

Myodocopid Ostracoda of the
Benthédi Expedition, 1977, to the
NE Mozambique Channel, Indian Ocean

LOUIS S. KORNICKER

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SMITHSONIAN INSTITUTION PRESS

Washington, D.C.

1992

ABSTRACT

Kornicker, Louis S. Myodocopid Ostracoda of the Benthédi Expedition, 1977, to the NE Mozambique Channel, Indian Ocean. *Smithsonian Contributions to Zoology*, number 531, 243 pages, 132 figures, 20 tables, 1992.—Twenty-eight species (25 new) in twenty genera in five families of myodocopid Ostracoda are described and illustrated from collections made mostly at shelf and upper bathyal depths in the northeastern end of the Mozambique Channel, primarily from the vicinity of Mayotte (Comoro Islands) and the Glorioso Islands, Geyser, Leven, and Zelee banks (Madagascar). All specimens were collected by French personnel during the Benthédi Expedition of 1977, under the auspices of three French institutions: Station Marine d'Endoume, University d'Aix-Marseille; Centre National de la Recherche Scientifique; Centre National pour l'Exploitation des Océans. The ontogeny is described for three new species of *Codonocera*, *Rutiderma*, and *Synasterope*, and a graph is presented showing the approximate relationship between the percentage of myodocopid species worldwide having lateral eyes and the depth of water in which they live. A possible relationship between morphology, locomotion, and mating habitat is discussed for the genus *Harbansus*.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging-in-Publication Data

Kornicker, Louis S., 1919-

Ostracoda of the Benthédi Expedition, 1977, to the NE Mozambique Channel, Indian Ocean / Louis S. Kornicker.

p. cm.—(Smithsonian contributions to zoology ; no. 531)

Includes bibliographical references.

1. Myodocopida—Mozambique Channel—Classification. 2. Benthédi Expedition (1977). I. Title. II. Series. QL444.085K68 1992 595.3'3—dc20 92-20590

⊗ The paper used in this publication meets the minimum requirements of the American National Standard for Permanence of Paper for Printed Library Materials Z39.48—1984.

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Myodocopid Ostracoda of the Benthédi Expedition, 1977, to the NE Mozambique Channel, Indian Ocean

Louis S. Kornicker

Introduction

This work reports on the Ostracoda in the order Myodocopida collected during the Benthédi Expedition conducted by the Station Marine d'Endoume, University d'Aix-Marseille (C.N.R.S./L.A. n°41), the Centre National de la Recherche Scientifique, and the Centre National pour l'Exploitation des Océans (C.N.E.X.O.), France, aboard R/V *Suroît*, during March and April, 1977, to the northeastern end of the Mozambique Channel, Indian Ocean, with special emphasis on samples from the vicinity of Mayotte (Comorro Islands) and the Glorioso Islands, Geysier, Leven, and Zelee Banks (Madagascar) (Figure 1). Two species of *Dantya* in this collection were described previously (Kornicker, 1983c:2, 11) but for completeness are listed herein in Table 1 and Appendix 1. *Thaumatococoncha porosa* Kornicker, 1985, in the order Halocyprida, from sta 87-CH in the present collection, also was described previously (Kornicker, 1985c:1013) and is not mentioned further herein. Although not present in the collection, *Harbansus dayi* Kornicker, *Chelicopia kornickeri* McKenzie, *Eurypylus petrosus* Brady, and *Synasterope oculata* Brady are discussed.

STATIONS.—The 27 stations from which myodocopids were collected range in depth from 3 to 3716 m, but only 2 are deeper than 550 m. The localities of stations from which ostracodes are reported are presented in chronological order in Appendix 1. Station localities are from a station list supplied to the author with the samples; the list has been filed in the Division of Crustacea, National Museum of Natural History, Smithsonian Institution. French names as they appear on the list are used herein unless an English name for the locality is listed in the National Intelligence Survey Gazetteer for Madagascar, which contains official standard names approved by the United States Board of Geographic Names, prepared in the Division of

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Geography, Department of the Interior, and published by the Central Intelligence Agency, Washington, D.C., May 1955.

SAMPLING.—Each station number is followed by an abbreviation identifying the type of gear used in collecting each sample: CH, trawl; D or DR, rock dredge; DS, sediment dredge of Charcot type with 1 mm screen; R or S, collected by SCUBA diver. Most samples (18) were collected by a diver, and each of these are from a narrow depth range of not more than 6 m, and usually only 1 or 2 m; 4 samples were collected with a rock dredge, and for these the depth range of a sample may be as much as 220 m; 4 samples were collected with a sediment dredge with a depth range per sample of up to 55 m; 1 sample was collected with a trawl at a constant depth of 3716 m. Samples are not quantitative but the high diversity of the area is indicated by the presence of as many as 8 species in 1 sample (sta 106-R), and 7 in another (sta 124-S), as well as in having a total of 30 species in the 27 samples.

DISPOSITION OF SPECIMENS.—Most of the specimens have been deposited at the Museum National d'Histoire Naturelle, Paris, France, and some of these have been assigned MNHN numbers. A few specimens have been deposited in the collections of the former United States National Museum (USNM), now the National Museum of Natural History, Smithsonian Institution; these have been assigned USNM numbers. The disposition of specimens is given in the text where the species is described and in Appendix 1.

ABBREVIATIONS.—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 I-III 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

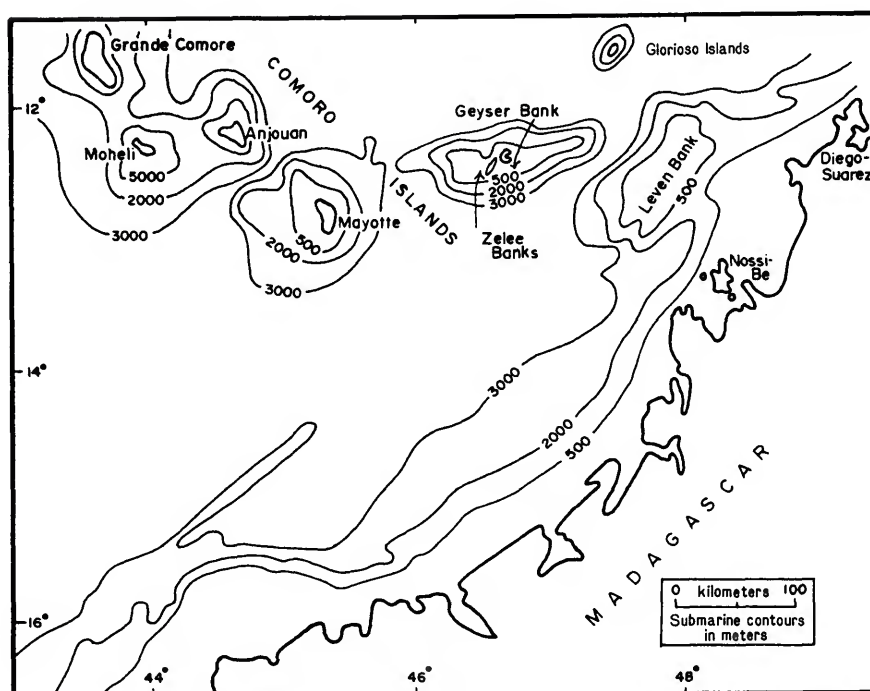


FIGURE 1.—Collecting area in northeastern Mozambique Channel, Indian Ocean. (From map in station list supplied by the Centre National de Tri d'Océanographie Biologique (CENTOB), France.)

BO	Bellonci organ
br	brush organ
co	copulatory organ
cox	coxale
dv	dorsal view
end	endopodite
epip	epipodite
esop	esophagus
ex	exopodite
fu	furca
gen	genital organ
gird	girdle
hrt	heart
im	inner margin of infold
inc	incisur
iv	inside view
lat	lateral process
le	lateral eye
ll	lower lip
lp	lamellar prolongation of selvage
lv	lateral view
me	medial eye
mnd	mandible
mo	mouth
mv	medial view
mx	maxilla
ov	outside view
precox	precoxale
prot	protopodite
pv	posterior view
sens	sensory bristle of 5th joint of 1st antenna

tes	testis
ul	upper lip
vv	ventral view
Y-scl	Y-sclerite

ACKNOWLEDGMENTS.—I wish to thank M. Segonzac, Centre National de Tri d'Océanographie Biologique (CENTOB), France, for sending the specimens, and Bernard A. Thomassin, Station Marine d'Endoume, University d'Aix-Marseille, who was Chief Scientist aboard R/V *Suroît*, for helpful correspondence concerning samples.

I am grateful to several people who assisted in preparation of this paper: Carolyn Gast rendered the shaded drawings of the carapaces, Jack Schroeder inked final drawings, Elizabeth Harrison-Nelson prepared the "Literature Cited" section, assisted in mounting and labeling figures, cataloged specimens, and helped in many other tasks, and Anne C. Cohen reviewed the manuscript. I also thank Diane M. Tyler, Smithsonian Institution Press, for editing and preparing the manuscript.

Biogeographic Comparisons

The genera *Paradoloria*, *Skogsbergia*, *Vargula*, *Tetragonodon*, *Rutiderma*, *Eusarsiella*, *Chelicopia*, *Eurypylus*, *Hep-tonema*, *Cylindroleberis*, *Synasterope*, and *Asteropterygion* are circumglobal in distribution, but only *Synasterope* has been

reported from the Arctic Ocean and Antarctic waters.

The pelagic genus *Cypridina* is primarily Indo-Pacific.

Codonocera has been collected previously in Indo-Pacific and Australasian waters (McKenzie, 1967:221; Kornicker, 1986d:119).

Paradoloria has been collected in the vicinity of Australia, Japan, and off the western coast and southern tip of Africa (Kornicker, 1989:13).

Harbansus is cosmopolitan but has not been reported previously in the Indian Ocean (Kornicker, 1978:13; 1983a:181).

Igene is an abyssal genus reported previously in the Pacific Quadrant within the Antarctic Convergence, off the Pacific Coast of Chile, and in the NE Pacific Ocean (Kornicker, 1975a:367; Chavtur, 1983:72).

Metasarsiella has been collected previously at Enewetak Atoll, Pacific Ocean (Kornicker, 1991:104).

Neomuelleriella has been reported previously from New Zealand (Kornicker, 1986a:40).

Dantya is known from the Caribbean Sea, the Central South Pacific Ocean, the continental shelf east of the Somali Republic, Indian Ocean, and the Mozambique Channel (Kornicker and Iliffe, 1989c:901).

Prionotoleberis has been reported previously from the Mediterranean Sea; off Mauritania, West Africa; and the Gulf of Mexico (Kornicker, 1986b:89).

Cycloleberis has been collected along the eastern, western, and northern coasts of Africa and along the western coast of Madagascar (Kornicker, 1981a:79).

Distribution of Myodocopida in the NE Mozambique Channel

Distribution of species in the study area clearly is influenced by water depth (Table 1). The only species collected at abyssal depths, *Igene bryx*, new species, is a member of a genus known only from abyssal depths (3702–5240 m) elsewhere (Kornicker, 1989, table 4). Members of the genus are without both lateral and medial eyes, and the exopodial bristles of the 2nd antennae of females are short and without natatory hairs indicating that they are either nonswimming or incapable of efficient swimming. Eight genera and species were collected at bathyal depths: (1) *Tetragonodon currax*, new species, collected at 1480 m, is a member of a genus known from mainly bathal depths elsewhere (636–2995 m) (Kornicker, 1989:82). Species of *Tetragonodon* are without lateral and medial eyes, and females are either nonswimmers or inefficient swimmers. (2) *Vargula arx*, new species, collected at 2 stations (sta 104-DR at 330–550 m, and sta 120-DS at 335–390 m), is a member of a genus known from shallow to abyssal depths. The absence of lateral eyes on *V. arx* suggests that it is restricted to deep water. (3) *Harbansus ferox*, new species, collected at 450 m, is a member of a genus known from shelf and bathyal depths

TABLE 1.—Distribution of species with and without lateral eyes compared to water depth (Shelf = 0–200 m, Bathyal = 200–2000 m, Abyssal = 2000+ m, * = species without lateral eyes on females (males of the blind species unknown), x = 1 sample.)

Taxon (depth range m)	Shelf	Bathyal	Abyssal
<i>Cypridina nex</i> (15–32)	xx		
<i>Cypridina segrex</i> (3–38)	xxxxxx		
<i>Codonocera phoenix</i> (3–350)	xxxx	xx	
<i>Paradoloria vanhoeffeni</i> (20–150)	xx		
<i>Skogsbergia calyx</i> (26)	x		
<i>Skogsbergia iota</i> (20–250)	x	x	
<i>Skogsbergia plax</i> (6–24)	xxx		
* <i>Vargula arx</i> (330–550)		xx	
<i>Vargula sagax</i> (18–24)	x		
<i>Harbansus thrix</i> (13–20)	xx		
* <i>Harbansus ferox</i> (450)		x	
* <i>Igene bryx</i> (3716)			x
* <i>Tetragonodon currax</i> (1480)		x	
<i>Rutiderma arx</i> (24–26)	xxx		
<i>Rutiderma rex</i> (26)	x		
<i>Eusarsiella falx</i> (250–550)		xxxx	
<i>Chelicopia radix</i> (18–24)	xx		
<i>Chelicopia obex</i> (26)	x		
<i>Eurypylus chaviuri</i> (3–33)	xxxxxxx		
<i>Metasarsiella benthedi</i> (50–150)	x		
<i>Neomuelleriella mayottensis</i> (32)	x		
<i>Dantya fossula</i> (24)	x		
<i>Dantya benthedi</i> (250–550)		xxx	
<i>Heptonema latex</i> (6–38)	xxxx		
<i>Cylindroleberis vix</i> (6–20)	xx		
<i>Cylindroleberis vibex</i> (15–24)	xx		
* <i>Prionotoleberis lux</i> (300–350)		x	
<i>Synasterope calix</i> (13–42)	xxxxxxx		
<i>Cycloleberis galatheae</i> (0–42)	x		
<i>Asteropterygion</i> sp. indet. (18–24)	xx		

elsewhere (1–1015 m). The absence of lateral eyes as well as the lack of distal natatory hairs on the exopodial bristles of the 2nd antenna of the female *H. ferox* only weakly suggests that the species is mainly a deeper water species because some species with those characters also are found in shelf waters (see discussion after description of *H. ferox*, herein). (4) *Eusarsiella falx*, new species, collected at 250–550 m (4 stations), is a member of a genus known from intertidal to bathyal (1120 m) depths (Kornicker, 1986a:41). The lateral eyes of *E. falx* are well developed and do not indicate deep water existence; however, because the species was collected at 4 bathyal stations, and not collected at the more numerous shelf stations, a deep water habitat is suggested. (5) *Prionotoleberis lux*, new species, collected at 300–350 m, is a member of a genus known from shelf and bathyal depths (55–1913 m) (Kornicker, 1989:118). The absence of lateral eyes in the female *P. lux* suggests that it is a deeper water species. (6) *Dantya benthedi* Kornicker, 1983, collected at 3 stations at depths of 250–550 m, is a member of a genus known from shelf and bathyal depths (24–550 m). The lateral eyes of *D. benthedi* are similar to those

of species from shallower depths, but the collection of *D. benthedi* at 3 bathyal and no shelf stations suggests that it may be restricted to bathyal depths. (7) *Skogsbergia iota*, new species, collected at 1 shelf station (24 m) and 1 bathyal station (250 m), is a member of a genus known from shelf and bathyal depths (2–250 m). Although the lateral eye of *S. iota* is well developed, it is much smaller than those of 2 other species of *Skogsbergia* collected only at shelf depths in the study area. (8) *Codonocera phoenix*, new species, collected at 3–350 m, is a member of a pelagic genus often collected in nets and trawls at shelf and slope depths.

The distribution of species collected at shelf depths in the study area is shown in Table 2, and the faunal resemblances as indicated by the Simpson Index (S.I.) (Kornicker, 1975a:31) for the 5 localities is presented in Table 3. The Simpson Indices suggest that the myodocopid populations of Zelee and Geysler Banks, which are part of the same topographic structure, are closely related (S.I. 80). Mayotte is closer geographically to Geysler and Zelee banks than to the Glorioso Islands and Leven Bank, but is separated from them by a deep channel reaching abyssal depths; the myodocopid population of Mayotte appears to be more closely related to that of Geysler Bank (S.I. 100) than it is to Zelee Bank (S.I. 50). Mayotte is separated from the Glorioso Islands and Leven Bank by a wide expanse of deep water; the myodocopid population of Mayotte is more closely related to that of the Glorioso Islands (S.I. 64) than it is to that of Leven Bank (S.I. 25). The Glorioso Islands are separated from Geysler and Zelee Banks by a deep channel; the S.I. for the

islands and each bank are 80 and 70 respectively. The Glorioso Islands are separated from Leven Bank by a channel about as deep and wide as between the islands and Geysler and Zelee Banks, but according to the S.I. of 25 the myodocopid populations are not closely related. The myodocopid population of Leven Bank is related more closely to that of Zelee Bank (S.I. 50) than it is to Geysler Bank (S.I. 25).

Relationship between Eye Development and Water Depth

The relationship between development of lateral eyes and water depth has been discussed by Kornicker (1975a:42; 1989:9). In the present collection, lateral eyes are possessed by all species at shelf depths (0–200 m), and 4 of 8 (50%) species at bathyal depths (200–2000 m) (Table 1). The single species collected at abyssal depths (2000+ m) is without lateral eyes.

A curve showing the approximate relationship between the percentage of myodocopid species with lateral eyes at different depths worldwide is presented in Figure 2 (data for the graph are from Appendix 2 and Table 4). The datum points are plotted at the midpoint of each discrete depth interval. Omitted from the graph are members of the Azygocypridininae, which have hirsute flap-like lateral "eyes" without ommatidia; species of *Gigantocypris* (small lateral eyes) and *Macrocypridina* (large lateral eyes), which are pelagic, living mainly in the water column; and members of the Rutidermatidae, Cyclasteropinae, and Asteropterioninae, which are found mainly at shelf and upper slope depths, and with few exceptions have lateral eyes.

TABLE 2.—Distribution of species at shelf depths (0–200 m) in NE Mozambique Channel (X = 1 sample).

Taxon	Mayotte	Glorioso Islands	Geysler Bank	Zelee Bank	Leven Bank
<i>Cypridina nex</i>	XX				
<i>Cypridina segrex</i>	XX	X	X	XX	
<i>Codonocera phoenix</i>	X	X	X	X	
<i>Paradoloria vanhoeffeni</i>				X	X
<i>Skogsbergia calyx</i>		X			
<i>Skogsbergia iota</i>	X				
<i>Skogsbergia plax</i>	X	X		X	
<i>Vargula sagax</i>				X	
<i>Harbansus thrax</i>	X		X		
<i>Rutiderma arx</i>		XXX			
<i>Rutiderma rex</i>		X			
<i>Chelicopia radix</i>		X		X	
<i>Chelicopia obex</i>		X			
<i>Eurypylus chavivuri</i>	XX	XX	XX	XX	
<i>Metasarsiella benthedi</i>					X
<i>Neomuelleriella mayottensis</i>	X				
<i>Dantya fossula</i>				X	
<i>Heptonema latex</i>	XXX	X			
<i>Cylindroleberis vix</i>	XX				
<i>Cylindroleberis vibex</i>	X	X			
<i>Synasterope calix</i>	XX		X	XX	X
<i>Cycloleberis galathea</i>					X
<i>Asteropterygion</i> sp. indet.		X		X	

TABLE 3.—Simpson Indices of species between localities.

Localities	Mayotte	Glorioso Islands	Geyser Bank	Zelee Bank	Leven Bank
Mayotte	-	64	100	50	25
Glorioso Islands	64	-	80	70	25
Geyser Bank	100	80	-	80	25
Zelee Bank	50	70	80	-	50
Leven Bank	25	25	25	50	-

TABLE 4.—Percentage of species with lateral eyes at discrete depths for selected species of Cypridinini, Cyndroleberidinae, Sarsiellidae, Philomedidae, and Myodocopina. Percentages were obtained by adding together the number of species at each depth interval and then determining the percentage of species with lateral eyes (nd = no data; males and females are treated separately only in the Philomedidae; data from Appendix 2).

Depth (meters)	Cypridinini	Cylindroleberidinae	Sarsiellidae	Philomedidae		Myodocopina*
				♂	♀	
0-200	100	87	100	97	69	90
200-500	86	77	75	92	67	74
500-1000	67	40	50	89	47	50
1000-2000	69	33	25	71	44	44
2000-3000	83	0	0	60	25	38
3000-4000	25	0	0	33	50	21
4000-5000	0	0	0	0	0	0
5000-6000	0	nd	nd	nd	nd	0

* Does not include male Philomedidae, Azygocypridininae, Gigantocypridinini, Rutidermatidae, Cyclasteropinae, and Asteropteroinae.

The eyes of the last two taxa were discussed by Kornicker (1981a:25). The data are few, especially at bathyal and abyssal depths, but the curve suggests that the percentage of species with lateral eyes decreases fairly sharply from about 90% at shelf depths (0-200 m) to about 50% at a depth of about 750 m (upper slope), then more gradually decreases to zero in the lower abyss. Clarkson (1967:373) refers to the work of Nicol (1959) who recorded that the normal-eyed crustaceans that he studied were just capable of response to light of an intensity equivalent to that present in depths of 700 m in clear water, so perhaps the break in slope of the percentage of eye-bearing Myodocopina at about 750 m is related to light intensity, but at the present state of knowledge this is speculative.

Lateral eyes among species having them vary considerably in number of ommatidia. In the Cypridinini and Cylindroleberidinae males and females have about the same number of ommatidia (with a few exceptions), but the ommatidia of the male eye as well as the eye itself may be larger than that of the

female (Appendix 2); whereas, in the Sarsiellidae, and especially in the Philomedidae, male eyes generally have more ommatidia. A few species have been reported with the lateral eyes of the female having a few more ommatidia than that of the male (Appendix 2). The number of ommatidia in lateral eyes is often difficult to accurately count because of the presence of dark pigment between ommatidia, which are usually amber in color; in the literature an approximate number, or a range, is often presented (Appendix 2). In Appendix 2, species without lateral eyes are listed as having 0 ommatidia, and if the number of ommatidia is unknown it is listed as "nd" (no data), even though the eye may have been described in the literature as being "well developed." In lateral view, some small ommatidia along the dorsal edge of eyes possessing many ommatidia often are obscured by other larger ommatidia. In a few species, a small lateral eye may be present without identifiable ommatidia. The same number of ommatidia in eyes of different species may not indicate the same degree of pattern

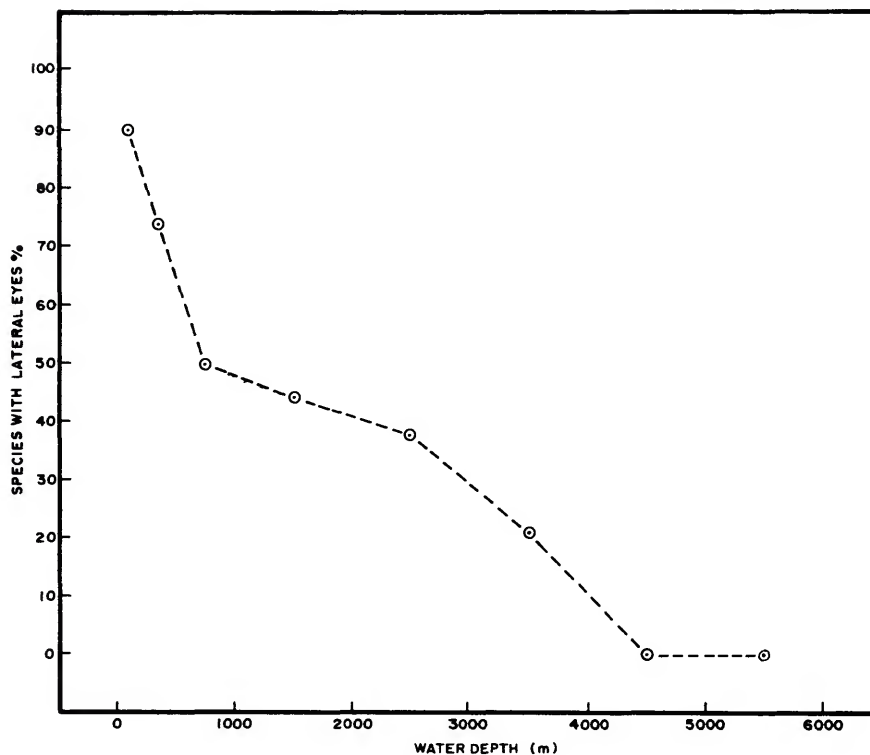


FIGURE 2.—Relationship between percentage of myodocopid species and lateral eyes at discrete depths, worldwide.

discrimination because the ommatidia may be better developed in some species than in others.

In general, the number of ommatidia decreases with water depth (Table 5, Figure 3). The average number of ommatidia at a discrete depth interval was calculated including species without lateral eyes, which were considered as having zero ommatidia (Figure 3). When species without lateral eyes are excluded from the calculation it becomes apparent that unlike other taxa the number of ommatidia of male Philomedidae having eyes does not decrease with depth (Table 6, Figure 4). A possible explanation for this is that during mating the male rises to shallower depths where having eyes is an advantage. This behavior is known only for the species *Philomedes brenda* (Kornicker, 1975a:76), which is an abundant species in northern latitudes, generally collected at shelf and upper slope depths and in plankton (Kornicker, 1988:1). In the adult female *P. brenda* exopodial bristles of the 2nd antenna are broken off after mating, which confines the female to the substrate. Broken bristles also are present in many adult females of deep-water Philomedidae having males with well-developed eyes. This similarity in behavior pattern of the females may

support the hypothesis that males of deep-water philomedids having well-developed lateral eyes rise in the water column during mating. The lateral eyes of female philomedids are usually minute with 2–4 small ommatidia and change little with depth (Figures 3, 4). In his description of the family Philomedidae Poulsen (1962:343) states that eyes are absent in females; actually about 60% of known species have eyes, but many are small and easily overlooked. Hallberg and Eloffsson (1989:362) present three reasons why some deep-sea species have large lateral eyes: (1) late invasion of the deep sea; (2) adaptation to light emitted by light-producing organs; and (3) they have planktonic larvae living in brighter habitats. To these should be added migration of species to photic zone during mating.

The known maximum depth of eye-bearing species varies with taxon (Appendix 2): Cypridinini, 3775 m; Philomedidae, 3480 m; Cylindroleberidinae, 1212 m; Sarsiellidae, 650 m. The number of known species without lateral eyes at discrete depths is presented in Table 7 (data from Appendix 2). It is clear that species without lateral eyes are not limited to deep water and that blind species at shallow depths are more common in some

TABLE 5.—Distribution of the number of ommatidia in lateral eyes with water depth (in meters) in selected species of Cypridinini, Cyndroleberidinae, Sarsiellidae, and Philomedidae. Calculations include species without lateral eyes, which are counted as having 0 ommatidia. Males and females are treated separately only in the Philomedidae. For the other taxa, in cases where males and females have different numbers of ommatidia, the greater number is used (nd = no data). Number of specimens and range of ommatidia at discrete depth intervals may be obtained from Appendix 2.

Depth	Cypridinini			Cyndroleberidinae			Sarsiellidae			Philomedidae	
	No of species	No. of ommatidia		No. of species	No. of ommatidia		No. of species	No. of ommatidia		Avg. no. of ommatidia	
		Avg.	Range		Avg.	Range		Avg.	Range	Male	Female
0-200	50	19	4-36	69	13	0-23	107	6	0-12	16	2.1
200-500	14	15	0-29	30	10	0-23	8	4	0-7	18	1.7
500-1000	9	9	0-20	10	3	0-13	6	2	0-5	16	1.1
1000-2000	13	4	0-16	6	1	0-5	4	1	0-5	13	0.7
2000-3000	6	4	0-7	5	0	0-0	1	0	0-0	13	0.7
3000-4000	4	1	0-4	3	0	0-0	3	0	0-0	10	1.3
4000-5000	3	0	0-0	5	0	0-0	2	0	0-0	0	0
5000-6000	1	0	0-0	0	nd	nd	0	nd	nd	nd	nd

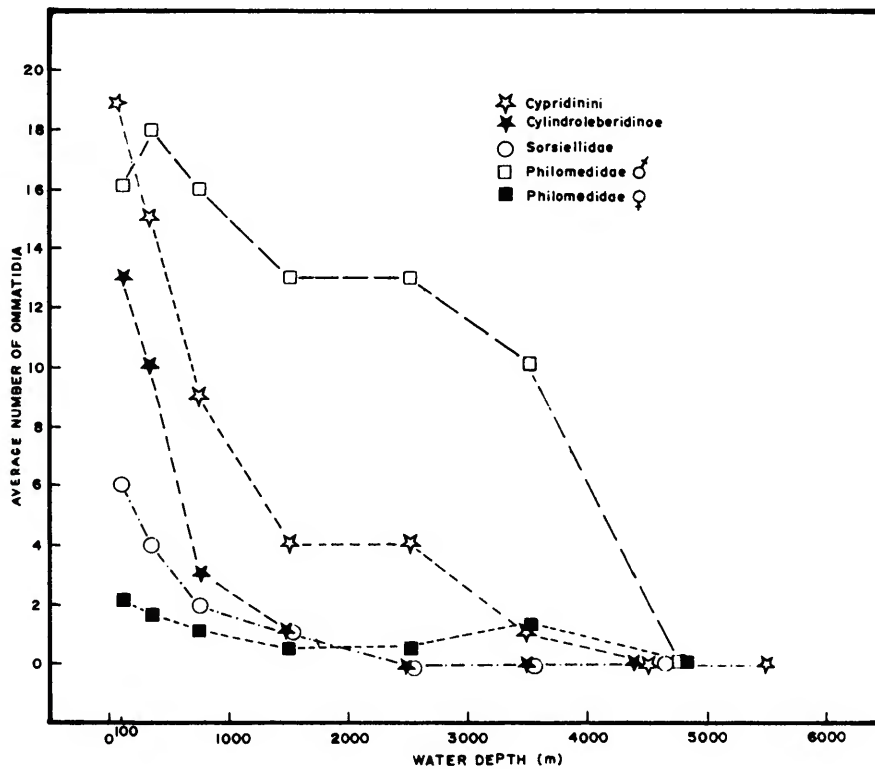


FIGURE 3.—Average number of ommatidia in lateral eyes of species of mydocopid families at discrete depths, worldwide. Males and females of the Philomedidae are shown separately. Species without lateral eyes are included in the averaging as having 0 ommatidia.

TABLE 6.—Distribution of the average number of ommatidia in lateral eyes with water depth (in meters) in selected species of Cypridinini, Cyndroleberidinae, Sarsiellidae, and Philomedidae excluding from calculations species without lateral eyes. In cases where males and females of the Cypridinini and Cyndroleberidinae have different numbers of ommatidia, the greater number is used (ns = no species with lateral eyes at given depth interval; - = no specimens of taxon reported at depth interval; number of specimens and range of number of ommatidia at discrete depth intervals obtained from Appendix 2).

Depth	Cypridinini Number ommatidia	Cyndroleberidinae Number ommatidia	Sarsiellidae		Philomedidae	
			Number ommatidia		Number ommatidia	
			Male	Female	Male	Female
0-200	19	15	7	4.6	16	3.1
200-500	17	13	5	4.0	20	2.6
500-1000	13	6	5	3.0	18	2.3
1000-2000	6	4	5	ns	18	2.3
2000-3000	5	ns	ns	ns	22	3.0
3000-4000	4	ns	ns	ns	20	2.5
4000-5000	ns	ns	ns	ns	ns	ns
5000-6000	ns	-	-	-	-	-

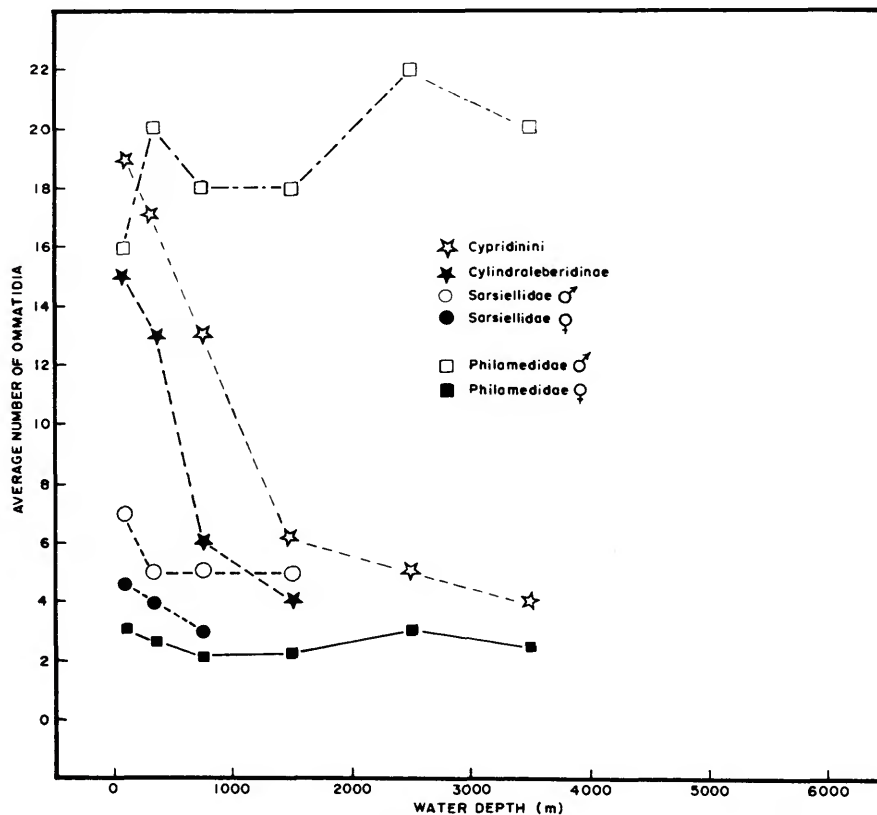


FIGURE 4.—Average number of ommatidia in lateral eyes of species of myodocopid families at discrete depths, worldwide. Males and females of the Philomedidae and Sarsiellidae are shown separately. Species without lateral eyes are excluded from the averaging.

TABLE 7.—Number of species at discrete depths (in meters) of Cypridinini, Cyndroleberidinae, Sarsiellidae, and Philomedidae without lateral eyes (nd = no data; males and females are treated separately only in the Philomedidae; data from Appendix 2).

Depth	Cypridinini	Cyndroleberidinae	Sarsiellidae	Philomedidae	
				Male	Female
Shelf					
0–200	0	9	1	1	15
Bathyal					
200–500	2	8	2	1	7
500–1000	3	6	3	1	8
1000–2000	4	4	3	2	9
Abyssal					
2000–3000	1	5	1	2	3
3000–4000	3	3	3	1	2
4000–5000	3	4	2	1	1
5000–6000	1	nd	nd	nd	nd

families than others (Table 7). Except for male Philomedidae, more blind species are known from bathyal depths than from either shelf or abyssal depths, and except for female Philomedidae, more blind species are known from abyssal depths than shelf depths. Because more collections have been made from shelf depths than from either bathyal or abyssal depths, additional collections from deep water should increase the ratio of blind species at bathal and abyssal depths to those at shelf depths. The ratio of blind species at bathyal depths to those at abyssal depths might not decrease when more collections at these depths become available because fewer species seem to inhabit abyssal waters.

In the descriptive part of this paper additional discussions are presented concerning the relationship between water depth and lateral eyes of species of *Harbansus* and changes in the number of ommatidia and eye size during the ontogeny of *Synasterope calix*.

The Exopodite of the Second Antenna of the Cypridinidae

Swimming is accomplished in the Myodocopa mainly by a sweeping movement of the exopodite of the 2nd antenna causing long hairs on some exopodial bristles to exert a backward thrust against the water. In the Myodocopina the exopodite has 9 joints of which joints 2–8 each bear 1 bristle and the 9th joint bears 2–8 bristles. The distribution of bristles with natatory hairs was discussed in a previous paper (Kornicker, 1975a:74). The present effort examines the distribution of bristles of the 9th joint in members of the Cypridinidae based mainly on a survey of the literature since the work of Skogsberg (1920), because before then descriptions seldom mentioned the number of bristles on the 9th joint (Appendix 3). In the discussion below it is assumed that all members of the Cypridinidae have 5 juvenile instars and a

single adult stage. For many species listed below the stage of development was estimated by the number of pectinate teeth on the main tooth of the 5th limb: 1 on instar I, 2 on instar II, 3 on instar III, 4 on instar IV, 5 on instar V, and 6 on the adult (Kornicker, 1991:3).

The distribution of species within each genus according to the number of bristles on the 9th joint of the adult is presented in Table 8. In the subfamily Azygocypridininae the 9th joint bears 7 or 8 bristles, whereas with one exception, the 9th joint in the subfamily Cypridininae bears no more than 4 bristles. In the Cypridininae 15 genera have only 4 bristles, 2 have only 2 bristles, and 3 have only 3 bristles; 1 genus (*Pterocypridina*) has 4 species with either 2, 3, or 4 bristles; 1 genus (*Skogsbergia*) has 10 species with 4 bristles and 1 with 3 bristles, and 1 genus (*Doloria*) has 6 species with 4 bristles and 1 with 7 bristles.

The number of bristles on the 9th joint of first instars is known for only 11 species; all have only 2 bristles (Appendix 3). Except for 3 species (*Melavargula japonica*, *M. nana*, and *Pterocypridina alata*), which have 2 bristles on the adult, the presence of 2 bristles on the 9th joint may be useful in identifying first instars. The number of bristles on second instars are known for 11 species; 10 have 3 bristles, and 1 (*Gigantocypris danae*) has either 3 or 4. Not all instars of species of *Melavargula* and *P. alata* are known, but because adults have only 2 bristles earlier instars are unlikely to have more than 2. Instars IV to adult in the Azygocypridininae have 5–7 or 8 bristles, and in the Cypridininae, except for *M. japonica*, *M. nana*, and *P. alata*, instars IV to adult have 3 or 4 bristles.

The change in number of bristles during ontogeny is known for only a few species, but it is apparent that the rate of increase during ontogeny differs among genera (Figure 5), and for species within genera (Appendix 3). In the genus *Azygocyprid-*

TABLE 8.—Distribution of species within each genus of Cypridinidae according to number of bristles on the 9th exopodial joint of the adult 2nd antenna. (Data from Appendix 2, includes only adults.)

Genus	Number of bristles							
	1	2	3	4	5	6	7	8
AZYGOCYPRIDININAE								
<i>Azygocypridina</i>	-	-	-	-	-	-	6	-
<i>Isocypridina</i>	-	-	-	-	-	-	-	1
CYPRIDININAE								
CYPRIDININI								
<i>Amphisiphonostra</i>	-	-	-	1	-	-	-	-
<i>Bathyvargula</i>	-	-	-	2	-	-	-	-
<i>Codonocera</i>	-	-	-	10	-	-	-	-
<i>Cypridina</i>	-	-	11	-	-	-	-	-
<i>Cypridinodes</i>	-	-	-	8	-	-	-	-
<i>Doloria</i>	-	-	-	6	-	-	1	-
<i>Hadacypridina</i>	-	-	-	2	-	-	-	-
<i>Macrocypridina</i>	-	-	-	2	-	-	-	-
<i>Melavargula</i>	-	2	-	-	-	-	-	-
<i>Metavargula</i>	-	-	-	8	-	-	-	-
<i>Monopia</i>	-	-	-	1	-	-	-	-
<i>Paracypridina</i>	-	-	2	-	-	-	-	-
<i>Paradoloria</i>	-	-	-	6	-	-	-	-
<i>Paravargula</i>	-	-	-	4	-	-	-	-
<i>Pterocypridina</i>	-	1	2	2	-	-	-	-
<i>Rheina</i>	-	-	-	1	-	-	-	-
<i>Rugosidoloria</i>	-	-	-	1	-	-	-	-
<i>Sheina</i>	-	-	-	4	-	-	-	-
<i>Siphonostra</i>	-	-	2	-	-	-	-	-
<i>Skogsbergia</i>	-	-	1	9	-	-	-	-
<i>Vargula</i>	-	-	-	32	-	-	-	-
GIGANTOCYPRIDININI								
<i>Gigantocypris</i>	-	-	-	4	-	-	-	-

ina 1 bristle is added on each succeeding instar from 2 in the first instar to 7 in the adult. In *Codonocera* 4 bristles are reached in the fourth instar and the number remains the same in later instars. In most species of *Gigantocypris* 4 bristles are attained in the fourth instar and the number remains the same in later instars. In most species of *Skogsbergia* instars II-IV have 3 bristles and instar V and the adult have 4. In *Cypridina* 3 bristles are attained in the second instar and the number remains the same in later instars.

Superorder MYODOCOPA Sars, 1866

The Myodocopa includes 2 orders: Myodocopida Sars, 1866, and Halocyprida Dana, 1853, of which only the former is in the present collection.

Order MYODOCOPIDA Sars, 1866

The Myodocopida, with a single suborder Myodocopina Sars, 1866.

Suborder MYODOCOPINA Sars, 1866

The Myodocopina includes 5 families, all represented in the present collection.

CYPRIDINIDAE Baird, 1850

The Cypridinidae includes 2 subfamilies: Cypridininae Baird, 1850, and Azygocypridininae Kornicker, 1970. Only the former is in the present collection.

CYPRIDININAE Baird, 1850

The Cypridininae includes 2 tribes: Cypridinini Baird, 1850, and Gigantocypridinini Hartmann, 1974 (in Hartmann and Puri, 1974:11). Only the former is in the present collection.

CYPRIDININI Baird, 1850

The Cypridinini includes 22 genera of which 5 are in the present collection: *Cypridina*, *Codonocera*, *Paradoloria*, *Skogsbergia*, and *Vargula*.

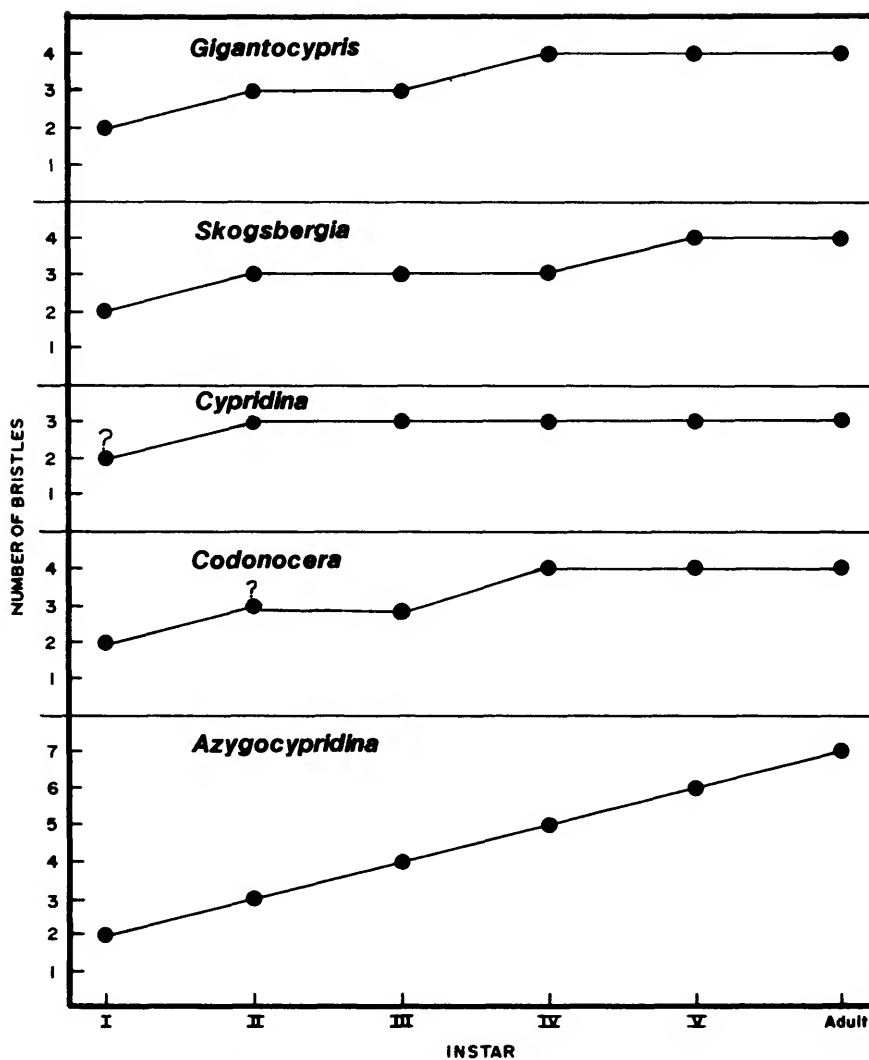


FIGURE 5.—Number of bristles on the 9th exopodial joint of the 2nd antenna of selected genera of Cypridinidae during ontogeny. An exception that is not shown on the graphs occurs in both *Skogsbergia* and *Gigantocypris*. The “?” indicates that no data are available and that the datum point is a prediction.

Cypridina Milne-Edwards, 1840

Cypridina Milne-Edwards, 1840:409.—Kornicker, 1991:27 [synonymy and discussion].

TYPE SPECIES.—*Cypridina Renaudii* Milne-Edwards, 1840:409, by monotypy.

DISTRIBUTION.—Indian and Pacific oceans between latitudes of about 35°N and 30°S, planktonic.

COMPOSITION.—Including 2 new species described herein, 23 species are recognized as species of *Cypridina* sensu Poulsen (1962:255), but only 14 are sufficiently known to recognize at the species level (Kornicker, 1991:27).

Cypridina nex, new species

FIGURES 6–12

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

HOLOTYPE.—MNHN Os 423, 1 undissected adult male in alcohol.

TYPE LOCALITY.—Sta 50-S, 28 May 1977, Bouéni Reef, Mayotte, 12°54′30″S, 44°58′30″E, depth 32 m.

PARATYPES.—Sta 18-S: 8 specimens (adult males, females, and juveniles) in alcohol. Sta 50-S: USNM 193698, adult male on slide and in alcohol; USNM 193700, adult female on slide and in alcohol; Paris: 1 undissected adult male in alcohol;

USNM 193701, 1 instar V female in process of ecdysis, on slide and in alcohol; USNM 193702, 1 instar V female, on slide and in alcohol.

DISTRIBUTION.—Sta 18-S, S Îlot Gombé Doumé, Mayotte, depth 15 m. Sta 50-S, Bouéni Reef, Mayotte, depth 32 m. Known depth range 15–32 m.

DESCRIPTION OF ADULT MALE (Figures 6–9a–f).—Carapace elongate with convex ventral and dorsal margins in lateral view (Figure 6a); anterodorsal corner of rostrum evenly rounded and inferior tip of rostrum pointed (Figure 6a,b); caudal processes well developed and with rounded posterior margin. Outer surface of valve just ventral to incisur with indistinct broad spines forming 2 rows (Figure 6d,e): dorsal row with 2–4 spines oriented ventrally, and ventral row with 5 spines folded inward (in lateral view outer edges of bases of the 5 spines appear as a scalloped ridge (Figure 6b,d,e), only when microscope is wracked downward are folded spines visible (Figure 6d,e); the 2–4 spines forming dorsal row are more transparent than spines of ventral row). Anteroventral edge of each valve with 23–31 bristles (USNM 193698 with 25 bristles or sockets of bristles on right valve and 31 on left valve (many bristles missing but sockets and canal leading to them show that bristles had been present); holotype with 23 bristles) and no teeth. Surface of valves smooth with few small bristles.

Infold: Rostral infold with 8 bristles plus paired bristles at inner end of incisur and 1 small bristle posterior to paired bristles (Figure 6f); most bristles of rostral infold double. Anteroventral infold with 3 short bristles including 1 near inner end of incisur, and 1 longer double bristle near inner edge of infold (Figure 6g). Narrow list with anterior end on anteroventral infold, extending along ventral infold, then broadening to form broad shelf at anterior end of caudal process. Ventral infold with 9 widely separated bristles along list and 1 bristle on left valve (near posterior end) between list and valve edge. Broad posterior list of left valve with 9 minute pustules near outer edge (Figure 6h); several minute spines and pores present on infold of caudal process between list and posterior edge of left valve. Broad posterior list of right valve with sclerotized bar along anterior edge and stout spines along posterior edge (13 stout spines on dorsal part plus about 14 minute spines along ventral end (not all shown)) (Figure 6i), and 7 minute spine-like bristles on shelf just anterior to spines along edge; 8 stout spines present beneath shelf, and 11 stout spines and several minute pores and spines on infold between shelf and posterior edge of right valve, some just within valve edge.

Central Adductor Muscle Attachments (Figure 6j): Numerous (about 21) individual ovoid attachments.

Carapace Size: MNHN Os 423, holotype, length 1.44 mm, height 0.81 mm. Sta 50-S: length 1.50 mm, height 0.84 mm; USNM 193698, length 1.49 mm, height 0.78 mm. Sta 18-S: length 1.51 mm, height 0.79 mm; length 1.44 mm, height 0.81 mm.

First Antenna (Figure 7b): 1st joint bare. 2nd joint with abundant medial spines forming rows. 3rd joint trapezoidal;

dorsal margin about twice length ventral margin, with short spinous dorsal bristle at midlength and longer terminal ventral bristle. 4th joint with 2 terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 8 long proximal filaments followed closely by 1 short slender filament, then by a space and a 2nd short slender filament. 6th joint with short medial bristle. 7th joint: a-bristle slightly shorter than bristle of 6th joint; b-bristle with tip extending past tip of sensory bristle of 5th joint, with short stout proximal branch (branch bearing diaphanous sucker followed by small node proximal to pointed tip), followed by 2 slender filaments (each with minute spine followed by 4 minute diaphanous suckers); c-bristle very long, with short stout proximal branch (branch bearing diaphanous sucker followed by small node proximal to pointed tip), followed by short bare proximal filament, 1 slender filament with minute spine followed by 3 minute diaphanous suckers, then 6 or more slender bare filaments. 8th joint: d- and e-bristles about same length as b-bristle, bare, diaphanous; f-bristle about same length as c-bristle, with 6 or more diaphanous filaments; g-bristle about 3 times length of b-bristle, with 10 marginal filaments.

Second Antenna: Protopodite with distal medial bristle (Figure 7a,c). Endopodite 1-jointed, with 6 bristles (3 minute proximal bristles followed by 2 longer and stouter bristles and distal long slender filament) (Figure 7c,d). Exopodite: 1st joint with few spines along concave dorsal margin; 2nd joint with few small indistinct ventral spines at midlength and 2 small basal spines; bristle of 2nd joint reaching 6th joint, with 7 stout ventral spines (5th spine slightly stouter than others); bristles of joints 3–8 long, with natatory hairs but no spines; 9th joint with 3 bristles (2 long with natatory hairs, 1 short dorsal with few short hairs); joints 3–7 with small slender basal spine (spine of 3rd joint slightly longer than others, about $\frac{1}{4}$ length of 3rd joint); joints 2–8 with minute spines forming rows along distal margins.

Mandible (Figure 7e, f): Coxale endite well developed with small proximal and long distal spines and 2 stout terminal spines, 1 on each side of small triangular process; small bristle at base of endite. Basale (Figure 7e): ventral margin with 2 small spinous ringed medial a-bristles, 1 small lateral b-bristle, 2 c-bristles (proximal small, distal long with short spines), and 2 d-bristles (proximal small with short spines; distal long, stout, with wreaths of long spines); dorsal margin with 3 bristles (1 distal to midlength, bare, 2 terminal (lateral bare, medial with short spines)); spines forming rows on medial and lateral surfaces and along proximal dorsal margin. Exopodite reaching just past distal end of dorsal margin of 1st endopodial joint, hirsute, with 2 distal bristles (distal of these shorter). 1st endopodial joint with 4 ventral bristles (1 minute bare, others longer, spinous, and unequal). 2nd endopodial joint: ventral margin spinous, with 2 single spine-like bristles and terminal paired spine-like bristles (lateral of paired bristles only slightly stouter and longer than spines along ventral margin of joint proximal to bristles and could be interpreted to be one of them); dorsal margin with 5 short spinous bristles, 2 medium length

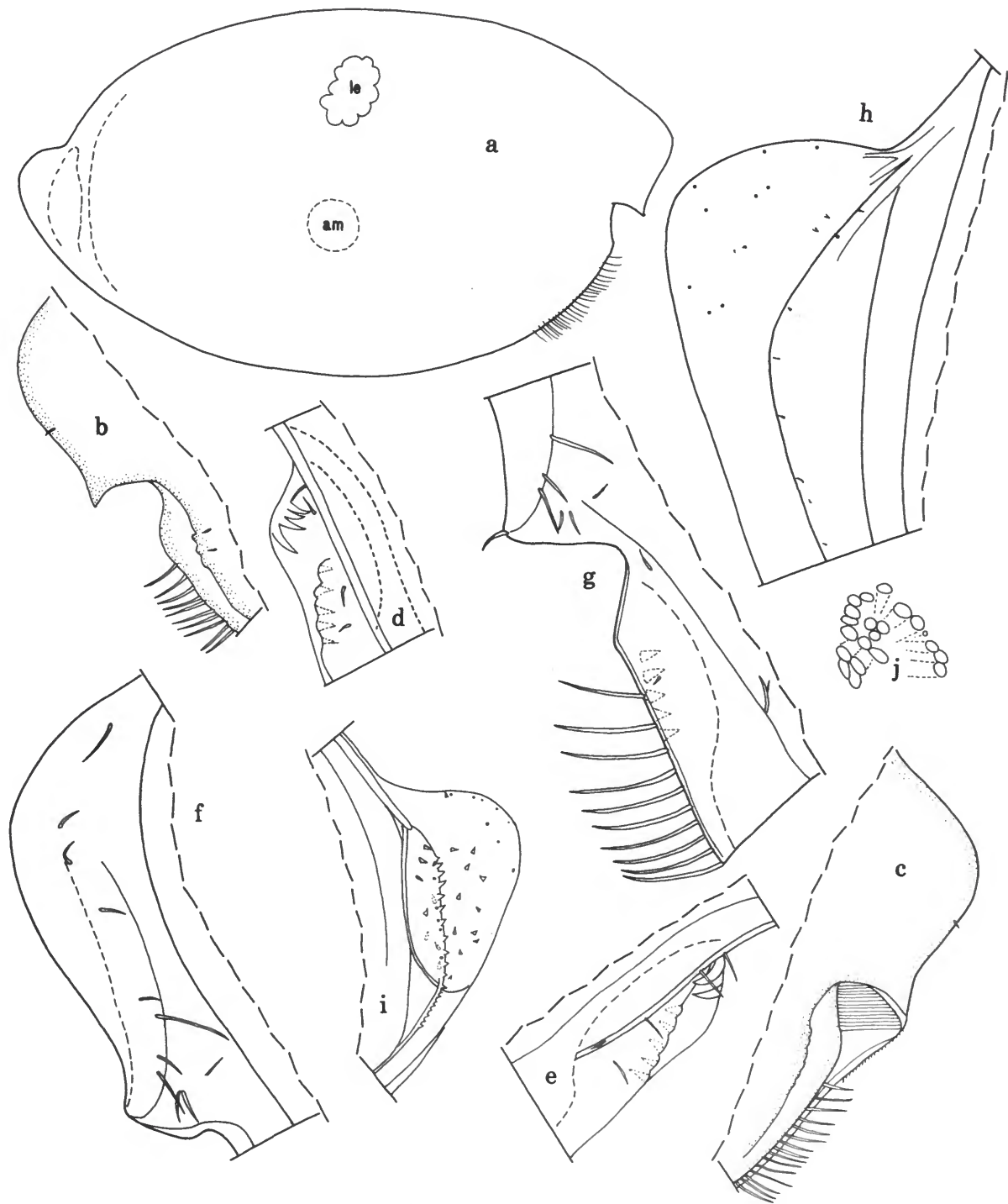


FIGURE 6.—*Cypridina nex*, new species, adult male, paratype, USNM 193698: *a*, complete specimen from right side, length 1.49 mm; *b,c*, anterior of left and right valves, ov; *d,e*, parts of edges of left and right valves just ventral to incisor, ov; *f*, rostrum of right valve, iv; *g*, part of anterior of right valve, iv; *h,i*, caudal process of left and right valves, iv; *j*, central adductor muscle attachments of right valve viewed through shell, anterior toward right.

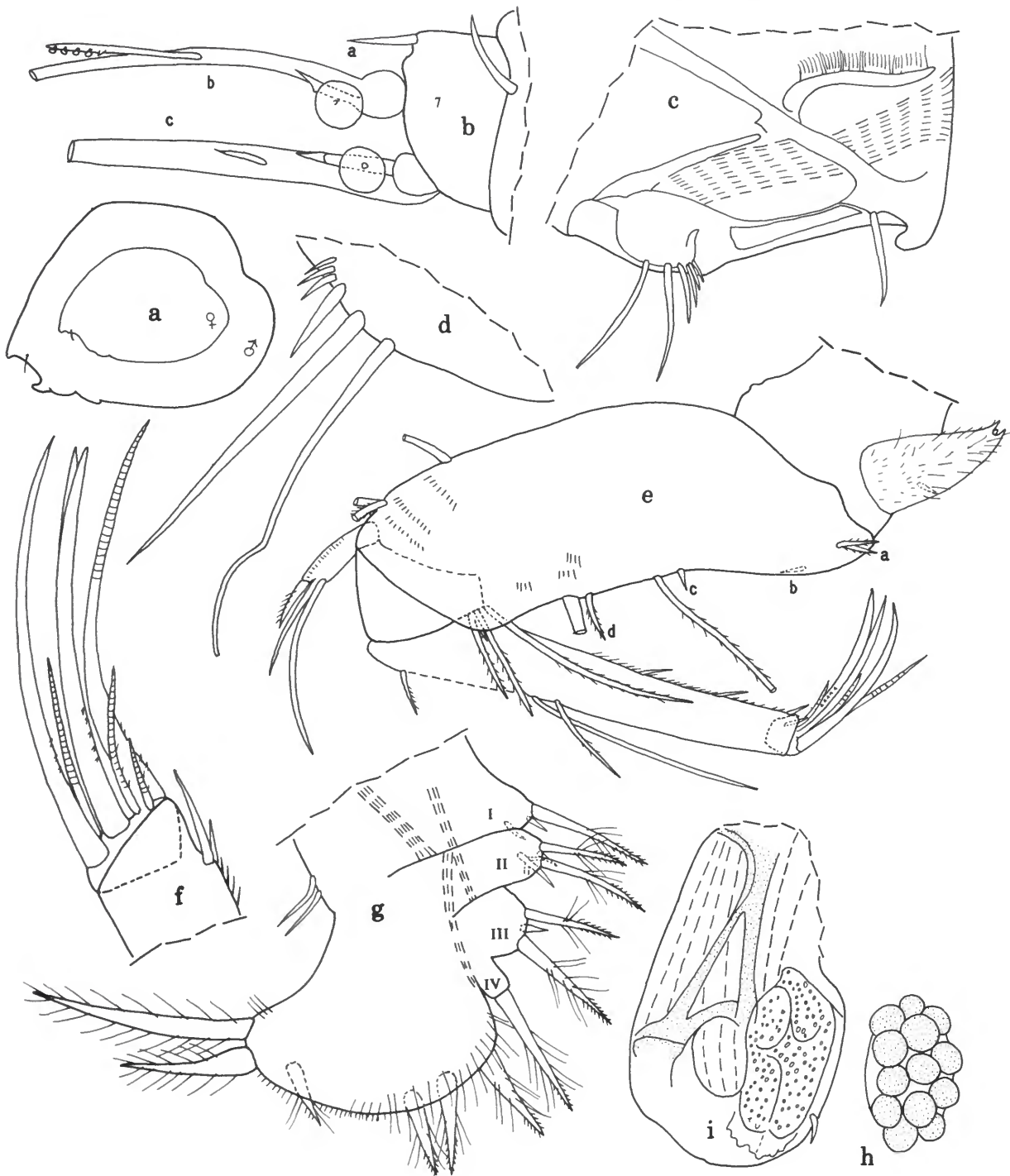


FIGURE 7.—*Cypridina nex*, new species, paratypes: *a*, outline of protopodite of right 2nd antenna of adult female (USNM 193700) within the outline of protopodite of right 2nd antenna of adult male (USNM 193698), mv. Adult male, USNM 193698: *b*, bristles of 6th and 7th joints of right 1st antenna, mv; *c*, protopodite and endopodite of left 2nd antenna, mv; *d*, endopodite of right 2nd antenna, mv; *e*, right mandible, mv; *f*, tip of left mandible, mv; *g*, right 6th limb, lv; *h*, right lateral eye viewed through shell, lv; *i*, left copulatory organ, lv.

bristles (1 proximal and 1 distal to long bristles), and 4 long bristles (only 1 short, 1 medium, and 1 long bristle shown on illustrated limb) (Figure 7e). 3rd endopodial joint with 3 stout equilength claws (with few indistinct proximal teeth on ventral margin) and 4 bristles (1 lateral bristle near dorsal edge and 3 near ventral edge (2 small medial, 1 long stout lateral with proximal part slightly S-shape, with few proximal ventral spines and distal rings)) (Figure 7f).

Maxilla: Endite I with 7 bristles, endites II and III each with 5 bristles (Figure 8a). Coxale with plumose dorsal bristle (Figure 8b). Basale with 2 short bristles near ventral margin (Figure 8b). Exopodite broad, hirsute, with 3 bristles (proximal and middle bristles with marginal hairs, other shorter, bare) (Figure 8c). Endopodite: 1st joint with dorsal hairs forming rows, a 2-pronged cutting tooth, 1 alpha-bristle with long marginal hairs and 2 beta-bristles (outer stout pectinate, inner slender bare or with few indistinct short hairs) (Figure 8d); 2nd joint with 3 slender bare a-bristles, 3 ringed spinous b-bristles, 2 small ringed c-bristles, and 3 pectinate d-bristles (posterior bristle ringed distally, others unringed) (Figure 8d).

Fifth Limb: Anterior tooth-like process of protopodite absent. Endite I with 5 bristles (Figure 8e, f); endite II with 6 bristles; endite III with about 6 bristles. 1st exopodial joint: main tooth comprising minute peg and 6 constituent pectinate teeth (approximate number of marginal cusps on each tooth: 4, 5, 6, 7, 7, 12); spinous bristle proximal to peg (Figure 8g); anterior side with 2 adjacent ringed bristles (rings not shown; inner bristle long, outer bristle shorter, both with long proximal spines) and 1 slender bristle (with long marginal hairs) closer to epipodite (Figure 8h). 2nd exopodial joint with 3 pectinate a-bristles (proximal weakly ringed, others unringed), 3 ringed pectinate b-bristles (outer bristle near inner lobe of 3rd exopodial joint and with long proximal spines), posterior ringed c-bristle with long proximal and short distal spines, and anterior d-bristle with long spines on proximal $\frac{2}{3}$ and ringed in distal $\frac{1}{3}$. 3rd exopodial joint: inner lobe with 3 bristles with short marginal spines (1 short, ringed, proximal; 1 short, unringed, terminal; 1 long, ringed, terminal); outer lobe hirsute, with 2 ringed bare terminal bristles. 4th and 5th exopodial joints fused, hirsute, with 3 ringed terminal bristles (shortest bare, others with short spines) (Figure 8g).

Sixth Limb (Figure 7g): With 2 small bare epipodial bristles. Endite I with 2 small medial bristles (1 near distal edge) and 1 long terminal bristle; endite II with 2 small medial bristles (1 near distal edge) and 2 long terminal bristles; endite III with 2 long terminal bristles and 1 small bristle between them; endite IV small, with 1 terminal bristle. End joint with 3 or 4 spinous bristles (with bases medial and set back from edge) followed by space, then 1 short bristle (with base medial and set back from edge) and 2 hirsute terminal bristles with bases on edge. Medial surface of endites II-IV and end joint hirsute; lateral side with stiff spines along anterior half of ventral edge of end joint.

Seventh Limb (Figure 9a,b): Proximal group with 2 bristles

(1 on each side), each with 3 bells. Terminal group with 6 bristles (3 on each side), each with 3 or 4 bells. Terminal comb with 7 teeth (longest tooth in middle, end tooth on each side of comb short with blunt tip). Short peg opposite comb of one limb of USNM 193698 but opposite limb without peg.

Furca (Figure 9c): Each lamella with 8 or 9 claws (generally 9); claw 2 nonarticulated, remaining claws articulated; claw 3 more slender than claw 4 and about same length; all claws with teeth along posterior edge (not shown); claw 1 with fairly large distal medial teeth (not shown); claw 1 of right lamella anterior to claw 1 of left lamella by width of claw base.

Bellonci Organ (Figure 9d): Short with triangular tip.

Eyes: Lateral eye well developed, with 13-15 dark amber-colored ommatidia, no pigment between ommatidia (Figure 7h). Medial eye unpigmented, bare, and smaller than lateral eye.

Upper Lip (Figure 9e): With 2 unpaired anterior processes, each with broad terminal pore, and 2 paired posterior processes; each of first paired processes with 2 (possibly 3) broad glandular processes at tip; each of second paired processes with 4 glandular processes on posterior edge and 1 at tip; second paired process longer and narrower than first paired process.

Genitalia (Figure 7i): Complex lobe on each side of body anterior to furca. (Each copulatory limb of USNM 193700 contains within it a brownish mass similar in color and texture to the contents of the testes of the same specimen, suggesting that the mass may be sperm. The mass is about 3 times the size of spermatophores on female USNM 193698 so that it is probably not a spermatophore; perhaps a spermatophore forms when the mass is attached to a female. However, it was not determined by staining that the mass is truly sperm.)

Posterior of Body: Evenly rounded, bare.

Y-Sclerite (Figure 9f): Typical for subfamily.

Pigmentation: None in carapace or appendages. Ommatidia of lateral eye dark amber color.

DESCRIPTION OF ADULT FEMALE (Figures 9g-i, 10).—Carapace similar in shape to that of adult male (Figure 9g). Outer surface of valve just ventral to incisur with diaphanous broad spines forming 2 rows (Figure 9h,i): dorsal row with 6 or 7 spines oriented posteroventrally and ventral row with 4 spines folded inward (in lateral view outer edges of bases of the 4 spines appear as a scalloped ridge) (Figure 9h,i). Anteroventral edge of each valve with 10-14 bristles (USNM 193700 with 10 bristles on left valve and 14 on right (some bristles missing but sockets present)) (Figure 9h,i). Surface of valves smooth with few bristles.

Infold: Rostral infold with 13 bristles plus paired bristles at inner end of incisur and 1 small bristle posterior to paired bristles (Figure 10a); most bristles of rostral infold double. Anteroventral infold with 3 short bristles including 1 near inner end of incisur, and 1 longer double bristle near inner margin of infold (Figure 10a). List similar to that of adult male. Ventral infold including posterior end of broad anteroventral infold with 9 or 10 small bristles along list and 2 bristles on left valve



FIGURE 8.—*Cypridina nex*, new species, adult male, paratype, USNM 193698: *a*, endites I–III of left maxilla, anterior to left, mv; *b*, left maxilla (not all bristles shown), mv; *c*, exopodite of left maxilla, mv; *d*, bristles of endopodial joints 1 and 2 of left maxilla, mv; *e*, endites I–III of left 5th limb, av; *f*, endites I–III of right 5th limb (not all bristles shown), pv; *g*, exopodite of right 5th limb, pv; *h*, endite III and exopodite of left 5th limb (not all bristles or teeth shown), av.

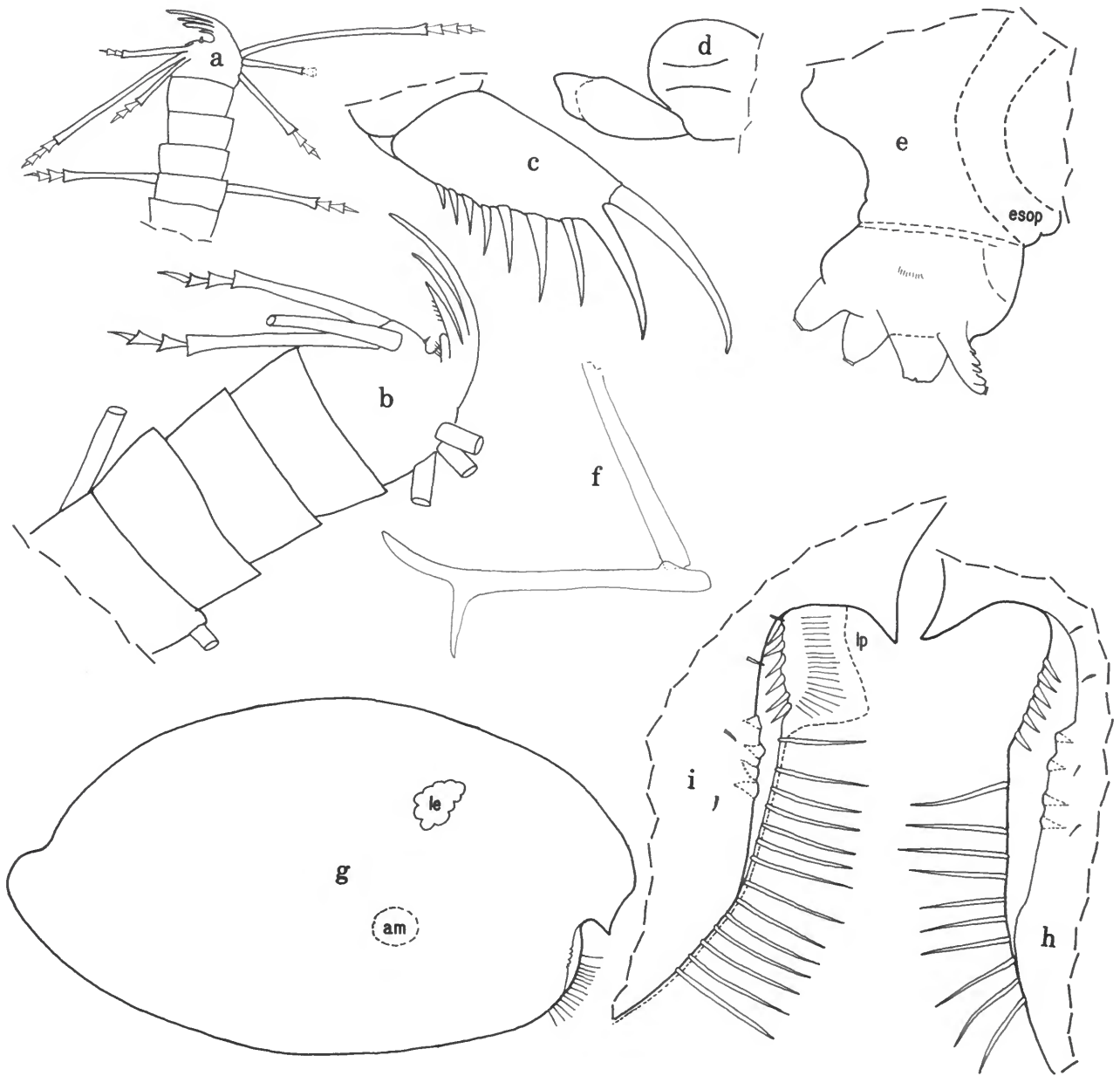


FIGURE 9.—*Cypridina nex*, new species, paratypes: adult male, USNM 193698: *a*, 7th limb; *b*, detail of *a*; *c*, right furcal lamella, lv; *d*, medial eye and Bellonci organ; *e*, upper lip and esophagus, lv; *f*, left Y-sclerite and ventral end of girdle, anterior to left. Adult female, USNM 193700: *g*, complete specimen from right side, length 1.30 mm; *h, i*, anterior ends of left and right valves, ov.

(near posterior end) between list and valve edge. Broad posterior list of left valve with 8 minute pustules near outer edge (Figure 10*b*). Broad posterior list of right valve with stout spines along posterior edge (13 stout spines on dorsal part plus about 7 minute spines along ventral end, and 7 minute

spine-like bristles on shelf just anterior to stout spines along edge; 6 stout spines present beneath shelf, and 10 stout spines and several minute pores and spines on infold between shelf and posterior edge of right valve, some forming row just within valve edge (Figure 10*c*).

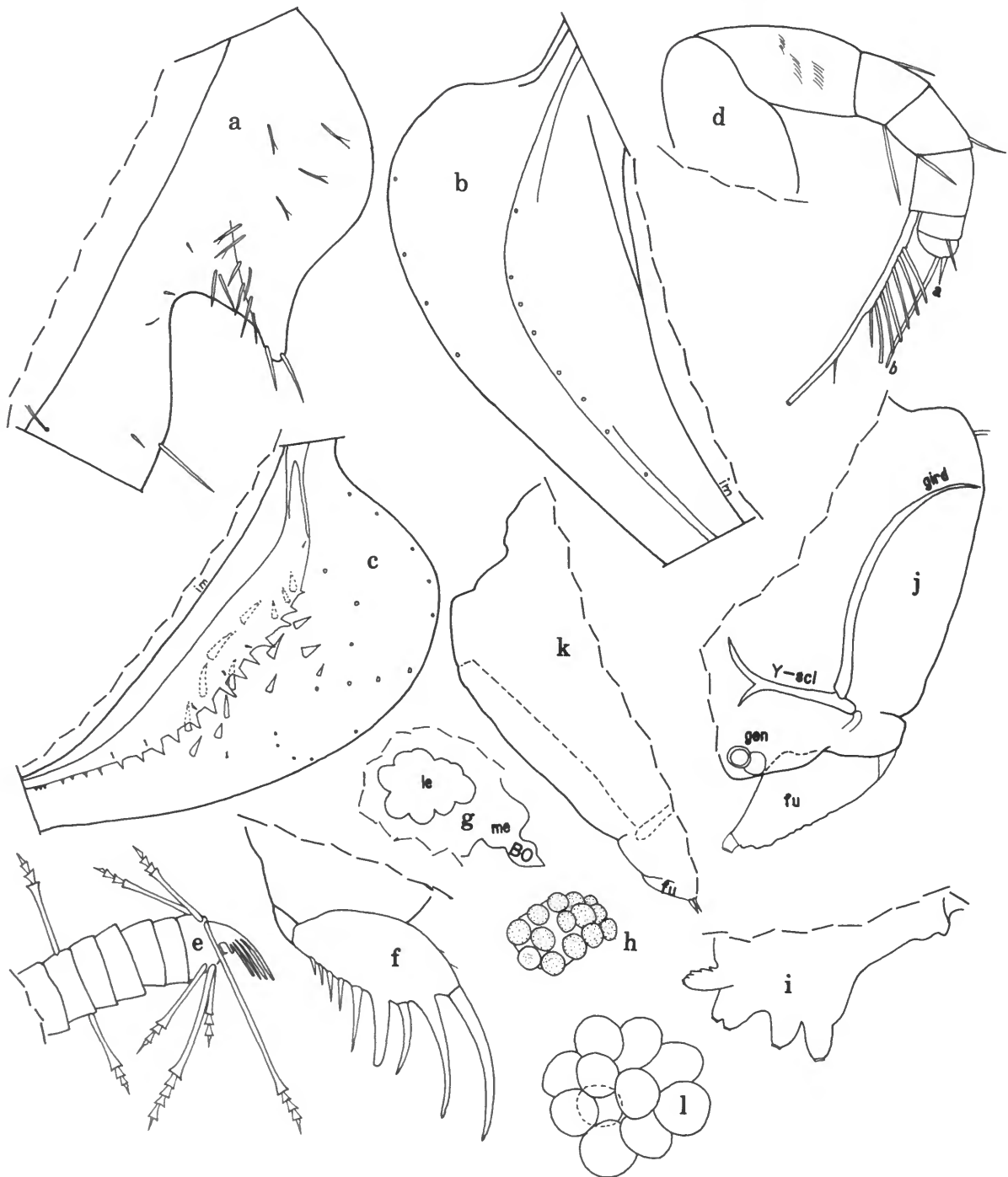


FIGURE 10.—*Cypridina nex*, new species, adult female, paratype, USNM 193700: *a*, anterior of left valve, iv; *b, c*, caudal processes of left and right valves, iv; *d*, left 1st antenna (not all bristles of 7th and 8th joints shown), mv; *e*, 7th limb; *f*, right furcal lamella, lv; *g*, right lateral eye, medial eye, and Bellonci organ; *h*, right lateral eye, lv; *i*, upper lip from right side, anterior to right; *j, k*, posterior of body from left and right sides; *l*, unextruded eggs on right side of body.

Carapace Size: USNM 193700, length 1.30 mm, height 0.74 mm. Specimens from sta 18-S: length 1.43 mm, height 0.73 mm; length 1.42 mm, height 0.78 mm.

First Antenna (Figure 10d): Joints 1–4 and 6 similar to those of adult male. Sensory bristle of 5th joint with 6 stout proximal filaments followed closely by 1 short slender filament, then by a space and 1 short slender filament (tip of bristle missing on both limbs of USNM 193700). 7th joint: a-bristle similar to, but slightly stouter than, bristle of 6th joint; b-bristle bare with pointed tip; c-bristle long with many filaments. 8th joint: d- and e-bristles bare with blunt tips; f- and g-bristles long with many filaments.

Second Antenna: Exopodite: bristle of 2nd joint short (reaching 6th joint) with 9 slender ventral spines. Limb otherwise similar to that of adult male.

Mandible: Coxale endite with small indistinct bristle near its base. Distal paired bristles of ventral margin of 2nd endopodial joint equal in length, both pointed and same size as 2 proximal bristles; limb otherwise similar to that of adult male.

Maxilla: Not examined in detail, but in general similar to that of adult male.

Fifth Limb: Fused 4th and 5th joints with 2 bristles; limb otherwise similar to that of adult male.

Sixth Limb: Endites I–III and end joint similar to those of adult male. Endite IV with 1 short spinous medial bristle and 1 long spinous terminal bristle.

Seventh Limb (Figure 10e): Similar to that of adult male, except terminal bristles with 3–5 bells.

Furca (Figure 10f): Each lamella with 9 claws; claws 2 and 4 nonarticulated, remaining claws articulated; claw 3 more slender than claw 4 and about same length or slightly shorter (tip of claw 4 broken off on specimen examined). Furca otherwise similar to that of adult male.

Bellonci Organ (Figure 10g): Short with triangular tip.

Eyes: Lateral eye well developed, with 14 dark amber ommatidia and no pigment between ommatidia (Figures 9g, 10g,h). Maximum length of female eye $\frac{3}{4}$ of maximum length of male eye. Medial eye smaller than lateral eye, unpigmented, bare (Figure 10g).

Upper Lip (Figure 10i): Similar to that of adult male.

Genitalia (Figure 10j): Small oval on each side of body anterior to furca; USNM 193700 with attached round spermatophore on each oval.

Posterior of Body (Figure 10j,k): With few indistinct spines.

Y-Sclerite (Figure 10j), *Pigmentation:* Similar to adult male.

Eggs: USNM 193700 with 21 large unextruded eggs (11 on right side, 10 on left) (Figure 10l). One specimen from sta 18-S (length 1.43 mm) with 3 eggs in marsupium and unextruded eggs of similar size; 2nd specimen from sta 18-S (length 1.42 mm) with unextruded eggs.

DESCRIPTION OF INSTAR V FEMALE (Figures 11, 12).—Carapace similar in shape to that of adult female (Figures 11a,

12a). Outer surface of valve just ventral to incisur with indistinct broad spines forming 2 rows: dorsal row with 3 or 4 spines oriented posteroventrally, and ventral row with 4 spines folded inward (Figures 11b, 12b). Anteroventral edge of valve with 10–17 bristles forming row (USNM 193701 with 17 bristles (Figure 11a,b); USNM 193702 with 10 or 11 (Figure 12b)).

Infold: Rostral infold with 10 bristles plus paired bristles at inner end of incisur and 1 small bristle posterior to paired bristles. Anteroventral and ventral infold similar to that of adult male. Broad list of caudal process of right valve with 12 stout spines along edge of dorsal part of shelf and several smaller spines along edge of ventral part (Figure 11c); total of about 14 stout spines beneath shelf and between shelf and posterior edge of caudal process (not shown). Broad list of caudal process of left valve similar to that of adult male.

Carapace Size: USNM 193701, length 0.97 mm, height 0.58 mm; USNM 193702, length 1.02 mm, height 0.63 mm.

First Antenna (Figure 12c): Joints 1–4 and 6 similar to those of adult female. Sensory bristle of 5th joint with 6 long stout proximal filaments (proximal 2 more slender than others) followed closely by 1 short slender filament, then space, a 2nd short slender filament, and bifurcate tip. 7th joint: a-bristle similar to bristle of 6th joint; b-bristle bare, about half length of sensory bristle of 5th joint; c-bristle long with short filaments (not shown). 8th joint with bristles similar to those of adult female (not illustrated).

Second Antenna: Protopodite with distal medial bristle (Figure 12d). Endopodite 1-jointed with 4 bristles and distal filament (Figure 12d). Exopodial bristles similar to those of adult female.

Mandible: Coxale endite similar to that of adult female, with small well-defined bristle near base. Basale, exopodite, and 1st and 3rd endopodial joints similar to those of adult female. 2nd endopodial joint: ventral margin with bristles similar to those of adult female; dorsal margin with 4 long and 3 short bristles (Figure 12e).

Maxilla: Same number of bristles as on adult male.

Fifth Limb (Figures 11d–f, 12f–h): Endite I with 3 bristles, endite II with 6 bristles plus 1 minute triangular tooth; endite III with 5 bristles plus 1 minute triangular tooth (Figure 12f). Exopodite: main tooth of 1st joint with smooth proximal peg and 5 pectinate constituent teeth (Figure 11e), otherwise joint similar to that of adult male; joints 2 and 3 similar to those of adult male; fused joints 4 and 5 with 2 or 3 bristles (Figure 12h).

Sixth Limb: With 1 or 2 small bare epipodial bristles. Endite I with 1 small medial bristle and 1 long terminal bristle; endites II and III similar to those of adult male; endite IV with 1 small bristle near distal margin and 1 long terminal bristle. End joint with 3 or 4 spinous bristles (with bases medial and set back slightly from edge) followed by space, then 1 short bristle (with base medial and set back from edge) and 2 hirsute terminal bristles with bases on edge. Limb hirsute as on limb of

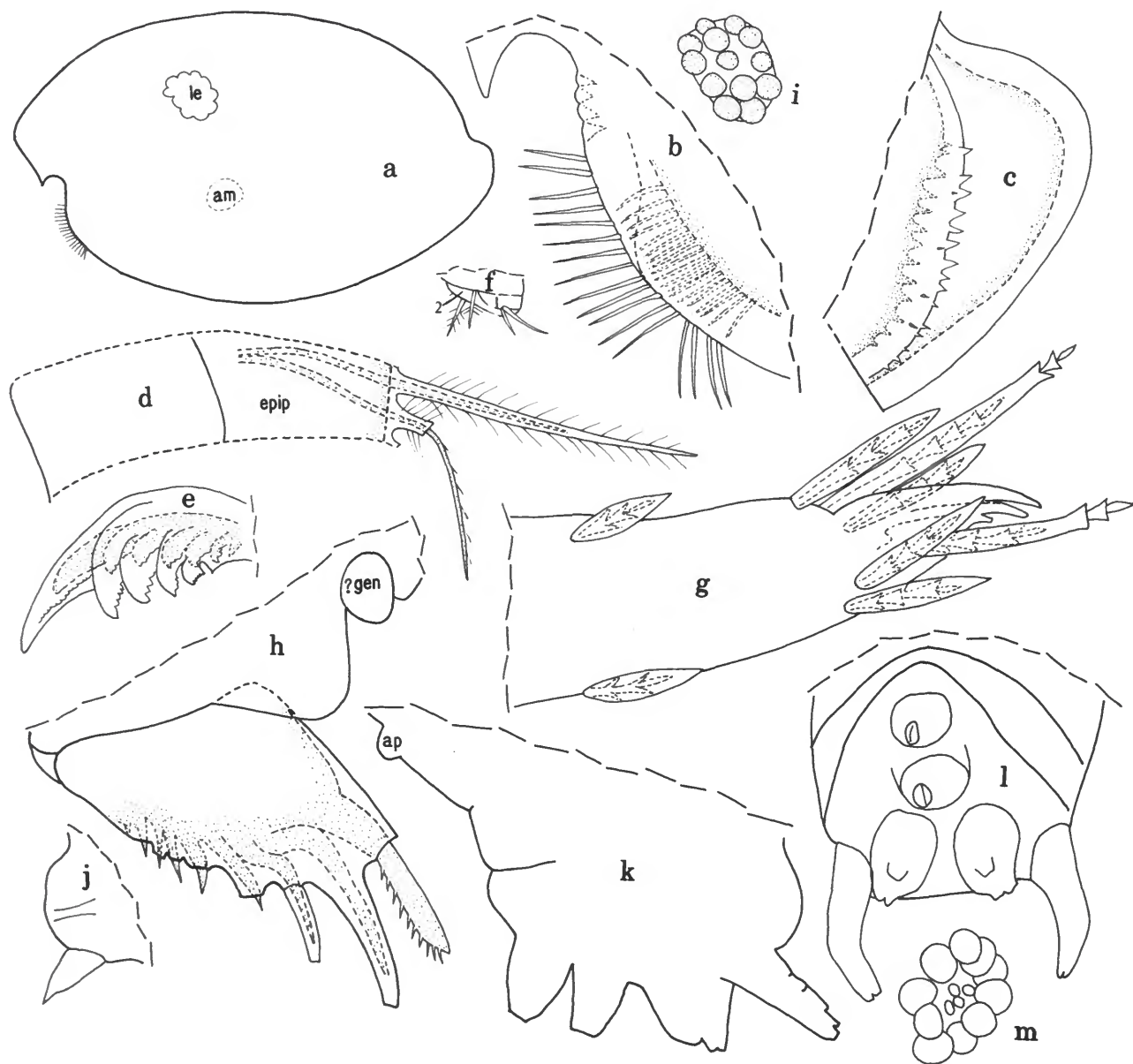


FIGURE 11.—*Cypridina nex*, new species, instar V female, paratype, USNM 193701: *a*, complete specimen from left side, length 0.97 mm; *b*, anterior of right valve (edge of adult valve within stippled), iv; *c*, caudal process of right valve (edge of adult valve within stippled), iv; *d*, part of epipodite of left 5th limb (bristles of adult within stippled), pv; *e*, main tooth of left 5th limb (tooth of adult within stippled), pv; *f*, 1st and 2nd exopodial joints of right 5th limb (not all bristles shown), av; *g*, 7th limb (bristles of adult within dashed); *h*, right lamella of furca (claws of adult furca within stippled; genital organ probably represents that of adult), lv; *i*, left lateral eye, lv; *j*, medial eye and Bellonci organ; *k*, upper lip and anterior process from left side, anterior to left; *l*, ventral oblique view of upper lip, anterior to top; *m*, unextruded eggs on left side of body, lv.

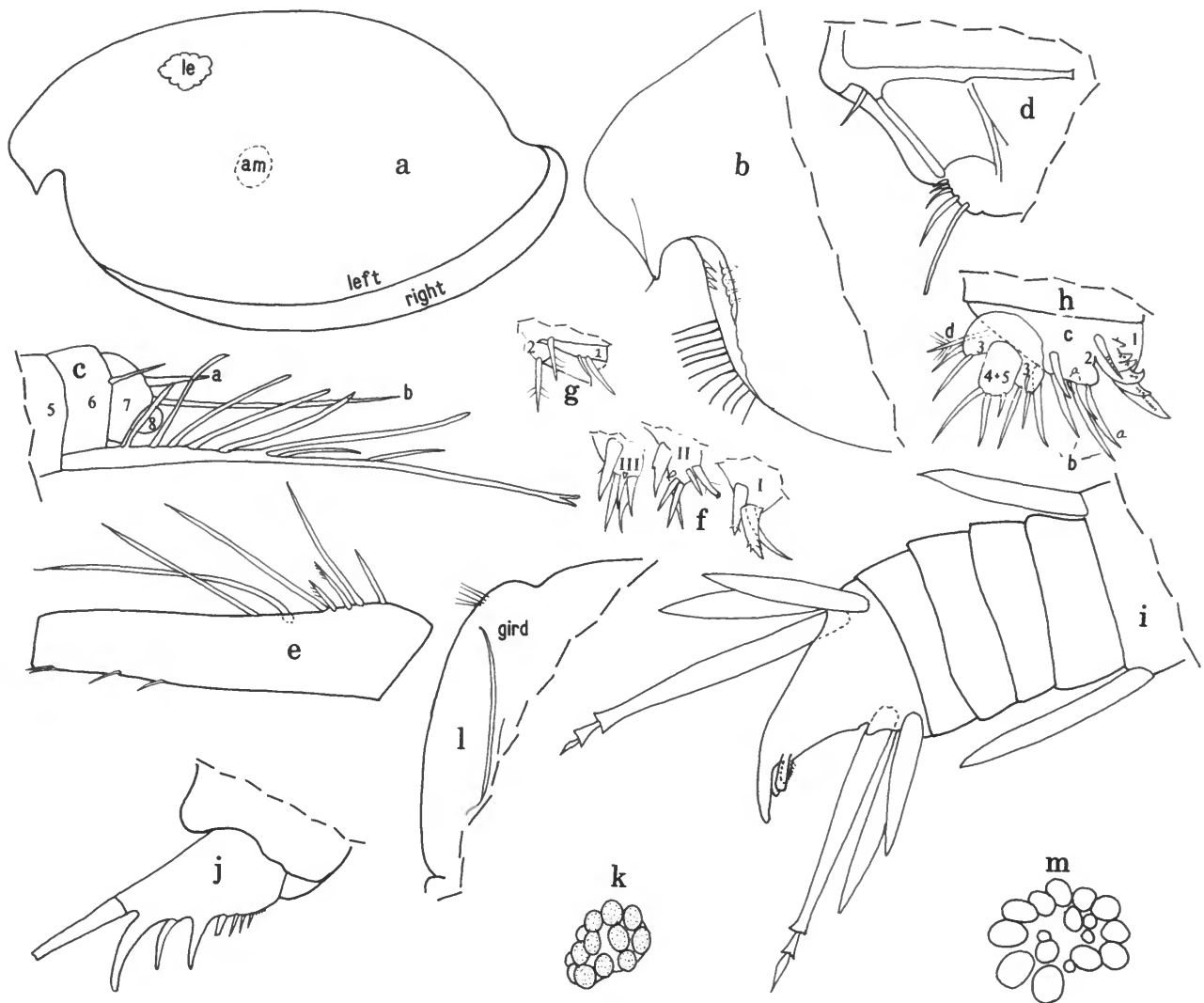


FIGURE 12.—*Cypridina nex*, new species, instar V female, paratype, USNM 193702: a, complete specimen from left side, length 1.02 mm; b, anterior of left valve, ov; c, left 1st antenna (not all bristles of 7th and 8th joints shown), mv; d, distal part of protopodite and endopodite of right 2nd antenna, mv; e, 2nd endopodial joint of right mandible, mv; f, endites I-III of left 5th limb, pv; g, 1st and 2nd exopodial joints of right 5th limb (not all bristles shown), av; h, exopodite of left 5th limb, pv; i, 7th limb; j, left furcal lamella, lv; k, left lateral eye, lv; l, posterior of body from right side; m, unextruded eggs on left side of body, lv.

adult male.

Seventh Limb (Figures 11g, 12i): With 2 bare diaphanous pointed proximal bristles (1 on each side), and 6 diaphanous terminal bristles: 4 (2 on each side) bare, pointed; 2 (1 on each side) with 2 bells. Terminus elongate with 1 long and 3 or 4 short teeth; small protuberance near base of bristle may represent incipient peg.

Furca (Figures 11h, 12j): Each lamella with 8 claws; claws 2 and 4 nonarticulated; base of claw 4 broader than base

of claw 3 but about same length. All claws with teeth along posterior edge (not shown); few distal teeth on posterior edge of claw 1 longer than proximal teeth; claw 1 also with teeth forming medial row (distal teeth larger); anterior margin of right lamella with few indistinct spines; lamellae following claw 8 with few minute spines; right lamella only slightly anterior to left lamella (by about $\frac{1}{3}$ width of base of claw 1).

Bellonci Organ (Figure 11j): Similar to that of adult female.

Eyes: Lateral eye well developed, with 13 amber-colored ommatidia (Figures 11*a,i*, 12*a,k*). Medial eye unpigmented, bare.

Upper Lip (Figure 11*k,l*): Similar to that of adult male.

Genitalia: Not observed on USNM 193702; observed on USNM 193701, but may be part of adult female within (Figure 11*h*).

Posterior of Body (Figure 12*l*): Posterodorsal corner evenly rounded and with row of stiff spines.

Y-Sclerite: Similar to that of adult female.

Pigmentation: None in carapace or appendages.

Eggs: USNM 193702 with 13 large and 3 or 4 minute unextruded eggs on each side (Figure 12*m*). USNM 193701 with 10 or 11 large and 4 minute unextruded eggs on each side (Figure 11*m*).

COMPARISONS.—The carapace of the new species *C. nex* resembles that of *C. multipilosa* Poulsen, 1962:266, of which only the adult male is known. In the description of the furca of that species Poulsen (1962:268) states, "Each lamella has 9 claws, gradually decreasing in size dorsally." The furca of *C. nex* differs in having a 4th claw much broader than the 3rd. Also, the 3 claws of the 3rd endopodial joint of the mandible are equilength on *C. nex*, whereas, 1 of the 3 is short on *C. multipilosa* (Poulsen, 1962:268, fig. 124*g*).

ONTOGENY AND SEXUAL DIMORPHISM.—The main difference in appendages between the instar V and the adult female occurs in the 7th limb, which has 6 of 8 bristles without bells on instar V and all 8 bristles with bells on the adult female (Figure 11*g*). The endopodite of the 2nd antenna bears 4 bristles and 1 filament on the instar V female and 5 bristles and 1 filament on both the adult male and female. The dorsal margin of the 2nd endopodial joint of the mandible bears 7 bristles on the instar V female and 11 on both the adult male and female. The furca bears 8 claws on the instar V female and 9 on the adult female. The furcae of the instar V female as well as the adult female have claws 2 and 4 nonarticulated, whereas, only claw 2 is nonarticulated on the furca of the adult male. The sensory bristle of the 5th joint of the 1st antenna of the instar V female as well as the adult female bears 6 long proximal filaments, whereas, the bristle of the adult male bears 8. The b-bristle of the 1st antenna is bare on the instar V and adult female and bears suckers and filaments on the adult male. The c-bristle of the adult male bears suckers that are absent on the adult female. The carapace of the adult female is smaller than that of the adult male (length 1.30 mm compared to 1.44–1.50 mm). The lateral eye of the adult female is smaller than that of the adult male (maximum length $\frac{3}{4}$ of maximum length of adult male eye). The protopodite of the 2nd antenna of the adult female is considerably smaller than that of the adult male (Figure 7*a*).

ECDYSIS.—Instar V female, USNM 193701, has visible within its integument and shell the adult stage indicating that molting was imminent when the specimen was captured and killed. The shell of the adult bears about 19 anteroventral bristles compared to 17 on instar V, and no part of the adult

bristles are inside instar V bristles (Figure 11*b*). On the infold of the caudal process of the right valve about 13 stout spines are on the outer edge of the broad list of the adult compared to about 10 on instar V, and the adult spines are not within instar V spines (Figure 11*c*). The bristles of joints 3, 4, and 6 of the adult 1st antenna lie within like bristles of instar V, but the sensory bristle of the 5th joint and the long bristles of joints 7 and 8 of the adult lie within joints 1–8 and are not visible within bristles of instar V. On the 2nd antenna the bristle of the protopodite of the adult lies within the bristle of instar V, and 4 bristles and 1 filament of the endopodite of the 2nd antenna of the adult are within the bristles and filament of instar V (the additional 5th bristle probably present on the adult could not be resolved). The bristles of the exopodite of the 2nd antenna of the adult are visible lying within joints 1–9 and extending into the bristles of instar V; the bristles of the adult project out of remaining stumps of broken exopodial bristles of instar V. Minute spines forming a row along the distal edge of exopodial joints 2–8 of the adult are visible just proximal to a similar row on joints of instar V. Mandibular bristles and claws of the adult project into bristles and claws of instar V (claws of 3rd endopodial joint project almost halfway into claws of instar V). Bristles and claws of the adult maxilla project into bristles and claws of instar V maxilla. The constituent teeth of the main tooth of the 1st exopodial joint of the 5th limb of the adult are visible within the teeth of instar V. The additional 6th tooth of the adult main tooth is added between the proximal tooth and peg of instar V (Figure 11*e*). Claws and bristles of adult 5th and 6th limbs project partway into claws and bristles of instar V (Figure 11*d,e*). Spines and hairs on the surface of the 6th limb as well as those on bristles are present on the adult limb inside the 6th limb of instar V. Seventh limb of adult visible within the 7th limb of instar V (Figure 11*g*). Many claws broken on furca of instar V, possibly with 8 claws on instar V and 9 on adult, but count uncertain. An oval just anterior to the furca probably represents the genitalia of the adult (Figure 11*h*), which was not evident on the instar V (USNM 193702) not visibly undergoing ecdysis. In general, when claws or bristles are broken off instar V the adult claws and bristles remain, suggesting that they are more durable than those of instar V. Although the edges of the joints of appendages of the adult are just inside the edges of like joints of instar V, bases of long bristles of the adult lie deeply within the limb and just a small part of the bristle is within the like bristle of instar V. Probably, the bristle of the adult is fully extended after the old integument is shed, thus simplifying shedding of old bristles.

Cypridina segrex, new species

FIGURES 13–18

ETYMOLOGY.—From the Greek *segrex* (apart, separate).

HOLOTYPE.—MNHN Os 426, 1 partly dissected instar V male in alcohol.

TYPE LOCALITY.—Sta 65-S, 29 Mar 1977, M'Sanga Tsohole Reef, Mayotte, 12°41'54"S, 44°59'18"E, depth 38 m.

PARATYPES.—Sta 32-S: Paris, 1 instar IV in alcohol, sex unknown; USNM 193764, 1 adult female on slide and in alcohol. Sta 65-S: Paris, 1 instar IV in alcohol, sex unknown (length 1.05 mm, height 0.61 mm); USNM 193767, 1 instar III male on slide and in alcohol. Sta 106-R: Paris, 1 instar IV female in alcohol. Sta 110-S: USNM 193766, 1 instar IV female on slide and in alcohol. Sta 117-S: Paris, 1 instar IV male in alcohol. Sta 124-S: Paris, 2 juveniles in alcohol (length 1.20 mm, height 0.66 mm; length 1.37 mm, height 0.72 mm); USNM 193765, 1 instar V male on slide and in alcohol.

DISTRIBUTION.—Sta 32-S, N Ile Pamanzi, depth 15–20 m. Sta 65-S, M'Sanga Tsohole Reef, Mayotte, depth 38 m. Sta 106-R, Zelee Bank, south border, depth 18–24 m. Sta 110-S, S Zelee Bank, 24 m. Sta 117-S, Geysir Bank, southern part of lagoon, depth 3–8 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 3–38 m.

DESCRIPTION OF ADULT FEMALE (Figures 13–15).—Carapace elongate with convex ventral and dorsal margins in lateral view (Figure 13a); anterodorsal corner of rostrum evenly rounded, anterior edge of rostrum concave in lateral view, and inferior tip of rostrum pointed (Figure 13a,b); caudal process well developed and with rounded posterior edge. Anteroventral edge of valves with neither teeth nor bristles, but with 3 short thread-like bristles with bases on lateral side near edge (Figure 13c). Outer surface of valves smooth, with few small bristles (bristle at anterodorsal corner of rostrum shown in Figure 13b).

Infold: Rostral infold with 36 divided bristles plus pair of divided bristles at inner end of incisur and 1 small double bristle posterior to paired bristles (Figure 13b). Narrow list with anterior end on anteroventral infold, extending along ventral infold, then broadening to form broad shelf at anterior end of caudal process. Anteroventral infold with 1 small double bristle near inner end of incisur, 17 double bristles in row along list, and 9 short double bristles between list and inner margin of infold (Figure 13c). Ventral infold with about 20 bristles along list and 1 bristle on left valve (near posterior end) between list and valve edge. Right valve: broad list along caudal process and posterior end of ventral margin with 28 stout spines along distal edge (Figure 13d), and about 18 minute spine-like bristles on shelf proximal to stout teeth; numerous minute spines and pores on infold of caudal process between list and valve edge (Figure 13d); stout sclerotized bar dorsal to caudal process; outer edge of infold of caudal process with 7 fairly long spines in row. Left valve: broad list along caudal process and posterior end of ventral margin with about 43 spines (smaller than those of right valve) along distal edge (not all shown in Figure 13e), and about 10 minute spine-like bristles on shelf proximal to teeth (not all shown); numerous minute pores and spines on infold of caudal process between list and valve edge; outer edge of infold of caudal process with 7 fairly long spines in row; no sclerotized bar dorsal to caudal process

but 3 or 4 small widely separated bristles in row (not shown).

Selvage: Lamellar prolongation of selvage: along anterior margin and inferior corner of rostrum narrow, nonstriate, and with smooth outer edge; along ventral edge of incisur broad, striate, with numerous minute spots (nodes?), and minute fringe along outer edge; along anteroventral margin of valve narrow with striations on proximal $\frac{1}{3}$ and with smooth outer edge; along anterior part of ventral margin narrow with striations on proximal $\frac{1}{2}$ and minute fringe along outer edge; along posterior $\frac{1}{2}$ of ventral margin broad with 2 lamellae (one about $\frac{2}{3}$ width of other, striate and with minute fringe along distal edge; other nonstriate and without fringe); along outer edge of caudal process and posterior edge of valve lamellar prolongation absent.

Carapace Size: USNM 193764, length 1.48 mm, height 0.81 mm.

First Antenna (Figure 13f,g): 1st joint bare. 2nd joint with abundant ventral and medial spines in rows. 3rd joint trapezoidal, with medial spines in rows, spinous dorsal bristle at midlength and longer terminal ventral bristle. 4th joint with 2 terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 6 or 7 long proximal filaments followed closely by 1 short slender filament, then a space and a longer slender filament; tip of bristle bifurcate (not shown) (Figure 13g). 6th joint with short medial bristle. 7th joint: a-bristle slightly longer and stouter than bristle of 6th joint, with marginal spines; b-bristle bare; c-bristle of right limb (tip of bristle of USNM 193764 broken off) with 7 short filaments each with small proximal marginal tooth. 8th joint: d- and e-bristles bare with blunt tips (not shown); f- and g-bristles long with many filaments, some with marginal spine (not shown). On left limb of USNM 193764, c- and f-bristles fused (aberrance).

Second Antenna: Protopodite with spinous distal medial bristle (Figure 13h); Endopodite 1-jointed, with 5 bristles (3 minute proximal bristles followed by 2 longer and stouter bristles) and long slender filament (Figure 13h). Exopodite: 1st joint with indistinct spines along concave dorsal margin; bristle of 2nd joint reaching to about 7th joint, with 4 slender ventral spines followed by 7 stout spines; bristles of joints 3–8 long, with natatory hairs but no spines; 9th joint with 3 bristles (2 long with natatory hairs, 1 short with few short hairs); joints 4–8 with basal spines (spine of 4th joint small, larger spines of joints 5–8 about same size, about same length as 9th joint); lateral spine of 9th joint longer than joint; joints 3–8 with minute spines forming row along distal margin.

Mandible (Figure 14a–c): Coxale endite well developed with small proximal and longer distal spines and 2 stout terminal spines, 1 on each side of small triangular process; small bristle near base of endite. Basale (Figure 14a): ventral margin with 2 small spinous ringed a-bristles, 1 small lateral b-bristle, 2 c-bristles (proximal small, distal long with short spines), and 2 d-bristles (proximal small with short spines; distal long, stout, with 3 proximal wreaths of long spines and distal short spines); dorsal margin with 3 bristles (1 at distal $\frac{3}{4}$,

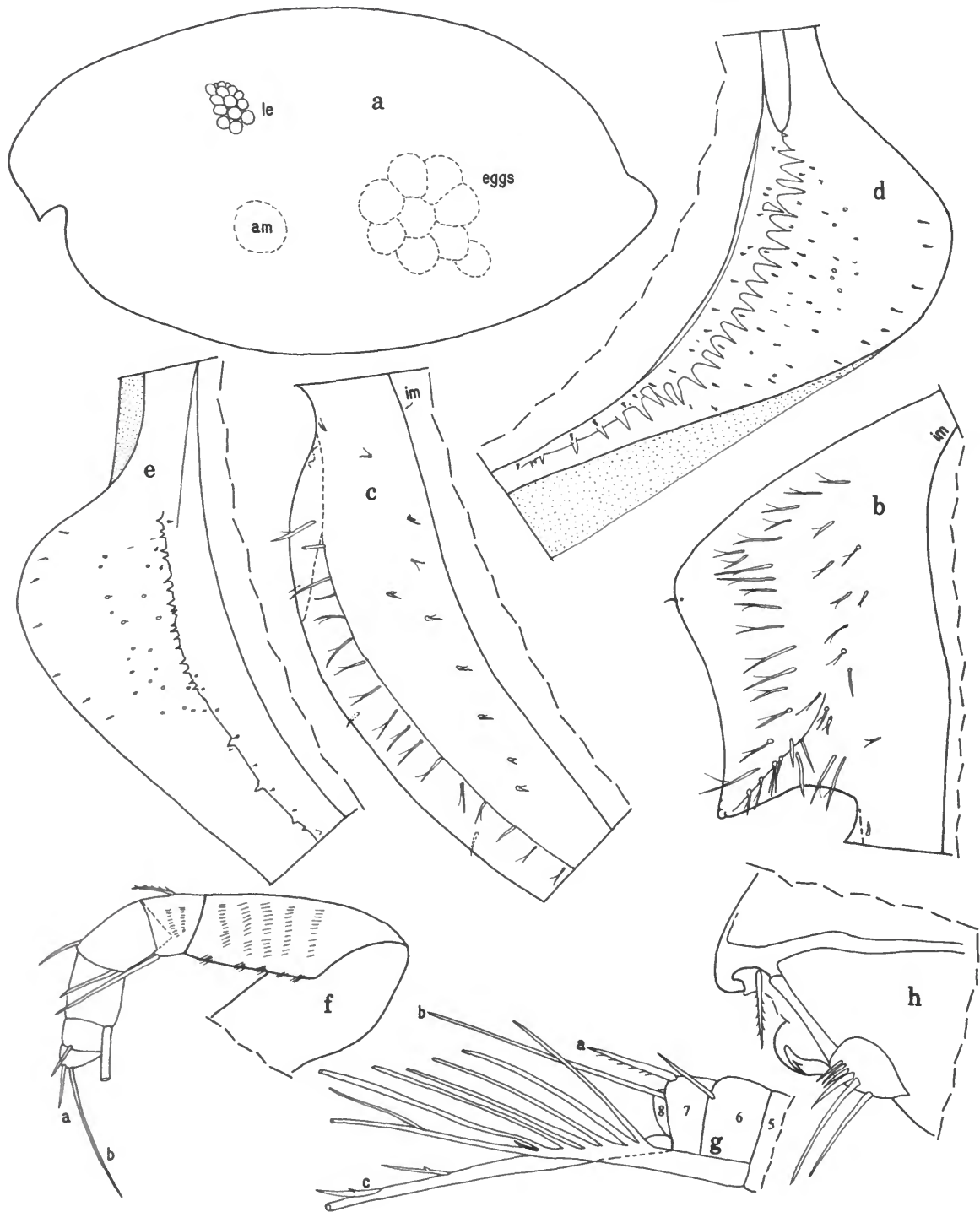


FIGURE 13.—*Cypridina segrex*, new species, adult female, paratype, USNM 193764: a, complete specimen from left side, length 1.48 mm; b, rostrum of right valve, iv; c, anteroventral margin of right valve, iv; d, e, caudal processes of right and left valves, iv; f, joints 1-7 of right 1st antenna (c-bristle of 7th joint not shown), mv; g, joints 5-8 of right 1st antenna (bristles of 8th joint not shown), mv; h, protopodite and endopodite of right 2nd antenna, mv.

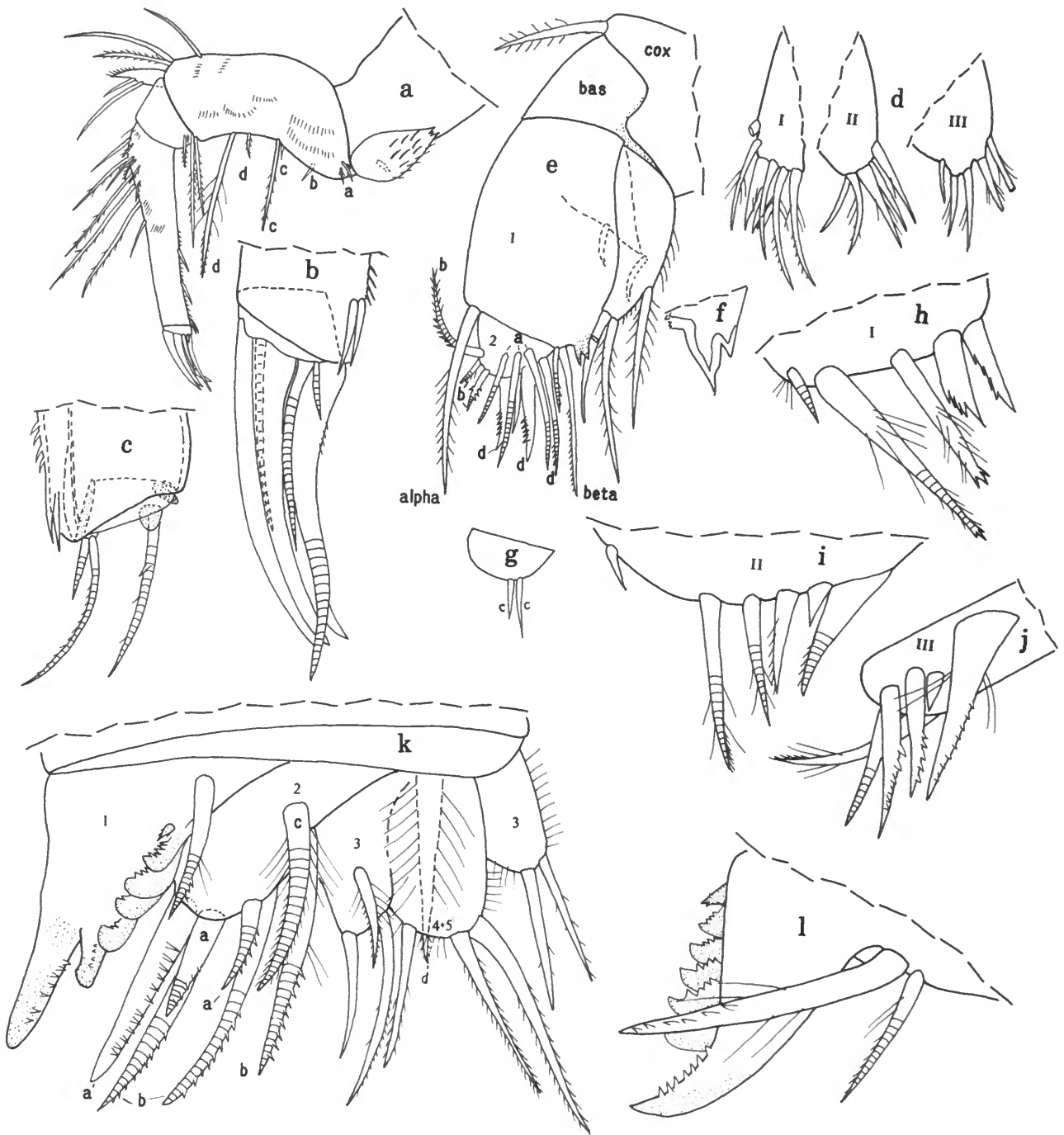


FIGURE 14.—*Cypridina segrex*, new species, adult female, paratype, USNM 193764: a, right mandible, mv; b, tip of right mandible, mv; c, tip of left mandible with claws and lateral ventral bristle missing (sclerotized parts stippled), mv; d, endites I-III of left maxilla, lv; e, left maxilla (c-bristles shown in g), lv; f, detail of cutting tooth of 1st endopodial joint of maxilla shown in e; g, c-bristles of 2nd endopodial joint of maxilla shown in e, lv; h-j, endites I-III of right 5th limb, pv; k, exopodite of right 5th limb, pv; l, main tooth and 2 anterior bristles (3rd anterior bristle not shown) of 1st exopodial joint of left 5th limb, av.

bare, 2 terminal (lateral bare, medial with short spines); medial surface spinous. Exopodite slightly longer than dorsal margin of 1st endopodial joint, hirsute, with 2 distal bristles (distal of these shorter). 1st endopodial joint with 4 ventral bristles (1 minute bare, others with short spines and unequal). 2nd endopodial joint: ventral margin and medial surface spinous; ventral margin with 2 single spine-like bristles and terminal paired spine-like bristles; dorsal margin with 4 short diaphanous spinous bristles, 3 medium length bare bristles, and 4 long bristles with short indistinct marginal spines. 3rd endopodial joint with 3 stout equilelength claws (at least 2 with few proximal ventral teeth) and 4 bristles (1 lateral bristle near dorsal edge and 3 near ventral edge (2 medial, 1 long stout lateral with proximal part slightly S-shape, with few proximal ventral spines and distal rings)) (Figure 14b,c).

Maxilla (Figure 14d-g): Endite I with 7 bristles, endites II and III each with 5 bristles (Figure 14d). Coxale with plumose dorsal bristle. Basale with 2 short bristles near ventral margin and 3rd endite. Exopodite broad, hirsute, with 3 bristles (proximal and middle bristles with long hairs on proximal $\frac{2}{3}$, other shorter, bare). Endopodite: 1st joint with dorsal hairs, a 2-pronged cutting tooth (Figure 14f), 1 alpha-bristle with long marginal hairs, and 2 beta-bristles (outer stout pectinate, inner slender with few short marginal hairs). 2nd joint with 3 slender bare a-bristles, 3 b-bristles (anterior longer, with proximal spines and distal hairs, others short, pectinate), 2 short medial c-bristles (anterior shorter) (Figure 14g), and 3 stout pectinate d-bristles (2 anterior unringed, posterior with distal rings).

Fifth Limb: Anterior tooth of protopodite absent. Endite I with 5 bristles; endite II with 6 bristles; endite III with 6 or 7 bristles (Figure 14h-j). 1st exopodial joint: main tooth comprising small pointed spinous peg and 6 constituent teeth (proximal 5 with 5 or 6 cusps, distal with 7 or 8) (Figure 14k,l); spinous bristle proximal to peg; anterior side with 2 adjacent ringed bristles (inner long, outer short, both with proximal spines) (Figure 14l), and 1 slender bristle closer to epipodite (not shown). 2nd exopodial joint with 3 pectinate a-bristles (proximal 2 weakly ringed, distal unringed), 3 ringed pectinate b-bristles (outer bristle near inner lobe of 3rd exopodial joint and with long proximal spines), posterior c-bristle with long proximal and short distal spines, and anterior d-bristle with long proximal spines. 3rd exopodial joint: inner lobe with 3 bristles (proximal ringed, with long proximal and short distal spines; longer of terminal bristles ringed, with few short spines, other unringed, bare); outer lobe hirsute, with 2 ringed terminal bristles with few indistinct short spines. 4th and 5th exopodial joints fused, hirsute, with 3 ringed terminal bristles with short marginal spines (Figure 14k).

