USNM 193936 with 8 claws on left lamella and 5 on right; left lamella with 5 spine clusters following posterior claw, right lamella with 1 or 2 clusters; all claws with teeth along posterior edges, some teeth longer than others; claws 1–3 with medial row of small proximal teeth; right lamella with few minute spines along anterior edge but without longer medial spines present on adult female.

Bellonci Organ (Figure 95g): Short elongate cylindrical with unevenly rounded tip.

Eyes: Lateral eye almost as large as medial eye, amber colored with 8 ommatidia (Figure 95e,f). Medial eye bare with brown pigment (Figure 95e,g).

Genitalia (Figure 93h): With testis and a 3-lobed copulatory organ on each side of body anterior to furca; longest lobe with terminal hook and subterminal triangular process adjacent to 3 small bristles; 2 shorter lobes with a few small bristles.

Anterior of Body (Figure 95e): Rounded process on each side of centerline between mandible and 1st antenna.

Posterior of Body (Figure 93h): Bare.

Y-Sclerite (Figure 93h): Similar to that of adult female.

COMPARISONS.—The carapaces of *P. benthedi* and *P. vibex* differ from that of *P. poorei* in having many ribs. The carapace of *P. poorei* differs from that of *P. globulus* in having a wing-like posterodorsal process.

DANTYINAE Kornicker and Cohen, 1978

This subfamily includes 2 genera: *Dantya* Kornicker and Cohen, 1978, and *Nealella* Kornicker and Caraion, 1980. Both have representatives in the present collection.

EMENDED DIAGNOSIS.—Endopodite of mandible: 1st and 2nd joints each with 2 ventral claws, or 1 ventral claw on 1st joint and 3 ventral claws on 2nd joint, or no claws on 1st joint and 1 ventral claw on 2nd joint.

Dantya Kornicker and Cohen, 1978

TYPE SPECIES.—*Dantya magnifica* Kornicker and Cohen, 1978.

COMPOSITION.—With the new species described herein, the genus includes 6 species. The genus was not known previously from the vicinity of Australia.

DISTRIBUTION.—Caribbean Sea, Indian Ocean, central South Pacific, and southern slope off Australia. The shallowest depth at which the genus has been collected is 2 m inside a marine cave, and the deepest is from a trawl that fished between 250 m and 550 m. On the Australian slope it was collected at 204 m.

Dantya tryx, new species

FIGURES 96, 97

ETYMOLOGY.—From the Greek *tryx* (new wine).

HOLOTYPE.—Undissected adult female (embryo in marsupium, but cannot be certain it is an ostracod) 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.

PARATYPE.—USNM 193926, ovigerous female on slide and in alcohol.

DISTRIBUTION.—Slope 1, 204 m.

DESCRIPTION OF ADULT FEMALE (Figures 96, 97).—Carapace elongate with pointed overhanging rostrum and short projecting caudal process (Figure 96a-f); considerable lateral overlap of valve edge in rostrum and anteroventral valve corner, less along ventral margin (Figure 96f).

Ornamentation: Carapace surface with large deep fossae (Figure 96a,b); fossae smaller in vicinity of central adductor muscle attachments; raised surface between fossae with densely packed papillae and large smooth round nodes without papillae (Figure 96a,b,e); similar papillae less densely packed on floor of fossae; distinct rib extending along midwidth of rostrum (Figure 96e). Shallow vertical sulcus present near midlength of valve extending from dorsal margin to valve midheight, sulcus then continues ventrally just posterior to adductor muscle attachments, terminating adjacent to ventral margin of muscle attachments (sulcus not shown). Surface of valves and anterior and ventral margins with divided bristles (Figure 96e); surface of inner side of valve overlap at

anteroventral corner with 7 single bristles of various lengths near and parallel to valve edge, a row of 3 fairly stout undivided bristles close to ventral margin of overlap, and anterior to them 4 additional bristles (the anterior of these with 3 threads) (Figure 96f).

Infold: Rostral infold with 4 spinous bristles along outer edge (whether these bristles are on infold, or on shell surface distal to outer edge of infold, could not be resolved) (Figure 96f); anteroventral infold with 5 or 6 striae; infold of caudal process with lip bearing 5 broad spinous bristles dorsal to 4 or 5 stout bare spines (Figure 96f,g); lip forms anterior edge of "pocket"; inner margin of infold anterior to ventral end of lip with 6 bristles in 3 groups of 3, 1, and 2 bristles (posterior pair shown in Figure 96g).

Selvae: Broad lamellar prolongation across incisur terminating anteriorly at ventral bristle on rostral infold (outer edge of prolongation dashed and indicated by arrow in Figure 96f); prolongation narrow along anteroventral and ventral valve margins, and absent along posterior tip of caudal process, with smooth outer edge except for fringe present on short section near posterior end of anteroventral corner.

Central Adductor Muscle Attachments (Figure 96h,i): Consisting of about 20 oval attachments (muscle ends shown in Figure 96h; only 17 of the attachments shown in Figure 96i); individual attachments appear to coincide with locations of small surface fossae. Surface without gel-like coating.

Carapace Size (length, height in mm): Holotype, 1.34, 0.74; USNM 193926, 1.43, 0.69.

First Antenna (Figure 97a): 1st joint bare. 2nd joint with medial, ventral, and dorsal spines, and 1 dorsal bristle with long spines. 3rd and 4th joint fused (these joints on right limb but not on left limb of USNM 193926 unusually long (Figure 97a)); 3rd joint with 2 bristles (1 ventral, 1 dorsal); 4th joint with 3 spinous bristles (2 ventral, 1 dorsal). Ventral bristle of 5th joint with 2 or 3 minute proximal filaments and spines distal to midlength. Small 6th joint fused to 5th, with spinous medial bristle about $\frac{1}{3}$ longer than length of combined 5th and 6th joints. 7th joint: a-bristle spinous, about $\frac{1}{3}$ longer than bristle of 6th joint; b-bristle about same length as bristle of 6th joint, shorter than a-bristle, bare; c-bristle as long as bristle of

FIGURE 96.—*Dantya tryx*, new species, ovigerous female, paratype, USNM 193926: a,b, right and left views, respectively, of complete specimen, length 1.43 mm (fossae stippled); c, complete specimen from right side showing locations of egg and central adductor muscle attachments; d, dorsal view of complete specimen, anterior to left (slightly oblique); e, detail of rostrum of right valve showing divided bristles (raised surface stippled; small circles on raised surface represent nodes); f, right valve, iv (outer surface stippled); g, caudal process, left valve, iv; h, adductor muscle bundles protruding from right side of body, anterior to right; i, central adductor muscle attachments of right valve, anterior to right (not all attachments shown); j, right maxilla, mv (not all bristles shown); k, left maxilla, lv (not all bristles shown); l, right 6th limb, mv; m, tip of 7th limb (only proximal part of bristles shown); n, medial eye and Bellonci organ.





FIGURE 97.—*Dantya tryx*, new species, ovigerous female, paratype, USNM 193926: *a*, anterior of body from left side, anterior to left (not all bristles shown on 1st antenna; right lateral eye shown); *b*, right lateral eye and part of right 2nd antenna, anterior to left; *c, d*, endopodite and part of protopodite of left and right 2nd antennae, respectively, *mv*; *e*, bristles of 8th and 9th joints of exopodite, right 2nd antenna, *mv*; *f*, left mandible, *mv*; *g*, endites I and II of left 5th limb, *av*; *h*, left 5th limb (joints 2, 4, and 5), *pv*; *i, j*, right 5th limb (distal part, not all bristles shown), *av*; *k*, posterior of body from right side, anterior to right (left furcal lamella not shown); *l*, anterior of body from right side, anterior to right.

5th joint, with 2 small proximal filaments and spines distal to midlength. 8th joint: d- and e-bristles as long as c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with about 3 short filaments; g-bristle as long as c-bristle, with about 5 short filaments. Bristle of 5th joint and c-, f-, and g-bristles with 2 minute processes at tip. (Spines on bristle of 5th joint and c-bristle of 7th joint not previously reported on members of family.) (Only stump of bristle of 5th joint and no bristles of joints 6–8 shown.)

Second Antenna: Protopodite bare (Figure 97b). Endopodite 2-jointed (Figure 97c,d): 1st joint with 2 small ringed proximal anterior bristles; 2nd joint of left limb of USNM 193926 with long spinous ventral bristle; right limb with short terminal bristle in addition to ventral bristle (possibly aberrancy because terminal bristle absent on endopodites of 5 previously described species of genus). Exopodite: 1st joint with small straight medial terminal bristle; bristles of joints 2–7 with 6–8 stout ventral spines on proximal segments, a few long dorsal hairs proximal to spines, and distal natatory hairs; bristle of 8th joint with 6 stout ventral spines, a few long ventral hairs proximal to spines, and distal natatory hairs. 9th joint with 3 bristles (ventral with slender ventral spines and distal natatory hairs; 2 dorsal short bare (Figure 97e); joint 2 with 2 rows of short spines; joints 3–7 with spines forming single row; joints 4–8 with small basal spines; spine of 8th joint about same length as 9th joint (dashed in Figure 97e).

Mandible (Figure 97f): Coxale endite with stout spine with long slender proximal spines and 2 indistinct minute distal spines; medial surface of coxale with rows of long spines in ventral half. Basale: medial side with few rows of long slender spines, and 2 unringed and 3 ringed bristles (2 with marginal spines) near ventral margin; lateral side near ventral margin with 3 ringed bristles with few spines; dorsal margin with 3 ringed bristles (1 proximal to midlength and 2 terminal (longest just reaching 2nd endopodial joint)). Exopodite about $1/5$ length of dorsal margin of 1st endopodial joint, with ringed subterminal bristle reaching past midlength of dorsal margin of 1st endopodial joint. 1st endopodial joint: dorsal margin with row of slender terminal spines; ventral margin with 3 terminal bristles (1 small bare ringed medial; 1 stout medial (with distal rings, claw-like proximal part, and slender marginal spines (proximal spines longer and slightly stouter than distal spines)); and 1 stout lateral claw-like with slender spines along ventral edge). 2nd endopodial joint: dorsal margin with 4 spinous bristles just distal to midlength (3 ringed, other unringed claw-like but tapering to point); ventral margin with tapering unringed claw-like bristle at midlength (with marginal spines (proximal spines stouter and longer)), and stout bare terminal claw; lateral side with small bare spine-like unringed bristle near terminal ventral claw and short unringed bare terminal claw at midwidth (dashed in Figure 97f). 3rd endopodial joint with 2 small ringed lateral bristles near ventral edge, 3 stout claws (dorsal claw reaching past midlength of longest claw and with 2 or 3 minute proximal spines; long medial claw with 1 or

2 small proximal spines; longest claw lateral and with 1 or 2 indistinct minute proximal spines (not shown)).

Maxilla (Figure 96j,k): Precoxale, coxale, and basale with hairs on or near dorsal margin (Figure 96k). Coxale with slender dorsal bristle. Endite I broad with 9 bristles (Figure 96j); endite II narrow with 3 bristles; endite III narrow with 5 bristles (1 subterminal on anterior margin, others terminal). Basale with slender medial bristle near ventral margin (Figure 96j) but no dorsal bristle. Exopodite with 3 equilength long terminal ringed bristles (Figure 96k). 1st endopodial joint with ringed alpha-bristle (with proximal spines) and stouter beta-bristle ringed distally. 2nd endopodial joint with 2 ringed spinous lateral a-bristles, 1 shorter ringed spinous medial c-bristle, and 5 pectinate terminal bristles (anterior slender and ringed distally; next short unringed; middle bristle longer, stouter, unringed; next similar to middle bristle; posterior bristle similar except ringed and with teeth extending almost to tip).

Fifth Limb (Figure 97g–j): Endite I with 2 bristles (Figure 97g). Endites II and III obscured, with total of about 9 bristles (endite II with about 5 bristles (Figure 97g)). 1st exopodial joint with 3 short pectinate anterior bristles and numerous hairs on outer part (Figure 97i). 2nd endopodial joint: large square tooth with proximal round tooth on inner side; posterior side with 3 bristles forming row (middle bristle longer) and 1 long bristle proximal to row (Figure 97h,j). 3rd exopodial joint with 2 bristles on outer lobe; no inner lobe apparent (Figure 97j). 4th and 5th exopodial joints fused, with total of 4 or 5 bristles (Figure 97h,j).

Sixth Limb (Figure 96l): With 1 small epipodial bristle. Endite I with 2 small spinous bristles; endite II with 2 longer spinous bristles; endites III and IV each with 5 long spinous bristles. End joint with 5 anterior bristles with short spines and 2 plumose posterior bristles. Medial and lateral sides of limb hirsute.

Seventh Limb (Figure 96m): Each limb with 3 or 4 proximal bristles (1 or 2 on each side), each with 3 or 4 bells, and 6 terminal bristles (3 on each side), each with 3–6 bells; bristles without marginal spines. Terminus with comb of 7 or 8 alate teeth (2 middle teeth more strongly sclerotized) opposite 2 small pegs of different lengths and with bulbous tips; bulge with sclerotized rim present within comb.

Furca (Figure 97k): Each lamella with 6 claws: 1, 2, and 4 primary claws; 3, 5, and 6 secondary claws; only claw 1 nonarticulated; claw 4 stouter than claw 3; claw 1 with lateral and medial row of slender teeth; claws 2, 3, 5 and 6 also with teeth; teeth not observed on claw 4, but possibly not resolved. Right lamella anterior to left by width of base of claw 1 and with spines along anterior margin.

Bellonci Organ (Figures 96n, 97a): Elongate, bare, with about 8 weak sutures (presence of sutures indicated mainly by lack of sclerotization in wall of organ) and 2 minute teeth at tip.

Eyes: Lateral eye with 5 amber-colored ommatidia (Figure 97a,b). Medial eye larger than lateral eye, bare, with brown

pigment (Figures 96n, 97a).

Upper Lip (Figure 97a): Single rounded lobe with small anterior concavity, minute anterior spine at dorsal end of concavity, and numerous hairs.

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

Brush-like Organ: Not observed (obscured).

Anterior of Body (Figure 97a,l): With rounded process between base of 1st antenna and upper lip.

Posterior of Body: Evenly rounded, bare.

Y-Sclerite (Figure 97k): Branching distally.

Number of Eggs: Holotype with larva in marsupium, but uncertain whether it is an ostracod (larva rather flat, jointed limb visible but furca or pigmented medial eye, if present, not visible), length 0.42 mm; USNM 193926 with 2 eggs in marsupium; length of 1 egg 0.29 mm (location of egg shown in Figure 96c).

COMPARISONS.—The narrower pointed rostrum on the shell separates *D. tryx* from *D. magnifica* Kornicker and Cohen, 1978:493, *D. fossula* Kornicker, 1983c:2, *D. piercei* Kornicker, 1983c:7, and *D. benthedi* Kornicker, 1983c:11, all having a rostrum with a rounded tip. *Dantya ferox* Kornicker and Iliffe, 1989c:901 differs from *D. tryx* in being smaller, in lacking a dorsal bristle on the 2nd joint of the 1st antenna, and in having a much shorter dorsal claw on the 3rd endopodial joint of the

mandible. The dorsal claw of the 3rd endopodial joint of the mandible reaches past midlength of the longest claw on *D. tryx*, but not on other known species of *Dantya*, except *D. benthedi* in which the dorsal claw is much longer. *Dantya tryx* is also the only species of *Dantya* with stout bare spines on the lip of the infold of the caudal process in addition to the usual spinous bristles.

Nealella Kornicker and Caraion, 1980

TYPE SPECIES.—*Nealella monothrix* Kornicker and Caraion, 1980:5.

COMPOSITION.—Three species of the genus are known from Australia: 2 from shallow water of the Great Barrier Reef (*Nealella* sp. A Kornicker and Caraion, 1980:17; *N. queenslandensis* Hall, 1985:518), and a new species from the present collection described herein. This brings the number of known species in the genus to 6.

DISTRIBUTION.—Indian Ocean (Bab el Mandeb, Sri Lanka, Tanzania), Great Barrier Reef and southeastern slope of Australia.

EMENDED DIAGNOSIS.—Mandible, endopodite of female and juveniles: ventral margin of 1st and 2nd joints each with 2 stout claws, or ventral margin of 1st joint without claws and 2nd joint with 1 claw (*N. lux*).

Key to Species of *Nealella*

(Does not include *N. ornithoides* (Brady, 1902))

1. 2nd endopodial joint of female 2nd antenna without bristle . . . *N. lux*, new species
2nd endopodial joint of female 2nd antenna with bristle 2
2. Carapace with horizontal rib near ventral margin not intersecting anteroventral edge of valve *N. monothrix*
Carapace with horizontal rib near ventral margin intersecting anteroventral edge of valve 3
3. Carapace with narrow tapered rostrum *Nealella* species A (juvenile)
Carapace with broad flaring rostrum 4
4. 4th joint of 1st antenna with 3 ventral bristles; 7th limb with 6 proximal bristles *N. queenslandensis*
4th joint of 1st antenna with 2 bristles; 7th limb with 10 proximal bristles *N. muelleri*

REMARKS.—Kornicker and Caraion (1980:5) presented a key to species of *Nealella* using as one character the presence or absence of an extremely long terminal bristle on the 7th limb. *Nealella* species A was the only species in the key not having a long bristle. On noting that the 7th limb of *Nealella* species A illustrated in their paper (fig. 16l) has 1 terminal bristle missing, I reexamined the slide on which the soft parts of USNM 157789 are mounted and found only one 7th limb, which is obviously the limb illustrated. The stump of the broken terminal bristle is slightly stouter than the 3 other terminal bristles; this suggests that the broken bristle may have been longer than other bristles, but its actual length must await collection of additional specimens.