Sixth Limb (Figure 15a): With 4 bare epipodial bristles. Endite I with 3 bristles (2 small medial, 1 long terminal); endite II with 4 bristles (2 small medial, 2 longer terminal); endite III with 2 long terminal bristles and 1 small bristle between them; endite IV with 2 bristles (1 short medial, 1 long terminal). End joint with 5 spinous bristles followed by space, then 1 short

bristle (with base medial and set back from edge) and 2 plumose terminal bristles. Medial surface of endites II-IV and end joint hirsute; lateral side with stiff spines along anterior edge and ventral edge of anterior half of end joint, and thin hairs along ventral edge of posterior half of end joint.

Seventh Limb (Figure 15b,c): Proximal group with 4 bristles (2 on each side), each with 3 bells. Terminal group with 5 bristles (2 or 3 on each side, each with 3 or 4 bells (longest with 4 bells others with 3)). Terminal comb with 5 spinous teeth (longest tooth in middle; end tooth on each side of comb short with rounded tip. Slender bare peg opposite comb. On 1 limb of USNM 193764, 3 bristles (including longest bristle) on peg side (Figure 15b), on opposite limb 3 bristles on comb side (Figure 15c).

Furca (Figure 15d): Each lamella with 8 or 9 claws (USNM 193764 with 9 on right lamella, 8 on left); claws 2 and 4 nonarticulated, remaining claws articulated; claw 3 more slender than claw 4 and about same length; all claws with teeth of similar size along posterior edge (not shown); claw 1 with large distal medial teeth; small spines on lamella following last claw; claw 1 of right lamella anterior to claw 1 of left lamella by width of claw base; anterior edge of right lamella proximal to claws with few spines (not shown).

Bellonci Organ (Figure 15e): Short with rounded process at tip.

Eyes: Lateral eye well developed, with 15 amber-colored ommatidia and brown pigment between ommatidia (Figure 15f). Medial eye smaller than lateral eye, unpigmented, bare (Figure 15e).

Upper Lip (Figure 15g): With 2 unpaired anterior processes, each with broad terminal pore, and 2 paired posterior processes; each of anterior paired processes with bifurcate tip (anterior branch with 1 terminal glandular process; posterior branch with 2 terminal glandular processes); each of posterior paired processes with 4 or 5 glandular processes on posterior edge (1 or 2 proximal, 3 distal) and 1 at tip; posterior paired process longer and narrower than anterior paired process and lateral to it.

Genitalia: Oval sclerotized ring with attached oval spermatopore on each side of body of USNM 193764 (Figure 15d,h).

Anterior of Body (Figure 15g): Small rounded knob just ventral to base of 1st antenna.

Posterior of Body (Figure 15h): Evenly rounded, bare.

Y-Sclerite (Figure 15h): Typical for subfamily.

Pigmentation: None in carapace or appendages. Brown pigment between ommatidia of lateral eye.

Eggs: USNM 193764 with many large unextruded eggs (Figure 13a).

DESCRIPTION OF INSTAR III MALE (Figure 16).—Carapace similar in shape (Figure 16a) to that of adult female; without bristles along anteroventral margin.

Carapace Size: USNM 193767, length 0.83 mm, height 0.49 mm.

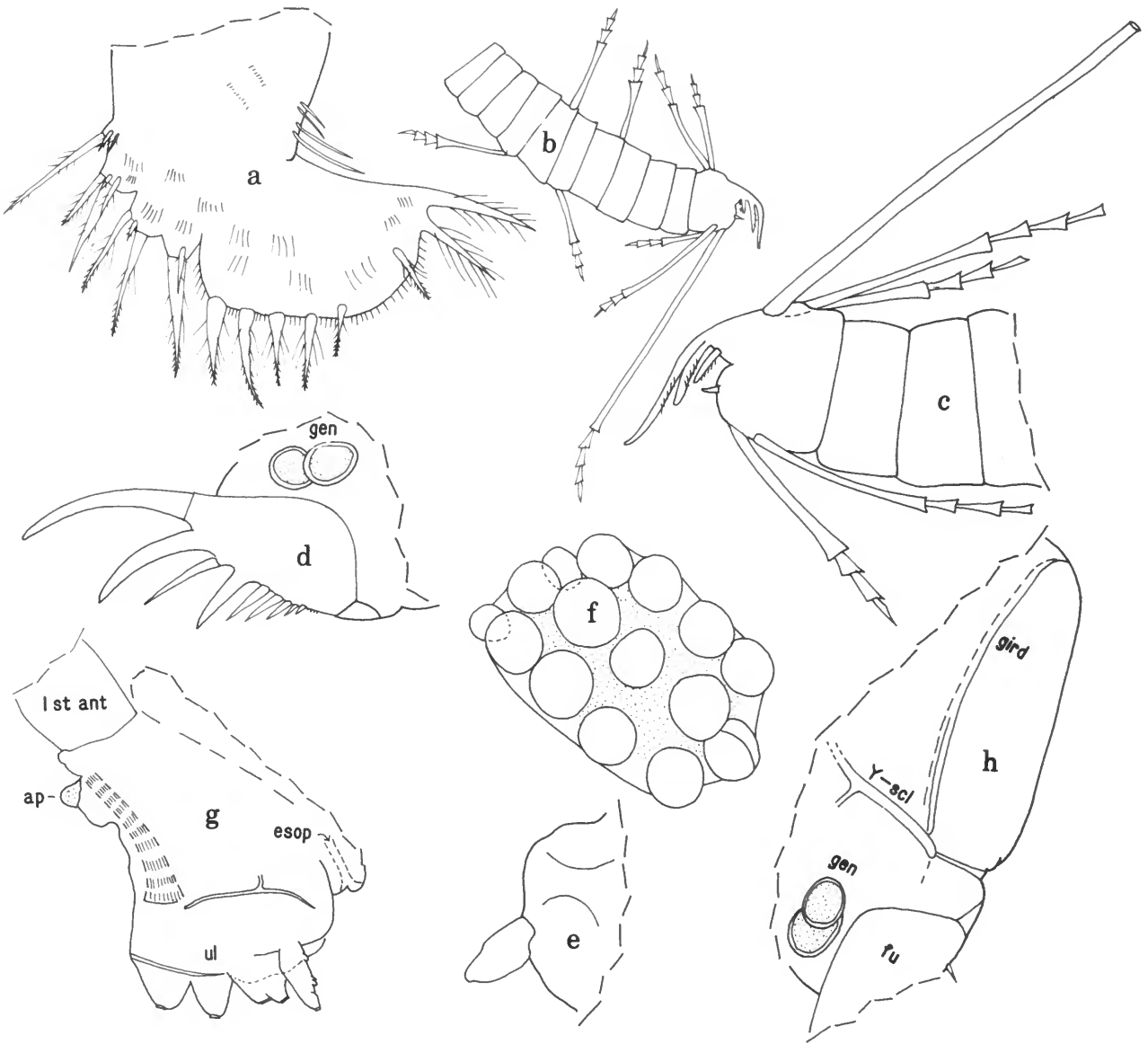


FIGURE 15.—*Cypridina segrex*, new species, adult female, paratype, USNM 193764: a, right 6th limb, mv; b, 7th limb; c, tip of 7th limb opposite that shown in b; d, left furcal lamella and genitalia, lv; e, medial eye and Bellonci organ; f, left lateral eye, lv; g, anterior of body from left side, anterior to left; h, posterior of body, anterior to left.

First Antenna (Figure 16b): 1st joint bare. 2nd joint with medial and ventral spines. 3rd joint with 2 bristles (short dorsal, long ventral); 4th joint with 2 short bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 4 long proximal filaments followed by space and 1 short slender filament (tip of bristle missing on both limbs of USNM 193767). 6th joint with short medial bristle. 7th joint: a-bristle similar to bristle of 6th joint; b-bristle well developed, with short filaments (2 proximal, 1

distal); c-bristle very long with 5 or 6 slender filaments. 8th joint: d- and e-bristles long, bare; f-bristle long, with 4 slender filaments; g-bristle very long, with 5 or more filaments.

Second Antenna: Protopodite similar to that of adult female (Figure 16c). Endopodite 1-jointed with 2 bristles and 1 filament (Figure 16c). Exopodite: bristle of 2nd joint reaching 6th joint, with 6 slender ventral spines; 9th joint with 3 bristles (dorsal bristle about twice length of 9th joint); exopodite

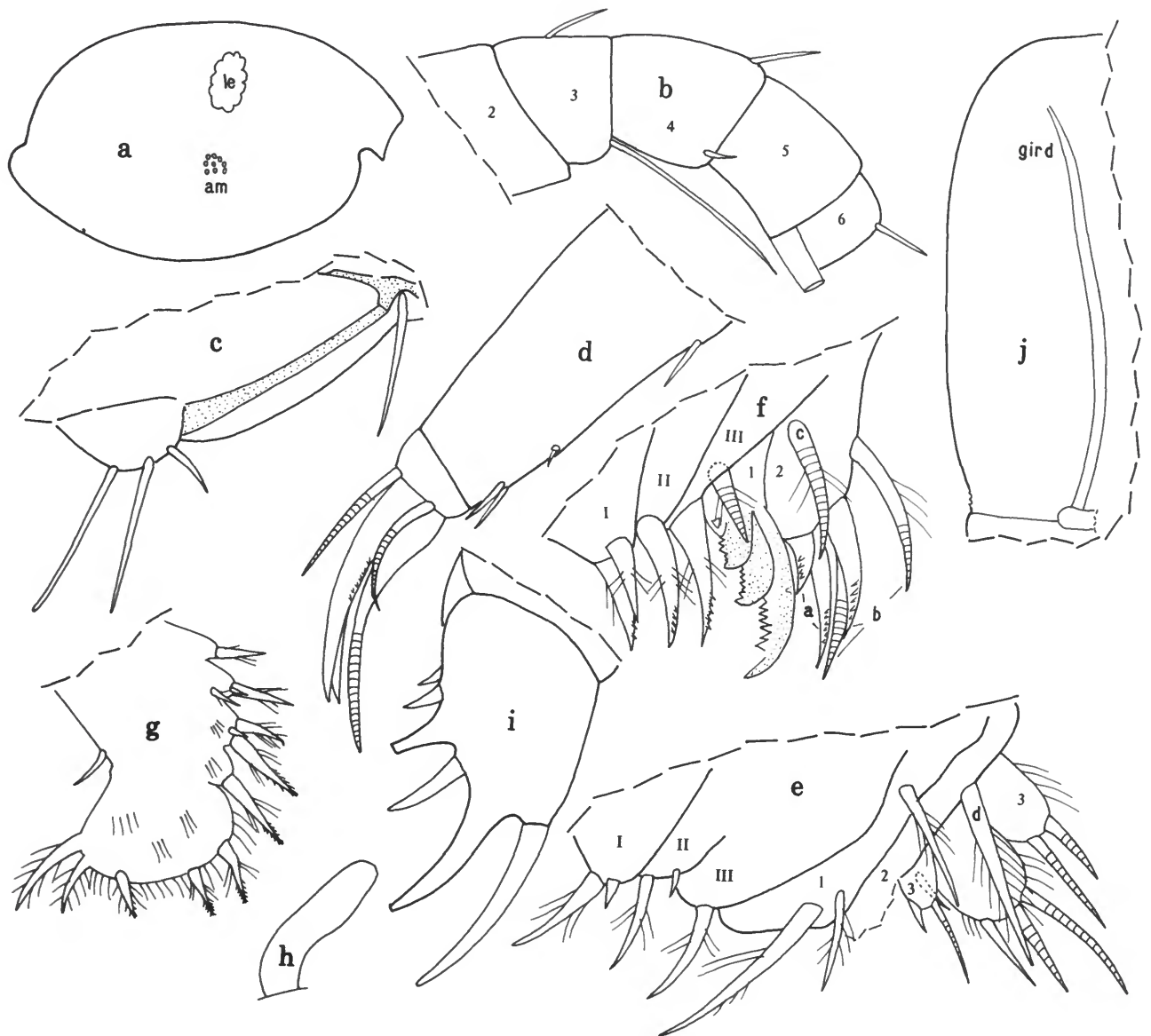


FIGURE 16.—*Cypridina segrex*, new species, instar III male, paratype, USNM 193767: a, complete specimen from right side, length 0.83 mm; b, joints 2–6 of left 1st antenna, mv; c, distal part of protopodite and endopodite of left 2nd antenna, mv; d, tip of right mandible, mv; e, left 5th limb (not all bristles shown), av; f, right 5th limb (not all bristles shown), pv; g, left 6th limb, mv; h, right 7th limb; i, right furcal lamella, lv; j, posterior of body, anterior to right.

otherwise similar to that of adult female.

Mandible (Figure 16d): Coxale endite spinous, similar to that of adult female, with small bristle near base. Basale, exopodite, and 1st endopodial joint similar to those of adult female. 2nd endopodial joint: ventral margin similar to that of adult female except distal of 2 single bristles smaller, indistinct;

dorsal margin with 4 long and 2 short bristles. 3rd endopodial joint similar to that of adult except without small medial ventral bristle; dorsal claw also absent but probably aberrance. (Claws of next instar (IV) visible within claws of 3rd joint (extending about $1/2$ length of claws of instar III) on right limb; all claws of instar III missing on left limb and 3 claws of instar IV

projecting from end of joint.)

Maxilla: Coxale with plumose dorsal bristle. Bristles of 3 endites not counted. Basale with 1 short ventral bristle. Exopodite and 1st endopodial joint similar to those of adult female. 2nd endopodial joint differs from that of adult female in having only 2 b-bristles.

Fifth Limb: Epipodite with about 28 bristles. Protopodial tooth absent. Bristles of 3 endites not counted (not all shown in Figure 16f). 1st exopodial joint: anterior side with 3 bristles similar to those of adult female (Figure 16e); main tooth with proximal bristle, small proximal peg, and 3 pectinate teeth (Figure 16f). 2nd exopodial joint with 2 unringed a-bristles, 3 ringed b-bristles, 1 posterior c-bristle, and 1 anterior d-bristle (Figure 16e, f). 3rd–5th exopodial joints with same number of bristles as on adult female (Figure 16e). (Main tooth of instar IV with 4 pectinate teeth visible inside of main tooth of USNM 193767; proximal tooth being added.)

Sixth Limb (Figure 16g): With 1 epipodial bristle. Endite I with 1 terminal bristle; endite II with 2 small medial bristles and 1 long terminal bristle; endite III with 2 stout terminal bristles and 1 small medial bristle between them; endite IV with 1 long terminal bristle. End joint with 5 bristles (2 spinous bristles followed by space and 1 spinous bristle (with base medially some distance from edge), then 2 plumose bristles. Limb with spines and hairs similar to those of adult female.

Seventh Limb (Figure 16h): Elongate, fairly short, bare, segmentation poorly developed. Limb observed only on right side of USNM 193767.

Furca (Figure 16i): Each lamella with 6 claws; claws 2 and 4 nonarticulated; claw 3 narrower than claw 4.

Bellonci Organ: Fragmented.

Eyes: Medial eye unpigmented. Lateral eye with 13 amber-colored ommatidia (all large), without pigment between ommatidia (outline of eye shown in Figure 16a).

Upper Lip: Similar to that of adult female.

Genitalia: Absent.

Anterior of Body: Similar to that of adult female.

Posterior of Body (Figure 16j): With spines forming row on posterodorsal corner.

Y-Sclerite: Similar to that of adult female.

Pigmentation: Ommatidia of lateral eye amber color.

Remarks: Appendages of instar IV visible within appendages of USNM 193767.

DESCRIPTION OF INSTAR IV FEMALE (Figure 17).—Carapace similar in shape to that of adult (Figure 17a); without bristles along anteroventral margin.

Infold: Rostral infold with 17 bristles and 2 additional bristles at inner end of incisur (Figure 17b). Right valve: list of caudal process and posterior end of ventral list with 16 stout spines forming continuous row along posterior edge of list; many minute spines on caudal process between list and posterior edge of process. Left valve: list of caudal process and posterior end of ventral list with continuous row of spines smaller than those of right valve; many minute spines between

list and posterior edge of caudal process.

Carapace Length: USNM 193766, length 0.94 mm, height 0.55 mm. Specimen from sta 106-R, length 0.96 mm, height 0.54 mm.

First Antenna: Distribution of bristles similar to those of adult female, but filaments on bristles not counted; b-bristle without filaments (female character).

Second Antenna: Protopodite similar to those of adult female. Endopodite 1-jointed with 3 bristles and 1 filament (Figure 17d). Exopodite: bristle of 2nd joint just reaching 7th joint, with 9 ventral spines (some stouter than others); exopodite otherwise similar to that of adult female.

Mandible: Similar to that of adult female.

Maxilla (Figure 17e): Endite bristles not counted. Coxale, basale, endopodite, and exopodite similar to those of adult female.

Fifth Limb (Figure 17f,g): Epipodite with 27 bristles (not shown). Bristles of 3 endites not counted (not all shown in Figure 17f). 1st exopodial joint: main tooth with proximal peg (with 2 terminal spines) and 4 pectinate teeth; 1 spinous bristle proximal to peg; 3 anterior bristles as on adult female (not shown). 2nd exopodial joint with 3 unringed a-bristles (proximal bristle small, peg-like), 3 ringed b-bristles, 1 posterior ringed c-bristle, and 1 anterior d-bristle (rings not shown on all bristles). Exopodial joints 3–5 similar to those of adult female.

Sixth Limb (Figure 17h): With 2 epipodial bristles. Endite I with 1 or 2 bristles (1 long terminal, 0 or 1 small medial); endite II with 2 short medial bristles and 2 terminal bristles (1 short, 1 long); endite III with 2 long terminal bristles and 1 short bristle between them; endite IV with 2 terminal bristles (1 long, 1 short). End joint with 4 spinous bristles followed by space, then 1 short spinous bristle (with base on medial side) and 2 plumose bristles with bases on edge; stout lateral spines along anterior edge and anterior part of ventral edge.

Seventh Limb (Figure 17i–k): Each limb elongate with 2 terminal bare diaphanous bristles, and small indistinct process at tip. Limbs missing on specimen from sta 106-R.

Furca: Each lamella with 7 claws; claws 2 and 4 nonarticulated; claw 3 narrower than claw 4 and about same length.

Bellonci Organ (Figure 17c): Small, elongate.

Eyes: Medial eye unpigmented, smaller than lateral eye (Figure 17c). Lateral eye with 13 large and 2 small amber-colored ommatidia, and lighter amber color between ommatidia (Figure 17a,c).

Upper Lip: Similar to that of adult female.

Genitalia: Absent.

Anterior of Body (Figure 17c): With rounded anterior process ventral to base of 1st antenna.

Posterior of Body: With spines forming row on posterodorsal corner.

Y-Sclerite: Similar to that of adult female.

Pigmentation: Lateral eye with amber-colored ommatidia;

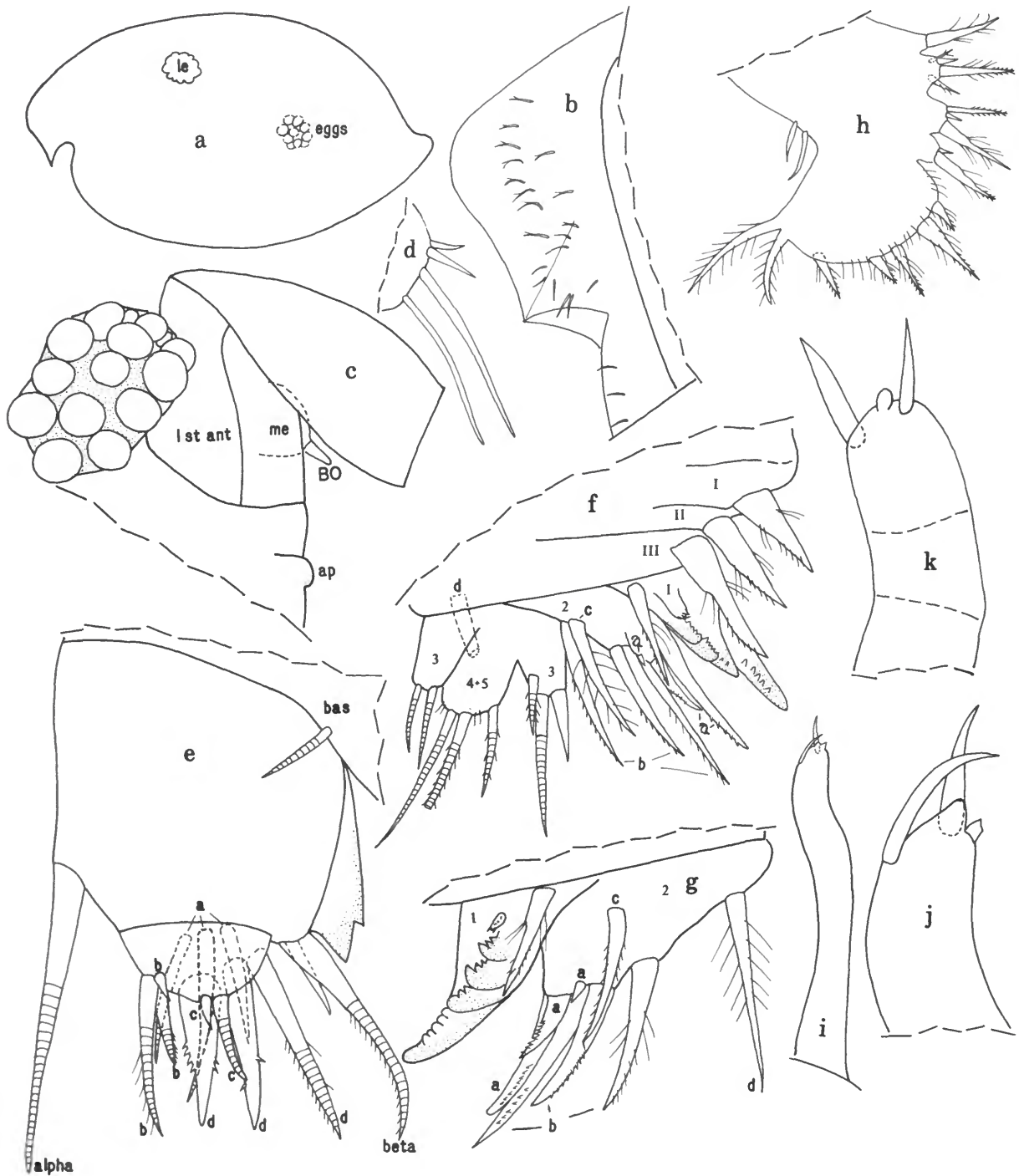


FIGURE 17.—*Cypridina segrex*, new species, instar IV female, paratype, USNM 193766: *a*, complete specimen from left side (eggs shown are unextruded and within left side of body), length 0.94 mm; *b*, anterior end of right valve, iv; *c*, anterodorsal part of body from right side, anterior to right; *d*, endopodite of left 2nd antenna, mv; *e*, endopodite and part of basale of right maxilla, mv; *f*, left 5th limb (not all endite bristles shown), pv; *g*, exopodial joints 1 and 2 of right 5th limb, pv; *h*, right 6th limb, lv; *i*, 7th limb; *j*, detail of tip of 7th limb shown in *i*; *k*, tip of 7th limb opposite that shown in *i*.

lighter amber color between ommatidia.

Eggs (Figure 17a): USNM 193766 and specimen from sta 106-R with 2 rosettes of small eggs (1 rosette on each side of body).

Remarks: The appendages of USNM 193766 have the appendages of instar V visible within them. It is evident by examination of the main tooth of the 5th limb that the small proximal 5th tooth of instar V is added in the proximal location. The presence of eggs within the body of the 4th instar (A-2) of *Cypridina* has been noted previously by Kornicker (1991:49) for *C. spina* Kornicker, 1991. This has not been reported in other genera of Myodocopa. The presence of eggs in a juvenile has been considered previously as an indication that the specimen is in the A-1 stage (for example, Kornicker, 1991:33); it is now apparent that additional criteria should be used.

DESCRIPTION OF INSTAR IV MALE (Figure 18a-c).—Carapace similar in shape to that of adult female; without bristles along anteroventral edge.

Carapace Size: Specimen from sta 117-S, length 1.05 mm, height 0.63 mm.

First Antenna: Similar to that of adult female but filaments of bristles not counted. b-bristle of 7th joint with small filaments.

Second Antenna, Mandible, Maxilla, Fifth and Sixth Limbs: Similar to those of instar IV female.

Seventh Limb: Missing from specimen (see "Remarks" below).

Furca (Figure 18a): Similar to that of instar IV female.

Bellonci Organ: Not observed.

Eyes: Medial eye not observed. Lateral eye similar to that of instar IV female.

Upper Lip: Similar to that of adult female.

Genitalia: Absent.

Anterior and Posterior of Body (Figure 18b): Similar to instar IV female.

Y-Sclerite: Left side normal (Figure 18b); right side aberrant in having additional small distal ventral branch (Figure 18c).

Pigmentation: Ommatidia of lateral eyes amber color.

Gut Content: Gut of specimen from sta 117-S with crustacean fragments.

Remarks: The body and appendages of the specimen from sta 117-S are without internal muscles suggesting that it might have been dead when captured. The presence of a gut filled with crustacean fragments mitigates against the specimen being a molted exuvium. The poor condition of the specimen may account for the absence of 7th limbs.

DESCRIPTION OF INSTAR V MALE (Figure 18d-h).—Carapace similar in shape to that of adult female; without bristles along anteroventral margin.

Infold (USNM 193765): Rostral infold with 12 bristles; inner end of incisur with 2 bristles and 1 small bristle posterior to them. Anteroventral infold with 2 bristles anterior to list and

3 bristles along list; ventral infold with 8 bristles along list; ventral infold of left valve anterior to caudal process with 1 bristle between list and valve edge; infold of caudal process of left valve with small spines along posterior edge of broad list and minute spines between list and posterior edge of process; caudal process of right valve obscured (right valve of holotype with stout spines along posterior edge of broad list of caudal process).

Carapace Size: USNM 193765, left valve, length 1.33 mm, height ~0.79 mm. MNHN Os 426, holotype, length 1.43 mm, height 0.77 mm.

First Antenna: Distribution of bristles similar to those of adult female. b-bristle with 3 proximal small filaments (male character); filaments of other bristles not counted.

Second Antenna: Protopodite similar to that of adult female. Endopodite 1-jointed with 4 bristles (2 small followed by 1 bristle about twice length of small bristles, then 1 bristle about 4 times length of small bristles) and 1 filament about $\frac{3}{4}$ length of longest bristle (Figure 18d). Exopodite: bristle of 2nd joint reaching 9th joint, with 11 or 12 ventral spines; exopodite otherwise similar to that of adult female.

Mandible: Similar distribution of bristles as that of adult female on basale, 1st and 3rd exopodial joints, and ventral margin of 2nd exopodial joint. Dorsal margin of 2nd exopodial joint with 7 bristles (3 long, 4 medium or short).

Maxilla: Limb similar to that of adult female.

Fifth Limb: Epipodite with 31 bristles. Protopodite without anterior tooth. Bristles of 3 endites not counted but appearing similar to those of adult female. 1st exopodial joint (Figure 18e): main tooth with small spined proximal peg and 5 pectinate teeth; bristle (with long proximal hairs and short distal spines) proximal to peg; anterior side with 3 bristles similar to those of adult female; 2nd–5th exopodial joints with same number of bristles as adult female.

Sixth Limb: With 2 epipodial bristles. Endite I with 2 small medial bristles and 1 long terminal bristle; endite II with 1 or 2 small medial bristles and 2 longer terminal bristles; endite III with 2 long terminal bristles and 1 small bristle between them; endite IV with 1 short medial subterminal bristle and 1 long terminal bristle. End joint with 6 bristles (3 spinous bristles followed by space, then 1 spinous bristle (with base medial and a slight distance from edge) followed by 2 plumose bristles with bases on edge). Medial surfaces of endites II–IV and end joint hirsute; long lateral spines along anterior edge and ventral edge of anterior half of end joint.

Seventh Limb (Figure 18f): 1 limb missing from USNM 193765. Other limb with 2 bare diaphanous proximal bristles, each with adult bristle (with 3 bells) inside (dashed) and 6 terminal diaphanous bristles (3 on each side: 2 bare, 1 with distal bell), each with adult bristle (with 3 or 4 bells) inside (dashed). Terminal joint long with comb with 2 teeth opposite single indistinct peg.

Furca (Figure 18g,h): Each lamella with 7 or 8 claws (USNM 193765 with 8 on left lamella, 7 on right); claws 2 and



FIGURE 18.—*Cypridina segrex*, new species, paratypes: instar IV male, unnumbered specimen from sta 117-S: *a*, right furcal lamella, lv; *b*, posterior of body from left side, anterior to left; *c*, right Y-sclerite, anterior to right. Instar V male, USNM 193765: *d*, endopodite of right 2nd antenna, mv; *e*, endites and exopodal joints 1 and 2 of left 5th limb (not all endite bristles shown), pv; *f*, 7th limb showing adult bristles within (dashed) and detail of tip; *g*, left furcal lamella and left copulatory organ, lv; *h*, furcal claws 1-5 of right lamella showing adult claws within (striated), lv.

4 nonarticulated; claw 3 narrower but about same length as claw 4; small spines along lamella following last claw.

Bellonci Organ: Obscured on USNM 193765.

Eyes: Medial eye with dark brown pigment. Lateral eye well developed, with black pigment between amber-colored ommatidia.

Upper Lip, Anterior of Body, Y-Sclerite: Similar to those of adult female.

Genitalia (Figure 18g): Well-developed lobe on each side of body anterior to furca.

Posterior of Body: With spines forming row on postero-dorsal corner.

Pigmentation: Medial eye with dark brown pigment; lateral eye with black pigment between ommatidia.

Remarks: The appendages of the adult are visible within the appendages of USNM 193765 (instar V male). By examining the internal claws of the furca, which unlike the external claws are not worn, it is evident that claws 1 and 2 have oblique tips whereas the remaining claws have symmetrical tips (Figure 18h). On the 1st antenna the large suckers of the adult are visible within the b- and c-bristles.

COMPARISONS.—*Cypridina segrex* is easily distinguished from *C. nex* described herein by the absence of bristles along the anteroventral shell margin. The infold of the rostrum of the adult female *C. segrex* bears over 30 bristles, which is many more than on other species for which the number is known. The shell of *C. spinula* Kornicker, 1991, is also without anteroventral bristles, but that species has much stouter spines on the infold of the caudal process between the list and posterior edge, as well as having about half the number of bristles on the rostral infold. The 7th limb of *C. segrex* differs from that of *C. serrata* var. *affirmans* Skogsberg, 1920, in having 4 rather than 2 bristles in the proximal group.

ONTOGENY AND SEXUAL DIMORPHISM.—*Cypridina segrex* is represented in the collection by juvenile instars III, IV, V, and the adult female (discussion below includes only those stages). The b-bristle of juveniles of *Cypridina* are with marginal filaments only on the male (Poulsen, 1962:255), and this character was used to identify sex of juveniles herein. The shape of the carapace of juveniles of *C. segrex* is similar to that of the adult female, and all have stout spines along the posterior edge of the list of the caudal process of the right valve, and smaller spines on the list of the left valve. A specific character of the species is the large number (36) of bristles on the rostral infold; only 17 bristles are present on an instar IV female and 12 on an instar V male, indicating that the specific character may not be useful in identifying juveniles.

First Antenna: The distribution of bristles on juvenile instars III–V is similar to that of the adult, but on instar III the ventral bristle of the 4th joint is much shorter. The number of long proximal filaments on the sensory bristle of the 5th joint increases from 4 on the instar III male to 6 or 7 on the adult female.

Second Antenna: Protopodite of juveniles similar to that of

adult. Endopodite of instar III with 2 bristles and 1 filament; the number of bristles increases by 1 on each succeeding stage (3 bristles and 1 filament on instar IV, 4 bristles and 1 filament on instar V, 5 bristles and 1 filament on the adult female). Exopodite with same number of bristles on juveniles and adult; the number of ventral spines on the bristle of the 2nd joint increases from 6 on instar III to 9 on instar IV, and 11 or 12 on instar V and adult.

Mandible: The coxale, basale, and 1st endopodial joint are similar in juveniles and adult female. The distal of the single ventral bristles on the ventral margin of the 2nd endopodial joint is minute and indistinct on instar III, and well developed on later stages. The number of dorsal bristles on the 2nd endopodial joint increases from 6 bristles on instar III to 11 bristles on the adult. The 3rd endopodial joint of instar III is lacking 1 of the 3 ventral bristles present on later stages.

Maxilla: Basale of instar III with only 1 bristle, later instars with 2. 2nd endopodial joint of instar III with 2 b-bristles, later instars with 3.

Fifth Limb: 1st exopodial joint: main tooth with 3 pectinate teeth on instar III, 4 on instar IV, 5 on instar V, and 6 on adult; otherwise, joint similar on all stages. 2nd exopodial joint: instar III with 2 a-bristles, later instars with 3; joint otherwise similar on all stages.

Sixth Limb: All stages with many bristles. Instar III with 1 epipodial bristle, instars IV and V with 2, adult female with 4.

Seventh Limb: Limb of instars III and IV weakly developed with joints unformed. Limb of instar III male without bristles, instar IV female with 2 terminal bare diaphanous bristles, instar V male with 2 bare diaphanous proximal bristles and 6 terminal diaphanous bristles (4 bare, 2 with 1 bell), adult female with 4 proximal bristles, each with 3 bells, and 5 terminal bristles, each with 3 or 4 bells.

Furca: Claws 2 and 4 nonarticulated and claw 3 narrower than claw 4 on all instars. Instar III with 6 claws, instar IV with 7, instar V with 7 or 8, adult female with 8 or 9.

Bellonci Organ: Not examined on instars III and V, but similar type on others.

Eyes: Lateral eye: instar III with 13 large ommatidia, later instars with 15 (13 large, 2 small); pigmentation varies. Medial eye similar on all instars except some with darker pigmentation.

Upper Lip, Anterior of Body, Y-Sclerite: Similar in all stages.

Genitalia: The male copulatory organ is well defined on instar V and adult. The female genitalia is well defined only on adult.

Posterior of Body: Posterodorsal corner of body of instars III–V with row of spines not present on adult.

Codonocera Brady, 1902

TYPE SPECIES.—*Codonocera cruenta* Brady, 1902:188, pl. XXII, figs. 1–10, by monotypy.

DISTRIBUTION.—Indo-Pacific and Australasian waters (McKenzie, 1967:221). The southernmost localities from

which the genus has been recorded is 34°04'S and Three Kings Island, both north of North Island, New Zealand (Barney, 1921:175), and the northernmost is 34°10'N, south of Korea (Poulsen, 1962:324). It ranges from the western Indian Ocean (44°59'18"E, near Mayotte (herein)), to the western Pacific (178°21'E, Fiji Islands (Poulsen, 1962:328)). The genus has not been reported previously from the western Indian Ocean.

COMPOSITION.—Poulsen (1962:311) divided the genus into 2 informal groups: the *goniacantha* group and the *cruenta* group. The new species described herein is in the former group.

LETTERING OF BRISTLES.—In general, I have followed Poulsen (1965:314) in identifying the a-, b-, c-, and d-bristles of

the mandibular basal, but they could be interpreted differently; for example, the ventral a-bristle may be equivalent to the b-bristle of some other genera of Cypridinidae. Lettering of bristles of the maxilla follow that used by Poulsen (1965:315).

DIAGNOSIS OF THE *goniacantha* GROUP.—Mandible with total of 5 claws and bristles on end joint; maxilla: exopodite with 3 plumose bristles; 1st endopodial joint with 1 beta-bristle; 2nd endopodial joint with 0 or 1 of the 3 a-bristles with spines and with total of 3 b- and c-bristles. 5th limb: 2nd exopodial joint with 3 a-bristles, and with total of 4 b'- and b''-bristles; outer lobe of 3rd exopodial joint with both bristles short and about the same length.

Key to Species of *Codonocera* in the *goniacantha* Group

1. 1st antenna with ventral spine on 1st joint *C. suensoni**
- 1st antenna without ventral spine on 1st joint 2
2. 5th limb with 4 constituent teeth in main tooth of 1st exopodial joint
- *C. phoenix*, new species
- 5th limb with 5 constituent teeth in main tooth of 1st exopodial joint 3
3. Mandible, longest claw 40%–45% length of 2nd joint *C. polygonia*
- Mandible, longest claw 55%–60% length of 2nd joint *C. goniacantha*

**C. pusilla* Müller, 1906, and *C. penicillum* Müller, 1906, also fall here. They are insufficiently known to tell if they belong in the *goniacantha* or *cruenta* groups.

Codonocera phoenix, new species

FIGURES 19–29

ETYMOLOGY.—From the Latin *phoenix* (purple-red) in reference to color of pigment in the shell and appendages.

HOLOTYPE.—MNHN Os 432, adult female in alcohol.

TYPE LOCALITY.—Sta 8-DR, 19 Mar 1977, W Glorioso Islands, 11°29'12"S, 47°18'12"E, depth 250 m.

PARATYPES.—Sta 8-DR: USNM 193704, adult female in alcohol; USNM 193705, adult female on 2 slides and in alcohol; USNM 193706, adult male on 2 slides and in alcohol; USNM 193707, USNM 193708, 2 adult females in alcohol; Paris, 2 adult females in alcohol. Sta 65-S: USNM 193760, 1 instar IV female on slide and in alcohol. Sta 72-DS: Paris, 2 adult females in alcohol; USNM 193762, 1 instar V female on slide and in alcohol. Sta 106-R: USNM 193758, 1 instar I on slide and in alcohol; Paris, 4 instar I in alcohol. Sta 117-S: USNM 193761, 1 instar III female in alcohol. Sta 124-S, USNM 193763, 1 instar V male on slide and in alcohol.

DISTRIBUTION.—Sta 8-DR, W Glorioso Islands, depth 250 m. Sta 65-S, M'Sanga Tsohole Reef, depth 38 m. Sta 72-DS, NNE north reef, Mayotte, depth 300–350 m. Sta 106-R, Zelee Bank, south border, depth 18–24 m. Sta 117-S, Geyser Bank, southern part of lagoon, depth 3–8 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 3–350 m. Members of *Codonocera* have been collected previously in plankton nets and are known to be pelagic; some

specimens of *C. phoenix* are from bottom sediments collected by divers indicating that members of the species live on the bottom at least part of the time.

DESCRIPTION OF ADULT MALE (Figures 19–21).—Carapace elongate with straight dorsal margin and broadly convex ventral margin; anterior of carapace broadly rounded dorsal to incisur except for slight concavity immediately above tip of rostrum (Figure 19a). Incisur short with broadly rounded posterior end; caudal process short with rounded posterior margin in lateral view; dorsal margin of caudal process forming obtuse angle with posterior edge of shell dorsal to process; anterior end of dorsal margin of left valve forming fairly sharp corner; posterodorsal corner of each valve narrowly rounded in lateral view. Anterior margin below incisur without medial grooves perpendicular to valve edge.

Surface Ornamentation: Narrow ridge along dorsal edge of incisur continuing ventrally and anteriorly and intersecting anterior edge of valve just ventral to incisur (Figure 19a). Surface of valves with abundant crescent-shape ridges (not shown); convex posterior edge of ridges minutely cusped. Long hairs forming vertical row near posterior end of each valve and extending along posterior part of dorsal margin; shorter hairs sparsely distributed over valve surface (not shown).

Shell Pigmentation (Figure 19a): About 70 purple chromatophores beneath shell of each valve, including about 12 forming row between shell and ventral infold.

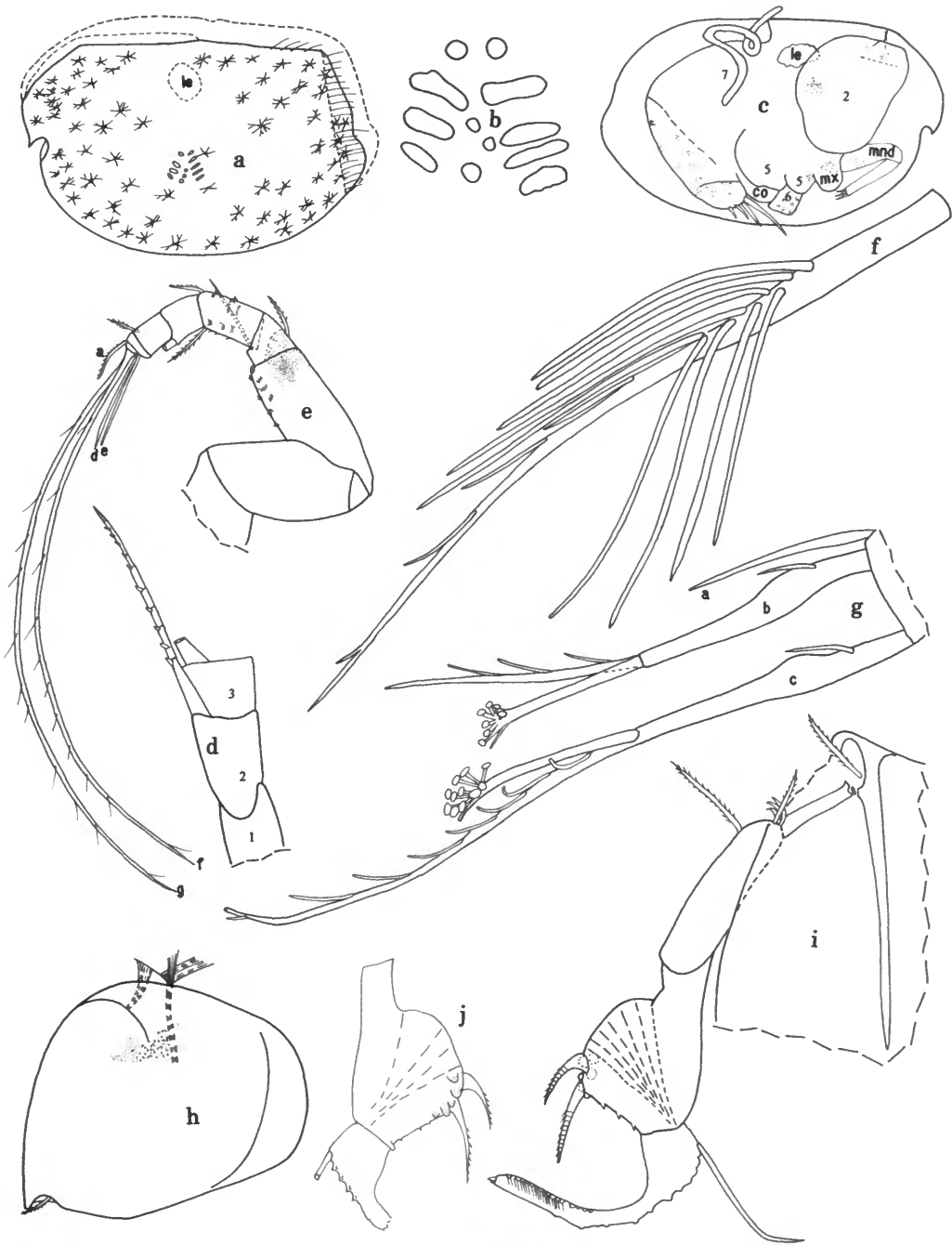


FIGURE 19.—*Codonocera phoenix*, new species, adult male, paratype, USNM 193706: *a*, complete specimen from left side (outline of right valve dashed), length 2.09 mm; *b*, central adductor muscles projecting from left side of body when left valve removed, anterior to left; *c*, body inside left valve showing location of some limbs (areas of purple pigment stippled; 2 stippled areas labeled with a "1" are on right 1st antenna); *d*, joints 1-3 of exopodite of right 2nd antenna, lv; *e*, left 1st antenna (areas with purple pigment stippled; b- and c-bristles of 7th joint not shown), lv; *f*, sensory bristle of right 1st antenna, mv; *g*, bristles of 7th joint of right 1st antenna, mv; *h*, right 2nd antenna (areas with purple pigment stippled), mv; *i*, protopodite and endopodite of right 2nd antenna, mv; *j*, part of endopodite of right 2nd antenna, lv.

Infold: Rostral infold with 12 long bristles (some divided) forming row parallel to valve edge and 1 long bristle posterior to row; 1 small bristle in posterior part of rostral infold near incisur; 2 small bristles at inner end of incisur, and 2 unequal bristles on dorsal edge of incisur. Anteroventral infold with 1 short bristle near inner margin of infold close to incisur, then 22 divided bristles forming row almost extending to midlength of ventral margin. List along ventral margin broadening near caudal process forming triangular flap just anterior to caudal process; flap bearing short bristles along edge and with pores present on ventral half. Crenulate list present at midwidth of ventral infold of left valve posterior to end of row of closely spaced anteroventral bristles; anteroventral infold of both valves and ventral infold of right valve without visible list.

Selvae: Lamella prolongation (with smooth outer edge) broadest in vicinity of incisur; selvae divided into dorsal and ventral segments at incisur; lamellar prolongation present along ventral edge of caudal process but not observed along posterior edge; indistinct narrow diaphanous prolongation (with smooth outer edge) present along posterior edge of the triangular flap at anterior edge of infold of caudal process.

Central Adductor Muscle Attachments (Figure 19a,b): Consisting of 2 vertical rows of elongate attachments (3 in anterior row, 4 in posterior row); 3 round attachments forming vertical row between rows of elongate attachments, and 2 round attachments dorsal to others.

Carapace Size: USNM 193706, length 2.09 mm, height 1.27 mm.

First Antenna (Figure 19e-g): 1st joint bare. 2nd joint with abundant spines forming rows on lateral and medial surfaces and along ventral margin. 3rd joint short, with 2 bristles bearing short marginal spines (dorsal bristle close to 2nd joint, longer ventral bristle terminal). 4th joint with spines forming rows on lateral surface and along ventral and dorsal margins, with 2 terminal bristles with short marginal spines. Sensory bristle of 5th joint with 9 long filaments on proximal broad part followed by 4 short filaments on distal narrow part (Figure 19f). Medial bristle of 6th joint near dorsal margin, with few indistinct short spines. 7th joint (Figure 19g): a-bristle stouter and slightly longer than bristle of 6th joint, with ventral spines; b-bristle almost 3 times length of a-bristle, with short bare filament proximal to bulbous part of bristle, then a long filament terminating in bouquet comprising about 7 suckers plus short stem without sucker; 3 short filaments on stem of b-bristle distal to filament with bouquet; c-bristle almost twice length of b-bristle, with short bare filament proximal to bulbous part of bristle, then a long stout filament terminating in bouquet comprising 11 suckers plus short stem without sucker; 8 slender filaments present on stem distal to filament with bouquet. 8th joint: d- and e-bristles about same length as b-bristle, bare with rounded tips each bearing minute papilla; f- and g-bristles about 5 times length of b-bristle, each with about 11 filaments, some with minute and widely separated marginal spines (Figure 19e (spines not shown)). Pigmentation: dense purple spot near distal edge of 2nd joint and scattered

purple granules extending into proximal part of 3rd joint (Figure 19e).

Second Antenna: Medial bristle of protopodite with short marginal spines (Figure 19h). Endopodite 3-jointed (Figure 19i,j): 1st joint cylindrical with 4 proximal bristles (1 long spinous and 3 short bare) and 1 long distal bristle with short marginal spines; 2nd joint broadening distally, with 2 pectinate marginal bristles, 5 small rounded teeth lateral to bristles, followed by 3 minute marginal nodes; 3rd joint: outer edge with proximal bristle, rounded corner, and about 12 nodes along edge (proximal 7 nodes more closely spaced, larger, and each with minute adjacent node on medial side; distal 5 nodes merely indicated by slight undulation in margin); inner edge of joint with about 17 distal serrations each with minute spines along edge (spines not shown); tip of joint with 2 small pointed teeth. Exopodite: bristle of 2nd joint reaching just past 9th joint, with 9 or 10 teeth on ventral margin (last 3 teeth smaller and more closely spaced); bristle with few sutures in toothed part and with slender tip (with many narrow sutures) distal to last tooth (Figure 19d); dorsal margin of bristle bare; bristles of joints 3-8 with natatory hairs, no spines; 1st joint with few minute spines forming rows on dorsal concave margin; joints 5 or 6 to 8 each with small basal spines with digitate tips; 9th joint with 1 short and 3 long bristles, all with natatory hairs; lateral spine of 9th joint obscured on specimen examined. Pigmentation: dense purple spot proximally on protopodite (Figure 19c,h).

Mandible (Figures 19c, 20a,b): Coxale endite stout, with abundant slender spines and tip bearing 1 or 2 stout spines (Figure 20a); small bristle near base of endite not observed. Basale with 3 slender ringed a-bristles adjacent to broad unringed spine, 1 small b-bristle just proximal to proximal c-bristle, 2 c-bristles (proximal longest and with widely separated short marginal spines, shortest with closely spaced short marginal spines), and 1 long d-bristle with proximal wreaths of long spines and short spines near tip; dorsal margin of basale with bristle (with few short marginal spines) distal to midlength and reaching past 1st endopodial joint, and 2 subterminal bristles with short marginal spines (medial bristle about $\frac{3}{4}$ length of lateral); medial surface of basale with few spines forming rows (Figure 20a). Exopodite about $\frac{4}{5}$ dorsal margin of 1st endopodial joint, hirsute along margin and pointed tip, with 2 subterminal bristles, both with marginal spines (distal bristle about $\frac{3}{4}$ length of proximal, stouter and with longer spines). 1st endopodial joint with 4 ventral bristles (1 minute, 1 slightly longer than dorsal margin of joint, 2 long, all with short marginal spines). 2nd endopodial joint (Figure 20b): medial surface, ventral and dorsal margins spinous; ventral margin with 3 slender bristles forming groups of 1 and 2 pointed bristles, all about same width and length and with short marginal spines; dorsal margin of joint with 35 bristles (15 bristles short, medium, or long, ringed, and with short marginal spines (including 1 long bristle at midlength with base on lateral side, others with bases along edge of joint); 13 short diaphanous pointed unringed bristles (each with indistinct



FIGURE 20.—*Codonocera phoenix*, new species, adult male, paratype, USNM 193706: *a*, proximal part of left mandible (areas of purple pigment stippled), mv; *b*, tip of left mandible and detail showing articulation of medial ventral claw, mv; *c*, part of left maxilla (areas of purple pigment stippled; endopodial bristles not shown), lv; *d*, endites I-III of right maxilla, mv; *e*, bristles of 2nd endopodial joint of left maxilla, mv; *f*, tip of exopodite of right maxilla; *g*, part of basale and endopodial joints of left maxilla (bristles of 2nd endopodial joint not shown), mv; *h*, left 5th limb (areas of purple pigment stippled; not all endite bristles shown), pv; *i*, endite III (not all bristles shown) and 1st exopodial joint (not all teeth or bristles shown) of right 5th limb, av; *j*, endites I-III (not all bristles shown) of left 5th limb, pv; *k*, right lateral eye (area of black pigment stippled), medial eye (area of brown pigment stippled), and Bellonci organ.

marginal hairs and long spine-like tip) forming oblique rows, each row with 1 to 3 bristles with bases on medial side; and 7 short unringed bristles (with long stout distal marginal spines) forming oblique rows of 2 or 3 bristles with bases lateral to bases of diaphanous bristles and medial to bases of ringed bristles). 3rd endopodial joint with 4 claws (shortest of 2 dorsal claws lateral, bare or with 2-4 proximal ventral spines (spines obscured on mounted specimen), and about 33% of longest ventral claw; medial of 2 dorsal claws bare, about 57% of longest ventral claw; 2 ventral claws (1 lateral, 1 medial), both longer than dorsal claws, with about 8 proximal ventral spines (distal spine longest); lateral of ventral claws longest, 42% length of 2nd endopodial joint (approximate length of claw determined by measuring length of straight line connecting ends of arc formed by curved claw; length of 2nd joint measured along joint midwidth); medial ventral claw almost as long as lateral ventral claw and 1 ringed medial bristle slightly longer than shortest claw, with short spines along ventral margin (Figure 20b). Bases of both ventral claws of 3rd joint with small recess at dorsal end fitting over small half-round process on distal edge of joint (detail in Figure 20b). Pigmentation: dense purple spot on coxale near endite with granules extending into base of endite, and another on basale near c- and d-bristles (Figure 20a).

Maxilla: Protopodite with fringe of dorsal hairs. Coxale with hirsute dorsal bristle (Figure 20c). Endite I with 6 spinous and pectinate bristles (Figure 20c,d); endite II with 5 spinous and pectinate bristles; endite III with 6 spinous and pectinate terminal bristles and 1 proximal bristle near base of endite. Basale with long stout hirsute ventral bristle. Exopodite with 3 stout hirsute bristles (Figure 20f). 1st endopodial joint hirsute, with narrow cutting tooth and small sclerotized node lateral to base of beta-bristle, 2 ringed alpha-bristles (with short widely separated marginal spines), and 1 stout pectinate beta-bristle (Figure 29g). 2nd endopodial joint with 3 ringed bare a-bristles, 1 b-bristle with single spine, 2 spinous c-bristles, and 3 stout pectinate d-bristles (Figure 20e). Pigmentation: dense purple spot proximally on endite I and purple granules extending distally into endites II and III (Figure 20c).

Fifth Limb: Protopodite with very low rounded tooth (Figure 20i). Endite I and endite II each with about 6 bristles; endite III with about 8 bristles (not all shown in Figure 20h-j). 1st exopodial joint: anterior side with 3 bristles (outer bristle near protopodial tooth, with indistinct short marginal hairs (Figure 20i); inner paired bristles comprising 1 long stout bristle with few proximal spines on inner side and distal rounded teeth on outer side, and 1 slender bristle about 1/3 length of stout bristle, with long proximal hairs and short distal spines); main tooth comprising minute bare peg and 4 constituent teeth (proximal tooth with 6 or 7 marginal cusps; distal tooth large with 4 or 5 small marginal cusps; remaining teeth with 6-8 marginal cusps); spines not observed on small ringed bristle proximal to peg (on specimen examined the bases of bristle and peg are beneath distal edge of endite III) (Figure

20h). 2nd exopodial joint with 3 stout pectinate unringed a-bristles (longest of these with 6 or 7 marginal cusps), 4 pectinate ringed b'- and b"-bristles (longest bristle with 20 pointed marginal cusps; shortest bristle with long proximal hairs), 1 short ringed posterior c-bristle with long proximal and short distal hairs, and 1 long anterior d-bristle with long proximal and short distal hairs (d-bristle not observed on right limb of USNM 193706). Inner lobe of 3rd exopodial joint with short proximal bristle with long proximal hairs and short distal spines, and long terminal bristle with short distal spines; outer lobe hirsute with 2 short bristles with minute hairs. 4th and 5th exopodial joints fused, hirsute, with 3 bristles, all with short marginal spines. Pigmentation: dense purple spots proximally in endites and purple granules extending into exopodite (none in outer lobe of joint 3) (Figure 20h).

Sixth Limb (Figure 21a): 3 epipodial bristles (longest with long proximal hairs, others with indistinct short hairs). Endite I with 1 long terminal bristle and 2 short proximal medial bristles, all with long proximal hairs and short distal spines; endite II with 1 long terminal bristle with long proximal hairs and short distal spines, and 1 short medial terminal bristle with knife-like tip; endite III with 2 long terminal bristles (with long proximal hairs and short distal spines) and 1 short bare bristle between them; endite IV not well defined from endite III, with 3 terminal bristles (1 long bristle with long proximal hairs and short distal spines, 1 shorter bristle with short marginal spines, and 1 small medial bare bristle). Skirt hirsute, with 21-24 bristles (2 posterior bristles plumose, others with either short spines or long proximal and short distal spines; bristle on anterior corner short; 3 or 4 short bristles (with short marginal spines) on anterior half of skirt with bases on lateral side some distance from edge; bristles on posterior half of skirt (excluding 2 plumose bristles) with bases on medial side some distance from edge). Pigmentation: limb with 7 or 8 dense purple spots including 4 on skirt.

Seventh Limb (Figures 19c, 21b,c): Limbs very long (Figure 19c); each with 4 or 5 proximal bristles (2 or 3 on each side), each with 3-5 bells, and 6 terminal bristles (3 on each side), each with 3-5 bells (one limb of USNM 193706 with only 1 terminal bristle on jaw side, probably aberration); proximal bristles with bases on distal corners of segments forming limb (Figure 21c). Comb with long curved middle tooth (with indistinct spines along outer edge), and long pointed lateral teeth (3 on each side of middle tooth) with marginal spines. Jaw opposite comb with minute spines distally (spines almost obscured by debris present between jaw and comb on both limbs of USNM 193706); sclerotized wedge to which muscle is attached present inside comb (Figure 21c).

Furca (Figures 19c, 21d): Each lamella with 4 claws decreasing in size posteriorly along lamella; each claw with lateral and medial row of small teeth along posterior margin; teeth absent near tips of claws; claws 1-3 with short hairs along anterior margin; minute spines forming row on lamella following claw 4; anterior margin of right lamella with short

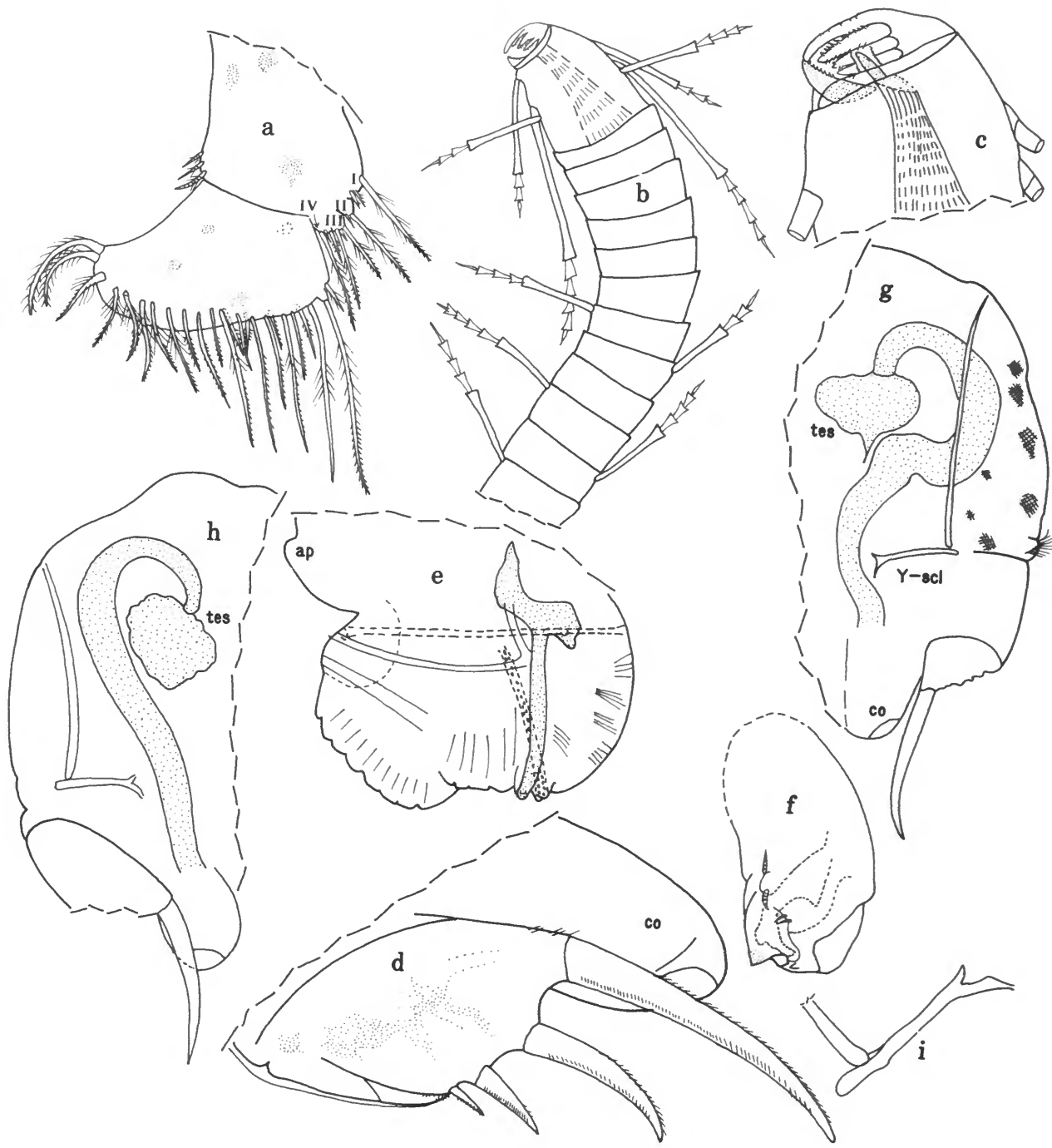


FIGURE 21.—*Codonocera phoenix*, new species, adult male, paratype, USNM 193706: *a*, left 6th limb (areas of purple pigment stippled), mv, *b*, 7th limb; *c*, detail of tip of 7th limb in *b*; *d*, right lamella of furca (areas of purple pigment stippled) and right copulatory organ; *e*, upper lip and anterior process from left side, anterior to left (coarse granular substance present in tube leading to posterior tusk and fine-grained substance present in tube leading to anterior tusk (stippled)); *f*, left copulatory organ, anterior to right; *g, h*, posterior of body from left and right sides (testis and tube leading to copulatory organ stippled; areas of purple pigment cross-hatched in *g*); *i*, right Y-sclerite, anterior to right.

distal hairs forming rows. Pigmentation: each lamellæ proximal to claws with 3 or 4 stellate purple spots.

Bellonci Organ (Figure 20k): Small with narrow blunt tip.

Eyes: Medial eye bare, with brown pigment (Figure 20k). Lateral eye with black pigment and about 29 ommatidia (exact number uncertain because ommatidia obscured by pigment) (Figures 19a,c, 20k).

Upper Lip (Figure 21e): Unpaired anterior part and paired posterior part with fairly large glandular openings; each paired part with 2 small tusks; base of anterior tusk lateral to base of posterior tusk; each tusk with 2 or 3 glandular openings near tip. Each tusk with internal canal; canal of anterior tusk containing granules much smaller than those in canal of posterior tusk (Figure 21e). 2 small glandular openings may be present high on lip proximal to tusks, but because of poor resolution they could not be identified with certainty as glandular openings. Posterior part of lip globose and hirsute.

Copulatory Limbs (Figure 21d,f-h): Well-developed paired lobes on each side of body anterior to furca; lobes with small bristles and terminal sclerotized parts. Long tubular vas deferens on each side of body, each entering dorsal edge of separate testes (Figure 21g,h).

Anterior of Body (Figure 21e): Small single anterior process just dorsal to upper lip (forms attachment for internal muscle bundles).

Posterior of Body (Figure 21g,h): Abundant hairs forming transverse row on margin in vicinity of posterior muscle attachment and posterior to end of Y-sclerite; hairs absent elsewhere (hairs not shown in Figure 21h). Pigmentation: body posterior to girdle with about 8 purple spots, 4 on each side.

Y-Sclerite (Figure 21g-i): Unusual, with short dorsal branch, and ventral branch forming obtuse angle with middle segment.

DESCRIPTION OF ADULT FEMALE (Figures 22–25).—Carapace higher relative to length than carapace of male, and also larger (Figure 22a); dorsal margin slightly convex; posterior end of caudal process only slightly convex (Figure 22d); incisur and anterior margin of carapace similar to that of adult male (Figure 22c).

Surface Ornamentation (Figure 22a–d): Similar to that of adult male except for absence of long posterior hairs.

Shell Pigmentation (Figure 22a,b): Right valve of USNM 193704 with about 53 stellate purple chromatophores (Figure 22a), some females with more; central ventral margin of right valve of USNM 193704 with purple granules but no chromatophores (Figure 22a), some females with chromatophores along ventral margin, similar to those of adult male.

Infold: Rostral infold with 10–14 long bristles (some divided) forming row parallel to valve edge and 1 long bristle posterior to row (Figure 22h); 1 small bristle in posterior part of rostral infold near incisur; 1 small bristle at inner end of incisur, and 2 unequal bristles on dorsal edge of incisur. Anteroventral infold with 1 short bristle near inner margin of infold close to incisur, then 23–26 closely spaced divided bristles forming

row extending almost to midlength of ventral margin; 5 additional smaller and more widely spaced bristles along ventral infold just distal to crenulate list of left valve, and 1 bristle posterior to crenulate list; about same number of bristles along ventral infold of right valve but crenulate list absent; infold of caudal process similar to that of adult male (Figure 22i,j).

Selvage: Similar to that of adult male. Posterior edge of triangular flap at anterior edge of infold of caudal process with lamellar prolongation similar to that of adult male (Figure 22i).

Carapace Size: MNHN Os 432, holotype, length 2.96 mm, height 2.03 mm; USNM 193704, length 2.66 mm, height 1.87 mm; USNM 193705, length 2.65 mm, height 1.97 mm; USNM 193707, length 2.75 mm, height 2.00 mm; USNM 193708, 2.92 mm, height 1.92 mm.

First Antenna (Figure 22g): Joints 1–4 and 6 similar to those of adult male. 5th joint: lateral surface differs from that of adult male in having spines forming rows on lateral surface and ventral and dorsal margins; sensory bristle similar to that of male (with 9 long filaments on proximal broad part followed by 4 short filaments on distal narrow part). 7th joint: a-bristle stouter and very slightly longer than bristle of 6th joint, with few ventral spines; b-bristle slightly longer than twice length of a-bristle, with 5 short marginal filaments; c-bristle about 4 times length of b-bristle, with 9 short marginal filaments including minute distal filament. 8th joint: d- and e-bristles about same length as b-bristle, bare with rounded tips; f-bristle stouter but slightly shorter than c-bristle, with 10 short marginal filaments; g-bristle about $\frac{1}{3}$ longer than f-bristle, with 9 or 10 short marginal filaments including minute distal filament, some filaments with few minute marginal spines. Pigmentation: purple granules distributed throughout 2nd and 3rd joints (no dense purple spot as in adult male).

Second Antenna: Except for pigmentation, protopodite similar to that of adult male (Figures 22e, 23a,b). Endopodite 3-jointed (Figures 22e, 23a): 1st joint elongate, with 4 proximal bristles (1 long spinous, 3 short bare) and 1 long distal bristle with short marginal spines; 2nd joint elongate, bare; 3rd joint short with long bare terminal filament. Exopodite: bristle of 2nd joint reaching past 9th joint, with 13 ventral teeth (last 5 teeth smaller and more closely spaced); sutures of bristle similar to those of adult male (Figure 23d); bristles of joints 3–8 similar to those of adult male; 1st joint with minute spines along dorsal concave margin; joints 4–8 with basal spines bearing minute marginal prong; length of basal spine of 8th joint about $\frac{1}{2}$ length of 9th joint (Figure 23c); 9th joint with smooth elongate lateral tooth about same length as joint, and 4 bristles (1 short dorsal, 3 long), all with natatory hairs. Pigmentation: protopodite with faint proximal purple area in same locality as dense purple spot on adult male.

Mandible: Coxale endite stout with abundant slender spines and tip with 2 stout spines (Figure 23e); small bristle near base not observed. Basale with 2 or 3 small ringed a-bristles adjacent to broad unringed spine (USNM 193705



FIGURE 22.—*Codonocera phoenix*, new species, adult female, paratypes: USNM 193704: *a*, complete specimen from right side (areas of purple pigment stippled; chromatophores also purple), length 2.66 mm; *b*, detail of purple chromatophore in right valve, ov; *c*, anterior end of right valve, iv; *d*, caudal process of right valve, iv. USNM 193708: *e*, protopodite and endopodite of left 2nd antenna, mv; *f*, genitalia of right side, iv. USNM 193705: *g*, right 1st antenna (not all bristles of 7th and 8th joints shown; areas of purple pigment stippled), lv; *h*, anterior end of left valve, iv; *i, j*, caudal processes of left and right valves, iv.



FIGURE 23.—*Codonocera phoenix*, new species, adult female, paratype, USNM 193705: a, protopodite and endopodite of right 2nd antenna (sclerites stippled), mv; b, detail of protopodite in a; c, joints 5-9 of exopodite of left 2nd antenna (not all bristles shown; sclerotized spines stippled), lv; d, bristle of 2nd joint of exopodite of left 2nd antenna, lv; e, proximal part of left mandible (areas of purple pigment stippled), mv; f, distal part of right mandible, mv; g, distal part of left mandible, mv; h, distal part of left mandible (bristles of 1st endopodial joint not shown), mv; i, a-bristles of basale of right mandible (sclerotized spine stippled), mv; j, right lateral eye (area of black pigment stippled), medial eye (area of brown pigment stippled), and Bellonci organ, lv; k, upper lip from right side, anterior to right.

with 2 a-bristles on left limb and 3 on right); joint otherwise similar to that of adult male (Figure 23e,i). Exopodite and 1st endopodial joint similar to those of adult male (Figure 23e). 2nd endopodial joint (Figure 23f-h): ventral margin with 3 slender pointed bristles forming groups of 1 and 2 bristles (left limb of USNM 193705 aberrant in having all 3 bristles forming single group, Figure 23g); dorsal bristles not counted but of similar type to those of adult male; spinosity of joint similar to that of adult male. 3rd endopodial joint with 4 claws and 1 bristle: shortest dorsal claw lateral, bare or with 2 indistinct proximal ventral spines (spines obscured on mounted specimen); longest dorsal claw medial, bare; 2 longest lateral and medial claws with 6-8 ventral spines (distal spine longest); longest lateral claw 47% length of 2nd endopodial joint; longest medial claw almost as long as lateral claw; medial dorsal claw 65% or 66% of longest lateral claw; lateral dorsal claw 40%-43% of longest lateral claw; medial ventral bristle about same length as shortest claw, with short spines along ventral and dorsal margins (Figure 23f-h). Pigmentation: diffuse purple granules in coxale and basale (denser in coxale endite) (Figure 23e).

Maxilla: Protopodite with fringe of dorsal hairs. Coxale with hirsute dorsal bristle with short spines near tip (Figure 24a). Endites I and II each with 5 spinous and pectinate bristles (Figure 24d); endite III with 6 spinous and pectinate terminal bristles and 1 proximal bristle near base of endite. Basale with long hirsute ventral bristle (Figure 24d). Exopodite broad, hirsute, with 3 bristles near tip, outer bristle about 40% of longest bristle, all bristles plumose and with short spines near tip (Figure 24b). 1st endopodial joint hirsute, with broad sclerotized margin in place of cutting tooth, but no projecting tooth; with small sclerotized node lateral to base of beta-bristle, 2 slender ringed alpha-bristles with short marginal spines, and 1 stout pectinate beta-bristle (Figure 24b). 2nd endopodial joint with 3 a-bristles (posterior bristle stouter and with few spines, others bare), 1 b-bristle with single spine, 2 spinous c-bristles, and 3 stout pectinate d-bristles (Figure 24b,c). Pigmentation: diffuse purple granules in endite I and distally on endites II and III.

Fifth Limb: Protopodite without anterior tooth. Endite I with 3 or more bristles, endites II and III each with about 6 bristles (Figure 25a). 1st exopodial joint: anterior side with bristles similar to those of adult male (Figure 25d); main tooth comprising minute bare peg and 4 constituent teeth (proximal tooth with 6 marginal cusps, next tooth with 8 cusps, next with 11 cusps, and last without cusps); a few long proximal hairs on small ringed bristle proximal to peg (Figure 25c). 2nd exopodial joint with 3 stout pectinate unringed a-bristles (longest with about 7 marginal cusps), 4 pectinate ringed b'-plus b''-bristles (largest with about 20 marginal cusps; inner bristle with long proximal hairs) (b'- and b''-bristles labeled as "b" in Figure 25b), 1 stout posterior c-bristle with long proximal hairs and distal teeth (Figure 25b), and 1 anterior d-bristle with long proximal hairs and short distal spines

(Figure 25d). 3rd-5th exopodial joints similar to those of adult male (Figure 25e). Pigmentation: diffuse purple granules in endites and extending into exopodial joints (none in outer lobe of 3rd joint).

Sixth Limb (Figure 25f): With 3 epipodial bristles. Endites similar to those of adult male. Skirt with 20-22 bristles of type similar to those of adult male. Pigmentation: fairly dense purple granules in endites II-IV, diffuse purple granules elsewhere, including skirt.

Seventh Limb: Similar to that of adult male (Figure 24e, f). (1 limb of USNM 193705 aberrant, without bristles or terminal comb, Figure 24g.)

Furca (Figure 24h): Similar to that of adult male. Pigmentation: each lamella with diffuse purple granules proximal to claws.

Bellonci Organ (Figure 23j): Differs from that of adult male in having pointed process at tip (USNM 193705, USNM 193708).

Eyes (Figures 22a, 23j): Similar to those of adult male.

Upper Lip (Figure 23k): Similar to that of adult male.

Genitalia: USNM 193708 with round sclerotized ring on each side of body anterior to base of furca, without spermatophore.

Posterior of Body (Figure 24i): Similar to that of adult male. Pigmentation: diffuse purple granules posterior to girdle.

Y-Sclerite (Figure 24i,j): Partly obscured on USNM 193705.

Eggs: USNM 193705 with ~20 unextruded eggs on each side of posterior part of body (Figure 24i). (No adult females in collection with eggs in marsupium; all adult females except USNM 193708 with unextruded eggs.)

DESCRIPTION OF INSTAR I (Figure 26).—Carapace similar in shape and surface ornamentation to adult (Figure 26a).

Infold: Similar in structure to that of adult but bristles not counted.

Carapace Size: USNM 193758, length 0.82 mm, height 0.56 mm. Sta 106-R: length 0.78 mm, height 0.57 mm.

First Antenna (Figure 26b): 1st joint bare. 2nd joint with distal medial and lateral spines. 3rd joint short, with 2 bristles (1 ventral, 1 lateral). 4th joint bare. Sensory bristle of 5th joint bare except for minute terminal papilla. 6th joint with short spinous medial bristle near dorsal margin. 7th joint: a-bristle similar to bristle of 6th joint; b-bristle 3 times length of a-bristle, with few widely separated marginal spines and terminal papilla; c-bristle more than twice length of b-bristle, with minute spines and terminal papilla. 8th joint: d- and e-bristles longer than b-bristle, with broadly tapering tip; f-bristle almost 3 times length of b-bristle, with minute spines and terminal papilla; g-bristle very long (tip missing on both limbs of USNM 193758), with minute spinous filaments. (Minute spines of c-, f-, and g-bristles not shown.)

Second Antenna (Figure 26c): Medial bristle of protopodite with short marginal spines. Endopodite 3-jointed: 1st joint cylindrical, short, bare; 2nd joint elongate bare; 3rd joint

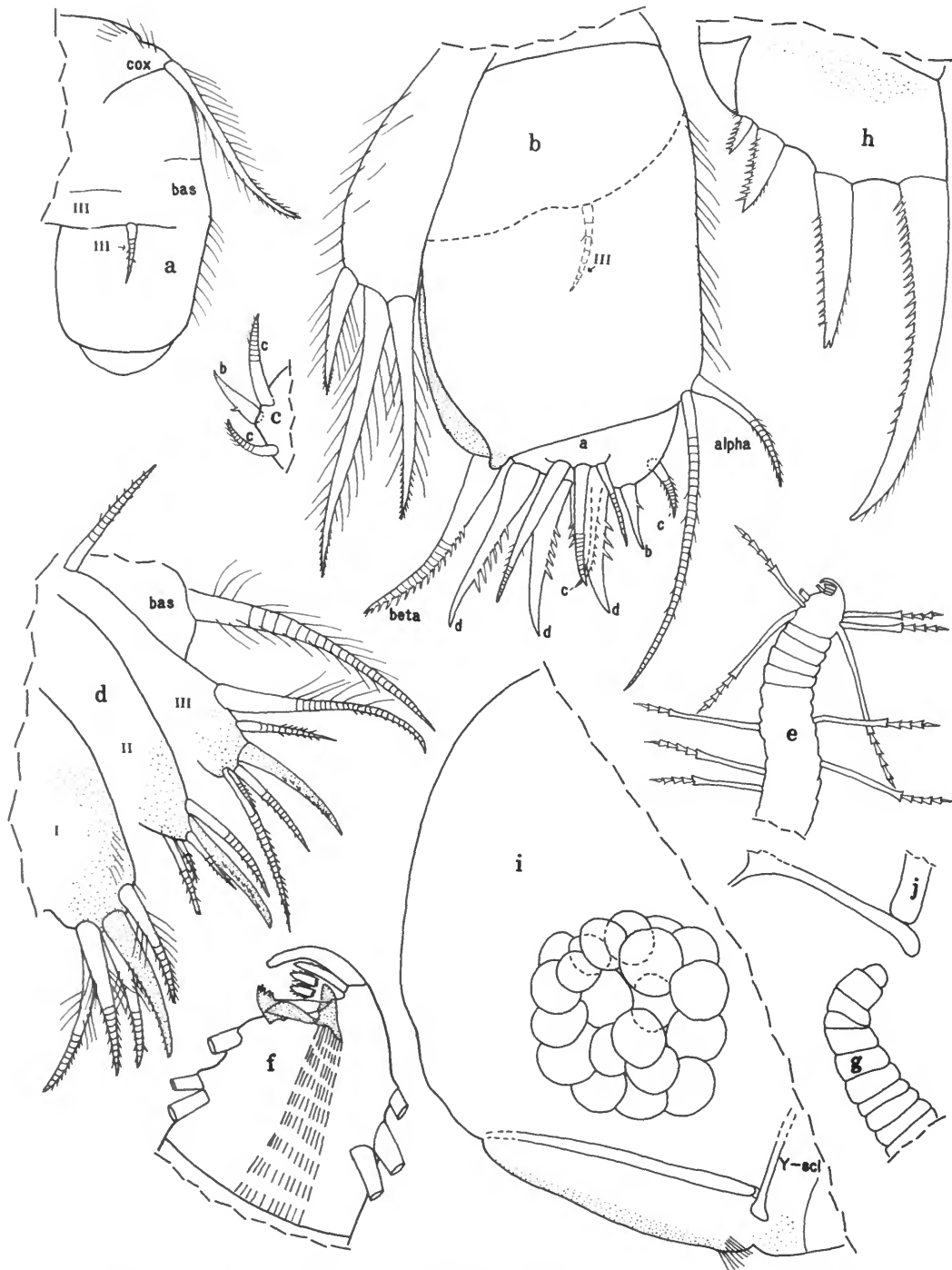


FIGURE 24.—*Codonocera phoenix*, new species, adult female, paratype, USNM 193705: a, part of right maxilla (not all bristles shown), mv; b, part of left maxilla; lv; c, b- and c-bristles of 2nd endopodial joint of right maxilla, mv; d, endites and ventral bristle of basale of left maxilla (areas of purple pigment on lobes stippled; stippling on claws indicates sclerotization), lv; e, 7th limb; f, detail of tip of 7th limb in e; g, aberrant 7th limb; h, right furcal lamella (area of purple pigment stippled), lv; i, posterior of body from right side showing unextruded eggs, anterior to right (area of purple pigment stippled); j, left Y-sclerite and proximal end of girdle, anterior to left.

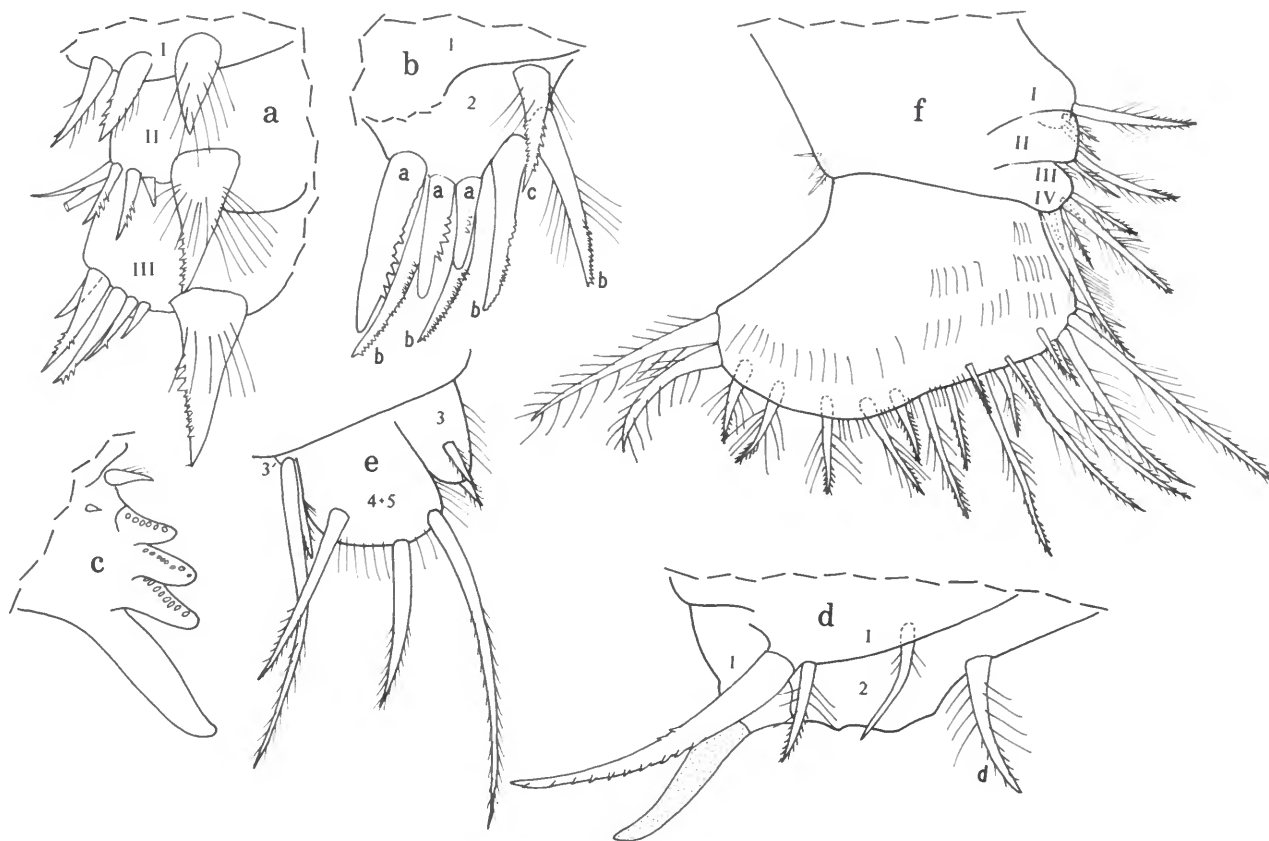


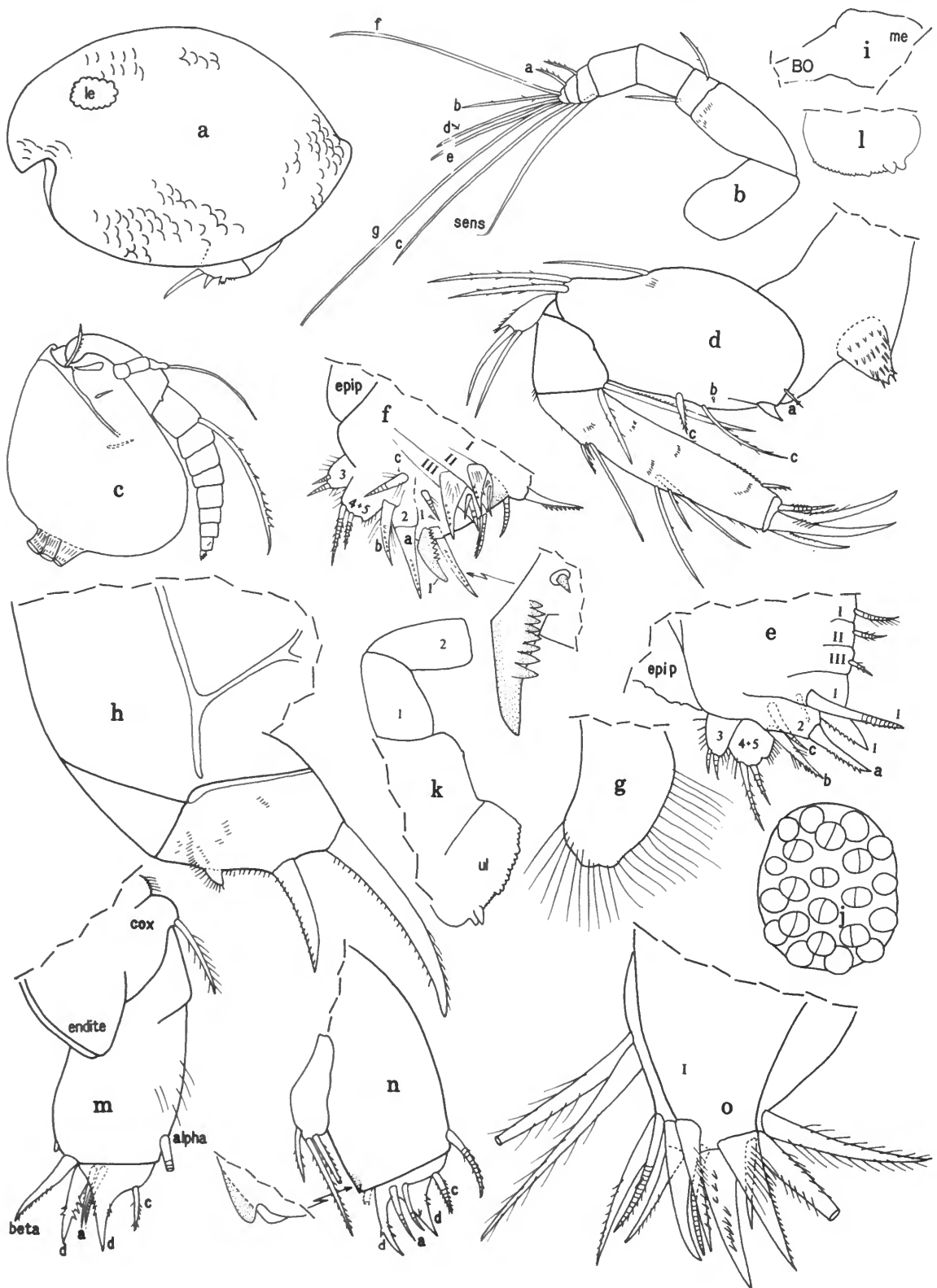
FIGURE 25.—*Codonocera phoenix*, new species, adult female, paratype, USNM 193705: a, endites of right 5th limb, pv; b, 2nd exopodial joint of right 5th limb, pv; c, main tooth of 1st exopodial joint of right 5th limb, pv; d, exopodial joints 1 and 2 of left 5th limb (not all teeth or bristles shown; longest tooth of main tooth stippled), av; e, exopodial joints 3-5 of right 5th limb, pv; f, right 6th limb, lv.

elongate with narrow part at midlength and long terminal filament. Exopodite: bristle of 2nd joint reaching past 9th joint, with 10 ventral teeth (last 5 teeth smaller and more closely spaced), bare dorsal margin, and narrow and closely ringed distal segment (with slender terminal spine) distal to distal ventral tooth; bristles of joints 3-8 with natatory hairs, no spines; 1st joint with minute triangular medial process on distal edge; 9th joint with few minute lateral spines at midlength, a broad lateral terminal spine with small spines along edge, and 2 bristles (1 long with natatory hairs, 1 short (dorsal) with short marginal spines); joints 2-8 with few indistinct spines in row along distal edge but no basal spines.

Mandible (Figure 26d): Coxale endite stout with abundant slender spines and tip with 2 stout spines; small tubular bristle near base of endite observed only on left limb of USNM 193757. Basale with 1 small ringed a-bristle (with few marginal spines) adjacent to broad unringed spine, 1 minute medial b-bristle just proximal to c-bristle, 2 c-bristles (proximal

longest and with short widely separated marginal spines, shortest with small closely placed marginal spines), and no d-bristle; dorsal margin of basale with 3 bristles (1 just distal to midlength, 2 terminal) with short marginal spines; medial surface of basale with few spines. Exopodite about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, hirsute along both margin and pointed tip, with 2 subterminal bristles (distal slightly shorter), both with marginal spines. 1st endopodial joint with 2 ventral bristles with short marginal spines. 2nd endopodial joint: medial surface, ventral and dorsal margins spinous; ventral margin with 1 pointed subterminal bristle; dorsal margin with 3 proximal bristles (1 long, 2 short diaphanous) and 3 distal bristles (2 long, 1 short diaphanous). 3rd endopodial joint with 3 claws (short dorsal claw lateral, with short ventral spines; 2 long claws with 4-6 long proximal ventral spines; longest lateral claw 54% length of 2nd endopodial joint) and 1 spinous ventral bristle.

Maxilla: Protopodite with fringe of dorsal hairs. Coxale



with hirsute dorsal bristle (Figure 26*m*). Endite I-III with total of 13 bristles (Figure 26*o*). No bristles observed on basale but they could be obscured. Exopodite with 3 bristles (short proximal and long middle bristle hirsute, other broken but with short indistinct spines on stump) (Figure 26*n*). 1st endopodial joint with small tapered cutting tooth (tooth lateral (detail in Figure 26*n*)), 1 ringed alpha-bristle, and 1 stout pectinate beta-bristle (Figure 26*m,n*). 2nd exopodial joint with 2 ringed a-bristles (posterior with few proximal spines, anterior bare), no b-bristle, 1 spinous anterior c-bristle, no posterior c-bristle, and 2 stout pectinate d-bristles (Figure 26*m,n*).

Fifth Limb: Without anterior tooth on protopodite. Endite I with 1 spinous ringed bristle (Figure 26*e*) and sclerotized unringed bristle (Figure 26*e, f*); endite II with 1 stout bristle (with long proximal hairs and small distal cusps), 1 small pointed unringed tooth-like bristle, and 2 slender spinous ringed bristles; endite III with stout bristle (with long proximal spines and small distal cusps), 2 slender unringed tooth-like bristles, and 2 spinous ringed bristles. 1st exopodial joint: anterior side with stout pectinate bristle; main tooth comprising small pointed peg and single stout tooth with 8 cusps (distal cusps larger); ringed bristle with long proximal hairs proximal to peg (Figure 26*f*). 2nd exopodial joint with stout pectinate ringed a-bristle with 7 cusps, 1 ringed b'- or b''-bristle with long proximal hairs and distal teeth, and 1 posterior ringed c-bristle with long proximal hairs. Inner lobe of 3rd exopodial joint absent; outer lobe hirsute with 2 short terminal bristles (Figure 26*e, f*). 4th and 5th exopodial joints fused, hirsute, with 2 short spinous bristles.

Sixth Limb (Figure 26*g*): Small, with marginal hairs but no bristles.

Seventh Limb: Absent.

Furca (Figure 26*a,h*): Each lamella with 3 claws; claws 1 and 2 long, articulated, with small teeth along posterior edges; claw 3 short, not clearly articulated, with long spines along terminal end and posterior edge (spines continue in row along lateral side of lamella proximal to claw); ventral edge of lamella between claws 2 and 3 spinous; anterior edge of claw 1 with distal hairs; lateral side of lamella with short spines in rows.

Bellonci Organ: Fragmented on USNM 193758 (proximal part shown in Figure 26*i*).

FIGURE 26 (opposite page).—*Codonocera phoenix*, new species, instar I (sex unknown), paratype, USNM 193758: *a*, complete specimen from left side (not all crescent-shape ridges shown), length 0.82 mm; *b*, left 1st antenna, lv; *c*, left 2nd antenna (not all exopodial bristles shown; only 1 bristle on protopodite, other structures represent sclerites), mv; *d*, right mandible, mv; *e*, right 5th limb (not all endite bristles shown), av; *f*, left 5th limb with detail of main tooth, pv; *g*, left 6th limb, mv; *h*, right furcal lamella and fused Y-sclerite and girdle, lv; *i*, medial eye and proximal part of Bellonci organ, anterior to left; *j*, lateral eye; *k*, anterior of body from right side with 1st and 2nd joints of 1st antenna at top and upper lip at bottom, anterior to right; *l*, upper lip from left side, anterior to left; *m*, part of left maxilla (endite bristles and exopodite not shown), mv; *n*, part of right maxilla with detail of cutting tooth, lv; *o*, bristles of endites I-III (endite I covers other endites in illustration).

Eyes: Medial eye bare (Figure 26*i*). Lateral eye with 22 amber-colored ommatidia (Figure 26*a,j*); no pigment between ommatidia.

Upper Lip (Figure 26*k,l*): Similar to adult.

Genitalia: Absent.

Anterior of Body (Figure 26*k*): Slightly swollen area ventral to base of 1st antenna.

Posterior of Body (Figure 26*h*): Evenly rounded, without hairs present on adult.

Y-Sclerite (Figure 26*h*): Posterior end fused to both ventral end of girdle and dorsal end of a sclerite extending to furca.

Pigmentation: Unlike adults, preserved carapace and limbs of USNM 193758 without purple pigment, and lateral eyes without black pigment between ommatidia.

DESCRIPTION OF INSTAR III FEMALE (Figure 27).—Carapace similar to that of adult female (Figure 27*a*).

Infold: Similar in structure to that of adult female but bristles not counted.

Carapace Size: USNM 193761, length 1.17 mm, height 0.80 mm.

First Antenna (Figure 27*b*): Distribution of bristles similar to those of adult female; filaments present on sensory bristle and b-, c-, e-, and f-bristles but not counted. Distribution of spines on joints not determined. (Bristles of joints 5-8 and armature of bristles not shown in Figure 27*b*.)

Second Antenna (Figure 27*c*): Protopodite similar to that of adult female. Endopodite with 1 or 2 bristles on 1st joint, otherwise similar to that of adult female. Exopodite: bristle of 2nd joint with about 7 ventral teeth, and 9th joint with 3 bristles, otherwise similar to that of adult female. (Exopodite not shown in Figure 27*c*.)

Mandible (Figure 27*d*): Basale with 2 slender ringed a-bristles adjacent to broad unringed spine, small b-bristle, 2 c-bristles, and 1 d-bristle without wreaths of long spines, otherwise joint similar to adult female. Exopodite similar to adult female. 1st endopodial joint without minute ventral bristle, otherwise similar to adult female. 2nd endopodial joint: dorsal margin with about 9 bristles; bristles on joint otherwise similar to adult female. 3rd endopodial joint similar to adult female (length of longest claw 45% length of 2nd endopodial joint). (Armature of bristles not shown in Figure 27*d*.)

Maxilla (Figure 27*e*): Endite I with 6 bristles; endites II and III each with 5 bristles. Exopodite and endopodial joints similar to adult female, but spines of some bristles not resolved on undissected specimen.

Fifth Limb: Epipodite with 45 bristles. Protopodite tooth absent. Endite I with 4 bristles; endite II with 5 bristles; endite III with 5 or 6 bristles. 1st exopodial joint: anterior side with 2 paired bristles near inner edge and 1 smaller bristle at joint midwidth (Figure 27*j*); main tooth comprising minute bare peg and 3 teeth (proximal 2 teeth pectinate, distal tooth larger, bare) (Figure 27*i*; stippled areas indicate sclerotized teeth). 2nd exopodial joint with 3 stout pectinate a-bristles, 4 b'- and b''-bristles (b'- and b''-bristles labeled "b" in Figure 27*j*), 1

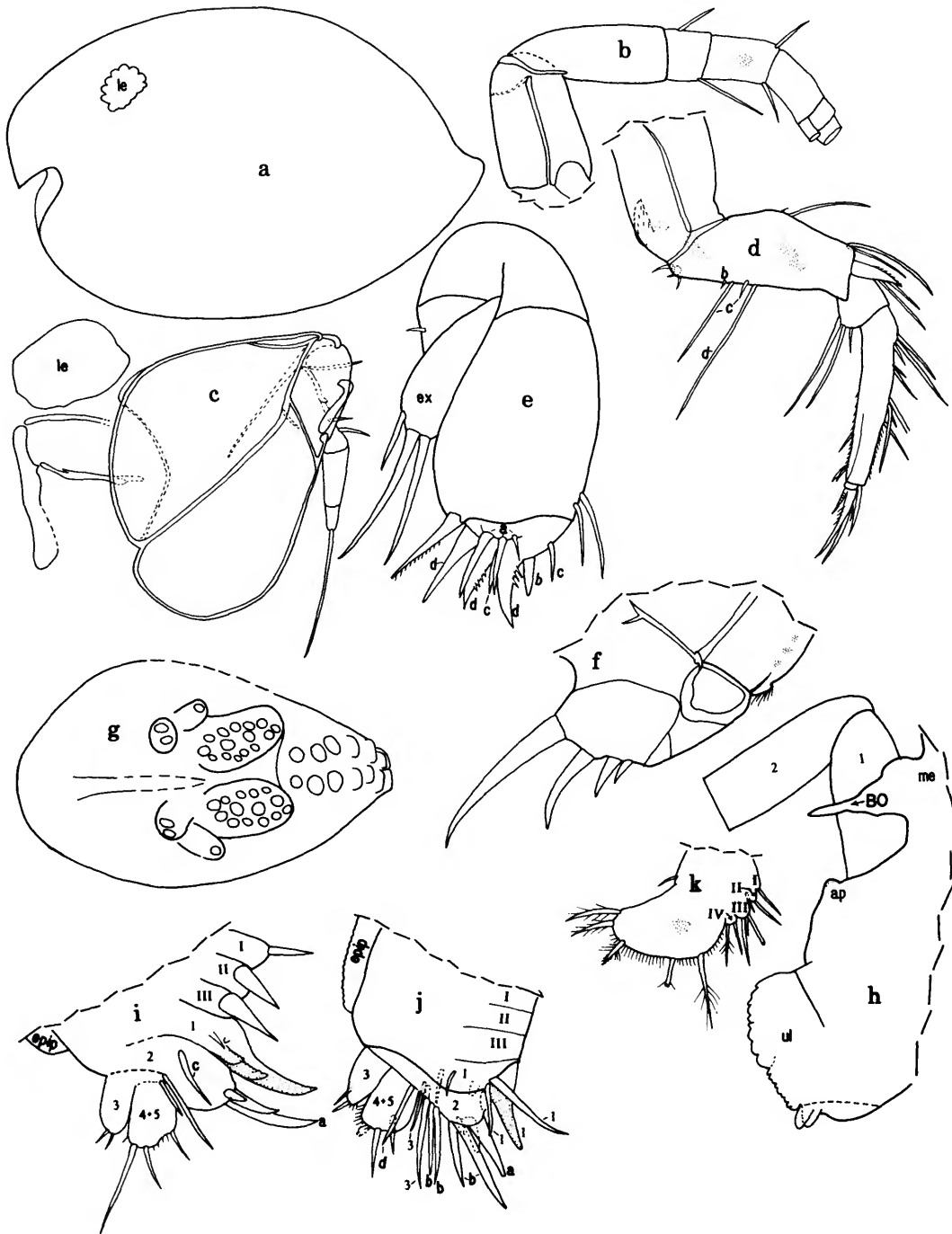


FIGURE 27.—*Codonocera phoenix*, new species, instar III female, paratype, USNM 193761: a, complete specimen from left side, length 1.17 mm; b, right 1st antenna (area of purple pigment stippled; bristles of joints 6–8 not shown), lv; c, outline of right lateral eye, and protopodite and endopodite of right 2nd antenna showing internal sclerites (medial sclerites and single distal protopodial bristle dashed), lv; d, right mandible (areas of purple pigment stippled), lv; e, right maxilla (endites and not all spines and hairs shown), lv; f, posterior of body from left side showing left furcal lamella and sclerites (areas of purple pigment stippled), anterior to left; g, upper lip, anterior to right, vv; h, anterior of body from left side, anterior to left; i, left 5th limb (not all endite bristles shown), pv; j, right 5th limb (endite bristles not shown), av; k, right 6th limb, lv.

posterior c-bristle, and 1 anterior d-bristle (Figure 27i,j). Exopodial joints 3–5 similar to adult female (Figure 27i,j). (Armature of bristles not shown in Figure 27i,j.)

Sixth Limb (Figure 27k): With 1 epipodial bristle. Endite I with 1 long terminal bristle; endite II with 2 bristles (1 short medial bristle, 1 long terminal); endite III with 2 long terminal bristles and 1 short bristle between them; endite IV with 2 terminal bristles. Skirt hirsute, with 5 bristles (2 posterior bristles plumose, others with long proximal spines). (Armature of many bristles not shown.)

Seventh Limb: Missing on specimen USNM 193761.

Furca (Figure 27f): Similar to adult (teeth of claws not shown).

Bellonci Organ (Figure 27h): Elongate with tapered tip.

Eyes: Medial eye bare unpigmented (Figure 27h). Lateral eye large with 20 amber-colored ommatidia and no pigment between ommatidia (Figure 27a,c).

Upper Lip (Figure 27g,h): Similar to that of adult.

Anterior of Body (Figure 27h): Small rounded process just ventral to base of 1st antennae.

Posterior of Body (Figure 27f): With hairs similar to those of adult.

Y-Sclerite (Figure 27f): Similar to that of adult.

Pigmentation: Carapace and some appendages with areas of purple pigment (pigment areas in some appendages stippled in Figure 27b,d,k).

Genitalia: Absent.

Gut Content: USNM 193761 with abundant crustacean fragments.

Remarks: The presence of a ventral bristle on the 4th joint of the 1st antenna and more than 1 bristle on the 6th limb indicates that the specimen from sta 117-S is at least the 3rd instar. The presence of 3 stout teeth on the main tooth of the 1st exopodial joint of the 5th limb indicates that the specimen is the 3rd instar. The 7th limb of a 3rd instar is usually elongate and bare, but the limb is absent on the present specimen, which is the only 3rd instar in the collection. The 3rd instar has not been described previously on other species of *Codonocera*, so it cannot be ascertained whether the absence of a 7th limb is normal; however, I am inclined to believe that its absence is anomalous, and that the limb probably is present on normal 3rd instars of *C. phoenix* as well as on other species of the genus. The limbs of the preserved specimen have most internal muscles absent and the transparent appendages permitted their description without separating them from the body. The terminal location of a long filament on the 3rd endopodial joint of the 2nd antenna of the present specimen suggests that it is female.

DESCRIPTION OF INSTAR IV FEMALE (Figure 28).—Carapace similar to that of adult female (Figure 28a).

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

Carapace Size: USNM 193760, length 1.44 mm, height 1.03 mm.

First Antenna: Similar distribution of bristles as on adult

female but filaments on bristles not counted.

Second Antenna: Protopodite similar to adult female. Endopodite similar to that of adult female except 1st joint with 3 (2 long, 1 short) instead of 4 bristles (Figure 28b). Exopodite: bristle of 2nd joint reaching joint 7, with 9 ventral teeth; exopodite otherwise similar to adult female.

Mandible: Coxale with minute bristle at base. Basale with 2 small ringed a-bristles adjacent to broad unringed spine, otherwise similar to adult female. Exopodite and 1st endopodial joint similar to adult female. 2nd endopodial joint: ventral margin with 3 bristles; dorsal margin with 12 bristles (7 short, medium, or long, all ringed and with short marginal spines, and 5 short bristles (unringed diaphanous or ringed proximally) with long proximal spines). 3rd endopodial joint similar to adult female, except longest lateral claw 51% length of 2nd endopodial joint, and both long claws with fewer spines (Figure 28c).

Maxilla (Figure 28d): Coxale with hirsute dorsal bristle. Endite bristles not counted. Basale with long stout hirsute ventral bristle and small terminal bristle at midwidth. Exopodite similar to that of adult female. 1st endopodial joint similar to adult female. 2nd endopodial joint with 3 a-bristles (posterior and middle with few proximal spines); remaining bristles similar to adult female.

Fifth Limb (Figure 28e,f): Protopodial tooth absent. Epipodite with 48 bristles. Endite I with 4 bristles; endites II and III each with 5 bristles. 1st exopodial joint: anterior side with 3 bristles similar to adult; main tooth with smooth proximal peg and 4 stout teeth (proximal tooth small with 1 stout marginal pointed cusp; 2nd tooth with 6 marginal cusps; 3rd tooth with 8 cusps, large distal tooth bare), and short ringed bristle proximal to smooth peg. 2nd exopodial joint with 3 stout unringed a-bristles (proximal small with 1 cusp, middle with 3 cusps, distal large with 5 cusps (not all shown)), 4 pectinate ringed b'- and b"-bristles (longest with 17 pointed marginal cusps), 1 ringed posterior c-bristle with long proximal hairs and short distal spines, and 1 long anterior d-bristle with long proximal hairs. Inner lobe of 3rd exopodial joint with 1 short proximal bristle (with few proximal hairs and short distal spines) and 1 long terminal bristle; outer lobe of 3rd joint hirsute, with 2 short bristles. 4th and 5th exopodial joints fused, hirsute, with 3 bristles with short marginal spines.

Sixth Limb: Well developed with many bristles.

Seventh Limb (Figure 28g): Long with 4 tapered bristles: 2 proximal (1 on each side) and 2 terminal (1 on each side), each with 1 bell (tip of 1 terminal bristle missing on only examined limb of USNM 193760). Comb with long middle tooth with indistinct marginal spines, and 4 lateral teeth (2 on each side). Jaw opposite comb with marginal spines.

Furca: Similar to adult.

Bellonci Organ: Not examined.

Eyes: Medial eye not examined. Lateral eye with 23 amber-colored ommatidia, without black pigment between ommatidia (Figure 28a).

Upper Lip: Similar to adult.

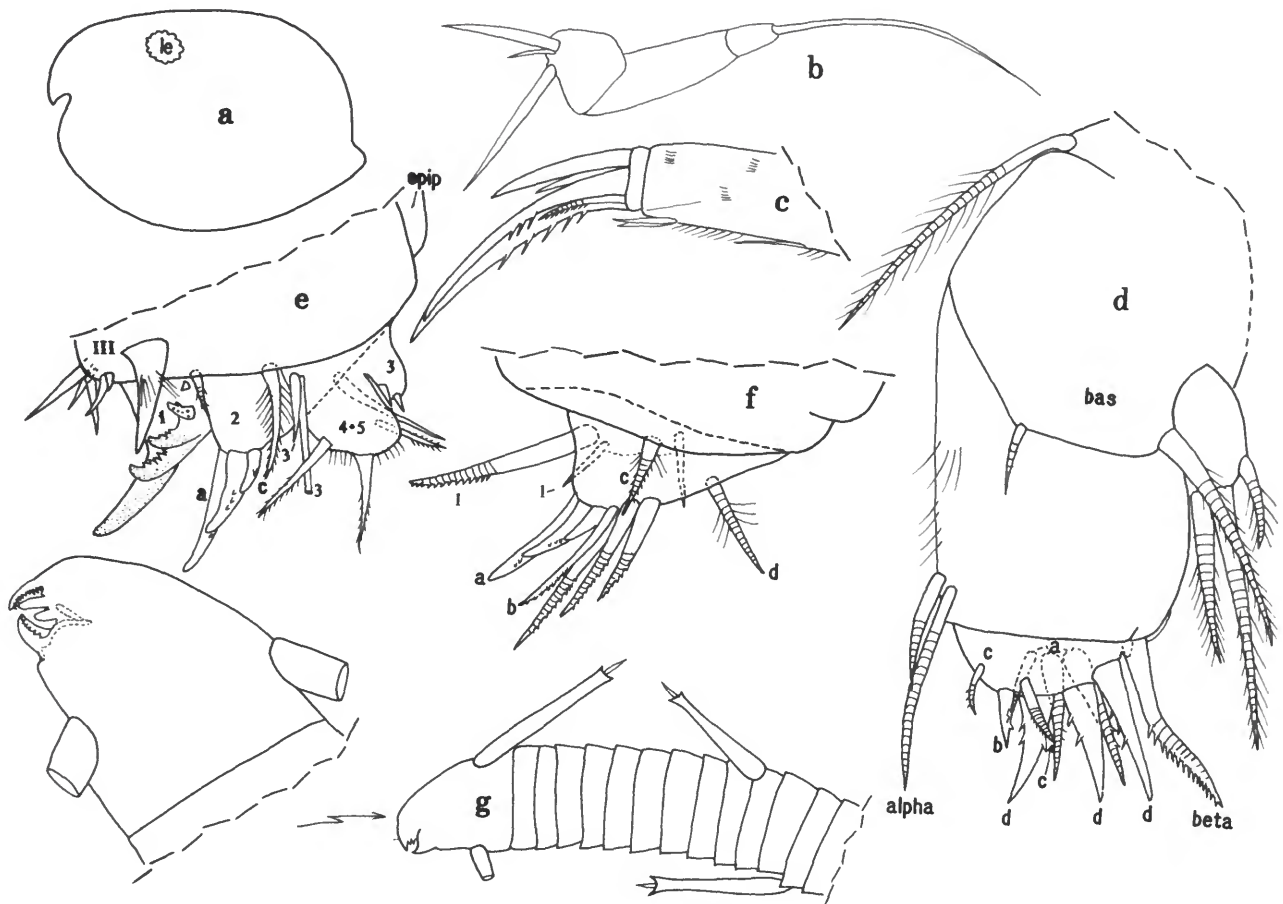


FIGURE 28.—*Codonocera phoenix*, new species, instar IV female, paratype, USNM 193760: a, complete specimen from left side, length 1.44 mm; b, endopodite of right 2nd antenna, mv; c, tip of right mandible, mv; d, right maxilla (endites not shown), mv; e, right 5th limb, pv; f, exopodial joints 1 and 2 of right 5th limb, pv; g, 7th limb and detail of tip.

Genitalia: Absent.

Anterior of Body: With small rounded process just ventral to base of 1st antenna.

Posterior of Body: Similar to adult.

Pigmentation: No purple pigment spots in carapace and appendages of preserved specimen USNM 193760.

DESCRIPTION OF INSTAR V FEMALE (Figure 29a-f).—Carapace similar to adult female (Figure 29a); many anastomosing purple chromatophores beneath shell of each valve (not all shown).

Infold: Similar structures as on adult but bristles not counted.

Carapace Size: USNM 193762, length 1.83 mm, height 1.41 mm.

First Antenna: Similar to adult female but filaments of bristles not counted. Pigmentation similar to adult male.

Second Antenna: Protopodite similar to adult. Endopodite:

1st joint with 2 long and 2 short bristles (Figure 29c); 1 long bristle missing on left limb of USNM 193762 (probably aberrant) (Figure 29b); 2nd and 3rd joints similar to those of adult. Exopodite: bristle of 2nd joint reaching 9th joint, with 9 ventral teeth; otherwise exopodite similar to adult female. Pigmentation similar to adult female.

Mandible: Similar to that of adult female but bristles along dorsal margin of 2nd endopodial joint not counted. Pigmentation similar to adult male.

Maxilla: Similar to that of adult. Pigmentation similar to adult male.

Fifth Limb (Figure 29d): Protopodial tooth absent. Endite I fragmented; endite II with 5 bristles; endite III with 6 bristles (Figure 29d). 1st exopodial joint: with 3 anterior bristles as on adult; main tooth similar to adult including number of cusps on the 4 teeth. Exopodial joints 2–5 similar to adult. Pigmentation similar to adult male.

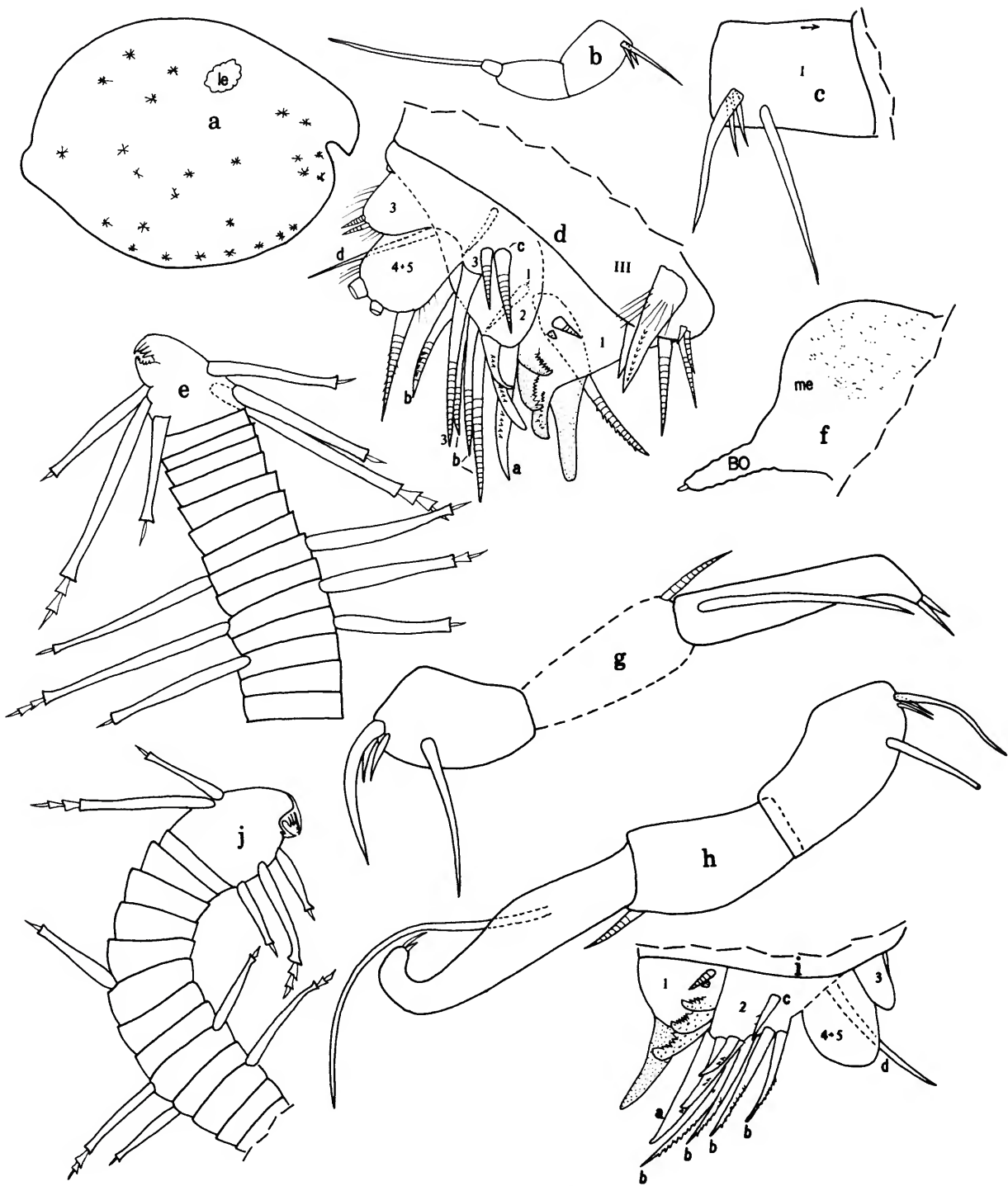


FIGURE 29.—*Codonocera phoenix*, new species, instar V, paratypes: female, USNM 193762: a, complete specimen from right side, length 1.83 mm; b, endopodite of left 2nd antenna, mv; c, 1st joint of endopodite of right 2nd antenna (proximal end to left), mv; d, left 5th limb (endites I and II not shown), pv; e, 7th limb; f, medial eye and Bellonci organ. Male, USNM 193763: g, h, endopodites of right and left 2nd antennae, mv; i, right 5th limb (endites and bristles of exopodial joints 3–5 not shown), pv; j, 7th limb.