Nealella lux, new species

FIGURES 98–100

ETYMOLOGY.—From the Latin *lux* (light).

HOLOTYPE.—Adult female on slide and 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 193941, adult female on slide and in alcohol; USNM 193942, undissected A-1 male.

DISTRIBUTION.—Slope 1, 204 m.

DESCRIPTION OF ADULT FEMALE (Figures 98–100a–g).—Carapace elongate with overhanging rostrum, small incisur, and projecting caudal process (Figure 98a–d); dorsal margin straight in vicinity of hinge line; posterodorsal corner of valve prominent.

Ornamentation: Surface with numerous irregular large fossae (Figure 98e) (fossae stippled but not all shown in Figure 98a,c); raised flat borders between fossae appearing smooth but with abundant minute papillae visible best along valve margins at high magnification ($\times 40$ objective, $\times 15$ ocular) and with row of widely spaced larger papillae (small circles in Figure 98e). Bristles (some divided) very sparse on lateral surface but more numerous on inner surface along anterior, anteroventral and ventral margins (Figure 98f,g).

Infold: Rostral infold with row of 3 bristles; a longer bristle (with broad basal part) anterior to row is interpreted to be on exterior surface of shell rather than on infold (Figure 98f,h); single bristle present at inner end of incisur; anteroventral infold with short bristle near incisur separated by space from row of 7–9 longer setose bristles with bases just distal to narrow list. Infold of caudal process with row of 8 broad setose bristles along ridge anterior to pocket, 1 small bare bristle anterior to row of setose bristles, and 2 pairs of bare bristles along inner edge of infold near ventral margin of valve (Figure 98g); 2 small pores with minute spines present along posterior edge of caudal process.

Selvae: Anterodorsal margin of valve with lamellar prolongation (wider and striate on right valve only) reaching anteriorly just past insertions of row of 3 bristles on rostral infold (Figure 98h); lamellar prolongation absent in vicinity of rostrum and anterior $\frac{1}{3}$ of ventral margin; broad lamellar prolongation along posterior $\frac{2}{3}$ of ventral margin (with anterior end at posterior bristle of row of bristles along anteroventral infold; anterior end of prolongation with marginal fringe of long hairs) (Figure 98d); ventral prolongation narrow along ventral edge of caudal process; prolongation absent along posterior edge of caudal process, and narrow along dorsal edge of caudal process and posterior edge of valve dorsal to caudal process.

Central Adductor Muscle Attachments (Figure 98a): Comprising about 19 individual attachments.

Carapace Size (length, height in mm): USNM 193941, 1.21, 0.68; holotype, 1.14, 0.66.

First Antenna (Figure 99a,h,i): 1st joint bare. 2nd joint with spinous dorsal bristle, rows of medial and ventral spines, and row of lateral spines along distal margin. 3rd joint fused to 4th, with 1 spinous dorsal bristle; 4th joint with 3 spinous terminal bristles (1 dorsal, 2 ventral). Long ventral bristle of 5th joint with several small filaments, distal ventral spines, and spine at tip. 6th joint fused to 5th, with short spinous medial bristle. 7th joint: a-bristle spinous, about twice length of bristle of 6th joint; b-bristle about $1\frac{1}{2}$ times length of a-bristle, with spine at tip; c-bristle same length as bristle of 5th joint, almost twice length of b-bristle, with several small filaments, distal ventral spines, and spine at tip. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f- bristle shorter than c-bristle, with several filaments and distal ventral spines; g-bristle same size as c-bristle with several short filaments and distal ventral spines. (Note: marginal spines on bristle of 5th joint, c-bristle of 7th joint, and f- and g-bristles of 8th joint unusual.) (Figure 99i).

Second Antenna: Protopodite bare (Figure 99f). Endopodite 2-jointed (Figure 99j): 1st joint with 1 proximal bristle; 2nd joint comprising small bare node. Exopodite: 1st joint with minute medial terminal bristle; bristle of 2nd joint with proximal ventral spines and distal natatory hairs; bristles of joints 3–8 with a few proximal dorsal hairs, then proximal ventral spines and distal natatory hairs; 9th joint with 2 bristles (ventral medium length with proximal ventral spines and distal natatory hairs, dorsal short with small hairs); joints 2–8 with minute spines forming row along distal margins.

Mandible (Figures 99b, 100a–c): Coxale endite a stout tooth with 1 stout and several slender spines near base and small distal spines (detail in Figure 100a). Coxale with slender ventral spines. Basale (Figure 100a): lateral side near ventral margin with row of 3 spinous ringed bristles; medial side near ventral margin with 5 bristles (distal longest); dorsal margin with 1 small ringed bristle at distal $\frac{2}{3}$ and 2 ringed subterminal bristles (lateral short, medial long). Exopodite minute (broader on USNM 193941 than on illustrated holotype) with short bare ringed bristle. 1st endopodial joint short (Figure 100a): lateral side with row of spines along distal edge near dorsal margin; medial side with 2 rows of short spines near midwidth; ventral margin with 3 short ringed bristles. 2nd endopodial joint (Figures 99b, 100a–c): dorsal margin with 3 short ringed distal bristles; ventral margin with 1 small unringed spinous subterminal bristle (USNM 193941 with few ventral spines proximal to bristle (Figure 99b)); lateral surface with small spines near subterminal ventral bristle, a row of spines in distal ventral corner near base of long terminal claw, and a short broad spine just dorsal to base of terminal claw (Figure 100c); terminal claw with proximal ventral and dorsal spines and with prolonged narrow tip (Figure 100c); medial side with 3 rows of short spines and broad terminal translucent shield medial to base of terminal bristle (Figures 99b, 100b). 3rd endopodial joint with 2 long terminal claws with prolonged narrow tips (lateral claw with ventral spines at base (Figure 100c, medial

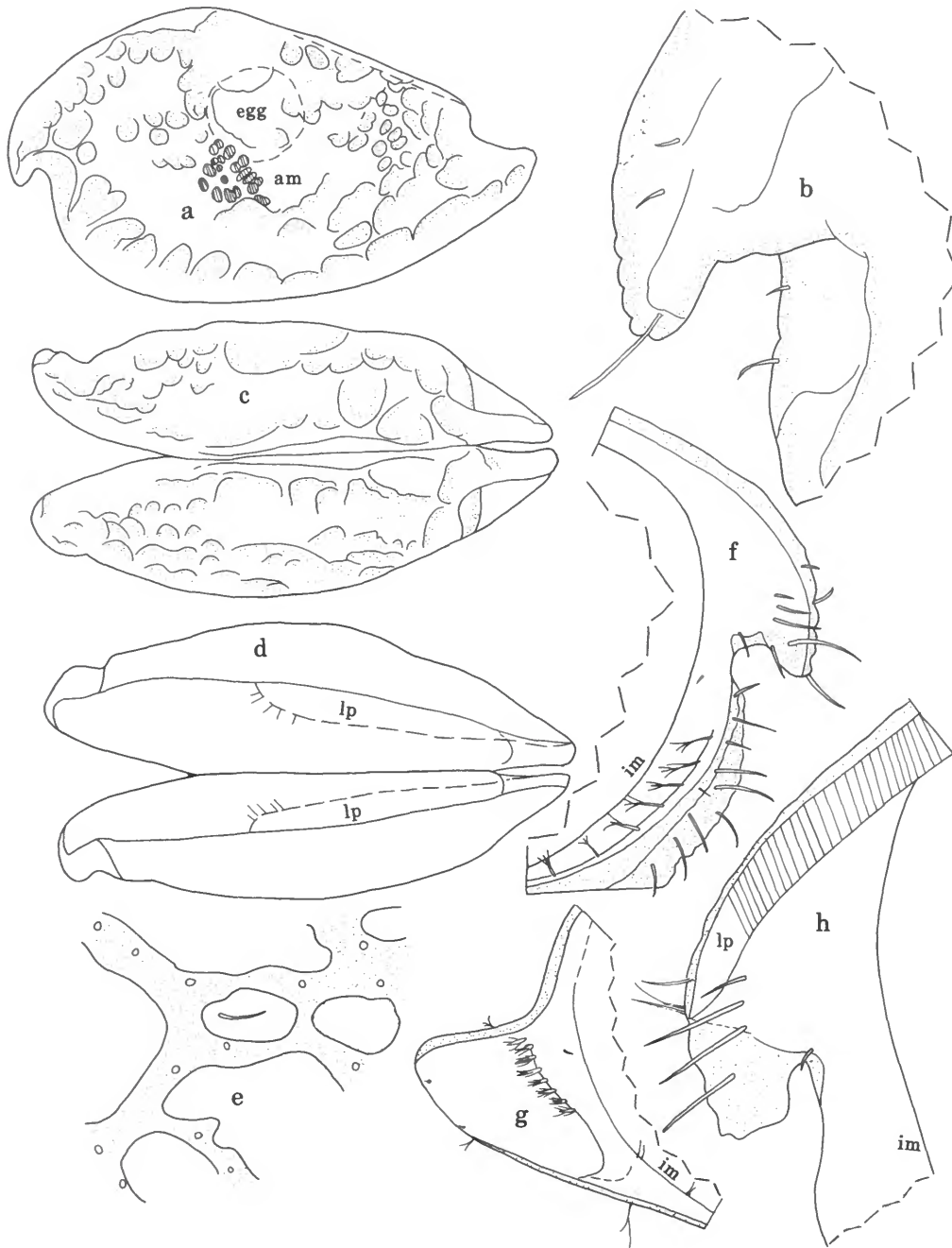


FIGURE 98.—*Neaella lux*, new species, adult female, paratype, USNM 193941: *a*, complete specimen from left side showing central adductor muscle attachments (striated) (fossae and low areas stippled), length 1.21 mm; *b*, detail from *a* (edges of valve and some high areas stippled); *c*, dorsal view of complete specimen (valves partly open) (some fossae stippled); *d*, ventral view of carapace with body removed; *e*, detail of ornamentation of left valve, ov (ridges stippled); *f, g*, anterior and posterior of left valve, respectively, iv; *h*, anterior of right valve, iv (lamellar prolongation of selva striated; surface of valve exposed to sea water stippled).

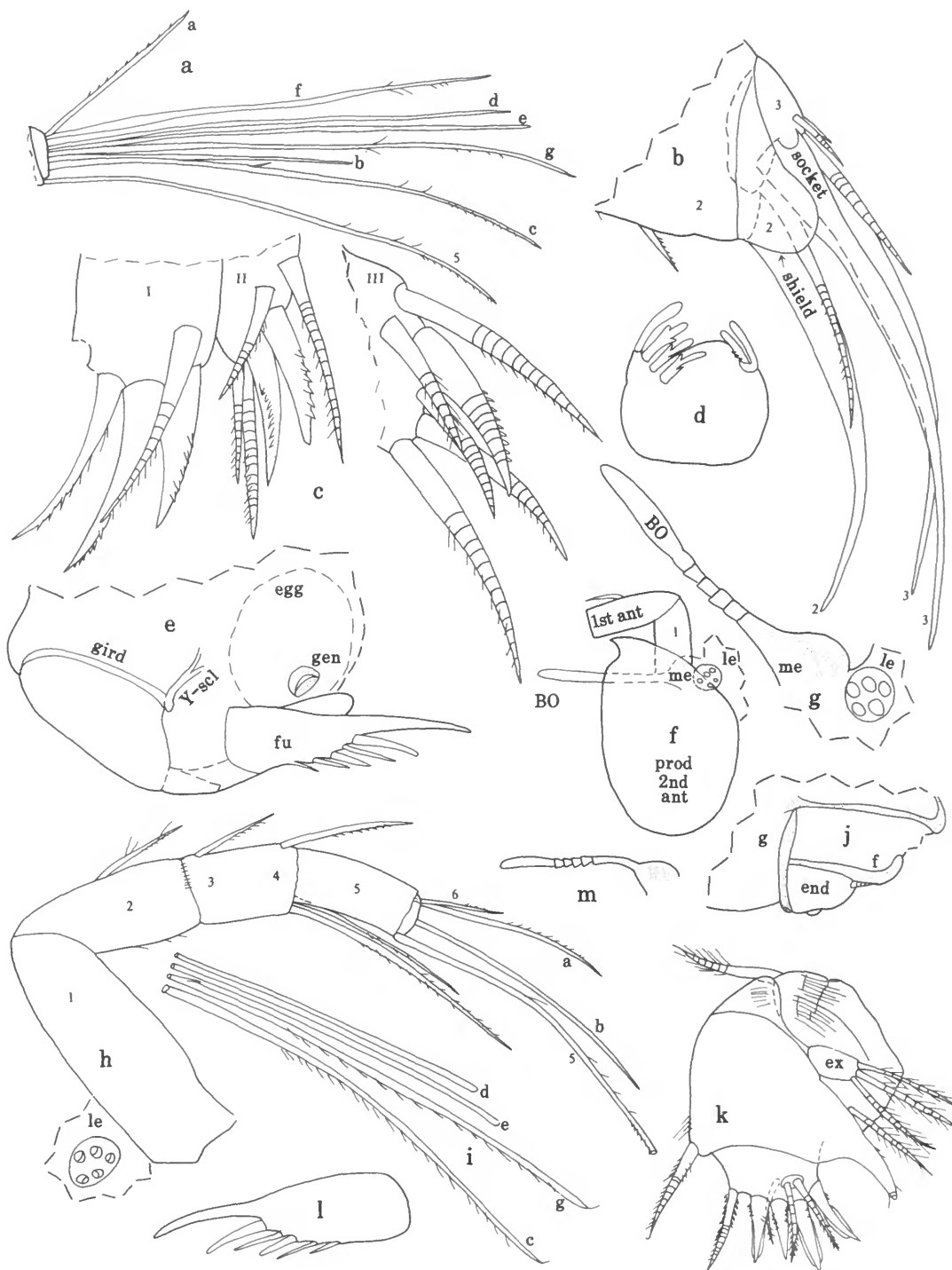


FIGURE 99.—*Neatella lux*, new species, adult female, paratype, USNM 193941: a, tip of right 1st antenna, lv; b, tip of left mandible, mv; c, endites, right maxilla, mv; d, tip of 7th limb; e, posterior of body from right side, anterior to right; f, dorsal part of anterior of body from left side, anterior to left; g, left lateral eye, medial eye, and Bellonci organ. Adult female, paratype, USNM 193942: h, right lateral eye and right 1st antenna, lv (not all bristles shown); i, tips of c-bristle of 7th joint and d-, e-, and g-bristles of 8th joint of right 1st antenna, lv; j, endopodite, left 2nd antenna, mv; k, left maxilla, lv; l, left lamella of furca (teeth not shown); m, medial eye and Bellonci organ.

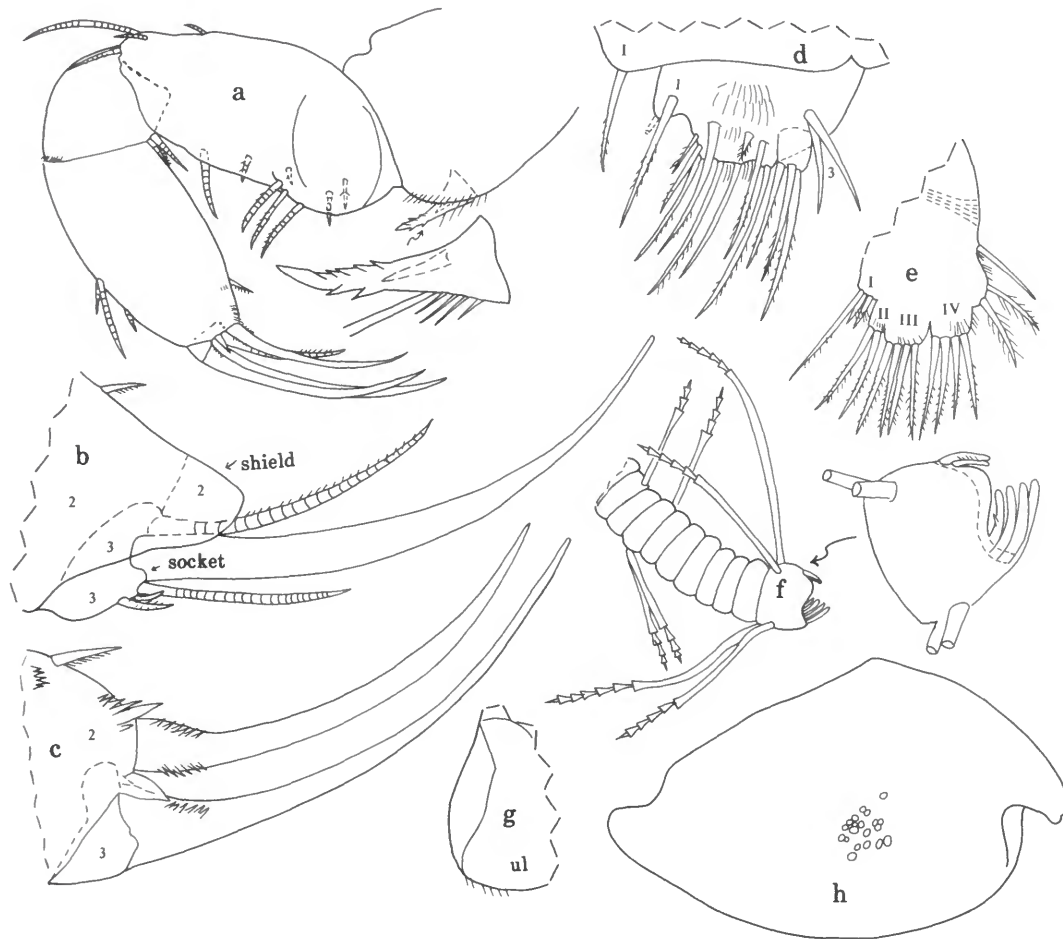


FIGURE 100.—*Nealella lux*, new species, adult female, paratype, holotype: *a*, left mandible (shield of 2nd joint and 3 dorsal bristles of 3rd joint not shown), lv; *b*, tip of endopodite of right mandible, mv (claw of 2nd joint and lateral claw of 3rd joint not shown); *c*, detail from *a* (medial claw of 3rd joint and bristles not shown); *d*, 5th limb; *e*, left 6th limb, lv; *f*, 7th limb with detail of tip; *g*, upper lip from left side, anterior to left. A-1 female, paratype, USNM 193942; *h*, complete specimen from right side with approximate central adductor muscle attachments, length 1.01 mm.

claw not shown); medial claw with small hemispherical basal socket (Figures 99*b*, 100*b*, lateral claw not shown), and 4 bristles (1 long ringed spinous ventral, 3 dorsal indistinct (1 long, 2 short proximal (1 short bristle could be a claw)) (Figures 99*b*, 100*b*)). (Note: translucent shield on 2nd endopodial joint unusual.)

Maxilla (Figure 99*c,k*): Coxale with plumose dorsal bristle and fringe of dorsal hairs. Endite I fragmented but with 4 bristles on remaining part (Figure 99*c*); endites II and III each with 6 bristles (Figure 99*c*). Basale with dorsal hairs and plumose bristle near exopodite (Figure 99*k*). Exopodite well developed, with 3 equilength plumose terminal bristles. 1st endopodial joint with rows of spines on both anterior margin and medial surface near anterior margin, 1 slender spinous

alpha-bristle, and 1 stouter spinous beta-bristle (tip broken off on illustrated limb). 2nd endopodial joint with 2 closely spaced lateral spinous a-bristles, 1 slender medial spinous c-bristle, and 5 end bristles: anterior bristle ringed in distal half, with stout spines on unringed part, slender spines on ringed part, and with terminal hook-like spine; posterior bristle unringed, with indistinct marginal teeth and distal flange; remaining 3 bristles unringed, with stout proximal teeth and distal flanges.

Fifth Limb (Figure 100*d*): Epipodite with 37 bristles. Single endite with 1 bristle. 1st exopodial joint with 2 bristles (2nd bristle broken off on illustrated limb). 2nd exopodial joint, inner lobe of 3rd joint and 4th joint not well defined, and interpretation uncertain, with total of 9 bristles; outer lobe of 3rd joint with 2 bristles; 5th joint forming separate lobe with 3

bristles (lobe could be interpreted as fused 4th and 5th joints). Exopodial joints 2-4 hirsute.

Sixth Limb (Figure 100e): Endite I with 3 spinous bristles (2 short, long 1 long); endite II with 2 spinous bristles; endite III with 4 or 5 spinous bristles; endite IV with 4 spinous bristles (this endite could be interpreted to be part of end joint; endite more clearly separated from end joint in USNM 193942 than in USNM 193941). End joint with 2 bristles with long marginal hairs. 1 bristle proximal to end joint interpreted to be epipodial bristle. Lateral surface with rows of spines on endites II-IV; medial surface of limb with abundant long hairs. All bristles ringed (rings not shown).

Seventh Limb (Figures 99d, 100f): Four bristles in proximal group, 2 on each side, each with 3 or 4 bells; 4 bristles in terminal group, 2 on each side, each with 5 or 6 bells. Terminus with comb of 7 alate teeth opposite 2 inward pointing pegs with indistinct marginal spines.

Furca (Figure 99e,l): Each lamella with 6 claws; claw 1 nonarticulated; claw 3 slenderer than claw 4; claws 1, 2, and 4 with teeth along posterior edge; claws 1 and 2 also with row of medial teeth; claws 3, 5, and 6 with slender teeth along both anterior and posterior edges; row of long medial hairs present at base of claw 1; right lamella anterior to left by width of base of claw 1 and with spines along anterior margin. Teeth of claws not shown.

Bellonci Organ (Figure 99f,g,m): Elongate, with about 5 sutures at midlength and rounded tip.

Eyes: Lateral eye small, unpigmented, with 5 divided ommatidia (Figure 99f,g,h). Medial eye slightly larger than lateral eye, bare, with brown pigment (Figure 99f,g,m).

Upper Lip (Figure 100g): Simple lobe, hirsute.

Genitalia (Figure 99e): Concave disc on each side of body anterior to furca (spermatophore absent).

Posterior of Body (Figure 99e): Evenly rounded, bare.

Y-Sclerite (Figure 99e): With ventral branch.

Eggs: USNM 193941 and holotype with few large unextruded eggs. Location of 2 different eggs in USNM 193941 shown in Figures 98a, 99e.

DESCRIPTION OF A-1 MALE (Figure 100h).—Carapace similar in shape and ornamentation to that of adult female (Figure 100h).

Carapace Size (length, height in mm): USNM 193942, 1.01, 0.62.

Second Antenna: Endopodite very long and with 1 or 2 small terminal bristles (not examined in detail).

Seventh Limb: Well developed and bearing bristles (not examined in detail).

COMPARISONS.—*Nealella lux* is the only known species in the subfamily without a bristle on the 2nd endopodial joint of the 2nd antenna of the female. The short 1st endopodial joint of the mandible with only 3 short ventral bristles and no stout claws differs from other known species of *Nealella*. *N. lux* unlike *N. queenslandensis*, *N. muelleri* Kornicker and Caraion, 1980, and *N. monothrix* Kornicker and Caraion, 1980, does not

have an extremely long terminal bristle on the 7th limb. Whether *N. ornithoides* or *Nealella* species A has a long bristle is not known.

CYLINDROLEBERIDIDAE Müller, 1906

The Cyndroleberididae include 3 subfamilies: Cyndroleberidinae, Cyclasteropinae, and Asteropteroinae. All have been reported from the vicinity of Australia (Kornicker, 1981c:18), and are represented in the present collection.

CYLINDROLEBERIDINAE Müller, 1906

The Cyndroleberidinae are represented in the collection by 9 genera: *Archasterope*, *Bathyleberis*, *Domromeus*, *Homasterope*, *Parasterope*, *Skogsbergiella*, *Synasterope*, *Xenoleberis*, new genus, and an undescribed genus, but only *Xenoleberis* is described herein.

Xenoleberis, new genus

ETYMOLOGY.—From the Greek *Xenos* (stranger, guest) plus the Greek *leberis* (sloughed skin).

TYPE SPECIES.—*Xenoleberis bex*, new species herein.

COMPOSITION.—The type species plus 2 species previously referred to the genus *Bathyleberis*: *X. californica* (Baker, 1979) and *X. yamadai* (Hiruta, 1979).

DISTRIBUTION.—*Xenoleberis bex* from south slope of Australia at 600 m. *Xenoleberis californica* from off Southern California at 9.1-401.4 m (Baker, 1979:288). *Xenoleberis yamadai* from off the coast of Hokkaido, Japan, at 3-5 m (Hiruta, 1979:99).

DIAGNOSIS.—Female carapace elongate with slightly convex ventral and dorsal margins. Ventral infold with narrow ridge just within valve edge. Carapaces of both male and female *X. yamadai* with melanophores, but these not reported on other species.

First Antenna: 2nd joint without lateral bristle (always?). Dorsal margin of 3rd joint with 6 spinous bristles. Sensory bristle of female 5th joint relatively short with 1 short slender proximal filament and 6 stouter terminal filaments. d-bristle of 8th joint well developed, bristle-like (tapering to point), without or without marginal spines.

Second Antenna: Endopodite of female with 3 distinct joints and long terminal filament.

Mandible: Basale endite with 3 end bristles (always?). Exopodite less than 1/4 length of dorsal margin of 1st endopodial joint. Dorsal margin of 2nd endopodial joint without long lateral e-bristle between b- and c-bristles.

Maxilla: Endopodite 2-jointed with short alpha-bristle and long beta-bristle on 1st joint and long terminal bristle on 2nd joint.

The genus is defined mainly on the bristle-like d-bristle of the 8th joint of the 1st antenna, the small exopodite of the mandible, and lack of an e-bristle on the 2nd endopodial joint of the mandible.

COMPARISONS.—Only *Bathyleberis* Komicker, 1975:538, and *Xenoleberis* have well-developed bristle-like (tapering to pointed tip) d-bristles on the 1st antennae. In other genera in the subfamily having well-developed d-bristles, the bristle is filament-like (with parallel sides and blunt tip). The mandible of *Xenoleberis* differs from that of *Bathyleberis* in having a much smaller exopodite and in lacking an e-bristle on the 2nd endopodial joint.

REMARKS CONCERNING *Bathyleberis californica* BAKER, 1979.—I examined a female paratype of *B. californica* (USNM 151394: appendages on slide; part of body (including lateral eyes) and carapace in alcohol). The lateral eye of the male but not the female was mentioned in the original description of the species. My examination of the female revealed that the lateral eye has 8 distinct ommatidia, the same number as in the male eye. The appendage slide is mostly dried out, but it was observed that the dorsal margin of the 2nd endopodial joint of the mandible has 3 small spines proximal to bristles similar to those of *X. bex*. I also confirmed that the e-bristle of the 2nd endopodial joint of the mandible is lacking.

Key to Species of *Xenoleberis*

1. Without lateral eyes *X. bex*, new species
With lateral eyes 2
2. Lateral eye with 8 ommatidia *X. californica*
Lateral eye with 16 ommatidia *X. yamadai*

Xenoleberis bex, new species

FIGURES 101-103

ETYMOLOGY.—From the Greek *bex* (cough).

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

TYPE LOCALITY.—Slope 39, 38°19.10'S, 149°14.30'E, Victoria, S of Point Hicks; depth 600 m.

PARATYPES.—None.

DISTRIBUTION.—Slope 39, 600 m.

DESCRIPTION OF ADULT FEMALE (Figures 101-103).—Carapace elongate with slightly convex ventral and dorsal margins (Figure 101*a,b*). Right valve with ventral and posterior edges set inward from valve margins (Figure 101*b,e*). Left valve with only middle part of ventral edge set slightly inward from valve margin.

Infold: Ventral infold with narrow ridge having anterior end near anteroventral corner and posterior end near posteroventral corner (Figure 101*b,c,e*); the ridge with wider space between it and valve margin on right valve than on left valve; a row of distinct pores between ridge and valve edge (Figure 101*c,e*). Narrow list with anterior end just ventral to inner end of incisur continues along ventral infold close to inner margin of infold, then broadens along posteroventral and posterior infold (Figure 101*b,c,e*). Rostral infold dorsal to list with row of about 50 long bristles just within outer edge, about 5 additional long bristles near tip, and many minute bristles; rostral infold between list and incisur with about 35 long bristles (Figure 101*d*); anteroventral infold with row of about 20 long bristles near outer edge and many minute bristles proximal to row; about 20 additional long bristles along anterior third of ventral margin, and about 20 widely spaced

bristles along middle part of ventral margin; infold between broad posteroventral-posterior list and valve edge with about 65 bristles (ventral 30 longer); about 15 long bristles in row anterior to ventral end of broad posteroventral list. Broad posteroventral-posterior list with 22-24 transparent flap-like bristles and 51-53 slender bristles (2-4 (mostly 2) slender bristles between each pair of flap-like bristles). Infold posterior to broad posterior list with 4 indistinct round tubular processes (4 small circles in Figure 101*e*); several minute pustules in vicinity of tubular processes. A row of small bristles (possibly pores and not bristles) just within posterior edge of valve dorsal to end of narrow ridge (Figure 100*e*). Right valve with dense row of long hairs between dorsal end of broad posterior list and valve edge (hairs probably represent selvage) (Figure 101*e*).

Selvage: Fringed lamellar prolongation along ventral edge of incisur.

Central Adductor Muscle Attachments (Figure 101*f*): About 13 ovoid attachments.

Carapace Size (length, height in mm): Holotype, 2.13, 1.03, height 48% of length.

First Antenna (Figure 101*h,g*): First joint with medial and lateral spines. 2nd joint with few ventral spines and 1 spinous dorsal bristle. 3rd joint without suture separating it from 4th joint except near ventral edge; 3rd plus 4th joints quadrate. 3rd joint with small ventral bristle and 6 dorsal bristles (2 single with long proximal and short distal spines followed by 2 lateral bristles with short spines and 2 medial bristles with long proximal and short distal spines (Figure 101*g*). 4th joint with few dorsal and lateral spines, 2 ventral bristles with short spines, and 1 long dorsal bristle with short spines. 5th joint with lateral row of short spines in distal dorsal corner; sensory bristle with short stout stem, 1 short slender proximal filament, and 6

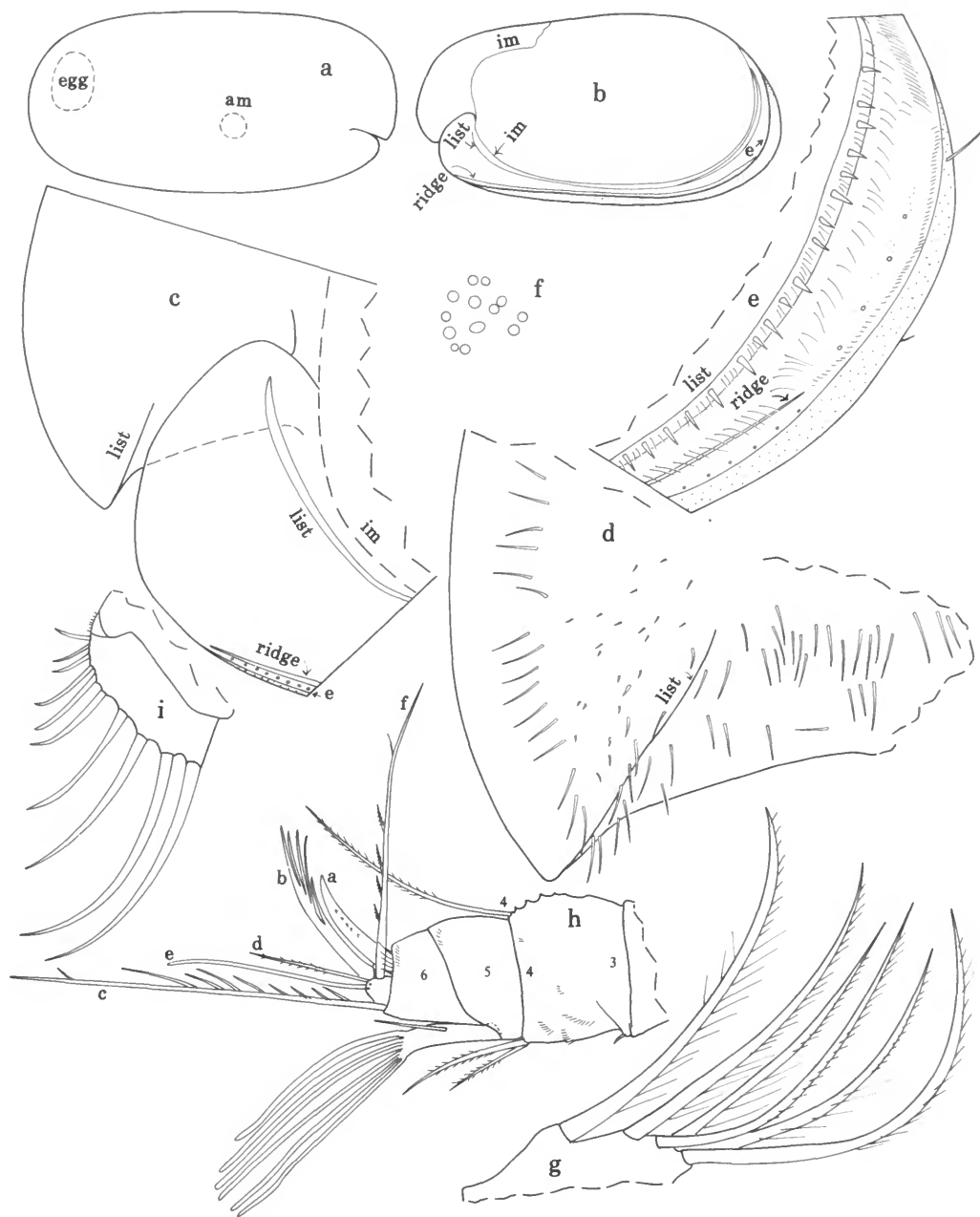


FIGURE 101.—*Xenoleberis bex*, new species, ovigerous female, holotype: *a*, complete specimen from right side showing locations of 1 egg and central adductor muscle attachments, length 2.13 mm; *b*, right valve, iv (infold bristles not shown); *c*, anterior, right valve, iv (infold bristles not shown); *d*, part of rostrum, right valve, iv; *e*, posterior, right valve, iv; *f*, central adductor muscle attachments, right valve, ov; *g*, dorsal bristles of 3rd joint of right 1st antenna, lv, anterior to right; *h*, distal joints of left 1st antenna, lv (not all bristles shown); *i*, right lamella of furca (teeth not shown).