Sixth Limb: With many bristles (skirt with at least 16 bristles). Purple pigment present in skirt (endites of USNM 193762 obscured).

Seventh Limb: One limb of USNM 193762 with 6 tapered proximal bristles (3 on each side), each with 1–3 bells, 6 tapered terminal bristles (3 on each side), each with 1–3 bells, and terminal comb similar to adult male (Figure 29e). Opposite limb of USNM 193762 differs in having only 4 tapered proximal bristles (2 on each side), each with 1–3 bells.

Furca: Similar to adult. Pigmentation similar to adult male.

Bellonci Organ (Figure 29f): Elongate with crenulate edge, with minute peg at tip.

Eyes: Medial eye bare, with brown pigment (Figure 29f). Lateral eye with black pigment and about 27 ommatidia (Figure 29a).

Upper Lip: Similar to adult.

Genitalia: Not observed.

Anterior and Posterior of Body: Similar to adult.

Y-Sclerite: Obscured on USNM 193762.

DESCRIPTION OF INSTAR V MALE (Figure 29g–j).—Carapace similar to adult.

Infold: Structures similar to adult but bristles not counted.

Carapace Size: USNM 193763 (shell distorted), length about 1.54 mm, height about 1.10 mm.

First Antenna: Similar to adult but filaments on bristles not counted.

Second Antenna: Protopodite similar to adult. Endopodite 3-jointed: 1st joint with 3 proximal bristles (1 long, 2 short) and 1 long distal bristle; 2nd joint broadening distally, with small terminal bristle; 3rd joint elongate, with long proximal filament and 2 small terminal bristles (Figure 29g,h). Exopodite similar to adult but ventral teeth of bristle of 2nd joint not counted.

Mandible: Similar to adult but dorsal bristles of 2nd endopodial joint not counted.

Maxilla: 1st endopodial joint similar to that of adult; remainder of limb not examined.

Fifth Limb (Figure 29i): Epipodite with 53 bristles (not shown). Protopodial tooth absent. Endite I fragmented; endite II with 5 bristles; endite III with 6 bristles. 1st exopodial joint: 3 anterior bristles similar to those of adult; main tooth with smooth proximal peg and 4 teeth (proximal tooth with 4 or 5 cusps; distal tooth large bare; remaining teeth with 5 cusps); ringed bristle proximal to peg. 2nd exopodial joint with 3 stout pectinate unringed a-bristles (longest of these with 6 cusps), 4 pectinate ringed b'- and b"-bristles (longest bristle with about 15 cusps), posterior c-bristle, and anterior d-bristle. Exopodial joints 3–5 similar to those of adult.

Sixth Limb: With many bristles.

Seventh Limb: Limbs very long. One limb of USNM 193763 with 5 proximal bristles (2 on jaw side, 3 on comb side), each with 1–3 bells, and 5 terminal bristles (3 on jaw side, 2 on comb side), each with 1–3 bells; opposite limb same

except for distribution of 5 terminal bristles (2 on jaw side, 3 on comb side) (Figure 29j). Comb with long curved tooth and 6 shorter teeth (3 on each side); jaw opposite comb curved and pointed.

Furca: Left lamella of USNM 193763 aberrant in having small 5th claw; right lamella with usual 4 claws.

Bellonci Organ: Obscured on USNM 193763.

Eyes: Medial eye with brown pigment. Lateral eye with 22 amber-colored ommatidia, without black pigment between ommatidia.

Upper Lip: Similar to adult.

Genitalia: Not observed.

Anterior and Posterior of Body: Similar to adult.

Pigmentation: Shell, 2nd and 3rd joints of 1st antenna, and skirt of 6th limb with diffuse purple pigment.

COMPARISONS.—The new species *C. phoenix* is a member of the *goniacantha* group of Poulsen (1962:311) and is compared in Table 9 to species that were referred to that group by Poulsen (1962:311, table 21). The only species in the group other than *C. phoenix* having only 4 constituent teeth in the main tooth of the 5th limb is *C. suensoni* Poulsen, 1962:317. *C. phoenix* differs from that species in not having a ventral tooth on the 1st joint of the 1st antenna.

Previously described species in the *goniacantha* group have no spines on the a-bristles of the maxilla or hairs on the 2 short bristles of the outer lobe of the 3rd joint of the 5th limb, and the largest tooth of the main tooth of the 5th limb is without cusps (Poulsen, 1962:311). *Codonocera phoenix* differs from the previously described species forming the group in that the maxillae of both the adult male and female bear a few spines on the posterior a-bristle, both bristles of the outer lobe of the 3rd joint of the 5th limb bear minute hairs (visible with compound microscope at $\times 1500$), and the largest tooth of the main tooth of the 5th limb bears a few cusps on the adult male but not on the adult female.

ONTOGENY AND SEXUAL DIMORPHISM (Table 10).—*Codonocera phoenix* has 5 juvenile instars, all except instar II are represented in the present collection, but by only a few specimens. In the genus *Codonocera* the endopodite of the 2nd antenna of males and females differs and was used to determine the sex of juveniles. The female carapace is larger than the male, but has a similar shape, and juveniles have a shape similar to the adult. In the brief descriptions below only those characters that vary during ontogeny are noted.

First Antenna: Bristles are absent on the 4th joint of instar I, and instars III to the adult have 2 bristles (1 ventral, 1 dorsal). Presumably, the missing instar II has a dorsal bristle on the 4th joint, if it is similar to the 2nd instar of other members of the Cypridinidae that have been described. The sensory bristle of the 5th joint and the b-, c-, e-, and f-bristles are without filaments on instar I and have filaments on instars III to the adult, and presumably has filaments on the missing instar II. The b-, c-, f-, and g-bristles of instar I have marginal spines that are absent on later instars, but bristles of later instars may have

TABLE 9.—Summary of characters by which the various species of *Codonocera* in the *goniicantha* group may be distinguished (F = female, M = male, + = present, - = absent, nd = no data; carapace lengths averaged). Data for *C. goniicantha*, *C. polygonia*, and *C. suenseni* from Poulsen, 1962, table 21.

Character	<i>goniicantha</i>	<i>polygonia</i>	<i>suenseni</i>	<i>phoenix</i>
Length of adult carapace (mm), M-F	3.1-3.1	2.1-2.5	nd-2.6	2.1-2.8
First antenna				
ventral spine on 1st joint	-	-	+	-
Filaments on sensory bristle, M-F	34-15	14-12	nd-14	13-13
Mandible				
2nd endopodial joint, ventral bristles	4	3	nd	3
3rd endopodial joint				
Length of longest claw as percent of 2nd endopodial joint	55-60	40-45	56	42-47
Spines on longest dorsal claw	+	-	-	-
Spines on ventral bristle	-	-	-	+
Maxilla				
Spines on posterior c-bristle	-	-	-	+
Fifth limb				
Main tooth, number of teeth	5	5	4	4
Cusps on largest constituent tooth	-	-	-	+,-*
Cusps on smallest a-bristle	-	+	+	+
Cusps on largest a-bristle	-	+	+	+

* Male with cusps, female without cusps.

spines on filaments. The b- and c-bristles of the adult male bear suckers.

Second Antenna: The 1st joint of the endopodite has no bristle on instar I, and the number increases gradually to 5 on the adult. All female instars are without bristles on the 2nd joint and have 1 long terminal filament on a small 3rd joint. The 2nd joint of the instar V male has 1 bristle and the adult male has 2. The 3rd joint of the instar V male as well as the adult has a long proximal bristle and 2 small terminal bristles, which are tooth-like in the adult. The endopodite of the adult male is developed as a clasper (Figure 19i). The 9th exopodial joint has 2 bristles on instar I, 3 on instar III, and 4 on later stages.

Mandible: The number of small slender a-bristles on the basale increases gradually from 1 on instar I to 3 on the adult. The d-bristle is absent on instar I and present on instar III and later instars. The 1st endopodial joint has 2 bristles on instar I, 3 on instar III, and 4 on later stages. The 2nd endopodial joint has 1 ventral bristle on instar I and 3 on instar III and later stages. The 3rd endopodial joint has 3 claws and 1 bristle on instar I and 4 claws and 1 bristle on instar III and later stages.

Maxilla: The 1st endopodial joint has 1 alpha-bristle on instar I and 2 on instar III and later stages. The 2nd endopodial joint has 5 bristles and claws on instar I and 9 on instar III and later stages.

Fifth Limb: The main tooth of the 1st exopodial joint has 1 cuspsate tooth on instar I, 3 on instar III, and 3 cuspsate teeth and 1 smooth tooth on instars IV, V, and the adult female; all 4 teeth

of the adult male are cuspsate. The total number of bristles on exopodial joints 4 and 5 is 2 on instar I, and 3 on instar III and later stages.

Sixth Limb: The limb is hirsute but without bristles on instar I and has many bristles on instar III and later stages. Presumably the 6th limb of the missing instar II bears a single bristle.

Seventh Limb: The limb is absent on instar I; bears 4 bristles, each with 1 bell, on instar IV; 10-12 bristles, each with 1-3 bells, on instar V; and 10 or 11 bristles, each with 3-5 bells, on the adult. The 7th limb is missing on instar III in the collection, but this is interpreted to be an aberrance, because in other members of the Cypridinidae the 7th limb of this instar is elongate and bare. The 7th limb of the missing instar II is probably small and bare.

Furca: The furca bears 3 claws on instar I and the 3rd claw is not articulated. Instars III to the adult have 4 articulated furcal claws.

Eyes and Upper Lip: Similar in all stages.

Pigmentation: Instar I (USNM 193758 and 4 in Paris) have neither purple pigment spots in shells and appendages nor black pigment in the lateral eye. Instar II (USNM 193761) has a few faint nonstellate purple pigment spots in the shell and some appendages, and no black pigment in the lateral eye. Female instar IV (USNM 193760) has neither purple pigment in shell and appendages nor black pigment in the lateral eye (the specimen was treated with a softening agent that may have

TABLE 10.—Comparison of selected characters of instars of *Codonocera phoenix* (F = female, M = male, nd = no data, U = sex unknown; instar II absent from collection and not listed in table; carapace lengths averaged).

Character	Instar					Adult	
	I	III	IV	V	V	F	M
	U	F	F	F	M		
Carapace length (mm)	0.82	1.17	1.44	1.83	1.54	2.79	2.09
First antenna bristles							
4th joint dorsal	0	1	1	1	1	1	1
4th joint ventral	0	1	1	1	1	1	1
Filaments on sensory bristle	0	many	many	many	many	13	13
Filaments on b-, c-, f-, g-bristles	0	many	many	many	many	many	many
Second antenna bristles							
Endopodite 1st joint	0	1-2	3	3-4	4	5	5
Exopodite 9th joint	2	3	4	4	4	4	4
Mandible bristles							
Basale							
Small a-bristles	1	2	2	3	3	2-3	3
d-bristle	0	1	1	1	1	1	1
Endopodite							
1st joint ventral	2	3	4	4	4	4	4
2nd joint ventral	1	3	3	3	3	3	3
3rd joint*	4	5	5	5	5	5	5
Maxilla endopodite							
1st joint alpha-bristles	1	2	2	2	2	2	2
2nd joint bristles*	5	9	9	9	nd	9	9
Fifth limb exopodite							
Teeth of main tooth	1	3	4	4	4	4	4
2nd joint							
a-bristles	1	3	3	3	3	3	3
b' + b"-bristles	1	4	4	4	4	4	4
3rd joint bristles							
Inner lobe	0	2	2	2	2	2	2
Outer lobe	2	2	2	2	2	2	2
4th + 5th joint bristles	2	3	3	3	3	3	3
Sixth limb							
Total bristles	0	14	many	many	many	36-38	37-40
Epipodial bristles	0	1	nd	nd	nd	3	3
Seventh limb bristles							
Proximal	0†	0‡	2§	4-6§	5§	4-5	4-5
Terminal	0†	0‡	2§	6§	5§	6	6
Number of bells	0†	0‡	1	1-3	1-3	3-5	3-5
Furcal claws	3	4	4	4	4	4	4

* Includes claws as well as bristles.

† 7th limb absent on instar I.

‡ 7th limb absent on specimen of instar III studied, but absence probably an aberrance (on Cypridinidae the 7th limb of instar III usually is elongate and bare).

§ Bristles tapering distally.

removed pigment). Male instar V (USNM 193763) has diffuse purple pigment in the shell and dark nonstellate pigment spots in the 2nd and 3rd joints of the 1st antenna and skirt of the 6th limb, but no black pigment in the lateral eye. Female instar V (USNM 193762) has stellate purple pigment spots in the carapace (Figure 29a), and nonstellate purple pigment spots in

the 1st and 2nd joints of the 1st antenna, the protopodite of the 2nd antenna, the coxale and basale of the mandible, and in the maxilla and 5th and 6th limbs; stellate purple spots are in the proximal part of the furca and in the posterior of the body posterior to the girdle, and black pigment is in the lateral eye. The adult males and females have many stellate purple spots on

the carapace as well as purple spots on many appendages. Observations herein concerning pigment within appendages of the adult female is based on study of USNM 193705 and 193708, and of the adult male USNM 193706; for those 3 specimens the pigment is more diffuse in female appendages than in those of the male.

THE FIFTH LIMB OF *Codonocera*.—Known species of this genus have 4, 5, or 6 teeth on the main tooth of the 1st exopodial joint (Kornicker, 1991:135). The main tooth of the 4th and 5th instars and the adult of *C. cuspidata* Kornicker, 1986d, was described by Kornicker (1986d:119): the 4th instar has 4 teeth, the 5th instar 5, and the adult 6. The 1st, 2nd, and 3rd instars of that species are unknown but probably have 1, 2, and 3 teeth, respectively. The first 4 instars of *C. phoenix* probably have the same number of teeth (1–4) as the first 4 instars of *C. cuspidata*, but later stages differ, because the number of teeth on *C. phoenix* does not go above 4. From this small amount of data it is possible to tentatively conclude that for those species of Cypridinidae having fewer than 6 teeth in the main tooth of the adult, the 1st instar has 1 tooth, and 1 tooth is added in each later instar until the total number of teeth that is present on the adult is reached; then, the number of teeth remains the same in all later stages.

FECUNDITY.—Poulsen (1962:319) reported a female of *C. suenisoni* with 15 newly laid eggs in the marsupium; this is the only report on the number of eggs laid by a species of *Codonocera*. No females of *C. phoenix* in the present collection have eggs in the marsupium but USNM 193705 has 40 eggs in the ovaries. If all these eggs were to be deposited in the marsupium at one time, the number of eggs (40) would be greater than the number reported for other species of Cypridinidae with the exceptions of *Gigantocypris muelleri* Skogsberg, 1920 (20–85 eggs), *Macrocypridina castanea* (Brady, 1897) (50–75 eggs) (Kornicker, 1975a:71), and *Azygocypridina imperialis* (Stebbing, 1901) (31–65 eggs) (Athersuch, 1980:158). The large number of eggs deposited by the first 2 species was attributed by Kornicker (1975a:49) to their being pelagic. Species of *Codonocera* have been collected at the surface as well as on the bottom, and could be classified as pelagic. Large clutch size supports the evidence that some pelagic Cypridinidae have more eggs per clutch than benthonic forms.

Paradoloria Hanai, 1974

TYPE SPECIES.—*Cypridina dorsoserrata* Müller, 1908; designation by Hanai (1974:119).

DISTRIBUTION.—Widespread; the southernmost record is in the vicinity of Australia and the northernmost record is in the Bay of Biscay. Known depth range is intertidal to 2210 m (Kornicker, 1989:13).

COMPOSITION.—The genus includes about 10 species (Kornicker, 1989:13). *Paradoloria vanhoeffeni* has a known range along the eastern coast of South Africa that includes the present study area. *Paradoloria dorsoserrata* (Müller, 1908) and *P. capensis* (Cleve, 1905) are known from the tip of South Africa, but the latter species probably does not belong in the genus (Kornicker, 1989:13).

Paradoloria vanhoeffeni (Müller, 1908)

FIGURES 30, 31

- Cypridina vanhoeffeni* Müller, 1908:62, 82, pl. 5: figs. 1–8, 13.—1912:10, 11.—Stebbing, 1910:517.—Triebel, 1941:331, fig. 62.—Sohn, 1974:725, fig. 1c.—Hartmann and Petersen, 1978:227 [location of types].
Cypridina vanhoeffeni Müller, 1908:176 [variant spelling in plate legend].
Cypridina (Vargula) Vanhoeffeni.—Skogsberg, 1920:194, 247, 262.
Cypridina Vanhoeffeni.—Monod, 1932:3, figs. 3, 4.
Paradoloria vanhoeffeni.—Poulsen, 1962:147–149, 152, 159–162, 334, fig. 80.
Cypridina (Paradoloria) vanhoeffeni.—Hartmann-Schröder and Hartmann, 1974:70.
Paradoloria vanhoeffeni.—Cohen and Kornicker, 1975:25.

HOLOTYPE.—None selected.

SYNTYPES.—Hamburg Zoological Institute and Zoological Museum (Hartmann and Petersen, 1978:227).

SYNTYPE LOCALITY.—Benthic off Simonstown, South Africa.

MATERIAL.—Sta 5-DR: USNM 193748, 1 adult female in alcohol. Sta 109-R: MNHN Os 436, instar V female in alcohol.

DISTRIBUTION.—Off Simonstown, South Africa; Madagascar (Monod, 1932:3); east coast of Africa from Cape of Good Hope to Mombassa (35°S–4°S) in 20–80 m (Poulsen, 1962:162). Sta 5-DR: W Leven Bank, depth 35–150 m. Sta 109-R: S Zelee Bank, depth 50 m. Known depth range 20–150 m.

DESCRIPTION OF INSTAR V FEMALE (Figures 30, 31a,b).—Carapace similar in shape to adult illustrated by Müller (1908, fig. 5:1), except caudal process more pointed and projecting (Figure 30a). Bar present on inside of rostrum of right valve near dorsal margin similar to that described by Poulsen (1962:159), not on left valve as illustrated by Müller (1908, fig. 5:3). Ventral edge of rostrum extending medially slightly past inner margin of selvage (Figure 30b,c).

Infold: 3 long rostral bristles near incisor of right valve with many short marginal hairs (Figure 30d,e). Finger-like blunt projection on rostral infold of right valve of adult male illustrated by Poulsen (1962, fig. 80a) not present. Broad list of caudal process with row of spines (Figures 30f, 31a); edge of list dorsal to teeth on right valve forming ridge projecting inward (Figure 30f). Teeth of posterior list of adult visible inside valve.

Carapace Size: MNHN Os 436, length 2.68 mm, height 1.87 mm.

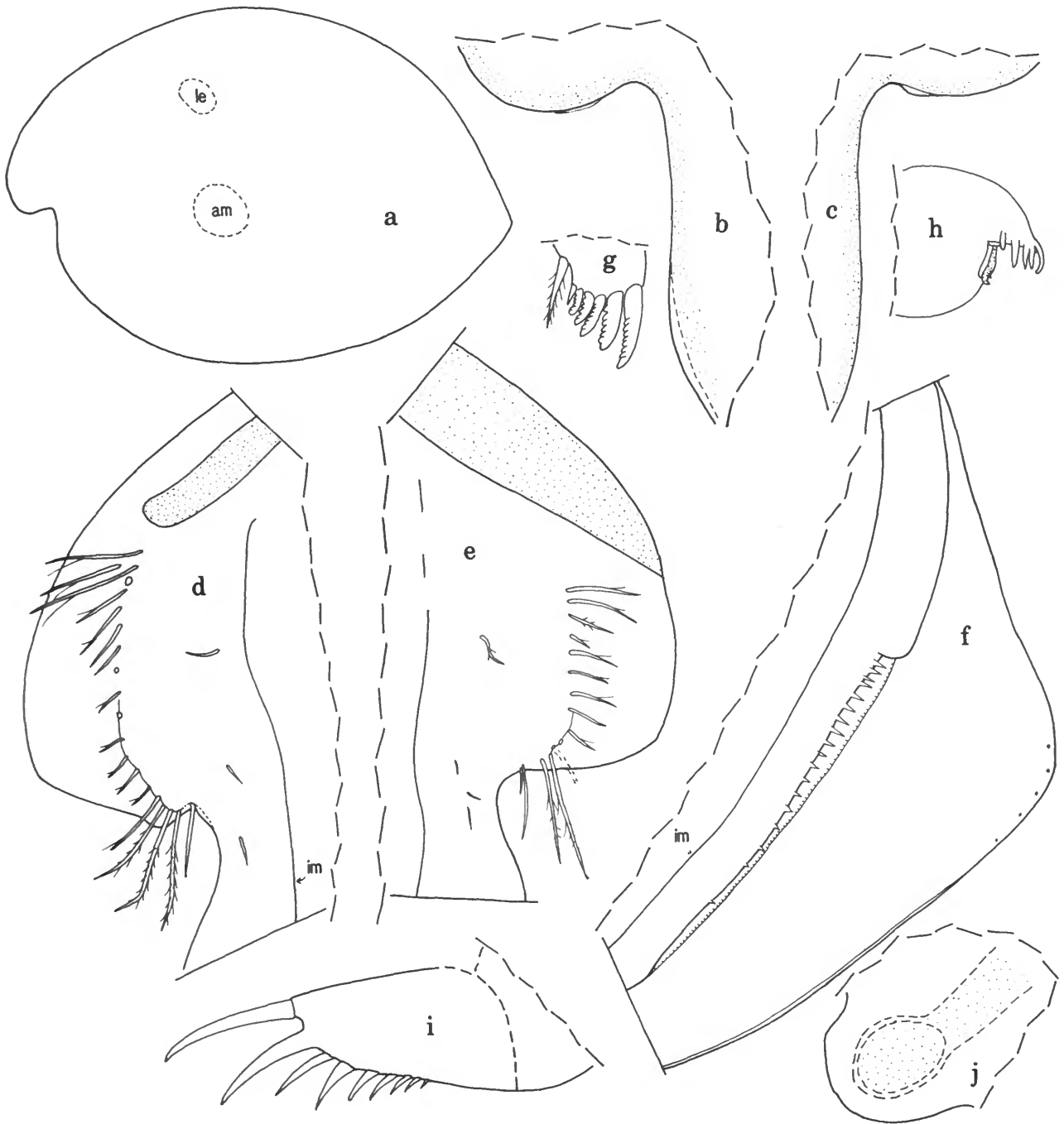


FIGURE 30.—*Paradoria vanhoeffeni* (Müller), instar V female, MNHN Os 436: a, complete specimen from left side, length 2.68 mm; b,c, incisus of left and right valves, ov; d,e, rostrum of right and left valves, iv; f, caudal process of right valve, iv; g, main tooth and proximal bristle of 1st exopodial joint of left 5th limb, pv; h, tip of 7th limb; i, left furcal lamella (teeth on claws not shown), iv; j, genital organ of adult visible within left side of instar V just anterior to furca.

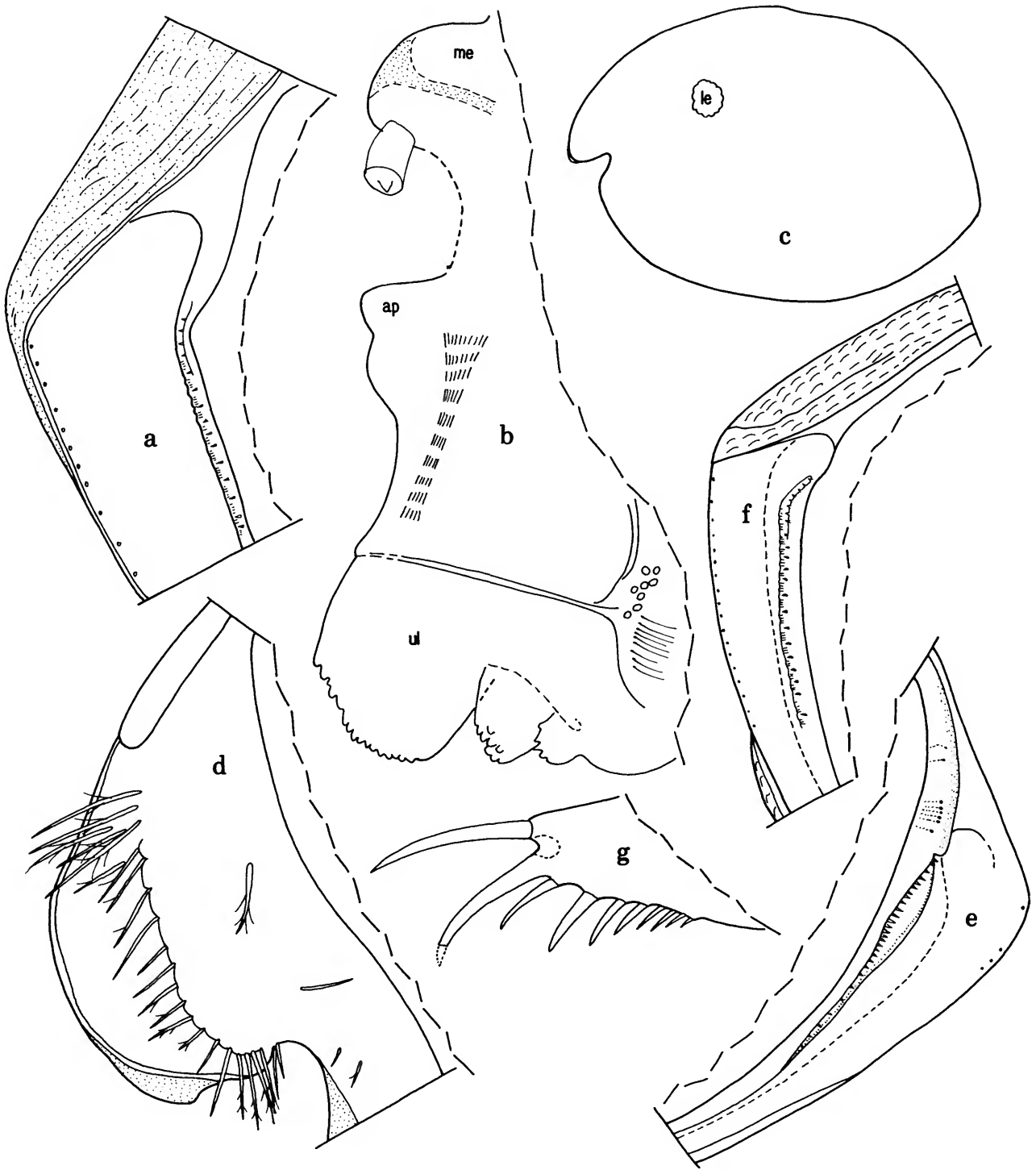


FIGURE 31.—*Paradoloria vanhoeffeni* (Müller): instar V female, MNHN Os 436: *a*, caudal process of left valve, iv; *b*, anterior of body from left side, anterior to left. Adult female, USNM 193748: *c*, complete specimen from left side, length 3.09 mm; *d*, rostrum of right valve, iv; *e*, *f*, caudal processes of right and left valves, iv; *g*, left furcal lamella, lv.

First Antenna: Joints 1–6 with bristles and spines similar to those of 1st antenna described by Poulsen (1962:159, fig. 80c).

Second Antenna: Endopodite similar to that described by Poulsen (1962:161) with 3 short and 2 long bristles on 1st joint (not 4 short bristles as on illustration of Poulsen (1962, fig. 80c)). Protopodite and exopodite similar to those described and illustrated by Poulsen (1962:161, fig. 80f).

Mandible: Similar to that described by Poulsen (1962:161).

Maxilla: Similar to that described and illustrated by Poulsen (1962:161, fig. 80g,h), including 2 dorsal bristles on coxale and 2 on basale, each pair with 1 long and 1 short bristle.

Fifth Limb: Main tooth comprising 5 pectinate teeth, 1 proximal smooth triangular tooth, and 1 spinous proximal bristle (Figure 30g).

Sixth Limb: With numerous bristles.

Seventh Limb (Figure 30h): Tooth opposite comb at right angle to comb similar to those illustrated by Müller (1908, fig. 5:13) and by Poulsen (1962, fig. 80:1) but with fewer comb teeth. Limb with many bristles tapering distally (juvenile character).

Furca (Figure 30i): Each lamella with 9 teeth; claw 2 nonarticulated; claw 3 narrower than claw 4.

Eyes: Lateral eye well developed, unpigmented (Figure 30a). Medial eye about same size as lateral eye, unpigmented, bare (Figure 31b).

Bellonci Organ (Figure 31b): Short, cylindrical, with pointed process at tip.

Upper Lip (Figure 31b): With unpaired anterior part, and paired posterior part with 2 short tusks on each side. (Lip more closely resembles that illustrated by Müller (1908, fig. 5:5) than that illustrated by Poulsen (1962, fig. 80n) in having a shorter anterior tusk.

Genitalia (Figure 30j): None present on specimen but genitalia with sclerotized rim visible on internal instar.

Anterior of Body (Figure 31b): With broad process midway between medial eye and upper lip.

Posterior of Body: Evenly rounded, bare.

Y-Sclerite: Typical for subfamily.

Remarks: The presence of 5 pectinate teeth on the main tooth of the 5th limb indicates that the specimen is the 5th instar (A-1). Small unextruded ovoids within the body may be eggs, but they could not be identified with certainty. The specimen has within it well-developed appendages of the next instar including genitalia, which could be either male or female. The 1st antenna of the internal instar does not have suckers visible that would have identified the internal instar as an adult male. It is tentatively concluded that the specimen is an instar V female.

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figure

31c-g).—Carapace similar in shape to that of instar V female (Figure 31c).

Infold (Figure 31d-f): Bristles and spines not counted but in general similar to those of instar V female.

Carapace Size: USNM 193748, length 3.09 mm, height 2.17 mm.

Furca (Figure 31g): Similar to instar V female except with 10 claws on each lamella.

Lateral Eye (Figure 31c): With 26 ommatidia and black pigment between them.

Posterior of Body: Evenly rounded, bare.

Eggs: USNM 193748 with many large unextruded eggs.

COMPARISONS.—Poulsen (1962:159) mentioned 2 shell characters of the specimens he described that differ from those described by Müller (1908:82), namely a chitinous bar on the inside of the rostrum being on the right valve of his specimen and on the left valve of Müller's specimen, and also the presence of a finger-like process on the inner side of the rostrum of his specimen and its absence on the illustration of Müller (1908, fig. 5:3). Another difference that could be of significance is length of the male carapace: Müller (1908:83) gives the length of the male as 3.25 mm, whereas, Poulsen (1962:161) gives the length of males as 2.5–2.6 mm. The valves of the instar V female and adult female studied herein differ from specimens described by Poulsen in the valves having many more teeth on the list of the caudal process (valves described by Poulsen (1962:159) have only 6 or 7 short triangular teeth near dorsal end of ridge). Also, the present valves have a bristle in place of the finger-like process inside the rostrum.

Skogsbergia Kornicker, 1974

Skogsbergia Poulsen, 1962 [nomen nudum].—Kornicker, 1974b [named type species].

TYPE SPECIES.—*Skogsbergia minuta* Poulsen, 1962 (subsequent designation, Kornicker, 1974b:3).

DISTRIBUTION.—The genus is circumglobal between about 60°N and 10°S. Known depth range 2–250 m. The genus has not been reported previously from the western Indian Ocean.

COMPOSITION.—Kornicker (1991:11) referred 10 species to this genus. Three new species are referred to the genus herein.

EMENDED DIAGNOSIS.—In his diagnosis of the genus Poulsen (1962:162) states, "The f- and g-bristles of the 8th joint are in the male proximally provided with a very large number of long, thin, hair-like filaments." Two species described herein, *S. iota* and *S. plax*, are without these filaments. Therefore, the diagnosis is emended to include species with or without the filaments. The main diagnostic generic characters are reduced endopodite of the 2nd antenna and an upper lip without long paired tusks.

Key to Species of *Skogsbergia*

1. Carapace with elongate caudal process 2
Carapace with evenly rounded posterior or with short caudal process 3
2. Caudal process delimited from dorsal margin by notch *S. hesperida*
Caudal process not delimited from dorsal margin by notch
. *S. calyx*, new species
3. Lateral eye small with 6–9 minute cells *S. galapagensis*
Lateral eye well developed with 25–30 ommatidia 4
4. Furcal claws 2 and 3 nonarticulate *S. squamosa*
No furcal claws nonarticulate 5
Only furcal claw 2 nonarticulate 6
5. Furcal claw 5 stouter than claw 4 *S. costai*
Furcal claw 5 not stouter than claw 4 *S. megalops*
6. f- and g-bristles of adult male 1st antenna with abundant long thread-like filaments 7
f- and g-bristles of adult male 1st antenna without abundant long thread-like filaments 11
7. Adult carapace shorter than 1.3 mm *S. minuta*
Adult carapace longer than 1.3 mm 8
8. Endopodite of 2nd antenna with 5 proximal bristles 9
Endopodite of 2nd antenna with 4 proximal bristles 10
9. 7th limb without teeth on jaw opposite comb *S. curvata*
7th limb with small teeth (2 on each side) on jaw opposite comb *S. lernerii*
10. Tip of anterior process between medial eye and upper lip of male bifurcate
. *S. menezii*
Tip of anterior process between medial eye and upper lip of male rounded
. *S. strophinx*
11. Caudal process delimited from posterior by distinct angle *S. iota*, new species
Caudal process not delimited from posterior by distinct angle
. *S. plax*, new species

Skogsbergia calyx, new species

FIGURES 32–34

ETYMOLOGY.—From the Latin *calyx* (cup, cover).

HOLOTYPE.—MNHN Os 437, adult female on slide and in alcohol.

TYPE LOCALITY.—Sta 101-DS, 8 Apr 1977, NW Île du Lys, Glorioso Islands, 11°25'42"S, 47°19'30"E, 26 m.

PARATYPES.—Sta 101-DS: USNM 193703, undissected juvenile in alcohol.

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT FEMALE (Figures 32–34).—Carapace elongate with convex dorsal and ventral margins and elongate caudal process with squarish tip (Figure 32a). Dorsal margin of caudal process forming obtuse angle with posterior margin of valve dorsal to caudal process but without notch like that present on *S. hesperida* (Müller, 1906, fig. XXX:21, 25) (Figure 32e, f). Anterodorsal corner of rostrum evenly rounded but anteroventral corner with medial flap-like extension

forming right angle similar to that on specimen referred to *S. hesperida* by Poulsen (1962, fig. 88a,b) (Figure 32b–d). Outer surface of rostrum with minute pores and scalloped ridge just proximal to ventral edge (Figure 32b); 2 narrow curved ridges extending from vicinity of inner end of incisur to anterior edge of valve ventral to incisur (outer ridge short and scalloped; inner ridge longer, scalloped in ventral half, and terminating in 4 or 5 minute segments at valve margin (Figure 32b)).

Infold: Rostral infold with 17–19 bristles (some bristles missing on USNM 193703 but their past presence indicated by empty sockets) (Figure 32c,d); 2 closely spaced marginal bristles at inner end of incisur, and 1 minute bristle just inward from them; 1 small indistinct bristle just proximal to ventral corner of inner end of incisur (Figure 32c,d). Narrow list extending from anteroventral infold, continuing along ventral margin of valve, and then broadening to form wide shelf at anterior end of caudal process (Figure 32e, f). Anteroventral list scalloped with a bifurcate bristle at anterior edge of each scallop, a total of about 25 bristles (Figure 32c (not all bristles

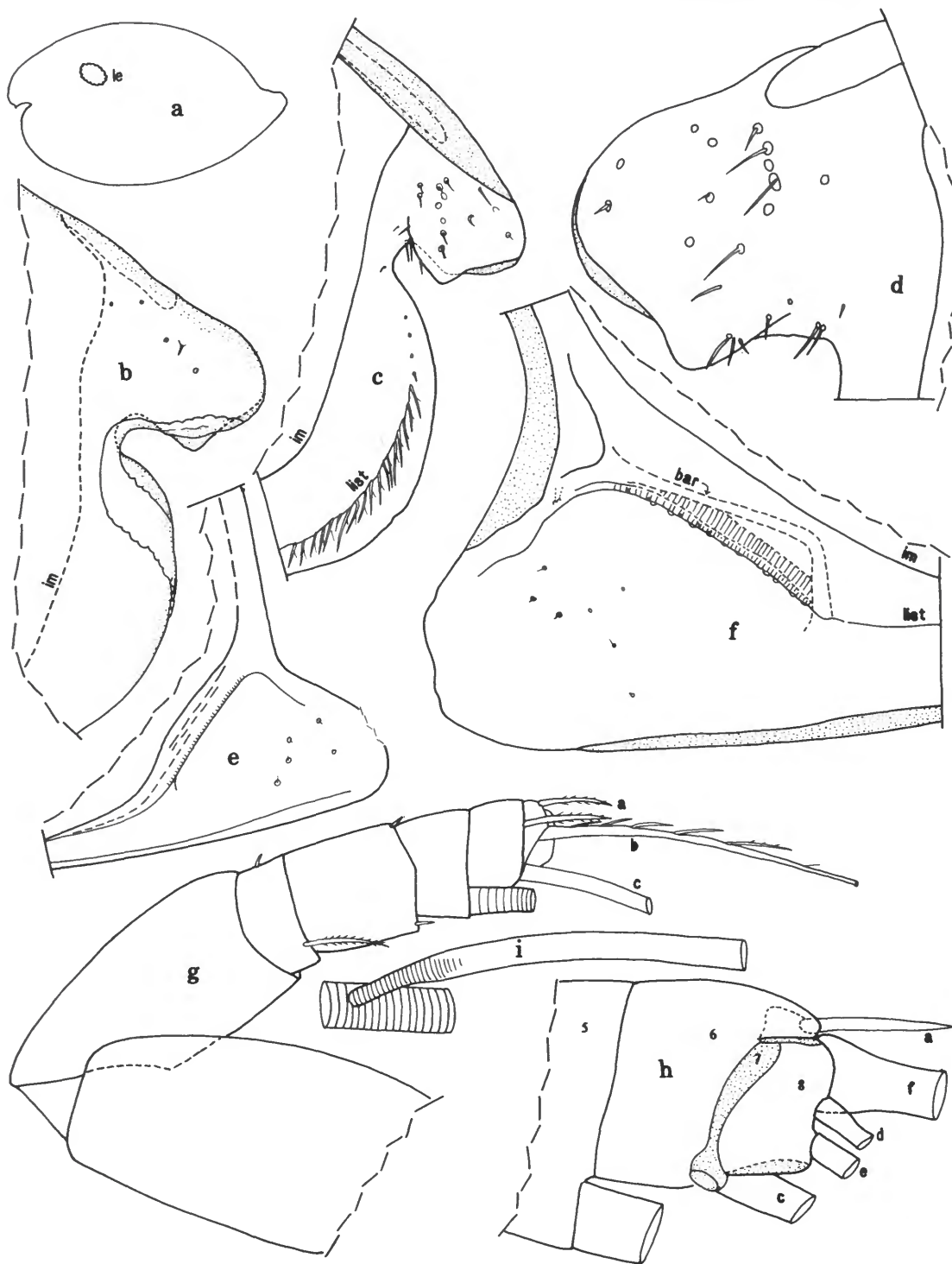


FIGURE 32.—*Skogsbergia calyx*, new species, adult female, holotype, MNHN Os 437: *a*, complete specimen from left side, length 1.59 mm; *b*, anterior of right valve, ov; *c*, anterior of left valve, lv; *d*, rostrum of right valve, lv; *e*, *f*, caudal processes of right and left valves, lv; *g*, left 1st antenna (bristles of 8th joint not shown), mv; *h*, tip of right 1st antenna (not all bristles shown), lv; *i*, proximal part of 4th filament of sensory bristle of 5th joint of left 1st antenna, mv.

shown)); anterior end of ventral list with 10 closely spaced bristles forming row continuing from anteroventral row; middle part of ventral list with few bristles; posterior edge of broad list at anterior end of caudal process with about 10 pores on minute protuberances, and numerous smaller pores between protuberances from which canals extend to anterior edge of broad list (Figure 32f). Broad posterior list of caudal process of left valve differs from that of right valve in having amber-colored oblique sclerotized bar beneath list (Figure 32f). Pocket posterior to list of caudal process with several minute pores, some with a small papilla (Figure 32e, f).

Carapace Size: MNHN Os 437, holotype, female, length 1.59 mm, height 0.92 mm.

First Antenna (Figure 32g-i): 1st joint bare. 2nd joint with few distal dorsal spines. 3rd joint with spinous ventral bristle about $\frac{3}{4}$ length of 4th joint, and small dorsal bristle at midlength (dorsal bristle of right limb of USNM 193703 reaching just past distal end of joint, that of left limb shorter (Figure 32g)). 4th joint with 2 minute terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 8 long stout filaments followed by 3 slender and shorter filaments, possibly more (tip of bristle missing on both limbs of USNM 193703); long stout filaments with short narrow weakly ringed part followed by broader unringed part (Figure 32i). 6th joint with short spinous medial bristle. 7th joint: a-bristle spinous, slightly stouter and shorter than bristle of 6th joint; b-bristle shorter than sensory bristle of 5th joint, with 5 short marginal filaments, some with spines, and with few marginal spines on stem following 5th filament; c-bristle about twice length of sensory bristle of 5th joint, with 10 marginal filaments, some with marginal spines (proximal 3 or 4 filaments and subterminal filament shorter than others); joint longer on medial side than on lateral side (Figure 32g, h). 8th joint: d- and e-bristles bare with blunt tips, slightly shorter than sensory bristle of 5th joint; f- and g-bristles about same length as c-bristle with 10 filaments, some with marginal spines; g-bristle with 11 filaments, some with marginal spines.

Second Antenna: Protopodite with short distal medial bristle with stout base (Figure 33a). Endopodite unjointed, with 4 proximal bristles (2 short and 1 long lateral (tip of long bristle missing on both limbs of USNM 193703), and 1 long medial), and 1 very long terminal filament (Figure 33a, b). Exopodite: bristle of 2nd joint with 2 or 3 slender ventral hair-like spines and 2 slender ventral spines just proximal to short narrow ringed terminal segment with minute terminal papilla (Figure 33c, d); bristle of joint 3 with proximal ventral and dorsal hairs followed by section with 12 ventral spines and dorsal hairs, then ventral and dorsal natatory hairs almost to tip (hairs near tip longer) (tip shown in Figure 33e), tip with minute papilla; bristle of joint 4 similar to that of joint 3 but with only 7 ventral spines; bristles of joints 5-8 with natatory hairs, no spines; 9th joint with 4 bristles (1 short, dorsal, with few hairs, next bristle medium length with natatory hairs and section with slender dorsal spines, next bristle long and stout with natatory

hairs and section with stout dorsal spines, ventral bristle long and stout with natatory hairs). Joints 3-7 or 8 with basal spines with 2 or more prongs, spines longer on distal joints; 8th joint of illustrated right limb of USNM 193703 without basal spine (Figure 33c), that of left limb with spine reaching just past end of 9th joint; 9th joint with slender lateral spine (on dorsal edge of joint) slightly longer than joint; joints 2-8 with indistinct minute terminal spines forming row in vicinity of dorsal corner.

Mandible (Figure 33f-h): Coxale endite with small triangular process between paired apical spines and small ringed bristle near base (Figure 33g). Basale (Figure 33f, h): dorsal margin with 1 short bare bristle at midlength and 2 longer spinous terminal bristles (proximal of these $\frac{2}{3}$ length of other); ventral margin with 3 a-bristles (including 1 small peg-like proximal bristle with base on lateral side near margin (missing on left limb of USNM 193703), 1 long bristle with base on margin, and 1 short bristle with base on lateral side inward from margin), no b-bristle, 2 c-bristles (1 long proximal spinous, 1 short distal bare (space between short and long bristles wider on left limb of holotype female than on right limb)), plus 1 small bare medial peg proximal to long c-bristle, and 1 long spinous d-bristle; lateral surface with spines forming few rows between a- and c-bristles (not shown). Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, hirsute distally, with 2 bristles (distal bristle almost $\frac{1}{2}$ length of proximal). 1st endopodial joint with 1 minute, 1 short, and 2 long bristles (1 long bristle missing on right limb of holotype female (Figure 33f)). 2nd endopodial joint: ventral margin with spines and with slender pectinate bristles forming 3 groups with 1 bristle in each of 2 proximal groups and paired bristles in terminal group (lateral bristle either slightly shorter or same length as medial); dorsal margin with 4 long bristles, few indistinct spines near base of short proximal bristle (bristle with short marginal spines), 3 short cleaning bristles with long marginal spines, and 1 short slender bristle (with short marginal spines) with base medial to distal long bristle; medial surface with indistinct spines forming rows. 3rd endopodial joint with 3 stout pectinate claws of unequal length, 2 short spinous medial ventral bristles, and 2 ringed lateral bristles (1 long ventral, 1 shorter dorsal) (all bristles with tubular tip).

Maxilla (Figures 33i-l, 34a): Endite I with 10 bristles (Figure 33i); endite II with 7 bristles (Figure 33j); endite III with 1 proximal and 6 terminal bristles (Figure 33k). Coxale with stout plumose dorsal bristle. Basale with slender dorsal bristle and short medial bristle (Figures 33l, 34a). Exopodite hirsute, with 3 bristles (inner bristle with short marginal spines, middle and short outer proximal bristle with long proximal spines). 1st endopodial joint with dorsal spines, triangular pointed cutting tooth, 2 slender subequal alpha-bristles with short marginal spines, and 2 beta-bristles (medial bristle stout pectinate, lateral bristle short, slender, with short marginal spines). 2nd endopodial joint with 4 a-bristles with few short marginal spines, 3 pectinate b-bristles (dorsal bristle ringed, middle bristle unringed and with only 1 stout anterior and 1

FIGURE 33 (opposite page).—*Skogsbergia calyx*, new species, adult female, holotype, MNHN Os 437: *a*, protopodite and endopodite of right 2nd antenna, mv; *b*, endopodite of left 2nd antenna, mv; *c*, exopodite of right 2nd antenna (bristles of 9th joint not shown), lv; *d*, bristle of 2nd exopodial joint of left 2nd antenna, mv; *e*, tip of bristle of 3rd exopodial joint of left 2nd antenna, mv; *f*, right mandible, mv; *g*, detail of coxale endite of mandible shown in *f*; *h*, basale and 1st endopodial joint of left mandible, mv; *i, j*, endites I and II of left maxilla, mv; *k*, bristles of endite III of right maxilla, mv; *l*, right maxilla, mv; *m*, anterior of body from left side, anterior to left; *n*, left lateral eye.

stout posterior tooth, inner bristle unringed, claw-like), 2 pectinate c-bristles ringed distally, and 3 stout pectinate claw-like d-bristles (ventral bristle ringed distally).

Fifth Limb (Figure 34*b-d*): Epipodite with 45 bristles. Protopodite with long cylindrical tooth with rounded tip (Figure 34*b*). Endites I, II, and III with about 6, 5, and 7 bristles, respectively (not all shown). 1st exopodial joint: main tooth with smooth small proximal peg and 6 constituent teeth (distal tooth with 7 cusps excluding tip of tooth) (Figure 34*c*); bristle proximal to peg with long proximal and short distal spines; anterior side with 3 bristles forming row (outer bristle stout pectinate, inner bristle small, bare), and 1 small bristle near tooth of protopodite. 2nd exopodial joint: with 4 pectinate, unringed, claw-like a-bristles (longest with 11 cusps), 3 pectinate ringed b'-bristles (longest with 15 cusps), and 4 pectinate ringed b''-bristles (longest with 22 cusps); posterior side with c-bristle with long proximal and short distal spines; anterior side with small d-bristle with few short marginal spines. 3rd endopodial joint: inner lobe with 1 proximal and 2 terminal bristles, all with long proximal spines (shortest of terminal bristles unringed; others ringed); outer lobe hirsute, with 1 proximal and 1 terminal bristle, both ringed and with long spines. 4th and 5th joints fused, hirsute, with small rounded terminal process bearing spines, and 4 ringed bristles with long proximal and short distal spines.

Sixth Limb (Figure 34*e, f*): 4 short bare epipodial bristles with tubular tips. Endite I with 3 short spinous proximal medial bristles and 2 long terminal bristles with long distal spines; endite II with 2 short spinous proximal medial bristles, 2 terminal bristles (1 long spinous, 1 minute), and small lateral spines (Figure 34*f*); endite III with 1 long spinous proximal medial bristle and 4 spinous terminal bristles (3 long, 1 short); endite IV with 1 long spinous proximal medial bristle and 4 spinous terminal bristles (3 long, 1 short). End joint with 14 or 15 bristles (3 short slender (with short marginal spines) near anterior end, 8 longer and stouter with long proximal and short distal spines, followed by 1 bristle either with long stiff proximal spines and long distal hairs or with long proximal and short distal spines, and 2 plumose posterior bristles; right limb only of USNM 193703 with small peg-like lateral bristle near base of 5th bristle counting from posterior end of joint); medial surface with distal hairs; lateral surface with stiff spines along

distal edge (absent near each end) (not shown).

Seventh Limb (Figure 34*g, h*): 5 bristles in proximal group (3 on comb side, 2 on peg side), each bristle with 3–5 bells; 12 bristles in distal group, all on terminal segment (6 on comb side, 6 on peg side), each bristle with 1–6 bells. Terminal comb with 3 long curved teeth, and on each side 3 short slender straight teeth with slightly rounded tips, and 2 short stout straight teeth with slightly rounded tips (Figure 34*h*); sclerotized ridge inside combs with indistinct spines (detail in Figure 34*h*); cup-like process with minute cusps along edge present opposite comb.

Furca (Figure 34*i*): Each lamella with 8 claws; claw 2 nonarticulated, remaining claws articulated; all claws with well-defined teeth along posterior edge and indistinct hairs along anterior edge (not shown); teeth similar in size along each claw; claw 1 with several distal medial teeth; right lamella anterior to left by width of claw 1 at base; right lamella with few indistinct spines along anterior edge proximal to claw 1; lamella following claw 8 with minute spines forming row.

Bellonci Organ (Figure 33*m*): Egg-shape with rounded tip.

Eyes: Medial eye unpigmented, bare (Figure 33*m*). Lateral eye larger than medial eye, with 28 ommatidia (dark amber color in transmitted light); matrix between ommatidia light amber color (Figures 32*a*, 33*n*).

Upper Lip (Figures 33*m*, 34*j*): Anterior unpaired part with large glandular processes; paired posterior part with small glandular processes along ventral edge and proximally along each side; small lateral lobe with 1 or 2 glandular processes present proximally on each side near posterior end of paired processes; a 2nd lateral lobe with 1 glandular process present on each side proximal to 1st lateral lobe; T-like sclerite on each side of lip, and 12 small glandular processes present just proximal to top of T (Figure 34*j*); hirsute lateral lobe on each side of posterior end of lip.

Genitalia (Figure 34*k*): Oval ring with attached spermatophore on each side of body anterior to furca and beneath epipodite of 5th limb. 5 minute bristles present near genitalia (these were observed near genitalia that had been removed from body and placed on slide under cover slip) (Figure 34*l*).

Anterior of Body (Figure 33*m*): With prominent rounded anterior process between medial eye and upper lip.

Posterior of Body (Figure 34*m*): Evenly rounded, bare.

Y-Sclerite (Figure 34*i*): With short indistinct ventral branch.

Pigmentation: None in carapace or appendages. Ommatidia of lateral eye with amber color.

COMPARISONS.—The carapace of *S. calyx* resembles that of *S. hesperida* (Müller, 1906) except for lacking a notch on the dorsal margin of the caudal process and in being smaller (carapace length 1.59 mm compared to 2.00–2.12 mm). The 2nd claw of the furca is nonarticulated on *S. calyx* and is

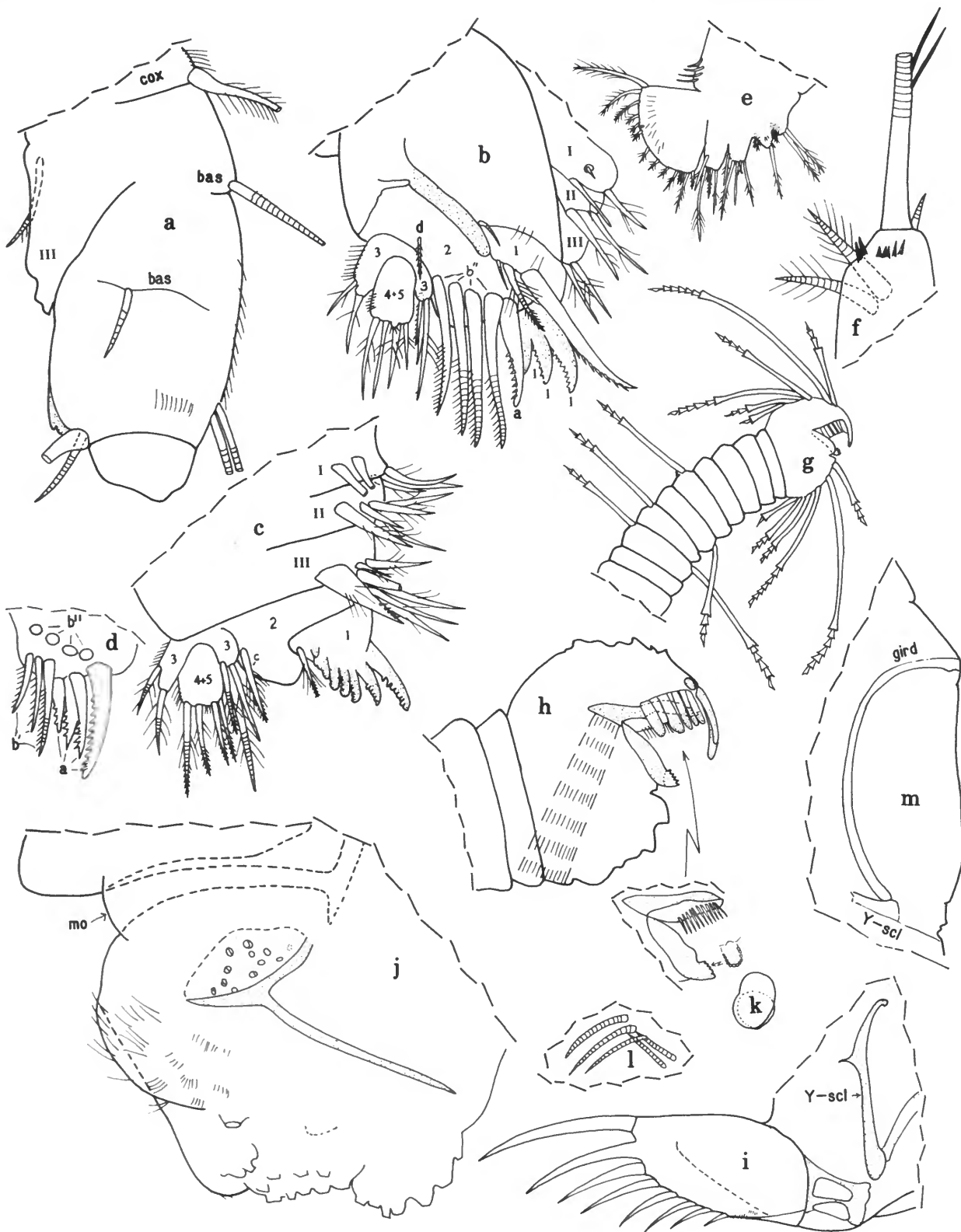


FIGURE 34 (opposite page).—*Skogsbergia calyx*, new species, adult female, holotype, MNHN Os 437: *a*, left maxilla (not all bristles shown), *mv*; *b*, left 5th limb (not all bristles of endites and 2nd exopodial joint, or teeth of main tooth shown), *av*; *c*, right 5th limb (*a*- and *b*-bristles of 2nd exopodial joint not shown), *pv*; *d*, *a*- and *b*'-bristles of 2nd exopodial joint of left 5th limb (4 *b*'-bristles represented by sockets), *av*; *e*, right 6th limb, *lv*; *f*, endite II of left 6th limb, *lv*; *g*, 7th limb; *h*, detail of tip of 7th limb shown in *g*; *i*, posterior of body from left side showing left furcal lamella and sclerites (stippled), anterior to left; *j*, upper lip and mouth from right side, anterior to right; *k*, left genitalia; *l*, bristles near genitalia; *m*, posterior of body from left side, anterior to left.

probably articulated on *S. hesperida* (Poulsen, 1962:175). The furca of the adult female *S. calyx* bears 8 claws on each lamella, whereas that of *S. hesperida* bears 9 or 10 (Poulsen, 1962:174). According to Poulsen (1962:174) the epipodite of the 5th limb of *S. hesperida* bears 60 bristles (45 on *S. calyx*) and the end joint of the 6th limb bears 20–22 short bristles (14 or 15 on *S. calyx*).

Skogsbergia iota, new species

FIGURES 35–39

ETYMOLOGY.—From the Greek *iota* (anything very small), in reference to small lateral eyes of the species.

HOLOTYPE.—MNHN Os 438, 1 undissected ovigerous female.

TYPE LOCALITY.—Sta 124-S, 12 Apr 1977, Mozambique Channel, SE Glorioso Islands, 11°32'06"S, 47°23'06"E, 24 m.

PARATYPES.—Sta 8-DR: USNM 193746, 1 adult male in alcohol. Sta 124-S: USNM 193739, 1 ovigerous female on slide and in alcohol; USNM 193741, 1 adult male on slide and in alcohol; USNM 193743, 4 ovigerous females in alcohol; USNM 193744, 6 adult males in alcohol; 209 specimens in alcohol including adult males and females and juveniles.

DISTRIBUTION.—Sta 8-DR, W Glorioso Islands, depth 250 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 24–250 m.

DESCRIPTION OF ADULT FEMALE (Figures 35–37).—Carapace elongate with convex ventral and dorsal margins and broad caudal process delimited from margin of valve dorsal to caudal process by obtuse angle (Figure 35a); anterior edge of rostrum only slightly convex and with minute lateral projection on tip reaching past valve edge (Figure 35d); narrow line extending from inner end of incisur to anteroventral corner of valve (Figure 35a). Surface smooth.

Infold: Rostral infold with 8 bristles forming outer row, 6 bristles proximal to outer row, 2 closely spaced bristles near inner edge of incisur, and 1 short bristle proximal to inner end of incisur (Figure 35d). Narrow list extending from anteroventral infold, continuing along ventral margin of valve, and then broadening to form wide shelf anterior to caudal process; anteroventral list and anterior end of ventral list with about 32 bristles forming row (only 3 anterior bristles shown in Figure 35d); middle part of ventral infold with 2 or 3 bristles.

Broad list at anterior end of caudal process with about 20 protuberances along posterior edge, numerous pore canals perpendicular to edge (Figure 35b,c), and about 45 minute structures forming bead-like row beneath flat surface of broad list at midwidth (not shown).

Selvae: Lamellar prolongation present along anterior and ventral margin, broadest and striated along dorsal edge of incisur, divided at inner end of incisur, and absent along dorsal half of caudal process. Along anterior half of ventral margin prolongation double, with proximal layer about $\frac{1}{3}$ width of total width of both layers and with serrate outer edge.

Central Adductor Muscle Attachments (Figure 35a): Comprising both elongate and ovoid attachments (not all shown).

Carapace Size: MNHN Os 438, holotype, length 1.20 mm, height 0.71 mm. USNM 193739, length 1.21 mm, height 0.72 mm. USNM 193743, 4 specimens: length 1.21 mm, height 0.73 mm; length 1.21 mm, height 0.77 mm; length 1.18 mm, height 0.72 mm; length 1.20 mm, height 0.72 mm.

First Antenna (Figure 35e, f): 1st joint bare. 2nd joint with indistinct minute spines forming few short rows along dorsal margin. 3rd joint short on medial side and longer on lateral side, with 2 short spinous bristles (1 ventral terminal, 1 dorsal with base proximal to midlength). 4th joint with 2 short spinous terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 9 long filaments followed by 2 shorter and slenderer filaments and 1 small subterminal filament. 6th joint with short spinous medial bristle. 7th joint: *a*-bristle spinous, about same length as bristle of 6th joint; *b*-bristle $\frac{2}{3}$ length of *a*-bristle, with 5 short marginal filaments, most with few minute marginal spines; *c*-bristle (not shown) longer than sensory bristle of 5th joint, with about 9 short filaments, some with few marginal spines. 8th joint: *d*- and *e*-bristles (not shown) slightly longer than *b*-bristle, bare with blunt tips; *f*- and *g*-bristles (not shown) similar to *c*-bristle.

Second Antenna: Protopodite with spinous distal medial bristle (Figure 36a,b). Endopodite single jointed, with 1 or 2 long and 2 short bristles and 1 very long terminal filament (filament on small protuberance that could be interpreted to be a 2nd joint) (Figure 36a,b). Exopodite: bristle of 2nd joint reaching just past 9th joint, aberrant on right limb of USNM 193739 (bristle bare except for subterminal spine), and on left limb bristle with 7 stout ventral spines in addition to subterminal spine; bristles of joints 3–8 with natatory hairs and slender spear-like spines; 9th joint with 3 (aberrance) or 4 bristles (2 long with hairs and spines, 1 medium, 0 or 1 short); joints 2–8 with basal spines increasing in length on distal joints (spine of 2nd joint minute, spine of 8th joint reaching just past distal end of 9th joint); lateral spine of 9th joint about same length as joint; joints 3–7 or 8 with indistinct minute spines forming row along distal edge.

Mandible: Coxale endite well developed, spinous, with 2 stout terminal spines and small peg between them; small proximal bristle present near base (coxale not shown). Basale: ventral margin with 3 small *a*-bristles (Figure 36d) (left limb of



FIGURE 35.—*Skogsbergia iota*, new species, adult female, paratype, USNM 193739: *a*, complete specimen from left side, length 1.21 mm; *b,c*, caudal processes of left and right valves (stippled ovals within "pocket" of right valve represent protistans), *iv*; *d*, anterior end of left valve, *iv*; *e*, right 1st antenna (not all bristles of 7th and 8th joints shown), *mv*; *f*, tip of right 1st antenna (not all bristles of 7th and 8th joints shown); *g*, right furcal lamella and right genitalia with attached spermatophore; *h*, posterior of body from left side.

USNM 193739 aberrant in having only 1 a-bristle, but small socket present where a-bristle present on other limb (Figure 36c)), 1 small b-bristle with base on lateral side of joint, minute medial peg proximal to 2 short c-bristles (1 c-bristle absent on left limb of USNM 193739 but empty socket shows where bristle had been (Figure 36d)), and 1 long spinous d-bristle; dorsal margin with 1 bristle proximal to joint midlength and 2 terminal bristles. Exopodite reaching just past midlength of dorsal margin of 1st endopodial joint, with 2 bristles (distal about $\frac{1}{2}$ length of proximal). 1st endopodial joint with 4 ventral bristles (1 minute, 1 short, 2 long). 2nd endopodial joint: ventral margin with distal pointed bristles forming 3 groups of 1, 1, and 2 bristles; dorsal margin with 4 long bristles, 2 medium bristles (1 proximal and 1 distal to long bristles), 1 short bristle distal to long bristles, and 7 or 8 short cleaning bristles (3rd cleaning bristle from proximal end with longer marginal spines than others). 3rd endopodial joint of USNM 193739 aberrant, with only 2 claws and 4 bristles on left limb (Figure 36e) and with end joint missing from right limb (Figure 36c). (End joint of adult male USNM 193741 normal with 3 claws and 4 bristles, and a normal female assumed to be similar.)

Maxilla: Endite I with 13 bristles (Figure 36f); endite II with 7 bristles (Figure 36g); endite III with 5 bristles (Figure 36h). Dorsal bristle of coxale missing from USNM 193739 (probably broken off during dissection). Basale with short dorsal bristle, long ventral bristle, and short medial bristle (Figure 36i). Exopodite hirsute, with 3 bristles (middle and short outer proximal bristles hirsute (Figure 36j)). 1st endopodial joint with 2 long slender alpha-bristles (Figure 36l) and 2 beta-bristles (medial bristle stout, with long proximal and short distal spines) (Figure 36k). 2nd endopodial joint with 4 a-bristles and 3 stout pectinate claw-like d-bristles (b- and c-bristles obscured on both mounted limbs of USNM 193739).

Fifth Limb: Protopodite with long cylindrical tooth with rounded tip (Figure 37a). Number of endite bristles not determined (not all shown in Figure 37c); endite II with small proximal anterior bristle; endite III with stout pectinate posterior bristle (Figure 37c). 1st endopodial joint: main tooth with smooth proximal peg and 6 constituent teeth (distal tooth with 9 cusps); bristle proximal to peg with few long proximal hairs (Figure 37b); anterior side of joint with 3 bristles (all with long spines, outer bristle stout, pectinate) forming row and 1 bristle with long spines near tooth of protopodite (Figure 37a); 2nd exopodial joint: with 4 pectinate, unringed, claw-like a-bristles (longest with 6 cusps), 3 pectinate ringed b'-bristles, 2 pectinate ringed b''-bristles, posterior c-bristle with long proximal hairs, and anterior stout d-bristle with long spines at midlength (Figure 37b,d). 3rd exopodial joint (Figure 37d): inner lobe with 1 short proximal and 2 long terminal bristles; outer lobe hirsute, with 2 bristles. 4th and 5th exopodial joints fused, hirsute, with 4 bristles, 2 on each side of low rounded

process (dashed in Figure 37d) (process absent on right limb of USNM 193739).

Sixth Limb (Figure 37e): 4 short bare epipodial bristles. Endite I with 2 short spinous proximal medial bristles and 1 long spinous terminal bristle; endite II with 2 short spinous proximal medial bristles and 2 terminal bristles (1 long spinous, 1 minute); endite III with 1 long spinous proximal medial bristle and 3 terminal bristles (1 long spinous, 1 long bare, 1 short spinous); endite IV with 1 long spinous proximal medial bristle and 4 or 5 spinous terminal bristles (2 or 3 long, 2 short). End joint with 12 or 13 bristles: 2 or 3 short slender at anterior end (1 or 2 ringed and with short spines, 1 unringed with few spines), followed by 1 longer bristle with long proximal and short distal spines, then 2 short bristles with short marginal spines, then 5 longer bristles with long proximal spines or hairs and short distal spines, and 2 longer hirsute posterior bristles. End joint also with medial hairs forming rows and with lateral spines along distal edge.

Seventh Limb (Figure 37f): 6 bristles in proximal group (3 on each side), each bristle with 4 or 5 bells; 11 bristles in distal group (5 on comb side, 6 on peg side), each with 1–7 bells. 1 limb of USNM 193739 with 1 bristle on comb side stouter and much longer than other bristles, and with 7 bells (Figure 37f); on other limb long bristle not present (possibly broken off). Terminus of USNM 193739 obscured on both limbs but approximately as shown in Figure 37f.

Furca (Figure 35g): Each lamella with 7 claws; claw 2 nonarticulated, about same width as claw 1 at base but stouter than claw 1 in distal part; claw 4 narrower than claw 5; all claws with well-defined teeth along posterior edge (not shown); teeth similar in size along each claw; claw 1 with several large distal medial teeth (not shown); right lamella anterior to left by width of claw 1 at base, and with few indistinct spines along anterior edge proximal to claw 1.

Bellonci Organ (Figure 37g): Short, cylindrical, with narrow proximal part and irregular tip.

Eyes: Medial eye unpigmented, bare (Figure 37g). Lateral eye about same size as medial eye, with 27 amber-color ommatidia and brown pigment between ommatidia (Figures 35a, 37g,h).

Upper Lip (Figure 37g,i): Anterior unpaired part with large glandular processes; paired posterior part with large glandular processes along ventral edge, followed by short lobe with 2 glandular processes, and then shorter lobe with 1 glandular process; L-shape sclerite proximally on each side of lip.

Genitalia (Figure 35g): Oval ring with attached elongate spermatophore on each side of body of USNM 193739.

Anterior of Body (Figure 37g): With prominent rounded anterior process between medial eye and upper lip.

Posterior of Body (Figure 35h): Bare rounded bulge present on posterodorsal corner dorsal to dorsal end of girdle. Posterior of body without hairs or spines.



FIGURE 36 (opposite page).—*Skogsbergia iota*, new species, adult female, paratype, USNM 193739: *a, b*, protopodites and endopodites of left and right 2nd antennae, mv; *c*, part of right mandible (1 a-bristle represented by socket; dorsal bristles of 2nd endopodial joint not shown), mv; *d*, ventral bristles of basale of left mandible (1 c-bristle represented by socket; d-bristle not shown), mv; *e*, 3rd endopodial joint of left mandible, mv; *f-h*, endites I-III of right maxilla, mv; *i*, part of left maxilla (not all bristles shown), lv; *j*, exopodite of left maxilla, lv; *k*, cutting tooth and beta-bristles of 1st endopodial joint of left maxilla, lv; *l*, alpha-bristles of 1st endopodial joint of right maxilla, mv.

Y-Sclerite (Figure 35h): Typical for subfamily.

Pigmentation: None in carapace or appendages; brown pigment between amber-color ommatidia of lateral eye.

Protistans: USNM 193739 with protistans in "pocket" of caudal process (Figure 35c).

Eggs: In marsupium: MNHN Os 438 and USNM 193739 each with 4 (Figure 35a). USNM 193743, 4 specimens: 1 with 4, 2 with 5, and 1 with 4 embryos with black lateral eyes and with appendages projecting from uncalcified shells.

DESCRIPTION OF ADULT MALE (Figures 38, 39).—Carapace, in general, similar to that of adult female but slightly smaller and caudal process projecting farther (Figure 38).

Carapace Size: USNM 193741, length 1.02 mm, height 0.65 mm. USNM 193744, 6 specimens: length 0.96 mm, height 0.60 mm; length 0.99 mm, height 0.62 mm; length 1.02 mm, height 0.62 mm; length 1.01 mm, height 0.61 mm; length 0.99 mm, height 0.63 mm; length 1.04 mm, height 0.63 mm. USNM 193746, length 1.01 mm, height 0.64 mm.

First Antenna (Figure 39a,b): 1st joint bare. 2nd joint with few indistinct distal ventral spines. 3rd joint shorter on medial side than on lateral side, with 2 spinous bristles (1 short ventral terminal, 1 longer dorsal with base near midlength). 4th joint with short spinous ventral bristle; dorsal bristle absent on both limbs of USNM 193741 (probably aberrant). Sensory bristle of 5th joint with 9 long proximal filaments followed by 3 shorter and slenderer filaments with few marginal spines, and 1 small subterminal filament. Medial bristle of 6th joint with few indistinct marginal spines. 7th joint: a-bristle reaching tip of bristle of 6th joint, with marginal spines; b-bristle almost 4 times length of a-bristle, with stout proximal filament with large transparent sucker, followed by 2 slender filaments each with 2 small suckers, then 1 short slender filament with few small marginal spines, and with few spines on bristle distal to last filament; c-bristle about twice length of b-bristle, with stout proximal filament with very large sucker, followed by slender filament with 2 small suckers, and then about 7 slender filaments, some with spines. 8th joint: d- and e-bristles about same length as b-bristle, bare with blunt tips; f-bristle about 1½ times length of b-bristle, with about 7 slender marginal filaments, some with small spines; g-bristle about twice length of b-bristle and about ¼ longer than sensory bristle of 5th joint, with about 13 slender filaments, some with small spines.

Second Antenna: Protopodite with spinous distal medial

bristle. Endopodite single jointed with 2 long and 2 short proximal bristles and long terminal filament. Exopodite: bristle of 2nd joint with proximal hairs followed by 6–9 stout ventral spines and 3 or 4 slender distal dorsal spines; bristles of joints 3 and 4 with stout proximal ventral spines and distal natatory hairs; joints 4–8 with natatory hairs; 9th joint with 4 bristles (dorsal bristle small with few hairs; remaining bristles long and with natatory hairs). Basal spines of joints 2–8, lateral spine of 9th joint, and small spines on joints 3–7 or 8 similar to those of adult female.

Mandible: 3rd endopodial joint with 3 claws (dorsal claw bare, others with proximal ventral spines) and 4 bristles (Figure 39c). Limb otherwise similar to that of adult female described, which has aberrant 3rd endopodial joints.

Maxilla: Coxale with hirsute slender dorsal bristle. Endite I with about 8 bristles; endite II with 6 bristles; endite III with 5 bristles. Basale, exopodite, and 1st endopodial joint similar to those of adult female. 2nd endopodial joint with 4 bare a-bristles (not shown), 2 or 3 pectinate b-bristles, 2 pectinate c-bristles, and 3 stout pectinate d-bristles (Figure 39d).

Fifth Limb: Endite I with 4 bristles; endite II with 5 bristles; endite III with 7 bristles. Protopodial tooth and exopodite similar to those of adult female.

Sixth Limb: With 3 short bare epipodial bristles. Endite I with 2 or 3 short spinous proximal medial bristles and 1 long spinous terminal bristle; endite II with 2 short spinous proximal medial bristles and 2 terminal bristles (1 long spinous, 1 minute); endite III with 1 long spinous proximal medial bristle and 3 spinous terminal bristles (2 long, 1 short between long bristles); endite IV with 1 long spinous proximal medial bristle and 3 spinous terminal bristles. End joint: right limb of USNM 193741 with 9 marginal bristles (1 short anterior unringed with short spines, followed by 1 small ringed with short spines, then 5 short ringed with long proximal and short distal spines, then 2 longer hirsute posterior bristles); left limb of USNM 193741 with 11 bristles (1 short anterior unringed with short spines, followed by 1 short ringed with short spines, then 1 longer with long proximal and short distal spines, 1 short with short spines, 5 short with long proximal and short distal spines, then 2 longer hirsute bristles). End joint also with long medial hairs and lateral spines along distal edge (Figure 39e).

Seventh Limb: 6 bristles in proximal group (3 on each side), each with 3–6 bells; distal group with 11 bristles (5 on comb side, 6 on peg side); both limbs of USNM 193741 with 1 bristle on comb side stouter and much longer than other bristles and with 7 bells; other bristles with 1–7 bells (Figure 39f). Terminus with comb of 2 long teeth in middle, then on each side 3 shorter teeth with rounded tips, and 2 teeth with flat tips (Figure 39g); short sclerotized bar opposite comb with terminal fan with 3 teeth on each side; a sclerotized bar extending from proximal end of bar projecting into comb (detail in Figure 39g).

Furca (Figure 39h,i): Similar to that of adult female.

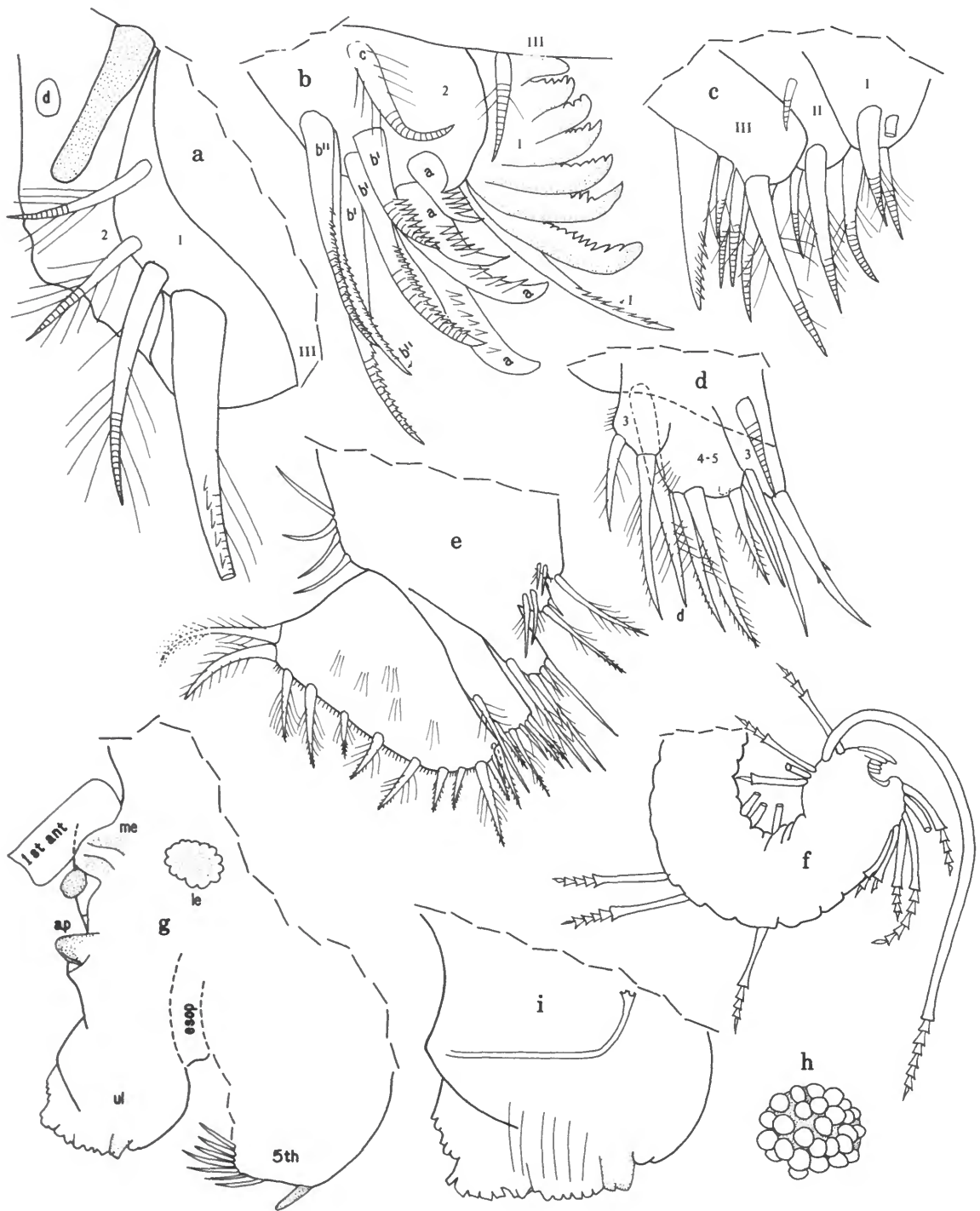


FIGURE 37.—*Skogsbergia iota*, new species, adult female, paratype, USNM 193739: *a*, protopodial tooth (stippled) and anterior bristles of 1st exopodial joint of right 5th limb (d-bristle of 2nd exopodial joint represented by labeled socket), av; *b*, joints 1 and 2 of left 5th limb, pv; *c*, endites I-III of right 5th limb (not all bristles shown), av; *d*, exopodial joints 3-5 of left 5th limb, pv; *e*, left 6th limb, mv; *f*, 7th limb; *g*, anterior of body from left side, anterior to left; *h*, right lateral eye; *i*, upper lip from left side, anterior to left.

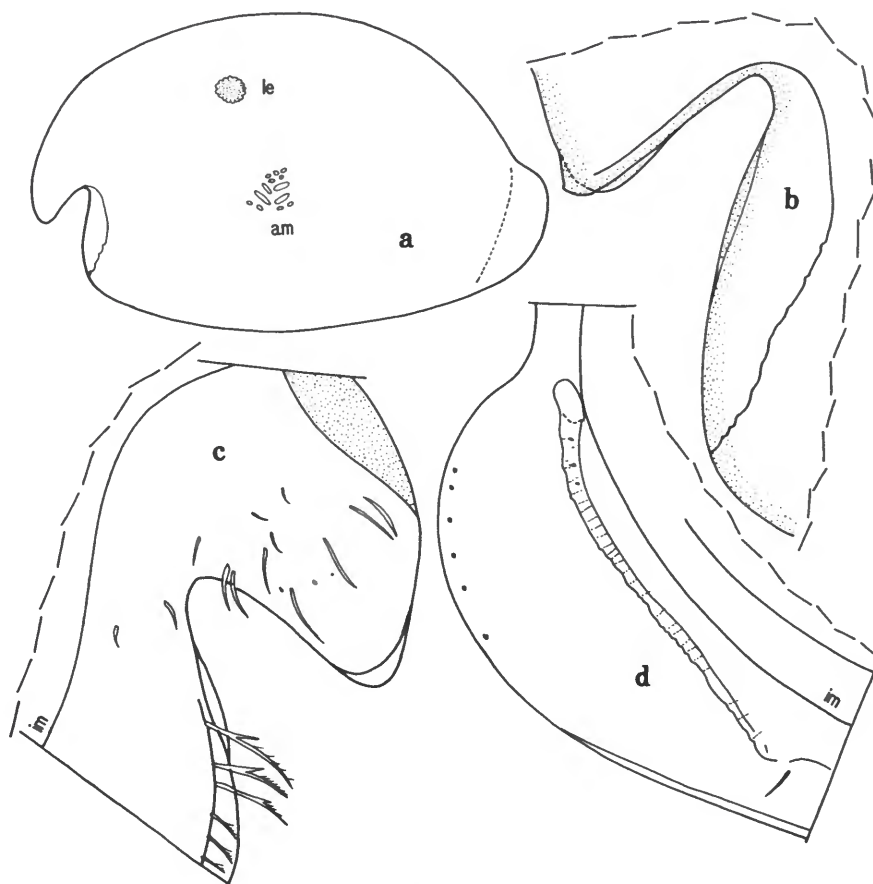


FIGURE 38.—*Skogsbergia iota*, new species, adult male, paratype, USNM 193741: a, complete specimen from left side, length 1.02 mm; b,c, outside and inside views of anterior of left valve; d, caudal process of left valve, iv.

Eyes (Figures 38a, 39j): Medial eye unpigmented bare. Lateral eye about same size as medial eye, with about 25 ommatidia and brown pigment between ommatidia.

Upper Lip (Figure 39k): Similar to that of adult female.

Genitalia (Figure 39i,l): Elongate copulatory limb on each side of body anterior to furca; internally on each side of body an elongate vas deferens entering posterior end of a globular testis. (Globular seminal vesicle at distal end of vas deferens as in sarsiellids not observed (Kornicker, 1969, fig. 2a,b).)

Anterior of Body (Figure 39j,k): Similar to that of adult female.

Posterior of Body (Figure 39l): Similar to that of adult female but posterodorsal bulge not as well developed.

Y-Sclerite (Figure 39i,l) and **Pigmentation**: Similar to that of adult female.

COMPARISONS.—The carapace of the female *S. iota* differs from that of *C. calyx* in being smaller and in having a higher and narrower caudal process. The lateral eye of *S. iota* relative

to the medial eye is much smaller than that of *S. calyx*. The 1st antenna of the adult male *S. iota* differs from those of previously described species of *Skogsbergia* males, which do not have abundant thin hair-like proximal filaments on the f- and g-bristles (*S. galapagensis* Kornicker and Iliffe, 1989a:8; *S. menezis* Kornicker, 1970a:10; *S. minuta* Poulsen, 1962:165; *S. curvata* Poulsen, 1962:168; *S. lernerii* (Kornicker, 1958:229; Poulsen, 1962:171 as *S. crenulata* Poulsen, 1962); *S. strophinx* Kornicker, 1991:12). The furca of *S. iota* differs from that of *S. squamosa* Kornicker, 1974b, fig. 2c in not having claw 3 nonarticulated, and from that of *S. costai* Kornicker, 1974b, fig. 2n in having claw 2 nonarticulated. The furca of *S. iota* differs from most known species of the genus in having only 7 claws on each lamella. Although the lateral eyes of *S. iota* have many ommatidia the diameter of the eye is relatively small and, because it is visible through the shell, provides a means of easily separating it from other species of *Skogsbergia* in the present collections.



FIGURE 39.—*Skogsbergia iota*, new species, adult male, paratype, USNM 193741: *a*, right 1st antenna (not all bristles of 7th and 8th joints shown), mv; *b*, bristles of joint 7 of right 1st antenna, mv; *c*, tip of right mandible, mv; *d*, bristles of 2nd endopodal joint of right maxilla (a-bristles not shown), mv; *e*, stout lateral spines along ventral edge of end joint of right 6th limb, mv; *f*, tip of 7th limb (not all bristles shown); *g*, detail of tip of 7th limb shown in *f*; *h*, right furcal lamella, lv; *i*, posterior of body from left side, anterior to left; *j*, anterior of upper part of body from right side, anterior to right; *k*, anterior of body from left side (lateral eye, medial eye, and Bellonci organ not shown), anterior to left; *l*, posterior of body from right side, anterior to right.

Skogsbergia plax, new species

FIGURES 40-44

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

HOLOTYPE.—MNHN Os 440, undissected adult male in alcohol.

TYPE LOCALITY.—Sta 124-S, 12 Apr 1977, Mozambique Channel, SE of Glorioso Islands, 11°32'06"S, 47°23'06"E, depth 24 m.

PARATYPES.—Sta 23-S: Paris, 1 adult male in alcohol. Sta 106-R: Paris, 1 adult male in alcohol; 1 instar II in alcohol; 1 undissected instar IV or V (length 0.86 mm, height 0.55) in alcohol. Sta 124-S: USNM 193738, 1 adult male on slide and in alcohol; USNM 193740, 1 adult female on slide and in alcohol; USNM 193742, 1 partly dissected instar ?V female in alcohol; USNM 193745, 1 partly dissected instar II in alcohol; Paris, 9 undissected adult males and 1 undissected juvenile (length 0.92 mm, height 0.55 mm) in alcohol.

DISTRIBUTION.—Sta 23-S, Vatou Islet, Mayotte, depth 6 m. Sta 106-R, Zelee Bank, south border, depth 18–24 m. Sta 124-S, SE Glorioso Islands, depth 24 m. Known depth range 6–24 m.

DESCRIPTION OF ADULT FEMALE (Figures 40–42a–f).—Carapace elongate with convex ventral and dorsal margins and evenly rounded posterior margin (Figure 40a,c); anterior margin of rostrum convex and with minute projection at tip (Figure 40d); narrow evenly curved line extending from inner end of incisur to anteroventral corner of valve (Figure 40b). Surface of valve smooth.

Infold: Rostral infold with about 10 bristles (some divided) forming vertical row, 2 closely spaced bristles anterior to ventral end of row near incisur, 2 closely spaced bristles at inner end of incisur, and 1 indistinct bristle proximal to inner end of incisur (Figure 40d). Narrow list extending from anteroventral infold, continuing along ventral margin of valve, and then broadening to form wide shelf anterior to caudal process. Anteroventral infold with 1 long bristle between incisur and anterior end of list, then about 18–21 fairly long bristles (most divided) along list (only anterior 2 shown in Figure 40d). Broad list at anterior end of caudal process of left valve with fairly even posterior edge, about 13 minute bristles forming row, and numerous closely spaced pore canals perpendicular to edge (Figure 40f); broad list of right valve narrower than that of left valve, with about 11 minute bristles, and without closely spaced pore canals (Figure 40e); 13–15 minute pores forming row just within distal edge of caudal process (Figure 40e, f).

Selvage: Lamellar prolongation with smooth outer edge present along anterior and ventral margins, absent along outer edge of caudal process and posterior valve margin; broadest and striated along dorsal edge of incisur, and divided at inner end of incisur. Prolongation along anterior half of ventral margin with 2nd layer (with serrate outer edge) about 1/2 total width of prolongation.

Carapace Size: USNM 193740, length 1.36 mm, height 0.81 mm.

First Antenna (Figure 40g): 1st joint bare. 2nd joint with indistinct spines along dorsal margin and distally along ventral margin. 3rd joint short on medial side and longer on lateral side, with 1 proximal dorsal bristle and 1 terminal ventral spinous bristle. 4th joint with 2 terminal bristles (1 ventral, 1 dorsal) with few indistinct spines. Sensory bristle of 5th joint with 9 long proximal filaments, 3 shorter and slenderer distal filaments, and 1 small subterminal filament. 6th joint with short spinous medial bristle. 7th joint: a-bristle longer than bristle of 6th joint, with few indistinct spines; b-bristle about twice length of a-bristle, with 4 short marginal filaments, some with spines; c-bristle longer than sensory bristle of 5th joint, with about 10 short marginal filaments (tip of bristle broken off on both limbs of USNM 193740). 8th joint: d- and e-bristles almost twice length of b-bristle, bare with blunt tips; f-bristle about 3 times length of b-bristle, slightly shorter than c-bristle, with 9 marginal filaments, some with spines; g-bristle similar to c-bristle, some filaments with marginal spines (tip of bristle broken off on both limbs of USNM 193740) (c-, d-, e-, f-, and g-bristles not shown).

Second Antenna: Protopodite with distal medial bristle (Figure 40h). Endopodite single jointed, with 4 proximal bristles (2 long, 2 short) and 1 long terminal filament (Figure 40h). Exopodite: bristle of 2nd joint reaching joint 8 or 9, with about 30 closely spaced, slender, spear-like ventral spines, and numerous smaller dorsal spines; bristles of joints 3 and 4 with slender spear-like proximal ventral spines and distal natatory hairs; bristles of joints 5–8 with only natatory hairs; 9th joint with 4 bristles (2 long and 1 medium with short flat spear-shape proximal dorsal hairs and slender natatory hairs; 1 short bare or with few hairs); joints 3–8 with stout basal spines (spine of joint 3 about 2/3 length of 4th joint; spine of 8th joint about 1 1/2 times length of 9th joint); lateral spine of 9th joint about same length as spine of 8th joint; joints 2–8 with minute indistinct spines forming row along distal edge.

Mandible: Coxale endite well developed, spinous, with 2 stout terminal spines and small peg between them (Figure 40i), with small proximal bristle near base. Basale: ventral margin with 3 small a-bristles, 1 small lateral b-bristle, 3 small c-bristles, and 1 long spinous d-bristle (Figure 40i); dorsal margin with 1 slender bristle just proximal to joint midlength and 2 terminal bristles. Exopodite about 3/4 length of dorsal margin of 1st endopodial joint, with 2 bristles (distal about 1/2 length of proximal). 1st endopodial joint with 4 ventral bristles (1 minute, 1 short and 1 long both with short spines, 1 long with wreaths of long spines). 2nd endopodial joint: ventral margin with distal pointed bristles forming 3 groups of 1, 1, and 2 bristles; dorsal margin with 5 long bristles, 2 medium bristles (1 proximal and 1 distal to long bristles), 2 short bristles (1 proximal and 1 distal to long bristles), and 6 short cleaning bristles. 3rd endopodial joint with 3 stout equilength claws (dorsal claw bare, others with 1–3 proximal ventral spines),



FIGURE 40.—*Skogsbergia plax*, new species, adult female, paratype, USNM 193740: *a*, complete specimen from right side, length 1.36 mm; *b*, *c*, anterior and posterior ends of right valve, ov; *d*, *e*, anterior and posterior ends of left valve, iv; *f*, posterior end of left valve, iv; *g*, right 1st antenna (not all bristles of 7th and 8th joints shown), mv; *h*, propodite and endopodite of right 2nd antenna, mv; *i*, proximal part of left mandible, mv; *j*, distal part of left mandible (dorsal bristles of 2nd endopodial joint not shown), mv; *k*, *l*, anterior process and upper lip from left and right sides.

and 4 bristles (Figure 40j).

Maxilla: Endite I with about 10 spinous bristles (not all shown) (Figure 41a); endite II with 7 spinous bristles (Figure 41b); endite III with 7 spinous bristles (Figure 41c). Coxale with spinous dorsal bristle (Figure 41f). Basale with short bristle near base of endite III, 1 longer bare dorsal bristle, 1 long spinous ventral bristle, and 1 short medial bristle (Figure 41g,e). Exopodite hirsute, with 3 bristles (1 subterminal spinous, 2 terminal (bristle closest to subterminal bristle spinous, other bare))(Figure 41g,e). 1st endopodial joint with evenly rounded hyaline cutting tooth, indistinct dorsal spines forming rows, 2 long slender bare alpha-bristles (bulge at base of lateral bristle), and 2 beta-bristles (outer stouter and pectinate) (Figure 41g). 2nd endopodial joint with 4 slender bare a-bristles (Figure 41g), 3 c-bristles (2 stout pectinate, 1 short slender medial) (Figure 41d,h), 3 pectinate b-bristles (outer ringed distally, others unringed) (Figure 41h), and 3 stout pectinate d-bristles (Figure 41h).

Fifth Limb: Endites I, II, and III with about 6, 6, and 5 bristles, respectively (Figure 42a,b). Protopodite with long slender tooth (Figure 42a). 1st exopodial joint: main tooth with stout smooth peg and 6 pectinate teeth (distal tooth with about 10 unequal marginal cusps) (Figure 42c); bristle proximal to peg with 4 broad spines (2 on each side); anterior side with 3 spinous bristles forming row (inner stouter) and 1 spinous bristle near protopodial tooth (Figure 42a). 2nd exopodial joint with 4 stout pectinate unringed a-bristles (2 proximal with long slender marginal teeth, 2 distal with 6 shorter marginal teeth), 4 pectinate ringed b'-bristles, 3 pectinate ringed b''-bristles, 1 spinous posterior c-bristle, and 1 spinous anterior d-bristle (Figure 42d). 3rd exopodial joint (Figure 42e): inner lobe with 1 spinous proximal bristle and 2 terminal bristles (outer with short spines, inner bare); outer lobe hirsute, with 2 spinous terminal bristles. 4th and 5th exopodial joints fused, hirsute, with 2 pairs of spinous terminal bristles with spinous node between pairs (Figure 42e).

Sixth Limb (Figure 42f): 3 short slender bare epipodial bristles. Endite I with 2 short spinous proximal medial bristles and 1 long spinous terminal bristle; endite II with 2 short spinous proximal medial bristles and 3 terminal bristles (2 long spinous, 1 minute); endite III with 1 long spinous proximal medial bristle and 4 terminal bristles (anterior with short spines, others with long proximal spines); endite IV with 1 long spinous proximal medial bristle and 5 spinous terminal bristles (anterior unringed with small spines, others ringed with long proximal spines (rings not shown)). End joint with 14 bristles (2 short bristles near anterior corner with bases on lateral surface, 1 unringed bristle at anterior corner, 9 short ringed bristles with long proximal spines and bases on medial surface, and 2 hirsute posterior bristles). End joint also with short spines forming rows on medial surface and long hairs on distal lateral surface.

Seventh Limb (Figure 41i-k): With total of 20 or 21 bristles: 10-12 bristles in proximal group (5-7 on each side),

each with 3 or 4 bells and long terminal process; terminal group with 5 bristles on comb side and 4 or 5 on jaw side, each with 2-4 bells and long terminal process. Comb with long middle tooth and on each side 1 short tooth with rounded tip and 3 short teeth with flat tips. Jaw opposite comb with minute distal teeth (jaw closed against comb on both limbs of USNM 193740) (Figure 41k).

Furca (Figure 41l): Each lamella with 8 claws; claw 2 nonarticulated and stouter than claw 1; claw 5 stouter than claw 4; all claws with teeth along posterior edge (not shown); claw 1 with large distal medial teeth; right lamella anterior to left by width of base of claw 1.

Bellonci Organ: Fragmented on USNM 193740.

Eyes: Medial eye fragmented on USNM 193740. Lateral eye large with about 29 ommatidia and brown pigment between ommatidia (Figure 40a).

Upper Lip (Figure 40k,l): Anterior unpaired part with large glandular openings; each side of paired posterior part with short lateral lobe with 2 glandular openings followed by smaller lateral lobe with 1 glandular opening.

Genitalia: Not observed.

Anterior of Body (Figure 40k,l): With pointed process dorsal to upper lip.

Posterior of Body (Figure 41m): Evenly rounded, bare.

Y-Sclerite: USNM 193740: right sclerite typical of subfamily (Figure 41l); left sclerite aberrant, with 2 prongs on ventral branch (Figure 41m).

Eggs: USNM 193740 with 5 eggs in marsupium (4 shown in Figure 40a).

DESCRIPTION OF ADULT MALE (Figures 42g-k, 43).—Carapace with posterior margin more sloping than that of adult female (Figure 43a).

Infold: Rostral infold in general similar to that of adult female (Figure 43b). Broad list of caudal process with straight posterior edge similar to that of adult female, but minute medial bristles not observed on right valve (Figure 43d) but present on left valve (Figure 43c); closely spaced pore canals present on broad posterior list of both valves.

Carapace Size: Sta 23-S: length 0.99 mm, height 0.60 mm. Sta 106-R: length 0.99 mm, height 0.59 mm. Sta 124-S: USNM 193738, length 0.96 mm, height 0.56 mm; MNHN Os 440, holotype, length 0.97 mm, height 0.58 mm; Paris, 9 specimens: length 0.94 mm, height 0.56 mm; length 1.03 mm, height 0.60 mm; length 0.94 mm, height 0.56 mm; length 0.97 mm, height 0.57 mm; length 0.96 mm, height 0.56 mm; length 0.97 mm, height 0.58 mm; length 0.94 mm, height 0.58 mm; length 0.98 mm, height 0.59 mm; length 0.97 mm, height 0.58 mm. Range: length 0.94-1.03 mm, height 0.56-0.60 mm.

First Antenna: Joints 1-6 similar to those of adult female (Figure 43e). 7th joint (Figure 43f): a-bristle slightly longer than bristle of 6th joint, with few short marginal spines; b-bristle shorter than sensory bristle of 5th joint, with short stout proximal filament with large sucker, followed by short slender filament with 2 small suckers, then paired filaments (1

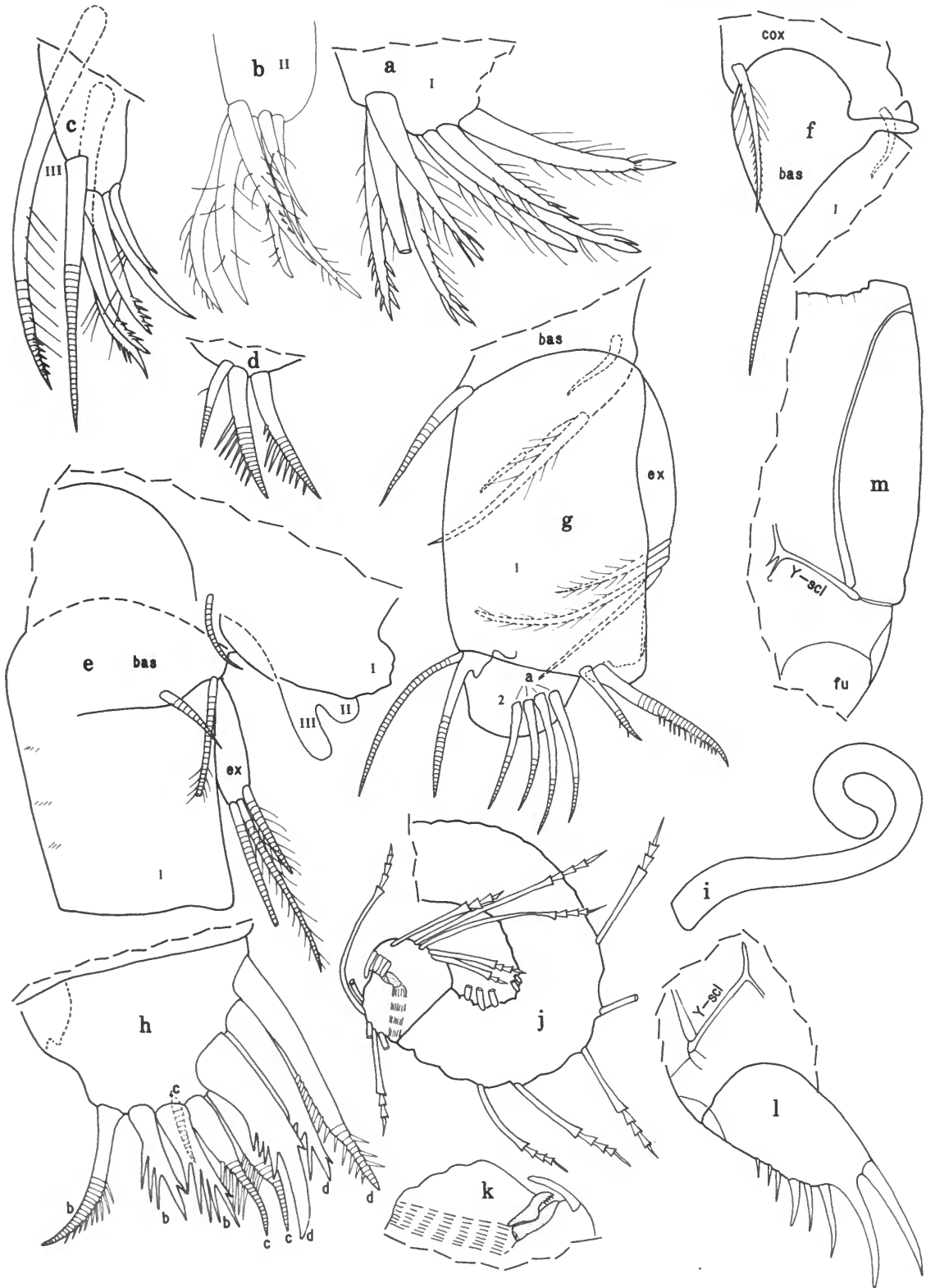


FIGURE 41 (opposite page).—*Skogsbergia plax*, new species, adult female, paratype, USNM 193740: *a-c*, endites I-III of right maxilla (not all bristles shown on endite I), mv; *d*, c-bristles of 2nd endopodial joint of right maxilla, mv; *e*, part of right maxilla, mv; *f,g*, parts of left maxilla, lv; *h*, bristles of 2nd endopodial joint of left maxilla (a-bristles not shown), lv; *i*, right 7th limb showing length and shape (bristles and terminal comb not shown), anterior to lower right; *j*, distal part of 7th limb; *k*, detail of sclerotized parts of 7th limb shown in *j* (only middle tooth of comb shown); *l*, furca and posterior of body from right side, anterior to right; *m*, posterior of body from left side, anterior to left.

short bare, 1 long with 2 small suckers) and 1 small bare filament; c-bristle longer than sensory bristle of 5th joint, with short stout proximal filament with large sucker (more than twice diameter of sucker on proximal filament of b-bristle), followed by slender filament with 2 small suckers, then paired filaments (1 short bare, 1 longer with 2 small suckers), 5 slender bare filaments, and 1 short slender bare subterminal filament. 8th joint: d- and e-bristles about same length as sensory bristle of 5th joint, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 8 short slender marginal filaments, some with minute spines; g-bristle about same length as c-bristle, with 9 slender marginal filaments, some with spines; f- and g-bristles without long proximal hairs.

Second Antenna (Figure 43g,h): Similar to that of adult female.

Mandible: Exopodite same length as dorsal margin of 1st endopodial joint, limb otherwise similar to that of adult female.

Maxilla (Figure 43i): Posterior 2 a-bristles of 2nd endopodial joint with few proximal marginal spines, limb otherwise similar to that of adult female (endite bristles not counted).

Fifth Limb (Figure 43j): Similar to that of adult female.

Sixth Limb: Epipodite with 3 or 4 short bare bristles. Endites I-III similar to those of adult female. Endite IV with 1 long proximal spinous medial bristle and 4 spinous terminal bristles. End joint with 11 or 12 bristles (2 short bristles near anterior corner with bases on lateral surface, 1 unringed bristle at anterior corner, 6 or 7 short ringed bristles with long ventral and short distal spines (most with bases on medial surface), and 2 hirsute posterior bristles).

Seventh Limb (Figures 42g, 43k): Each limb with 17-20 bristles: 9 or 10 bristles in proximal group (4 or 5 on each side), each with 4 or 5 bells and long terminal process; terminal group with 5 bristles on comb side and 3-5 on jaw side, each with 1-4 bells. Terminal comb and jaw similar to those of adult female USNM 193740, except jaw open on USNM 193738 and closed on USNM 193740. Distal end of limb curled clockwise.

Furca (Figure 43l): Similar to that of adult female.

Bellonci Organ (Figure 42i): Short, cylindrical, with small process at tip.

Eyes: Medial eye unpigmented, bare (Figure 42i). Lateral eye about twice size of medial eye, with 28-32 ommatidia and brown pigment between ommatidia (Figures 42j, 43a,e).

Upper Lip (Figure 43m): In general similar to that of adult

female but short lateral lobes of paired part less well defined on specimen studied (USNM 193738).

Genitalia (Figure 42h,k): Elongate lobe on each side of body anterior to furca. Spermatophore may be present at distal end (Figure 42h).

Anterior and Posterior of Body: Similar to those of adult female.

Y-Sclerite: Typical for subfamily.

DESCRIPTION OF INSTAR II (sex unknown) (Figure 44a-e).—Carapace shape similar to that of adult male (Figure 44a). Lamellar prolongation of selvage broad along ventral and dorsal edges of incisur and anterior edge of rostrum.

Carapace Size: Sta 124-S: USNM 193745, length 0.70 mm, height 0.40 mm. Sta 106-R: length 0.67 mm, height 0.39 mm.

First Antenna: 1st and 2nd joints bare. 3rd joint with 2 bristles (1 ventral, 1 dorsal). 4th joint with 1 dorsal bristle. Sensory bristle of 5th joint stout and with filaments. Bristles of joints 6-8 similar in number to those of adult female but number of marginal filaments on b-, c-, f-, and g-bristles not determined.

Second Antenna: 9th joint with 3 bristles.

Mandible and Maxilla: Well developed.

Fifth Limb: Epipodite with about 28 bristles. 3 endites well developed but bristles not counted. Exopodite: 1st joint: main tooth with spinous proximal bristle followed by smooth peg and 2 pectinate teeth; anterior side with at least 1 bristle. 2nd joint with 3 pectinate a-bristles, 3 pectinate b'-bristles, 2 pectinate b''-bristles, 1 posterior c-bristle, and 1 anterior d-bristle with long spines at midlength. 3rd joint: inner lobe with 1 proximal and 1 terminal bristle; outer lobe with 2 terminal bristles. 4th and 5th joints fused, with 3 terminal bristles.

Sixth Limb (Figure 44b): With 1 spinous anterior bristle on single endite; end joint with marginal spines.

Seventh Limb: Minute or absent (limb absent on right side and not observed with certainty on left side).

Furca (Figure 44c): With 5 claws on each lamella; claw 2 nonarticulated and stouter than claw 1; claw 4 same width as, or broader than, claw 3 and slightly shorter; claw 5 small; all claws with teeth along posterior edges (not shown).

Bellonci Organ (Figure 44d): Elongate.

Eyes: Medial eye unpigmented (Figure 44d). Lateral eye large with many ommatidia and brown pigment between ommatidia (Figure 44a).

Upper Lip (Figure 44d): Similar to that of adult.

Genitalia: Absent.

Anterior of Body (Figure 44d): With broad anterior process between medial eye and upper lip.

Posterior of Body (Figure 44e): With spinous posterodorsal process.

Y-Sclerite (Figure 44e): Ventral branch not observed, possibly obscured.

DESCRIPTION OF INSTAR ?V FEMALE (Figure 44f-h).—

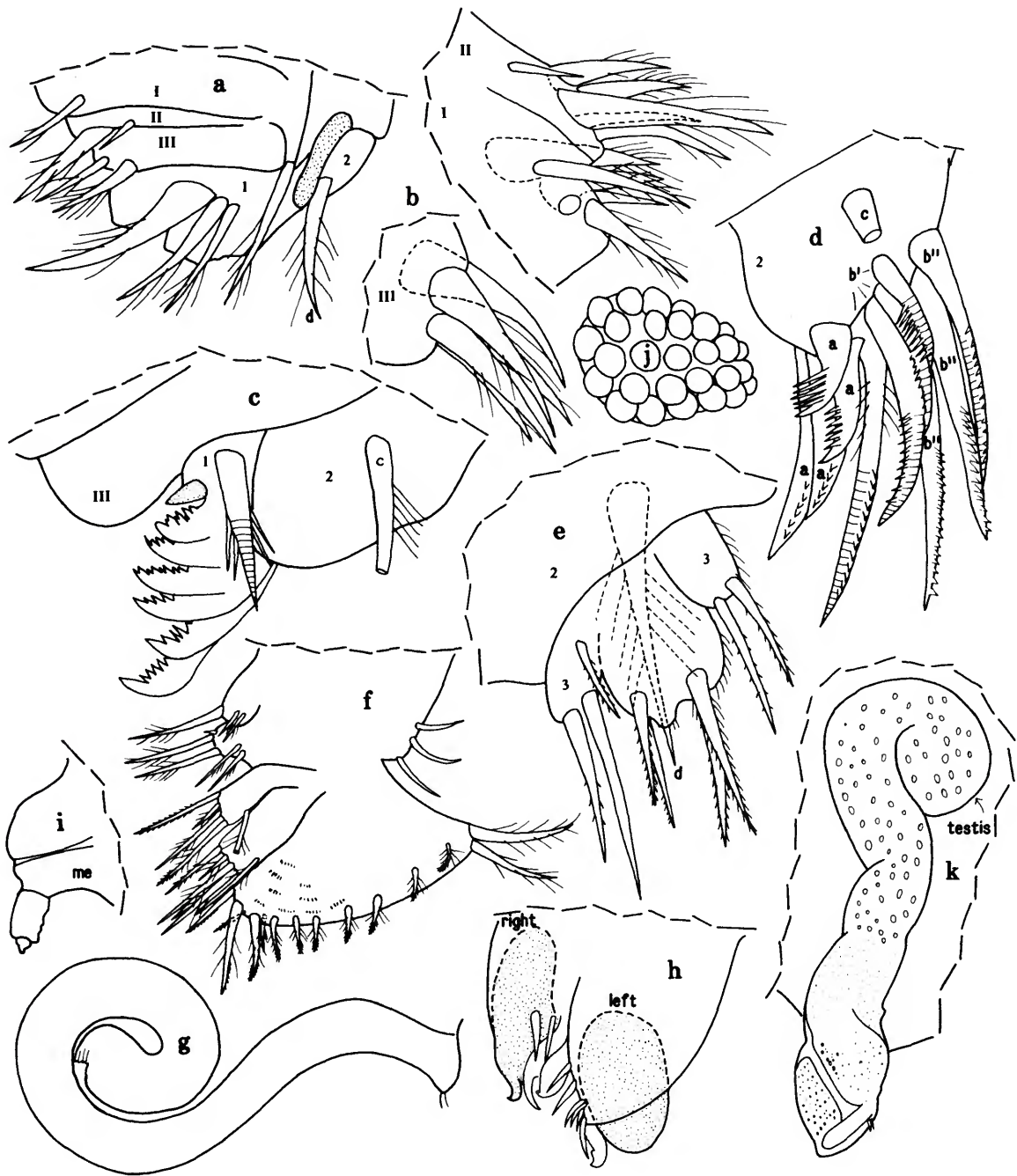


FIGURE 42.—*Skogsbergia plax*, new species, paratypes: adult female, USNM 193740: a, part of left 5th limb (not all bristles shown), av; b, endites I-III of left 5th limb, av; c, main tooth of 1st exopodial joint of right 5th limb (bristles of endite III not shown), pv; d, bristles of 2nd exopodial joint of right 5th limb, pv; e, exopodial joints 2-5 of right 5th limb, pv; f, right 6th limb, mv. Adult male (unnumbered specimen from sta 106-R): g, left 7th limb showing length and shape (bristles and details of tip not shown), anterior to bottom; h, tip of left and right copulatory organs, anterior to left (stippled ovals may be spermatophores). Adult male, USNM 193738: i, medial eye and Bellonci organ; j, right lateral eye; k, testis and copulatory organ of right side, anterior to right.



FIGURE 43.—*Skogsbergia plax*, new species, adult male, paratype, USNM 193738: *a*, complete specimen from right side, length 0.96 mm; *b, c*, anterior and posterior ends of left valve, iv; *d*, posterior end of right valve, iv; *e*, left lateral eye (lv) and right 1st antenna (not all bristles of 7th and 8th joints shown), mv; *f*, bristles of 7th joint of right 1st antenna, mv; *g*, protopodite and endopodite of left 2nd antenna, mv; *h*, detail of endopodite shown in *g*; *i*, part of right maxilla, lv; *j*, main tooth of 1st exopodial joint and a-bristles of 2nd exopodial joint of left 5th limb, pv; *k*, tip of 7th limb (bristles not shown); *l*, right furcal lamella; *m*, anterior process and upper lip, anterior to left.

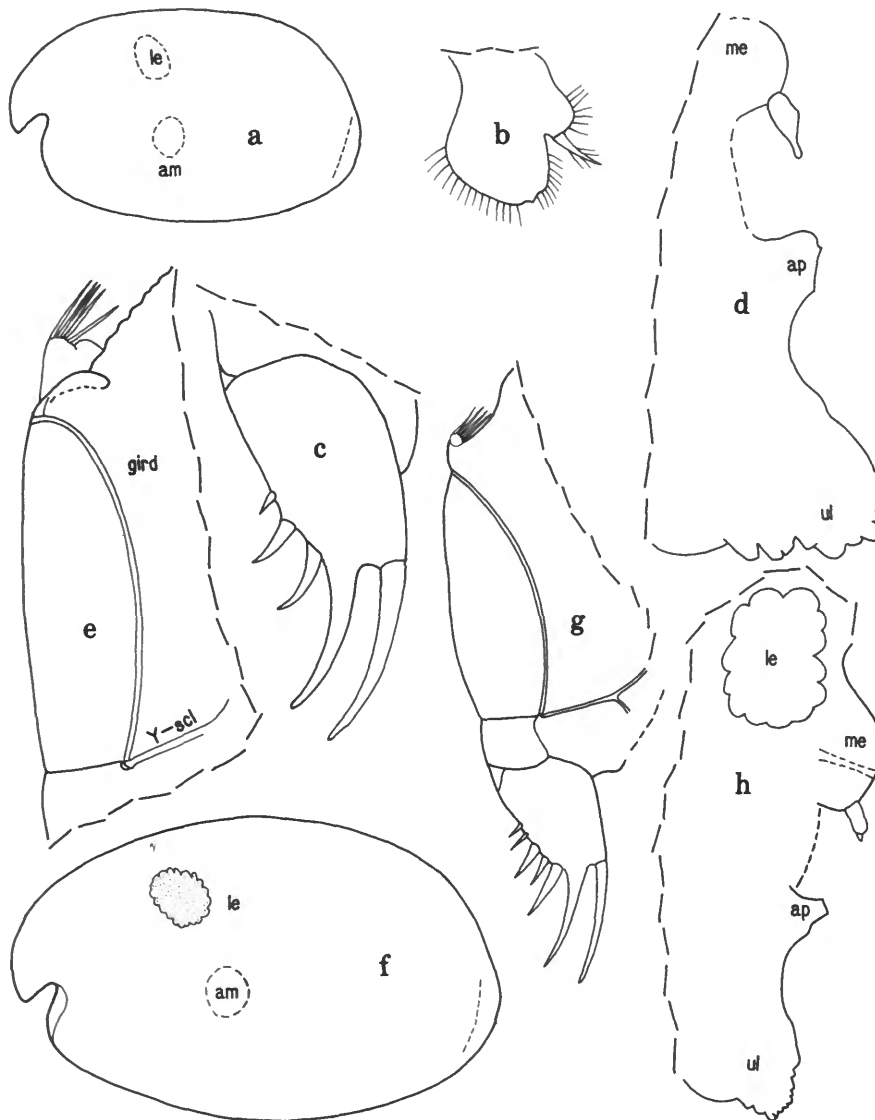


FIGURE 44.—*Skogsbergia plax*, new species, paratypes: instar II (sex unknown), USNM 193745: *a*, complete specimen from left side, length 0.70 mm; *b*, right 6th limb, lv; *c*, right furcal lamella, lv; *d*, anterior of body, anterior to right; *e*, upper part of posterior of body, anterior to right. Instar ?V female, USNM 193742: *f*, complete specimen from left side, length 0.97 mm; *g, h*, posterior and anterior of body from right side, anterior to right.