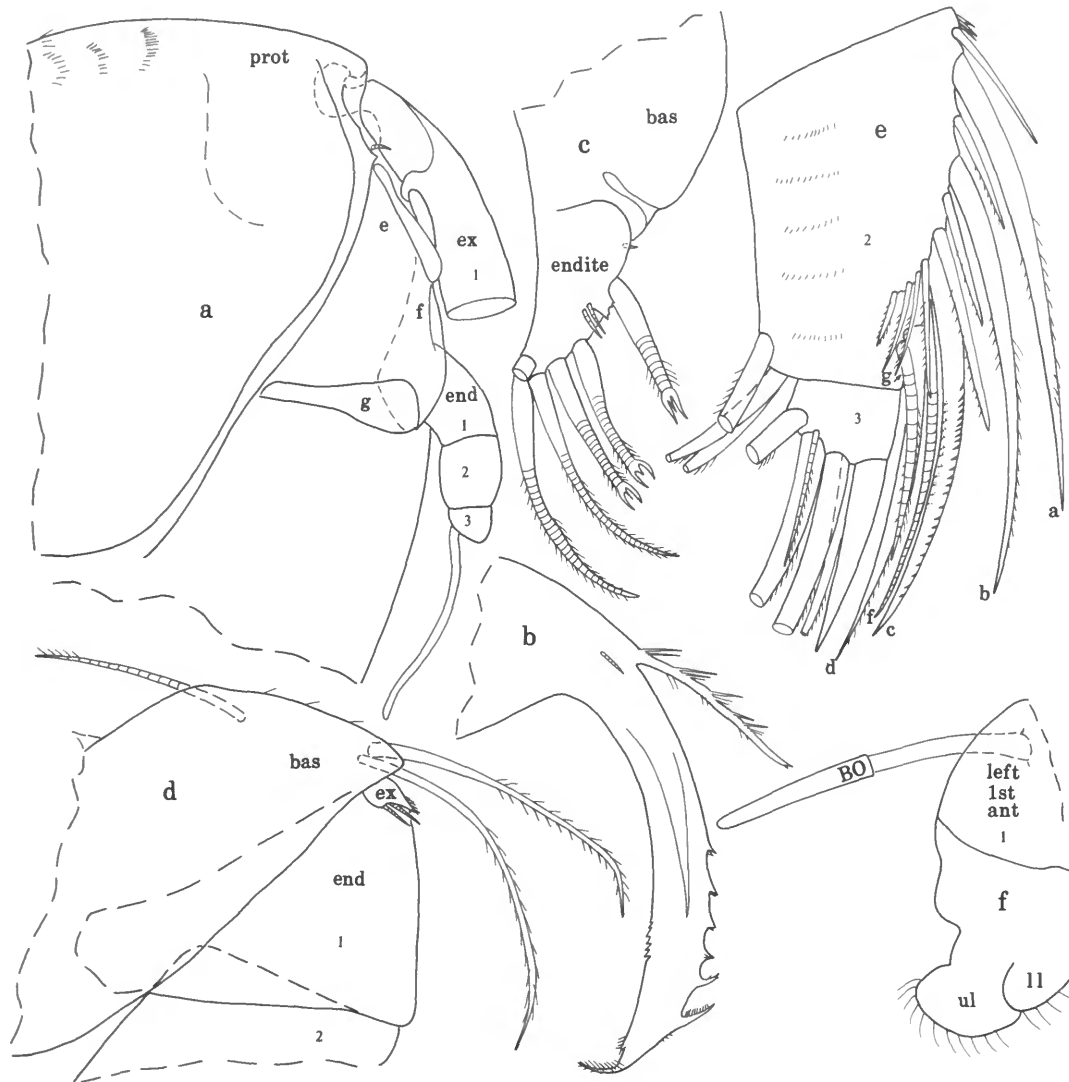


FIGURE 102.—*Xenoleberis bex*, new species, ovigerous female, holotype: *a*, distal protopodite, endopodite and part of 1st exopodial joint, left 2nd antenna, mv; *b, c*, coxale and basale endites, respectively, left mandible, mv; *d*, part of right mandible, lv; *e*, part of endopodite, left mandible, mv; *f*, anterior of body from left side, anterior to left (medial eye not shown).

stout terminal filaments (2 distal filaments not fused at proximal end). 6th joint with lateral row of short spines in distal dorsal corner, long terminal hairs along dorsal part of distal edge (hairs on both lateral and medial sides), and 1 long medial bristle (with few short spines) near ventral margin (bristle not shown). 7th joint: a-bristle claw-like, short, with small lateral teeth; stout b-bristle about $\frac{1}{3}$ longer than a-bristle, with 4 marginal filaments (filaments and stem with minute terminal process); c-bristle about twice length of b-bristle, with 9 or 10 marginal filaments (8 or 9 proximal, 1 distal) (filaments and stem with minute terminal process). 8th joint: d-bristle more

than half length of e-bristle, unringed, bristle-like (tapering to point) with minute marginal spines; e-bristle about twice length of a-bristle, with narrowly spaced indistinct rings, filament-like (with parallel sides) with blunt tip; minute lateral pore near base of d- and e-bristles; f-bristle about $\frac{3}{4}$ length of c-bristle, bent dorsally, with 4 spinous proximal filaments and 1 bare distal filament (filaments and stem with minute terminal process); g-bristle about same length as c-bristle, with 7 filaments (6 proximal, 1 distal) (filaments and stem with minute terminal process) (g-bristle not shown).

Second Antenna (Figure 102a): Protopodite with rows of



FIGURE 103.—*Xenoleberis bex*, new species, ovigerous female, holotype: *a*, endites, right maxilla, mv; *b*, left maxilla, mv (endite I not shown); *c*, comb of right 5th limb, mv (only 2 bristles shown on ventral edge, see detail); *d*, left 6th limb, lv; *e*, anterior part of right 6th limb, mv; *f*, 7th limb; *g*, medial eye and Bellonci organ.

medial spines near dorsal margin and small distal medial bristle. Endopodite distinctly 3-jointed with long subterminal filament. Exopodite: 1st joint bare; bristle of 2nd joint reaching 7th or 8th joints, with abundant slender ventral spines; long bristles of joints 3 and 4 or 3-6 with proximal ventral spines and distal natatory hairs; long bristles of joints 5-8 or 7 and 8 with natatory hairs, no spines; 9th joint with 3 bristles (2 long

with natatory hairs, 1 short (dorsal) bare); joints 3-8 each with small basal spine (spine of 8th joint about 1/4 length of 9th joint); 9th joint with small lateral spine about 1/3-1/2 length of joint; joints 2-8 with row of spines along distal edge (some spines (near dorsal edge) of 3rd joint longer than on other joints).

Mandible: Coxale endite (Figure 102*b*): ventral branch

with spines forming 4 oblique rows and tip with 2 spines; small bristle near base of branch; dorsal branch with 3 small double teeth pointing distally followed by 1 small double perpendicular tooth, 1 elongate recurved tooth with few small spines, and long main spine with long slender spines along concave edge; tip of branch prolonged as slender hair-like spine with long proximal marginal hairs that are also on distal end of ventral edge of tip; posterior bristle represented by small stump bearing marginal spines; spines also present on dorsal edge of endite adjacent to stump; dorsal edge of endite at about $\frac{2}{3}$ length serrate. Basale endite (Figure 102c): with 3 spinous end bristles (illustrated endite of left limb of holotype with 1 bristle represented by stump), 3 triaenid bristles with 3 or 4 pairs of spines excluding terminal pair, 2 equilength dwarf bristles, glandular peg, and 1 minute spine or bristle near proximal ventral end (latter possibly on basale rather than endite). Basale (Figure 102c,d): ventral margin with narrow U-shaped depression near endite (Figure 102c); dorsal margin with indistinct distal spines, 1 backward oriented spinous bristle near midlength, and 2 subequal spinous terminal bristles (Figure 102d). Exopodite about $\frac{1}{6}$ length of dorsal margin of 1st endopodial joint, hirsute, with 2 small spinous subterminal bristles (Figure 102d). 1st endopodial joint with 3 long spinous ventral bristles (not shown). 2nd endopodial joint (Figure 102e): ventral margin with 3 terminal bristles with short spines; dorsal margin with 3 small indistinct spines proximal to short spinous proximal bristle, stout spinous a-, b-, c-, and d-bristles (c-bristle slightly stouter than others and with stouter and more closely spaced marginal spines); medial surface with rows of minute spines, 1 short spinous cleaning bristle between a- and b-bristles and between b- and c-bristles (both almost on ventral edge), 5 spinous cleaning bristles forming oblique row adjacent to c-bristle (outer of these fairly stout), and long spinous g-bristle adjacent to distal edge of base of c-bristle; lateral surface without e-bristle between b- and c-bristles, and with long spinous f-bristle between c- and d-bristles (all bristles ringed, but rings shown only on f- and g-bristles). 3rd endopodial joint with fairly short, straight, bare, dorsal claw and 5 ringed bristles (4 long stout, 1 short slender medial, all with short spines; rings shown only on short medial bristle) (Figure 102e).

Maxilla (Figure 103a,b): Epipodite fairly short with hirsute tip not reaching midlength of dorsal margin of basale (Figure 103a). Endite I with 4 bristles (3 long spinous, 1 short bare); endite II with long hairs and 3 hirsute bristles (distal shorter) (Figure 103b). Basale: medial surface with 2 proximal bristles near dorsal margin; lateral surface with 1 proximal and 1 distal bristle near ventral margin; ventral margin with backward oriented proximal bristle and long spinous terminal bristle. 1st endopodial joint with short bare alpha-bristle and long bare beta-bristle. 2nd endopodial joint with long terminal bristle (with indistinct spines) reaching just past beta-bristle of 1st joint.

Fifth Limb (Figure 103c): Comb with short medial hairs

along ventral edge, long distal dorsal hairs, stout spinous exopodial bristle reaching past distal end, 2 small slender lateral bristles just ventral to base of stout bristle, 2 fairly widely separated pairs of lateral bristles close to ventral edge near midlength, 3 spinous lateral bristles (1 proximal, 2 distal) with bases almost on ventral edge, and 36 spinous bristles along ventral edge, each with short bare subterminal bulbous part (detail in Figure 103c).

Sixth Limb (Figure 103d,e): Minute proximal medial bristle just anterior to trunk midwidth (Figure 103d,e); anterior margin with single endite suture with bare bristle; a 2nd bare bristle present between endite and anterior end of limb probably also endite bristle but usual endite suture absent (Figure 103e); anteroventral corner of skirt with 4 or 5 spinous bristles (2nd bristle from anterior tip stouter and longer than others); lateral flap with long hairs but no bristles; ventral and posteroventral margin of skirt with total of about 19 spinous bristles (those at posterior corner longer) (Figure 103d).

Seventh Limb (Figure 103f): Each limb with 14 bristles: 8 proximal (4 on each side), 6 distal (3 on each side), each bristle with 3–5 bells. Terminus with opposing combs each with 11 or 12 spinous teeth.

Furca (Figure 101i): Each lamella with 10 claws; posterior 1 or 2 claws bristle-like.

Bellonci Organ (Figures 102f, 103g): Elongate, broader and with suture or wrinkle at midlength, then tapering to broadly rounded tip.

Eyes: Lateral eyes absent. Medial eye unpigmented, bare (Figure 103g).

Lips (Figure 102f): Upper lip a hirsute lobe (without spines) on each side of bare saddle. Lower lip a hirsute flap on each side of mouth.

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

Posterior of Body: Obscured by gills but probably without thumb-like dorsal process.

Y-Sclerite: Typical for subfamily.

Gills: Well developed.

Number of Eggs: Holotype with 13 eggs in marsupium, length of typical egg 0.38 mm. Location of 1 egg shown in Figure 101a.

COMPARISONS.—*Xenoleberis bex* differs from other species in the genus in lacking lateral eyes. The carapace is without the melanophores of *X. yamadai*.

CYCLASTEROPINAE Poulsen, 1965

The Cyclasteropinae include 3 tribes: Cyclasteropini Poulsen, 1965, Cycloleberidini Hartmann, 1974, and Tetraleberidini Kornicker, 1981 (Kornicker, 1981c:72). All have been reported from the vicinity of Australia (Kornicker, 1981c:18) but only the Cycloleberidini are represented in the present collection.

CYCLOLEBERIDINI Hartmann, 1974

Only the genus *Leuroleberis* is represented in the collection.

Leuroleberis Kornicker, 1981

TYPE SPECIES.—*Leuroleberis sharpei* Kornicker, 1981:97.

COMPOSITION.—Only 1 species, *L. mackenziei* Kornicker, 1981, is known from the vicinity of Australia.

Leuroleberis mackenziei Kornicker, 1981

FIGURE 104

Cycloleberis bradyi Poulsen, 1965:268, figs 93, 94 [part; 2 juvenile females only, not adult male holotype; that specimen referred to *Leuroleberis zealandica* (Baird, 1850b) (Kornicker, 1979:23, 1981c:115)].

Leuroleberis mackenziei Kornicker, 1981c:115, figs. 8a, 34–38; plates 21–23.

HOLOTYPE.—Juvenile female, 4.8 mm, described by Poulsen (1965:277, fig. 93) in the Zoological Museum of Copenhagen (Kornicker, 1981c:115).

TYPE LOCALITY.—*Galathea* sta 541, Moreton Bay, Brisbane, E-Australia, 22 m, 5 Nov 1951.

MATERIAL.—Slope 1, 1 adult male and 1 juvenile.

DISTRIBUTION.—Previously reported from off eastern Australia at depths of at depths of 12–50 m (Kornicker, 1981:115). In the present collection from Slope 1, 204 m.

SUPPLEMENTARY DESCRIPTION OF ADULT MALE (Figure 104).—Carapace without depression in dorsal margin shown in illustration of Kornicker (1981c, fig. 36) (Figure 104).

Carapace Size (length, height in mm): Specimen from Slope 1, 5.1, 3.6.

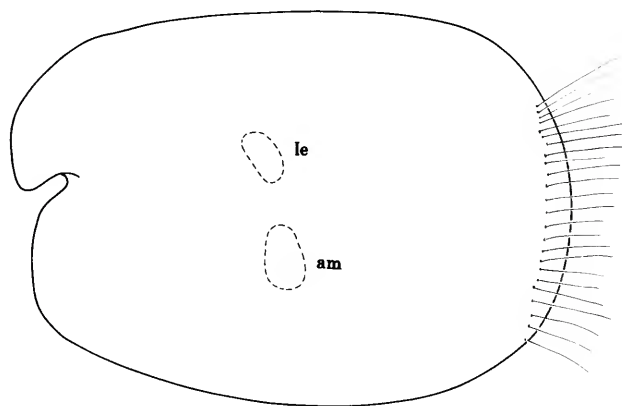


FIGURE 104.—*Leuroleberis mackenziei* Kornicker, 1981, adult male, complete specimen from left side, length 5.1 mm.

ASTEROPTERONINAE Kornicker, 1981c

Two genera of the Asteropterioninae 2 are known from Australia: *Asteropterygion* and *Macroasteropteron*, new genus, herein.

Asteropterygion Kornicker, 1981c

TYPE SPECIES.—*Asteropterygion thomassini* Kornicker, 1981c.

COMPOSITION.—Two species of this genus have been reported in the vicinity of Australia, *A. magnum* (Poulsen, 1965) and *A. liguriae* (Granata, 1915); only the former is in the present collection.

DISTRIBUTION.—Cosmopolitan between about 34°N and 41°S. Known depth range of 0–363 m (1100? m).

Asteropterygion magnum (Poulsen, 1965)

Asteropteron magnum Poulsen, 1965:178, figs. 57–60.—Kornicker, 1975:562.

Asteropterygion magnum (Poulsen).—Kornicker, 1981c:320, figs. 9a, 11i, 12b, 14b, 15a, 16b, 17a, 150h, 155; plates 158–161.

HOLOTYPE.—Female with eggs in ovaries, carapace length 4.0 mm, in the Zoological Museum, Copenhagen.

TYPE LOCALITY.—Off Disaster Bay, SE Australia, 65–90 m.

MATERIAL.—Slope 1: 6 undissected specimens in alcohol. Slope 21: 1 undissected instar I in alcohol. Slope 22: 1 undissected instar I in alcohol.

DISTRIBUTION.—Previously reported off SE Australia at depths of 65–100 m. In present collection: Slope 1, 204 m; Slope 21, 220 m; Slope 22, 363 m. Known depth range 65–363 m.

Macroasteropteron, new genus

ETYMOLOGY.—From the Greek *macros* (long) plus the generic name *Asteropteron*.

TYPE SPECIES.—*Macroasteropteron mindax* Kornicker, herein.

COMPOSITION.—This genus includes only the type species.

DISTRIBUTION.—SE slope of Australia, 996 m.

DIAGNOSIS.—The genus is defined on the following characters, which are based on the type species, and may have to be modified if additional species become known.

Carapace: Outer surface without ribs, rostrum small, and incisur shallow. Dorsal margin with locking structures at each end. Infold of rostrum with few bristles, and infold of posterior without setal bristles.

First Antenna: 2nd joint short, separated from long 3rd joint by weak suture, and without bristles (Figure 108g); 7th and 8th joints well developed (Figures 106b,c). Sensory bristle of 5th joint with 2 small proximal filaments followed by 2 long filaments and bifurcate tip; a-bristle of 7th joint bristle-like; b-bristle of 7th joint small; d-bristle of 8th joint absent; e-bristle of 8th joint well developed, filament-like (Figure 106b).

Second Antenna (Figure 106e): Protopodite with short distal medial bristle. Endopodite 3-jointed: 1st joint short with small bristles; 2nd joint short hirsute with or without a bristle; 3rd joint hirsute, elongate, triangular, without terminal bristle. Exopodite without basal spines.

Mandible: Exopodite well developed, with 2 short terminal bristles. 2nd endopodial joint elongate, about twice length of 1st endopodial joint.

Maxilla (Figure 107c,d): Anterior end of baleen comb (not shown except as sockets) reaching anterior corner of basale; long spinous terminal bristle usually on ventral margin of basale on dorsal margin at anterior corner. Exopodite absent. Endopodite: 1st joint elongate, hirsute, with fairly long displaced distal alpha-bristle on posterior margin and long terminal displaced beta-bristle near anterior margin; 2nd endopodial joint with 1 long and 2 short bristles. (The location of the alpha- and beta-bristles are interpreted to be reversed because of their distal and terminal locations, respectively.)

Fifth Limb: Comb elongate with 1 small lateral bristle on type species (Figure 107e,f).

Sixth Limb: Anterior margin of trunk with numerous medial bristles; skirt with rounded anterior and posterior ends and numerous bristles on medial surface and margins of anterior and posterior corners (Figure 107g).

Seventh Limb: With bulbous bilobed tip with peripheral spinous teeth (Figure 107i,j).

Furca: No secondary claws between main claws. Claws 1–3 much longer and stouter than following claws. Each lamella of type species with 3 stout claws followed by 5 smaller claws (Figure 108d).

Upper Lip: Two lobes without long anterior spines. Anterior margin of body dorsal to upper lip with short process with straight anterior edge bearing short spines (Figure 108a,b).

Posterior of Body: With spinous finger-like dorsal process (Figure 108d,f).

Gills: Type species with 3 small diaphanous gills on each side of dorsal margin anterior to finger-like process (Figure 108d,e).

COMPARISONS.—*Macroasteropteron* differs from other genera in the subfamily in having a 1st antenna with a short 2nd joint (without bristles) separated from 3rd joint by indistinct suture (Figure 106a) in having a 2nd antenna with a 3-jointed endopodite without a bristle on 3rd joint (Figure 106d,e), and in having a 7th limb with a large bulbous terminal process (Figure 107i,j). The maxilla of the type species is very unusual (Figure 107a–d), and whether it is normal, aberrant, or twisted (does not appear to be twisted) must await the study of additional specimens (see description in “Diagnosis” and below).

Macroasteropteron mindax, new species

FIGURES 105–108

ETYMOLOGY.—From the Greek *mindax* (a Persian incense).

HOLOTYPE.—Adult female with unextruded eggs on slide and in alcohol in the 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.—None.

DISTRIBUTION.—Slope 53, 996 m.

DESCRIPTION OF ADULT FEMALE (Figures 105–108).—Carapace oval in lateral view with small rostrum and shallow incisure (Figure 105). Surface with minute spines and scattered short and long bristles more numerous along margins (Figure 105b,c,e). Dorsal margin anterior to anterior juncture and posterior to posterior juncture with locking structures (Figure 105d–h).

Infold: Infold of rostrum with 2 small divided bristles (Figure 105e,f). Posterior infold with many small undivided bristles (Figure 105g,h). Crenulations visible beneath anterior-ventral and ventral infolds viewed from inside (Figure 105e) (crenulations more irregular along posterior half of ventral margin). Vestment of posterodorsal corner of right valve with long spines (Figure 105h).

Selvage: Continuous narrowly striate lamellar prolongation with smooth outer edge extending from dorsal end of anterior margin of rostrum to midheight of posterior margin of valve at locking structures; prolongation narrower along posterior margin.

Central Adductor Muscle Attachments (Figure 105a,d): About 20 ovoid attachments.

Carapace Size (length, height in mm): Holotype, 1.42, 1.02.

First Antenna (Figures 106a–c, 108g): Joints 1–7 spinous; 2nd joint short, separated from 3rd joint by indistinct suture; 3rd joint long with 2 bristles (1 ventral terminal, 1 dorsal at distal $\frac{2}{3}$); 4th joint long with 3 terminal bristles (1 dorsal, 2 ventral). Sensory bristle of 5th joint with 2 small bare proximal filaments, then 2 long filaments each with 2 terminal spines, then bifurcating into 2 filaments (each about half length of long filaments) each with 2 spines at tip. 6th joint fused to 5th, with small medial bristle. 7th joint: a-bristle ringed, not claw-like, with long proximal and shorter distal spines; b-bristle short, about same length as bristle of 6th joint, with stout proximal part (possibly stump of incompletely shed bristle of previous instar); c-bristle about same length as sensory bristle of 5th joint, with 4 bare proximal filaments and bifurcate tip. 8th joint: d-bristle absent; e-bristle about half length of c-bristle, bare with blunt tip; f-bristle slightly longer than e-bristle, with 3 bare proximal filaments and bifurcate tip; g-bristle slightly shorter than c-bristle, with 4 bare proximal filaments and bifurcate tip.

Second Antenna (Figure 106d,e): Protopodite spinous, with small distomedial bristle. Endopodite 3-jointed: 1st joint short, with medial spines and 4 small ringed bristles (bare or with few indistinct spines); 2nd joint short spinous, with no or 1 small ringed bristle; 3rd joint spinous, elongate, triangular, with small indistinct proximal tooth and minute cylindrical terminal process. Exopodite: 1st joint with small, slightly curved, tubular, medial, terminal bristle; bristles of joints 2–8 with natatory hairs, no spines; 9th joint with 3 bristles (2 long with natatory hairs, 1 short bare (dorsal)); basal spines absent;

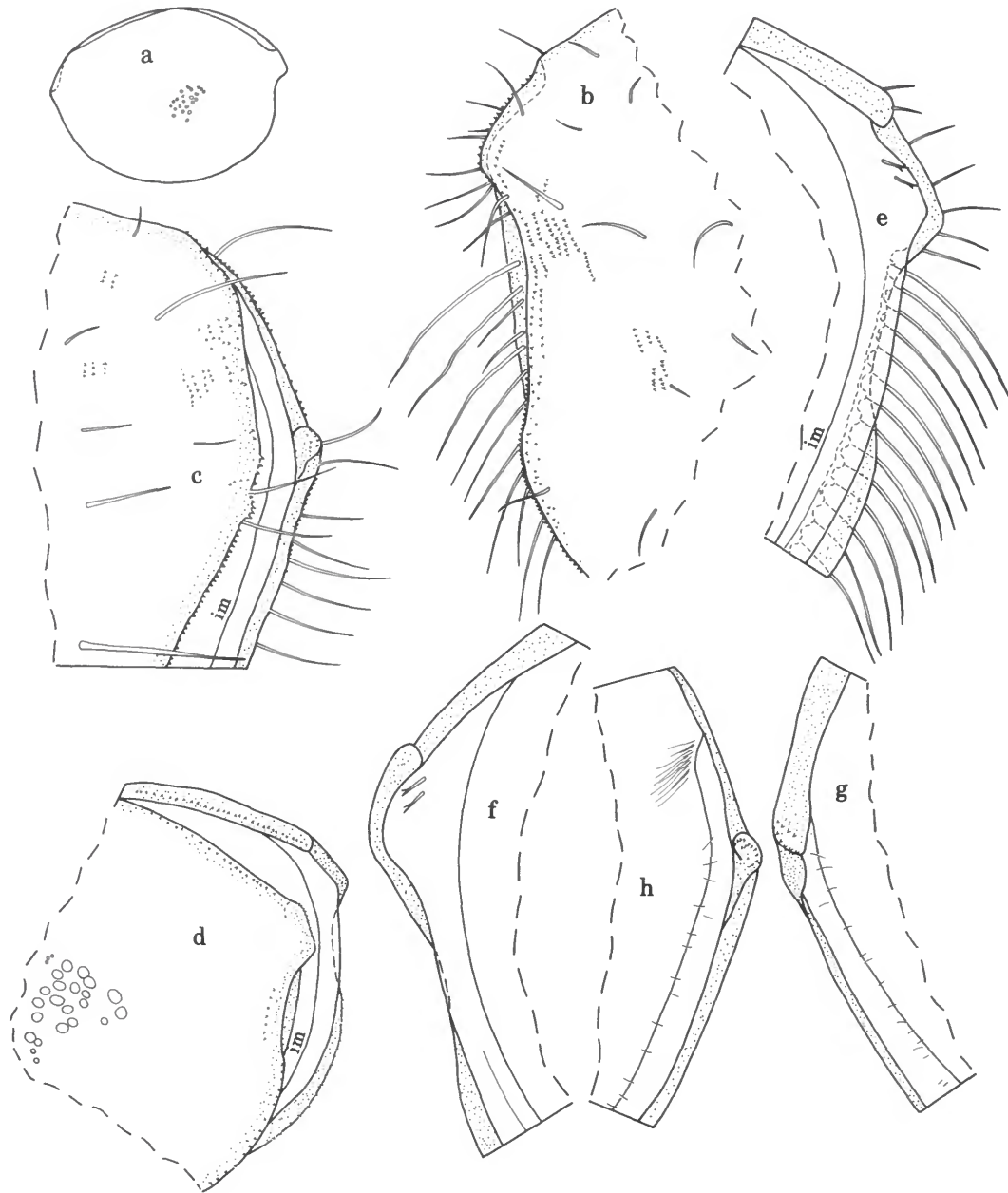


FIGURE 105.—*Macroasteropteron mindax*, new species, adult female, holotype: *a*, complete specimen from right side, length 1.42 mm; *b*, anterior left valve, ov; *c*, posterior of attached valves showing inner side of right valve; *d*, anterior of attached valves showing inner side of left valve; *e, f*, anterior of left and right valves, respectively, iv; *g, h*, posterior of left and right valves, respectively, iv.

joints 2–8 with minute indistinct spines along distal edges.

Mandible: Coxale endite: ventral branch with 4–6 rows of spines and tip with stout dorsal tooth and 2 pairs of smaller teeth (Figure 106*e, f*); dorsal branch with 6 small pointed distal ventral processes including main spine; tip indistinct, rounded, right limb of holotype with terminal hairs (Figure 106*f*), left limb with terminal spines (could not resolve with certainty

whether spine at midheight stouter than others) (Figure 106*g*); usual terminal dorsal bristle not observed; small slender ringed medial bristle present near base of ventral branch (Figure 106*f*). Basale endite with 8 stout spinous bristles and 1 indistinct dwarf bristle (Figure 106*b*). Basale (Figure 106*h*): ventral margin with 4 ringed triaenid bristles and 2 longer slender terminal ringed bristles (bases of latter on small lobe

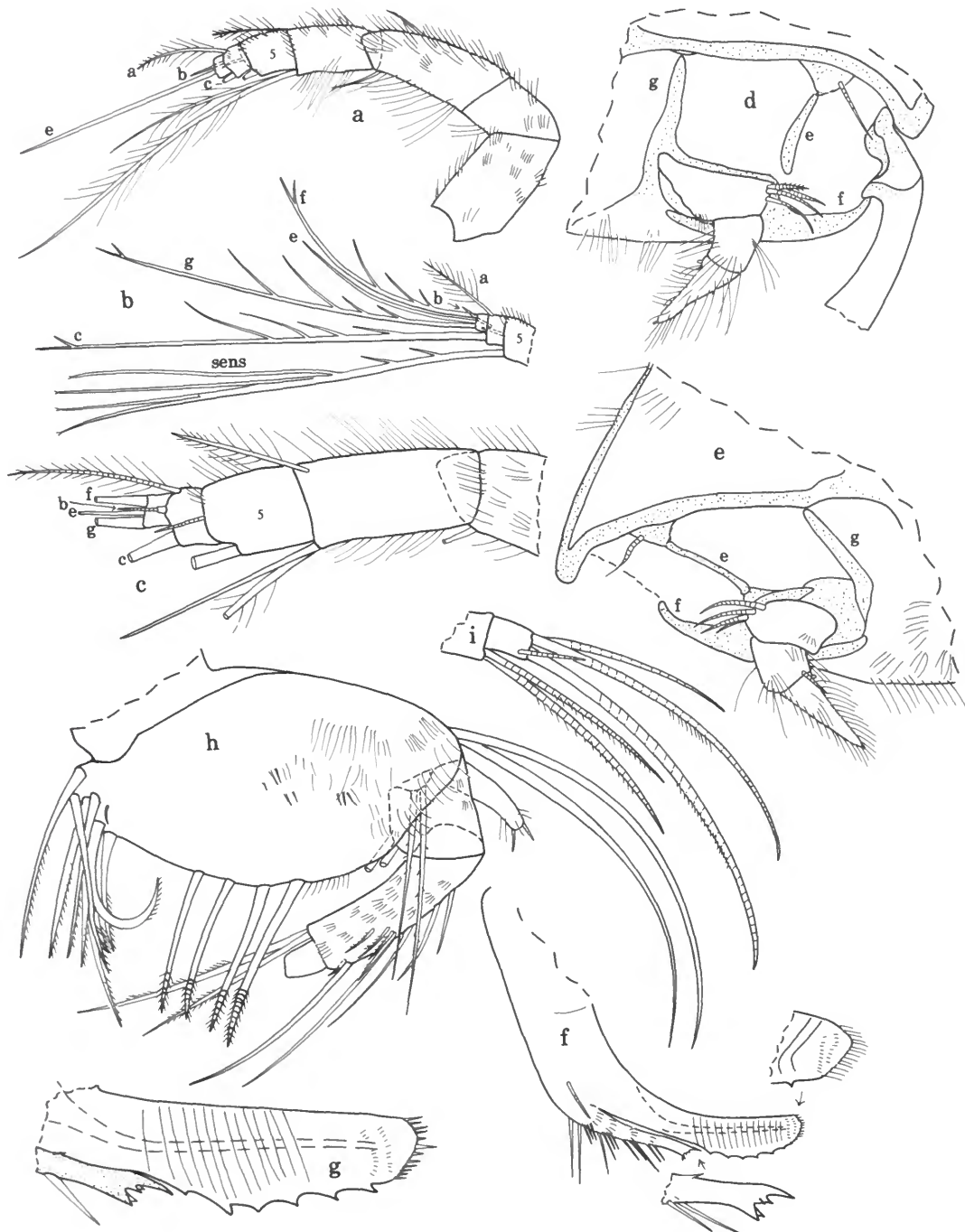


FIGURE 106.—*Macroasteropteron mindax*, new species, adult female, holotype: *a*, left 1st antenna, lv (not all bristles shown); *b*, tip of limb shown in *a*; *c*, part of right 1st antenna, mv; *d*, endopodite and part of protopodite and exopodite of left 2nd antenna, mv; *e*, endopodite and part of protopodite of right 2nd antenna, mv; *f*, coxale endite of right mandible, mv; *g*, coxale endite of left mandible, lv; *h*, part of left mandible, mv (not all bristles shown); *i*, tip of left mandible, mv.