Carapace shape similar to that of adult male (Figure 44*f*). Broad list of caudal process with straight dorsal margin and numerous pore canals.

Carapace Size: USNM 193742, length 0.97 mm, height 0.63 mm.

First Antenna: Joints 1–4 and 6 similar to that of adult female. Stout sensory bristle of 5th joint with filaments. Bristles of joints 7 and 8 not examined in detail, but b-bristle about twice length of a-bristle.

Second Antenna: Exopodite similar to that of adult female. Endopodite similar to that of adult female but number of small bristles not determined. Bristle of 2nd exopodial joint with numerous slender ventral spines; 9th joint with 4 bristles.

Mandible and Maxilla: Well developed.

Fifth Limb: Main tooth of 1st exopodial joint with smooth proximal peg followed by 5 pectinate teeth, and spinous bristle proximal to peg.

Sixth Limb: Well developed.

Seventh Limb: With 4 short strongly tapering proximal bristles (2 on each side), each with 1 bell. Number of terminal bristles not determined and terminal processes not studied.

Furca (Figure 44g): Each limb with 7 claws; claw 2 stouter than claw 1 and nonarticulated; claw 5 stouter than claw 4.

Bellonci Organ (Figure 44h): Elongate.

Eyes: Lateral eye larger than medial eye, with many ommatidia and with light brown pigment between ommatidia (Figure 44f,h). Medial eye unpigmented, bare (Figure 44h).

Upper Lip (Figure 44h): Similar to that of adult female.

Genitalia: None observed.

Anterior of Body (Figure 44h): Unlike adult, tip of anterior process not pointed.

Posterior of Body (Figure 44g): Posterodorsal corner with small process with long spines.

Y-Sclerite (Figure 44g): Typical of adults in subfamily.

Age and Sex of Specimen: Because the carapace of the juvenile specimen (USNM 193742) is about the same size as that of the adult male (0.97 mm for juvenile, 0.94–1.03 mm for adult male) but smaller than that of the adult female (length 1.36 mm) the juvenile is probably female; however, no genitalia were observed on the specimen. The juvenile has bristles on the 7th limb, which indicates that it is not at a stage younger than instar IV. The main tooth of the 5th limb of the juvenile bears 5 pectinate teeth compared to 6 on the adult; because of this it is tentatively concluded that the specimen is an instar V. The growth factor for carapace length for the juvenile female and adult female is 1.40, which is much higher than expected (the data in Kornicker and Iliffe (1989a, table 10) indicates that the growth factor for length for the instar V and adult female of *Skogsbergia galapagensis* is 1.15–1.22), but as only 2 specimens enter into the present calculation, the large growth factor could be the result of sampling error. The large difference between the size of the adult male and female of *S. plax* suggests that they may not be conspecific, but this possibility is tentatively rejected because of their similarity in morphology; the presence of both sexes in the same sample also was weighed in the decision.

REMARKS.—The presence of a small process bearing spines on the posterodorsal corner of the animal is a known juvenile character reported on instars I–III of *Skogsbergia galapagensis* by Kornicker and Iliffe (1989a:22) and on instars I–III (rarely on instar IV) of *Skogsbergia leneri* by Cohen (1983:247). The spinous process has not been reported previously on an instar V. The spinous process also was observed on a juvenile (length 0.92 mm, height 0.55) sent to Paris.

COMPARISONS.—Both *S. plax* and *S. iota* are present in a sample from sta 124-S, and are about the same size, but they are easily distinguished by the larger lateral eye of *S. plax*, which is visible through the shell, and by the presence of a broader caudal process on *S. iota* (the dorsal end of the caudal process is separated from the posterior edge of the valve dorsal to the caudal process by a distinct angle on *S. iota*, but not on *S. plax*). The carapace of *S. plax* is without the elongate caudal process

present on *S. calyx*. *S. plax* resembles *S. minuta* Poulsen (1962:164) and *S. strophinx* Kornicker (1991:12) in size as well as in having an evenly rounded posterior margin in lateral view. The f- and g-bristles of the 1st antenna of the adult male *S. plax* are without the long thin hair-like proximal filaments present on *S. minuta* and *S. strophinx*. Other differences between *S. minuta* and *S. plax* occur in the number of bristles on the rostral infold, number of a-, b'-, and b''-bristles on the 2nd exopodial joint of the 5th limb, and number of bristles on the 7th limb. *Skogsbergia plax* differs from *S. menezis* Kornicker (1970a:10) as follows: the carapace of *S. plax* is smaller, the f- and g-bristles of the male 1st antenna are without proximal hair-like filaments on *S. plax*, and the basal spines of the exopodite of the 2nd antenna are shorter on *S. plax*.

Vargula Skogsberg, 1920

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

DISTRIBUTION.—Circumglobal; range extends from about 80°N to 74°S. The known depth range is intertidal to 3431 m (Kornicker, 1975a:155). The genus has not been reported previously from off the eastern coast of Africa.

COMPOSITION.—Including 2 new species described herein, the genus comprises about 36 species; 14 are associated with coral reefs of the West Indies (Cohen and Morin, 1986:1; 1989:297; Morin and Cohen, 1988:620).

Vargula arx, new species

FIGURES 45–48

ETYMOLOGY.—From the Latin *arx*, *arcis* (stronghold).

HOLOTYPE.—MNHN Os 445, undissected instar V female in alcohol.

TYPE LOCALITY.—Sta 120-DS, 12 Apr 1977, SE Glorioso Islands, 11°30'S, 47°24'42"E, depth 335–390 m.

PARATYPES.—Sta 104-DR: 1 undissected instar IV in alcohol. Sta 120-DS: USNM 193755, 1 instar V female on slide and in alcohol.

DISTRIBUTION.—Sta 104-DR, N Île du Lys, Glorioso Islands, depth 330–550 m. Sta 120-DS, SE Glorioso Islands, depth 335–390 m. Known depth range 330–550 m.

REMARKS.—The collection contains 2 A-1 instars and 1 A-2 instar of this species. They are assumed to be instars V and IV respectively because known members of the Cypridininae have 5 juvenile instars (Hiruta, 1983:675).

DESCRIPTION OF INSTAR V FEMALE (Figures 45–48a–h).—Carapace oval in lateral view with narrow but distinctly projecting caudal process; posterior of caudal process convex; dorsal end of narrow incisor at valve midheight (Figure 45a).

Infold: Rostral infold with about 16 bristles, mostly divided (Figure 45b); 2 short bristles just ventral to inner end of incisor; anteroventral infold with 12 divided bristles along

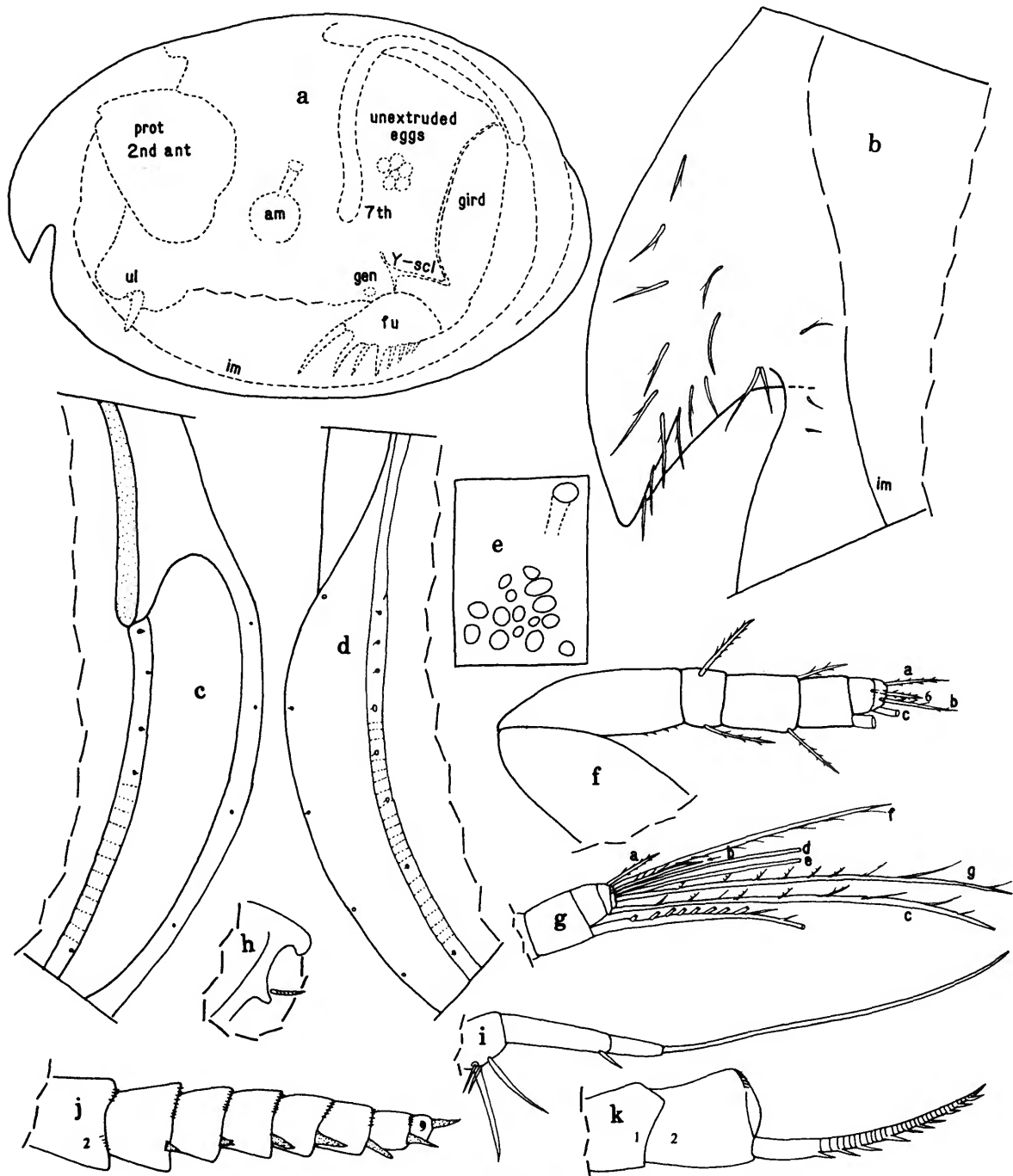


FIGURE 45.—*Vargula arx*, new species, instar V female, paratype, USNM 193755: a, outline of complete specimen showing location of some appendages and unextruded eggs, length of carapace 1.36 mm; b,c, anterior and posterior ends of right valve, iv; d, posterior end of left valve, iv; e, central adductor muscles protruding from left side of body when left valve removed, anterior to left; f, right 1st antenna (bristles of 8th joint not shown), lv; g, tip of right 1st antenna (bristle of 6th joint not shown), lv; h, bristle on protopodite of left 2nd antenna, mv; i, endopodite of left 2nd antenna, lv; j, exopodite of left 2nd antenna, lv; k, bristle of 2nd exopodial joint of left 2nd antenna, lv.

narrow list near outer edge of valve; ventral infold bare; broad ridge (list) along anterior margin of caudal process with 5–8 pores each with minute spine (Figure 45c,d), and with a few smaller pores without spines (not shown); many internal pore canals on ridge perpendicular to edges of ridge (Figure 45c,d); 4 or 5 small pores just within outer edge of caudal process; right valve only with sclerotized ridge (stippled in Figure 45c) on anterior edge of infold dorsal to caudal process.

Selvae: Lamellar prolongation of selvae along ventral edge of incisur broad, ribbed, and with minute fringe along outer edge; narrow lamellar prolongation with smooth outer edge along anterior edge of rostrum; lamellar prolongation along anteroventral and ventral margins narrow, with smooth outer edge and thin indistinct striations perpendicular to edge; lamellar prolongation absent along caudal process and posterior edge of valves.

Central Adductor Muscle Attachments (Figure 45e): Comprising cluster of about 15 ovoid individual attachments and 1 round attachment dorsal to others.

Carapace Size: MNHN Os 445, holotype, shell torn, length about 1.33 mm. USNM 193755, length 1.36 mm, height 0.93 mm.

First Antenna (Figure 45f,g): 1st joint bare. 2nd joint with medial and ventral spines. 3rd joint short, with 2 spinous bristles (1 ventral, 1 dorsal). 4th joint elongate, with 2 bristles (1 ventral, 1 dorsal) with few spines. Sensory bristle of 5th joint with 8 stout proximal filaments followed by 3 slender filaments (tip broken off on illustrated limb, which shows only 2 slender filaments). Short medial bristle of 6th joint with marginal spines. 7th joint: a-bristle longer than bristle of 6th joint, with short marginal spines; b-bristle about $\frac{1}{3}$ longer than a-bristle, with 3 short proximal filaments and few short distal spines; c-bristle long with 9 marginal filaments, some with spines. 8th joint: d- and e-bristles about twice length of b-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 9 marginal filaments, some with spines; g-bristle about same length as c-bristle, with 9 marginal filaments, some with spines.

Second Antenna: Protopodite with short distal medial bristle (Figure 45a,h). Endopodite 3-jointed (Figure 45i): 1st joint with 3 proximal bristles (1 long, 2 short) and 1 distal bristle slightly shorter than long proximal bristle; elongate 2nd joint with short terminal bristle; elongate 3rd joint with long terminal filament about $1\frac{3}{4}$ times length of stem. Exopodite: bristle of 2nd joint reaching to about 8th joint, with 10 ventral spines (Figure 45k); long bristles of joints 3–8 with natatory hairs; 9th joint with 3 bristles (1 long, 1 medium, and 1 short (dorsal)), all with natatory hairs; joints 3–8 with basal spines longer on distal joints (Figure 45j); basal spine of 8th joint longer than 9th joint; 9th joint with lateral spine longer than joint; joints 2–8 with minute spines forming rows along distal edge.

Mandible (Figure 46a,b): Coxale endite spinous, with 2 stout terminal spines with elongate peg between them, and minute proximal bristle. Basale: ventral margin with 2 small

a-bristles, 1 small b-bristle (with base on lateral surface), 2 c-bristles, and 2 d-bristles (distal long with wreaths of long spines); dorsal margin with 1 slender bristle just distal to midlength, and 2 slender terminal bristles; medial and lateral surfaces with short spines in rows near ventral margin. Exopodite almost as long as dorsal margin of 1st endopodial joint, with distal hairs and 2 slender subterminal bristles (distal bristle about $\frac{1}{3}$ length of proximal). 1st endopodial joint with 4 ventral bristles (2 long, 1 short, 1 minute). 2nd endopodial joint: ventral margin with spines and 4 distal bristles (2 single, 2 paired terminal; lateral bristle of terminal pair ringed and slightly longer than sclerotized unringed medial bristle); dorsal margin with 9 bristles (4 long, 1 medium proximal, 4 short medial); medial surface with spines in rows (not shown). 3rd endopodial joint with 3 stout claws (2 with ventral teeth) and 4 bristles (including 1 minute ventral) (Figure 46b).

Maxilla: Endite I with 10 bristles (some with triaenid and spear-like tips) (Figure 46c); endites II and III each with 5 spinous bristles. Coxale with long dorsal bristle with short hairs. Basale with 1 or 2 small distal bristles and 1 long ventral bristle (Figure 46d,g). Exopodite hirsute, with 3 bristles (proximal and outer terminal bristles with long proximal hairs; inner terminal bristle bare) (Figure 46d,e). 1st endopodial joint spinous, with 2 spinous alpha-bristles, 3 beta-bristles (inner short bare, others pectinate), and cutting tooth with 2 nodes (Figure 46e). 2nd endopodial joint with 4 a-bristles (2 inner bare, others longer and with few spines), 3 pectinate b-bristles, 2 pectinate c-bristles, and 3 pectinate d-bristles (2 inner, unringed, claw-like) (Figure 46e, f).

Fifth Limb: Epipodite with about 48 bristles. Protopodite with sinuate anterior tooth (Figure 47c). Endites I, II, and III each with about 6 spinous and pectinate bristles (Figure 47a). 1st exopodial joint: anterior side with 3 closely spaced bristles in row and 1 near midwidth (Figure 47c); main tooth with smooth proximal peg and 5 stout cusped teeth (distal tooth with 10–12 marginal cusps); spinous ringed bristle proximal to main tooth (Figure 47b,e). 2nd exopodial joint with about 4 pectinate unringed a-bristles, 3 pectinate ringed b'-bristles, 4 pectinate ringed b''-bristles, 1 posterior ringed c-bristle, and 1 anterior ringed d-bristle (c- and d-bristles with long proximal hairs) (Figure 47b,c, f–h). 3rd exopodial joint: inner lobe with 3 ringed bristles (proximal with long proximal hairs; 2 terminal with short spines); outer lobe hirsute, with 2 terminal bristles with long proximal hairs. 4th and 5th joints fused, hirsute, comprising 2 lobes with 2 spinous bristles on each lobe; cluster of spines between lobes (spines on small process on right limb of USNM 193755 but not on left (Figure 47c)).

Sixth Limb (Figure 48a): With 2 bare epipodial bristles. Endite I with 2 bristles (1 small medial, 1 long terminal); endite II with 5 spinous bristles; endite III with 4 spinous bristles; endite IV with 3 spinous bristles. Ventral edge of skirt with 5 anterior bristles (with long proximal and short distal spines) separated by space from 3 bristles (anterior with long proximal and short distal spines, 2 posterior hirsute); ventral edge of skirt



FIGURE 46.—*Vargula arx*, new species, instar V female, paratype, USNM 193755: *a*, left mandible, lv; *b*, detail of tip of mandible shown in *a*; *c*, endites I–III of right maxilla, lv; *d*, part of left maxilla (not all bristles shown), lv; *e*, detail from maxilla shown in *d*; *f*, bristles of 2nd endopodial joint of right maxilla (*a*-bristles not shown), lv; *g*, part of right maxilla (all bristles not shown), lv.

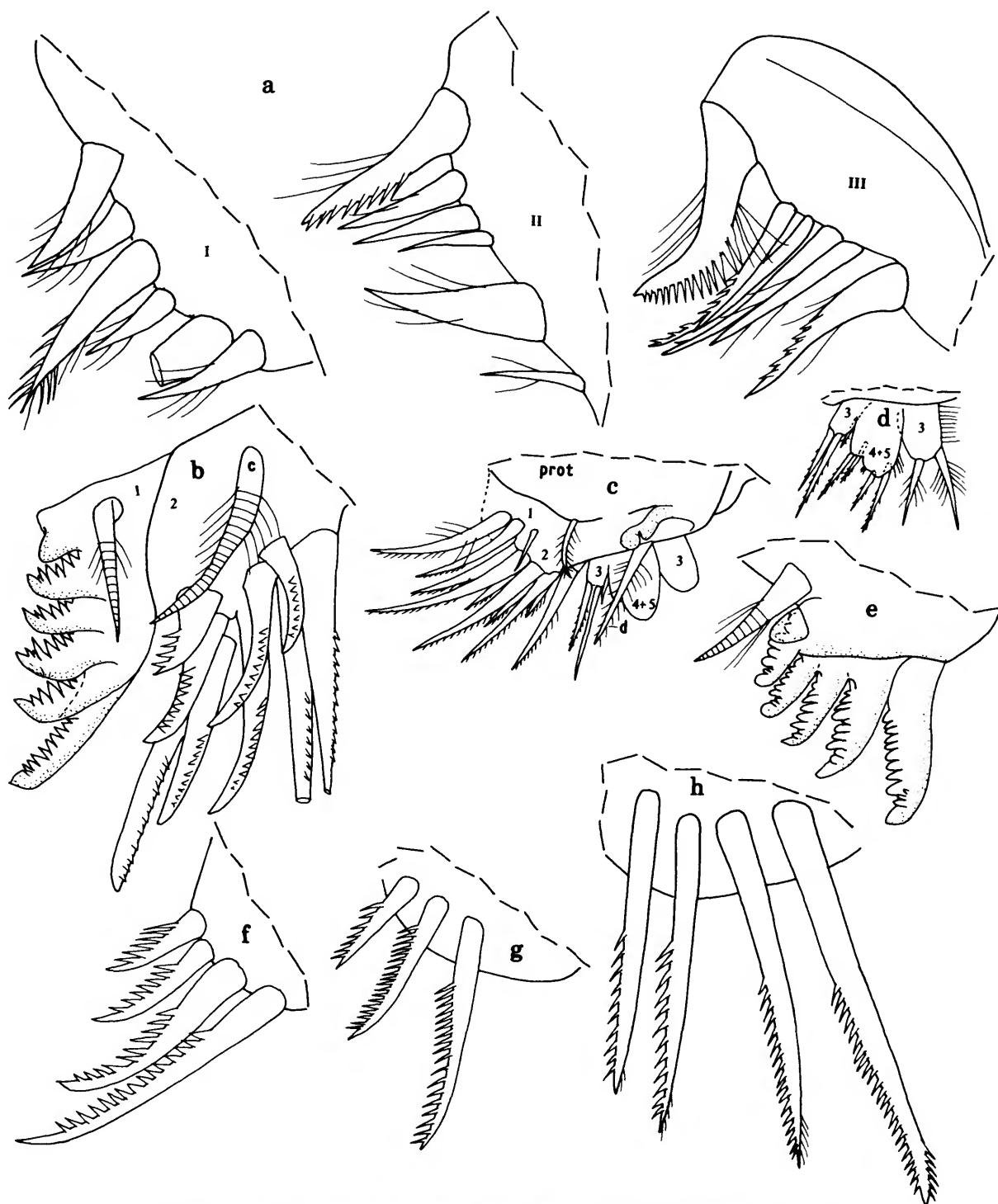


FIGURE 47.—*Vargula arx*, new species, instar V female, paratype, USNM 193755: a, endites I-III of right 5th limb; b, 1st and 2nd exopodial joints of the right 5th limb, pv; c, left 5th limb (endites not shown; not all bristles shown), av; d, exopodial joints 3-5 of left 5th limb, av; e, main tooth of 1st exopodial joint of left 5th limb, pv; f-h, a-, b'-, and b"-bristles of 2nd exopodial joint of left 5th limb, pv.



FIGURE 48.—*Vargula arx*, new species, paratypes: instar V female, USNM 193755: *a*, left 6th limb, mv; *b*, 7th limb and detail of tip; *c*, medial eye and Bellonci organ; *d*, posterior of body from left side, anterior to left; *e*, upper part of anterior of body showing anterior process and 1st and 2nd joints of right 1st antenna; *f*, upper lip from left side, anterior to left; *g*, oblique view of upper lip from left, anterior to left; *h*, posterior of body from left side, anterior to left. Instar IV (sex unknown), unnumbered specimen from sta 104-DR: *i*, complete specimen from left side, length 1.15 mm; *j*, left furcal lamella, lv.

anterior to 2 posterior hirsute bristles with stiff lateral spines; anterior edge of skirt with few long stiff spines; medial surfaces of skirt and endites III and IV with long hairs.

Seventh Limb (Figures 45a, 48b): 6 short tapered bristles in proximal group (3 on each side) each with 1 bell. 8 tapered bristles in terminal group (4 on each side: 2 short with 1 bell, 1 long and 1 short each with 3 bells). Terminus with comb of 9 alate teeth opposite single short peg. (Tapered bristles are characteristic of juveniles.)

Furca (Figures 45a, 48d): Each lamella with 8 claws; claws 2 and 4 nonarticulated; base of claw 2 stouter than base of claw 1; claw 3 slightly longer than claw 4 but much narrower; claw 1 of right lamella anterior to claw 1 of left lamella by width of claw base; each claw with rows of medial and lateral teeth (not all shown); a few teeth on each claw larger than others but most similar.

Bellonci Organ (Figure 48c): Elongate with pointed tip.

Eyes: Lateral eyes absent. Medial eye unpigmented, bare (Figure 48c).

Upper Lip (Figures 45a, 48f,g): Anterior unpaired part with about 20 fairly large glandular openings (not all shown). Paired posterior part with 2 long tusks, 1 on each side; base of tusk bulbous; each tusk with 2 lateral glandular processes at midlength and 2 terminal; posterior edge of tusk straight, without glandular processes; several long hairs at midlength; posterior part of lip globose, hirsute.

Genitalia (Figure 48d): Round light amber area on each side of body anterior to furca; duct visible leading into body from round area; spermatopore absent.

Anterior of Body (Figure 48e,g): A single rounded anterior process present just ventral to bases of 1st antennae.

Posterior of Body (Figure 48h): Evenly rounded, bare.

Y-Sclerite (Figures 45a, 48d,h): Typical for subfamily.

Eggs: USNM 193755 with small unextruded eggs (Figure 45a).

DESCRIPTION OF INSTAR IV (sex unknown) (Figure 48i,j).—Carapace similar in shape to that of instar V female (Figure 48i).

Carapace Size: Sta 104-DR: length 1.15 mm, height 0.78 mm.

Seventh Limb: Each limb without proximal bristles, but with 4 tapered terminal bristles (2 on each side: 1 short and 1 long, each with 1 bell). Terminus with comb opposite single peg.

Furca (Figure 48j): Each lamella with 7 claws; claws 2 and 4 nonarticulated; claw 3 longer than claw 4 and much narrower; base of claw 2 broader than base of claw 1; claw 1 of right lamella anterior to claw 1 of left lamella by width of claw base.

COMPARISONS.—Only 3 additional species of *Vargula* without lateral eyes on the female are known: *V. lusca* Kornicker, 1975a, *V. dentata* Kornicker, 1975a, and *V. sutura* Kornicker, 1975a. The tusks of the upper lip of *V. arx* differs from that of other species with blind females in having only 4

glandular processes. The tusks of the upper lip of *V. dentata* bears a tooth absent on *V. arx*. The furca of *V. arx* differs from *V. sutura* in not having all claws articulated. The adult female of *V. arx* is unknown but the carapace length is probably less than 2 mm, whereas, the carapace of the adult female *V. lusca* is 2.79 mm (Kornicker, 1975a:190). The female of *V. sekiguchii* Hiruta, 1984, has a small dark brown lateral eye without ommatidia. The carapace of *V. sekiguchii* is larger than that of *V. arx* and the mandible and 6th and 7th limbs differ.

REMARKS CONCERNING BLINDNESS.—The depth ranges of known *Vargula* having females either without lateral eyes or with a small lateral eye without ommatidia (*V. sekiguchii*) are listed below; all are from bathyal and abyssal depths. The adult male of *V. dentata* is without lateral eyes (Kornicker, 1975a:189); whereas, the A-1 male (adult male unknown) of *V. sekiguchii* has well-developed lateral eyes with 20 ommatidia (Hiruta, 1984:55); males of the remaining species are unknown. Several species of *Vargula* with lateral eyes having 4–16 ommatidia have been reported from bathyal depths but none deeper than 1212 m (Kornicker, 1975a:66). Species of *Vargula* collected in shallow water in the vicinity of coral reefs have well-developed lateral eyes (Cohen and Morin, 1989:331). The only species of *Vargula* recorded from abyssal depths (*V. sutura*) is without lateral eyes. The maximum depth for Cypridininae with lateral eyes is 3775 m (Kornicker, 1975a:48).

Species	Depth (m)
<i>V. arx</i>	330–550
<i>V. dentata</i>	429–1978
<i>V. lusca</i>	910–915
<i>V. sekiguchii</i>	520
<i>V. sutura</i>	3386–3477

Vargula sagax, new species

FIGURES 49–54

ETYMOLOGY.—From the Latin *sagax* (wise).

HOLOTYPE.—MNHN Os 447, instar V (sex unknown) on slide and in alcohol.

TYPE LOCALITY.—Sta 106-R, 9 Apr 1977, Zelee Bank, south border, 12°25'30"S, 46°16'18"E, depth 18–24 m.

PARATYPE.—Sta 106-R: USNM 193757, 1 dissected instar I in alcohol.

DISTRIBUTION.—Collected only at type locality.

REMARKS.—The holotype is identified as an instar V because of having 5 pectinate teeth on the main tooth of the 5th limb. The specimens from sta 106-R appeared to have been dried and were restored by soaking in a solution of a detergent (Conrad 70 (see Kornicker, 1976b:365)).

DESCRIPTION OF INSTAR V (sex unknown) (Figures 49–52).—Carapace of holotype decalcified and somewhat distorted (Figure 49a). Anterior margin of rostrum convex; caudal process narrow. Surface of carapace with scale-like markings visible on holotype mainly on rostrum (Figure 49b); scales

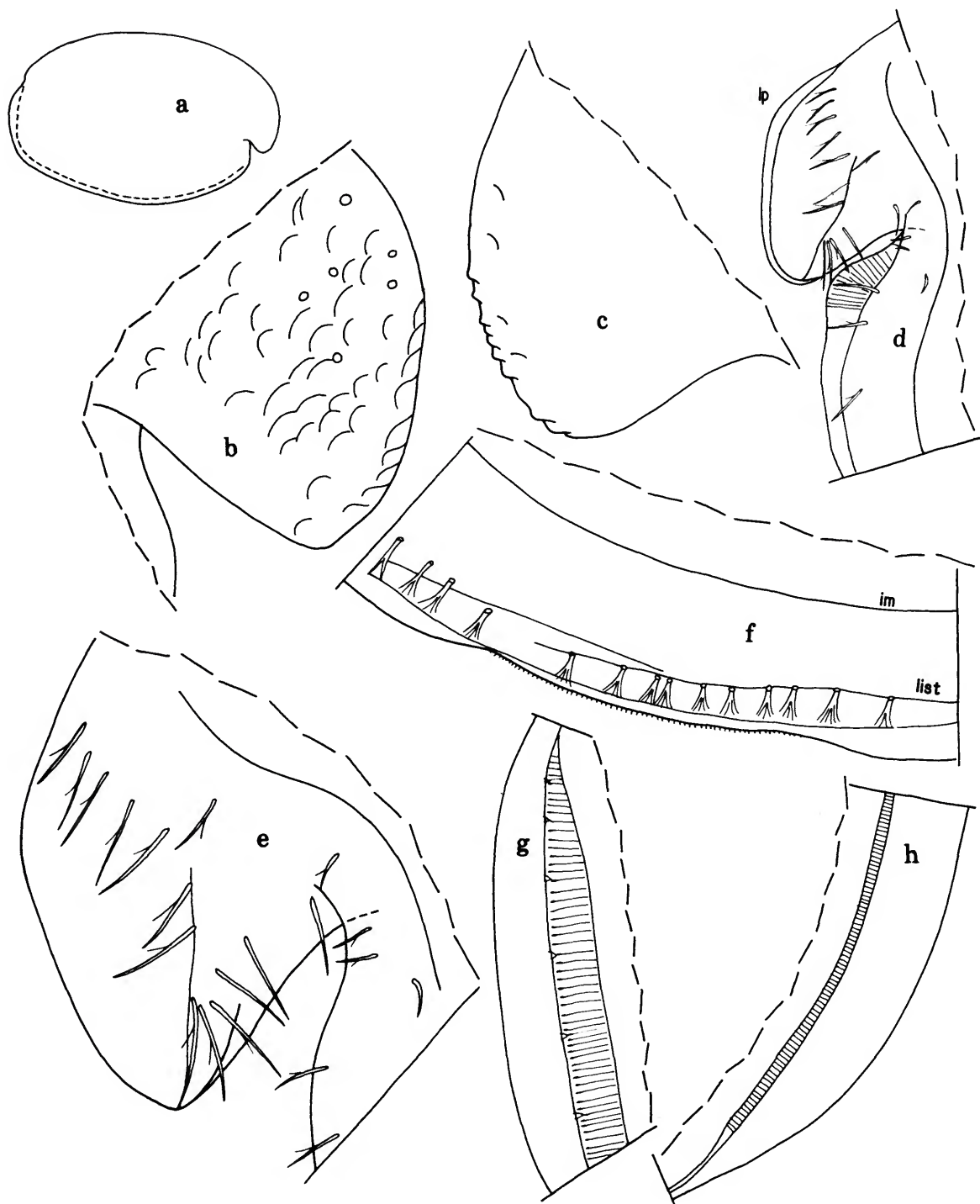


FIGURE 49.—*Vargula sagax*, new species, instar V (sex unknown), holotype, MNHN Os 447: *a*, complete specimen from right side, length ~1.53 mm; *b, c*, anterior ends of right and left valves, ov; *d, e*, anterior end of right valve, iv; *f*, anteroventral margin of right valve, iv; *g*, detail of list of caudal process of left valve, iv; *h*, caudal process of right valve, iv.

along anterior edge of rostrum project slightly past edge resulting in it appearing digitate in lateral view (Figure 49c). Valve surface with scattered small round pores (Figure 49b).

Infold: Rostral infold with 6 bristles (some divided) in row between list and incisur parallel to ventral edge of rostrum, 6 or 7 divided bristles in vertical row, and 1 divided bristle posterior to vertical row (Figure 49d,e); 3 divided bristles posterior to inner end of incisur (Figure 49e). Anteroventral infold with 1 small bristle ventral to incisur near inner margin of infold and 5 divided bristles in row just within valve edge (only 2 bristles shown in Figure 49e). Ventral end of anteroventral infold and anterior end of ventral infold with total of 13 or 14 setose bristles in row along list (Figure 49f); middle and posterior parts of infold of ventral margin with narrow list without bristles. List along anterior edge of caudal process broad with fairly straight posterior edge, numerous pore canals perpendicular to edge on both valves, and several minute pores or papillae on or near outer edge on left valve (Figure 49g), but pores not observed on right valve of holotype (Figure 49h).

Selvage: Lamellar prolongation of selvage along ventral edge of incisur broad, ribbed, and with minutely serrate outer edge; narrow lamellar prolongation with smooth outer margin along anterior edge of rostrum; lamellar prolongation along anterior edge of anteroventral valve margin fairly broad, with smooth outer edge and without ribs; short segment of lamellar prolongation along ventral edge of anteroventral valve margin narrow with minutely serrate outer edge (Figure 49f) (narrow serrate segment not present on *V. arx* described herein; Skogsberg (1920:318) mentions a similar narrow segment on *Cypridina serrata affirmans* Skogsberg, 1920); lamellar prolongation along ventral margin of valve fairly broad, with smooth outer edge and without ribs; lamellar prolongation absent along outer edge of caudal process and posterior edge of valve.

Carapace Size: MNHN Os 447, holotype, length 1.53 mm, height 1.05 mm (valve distorted and measurements approximate).

First Antenna (Figure 50a,b): 1st joint bare. 2nd joint with few minute ventral spines. 3rd joint short, with 2 bristles (1 ventral, 1 dorsal). 4th joint elongate, with 1 dorsal bristle and no or 1 ventral bristle. Sensory bristle of 5th joint with 8 stout proximal filaments followed by 3 slender filaments. 6th joint with short spinous medial bristle near dorsal margin. 7th joint: a-bristle slightly longer than bristle of 6th joint, with few minute spines; b-bristle about $\frac{1}{3}$ longer than a-bristle, with 3 or 4 short proximal filaments with minute spines; c-bristle long with 9 marginal filaments, most with spines. 8th joint: d- and e-bristles about twice length of b-bristle, bare with blunt tips; f-bristle about $\frac{2}{3}$ length of c-bristle, with 9 marginal filaments, most with spines; g-bristle about same length as c-bristle, with 10 marginal filaments, most with spines.

Second Antenna: Protopodite with short distal medial bristle with few marginal spines (Figure 50c). Endopodite

3-jointed (Figure 50d): 1st joint with 3 proximal bristles (1 long, 2 short) and 1 long distal bristle (bristle broken on both limbs of holotype); elongate 2nd joint with short terminal bristle; elongate 3rd joint with long terminal filament (tip may be missing on illustrated limb). Exopodite (Figure 50e): 1st joint with broad terminal triangular medial process; bristle of 2nd joint reaching 9th joint, with 10 stout ventral spines; bristles of joints 3–8 with natatory hairs; 9th joint with 4 bristles (2 long and 1 medium with natatory hairs, 1 short (dorsal) bare); joints 3–8 with basal spines longer on distal joints; basal spine of 8th joint longer than 9th joint; 9th joint with lateral spine longer than joint; joints 2–8 with minute spines in row near distal edge.

Mandible (Figure 50f–h): Coxale endite spinous, with terminal spines closely spaced, larger than adjacent spines but without usual peg between them; minute proximal bristle present. Basale without spines; ventral margin with 2 a-bristles (1 minute, 1 with length greater than width of basale, with marginal spines), 1 small b-bristle (with base on lateral surface), 2 spinous c-bristles (proximal short), and 2 d-bristles (proximal with short spines, distal longer with wreaths of long spines); c- and d-bristles close to each other; dorsal margin with 1 slender bristle at $\frac{2}{3}$ joint length, and 2 slender terminal bristles. Exopodite about same length as dorsal margin of 1st endopodial joint, with distal hairs and 2 slender subterminal bristles (distal bristle $\frac{1}{2}$ length of proximal). 1st endopodial joint with 3 or 4 ventral bristles (2 long, 1 short, 0 or 1 minute). 2nd endopodial joint: ventral margin with spines and 3 distal bristles (1 single ringed, 2 shorter paired terminal, both about same length (medial sclerotized unringed, other obscured, probably ringed)); dorsal margin with few spines, 8 or 9 bristles (4 long, 2 medium, 2 or 3 short); medial surface with minute spines in few rows. 3rd endopodial joint with 3 stout claws (dorsal claw of right mandible of holotype with few proximal ventral teeth (not shown) not observed on left limb) and 3 bristles (lateral ventral bristle of left limb of holotype with distal bulge (Figure 50h) not on bristle of right limb (Figure 50f)).

Maxilla: Endite I with 11 spinous and pectinate bristles; endites II and III each with 4 bristles (Figure 51a). Precoxale and coxale with spines near dorsal margin; coxale without dorsal bristle (probably broken off during dissection). Basale with 1 long ventral bristle near base of exopodite and 1 medial bristle near midlength of 1st exopodial joint (Figure 51b). Exopodite hirsute, with 3 bristles (proximal and outer terminal bristles with long hairs; inner terminal bristle bare) (Figure 51b,c). 1st endopodial joint spinous, with 2 short spinous alpha-bristles, 2 short beta-bristles (1 short ringed bare or with few spines; 1 longer ringed pectinate (could be d-bristle on 2nd joint), and cutting tooth with 2 nodes (1 much larger) (Figure 51b–d)). 2nd endopodial joint with 4 ringed pectinate a-bristles, 3 stout claw-like pectinate b-bristles (inner unringed, others ringed), 2 weakly ringed c-bristles with stout proximal teeth and distal slender spines perpendicular to bristles, and 3

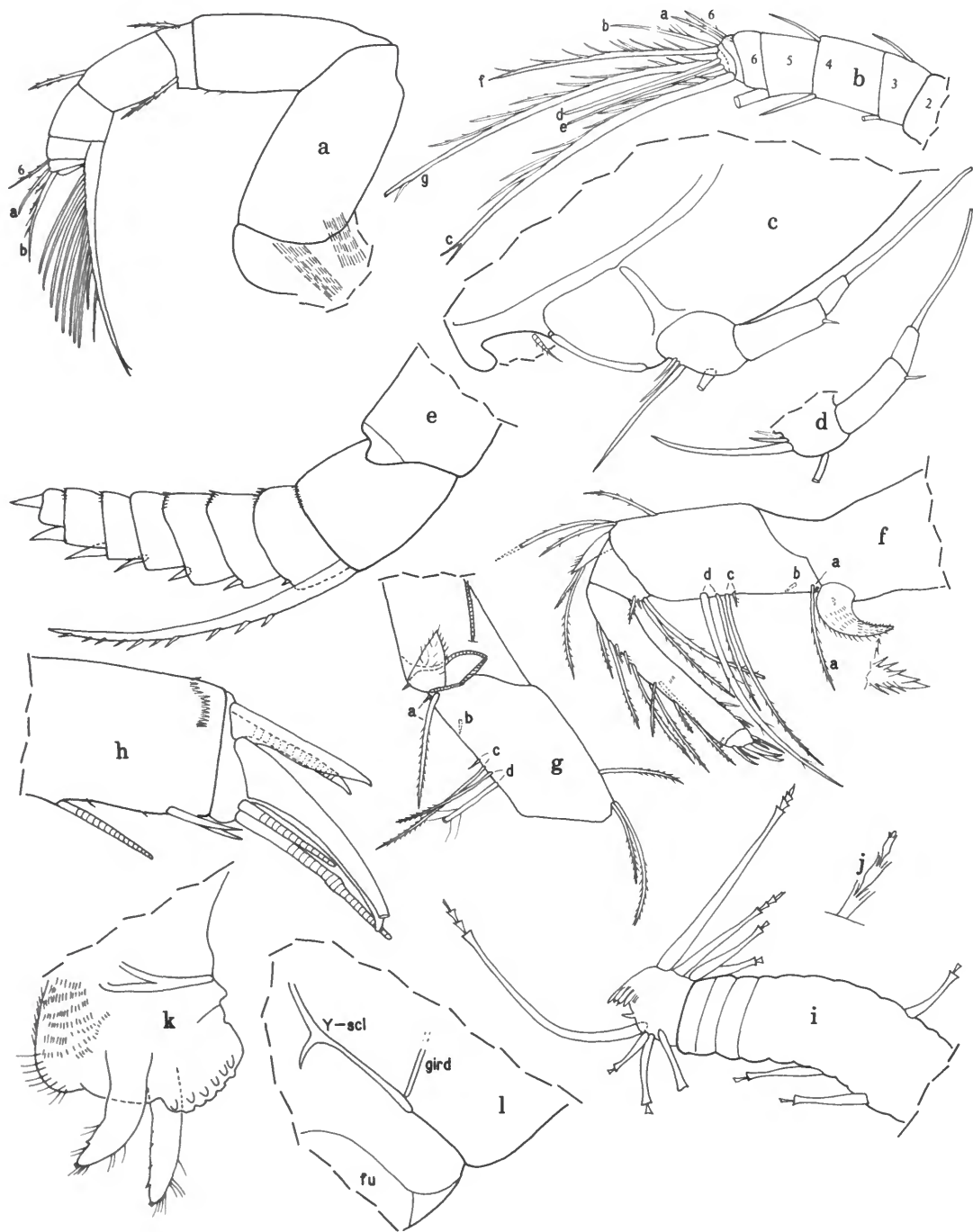


FIGURE 50.—*Vargula sagax*, new species, instar V (sex unknown), holotype, MNHN Os 447: *a*, right 1st antenna (not all bristles of 7th and 8th joints shown), mv; *b*, joints 2-9 of left 1st antenna, lv; *c*, protopodite and endopodite of right 2nd antenna, mv; *d*, endopodite of left 2nd antenna, lv; *e*, exopodite of right 2nd antenna (only bristle of 2nd joint shown), mv; *f*, right mandible, mv; *g*, coxale and basale of left mandible (2 long segmented filament-like protistans on coxale), mv; *h*, tip of left mandible, mv; *i*, 7th limb; *j*, detail of 2 bells and terminal process of a bristle from 7th limb opposite that shown in *i*; *k*, upper lip from right side, anterior to right; *l*, part of posterior end of body from right side showing right Y-sclerite.

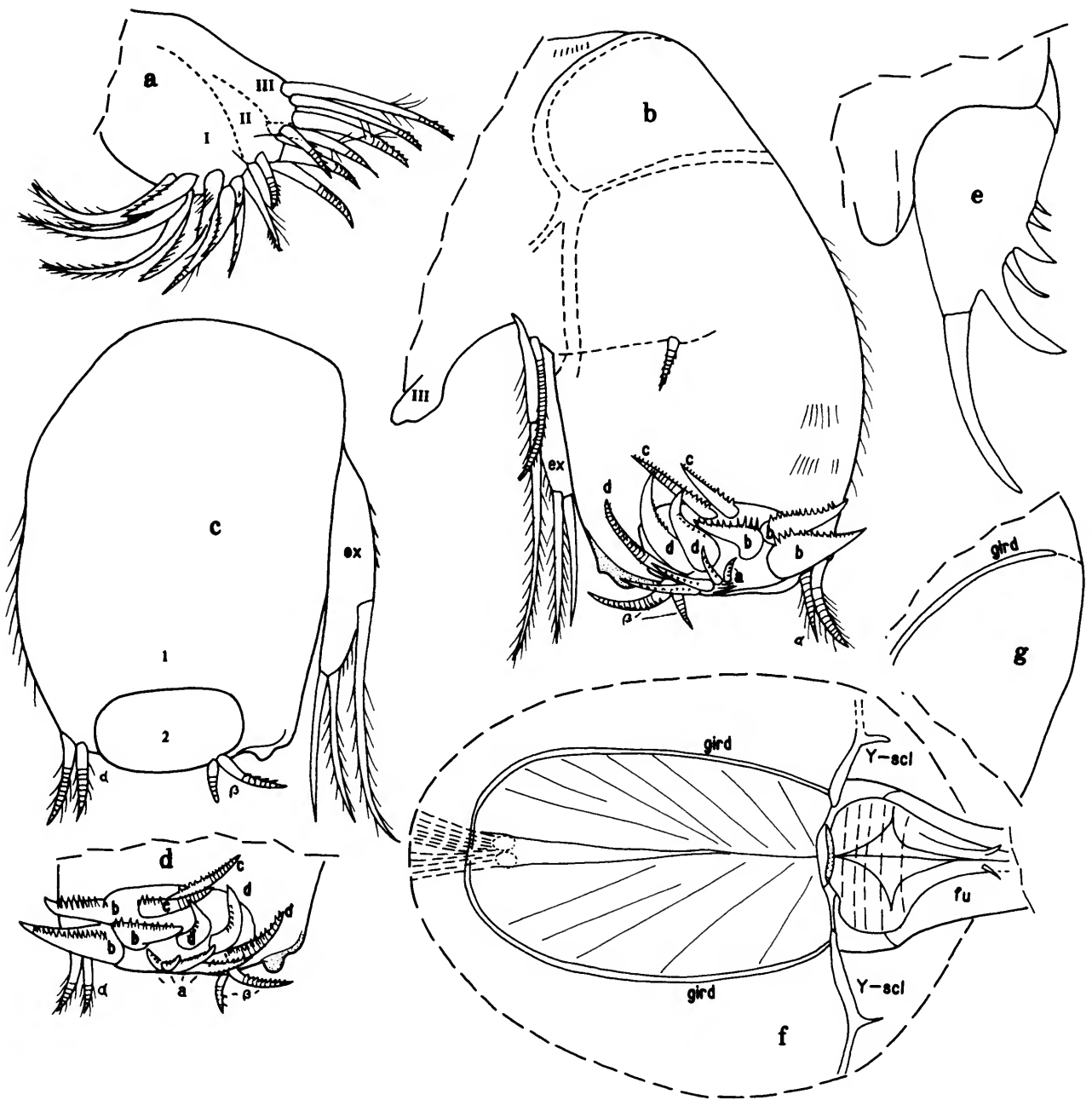


FIGURE 51.—*Vargula sagax*, new species, instar V (sex unknown), holotype, MNHN Os 447: a, endites I-III of left maxilla, mv; b, part of left maxilla, mv; c, part of right maxilla, mv; d, tip of right maxilla, mv; e, left furcal lamella, lv; f, ventral view of posterior of body, anterior to right; g, left side of posterior end of body in vicinity of girdle, anterior to left.

d-bristles (2 stout pectinate claw-like, 1 ringed finely pectinate) (Figure 51*b,d*). (5 stout unringed claw-like bristles of 2nd endopodial joint more than usually present on species of *Vargula*, and bristles unusually short.)

Fifth Limb: Epipodite with 43 bristles. Protopodite with very long anterior tooth with bent tip (Figure 52*d*). Endite I with about 6 bristles; bristles obscured on endites II and III (Figure 52*a*). 1st exopodial joint: anterior side with 3 ringed bristles in row (2 long, stout, with long proximal and short distal spines, 1 small with short spines) (Figure 52*d*); main tooth with smooth proximal peg and 5 stout cusped teeth (proximal tooth with broad proximal part with 7 cusps and smaller distal part with 3 cusps; distal tooth with 12 cusps) (Figure 52*b,c*); spinous ringed bristle proximal to main tooth. 2nd exopodial joint with 4 pectinate unringed a-bristles, 4 pectinate ringed b'-bristles, 4 pectinate ringed b"-bristles, 1 stout posterior ringed c-bristle with long proximal hairs (Figure 52*b,d*), and 1 small anterior ringed d-bristle with long proximal hairs (Figure 52*d*). 3rd exopodial joint (Figure 52*e*): inner lobe with 3 ringed bristles; outer lobe hirsute, with 2 ringed terminal bristles. 4th and 5th exopodial joints obscured on both limbs of holotype, with at least 3 ringed bristles (Figure 52*e*).

Sixth Limb (Figure 52*f,g*): With 3 or 4 bare epipodial bristles. Endite I with 3 spinous bristles (2 small medial, 1 long terminal); endite II with 4 spinous bristles (2 small medial, 2 long terminal); endite III with 4 spinous bristles (1 medial near terminal end, 3 terminal (1 short, 2 long)); endite IV with 3 spinous bristles (1 short, 2 long). Ventral edge of skirt with 3 or 4 anterior bristles (with long proximal and short distal spines) separated by space from 3 bristles (anterior with long proximal and short distal spines, 2 posterior with long hairs); ventral edge of skirt except near anterior and posterior margins with long lateral and medial hairs; medial surface of skirt and endites III and IV with long hairs.

Seventh Limb: One limb with 4 tapered proximal bristles (3 on peg side, 1 on comb side) each with 1 bell; terminus with 9 tapered bristles (4 on peg side, 5 on comb side) each with 1 or 2 bells. Opposite limb (Figure 50*i*) with 3 tapered proximal bristles (2 on peg side, 1 on comb side) each with 1 bell (some proximal bristles may have broken off); terminus with 8 tapered bristles (4 on each side) each with 1–3 bells. Terminus with 10 comb teeth (proximal tooth on each side short; middle tooth longest) opposite single pointed peg. Tip of bristle distal to bells narrow bell-like with small terminal process (Figure 50*j*).

Furca (Figure 51*e, f*): Each lamella with 6 claws; claws 2 and 4 nonarticulated; claw 3 about same length as claw 4 but much narrower; claw 1 of right lamella anterior to claw 1 of left lamella by width of base; each claw with rows of medial and lateral teeth (not shown); a few teeth on each claw larger than others but most similar.

Bellonci Organ (Figure 52*h*): Short with pointed tip.

Eyes: Medial eye unpigmented, bare. Lateral eye well

developed with 16 amber-color ommatidia (Figure 52*i*); no pigment between ommatidia.

Upper Lip (Figure 50*k*): Anterior unpaired part with relatively few widely separated small glandular processes with rounded tips. Paired posterior part with 2 long tapered tusks (1 on each side) each with long distal hairs, 2 small glandular processes on posterior edge, and 1 fairly long diaphanous glandular process at tip. Globous posterior part of lip with abundant short spines on proximal lateral and posterior surfaces, and long hairs on posteroventral curvature.

Genitalia: Holotype with lobe anterior to caudal process, but whether lobe is male copulatory limb or excreta projecting from anus, could not be determined (Figure 51*e*).

Anterior of Body: Not observed.

Posterior of Body (Figure 51*f,g*): Evenly rounded, bare.

Y-Sclerite (Figures 50*l, 51f*): Typical for subfamily.

Protistans (Figure 50*g*): Segmented filaments on mandible.

DESCRIPTION OF INSTAR I (sex unknown) (Figures 53, 54).—Carapace uncalcified, distorted but in general similar in shape to that of instar V.

Infold: Rostral infold with about 9 bristles, some divided (Figure 53*a*); anteroventral infold with 2 bristles near dorsal end and 5 divided bristles in row just within valve edge (only 1 bristle shown in Figure 53*a*). Ventral end of anteroventral infold and anterior end of ventral infold with total of about 8 setose bristles (Figure 53*b*). Infold of caudal process similar to instar V (Figure 53*c*).

Selva: Similar to instar V including short narrow serrate segment along ventral end of anteroventral margin of valve (Figure 53*b*).

Carapace Size: USNM 193757, length about 0.68 mm, height about 0.45 mm.

First Antenna (Figure 53*d,e*): 1st and 2nd joints bare. 3rd joint short with 2 bristles (1 ventral, 1 dorsal). 4th joint elongate bare. Sensory bristle of 5th joint bare; medial bristle of 6th joint near joint midheight but closer to dorsal margin, with few marginal spines. 7th joint: a-bristle slightly stouter and longer than bristle of 6th joint, with few marginal spines; b-bristle about twice length of a-bristle, with few widely separated marginal spines; c-bristle long with few widely separated marginal spines. 8th joint: d- and e-bristles long bare; f- and g-bristles long with widely separated minute marginal spines. (Tips of c-, d-, f-, and g-bristles broken off on both limbs of USNM 193757.)

Second Antenna (Figure 53*f*): Protopodite with short distal medial bristle. Endopodite 3-jointed: 1st joint short bare; 2nd joint elongate bare with small terminal bristle; elongate 3rd joint with terminal filament about twice length of stem. Exopodite 9-jointed: 1st joint with minute triangular medial spine at joint midwidth; bristle of 2nd joint reaching 8th joint, with 6–8 marginal spines decreasing in length distally along bristle; bristles of joints 3–8 with natatory hairs (not shown);



FIGURE 52.—*Vargula sagax*, new species, instar V (sex unknown), holotype, MNHN Os 447: a, endites I-III of left 5th limb, pv; b, left 5th limb (endites and exopodial joints 3-5 not shown), pv; c, main tooth of 1st exopodial joint of left 5th limb, pv; d, part of right 5th limb (not all bristles shown), av; e, exopodial joints 3-5 of right 5th limb (4th and 5th joints obscured on slide), av; f, endites I-IV of right 6th limb, lv; g, left 6th limb, lv; h, medial eye and Bellonci organ, either dv or vv; i, lateral eye.

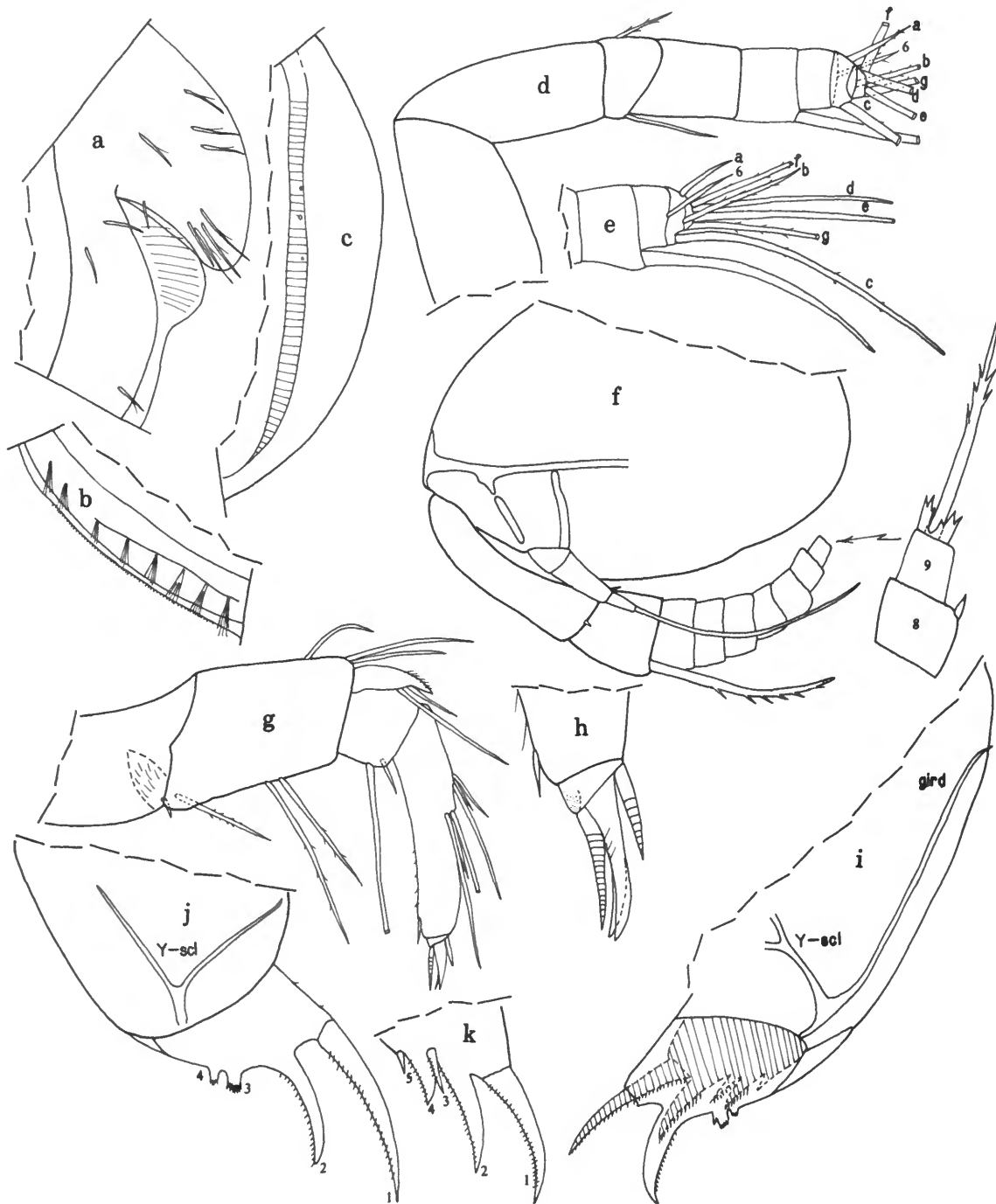


FIGURE 53.—*Vargula sagax*, new species, instar I (sex unknown), paratype, USNM 193757: *a*, anterior end of left valve, iv; *b*, anteroventral margin of left valve, anterior to left, iv; *c*, posterior end of right valve, iv; *d*, right 1st antenna, lv; *e*, tip of left 1st antenna, mv; *f*, right 2nd antenna and detail of exopodial joints 8 and 9 (not all bristles shown), mv; *g*, right mandible, lv; *h*, detail of tip of right mandible shown in *g*; *i*, posterior of body showing left furcal lamella of instar I (striated) inside left furcal lamella of instar I; *j*, posterior of body from right side showing Y-sclerite and right furcal lamella; *k*, right furcal lamella of instar II visible within right furcal lamella of instar I.

proximal ventral hairs of bristle of 3rd joint slightly stouter, spine-like; 9th joint with 2 bristles (1 long with natatory hairs (not shown), 1 short with few distal spines (Figure 53f)); joints 3–8 with small basal spines (not shown); 9th joint with 2 lateral spines with minute marginal spines (Figure 53f); joints 2–8 with minute spines in row near distal edge (not shown).

Mandible (Figure 53g,h): Coxale endite spinous, with minute bristle at base. Basale: ventral margin with long a-bristle (absent on left limb of USNM 193757), no b-bristle, long c-bristle, and long d-bristle close to c-bristle (all bristles with few indistinct marginal spines); dorsal margin with 3 bristles as on instar V. Exopodite similar to instar V. 1st endopodial joint with 2 bristles (1 long, 1 short). 2nd endopodial joint: ventral margin with spines and 2 (paired) small terminal bristles (medial unringed, other obscured); dorsal margin with 6 bristles (3 long, 3 short). 3rd endopodial joint with 2 stout claws and 2 ringed bristles (1 ventral, 1 dorsal).

Maxilla: Endite I with 5 bristles; endites II and III each with 2 or 3 bristles (Figure 54a). Precoxale and coxale with spines near dorsal margin; coxale without dorsal bristle. Basale with 1 small medial bristle near midlength of 1st exopodial joint (Figure 54c). Exopodite similar to instar V (Figure 54b). 1st endopodial joint spinous, with 1 short hirsute alpha-bristle, 1 pectinate beta-bristle, and triangular cutting tooth (Figure 54c). 2nd endopodial joint with 2 stout ringed pectinate ?a-bristles, 1 pectinate claw-like unringed ?b-bristle, and 2 ?d-bristles (Figure 54d).

Fifth Limb: Epipodite with 33–39 bristles. Tooth of protopodite small or absent. Endite I with 2 bristles, endites II and III each with 4 or 5 bristles (Figure 54e). 1st exopodial joint: main tooth with 1 stout pectinate tooth and small triangular proximal peg (Figure 54f,g); spinous bristle proximal to peg. 2nd exopodial joint with 1 stout pectinate a-bristle and 3 spinous and pectinate bristles (1 of the 3 could be on 1st joint) (Figure 54f). 3rd exopodial joint (Figure 54f): inner lobe absent; outer lobe with 2 slender bristles. 4th and 5th exopodial joints fused, with 2 terminal bristles.

Sixth Limb (Figure 54i): Small, diaphanous, with long marginal hairs; small proximal spine on posterior edge of left limb of USNM 193757 but not on right. Limbs appear devoid of muscle bundles.

Seventh Limb: Absent.

Furca: Each lamella with 4 claws: claw 1 stout articulated; claw 2 stout nonarticulated; claws 3 and 4 short nonarticulated, with terminal spines; wide space between claws 2 and 3 (Figure 53i,j). Furcal claws of instar II visible through claws of instar I (Figure 53i). Each lamella of instar II with 5 claws: claw 1 stout articulated; claws 2 and 4 stout nonarticulated; claws 3 and 5 slender articulated (Figure 53k). From location of claw 4 of instar II relative to claws of instar I, claw 4 of instar II appears to replace claw 3 of instar I, and claw 3 of instar II appears to fill in space between claws 3 and 4 of instar I (Figure 53i), but speculative. Claw 1 of right lamella of instar I broken

off and claw 1 of instar II projects in its place in Figure 53i (lamella of instar II lined).

Bellonci Organ and Eyes: Lateral eye well developed with 12 ommatidia (10 large, 2 small) (Figure 54j). Medial eye and Bellonci Organ obscured on USNM 193757.

Upper Lip (Figure 54k): With long tapered tusks with proximal row of short spines and long distal hairs and long glandular process at tip; in general, similar to instar V.

Anterior of Body: Not observed.

Posterior of Body (Figure 53i): Evenly rounded, bare.

Y-Sclerite: Proximal end of Y-sclerite fused to both ventral end of girdle and dorsal end of a sclerite extending to furca (Figure 53i,j). USNM 193757 with ventral branch on left Y-sclerite (Figure 53i) but not on right (Figure 53j). Girdle of same specimen not fully developed on right side (Figure 53j).

COMPARISONS.—The new species *V. sagax* has an a-bristle on the mandibular basale longer than the width of the joint. Two other species of *Vargula* having a long a-bristle are *V. plicata* Poulsen (1962:189), and *V. sekiguchii* Hiruta (1984:53), especially the former. On the mandibular basale of both of those species the c-bristles are fairly widely separated from the d-bristles, whereas on *V. sagax* they are close together. The mandible of *V. plicata* also differs from *V. sagax* in having a stout finger-like medial terminal bristle on the 2nd endopodial joint, and in having on the 3rd endopodial joint a stout swollen part on the longest ventral bristle. The 7th limb of *V. sekiguchii* differs from *V. sagax* in having a “dorsal jaw” (Hiruta, 1984:59). The mandible of *V. sagax* differs from that of *V. arx* described herein in having a long a-bristle on the mandibular basale. The lateral eye is absent on *V. arx* (female) and present on *V. sagax* (sex unknown), but it is possible that it is present on the male *V. arx*.

COMPARATIVE MORPHOLOGY OF INSTARS I AND V.—The carapaces of both instars are quite similar except for size, and for the 1st instar having fewer anteroventral bristles on the infold. The lamellar prolongations of the selvage of both instars have an unusual narrow serrated segment along the anteroventral margin. The 1st antenna of instar I unlike instar V is without bristles on the 4th joint, and the sensory bristle of the 5th joint as well as the b-, c-, f-, and g-bristles of the 7th and 8th joints are without filaments (the last 4 bristles of instar I have minute marginal spines). The 2nd antenna of instar I differs from that of instar V mainly in having no bristles instead of 4 on the 1st endopodial joint, and 2 instead of 4 on the 9th exopodial joint. The mandible of instar I has fewer bristles on the basale and 1st, 2nd, and 3rd endopodial joints. The maxilla of instar I is well developed but has fewer bristles on most joints. The 5th limb of instar I bears only 1 pectinate tooth on the main tooth of the 1st exopodial joint compared to 5 for instar V, and the inner lobe of the 3rd exopodial joint is without bristles. The 6th limb is present on instar I but is without bristles. The 7th limb is absent on instar I. The furca of instar I bears on each lamella 4 claws compared to 6 on instar V, and only claw 1 is articulated. The appendages of instar II are

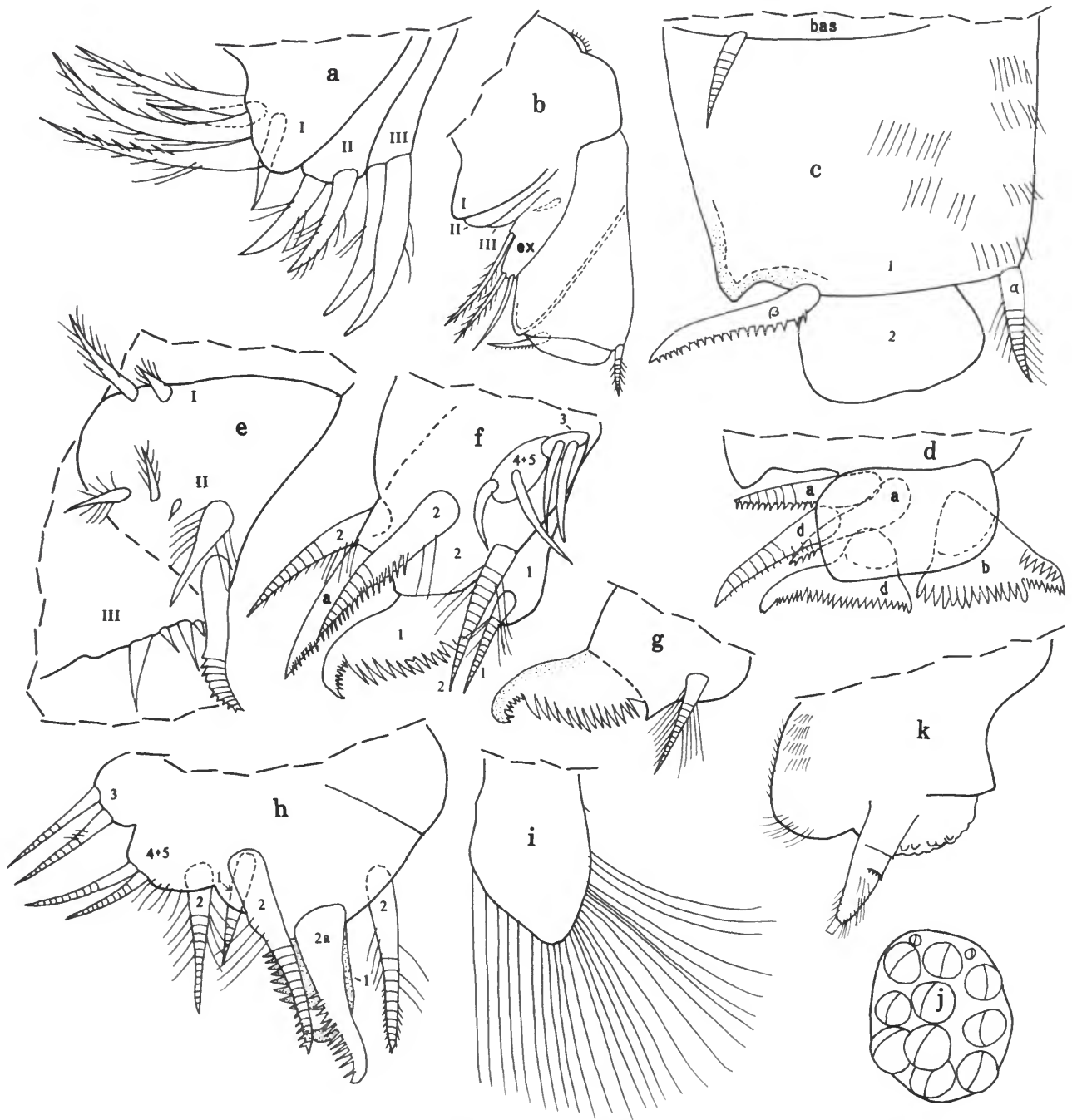


FIGURE 54.—*Vargula sagax*, new species, instar I (sex unknown), paratype, USNM 193757: *a*, endites I–III of right maxilla, lv; *b*, part of right maxilla, lv; *c*, part of left maxilla, mv; *d*, bristles of 2nd endopodial joint of left maxilla, mv; *e*, endites I–III of right 5th limb, av; *f*, part of right 5th limb, ?av; *g*, detail of main tooth of 1st exopodial joint of 5th limb shown in *f*, av; *h*, part of left 5th limb (main tooth of 1st exopodial joint stippled), ?av; *i*, left 6th limb, lv; *j*, lateral eye; *k*, upper lip from right side, anterior to right.

visible within instar I of the specimen studied (USNM 193757). The furca of instar II bears on each lamella 5 claws of which claws 1, 3, and 5 are articulated. On the adult furca claws 1, 3, 5, and 6 are articulated.

Hiruta (1980:145) described all stages of *Vargula hilgendorffii* (Müller, 1890). Taking into consideration that *sagax* and *hilgendorffii* differ morphologically, the 1st and 5th instars of both species are quite similar; for example, on instar I the sensory bristle as well as the b-, c-, f-, and g-bristles of the 1st antenna are without filaments, the main tooth of the 5th limb has only 1 pectinate tooth (5 on instar V), the 6th limb is without bristles, and the 7th limb is absent (Hiruta (1980:149) states "not observed" for *V. hilgendorffii*). It is also of interest that the 2nd endopodial joint of the 2nd antenna bears a terminal bristle on the 1st instars of both species. The presence of a bristle in this location on the adult is one of several characters identifying the genus. Apparently, the bristle also may be useful in identifying juveniles.

REMARKS CONCERNING THE Y-SCLERITE OF INSTAR I.—This is known for only a few species in the Cypridinidae, but it is evident that the Y-sclerite differs from those of later instars. Unlike the Y-sclerite in later instars, that of the 1st instar is fused both to the girdle and to a sclerite extending to the furca: *Vargula sagax* (herein); *Codonocera* species A (Kornicker, 1991, fig. 11j), and possibly *Vargula hilgendorffii* (Hiruta, 1980, fig. 6:5). In the Cylindroleberididae the Y-sclerite of the

1st instar is known for *Asteropterygion* species indeterminate (herein) and *Asteropteron fuscum* (Hiruta, 1979a, fig. 8:3). The Y-sclerites of both species have a ventral branch not present on adults.

PHILOMEDIDAE Müller, 1906

This family includes 2 subfamilies, Pseudophilomedinae and Philomedinae. Both subfamilies are in the collections.

PSEUDOPHILOMEDINAE Kornicker, 1967

This subfamily includes 5 genera of which 2 are in the collections: *Harbansus* and *Tetragonodon*.

***Harbansus* Kornicker, 1978**

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

DISTRIBUTION.—The genus is widespread in the Atlantic and Pacific oceans, in the Gulf of Mexico, and in the Coral Sea off Queensland, Australia (Kornicker, 1978:13; 1983a:181). Its known depth range is 1–1015 m. The genus has not been reported previously from the Indian Ocean.

COMPOSITION.—Including the 2 new species described herein the genus includes 13 species plus 2 left in open nomenclature (Kornicker, 1978:16; 1983a:181; 1991:74).

Key to Adult Females* of Species of *Harbansus*

(Does not include 2 species left in open nomenclature (Kornicker, 1978:49))

1. Carapace longer than 2.0 mm *H. magnus*
Carapace shorter than 1.5 mm 2
2. Claw 1 of furca with distal teeth longer than width of claw at midlength
. *H. ferox*, new species
Claw 1 of furca with distal teeth about same length as claw width at midlength . .
. 3
3. Carapace with lateral ribs 4
Carapace without lateral ribs 8
4. Third endopodial joint of mandible with 2 claws *H. slatteryi*
Third endopodial joint of mandible with 3 claws 5
5. Tip of 2nd joint of endopodite of 2nd antenna with short bristle . . *H. bradmyersi*
Tip of 2nd joint of endopodite of 2nd antenna bare or with minute spine 6
6. Fourth joint of 1st antenna with 3 bristles *H. paucichelatus*
Fourth joint of 1st antenna with 5 or 6 bristles 7
7. Second endopodial joint of mandible with 2 ventral bristles in terminal group . .
. *H. thrix*, new species
Second endopodial joint of mandible with 3 ventral bristles in terminal group . . .
. *H. vix*
8. Anterior edge of valve cuts obliquely across distal end of rostrum
. *H. schornikovi*
Anterior edge of valve parallel to distal end of rostrum 9

9. Bellonci organ very short *H. rhabdion*
 Bellonci organ long 10
10. Second joint of endopodite of 2nd antenna minute *H. bowenae*
 Second joint of endopodite of 2nd antenna elongate 11
11. Distal end of 2nd joint of endopodite of 2nd antenna bare *H. dayi*
 Distal end of 2nd joint of endopodite of 2nd antenna with terminal bristle . . . 12
12. Distal group of bristles on ventral margin of 2nd endopodial joint of mandible with
 2 bristles plus a long claw *H. barnardi*
 Distal group of bristles on ventral margin of 2nd endopodial joint of mandible with
 only 2 bristles *H. mayeri*

* Exceptions are *H. magnus* known only from an A-1 female and *H. schornikovi* known only from an male.

Harbansus thrix, new species

FIGURES 55-57

ETYMOLOGY.—From the Greek *thrix* (hair) in reference to wreath of spines on the bristle of the 2nd joint of the endopodite of the 2nd antenna of the female.

HOLOTYPE.—MNHN Os 448, A-1 female on slide and in alcohol.

TYPE LOCALITY.—Sta 75-R, 30 Mar 1977, N Dzaoudzi, Mayotte, 12°46'24"S, 45°15'18"E, depth 20 m.

PARATYPES.—Sta 75-R: 1 A-1 male (length 0.73 mm, height 0.38 mm) undissected and in alcohol. Sta 116-S: USNM 193691, 1 ovigerous female on slide and in alcohol.

DISTRIBUTION.—Sta 75-R, N Dzaoudzi, Mayotte, depth 20 m. Sta 116-S, Geysers Bank, southern part of lagoon, depth 13 m. Known depth range 13-20 m.

DESCRIPTION OF ADULT FEMALE (Figures 55, 56*a-i*).—Each valve with overhanging rostrum and well-developed caudal process (caudal process of right valve of USNM 193691 more rounded than that of left), and with poorly defined lateral ribs (Figure 55*a,b,e*). Rostrum with narrow ridge extending to anterior edge of rostrum. Anterior edge of rostrum with about 12 minute tubercles (Figure 55*e,f*). Surface of valves with well-developed fossae having crenulate inner edge (Figure 55*a,b,e*; crenulate edge not shown). Single and setose bristles sparsely distributed over valve surface (Figure 55*a,d,e*).

Infold: Infold of rostrum with 4 bristles forming row and paired bristles at inner end of incisur (Figure 55*f*); 1 small bristle ventral to inner end of incisur. Infold of caudal process with 5 setose bristles forming row along anterior edge of pocket (Figure 55*g*). Anteroventral infold with 6 or 7 ridges parallel to valve edge.

Selvae: Wide lamellar prolongation divided in vicinity of incisur.

Central Adductor Muscle Attachments (Figure 55*a-c*): Comprising many elongate and ovoid attachments.

Carapace Size: USNM 193691, length 1.03 mm, height 0.52 mm.

First Antenna (Figure 55*h*): 1st joint with few minute

spines forming lateral rows near dorsal margin. 2nd joint: dorsal margin with long proximal spines and bare distal bristle; medial side with short spines forming rows near ventral margin (not shown on illustrated limb); medial side with minute spines along distal margin. 3rd joint short, with 3 bristles (2 dorsal, 1 medial near ventral margin). 4th joint elongate, with 5 or 6 bristles (2 or 3 dorsal, 3 ventral). Sensory bristle of 5th joint with 2 short proximal filaments, 3 longer subterminal filaments, and tip of stem with 2 minute papillae. 6th joint minute, fused to 5th, with short medial bristle near dorsal margin. Bristles of joints 2-6 with minute terminal spine. 7th joint: a-bristle about length of 5th joint; b-bristle shorter than sensory bristle of 5th joint, with a pair of short distal filaments, and tip with 2 minute papillae; c-bristle same length as sensory bristle, with 3 short proximal filaments, 3 longer subterminal filaments, and stem with 2 minute terminal papillae. 8th joint: d- and e-bristles same length as c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 2 short proximal filaments and 3 longer subterminal filaments (tip of stem missing on specimen examined); g-bristle same length as c-bristle, with 1 short proximal filament and 3 longer subterminal filaments (tip of stem missing on specimen examined).

Second Antenna (Figure 55*i-k*): Protopodite bare. Endopodite 2-jointed (Figure 55*i*): 1st joint with 2 short bristles; 2nd joint with broadly rounded bare tip and long ventral bristle with wreaths of long spines near midlength. Exopodite: 1st joint with minute bent medial bristle on distal margin; bristles of joints 2-8 with 7-9 stout proximal ventral spines and distal natatory hairs but no proximal hairs (Figure 55*j*). 9th joint with 2 bristles (Figure 55*k*); ventral bristle about $\frac{3}{4}$ length of bristle of 8th joint, with 7 small ventral spines followed by minute spines along both margins and long hairs near tip; dorsal bristle small, about same length as joints 6-9, with few minute spines. Joints 4-8 with short stout basal spines (Figure 55*k*). Joints 2-8 with minute spines forming row along distal edge.

Mandible (Figure 55*l*): Coxale endite spinous, bifurcate at tip. Basale: medial surface spinous, with 3 small bristles near ventral margin (2 proximal, 1 at midlength); lateral surface with



FIGURE 55.—*Harbansus thrix*, new species, adult female, paratype, USNM 193691: *a, b*, complete specimen from right and left sides (shell fossae are representative), length 1.03 mm; *c*, approximation of central adductor muscle attachments as seen through left valve shown in *b*, anterior to left; *d*, 1 setal bristle and 2 single bristles on posterior margin of right valve shown in *a*, anterior to right, ov; *e*, detail of anterior of right valve shown in *a*, ov; *f*, anterior end of right valve, iv; *g*, caudal process of right valve, iv; *h*, left 1st antenna, lv; *i*, protopodite and endopodite of right 2nd antenna, mv; *j*, 3rd exopodial joint of left 2nd antenna, mv; *k*, exopodial joints 7-9 of right 2nd antenna, lv; *l*, left mandible with detail of tip, mv; *m*, right maxilla (beta-bristles of 1st endopodial joint not shown), mv; *n*, exopodite of left maxilla, mv; *o*, beta-bristles of 1st endopodial joint of right maxilla, mv.

2 long spinous bristles and long hairs near ventral margin; ventral margin with 1 long spinous terminal bristle; dorsal margin with 3 bristles (1 at midlength, 2 terminal). Exopodite: about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, hirsute near tip, with 2 bristles (terminal bristle about $\frac{1}{2}$ length proximal bristle). Endopodite: ventral margin of 1st joint with 3 bristles (2 long with wreaths of long spines, 1 short with short spines). Ventral margin of 2nd joint with bristles forming 2 distal groups, each with 2 spinous bristles (medial bristle in proximal pair longer than others); dorsal margin with 6 bristles near midlength (2 or 3 with bases on lateral side; proximal marginal bristle short). 3rd joint with 3 claws (dorsal claw small, larger claws with minute ventral spines) and 3 bristles.

Maxilla (Figure 55m-o): Endites I and II each with 6

bristles; endite III with 7 bristles plus 1 proximal lateral bristle (latter bristle observed only on left limb of specimen examined). Precoxale, coxale, and proximal part of basale with fringe of dorsal hairs. Coxale with spinous dorsal bristle. Basale with 3 long bristles along distal margin (not all shown). Exopodite short with 3 bristles (2 long spinous, 1 short bare) (Figure 55n). Endopodite: 1st joint with 1 spinous alpha-bristle, 3 beta-bristles (Figure 55o), and spines forming rows along dorsal margin. 2nd joint with 9 bristles including 3 claw-like bristles.

Fifth Limb (Figure 56a,b): Endites obscured (endite I with 1 bristle, others with more). Exopodite: 1st joint with 2 anterior bristles at midwidth of distal margin and 1 short bristle on hirsute lobe on outer corner; main tooth obscured but with 3

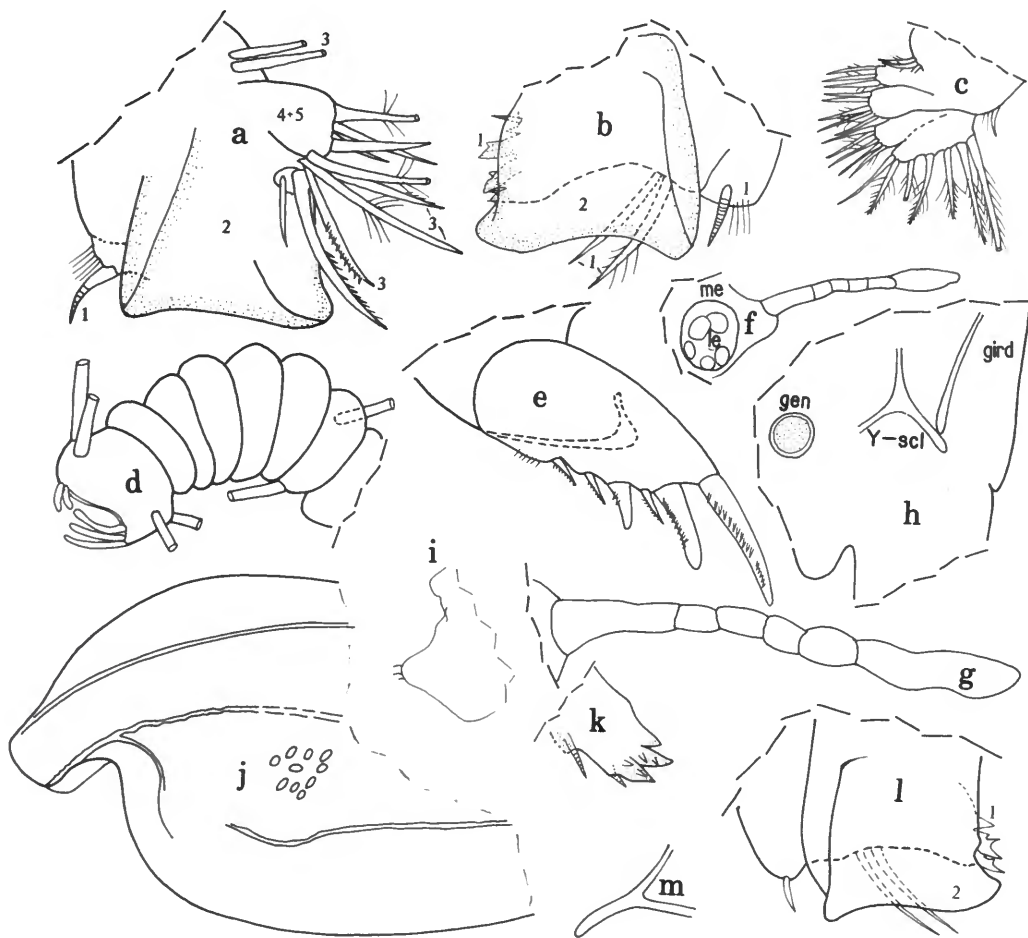


FIGURE 56.—*Harbansus thrix*, new species: adult female, paratype, USNM 193691: a, left 5th limb, pv; b, exopodial joints 1 and 2 of right 5th limb, pv; c, 6th limb; d, 7th limb (only proximal parts of bristles shown); e, right lamella of furca, lv; f, left lateral eye, medial eye, and Bellonci organ; g, Bellonci organ; h, posterior of body from left side, anterior to left; i, upper lip from left side, anterior to left. A-1 female, holotype: j, anterior part of complete specimen, length 0.74 mm; k, main tooth of right 5th limb as seen through 2nd exopodial joint, pv; l, part of left 5th limb, pv; m, right Y-sclerite, anterior to right, lv.

stout teeth, smaller pointed tooth, and proximal bristle (Figure 56b). 2nd joint with large squarish tooth with 2 posterior bristles (1 short slender, 1 long stout pectinate) (Figure 56a); anterior side of joint obscured. 3rd joint with 3 bristles on inner lobe and 2 on outer lobe. 4th and 5th joints fused, with total of 5 bristles.

Sixth Limb (Figure 56c): With 1 epipodial bristle. Endite I small, with 3 spinous bristles; endite II elongate, with 3 spinous bristles; endite III with 5 bristles; endite IV narrower than endite III, with 5 spinous bristles. End joint not prolonged posteriorly, with 7 bristles (5 spinous anterior and 2 hirsute posterior). Endites III and IV and end joint with hairs forming rows (not shown on illustrated limb).

Seventh Limb (Figure 56d): Each limb with 2 proximal bristles (1 on each side) with distal spines and 2 bells, and 4 terminal bristles (2 on each side) with distal spines and 3 or 4 bells (only proximal part of bristles shown on illustrated limb). Terminus with comb of 5 recurved teeth opposite 4 recurved pegs (not all pegs and teeth shown on illustrated limb).

Furca (Figure 56e): Each lamella with 6 claws: claws 1, 2, and 4 stout; claws 3, 5, and 6 shorter and more slender; all claws with short teeth along posterior margin; claw 1 with teeth forming 2 rows (distal medial tooth stout, others small); hairs present on lamellae following claws. Right lamella slightly anterior to left.

Bellonci Organ (Figure 56g,h): Elongate with about 5 sutures in middle part and short broader distal part.

Eyes (Figure 56f): Medial eye bare, unpigmented. Lateral eye smaller than medial eye, with 5 amber-color ommatidia.

Upper Lip (Figure 56i): With minute spines or processes at anterior tip.

Genitalia (Figure 56h): Oval ring on each side of body anterior to furca.

Posterior of Body (Figure 56h): Bare.

Y-Sclerite (Figure 56h): Branching distally.

Eggs: USNM 193691 with 3 eggs in marsupium and 3 much smaller unextruded eggs (Figure 55a).

DESCRIPTION OF A-1 FEMALE HOLOTYPE (MNHN Os 448) (Figures 56j-m, 57).—Carapace similar to that of adult female (Figures 56j, 57).

Carapace Size: Length 0.74 mm, height 0.34 mm.

First Antenna: 1st joint bare. 2nd joint with 1 dorsal bristle. 3rd joint with 3 bristles (1 ventral, 2 dorsal). 4th joint with 4 bristles (2 ventral, 2 dorsal). Joints 5-8 with same number of bristles as on adult female but bristles not examined in detail. (Right limb aberrant and with fewer bristles on joints 2-4.)

Second Antenna: Protopodite, endopodite, and exopodite similar to those of adult female. Exopodite with bristles of joints 2-8 and long bristle of 9th joint with proximal ventral spines and distal natatory hairs.

Mandible: Differs from adult female in having 3 instead of 2 proximal medial bristles on basale.

Maxilla and Fifth Limb (Figure 56k,l): Similar to those of

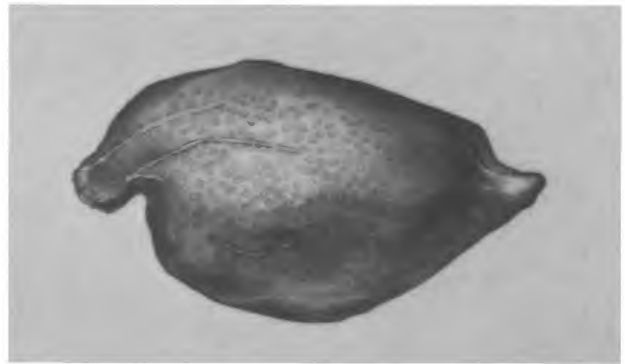


FIGURE 57.—*Harbansus thrix*, new species, A-1 female, holotype, MNHN Os 448, complete specimen from left side, length 0.74 mm.

adult female.

Sixth Limb: Similar to that of adult female except with 2 rather than 1 epipodial bristle.

Seventh Limb: Similar to that of adult female except bristles strongly tapering and with only 1 or 2 bells.

Furca, Bellonci Organ, Eyes, Upper Lip, and Posterior of Body: Similar to those of adult female.

Y-Sclerite (Figure 56m): Distal branches forming smaller angle than on adult female.

COMPARISONS.—In the key to species of *Harbansus* in Kornicker (1978:16) the new species *H. thrix* keys out to *H. paucichelatus*. However, the adult female of *H. thrix* differs from that of *H. paucichelatus* in having 5 or 6 rather than 3 bristles on the 4th joint of the 1st antenna, in having wreaths of long spines on the ventral bristle of the 2nd endopodial joint of the 2nd antenna, and having 2 rather than 1 proximal medial bristles on the basale of the mandible. The adult female of *H. thrix* differs from that of *H. slatteryi* Kornicker, 1983a:181 in having 5 or 6 rather than 3 bristles on the 4th joint of the 1st antenna, 3 rather than 2 claws on the 3rd endopodial joint of the mandible, and 5 rather than 2 ommatidia in the lateral eye.

Harbansus ferox, new species

FIGURES 58-60

ETYMOLOGY.—From the Latin *ferox* (wild, spirited, fierce) in reference to the unusual long teeth on the anterior claw of the furca.

HOLOTYPE.—MNHN Os 450, adult female in alcohol (furca missing).

TYPE LOCALITY.—Sta 71-DS, 30 Mar 1977, NE north reef, Mayotte, 12°29'54"S, 45°02'E, depth 450 m.

PARATYPE.—Sta 71-DS: USNM 193768, adult female on slide and in alcohol (furca and upper lip lost).

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT FEMALE (Figures 58-60).—

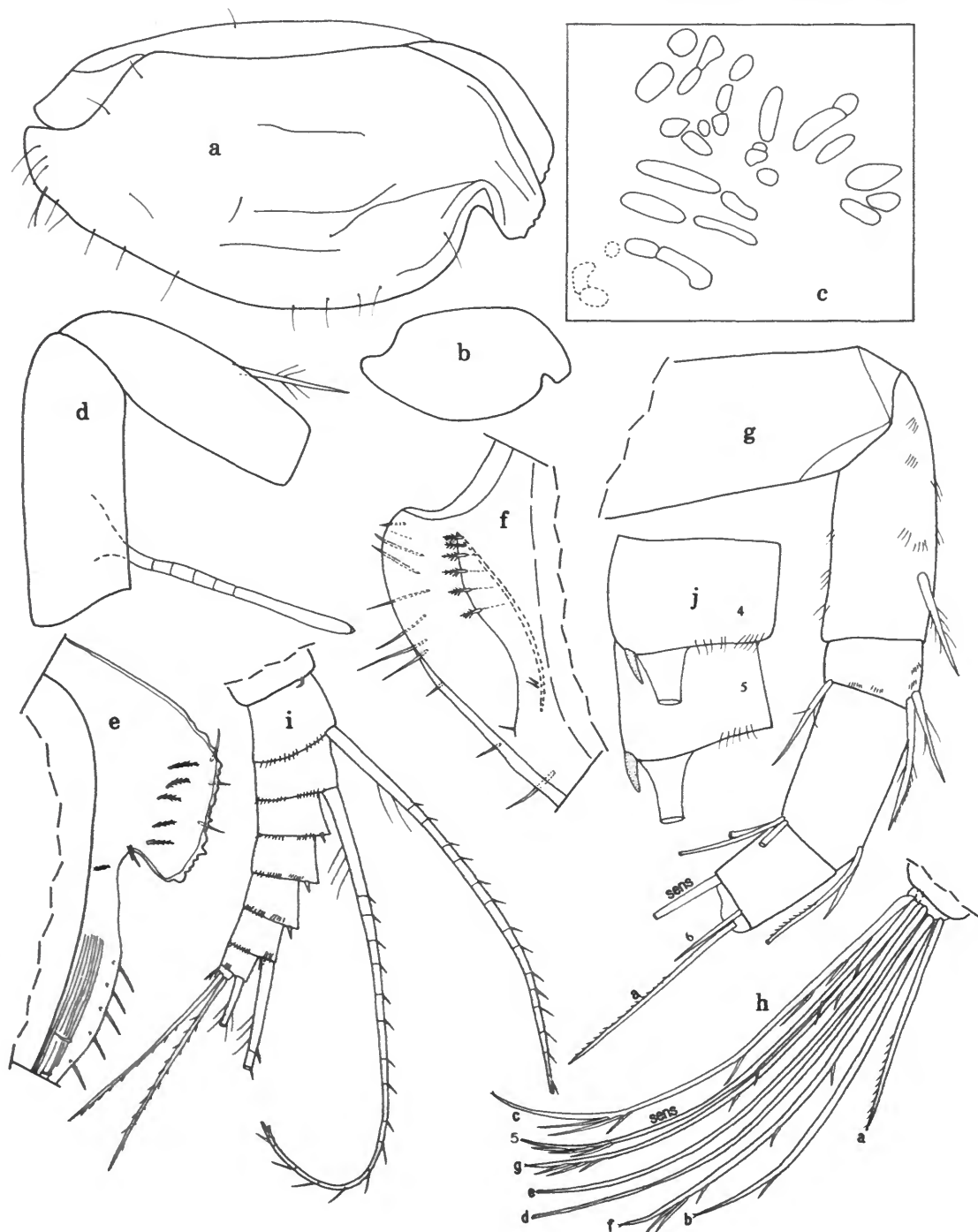


FIGURE 58.—*Harbansus ferox*, new species, adult female: holotype, MNHN Os 450: *a, b*, complete specimen from right side, length 1.25 mm; *c*, central adductor muscle attachments as seen through left valve, anterior to left; *d*, joints 1 and 2 of right 1st antenna, medial eye (dashed), and Bellonci organ, lv. Paratype, USNM 193768: *e, f*, anterior and posterior ends of left valve, iv; *g*, left 1st antenna (not all bristles of joints 7 and 8 shown), mv; *h*, tip of right 1st antenna, lv; *i*, exopodite of left 2nd antenna (bristles of joints 4–6 not shown), mv; *j*, exopodial joints 4 and 5 of right 2nd antenna, mv.

Carapace uncalcified, flexible, and distorted on both specimens in collection. Rostrum overhanging incisur; anterior edge of rostrum with minute processes (Figure 58a,b,e); caudal process well developed, projecting posteriorly (Figure 58b,f). Surface of valves smooth, without fossae; single bristles sparsely distributed over valve surface, more numerous along ventral edge of valve and near posterior edge of caudal process (Figure 58a,e,f). Except for indication of 2 ribs on rostrum, poor condition of valves prevents conclusions concerning presence or absence of ribs on main part of shell.

Infold: Infold of rostrum with 5 bristles in row and paired bristles at inner end of incisur (Figure 58e); 1 small spinous bristle ventral to inner end of incisur. Infold of caudal process with 6 setose bristles forming row along posterior edge of shelf at anterior end of pocket (Figure 58f). Anteroventral infold with 7 ridges parallel to valve edge. Ventral infold near anteroventral margin with 3 bristles in row (only 2 anterior shown in Figure 58e).

Selvage: Wide lamellar prolongation with marginal fringe divided in vicinity of incisur.

Central Adductor Muscle Attachments (Figure 58c): Comprising many elongate and ovoid attachments.

Carapace Size: MNHN Os 450, holotype, length 1.25 mm, height 0.68 mm; USNM 193768, right valve, length 1.15 mm, height 0.71 mm.

First Antenna (Figure 58g,h): 1st joint bare. 2nd joint: medial surface with few rows of long hairs; lateral surface with spines in row along distal margin; dorsal margin with spines in rows and 1 distal bristle with long proximal spines; ventral margin with spines in rows. 3rd joint short, with medial, lateral, dorsal, and ventral spines in rows and 3 spinous bristles (2 dorsal, 1 ventral). 4th joint elongate, with 5 bristles (2 dorsal, 3 ventral). Sensory bristle of 5th joint with 3 short proximal filaments, 3 longer subterminal filaments (tip of stem missing on USNM 193768 and at least 1 limb of holotype). 6th joint minute, fused to 5th, with short medial bristle near dorsal margin. 7th joint: a-bristle slightly longer than 5th joint; b-bristle shorter than sensory bristle of 5th joint, with 1 distal filament, and 2 minute terminal papillae; c-bristle with 4 short filaments, 2 longer subterminal filaments, and stem with 2 minute terminal papillae. 8th joint: d- and e-bristles same length as c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 3 short filaments, 2 longer subterminal filaments, and 2 minute terminal papillae; g-bristle same length as c-bristle, with 3 short filaments, 2 longer subterminal filaments, and tip with 2 minute papillae.

Second Antenna: Protopodite bare. Endopodite 2-jointed (Figure 59a,b): 1st joint with 3 small bristles; 2nd joint broadening distally, with long ringed ventral bristle with 2 proximal wreaths of long spines, and broadly rounded tip with small unringed terminal bristle with minute papilla at tip. Exopodite 9-jointed (Figure 58i): 1st joint with minute bent medial bristle on distal margin; bristles of joints 2–8 with few long proximal dorsal hairs near base followed by about 15 stout

ventral spines and without distal natatory hairs; 9th joint with 3 ringed (rings not shown) bristles (1 minute dorsal with small slender marginal spines; middle and ventral bristles about same length as combined lengths of joints 3–9; middle bristle with minute indistinct ventral spines; ventral bristle with stouter ventral and dorsal spines). Joints 4–8 with slender basal spines longer on distal joints (Figure 58i,j); joints 2–8 with minute spines in row along distal edge; lateral spine of 9th joint not observed.

Mandible (Figure 59c): Coxale endite spinous, deeply bifurcate at tip. Basale: medial surface spinous; 3 small proximal bristles near ventral margin (2 medial, 1 either lateral or on ventral edge); 1 small medial bristle near midlength of ventral margin; lateral surface with long hairs and 3 long spinous bristles near midwidth but closer to ventral margin; ventral margin with 1 long spinous terminal bristle; dorsal margin with 3 bristles (1 at midlength, 2 terminal). Exopodite about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, hirsute near tip, with 2 bristles (terminal bristle bare, about $\frac{2}{3}$ length of proximal bristle; proximal bristle with wreath of long spines near midlength). 1st endopodial joint: ventral margin with 3 bristles (2 long, each with wreath of long spines near midlength and short distal spines; 1 short with short spines); medial surface with indistinct rows of hairs and spines. 2nd endopodial joint: ventral margin with spinous bristles forming 2 distal groups (proximal group with 1 ringed bristle; distal group with 2 bristles (medial unringed, lateral ringed)); 2 rows of stout spines on ventral margin proximal to bristles; dorsal margin with 7 or 8 spinous bristles near midlength (illustrated right limb of USNM 193768 has only 5 bristles, but 2 empty sockets visible; left limb with 8 bristles); medial surface with proximal rows of spines near dorsal margin. 3rd endopodial joint with 3 claws (dorsal claw minute; 2 larger claws with minute ventral spines) and 3 bristles.

Maxilla: Endites I and II each with 6 bristles (Figure 59d); endite III with 7 bristles plus 1 proximal lateral bristle (Figure 59d). Coxale with 1 dorsal bristle (Figure 59g). Basale with 2 long distal bristles with long spines near midlength (Figure 59e,g). Exopodite short with 3 bristles (2 long with spines, 1 short bare) (Figure 59e,g). Endopodite: 1st joint with 1 spinous alpha-bristle and 3 beta-bristles (Figure 59e,g). 2nd joint with 9 bristles including 3 unringed claw-like bristles (Figure 59f,h).

Fifth Limb: Epipodite with 49 plumose bristles. Endite I with 1 bristle; endites II and III with total of about 15 bristles (Figure 60a). 1st exopodial joint: anterior side with 2 bristles at midwidth of distal margin and 1 short bristle on hirsute lobe on outer corner (Figure 60b,e); main tooth with proximal smooth pointed tooth and 4 distal cusped teeth (when not compressed under cover slip 2 distal teeth form bilobed tip (Figure 60d), but when compressed under cover slip bilobed tip not apparent (Figure 60c)); bristle present proximal to smooth proximal tooth of main tooth. 2nd exopodial joint with large squarish tooth when viewed compressed under cover slip (Figure 60e), but appearing triangular when not compressed (Figure 60b);

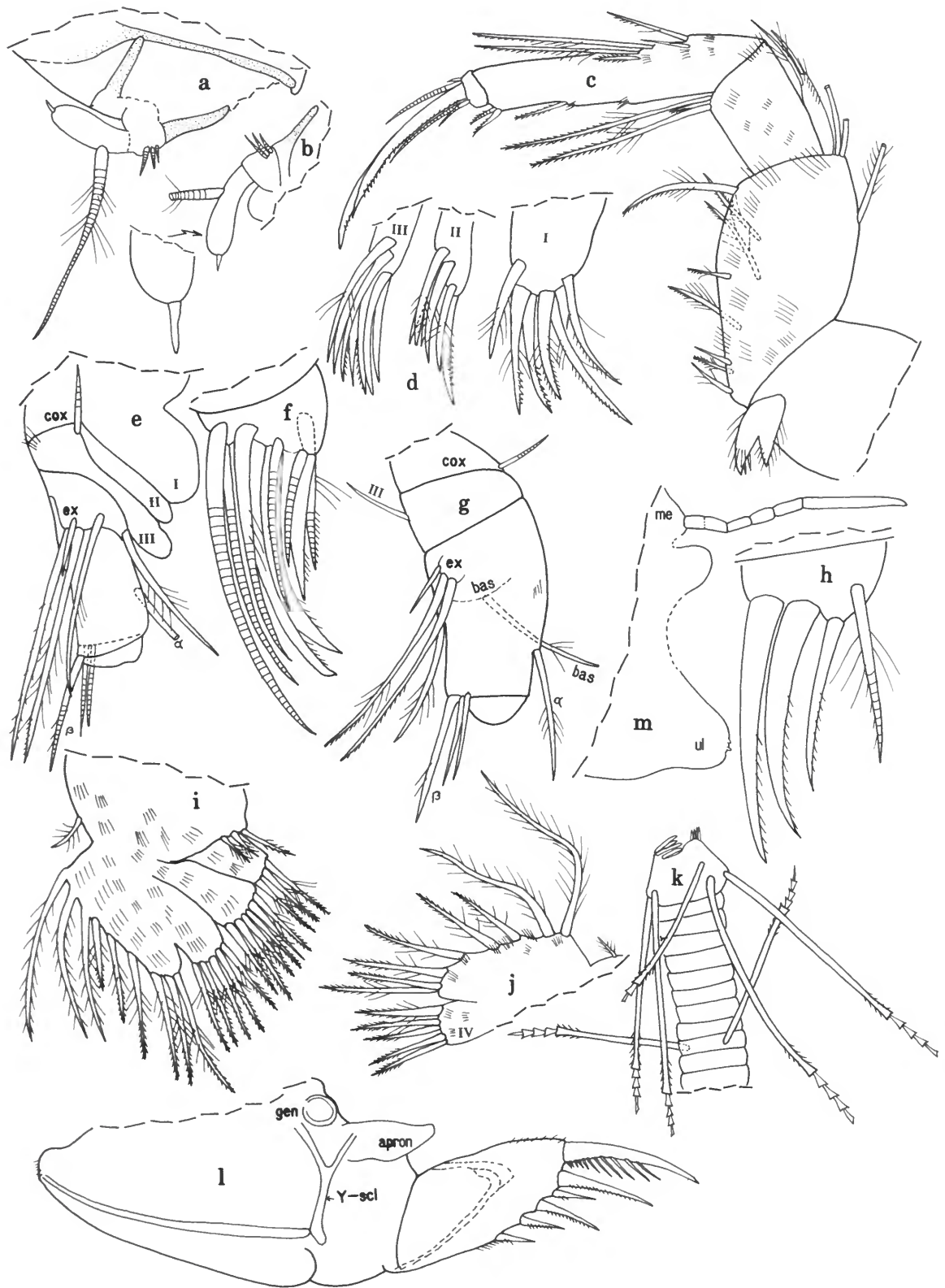


FIGURE 59 (opposite page).—*Harbansus ferox*, new species, adult female, paratype, USNM 193768: *a*, protopodite and endopodite of left 2nd antenna, mv; *b*, endopodite of right 2nd antenna and detail of tip, mv; *c*, right mandible, mv; *d*, endites I-III of left maxilla, lv; *e*, left maxilla (not all bristles shown), lv; *f*, 2nd endopodial joint of left maxilla, anterior to right, mv; *g*, right maxilla (not all bristles shown), lv; *h*, 2nd endopodial joint of right maxilla showing only anterior bristle and 3 claws, anterior to right, lv; *i*, left 6th limb, mv; *j*, epipodial bristle, endite IV, and end joint of left 6th limb, mv; *k*, 7th limb; *l,m*, posterior and anterior of body from right side, anterior to right.

posterior side with row of 3 closely spaced bristles (middle bristle long, flanking bristles short) and 1 long bristle proximal to them (Figure 60e). 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer "lobe" (outer lobe actually not present but usual location of lobe indicated by bristles) (Figure 60f). 4th and 5th exopodial joints fused, with total of 6 spinous bristles.

Sixth Limb (Figure 59i,j): With 1 epipodial bristle with long proximal spines. Endite I small with 3 or 4 bristles (2 short with long spines, 1 or 2 longer, thinner, with few indistinct small spines); endite II with 3 bristles, endite III with 6, endite IV with 5, all with long proximal and short distal spines. End joint not prolonged posteriorly, with 8 or 9 bristles (7 anterior with long proximal and short distal spines, 2 or 3 hirsute posterior). Medial surface of limb including endites with abundant hairs (Figure 59i); lateral surface with fewer hairs (Figure 59j).

Seventh Limb (Figure 59k): Limb very long, with 2 proximal bristles (1 on each side) with distal spines and 4 bells, and 5 terminal bristles (2 on comb side, 3 on peg side) with distal spines and 2 or 4 bells. Terminus with 8 recurved teeth opposite 6 straight or slightly curved pegs (not all pegs or teeth shown on illustrated limb).

Furca (Figure 59l): Each lamella with 6 claws; claw 3 shorter and thinner than claw 4; all claws with teeth along posterior margin, but only claw 1 with length of some teeth about twice width of claw at midlength; spines on lamella following claw 6, and along anterior of right lamella. Right lamella slightly anterior to left. Apron-like flap anterior to furca.

Bellonci Organ (Figure 59m): Elongate with 5 or 6 proximal sutures; cylindrical distal to sutures, with unevenly rounded or triangular tip.

Eyes: Medial eye unpigmented, poorly developed (Figure 59m). Lateral eye absent.

Upper Lip (Figures 59m, 60g,h): Large with minute processes at anterior tip. Thin translucent flap near posterior end of lip lateral to each side of mouth (Figure 60g,h). Brownish elongate organ (?gland) in body dorsal to upper lip (Figure 60g,h).

Genitalia (Figures 59l, 60i): Oval horseshoe-shape sclerotized ring on each side of body anterior to furca; ring containing small round spheres, some paired with a darker sphere (spermatozoa) (Figure 60i).

Brush Organ (Figure 60j): Comprising about 5 minute

ringed bristles near genital ring.

Posterior of Body (Figure 59l): With few minute spines on posterodorsal corner at dorsal end of girdle.

Anterior of Body (Figure 59m): Rounded process just ventral to medial eye.

Y-Sclerite (Figure 59l): Branching distally.

COMPARISONS.—The furca of *H. ferox* differs from other species of the genus in the great length of the teeth on the anterior claw (distal teeth more than twice length of width of claw at midlength, about twice length of teeth of other species). *Harbansus ferox* resembles *H. bowenae* in having only 1 bristle in the proximal group on the ventral margin of the 2nd endopodial joint of the mandible, all other known species have 2. *Harbansus ferox* differs from *H. bowenae* in having 5 rather than 3 bristles on the rostral infold, and an endopodite of the female 2nd antenna with 3 rather than 1 bristle on the 1st joint and a long rather than short 2nd joint. Selected morphological characters of species of *Harbansus* are compared in Table 11.

GENTILIA OF FEMALE *Harbansus*.—Wingstrand (1988, fig. 1c; pl. 1: fig. 4) illustrated a spermatozoa of *Harbansus paucichelatus* and a section through a spermatophore of *Philomedes lilljeborgii*, respectively. A spermatophore is attached to each genital lobe of *H. thrix* (Figure 56h) and *H. ferox* (Figure 60i). The spermatophore attached to *H. ferox* (USNM 193768) was observed under oil immersion ($\times 100$ objective, $\times 15$ ocular) (Figure 60i) and contains spermatozoa resembling those illustrated by Wingstrand (1988, pl. 1: fig. 4). Several minute bristles (brush organ) were observed near the genitalia of *H. ferox* (Figure 60i). Similar bristles have been reported previously on females of *H. mayeri* (Kornicker, 1978, fig. 17g) and *Harbansus* species A (Kornicker, 1978:49), and probably are present on other known species of *Harbansus*, but are difficult to see unless the specimen is observed under a cover slip and with oil immersion lens ($\times 100$ objective, $\times 15$ ocular).

METHODS OF LOCOMOTION BY SPECIES OF *Harbansus*.—Some members of *Harbansus* have natatory hairs on bristles of the exopodites of the 2nd antennae indicating that they are swimmers, whereas others have only spines indicating that they are crawlers (Kornicker, 1978:11). Additional species are now known and more data is available since my 1978 analysis (Table 12). Adult males of 5 species have been described; all are capable of swimming. The adult females of 2 species with swimming males are also swimmers (*H. paucichelatus*, *H. slatteryi*), whereas the adult females of the remaining 3 species are crawlers (*H. bowenae*, *H. bradmyersi*, *H. dayi*). Adult females, but not adult males, are known for 8 additional species (2 in open nomenclature). Of these, 7 are crawlers (*H. barnardi*, *H. ferox*, *H. mayeri*, *H. rhabdion*, *H. vix*, *H. species A*, *H. species B*) and 1 is a swimmer (*H. thrix*).

Juvenile females are known for 6 species: 2 are swimmers (*H. thrix*, *H. paucichelatus*) and 4 are crawlers (*H. bowenae*, *H. dayi*, *H. magnus*, *H. schornikovi*). Adults of the last 2 species are unknown. The 2 species with swimming juvenile females also have swimming female adults. The 2 species with known

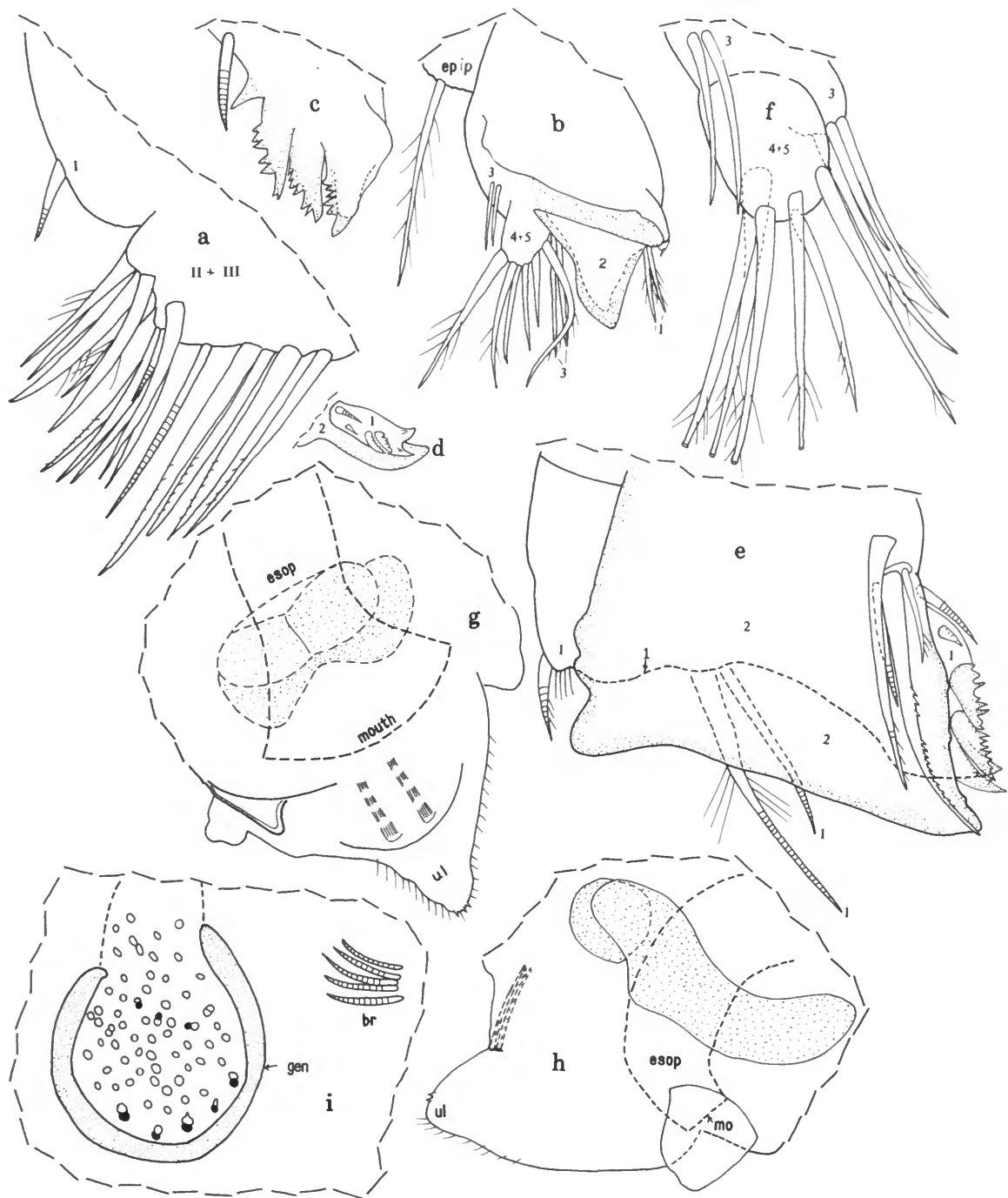


FIGURE 60.—*Harbansus ferox*, new species, adult female, paratype, USNM 193768: a, endites I-III of right 5th limb, pv; b, right 5th limb (endites and main tooth of 1st exopodial joint not shown), pv; c, main tooth of 1st exopodial joint of right 5th limb as seen through large tooth of 2nd exopodial joint, pv; d, main tooth of 1st exopodial joint and tip of large tooth of 2nd exopodial joint (stippled) of right 5th limb, av; e, left 5th limb, pv; f, exopodial joints 3-5 of left 5th limb, pv; g, upper lip and mouth (organ with brown pigment stippled), dv; h, upper lip and mouth from left side (organ with brown pigment stippled), anterior to left; i, brush organ, and genitalia containing sperm.

TABLE 11.—Comparison of carapace length and distribution of some bristles of first antennae and mandibles of species of *Harbansus* (*H. magnus* and *H. schornikovi* from A-1 juveniles, other species from adult females; d = dorsal, dist = distal, prox = proximal, v = ventral).

Species	Carapace length mm	First antenna			Mandible (endopodite)			Source
		2nd joint	4th joint		2nd joint (v)		3rd joint	
		v	v	d	prox	dist	claws	
<i>H. barnardi</i>	1.01	0	3	2	2	3	3	Kornicker (1978)
<i>H. bowenae</i>	0.92-1.14	0	3	1	1	2	3	Kornicker (1978; 1984a)
<i>H. bradmyersi</i>	0.91-0.95	0	2	1	2	2	3	Kornicker (1978; 1979a)
<i>H. dayi</i>	1.34-1.44	1	2	1	2	2	3	Kornicker (1978; 1984a)
<i>H. ferox</i>	1.15-1.25	0	3	2	1	2	3	Herein
<i>H. magnus</i>	2.19	0	2	1	2	2	3	Kornicker (1984a)
<i>H. mayeri</i>	0.96-1.06	0	2	1	2	2	3	Kornicker (1978)
<i>H. paucichelatus</i>	0.80-1.20	0	2	1	2	2	3	Kornicker (1978; 1984a)
<i>H. rhabdion</i>	1.41	1	2	1	2	2	3	Kornicker (1970b)
<i>H. schornikovi</i>	0.96	1	2	2	2	2	3	Kornicker and Caraion (1977)
<i>H. slatteryi</i>	1.00-1.08	0	2	1	2	2	2	Kornicker (1983a)
<i>H. thrix</i>	1.03	0	3	2-3	2	2	3	Herein
<i>H. vix</i>	0.87	0	3	2	2	3	3	Kornicker (1991)
<i>H. species A</i>	1.18	0	2	1	2	2	3	Kornicker (1978)
<i>H. species B</i>	1.26	0	2	1	2	2	3	Kornicker (1978)

TABLE 12.—Method of locomotion and number of ommatidia in lateral eyes of species of *Harbansus* (C = crawlers, F = female, M = male, nd = no data, S = swimmers; number of ommatidia in lateral eye given on right of slash mark (example: C/2 indicates crawler with 2 ommatidia in lateral eye)).

Species	Depth (meters)	Juvenile		Adult		Source
		F	M	F	M	
<i>H. barnardi</i>	2	nd	C/9	C/3	nd	Kornicker (1978:48)
<i>H. bowenae</i>	42-196	C/0	C/0	C/0	S/0	Kornicker (1978:43; 1984a:76)
<i>H. bradmyersi</i>	18-60	nd	nd	C/5-6	S/13	Kornicker (1978:27; 1979a:1007)
<i>H. dayi</i>	42-198	C/0	C/8	C/0	S/5	Kornicker (1978:36, 38; 1984a:76; herein)
<i>H. ferox</i>	450	nd	nd	C/0	nd	Herein
<i>H. magnus</i>	460	C/0	nd	nd	nd	Kornicker (1984a:68)
<i>H. mayeri</i>	8	nd	nd	C/4	nd	Kornicker (1978:31)
<i>H. paucichelatus</i>	1-135	S/3-5	nd	S/3-5	S/12	Kornicker (1978:21, 23; 1984a:60)
<i>H. rhabdion</i>	991-1015	nd	nd	C/0	nd	Kornicker (1970b:36)
<i>H. schornikovi</i>	260	C/0	C/0	nd	nd	Kornicker and Caraion (1977:31, 32)
<i>H. slatteryi</i>	2-12	nd	nd	S/2	S/7	Kornicker (1983a:184, 188)
<i>H. thrix</i>	13-20	S/5	nd	S/5	nd	Herein
<i>H. vix</i>	3-7	nd	nd	C/5	nd	Kornicker (1991:74)
<i>H. species A</i>	73-102	nd	nd	C/5	nd	Kornicker (1978:49)
<i>H. species B</i>	140	nd	nd	C/5	nd	Kornicker (1978:49)

female adults and crawling juvenile females have crawling female adults. Juvenile males are known for 4 species; all are crawlers. Of these, the adult is unknown for *H. schornikovi*; the adult female, which is a crawler, but not the adult male, is known for *H. barnardi*; and the adult female (crawler) and adult male (swimmer) is known for *H. bowenae* and *H. dayi*. Both juvenile males and females are known for only 3 species (*H. bowenae*, *H. dayi*, *H. schornikovi*); all are crawlers.

In summary adult males are swimmers, whereas juveniles and adult females of some species are swimmers and of other

species crawlers, mostly the latter. Whether juveniles of either sex are swimmers or crawlers appears to depend on the method of locomotion of the adult female and not the adult male; swimming adult females have swimming juveniles, and crawling adult females have crawling juveniles (no juvenile males have been described for species having swimming females, but if juvenile females are swimmers, it is likely that juveniles males are also).

The known depth range of the 5 species with known adult males (all swimmers) is 1-198 m. The known depth range of

the 3 species with swimming adult females is 1–135 m. The known depth range of crawlers (12 species including juveniles and adults) is 2–1015 m. In the depth range 1–135 m in which swimming adult females occur, 8 species have crawling adult females. At bathyal depths (260–1015 m) only crawlers (4 species) have been collected; no adult males are known from bathyal depths. The genus has not been collected at abyssal depths.

Some species of the Philomedidae copulate in the water column; for example, *Philomedes brenda* (Kornicker, 1975a:76). In order to couple above the bottom both the male and female must be able to swim. The only known species of *Harbansus* with swimming females are *H. paucichelatus*, *H. slatteryi*, and *H. thrix*, and therefore, these are the only species that could couple above the bottom; all other known species of *Harbansus* (12) are crawlers and they couple on the bottom.

RELATIONSHIP BETWEEN WATER DEPTH AND LATERAL EYES OF *Harbansus* (Table 12).—The relationship of water depth and lateral eyes among selected Myodocopina is discussed previously herein, "Relationship between Eye Development and Water Depth." The present discussion concerns only the genus *Harbansus*. Adult males are known for only 5 species of *Harbansus*: 1 without lateral eyes (*H. bowenae*) and 4 with 5–13 ommatidia in each lateral eye (*H. bradmyersi*, *H. dayi*, *H. paucichelatus*, *H. slatteryi*). Adult females are either without lateral eyes (*H. bowenae*, *H. dayi*, *H. ferox*, *H. rhabdion*) or with small eyes with 2–6 ommatidia (*H. barnardi*, *H. bradmyersi*, *H. mayeri*, *H. paucichelatus*, *H. slatteryi*, *H. thrix*, *H. vix*, *H. species A*, *H. species B*). Three of the species having adult males with eyes also have adult females with eyes, but 1 (*H. dayi*) has a female without lateral eyes. The known depth range of species with eyes is 1–198 m, and without eyes 42–1015 m. Two species known only from juveniles (*H. magnus*, *H. schornikovi*) are without eyes, and it can be assumed that the adult females of those species are also without eyes. Of shelf species (0–200 m) about 18% of adult females are without lateral eyes. Of bathyal species (200–2000 m) 100% of adult females (assuming eyes of juveniles are similar to those of unknown adult females) are without lateral eyes. Adult males are known only from shelf depths, and only 1 of 5 species (20%) is without lateral eyes.

CORRECTION OF DESCRIPTION OF LATERAL EYES OF *Harbansus dayi*.—Kornicker (1978:36) did not observe a lateral eye on the adult female of *Harbansus dayi*, but in a later diagnosis of the species (Kornicker, 1984a:76) he stated that the lateral eyes of both the males and females are small. In order to eliminate this inconsistency, I reexamined 3 adult female paratypes (USNM 156784, 156914, 156958) and could not identify a lateral eye with certainty, and tentatively conclude that the female is without lateral eyes. The lateral eyes on females of those species of *Harbansus* having them are quite small and sometimes difficult to resolve. When the ostracode is removed from its shell the integument tears in the vicinity of the eyes sometimes exposing cells that may resemble ommat-

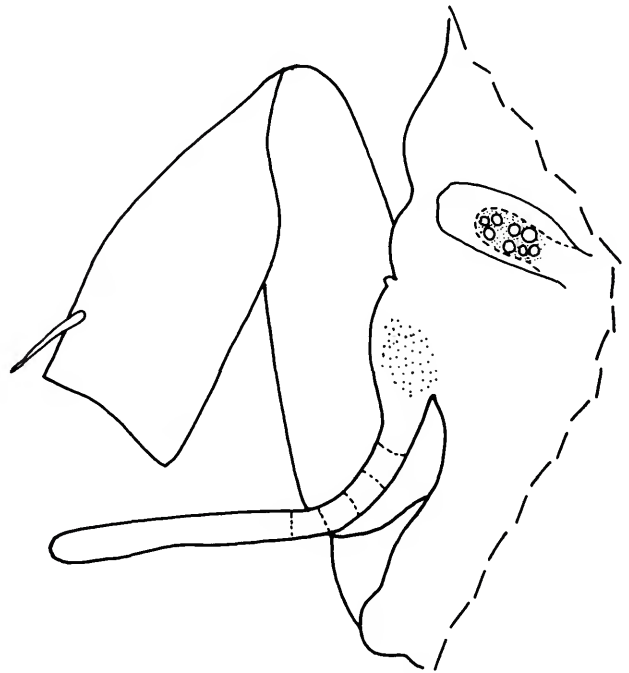


FIGURE 61.—*Harbansus dayi* Kornicker, instar III male, paratype, USNM 156952B, anterior of body from left side, anterior to left.

idia, and clusters of these cells could be misinterpreted to be lateral eyes.

The juvenile lateral eye in the Philomedidae is similar to that of the adult of the same sex, although smaller, and may have fewer ommatidia. Therefore, the statement that lateral eyes were not observed in juvenile males of *H. dayi* by Kornicker (1978:39) represents an anomaly, because the adult male has lateral eyes, although smaller than lateral eyes in males of other species of *Harbansus*. I reexamined 2 juvenile male paratypes (USNM 156952A, B) and found that they have small lateral eyes (Figure 61).

Tetragonodon Brady and Norman, 1896

TYPE SPECIES.—*Bradycinetus ctenorhynchus* Brady, 1887:199, subsequent designation, Sylvester-Bradley, 1961:Q400.

DISTRIBUTION.—West Coast of Africa and Europe between 20°41'N and 38°38'N at depths of 636–2995 m; Gulf of Mexico at a depth of 1000–1200 m; Bay of Biscay at a depth of 1980–2006 m (Kornicker, 1989:82); Mozambique Channel at a depth of 1300–1480 m. Known depth range 636–2995 m. The genus has not been reported previously from the Indian Ocean.

COMPOSITION.—Including a new species described herein the genus comprises 4 species.

Key to Adult Females of Species of *Tetragonodon*

1. Shell with tip of rostrum pointed 2
Shell with tip of rostrum rounded 3
2. Short bristles of shell surface slender; 2nd endopodial joint of 2nd antenna with 1 bristle *T. ctenorhynchus*
Short bristles of shell surface stout; 2nd endopodial joint of 2nd antenna with 2 bristles *T. currax*, new species
3. Short bristles of shell surface slender; 2nd endopodial joint of 2nd antenna with 1 bristle *T. pellax*
Short bristles of shell surface broad with sclerotized tip; 2nd endopodial joint of 2nd antenna with 2 bristles *T. rhamphodes*

Tetragonodon currax, new speciesFIGURES 62–66, 67*h,i*ETYMOLOGY.—From the Latin *currax* (swift).

HOLOTYPE.—MNHN Os 453, partly dissected female in alcohol.

TYPE LOCALITY.—Sta 40-D, 27 Mar 1977, Mayotte Island slope, east of Bandele Reef, depth 1300–1480 m.

PARATYPES.—Sta 40-D: USNM 193731, 1 ovigerous female on slide and in alcohol; USNM 193732, 1 undissected adult female in alcohol.

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT FEMALE (Figures 62–66, 67*h,i*).—Carapace elongate with prominent rostrum and caudal process (Figure 62*a–c*); rostrum with lateral overlap along anterior and ventral margins and with pointed tip (Figure 62*e*); hinge long, straight, indented.

Ornamentation: Lateral surface with shallow fossae barely visible in decalcified specimens, and with scattered long bristles (most with short stout basal part) (Figure 62*a,b,d,e*), and fewer short stout spine-like bristles (except for small sclerotized tip bristles appear soft, and most bristles have distal halves broken off) (Figure 62*d*). Rostrum with 3 rounded lateral processes forming row parallel to ventral edge, and along dorsal edge near tip a triangular tooth-like process followed by smaller teeth forming row (Figure 62*b*); 6 processes present along proximal dorsal edge of rostrum (these are seen best with valve viewed from inside (Figure 62*e*)). (On Figure 62*c* the tips of stout spine-like bristles that are broken off have been reconstructed as dashed lines.)

Infold: Rostral infold with 4 hirsute bristles and 2 short bristles at inner end of incisur (Figure 62*e*); infold just ventral to incisur with short setose bristle; anteroventral infold and anterior half of ventral infold with about 8 narrow ridges paralleling valve margin, but without bristles. List of caudal process with 6 flat spinous bristles (Figure 63*a*); inner edge of infold anterior to caudal process with 2 or 3 small bristles; posterior edge of infold of caudal process with 2 minute bristles ventral to midheight of edge and 1 longer bristle with base in indented area at dorsal end of edge (Figure 63*a*).

Selvage: Wide fringed lamellar prolongation present along valve margin except along hinge and posterior edge of caudal process; prolongation divided in vicinity of incisur (Figure 62*e*).

Central Adductor Muscle Attachments (Figure 66*a,b*): Comprising about 46 small ovoid attachments.

Carapace Size: MNHN Os 453, holotype, length 2.10 mm, height 1.32 mm; USNM 193731, length 2.34 mm, height 1.39 mm; USNM 193732, length 2.12 mm, height 1.38 mm.

First Antenna (Figure 63*b,c*): 1st joint with lateral spines forming rows (not shown). 2nd joint with spines forming rows on medial surface near dorsal margin, on ventral (few proximal) and dorsal margins, and on lateral surface along distal edge near dorsal margin (not shown), and 1 dorsal bristle with long proximal and short distal spines. 3rd joint with distal dorsal spines and 3 spinous bristles (2 dorsal, 1 ventral). 4th joint long, with 2 subterminal bristles (1 dorsal, 1 ventral). Stout sensory bristle of 5th joint with 3 short proximal filaments and 4 terminal filaments. 6th joint minute, fused to 5th, with short medial spinous bristle. 7th joint: a-bristle about twice length of bristle of 6th joint, with few long proximal hairs and short distal spines; b-bristle slightly shorter than sensory bristle of 5th joint, with 4 terminal filaments; c-bristle as long as sensory bristle, with 2 short proximal filaments and 4 terminal filaments. 8th joint: d- and e-bristles as long as c-bristle, bare with blunt processes at tips; f-bristle about same length as b-bristle, with 2 proximal and 4 terminal filaments; g-bristle slightly longer than c-bristle, with 2 short proximal and 4 terminal filaments. (Bristles of 7th and 8th joints obscured each other on mounted specimen, and some could have 3 rather than 4 terminal filaments.)

Second Antenna: Protopodite bare. Endopodite 2-jointed (Figure 63*d,e*): 1st joint with distal hairs forming rows and short ventral bristle with few indistinct marginal hairs; 2nd joint elongate with 2 terminal bristles (longest with long proximal and short distal spines; other with short spines). Exopodite: 1st joint with small medial tubular bristle (Figure 63*f*); bristle of 2nd joint reaching just past 9th joint, bristles of joints 3–8 slightly longer; bristles of joints 2–8 bare except for tuft of hairs at tips (Figure 63*g*); 9th joint with 3

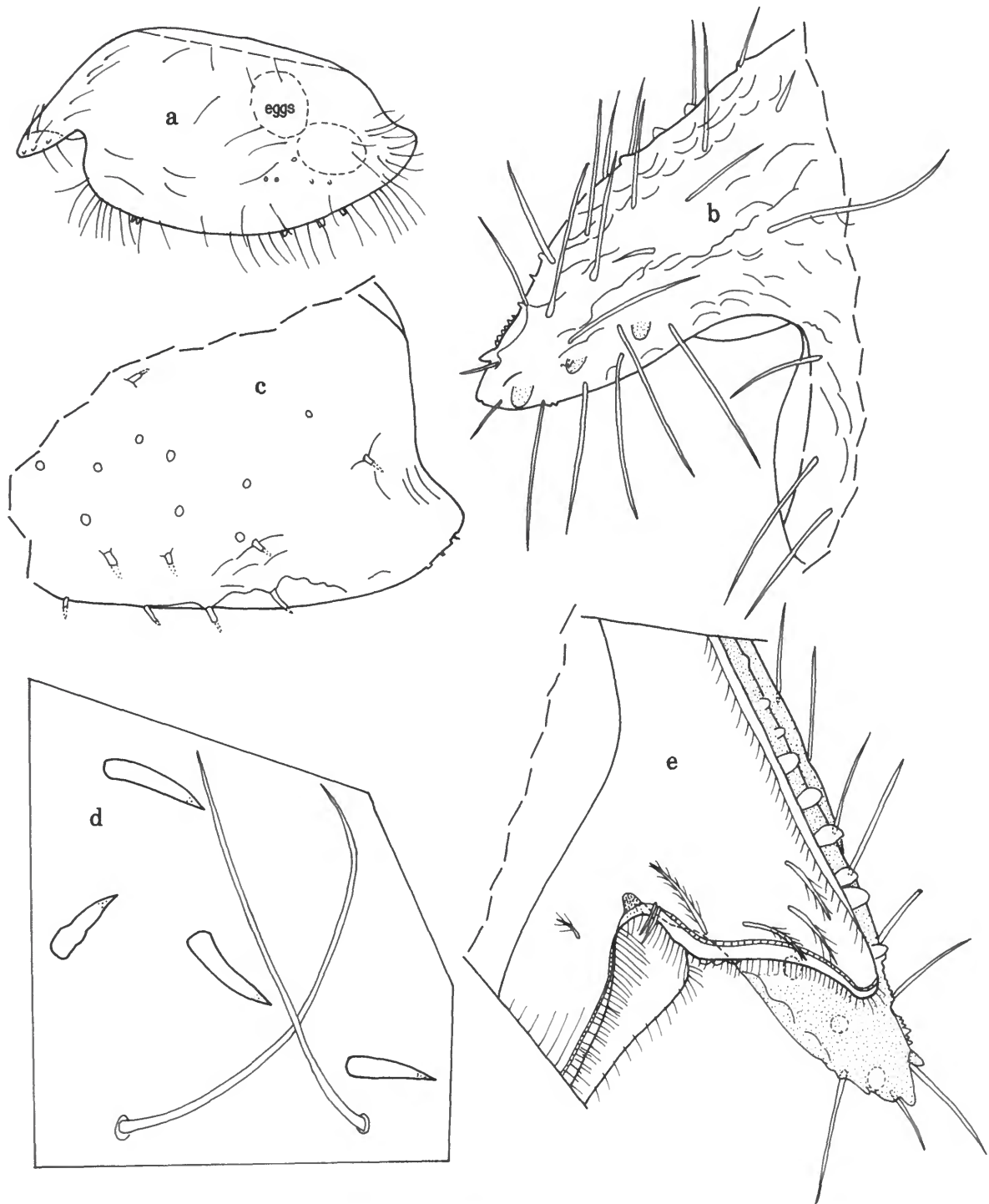


FIGURE 62.—*Tetragonodon currax*, adult female, paratype, USNM 193731: *a*, complete specimen from left side, length 2.34 mm; *b*, anterior end of left valve, ov; *c*, posterior end of left valve (dashed tips of bristles represent missing parts of bristles; long bristles not shown), ov; *d*, surface bristles on left valve near ventral margin and posterior to midlength (tips of short bristles appear sclerotized (stippled), whereas, proximal part of short bristles appears soft); *e*, anterior of left valve, iv.

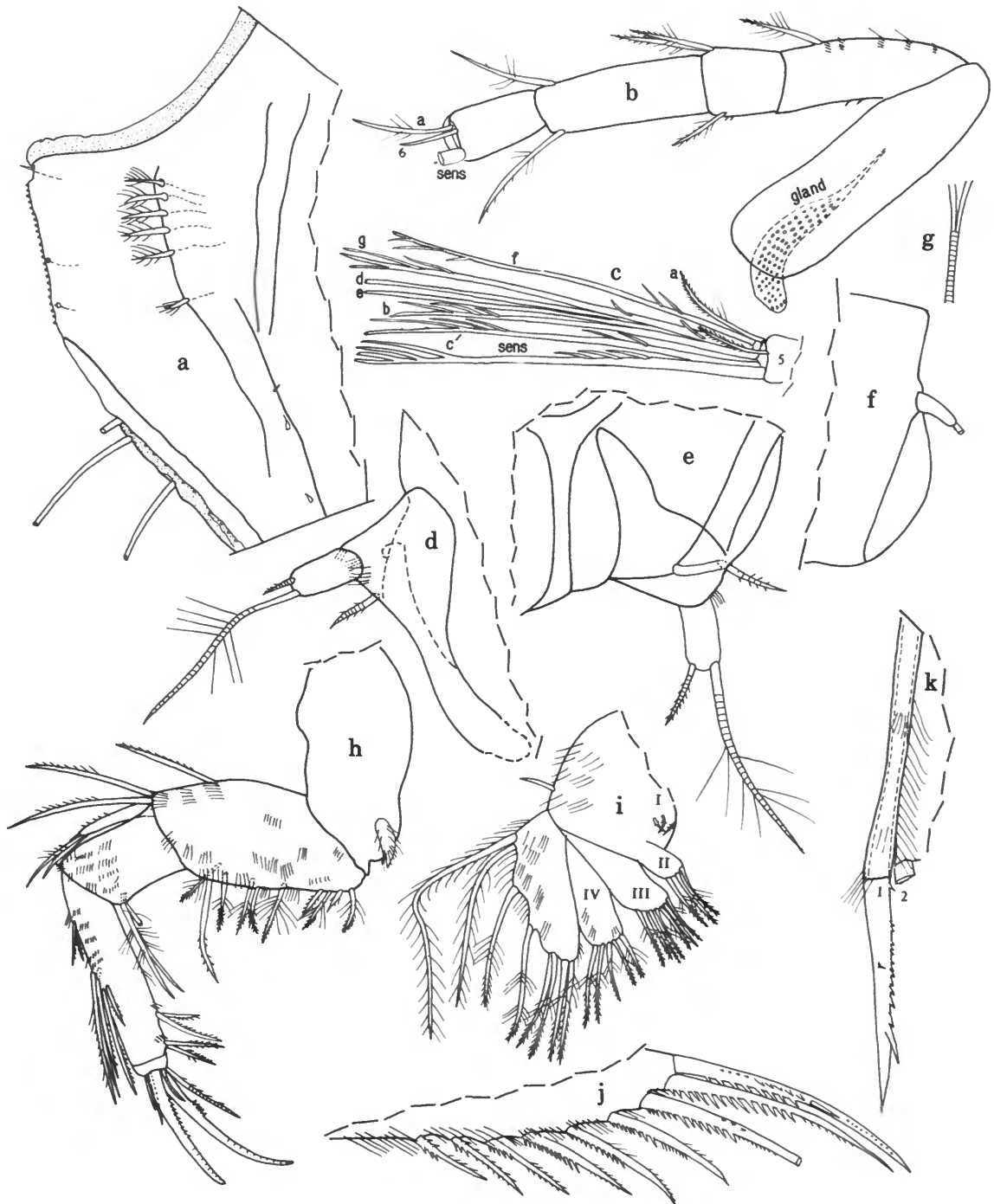


FIGURE 63.—*Tetragonodon currax*, adult female, paratype, USNM 193731: a, caudal process of left valve, lv; b, right 1st antenna (not all bristles of 7th and 8th joints shown), mv; c, tip of right 1st antenna shown in b, mv; d, protopodite and endopodite of right 2nd antenna, lv; e, protopodite and endopodite of left 2nd antenna, mv; f, small tubular medial bristle on distal edge of 1st exopodial joint of left 2nd antenna, ventral edge to top, mv; g, tip of bristle of 2nd exopodial joint of left 2nd antenna, mv; h, right mandible, mv; i, 6th limb; j, claws of left furcal lamella, mv; k, claw 1 and proximal part of claw 2 of right furcal lamella, mv.

bristles (1 long, 1 medium, 1 short), all bare except for tuft of hairs at tips; joints 2-8 with spines forming rows along distal edge.

Mandible (Figure 63h): Coxale endite spinous, tip bifurcate, without bristle near base. Basale: dorsal margin with 3 spinous bristles (1 just distal to midlength, 2 terminal); ventral margin with 1 spinous subterminal bristle; medial surface spinous, with 5 short spinous bristles on or near ventral margin (4 proximal, 1 distal to midlength) (these bristles could be interpreted to be ventral bristles); lateral surface spinous, with 4 spinous bristles near ventral margin. Exopodite hirsute, about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, with 2 spinous subterminal bristles. 1st endopodial joint with medial spines and 3 ventral bristles. 2nd endopodial joint: medial surface, proximal dorsal margin, and ventral margin spinous; dorsal margin with spinous bristles forming 2 groups with 2 bristles in proximal group and 5 in distal group (distal group actually 2 closely spaced groups with 3 bristles in proximal group and 2 in distal group); ventral margin with 4 spinous bristles forming 2 groups (2 bristles in each group). 3rd endopodial joint with 3 claws (dorsal claw small with few teeth, others stout with ventral teeth) and 3 slender ringed bristles.

Maxilla: Precoxale and coxale with fringe of dorsal hairs; coxale with spinous dorsal bristle (Figure 64a). Endite I with 6 spinous and pectinate bristles; endite II with 5 spinous and pectinate bristles; endite III with 7 bristles (Figure 64a). Basale with 3 spinous bristles (2 ventral, 1 dorsal). Exopodite with 3 spinous bristles (2 long, 1 short) (Figure 64c). 1st endopodial joint with spines on and near dorsal margin, 1 spinous alpha-bristle, 2 spinous beta-bristles, and node medial to longest beta-bristle (Figure 64c). 2nd endopodial joint with 3 long spinous a-bristles, 4 spinous ringed bristles, and 3 stout claws with few teeth (Figure 64b,d).

Fifth Limb: Epipodite with about 50 spinous bristles. Endite I with 2 bristles; endite II with 5 or 6 bristles; endite III with 9 or 10 spinous and pectinate bristles (Figure 65a-d). 1st exopodial joint: main tooth with 1 proximal and 3 distal pointed spine-like teeth and 2 stout terminal teeth (inner bifurcate) (Figure 65f); anterior side with 2 spinous bristles; outer edge with hirsute proximal lobe with small slender spinous bristle (Figure 65e). 2nd exopodial joint with large square tooth with 3 posterior bristles forming row near inner edge (Figure 65a,g). 3rd exopodial joint with 3 bristles on inner lobe and 2 small spinous bristles on outer lobe (Figure 65a,d,g). 4th and 5th exopodial joints fused, with total of 5 spinous bristles (65a,d,g).

Sixth Limb (Figure 63i): Epipodite with 1 short bare bristle. Endite I with 3 short bristles with indistinct short hairs; endite II with 3 terminal bristles with long proximal and short distal spines; endite III broad with 7 terminal bristles with long proximal and short distal spines (2 or 3 of the bristles with the short spines along only 1 edge); endite IV about same breadth as 3rd, with 5 bristles with long proximal and short distal spines (1 or 2 of the bristles with the short spines along only 1 edge).

End joint with 6 or 7 spinous bristles (with long proximal and short distal spines) followed by 2 hirsute bristles. Posterior part of stem, endite IV, and end joint hirsute.

Seventh Limb (Figure 64e,f): Proximal group with 4 bristles (2 on each side), each with 3 or 4 (usually 4) bells and distal marginal spines; terminal group with 6 bristles (3 on each side, 2 with 2 bells, 4 with 6 or 7 (usually 6) bells), all with distal marginal spines. Terminus with comb of 10-12 spinous teeth (with rounded tips) opposite comb of 7 or 8 bare pegs (lateral pegs short and with square tips; middle pegs slightly longer and with rounded tips) (not all comb teeth and pegs shown in Figure 64e,f). (Small lateral comb tooth (with base proximal to bases of other teeth) on 7th limb of USNM 193731 (Figure 64f) not present on opposite limb.)

Furca: Each lamella with 8-10 (9 claws on at least 1 lamella of 3 specimens examined) articulated claws decreasing in length and width posteriorly along lamella (Figure 63j). Medial side of claw 1 with long distal tooth and shorter teeth proximal and distal to long tooth; posterior edge of claw 1 with small teeth of varying length proximally, and very small teeth along distal third; remaining claws with proximal teeth stouter than distal teeth; claws 2 and 3 with small distal medial teeth near anterior edge; claws posterior to claw 3 with distal hairs along anterior edge; inner surface of lamellae with long hairs between bases of claws and following claws; right lamella anterior to left lamella by width of claw 1 at base; right lamella with sclerotized medial rib (with long hairs) parallel to anterior edge of lamella (distance of rib from anterior edge same as width of claw 1 at base) (Figure 63k); right lamella near anterior edge with medial hairs forming transverse rows (Figure 63k).

Bellonci Organ, Medial and Lateral Eyes: Absent. (The illustrations of the anterior of the body of USNM 193731 (Figure 64g,h) and holotype (Figure 66c,d) show the absence of a medial eye and Bellonci organ. It is possible that the area that would have contained the Bellonci organ was torn from USNM 193731 (Figure 64g) when the 1st antennae were removed; however, the specimen was examined prior to removal of the 1st antennae, and the Bellonci organ was not observed, nor is it now attached to either of the removed 1st antennae. USNM 193732 was left intact, but it is assumed that it also lacks a Bellonci organ.)

Upper Lip (Figures 64g,h, 66d): Projecting anteriorly, with minute processes at tip.

Anterior of Body (Figures 64g,h, 66c,d): With low rounded process between Bellonci organ and upper lip (anterior

FIGURE 64 (opposite page).—*Tetragonodon currax*, adult female, paratype, USNM 193731: a, left maxilla (not all bristles shown), mv; b, bristles of 2nd endopodial joint of maxilla shown in a, anterior to right (a-bristles not shown), mv; c, part of right maxilla, lv; d, bristles of 2nd endopodial joint of maxilla shown in c, lv; e, 7th limb (spines of comb teeth not shown); f, detail of tip of 7th limb shown in e; g, anterior of body from anterior; h, oblique view of anterior of body; i, posterior of body from right side, anterior to right; j, egg with some appendages formed, anterior to right.

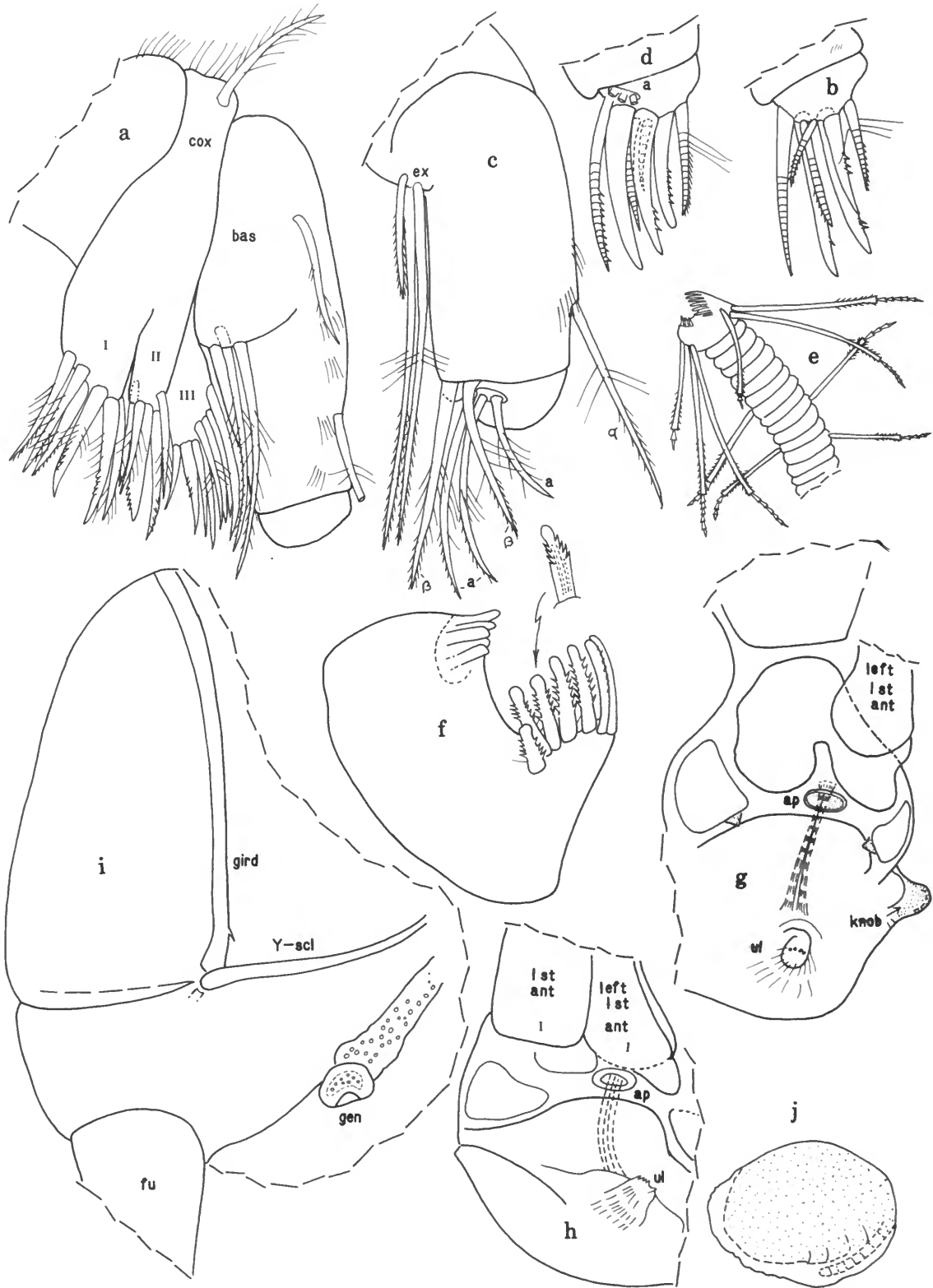




FIGURE 65.—*Tetragonodon currax*, adult female, paratype, USNM 193731, 5th limb: *a*, right limb (not under cover slip; inner bristles of 3rd exopodial joint not shown), pv; *b, c*, endites II and III of right limb, pv; *d*, left limb (not under cover slip), av; *e*, left limb (under cover slip), av; *f*, main tooth of 1st exopodial joint of left limb, from *e*, av; *g*, left limb (not under cover slip; only 1 of 3 bristles on inner lobe of 3rd joint shown; main tooth of 1st exopodial joint not shown), pv.

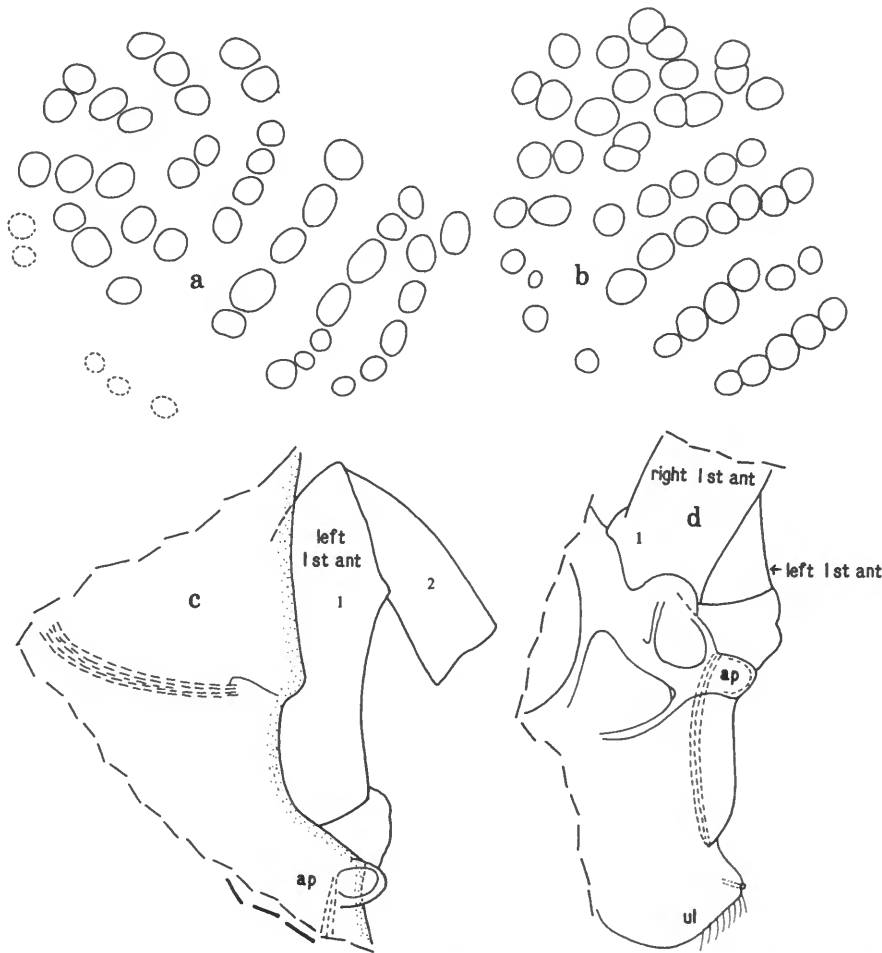


FIGURE 66.—*Tetragonodon currax*, adult female: paratype, USNM 193732: *a*, central adductor muscle attachments of right valve, anterior to right, ov. Holotype, MNHN Os 453: *b*, central adductor muscle attachments of right valve, anterior to right, ov; *c*, anterior of upper part of body with right 1st and 2nd antennae removed, anterior to right (anterior edge of body stippled); *d*, anterior of body with right 2nd antenna removed, anterior to right.

view of body (Figure 64*g,h*) shows process as ring at midwidth and midheight).

Posterior of Body (Figure 64*i*): Evenly rounded, bare.

Y-Sclerite (Figure 64*i*): Without ventral branch.

Genitalia (Figure 64*i*): Yellow oval sclerotized ring on each side of body anterior to furca.

Eggs: USNM 193731 with 5 well-developed eggs (with 2nd antennae visible) in marsupium (2 eggs shown in Figure 62*a*), each egg enclosed in diaphanous sheath; length of illustrated egg 0.44 mm, height 0.34 (Figure 64*j*); all eggs of similar size.

COMPARISONS.—Kornicker (1989:82) recognized 3 species of *Tetragonodon*: *T. ctenorhynchus*, *T. pallax*, and *T. rhampho-*

des. I reexamined specimens of those species in the collections of the National Museum of Natural History. The outer surfaces of the carapaces of those species as well as that of the new species *T. currax* have, in addition to many long bristles, short "bristles" that differ in morphology among the species: *T. pallax* (Figure 67*e*) and *T. ctenorhynchus* (Figure 67*c*) have slender spine-like bristles, *T. rhamphodes* has relatively few bristles and they are short and stout with a broad sclerotized terminal spine (Figure 67*g*), and *T. currax* has elongate stout bristles with a sclerotized tip (Figure 67*i*). The rostra of *T. ctenorhynchus* (Figure 67*a,b*) and *T. currax* (Figure 67*h*) are pointed, whereas those of *T. rhamphodes* (Figure 67*f*) and *T. pallax* (Figure 67*d*) are more broadly rounded. The outer



FIGURE 67.—*Tetragonodon ctenorynchus* (Brady), adult female, USNM 150103, length 1.04 mm: *a, b*, anterior ends of right and left valves, *ov*; *c*, short bristle on outer surface of valve. *T. pellax* Kormicker, paratype, adult female, USNM 158596, length 1.99 mm: *d*, anterior end of left valve, *ov*; *e*, short bristle on outer surface of valve. *T. ramphodes* Kormicker, holotype, probably A-1 female, USNM 122073, length 1.91 mm: *f*, anterior end of left valve, *ov*; *g*, 2 short stout bristles each with terminal spine on outer surface of valve. *T. currax*, new species, paratype, adult female, USNM 193731, length 2.34 mm: *h*, anterior end of left valve, *ov*; *i*, short bristle on outer surface of valve.

surface of the rostrum of *T. currax* bears 3 rounded processes absent on *T. ctenorhynchus*. The endopodite of the female 2nd antenna of *T. currax* differs from those of *T. ctenorhynchus* and *T. pellax* in having 2 bristles rather than 1 on the 2nd joint. *Tetragonodon currax* differs from *T. pellax* in not having a Bellonci organ. The female 7th limb of *T. currax* has 4 bristles in the proximal group, whereas the limbs of *T. rhamphodes* and *T. pellax* have 6. Note: Kornicker (1968:456) identified the unique specimen described as *T. rhamphodes* as a "female without eggs." After reexamining the 7th limb I find the bristles on the limb to be fairly strongly tapered (a juvenile character) and conclude that the specimen is probably an A-1 female.

PHILOMEDINAE Müller, 1906

The subfamily includes 7 genera (*Anarthron*, *Euphilomedes*, *Igene*, *Paraphilomedes*, *Philomedes*, *Scleroconcha*, *Zeugophilomedes*) of which only *Igene* is in the collections.

Igene Kornicker, 1975

Igene Kornicker, 1975a:367.

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

DISTRIBUTION.—Pacific Quadrant within the Antarctic Convergence, 3386–3817 m; off Pacific coast of Chile, 4303 m; northeast Pacific, 4945–5340 m; southeast of Glorioso Islands, Indian Ocean, 3716 m. The genus has not been reported previously in the Indian Ocean.

COMPOSITION.—Including the new species described herein, 3 species are known in the genus: *I. walleni* Kornicker, 1975a, *I. curtus* Chavtur, 1983, and *I. bryx*, new species.

Igene bryx, new species

FIGURES 68–71

ETYMOLOGY.—From the Greek *bryx* (depth of the sea) in reference to the abyssal depth at which the species was collected.

HOLOTYPE.—MNHN Os 451, undissected adult female in alcohol.

TYPE LOCALITY.—Sta 87-CH, 3 Apr 1977, SE Glorioso Islands, 11°44'S, 47°35'E, depth 3716 m.

PARATYPES.—Sta 87-CH: USNM 193749, 1 ovigerous female on slide and in alcohol; USNM 193750, 1 adult female in alcohol (body posterior to maxilla missing from specimen); Paris, 1 juvenile (length 0.94 mm, height 0.58 mm; 6 claws on each lamella of furca).

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT FEMALE (Figures 68–71).—Carapace oval in lateral view with prominent rostrum and broad incisur (Figures 68a,b,d–f, 71j). Posteroventral corner with small but distinct projecting caudal process (Figure 68h,i).

In lateral view anterior corner of rostrum pointed, posterior corner rounded (Figure 68b,e), and distal edge concave. Outer surface of carapace with sparsely distributed unbranched bristles (Figure 68e,i). Carapace uncalcified (preserved specimens flexible).

Infold: Infold of rostrum with short list extending from posterior corner (Figure 68g). Narrow list with anterior end in vicinity of anteroventral striae continues along ventral and posterior parts of infold and terminates in posterior juncture of dorsal hinge; distance between list and valve edge greatest in vicinity of caudal process and just anterior to process; part of infold between list and valve edge opaque whereas part of infold between list and inner margin of infold transparent. Infold of rostrum with 8 or 9 spinous bristles in row oblique to anterior edge (Figure 68g), 2 short bristles between rostral list and incisur, and 1 short bristle just posterior to ventral end of incisur (Figure 68g). Anteroventral infold with about 10 striae but no bristles; anterior $\frac{2}{3}$ of ventral infold without bristles; posterior $\frac{1}{3}$ with about 20 small bristles along list; list of posterior infold (including caudal process) with about 14 bristles (including about 8 fairly long unbranched bristles) (Figure 68h, not all bristles shown); infold in vicinity of caudal process between list and valve edge with 7 small bristles; ventral and posterior parts of infold between list and inner margin of infold without bristles.

Selva: Broad lamellar prolongation along anterior, ventral, and posterior margins of carapace and also along anterior part of dorsal margin; prolongation unsegmented (with smooth outer edge) between anterior juncture of dorsal hinge and anterodorsal corner of carapace; prolongation segmented (with fringe of long hairs along outer edge) along anterior and ventral edge of rostrum; prolongation divided at inner end of incisur; prolongation along ventral edge of incisur broad, striate at inner end of incisur, and with fringe of hairs along outer edge (Figure 68b,f); prolongation at inner end of ventral edge of incisur and along anterior $\frac{1}{3}$ of ventral margin with long medial bristles (some with bases on prolongation near proximal edge, but most with bases on valve edge); prolongation along posterior $\frac{2}{3}$ of ventral edge of carapace unsegmented and with fringe along outer edge; prolongation narrow (without fringe) along caudal process and on ventral edge of carapace just anterior to process; prolongation between dorsal end of caudal process and posterior juncture of dorsal hinge broad, nonstriated, with long distal fringe on ventral $\frac{2}{3}$ and without fringe on dorsal $\frac{1}{3}$, and with 2nd narrow prolongation (with distal fringe) along inner $\frac{1}{3}$ of broad prolongation.

Carapace Size: MNHN Os 451, holotype, left valve, length 1.51 mm, height 1.22 mm; USNM 193749, length 1.49 mm, height 1.10 mm; USNM 193750, length 1.49 mm, height 0.90 mm.

First Antenna (Figure 69a,b): 1st joint with medial and lateral spines. 2nd joint with medial and lateral spines and 2 spinous bristles (1 dorsal, 1 lateral). 3rd joint short, dorsal edge longer than ventral, with medial and lateral spines, small distal

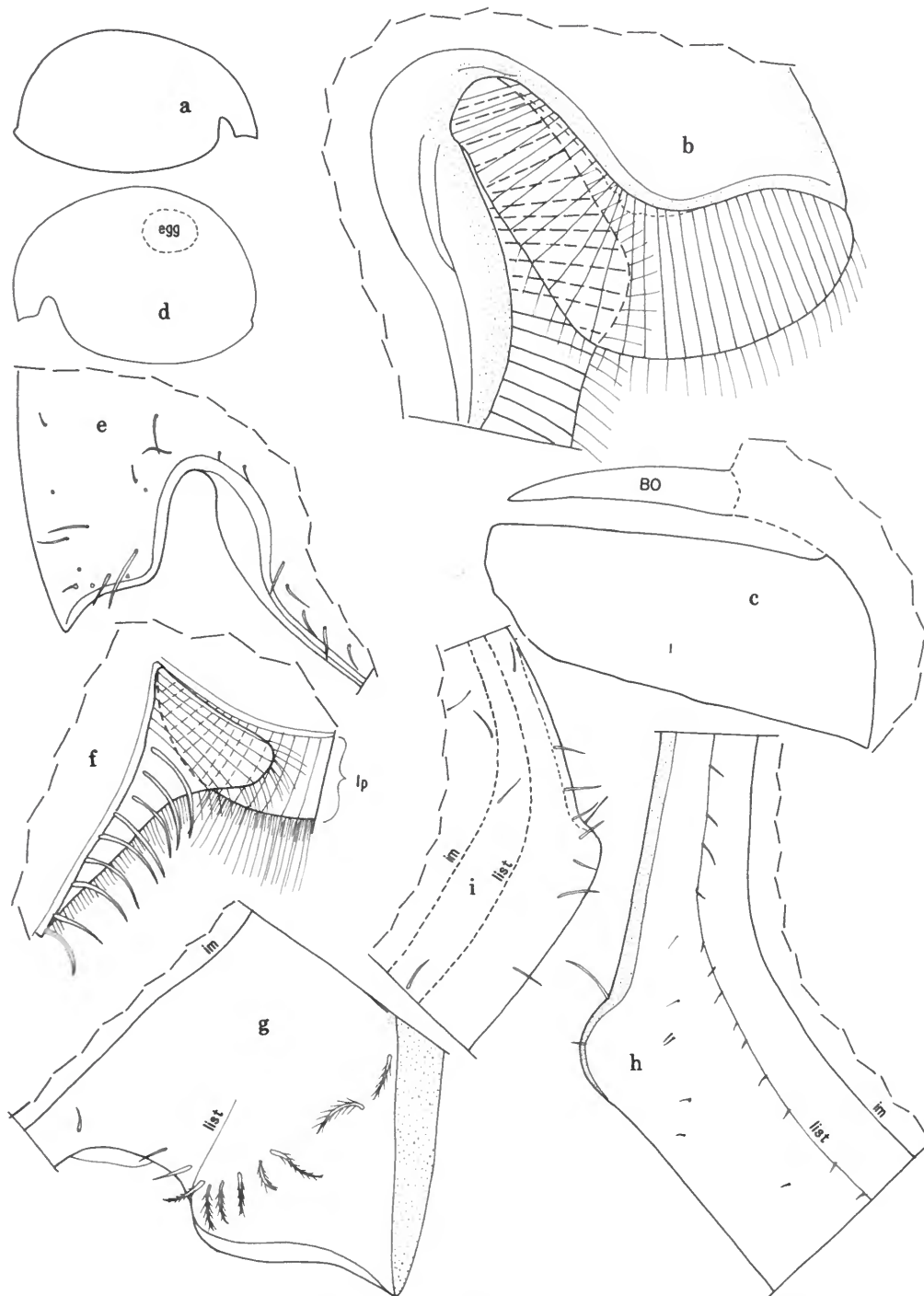


FIGURE 68.—*Igene bryx*, new species, adult female, paratypes: USNM 193750: *a*, outline of complete specimen from right side, length 1.49 mm, ov; *b*, anterior end of right valve showing lamellar prolongation of selva, anterior to right, ov; *c*, anterior of body showing 1st joint of left 1st antenna and Bellonci organ. USNM 193749: *d*, outline of complete specimen, length 1.49 mm; *e*, anterior end of left valve, ov; *f*, incisur and anteroventral margin of right valve showing lamellar prolongation of selva, anterior to right, ov; *g*, anterior end of left valve, iv; *h*, posterior end of left valve, iv; *i*, posterior end of left valve, ov.



FIGURE 69.—*Igene bryx*, new species, paratype, adult female, USNM 193749: *a*, left 1st antenna (not all bristles of joints 7 and 8 shown), mv; *b*, tip of left 1st antenna shown in *a*, mv; *c*, part of protopodite of left 2nd antenna showing medial spines and hairs, anterior to right, mv; *d*, protopodite and endopodite of left 2nd antenna, mv; *e*, joints 7-9 of aberrant exopodite of right 2nd antenna, mv; *f*, left mandible, mv; *g-i*, endites I-III of left 5th limb, av; *j*, exopodial joints 1 and 2 of left 5th limb, av; *k*, main tooth of 1st exopodial joint of left 5th limb, av; *l*, posterior bristles of 2nd exopodial joint of right 5th limb, av; *m*, exopodial joints 3-5 of right 5th limb (bristles of inner lobe obscured on slide and not shown), av.

spines on ventral margin, and 2 or 3 spinous bristles (1 ventral, 1 or 2 dorsal). 4th joint with medial spines and 4 spinous bristles (3 ventral, 1 dorsal). Sensory bristle of long 5th joint with 3 short proximal, 1 longer subterminal, and 4 short terminal filaments. 6th joint fused to 5th, minute, with spinous medial bristle. 7th joint: a-bristle slightly longer than bristle of 6th joint, with short marginal spines; b-bristle about twice length of a-bristle, with 1 short proximal and 4 short terminal filaments; c-bristle same length as sensory bristle of 5th joint, with 3 short proximal and 4 terminal filaments. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 2 proximal and 4 terminal filaments; g-bristle same length as c-bristle, with 4 proximal and 4 terminal filaments. (Not all filaments illustrated.)

Second Antenna: Dorsal half of protopodite with medial spines and hairs (Figure 69c). Endopodite 2-jointed (Figure 69d): 1st joint with 4 bare bristles (bases appear to be on medial ridge that may be part of protopodite); 2nd joint with long ventral bristle with long hairs, and short bare ringed terminal bristle. Exopodite: 1st joint with minute, straight, tubular, medial bristle; bristles of joints 1–8 bare, each only slightly longer than total length of joints 2–9 and each with minute talon-like tip; 9th joint with 6 bristles (4 shortest bristles dorsal, with short marginal spines; 2 longer bristles ventral, with 3 or 4 short distal ventral spines) (Figure 69e); joints 2–8 with 1 or 2 rows of distal spines. (Exopodite of right limb of USNM 193479 (Figure 69e) aberrant in having short 5th, 6th, and 9th joints, and no bristles on joints 5 and 8.)

Mandible (Figure 69f): Coxale endite deeply bifurcate, spinous, with minute ringed bristle near base. Basale: medial surface with rows of spines, abundant long hairs near ventral margin, 3 stout pectinate bristles and 2 short, slender, spinous, ringed bristles at proximal ventral corner, and 1 longer bristle (with long proximal and short distal spines) at midlength; ventral margin with 4 or 5 bristles (2 or 3 proximal bristles shorter) with long proximal and short distal spines; dorsal margin with 3 spinous bristles (1 at about $\frac{2}{3}$ length of margin, 2 terminal); lateral surface with rows of spines and abundant hairs in ventral half. Exopodite about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, with hirsute distal pad and 2 subterminal bristles (outer bristle with short spines, inner bristle longer and with wreaths of long spines and small distal spines). Endopodite: 1st joint with 3 spinous ventral bristles, and row of medial spines near distal dorsal corner. 2nd joint: proximal medial surface with rows of spines; ventral margin with spinous bristles forming 2 groups (2 in proximal group, 3 in distal); dorsal margin with spinous bristles forming 2 closely spaced groups (proximal group with 3 spinous bristles, distal with 6). 3rd joint with 3 claws (dorsal claw short, medial claw long with few ventral teeth at midlength, lateral claw longest) and 3 bristles.

Maxilla: Dorsal margin of precoxale and coxale with dorsal fringe of hairs. Coxale with fairly long plumose dorsal

bristle (Figure 71d). Endite I broad with 10 spinous and pectinate bristles (Figure 71a); endite II narrow, with 6 spinous and pectinate bristles (Figure 71b); endite III narrow, with proximal hairs and about 7 spinous and pectinate bristles (Figure 71c); 1 proximal bristle on either 1st or 2nd endite (Figure 71b,d). Basale with 2 long spinous bristles (1 ventral, 1 medial, none dorsal) (Figure 71d). Exopodite short with 3 bristles (proximal short with few marginal spines, outer of 2 long terminal bristles with long proximal hairs and short distal spines, inner long bristle bare or with short spines) (Figure 71d). Endopodite: 1st joint with spines along anterior margin, 1 long alpha-bristle with long hairs at midlength and spine at tip, and 3 beta-bristles (bare or with few spines, all with tubular tips; posterior bristle on small pedestal) (Figure 71d,f,g). 2nd joint with 3 bare lateral a-bristles with tubular tips, 2 b-bristles (anterior ringed, with marginal spines, posterior claw-like with marginal teeth), 2 ringed c-bristles with tubular tips, and 3 pectinate d-bristles (2 anterior claw-like, posterior bristle ringed) (Figure 71e–g).

Fifth Limb: Epipodite with 41 or 42 bristles. Endites I and II each with 6 or 7 bristles (Figure 69g,h); endite III with 9 or 10 bristles (Figure 69i). 1st exopodial joint: main tooth with 4 pectinate teeth (proximal tooth slender with long thin spine-like cusps; following tooth stouter, with 5 pointed cusps; next tooth stoutest, with 5 pointed cusps (proximal cusp much larger than others); protuberance anterior to distal tooth smooth, rounded (Figure 69j,k)); 1 spinous bristle just proximal to main tooth; anterior side of joint with 2 long bristles at midwidth and 1 short bristle on small lobe at proximal outer corner (Figure 69j). 2nd exopodial joint: large flat triangular tooth; inner edge of tooth obscured and teeth not observed; posterior side with stout c-bristle and 3 bristles forming row (1 small bristle on each side of large bristle) (Figure 69l). Inner lobe of 3rd joint obscured (with about 3 bristles); outer lobe with 2 hirsute bristles; fused 4th and 5th joints with total of 6 spinous bristles (Figure 69m).

Sixth Limb (Figure 70a): Single epipodial bristle with long proximal and short distal hairs. Endite I with 2 or 3 short plumose medial bristles and 1 long terminal bristle with wreaths of long hairs; endite II with 1 short spinous medial bristle and 3 long spinous terminal bristles; endite III with 6 or 7 spinous terminal bristles; endite IV with 7 spinous terminal bristles. End joint with 9 hirsute and spinous bristles.

Seventh Limb (Figure 70b,c): Proximal group with 2 bristles (1 on each side) with distal spines and 3 or 4 bells; terminal group with 5 spinous bristles (2 on comb side with 4 or 5 bells; 3 on peg side with 1, 5, and 5 bells). Terminus with about 5 spinous teeth in comb opposite 2 pegs (1 with round tip, other pointed) (Figure 70c).

Furca (Figure 70d): Each lamella with 9 slender claws decreasing in length posteriorly along lamella; claws 1–4 with stout teeth along posterior edge interspersed with smaller teeth; claws 5–9 with slender spine-like teeth along posterior edge, some claws with spines along anterior edge; claws 1–4 or 5

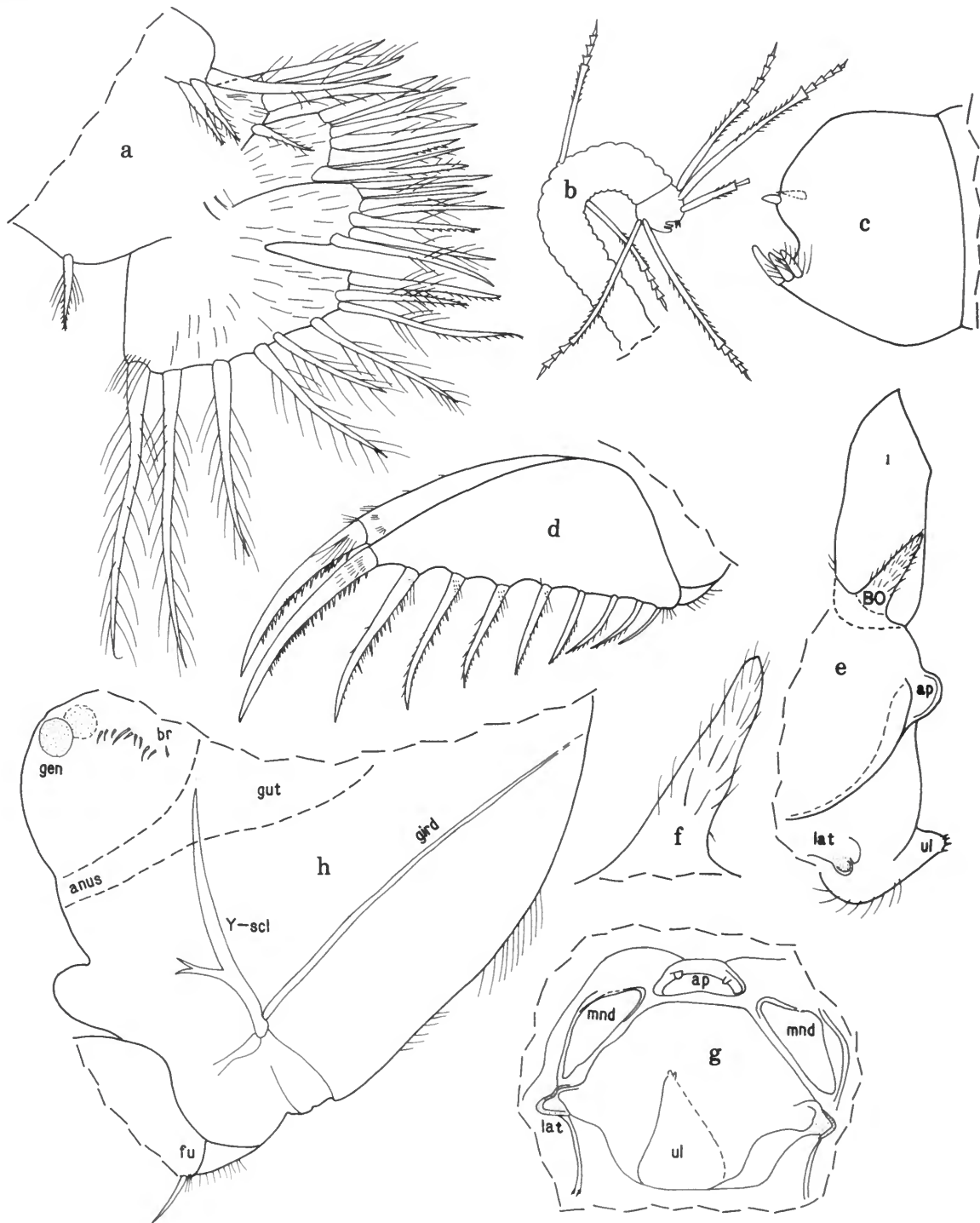


FIGURE 70.—*Igene bryx*, new species, paratype, adult female, USNM 193749: *a*, left 6th limb, mv; *b*, 7th limb; *c*, tip of 7th limb opposite that shown in *b* (bristles not shown); *d*, left furcal lamella and claw 1 of right lamella; *e*, anterior of body from right side, anterior to right; *f*, Bellonci organ; *g*, anterior view of ventral half of anterior of body; *h*, posterior of body from left side, anterior to left.

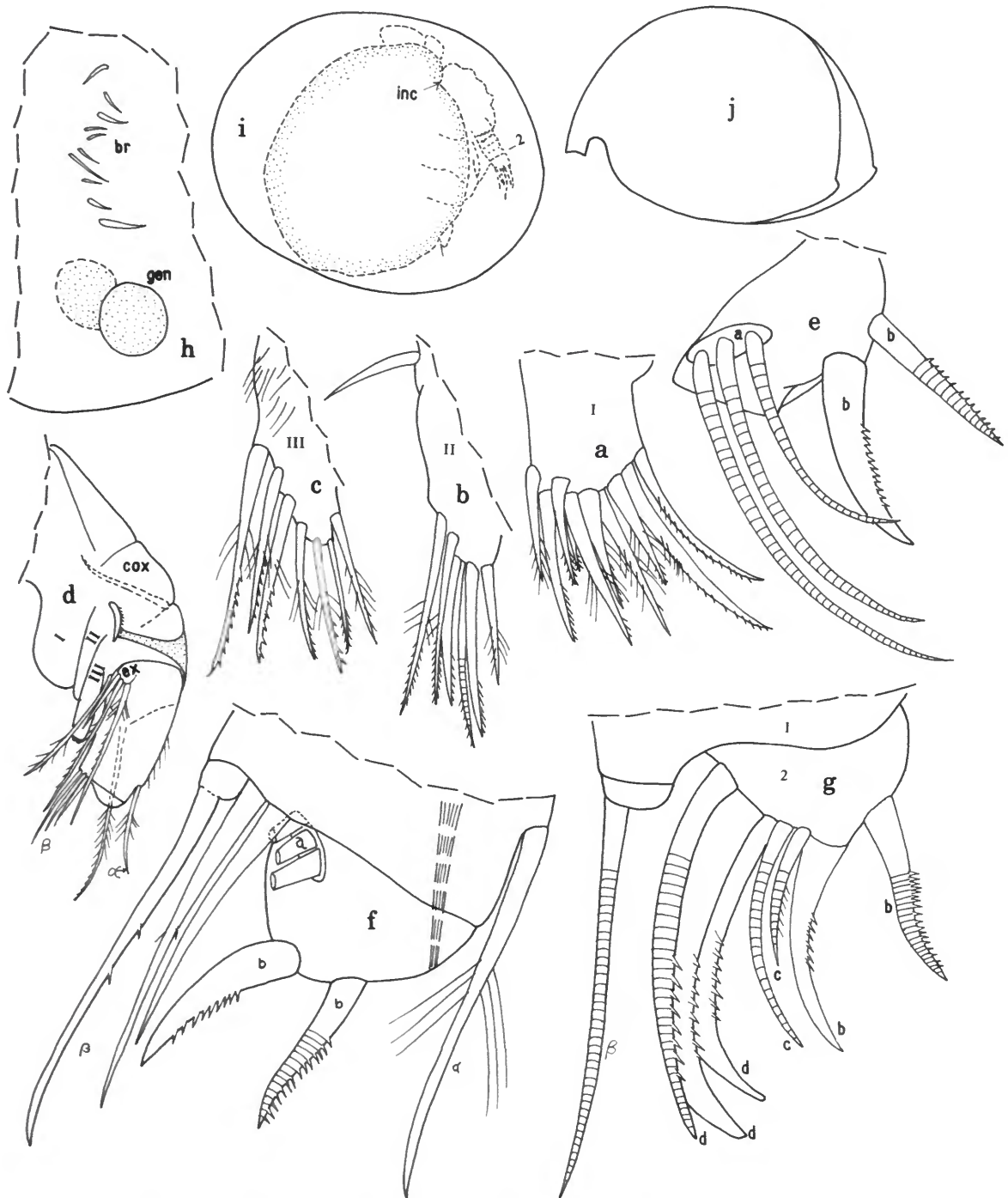


FIGURE 71.—*Igene bryx*, new species, adult female: paratype, USNM 193749: *a-c*, endites I-III of left maxilla, lv; *d*, part of right maxilla, lv; *e*, some bristles of 2nd endopodial joint of right maxilla, lv; *f*, tip of right maxilla (not all bristles shown), mv; *g*, tip of left maxilla (not all bristles shown), lv; *h*, part of body anterior to furca from right side showing brush organ and both left and right genitalia, anterior to right; *i*, well-developed egg within marsupium showing appendages and carapace (edge of carapace stippled), length of egg 0.37 mm. Holotype, MNHN Os 451: *j*, outline of complete specimen from left side, length 1.51 mm.

with long medial spines in row near base; long spines on lamella following last claw. Right lamella anterior to left by width of base of claw 1.

Bellonci Organ (Figures 68c, 70e, f): Short, conical, spinous, unsegmented. (On both specimens examined (USNM 193749, 193750) Bellonci organ covered by debris.)

Eyes: Medial and lateral eyes absent.

Upper Lip (Figure 70e, g): Conical with tubular processes on anterior tip.

Brush Organ (Figures 70h, 71h): 10 minute bristles in row on each side of body dorsal to genitalia.

Genitalia (Figures 70h, 71h): Yellow oval on each side of body anterior to anus.

Anterior of Body: With single round process midway between Bellonci organ and upper lip (Figure 70e, g). Sclerotized process projecting laterally on body at each side of upper lip (Figure 70e, g).

Posterior of Body (Figure 70h): Posterior spinous; postero-dorsal corner evenly rounded, bare.

Y-Sclerite (Figure 70h): Dorsal branch long; ventral branch short, bifurcate distally.

Eggs: Single egg of USNM 193749 with well-developed internal embryo having 2nd antenna with exopodite and shell with incisur (Figure 71i); maximum length of egg 0.37 mm; lateral eyes absent.

REMARKS.—The Y-sclerites are known for 2 species of this genus (*I. walleni*, *I. bryx*). Both have a bifurcate ventral branch suggesting that the Y-sclerite may have diagnostic value because the ventral branch is not bifurcate in the other genera of the family (Kornicker, 1975a, fig. 430). The bristles of the exopodites of the female 2nd antennae of *I. walleni* and *I. bryx* (unknown for *I. curtus*) are without natatory hairs indicating that females of the genus cannot swim efficiently. The adult

male of *I. walleni*, which bears natatory hairs on exopodial bristles of the 2nd antenna, is capable of efficient swimming (adult males of *I. bryx* and *I. curtus* are unknown). *Igene* is known only from abyssal depths and is without medial and lateral eyes.

COMPARISONS.—*Igene bryx* differs from *I. walleni* and *I. curtus* in having a small but distinct projecting caudal process on the carapace, and in having a terminal bristle on the 2nd joint of the endopodite of the female 2nd antenna.

RUTIDERMATIDAE Brady and Norman, 1896

DISTRIBUTION.—Widespread between latitudes of 45°N and 53°S, generally at depths of intertidal to 560 m, possibly deeper on the continental slope (Cohen and Kornicker, 1987:2).

COMPOSITION.—This family includes 3 genera (Cohen and Kornicker, 1987:1-8): *Rutiderma* Brady and Norman, 1896; *Alternochelata* Kornicker, 1958; and *Scleraner* Kornicker, 1975a. Only *Rutiderma* are in the present collection.

***Rutiderma* Brady and Norman, 1896**

TYPE SPECIES.—*Rutiderma compressa* Brady and Norman, 1896:673.

DISTRIBUTION.—Widespread between latitudes of 45°N and 53°S and depths of intertidal to 317 m (questionably collected at 1834 m) (Cohen and Kornicker, 1987:3). Hartmann (1974:237) reported juveniles from the Pacific coast of South Africa and in the vicinity of Mozambique, Indian Ocean, as *Rutiderma* cf. *compressa* Brady and Norman.

COMPOSITION.—Including 2 new species described herein the genus contains 28 species plus about 11 left in open nomenclature (Cohen and Kornicker, 1987:2; Kornicker, 1991:81).

Key to Instars of *Rutiderma*

1. 4th joint of 1st antenna without bristles, 6th limb without bristles, 7th limb absent Instar I
- 4th joint of 1st antenna with bristles, 6th limb with bristles, 7th limb present (possibly absent) 2
2. 4th joint of 1st antenna with 1 bristle (dorsal), 6th limb with 1 bristle, 7th limb minute (possibly absent) Instar II
- 4th joint of 1st antenna with 2 or more bristles, 6th limb with many bristles, 7th limb elongate (bare or with bristles) 3
3. 4th joint of 1st antenna with 2 bristles (1 ventral, 1 dorsal), 7th limb bare Instar III
- 4th joint of 1st antenna with 2 or more bristles, 7th limb with bristles 4
4. 7th limb with tapering bristles (especially proximal group) Instar IV
- 7th limb with cylindrical bristles 5
5. Claw of 2nd endopodial joint of mandible forming pincer with claw of 3rd joint Adult female
- 2nd endopodial joint of mandible without claw Adult male

Rutiderma arx, new species

FIGURES 72-79

ETYMOLOGY.—From the Latin *arx* (stronghold, fortress).

HOLOTYPE.—MNHN Os 272, ovigerous female in alcohol.

TYPE LOCALITY.—Sta 101-DS, 8 Apr 1977, NW Île du Lys, Glorioso Islands, 11°25'42"S, 47°19'30"E, depth 26 m.

PARATYPES.—Sta 101-DS: USNM 193410, 2 adult females plus 1 ovigerous female in alcohol; USNM 193411, 1 adult female on slide and in alcohol; USNM 193409, 1 adult male on slide and in alcohol; USNM 193412, 1 instar II in alcohol; USNM 193413, 1 instar III male in alcohol; USNM 193414, 1 instar IV male; MNHN Os 274, 1 instar II; MNHN Os 273, 8 instar IV, all in alcohol. Sta 124-S: USNM 193417A,B,C, 3 instar I; USNM 193418, 3 instar II, 2 instar III; USNM 193419, 4 adult females, 4 instar IV, 2 instar III; MNHN Os 279, 6 adult females (some ovigerous), 7 instar IV, 10 instar III, all in alcohol.

NONTYPES.—Sta 101-DS: MNHN Os 275, 1 adult male (1st and 2nd antenna missing from specimen).

DISTRIBUTION.—Sta 101-DS, NW Île du Lys, Glorioso Islands, depth 26 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 24-26 m.

DESCRIPTION OF ADULT FEMALE (Figures 72-75a-d).—Carapace oval in lateral view with very slight indication of incisur; caudal process well developed (Figures 72, 73a-g). Carapace without lateral ribs but posterior edge of broad posterior surface forms rather steep embankment indicated by vertical line in Figure 73a,b. Right valve with posterodorsal protuberance (Figure 73a,d) absent on left valve (Figure 73b,c).

Ornamentation: Surface with distinct small round fossae and scattered hairs; hairs more abundant along anterior and ventral margins; lateral ribs absent (Figure 72). Edge of valve between inner margin of selvage and outer edge of valve with bristles forming medial row comprising 1 or 2 small bristles between longer bristles (Figure 73e-g).

Infold: Rostral infold with 7 or 8 bristles forming row paralleling anterodorsal margin (Figure 73g; all bristles not shown on illustration); 1 minute bristle present near outer edge at slight indentation at ventral end of rostrum (Figure 73g); anteroventral infold striate, with 7 bristles forming row paralleling anteroventral margin (only 3 bristles shown in Figure 73g). Infold of caudal process with "pocket" having 8 or 9 bristles along dorsal edge; 3 or 4 additional bristles anterior to pocket seemingly a continuation of bristles forming row along dorsal edge of pocket. Posterior infold with small bristle near inner edge dorsal to caudal process (Figure 73e, f).

Selvage: Lamellar prolongation of selvage with narrow striations, and divided at inner end of incisur; prolongation with marginal hairs along anterior edge of rostrum, anteroventral margin of valve, and anterior half of ventral margin of valve, bare elsewhere; marginal hairs longest along anterior margin of



FIGURE 72.—*Rutiderma arx*, new species, adult female, paratype, USNM 193411, complete specimen from right side, length 1.43 mm.

rostrum and anteroventral margin of valve.

Central Adductor Muscle Attachments (Figure 73h): Comprising 16 ovoid scars at midheight of valve and just anterior to midlength.

Carapace Size: MNHN Os 272, holotype, length 1.39 mm, height 1.04 mm. USNM 193411, length 1.43 mm, height 1.06 mm. USNM 193410, 3 specimens, length 1.40 mm, height 1.03 mm; length 1.42 mm, height 1.06 mm; ovigerous, length 1.39 mm, height 1.00 mm. USNM 193419 (part), 3 specimens, length 1.45 mm, height 1.06 mm; length 1.46 mm, height 1.06 mm; length 1.46 mm, height 1.04 mm. Average length 1.43 mm, average height 1.04 mm.

First Antenna (Figure 74a,b): 1st joint bare. 2nd joint with spines forming rows on medial surface near dorsal margin, proximally on dorsal margin, and along distal lateral end, with dorsal bristle with indistinct marginal spines, and distal lateral bristle (missing on illustrated left limb but shown with dashes based on bristle of right limb). 3rd joint fused to 4th, with 3 bristles (1 ventral, 2 dorsal). 4th joint elongate, with 3 bristles (2 ventral, 1 dorsal). 5th joint elongate with lateral spines forming row along distal end near ventral margin (Figure 74b); sensory bristle with 2 small proximal filaments and terminal spine. 6th joint minute, fused to 5th, with spinous medial bristle. 7th joint: a-bristle spinous, slightly longer than bristle of 6th joint; b-bristle slightly shorter than a-bristle, with slight protuberance at midlength and terminal spine; c-bristle about same length as sensory bristle of 5th joint, with small proximal filament, 2 small distal marginal spines, and terminal spine. 8th joint: d- and e-bristles shorter than c-bristle, bare with blunt tips; f-bristle with 2 small proximal filaments, 2 minute distal marginal spines, and terminal spine; distal 1/3 of bristle crooked, with narrowly spaced rings and unusually slender;

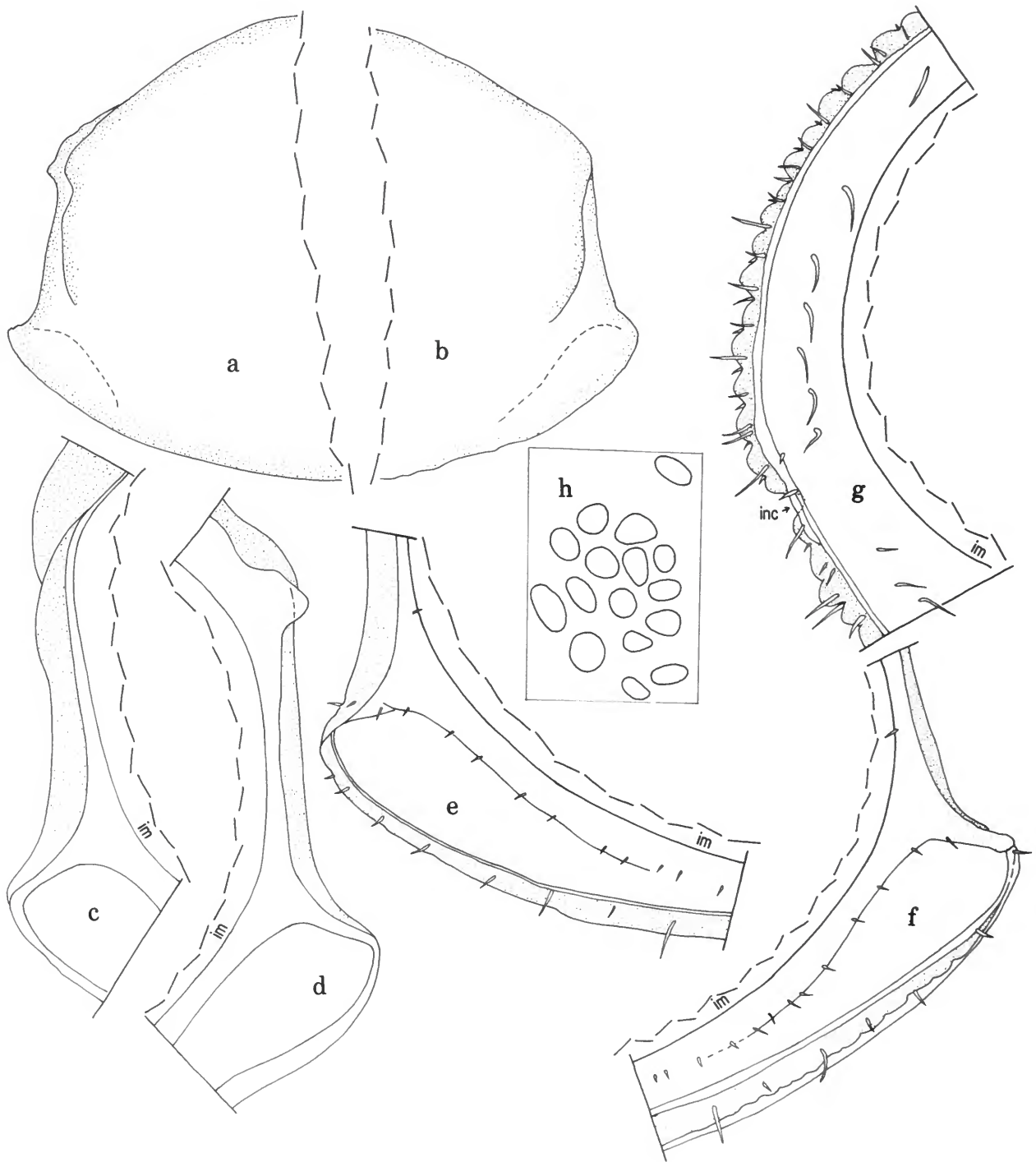


FIGURE 73.—*Ruiderma arx*, new species, adult female, paratype, USNM 193411: *a, b*, posterior ends of right and left valves, ov; *c, d*, posterior ends of left and right valves, iv; *e, f*, caudal processes of left and right valves, iv; *g*, anterior end of right valve, iv; *h*, central adductor muscle attachments of left valve, anterior to left, ov.

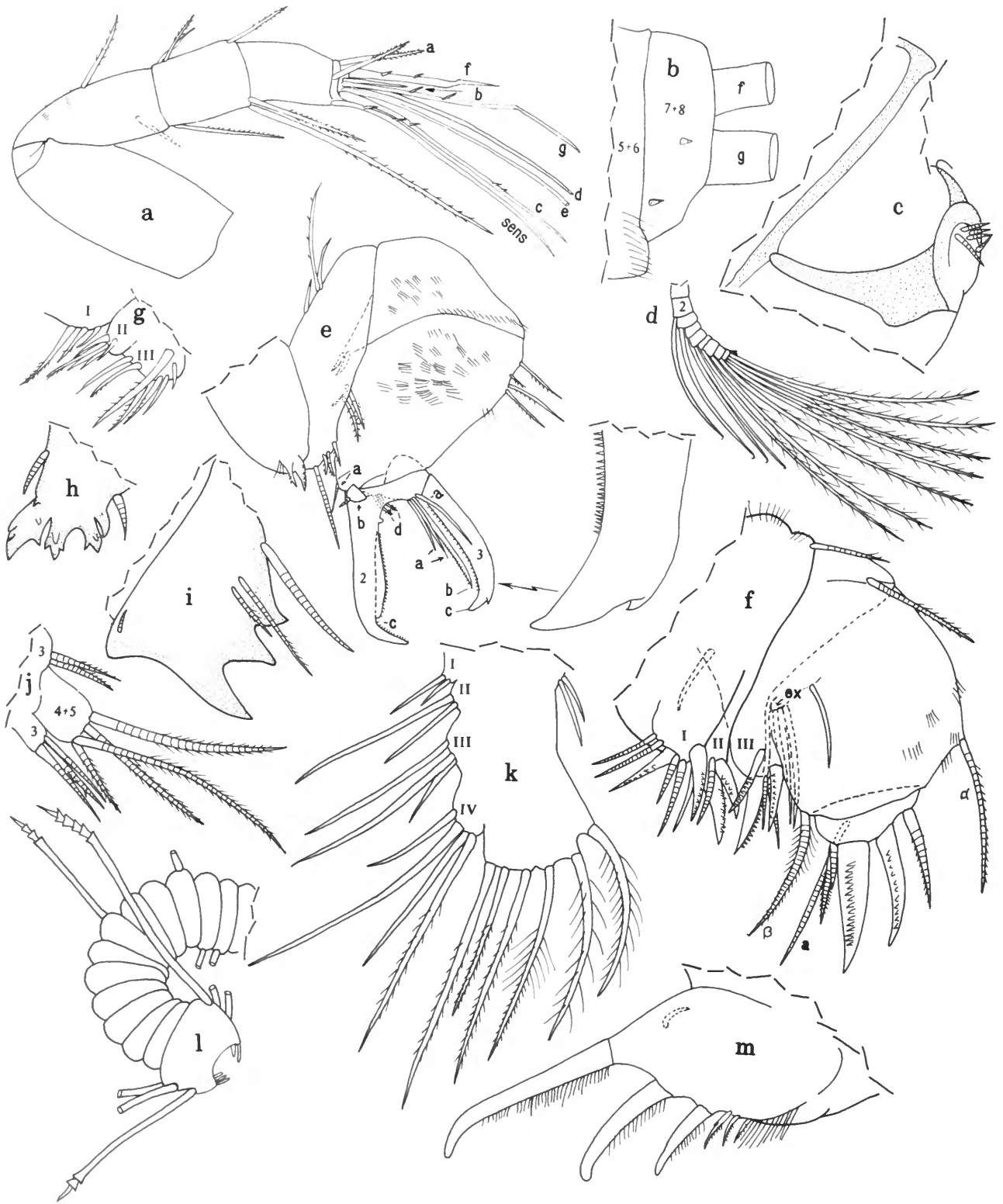


FIGURE 74 (opposite page).—*Ruiderma arx*, new species, adult female, paratype, USNM 193411: *a*, left 1st antenna, mv; *b*, tip of right 1st antenna (not all bristles shown), lv; *c*, protopodite and endopodite of left 2nd antenna, mv; *d*, exopodite of right 2nd antenna, mv; *e*, left mandible and detail of tip of c-bristle, mv; *f*, left maxilla, mv; *g*, endites of right 5th limb, av; *h*, main tooth of 1st exopodial joint of right 5th limb, av; *i*, 2nd exopodial joint of left 5th limb, pv; *j*, exopodial joints 3–5 of left 5th limb, pv; *k*, 6th limb (spines on most bristles not shown); *l*, 7th limb; *m*, left furcal lamella, lv.

g-bristle with 2 proximal filaments and terminal spine; distal $\frac{1}{3}$ of bristle crooked, with narrowly spaced rings, and slender (similar to f-bristle). Lateral side of fused 7th and 8th joint with 2 minute processes (Figure 74b).

Second Antenna (Figure 74c,d): Protopodite bare. Endopodite comprising single joint with 4 proximal bristles (1 slightly longer than others) and 1 distal bristle about same length as short proximal bristles). Exopodite: long 1st joint with small terminal tubular bristle near ventral margin; bristle of 2nd joint about $\frac{1}{3}$ longer than combined lengths of joints 2–9; bristles of joints 2–5 with short blunt spines along ventral margin and recurved tips; bristles of joints 6–8 with natatory hairs, minute distal spines, and straight tips; 9th joint with 6 bristles (4 long with natatory hairs, 2 small, bare, dorsal, all with straight tips). Minute indistinct spines along distal edge of some joints.

Mandible (Figure 74e): Coxale endite bifurcate (with distal branch stouter, and proximal branch with long hairs near base, both branches pectinate). Basale: dorsal margin with 3 bristles at midlength; ventral margin with 7 bristles (2 proximal, unringed, pectinate; 2 proximal, ringed, bare or with marginal spines; 3 at midlength, ringed, with marginal spines). Exopodite absent. 1st endopodial joint triangular, with medial spines forming rows and 2 small ventral bristles. 2nd endopodial joint: medial surface with spines forming rows; dorsal margin with 4 bristles with indistinct marginal spines; ventral margin with 2 terminal a-bristles (medial of these minute), and 1 terminal b-bristle in form of small process with small, terminal, ringed, tubular bristle; c-bristle stout, claw-like, unringed, with proximal dorsal tooth and serrate dorsal margin; 2 d-bristles lateral and with marginal spines. 3rd endopodial joint: 3 ringed a-bristles; b-bristle unringed, claw-like, with ventral teeth perpendicular to bristle; c-bristle stout, claw-like, unringed, with small distal tooth on dorsal margin and small teeth along ventral margin except near tip.

Maxilla (Figure 74f): 3 well-developed endites, each with 2 or 3 stout, terminal, pectinate claws (I and III with 3 claws, II with 2 claws) and 2–4 ringed, terminal, pectinate or spinous bristles; endite III also with 1 proximal bristle (dashed on illustrated limb). Precoxale with long dorsal hairs. Coxale with dorsal hairs and short dorsal bristle. Basale with 3 spinous bristles (1 dorsal, 1 medial, 1 ventral). 1st endopodial joint with 1 spinous alpha-bristle and 1 beta-bristle with long proximal and short distal spines. 2nd endopodial joint with 1 or 2 spinous a-bristles, 2 terminal stout pectinate claws, 1 spinous bristle

dorsal to claws, and 2 spinous bristles ventral to claws. Exopodite small, with 3 bristles.

Fifth Limb: Endite I with 3 bristles; endite II with about 5 bristles; endite III with about 7 bristles (Figure 74g). 1st exopodial joint with 4 constituent teeth (Figure 74h): proximal tooth small, smooth; 2nd to 4th teeth larger and with marginal teeth; 1 marginal bristle proximal to proximal tooth, and 1 proximal to distal tooth (Figure 74h). 2nd exopodial joint comprising large flat sclerotized tooth having 3 smooth lobes forming inner margin, 1 stout bristle on inner margin, 2 smaller posterior bristles near inner lobe of flat tooth, and 1 small slender posterior bristle near proximal outer corner (Figure 74i). Inner lobe of 3rd exopodial joint with 3 fairly long pectinate or spinous bristles, outer lobe with 2 spinous bristles (Figure 74j). 4th and 5th exopodial joints fused, with total of 4 spinous bristles.

Sixth Limb (Figure 74k): Endite I with 2 or 3 spinous bristles; endite II with 2 spinous bristles; endite III with 3 spinous bristles, endite IV with 3 or 4 spinous bristles. End joint with 6 bristles (anterior 3 with short marginal spines, next with long proximal and short distal spines, posterior 2 hirsute). 2 epipodial bristles present.

Seventh Limb (Figure 74l): 4 bristles in proximal group, 2 on each side, each bristle with 2 or 3 bells and distal marginal spines. 6 bristles in terminal group, 3 on each side, each bristle with 2–5 bells and distal marginal spines. Terminus with opposing combs with indistinct teeth (about 4 teeth on one side, 5 or 6 on other).

Furca (Figure 74m): Each lamella with 3 stout claws followed by 3 smaller claws; long hairs along margin of lamellae following claws; claws 1–3 with rounded tips (worn?), claws 4–6 with slender pointed claws; claws with slender spines along posterior margins; claw 1 also with few hairs along anterior margin; right lamella slightly anterior to left lamella; claw 1 of right lamella with long hairs forming medial row near base and hairs along anterior margin proximal to claw 1.

Bellonci Organ (Figure 75a): Elongate with broad middle segment, then tapering to slender tip. Tip of USNM 193411 bifurcate (observed at high resolution, $\times 100$ objective, $\times 15$ ocular, but bifurcation not apparent at lower resolution).

Eyes: Lateral eyes small, unpigmented, with 4 ommatidia (Figure 75a,c). Medial eye unpigmented, USNM 193411 with 1 short and 2 long filaments (Figure 75a).

Upper Lip (Figure 75a): Simple, rounded in lateral view.

Posterior of Body (Figure 75d): Hirsute.

Y-Sclerite (Figure 75d): Without distal ventral branch.

Eggs: Holotype and 1 specimen of USNM 193410 each with 4 eggs in marsupium; USNM 193411 with few large unextruded eggs.

DESCRIPTION OF ADULT MALE (Figures 75e–m, 76a–e).—Carapace with well-developed rostrum, incisur, and caudal process (Figures 75e, 76a). Posterodorsal corner prominent, rounded.

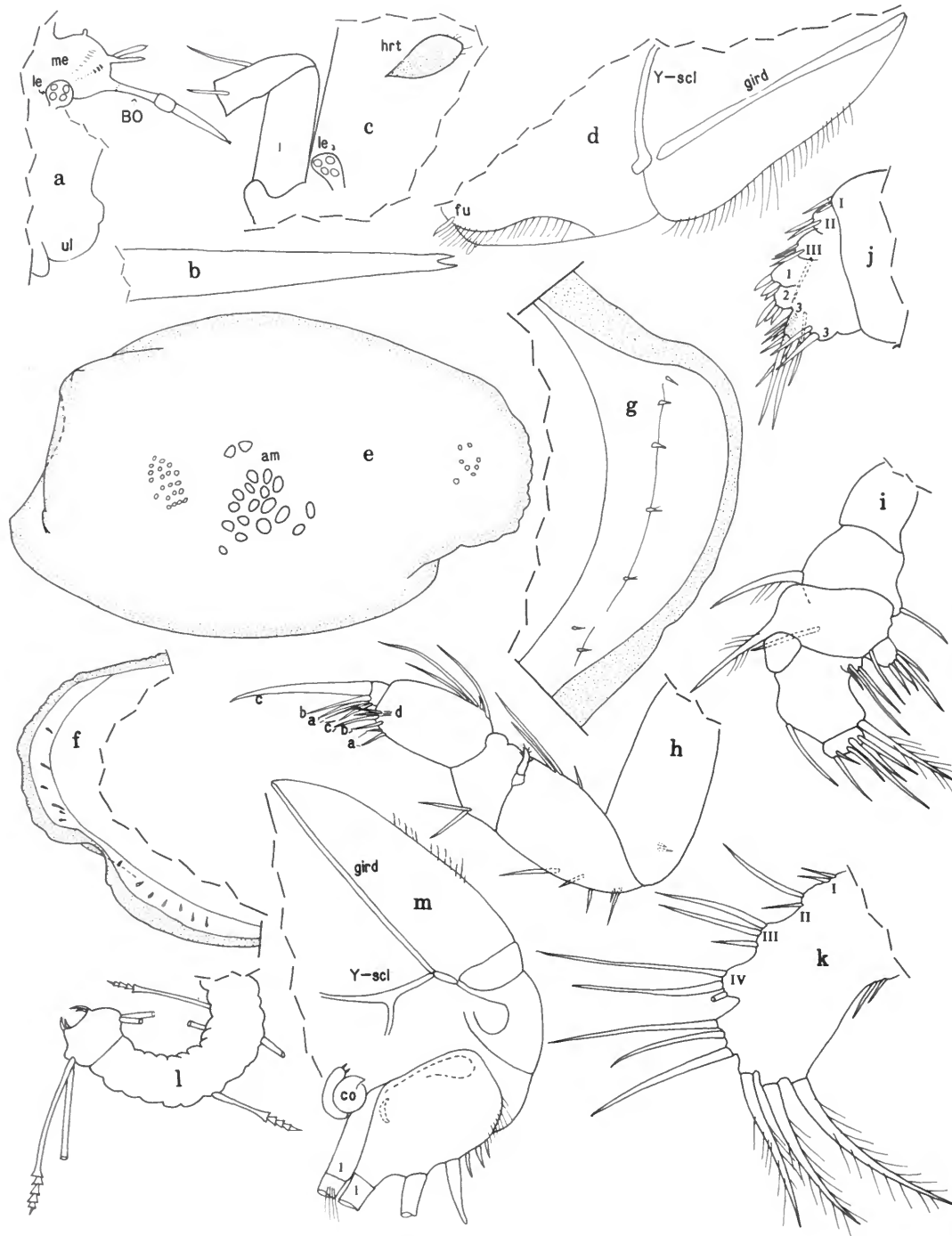


FIGURE 75.—*Ruiderma arx*, new species, paratypes: adult female, USNM 193411: *a*, anterior of body from right side, anterior to right; *b*, tip of Bellonci organ; *c*, dorsal part of anterior of body, anterior to left; *d*, posterior of body from left side, anterior to upper left. Adult male, MNHN Os 275: *e*, complete specimen from right side (small fossae are representative), length 1.34 mm; *f,g*, anterior and posterior ends of right valve, *iv*; *h*, left mandible, *lv*; *i*, left maxilla (not all bristles shown), *lv*; *j*, left 5th limb (not all bristles shown), *lv*; *k*, 6th limb; *l*, 7th limb; *m*, posterior of body from left side, *lv*.

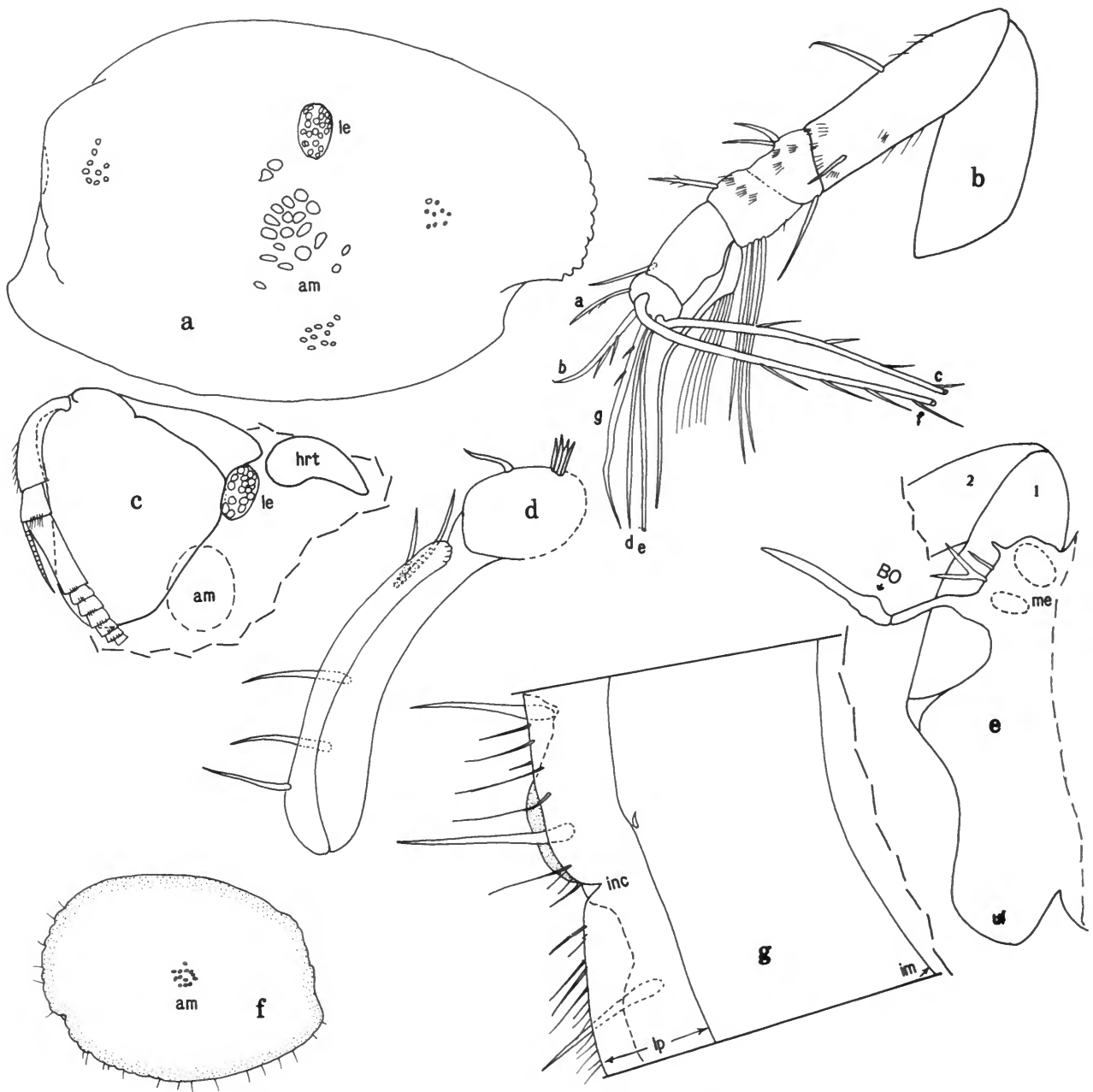


FIGURE 76.—*Rutiderma arx*, new species, paratypes: adult male, USNM 193409: *a*, complete specimen from right side, length 1.30 mm; *b*, left 1st antenna, lv; *c*, dorsal part of anterior of body from left side, anterior to left; *d*, endopodite of left 2nd antenna, lv; *e*, anterior of body from left side showing 1st and 2nd joints of right 1st antenna, medial eye, Bellonic organ, and upper lip. Instar I, USNM 193417A: *f*, complete specimen from left side, length 0.69 mm; *g*, anterior end of right valve, iv.

Infold: Rostral infold with 6 bristles; anteroventral infold with 7 bristles (Figure 75f); infold of caudal process with shallow "pocket" with 6 small bristles along dorsal edge and 1 small bristle proximal to edge (Figure 75g).

Ornamentation (Figures 75e, 76a): Lateral surface with small round fossae and smaller pits between fossae similar to those of female carapace.

Central Adductor Muscle Attachments (Figures 75e, 76a): Comprising about 20 oval attachments.

Carapace Size: MNHN Os 275, length 1.34 mm, height 0.84 mm; USNM 193409, length 1.30 mm, height 0.85 mm. Average length 1.32 mm, average height 0.85 mm.

First Antenna (Figure 76b): 1st joint bare, joints 2–4 with surface hairs forming rows. 2nd joint with 1 dorsal and 1 lateral bristle, each with thread-like slender tip. 3rd joint shorter on medial side, terminal suture well defined on medial side but poorly defined in dorsal half on lateral side; with 3 bristles (2 dorsal, 1 ventral). 4th joint elongate, with 4 bristles (3 ventral, 1 dorsal). 5th joint small, wedged ventrally between 4th and 6th joints; sensory bristle with short, stout, proximal segment with numerous filaments (only few shown on illustrated limb). 6th joint elongate, with short medial bristle near distal dorsal corner. 7th joint: a-bristle about same length as bristle of 6th joint; b-bristle almost twice length of a-bristle, with 2 proximal filaments and terminal spine, and with very slender distal $\frac{1}{3}$; c-bristle long, stout, with about 11 filaments (not all shown). 8th joint: d- and e-bristles about twice length of b-bristle, bare with blunt tips; f-bristle similar to c-bristle but slightly shorter, with 10 filaments (not all shown); g-bristle about twice length of b-bristle, with 2 short proximal filaments and terminal spine, and with distal $\frac{1}{3}$ crooked and very slender.

Second Antenna: Protopodite bare (Figure 76c). Endopodite 3-jointed (Figure 76d): 1st joint short with 5 small anterior bristles (4 proximal, 1 distal); 2nd joint elongate with 2 small bristles distal to midlength; 3rd joint reflexed on 2nd with 1 small proximal bristle and 2 smaller subterminal bristles, and with rounded tip with indistinct crescent-like ridges. Exopodite (Figure 76c): 1st joint elongate, minute medial bristle near middle of distal margin, and spines forming rows along ventral edge; 2nd joint short, with bare bristle with slightly curved tip reaching 4th joint; 3rd joint about $2\frac{1}{2}$ times length of 2nd joint; bristles of joints 3–8 long with natatory hairs and straight tips; 9th joint with 1 small bare bristle and 4 long bristles with natatory hairs and straight tips; 2nd joint with long lateral spines along terminal edge; joints 3–8 with shorter lateral spines along terminal edge; 8th joint also with minute lateral basal spine.

Mandible (Figure 75h): Coxale endite comprising 2 minute spines. Basale with 5 ventral and 3 dorsal bristles. Exopodite elongate, hirsute. 1st endopodial joint with 2 ventral bristles. 2nd endopodial joint: dorsal margin with 4 bristles; ventral margin with 2 a-bristles, 1 b-bristle, 1 c-bristle, and 2 d-bristles. 3rd endopodial joint with 3 a-bristles, 1 b-bristle, and 1 long, slender, claw-like c-bristle with incomplete rings.

Maxilla (Figure 75i): Reduced, with 3 endites (not all bristles shown on illustrated limb). Coxale with hirsute dorsal bristle. Basale with hirsute dorsal bristle, 1 ventral bristle, and 1 medial bristle. Exopodite with 3 bristles (2 long, 1 short). 1st endopodial joint with 1 alpha- and 1 beta-bristle. 2nd endopodial joint with 6 bristles.

Fifth Limb (Figure 75j): 3 endites with slender bristles. 1st and 2nd exopodial joints each with 3 broad finger-like bristles and several slender bristles. 3rd exopodial joint with 2 bristles on outer lobe; inner lobe obscured but appearing to have 3 bristles. 4th and 5th exopodial joints fused, with total of 4 bristles. (Not all bristles of endites and 1st and 2nd exopodial joints shown on illustrated limb.)

Sixth Limb (Figure 75k): With 2 epipodial bristles. Endites I and II each with 2 bristles; endites III and IV each with 3 bristles. End joint with 6 bristles of which posterior 3 hirsute. Bristles of endites and anterior 3 bristles of end joint either bare or with short marginal spines, some bristles with few long hairs proximally.

Seventh Limb (Figure 75l): 4 bristles in both proximal and terminal groups, 2 on each side for each group, each bristle with 3–5 bells. Terminus with opposing combs, each with 2 or 3 teeth. Marginal spines not observed on bristles, which were examined with $\times 40$ objective and $\times 15$ ocular with appendage not under cover slip.

Furca (Figure 75m): Similar to that of female.

Bellonci Organ (Figure 76e): Similar to that of female but tip pointed at observed magnification ($\times 20$ objective, $\times 15$ ocular).

Eyes: Medial eye with 4 dorsal filaments, unpigmented (Figure 76e). Lateral eyes well developed with 15–20 ommatidia, unpigmented (Figure 76c).

Genitalia (Figure 75m): Copulatory organ comprising 2 or 3 small lobes on each side of body.

Upper Lip (Figure 76e) and *Posterior of Body* (Figure 75m): Similar to those of female.

Y-Sclerite: With distinct ventral branch on both sclerites of specimen of MNHN Os 275 (Figure 75m); ventral branch on USNM 193409 indistinct.

Heart (Figure 76c): Larger than that of female.

DESCRIPTION OF INSTAR I (Figures 76f, g, 77).—Carapace similar in shape and ornamentation to that of adult female, except caudal process less produced (Figure 76f).

Infold: Anterior infold dorsal to incisur with 3 long bristles at infold midwidth and 1 small bristle near outer edge of infold at incisur (only small bristle shown in Figure 76g); anteroventral infold with 1 bristle at infold midwidth; infold of caudal process without "pocket," with 4 bristles forming row (dorsal bristle minute, others longer and with long terminal spine) (Figure 77a,b); 3 smaller bristles on ventral infold just anterior to caudal process and closer to inner margin than bristles of caudal process; 2 small bristles on inner edge of infold just dorsal to caudal process; anteroventral infold without striations.

Selvage: Selvage with broad lamellar prolongation with

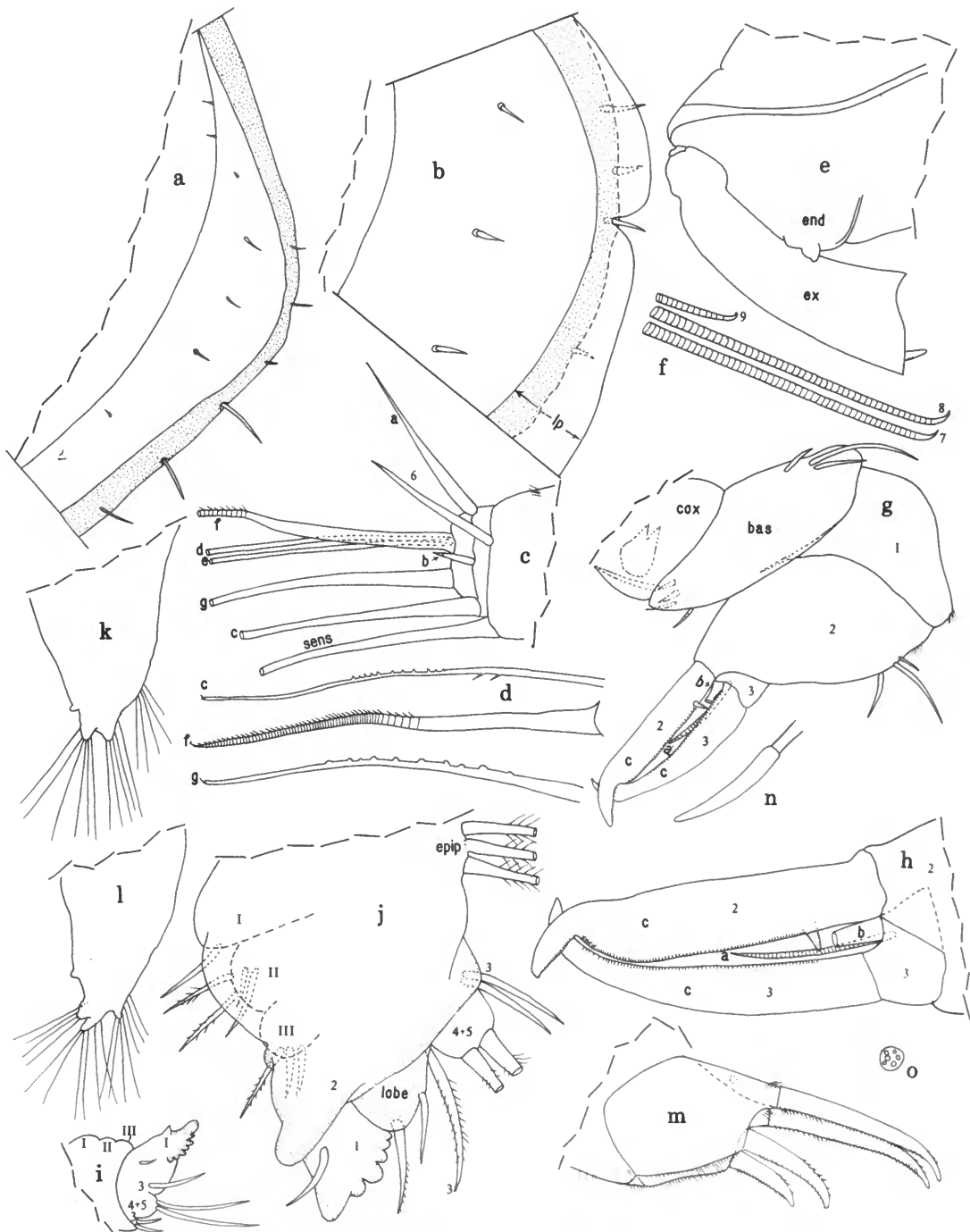


FIGURE 77.—*Ruiderma arx*, new species, instar I (sex unknown), paratypes: USNM 193417A: a, caudal process of right valve, iv; b, tip of caudal process of right valve, iv; c, tip of right 1st antenna, mv; d, f-bristle, and distal halves of c- and g-bristles of right 1st antenna, mv; e, protopodite, endopodite, and 1st exopodial joint of right 2nd antenna, mv; f, tips of long bristles of exopodial joints 7-9 of right 2nd antenna, mv; g, right mandible, lv; h, detail of tip of mandible shown in g, lv; i, tip of left 5th limb (not all bristles shown; limb not under cover slip), pv; j, left 5th limb (limb under cover slip), pv; k, l, right and left 6th limbs; m, right and left furcal lamellae; n, Bellonci organ. USNM 193417B: o, right lateral eye.

narrow striations perpendicular to edge; anterior prolongation dorsal to incisur and anteroventral prolongation with fringe of long hairs; anterodorsal selvage with short fringe; ventral prolongation with short fringe except near caudal process; narrow selvage along caudal process without fringe. Lamellar prolongation indistinctly divided at incisur (Figure 76g), and indented at tip of caudal process medial to short bristle (Figure 77b).

Carapace Size: USNM 193417A,B,C: length 0.69 mm, height 0.48 mm; length 0.67 mm, height 0.48 mm; length 0.68 mm, height 0.50 mm. Average length 0.68 mm, average height 0.49 mm.

First Antenna (Figure 77c,d): 1st joint bare. 2nd joint with dorsal spines but without bristles. 3rd joint fused to 4th, with 2 bristles (1 ventral, 1 dorsal) and dorsal spines forming row proximal to bristle. 4th joint without bristles, with terminal dorsal spines forming row. 5th and 6th joints fused; 5th joint with dorsal spines forming distal row, and long terminal ventral bristle (sensory bristle, bare except for spine at tip). 6th joint with small medial bristle. 7th joint: a- bristle short; b-bristle about $\frac{1}{4}$ length of a-bristle, with spine at tip; c-bristle long slender, with 2 indistinct short distal filaments, about 11 minute rounded distal teeth, and terminal spine (Figure 77d). 8th joint: d- and e-bristles long with blunt tips; f-bristle with crooked distal half and distal marginal spines and terminal spine (Figure 77d); g-bristle long, slender, with 9 small rounded distal teeth and terminal spine (Figure 77d).

Second Antenna: Protopodite bare (Figure 77e). Endopodite single jointed, bare, with small terminal protuberance (Figure 77e). Exopodite with 9 joints: 1st joint with minute medial tubular bristle on terminal edge; bristles of joints 2–8 long, bare, with hook-like tips (Figure 77f); 9th joint with 2 bare bristles (1 long with hook-like tip, 1 short with straight tip).

Mandible (Figure 77g,h): Coxale endite bifurcate. Basale: dorsal margin with 3 bristles distal to midlength; ventral margin with 5 bristles: 4 medial in proximal corner (2 pectinate unringed, 2 ringed); 1 on ventral margin proximal to midlength. Exopodite absent. 1st endopodial joint with medial spines forming rows, and 1 ventral bristle. 2nd endopodial joint with medial spines forming rows; dorsal margin with 3 bristles; c-bristle stout, claw-like, unringed, with proximal dorsal tooth (more pointed than that of adult), and serrate dorsal margin. 3rd endopodial joint with 1 ringed a-bristle, 1 unringed b-bristle with ventral teeth perpendicular to bristle, and 1 stout, claw-like, unringed c-bristle with small teeth along ventral margin except near tip (distal dorsal tooth absent). When jaws closed tip of claw of 3rd joint medial to that of 2nd joint.

Maxilla: Endite I with 2 stout pectinate claw-like bristles and 2 slender bristles; endites II and III each with 2 stout pectinate claw-like bristles and several slender bristles. Precoxale with dorsal fringe of long hairs. Coxale with dorsal bristle. Exopodite with 3 bristles (1 long, 1 medium, 1 short).

Basale with 3 bristles (1 dorsal, 1 ventral, 1 medial). 1st endopodial joint with 1 alpha-bristle and 1 beta-bristle. 2nd endopodial joint with 1 terminal stout unringed pectinate claw-like bristle, 1 stout ringed pectinate bristle, and 2 slender bristles.

Fifth Limb (Figure 77i,j): 3 endites present. Main tooth of 1st exopodial joint with 6 or 7 rounded teeth forming row along edge and 1 bristle along each edge proximal to teeth; large flat tooth of 2nd exopodial joint interpreted to comprise 1 rounded lobe along inner margin. Inner lobe of 3rd exopodial joint with 1 bristle, outer lobe with 2 bristles; fused 4th and 5th exopodial joints with total of 2 bristles.

Sixth Limb (Figure 77k,l): Slender, flap-like, distal edge with 2 or 3 processes bearing long hairs, but without bristles.

Seventh Limb: Absent.

Furca (Figure 77m): With 2 stout claws followed by spines and long hairs.

Bellonci Organ (Figure 77n): With rounded tip.

Eyes: Lateral eye minute, with about 6 ommatidia (Figure 77o). Medial eye bare, unpigmented.

Posterior of Body: Hirsute.

Y-Sclerite: Absent.

DESCRIPTION OF INSTAR II (Figure 78).—Carapace similar in shape and ornamentation to that of adult female (Figure 78a). Caudal process more produced than that of instar I.

Infold: Anterior infold dorsal to incisur with 3 long bristles forming row, and 1 smaller bristle near outer edge of infold at incisur; anteroventral infold with striations paralleling valve edge, and 1 bristle ventral to incisur; infold of caudal process without "pocket," with 3 bristles forming row at midwidth of infold.

Selvage: With broad lamellar prolongation divided at incisur and indented at tip of caudal process, with marginal fringe of hairs similar to that of adult female.

Carapace Size: MNHN Os 274, length 0.90 mm, height 0.64 mm. USNM 193412, length 0.82 mm, height 0.68 mm. USNM 193418 (part), 2 specimens, length 0.86 mm, height 0.68 mm; length 0.88 mm, height 0.64 mm. Average length 0.87 mm, average height 0.64 mm.