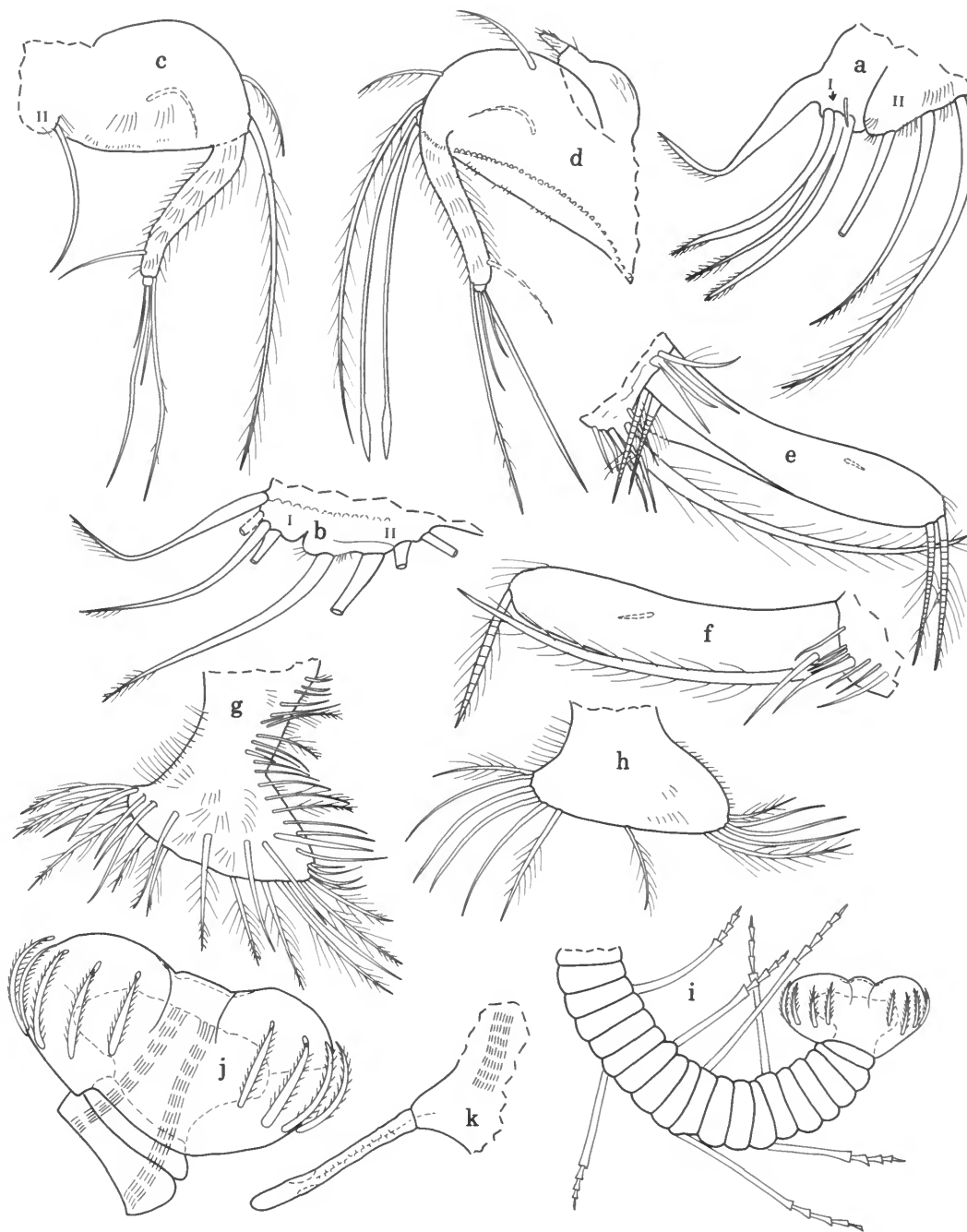


FIGURE 107.—*Macroasteropteron mindax*, new species, adult female, holotype: *a*, endites of left maxilla and stout proximal bristle of balen comb, mv (1 bristle of endite II shown in *c*); *b*, endites of right maxilla and stout proximal bristle of balen comb, lv; *c,d*, left and right maxillae (sockets of comb bristles shown in *d*), respectively, mv; *e,f*, combs of left and right 5th limbs (most ventral bristles of comb not shown), respectively, mv; *g*, left 6th limb, mv; *h*, right 6th limb, lv (medial bristles not shown); *i*, 7th limb; *j*, detail of tip of limb shown in *i*; *k*, medial eye and Bellonci organ.

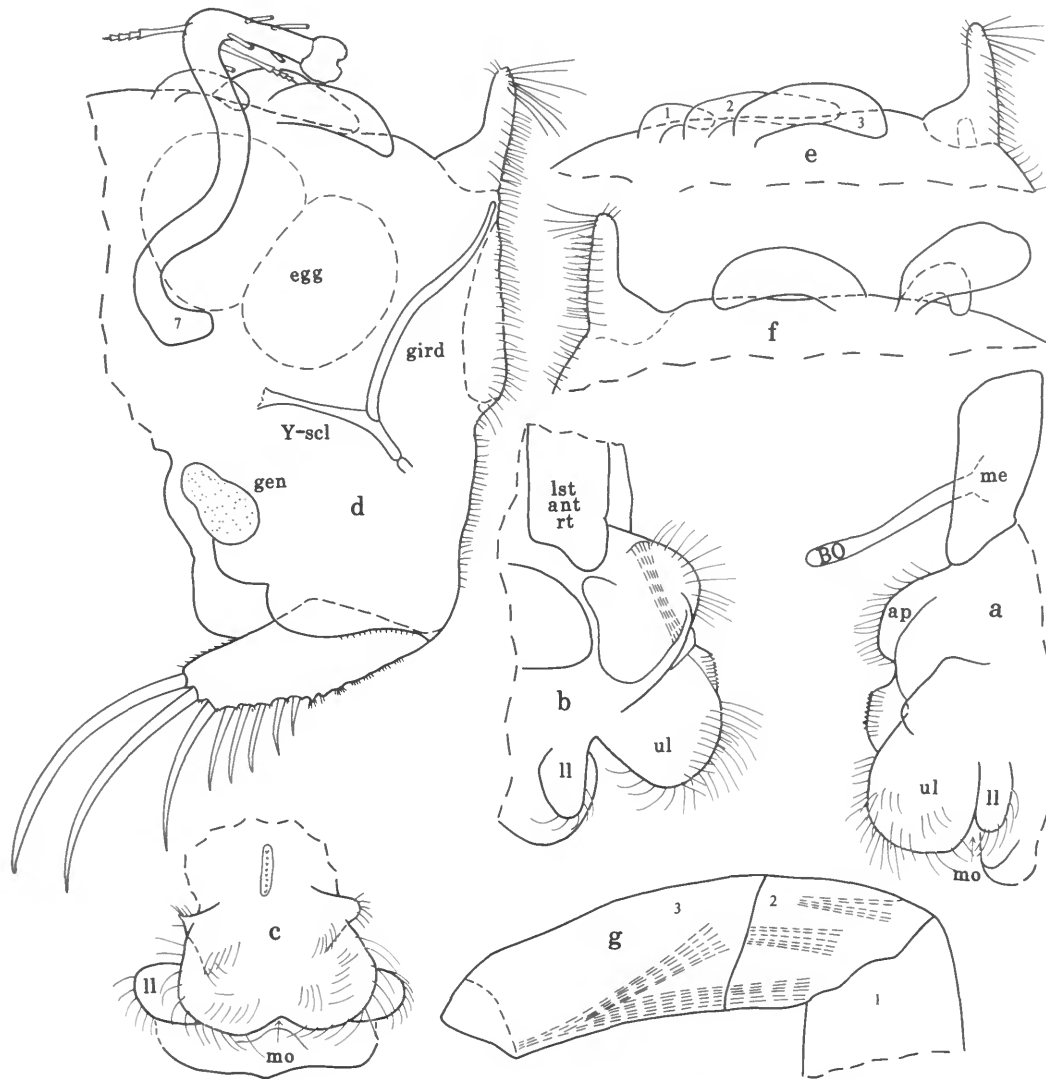


FIGURE 108.—*Macroasteropteron mindax*, new species, adult female, holotype: *a, b*, anterior of body from left and right sides, respectively; *c*, ventral half of body, *av*; *d*, posterior of body from left side showing 7th limb, furca, genital organ, posterior spines and thumb-like process, gills, sclerites, and 2 eggs; *e, f*, finger-like process and gills of posterodorsal part of body from left and right sides, respectively; *g*, joints 1-3 of left 1st antenna showing internal muscles of joints 2 and 3, *lv*.

beneath terminal medial edge of joint on illustrated limb) with indistinct short spines; dorsal margin with 2 long bare subterminal ringed bristles; medial surface spinous (spines long near dorsal margin, shorter and stouter at midheight (not all spines shown)); lateral side with spines near dorsal margin. Exopodite about same length as dorsal margin of 1st endopodial joint, hirsute distally, with rounded tip and 2 small ringed terminal bristles. 1st endopodial joint with few rows of medial spines and 2 long ventral ringed bristles with long proximal and short distal spines (only proximal ends of bristles

shown). 2nd endopodial joint (Figure 106*h*): ventral margin with 2 long terminal ringed bristles with short spines; dorsal margin with 3 short or medium proximal ringed bristles, 2 long distal ringed bristles, 1 very small ringed bristle lateral to distal long bristle, and 4 short spinous unringed cleaning bristles medial to proximal long bristle; medial surface of joint with rows of spines. 3rd exopodial joint with 4 ringed bristles (2 long stout claw-like bristles ringed (rings incomplete) except at talon-like tips and with indistinct small ventral spines, 1 ringed bristle somewhat claw-like about half length of longest bristle,

and 1 small ringed medial bristle with small spines) (Figure 106i). (Rings not shown on all bristles.)

Maxilla: Epipodite short, hirsute, diaphanous, with pointed tip (Figure 107d). Endite I with 3 long bristles with spines at tip and 1 minute indistinct medial bristle (Figure 107a,b); endite II with 4 long bristles (anterior bristle of left limb shown in Figure 107c; 3 posterior bristles shown in Figure 107a). Baleen comb extends laterally past 1st endopodial joint (anterior end of comb at anterior distal corner of basale) (anterior 2 bristles of comb shown in Figure 107d) (proximal bristle of comb shown in Figure 107a,b). Basale (Figure 107c,d): lateral side with long slender bristle at midlength and midheight; dorsal margin with no or 1 proximal bristle, 1 distal bristle, and 1 long spinous terminal bristle (this bristle usually adjacent to posterior edge of 1st endopodial joint in other Asteropteroinae); medial surface with spines in ventral half. Exopodite absent. 1st endopodial joint medial to anterior end of basale, spinous, with short alpha-bristle on posterior side and long terminal beta-bristle on anterior side (reverse of usual location of these bristles). 2nd endopodial joint with 1 long and 2 short bare bristles. (The 1st endopodial joint appears to be reversed, with the margin anterior in other members of the family, posterior on this specimen. Although possible, the 2 limbs mounted on the slide do not appear to have been mechanically twisted during the mounting process suggesting that the reversal is either an aberrancy or a generic character.) (Right limb of holotype without alpha-bristle, but empty socket visible on 1st endopodial joint, and a loose bristle present not far from socket is about same length as alpha-bristle on left limb. The bristle is shown dashed in Figure 107d.)

Fifth Limb (Figure 107e,f): Comb with single row of 26 spinous ventral ringed bristles (only 2 proximal and 2 distal bristles shown on illustrated left limb (Figure 107e), and 1 distal bristle on illustrated right limb (Figure 107f)) and 1 small distal lateral bristle near dorsal margin; proximal medial bristles (rings not shown) on illustrated limbs are interpreted not to be on comb. (Rings are shown on only ventral bristles.)

Sixth Limb (Figure 107g,h): Limb hirsute. Anterior margin of trunk with about 13 spinous medial ringed bristles. Skirt short with rounded anterior and posterior ends, with about 31 spinous ringed bristles on medial surface and along edge (Figure 107g; medial bristles not shown on Figure 107h). (Rings and not all spines shown on bristles.) (Shape of end joint unusual for subfamily.)

Seventh Limb (Figures 107i,j, 108d): One limb with 7 (3 + 4) proximal bristles, other with 9 (5 + 4); each bristle with 3–5 bells. Terminus with large bilobed process surrounded by 16 or 17 spinous teeth (8 or 9 on each lobe); 2 internal muscles attached at distal third (Figure 107j).

Furca (Figure 108d): Each lamella with 8 claws (3 stout claws followed by 5 shorter slender claws) followed by 3–5 short spinous processes, then groups of minute spines; small spines on lamella just posterior to each claw; all claws with closely spaced slender teeth along posterior edge (not shown); claws 1–3 with thin spines along anterior edge (not shown);

anterior edge of lamella with spines.

Bellonci Organ (Figures 107k, 108a): Elongate, slightly broader in distal third, with rounded tip.

Eyes: Lateral eyes absent. Medial eye small, unpigmented (Figure 107k).

Lips (Figure 108a–c): Upper lip 2 hirsute lobes without anterior spines; elongate process at body midwidth just dorsal to lobes with vertical row of minute spines. Lower lip a hirsute flap at each side of mouth and posterior to each lobe of upper lip.

Genitalia (Figure 108d): Oval on each side of body anterior to furca.

Anterior of Body (Figure 108a–c): With large hirsute bulge between medial eye and upper lip dorsal to spiny ridges. Small lateral process at each side of body near dorsal end of upper lip (Figure 108c).

Posterior of Body (Figure 108d–f): Posterior spinous with spinous finger-like dorsal process.

Y-Sclerite (Figure 108d): Anterior end not protracted (somewhat obscured).

Gills (Figure 108d–f): Three indistinct diaphanous gills on each side of dorsal margin of body anterior to finger-like dorsal process.

Number of Eggs: Holotype with 8 large unextruded eggs (4 on each side) of similar size (2 eggs shown in Figure 108d); length of 1 egg, 0.2 mm.

REMARKS.—The lateral and medial sutures separating the 2nd and 3rd joints of the 1st antenna are visible although not well defined; the division is better defined by minute separations in the sclerotized integument at the ventral and dorsal ends of the sutures. The conclusion that the boundary between the joints occurs in this area is supported by the location of internal muscles (Figure 108g).

Sclerites of the Protopodite of the Second Antenna

Hansen (1925:57) studied the sclerites of appendages of many Crustacea including some Myodocopina. He described and illustrated the sclerites of the protopodites of the 2nd antennae of a member of the Cypridinidae (female *Vargula norvegica* (Baird, 1860)), Philomedidae (female *Philomedes brenda* (Baird, 1850a)), and Cylindroleberidinae (*Asterope* sp., sex unknown) (Hansen, 1925: plate III: figs. 3a,b, 4a; plate IV: fig. 1a,b). The present study concerns only the medial sclerites located in the anterior corner of the protopodite of the 2nd antenna. In that area a long sclerite divides the protopodite into roughly equal dorsal and ventral parts (Figure 109g). That sclerite is termed here the median longitudinal sclerite (MLS). Three sclerites ventral to the MLS were designated e-, f-, and g-sclerites by Hansen (1925:58), and those designations are used herein (Figures 109, 111). The anterior end of the MLS curves dorsally to form a rim around the dorsal edge of the protopodite (Figure 109h), but in this study the anterior end of the MLS is considered to be the point of intersection with the anterior edge of the protopodite. A socket in the MLS at the

point of intersection is the receptacle for a hook (Figure 109j) on the proximal ventral end of the 1st joint of the exopodite (Figure 109a,c,e,f); this socket is 1 of 2 points of articulation for the exopodite. The f-sclerite forms a receptacle for the base of the endopodite and is more or less wish-bone shaped with 1 arm on the medial side of the base of the endopodite and the other arm on the lateral side. The stem of the wish-bone is anterior and terminates at the anterior end of the ventral margin of the protopodite. The anterior end of the f-sclerite is generally recurved and fits inside a hook (Figure 109j) on the proximal dorsal end of the 1st joint of the exopodite (Figure 109a,c,e); this is the 2nd point of articulation for the exopodite. Although the f-sclerite is considered to be a single sclerite herein, on some species it is complex comprising more than 1 sclerite (Figure 109c,g). The g-sclerite usually connects the posterior end of the f-sclerite with the MLS (Figure 109e). The sclerite is strongly sclerotized throughout its length on some species (Figure 109e), but is sclerotized strongly only at its dorsal end in others (Figure 109a). The e-sclerite, which is not present on all forms, connects the f-sclerite, at a point just anterior to the base of the endopodite, to the MLS (Figure 109i). The posterior end of the MLS is quite variable, having a single or bifurcate tip terminating just posterior to the g-sclerite in some forms (Figure 111d), and being extremely complex and joining unnamed sclerites in other forms (Figure 111c).

The present study of the distribution of sclerites, which is based mainly on species in the present collection, but includes observations of some additional species of the Philomedidae and Rutidermatidae plus review of illustrations in some of my previous papers, suggests that the families may be grouped as follows: Group 1, females with e-sclerite: Cypridinidae and Cylindroleberididae. Group 2, females without e-sclerite: Philomedidae, Sarsiellidae, Rutidermatidae. Further, Group 2 may be subdivided into 3 subgroups: Group 2A, males without e-sclerite: Sarsiellidae. Group 2B, males with e-sclerite: Rutidermatidae. Group 2C, some males with e-sclerite: Philomedidae. In the Cypridinidae, Cylindroleberididae, and Sarsiellidae, the distribution of sclerites is similar for males and females; whereas, in the Rutidermatidae and some Philomedidae males and females differ.

CYPRIDINIDAE (Figures 8g, 14h, 21h, 25g, 34e, 38f, 109a,b,j, 110).—The e-sclerite is a stout bar that articulates at its dorsal end with a distal process on the medial longitudinal sclerite (MLS) and at its ventral end with the f-sclerite near the base of the endopodite (Figure 109a,b). The g-sclerite varies among species: the dorsal end of the sclerite terminates at the MLS (Figure 109a), or close to it (Figure 109b); the sclerite is more strongly sclerotized at its dorsal end, and the extent of sclerotization distally varies on different species; the ventral end of the sclerite indistinctly terminates at the f-sclerite posterior to the endopodite. The posterior end of the MLS is slender, either single or bifurcate, and does not connect with other sclerites (Figures 109a, 110). The f-sclerite of *Cypridinodes wyvillethomsoni* has a sclerotized cup-like depression just posterior to the endopodite (Figure 109b). All cypridinids

studied herein have e-, f-, and g-sclerites, and the sclerites of males and females of the same species are similar.

It was observed herein that the proximal end of the MLS is bifurcate in 2 species of *Pterocypridina* (Figure 110 dd,ee) and not bifurcate in another (Figure 110cc); this type character difference is useful in identification. Therefore, the MLS was examined in most species of Cypridinidae encountered herein (Figure 110). The posterior end of the MLS is well defined on some species but in most it blends into the massive muscles of the protopodite (indicated by tip with either open end or dashes in Figure 110); probably, tip differences will be of limited use in taxonomic discrimination. With a few minor exceptions the MLS of different specimens of the same species are similar (Figure 110a-d). The MLS of the left and right protopodites of the same specimen are generally quite similar, but in a few specimens they differ slightly, for example *Vargula psydrax* (USNM 193900) (Figure 110f,g), and *Paradoloria* species C (USNM 193896) (Figure 110u,v), in which the MLS differs at the posterior end. The adult male and female of the same species have a similar MLS (Figure 110a-c,d; k,m; o,p; x-z, aa; jj,kk; mm,nn). The MLS of all cypridinids examined has a distal ventral process articulating with the e-sclerite (Figures 109a,b, 110). Most specimens also have a smaller proximal ventral process on the MLS near the dorsal end of the g-sclerite; in some specimens the g-sclerite terminates on the process (Figure 109a), but in others it terminates just proximal to the process (Figure 110ll). The proximal process is absent in some species in the collection (both species of the Azygocypridininae (Figure 110oo,pp), the only species of *Cypridinodes* (Figures 109b, 110z,aa), and *Vargula triifax* (Figure 110o,p)). The presence or absence of a proximal process on the MLS should prove useful for taxonomic discrimination. Among species having a proximal process, the process is better developed in some, and this may have some use in identification.

PHILOMEDIDAE (Figures 45f, 47h, 50g, 52e, 56e, 61i, 109c-i).—In the female *Philomedes brenda* illustrated by Hansen (1925, pl. 3: fig. 4) the f- and g-sclerites are similar to those of the Cypridinidae but the e-sclerite is lacking. The MLS differs from that of the Cypridinidae in having neither a distal ventral process, which in the Cypridinidae articulates with the e-sclerite, nor a proximal ventral process, which in the Cypridinidae is close to the dorsal end of the g-sclerite. The

FIGURE 109.—Sclerites of distal end of medial side of protopodite of 2nd antenna (R = right limb, L = left limb): a, *Paradoloria* species B, adult male, USNM 193851 (L); b, *Cypridinodes wyvillethomsoni* (Brady, 1880), adult male, USNM 193907 (L); c, *Pleoschisma pnyx*, new species, ovigerous female, paratype, USNM 193928 (R); d, *Philomedes brenda* (Baird, 1850a), adult male, USNM 157873 (L); e, *Philomedes pnyx*, new species, adult female, holotype (R); f, *Harbansus* species A, ovigerous female, USNM 193998 (L); g, *Harbansus* species B, adult male, USNM 193924 (L); h, *Harbansus* species B, adult female, USNM 193925 (L); i, *Pseudophilomedes darbyi* Kornicker, 1989 (in Kornicker and Iliffe, 1989a), adult male, USNM 158413 (L); j, *Metavargula* species B, ovigerous female, lateral view of proximal end of exopodite of 2nd antenna, USNM 193852 (R). (Species left in open nomenclature are new species in the collection to be described in later papers.)



sclerites of the protopodite of all female Philomedidae (Figure 109c,e,f,h) in the present collection as well as A-1 males (*Igene* species A, *Pseudophilomedes fornix*) are similar to those of the female *P. brenda*. Adult male Philomedidae are sparse in the collection. The protopodite of the male *Harbansus* species B differs from that of the female in having a small distal ventral triangular process on the MLS (Figure 109g,h), and the protopodites of the male *Philomedes thorax* and *Pleoschisma pnyx* differ from those of the female in having an e-sclerite (Figures 56e, 109c). The protopodite of the male *Scleroconcha* species A differs from those of the female in having an e-sclerite as well as a triangular ventral process distal to the e-sclerite. Because of those differences, some additional male Philomedidae in the collection of this museum were included in the study. The protopodite of the male *P. brenda* (USNM 157873) unlike that of the female has an e-sclerite (Figure 109d). The protopodites of the male *Pseudophilomedes darbyi* Kornicker, 1989 (in Kornicker and Iliffe, 1989a) (USNM 158413) and *Pseudophilomedes kylix* Kornicker, 1989 (in Kornicker and Iliffe, 1989a) (male USNM 193155, female USNM 193154)) differ from those of the female in having an e-sclerite as well as a triangular ventral process distal to the e-sclerite (Figure 109i). Thus, from examination of only a few species it is shown that sclerites of the adult male differ from those of the female, and include at least 3 types: type 1, with distal ventral triangular protuberance on MLS and without e-sclerite (example *Harbansus* species B (Figure 105g)); type 2, with distal ventral triangular protuberance on MLS and with e-sclerite (example *Pseudophilomedes darbyi* (Figure 109i)); type 3, with e-sclerite and without distal ventral triangular process on MLS (example *Philomedes brenda* (Figure 105d)). The data suggest that the sclerites of the male may be useful in taxonomic discrimination. The proximal end of the MLS of the Philomedidae differs from that of the Cypridinidae in being more complex and connecting with additional sclerites.

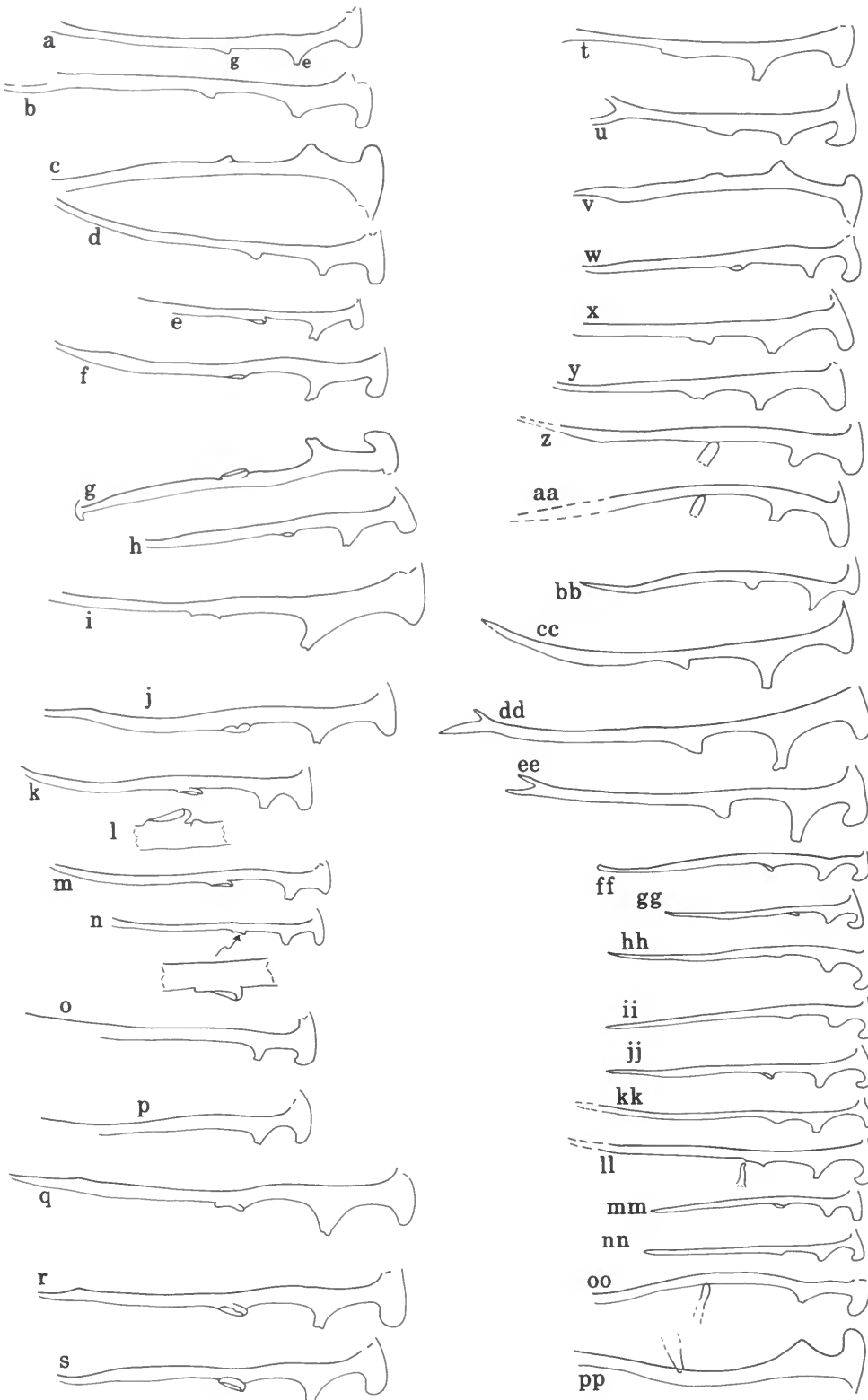
RUTIDERMATIDAE (Figures 65i, 67h, 71f, 111a,b).—The sclerites of the male and female *Rutidermata hartmanni* Poulsen, 1965, were illustrated by Kornicker (1985a, fig. 8). The sclerites of the protopodites of a female *Metaschisma nex* (Figure 111b), a male and female *Scleraner trifax* (Figures 65i, 67h) and a male *Rutiderma loma* (Juday, 1907) (Figure 111a) are illustrated herein. The female protopodite bears f- and g-sclerites (Figures 65i, 111b); whereas, the male protopodite has e-, f-, and g-sclerites (Figures 67h, 111a). The proximal end of the (MLS) is variable, and the ventral margin is without a stout distal process at the point of articulation of the e-sclerite. The MLS at the point of articulation of the g-sclerite may either be straight (Figures 67h, 111a,b) or have a small process (Figure 65i). The protopodite of an A-1 male *Metaschisma nex* (USNM 193932) in the collection is similar to that of the adult female in not having an e-sclerite, and in having a straight g-sclerite.

SARSIELLIDAE (Figures 72i, 76i, 79i, 81d, 82h, 85d, 87a, 90i, 93a, 94g, 97c,d, 99j, 111c).—In this family the MLS is without proximal or distal processes on the ventral margin and its

proximal end is broad and complex (Figure 111c). The f-sclerite at the base of the endopodite usually consists of a single sclerite, and the g-sclerite articulates with the MLS just distal to its flaring proximal end. Males and females have fairly similar sclerites; neither has an e-sclerite. The distribution of the sclerites is fairly similar to those of female Philomedidae.

CYLINDROLEBERIDIDAE (Figures 102a, 106d,e, 111d-k).—Hansen (1925:58, pl. III: fig. 3a,b) described the distal sclerites on the medial side of the protopodite of the 2nd antenna of a specimen of *Asterope* sp. (sex unspecified) as having well-developed e- and f-sclerites and a g-sclerite better “marked off” than those found in the Cypridinidae. The distal ventral process of the MLS is generally shorter than that of the Cypridinidae. The small proximal ventral process of the MLS is either a triangular node (Figure 111g-i) or concave at its tip (Figure 111d-f,j,k). The posterior end of the MLS on some specimens is fairly well defined, whereas in others the MLS curves dorsally and joins the rim along the dorsal edge of the protopodite; however, this variability may not be very useful in taxonomic discrimination because variations occur on the left and right limbs of the same specimen of some observed species (Figure 111h,i). Both males and females have e-, f-, and g-sclerites, but on some males the g-sclerite is less well defined (Figure 111j). The differences among the MLS of different species are small and probably of limited use in taxonomic discrimination.

FIGURE 110.—Median longitudinal sclerites (MLS) of protopodite of 2nd antenna (R = right limb, L = left limb): *Pseudodoloria plax*, new species: a, ovigerous female, paratype, USNM 193832 (L); b,c, ovigerous female, paratype, USNM 193860 (L, R); d, adult male, paratype, USNM 193833 (L). *Vargula straux*, new species: e, ovigerous female, paratype, USNM 193892 (L). *Vargula psydrax*, new species, ovigerous females, paratypes: f,g, USNM 193900 (L, R); h, USNM 193995 (L). *Vargula vix*, new species: i, ovigerous female, holotype (L). *Vargula matrix*, new species: j, adult female, paratype, USNM 193970 (L). *Vargula hex*, new species: k, ovigerous female, paratype, USNM 193835, complete sclerite (L); l, detail of socket for g-sclerite (R); m, adult male, paratype (L). *Vargula fugax*, new species: n, adult female, holotype (L). *Vargula trifax*, new species, paratypes: o, ovigerous female, USNM 193905 (L); p, adult male, USNM 193948 (L). *Paradoloria* species B, adult females: q, USNM 193848 (L); r, USNM 193849 (L); s, adult male, USNM 193851 (L). *Paradoloria* species C: t, ovigerous female, USNM 193897 (L); u, v, adult male, unnumbered specimen (L, R). *Paradoloria* species D: w, adult male, USNM 193949 (L). *Paradoloria* species E: x, ovigerous female, USNM 193952 (L); y, adult male, USNM 193953 (L). *Cypridinodes wyvillethomsoni* (Brady, 1880): z, ovigerous female, USNM 193906 (L); aa, adult male, USNM 193907 (L). *Skogsbergia* species A: bb, ovigerous female, unnumbered specimen (L). *Pterocypridina* species A: cc, adult female, USNM 193997 (L). *Pterocypridina* species B: dd, ovigerous female, unnumbered specimen (L). *Pterocypridina dedeckeri* Kornicker, 1983b: ee, ovigerous female, holotype, USNM 158240 (L). *Metavargula* species A: ff, adult female, unnumbered specimen (L). *Metavargula* species B: gg, ovigerous female, USNM 193852 (L). *Metavargula* species C, ovigerous females: hh, USNM 193857(L); ii, unnumbered specimen (L). *Metavargula* species D: jj, adult female, USNM 193951 (L); kk, adult male, USNM 193950 (L); ll, ovigerous female, USNM 193854 (L). *Metavargula* species E: mm, adult female, unnumbered specimen (L); nn, adult male, USNM 193855 (L). *Isocypridina* species A: oo, adult male, USNM 193956 (R). *Azygocypridina lowryi* Kornicker, 1985b: pp, instar III female, unnumbered specimen (L). (Species left in open nomenclature are new species in the collection to be described in future papers.)