First Antenna (Figure 78b): 1st joint without bristles. 2nd joint with 2 bristles (1 dorsal, 1 lateral). 3rd joint fused to 4th, with 2 bristles (1 ventral, 1 dorsal). 4th joint with 1 terminal dorsal bristle. 5th joint with spines forming row near base of long terminal ventral bristle with small proximal filament, minute distal spine, and terminal spine. 6th joint with small medial bristle. 7th joint: a-bristle slightly longer than bristle of 6th joint; b-bristle about $\frac{1}{4}$ length of a-bristle; c-bristle about same length as sensory bristle of 5th joint, with short proximal filament, minute distal spine, and terminal spine. 8th joint: d- and e-bristles about same length as c-bristle, bare with blunt tips (bases of bristles on small pedestal); f-bristle with small proximal filament and terminal spine (distal $\frac{1}{3}$ of bristle crooked, slender, and with closely spaced rings); g-bristle about

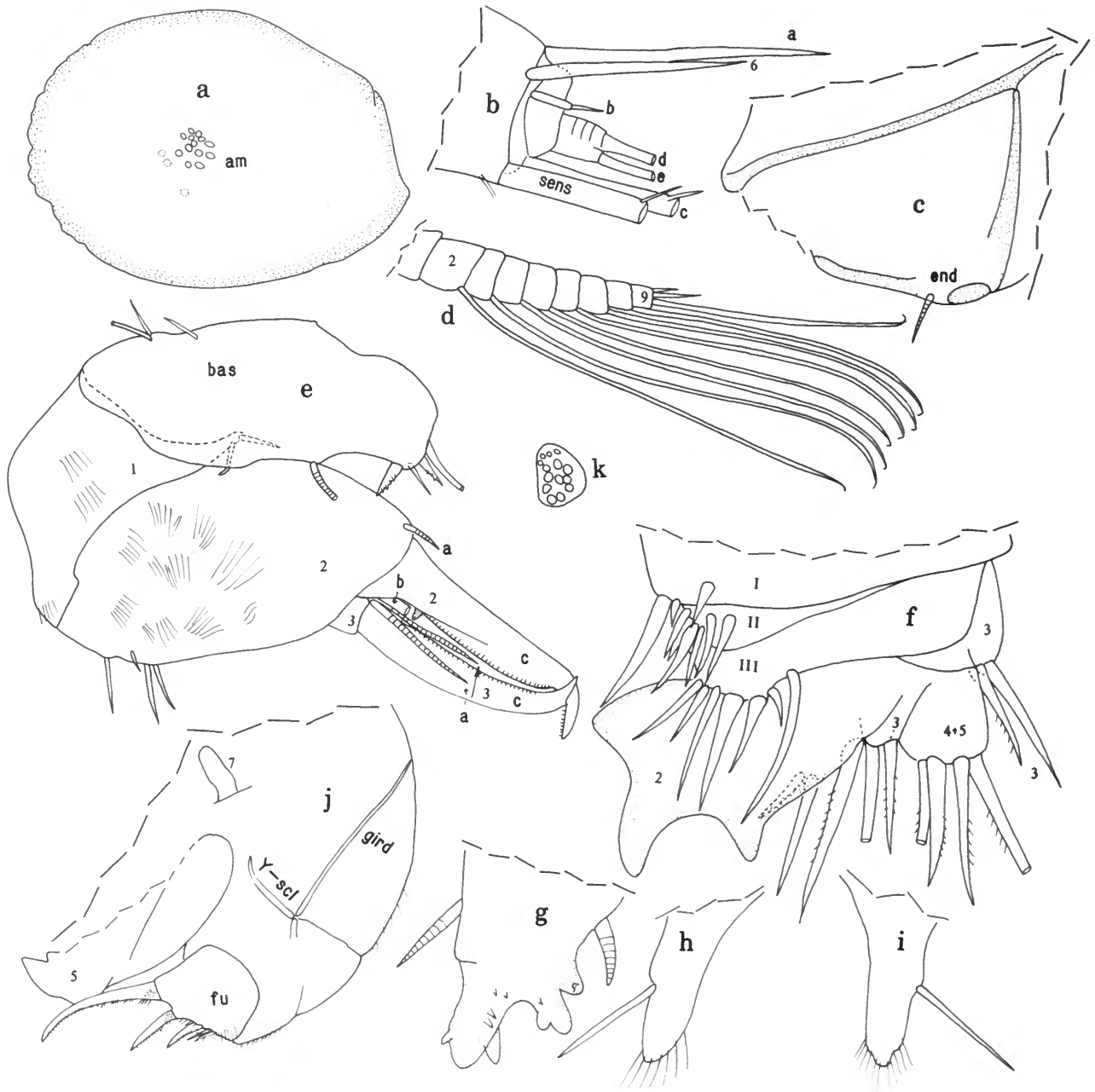


FIGURE 78.—*Rutiderma arx*, new species, instar II (sex unknown), paratype, USNM 193412: *a*, complete specimen from left side, length 0.82 mm; *b*, tip of left 1st antenna (f- and g-bristles not shown), mv; *c*, protopodite and endopodite of right 2nd antenna, mv; *d*, exopodite of right 2nd antenna, mv; *e*, right mandible (coxale not shown), mv; *f*, right 5th limb (1st exopodial joint not shown), av; *g*, 1st exopodial joint of left 5th limb, av; *h*, *i*, left and right 6th limbs, lv; *j*, posterior of body from left side, anterior to left; *k*, right lateral eye, anterior to right.

same length as c-bristle, with fairly long proximal filament and terminal spine (distal $\frac{1}{4}$ of bristle crooked, slender, and with closely spaced rings).

Second Antenna: Protopodite bare. Endopodite single jointed with 1 bristle (Figure 78c). Exopodite with 9 joints (Figure 78d); joint 1 with minute medial terminal bristle; bristles of joints 2–8 long, bare, with recurved tips; 9th joint with 3 bare bristles (2 short with straight tips, 1 long with recurved tip).

Mandible (Figure 78e): Coxale endite bifurcate. Basale: dorsal margin with 3 bristles distal to midlength; ventral margin with 4 proximal bristles (2 unringed pectinate, 2 ringed), and 1 bristle distal to midlength. Exopodite absent. 1st endopodial joint triangular, with medial spines forming rows, and 2 small ventral bristles. 2nd endopodial joint: medial surface with spines forming rows; dorsal margin with 4 bristles; ventral margin with 1 terminal a-bristle, 1 stout claw-like c-bristle with proximal dorsal tooth and serrate dorsal margin. 3rd endopodial joint: 2 ringed a-bristles, 1 unringed b-bristle, and stout claw-like c-bristle with small distal tooth on dorsal margin and small teeth along ventral margin except near tip.

Maxilla: Endite I with 2 stout claw-like bristles and 2 slender bristles; endites II and III each with 3 stout claw-like bristles and several slender bristles. Dorsal margin of precoxale missing on specimen examined. Coxale without dorsal fringe of hairs, with 1 short dorsal bristle. Basale with 3 bristles (1 dorsal, 1 ventral, 1 medial). Exopodite not observed (obscured on specimen examined). 1st endopodial joint with 1 alpha-bristle and 1 beta-bristle. 2nd endopodial joint with 2 stout unringed claw-like bristles, 1 ringed pectinate bristle, and 4 slender bristles.

Fifth Limb (Figure 78f,g): Endite I with 3 bristles, endite II with 6 bristles, endite III with 7 bristles. Main tooth of 1st exopodial joint with 3 constituent teeth (Figure 78g): proximal tooth small smooth, 2nd to 3rd teeth larger and with marginal teeth; 1 marginal bristle proximal to proximal tooth, and 1 bristle proximal to distal tooth. 2nd exopodial joint comprising large flat tooth having 2 smooth lobes forming inner margin, 1 stout bristle on inner margin, and 2 posterior bristles proximal to inner lobe of flat tooth. Inner and outer lobes of 3rd exopodial joint each with 2 bristles. 4th and 5th exopodial joints fused, with total of 4 bristles. Epipodite well developed.

Sixth Limb (Figure 78h,i): Slender, flap-like, with distal hairs and single anterior bristle at midheight.

Seventh Limb (Figure 78j): Small, bare.

Furca (Figure 78j): With 3 stout claws followed by 2 small claws; hairs along lamellae following claws and between claws; long hairs forming medial row on claws 1 and 2 near bases. Claw 1 with teeth forming 5 rows separated by small space along concave margin and few distal hairs along convex margin; teeth of claws 2 and 3 finer than those of claw 1; claws 4 and 5 straight and with slender spines and hairs along anterior and dorsal margins.

Bellonci Organ: Tip with small terminal protuberance

(bifurcation not observed on whole mount examined with $\times 40$ objective and $\times 15$ ocular).

Eyes: Medial eye unpigmented, with 3 dorsal filaments. Lateral eye small with about 14 indistinct ommatidia (Figure 78k).

Y-Sclerite (Figure 78j): Without ventral branch (similar to that of adult female).

Posterior of Body (Figure 78j): Hirsute.

Gut Content: USNM 193412 with 2 harpacticoid copepods (1 almost complete, identified by T.E. Bowman) and segments of ringed hollow cylinder (possibly nematode).

Remarks: The large number of ommatidia in the lateral eyes of USNM 193412 suggests that it is male, but this conclusion is not supported by single joint comprising the endopodite of the 2nd antenna.

DESCRIPTION OF INSTAR III MALE (Figure 79a–j).—Carapace similar in shape and ornamentation to that of adult female.

Infold: Anterior infold dorsal to incisur with 4 long bristles forming row and 1 minute bristle near outer edge of infold at incisur; anteroventral infold striate, with 4 bristles forming row at midwidth ventral to striations; infold of caudal process without “pocket,” with 4 bristles forming row and 1 bristle closer to tip of process on left valve of USNM 193413, but absent on right valve.

Selvage: Similar to that of adult female.

Carapace Size: USNM 193413, length 1.07 mm, height 0.79 mm. Sex not determined on following: USNM 193418 (part), 2 specimens, length 1.04 mm, height 0.76 mm; length 1.03 mm, height 0.76 mm; USNM 193419 (part), 2 specimens, length 1.02 mm, height 0.74 mm; length 1.02 mm, height 0.73 mm. Average length 1.04 mm, average height 0.76 mm.

First Antenna: Similar to that of instar II except for having 2 dorsal bristles on 3rd joint, and a ventral as well as a dorsal bristle on 4th joint; also, some bristles of joints 5–8 bear filaments. b-bristle of 7th joint about $\frac{1}{2}$ length of a-bristle.

Second Antenna: Protopodite bare. Exopodite similar to that of instar II except for 9th joint having 4 bristles (2 short, 1 medium, 1 long); all bristles of exopodite bare; all except 2 short bristles of 9th joint with recurved tips. Endopodite 2-jointed (Figure 79b): 1st joint with short bristle (possibly more); 2nd joint elongate with 3 bristles (2 marginal, 1 terminal).

Mandible (Figure 79c): Coxale endite bifurcate, pectinate, and spinous. Basale: dorsal margin with 3 distal bristles; ventral margin with 7 bristles (2 proximal, unringed, pectinate; 2 proximal ringed; 3 near midlength). Exopodite absent. 1st endopodial joint triangular, with medial spines and 2 ventral bristles. 2nd endopodial joint: medial surface with spines forming rows; dorsal margin with 4 bristles; ventral margin with 1 terminal a-bristle, 1 terminal b-bristle (in form of small process with small terminal bristle); stout c-bristle with proximal dorsal tooth and serrate dorsal margin; and 1 lateral d-bristle. 3rd endopodial joint: 3 ringed a-bristles, 1 unringed

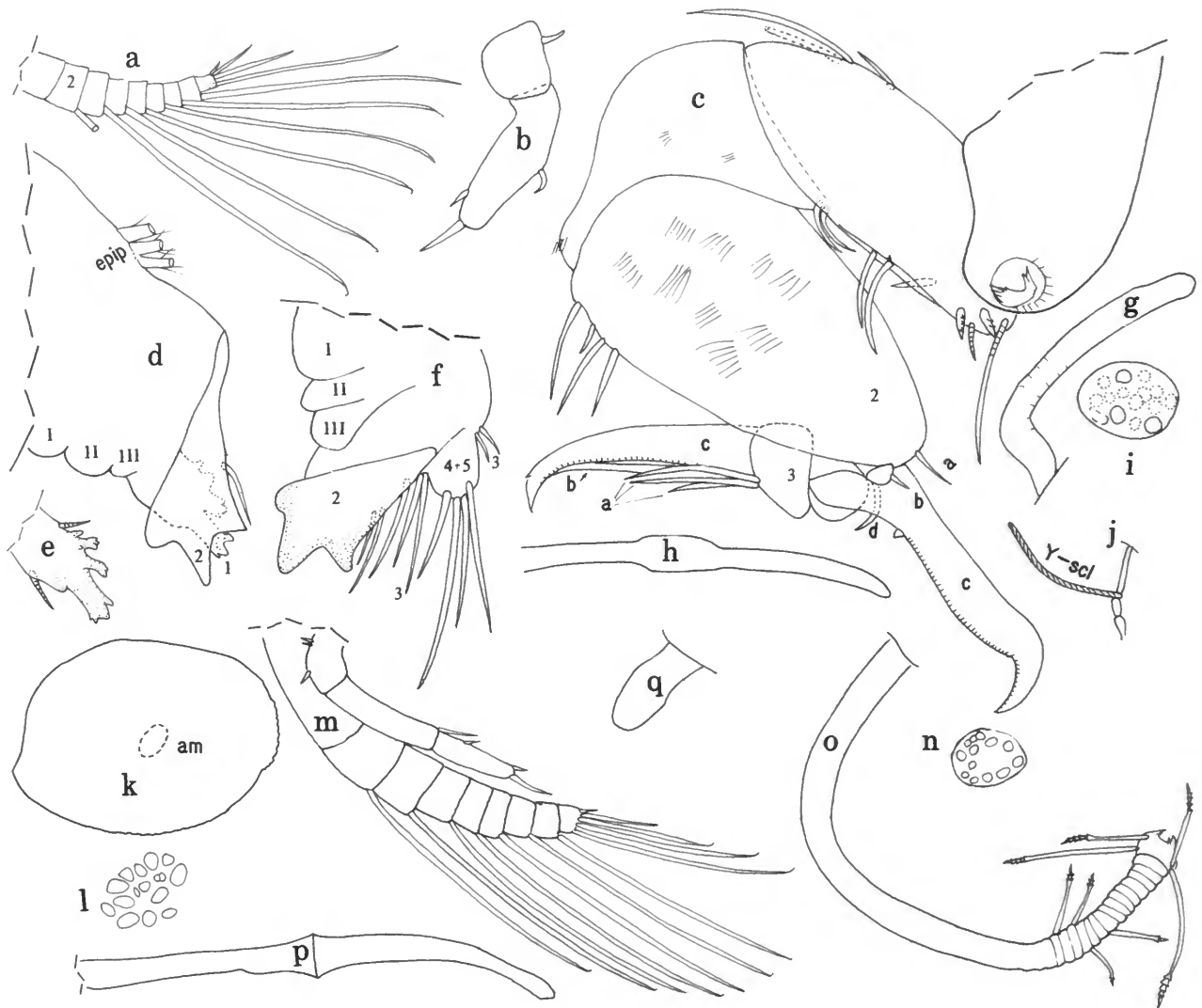


FIGURE 79.—*Ruiderma arx*, new species, males, paratypes: instar III, USNM 193413: a, exopodite of 2nd antenna; b, endopodite of right 2nd antenna, lv; c, right mandible, mv; d, left 5th limb (not all bristles shown), lv; e, main tooth of 1st exopodial joint of right 5th limb, av; f, right 5th limb (1st exopodial joint and many bristles not shown), av; g, left 7th limb; h, Bellonci organ; i, right lateral eye, anterior to right; j, left Y-sclerite (striated), anterior to left. Instar IV, USNM 193414: k, complete specimen from right side, length 1.26 mm; l, central adductor muscle attachments of right valve, anterior to right; m, endopodite and exopodite of right 2nd antenna, mv; n, right lateral eye; o, right 7th limb (only distal rings shown), lv; p, Bellonci organ; q, right copulatory organ.

b-bristle, and stout c-bristle with small distal tooth on dorsal margin and small teeth along ventral margin except near tip.

Maxilla: Endite I with 6 bristles (2 claw-like pectinate, 4 slender ringed); endite II with 5 bristles (2 claw-like pectinate, 3 slender ringed); endite III with 6 bristles (3 claw-like pectinate, 3 slender ringed). Coxale with short dorsal bristle. Basale with 3 bristles (1 dorsal, 1 medial, 1 ventral). Exopodite with 3 bristles (2 long, 1 short). 1st endopodial joint with 1

alpha-bristle and 1 beta-bristle. 2nd endopodial joint with 2 stout pectinate claws and 5 bristles.

Fifth Limb (Figure 79d-f): Epipodite with 34 spinous bristles. Endite I with 3 bristles; endite II with 4 bristles; endite III with 7 bristles. Main tooth of 1st exopodial joint with 4 constituent teeth (Figure 79e): proximal tooth small smooth; 2nd to 4th teeth larger and with marginal teeth; 1 marginal bristle proximal to proximal tooth and 1 bristle proximal to

distal tooth. 2nd exopodial joint comprising large flat sclerotized tooth with 2 smooth lobes forming inner margin, 1 stout bristle on inner margin, and smaller posterior bristles near inner lobe.

Sixth Limb: With many bristles (end joint with 4 bristles; bristles of endites not counted).

Seventh Limb (Figure 79g): Elongate, bare; proximal part with slight indication of segmentation.

Furca: Similar to that of instar II (3 stout claws followed by 2 weak claws).

Bellonci Organ (Figure 79h): Similar to that of female except for rounded tip.

Eyes: Medial eye obscured on specimen studied. Lateral eye with 4 well-defined and many poorly defined ommatidia (Figure 79i).

Posterior of Body: Similar to that of adult female.

Y-Sclerite (Figure 79j): Unbranched, similar to that of adult female.

DESCRIPTION OF INSTAR IV MALE (Figure 79k-q).—Carapace similar in ornamentation and shape to that of adult female (Figure 79k).

Infold: Anterior infold dorsal to incisur with 5 long bristles forming row and minute bristle at outer edge of infold at incisur; anteroventral infold striate, with 3–6 bristles forming row; infold of caudal process with well-developed “pocket” with 6 bristles forming row along edge (posterior of these with base slightly ventral to edge of pocket), and few additional smaller bristles on ventral infold just anterior to caudal process.

Selvae: Similar to that of adult female.

Carapace Size: USNM 193414, length 1.26 mm, height 0.94 mm. Sex undetermined on the following: USNM 193419 (part), 4 specimens, length 1.27 mm, height 0.94 mm; length 1.31 mm, height 0.90 mm; length 1.26 mm, height 0.93 mm; length 1.23 mm, height 0.92 mm. Average length 1.27 mm, average height 0.93 mm.

Central Adductor Muscle Attachments (Figure 79l): Comprising about 15 individual scars.

First Antenna: Distribution of bristles similar to that of instar III; b-bristle about $\frac{3}{4}$ length of a-bristle.

Second Antenna (Figure 79m): Protopodite bare. Exopodite similar to that of instar III except for 9th joint having 5 bristles (2 short); all bristles of exopodite bare, and except for 2 short bristles of 9th joint, all with recurved tips. Endopodite 3 jointed: 1st joint with 3 short bristles (2 proximal, 1 distal); 2nd joint elongate with 1 terminal bristle; 3rd joint elongate with 3 bristles (1 short, proximal; 1 long, terminal; 1 short, subterminal).

Mandible: Differs from instar III male in having only 1 instead of 3 ventral bristles at midlength of basale, and 2 d-bristles on the 2nd endopodial joint. (The presence of only 1 rather than 3 ventral bristles at midlength of basale may be an aberrance.)

Maxilla: Endite I with 5 bristles (3 pectinate claw-like, 2 slender ringed); endite II with 4 bristles (2 pectinate claw-like,

2 ringed slender); endite III with 6 bristles (3 pectinate claw-like, 3 ringed slender). Coxale with short dorsal bristle. Basale with 3 bristles (1 dorsal, 1 ventral, 1 medial). Exopodite small with 3 bristles (2 long, 1 short). 1st endopodial joint with 1 alpha-bristle and 1 beta-bristle. 2nd endopodial joint with 2 stout pectinate claws and 4 ringed bristles.

Fifth Limb: Endite I with 3 bristles; endite II with 5 bristles; endite III with 7 bristles. Main tooth of 1st exopodial joint with 4 constituent teeth and 2 bristles similar to those of adult female. 2nd exopodial tooth with large flat tooth with 3 lobes along inner margin and 4 bristles similar to those of adult female. 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer lobe. 4th and 5th joints fused, with total of 4 bristles.

Sixth Limb: With many bristles (end joint with 5 bristles (posterior 2 hirsute)).

Seventh Limb (Figure 79o): 4 bristles in proximal group (2 on each side), each bristle tapering and with 1 or 2 bells; 4 bristles in terminal group (1 short and 1 longer on each side), each bristle with 3 or 4 bells, shorter bristles tapering. Terminus with opposing combs, each with 2 or 3 minute teeth.

Furca: Similar to that of adult female.

Bellonci Organ (Figure 79p): Similar to that of instar III except tip more pointed.

Eyes: Medial eye obscured on specimen studied. Lateral eye unpigmented, with 13 small ommatidia (Figure 79n).

Genitalia (Figure 79q): Copulatory organ comprising small bare lobe.

Posterior of Body and Y-Sclerite: Similar to those of adult female.

COMPARISONS.—*Rutiderma arx* differs from both *R. leloeffi* Kornicker, 1975b, and *R. tridens* Kornicker and Caraion, 1978, in the female carapace having a smaller rostrum, and in the terminal claw of the 2nd endopodial joint of the female mandible not having a pronounced tip. The infold of the caudal process of *R. tridens* has 3 “teeth” along the dorsal margin of the “pocket” that are absent on *R. arx*, and the carapace of *R. tridens* bears lateral ribs absent on *R. arx*. *Rutiderma irrostratum* Kornicker and Caraion, 1978, differs from *R. arx* in having a carapace with lateral ribs, and in having marginal teeth on the 3 lobes of the large flat tooth forming the 2nd exopodial joint of the 5th limb. The carapace of *R. arx* differs from that of *R. compressum* Brady and Norman, 1896, and *R. normani* Poulsen, 1965, in lacking lateral ribs. Only the male is known of *R. fuscum* Poulsen, 1965; the posterior edge of the alar process on the carapace of that species bears a backward pointing triangular process at the ventral and dorsal ends that is not present on the male of *R. arx*. The male *R. arx* (length 1.30–1.34 mm) is longer than the male *R. fuscum* (length 1.10 mm).

ONTOGENY (Tables 13–17; Figure 80).—Juveniles of Rutidermatidae have received little study. Poulsen (1965:28–31) described 4 juveniles of *R. normani*, and these were interpreted by Hiruta (1983:674) to be instars II, III, and IV; I concur with Hiruta. Kornicker (1985a:20–23) described instars

II, III, and IV of *R. hartmanni*. Poulsen (1965:30) stated that the sex of 2 early instars of *R. hartmanni* could not be ascertained, but the legend to his fig. 7 illustrating them identified both as "females?"; the endopodites of the illustrated 2nd antennae (fig. 7b,i) suggest that the juveniles are males. Juveniles interpreted to be instars I, II, III, and IV of *R. arx* are described herein.

Carapace: The shape of the carapace of instar I differs from those of later stages in having a less-produced caudal process (Figure 76f). The anteroventral infold differs in not having striae, which appear first on instar II. The number of long bristles on the anterior infold dorsal to the incisor is 3 on instars I and II, 4 on instar III, 5 on instar IV, and 6-8 on adults. The number of bristles on the anteroventral infold is 1 on instars I and II, 4 on instar III, 3-6 on instar IV, and 7 on adults. The "pocket" on the infold of the caudal process appears first on instar IV. The number of bristles on the infold of the caudal process is 4 (including 1 minute bristle) on instar I, 3 on instar II, 4 or 5 on instar III, 6 on instar IV, and 8 or 9 on the adult. The selva is similar on all stages, but hairs forming a fringe on the lamellar prolongation along anterior margin of valves are

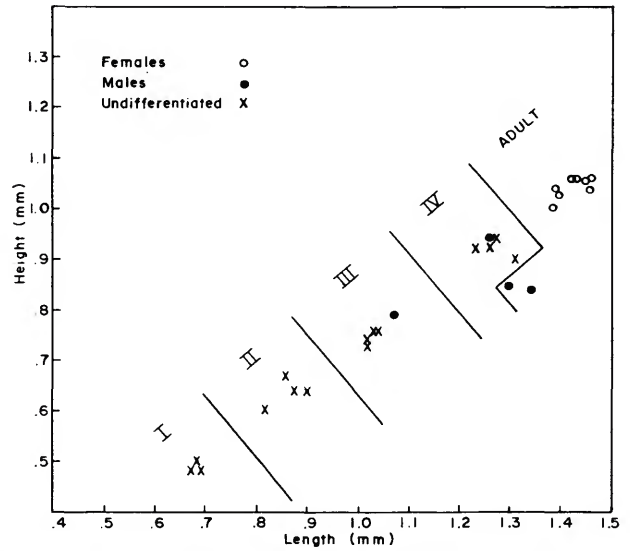


FIGURE 80.—*Rutiderma arx*, new species, carapace length-height graph of instars I-IV and adults.

TABLE 13.—Average shell dimension and calculated growth factors for *Rutiderma arx*. (Average dimensions of juveniles include both males and females.)

Growth stage	Average length (mm)	Growth factor	Average height (mm)	Growth factor	Number of specimens
I	0.68	1.28	0.49	1.31	3
II	0.87	1.20	0.64	1.19	4
III	1.04	1.22	0.76	1.22	5
IV	1.27	1.13 ♀ 1.04 ♂	0.93	1.12 ♀ 0.91 ♂	5
Adult female	1.43		1.04		8
Adult male	1.32		0.85		2

relatively longer on instar I. Average lengths and heights of instars and adults growth factors are presented in Table 13.

First Antenna: The rate of addition of bristles to joints of the 1st antenna are presented in Table 14. The distribution of bristles on the 4th joint supports the key to early myodocopid instars by Hiruta (1983:673) in which the 1st instar is identified by not having bristles on the joint, the 2nd instar is without a ventral bristle, and later instars have a ventral bristle. The sensory bristle of the 5th joint is without marginal filaments on instar I and has 1 or 2 filaments on later instars. The length of the b-bristle of the 7th joint relative to the length of the a-bristle increases on each stage from 1/4 on instar I to equal length on

the adult female and twice the length on the adult male. The c-bristle of the 7th joint and the g-bristle of the 8th joint are unusual on instar I in having 9-11 minute, rounded, distal, marginal teeth not present on later stages. The f-bristle of instar I has distal marginal spines not present on later stages. On instar I only the c-bristle was observed to have marginal filaments, and these (2) were minute and indistinct. On instar II and on the adult female 1 or 2 filaments were observed on the c-, f-, and g-bristles. On the adult male the c- and f-bristles are extremely long and bear 10 or 11 marginal filaments.

Second Antenna: The single-jointed endopodite of instar I is without bristles, has 1 bristle on instar II, and 5 bristles on the

TABLE 14.—Number of bristles on each joint of 1st antenna of *Rutiderma arx* (d = dorsal, l = lateral, m = medial, t = total, v = ventral).

Stage	First t	Second l/d	Third v/d	Fourth v/d	Fifth v	Sixth m	Seventh t	Eighth t
I	0	0/0	1/1	0/0	1	1	3	4
II	0	1/1	1/1	0/1	1	1	3	4
III (male)	0	1/1	1/2	1/1	1	1	3	4
IV (male)	0	1/1	1/2	1/1	1	1	3	4
Adult								
female	0	1/1	1/2	2/1	1	1	3	4
male	0	1/1	1/2	3/1	1	1	3	4

TABLE 15.—Morphology of 2nd antenna, 6th and 7th limbs, and caudal furca of *Rutiderma arx* (X = 1 primary furcal claw, x = 1 secondary furcal claw).

Stage	Second antenna bristles on 9th joint	Sixth limb bristles	Seventh limb length, bristles	Caudal furca claws
I	2	0	absent	XX
II	3	1	short, bare	XXXxx
III (male)	4	many	long, bare	XXXxx
IV (male)	5	many	long, 8 tapering	XXXxxx
Adult				
female	6	many	long, 10 cylindrical	XXXxxx
male	5	many	long, 8 cylindrical	XXXxxx

TABLE 16.—Rates of addition of bristles on joints of mandibles of *Rutiderma arx*.

Stage	Coxale endite	Basale	Endopodite							
			1st joint	2nd joint				3rd joint		
				a	b	c	d	a	b	c
I	stout	8	1	0	0	1	0	1	1	1
II	stout	8	2	1	0	1	0	2	1	1
III	stout	10	2	1	1	1	1	3	1	1
IV	stout	8*	2	1	1	1	2	3	1	1
Adult										
female	stout	10	2	2	1	1	2	3	1	1
male	minute	8	2	2	1†	1‡	2	3	1	1

* Instar IV male may be aberrant and might normally have 10 bristles.

† b-bristle of adult male a normal bristle, on juveniles and adult female a small spade-like process with minute terminal bristle.

‡ c-bristle claw-like, but slenderer on adult male than on juveniles and adult female; also, c-bristle of adult male with incomplete rings absent on juveniles and adult female.

adult female. On male instar III the endopodite has 2 joints, which increases to 3 joints on instar IV and the adult. On male instar IV the endopodite is straight, whereas, on the adult the 3rd joint is reflexed on the 2nd. All bristles of the exopodite of juveniles are without natatory setae, and therefore are probably incapable of efficient swimming. Natatory setae are on joints

6-9 of the adult female and joints 3-9 of the adult male, indicating that the male is a better swimmer than the female. Except for 1 or 2 small bristles on the 9th exopodial joint, bristles without natatory hairs have recurved tips of unknown purpose. On instar I the tips are more strongly curved and hook-like (Figure 77f), suggesting that they may be used for

adhering. The rate of addition of bristles of the 9th exopodial joint is presented in Table 15.

Mandible: Juvenile mandibles in the Rutidermatidae are similar to that of the adult female, differing considerably from the adult male (Kornicker, 1985a:11). The rate of addition of bristles of the mandible is presented in Table 16. The lettering system used for bristles of the 2nd and 3rd endopodial joints is that proposed by Kornicker (1985a:2).

Maxilla: Juveniles and the adult female have similar maxillae, but the adult male maxilla is reduced and without claw-like bristles on the endites and 2nd endopodial joint. The total number of claw-like bristles on the 3 endites is 6 on instar I, 7 on instars II and III, 8 on instar IV and the adult female. The number of claw-like bristles on the 2nd endopodial joint is 1 on instar I, 2 on later juvenile instars and the adult female. The exopodite bears 3 bristles on all juvenile instars and on the adult male and female.

Fifth Limb: Juveniles and the adult female have similar 5th limbs, but the adult male fifth limb has a reduced exopodite without stout teeth on the 1st and 2nd joints. The main tooth of the 1st exopodial joint of instar I is not divided into 3 or 4 large teeth as in later stages, instead it comprises a single arcuate row of 6 or 7 small rounded teeth. The number of teeth comprising the main tooth is 3 on instar II, and 4 on later instars and the adult female. The large flat tooth of the 2nd exopodial joint differs considerably on instar I, and was difficult to interpret on the specimen studied, but appears to have a single rounded lobe in place of the 2 or 3 more acuminate lobes of later instars. The number of lobes on the inner margin of the flat tooth is 2 on instars II and III, and 3 on instar IV and the adult female.

Sixth Limb (Table 15): The 6th limb of instar I is slender, flap-like, with 2 or 3 small processes bearing long stiff hairs and is without bristles. The limb of instar II is also slender but bears 1 long proximal bristle on the anterior margin. The limbs of later juveniles as well as adults are broad and bear many bristles.

Seventh Limb (Table 15): The limb is absent on instar I, short and bare on instar II, elongate and bare on instar III, elongate and with bristles on instar IV and adults. The bristles taper slightly on instar IV, and are cylindrical on the adult. Each limb of instar IV and the adult male bears 8 bristles whereas that of the adult female bears 10.

Furca (Table 15): The number of primary claws on each lamella of the furca is 2 on instar I and 3 on later stages. The number of secondary claws is 0 on instar I, 2 on instars II and III, and 3 on instar IV and the adults.

Bellonci Organ: The tip of the organ is rounded on instars I and III, pointed on instar IV and the adult male, and minutely bifurcate on the adult female (USNM 193411). The tip bears a small protuberance on instar II. The shape of the tip may vary on different individuals, but the degree of variability was not studied herein.

Medial Eye: The number of dorsal filaments is 0 on instar I, 3 on instar II and the adult female (USNM 193411), and 4 on

TABLE 17.—Comparisons of some appendages of instars II and III of *Rutiderma arx*, *R. hartmanni*, and *R. normani* (nd = no data, n/ob = not observed).

Character	<i>arx</i>	<i>hartmanni</i>	<i>normani</i>
INSTAR II			
1st antenna			
bristles 2nd joint	2	2	2
bristles 3rd joint	2	2	2
bristles 4th joint	1	1	1
2nd antenna			
bristles 9th joint	3	3	3
Mandible			
2nd endopodial joint			
a-bristle	1	1	nd
b-bristle	0	0	nd
d-bristle	0	1	nd
3rd endopodial joint			
a-bristle	2	2	nd
b-bristle	1	1	nd
5th limb			
1st exopodial joint			
number of teeth	3	3	2
2nd exopodial joint			
number of lobes, inner edge	2	2	2
6th limb			
number of bristles	1	1	1
7th limb	small, bare	small, bare	n/ob
Furca			
number of primary claws	3	3	3
number of secondary claws	2	2	2
INSTAR III			
1st antenna			
bristles 2nd joint	2	2	2
bristles 3rd joint	3	3	3
bristles 4th joint	2	2	2
2nd antenna			
bristles 9th joint	4	4	4
Mandible			
2nd endopodial joint			
a-bristle	1	2	nd
b-bristle	1	1	nd
d-bristle	1	1	nd
3rd endopodial joint			
a-bristle	3	2	nd
b-bristle	1	1	nd
5th limb			
1st exopodial joint			
number of teeth	4	3	4
2nd exopodial joint			
number of teeth, inner edge	2	2	2
6th limb			
number of bristles	many	many	many
7th limb			
elongate, bare	yes	yes	yes
Furca			
number of primary claws	3	4	3
number of secondary claws	2	2	2

the adult male (USNM 193409). The medial eye was obscured on the examined specimens of instars III and IV. The number of filaments probably varies on different individuals.

Lateral Eye: The lateral eye of the adult female is small with 4 minute ommatidia, whereas, that of the adult male is large with 15–20 ommatidia. The eye of the male instar IV is well developed with about 13 ommatidia; the eye of the male instar III also is well developed with many ommatidia of which only 4 are distinct. The ommatidia in instars I and II were not well defined, and some interpreted herein to be ommatidia could in fact be cells unrelated to ommatidia; USNM 193417A (instar I) has 5 cells or ommatidia, and USNM 193412 (instar II) has about 14.

Posterior of Body: The posterior margin of the body dorsal to the furca is hirsute on all instars and adults observed.

Y-Sclerite: The Y-sclerite is absent in instar I and is unbranched on all later juvenile instars and on the adult female. Of the 2 adult males examined, 1 is distinctly branched, and on the other (USNM 193409) the ventral branch is indistinct.

DISCUSSION: During ontogeny the addition of appendages and, with few exceptions, the addition to appendages of bristles and claws are similar for *R. normani*, *R. hartmanni*, and *R. arx* (Table 17). (Poulsen (1965:30) did not observe a 7th limb on instar II of *normani*; but it could have been overlooked because of its small size.) *Rutiderma normani*, *R. hartmanni*, and *R. arx* appear to have 4 juvenile growth stages (Figure 80). Because of the similarity of the 6th limbs of instar II of the 3 species, and the 7th limbs of instar III, it is predicted that instar I of both *hartmanni* and *normani* are similar to that of *arx*, which has no bristles on the 6th limb, no 7th limb, and no bristles on the 4th segment of the 1st antenna. Except for some Cyllindroleberididae, early instars of myodocopids have bristles added to the 6th and 7th limbs in a predictable manner. Therefore, it is possible to construct a key to the instars of *Rutiderma*. In the key it is assumed that the genus has a total of 5 growth stages. If some members of the genus should have more than 5 stages the additional stage would probably appear after stage III.

Rutiderma rex, new species

FIGURES 81–83

ETYMOLOGY.—From the Latin *rex*, king.

HOLOTYPE.—MNHN Os 277, ovigerous female in alcohol.

TYPE LOCALITY.—Sta 101-DS, 8 Apr 1977, NW Île du Lys, Glorioso Islands, 11°25'42"S, 47°19'30"E, depth 26 m.

PARATYPES.—Sta 101-DS: USNM 193415, 1 ovigerous female on slide and in alcohol; MNHN Os 278, 1 adult female in alcohol.

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT FEMALE (Figures 81–83).—Carapace rugose, with 2 stout horizontal ribs (1 dorsal and 1 ventral to central adductor muscle attachments; attachments not

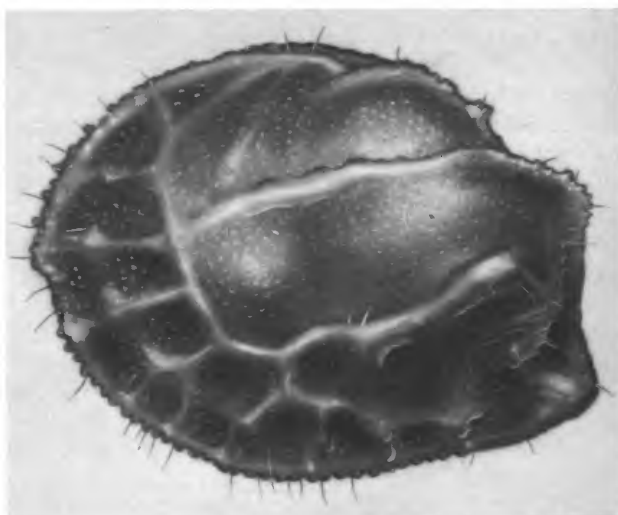


FIGURE 81.—*Rutiderma rex*, new species, adult female, paratype, USNM 193415, complete specimen from left side, length 0.92 mm.

shown in Figure 81, but they are located on highlighted mound just anterior to valve midlength); anterior end of ventral horizontal rib bending dorsally just anterior to central adductor muscle attachments and forming curving rib terminating near dorsal margin at about midlength of valve; anterior part of curving rib with 4 radial riblets extending anteriorly and reaching anterior edge of valve; about 5 radial riblets along ventral edge of valve extending dorsally but not reaching ventral horizontal rib; dorsal horizontal rib terminating posteriorly in stout backward oriented process; ventral end of stout process continuing as vertical rib extending ventrally and terminating just anterior to caudal process; a small curving rib bearing 6 or 7 minute processes lying just within and paralleling posterodorsal corner of each valve; posterior edge of right valve only with stout process lying medial to the much stouter process at posterior end of dorsal horizontal rib. Incisur minute, and caudal process short, triangular in lateral view.

Ornamentation (Figures 81, 82a): Surface with abundant small fossae; bristles numerous along ventral and anterior margins and sparse on lateral surface; anterior and ventral edges of valve scalloped.

Infold: Anterodorsal infold above minute angle (angle indicates location of incisur) with 4 or 5 bristles forming row paralleling anterodorsal margin (Figure 82a); anteroventral infold striate, with 1 small bristle followed by 3 or 4 bristles forming row paralleling anteroventral margin. Infold of caudal process with "pocket" having 4 or 5 small bristles along dorsal edge; 5 small additional bristles anterior to pocket seemingly a continuation of bristles forming row along dorsal edge of pocket. Posterior infold with small bristle near inner edge of infold dorsal to caudal process (Figure 82b,c). Left valve of

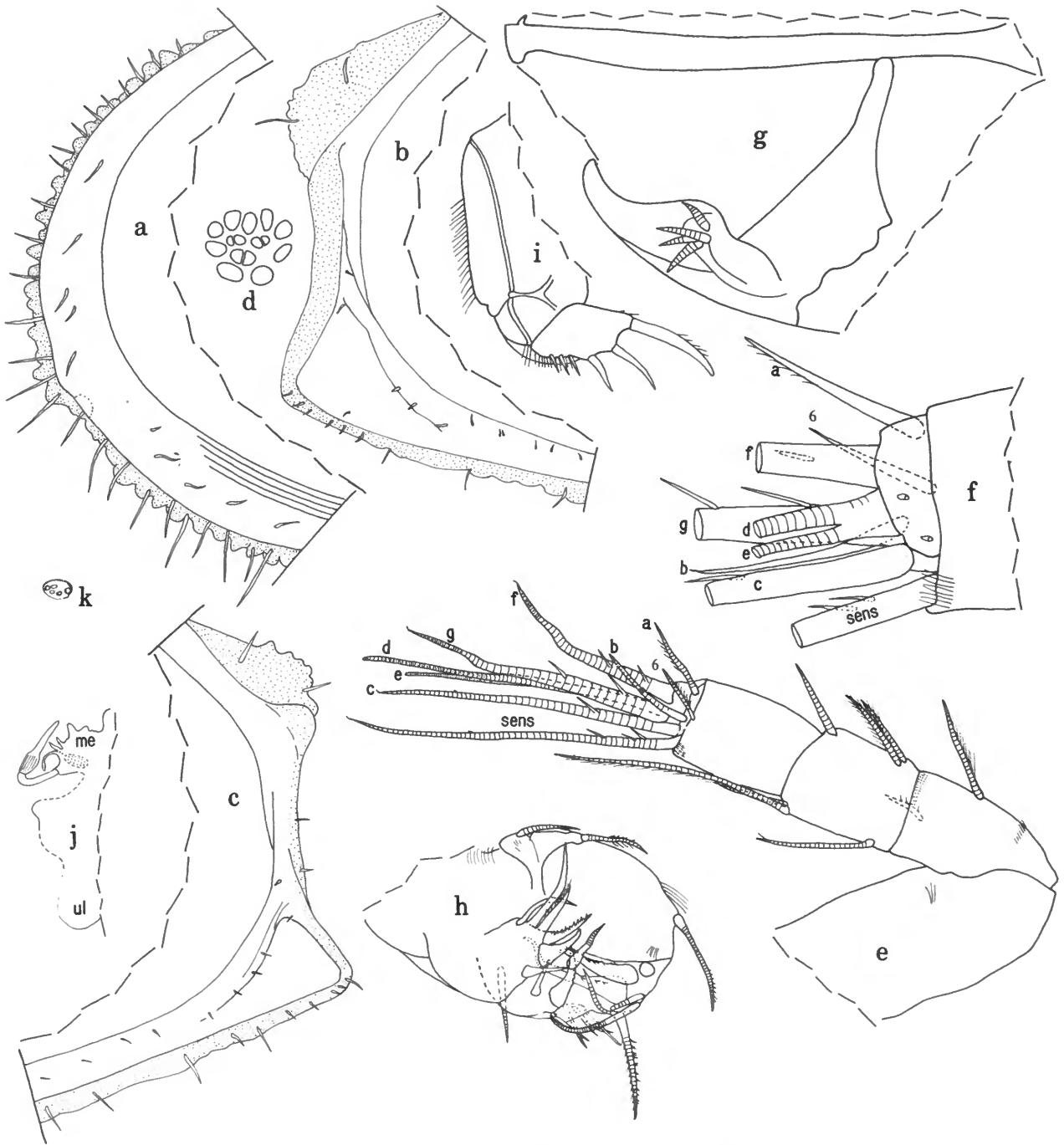


FIGURE 82.—*Ruiderma rex*, new species, adult female, paratype, USNM 193415: *a*, anterior end of right valve, iv; *b, c*, posterior ends of left and right valves, iv; *d*, ends of central adductor muscle attachments projecting from body when left valve removed, anterior to left; *e*, right 1st antenna, mv; *f*, tip of left 1st antenna, lv; *g*, protopodite and endopodite of right 2nd antenna, mv; *h*, maxilla; *i*, posterior of body from right side, anterior to right; *j*, anterior of body showing medial eye, Bellonci organ, and upper lip; *k*, lateral eye.

USNM 193415 with minute bristle in pocket of caudal process near ventral margin of valve (Figure 82b).

Selvage: Lamellar prolongation of selvage undivided at incisur and tip of caudal process, with marginal hairs along anterodorsal, anteroventral, and anterior half of ventral margin of valve, bare elsewhere; marginal hairs longest along anterior margin dorsal to incisur and anteroventral margin.

Central Adductor Muscle Attachments (Figure 82d): Comprising 15 ovoid attachments at valve midheight just anterior to midlength, and between lateral ribs.

Carapace Size: MNHN Os 277, holotype, length 0.90 mm, height 0.70 mm. USNM 193415, length 0.92 mm, height 0.68 mm. MNHN Os 278, length 0.92 mm, height 0.72 mm.

First Antenna (Figure 82e, f): 1st joint with few distal medial spines, and proximal lateral spines forming 2 rows near ventral margin (lateral spines not shown on illustration). 2nd joint with proximal spines forming row near dorsal margin, distal lateral spines forming row near ventral margin, dorsal bristle with marginal spines, and distal spinous lateral bristle. 3rd joint fused to 4th, with 3 spinous bristles (2 dorsal, 1 ventral). 4th joint elongate, with 3 bristles (2 ventral, 1 dorsal). 5th joint elongate, with lateral spines forming row near base of sensory bristle (Figure 82f); sensory bristle with 3 proximal filaments, 1 minute distal marginal spine, and terminal spine. 6th joint minute, fused to 5th, with spinous medial bristle. 7th joint: a-bristle spinous, slightly longer than bristle of 6th joint; b-bristle slightly longer than a-bristle, with minute protuberance at midlength and terminal spine; c-bristle slightly shorter than sensory bristle of 5th joint, with small proximal filament, 1 minute distal spine, and terminal spine. 8th joint: d- and e-bristles fused at base (Figure 82f); d-bristle about same length as c-bristle, bare with blunt tip; e-bristle narrower and slightly shorter than d-bristle, bare with blunt tip; f-bristle with 2 small proximal filaments and terminal spine; distal $\frac{1}{3}$ of bristle crooked, slender, with narrowly spaced rings; g-bristle with 2 small proximal filaments and terminal spine; distal $\frac{1}{4}$ of bristle crooked, slender, and with narrowly spaced rings. Lateral side of fused 7th and 8th joints with 2 minute processes near midwidth (Figure 82f).

Second Antenna (Figure 82g): Protopodite bare. Endopodite comprising single joint with 4 proximal bristles of equal length. Exopodite: long 1st joint with small terminal tubular bristle near ventral margin; bristle of 2nd joint almost twice length of combined lengths of joint 2-9; bristles of joints 2-5 about same length, with minute blunt spines along ventral margins and recurved tips; bristles of joints 6-8 long, with natatory hairs, no spines; 9th joint with 6 bristles (3 long with natatory hairs, 1 medium with natatory hairs, 2 minute, bare, dorsal). Spines not observed on joints.

Mandible (Figure 83a-c): Coxale endite bifurcate (with distal branch stouter, both branches with long hairs near base and pectinate). Basale: dorsal margin with 3 bristles at midlength (1 long, 2 short); ventral margin with 7 bristles (2 proximal, unringed, pectinate; others ringed, bare, or with marginal spines). Exopodite absent. 1st endopodial joint

triangular, with medial spines forming rows and 2 small ventral bristles. 2nd endopodial joint: medial surface with spines forming rows; dorsal margin with 4 spinous bristles; ventral margin with 1 terminal a-bristle, 1 terminal b-bristle in form of small process with small, terminal, ringed, tubular bristle; c-bristle stout claw-like unringed, with proximal dorsal tooth and serrate dorsal margin; 2 d-bristles lateral and with marginal spines. 3rd endopodial joint: 3 ringed a-bristles; b-bristle unringed, claw-like, with ventral teeth perpendicular to bristle; c-bristle stout claw-like unringed, with small teeth along ventral margin except near tip, and with minute distal dorsal tooth (obscured on illustrated specimen with closed jaws). Closed jaws with tip of claw-like c-bristle of 3rd joint medial to tip of claw-like c-bristle of 2nd joint (Figure 83b).

Maxilla (Figure 82h): 3 well-developed endites, each with 2 or 3 stout, terminal, pectinate, claw-like bristles and additional ringed bristles. Precoxale with dorsal fringe of long hairs. Coxale with dorsal hairs and short dorsal bristle. Basale with 2 short spinous bristles (1 ventral, 1 dorsal). 1st endopodial joint with 1 spinous alpha-bristle and 1 spinous beta-bristle. 2nd endopodial joint with 2 stout pectinate claw-like bristles and several ringed bristles. Exopodite small with 3 bristles (not shown on illustrated limb). (Limbs of specimen studied curled in a manner making it difficult to ascertain exact number of bristles.)

Fifth Limb (Figure 83d,e): Endites I and II each with 3 bristles; endite III with about 9 bristles (not all shown on illustrated limb). 1st exopodial joint with 4 constituent teeth: proximal tooth small, smooth; 2nd to 4th teeth larger and with marginal teeth; 1 bristle proximal to proximal tooth, and 1 proximal to distal tooth (Figure 83e). 2nd exopodial joint comprising large flat sclerotized tooth having 3 smooth lobes forming inner margin, 1 stout bristle on inner margin, 2 smaller posterior bristles near inner lobe of flat tooth, and 2 minute posterior spine-like bristles near outer corner of flat tooth (Figure 83e). Inner lobe of 3rd exopodial joint with 3 spinous bristles; outer lobe with 2 bristles (Figure 83d). 4th and 5th exopodial joints fused, with total of 3 or 4 spinous bristles.

Sixth Limb (Figure 83f): With 2 epipodial bristles. Endite I with 3 bristles; endites II-IV each with 2 bristles. End joint with 6 bristles (anterior 2 with short marginal spines, next 2 with long proximal and short distal spines, posterior 2 plumose).

Seventh Limb (Figure 83g,h): 3 or 4 bristles in proximal group, 1 or 2 on each side, each bristle with 2 or 3 bells and distal marginal spines. 5 or 6 bristles in terminal group, 2 or 3 on each side, each bristle with 2-5 bells and distal marginal spines. Terminus with opposing combs with indistinct teeth (about 6 teeth on 1 side, 4 on other).

Furca (Figure 82i): Each lamella with 3 stout claws followed by 3 smaller claws; long hairs along margin of lamellae following claws; claws 1-3 with distal $\frac{1}{3}$ slightly crooked; tips of claws 1 and 2 slightly rounded; tip of claw 3 pointed; tips of claws 4-6 slender and pointed; claws with slender closely spaced spines along posterior margins (not

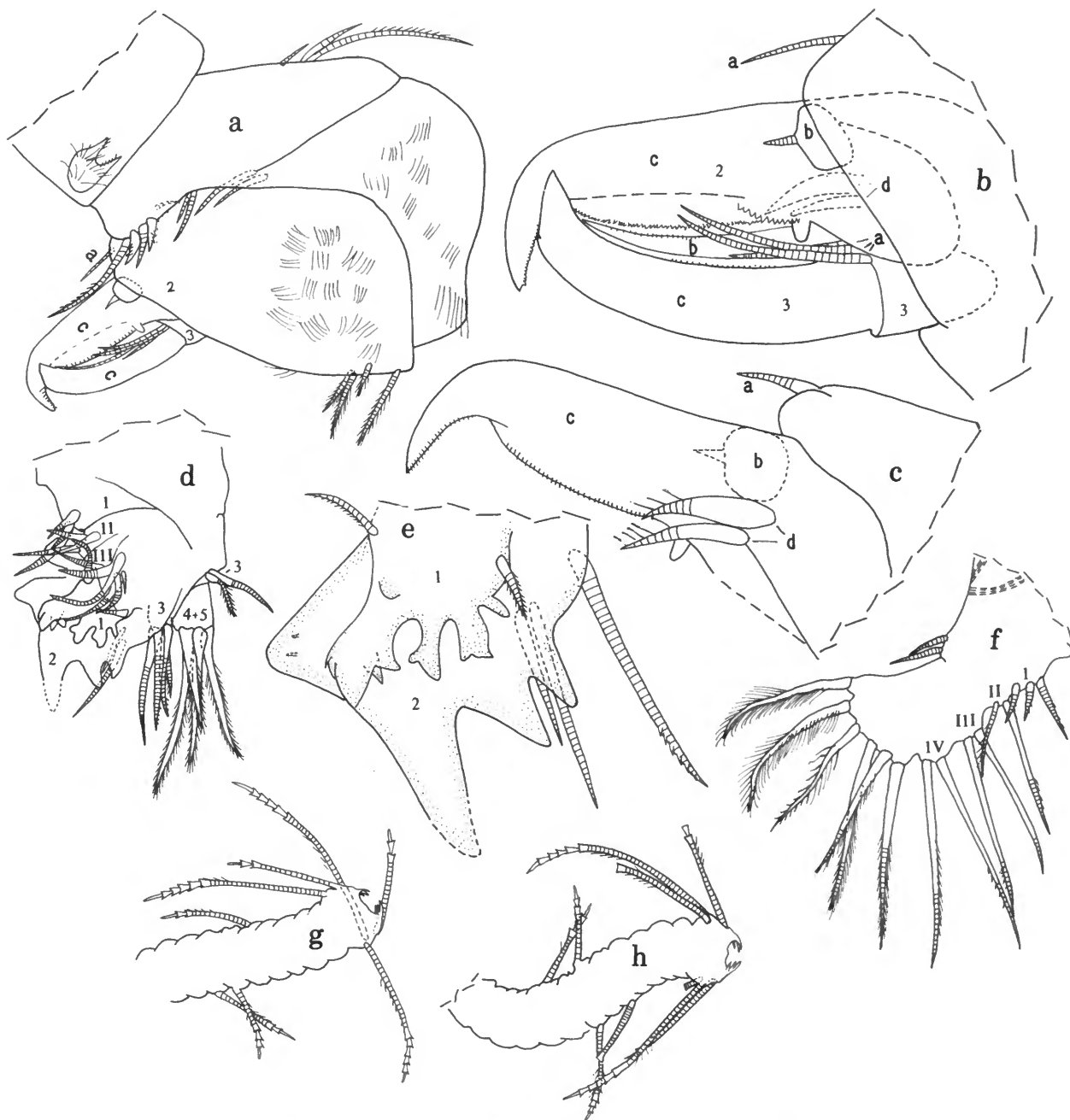


FIGURE 83.—*Rutiderma rex*, new species, adult female, paratype, USNM 193415: a, left mandible, mv; b, detail of tip of mandible shown in a, mv; c, part of 1st and 2nd endopodial joints of right mandible, lv; d, right 5th limb, av; e, detail from 5th limb shown in d, av; f, right 6th limb, mv; g, h, 7th limbs.

shown); claw 1 with distal hairs along anterior margin, remaining claws with fewer anterior hairs (not shown); claw 1 of right lamella with long hairs forming medial row near base; anterior edge of right lamella proximal to claw 1 with few hairs;

right lamella slightly anterior to left resulting in claws 1-3 of left lamella positioned in spaces separating claws 1-3 of right lamella in lateral view.

Bellonci Organ (Figure 82j): Elongate, broad segment at

midlength with striate surface (visible at high magnification, $\times 100$ objective, $\times 15$ ocular) and without distal suture; tip broadly rounded.

Eyes: Medial eye unpigmented; eye of USNM 193415 with 1 long and 2 shorter filaments (Figure 82j). Lateral eye minute, indistinct, unpigmented, with 4 or 5 ommatidia (Figure 82k).

Upper Lip (Figure 82j): Simple, rounded in lateral view.

Posterior of Body (Figure 82i): Hirsute.

Y-Sclerite (Figure 82i): With ventral branch.

Eggs: Holotype with 3 eggs in marsupium, USNM 193415 with 4.

COMPARISONS.—The carapace of *R. rex* with its rugosity and minute incisur resembles that of *Rutiderma compressum* Brady and Norman, 1896:673. The carapace of *R. rex* is much smaller (length of *R. compressum* 1.50 mm compared to 0.90–0.92 mm for *R. rex*); the tip of the claw-like c-bristle on the 2nd endopodial joint of the mandible of *R. compressum* is produced and pointed (Brady and Norman, 1896, pl. LVIII: fig. 14), unlike that of *R. rex* (Figure 83c). Only the male is known of *Rutiderma fuscum* Poulsen, 1965:41, so its carapace and most appendages are not directly comparable with those of the female *R. rex* (male unknown). However, *R. fuscum* has a pointed Bellonci organ (Poulsen, 1965, fig. 1), whereas that of *R. rex* is broadly rounded, indicating that they are not conspecific. The small size and rugosity of the carapace of *R.*

rex easily distinguishes it from *R. arx*, the only other species of *Rutiderma* in the present collection; they differ also in the morphology of the Y-sclerite, which is unbranched in *R. arx* and branched in *R. rex*. The carapace of *R. rex* differs from that of *R. vox* Kornicker (1991:78) in having a smaller rostral projection.

SARSIELLIDAE Brady and Norman, 1896

This family includes 2 subfamilies: Sarsiellinae Brady and Norman, 1896, and Dantynaie Kornicker and Cohen, 1978. Two species in the latter subfamily, *Dantya benthedii* Kornicker, 1983c, and *Dantya fossula* Kornicker, 1983c, both in the present collection, were described previously by Kornicker (1983c:11), and for completeness are also listed herein in Tables 1 and 2 and Appendix 1. The species described herein are members of the Sarsiellinae. The known latitudinal range of members of this family is 63°N to 73°29'S, and the known depth range is intertidal to 4758 m (Kornicker and Caraion, 1980:2).

SARSIELLINAE Brady and Norman, 1896

This subfamily includes 13 genera (Kornicker, 1991:84). Five genera are in the present collection: *Chelicopia*, *Eusarsiella*, *Metasarsiella*, *Neomuelleriella*, and *Eurypylus*. Distribution is same as for family Sarsiellidae.

Key to Genera of SARSIELLINAE in the Study Area

(Adult females and Instar IV Females)

1. Furca without secondary claws between primary claws 2
Furca with secondary claws between primary claws 4
2. Furca with claws 1 and 2 nonarticulated *Eurypylus*
Furca with only claw 1 nonarticulated 3
3. Furca with 5 claws *Eusarsiella*
Furca with 6 claws *Metasarsiella*
4. Furca with claw 4 nonarticulated *Chelicopia*
Furca with claw 4 articulated *Neomuelleriella*

Eusarsiella Cohen and Kornicker, 1975

Eusarsiella Poulsen, 1965 [part].—Cohen and Kornicker, 1975 [part].—Kornicker, 1986a:41 [emended].—Kornicker, 1991:92.

TYPE SPECIES.—*Sarsiella tumida* Scott, 1905, by subsequent designation in Cohen and Kornicker (1975, table 1).

DISTRIBUTION.—World-wide between latitudes of about 63°N and 37°S. Known depth range is intertidal to 1120 m (Kornicker, 1986a:41).

COMPOSITION.—Including a new species described herein the genus comprises 60 species (Kornicker, 1986a:143; 1987a:134; 1991:92; Cohen 1989:304).

Eusarsiella falx, new species

FIGURES 84–86

ETYMOLOGY.—From the Latin *falx* (sickle, scythe).

HOLOTYPE.—MNHN Os 454, undissected adult female in alcohol with chonistomatid egg case in marsupium (visible through shell).

TYPE LOCALITY.—Sta 8-DR, 19 Mar 1977, W Glorioso Islands, 11°29'12"S, 47°18'12"E, depth 250 m.

PARATYPES.—Sta 8-DR: 3 undissected adult females in alcohol. Sta 72-DS: USNM 193782, 1 partly dissected A-1

male in alcohol; USNM 193783, 1 undissected A-1 female in alcohol; USNM 193784, 1 undissected ovigerous female in alcohol; Paris, 3 undissected adult females. Sta 104-DR: Paris, 2 undissected specimens in alcohol. Sta 120-DS: USNM 193710, 1 adult female on slide and in alcohol, 1 undissected adult female, and 1 undissected juvenile in alcohol.

DISTRIBUTION.—Sta 8-DR, W Glorioso Islands, depth 250 m. Sta 72-DS: NNE north reef, Mayotte, depth 300–350 m. Sta 104-DR, N Île du Lys, Glorioso Islands, depth 330–550 m. Sta 120-DS, SE Glorioso Islands, depth 335–390 m. Known depth range 250–550 m.

DESCRIPTION OF ADULT FEMALE (Figures 84–86a–k).—Carapace oval in lateral view with long slender caudal process projecting posteroventrally (Figures 84, 85a, 86a); posterodorsal part of valves bulbous with anterior end of dorsal margin of bulb extending laterally at midlength of dorsal margin of valve (Figure 86b). Valves without prominent rostrum or incisur but with minute overlap at midheight of ventral margin indicating position of rostrum (not shown).

Ornamentation: Surface of valves with abundant round shallow fossae with bare bottoms (Figure 84); area between fossae with numerous short bristles with fairly parallel sides; most bristles with pointed tips, but very few with tips either blunt or with minute bulbs. Lateral surface of valves with few very long slender bristles with stout ribbed bases (not shown); anterior edge of valves with long bristles with stout ribbed bases (Figure 84); similar bristles sparsely distributed along ventral margin. Surface of valves with gelatinous coat covering short bristles.

Infold: Anterior infold with small bristle at inner margin just ventral to valve midheight (Figure 86c). Infold of caudal process with 7 or 8 small bristles forming row across base (Figure 86d); 2 setal bristles near outer edge of infold just dorsal to caudal process; 2 bristles at inner edge of infold just anterior to caudal process.

Selvage: Broad lamellar prolongation with smooth outer edge along anterior (Figure 86c), ventral, and posterior valve margins, and forming flap at distal end of caudal process (dashed in Figure 86d).

Central Adductor Muscle Attachments (Figure 85a): Comprising about 13 small oval attachments.

Carapace Size (specimen oriented so that caudal process does not enter into height measurement): MNHN Os 454, holotype, length with caudal process 1.73 mm, length without caudal process 1.46 mm, height 1.37 mm; USNM 193710, length with caudal process 1.86 mm, length without caudal process 1.74 mm, height 1.41 mm. Sta DR-8, 3 specimens: length with caudal process 1.75 mm, length without caudal process 1.55 mm, height 1.37 mm; length with caudal process 1.63 mm, length without caudal process 1.55 mm, height 1.37 mm; length with caudal process 1.63 mm, length without caudal process 1.50 mm, height 1.34 mm. Sta 72-DS, 2 specimens: ovigerous, length with caudal process 1.38 mm, length without caudal process 1.35 mm, height 1.09 mm;

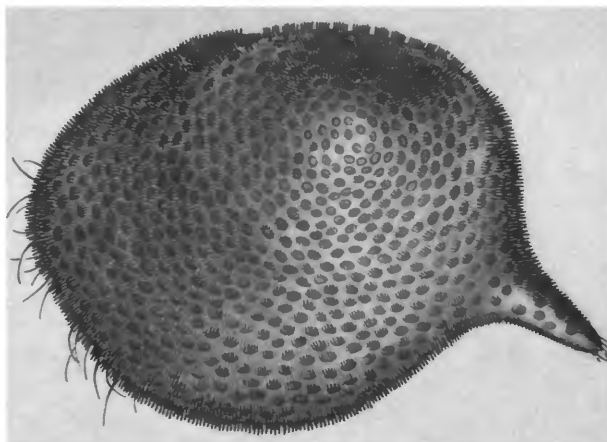


FIGURE 84.—*Eusarsiella falx*, new species, adult female, paratype, USNM 193710, complete specimen from left side, length 1.86 mm.

nonovigerous, length with caudal process 1.56 mm, length without caudal process 1.32, height 1.17 mm.

First Antenna (Figure 85b): 1st joint bare. 2nd joint with spines forming rows along dorsal and ventral margins, and on lateral surface near ventral margin, and 1 long dorsal bristle with long proximal hairs and short distal spines. 3rd and 4th joints fused; 3rd joint short with 2 long bristles (dorsal bristle with long proximal hairs and short distal spines; ventral bristle with long hairs becoming shorter distally along bristle). 4th joint long, with 2 bristles, both with short distal hairs or spines (ventral bristle more than twice length of dorsal bristle). Sensory bristle of 5th joint with minute filament proximal to midlength and terminal spine. 6th joint fused to 5th, with small bare medial bristle. 7th joint: a-bristle more than twice length of bristle of 6th joint, with short marginal spines; b-bristle longer than a-bristle, bare except for terminal spine; c-bristle about same length as sensory bristle of 5th joint, with 2 distal and 1 subterminal minute filaments, and terminal spine. 8th joint: d- and e-bristles shorter than c-bristle, bare with blunt tips; f-bristle about same length as d- and e-bristles, bare except for terminal spine; g-bristle about same length as c-bristle, with 3 small marginal filaments (proximal longer).

Second Antenna (Figure 85c): Protopodite bare. Endopodite 2-jointed: 1st joint with 2 short bare proximal anterior bristles; 2nd joint small with long terminal bristle with short marginal spines and terminal spine. Exopodite: 1st joint with small recurved medial terminal tubular bristle; bristle of 2nd joint long, with few long proximal dorsal hairs, then 12 short nub-like ventral spines followed by 4 long slender ventral spines, then distal ventral and dorsal natatory hairs; bristle of joint 3 with few long proximal dorsal hairs, then 12 nub-like spines followed by 4 long slender ventral spines, then ventral and dorsal natatory hairs; bristle of joint 4 with few long proximal dorsal hairs, then 10 ventral nub-like spines followed



FIGURE 85.—*Eusarsiella falx*, new species, adult female, paratype, USNM 193710: *a*, outline of complete specimen from right side and detail of central adductor muscle attachments of right valve; *b*, right 1st antenna, mv; *c*, protopodite, endopodite, and exopodite, and exopodial joints 1 and 2 of right 2nd antenna, mv; *d*, right mandible, mv; *e*, right maxilla, lv; *f*, 5th limb; *g*, 6th limb; *h*, 7th limb; *i*, anterior of body showing medial eye, Bellonci organ, and upper lip; *j*, left lateral eye, medial eye, and Bellonci organ.

by 5 long slender ventral spines, then ventral and dorsal natatory hairs; bristles of joints 5 and 6 each with few long proximal dorsal hairs, then 7 ventral spines (some nub-like) followed by ventral and dorsal natatory hairs; bristles of joints 7 and 8 each with few proximal ventral hairs, then 5–7 ventral spines (bristle of 7th joint with only 1 nub-like spine, bristle of 8th joint with none) followed by ventral and dorsal natatory hairs. 9th joint with 2 bristles: ventral long with natatory hairs, no spines; dorsal short with short hairs. Joints 2–6 with minute spines forming short distal row. (The small nub-like ventral spines on some bristles may be an aberrance but are on both limbs of USNM 193710.)

Mandible (Figure 85d): Coxale endite represented by stout spine with 2 minute spines at tip. Coxale with long hairs and spines along ventral surface. Basale: ventral margin with 3 ringed bristles with bases on medial side just proximal to sclerotized internal boss and 3 small bristles distal to boss (1 medial, 2 lateral); dorsal margin with 1 small pointed spine-like bristle distal to midlength and 2 terminal (medial minute spine-like, lateral longer, weakly ringed). 1st endopodial joint: medial surface with spines forming rows, slender spines forming row in distal dorsal corner, and small spine-like bristle at base of long ventral claw; proximal dorsal edge of claw with minute perpendicular internal lineations (Figure 85d). 2nd endopodial joint with stout ventral claw and small dorsal bristle. 3rd endopodial joint with stout terminal claw, and 2 small bristles at base (1 dorsal, 1 longer ventral).

Maxilla (Figures 85e, 86e–h): Precoxale and coxale with dorsal fringe (Figure 85e). Endite I with 6 bristles (Figure 86e); endite II obscured on mounted specimen but with 4 bristles visible (Figure 86f); endite III with 6 bristles (Figure 86g). Coxale with short bare dorsal bristle. Basale with short bristle (with widely separated marginal spines) near base of exopodite. Exopodite small with 2 bristles (long spinous bristle more than twice length of short bare bristle) (Figure 85e). 1st endopodial joint with distal spines along anterior margin, 1 alpha-bristle (1 tooth proximal to ringed part, slender spines along ringed part), and 1 beta-bristle (few teeth proximal to ringed part, short spines along ringed part). 2nd endopodial joint with 2 slender ringed a-bristles with minute indistinct spines (posterior bristle longer), 1 slender bare ringed c-bristle, and 5 stout terminal pectinate bristles.

Fifth Limb (Figure 85f): Single endite with 1 bare bristle. 1st exopodial joint with 2 spinous bristles (spines stouter and longer on longest bristle). 2nd to 5th exopodial joints almost completely fused, but comprising 2 lobes with 4 terminal bristles on inner lobe and 1 proximal and 5 terminal bristles on outer lobe (proximal bristle could have base on inner lobe), both lobes hirsute.

Sixth Limb (Figure 85g): Single endite with 3 bare bristles (1 medium, 2 short). End joint with 11 or 12 spinous bristles along ventral margin and 2 hirsute posterior bristles. Posterior

edge of limb and lateral and medial sides near posterior edge hirsute.

Seventh Limb (Figure 85h): Each limb with 2 proximal bristles (1 on each side on same or different segments; each with 4 or 5 bells) and 6 terminal bristles (3 on each side, each with 3–8 bells). Terminus with opposing combs, each with 6 or 7 teeth (not all shown).

Furca (Figure 86i): Each limb with 5 claws; claw 1 nonarticulated, others articulated; posterior margin of each claw with many slender teeth between few stout teeth; margin of lamellae following claw 5 with 3 or 4 teeth on right lamella and 5 or 6 on left; medial hairs at base of claw 1; anterior margins of right and left lamellae with few minute spines (more on right). Right lamella anterior to left by about width of base of claw 1.

Bellonci Organ (Figures 85i,j, 86j): Elongate, broadening distally, with broadly rounded tip.

Eyes: Medial eye bare, with brown pigment (Figures 85i,j, 86j). Lateral eye with light brown pigment, with 4 or 5 small light amber-colored ommatidia (Figure 85j).

Upper Lip (Figure 85i): With rounded projecting tip.

Genitalia (Figure 86i,k): Round sclerotized ring on each side of body anterior to base of furca.

Anterior of Body (Figure 85i): Midline of anterior of body between medial eye and upper lip without anterior process, but a triangular process present lateral to midline on anterior edge of sclerotized rim of socket for base of mandible.

Posterior of Body (Figure 86k): Bare.

Y-Sclerite (Figure 86k): Typical for subfamily.

Eggs: USNM 193710 with 2 large unextruded eggs; USNM 193784 with 2 eggs in marsupium (Figure 86a).

Parasites: Holotype and 3 paratypes (from same sample as holotype) with choniostomatid ovisacs in marsupium; the valves were not opened but the ovisacs are visible through shell (eggs of the ostracode may also be present but could not be identified with certainty). USNM 193710 with 2 choniostomatid ovisacs in marsupium.

DESCRIPTION OF A-1 MALE (Figure 86l–p).—Carapace with more truncate posterior margin than that of adult female (Figure 86l), but with similar bristles on outer surface.

Carapace Size: USNM 193782, length with caudal process 1.19 mm, length without caudal process 1.01 mm, height 0.85 mm.

First Antenna: Ventral bristle of 4th joint just reaching distal margin of 8th joint; limb otherwise similar to that of adult female, but filaments of bristles of end joints not counted.

Second Antenna: Protopodite and exopodite similar to those of adult female except for bristles having pointed spines (no nub-like spines as on some female bristles). Endopodite 2-jointed (Figure 86m): 1st joint similar to that of adult female; 2nd joint larger than that of adult female and with 2 bristles (anterior bristle short).



FIGURE 86 (opposite page).—*Eusarsiella falx*, new species, paratypes: adult female, USNM 193784: *a*, complete specimen from right side. Adult female, USNM 193710: *b*, dorsal edge of left valve at midlength showing anterodorsal edge of posterodorsal bulge, anterior to left, *ov*; *c*, part of anterior margin near midheight of left valve showing small bristle near inner margin of infold, *iv*; *d*, caudal process of left valve, anterior to right, *iv*; *e-g*, endites I-III of left maxilla, *mv*; *h*, left maxilla (exopodite and many endite bristles not shown), *mv*; *i*, posterior of body from right side showing right furcal lamella and right genitalia, anterior to right; *j*, medial eye and Bellonci organ; *k*, posterior of body from left side showing Y-sclerite, girdle, and genitalia, anterior to left. A-1 male, USNM 193782: *l*, outline of carapace from right side, length including caudal process 1.19 mm; *m*, protopodite and endopodite of left 2nd antenna, *mv*; *n*, left 7th limb; *o*, anterior of dorsal part of body from right side showing right lateral eye, medial eye, and proximal part of Bellonci organ; *p*, part of body from right side showing left and right copulatory lobes and transparent apron anterior to proximal end of furca. A-1 female, USNM 193783, *q*, complete specimen from left side, length including caudal process 1.28 mm.

Mandible, Maxilla, Fifth and Sixth Limbs: Not examined in detail, but appearing similar to those of adult female.

Seventh Limb (Figure 86n): Well developed, with 2 tapered proximal bristles (1 on each side), each with 3 bells, and 4 tapered terminal bristles (2 on each side), each with 3 or 4 bells. Terminus with opposing combs.

Furca, Bellonci Organ, Upper Lip, Anterior and Posterior of Body, and Y-Sclerite: Similar to those of adult female.

Eyes (Figure 86o): Medial eye similar to that of adult female. Lateral eye with light brown pigment and indistinct ommatidia.

Genitalia (Figure 86p): Comprising 2 small lobes (1 with 1 or 2 minute bristles) on each side of body.

Remarks: The specimen was identified as male by its genitalia. The endopodite of the 2nd antenna indicates that the endopodite of the adult male will be 2-jointed and not prehensile. The 7th limb indicates that the limb of the adult male will be well developed and have terminal combs.

DESCRIPTION OF A-1 FEMALE (Figure 86q).—Carapace similar in outline to that of A-1 male and with similar bristles on outer surface (Figure 86q).

Carapace Size: USNM 193783, length with caudal process 1.28 mm, length without caudal process 1.04 mm, height 0.93 mm.

First Antenna: Ventral bristle of 4th joint about 1¼ times length of 5th joint; limb otherwise similar to that of adult female.

Second Antenna, Mandible, Maxilla, Fifth and Sixth Limbs, Furca, Bellonci Organ, Eyes, Upper Lip, Anterior and Posterior of Body, and Y-Sclerite: Not examined in detail but appearing similar to those of adult female.

Seventh Limb: Similar to that of A-1 male.

Genitalia: Not developed.

COMPARISONS—The following combination of characters distinguishes female *E. falx* from females of other species of *Eusarsiella*. Shell: large size of shell (length 1.38–1.86 mm including caudal process, 1.32–1.74 excluding caudal process), absence of ribs on carapace, elongate caudal process, row of 7

or 8 bristles across base of infold of caudal process. Appendages: ventral bristle on 3rd joint of 1st antenna unusually long (length 52% of combined lengths of joints 2–8 measured at midwidth), ventral margin of 4th joint of 1st antenna with only 1 bristle, endopodite of 2nd antenna with small 2nd joint bearing long terminal bristle (length of bristle 90% length of endopodite (including both joints)). Based on study of the A-1 male, the adult male of *E. falx* probably will not have a prehensile endopodite of the 2nd antenna, and the 7th limb will be well developed with bristles and terminal teeth.

Chelicopia Kornicker, 1958

Chelicopia Kornicker, 1958:253.—1986a:28.—Poulsen, 1965:56.

TYPE SPECIES.—*Chelicopia arostrata* Kornicker, 1958:253, monotypy.

DISTRIBUTION.—Bahama Islands; Pacific coast of El Salvador; Scammon Lagoon, Baja California, Mexico; Tasman Sea off the west coast of South Island, New Zealand; Lizard Island, Australia; Mozambique Channel. Known depth range 1–768 m.

COMPOSITION.—Including 2 new species described herein the genus comprises 8 species, but 2 of them *C. kornickeri* McKenzie, 1965:69, and *C. rotunda* (Hartmann, 1959:199) may be junior synonyms of *C. arostrata* Kornicker, 1958:253 (see “Remarks” below).

REMARKS.—McKenzie (1965:69) proposed the new species *Chelicopia kornickeri* McKenzie for a female collected in Scammon Lagoon, Baja California. I reexamined some appendages of the holotype (USNM 110912) (Figure 92) and find them quite similar to those of the female *C. arostrata* as described by Kornicker (1986:29), except each lamella of the furca of *C. arostrata* has 7 or 8 claws (usually 8), whereas the unique female of *C. kornickeri* has 7. Study of additional specimens of *C. kornickeri* are required to determine whether the species consistently has only 7 furcal claws. Hartmann (1959:199) described *Sarsiella rotunda* Hartmann, 1959 (= *Chelicopia rotunda*) from the Pacific coast of El Salvador. That species bears 7 furcal claws on the instar IV male and adult male (Hartmann, 1959, figs. 30:20, 32:25), and in an illustrated mandible of the instar IV male the dorsal margins of the stout claws of the 1st and 2nd endopodial joints are smooth (Hartmann, 1959, fig. 30:12) not digitate as they are on the adult females of *C. arostrata* and *C. kornickeri*, but the digitations are easily overlooked. Although I take no taxonomic action here, I think it likely that *C. arostrata*, *C. rotunda*, and *C. kornickeri* are conspecific, and therefore, in the key to species of *Chelicopia* the 3 species are in the same couplet. The adult females of *C. tasmanensis*, *C. radix*, *C. obex*, and probably *C. rotunda* are unknown; in the key an assumption is made that for those species the selected characters of the adult female and instar IV juveniles are the same.

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 stalk-like "bristles" with flaring digitate tips
. *C. radix*, new species
Surface of carapace with only slender nondigitate bristles 3
3. Furca with 6 claws 4
Furca with 7 or 8 claws 5
4. Endopodite of 1st joint of female 2nd antenna with 2 bristles . . . *C. tasmanensis*
Endopodite of 1st joint of female 2nd antenna with 1 bristle . . . *C. squameospinosa*
5. Carapace with projecting caudal process *C. obex*, new species
Carapace without projecting caudal process
. *C. arostrata*, *C. rotunda*, and *C. kornickeri*

Chelicopia radix, new species

FIGURES 87-89

ETYMOLOGY.—From the Latin *radix* (root).

HOLOTYPE.—MNHN Os 459, undissected instar IV female in alcohol.

TYPE LOCALITY.—Sta 124-S, 12 Apr 1977, Mozambique Channel, SE Glorioso Islands, 11°32'06"S, 47°23'06"E, depth 24 m.

PARATYPES.—Sta 106-R: USNM 193712, 1 instar IV male instar on slide and in alcohol; 1 instar IV ?female. Sta 124-S: USNM 193711, 1 instar IV female on slide and in alcohol; Paris, 1 instar IV undissected female in alcohol.

DISTRIBUTION.—Sta 106-R, Zelee Bank, south border, depth 18-24 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 18-24 m.

DESCRIPTION OF INSTAR IV FEMALE (Figures 87, 88).—Carapace oval in lateral view with slight flattening of posterodorsal margin (Figure 87a). Projecting caudal process absent but caudal area indicated by extremely slight flattening of posteroventral corner of valve margin viewed laterally (Figure 87a), and valve edge slightly concave when viewed medially (Figure 87b,d,e); valve margin in caudal area also marked by long slender bristles more numerous than elsewhere (Figure 87a,d).

Ornamentation: In transmitted light shell with abundant small ring-like structures, each with diaphanous "skirt" with digitate edge (Figure 87a) (skirt easily visible when structure viewed from side (detail at lower left of Figure 87a), but in end view only digitate edge visible, and only barely so (detail at lower right of Figure 87a). Number of digitations range from about 2 to 10. Skirts vary in length from being about equal to ring diameter at base of structure to about 5 times ring diameter; the latter type present along posterior edge of shell and appear stalk-like (Figure 87d). Short thumb-like processes, with same diameter as ring-like structures, form single row along anterodorsal, anterior, and anteroventral valve edges (Figure 87c); surface of valves without gelatinous coating.*Surface Bristles:* Bristles sparsely distributed on outer surface of valves, more numerous along anterior and ventral margins, and especially abundant along outer margin of caudal area (Figure 87a,d). Bristles of several types: short and long slender bristles without surface structures; short and long bristles with short broad part bearing transverse ribs (broad part near midlength on long bristles and on some short bristles, and proximal on most short bristles); some bristles bending sharply just distal to broad part but other bristles straight (Figure 87c,d). Anterior and ventral margins of valves overhanging valve edge (Figure 87b); inner surface of overhang (inward from row of short thumb-like processes) with numerous small spines pointing outward, short bristles (with stout ribbed proximal part) forming row near valve edge, and longer bristles (with stout ribbed part near midlength) forming outer row (Figure 87c). Minute spines present on outside surface of valves just proximal to anterior and anteroventral margins (not shown, but similar to those along inner surface of overhang, Figure 87c).*Infold:* Broad infold along anterior and ventral margins, and in caudal area, but inner margin not well defined in the latter (Figure 87c-e). Anterior infold with small bristle near valve midheight (Figure 87c). Infold of caudal area with 3 bristles (1 long, 2 short) along posterior concave edge, and 10 or 11 bristles anterior to edge (7 to 9 better defined than others and forming row close to posterior edge (Figure 87d,e)). 2 setal bristles on infold just dorsal to caudal area (Figure 87b,d,e).*Selva:* Broad undivided lamellar prolongation with smooth outer edge present along anterior and ventral margins; prolongation along outer edge of caudal area difficult to resolve but probably narrow.*Central Adductor Muscle Attachments* (Figure 87f): Comprising 9-13 oval individual attachments.*Carapace Size:* Sta 124-S: MNHN Os 459, holotype, length 0.81 mm, height 0.63 mm; USNM 193711, length 0.90 mm, height 0.71 mm. Sta 124-S: Paris, distorted specimen, length (measured while viewed dorsally) of left valve 0.82 mm. Sta 106-R: Paris, length 0.88 mm, height 0.69 mm (specimen

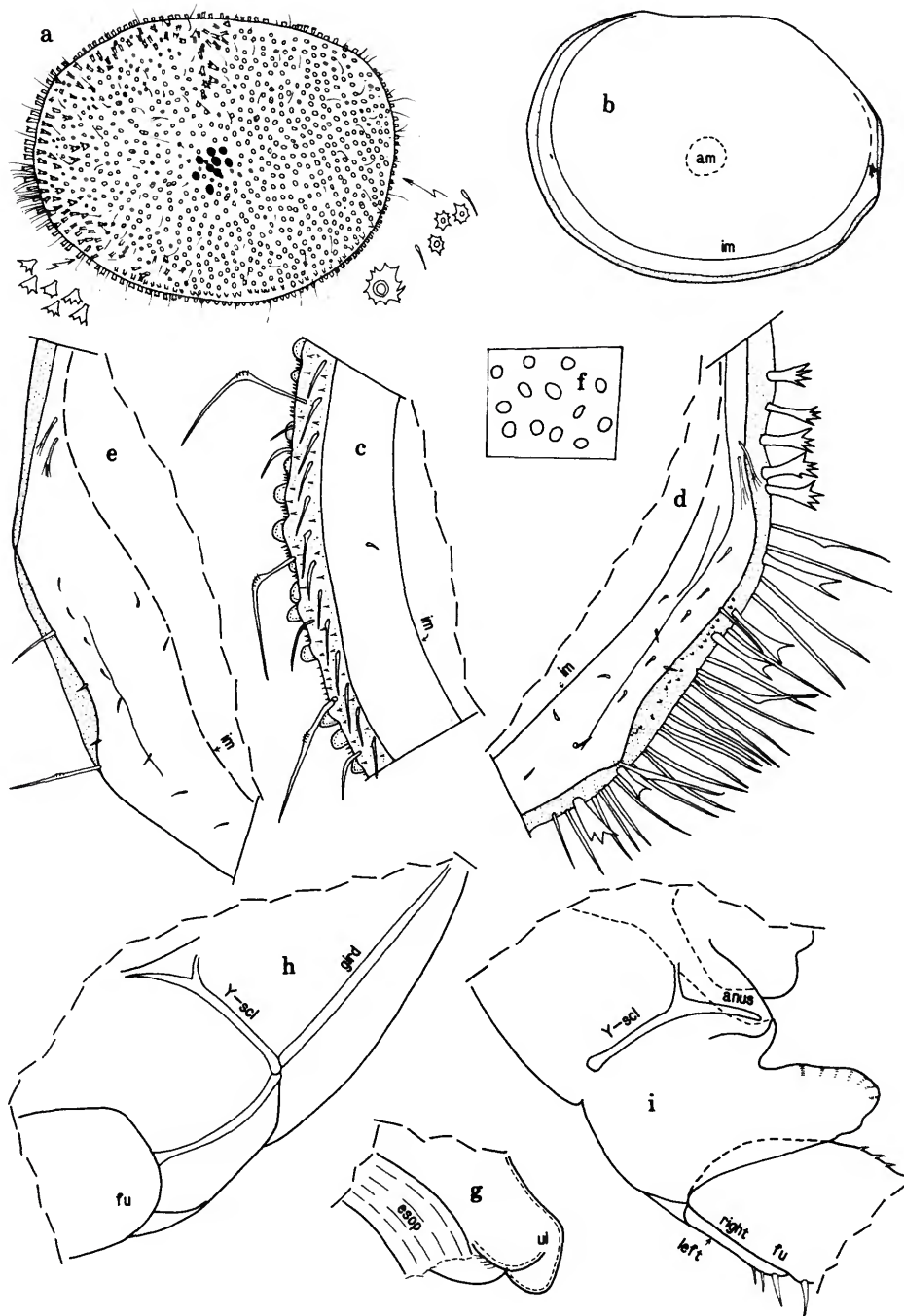


FIGURE 87.—*Chelicopia radix*, new species, instar IV female, paratype, USNM 193711: a, complete specimen from right side with details of 10 structures with diaphanous "skirts" and 2 simple bristles (detail of largest structure is from near center of valve), carapace length 0.90 mm; b, right valve, iv; c, anterior end of right valve, iv; d, posteroventral corner of right valve, iv; e, posteroventral corner of left valve (bristles of outer surface not shown), iv; f, central adductor muscle attachments of left valve, anterior to left, ov; g, upper lip and part of esophagus from right side, anterior to right; h, posterior of body from left side, anterior to left; i, posterior of body from right side, anterior to right.

left intact, may not be female).

First Antenna (Figure 88a): 1st joint with 5 or 6 minute distal medial spines forming row. 2nd joint with few spines along ventral and dorsal margins and on medial and lateral surfaces, with 1 dorsal bristle with few long proximal hairs and short distal spines. 3rd joint fused to 4th; 3rd joint with 2 long spinous bristles (1 dorsal; 1 longer, ventral). 4th joint with 2 long bristles (dorsal bristle with few indistinct spines; ventral bristle longer and with long marginal hairs). Sensory bristle of long 5th joint with 2 minute proximal filaments. 6th joint fused to 5th, with short medial bristle with few marginal hairs. 7th joint: a-bristle about 3 times length of bristle of 6th joint, with short marginal spines; b-bristle slightly shorter than a-bristle, with long terminal spine; c-bristle slightly longer than sensory bristle of 5th joint, with 2 minute marginal filaments and terminal spine. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 2 minute proximal filaments and terminal spine; g-bristle shorter than c-bristle and longer than f-bristle, with 2 proximal filaments (length of proximal of these about twice diameter of bristle at base of filament; other about same diameter of bristle) and terminal spine.

Second Antenna: Protopodite bare (Figure 88b). Endopodite 1-jointed with 1 small proximal anterior bristle and medial spines forming rows; ventral margin either smoothly rounded (Figure 88b), or with very slight bulge. Exopodite: 1st joint with minute straight tubular medial bristle on terminal margin; bristle of 2nd joint long, with ventral spines (stout proximal spines becoming more slender distally along bristle) and natatory hairs near tip; bristles of joints 3–8 with stout proximal ventral spines and distal natatory hairs; 9th joint with 2 bristles (ventral bristle shorter and slenderer than bristle of 8th joint, with slender proximal spines and distal natatory hairs; dorsal bristle short and slender with few short hairs); joints 2–7 or 4–6 with few small spines along distal margins.

Mandible (Figure 88c–e): Coxale endite consisting of stout spine with few small marginal spines. Coxale with numerous slender spines along ventral margin. Basale: dorsal margin with unringed spine-like bristle at midlength, and 2 subterminal bristles (longer with faint rings, other unringed spine-like); ventral margin with 5 short bristles (2 proximal, 3 distal) with bases on medial side; lateral surface with 1 short bristle near ventral margin. Exopodite small with base inward from dorsal margin of basale, and with minute terminal bristle (not shown but similar to that of instar IV male, Figure 89c). 1st endopodial joint: medial surface with spines forming distal crescentic row, spines along distal margin in dorsal corner, and 2 spines near base of terminal ventral claw; lateral surface with spines forming rows (Figure 88c,d); dorsal margin with subterminal and terminal spines forming part of rows continuing on medial and lateral surfaces of joint; ventral margin with short spinous bristle at midlength and long terminal claw with 2 proximal prongs (1 dorsal and 1 ventral much longer and stouter) (Figure 88c,d); proximal dorsal edge of claw with

minute perpendicular striations that may be internal. 2nd endopodial joint: lateral surface with spines forming rows including row along terminal edge; terminal lateral edge of joint extends slightly past terminal medial edge; dorsal margin with 2 single spine-like bristles near midlength; ventral margin with stout terminal claw about same width but longer than claw of 1st joint. 3rd endopodial joint with stout terminal claw, 1 small dorsal bristle, and 2 ventral bristles (1 small slender and 1 stout knife-like that could be interpreted to be a prong on terminal claw) (Figure 88e).

Maxilla (Figure 88f–i): Protopodite with dorsal fringe of long hairs. Coxale with 1 short bare dorsal bristle. Endite I with few minute proximal spines and 6 bristles (3 stout unringed, others ringed and either pectinate or spinous) (Figure 88f), endite II with long proximal spines and 4 bristles (2 stout unringed pectinate, others ringed and at least 1 spinous) (Figure 88h), endite III with 6 bristles (1 stout unringed pectinate, other ringed and either spinous or pectinate) (Figure 88f). Protopodite with thin flat diaphanous process (thumb-like in outline) near exopodite, and 1 short bristle adjacent to exopodite (Figure 88g). Exopodite with 2 bristles (shortest reaching past midlength of longest) (Figure 88g,i). Endopodite: 1st joint with slender spinous alpha- and beta-bristles with distal rings; 2nd joint with 2 slender a-bristles (posterior bristle longer), 1 slender c-bristle, and 5 stout pectinate terminal bristles.

Fifth Limb (Figure 88j,k): Epipodite with 36 bristles. Single endite with short bare bristle. 1st exopodial joint with 2 spinous bristles. Exopodial joints 2–5 not well defined from each other: joint 2 with 4 bristles (3 long terminal and 1 short proximal), all with short spines; inner lobe of 3rd joint with 3 bristles (1 short bare, 1 long bare, 1 long spinous); outer lobe of 3rd joint with 1 bristle with long terminal spine (this bristle missing on left limb of USNM 193711, Figure 88j); 4th and 5th joints with 2 long spinous bristles; 2nd to 3rd joints hirsute. Both endite and exopodial bristles ringed distally (not shown).

Sixth Limb (Figure 88l): Endite I with 3 short bristles. Endite II with 5 long spinous bristles (endite closer to end joint when limb compressed under cover slip than with cover slip absent as in Figure 88l, and could be interpreted to be part of end joint). End joint with 10 or 11 bristles (2 posterior bristles not greatly different from other long bristles on limb). Limb hirsute.

Seventh Limb (Figure 88m): Proximal group with 4 tapering bristles (2 on each side), each with 2 bells. Terminal group with 4 tapering bristles (2 on each side), each with 4 bells. Terminus with comb comprising 4 or 5 teeth (not all shown); side opposite comb bare. (Tapering bristles are juvenile character.)

Furca (Figure 88n): Each lamella with 6 claws: claws 1, 2, and 4 stout, primary, nonarticulated, and with narrowly rounded tips; claws 3, 5, and 6 short, slender, secondary, articulated, and with pointed tips. Claw 1 with 2 rows of teeth oriented posteriorly; claws 2–5 with single row; a few teeth on claws 1, 2, and 4 slightly stouter than others; no teeth observed



FIGURE 88.—*Chelicopia radix*, new species, instar IV female, paratype, USNM 193711: a, right 1st antenna, mv; b, protopodite and endopodite of left 2nd antenna, mv; c, left mandible, mv; d, endopodial joints 1-3 of right mandible showing lateral spines, lv; e, small bristles of endopodial joints 2 and 3 of left mandible, mv; f, right maxilla (bristles of endite II not shown), mv; g, exopodite as seen through maxilla shown in f, mv; h, endite II of maxilla shown in f, mv; i, left maxilla (endites and bristles of 2nd endopodial joint not shown), lv; j, left 5th limb, lv; k, right 5th limb, mv; l, right 6th limb, lv; m, 7th limb; n, left furcal lamella and claw 1 of right lamella; o, anterior of body from left side, anterior to left.

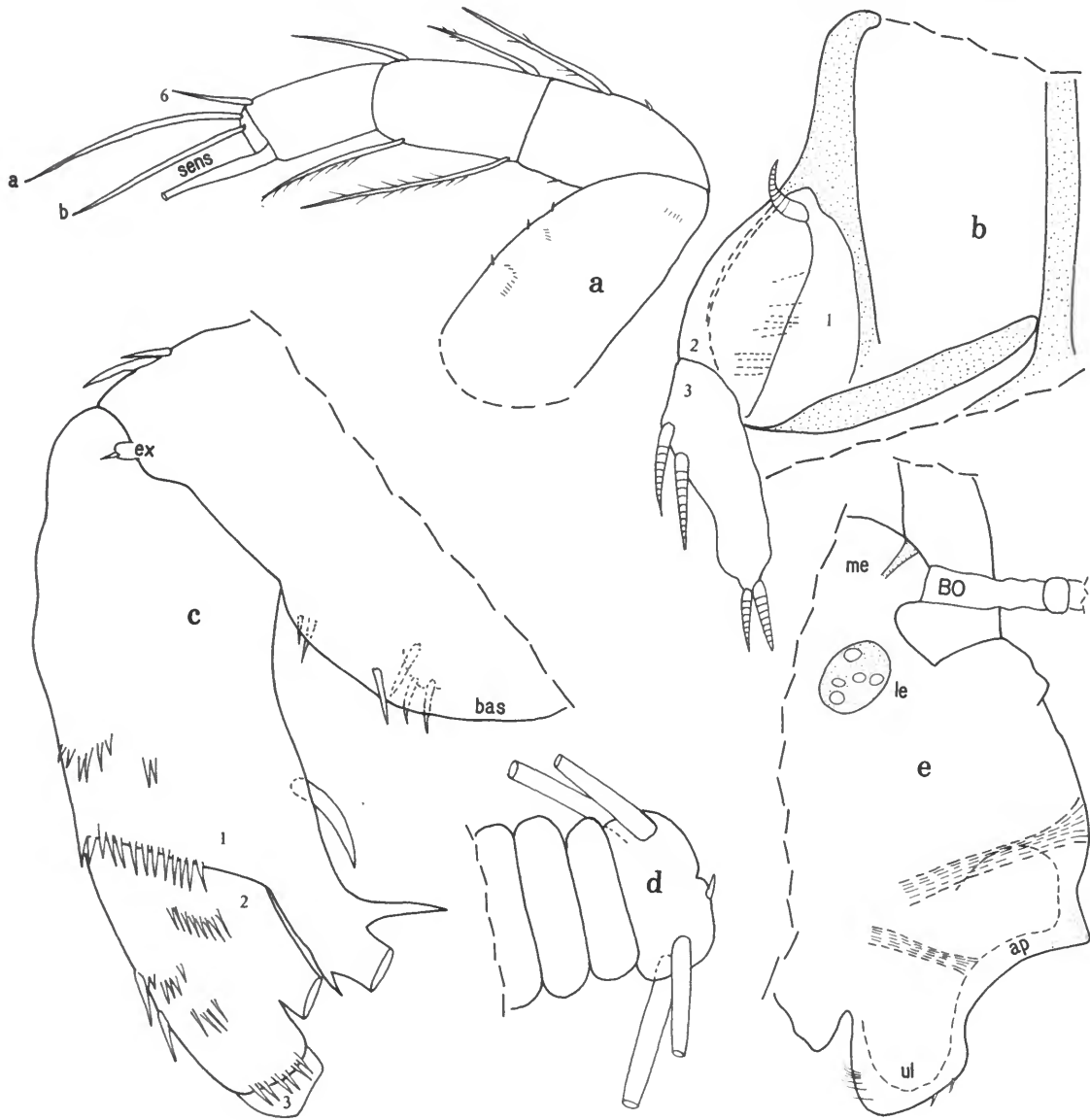


FIGURE 89.—*Chelicopia radix*, new species, instar IV male, paratype, USNM 193712: a, right 1st antenna (not all bristles of 7th and 8th joints shown), mv; b, protodipite and endopodite of right 2nd antenna, mv; c, part of left mandible, lv; d, tip of 7th limb; e, anterior of body from right side, anterior to left.

on claw 6. Claws 1-5 with hairs or slender spines along anterior edges (not all shown). Long hairs forming medial row near base of claw 1, and also medially near anterior of right lamella. Several spines on edge of lamellae following claw 6 and along anterior edge of right lamella dorsal to claw 1. Right lamella anterior to left by about width of claw 1 at base (Figure 88n). A broad "apron" (with rows of minute spines) extending anteriorly just proximal to lamellae.

Bellonci Organ (Figure 88o): Elongate with 3 well-defined

sutures near midlength and 4 additional incipient sutures marked by small marginal indentations (3 proximal, 1 distal); tip broadly rounded.

Eyes: Medial eye bare with brown pigment (Figure 88o). Lateral eye smaller than medial eye, with brown pigment and 5 amber-colored ommatidia (Figure 88o).

Upper Lip (Figure 87g): Somewhat triangular in lateral view, with short hairs.

Genitalia: None observed.

Anterior of Body: Sclerotized triangular process on each side of anterior of body just dorsal to protopodite of mandible (Figure 88a,o). (Process not equivalent to single anterior process at midwidth of anterior surface of body present on cypridinids.)

Posterior of Body (Figure 87h): Evenly rounded except for indentation near posterior end of Y-sclerite, bare.

Y-Sclerite (Figure 87h,i): Typical for subfamily.

Remarks: The key to developmental stages of Sarsiellidae presented in Kornicker (1981b:385) was used to identify the specimens described above as stage IV instars. The single-jointed endopodite of the 2nd antenna of the stage IV instars indicates that the specimens are females. It is likely that the 7th limb of the unknown adult female bears 6 terminal bristles rather than 4 as on the stage IV females. It is of interest that prongs (3) are present on the ventral claw of the 1st endopodial joint of the mandible of *Dantya benthedi* Kornicker, 1983c, in the Dantyninae; the same claw of *C. radix* bears 2 similar prongs; this is probably the result of convergence.

DESCRIPTION OF INSTAR IV MALE (Figure 89).—Carapace similar to that of instar IV female.

Carapace Size: USNM 193712, carapace distorted, length about 1.34 mm.

First Antenna (Figure 89a): 1st joint with few ventral spines. Limb otherwise similar to that of instar IV female.

Second Antenna: Protopodite similar to that of instar IV female. Endopodite 3-jointed (Figure 89b): 1st joint with 1 small proximal anterior bristle and medial spines forming rows; 2nd joint elongate bare; 3rd joint about same length as 2nd, with 2 proximal bristles and 2 smaller terminal bristles; all endopodial bristles ringed, bare, and with slender drawn-out tips. Exopodite: minute terminal medial bristle of 1st joint bent at right angle; limb otherwise similar to that of instar IV female.

Mandible (Figure 89c) and *Maxilla:* Similar to those of instar IV female.

Fifth and Sixth Limbs: Not examined in detail but appearing similar to those of instar IV female.

Seventh Limb (Figure 89d): Well developed. Proximal group with 2 tapered bristles (1 on each side of 8th segment counted from base of terminus), each with 3 bells. Terminal group with 4 untapered bristles (1 long and 1 short on each side), each with 5 bells. Terminus with small indentation at midwidth and 1 minute spine on one side of indentation and none on other side.

Furca: Main claws 1, 2, and 4 with blunt tips; furca otherwise similar to that of instar IV female.

Bellonci Organ (Figure 89e): Distal part broken off on USNM 193712 but remaining part suggests organ similar to that of instar IV female.

Eyes (Figure 89e), *Upper Lip* (Figure 89e), *Anterior* (Figure 89e) and *Posterior of Body*, and *Y-Sclerite:* Similar to those of instar IV female.

Genitalia: Obscured on USNM 193712, but not large if present.

COMPARISONS.—The digitate “bristles” on the outer surface of the shell of *C. radix* and the 2 prongs on the stout ventral claw of the 1st endopodial joint of the mandible are not present on previously described species of the genus.

Chelicopia obex, new species

FIGURES 90, 91

ETYMOLOGY.—From the Latin *obex* (bar, bolt, boom).

HOLOTYPE.—MNHN Os 462, undissected instar IV male in alcohol.

TYPE LOCALITY.—Sta 101-DS, 8 Apr 1977, NW Île du Lys, Glorioso Islands, 11°25'42"S, 47°19'30"E, depth 26 m.

PARATYPES.—Sta 101-DS: USNM 193713, instar IV male on slide and in alcohol.

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF INSTAR IV MALE (Figures 90, 91).—Carapace oval in lateral view with small projecting posteroventral caudal process with rounded distal margin (Figure 90a-c). Rostrum absent.

Ornamentation: Surface with indistinct shallow fossae with rim of minute spines (on USNM 193713 fossae visible just on posterior part of shell) (Figure 90d). Minute spines forming intersecting rows (on USNM 193713 spines more clearly visible along shell margins, and especially in area of caudal process (Figure 90c) and along edges of valve (Figure 90c,e-g)).

Surface Bristles: Outside surface and valve margins with short and long bristles (Figure 90b). Long and short bristles along edge of valves generally with pointed tip, but those on lateral surface mostly with small bulbous tip (in Figure 90b the distribution of bulbous and pointed bristles are not accurately differentiated). Pointed bristles appear to merge from open pore (depression around base of bristle) whereas bulbous bristles emerge from closed pore (no depression around base of bristle). All bulbous bristles taper gradually to proximal end of bulb-like tip; most pointed bristles taper gradually to tip; however, a very few pointed bristles with slight broadening at the base.

Infold: Small bristle on anterior infold near inner margin usually present on the Sarsiellinae not observed on specimen examined (USNM 193713) (Figure 90e). Infold of caudal process with 3 or 4 small bristles forming row anterior to process and 6 smaller bristles (some in pairs) at inner margin of infold (Figure 90f,g); 2 or 3 setal bristles in row just dorsal to caudal process.

Selva: Broad lameller prolongation along anterior, ventral, and posterior margins; long marginal fringe present on prolongation along anteroventral, ventral, and posterior margins of left valve, but absent along terminal square edge of caudal process (Figure 90g). Fringe not observed on lamellar prolongation of right valve.

Central Adductor Muscle Attachments (Figure

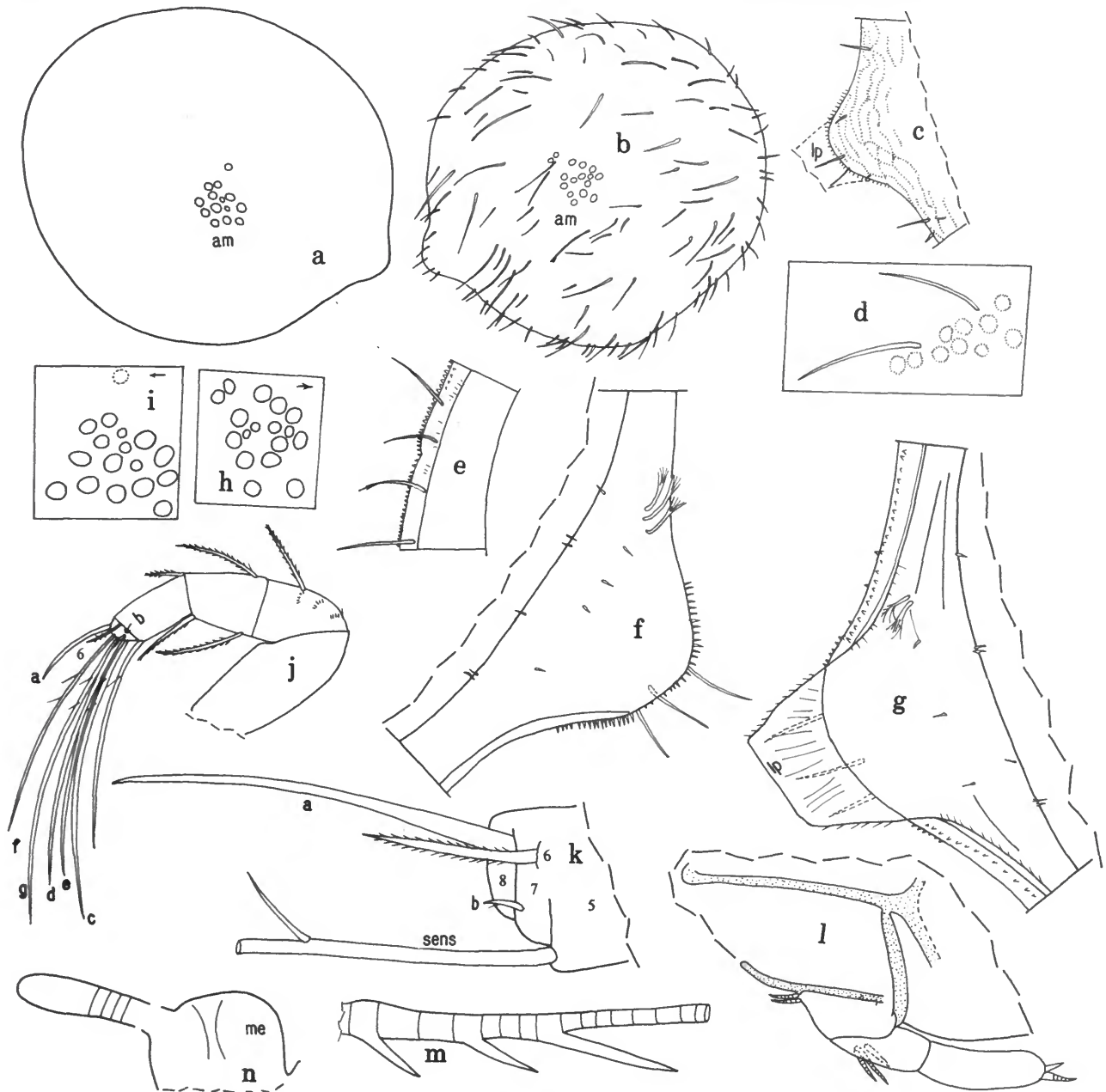


FIGURE 90.—*Chelicopia obex*, new species, instar IV male: holotype, MNHN Os 462: *a*, outline of complete specimen from left side showing central adductor muscle attachments (surface bristles not shown), length including caudal process 0.81 mm. Paratype, USNM 193713: *b*, complete specimen from right side, length including caudal process 0.77 mm; *c*, caudal process of right valve, anterior to right, ov; *d*, detail of fossae and 2 bristles near anterior of right valve shown in *b*, ov; *e*, anterior end of right valve at midheight, iv; *f*, caudal process of right valve, iv; *g*, caudal process of left valve with lamellar prolongation of selvage; *h, i*, central adductor muscle attachments of right and left valves, ov; *j*, right 1st antenna, mv; *k*, detail of tip of 1st antenna shown in *j* (not all bristles shown), mv; *l*, protopodite and endopodite of right 2nd antenna, mv; *m*, part of bristle of 3rd exopodial joint of left 2nd antenna, lv; *n*, medial eye and Bellonci organ.

90a,h,i): Comprising 17 individual ovoid attachments.

Carapace Size: MNHN Os 462, holotype, length with caudal process 0.81 mm, length without caudal process 0.79 mm, height 0.70 mm; USNM 193713, length with caudal process 0.77 mm, height 0.71 mm.

First Antenna (Figure 90j,k): 1st joint bare. 2nd joint with minute spines forming proximal rows on medial surface near dorsal margin and along dorsal margin, and distal rows on lateral surface near dorsal margin, and 1 spinous dorsal bristle near midlength. 3rd joint fused to 4th, with 2 long spinous bristles (1 ventral, 1 dorsal). 4th joint with 2 spinous terminal bristles (1 long ventral, 1 short dorsal). Sensory bristle of long 5th joint with 1 fairly long proximal filament. 6th joint fused to 5th, with short spinous medial bristle. 7th joint: a-bristle more than twice length of bristle of 6th joint, bare; b-bristle minute, about $\frac{1}{4}$ length of bristle of 6th joint, with 1 minute spine (filament?) (Figure 90k); c-bristle longer than sensory bristle of 5th joint, with 2 fairly long proximal filaments. 8th joint (Figure 90j): d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle shorter than c-bristle, with 2 fairly long proximal filaments; g-bristle about same length as c-bristle, with 2 fairly long proximal filaments.

Second Antenna: Protopodite bare. Endopodite 3-jointed (Figure 90l): 1st joint with 2 small anterior proximal bristles; 2nd joint elongate, with 3 small proximal bristles; 3rd joint longer than 2nd, with 2 small terminal bristles. Exopodite: 1st joint with small straight terminal medial tubular bristle; bristle of 2nd joint long, with 8 stout proximal ventral spines and distal natatory hairs; bristles of joints 2–8 with ventral spines and distal natatory hairs (distal spines of bristles of joints 3–5 unusually long (Figure 90m)); ventral spines of bristle of 8th joint absent or relatively small; small 9th joint with 2 bristles (ventral bristle medium length, with natatory hairs, no spines; dorsal bristle minute, either bare or with few short hairs).

Mandible (Figure 91a–d): Coxale endite represented by stout spine with 2 minute marginal spines. Coxale with long hairs forming relatively short row along ventral margin. Basale: with 4 medial bristles (3 proximal forming cluster, and 1 distal and closer to ventral margin) and 3 lateral bristles near distal medial bristle; dorsal margin with 1 small subterminal spine-like bristle. Exopodite small with small ventral bristle at midlength (Figure 91a,b). 1st endopodial joint: dorsal margin with proximal angular corner and few terminal spines forming part of row extending onto medial surface of joint; medial surface with minute spines forming distal rows; ventral margin with stout terminal claw with 6 small dorsal ridges near tip, and small spines forming row proximal to ridges (spines arranged in 3 sets (Figure 91d)). 2nd endopodial joint with stout terminal claw with 10 short dorsal ridges near tip and minute spines forming row proximal to ridges. 3rd endopodial joint with stout terminal claw and 4 small bristles near base of claw (3 ventral, 1 dorsal) (Figure 91b).

Maxilla: Endite I with 5 bristles; endite II with 4 bristles,

endite III with 6 bristles (Figure 91e). Coxale with short dorsal bristle (not shown). Basale with 1 short bristle near exopodite (bristle could be interpreted to be proximal on endite III) and few hairs on anterior margin. Exopodite small, with 2 bare bristles (Figure 91f). 1st endopodial joint with stout alpha- and beta-bristles and 3 sets of hairs along anterior margin (proximal set with stoutest hairs). 2nd endopodial joint with 2 short a-bristles (posterior longest and with few marginal spines), 1 short c-bristle, and 5 pectinate end bristles.

Fifth Limb (Figure 91g): Epipodial appendage with 34 bristles. Single endite with 1 small bare bristle. Exopodite: 1st joint with 3 bristles; joints 2–5 fused, with total of 11 or 12 bristles. Limb hirsute. All exopodial bristles ringed (not shown).

Sixth Limb (Figure 91h): Endite I with 3 bare bristles (2 long, 1 short). Endite II with 1 long bristle. End joint with 14 or 15 bristles (2 posterior bristles with long proximal and short distal hairs, remaining bristles with short hairs or spines). Limb hirsute (only few hairs shown). All bristles ringed (not shown).

Seventh Limb (Figure 91i): Well developed. Proximal group with 2 tapering bristles (1 on each side) on either the same segment or on adjacent segments, each bristle with 2 bells. Terminal group with 4 tapering bristles (2 on each side), each with 3 bells. Terminus with opposing small combs, each with 2 or 3 minute spine-like teeth (not all shown). (Tapering bristles a juvenile character.)

Furca (Figure 91j): Each lamella with 7 or 8 claws (USNM 193713 with 7 claws on left lamella and 8 on right); claws 1, 2, and 4 primary, nonarticulated, and with narrowly rounded tips; claw 3 and claws 5 to 7 or 8 secondary, articulated, and with pointed tips. Claw 1 with small slender proximal teeth forming medial row, longer teeth forming lateral row (4 distal teeth very large), and few hairs along anterior margin. Claw 2 with teeth along posterior margin (some longer than others) and few hairs along anterior margin. Claw 4 with small teeth (some larger than others) along posterior margin and few hairs along anterior margin. Claw 3 with minute teeth along posterior margin and few teeth along anterior margin. Claws 5–7 or 8 with minute teeth along posterior margin and fewer similar teeth along anterior margin. Long hairs on lamellae following claws and also medial to the secondary claws following primary claw 4. 2 indistinct spines on each lamella following last claw and near proximal end of lamella (Figure 91j). Right lamella anterior to left by width of claw 1 at base.

Bellonci Organ (Figure 90n): Elongate, broadening to rounded tip, with weak sutures.

Eyes: Lateral eye unpigmented with 10 amber-colored ommatidia (5 large, 5 small, all divided by a suture) (Figure 91k,l). Medial eye about same size as lateral eye, bare, unpigmented (Figure 90n).

Upper Lip (Figure 91m): Evenly rounded and with few long ventral hairs.