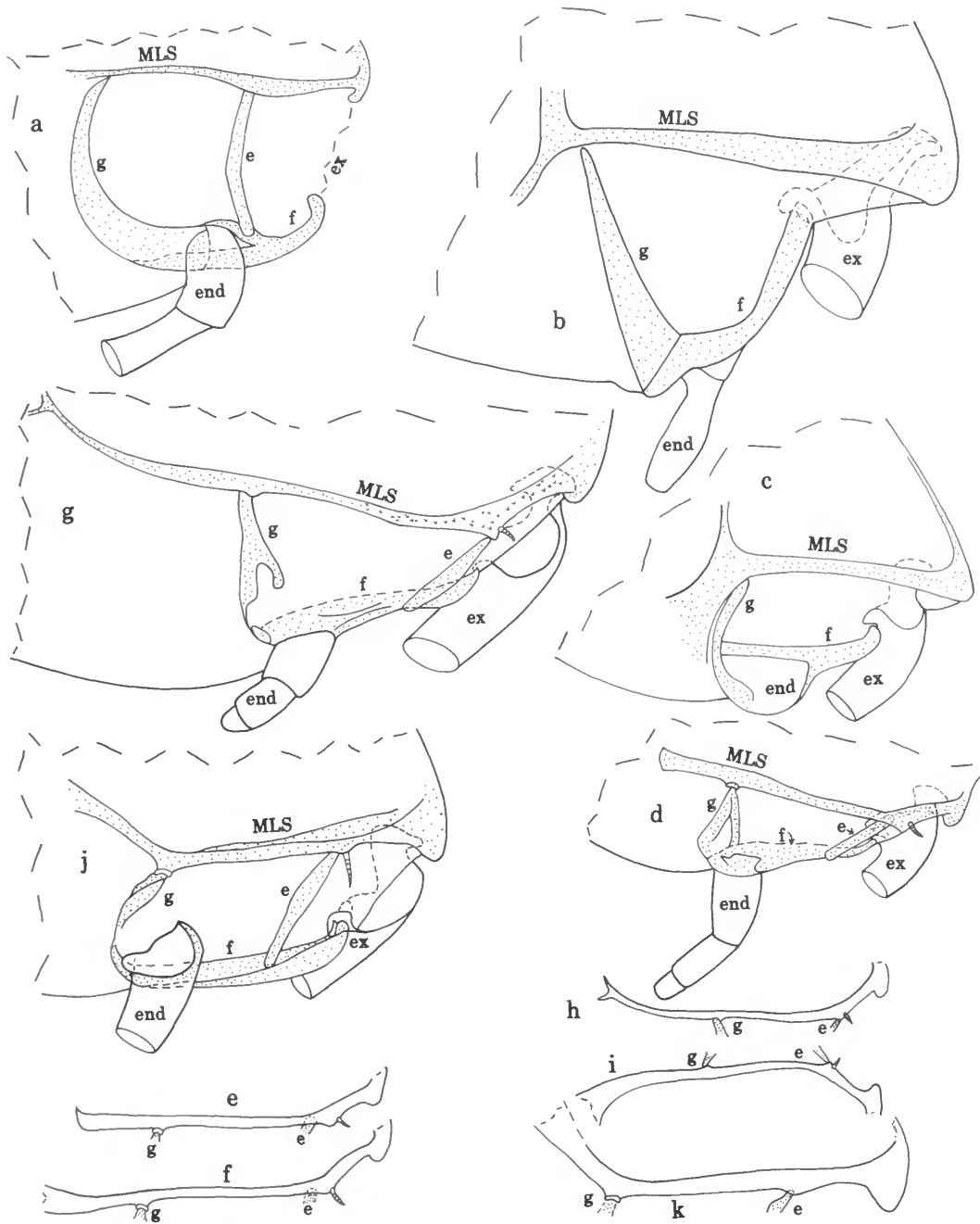


FIGURE 111.—Sclerites of distal end of medial side of protopodite of 2nd antenna (R = right limb, L = left limb): a, *Rutiderma loma* (Juday, 1907), adult male, USNM 158260 (L); b, *Metaschisma nex*, new species, ovigerous female, paratype, USNM 193931 (L); c, *Chelicopia pertinex*, new species, adult female, paratype, USNM 193933 (L). *Xandarasterope* (nomen nudem) species A, ovigerous females: d, USNM 193999 (L); e, detail of MLS in d; f, detail of MLS, USNM 193958 (L). *Archasterope* species A: g, ovigerous female, USNM 193983 (L); h, detail of MLS in g; i, detail of MLS, ovigerous female, USNM 193983 (R); j, adult male, USNM 193984 (L); k, detail of MLS in j. (Species left in open nomenclature are new species in the collection to be described in future papers.)

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.

Vargula trifax; *Pleoschisma pseudoferox*; *P. pnyx*; *Chelicopia pertinex*; *C. triplex*; *Dantya tryx*; *Eusarsiella fallomagna*; *Nealella lux*; *Parasarsiella poorei*; *Metaschisma nex*; *Scleraner trifax*; *Asteroptyrgion magnum*; *Leuroleberis mackenziei*.

Slope 2: New South Wales off Nowra (34°57.90'S, 151°08.00'E), 503 m, bryozoa and shell, 14 Jul 1986.

Eusarsiella bex.

Slope 17: New South Wales off Nowra (34°43.10'S, 151°23.00'E), 2250 m, 17 Jul 1986.

Vargula psydrax.

Slope 19: New South Wales off Eden (37°07.30'S, 150°20.20'E), 520 m, gray coarse shell, 20 Jul 1986.

Pleoschisma pnyx; *Eusarsiella bex*; *E. edax*.

Slope 21: New South Wales off Eden (36°57.40'S, 150°18.80'E), 220 m, muddy shell, 20 Jul 1986.

Pleoschisma mindax; *P. pnyx*; *Scleraner trifax*; *Asteroptyrgion magnum*.

Slope 22: New South Wales off Eden (37°06'S, 150°20.70'E), 363 m, coarse shell, 21 Jul 1986.

Vargula trifax; *V. vertex*; *Pleoschisma pnyx*; *Scleraner trifax*; *Chelicopia pertinex*; *Eusarsiella edax*; *E. iayx*; *Asteroptyrgion magnum*.

Slope 25: Victoria south of Point Hicks (38°25.90'S, 148°58.60'E), 1850 m, muddy, sandstone, 22 Jul 1986.

Vargula psydrax; *Philomedes sphynx*.

Slope 27: Victoria south of Point Hicks (38°25.00'S, 149°0.00'E), 1500 m, compacted clay, 22 July 1986.

Pseudodoloria plax

Slope 32: Victoria south of Point Hicks (38°21.90'S, 149°20.00'E), 1000 m, 23 Jul 1986.

Pseudodoloria plax; *Vargula fugax*; *V. hex*; *Philomedes ptyx*.

Slope 33: Victoria south of Point Hicks (38°19.60'S, 149°24.30'E), 930 m, rock, rubble, clay, sand, biogenic sediments, 23 Jul 1986.

Vargula hex.

Slope 34: Victoria south of Point Hicks (38°16.40'S, 149°27.60'E), 800 m, coarse shell, biogenic sediments, 23 Jul 1986.

Vargula dentata; *Philomedes thorax*.

Slope 39: Victoria south of Point Hicks (38°19.10'S, 149°14.30'E), 600 m, coarse sand, 24 Jul 1986.

Vargula stranx; *Xenoleberis bex*.

Slope 40: Victoria south of Point Hicks (38°17.70'S, 149°11.30'E), 400 m, coarse sand, gravel, mud, many sponges, 24 Jul 1986.

Pseudodoloria plax; *Vargula trifax*; *V. vix*; *Chelicopia pertinex*; *Eusarsiella edax*; *E. fallomagna*; *E. iayx*.

Slope 45: Tasmania off Freycinet Peninsula (42°2.20'S, 148°38.70'E), 800 m, coarse shelly sand, 27 Jul 1986.

Vargula stranx

- Slope 46: Tasmania off Freycinet Peninsula (42°0.20 'S, 148°37.70'E), 720 m, coarse shelly sand, 27 Jul 1986.
Vargula straux; *Philomedes fortax*; *Eusarsiella bex*; *E. iayx*.
- Slope 47: Tasmania off Freycinet Peninsula (41°58.60'S, 148°38.80'E), 500 m, coarse shell, 27 Jul 1986.
Vargula hex; *Eusarsiella iayx*.
- Slope 48: Tasmania off Freycinet Peninsula (41°57.50'S, 148°37.90'E), 400 m, coarse shell, 27 Jul 1986.
Vargula rapax; *Eusarsiella iayx*; *Scleraner trifax*.
- 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.
Vargula fugax; *V. dentata*; *V. psydrax*; *Pseudophilomedes fornix*; *Macroasteropteron mindax*.
- 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.
Vargula psydrax; *V. trifax*; *Eusarsiella bex*; *E. edax*; *E. fallomagna*; *E. iayx*.
- Slope 66: Victoria 96 km S of Point Hicks (38°40.29'S, 149°18.06'E, 2900 m, to 38°39.44'S, 149°15.04'E, 2900 m), compacted clay, 25 Oct 1988.
Philomedes pseudolofthousae.
- Slope 67: Victoria 67 km S of Point Hicks (38°23.95'S, 149°17.02'E), 1277 m, fine mud with coral, 25 Oct 1988.
Pseudodoloria plax; *Vargula matrix*; *V. psydrax*.
- 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.
Vargula matrix; *V. psydrax*; *Philomedes pseudolofthousae*; *P. ptyx*.
- 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 mud aggregate, 30 Oct 1988.
Vargula psydrax.

Appendix 2

Material from Museum of Victoria "Crustacea" Database

CYLINDROLEBERIDIDAE

Leuroleberis mackenziei Kornicker, 1981

Other material stn SLOPE 1, NMV J35514 (1 adult male, 1 juv)

Macroasteropteron mindax

holotype stn SLOPE 53, NMV J35560 (1 female, 1 slide)

Xenoleberis bex

holotype stn SLOPE 39, NMV J35567 (1 ovig female, 1 slide)

CYPRIDINIDAE

Pseudodoloria plax

paratype stn SLOPE 32, NMV J35524 (5 males, 4 females)

paratype stn SLOPE 32, NMV J35532 (7)

paratype stn SLOPE 67, NMV J35608 (1 partly dissected juv)

paratype stn SLOPE 67, NMV J35609 (1 partly dissected female)

paratype stn SLOPE 67, NMV J35610 (5 juvs)

holotype stn SLOPE 32, NMV J35540 (1 ovig female)

Vargula dentata Kornicker, 1975

Other material stn SLOPE 34, NMV J35521 (1 ovig female, 1 slide)

Vargula fugax

paratype stn SLOPE 53, NMV J35586 (1 adult male, 2 juvs)

paratype stn SLOPE 53, NMV J35596 (1 adult male, 1 slide)

holotype stn SLOPE 32, NMV J35538 (1 female, 1 slide)

Vargula hex

paratype stn SLOPE 47, NMV J35534 (1 ovig female, 1 slide)

paratype stn SLOPE 32, NMV J15829 (1 adult female)

paratype stn SLOPE 33, NMV J15830 (1 partly dissected ovig female)

paratype stn SLOPE 32, NMV J35553 (4 females)

paratype stn SLOPE 32, NMV J35573 (1 adult female)

holotype stn SLOPE 32, NMV J35554 (1 female)

Vargula matrix

holotype stn SLOPE 69, NMV J35597 (1 partly dissected ovig female)

Vargula psydrax

paratype stn SLOPE 17, NMV J15823 (1 juv)

paratype stn SLOPE 53, NMV J35520 (13 females, 5 males, 9 juvs)

paratype stn SLOPE 69, NMV J35519 (1 female)

paratype stn SLOPE 81, NMV J35531 (1 juv)

paratype stn SLOPE 67, NMV J35533 (2 males)

paratype stn SLOPE 67, NMV J35536 (1 female)

holotype stn SLOPE 69, NMV J35526 (1 ovig female)

Vargula rapax

paratype stn SLOPE 48, NMV J35558 (4 females, 2 juvs)

holotype stn SLOPE 48, NMV J35579 (1 undissected ovig female)

Vargula strax

paratype stn SLOPE 39, NMV J15832 (1 female)

paratype stn SLOPE 45, NMV J15834 (11)

paratype stn SLOPE 39, NMV J35543 (1 partly dissected female)

holotype stn SLOPE 46, NMV J35541 (1 ovig female)

Vargula trifax

paratype stn SLOPE 22, NMV J15826 (1 male)

paratype stn SLOPE 40, NMV J15833 (31)

paratype stn SLOPE 56, NMV J17673 (4)

paratype stn SLOPE 40, NMV J35545 (9)

paratype stn SLOPE 1, NMV J35574 (13)

paratype stn SLOPE 1, NMV J35593 (1 female)

paratype stn SLOPE 1, NMV J35601 (1 female)

holotype stn SLOPE 40, NMV J35537 (1 ovig female)

Vargula vertex

paratype stn SLOPE 22, NMV J35575 (partly dissected A-I male)

holotype stn SLOPE 22, NMV J35585 (1 adult male, 1 slide)

Vargula vix

paratype stn SLOPE 40, NMV J35555 (4 females)

paratype stn SLOPE 40, NMV J35582 (1 partly dissected adult female, 1 slide)

holotype stn SLOPE 40, NMV J35564 (1 ovig female, 1 slide)

PHILOMEDIDAE

Philomedes fortax

holotype stn SLOPE 46, NMV J35557 (1 female, 1 slide)

Philomedes pseudolothousae

paratype stn SLOPE 69, NMV J35577 (5 undissected juvs)

paratype stn SLOPE 69, NMV J35587 (1 undissected adult female)

paratype stn SLOPE 69, NMV J35590 (1 partly dissected A-I male)

holotype stn SLOPE 69, NMV J35556 (1 female)

Philomedes ptyx

paratype stn SLOPE 69, NMV J35569 (1 adult female, 1 slide)

- holotype stn SLOPE 32, NMV J35559 (1 female, 1 slide)
- Philomedes sphinx*
holotype stn SLOPE 25, NMV J35578 (1 adult female, 1 slide)
- Philomedes thorax*
paratype stn SLOPE 34, NMV J35515 (1 male, 1 juvenile)
holotype stn SLOPE 34, NMV J35528 (1 ovig female, 1 slide)
- Pleoschisma mindax*
paratype stn SLOPE 21, NMV J35542 (1 male, 2 slides)
holotype stn SLOPE 21, NMV J35551 (1 A-I male, 1 slide)
- Pleoschisma pnyx*
paratype stn SLOPE 21, NMV J15825 (1 juv)
paratype stn SLOPE 19, NMV J35516 (1 juv)
paratype stn SLOPE 1, NMV J35598 (5 females, 5 instars V, 1 instar IV)
paratype stn SLOPE 22, NMV J35599 (2 females, 2 juvs)
holotype stn SLOPE 1, NMV J35580 (1 partly dissected adult female, 1 slide)
- Pleoschisma pseudoferox*
holotype stn SLOPE 1, NMV J35588 (1 late larval stage female (A-I or A-II), 1 slide)
- Pseudophilomedes fornix*
holotype stn SLOPE 53, NMV J35548 (1 ovig female, 1 slide)

RUTIDERMATIDAE

- Metaschisma nex*
paratype stn SLOPE 1, NMV J35547 (15)
holotype stn SLOPE 1, NMV J35600 (1 ovig female)
- Scleraner trifax*
paratype stn SLOPE 1, NMV J15818 (19)
paratype stn SLOPE 22, NMV J35518 (20)
paratype stn SLOPE 48, NMV J35530 (1 A-I male)
paratype stn SLOPE 21, NMV J35549 (1 ovig female, 1 juv)
holotype stn SLOPE 1, NMV J35525 (1 ovig female)

SARSIELLIDAE

- Chelicopia pertinex*
paratype stn SLOPE 1, NMV J35517 (3 females)
paratype stn SLOPE 40, NMV J35539 (1 female)
paratype stn SLOPE 22, NMV J35605 (2 partly dissected ovig females)
paratype stn SLOPE 22, NMV J35606 (3)
paratype stn SLOPE 22, NMV J35607 (2 females)
holotype stn SLOPE 1, NMV J35523 (1 adult undissected female)

- Chelicopia triplex*
paratype stn SLOPE 1, NMV J35529 (5 females)
holotype stn SLOPE 1, NMV J35522 (1 female)
- Dantya tryx*
holotype stn SLOPE 1, NMV J35568 (1 adult undissected female)
- Eusarsiella hex*
Paratype stn SLOPE 2, NMV J15819 (5 females)
paratype stn SLOPE 46, NMV J35544 (2)
paratype stn SLOPE 56, NMV J35550 (2 ovig females)
paratype stn SLOPE 19, NMV J35552 (4 ovig females, 2 females)
holotype stn SLOPE 46, NMV J35535 (1 female)
- Eusarsiella edax*
Other material stn SLOPE 56, NMV J35581 (1 adult male)
stn SLOPE 19, NMV J35594 (1 juv)
paratype stn SLOPE 22, NMV J35572 (3 ovig females, 2 adult females, 1 juv)
paratype stn SLOPE 40, NMV J35584 (2 ovig females)
holotype stn SLOPE 22, NMV J35562 (1 ovig female)
- Eusarsiella fallomagna*
paratype stn SLOPE 56, NMV J35563 (7 females)
paratype stn SLOPE 1, NMV J35571 (1 undissected ovig female)
paratype stn SLOPE 40, NMV J35591 (1 undissected adult female)
holotype stn SLOPE 1, NMV J35583 (1 undissected ovig female)
- Eusarsiella iayx*
paratype stn SLOPE 22, NMV J35561 (5 females)
paratype stn SLOPE 46, NMV J35565 (1 late instar)
paratype stn SLOPE 40, NMV J35566 (10 ovig females, 1 adult female)
paratype stn SLOPE 48, NMV J35576 (3 ovig females, 3 adult females, 3 juv)
paratype stn SLOPE 47, NMV J35595 (1 adult female)
holotype stn SLOPE 48, NMV J35592 (1 partly dissected ovig female)
- Nealella lux*
holotype stn SLOPE 1, NMV J35546 (1 adult female, 1 slide)
- Parasarsiella poorei*
Other material stn SLOPE 1, NMV J35570 (1 early juv)
paratype stn SLOPE 1, NMV J35527 (6 females)
paratype stn SLOPE 1, NMV J35602 (1 late juv)
paratype stn SLOPE 1, NMV J35603 (1 ovig female)
paratype stn SLOPE 1, NMV J35604 (1 adult male)
holotype stn SLOPE 1, NMV J35589 (1 ovig female)

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