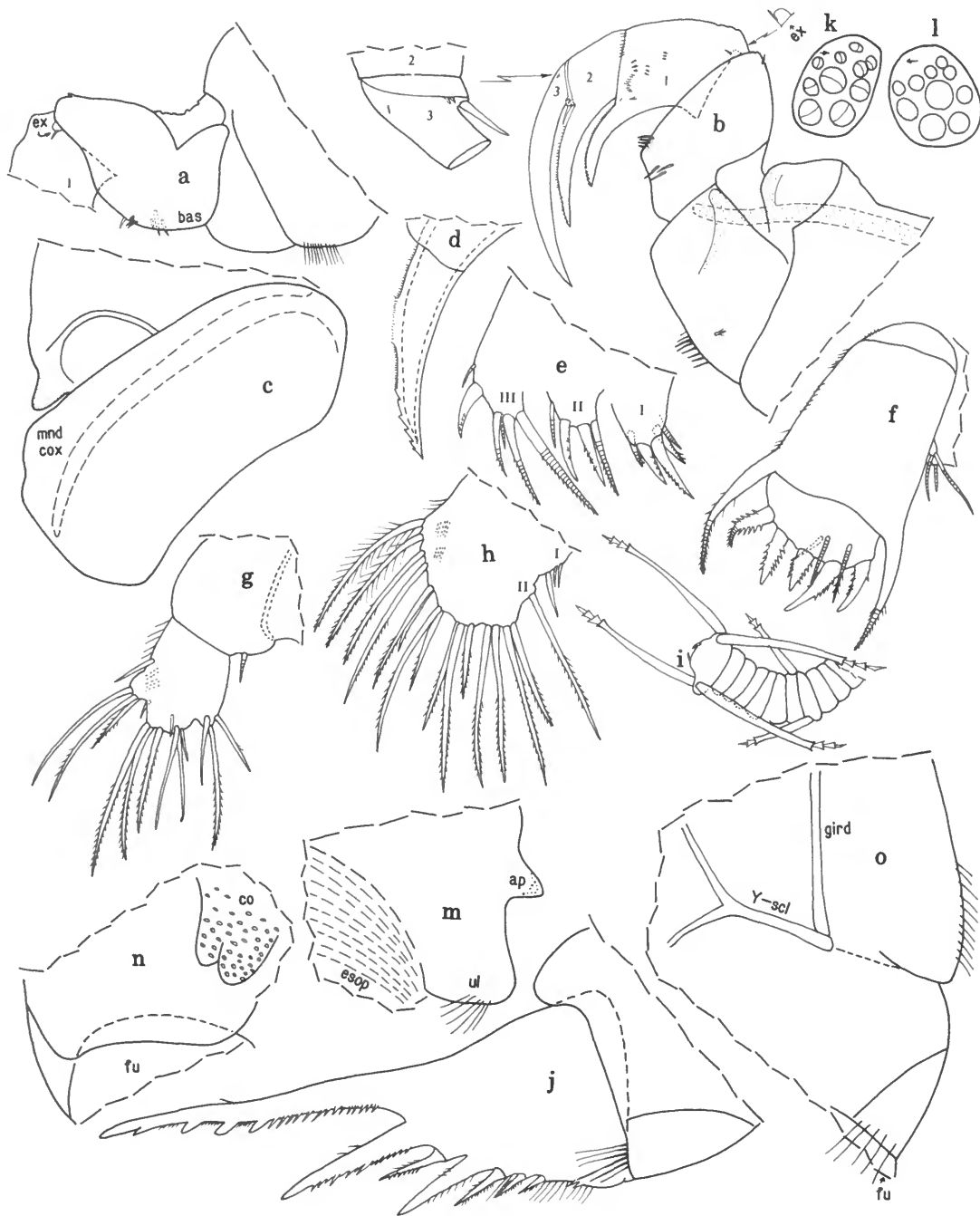


FIGURE 91.—*Chelicopia obex*, new species, instar IV male, paratype, USNM 193713: a, proximal part of left mandible, lv; b, right mandible, mv; c, process (stippled) on anterior of body just dorsal to anterior end of coxale of left mandible (a similar process also present dorsal to coxale of right mandible), lv; d, detail of claw of 1st endopodial joint of left mandible, lv; e, endites I-III of right maxilla, mv; f, left maxilla (endites not shown), lv; g, 5th limb; h, left 6th limb, lv; i, 7th limb; j, left furcal lamella, lv; k, l, right and left lateral eyes; m, anterior of body from right side showing sclerotized triangular process, upper lip, and anterior part of esophagus, anterior to right; n, posterior part of body from right side showing 2 copulatory lobes near furca, anterior to right; o, posterior of body from left side, anterior to left.

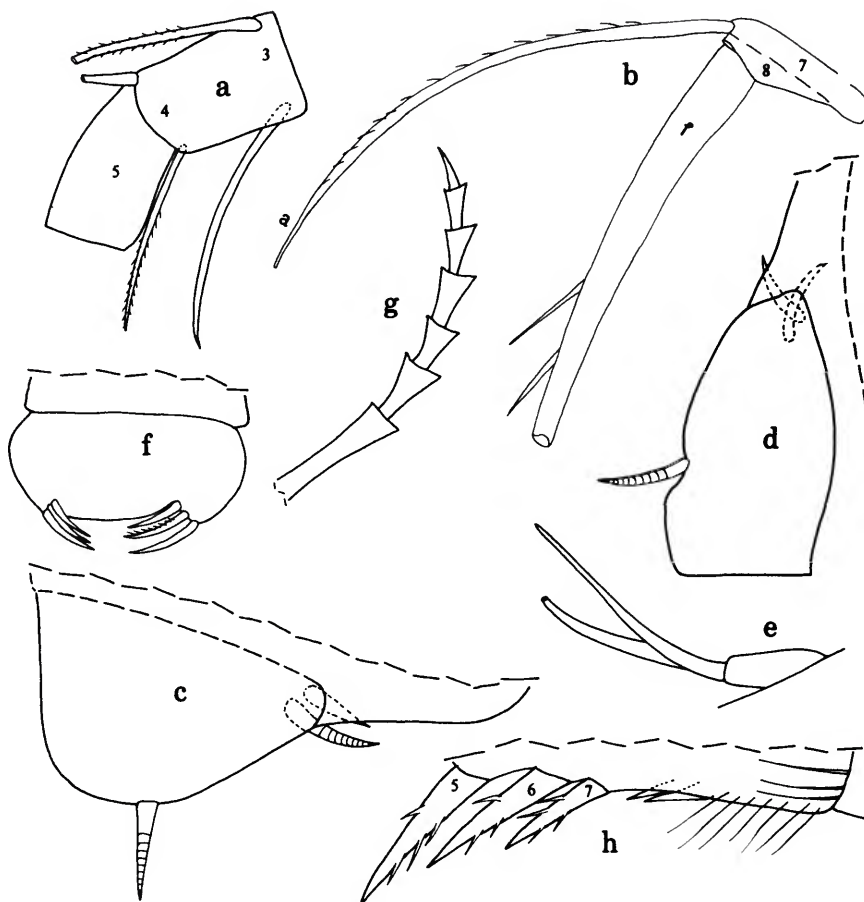


FIGURE 92.—*Chelicopia kornickeri* McKenzie, female, holotype, USNM 110912: a, joints 3-5 of left 1st antenna, lv; b, a-bristle of 7th joint and proximal part of f-bristle of 8th joint of left 1st antenna shown in a, lv; c,d, endopodites of right and left 2nd antennae, lv; e, exopodite of left maxilla, mv; f, combs at tip of 7th limb (bristles not shown); g, distal end of bristle on terminal segment of 7th limb; h, claws 5-7 (followed by 2 spines and many hairs) of left furcal lamella, lv.

Genitalia (Figure 91n): Comprising 2 small lobes on each side of body anterior to furca (lobes containing small globules or cells).

Anterior of Body (Figure 91m): Small triangular process on anterior just dorsal to each mandible.

Posterior of Body: Long hairs forming lateral row just proximal to furca (Figure 91j,o); additional long hairs just dorsal to a small indentation posterior to posterior end of Y-sclerite (Figure 91o).

Y-Sclerite (Figure 91o): Typical for subfamily.

COMPARISONS.—*Chelicopia obex* is quite similar to *C. arostrata*, *C. rotunda*, and *C. kornickeri*, and all could be conspecific. Details of the appendages of some of the species are not known but from what is available it is apparent that their appendages are quite similar. I propose *C. obex* as a new

species because of its projecting caudal process, which is not present on juveniles or adults of the 3 previously described species. However, because *C. obex* is known only from the instar IV male, it is not known whether the projecting caudal process also is present on the adult, but I here assume that it is.

For comparative purposes I examined the holotype of *C. kornickeri* McKenzie, 1965 (USNM 110912), and have illustrated some of the appendages (Figure 92).

Eurypylus Brady, 1869

Eurypylus Brady, 1869:141.—Kornicker and McKenzie, 1976:348 [diagnosis, key].—Kornicker, 1986a:33 [key].

TYPE SPECIES.—*Eurypylus petrosus* Brady, 1869:141, monotypy.

DISTRIBUTION.—Continental shelf off Georgia, North America; mangrove area in vicinity of Tanzania, East Africa; Cape Verde Islands off West Africa; shallow water in vicinity of Singapore; Lizard Island lagoon, Australia. Herein: in vicinity of Mayotte and Glorioso Islands. Known depth range shallow

water to 33 m.

COMPOSITION.—This genus includes 6 species: *E. petrosus* Brady, 1869:141; *E. setifer* (Poulsen, 1965:62); *E. concentricostatus* (Hartmann, 1974:235); *E. pulcher* Hall, 1985:500; *E. rousei* (Darby, 1965:37); and *E. chavturi*, new species.

Key to Species of *Eurypylus*

(Adult and Instar IV Females)

1. Each lamella of furca with 4 claws *E. petrosus**
- Each lamella of furca with 7 or 8 claws *E. setifer*
- Each lamella of furca with 5 claws 2
2. Endopodite of 2nd antenna with long ventral bristle *E. rousei*
- Endopodite of 2nd antenna without ventral bristle 3
3. Carapace with concentric rib *E. concentricostatus*
- Carapace without concentric rib 4
4. Carapace with small projecting rostrum *E. chavturi*, new species
- Carapace without projecting rostrum *E. pulcher*

* Only known specimen may be a juvenile (see "Remarks" at end of this description).

Eurypylus chavturi, new species

FIGURES 93–97

ETYMOLOGY.—The species is named for V.G. Chavtur, Institute of Marine Biology, Vladivostok, Russia.

HOLOTYPE.—MNHN Os 80, ovigerous female in alcohol.

TYPE LOCALITY.—Sta 101-DS, 8 Apr 1977, NW Île du Lys, Glorioso Islands, 11°25'42"S, 47°19'30"E, depth 26 m.

PARATYPES.—Sta 24-S: USNM 158147, 2 ovigerous females and 1 juvenile in alcohol. Sta 32-S: USNM 193781, 1 instar III male in alcohol. Sta 46-S: MNHN Os 86, 1 female in alcohol. Sta 79-S: MNHN Os 85, 4 females in alcohol. Sta 101-DS: MNHN Os 81, 25 specimens in alcohol; USNM 193162, 10 females in alcohol. Sta 106-R: USNM 158612, 2 adult females and 2 juveniles in alcohol. Sta 110-S: MNHN Os 82, 1 adult female in alcohol. Sta 116-S: MNHN Os 83, 13 specimens including 1 instar IV male in alcohol. Sta 117-S: MNHN Os 84, 1 female in alcohol; USNM 158614, 1 adult male on slide and in alcohol; USNM 158613, 1 adult female on slide and in alcohol. Sta 124-S: MNHN Os 87, 75 specimens in alcohol.

DISTRIBUTION.—Sta 24-S, M'Zamboro Pass, Mayotte, depth 16–18 m. Sta 32-S, N Pamanzi Island, Mayotte, depth 15–20 m. Sta 46-S, south of barrier reef, Mayotte, depth 33 m. Sta 79-S, L'Iris Bank, Mayotte, depth 25 m. Sta 101-DS, NW Île du Lys, Glorioso Islands, depth 26 m. Sta 106-R, Zelee Bank, south border, depth 18–24 m. Sta 110-S, S Zelee Bank, depth 24 m. Sta 116-S, Geyser Bank, southern part of lagoon, depth 13 m. Sta 117-S, Geyser Bank, southern part of lagoon, depth 3–8 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 3–33 m.

DESCRIPTION OF ADULT FEMALE (Figures 93–95).—Carapace oval in lateral view, with small but well-defined incisur and short, broad caudal process (Figure 93).

Ornamentation: Surface with well-defined fossae; area between fossae with abundant pustules divided into polygons by narrow sutures (Figure 94); bottom of fossae with minute pustules; surface of valve with very few lateral bristles (Figures 94, 95a), some divided; marginal bristles more numerous, some divided. Surface without gelatinous coating.

Infold (Figure 95a–c): Inner edge of anterior infold with 1

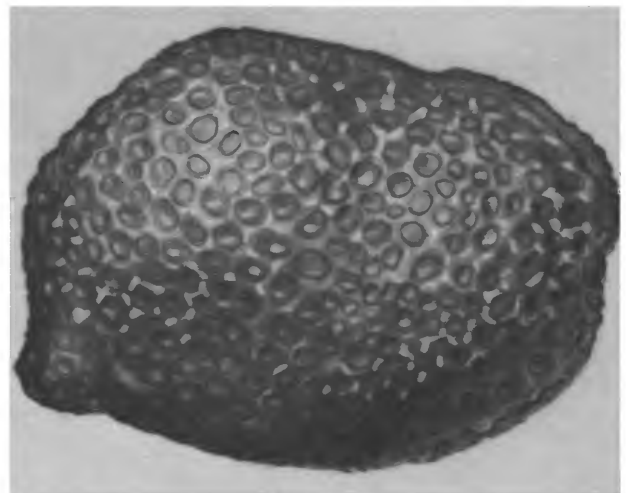


FIGURE 93.—*Eurypylus chavturi*, new species, adult female, paratype, USNM 158613, complete specimen from right side, length 0.92 mm.

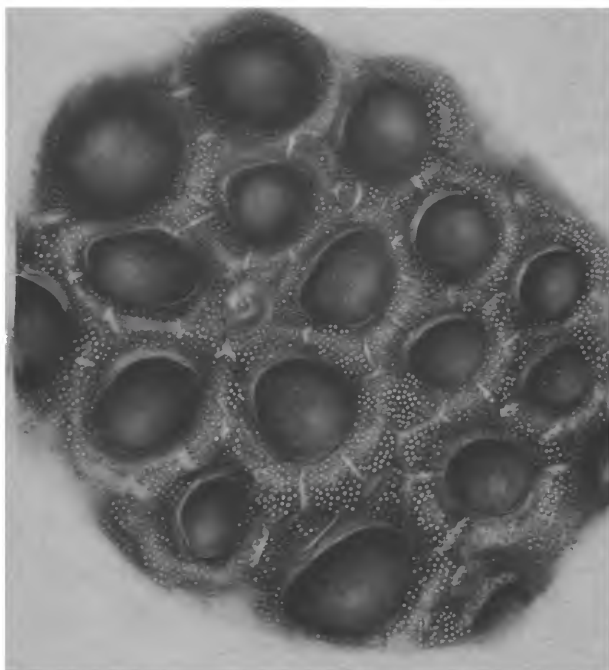


FIGURE 94.—*Eurypylus chavturi*, new species, adult female, paratype, USNM 158613, detail of surface structures.

minute bristle just ventral to incisur. Infold of caudal process with well-defined curving list; list concave posteriorly and bearing 9–11 bare bristles; list of right valve usually better defined than that of left valve, and forming anterior edge of pocket. Posterior infold just dorsal to caudal process with 2 setal bristles; several small bristles along inner edge of infold in vicinity of caudal process.

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

Central Adductor Muscle Attachments: Consisting of about 19 ovoid attachments.

Carapace Size: MNHN Os 80, holotype, length 0.89 mm, height 0.69 mm. USNM 193162 part, 3 ovigerous females, length 0.86 mm, height 0.64 mm; length 0.84 mm, height 0.64 mm; length 0.83 mm, height 0.60 mm. MNHN Os 82, length 0.88 mm, height 0.64 mm. USNM 158613, length 0.92 mm, height 0.73 mm.

First Antenna (Figure 95d): 1st joint bare. 2nd joint with dorsal spines and 1 dorsal bristle with few long hairs. 3rd joint fused to 4th; 3rd joint short with 2 bristles (1 ventral, 1 dorsal); 4th joint long with 3 bristles (2 ventral, 1 dorsal). Sensory bristle of 5th limb with minute distal marginal filament and spine at tip. 6th joint with small medial bristle near dorsal margin. 7th joint: a-bristle about 4 times length of bristle of 6th joint; b-bristle $\frac{3}{4}$ to same length of a-bristle; c-bristle slightly longer than sensory bristle of 5th joint, with 1 minute distal

marginal filament and spine at tip. 8th joint: d- and e-bristles about $\frac{2}{3}$ length of c-bristle, bare with blunt tips; f-bristle about $\frac{2}{3}$ length of c-bristle, with minute filament near middle and spine at tip; g-bristle slightly shorter than sensory bristle of 5th joint, with 2 short marginal filaments on proximal half, and with spine at tip. (Not all filaments of bristles of 7th and 8th joints shown in illustrated limb.)

Second Antenna (Figure 95e): Protopodite bare. Endopodite with 2 short anterior bristles on 1st joint and small bare 2nd joint without basal suture. Exopodite: distal end of 1st joint with small recurved medial bristle and long dorsal hairs; bristle of 2nd joint with 1 dorsal proximal hair followed by 12 stout proximal spines on ventral margin and distal natatory hairs; bristles of joints 3–7 with proximal dorsal hairs followed by proximal ventral spines and distal natatory hairs; bristle of 8th joint with proximal ventral spines and distal natatory hairs; 9th joint with 2 bristles (1 short, bare; 1 long with natatory hairs).

Mandible (Figure 95f): Coxale endite represented by small spine; coxale with hairs along ventral margin. Basale with 2 spine-like dorsal bristles (1 near midlength (not shown), 1 terminal), and 5 short bristles on or near ventral margin. Minute lateral process of distal margin of basale might represent exopodite. Endopodite: spines of 1st joint on medial surface and at distal edge of dorsal margin forming a row extending onto medial and lateral surfaces of joint; ventral margin of joint with usual stout terminal claw; 2nd joint with minute terminal bristle on dorsal margin, stout ventral claw, and 2 minute, faint, spine-like medial bristles on distal margin (not shown); 3rd joint with stout terminal claw and small ventral bristle.

Maxilla (Figure 95g): Endite I with 6 bristles (3 pectinate); endite II with 4 bristles (2 pectinate); endite III with 6 bristles (3 pectinate). Precoxale and coxale with fringe of hairs; coxale with short dorsal bristle. Basale with slender bristle near base of exopodite. Exopodite with 2 bare bristles (shorter bristle about $\frac{2}{3}$ length of other). Endopodite: 1st joint with slender, spinous, alpha- and beta-bristles; 2nd joint with 2 a-bristles, 1 short c-bristle, and 5 pectinate end bristles (presence of only 4 end bristles on right limb of holotype considered aberrant).

Fifth Limb (Figure 95h): Epipodial appendage with 34 plumose bristles. Single endite with 1 small bristle. Exopodite: 1st joint with proximal hairs and 2 terminal bristles; 2nd–5th joints fused, hirsute, with total of 8 or 9 bristles.

Sixth Limb (Figure 95i): Single endite with 3 short bristles. End joint with 9 spinous ventral bristles followed by space and 2 posterior bristles (ventral of these bare or with few spines or hairs, other plumose; 1 limb of holotype with ventral bristle broken off near base); lateral and medial surfaces of end joint with faint spines forming rows.

Seventh Limb (Figure 95j): Each limb with 2 proximal bristles, 1 on each side of same segment (each bristle with 4 bells), and 6 terminal bristles, 3 on each side (2 short bristles with 3 bells, 4 longer bristles with 6–8 bells); all bristles without marginal spines. Terminus with opposing combs (1 with 3 short teeth, other with 5 teeth of which middle tooth

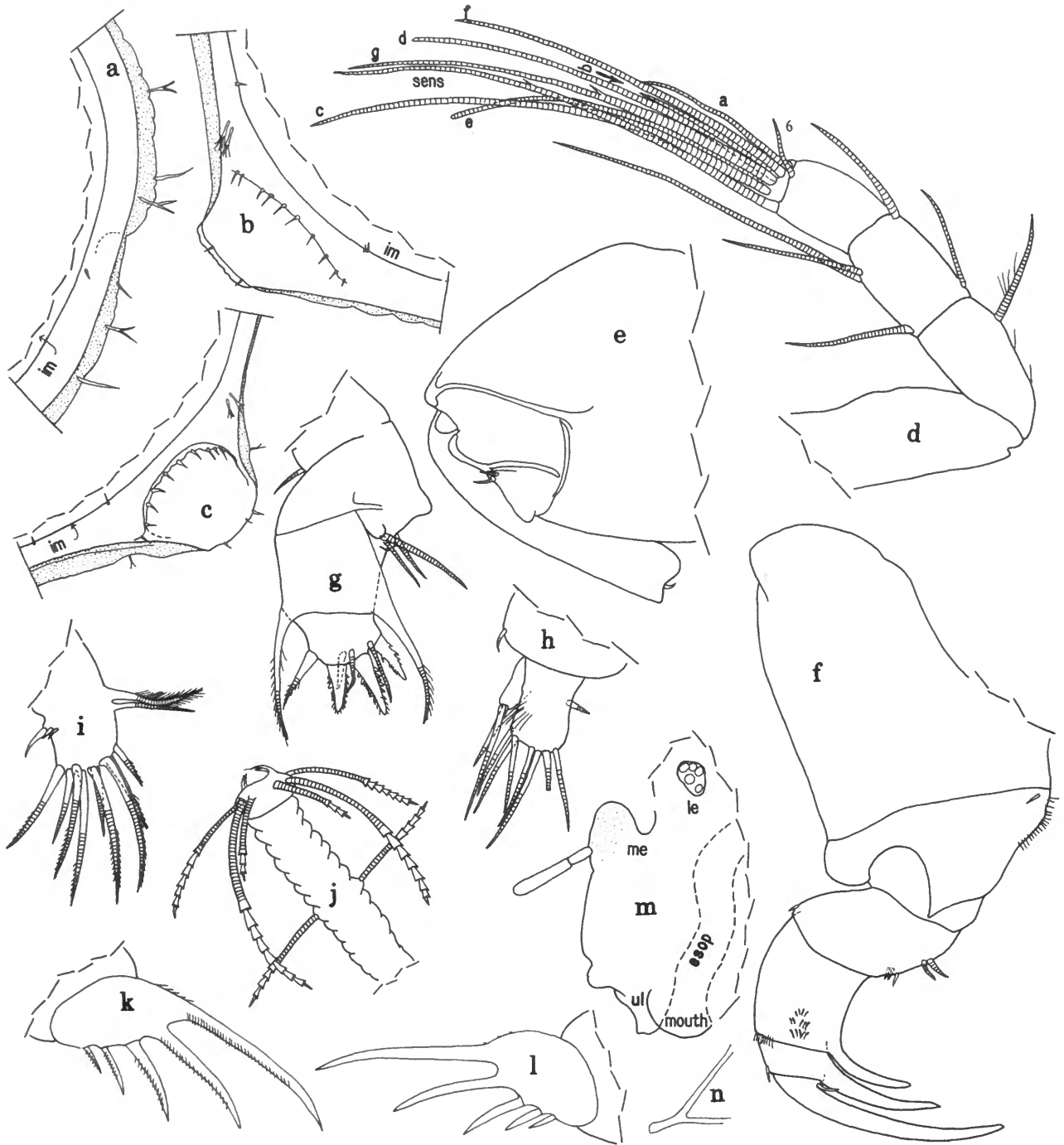


FIGURE 95.—*Eurypylus chavturi*, new species, adult female, paratype, USNM 158613: *a*, anterior of left valve, *iv*; *b, c*, caudal processes of left and right valves, *iv*; *d*, right 1st antenna, *mv*; *e*, protopodite, endopodite, and 1st joint of exopodite of right 2nd antenna, *mv*; *f*, right mandible, *mv*; *g*, left maxilla (endite bristles not shown), *lv*; *h*, 5th limb; *i*, 6th limb; *j*, 7th limb; *k, l*, right and left furcal lamellae (teeth of claws not shown in *l*); *lv*; *m*, anterior of body from left side, anterior to left; *n*, right Y-sclerite, anterior to right.

longer than others).

Furca (Figure 95k,l): Each lamella with 5 claws decreasing in length posteriorly along lamella; claws 1 and 2 nonarticulated, claws 3, 4, and 5 articulated; all claws with marginal teeth; marginal teeth on claw 1 without large teeth interspersed between smaller teeth; anterior of right and left lamellae with spines; right lamella slightly anterior to left. (The caudal furcae of 10 adult females were examined. Except for 1 specimen having 6 claws on one lamella, all specimens have 5 furcal claws. On all specimens the 1st and 2nd claws are nonarticulated and claws 3–5 (and 6) are articulated.)

Bellonci Organ (Figure 95m): Divided by suture into short proximal and longer and wider distal part; distal end rounded, with minute spines visible at high magnification ($\times 100$ oil immersion objective, $\times 15$ ocular; spines not shown on illustrated organ).

Eyes (Figure 95m): Medial and lateral eyes unpigmented; lateral eye smaller than medial eye, with 5 ommatidia.

Upper Lip (Figure 95m): Consisting of helmet-shaped lobe.

Genitalia: Oval sclerotized ring on each side of body.

Y-Sclerite (Figure 95n): Typical for subfamily.

Eggs: Oviparous females with 2 or 3 eggs in marsupium, some also with smaller unextruded eggs.

DESCRIPTION OF ADULT MALE (Figures 96, 97a–j).—Carapace similar to that of adult female except for having a more prominent rostrum and broader caudal process (Figure 96).

Ornamentation (Figure 96): Similar to that of adult female (sutures between fossae not shown on illustrated valve).

Infold: Infold broad posterior to rostrum; small bristle at inner edge of infold ventral to incisur (Figure 97a); posterior infold with straight list (list less defined than on female) bearing 4 or 5 small bare bristles; 2 setal bristles dorsal to caudal process (Figure 97b).

Selvage: Similar to that of adult female.

Carapace Size: USNM 158614, length 0.75 mm, height 0.51 mm.

First Antenna (Figure 97c): 1st joint bare. 2nd joint with dorsal spines and 1 dorsal bristle with few long marginal hairs. 3rd and 4th joints fused; 3rd joint short with 2 bristles (1 ventral, 1 dorsal); 4th joint long with 3 bristles (2 ventral, 1 dorsal). 5th joint short, ventral, wedged between 4th and 6th joints; sensory bristle with short proximal cup bearing numerous long filaments (filaments not shown); stem with 4 marginal filaments. 6th joint long, with short medial bristle near dorsal margin. 7th joint: a-bristle about 4 times length of bristle of 6th joint; b-bristle bare, about same length as a-bristle; c-bristle reaching slightly past sensory bristle of 5th joint, with 5 marginal filaments. 8th joint: d- and e-bristles well developed, bare, with blunt tips; f-bristle shorter than c-bristle, with 3 marginal filaments; g-bristle about same length as c-bristle, with 5 marginal filaments.

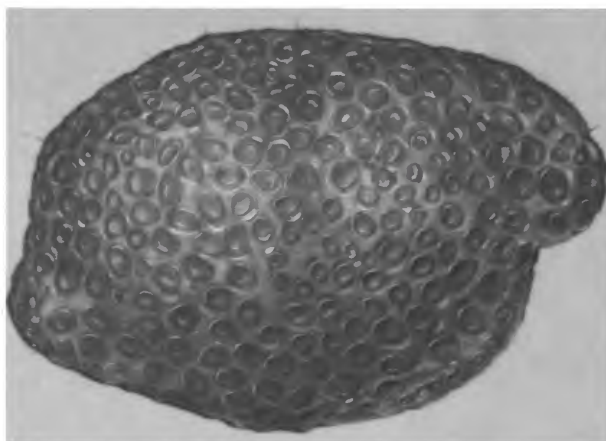


FIGURE 96.—*Eurypylus chavturi*, new species, adult male, paratype, USNM 158614, complete specimen from right side, length 0.75 mm.

Second Antenna: Protopodite bare (Figure 97d). Endopodite 3-jointed (Figure 97d): 1st joint with 2 short, proximal, anterior bristles, and distal medial row of spines (anterior of these appearing stouter than others); 2nd joint elongate, with 2 proximal bristles; 3rd joint about same length as 2nd, reflexed, with 2 minute terminal bristles, and with faint terminal ridges. Exopodite: 1st joint elongate, with minute recurved medial bristle on distal margin; bristles of joints 2–7 with proximal ventral spines and distal natatory hairs; 9th joint with 2 bristles (1 long with natatory hairs, 1 short, bare); distal edge of some joints with faint spines forming rows.

Mandible (Figure 97e): Coxale endite represented by minute spine. Basale: dorsal margin with distal bristles forming 2 groups (1 bristle in proximal group, 2 in distal group); medial side with 1 short stout bristle near middle, and 3 small bristles near ventral margin; ventral margin with 2 small bristles. Exopodite well developed, hirsute, with tip extending onto medial surface of 1st exopodial joint (similar orientation as exopodite of male ruderatids). Endopodite: ventral margin of 1st joint with 1 long ringed bristle with long proximal marginal hairs and short distal spines, and 1 short ringed bristle; medial surface with long hairs near dorsal margin, and shorter spines forming rows; 2nd joint with 2 stout, ringed bristles at midlength of dorsal margin, and 1 long, ringed ventral bristle; medial surface with distal spines forming rows; 3rd joint with stout terminal claw and 2 ventral bristles.

Maxilla: Very small; coxale with dorsal bristle; endites and basale with weakly developed bristles; exopodite with 2 long fairly well developed bristles. Endopodite with 2 joints bearing weakly developed bristles.

Fifth Limb (Figure 97f): Epipodite appendage with 32 bristles. Single endite with 1 small bristle. Exopodite: 1st joint with 2 weakly developed bristles; joints 2–5 fused, with total of

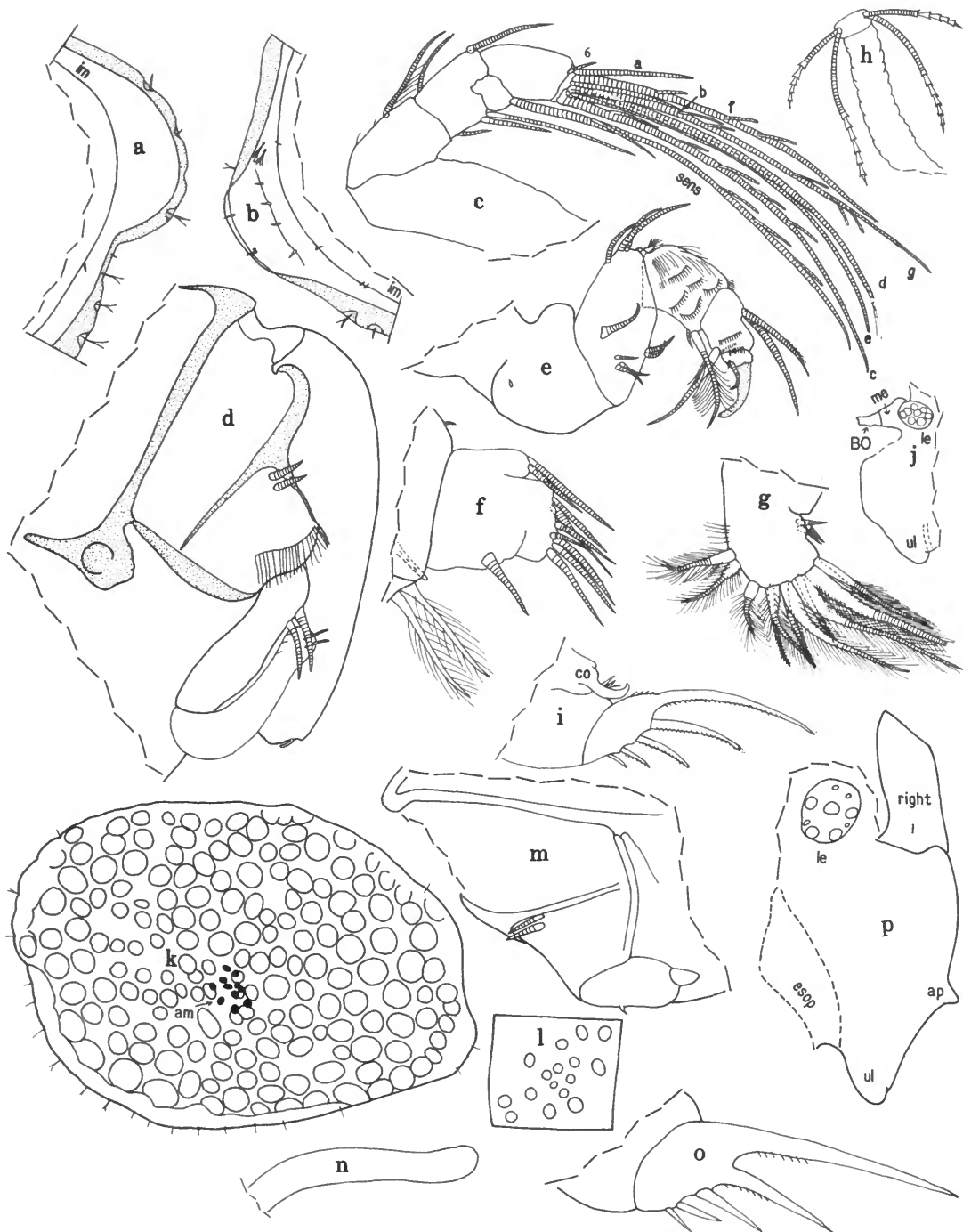


FIGURE 97.—*Euryptylus chavturi*, new species, paratypes: adult male, USNM 193614: *a, b*, anterior and posterior ends of left valve, *iv*; *c*, left 1st antenna, *mv*; *d*, protopodite, endopodite, and 1st exopodial joint of left 2nd antenna, *mv*; *e*, left mandible, *mv*; *f*, 5th limb; *g*, 6th limb; *h*, 7th limb; *i*, right furcal lamella and right copulatory organ, *lv*; *j*, anterior of body from left side (distal part of Bellonci organ broken off), anterior to left. Instar III male, USNM 193781: *k*, complete specimen from left side, length 0.56 mm; *l*, central adductor muscles projecting from right side of body with right valve removed, anterior to right; *m*, protopodite and endopodite of right 2nd antenna, *mv*; *n*, 7th limb; *o*, right furcal lamella, *lv*; *p*, anterior of body from right side, anterior to right.

8 weakly developed bristles. Minute node between epipodite and exopodite may be glandular process (Figure 97f).

Sixth Limb (Figure 97g): Single endite with 3 short bristles. End joint with 8 hirsute bristles and 4 bristles with short marginal spines (the longer hirsute bristles at anterior part of limb); lateral and medial surfaces of end joint hirsute.

Seventh Limb (Figure 97h): Well developed, with 4 terminal bristles (2 on each side), each with 5 or 6 bells; terminus without comb teeth.

Furca (Figure 97i): Differs from that of adult female in not having 2nd claw fused to lamella.

Bellonci Organ (Figure 97j): Broken off near base on specimen studied.

Eyes (Figure 97j): Lateral and medial eyes without pigment. Lateral eye about same size as medial eye, with 8 divided ommatidia (diameter of 3 ommatidia greater than others).

Upper Lip (Figure 97j): Simple curved lobe.

Copulatory Appendage (Figure 97i): Lobate, with 1 lobe terminating in sclerotized hook and bearing bristles.

Y-Sclerite: Similar to that of adult female.

DESCRIPTION OF INSTAR III MALE (Figure 97k-p).—In general, carapace similar in shape and ornamentation to that of adult female but without narrow sutures forming polygons (Figure 97k).

Central Adductor Muscle Attachments (Figure 97l): Consisting of about 16 oval attachments (not all shown on illustrated carapace).

Carapace Size: USNM 193781, length 0.56 mm, height 0.39 mm.

First Antenna: 1st–3rd and 6th joints similar to those of adult female. 4th joint with 2 bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with small filament about $\frac{1}{4}$ length from proximal end, and terminal spine. 7th joint: a-bristle about 4 times length of bristle of 6th joint; b-bristle about $\frac{1}{3}$ length of a-bristle, bare; c-bristle with small filament about $\frac{1}{3}$ length from proximal end, and terminal spine. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle about $\frac{3}{4}$ length of c-bristle, bare except for spine at tip; g-bristle about same length as c-bristle, bare except for spine at tip.

Second Antenna: In general, protopodite and exopodite similar to those of adult female. Endopodite 3-jointed (Figure 97m): 1st joint with 2 short proximal anterior bristles, and without medial spines present on adult male; 2nd joint elongate with spine-like bristle; 3rd joint small, bare.

Mandible, Fifth and Sixth Limbs: Well developed.

Seventh Limb (Figure 97n): Elongate, bare, without sutures forming rings.

Furca (Figure 97o): Same number of claws as on adult. Right lamella anterior to left by width of base of claw 1.

Bellonci Organ: Not observed (probably fragmented).

Eyes: Medial eye about same size as lateral eye, unpigmented. Lateral eye without pigment, with 5 large amber-colored

ommatidia and several smaller similarly colored cells (ommatidia?) (Figure 97p).

Upper Lip (Figure 97p): Similar to that of adult female.

DESCRIPTION OF INSTAR IV MALE (MNHN Os 83 part).—Carapace similar in shape to that of adult female.

Ornamentation: Similar to that of adult male and female in having fossae, abundant pustules, and divided bristles, but differs in not having narrow sutures forming polygons.

Infold: Infold of caudal process without well-defined list as on adults.

Carapace Size: Length 0.65 mm, height 0.48 mm.

First Antenna: Distribution of bristles similar to those of adult female.

Second Antenna: Protopodite and exopodite similar to those of adult female. Endopodite 3-jointed: 1st joint similar to that of adult male, with 2 proximal anterior bristles; 2nd joint elongate, about same length as 1st joint but narrower, with 2 small proximal bristles; 3rd joint about same length and width as 2nd joint, with 2 small terminal bristles, not reflexed as on adult male.

Mandible, Maxilla, Fifth and Sixth Limbs: Not examined in detail but similar to those of adult female.

Seventh Limb: Similar to that of adult male except for bristles strongly tapering and bearing only 3 bells.

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

Eyes: Medial eye similar to that of adult male and female. Lateral eye about same size as medial eye, with 5 ommatidia.

Copulatory Organ: Not observed.

COMPARISONS.—The new species differs from *E. petrosus* Brady, 1869:141 in having 5 instead of 4 furcal claws on each lamella, and from *E. concentricostatus* (Hartmann, 1974:235) in not having a concentric rib on the carapace. Outwardly the carapace of *E. chavturi* resembles that of *Junctichela margalefi* Kornicker and Caraion, 1978:48, but it is much smaller, and the appendages differ; for example, *J. margalefi* has furcal claws 1–3 fused to the lamella, compared to claw 1 for the adult male and claws 1 and 2 for the adult female of *E. chavturi*.

ONTOGENY AND SEXUAL DIMORPHISM.—The furcae of the adult female and the A-1 male have the 1st and 2nd claws fused to the lamella, whereas, the furca of the adult male has only the 1st claw fused. An opposite relationship exists between the furca and female furcae of *Neomuelleriella hispida* (Brady, 1898:439) (Kornicker, 1975a:633).

REMARKS CONCERNING *Eurypylus petrosus* Brady, 1869.—The single specimen referred to this species by Brady (1869:141) was redescribed by Kornicker and McKenzie (1976:347). It may be a juvenile, but because of its having a well-defined 7th limb (ringed segment illustrated by Kornicker and McKenzie (1976, fig. 1h)), it is not younger than instar III. Instar III of *E. chavturi* bears 5 claws on each lamella of the furca, the same number that is on the adult. Therefore, it seems likely that the adult *E. petrosus* has only 4 claws, the same number that is on the only known specimen.

Metasarsiella Kornicker, 1991

Metasarsiella Kornicker, 1991:104–105.

TYPE SPECIES.—*Metasarsiella vibex* Kornicker, 1991:104–109, figs. 57–60.

DISTRIBUTION.—Enewetak Atoll lagoon; Leven Bank, SE of Glorioso Islands. Known depth range 3–150 m.

COMPOSITION.—This genus includes 2 species: *M. vibex* and *M. benthedi*, new species.

Metasarsiella benthedi, new species

FIGURES 98, 99

ETYMOLOGY.—The specific name for the expedition during which the holotype was collected, Benthédi.

HOLOTYPE.—MNHN Os 89, ovigerous female on slide and in alcohol.

TYPE LOCALITY.—Sta 5-DR, 18 Mar 1977, W Leven Bank, 12°32'S, 47°40'12"E, depth 150 m at beginning of rock dredging and 50 m at end.

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT FEMALE (Figures 98, 99).—Carapace oval in lateral view with prominent caudal process oriented posteriorly (Figure 98).

Ornamentation (Figure 98): Posterior process near midheight projecting past valve edge; narrow ridge lying just within valve edge along anterior, ventral, and dorsal margins; dorsal part of ridge terminating in prominent posterodorsal process; ventral part of ridge terminating on caudal process; ventral and anterior part of ridge with riblets extending toward valve edge; posterodorsal process and ventral part of ridge connected by thin vertical rib in posterior part of valve; ventral end of vertical rib terminating in small posteroventral process; U-shape ridge extending from small posteroventral process anteriorly past central adductor muscle attachments, then bending dorsally, and then posteriorly, terminating on posterodorsal process; anterior and dorsal parts of U-shape process with 4 or 5 low radial ribs extending to ridge lying just within valve edge. Surface of valve with many distinct fossae having minute pustules at bottom; anterior and ventral margins of valve with many bristles, but bristles extremely sparse on lateral surface; all bristles fairly long, some slender, some with broad bases; surface of valve without gelatinous coating.

Infold (Figure 99a,c–e): Infold of caudal process with 5–7 short bristles (Figure 99d,e); posterior infold with 2 setal bristles; anterior infold with minute bristle at midheight (Figure 99c); inner margin of ventral infold just anterior to caudal process with 2 individual minute bristles.

Selvage (Figure 99a,c,e): Lamellar prolongation broad along anterodorsal, anterior, ventral, and posterior margins of valve, and with marginal fringe along anterior margin as well as along anterior part of ventral margin (Figure 99a,c).

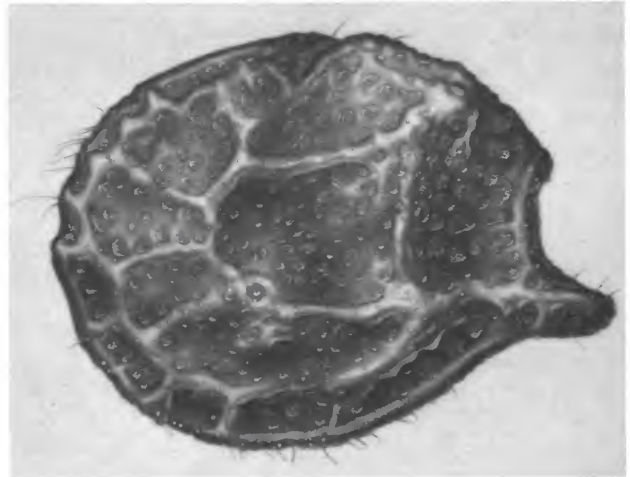


FIGURE 98.—*Metasarsiella benthedi*, new species, adult female, holotype, MNHN Os 89, complete specimen from left side, length including caudal process 0.77 mm.

Central Adductor Muscle Attachments (Figure 99b): Consisting of about 18 individual ovoid scars.

Carapace Size: MNHN Os 89, holotype, length with caudal process 0.77 mm, length without caudal process 0.73 mm, height 0.59 mm.

First Antenna (Figure 99f): 1st joint bare. 2nd joint with ventral and dorsal spines and 1 spinous dorsal bristle. 3rd and 4th joints fused; short 3rd joint with 2 bristles (1 ventral, 1 dorsal); long 4th joint with 3 bristles (2 ventral, 1 dorsal). Sensory bristle of long 5th joint with 1 or 2 minute marginal filaments. 5th and 6th joints fused; medial bristle of 6th joint short, with base near dorsal margin. 7th joint: a-bristle about twice length of bristle of 6th joint; b-bristle broken on both limbs examined, stump longer than a-bristle; c-bristle about same length as sensory bristle of 5th joint, with 1 minute distal filament. 8th joint: d- and e-bristles well developed, bare with blunt tips; f-bristle about $\frac{3}{4}$ length of c-bristle, bare except for spine at tip; g-bristle about same length as c-bristle, with minute distal marginal filament.

Second Antenna (Figure 99g): Protopodite bare. Endopodite single jointed, with 2 proximal anterior bristles and small terminal bulge (bulge could be considered 2nd joint). Exopodite: 1st joint with small recurved medial bristle on distal margin at about midwidth; bristle of 2nd joint with slender proximal ventral spines and distal natatory hairs; bristle of 3rd joint with few ventral spines near middle and natatory hairs; remaining bristles with only natatory hairs; 9th joint with 1 short bare bristle and 1 long bristle with natatory hairs.

Mandible (Figure 99h): Coxale endite consisting of small sclerotized spine; ventral margin of coxale with long hairs. Basale: dorsal margin with 1 minute spine-like bristle at

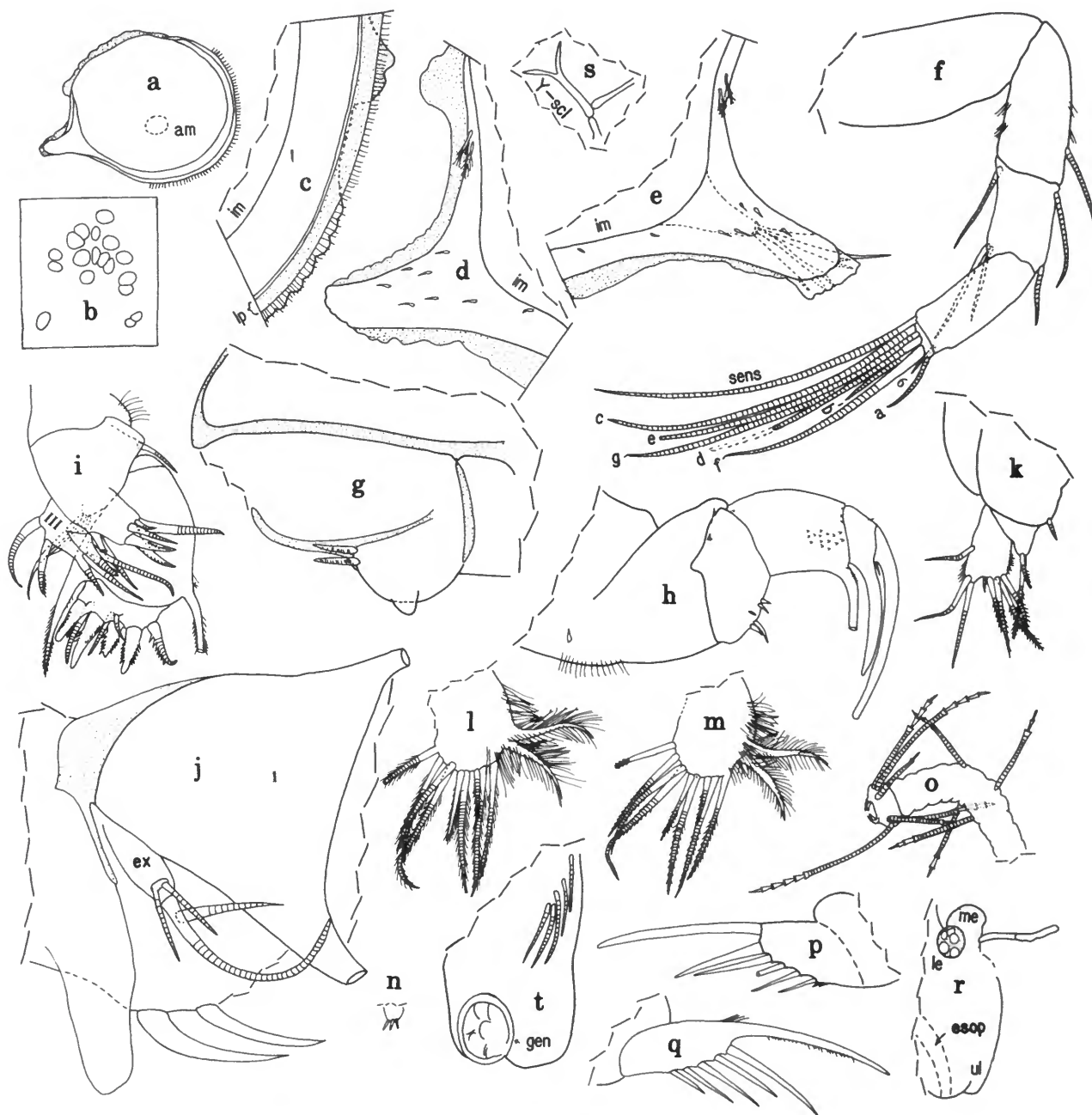


FIGURE 99.—*Metasarsiella benthedii*, new species, adult female, holotype, MNHN Os 89: a, left valve (infold bristles not shown), iv; b, central adductor muscle attachments of right valve, anterior to left, iv; c, anterior end of right valve at midheight, iv; d, e, posterior ends of left and right valves, iv; f, right 1st antenna, lv; g, protopodite and endopodite of right 2nd antenna, mv; h, left mandible, mv; i, left maxilla, mv; j, part of right maxilla, lv; k, 5th limb; l, m, 6th limbs; n, endite of 6th limb (sketch); o, 7th limb; p, q, left and right furcal lamellae; r, anterior of body from right side, anterior to right; s, left Y-sclerite, anterior to left; t, brush organ and genitalia on right side of body, anterior to right.

midlength and 1 terminal; 5 small bristles on or near ventral margin; distal margin with minute lateral spine near dorsal margin (representing exopodite?). Endopodite: 1st joint with small distal medial spines, and ventral claw with minute proximal teeth along anterior edge (tip of claw broken off on illustrated limb); 2nd joint with minute dorsal spine-like bristle and stout ventral claw (tip of claw of illustrated limb appears worn); 3rd joint with 1 minute spine-like ventral bristle and stout terminal claw (tip of claw appears worn on illustrated limb).

Maxilla (Figure 99i,j): Precoxale and coxale with dorsal fringe of hairs; coxale with short dorsal bristle. Endite I with 6 bristles (1 anterior, 5 terminal); endite II with 4 or 5 bristles; endite III with 5 bristles. Transparent finger-like process extending from base of endites (Figure 99j): Basale with bristle near base of exopodite. Exopodite with 2 short bristles and 1 long terminal bristle (Figure 99j). Endopodite: 1st joint with stout spinous and pectinate alpha- and beta-bristles; 2nd joint with 2 a-bristles, 1 c-bristle, and 5 pectinate end bristles (a-bristles of subequal length, both longer than c-bristle) (Figure 99i).

Fifth Limb (Figure 99k): Epipodite with 28 bristles. Single endite with 1 short bristle. Exopodite: 1st joint with 2 bristles; joints 2–5 hirsute, fused, with total of 8 bristles.

Sixth Limb (Figure 99l–n): Single endite with 3 short bristles (Figure 99n; not shown on Figure 99l,m). End joint with 9 spinous bristles in addition to 2 plumose posterior bristles; posterior half of end joint with long hairs forming medial and lateral rows.

Seventh Limb (Figure 99o): Each limb with 10 bristles (4 in proximal group, 2 on each side, and 6 in terminal group, 3 on each side), each bristle with 2–5 bells and without marginal spines; terminus with opposing combs, each with 3–5 teeth.

Furca (Figure 99p,q): Each lamella with 6 claws; only claw 1 fused to lamella (claw 1 of left lamella of holotype not fused, but considered an aberrancy (Figure 99p)); claws decreasing in length along lamella, except claws 3 and 4 about same length and height; all claws with teeth along posterior edge, some teeth stouter than others (not all shown); right lamella slightly anterior to left and with long hairs distally along anterior margin (bases of hairs medial); hairs medially at base of claw 1, and on lamellae following claws; left lamella with 2 spines following claws.

Bellonci Organ (Figure 99r): Elongate with rounded tip; weakly developed.

Eyes (Figure 99r): Lateral eye small, unpigmented, with 4 or 5 minute ommatidia. Medial eye unpigmented, bare, larger than lateral eye.

Upper Lip (Figure 99r): Simple lobe with rounded anteroventral corner.

Genitalia (Figure 99t): Oval sclerotized ring on each side of body anterior to furca.

Brush Organ (Figure 99t): Consisting of 5 minute bristles.

Y-Sclerite (Figure 99s): Typical for subfamily.

Eggs: Holotype with 2 eggs in marsupium and 2 smaller

unextruded eggs.

Gut Content: Holotype with harpacticoid copepod (identified by T.E. Bowman, 1985).

COMPARISONS.—*Metasarsiella benthedi* is close to the type species *M. vibex*. *Metasarsiella benthedi* is known from only 1 female, and *M. vibex* from 1 female and a juvenile male, so that intraspecific variability is unknown. The carapace of *M. benthedi* bears a curved vertical rib just anterior to the central adductor muscle attachments that is not present on *M. vibex*. *Metasarsiella benthedi* also differs from *M. vibex* in having 2 rather than 1 ventral bristle on the 4th joint of the 1st antenna, and 4 rather than 2 proximal bristles on the 7th limb.

Neomuelleriella Kornicker, 1986

Neomuelleriella Kornicker, 1986a:40.

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

DISTRIBUTION.—New Zealand; Bouéni Reef, Mayotte. Known depth range shallow to 33 m.

COMPOSITION.—This genus includes 3 species: *N. hispida* (Brady, 1898:439), *N. zealandica* (Poulsen, 1965:58), and *N. mayottensis*, new species.

Neomuelleriella mayottensis, new species

FIGURES 100, 101

ETYMOLOGY.—The species is named for the island of Mayotte, part of the Comoro Islands, Indian Ocean.

HOLOTYPE.—MNHN Os 88, adult male in alcohol and on slides.

TYPE LOCALITY.—Sta 50-S, 28 Mar 1977, Bouéni Reef, Mayotte, 12°54'30"S, 44°58'30"E, depth 32 m.

DISTRIBUTION.—Collected only at type locality.

DESCRIPTION OF ADULT MALE (Figures 100, 101).—Carapace oval in lateral view, with evenly rounded posterior end and shallow anterior incisure (Figure 100).

Ornamentation (Figure 100): Surface with dense covering of pointed hairs; longer hairs with slightly broader proximal $\frac{1}{2}$ or $\frac{2}{3}$ present along anterior and ventral margins, and sparsely distributed on lateral surface; hairs along posteroventral curvature more abundant than elsewhere.

Infold: Anteroventral infold with minute bristle at mid-width ventral to rostrum (Figure 101a). Posterior infold with 2 setal bristles. Posteroventral infold broad with 5 or 6 small bristles forming row distal to middle and with few minute bristles near inner edge (Figure 101b) (the broad posteroventral selvage is medial to part of valve bearing extremely dense surface bristles).

Selvage: Broad lamellar prolongation present along anterior, ventral, and posterior margins. Outer margin of prolongation with fringe of long hairs (Figure 101a).

Carapace Size: MNHN Os 88, holotype, length 0.82 mm,

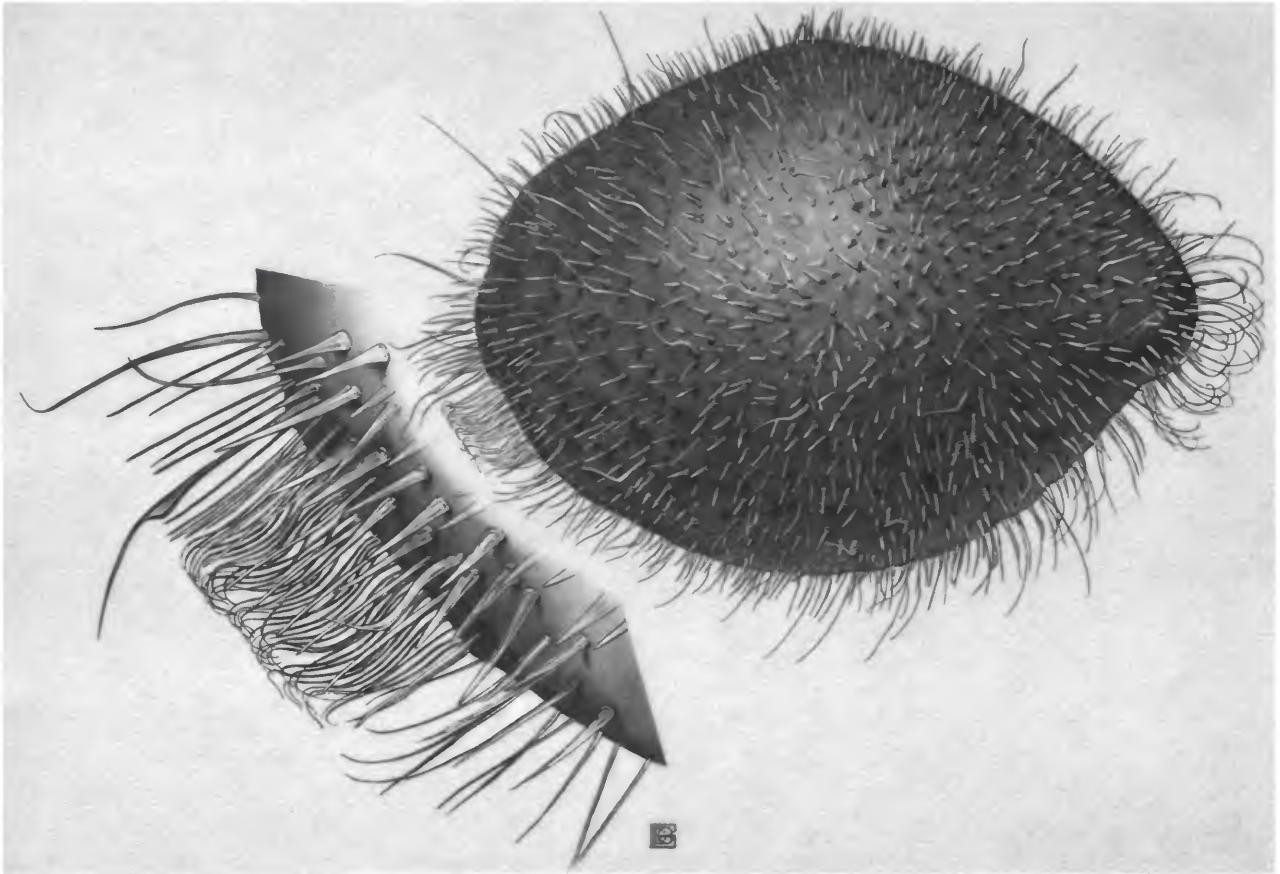


FIGURE 100.—*Neomuelleriella mayottensis*, new species, adult male, holotype, MNHN Os 88, complete specimen from right side and detail of posteroventral corner, length 0.82 mm.

height 0.61 mm.

First Antenna (Figure 101c): 1st joint bare. 2nd joint with 1 dorsal bristle with few marginal spines. 3rd joint fused to 4th and with 1 dorsal bristle with few marginal spines. 4th joint elongate, with 1 short dorsal and 1 minute ventral bristle. 5th joint small, triangular; sensory bristle with abundant filaments in cuplike proximal part (filaments not shown); main stem of sensory bristle with 3 or 4 minute marginal filaments and spine at tip. 6th joint elongate, with short, terminal, medial bristle. 7th joint: a-bristle 2 or 3 times as long as bristle of 6th joint; b-bristle twice as long as a-bristle, bare; c-bristle reaching just past tip of sensory bristle of 5th joint, with 3 filaments near middle, 2 shorter distal filaments, and spine at tip. 8th joint: d- and e-bristles slightly shorter than c-bristle, bare with blunt tips; f-bristle shorter than d- and e-bristles, with 2 short and 1 minute filament near middle; g-bristle as long as c-bristle, with 3 short marginal filaments near middle, 2 distal filaments, and spine at tip. (A distal suture on lateral side of 2nd joint (Figure 101c) could be interpreted as proximal suture of 3rd joint; this suture absent on medial side.)

Second Antenna: Protopodite bare. Endopodite of right

limb 2-jointed (Figure 101e): 1st joint with 1 short, proximal, anterior bristle, and spines in rows; 2nd joint narrow, with 2 long, spinous, terminal bristles. Endopodite of left limb (probably aberrant) (Figure 101d) differs from endopodite of right limb in not having proximal bristle on 1st joint, and in having 1 bristle and a short process on tip of 2nd joint. Left exopodite aberrant in having only 7 joints (no bristle on 7th joint). Right exopodite: 1st joint elongate, with small, bent, medial bristle on terminal edge; 2nd joint about twice length of 3rd joint measured along ventral margin, with long bristle with slender, proximal, ventral spines, and distal natatory hairs; bristle of joint 3 long, with 4 proximal ventral spines, and distal natatory hairs; bristles of joints 4–8 long with natatory hairs, no spines; small 9th joint with 2 bristles (1 long with natatory hairs, 1 very short).

Mandible (Figure 101f): Coxale endite represented by small spine. Basale: medial side near ventral margin with 4 short bristles (3 near middle, 1 distal); ventral margin with 1 long spinous bristle; dorsal margin with 2 subterminal bristles. Exopodite triangular, hirsute. 1st endopodial joint: lateral side with cluster of long hairs near exopodite, and spines along



FIGURE 101.—*Neomuelleriella mayottensis*, new species, adult male, holotype, MNHN Os 88: *a, b*, anterior and posterior of right valve, *iv*; *c*, right 1st antenna, *lv*; *d, e*, protopodites and endopodites of left and right 2nd antennae, *mv*; *f*, left mandible, *lv*; *g*, maxilla; *h*, 5th limb; *i*, 6th limb; *j*, 7th limb; *k*, right furcal lamella, *lv*; *l*, medial eye and Bellonci organ; *m*, right lateral eye, medial eye, and Bellonci organ; *n*, lateral eye; *o*, right copulatory organ, anterior to right, *lv*; *p*, right Y-sclerite, anterior to right.

distal margin; medial side hirsute along dorsal half; ventral margin with 3 bristles (1 long, 2 short). 2nd endopodial joint: medial side with distal spines in row; ventral margin with 1 terminal bristle; dorsal margin with 2 proximal bristles. 3rd endopodial joint with stout, bare, curved, terminal claw, and 3 bristles (2 ventral, 1 dorsal).

Maxilla (Figure 101g): Limb minute, hirsute, with many bristles.

Fifth Limb (Figure 101h): Epipodite appendage with 33 bristles. Single endite with 1 small bristle. Exopodite: 1st joint with 2 ringed bristles; joints 2-5 fused, hirsute, with total of 8 or 9 ringed bristles.

Sixth Limb (Figure 101i): Single endite with 3 bristles. End joint with 16 or 17 bristles (2 posterior bristles more hirsute than others).

Seventh Limb (Figure 101j): 4 bristles in distal group (2 on each side), each bristle with 5 or 6 bells; 1 bristle in proximal group, with 4 bells. Terminus with 1 recurved pointed tooth.

Furca (Figure 101k): Each lamella with 6 claws; claws 1 and 2 nonarticulate, remaining claws articulate; claw 3 about same length but more slender than claw 4; claws 1-5 with stout posterior teeth proximally and more slender teeth distally; claw 6 with slender spines along anterior and posterior margins; claws 4 and 5 with faint spines along anterior margins; a few indistinct, distal, anterior hairs present on claws 1 and 2. Long hairs medial to and posterior to claw 6 about 3/4 length of claw 6 of left lamella.

Bellonci Organ (Figure 101l,m): Elongate, with 2 proximal sutures, wrinkled in middle section, broadening to rounded tip.

Eyes: Both medial and lateral eyes with brown pigment (Figure 101l,m); medial eye bare; lateral eye smaller than medial eye, with 4 divided ommatidia (Figure 101m,n).

Copulatory Organ (Figure 101o): Consisting of 3 lobes on each side of body; distal lobe with sclerotized, recurved, terminal process with tooth along inner margin; bristles present on 2 lobes.

Y-Sclerite: Right sclerite with small proximal projection on ventral margin of ventral branch (Figure 101p). Left sclerite obscured on mounted specimen.

COMPARISONS.—The carapace of the new species *N. mayottensis* differs from *N. hispida* and *N. zealandica* in not having a long caudal process. The carapace of *N. mayottensis* resembles that of *Chelicopia squamosa* Hall, 1985 (only adult female known), but that species has the 3rd furcal claw nonarticulated, and many carapace bristles form a right-angle at midlength.

CYLINDROLEBERIDIDAE Müller, 1906

This family includes 3 subfamilies: Cyndroleberidinae, Cyclasteropinae, and Asteropteroinae. All are represented in the collections.

CYLINDROLEBERIDINAE Müller, 1906

The Cyndroleberidinae comprise 16 genera of which 4 are represented in the collections: *Heptonema*, *Cyndroleberis*, *Prionotoleberis*, and *Synasterope*.

***Heptonema* Cohen and Kornicker, 1975**

Heptonema Poulsen, 1965 [nomen nudum].—Cohen and Kornicker, 1975 [named type species].

TYPE SPECIES.—*Heptonema serrata* Poulsen, 1965:329, subsequent designation by Cohen and Kornicker (1975:23).

DISTRIBUTION.—Members of this genus have been collected in the Virgin Islands, West Indies, off the Atlantic coast of North America, in the vicinity of the Kei Islands, East Indies, and at Enewetak Atoll, Pacific. The new species *H. latex* described herein is the first report of the genus in the Indian Ocean. The known depth range of the genus is 5-210 m (Kornicker, 1986b:54; 1991:117; herein).

COMPOSITION.—Including the new species described herein, the genus comprises 5 species.

EMENDED DIAGNOSIS.—Poulsen (1965:329) included 2 species in the genus. This emended diagnosis expands that of Poulsen where necessary to include 3 additional species (*H. laum* Kornicker, 1986b, *H. homelix* Kornicker, 1991, and *H. latex*, new species). The genus is defined by having on the sensory bristle of the female 1st antenna 7 terminal filaments and no small proximal filament, and by having on the 8th joint of the 1st antenna a minute or no d-bristle, and by having on the mandible an exopodite at least 1/2 the length of the dorsal margin of the 1st endopodial joint.

Second Antenna: Protopodite with or without spines. Exopodial joints with or without basal spines.

Maxilla: Dorsal margin of basale with 1 or 2 bristles.

Fifth Limb: Comb with 2 or more exopodial bristles.

Sixth Limb: Posteroventral margin of skirt without bristles or with many bristles.

Seventh Limb: With 4 or 6 bristles in proximal group.

Medial Eye: Bare or with dorsal hairs.

Posterior of Body: Posterior margin of body dorsal to furca either bare or spinous.

Key to Species of *Heptonema*

1. First antenna with 6 dorsal bristles on 3rd joint and 2 ventral bristles on 4th joint; mandible with 1 bristle at midlength on dorsal margin of basale; 6th limb without bristles on posteroventral margin of skirt 2
- First antenna with 4 or 5 dorsal bristles on 3rd joint and 1 ventral bristle on 4th joint; mandible without bristle at midlength on dorsal margin of basale; 6th limb with many bristles on posteroventral margin of skirt 4

2. Seventh limb with 6 proximal bristles (3 on each side) *H. keiensis*
Seventh limb with 4 proximal bristles (3 on 1 side, 1 on other) 3
3. Maxilla with long distal bristle on dorsal margin of basale *H. latum*
Maxilla without distal bristle on dorsal margin of basale *H. latex*, new species
4. First antenna with 4 dorsal bristles on 3rd joint *H. serratum*
First antenna with 5 dorsal bristles on 3rd joint *H. homelix*

Heptonema latex, new species

FIGURES 102-105

ETYMOLOGY.—From the Latin *latex* (fluid).

HOLOTYPE.—MNHN Os 463, undissected ovigerous female in alcohol.

TYPE LOCALITY.—Sta 50-S, 28 May 1977, Bouéni Reef, Mayotte, 12°54'30"S, 44°58'30"E, depth 32 m.

PARATYPES.—Sta 23-S: 1 adult female in alcohol. Sta 50-S: USNM 193695, ovigerous female on slide and in alcohol; USNM 193694, 1 adult male on slide and in alcohol; USNM 193697, 2 adult females and 1 juvenile male; Paris, 1 adult male and 4 adult females in alcohol (lost). Sta 65-S, Paris, 1 ovigerous female in alcohol. Sta 124-S: Paris, 1 ovigerous female in alcohol.

DISTRIBUTION.—Sta 23-S, Vatou Islet, Mayotte, depth 6 m. Sta 50-S, Bouéni Reef, Mayotte, depth 32 m. Sta 65-S, M'Sanga Tsohole Reef, Mayotte, depth 38 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 6-38 m.

DESCRIPTION OF ADULT FEMALE (Figures 102, 103).—Carapace elongate with convex dorsal margin and less convex ventral margin (Figure 102a); posterodorsal curvature more acuminate than posteroventral curvature; incisur ventral to midheight.

Infold: Rostral infold with 17-25 bristles ventral to oblique list (most forming row) and 60 bristles on and dorsal to list (Figure 102c). Broad anteroventral infold with 47-64 bristles (Figure 102c). Ventral infold with 13-15 bristles forming single row ventral to list. List with anterior end just ventral to inner end of incisur, then continuing along ventral margin and broadening along posterior infold (Figure 102c-e). Posteroventral infold with 11-13 bristles forming row just within outer edge of valve; 3 additional bristles on posterior infold just within edge of valve, and 4 scoop-like processes forming row near midwidth of posterior infold (Figure 102d). Broad posterior list with 21 transparent flap-like bristles (each with tubular pores at base) and 10 minute bristles (not more than 1 bristle between adjacent flap-like bristles). Vestment anterior to inner margin of posterior infold and broad posterior list forming scallops (Figure 102d-f). Numerous "tendons" present between posterior infold and outer surface of valve, mostly between broad posterior list and scallops (Figure 102f), none observed anterior to scallops. Ventral list with broad lamellar prolongation with smooth outer edge.

Central Adductor Muscle Attachments: Consisting of

about 11 ovoid attachments (Figure 102b).

Carapace Size: MNHN Os 463, holotype, length 1.10 mm, height 0.60 mm. Sta 23-S: length 1.27 mm, height 0.63 mm. Sta 50-S: USNM 193695, length 1.15 mm, height 0.60 mm; Paris, 3 specimens, length 1.08 mm, height 0.61 mm; length 1.17 mm, height 0.61 mm; length 1.12 mm, height 0.60 mm. Sta 65-S: length 1.12 mm, height 0.59 mm.

First Antenna (Figure 102g): 1st joint with many medial and fewer lateral spines. 2nd joint with medial and lateral spines, 1 spinous dorsal bristle, and 1 lateral bristle with few marginal spines. 3rd and 4th joints fused except near ventral margin; 3rd joint with minute ventral bristle and 6 dorsal bristles (1st and 2nd bristles single and with long spines; 3rd and 4th bristles adjacent to each other, both with long spines; 5th and 6th bristles adjacent to each other (lateral bristle with long spines, medial bristle with short spines)). Boundary between 4th and 5th joints deeply concave; 4th joint with long dorsal bristle with short marginal spines, and 2 bare terminal ventral bristles (medial bristle $\frac{1}{2}$ length of lateral bristle); ventral margin of 4th joint with few subterminal spines. Sensory bristle of 5th joint with stout proximal part and 7 long terminal filaments (proximal filament more slender than others and not as long). Medial bristle of 6th joint long, with short indistinct marginal spines. 7th joint: a-bristle claw-like, with dorsal spines; b-bristle slightly longer than a-bristle, with 4 marginal filaments (proximal 2 more slender than others); c-bristle about twice length of a-bristle, with 4 short proximal and 1 longer distal marginal filaments. 8th joint: d-bristle represented by minute peg (not shown); e-bristle about same length as b-bristle, bare with blunt tip; f-bristle bent dorsally, with 3 proximal and 1 distal filaments on anterior margin; g-bristle shorter than c-bristle, with 4 proximal and 1 distal filaments.

Second Antenna: Protopodite with long distal dorsal spines and shorter medial spines near dorsal margin, and small distal medial bristle (Figure 102h). Endopodite 2-jointed (Figure 102h): 1st joint bare, 2nd joint with long subterminal filament. Exopodite 9-jointed: 1st joint without distal medial bristle; bristle of 2nd joint reaching 9th joint, with abundant slender ventral spines but no natatory hairs; bristles of joints 3 and 4 long, with natatory hairs, and few slender spines proximal to midlength; bristles of joints 5-8 with only natatory hairs; 9th joint with 3 bristles (1 long and 1 medium with natatory hairs, 1 short with short slender marginal spines) and lateral spine about $\frac{1}{2}$ length of 9th joint and with digitate tip; basal spines absent; joints 2-7 and possibly 8 with minute indistinct spines

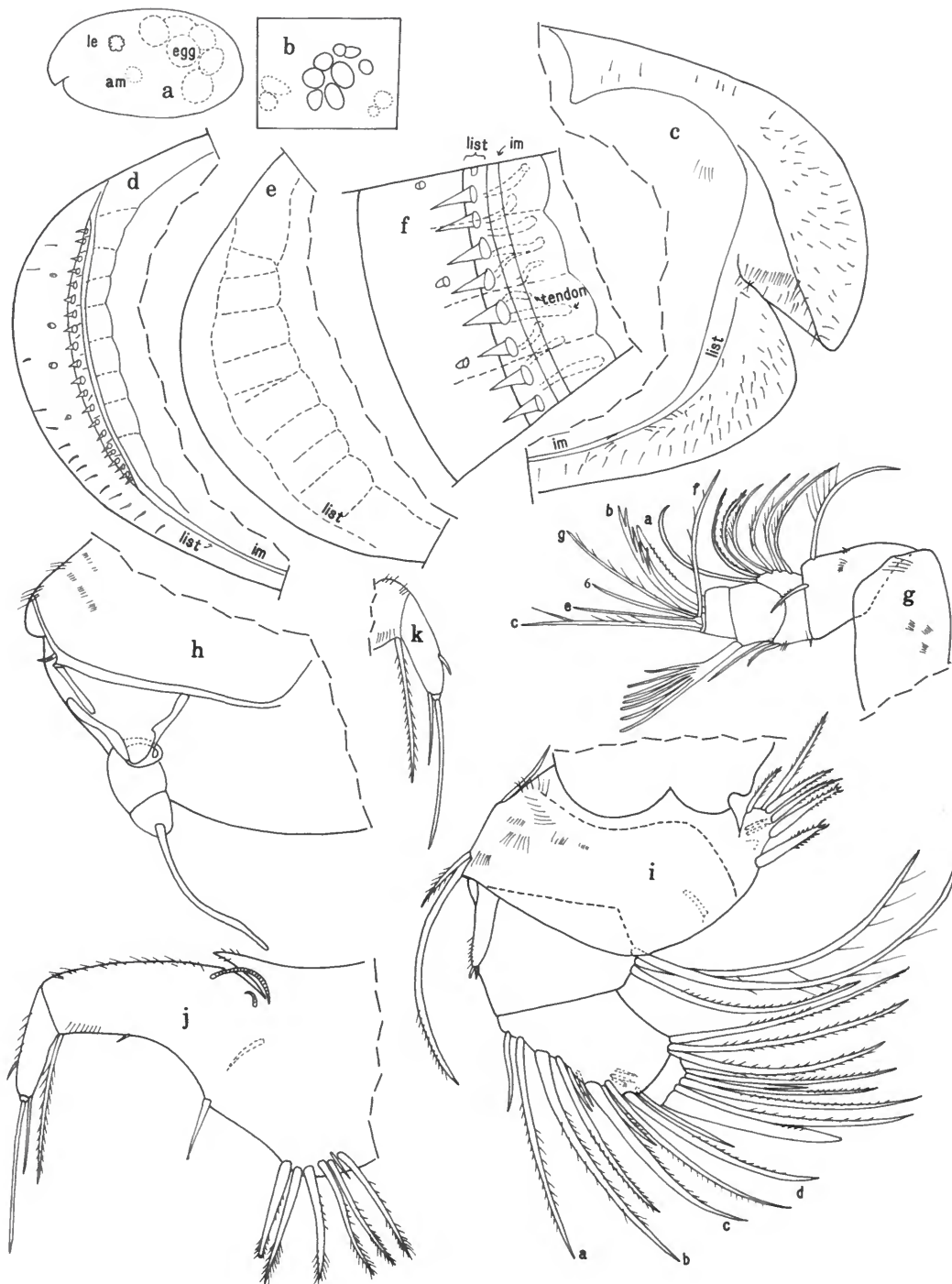


FIGURE 102.—*Heptonema latex*, new species, adult female, paratype, USNM 193695: *a*, complete specimen from left side, length 1.15 mm; *b*, central adductor muscle attachments of right valve, anterior to right, ov; *c,d*, anterior and posterior ends of left valve, lv; *e*, posterior end of right valve showing internal structures, ov; *f*, detail of posterior end of left valve showing representative “tendons” (tendons not present anterior to scalloped inner margin of infold; minute bristles of list not shown); *g*, left 1st antenna, lv; *h*, protopodite and endopodite of right 2nd antenna, mv; *i*, left mandible (coxale endite not shown), lv; *j*, right maxilla, mv; *k*, tip of left maxilla, mv.

forming row near distal margin (spines near distal dorsal corner stouter).

Mandible (Figure 102i): Coxale endite broken off both limbs of holotype. Basale endite with 4 spinous end bristles, 2 triaenid bristles with 7 or 8 slender indistinct paired spines excluding stouter terminal pair, 2 dwarf bristles, and glandular peg. Basale: lateral surface with spines on dorsal half; dorsal margin with 1 bare backward pointing bristle at midlength, and 2 spinous terminal bristles (short bristle about $\frac{1}{3}$ length of long bristle). Exopodite about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, hirsute distally and with 2 short terminal bristles. 1st endopodial joint with 3 long spinous ventral bristles. 2nd endopodial joint: ventral margin with 3 long bristles with short marginal spines; dorsal margin with stout spinous a-, b-, c-, and d-bristles, and 1 short bristle proximal to a-bristle; lateral surface near dorsal margin with 1 long spinous bristle between b- and c-bristles, and 1 long spinous bristle between c- and d-bristles; medial surface with 2 cleaning bristles between b- and c-bristles, 4 cleaning bristles forming oblique row between c- and d-bristles, and 1 long bristle with base just distal to base of d-bristle. 3rd endopodial joint with 1 straight claw with ventral spines, and 5 spinous bristles.

Maxilla (Figure 102j,k): Epipodite short, pointed, with few distal hairs. Endite I with 1 short and 3 long bristles; endite II with 3 long bristles. Basale: dorsal margin hirsute, with 2 proximal bristles with bases on medial side (proximal of these about $\frac{1}{3}$ length of other); ventral margin with 1 long backward pointing proximal bristle, 1 small distal bristle, and 1 long spinous terminal bristle; lateral side with 1 proximal bristle. 1st endopodial joint with 1 short alpha-bristle and 1 long beta-bristle. 2nd endopodial joint with long terminal bristle about twice length of beta-bristle.

Fifth Limb (Figure 103a): Lateral side with long spinous exopodial bristle extending past end of comb, 1 short slender bristle just ventral to base of long bristle, 2 pairs of bristles closer to ventral edge of comb, and 2 distal bristles near ventral margin; distal dorsal corner of comb with long hairs; ventral margin of comb with about 38 spinous bristles (2 terminal bristles longer than others; bristles forming single row along distal half of comb, and double row along proximal half with shorter bristles medial, each with base between adjacent longer bristles).

Sixth Limb (Figure 103b,c): Posterior end of skirt broadly rounded. Small medial bristle in proximal anterior corner (not observed on left limb of USNM 193695). Upper and lower endites each with 1 small bristle with minute terminal papilla; anteroventral corner with 2 small bare bristles with minute terminal papilla; hirsute lateral flap without bristles; ventral margin of skirt without bristles; hairs thinner and more abundant along posterior part of skirt.

Seventh Limb (Figure 103d): 4 bristles in proximal group (3 on 1 side, 1 on other), each with 2 or 3 bells; 6 bristles in

distal group (3 on each side), each with 2 or 3 bells. Terminus with opposing combs, each with 6 spinous teeth.

Furca (Figure 103e): Each lamella with 8 claws; claw 8 bristle-like, oriented posteriorly; posterior margin of claw 1 with few long teeth between shorter teeth (not shown); teeth indistinct on other claws.

Bellonci Organ (Figure 103f,g): Elongate, broadening at midlength, with broadly rounded tip.

Eyes: Medial eye unpigmented, with hairs along dorsal margin (Figure 103f,g). Lateral eye slightly larger than medial eye, with 16 amber-colored ommatidia and no pigment between ommatidia (Figures 102a, 103h).

Lips (Figure 103f,g,i): Upper lip with 2 hirsute lobes each with 2 slender anterior spines. Lower lip a hirsute flap on each side of mouth.

Genitalia (Figure 103e): Oval ring on each side of body anterior to furca.

Posterior of Body (Figure 103e): Posterodorsal corner with rounded spinous knob.

Y-Sclerite (Figure 103e): Typical for subfamily.

Gills: Present.

Eggs: USNM 193695 with 10 eggs in marsupium (6 shown in Figure 102a); 2 specimens from sta 50-S with 1 and 8 eggs in marsupium; specimen from sta 65-S with 5 eggs in marsupium.

DESCRIPTION OF ADULT MALE (Figures 104, 105).—Carapace in lateral view with posterior half of dorsal margin sloping ventrally resulting in narrow posterior end (Figure 104a). Incisur broader and projecting farther than in female.

Infold: Rostral infold between list and incisur with 12 bristles forming row and 4 bristles ventral to row, and 71 bristles on and dorsal to list. Broad anteroventral infold with 79 bristles (some small). Ventral infold with 13 bristles forming single row. Position of list similar to that of adult female. Posteroventral infold with 10–12 bristles forming row just within outer edge of valve; 1 additional bristle on posterodorsal infold just within outer edge of right valve of USNM 193694 but none on left valve, and 4 scoop-like processes forming row near midwidth similar to those of adult female. Broad posterior list with 19 or 20 transparent flap-like bristles and 9–12 minute bristles along anterior margin of list (not more than 1 bristle between adjacent flap-like bristles). Vestment anterior to inner margin of posterior infold scalloped as on adult female and with similar “tendons.”

Central Adductor Muscle Attachments (Figure 104b): Consisting of about 17 ovoid attachments.

Carapace Size: Sta 50-S: USNM 193694, length 1.29 mm, height 0.62 mm; Paris, length 1.32 mm, height 0.64 mm.

First Antenna (Figure 104c-f): 1st joint bare except for few lateral hairs. 2nd joint with lateral and medial spines and 2 bristles (1 spinous dorsal, 1 bare lateral). 3rd joint: triangular, shorter on medial side than on lateral side; with minute ventral bristle with base on medial surface slightly dorsal to ventral

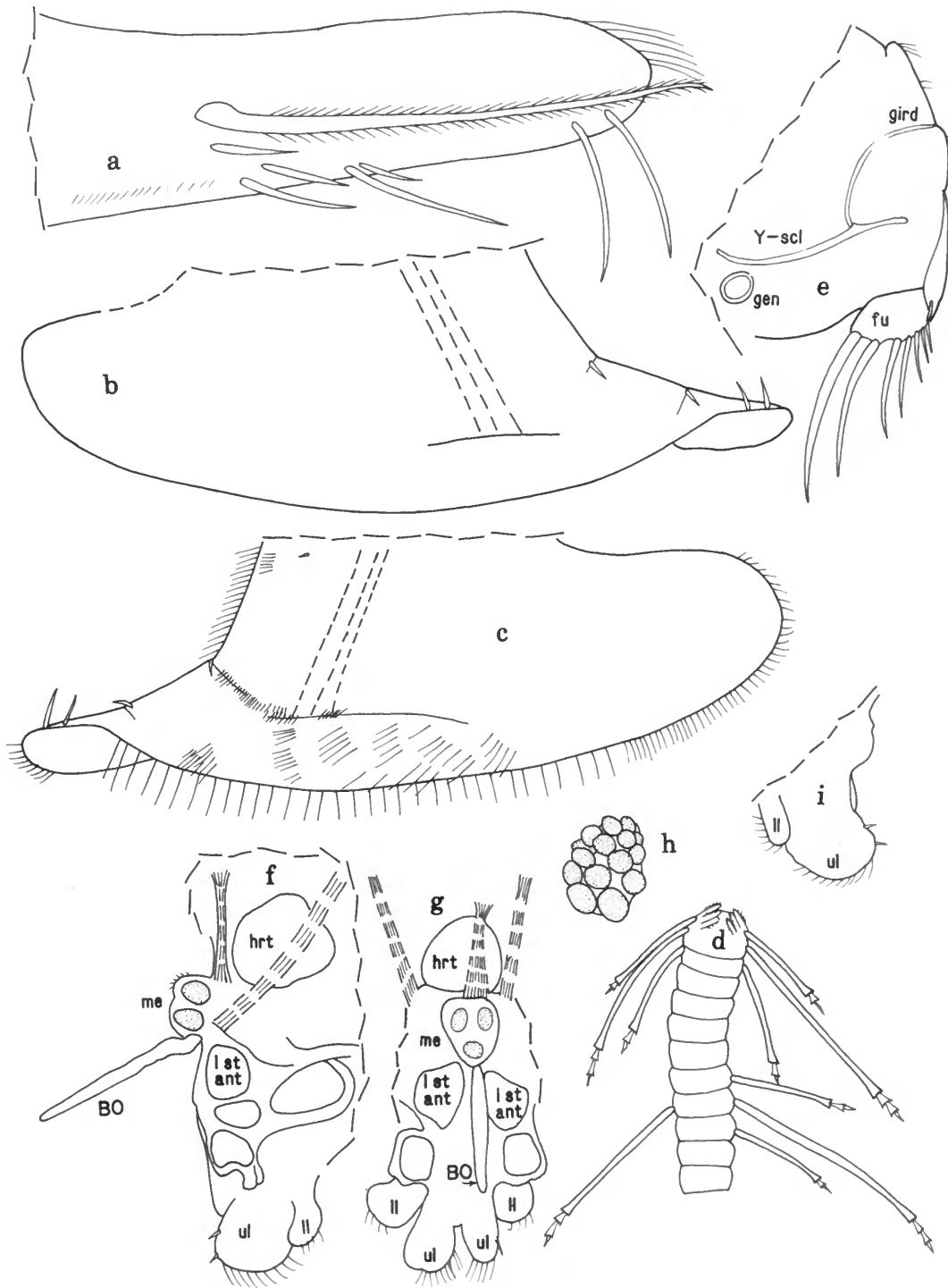


FIGURE 103.—*Heptonema latex*, new species, adult female, paratype, USNM 193695: *a*, comb of right 5th limb, lv; *b, c*, left and right 6th limbs (hairs not shown in *b*), mv; *d*, 7th limb; *e*, posterior of body from left side, anterior to left, lv; *f, g*, anterior of body from left side and from anterior; *h*, right lateral eye, anterior to right, lv; *i*, upper and lower lips, anterior to right.

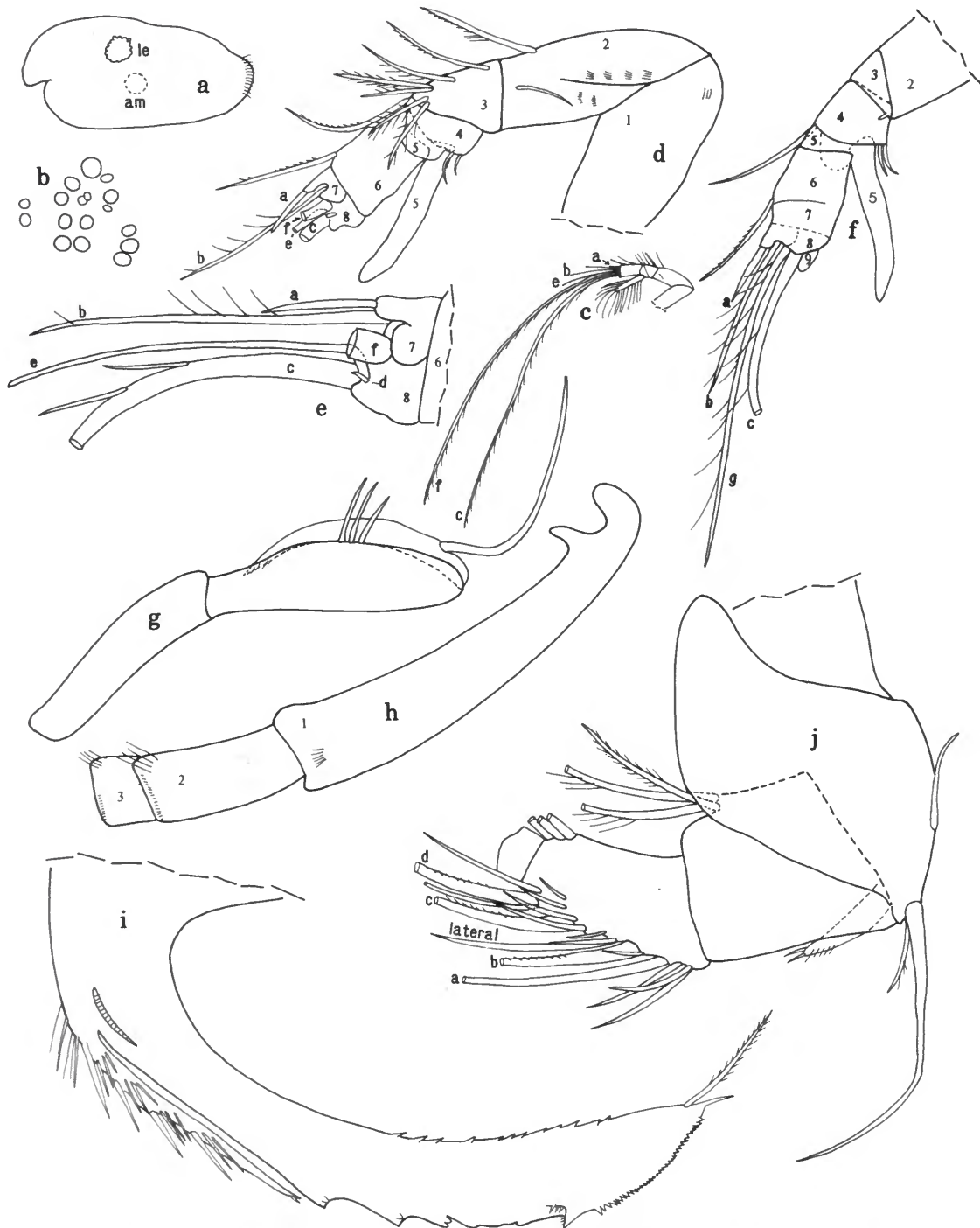


FIGURE 104.—*Heptonema latex*, new species, adult male, paratype, USNM 193694: *a*, complete specimen from left side, length 1.29 mm; *b*, central adductor muscle attachments of right valve, anterior to right, lv; *c-e*, left 1st antenna (not all bristles shown), lv; *f*, distal part of right 1st antenna (*d*-, *e*-, and *f*-bristles not shown); *g*, endopodite of right 2nd antenna, lv; *h*, exopodial joints 1-3 of right 2nd antenna (bristles not shown), lv; *i*, coxale endite of right mandible, mv; *j*, left mandible (coxale endite and bristles of basale endite and 3rd endopodial joint not shown), mv.

margin (Figure 104f); long dorsal margin with 6 spinous bristles with bases on lateral surface. 4th joint shorter on medial side than on lateral side, with 3 bristles (1 long dorsal, 2 short ventral). 5th joint short on medial side, longer on lateral side, partly fused to 4th joint and with convex distal margin; sensory bristle stout with abundant thin filaments (filaments not shown). 6th joint shorter on medial side than on lateral side; bristle of 6th joint long, with short marginal spines and base on dorsal margin. 7th joint shorter on lateral side than on medial side: a-bristle claw-like, with few indistinct ventral and dorsal hairs; b-bristle about twice length of a-bristle, with 5 short marginal filaments (Figure 104e); c-bristle very long with 25 short filaments (Figure 104c). 8th joint short and narrow, lateral to base of c-bristle of 7th joint, with proximal margin adjacent to 6th joint on lateral side and 7th joint on medial side: d-bristle minute, peg-like, lateral and slightly ventral to base of e-bristle; e-bristle about same length as b-bristle, bare with blunt tip; f-bristle similar to c-bristle; g-bristle twice length of b-bristle, with 9 marginal filaments (Figure 104f).

Second Antenna: Protopodite with small distal medial bristle. Endopodite with 3 elongate joints (Figure 104g): 2nd joint with 3 short bristles at midlength; 3rd joint with 1 long proximal filament and minute ridges at tip. Exopodite (Figure 104h): 3rd joint $\frac{1}{3}$ length of 2nd; bristles of joints 2-8 about same length, all with natatory hairs, no spines; 9th joint with 3 long bristles with natatory hairs, no spines; 1st joint with distal spines forming row; joints 2-8 with long hairs forming lateral row near dorsal margin and minute spines forming row along distal edge; 9th joint with small terminal spine on ventral margin; basal spines absent.

Mandible (Figure 104i,j): Coxale endite (Figure 104i): ventral branch with proximal ventral spines followed by stouter spines forming 4 oblique rows, then pointed tip with 1 or 2 indistinct minute spines; dorsal branch with 3 paired ventral spines followed by 4 low rounded nodes and short main spine, then serrate margin between main spine and tip; tip with short bristle; posterior edge with serration proximal to long subterminal bristle with indistinct hairs. Basale endite small, with 4 end bristles (1 bare, 2 short and 1 longer with marginal spines), 2 triaenid bristles with 9 paired slender spines and stouter terminal pair, 1 dwarf bristle, and glandular peg (some bristles missing on right limb of USNM 193694). Dorsal margin of basale with 1 slender backward pointing bristle at midlength, and 2 terminal bristles (slender lateral bristle $\frac{1}{4}$ length of stout medial bristle; medial bristle much stouter than medial bristle on adult female) (Figure 104j). Exopodite shorter than that of female, about $\frac{1}{2}$ length of dorsal margin of 1st endopodial joint, hirsute distally and with 2 small terminal bristles. 1st endopodial joint with 3 ventral bristles (2 long with long proximal and shorter distal spines, 1 shorter with only short spines). 2nd endopodial joint (Figure 104j): ventral margin with 3 long spinous terminal bristles; dorsal margin with stout a-, b-, c-, and d-bristles (a-bristle bare, others spinous), and 3 short bristles proximal to a-bristle; medial

surface at dorsal margin with 7 cleaning bristles (1 near base of b-bristle, 2 between b- and c-bristles, and 4 forming oblique row between c- and d-bristles), and 1 long bare bristle distal to base of d-bristle; lateral side at dorsal margin with 1 long bristle between b- and c-bristles and 1 long bristle between c- and d-bristles. 3rd endopodial joint with dorsal claw (with many ventral and fewer dorsal spines) and 5 spinous bristles.

Maxilla (Figure 105a): Epipodite short, pointed. Endite I with 4 bristles (3 long spinous, 1 short slender). Endite II with 3 stout spinous bristles (middle bristle shorter). Basale narrow, dorsal margin with 2 proximal bristles (with bases on medial surface); ventral margin with 1 proximal bristle and 1 small distal bristle with base on lateral side, and 1 long spinous terminal bristle; lateral side with 1 short proximal bristle. 1st endopodial joint with small alpha-bristle and fairly short beta-bristle. 2nd endopodial joint with long terminal bristle about twice length of beta-bristle of 1st joint.

Fifth Limb (Figure 105b,c): Comb with 34 bristles along ventral margin; lateral side with long stout spinous exopodial bristle reaching past end of comb, 1 slender bristle just ventral to base of stout bristle, 2 pairs of bristles closer to ventral margin, 1 bristle ventral to proximal pair and almost on ventral margin (Figure 105c), and 2 distal bristles close to ventral margin. Epipodite with 53 bristles.

Sixth Limb (Figure 105d): Similar to that of adult female, except the 2 bristles of anteroventral corner spinous, not bare as on female, and stout widely separated spines along ventral margin absent, only thin closely spaced hairs present.

Seventh Limb: Similar to that of adult female, with same number of bristles (10), comb teeth (6 on each side), segments (56 or 57), and same total length.

Furca (Figure 105e): Each lamella with 8 claws. Similar to furca of adult female except 8th bristle-like claw not oriented posteriorly, and teeth of claw 1 similar in size (not shown).

Bellonci Organ (Figure 105f): Similar to that of adult female.

Eyes: Medial eye similar to that of adult female except hairs not observed (Figure 105f). Lateral eye larger than medial eye, with 21 amber-colored ommatidia; no pigment between ommatidia (Figure 105g).

Lips (Figure 105h): Similar to those of adult female, each lobe of upper lip with 1 or 2 anterior spines; anterior spine present on saddle between lobes.

Genitalia (Figure 105e,i): Well developed, elongate, divided distally, each branch with 2 lobes, at least one with few minute bristles.

Posterior of Body and Y-Sclerite: Similar to those of adult female.

Gills: Well developed.

COMPARISONS.—The 6th limb of *H. latex* resembles those of *H. keiensis* Poulsen, 1965:334, and *H. latum* Kornicker, 1986b:54, in having a skirt with posterior end broadly rounded and no posteroventral bristles. The dorsal margin of the basale of the maxilla of *H. latex* is without the long distal bristle

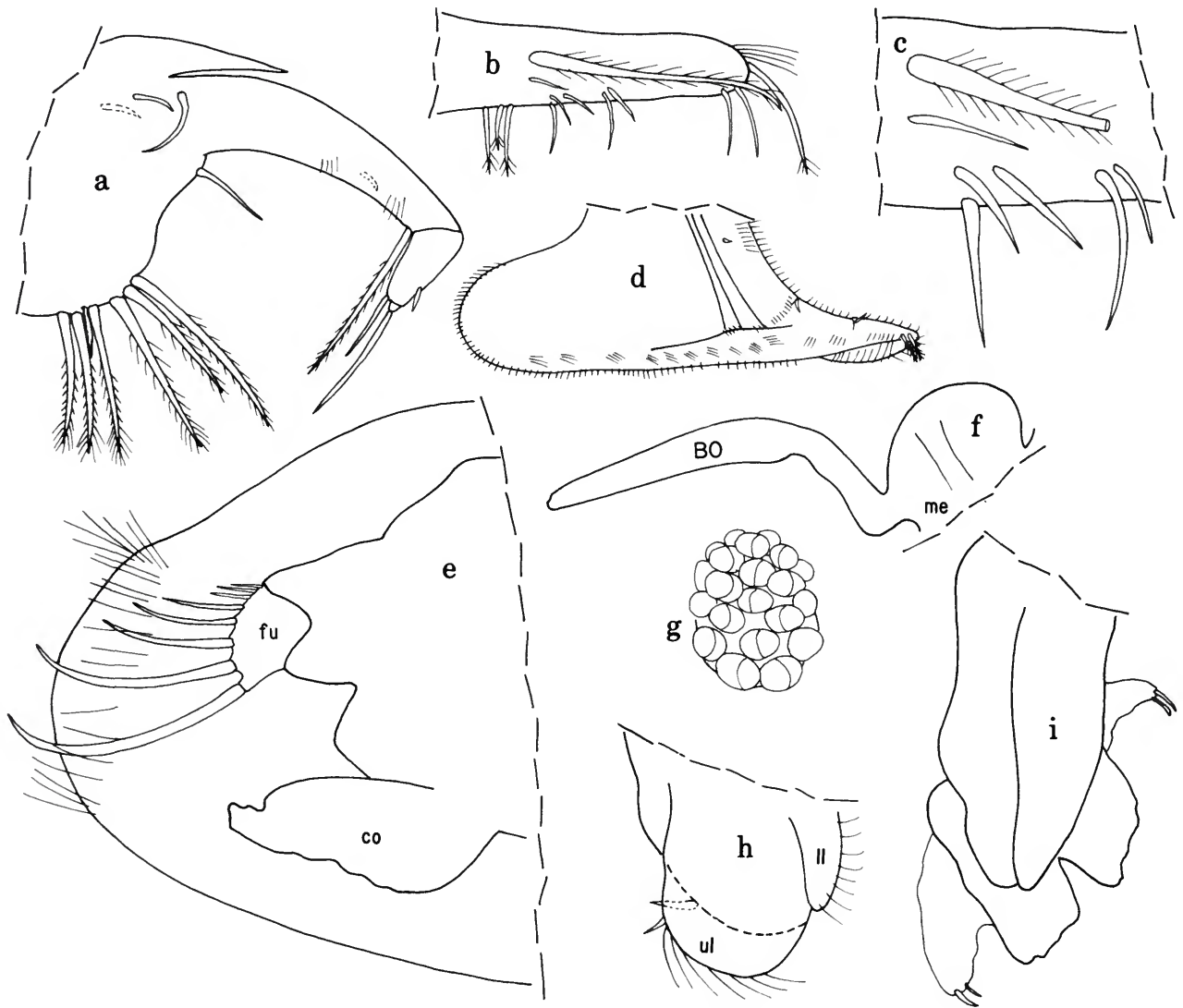


FIGURE 105.—*Heptonema latex*, new species, adult male, paratype, USNM 193694: a, left maxilla, mv; b, comb of right 5th limb, lv; c, detail from b; d, left 6th limb, mv; e, furca and copulatory organ as seen through right ventral valve, anterior to right, ov; f, medial eye and Bellonci organ, anterior to left, lv; g, lateral eye; h, upper and lower lips from left side, anterior to left; i, outline of copulatory organs (not under cover slip, venter to upper right).

present on *H. latum*. The basale of the maxilla of *H. keiensis* differs from that of *H. latex* in having 2 rather than 1 proximal ventral bristle, and 1 rather than 2 proximal dorsal bristles; also, the 7th limb differs in having 6 rather than 4 proximal bristles.

Cylindroleberis Brady, 1868

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

DISTRIBUTION.—In general, members of the genus have been collected between latitudes of about 58°N and 26°S. The adult male of *C. nodulifera* (Poulsen, 1965) was collected on the surface of the Red Sea at night using artificial light (Poulsen, 1965:447), but species are generally part of the benthos in shallow water (intertidal to 52 m) (Kornicker and Caraion, 1974:29; Kornicker, 1991:110). The genus has not been reported previously from the western Indian Ocean, but has been reported from the Gulf of Mannar, Sri Lanka, by James (1976:604).

COMPOSITION.—Including the 2 new species described herein the genus comprises 11 species and 1 variety (Kornicker, 1991:110).

Cylindroleberis vix, new species

FIGURES 106–109

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

HOLOTYPE.—MNHN Os 467, undissected ovigerous female in alcohol.

TYPE LOCALITY.—Sta 32-S, 25 Mar 1977, N Pamanzi Island, Mayotte, 12°45'06"S, 45°17'54"E, depth 15–20 m.

PARATYPES.—Sta 23-S: Paris, 1 ovigerous female and 1 early instar in alcohol. Sta 32-S: USNM 193751, 1 adult female in alcohol; USNM 193752, 1 adult female on slide and in alcohol; Paris, 1 A-1 instar in alcohol, 1 A-2 instar in alcohol, and 1 early instar in alcohol (length 1.24 mm, height 0.52 mm; height 42% of length).

DISTRIBUTION.—Sta 23-S, Vatou Islet, Mayotte, depth 6 m. Sta 32-S, N Pamanzi Island, Mayotte, depth 15–20 m. Known depth range 6–20 m.

DESCRIPTION OF ADULT FEMALE (Figures 106–109).—Carapace elongate with parallel straight dorsal and ventral margins, in lateral view anterior and posterior margins evenly rounded (Figure 106a,e,m,n); outer surface with abundant minute pores; a few widely separated slender bristles present along inner side of shell just proximal to ventral margin and distal to selvage (1 bristle shown in Figure 106f).

Infold: Rostral infold with 10 bristles between list and incisur, and about 24 long and 20 short bristles dorsal to list (Figure 107a, not all bristles dorsal to list shown). Broad anteroventral infold with about 25 long and 15 short bristles (Figure 107a, not all bristles shown). Anterior $\frac{2}{3}$ of ventral infold with about 21 short bristles in row ending posteriorly where list broadens and bears flap-like bristles. Narrow list beginning near inner margin of infold just ventral to inner end of incisur, extending along anterior $\frac{2}{3}$ of ventral infold, then broadening and continuing on posterior infold (Figures 106f,m,n, 107b,c). Broad posterior list with 28–33 broad transparent flap-like bristles and about 24 short bristles (not more than 1 short bristle between each pair of flap-like bristles) (Figure 107b,c, not all bristles shown). About 10 long bristles in row on ventral infold between anterior part of broad list and valve edge (Figure 107b,c, only 2 or 3 long bristles shown). 3 scoop-like processes on posterior infold between list and valve edge (Figure 107b,c); several (about 6) tube-like pores present in vicinity of processes (shown as dashed lines). Infold of posterodorsal corner of right valve with small flat triangular process with row of long hairs (Figures 106g, 107c).

Selvage: Selvage set inward from valve edge along ventral and posteroventral shell margins, and on the right valve of USNM 193752, but not on USNM 193751, also set inward from posterior edge (Figure 106f). Selvage medial to valve

edge along ventral and posterior shell margins. Selvage with narrow lamellar prolongation (fringed with long marginal hairs) at inner $\frac{2}{3}$ of ventral margin of incisur (Figure 106p). Selvage with narrow lamellar prolongation (fringed with short marginal hairs) along posterior margin just anterior to anterior juncture of hinge. Lamellar prolongation not observed elsewhere. Selvage along ventral margin of shell broad, bearing row of minute pores (Figure 106f).

Central Adductor Muscle Attachments (Figure 106b,c,q): Comprising 14 ovoid individual attachments.

Carapace Size: MNHN Os 467, holotype, length 2.16, height 0.75 mm; height 35% of length. USNM 193751, length 2.17 mm, height 0.79 mm; height 36% of length. USNM 193752, length 2.15 mm, height 0.71 mm; height 33% of length.

First Antenna (Figure 107d-f): 1st joint with medial spines. 2nd joint with proximal cluster of hairs on medial surface, 1 backward curving dorsal bristle with long spines, and 1 shorter distal lateral bristle with short spines. 3rd joint fused to 4th, without medial suture separating them but with indistinct lateral suture on ventral half of joint. Inferred 3rd joint with minute bristle at short ventral margin and 6 spinous bristles (4 single and 2 paired) on long dorsal margin (1st, 2nd, and 4th single bristles and medial of paired bristles with long spines, 3rd single bristle and lateral of paired bristles with short spines). Inferred 4th joint with long ventral and short dorsal margin; dorsal margin with long bristle (with base on medial side) with short marginal spines; ventral margin with 2 slender terminal bristles with short marginal spines; lateral surface with spines at distal ventral corner. Sensory bristle of 5th joint stout, with 1 short proximal filament and 6 long terminal filaments. 6th joint with long medial bristle with short marginal spines. 7th joint: a-bristle claw-like, bare, with blunt tip (worn?); b-bristle about twice length of a-bristle, with 1 short filament at midlength and 3 longer distal marginal filaments; c-bristle about twice length of b-bristle, with 4 or 5 short marginal filaments. 8th joint: d-bristle absent; e-bristle about same length as b-bristle, bare with blunt tip, minute lateral pore at base (Figure 107f); f-bristle bent dorsally, about same length as b-bristle, with 4 short marginal filaments (filaments and distal half of stem with short spines); g-bristle similar to c-bristle.

Second Antenna: Protopodite bare, without medial bristle. Endopodite distinctly 3-jointed, with terminal filament about same length as stem (Figure 107g). Exopodite: bristle of 2nd joint reaching just past 9th joint, with abundant slender ventral spines (spines thinner on distal half); bristles of joints 3–8 with proximal ventral spines and distal natatory hairs; 9th joint with 4 bristles (2 long with proximal ventral spines and distal natatory hairs, 1 medium and 1 short (dorsal) with slender ventral spines but no natatory hairs); joints 3–8 with basal spines (spines stouter on distal joints); spine of 8th joint about $\frac{1}{2}$ length of 9th joint; 9th joint with lateral spine about same length as spine of 8th joint but broader; joints 2–8 with minute spines forming rows along distal margin.

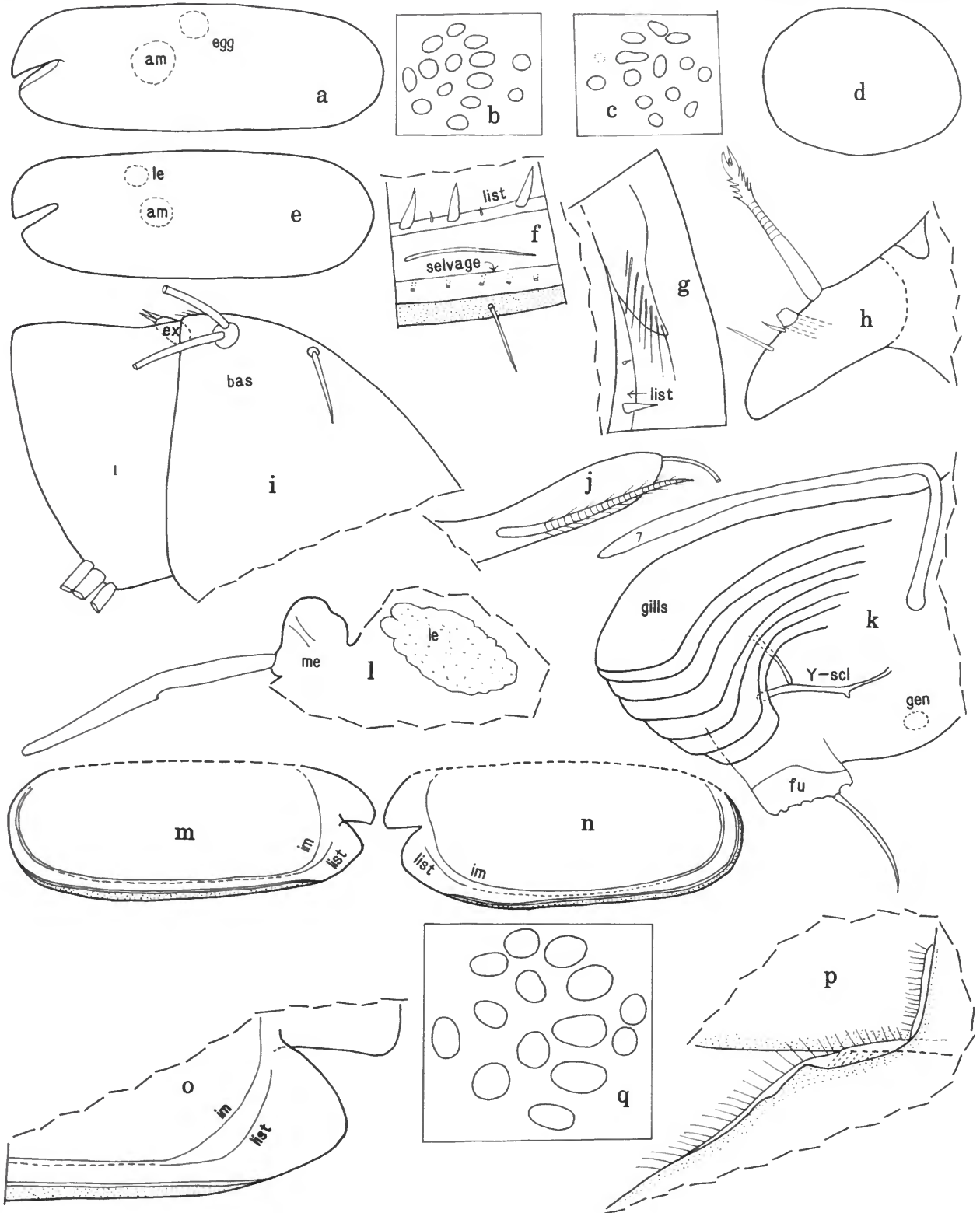


FIGURE 106 (opposite page).—*Cylindroleberis vix*, new species, adult females: holotype, MNHN Os 467: *a*, complete specimen from left side showing position of egg within carapace, ov; *b,c*, central adductor muscle attachments of left and right valves, ov; *d*, outline of egg from marsupium, maximum length 0.21 mm. Paratype, USNM 193751: *e*, complete specimen from left side, length 2.17 mm, ov; *f*, part of posteroventral corner of valve, anterior to left, iv; *g*, posterodorsal corner of right valve, anterior to left, iv; *h*, basale endite of right mandible (4 end bristles and 2 triaenid bristles not shown), mv; *i*, part of right mandible, mv; *j*, comb of right 5th limb (not under cover slip; 6 short exopodial bristles and ventral bristles not shown); *k*, posterior of body from right side (5th and 6th limbs, bristles of 7th limb, and most furcal claws not shown), anterior to right, iv; *l*, outline of left lateral eye, medial eye, and Bellonci organ, anterior to left. Paratype, USNM 193752: *m,n*, left and right valves (stippled margin is distal to ventral edge of valves), length of specimen 2.15 mm, iv; *o*, detail from *m*; *p*, inner end of incisur of right valve showing fringed lamellar prolongation of selvage (edge of valve stippled), iv; *q*, central adductor muscle attachments of left valve, anterior to left, ov.

Mandible: Coxale endite (Figure 108a): 1 small medial bristle near base of ventral branch; ventral branch with 3 oblique rows of spines, tip with 1 fairly long dorsal spine, 1 minute triangular ventral spine, and 1 slender spine between them (detail in Figure 108a). Dorsal branch: distal ventral margin with 2 pairs of triangular backward-pointing teeth followed by 2 or 3 rounded teeth, then short main spine; margin between main spine and tip of branch with small spines; tip with short spine-like prolongation; bristle on dorsal margin of branch with base set back from tip of branch, hirsute, extending well past tip; dorsal margin serrate distally. Basale endite with 4 pectinate end bristles, 3 triaenid bristles with 4 or 5 pairs of marginal spines excluding terminal pair (Figure 108b), 2 bare dwarf bristles (longest 2 or 3 times length of other (Figures 106h, 108c)), glandular peg, and few proximal medial hairs. Basale: medial surface with few hairs near ventral margin; dorsal margin with 1 short bare backward-pointing bristle just distal to midlength (on USNM 193752 bristle projecting outward from margin (Figure 108b); on USNM 193751 bristle not projecting outward, folded back on medial surface of basale (Figure 106i)), and 2 long slender terminal bristles with short marginal hairs; ventral margin either bare or with 1 triaenid bristle (near base of endite) with 4 or 5 pairs of marginal spines excluding terminal pair. Exopodite about $\frac{1}{4}$ length of dorsal margin of 1st endopodial joint, with 2 small bristles (Figure 108d). 1st endopodial joint with 3 long ventral bristles (2 with long spines, 1 with only short spines). 2nd endopodial joint: medial surface with minute spines in rows; ventral margin with 3 long terminal bristles with short marginal spines; dorsal margin with stout a-, b-, c-, and d-bristles (d-bristle slightly stouter and with more marginal spines than others), 1 short bare bristle proximal to a-bristle, 1 short spinous cleaning bristle between b- and c-bristles (closer to b-bristle), 6 spinous cleaning bristles forming oblique row on medial surface in vicinity of c- and d-bristles, 1 long slender spinous bristle on medial surface just distal to d-bristle, 1 long spinous bristle on

lateral surface with base between c- and d-bristles, and no lateral bristle between b- and c-bristles. 3rd endopodial joint with short stout dorsal claw with rounded tip (worn?), 3 longer spinous stout terminal bristles, 1 long stout spinous bristle with base on lateral surface near dorsal claw, and 1 short spinous bristle with base on medial surface.

Maxilla (Figure 107h): Epipodite not reaching middle of dorsal margin of basale, with hairs at tip. Endite I with 3 long and 1 short bristle. Endite II with 3 long spinous bristles and few long hairs near bases of bristles. Basale: ventral margin with 1 short proximal bristle, 1 small indistinct distal bristle, and 1 long spinous terminal bristle; dorsal margin with distal hairs and 2 small bristles with bases on medial surface (1 proximal, 1 distal); lateral surface with 1 short proximal bristle; medial surface with long distal hairs near ventral margin. Basale and 1st endopodial joint separated by barely visible suture. 1st endopodial joint with short distal alpha-bristle and long spinous beta-bristle. 2nd endopodial joint with long spinous terminal bristle reaching past tip of beta-bristle.

Fifth Limb: Comb elongate with distal ventral bristles much longer than proximal bristles (Figure 108e). Stout exopodial bristle reaching past end of comb (Figure 106j); 2 slender bristles just ventral to base of stout bristle (Figure 108g), 2 pairs of bristles near ventral margin, and 1 bristle with base almost on ventral margin (Figure 108f).

Sixth Limb (Figure 108h): Medial surface with small proximal bristle near vertical muscle bundle. Anterior margin with 2 endites, each with 1 spinous bristle (distal endite with longer bristle). Anterior tip of skirt with 6 spinous bristles; lateral flap with 1 small spinous bristle; posteroventral margin with 31–36 spinous bristles.

Seventh Limb (Figures 106k, 108i): 6 bristles in proximal group (3 on each side) with 3–5 bells; 2 bristles (1 on each side with 4 bells) on segment just proximal to terminus; 4 bristles on terminus (2 on each side, 1 with 3 bells, 1 with 5). Terminus with opposing combs, each with 14–16 spinous teeth.

Furca (Figure 109a,b): Each lamella with 9 claws followed by 1 or 2 bristle-like claws; each claw with spines along anterior and posterior margins; claw 1 of right lamella anterior to claw 1 of left lamella by width of base of claw; posterior claws of lamellae followed by single rounded process with minute spines along posterior edge.

Bellonci Organ (Figures 106l, 109c): Elongate, broadest at midlength, with rounded tip.

Eyes: Medial eye unpigmented, bare (Figures 106l, 109c). Lateral eye larger than medial eye, with about 17 ommatidia and black pigment between ommatidia (Figures 106e, 109d).

Lips (Figure 109c): Upper lip a hirsute lobe on each side of low saddle, without spines on lobes or saddle. Lower lip a hirsute lateral flap on each side of mouth.

Genitalia (Figures 106k, 109a): Small amber-colored oval on each side of body anterior to furca.

Posterior of Body (Figure 109e): A low spinous process at

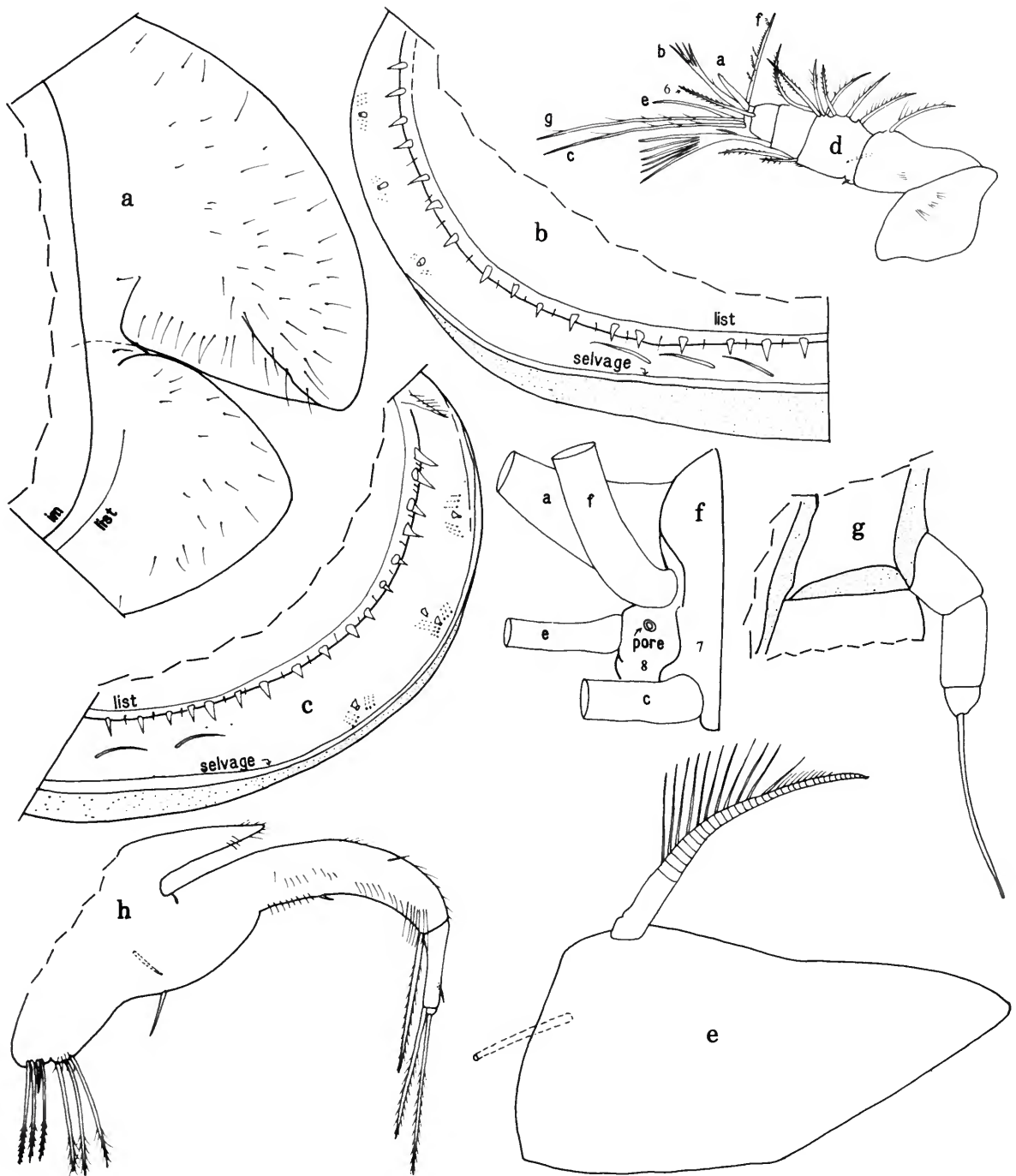


FIGURE 107.—*Cylindroleberis vix*, new species, adult female, paratype, USNM 193752: a, anterior end of left valve, iv; b, c, posterior ends of left and right valves, iv; d, right 1st antenna, mv; e, detail of 2nd joint of 1st antenna shown in d; f, detail of tip of 1st antenna shown in d (not all bristles shown); g, protopodite and endopodite of left 2nd antenna (sclerites stippled), mv; h, left maxilla, mv.

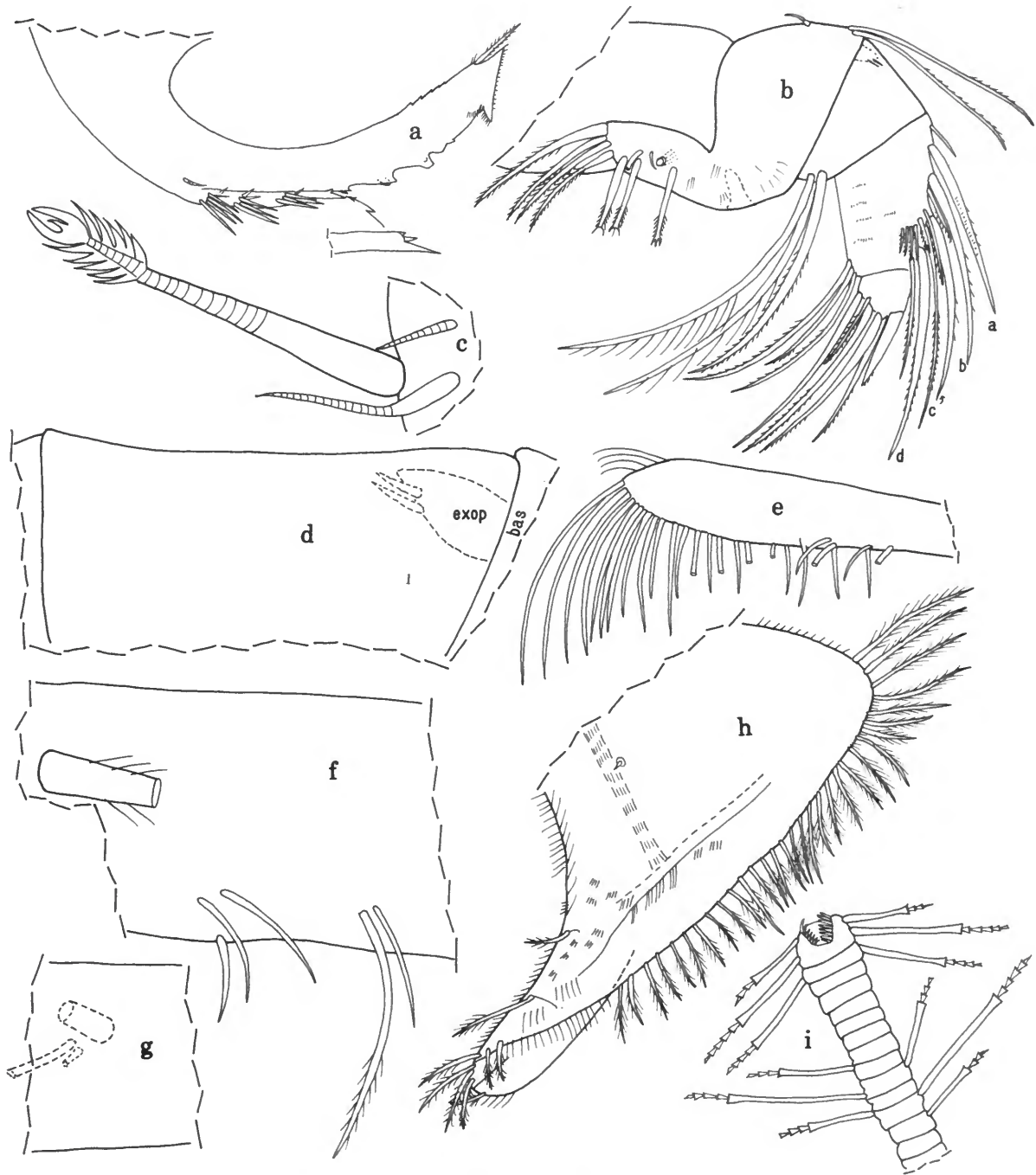


FIGURE 108.—*Cylindroleberis vix*, new species, adult female, paratype, USNM 193752: *a*, coxale endite and detail of tip of ventral branch of right mandible, mv; *b*, left mandible (coxale endite not shown), mv; *c*, 2 dwarf bristles and 1 triaenid bristle of basale endite of right mandible, mv; *d*, part of right mandible, mv; *e*, comb of left 5th limb (not all ventral bristles shown; stout exopodial bristle and pair of bristles usually just ventral to its base missing from limb), lv; *f*, part of comb of right 5th limb (pair of slender bristles just ventral to base of stout bristle not shown), lv; *g*, proximal parts of stout exopodial bristle and pair of bristles just ventral to base of stout bristle of right 5th limb, mv; *h*, right 6th limb, mv; *i*, 7th limb.

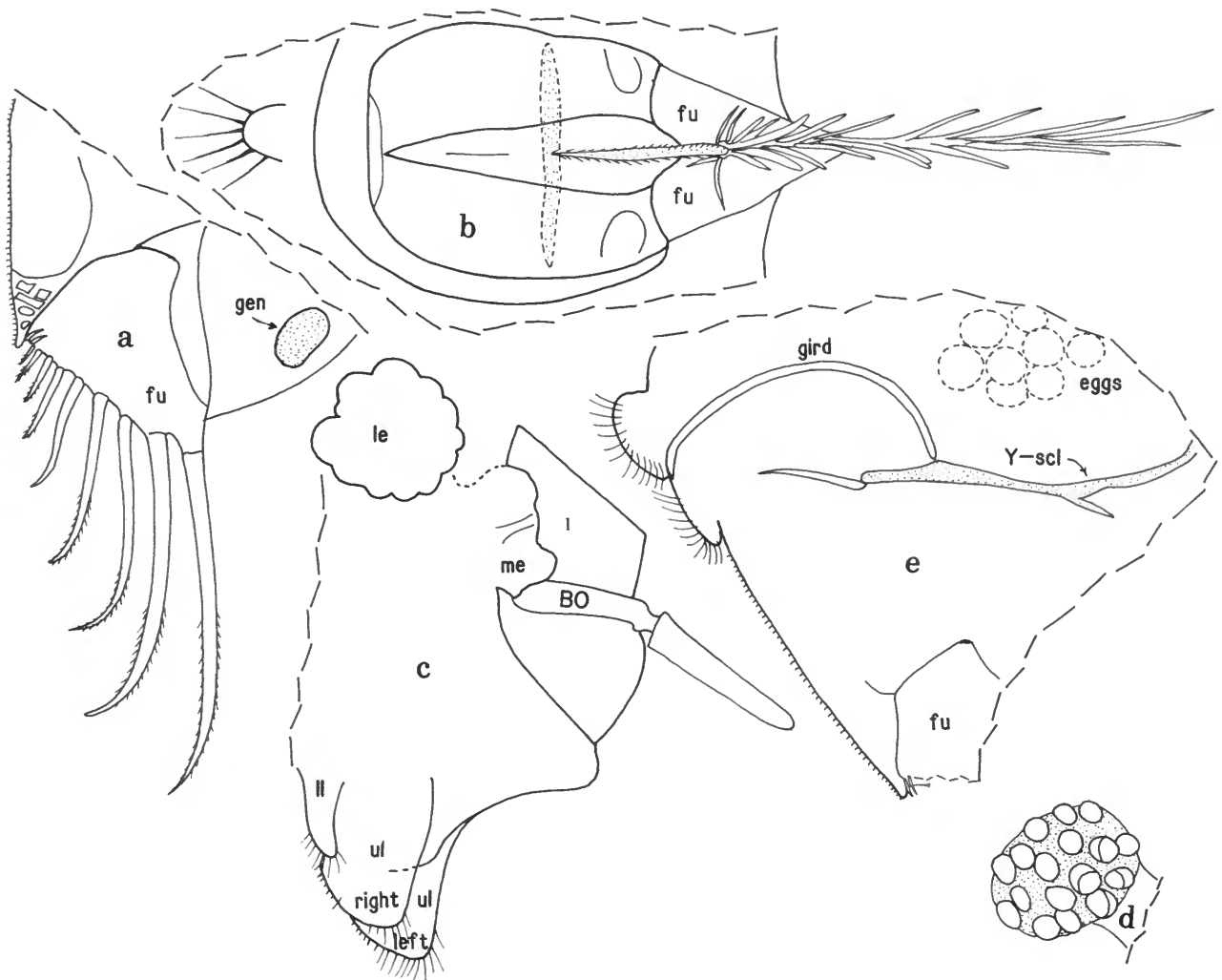


FIGURE 109.—*Cyndrolebris vix*, new species, adult female, paratype, USNM 193752: a, posterior of body from right side showing right furcal lamella and right genitalia (stippled), lv; b, posterior of body, anterior to right, vv; c, anterior of body from right side, anterior to right, lv; d, lateral eye; e, posterodorsal part of body from right side, anterior to right.

posterodorsal corner dorsal to posterior end of girdle; a 2nd spinous lobe just ventral to posterior end of girdle; posterior margin between 2nd lobe and furca with abundant minute spines.

Y-Sclerite (Figures 106k, 109e): With short ventral branch.

Gills (Figure 106k): 7 long posterior gills on each side of body.

Eggs: MNHN Os 467, holotype with 1 egg in marsupium (maximum length of egg 0.21 mm (Figure 106a,d)). USNM 193752 with many small unextruded eggs (Figure 109e).

DESCRIPTION OF A-2 FEMALE.—Carapace with shape similar to that of adult female.

Carapace Size: Paris, length 1.39 mm, height 0.54 mm; height 39% of length.

First Antenna: Sensory bristle of 5th joint of 1st antenna similar to that of adult female except for lacking short proximal filament.

Second Antenna: 9th joint of exopodite with only 3 bristles, limb otherwise similar to that of adult female.

Seventh Limb: With tapering bristles (2 on segment just proximal to terminus, 4 on terminus; bristles of proximal group not counted).

DESCRIPTION OF A-1 FEMALE.—Carapace with shape similar to that of adult female.

Carapace Size: Paris, length 1.77 mm, height 0.66 mm; height 37% of length.

First Antenna: Sensory bristle of 5th joint of 1st antenna similar to that of adult female.

Second Antenna: 9th joint of exopodite with 4 bristles, similar to that of adult female.

COMPARISONS.—In the key to species of *Cylindroleberis* in Kornicker (1991:110) the female *C. vix* keys out as *C. bacescui* Kornicker and Caraion, 1974, or possibly *C. grimaldi* Skogsberg, 1920. The carapace of the female *C. vix* is more elongate than either species (height as percent of length: *C. vix* 33%–35%, *C. bacescui* 40%–42% (Kornicker and Caraion, 1974:31), *C. grimaldi* 45% (Skogsberg, 1920:510)). The carapace length of the female *C. vix* is 2.15–2.17 mm (3 specimens), longer than other species referred to the genus, which range in length from 1.1 to 1.91 mm (Kornicker, 1991:110). The skirt of the 6th limb of *C. vix* bears 31–36 posteroventral bristles, compared to 23–26 bristles for *C. bacescui* (Kornicker and Caraion, 1974:34), and 17–25 for *C. grimaldi* (Skogsberg, 1920:513).

REMARKS.—A small proximal filament on the sensory bristle of the female 1st antenna, which is one of the major characteristics of the genus, is present on the adult and A-1 instar but absent on the A-2 instar of *C. vix*. The sensory bristle has not been described previously on the A-2 instar of other species of the genus. A new species (*C. vibex*) described herein is also without a short proximal filament on the sensory bristle of the A-2 instar suggesting that the absence of the filament may be commonplace for juveniles of the genus.

Cylindroleberis vibex, new species

FIGURES 110–112

ETYMOLOGY.—From the Latin *vibex* (mark, weal) in reference to the notch on the dorsal margin of the 6th joint of the female 1st antenna.

HOLOTYPE.—1 MNHN Os 470, undissected ovigerous female in alcohol.

TYPE LOCALITY.—Sta 23-S, 23 Mar 1977, Vatou Islet, Mayotte, 12°46'12"S, 45°15'30"E, depth 6 m.

PARATYPES.—Sta 23-S: Paris, 1 adult female in alcohol. Sta 32-S: USNM 193753, 1 ovigerous female on slide and in alcohol; USNM 193769, 1 A-2 female on slide and in alcohol; Paris, 1 A-1 undissected female in alcohol. Sta 124-S: Paris, 1 ovigerous female and 3 specimens in alcohol.

DISTRIBUTION.—Sta 23-S, Vatou Islet, Mayotte, depth 6 m. Sta 32-S, N Pamanzi Island, Mayotte, depth 15–20 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 6–24 m.

DESCRIPTION OF ADULT FEMALE (Figures 110, 111).—Carapace elongate with parallel straight dorsal and ventral margins; in lateral view anterior and posterior margins evenly rounded, or with posterodorsal margin slightly less rounded

(Figure 110a). Outer surface with abundant minute pores.

Infold: Rostral infold with 6 bristles in row between list and incisor and about 15 long and 25 short bristles dorsal to list (Figure 110b; not all bristles shown). Broad anteroventral infold with about 15 long and 20 short bristles. Anterior $\frac{3}{4}$ of ventral infold with about 15 bristles in row ending posteriorly where list broadens and bears flap-like bristles. Narrow list beginning near inner margin of infold just ventral to inner end of incisor, extending along anterior $\frac{3}{4}$ of ventral infold, then broadening and continuing on posterior infold (Figure 110c). Broad list with 24 broad transparent flap-like bristles and about 12 short bristles (not more than 1 short bristle between each pair of flap-like bristles) (Figure 110c; not all bristles shown). Only 1 or 2 long bristles on ventral infold between anterior part of broad list and valve edge. Posterior infold with 5 scoop-like processes and numerous tubular pores forming 2 rows between list and valve edge (Figure 110c); additional pores along edge appear to exit on outer surface of valve (not shown). Right valve with fringe of hairs near posterior juncture of hinge (Figure 110c).

Selva: Fringed lamellar prolongation along proximal $\frac{2}{3}$ of ventral edge of incisor.

Central Adductor Muscle Attachments (Figure 110d): With about 16 individual ovoid attachments. An elongate clear area dorsal to adductor muscles.

Carapace Size: MNHN Os 470, holotype, length 1.52 mm, height 0.60 mm; height 39% of length. USNM 193753, length 1.50 mm, height 0.60 mm; height 40% of length. Paris, length 1.49 mm, height 0.63 mm; height 42% of length.

First Antenna (Figure 110e–g): 1st joint with rows of medial spines (not shown). 2nd joint with few proximal medial spines (not shown) and 2 spinous bristles (1 lateral; 1 stouter, longer, dorsal). 3rd joint separated from 4th by indistinct suture; combined joints forming square. 3rd joint with minute bristle on short ventral margin and 6 stout spinous bristles (4 single bristles and 2 paired distal bristles) on long dorsal margin. 4th joint with few indistinct distal ventral spines, 2 slender terminal bristles on long ventral margin, and 1 stout spinous bristle on short dorsal margin. 5th joint: dorsal margin slightly sinuate; sensory bristle with short stout stem, with short slender proximal filament and 6 long stout terminal filaments. 6th joint: dorsal margin of both limbs of USNM 193753 with proximal notch; medial bristle spinous, with tip reaching past a-bristle of 7th joint. 7th joint: a-bristle claw-like, bare, with rounded tip (worn?); b-bristle about $\frac{1}{3}$ longer than a-bristle, with 1 short proximal and 3 longer distal marginal filaments; c-bristle long, with 6 short marginal filaments. 8th joint: d-bristle minute (visible only under $\times 100$ oil immersion lens, $\times 15$ objective) (Figure 110g); e-bristle about same length as b-bristle, bare with blunt tip, with small lateral pore on base; f-bristle bent dorsally, with 5 spinous marginal filaments, and distal marginal spines; g-bristle same length as c-bristle, with 5 or 6 short marginal filaments.

Second Antenna: Protopodite with small distal medial

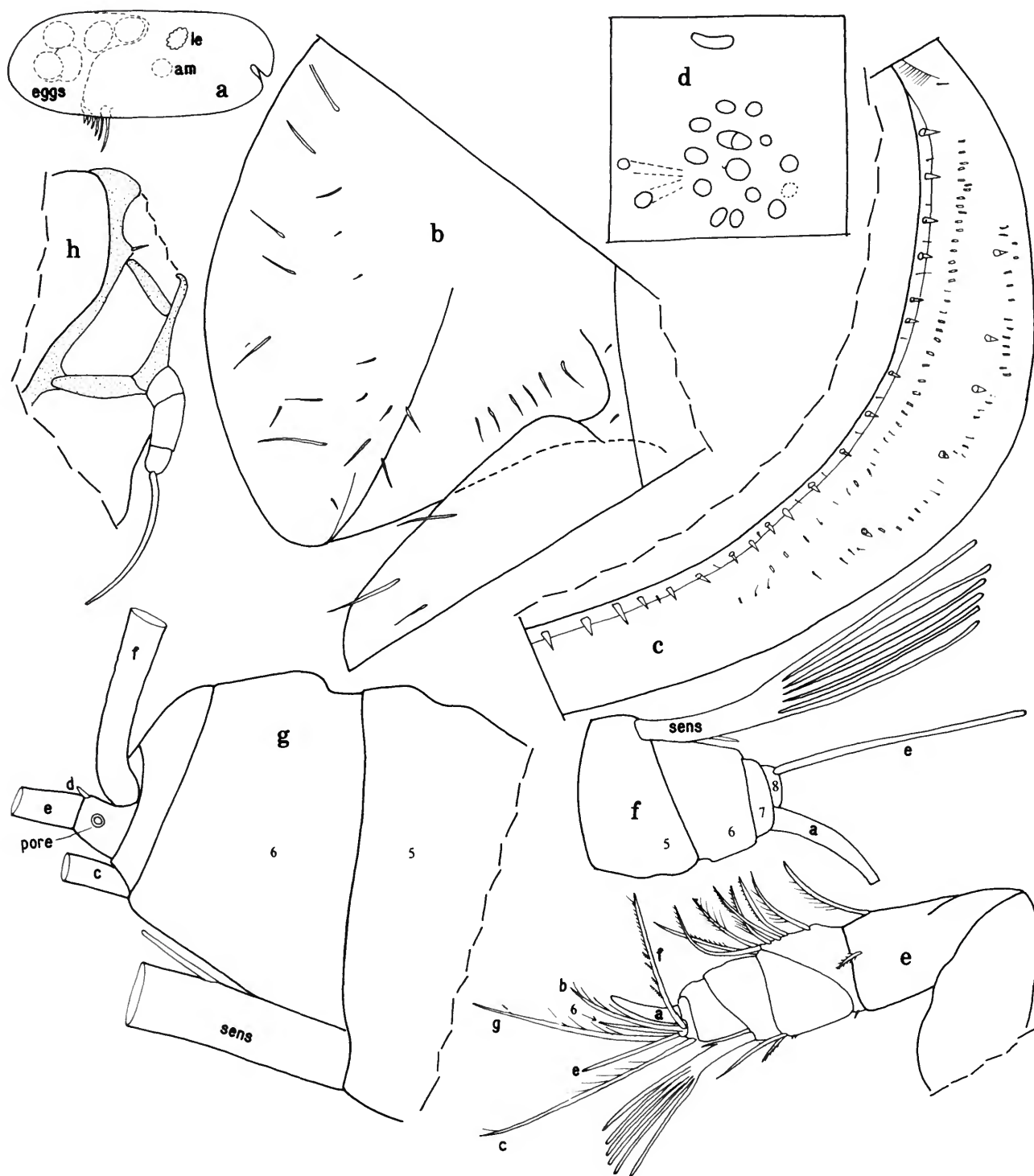


FIGURE 110.—*Cylindroleberis vibex*, new species, adult female, paratype, USNM 193753: a, complete specimen from right side (some furcal claws shown projecting from carapace), length 1.50 mm, ov; b, c, anterior and posterior ends of right valve, iv; d, central adductor muscle attachments of right valve, anterior to right, ov; e, left 1st antenna, lv; f, g, details of 1st antenna shown in e, not all bristles shown, lv; h, protopodite and endopodite of left 2nd antenna, mv.

bristle (Figure 110h) and few rows of short medial spines near dorsal margin (not shown). Endopodite distinctly 3-jointed, with long terminal filament about $\frac{1}{4}$ longer than stem (Figure 110h). Exopodite: bristle of 2nd joint reaching 9th joint, with abundant slender ventral spines; bristles of joints 3–8 with stout proximal ventral spines and distal natatory hairs; 9th joint with 4 bristles (1 long ventral with proximal ventral spines and distal natatory hairs, 1 medium with natatory hairs, 2 small with short hairs). Joints 3–8 with basal spines; spine of 8th joint about $\frac{3}{4}$ length of 9th joint; lateral spine of 9th joint about length of joint; joints 2–8 with minute lateral spines in row along distal margin; joints 2 and 3 with longer medial spines in row near distal margin.

Mandible (Figure 111a–c): Both endites of coxale of USNM 193753 broken off in mouth but all except tip visible within mouth on slide (Figure 111a); 1 small ringed medial bristle near base of ventral branch; ventral branch with 3 or 4 clusters of spines; tip of branch with stout ventral spine and 2 or 3 shorter spines; distal ventral margin of dorsal branch with 2 pointed teeth followed by 2 rounded teeth; tip of branch obscured. Basale endite with 4 pectinate end bristles, 3 triaenid bristles with 3 or 4 pairs of spines excluding terminal pair, 2 dwarf bristles (longest twice length of other), and glandular peg. Basale: ventral margin with small bristle (with narrow ringed distal part (detail in Figure 111b)) proximal to U-shape depression; dorsal margin with 2 or 3 ringed bristles (bare or with short spines) just proximal to midlength, 2 long, slender, ringed, terminal bristles with short marginal spines, a few indistinct spines proximal to terminal bristles, and 2 stout terminal spines (Figure 111b,c). Exopodite about $\frac{1}{4}$ length of dorsal margin of 1st endopodial joint, hirsute, with 1 or 2 short bristles (obscured and exact number of bristles not resolved) (Figure 111c). 1st endopodial joint with 3 long ventral bristles (2 with long spines, 1 with only short spines). 2nd endopodial joint: medial surface with minute spines in rows; ventral margin with 3 long terminal bristles with short marginal spines; dorsal margin with stout a-, b-, c-, and d-bristles (d-bristle with more spines than others, but not stouter), 1 short bare bristle proximal to a-bristle, 1 short spinous cleaning bristle between b- and c-bristles (closer to b-bristle), 5 spinous cleaning bristles forming oblique row on medial surface in vicinity of c- and d-bristles, 1 long slender spinous bristle on medial surface just distal to d-bristle, 1 long spinous bristle on lateral surface with base between c- and d-bristles, and no lateral bristle between b- and c-bristles. 3rd endopodial joint with short stout dorsal claw with rounded tip (worm?) and indistinct teeth along ventral margin, 3 longer spinous terminal bristles, 1 long spinous bristle with base on lateral surface near dorsal claw, and 1 short spinous bristle with base on medial surface.

Maxilla (Figure 111d): Epipodite not reaching middle of dorsal margin of basale, with hairs at tip. Endite I with 3 long and 1 short bristle; endite II with 3 long spinous bristles. Basale: ventral margin with 1 short proximal bristle, 1 small indistinct distal bristle, and 1 long spinous terminal bristle; dorsal margin with distal hairs, and 2 small bristles with bases

on medial surface (1 proximal, 1 distal); lateral surface with short proximal bristle; medial surface with very long hairs distally near ventral margin. 1st endopodial joint separated from basale by well-defined suture, with short alpha-bristle and long beta-bristle with few indistinct spines. 2nd endopodial joint with long bristle (with short marginal spines) reaching past tip of beta-bristle.

Fifth Limb (Figure 111e): Comb with stout spinous exopodial bristle reaching past end of comb, 2 slender bristles just ventral to base of stout bristle, 2 pairs of bristles at midlength close to ventral margin, and 1 bristle almost on ventral margin; 2 bristles at anterior end with bases just dorsal to ventral margin; ventral margin with long distal bristles (not all ventral bristles shown).

Sixth Limb (Figure 111f): Medial surface with small proximal bristle near vertical muscle bundle (dotted outline in Figure 111f). Anterior margin with 2 endites each with 1 spinous bristle (distal endite with longer bristle). Anterior tip of skirt with 5 spinous bristles; lateral flap with 1 small spinous bristle; posteroventral margin with 21 or 22 spinous bristles.

Seventh Limb (Figure 111g): 6 bristles in proximal group (3 on each side; 2 with 3 bells, 1 with 5); 2 bristles (1 on each side with 3 bells) on segment just proximal to terminus; 4 bristles on terminus (2 on each side; 1 with 3 bells, 1 with 5). Terminus with opposing combs each with 10 or 11 spinous teeth.

Furca (Figure 111j): Each lamella with 8 claws followed by 1 bristle-like backward directed claw; claws 1–8 with spines along posterior margin (not shown); claws 1–4 with distal spines along anterior margin; claw 1 of right lamella anterior to claw 1 of left lamella by width of base of claw; posterior claws of lamellae followed by single small triangular process with spines along posterior edge.

Bellonci Organ (Figure 111h): Elongate, broadest near midlength, with rounded tip.

Eyes: Medial eye unpigmented, bare (Figure 111h). Lateral eye about same size as medial eye, with 19 ommatidia and brown pigment between ommatidia (Figures 110a, 111h,i).

Upper Lip (Figure 111k): Hirsute lobe on each side of low saddle, without spines on either lobes or saddle.

Genitalia (Figure 111j): Small amber-colored area on each side of body anterior to furca.

Posterior of Body (Figure 111j): A spinous lobe dorsal and ventral to intersection of internal girdle with posterodorsal margin of body. Minute spines along edge posterior to furcal lamellae.

Y-Sclerite (Figure 111j): With short ventral branch.

Gills: 7 long posterior gills on each side of body.

Eggs: MNHN Os 470, holotype with 7 eggs in marsupium; USNM 193753 with 5 eggs in marsupium (length of 1 egg, 0.17 mm) (Figure 110a).

DESCRIPTION OF A-2 FEMALE (Figure 112a–d).—Shape of carapace similar to that of adult female except higher anteriorly (Figure 112a).

Infold: Not examined.

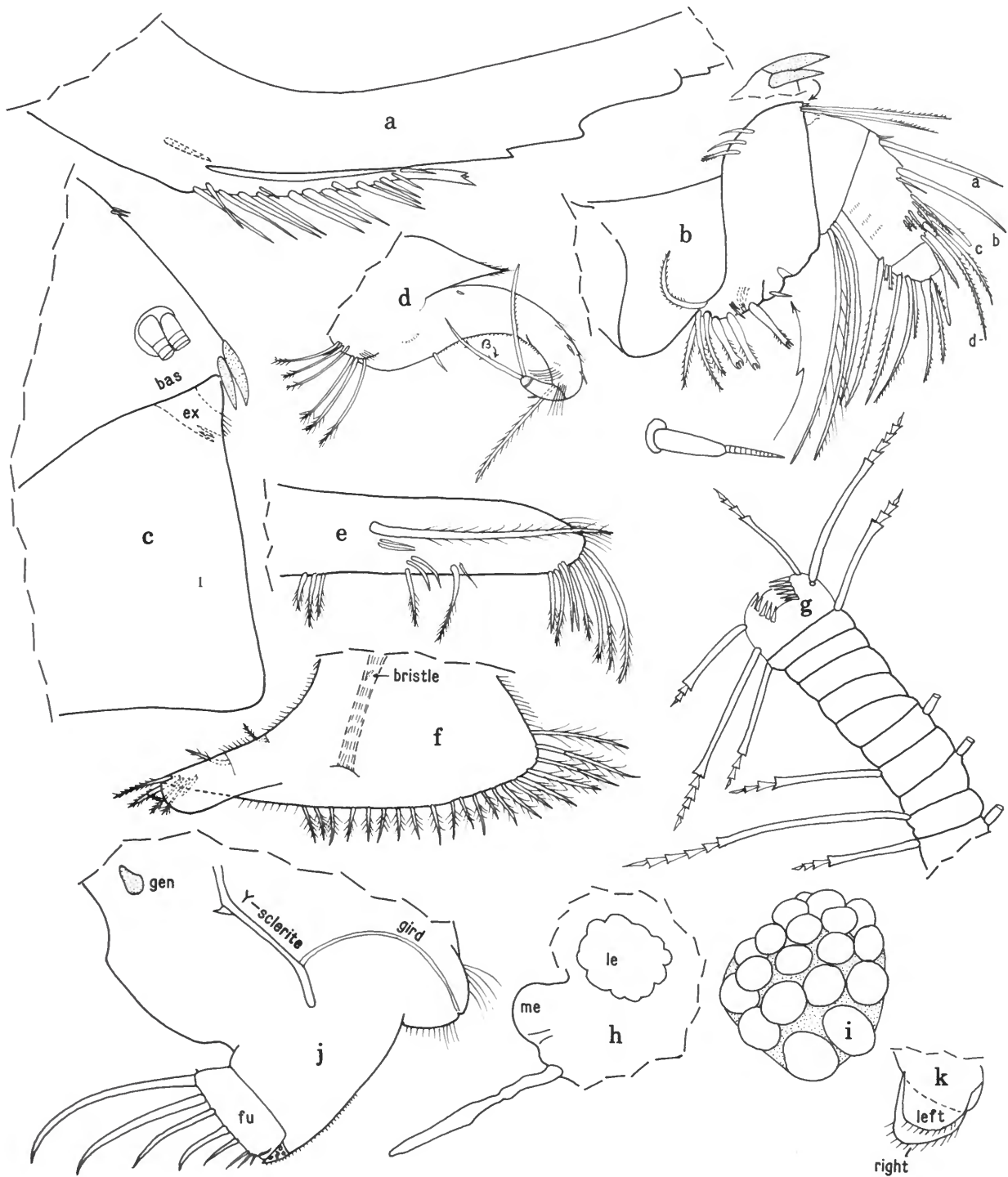


FIGURE 111.—*Cylindrolebris vibex*, new species, adult female, paratype, USNM 193753: a, proximal part of coxale endite of left mandible, lv; b, left mandible (coxale endite not shown), mv; c, part of left mandible, mv; d, left maxilla, mv; e, comb of right 5th limb, lv; f, left 6th limb, lv; g, 7th limb; h, outline of left lateral eye, medial eye, and Bellonci organ, anterior to left; i, right lateral eye, anterior to right; j, posterior of body from left side, anterior to left (not all appendages shown); k, upper lip, anterior to right.

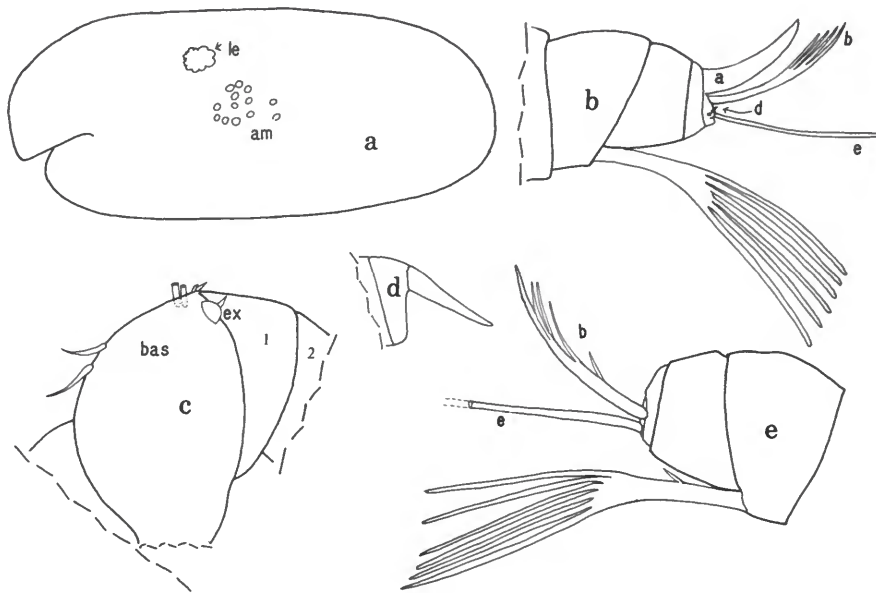


FIGURE 112.—*Cylindroleberis vibex*, new species, paratypes: A-2 female, USNM 193769: *a*, complete specimen from right side, length 1.03 mm; *b*, tip of right 1st antenna, lv; *c*, part of right mandible, not all bristles shown, lv; *d*, terminal claw of 3rd endopodial joint of right mandible, lv. A-1 female (unnumbered specimen from sta 32-S): *e*, tip of right 1st antenna (not all bristles shown), mv.

Central Adductor Muscle Attachments (Figure 112a): Comprising about 13 ovoid individual scars.

Carapace Size: USNM 193769, length 1.03 mm, height 0.45 mm; height 44% of length.

First Antenna (Figure 112b): Joints 1–4 and 6 similar to those of adult female. Sensory bristle of 5th joint differs from that of adult female in lacking short proximal filament. 7th joint: claw-like a-bristle with pointed tip (tip of adult bristle rounded, probably worn); b-bristle differs from that of adult in having 3 instead of 4 marginal filaments; c-bristle similar to that of adult. 8th joint: d- and e-bristles similar to those of adult, also with lateral pore on base of e-bristle; f-bristle similar to that of adult except with only 4 marginal filaments; g-bristle same length as c-bristle, with 5 short marginal filaments. Proximal notch on dorsal margin of 6th joint not as deep as that of adult female.

Second Antenna: Except for having only 3 bristles on the 9th exopodial joint (lacking small dorsal bristle), limb similar to that of adult female.

Mandible (Figure 112c,d): Basale: dorsal margin of both limbs with 2 bristles at midlength, and 2 terminal spines similar to those of adult female. Exopodite appearing to have only 1 terminal bristle, but not seen clearly. 3rd endopodial joint with pointed claw, not rounded as on adult.

Seventh Limb: 5 or 6 tapered bristles in proximal group (2 or 3 on each side with 2 or 3 bells); 2 tapered bristles on

segment proximal to terminus (1 on each side with 2 bells); 4 bristles on terminus (2 on each side, 1 with 1 bell, and other with 3 bells). Terminus with small opposing combs, each with about 8 spinous teeth.

DESCRIPTION OF A-1 FEMALE (Figure 112e).—Shape of carapace similar to that of adult female.

Carapace Size: Paris, length 1.27 mm, height about 0.48 mm; height about 38% of length.

First Antenna (Figure 112e): Sensory bristle of 5th joint and notch in dorsal margin of 6th joint similar to those of adult female. b-bristle of 7th joint and e-bristle of 8th joint similar to those of adult female, remaining bristles not examined in detail.

Second Antenna: Similar to that of adult female.

REMARKS.—The absence of a small proximal filament on the sensory bristle of the 5th joint of the 1st antenna of the A-2 female has been noted only on 1 other species of the genus (*C. vix* described herein). The proximal bristle is present on the A-1 female as well as on the adult.

COMPARISONS.—The dorsal margin of the mandibular basale of *C. vibex* bears 2 stout spines not reported on previously described species of *Cylindroleberis*. (Poulsen (1965, fig. 119g) illustrated a single and larger spine in that location is present on *Diasterope canina*.) The adult female 1st antenna has a notch proximally on the dorsal margin of the 6th joint not described on other species of the genus; the notch is much shallower on the A-2 female.

Prionotoleberis Kornicker, 1974

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

DISTRIBUTION.—*Prionotoleberis abyssicola* from the vicinity of the Lofoten Islands, and between Finmark and Beeren Island, at depths of 290–345 m; *P. gyion* from the Gulf of Naples at a depth of 55 m; *P. norvegica* from the vicinity of Sweden and Norway at depths of 70–160 m; *P. pax* from the Atlantic Ocean off Mauritania at depths of 96–338 m; *P. rex* from the Bay of Biscay at depths of 1845–1913 m; *P. salomani* from the Gulf of Mexico at a depth of 13 m; and *P. lux*, new species, from near Mayotte, Indian Ocean, at a depth of 300–350 m. The new species is the first report of the genus in the Indian Ocean. Known depth range 13–1913 m.

COMPOSITION.—Including the new species described herein the genus comprises 7 species: *P. abyssicola* (Sars, 1869, 1870) (new combination), *P. gyion* Kornicker, 1974b, *P. norvegica*

(Sars, 1869), *P. pax* Kornicker and Caraion, 1974, *P. rex* Kornicker, 1989, and *P. lux*, new species.

EMENDED DIAGNOSIS.—In the original diagnosis (Kornicker, 1974b:43) it was stated that the d-bristle of the 8th joint of the 1st antenna is absent or minute, and that the exopodite of the mandible is longer than $\frac{1}{2}$ length of dorsal margin of the 1st endopodial joint. In *P. lux*, new species, the d-bristle is fairly long, about $\frac{1}{6}$ the length of the e-bristle. Therefore, the diagnosis is emended to include species having a d-bristle either absent, minute, or as long as $\frac{1}{6}$ the length of the e-bristle. In *P. rex* Kornicker, 1989, the exopodite of the mandible reaches to about midlength of the dorsal margin of the 1st endopodial joint. Therefore, the diagnosis is emended to include species with a mandibular exopodite equal to, or longer than, $\frac{1}{2}$ length of dorsal margin of the 1st endopodial joint. In addition to the above, the genus is characterized by having on the sensory bristle of the female 1st antenna 1 proximal and 6 longer terminal filaments.

Key to Species of *Prionotoleberis*

1. Lateral eyes of female well developed 2
Lateral eyes of female absent 4
2. Dorsal margin of basale of maxilla with 3 bristles *P. gyion*
Dorsal margin of basale of maxilla with 2 bristles *P. salomani*
Dorsal margin of basale of maxilla with 6 bristles 3
3. Female carapace shorter than 1.8 mm *P. pax*
Female carapace longer than 1.9 mm *P. norvegica*
4. Female first antenna with d-bristle $\frac{1}{6}$ length of e-bristle *P. lux*, new species
Female first antenna with minute d-bristle 5
5. Ventral margin of basale of maxilla with single proximal bristle *P. abyssicola*
Ventral margin of basale of maxilla with paired proximal bristles *P. rex*

Prionotoleberis lux, new species

FIGURES 113, 114

ETYMOLOGY.—From the Latin *lux* (light).

HOLOTYPE.—MNHN Os 476, 1 undissected adult female with well-developed genitalia.

TYPE LOCALITY.—Sta 72-DS, 30 Mar 1997, NNE north reef, Mayotte, 12°31'S, 45°02'18"E, depth 300–350 m.

PARATYPES.—Sta 72-DS: USNM 193754, 1 adult female on slide and in alcohol; Paris, 1 adult female in alcohol (specimen missing 1st antennae, mandibles, right 2nd antenna, left maxilla). Sta 120-DS: Paris, 1 partly dissected adult female with small unextruded eggs, in alcohol.

DISTRIBUTION.—Sta 72-DS, NNE north reef, Mayotte, depth 300–350 m. Sta 120-DS, SE Glorioso Islands, depth 335–390 m. Known depth range 300–390 m.

DESCRIPTION OF ADULT FEMALE (Figures 113, 114).—Carapace elongate with slightly convex ventral and dorsal margins (Figure 113b); in lateral view anterior and posterior

ends evenly rounded.

Infold: Rostral infold with about 16 bristles between list and incisur, and about 65 bristles dorsal to list (not all bristles shown in Figure 113c); broad anteroventral infold with about 65 bristles (not all shown); anterior $\frac{2}{3}$ of ventral margin with about 15 bristles in row ending where list broadens and bears flap-like bristles. Narrow list beginning near inner margin of infold just ventral to inner end of incisur, extending along anterior $\frac{2}{3}$ of ventral infold, then broadening and continuing on posterior infold (Figure 113d). Broad list with 21 broad transparent flap-like bristles and 18 small bristles (not more than 1 small bristle between each pair of flap-like bristles) (Figure 113d). About 7 bristles in row on ventral infold between anterior part of broad list and valve edge (Figure 113d). 3 small tubular processes along posterior infold between list and selvage (Figure 113d). Infold of posterodorsal corner of right valve with long hairs forming row (Figure 113d).

Selvage: Selvage set inward from valve edge along



FIGURE 113.—*Prionotoleberis lux*, new species, adult females: holotype, MNHN Os 476: a, tip of left 1st antenna (not all bristles shown; not under cover slip), mv. Paratype, USNM 193754: b, complete specimen from left side, length 1.74 mm; c, d, anterior and posterior ends of right valve, iv; e, central adductor muscle ends projecting from right side of body when right valve removed, anterior to right; f, right 1st antenna (bristles of joints 6-8 not shown), lv; g, tip of right 1st antenna, lv; h, detail of d- and e-bristles in g; i, bristle of protopodite of right 2nd antenna, mv; j, protopodite, endopodite, and exopodial joints 1-3 of right 2nd antenna, lv; k, joints 1 and 2 of right 1st antenna and protopodite of right 2nd antenna (sclerite stippled).

posterior $\frac{3}{4}$ of ventral margin and posterior margin, and also medial to margins. Selvage with narrow lamellar prolongation with marginal fringe along inner $\frac{1}{2}$ of ventral margin of incisur. (Hairs on posterodorsal infold may be lamellar prolongation of selvage.)

Vestment (Figure 113c): Anterodorsal corner proximal to infold with 3 clusters of long spines.

Central Adductor Muscle Attachments (Figure 113e): Comprising 13 ovoid individual attachments. An oval clear area dorsal to attachments.

Carapace Size: USNM 193754, length 1.74 mm, height 0.85 mm; MNHN Os 476, holotype, carapace somewhat distorted, length only about 1.64 mm; another specimen from type locality, carapace somewhat distorted, measured after body removed, length 1.68 mm, height about 0.94 mm. Specimen from sta 120-DS, length 1.84 mm, height 0.93 mm.

First Antenna (Figure 113a, f-h, k): 1st joint with medial and lateral spines. 2nd joint: lateral side with rows of spines, slender distal bristle with few marginal spines, and small notch in distal margin near ventral edge of joint; medial side with rows of long spines near ventral margin; dorsal margin with stout spinous bristle. 3rd joint with well-defined suture separating it from 4th joint; with minute ventral bristle, 6 dorsal bristles (4 single and 2 paired; 1st, 2nd, 4th, and lateral of paired bristles with long spines, others with short spines), and few lateral spines near ventral margin. 4th joint with few rows of minute ventral spines, stout dorsal bristle with short marginal spines, and 2 slender ventral bristles with short marginal spines. Sensory bristle of 5th joint stout, with fairly long slender proximal filament and 6 stout terminal filaments. 6th joint with long medial bristle with short marginal spines. 7th joint: a-bristle claw-like, bare; b-bristle almost twice length of a-bristle, with 4 marginal filaments; c-bristle about $\frac{1}{4}$ longer than b-bristle, with 8 marginal filaments. 8th joint: d-bristle about $\frac{1}{6}$ length of e-bristle, slender, tapering distally, with minute spine at tip and minute indistinct tube near base; e-bristle shorter than b-bristle, bare with blunt tip; no lateral pore on base of d- and e-bristles; f-bristle about twice length of a-bristle, bent dorsally, with 5 short marginal filaments (filaments and distal part of stem with marginal spines); g-bristle same length as c-bristle, with 7 marginal filaments.

Second Antenna: Protopodite with few rows of short medial spines near middle (not shown), and small distal medial bristle (Figure 113i). Endopodite with 3 well-defined joints, with terminal filament about 3 times length of stem (Figure 113j). Exopodite: bristle of 2nd joint reaching 9th joint, with numerous slender ventral spines; bristles of joints 3-6 with ventral spines and natatory hairs; bristles of joints 7 and 8 with natatory hairs, no spines; 9th joint with 4 bristles (2 long with natatory hairs, 2 short with small dorsal spines, no hairs); joints 3-8 with basal spines increasing slightly in length on distal joints (spine of 8th joint about $\frac{3}{4}$ length of 9th joint); 9th joint with lateral spine similar to basal spine of 8th joint; joints 3-8 with minute spines forming rows along distal edge.

Mandible (Figure 114a): Coxale endite broken off on both limbs of USNM 193754 but small bristle present near base of ventral branch. Basale endite with 4 spinous end bristles, 3 triaenid bristles each with 6 pairs of minute spines not including terminal pair, 2 dwarf bristles, and glandular peg. Basale: ventral margin with small triaenid bristle near base of endite (could be interpreted to be on endite) with few minute distal marginal spines and very small terminal pair of spines; dorsal margin with 2 long slender subterminal bristles with short marginal spines, and 1 slender backward-pointing bristle at midlength on holotype and USNM 193754 but none on specimen from sta 120-DS; medial surface without spines. Exopodite about $\frac{2}{3}$ length of dorsal margin of 1st endopodial joint, with distal hairs and 2 short terminal bristles. 1st endopodial joint with 3 long ventral bristles (2 with long spines, 1 with only short spines). 2nd endopodial joint: medial surface with minute spines forming rows; ventral margin with 3 long terminal bristles with short marginal spines; dorsal margin with 1 or 2 small slender proximal bristles, stout a-, b-, c-, and d-bristles (d-bristle slightly slenderer than c-bristle, also longer and with more marginal spines), 1-3 spinous cleaning bristles near base of b-bristle, oblique row of 4 spinous cleaning bristles between b- and c-bristles, oblique row of 7 spinous cleaning bristles (outer bristle with longest spines) near base of c-bristle, 1 long slender bristle with base on medial side just distal to base of d-bristle, 1 long slender bristle with base on lateral side between c- and d-bristles, and no lateral bristle between b- and c-bristles. 3rd endopodial joint with stout straight dorsal claw, 3 long stout terminal bristles, 1 long spinous bristle with base on lateral side near dorsal claw, and 1 short spinous bristle with base on medial side.

Maxilla (Figure 114b): Hirsute pointed epipodite reaching to about middle of dorsal margin of basale. Endite I with 1 short and 3 long bristles; endite II with 3 long bristles. Basale: dorsal margin spinous, with 2 bristles (1 proximal, 1 distal) with bases on medial surface; ventral margin with 1 proximal backward-pointing bristle, 1 minute distal bristle, and 1 long spinous terminal bristle; medial surface spinous, especially along ventral margin (spines near endopodite longer); lateral side with short proximal bristle. Endopodite: 1st joint with short alpha-bristle and long bare beta-bristle; 2nd endopodial joint with long bare terminal bristle reaching slightly past tip of beta-bristle.

Fifth Limb (Figure 114c): Comb with stout spinous exopodial bristle reaching past end of comb, 2 slender bristles just ventral to base of stout bristle, 2 pairs of bristles at midlength close to ventral margin, 1 bristle almost on ventral margin close to proximal pair, 2 bristles at anterior end with bases just dorsal to ventral margin, 1 bristle at proximal end with base almost on ventral margin, and ventral bristles forming row with distal bristles longer (not all ventral bristles shown).

Sixth Limb (Figure 114d): Medial surface with small bristle in proximal anterior corner. Anterior margin with 2

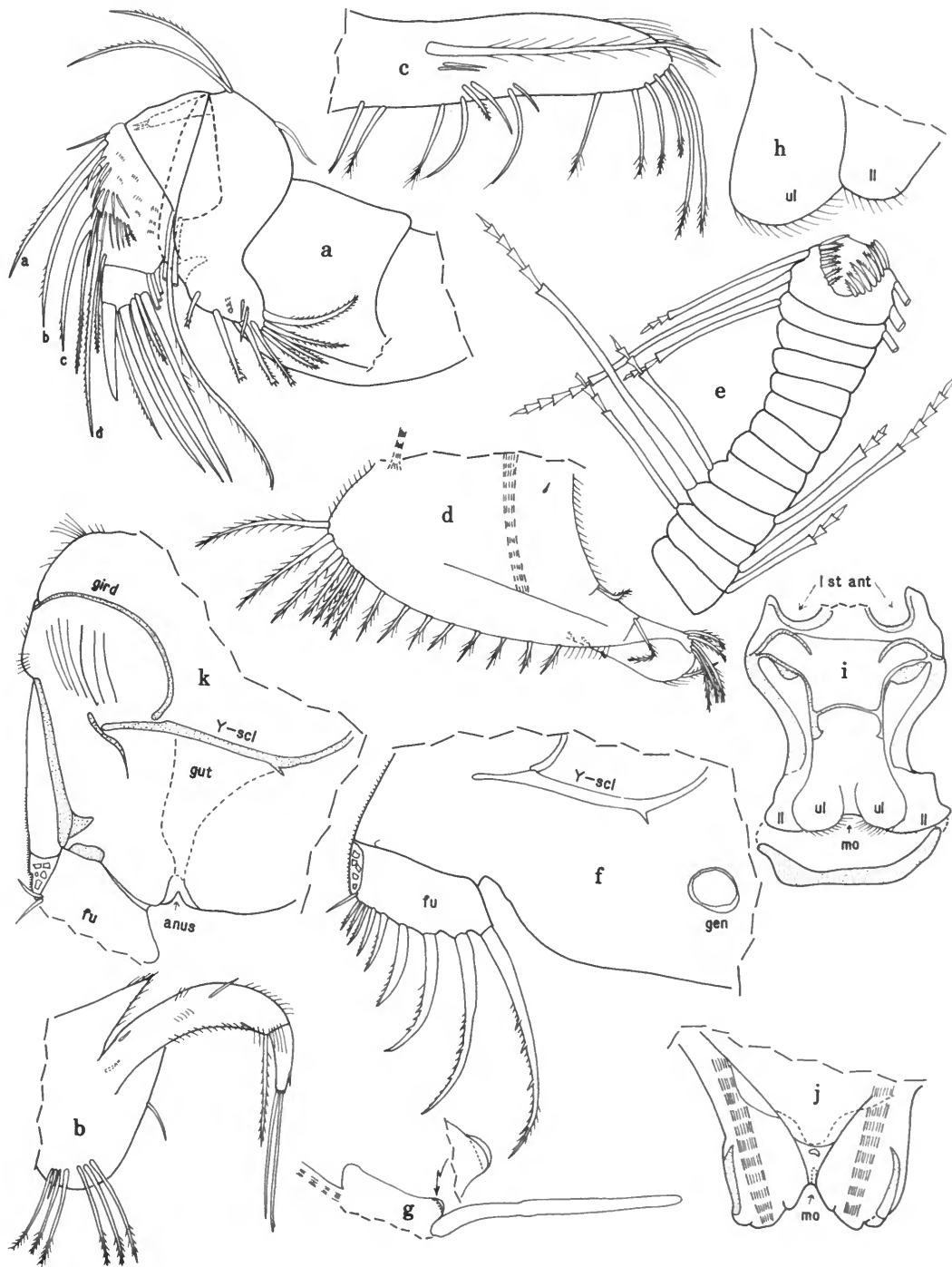


FIGURE 114.—*Prionotoleberis lux*, new species, adult females, paratypes: USNM 193754: a, right mandible (coxale endite not shown), mv; b, left maxilla (not all bristles shown), mv; c, comb of right 5th limb, lv; d, left 6th limb, mv; e, 7th limb; f, posterior of body from right side, anterior to right, lv; g, medial eye and Bellonci organ from right side, anterior to right, lv; h, upper and lower lips, anterior to left; i, anterior of body from anterior (sclerites stippled; not all appendages shown); j, posterior view of mouth area (sclerites stippled). Unnumbered female from sta 72-DS: k, posterior of body from right side, anterior to right (sclerites stippled).

endites each with 1 spinous bristle (distal endite with longer bristle). Anterior tip of skirt with 5 spinous bristles; lateral flap with 1 slender spinous anterior bristle and 3 proximal ventral spines along edge; posteroventral margin of skirt with 15 spinous bristles.

Seventh Limb (Figure 114e): 6 bristles in proximal group (3 on each side: 2 with 3 bells, 1 with 5); 2 bristles (1 on each side with 3 bells) on segment just proximal to terminus; 4 bristles on terminus (2 on each side; 1 with 3 bells, 1 with 5). Terminus with opposing combs each with 14 or 15 spinous teeth.

Furca (Figure 114f): Each lamella with 10 claws, posterior claw pointing backward, indistinctly ringed, somewhat bristle-like but not markedly so; claws 8 and 9 as slender as claw 10; bases of claws 7–10 very close to each other; claw 1 of right lamella anterior to claw 1 of left lamella by width of base of claw; posterior of lamella with small triangular process with spines along posterior edge.

Bellonci Organ (Figure 114g): Elongate, very slightly broader at point $\frac{1}{3}$ from proximal end; tip broadly rounded.

Eyes: Lateral eyes absent. Medial eye narrow, bare, without linear internal structures usually present in *Cylindroleberidinae*; anterior edge near insertion of Bellonci organ with paired rounded corners (Figure 114g).

Lips (Figure 114h–j): Upper lip with hirsute lobe on each side of low saddle; lobes and saddle without spines (Figure 114h,i). Lower lip a hirsute flap on each side of mouth (Figure 114h,i). Mouth obscured but probably narrow slit (Figure 114i).

Genitalia (Figure 114f): Small oval area on each side of body anterior to furca.

Posterior of Body (Figure 114k): Posterior with low spinous bulge in vicinity of posterior end of girdle; cluster of long spines on posterodorsal curvature; small spines along posterior edge dorsal to furca.

Y-Sclerite (Figure 114f,k): With small distal ventral branch.

Gills: With 7 elongate gills on each side of posterior of body.

REMARKS.—The d-bristle on the 1st antenna of *P. lux* is ringed in the middle part, unringed in the proximal and distal $\frac{1}{4}$, and tapers from its base to tip, which bears a minute spine. The tip is not blunt like that of the e-bristle, and therefore, in this character the d-bristle is more bristle-like than filament-like. Although the d-bristle is longer than encountered in other species of *Prionotoleberis*, it is shorter than d-bristles encountered in species of either *Archasterope*, *Bathyleberis*, *Empoulsenia*, or *Skogsbergiella*.

COMPARISONS.—Only 2 other species of *Prionotoleberis* without lateral eyes are known: *P. abyssicola* (Sars, 1870) and *P. rex* Kornicker, 1989:120. The 1st antenna of *P. lux* differs from those 2 species in having a longer d-bristle.

Synasterope Kornicker, 1975

Synasterope Poulsen, 1965 [nomen nudum].—Kornicker, 1975a [named type species].

TYPE SPECIES.—*Synasterope implumis* Poulsen, 1965, by subsequent designation (Kornicker, 1975a:440).

DISTRIBUTION.—Members of the genus are widespread between latitudes of about 47.5°N and 73°S and depths of 1–4450 m (Kornicker, 1989:101).

COMPOSITION.—Including the new species described herein this genus comprises about 25 species. Hartmann (1985:98) described a species (?*Synasterope brevisetae*) from the Indian Ocean, and Brady (1902:179) described *S. oculata* from Trincomalee, Sri Lanka. The latter species also was reported from the Red Sea by Poulsen (1965:413), and from off the southeastern coast of India by James (1976:611).

Synasterope calix, new species

FIGURES 115–130

ETYMOLOGY.—From the Latin *calix* (cup).

HOLOTYPE.—MNHN Os 477, undissected instar V female in alcohol.

TYPE LOCALITY.—R/V *Suroit*, sta 106-R, 9 Apr 1977, Zelee Bank, south border, 12°25'30"S, 46°16'18"E, depth 18–24 m.

PARATYPES.—Sta 1-S: Paris, 1 adult male in alcohol. Sta 18-S: Paris, 1 adult male in alcohol. Sta 50-S: Paris, 1 instar IV male in alcohol; USNM 193699, 1 instar V male on 1 slide and in alcohol; USNM 193779, 1 instar IV male on 1 slide and in alcohol; USNM 193693, 1 adult female on 2 slides and in alcohol; USNM 193696, 1 adult male on 1 slide and in alcohol. Sta 51-S: Paris, 1 adult male in alcohol. Sta 106-R: Paris, 2 instar IV males (1 dissected) and 18 juveniles, all in alcohol; USNM 193772, 1 instar II on 1 slide and in alcohol; USNM 193773, 1 instar II in alcohol; USNM 193774, 1 instar III on 1 slide and in alcohol; USNM 193775, 1 instar IV female on 1 slide and in alcohol; USNM 193770, 1 instar I on 1 slide and in alcohol; USNM 193771, 1 instar I on 1 slide and in alcohol; USNM 193776, 1 instar IV male on 1 slide and in alcohol; USNM 193780, 1 instar V female in alcohol. Sta 111-S: USNM 193692, 1 instar V male on 2 slides and in alcohol. Sta 116-S: Paris, 7 juveniles in alcohol; USNM 193777, 1 instar V male on 1 slide and in alcohol; USNM 193778, 1 instar V male on 1 slide and in alcohol. Sta 124-S: Paris, 45 specimens in alcohol.

DISTRIBUTION.—Sta 1-S, western side of Leven Bank, depth 42 m. Sta 18-S, S Îlot Gombé Doumé, Mayotte, depth 15 m. Sta 50-S, Bouéni Reef, Mayotte, depth 32 m. Sta 51-S, Bouéni faro, Mayotte, depth 15 m. Sta 106-R, Zelee Bank, south border, depth 18–24 m. Sta 111-S, S Zelee Bank, depth 24 m. Sta 116-S, Geyser Bank, southern part of lagoon, depth 13 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, depth 24 m. Known depth range 13–42 m.

REMARKS CONCERNING LETTERING OF BRISTLES.—In some illustrations, bristles along the dorsal margin of the 3rd joint of the 1st antenna are lettered “a” to “f,” and bristles along the dorsal margin of the 2nd endopodial joint of the mandible are lettered “a” to “g”; the explanation of the system of lettering is given in “Order of Bristle Additions,” p. 220. In some illustrations of the 3rd endopodial joint of the mandible, bristles are lettered “a” to “f”; the explanation of the system of lettering is given in “Discussion of Bristles of the Third Endopodial Joint of Mandible,” p. 222.

DESCRIPTION OF ADULT FEMALE (Figures 115, 116).—Carapace elongate with evenly rounded anterior and posterior margins and slightly convex parallel ventral and dorsal margins (Figure 115a); incisur slit-like and just ventral to valve midheight. Numerous patches of closely packed “globules” widely distributed beneath valve surface (Figure 115f).

Infold: Rostral infold with about 14 bristles between list and incisur and about 40 bristles dorsal to list including small bristles forming row near dorsal margin (Figure 115b; not all dorsal bristles shown). Broad anteroventral infold (extending from incisur to point where bristles form double row along anterior end of ventral infold) with about 30 bristles (Figure 115f). Ventral infold with about 25 bristles forming row ending posteriorly at point where list becomes broad. List beginning at inner margin of infold near posterior end of incisur, extending along ventral margin, and continuing on posterior infold where it broadens; list approaching ventral edge of valve at midlength. Broad posterior list with 46–49 broad, transparent, flap-like bristles and about 20 slender bristles (not more than 1 bristle between each pair of flap-like bristles (only 2 flap-like bristles shown in Figure 115c, both marked with arrows); 4 long bristles along posteroventral part of list, remaining bristles minute) (Figure 115c,e); 18 bristles forming row between posterior list and posterior valve margin; 9 tubular pores forming row close to posterior edge of valve, and which may exit on outer surface of shell (Figure 115c). Long “tendons” extending anteriorly from beneath posterior infold (posterior end of some tendons terminating at list but others terminating closer to posterior margin of valve) (Figure 115e). (Note: the 9 tubular pores on the posterior infold along valve edge are not similar to scoop-like processes present on some cylindroleberids.)

Vestment (Figure 115b): Spines forming few clusters in anterodorsal part of valve just posterior to inner margin of infold.

Central Adductor Muscle Attachments (Figure 115d): About 20 ovoid and elongate attachments at valve midheight just anterior to valve midlength.

Carapace Size: USNM 193693, length 1.52 mm, height 0.91 mm; height 60% of length.

First Antenna (Figure 115g,h): 1st joint with medial and lateral spines. 2nd joint with proximal ventral spines, medial

spines, and dorsal bristle with long stout anterior spines at midlength and small spines distally. 3rd joint: short ventral margin with small bristle; long dorsal margin with 6 bristles (proximal bristle with long stout anterior spines at midlength and small spines distally; 2nd–4th bristles with few long anterior spines at midlength and short spines distally; 5th bristle with base on lateral side of joint and proximal part parallel to dorsal margin of joint, with few long anterior spines at midlength and short spines distally; 6th bristle with only short spines). 4th joint with well-defined oblique proximal margin and concave distal margin; combined 3rd and 4th joints forming square; short dorsal margin with stout bristle with short marginal spines; long ventral margin with 2 terminal bristles with minute marginal spines. Sensory bristle of 5th joint with long stem with 6 terminal filaments and no proximal filament. Medial bristle of 6th joint long with short marginal spines. 7th joint: a-bristle claw-like slightly concave dorsally, bare; b-bristle with 3 marginal filaments (distal filament with stout proximal part); c-bristle long, with 4 proximal and 1 distal filaments. 8th joint: d-bristle represented by minute peg (Figure 115h); e-bristle with distal part broken off both limbs of USNM 193693; f-bristle bent dorsally, with 4 proximal and 1 subterminal short filaments (stem between proximal and subterminal filaments with short thin hairs); g-bristle long (tip broken off illustrated limb) with 4 filaments on remaining part.

Second Antenna (Figure 116a): Protodipite with few slender spines along dorsal margin and on medial surface near dorsal margin, few lateral spines along ventral margin, and small distal medial bristle. Endopodite 3-jointed, with long terminal filament. Exopodite: bristle of 2nd joint with dense row of slender ventral spines; bristles of joints 3–8 with natatory hairs and proximal stout ventral spines; 9th joint with 4 bristles (2 long with natatory hairs and stout proximal ventral spines, 2 short with short hair-like spines); joints 3–8 with stout basal spines longer on distal joints (spine of 8th joint about $\frac{3}{4}$ length of 9th joint), and minute spines forming row along dorsal corner; 9th joint with lateral spine about same size as basal spine of 8th joint.

Mandible (Figure 115i,j): Coxale endite (broken off on left limb of holotype but present on right limb) (Figure 115j): small bristle near base of ventral branch; ventral branch with spines forming 4 oblique rows, and long slender tip with minute subterminal spine; ventral margin of dorsal branch with 3 low pointed teeth followed by 4 rounded teeth, short main spine, and drawn-out tip with marginal spines between main spine and tip; small spiney indentation present distally on dorsal margin of branch but bristle absent, possibly broken off. Basale endite with 4 spinous end bristles, small glandular peg, 1 slender fairly long dwarf bristle, and 3 triaenid bristles with 3 or 4 pairs of spines proximal to terminal pair. Basale: ventral margin near endite with 1 triaenid bristle similar to those of endite and proximal to narrow internal U-shape boss; dorsal margin with

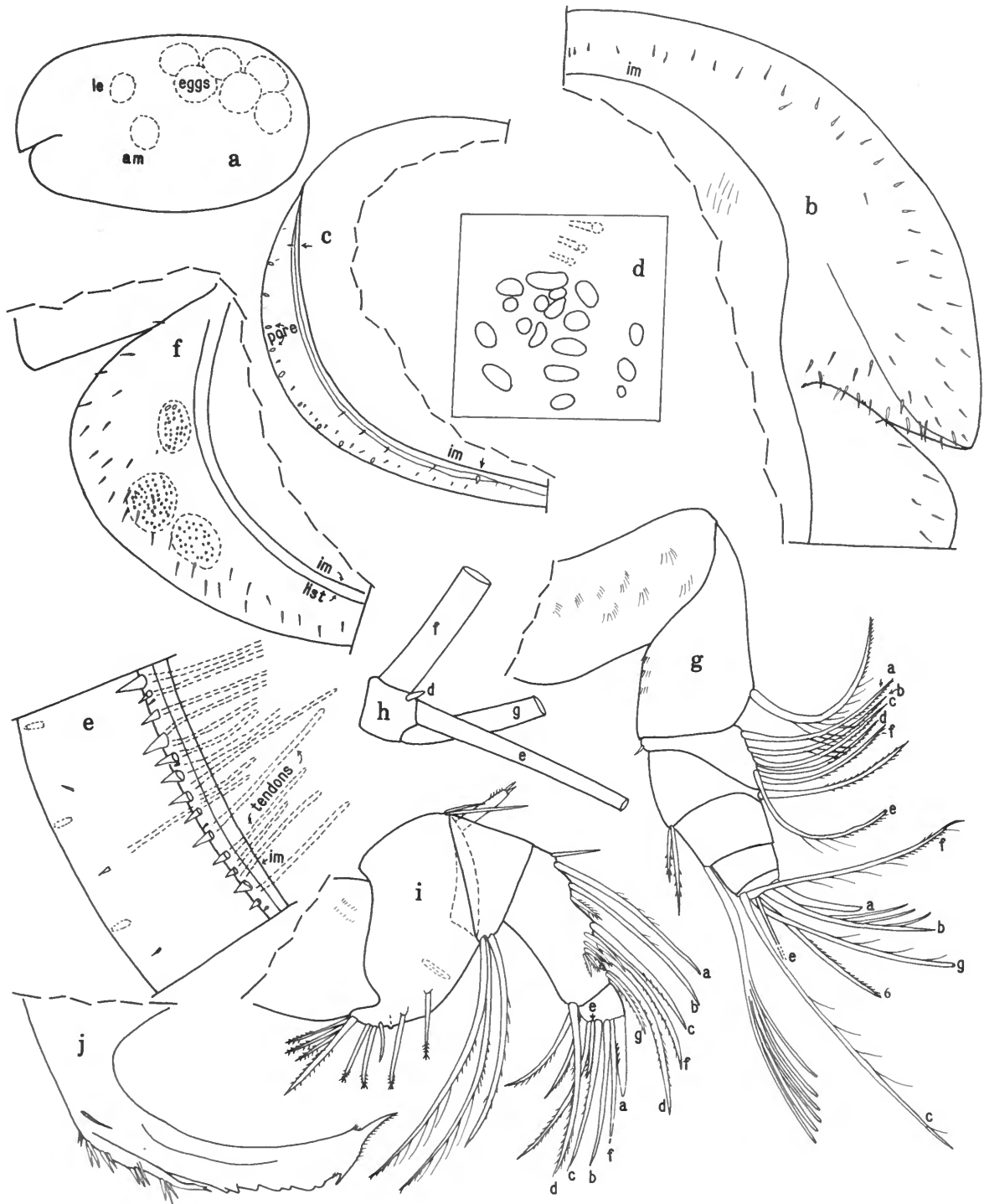


FIGURE 115.—*Synasterope calix*, new species, adult female, paratype, USNM 193693: *a*, complete specimen from left side, length 1.52 mm; *b, c*, anterior and posterior ends of left valve (bristles of list not shown in *c*), *iv*; *d*, central adductor muscle attachments of left valve, anterior to left, *ov*; *e*, part of posterior end of left valve, anterior to right, *iv*; *f*, anterior of right valve, *iv*; *g*, right 1st antenna (d-bristle not shown), *lv*; *h*, 8th joint of 1st antenna shown in *g*, *lv*; *i*, left mandible (coxale endite not shown), *mv*; *j*, coxale endite of right mandible, *mv*.



FIGURE 116.—*Synasterope calix*, new species, adult female, paratype, USNM 193693: *a*, protopodite and endopodite of right 2nd antenna, mv; *b*, left maxilla (not all bristles shown), mv; *c*, comb of left 5th limb (not all bristles shown), mv; *d*, right 6th limb and right lower lip, mv; *e*, 7th limb; *f*, left furcal lamella (teeth of claws not shown), lv; *g*, medial eye and Bellonci organ, anterior to left, lv; *h*, left lateral eye, anterior to left, lv; *i*, posteroventral part of body from right side, anterior to right (only furcal claws 1 and 2 of right lamella shown), lv; *j*, posterior of body from left side, anterior to left (only 3 posterior claws of left furcal lamella shown), lv; *k*, left Y-sclerite, anterior to left, lv; *l*, upper lip, anterior to left.

2 terminal bristles (lateral about $\frac{1}{2}$ length of medial); lateral and medial sides without spines. Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, hirsute distally and with 2 short terminal bristles. 1st endopodial joint with 3 long spinous ventral bristles. 2nd endopodial joint: ventral margin with 3 spinous terminal bristles; dorsal margin with a-, b-, c-, and d-bristles (all with some posterior spines and anterior minute teeth; c- and d-bristles stouter than a- and b-bristles, d-bristle longer than others), 1 short bristle proximal to a-bristle, and 1 short spinous bristle (cleaning bristle) between b- and c-bristles; medial side with 5 spinous cleaning bristles forming oblique row between bases of c- and d-bristles, 1 longer spinous bristle distal to base of d-bristles, and no spines; lateral side with no bristle between b- and c-bristles, and 1 long spinous f-bristle between c- and d-bristles. 3rd endopodial joint with straight claw with few ventral teeth, and 5 bristles.

Maxilla (Figure 116b): Epipodite slender with hirsute pointed tip reaching middle of dorsal margin of basale. Endites I and II each with 4 bristles (3 long and 1 short). Basale: dorsal margin with 3 bristles with bases on medial side (1 short proximal, 1 at midlength (broken on both limbs of illustrated specimen), and 1 fairly long distal bristle); ventral margin with 1 backward-pointing proximal bristle, 1 minute indistinct distal bristle, and 1 long spinous terminal bristle; lateral side with 1 small proximal bristle; medial surface spinous. Endopodite: 1st joint spinous, with short alpha-bristle and long bare beta-bristle; 2nd joint with long bare terminal bristle reaching past beta-bristle.

Fifth Limb (Figure 116c): Comb unusually long; lateral side of comb with stout spinous exopodial bristle extending past distal end, 1 short slender bristle ventral to base of stout bristle, 2 pairs of bristles closer to ventral margin, and 1 bristle just proximal to proximal pair with base almost on ventral margin; ventral margin of comb with 43 bristles (not all shown) (5 anterior bristles longer than others; shorter bristles of ventral margin comprising row of alternating short and slightly longer bristles, all with marginal spines and longer spines at tip); anterodorsal corner of comb with few long hairs.

Sixth Limb (Figure 116d): Small medial bristle near proximal anterior corner (not shown). Anterior margin with slender bristle at upper endite and much longer and stouter bristle at lower endite (upper bristle about half length of lower bristle). Skirt: anterior end with 3 hirsute ventral bristles, and 1 hirsute bristle on anterior end of lateral flap; ventral margin at midlength with 11 or 12 bristles with long proximal and short distal spines; posterior end rounded, with 4 spinous bristles. Limb hirsute; anterior margin dorsal to upper endite with widely spaced stout hairs with bases on medial side and abundant finer hairs with bases on lateral side; ventral margin with widely separated stout hairs except between bristles at midlength and at posterior end.

Seventh Limb (Figure 116e): Proximal group with 6 bristles (3 on each side), each with 3 or 4 bells. Distal group with 6 bristles, 3 on each side (4 on terminus, 2 on segment

proximal to terminus), each with 3 or 4 bells. Terminus with opposing combs: one with 14 spinous teeth, other with 10 (spines of teeth not shown on illustrated limb).

Furca (Figure 116f): Each lamella with 9 claws; claws 7-9 ringed; claws 8 and 9 bristle-like and bending posteriorly; claws 1-6 with minute teeth along posterior edge, some teeth slightly stouter than others (teeth not shown on illustrated limbs); claws 1 and 2 with few anterior teeth near tip; right lamella anterior to left by width of claw 1. Lamellae following claws with small spines.

Bellonci Organ (Figure 116g): Elongate, slightly wider at midlength, with broadly rounded tip.

Eyes: Medial eye without pigment, with indistinct dorsal hairs (Figure 116g). Lateral eye about same size as medial eye, with 17 amber-colored ommatidia and without pigment between ommatidia (Figures 115a, 116h).

Lips: Upper lip comprising hirsute lobe on each side of saddle (Figure 116i). Lower lip comprising hirsute flap on each side of mouth (Figure 116d).

Genitalia (Figure 116i): Oval ring on each side of body anterior to furca.

Posterior of Body (Figure 116j): Posterior margin spinous; posterodorsal corner rounded and with long spines; long hairs forming lateral row near posterior end of girdle and extending well past posterior edge of body.

Y-Sclerite (Figure 116i-k): Elongate, with minute distal ventral branch.

Gills: Well developed.

DESCRIPTION OF ADULT MALE (Figures 117-119).—Shape similar to that of adult female but some carapaces more elongate than that of adult female, with more open incisur, slightly more rounded inferior corner of rostrum, and slightly flatter posterodorsal corner (Figures 117a, 119a,e); posterior end of carapace with hairs forming vertical row. Patches of closely spaced globules present as in shell of adult female. (USNM 193696 with abundant clusters of needle-like foreign substance between shell and vestment as well as between shell and infold.)

Infold: Infold dorsal to incisur with about 40 bristles (Figure 117b; not all dorsal bristles shown). Broad anteroventral list with about 25 bristles (Figure 117b). Ventral infold with about 11 bristles forming row ending posteriorly where list becomes broad. Location of list along ventral and posterior infold similar to that of adult female. Broad posterior list with 32-34 broad flap-like transparent bristles, and 9-11 minute bristles (not more than 1 bristle between each pair of flap-like bristles). 15 or 16 bristles forming row between posterior list and posterior valve margin. 8-10 indistinct tubular pores similar to those on carapace of adult female forming row close to posterior edge of valve (Figure 117c,d) (the pores appear to be beneath the infold and may exit on outer surface of shell, but point of exit could not be resolved). (The tubular pores are not similar to scoop-like processes on some cylindroleberids, which generally are closer to midwidth of infold and exit on

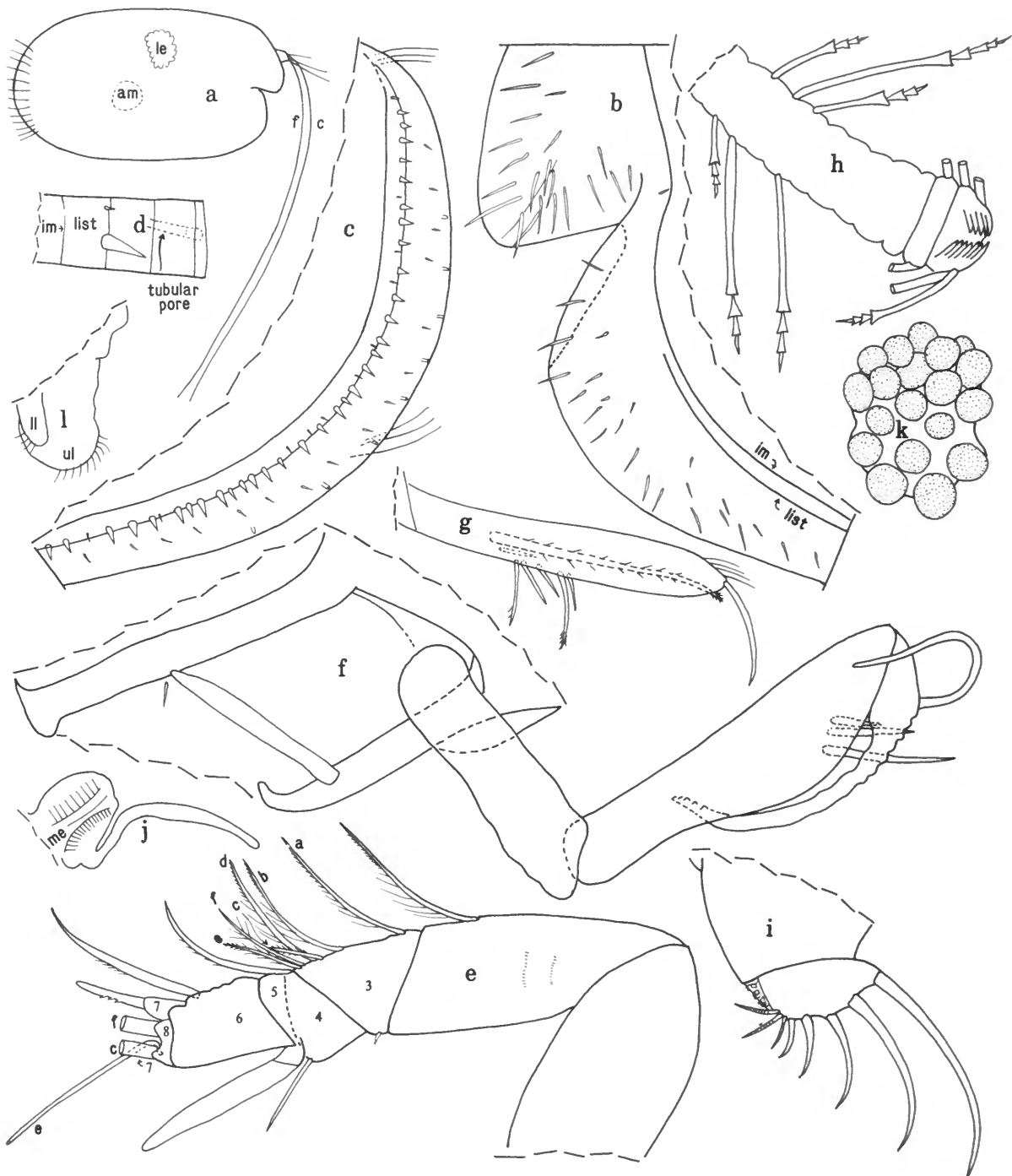


FIGURE 117.—*Synasterope calix*, new species, adult male, paratype, USNM 193696: *a*, complete specimen from right side with tip of right 1st antenna extruding from carapace, length of carapace 1.57 mm; *b,c*, anterior and posterior ends of right valve, iv; *d*, detail of posterior end of right valve shown in *c*, iv; *e*, left 1st antenna (not all bristles of joints 7 and 8 shown), lv; *f*, protopodite and endopodite of right 2nd antenna, mv; *g*, comb of left 5th limb, mv; *h*, 7th limb; *i*, right furcal lamella, lv; *j*, medial eye and Bellonci organ, anterior to right, lv; *k*, right lateral eye, anterior to right, lv; *l*, upper and lower lips from right side, anterior to right.

infold.)

Carapace Size: Sta 50-S: USNM 193696, length 1.57 mm, height 0.88 mm; height 56% of length. Sta 1-S: Paris, length 1.35 mm, height 0.72 mm; height 53% of length. Sta 18-S: Paris, length 1.36 mm, height 0.81 mm; height 60% of length. Sta 51-S: Paris, length 1.45 mm, height 0.80 mm; height 55% of length.

First Antenna (Figures 117a,e, 119a,b): 1st joint with long medial spines near ventral margin (not shown). 2nd joint with minute spines forming few lateral rows, many spines forming medial rows, and 1 spinous dorsal bristle. 3rd joint triangular, with minute ventral bristle and 6 dorsal bristles (proximal bristle with long proximal and short distal spines; 2nd bristle some distance from 1st and with similar spines; 3rd and 4th bristles spinous, paired, with lateral bristle slender; 5th bristle stout, spinous, with base on medial side; 6th bristle slender, spinous, with base on lateral side and close to 5th). 4th joint with long ventral and short dorsal margins; dorsal margin with long stout spinous bristle; ventral margin with 1 (aberrant?) or 2 terminal bristles. 5th joint fused to 4th on lateral side and separated by suture on medial side; sensory bristle stout with abundant slender filaments and few stouter terminal filaments (filaments not shown). 6th joint with medial bristle near dorsal margin, long stout with few spines. 7th joint: a-bristle claw-like with few minute indistinct ventral teeth, and base on short pedestal; b-bristle almost 4 times length of a-bristle, with 2 short proximal and 3 longer distal filaments; c-bristle very long, tip missing on specimen examined, but remaining part with 22 filaments. 8th joint: d-bristle absent or represented by minute indistinct peg; e-bristle about 3 times length of a-bristle, slightly shorter than b-bristle, bare with blunt tip; f-bristle similar to c-bristle, tip broken on specimen examined but with 21 filaments on remaining part; g-bristle 5 times length of a-bristle, with 9 filaments (proximal 3 closely spaced).

Second Antenna: Protopodite with minute distal medial bristle but no spines (Figure 117f). Endopodite 3-jointed (Figure 117f): 1st joint elongate, bare; 2nd joint longer than 1st, with 3 short bristles forming row (proximal bristle about 3 times length of distal); elongate 3rd joint narrow, reflexed, with proximal inner and outer margins undulate, 1 long proximal bristle, and 4 ridges at inner margin of tip. Exopodite: 1st joint bare; length of 2nd joint same as total length of joints 3–5; joints 2–8 with long hairs forming row at distal inner edge, minute spines forming row along middle part of distal edge, stouter spines forming row at distal outer edge, and stout basal spine; 9th joint with stout spine about $\frac{3}{4}$ length of joint and at outer edge; bristles of joints 2–8 and 4 bristles of 9th joint with natatory hairs, no spines.

Mandible: Coxale endite: small unringed bristle may be near base of ventral branch and is illustrated, but its presence could not be resolved with certainty (bristles shown in Figure 118a) (a bristle is present on A-1 male and adult female, so is likely to be present on male); ventral branch with spines forming 4 oblique rows and tip with 2 minute teeth; 3 pointed

teeth on ventral margin of dorsal branch between tip of ventral branch and small main spine; terminal spine fairly long; dorsal bristle set back from tip of branch and reaching past end of terminal spine (Figure 118a). Basale endite with 4 spinous end bristles, 2 or 3 triaenid bristles with 4 or 5 paired spines proximal to terminal pair, 1 slender dwarf bristle, and glandular peg (Figure 118b,d). Basale: ventral margin either with small bristle with few minute spines (right limb of USNM 193696 (Figure 118b)) or with small triaenid bristle with 1 or 2 paired spines proximal to terminal pair (left limb of USNM 193696 (Figure 118d)); dorsal margin with 1 backward oriented bristle distal to midlength (this bristle absent on unnumbered specimen from sta 51-S), and 2 terminal bristles (lateral less than $\frac{1}{2}$ length of medial). Exopodite about $\frac{3}{4}$ length of dorsal margin of 1st endopodial joint, hirsute distally and with 2 short terminal bristles (Figures 118b, 119g). 1st endopodial joint (Figure 118b): ventral margin with 3 spinous bristles (anterior edge of proximal medial bristle with long spines followed by short spines, then long spines; anterior edge of proximal lateral bristle with short spines followed by long spines; distal medial bristle shorter than others, with proximal wreathes of long spines). 2nd endopodial joint (Figure 118c): ventral margin with 3 spinous terminal bristles; dorsal margin with 2 slender proximal bristles, stout a-, b-, c-, and d-bristles (a- and b-bristles more slender, c-bristle stouter and shorter than others, d-bristle slightly less stout than c-bristle, all bristles with indistinct posterior spines, a-bristle with more than others); medial side with 1 short spinous cleaning bristle between b- and c-bristles, 5 spinous cleaning bristles forming oblique row between bases of c- and d-bristles, 1 longer spinous g-bristle distal to base of d-bristle, and indistinct spines forming rows; lateral side with no bristle between b- and c-bristles and 1 long spinous f-bristle between c- and d-bristles. 3rd endopodial joint with stout claw with few ventral teeth and 5 bristles (short medial bristle and long ventral bristle with short spines, others bare). (Male from sta 18-S is without dorsal bristle distal to midlength of basale but the presence of an indistinct socket suggests that a bristle may have once been present.)

Maxilla (Figure 118e): Epipodite slender with hirsute pointed tip almost reaching middle of dorsal margin of basale. Endites I and II each with 4 bristles (3 long, 1 short). Basale: hirsute, dorsal margin with 3 bristles with bases on medial side (1 short proximal, 1 near midlength (broken on both limbs of USNM 193696), and 1 fairly long distal bristle); ventral margin with 1 proximal bristle, 1 smaller but well-developed ringed distal bristle, and 1 long spinous terminal bristle. 1st endopodial joint hirsute, with short alpha-bristle and long bare beta-bristle; 2nd joint with long bare terminal bristle reaching past beta-bristle. (Condition of maxilla of USNM 193696 did not permit determination of presence of usual proximal lateral bristle.)

Fifth Limb (Figure 117g): Epipodite with about 59 bristles. Comb similar to that of adult female, but ventral bristles not counted.



FIGURE 118.—*Synasterope calix*, new species, adult male, paratype, USNM 193696: a, coxale endite of right mandible and detail of tip of dorsal branch, mv; b, proximal part of right mandible (coxale endite not shown); c, bristles of 2nd endopodial joint of right mandible, mv; d, basale endite of left mandible, mv; e, right maxilla, mv; f, right 6th limb, mv; g, anterior end of left 6th limb, mv; h, posterior of body from left side, anterior to left, lv.

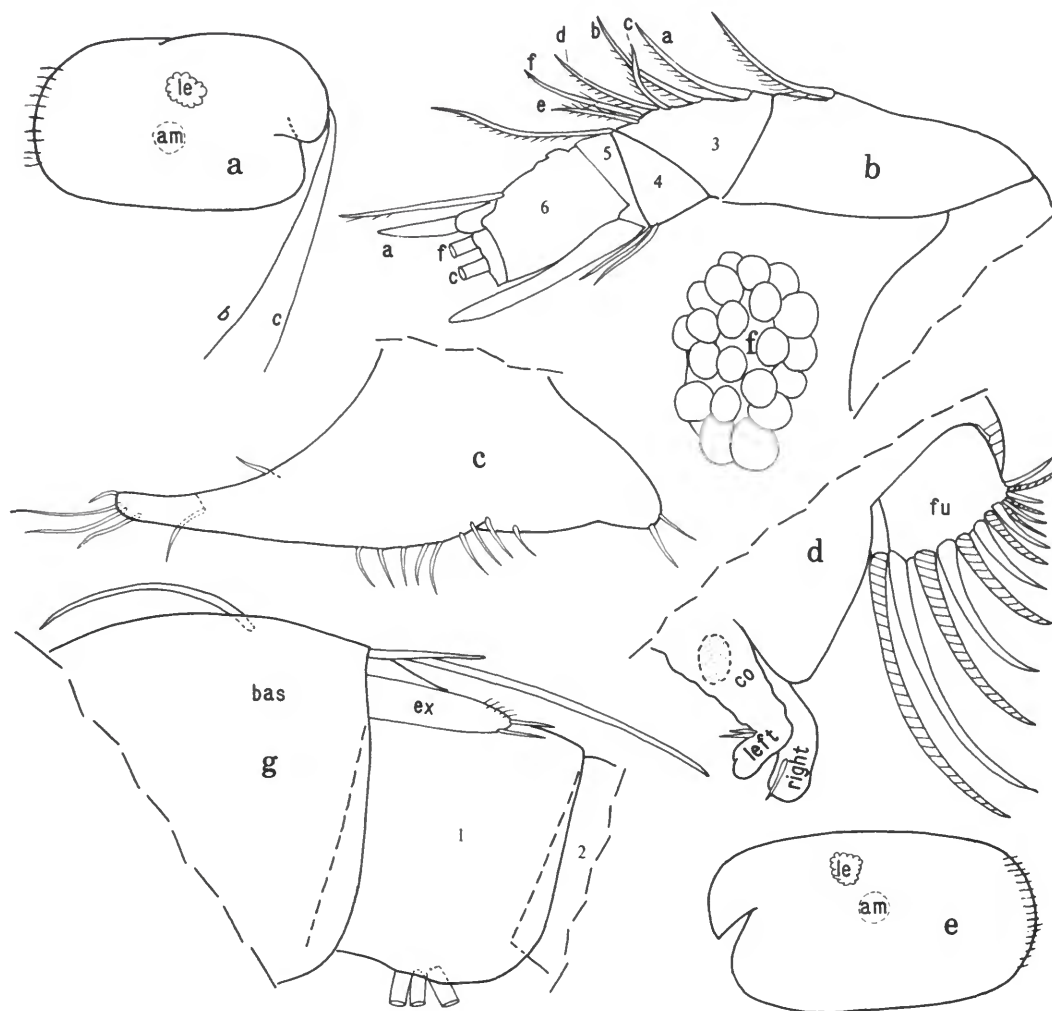


FIGURE 119.—*Synasterope calix*, new species, adult males, paratypes: unnumbered specimen from sta 1-S: a, complete specimen from right side with c- and f-bristles of right 1st antenna, length of carapace 1.35 mm; b, left 1st antenna (not all bristles of joints 7 and 8 shown), lv; c, left 6th limb (spines of bristles not shown), lv; d, furca and copulatory organ (claws of right lamella striated), lv. Unnumbered specimen from sta 51-S: e, complete specimen from left side, length 1.45 mm; f, lateral eye. Unnumbered specimen from sta 18-S: g, part of right mandible, lv.

Sixth Limb (Figures 118f,g, 119c): Small medial bristle near proximal anterior corner. Anterior margin with slender bristle (with few distal hairs) at upper endite and longer, stouter, hirsute bristle at lower endite. Skirt: anterior end with 3 hirsute ventral bristles and 1 smaller hirsute bristle at anterior end of lateral flap; ventral margin at midlength with 9 bristles with long proximal and short distal spines; posterior end rounded, with 2-4 spinous bristles. Limb hirsute.

Seventh Limb (Figure 117h): Proximal group with 6 bristles (3 on each side), each with 2-4 bells. Distal group with 6 bristles, 3 on each side (4 on terminus, 2 on segment proximal to terminus), each with 3 or 4 bells. Terminus with opposing

combs: one with 14 spinous teeth, other with 10 (spines of teeth not shown on illustrated limb).

Furca (Figures 118h, 119d): Each lamella with 8 claws; claws 7 and 8 ringed, bristle-like, bare, and bending posteriorly; claws 1-6 with minute teeth along posterior edge (not shown); right lamella anterior to left by width of claw 1; claws 2-4 of right lamella slightly longer than same numbered claws of left lamella (Figure 117j). Lamellae following claws with small spines.

Bellonci Organ (Figure 117j): Similar to that of adult female.

Eyes: Medial eye without pigment (presence or absence of

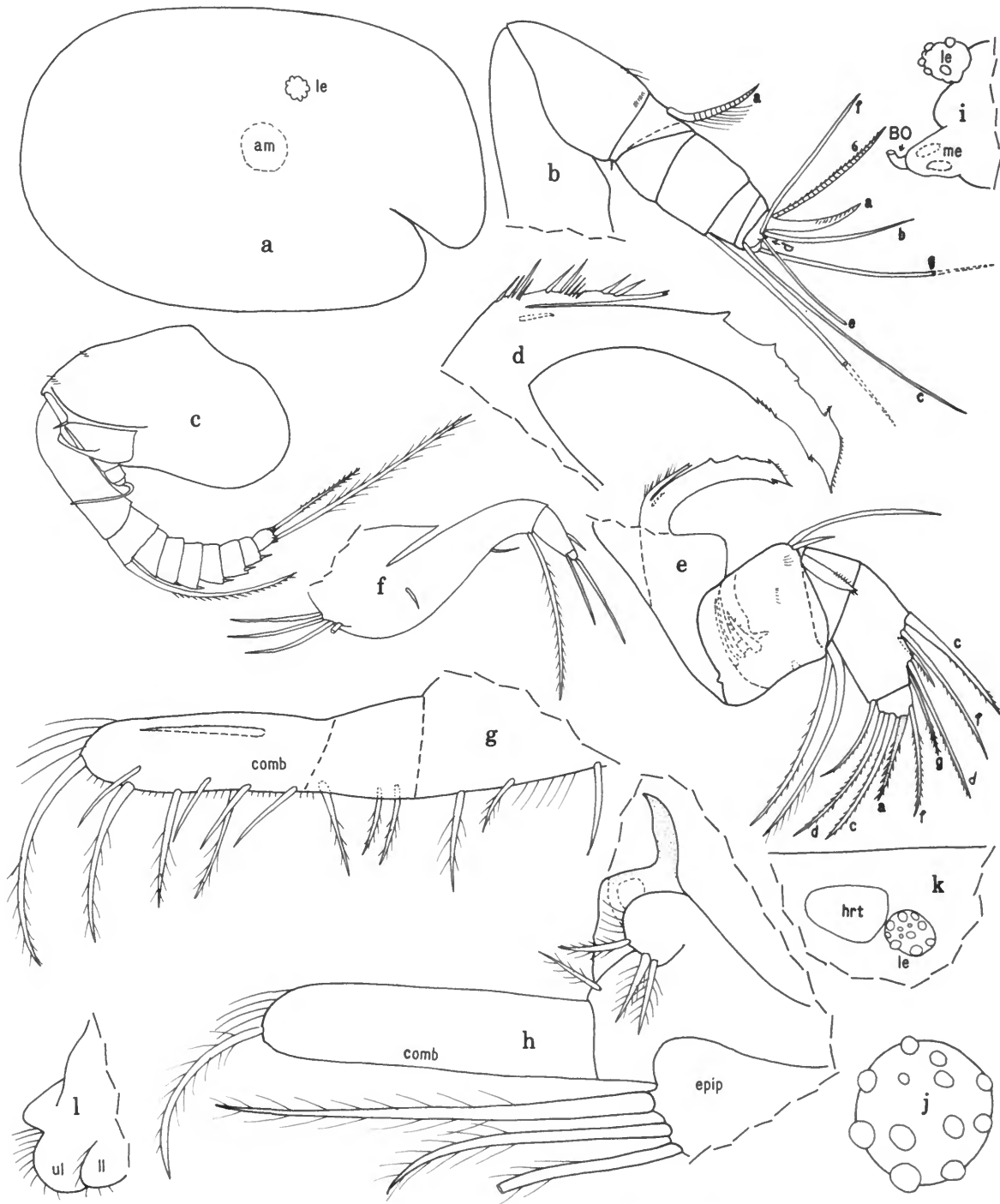


FIGURE 120.—*Synasterope calix*, new species, instar I (sex unknown), paratype, USNM 193770: *a*, complete specimen from right side, length ~0.56 mm (carapace distorted); *b*, right 1st antenna, lv; *c*, right 2nd antenna (not all exopodial bristles shown), mv; *d*, coxale endite of right mandible, lv; *e*, right mandible, lv; *f*, left maxilla, mv; *g*, comb of left 5th limb, lv; *h*, left 5th limb (ventral and exopodial bristles of comb not shown), lv; *i*, lateral eye (not all ommatidia shown), medial eye, and Bellonci organ; *j*, lateral eye; *k*, heart and right lateral eye as seen through right valve, anterior to right; *l*, upper and lower lips from left side, anterior to left.

hairs could not be determined) (Figure 117j). Lateral eye larger than medial eye, with 19–21 dark amber-colored ommatidia and with or without brownish red pigment between ommatidia (Figures 117a,k, 119a,e,f).

Lips (Figure 117l): Similar to lips of adult female except slender spine observed on anterior margin of lobes of upper lip.

Genitalia (Figure 119d): Lobe on each side of body anterior to furca.

Posterior of Body (Figure 118h): Posterodorsal corner rounded and with long spines.

Y-Sclerite (Figure 118h): Similar to that of adult female.

Gills (Figure 118h): 7 well-developed gills on each side of posterior of body.

DESCRIPTION OF INSTAR I (sex unknown) (Figures 120, 121).—Carapace similar to that of adult female (Figures 120a, 121b). Patches of closely packed globules present as in adult shell.

Carapace Size: Sta 106-R: USNM 193770, carapace distorted, length ~0.56 mm, height ~0.34 mm; height ~61% of length. USNM 193771, length 0.63 mm, height 0.37 mm; height 59% of length.

First Antenna (Figures 120b, 121c): 1st joint with few rows of long spines on medial surface. 2nd joint with few dorsal spines and lateral spines forming row near distal edge. 3rd joint: short ventral margin with small bristle; long dorsal margin with a stout bristle with long stout anterior spines to midlength. 4th joint with indistinct oblique proximal margin and slightly concave distal margin; combined 3rd and 4th joints not as long as wide. Sensory bristle of long 5th joint without filaments. Medial bristle of 6th joint long, ringed, with short spines. 7th joint: a-bristle claw-like, concave dorsally; b-bristle about $\frac{1}{3}$ longer than a-bristle, with minute papilla at tip, without filaments; c-bristle about 3 times length of a-bristle, with minute papilla at tip, without filaments. 8th joint: d-bristle represented by minute peg; e-bristle about same length as a-bristle, bare with blunt tip; f-bristle bare, bent dorsally, longer than b-bristle, about $\frac{2}{3}$ length of c-bristle, with minute papilla at tip, without filaments; g-bristle without marginal filaments, with minute papilla at tip.

Second Antenna (Figure 120c): Protopodite with small distal medial bristle, a few distal medial spines in rows near dorsal margin. Endopodite 3-jointed with long terminal filament. Exopodite: bristle of 2nd joint with slender ventral spines; bristle of joint 3 with about 15 small slender closely placed ventral spines and distal natatory hairs; bristles of joints 4–8 with few stout proximal widely spaced ventral spines and distal natatory hairs (number of spines on each bristle in order: 3, 3, 3, 3, 2); 9th joint with 2 bristles (ventral bristle either without spines or with few proximal ventral spines, with natatory hairs; dorsal bristle $\frac{1}{2}$ length of ventral, with short hairs); joints 4–8 with basal spines; 9th joint with lateral spine about same length as spine of 8th joint but broader, and 2 or 3 additional spines on distal dorsal edge; joints 2–8 with minute spines forming row along distal edge. (9th joint could be

interpreted to be fused 9th and 10th joints, with 1 stout bristle and 2 or 3 basal spines on 9th joint, and 1 lateral spine and 1 medium length bristle on 10th joint.)

Mandible (Figures 120d,e, 121d,e): Coxale endite (Figures 120d,e, 121d): ventral branch with spines in 3 oblique rows (some spines much stouter than others); tip of branch pointed, with small spine at dorsal corner; ventral margin of dorsal branch with distal teeth (2 adjacent pointed teeth, followed by small space and 3 small teeth), then short main spine; tip of dorsal branch drawn out to fine point; dorsal margin with few distal serration then minute spines at base of hirsute dorsal bristle (this bristle broken off on USNM 193770); small medial bristle near base of ventral branch. Basale endite not projecting backward past proximal margin of basale as on later instars, with 1 triaenid bristle with 3 or 4 paired marginal spines and large terminal part, 2 end bristles, and 1 fairly long dwarf bristle (Figure 121e). Basale (Figure 120e): ventral margin bare; dorsal margin with 2 terminal bristles (length of lateral about $\frac{1}{4}$ to $\frac{1}{3}$ of medial); lateral side with spines forming row near exopodite (spines present only on right limb of USNM 193770). Exopodite reaching just past distal edge of 1st endopodial joint, hirsute distally and with 2 short terminal bristles. 1st endopodial joint with 2 long stout spinous ventral bristles. 2nd endopodial joint: ventral margin with 1 spinous terminal bristle; dorsal margin with 2 stout spinous bristles (interpreted to be c- and d-bristles); medial side with 1 short slender spinous cleaning bristle distal to c-bristle, and 1 slender spinous g-bristle just distal to d-bristle; lateral side with 1 long slender spinous f-bristle just distal to c-bristle. 3rd endopodial joint with straight claw with ventral teeth and few dorsal spines, and 3 spinous bristles (bristle on dorsal edge proximal to claw not in this position in later instars).

Maxilla (Figure 120f): Epipodite with pointed tip. Endites with total of 4 stout bristles. Basale: 1 proximal medial bristle at midheight; ventral margin with 1 distal bristle (longer than bristle of adult), and 1 long spinous terminal bristle; without distal dorsal bristles (present on adult). Endopodite: 1st joint with 1 short dorsal alpha-bristle and 1 long ventral terminal beta-bristle; 2nd joint with terminal bristle longer than terminal bristle of 1st joint.

Fifth Limb (Figure 120g,h): Epipodite with about 42 bristles. Comb with 4 widely separated slender lateral bristles near ventral edge and about 7 spinous bristles along ventral edge (Figure 120g); usual stout spinous exopodial bristle indistinct on USNM 193770 and 193771, but observed on both (partly dashed in Figure 120g).

Sixth Limb (Figure 121f,g): Hirsute; posteroventral corner of skirt with hirsute triangular extension; limb without endites or medial bristle in anterodorsal corner. Shape in lateral or medial view differing from that of adult in not having broadly rounded posteroventral corner.

Seventh Limb: Absent.

Furca (Figure 121a): Each lamella with 3 claws; claws 2

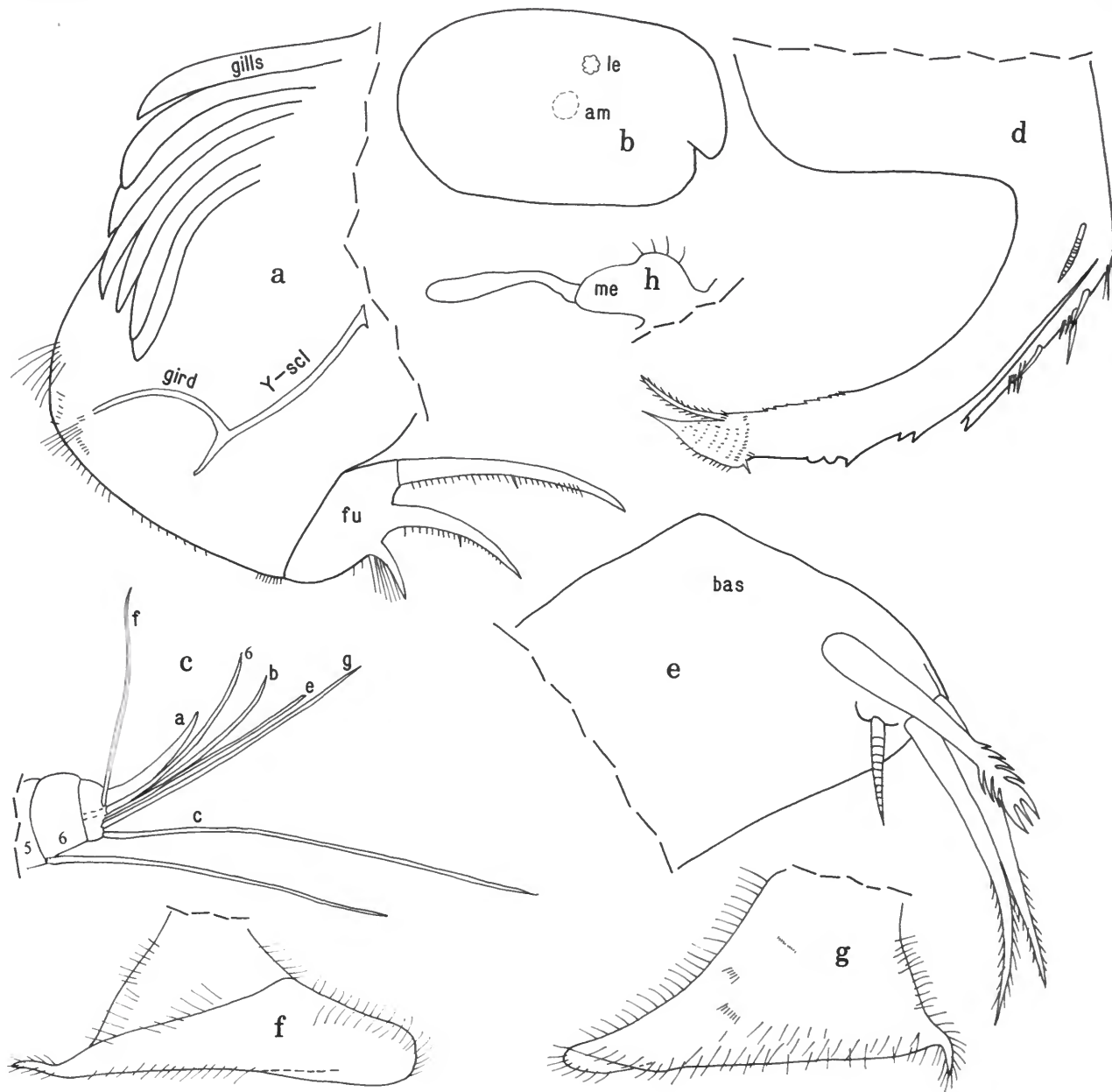


FIGURE 121.—*Synasterope calix*, new species, instar I (sex unknown), paratypes: USNM 193770: a, posterior of body from right side, anterior to right, lv. USNM 193771: b, complete specimen from right side, length 0.63 mm; c, tip of right 1st antenna (not under cover slip; d-bristle not shown), lv; d, coxale endite of left mandible, mv; e, basale endite of left mandible, mv; f, g, left and right 6th limbs (not under cover slip), mv; h, medial eye and Bellonci organ, anterior to left, lv.

and 3 nonarticulated; claws 1 and 2 with small teeth along posterior edge (tooth at midlength longer than others and teeth in distal half more closely spaced); claw 3 with long spines along posterior edge; few minute spines on lamella following

claw 3; right lamella anterior to left by width of base of claw 1. *Bellonci Organ* (Figure 121h): Elongate, unsegmented, broadening distally with rounded tip.

Eyes: Medial eye without pigment, with few dorsal hairs

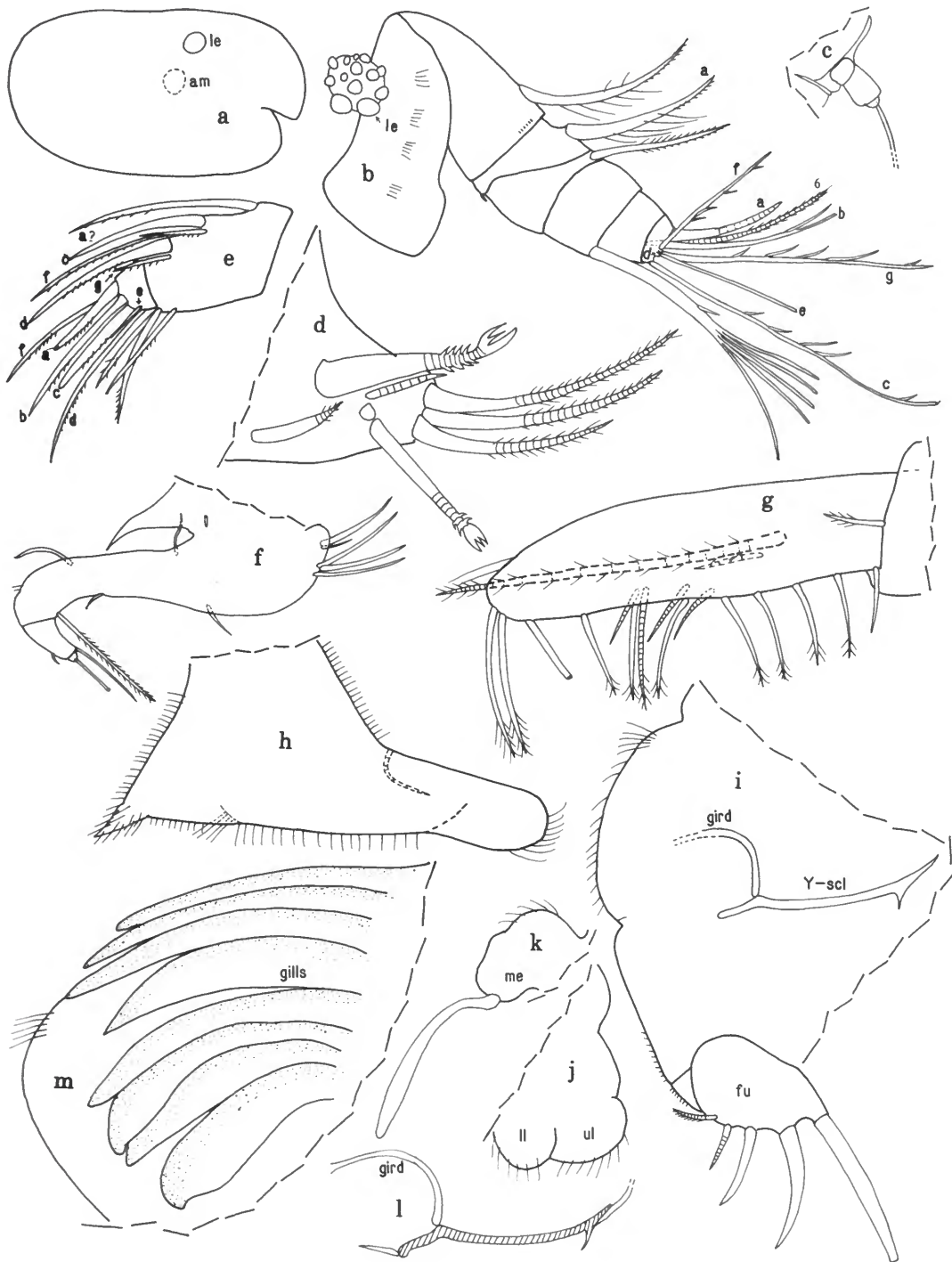


FIGURE 122.—*Synasterope calix*, new species, instar II (sex unknown), paratypes: USNM 193772: *a*, complete specimen from right side, length 0.72 mm; *b*, right lateral eye and right 1st antenna, lv; *c*, protopodite and endopodite of left 2nd antenna, mv; *d*, basal endite of right mandible, mv; *e*, 2nd and 3rd endopodial joints of right mandible, mv; *f*, left maxilla, lv; *g*, comb of right 5th limb, mv; *h*, right 6th limb, lv; *i*, posterior of body from right side, anterior to right, lv; *j*, upper and lower lips from right side, anterior to right, lv. USNM 193773: *k*, medial eye and Bellonci organ, anterior to left, lv; *l*, right Y-sclerite (striated), anterior to right, lv; *m*, posterodorsal part of body from right side, anterior to right, lv.

(Figure 121h). Lateral eye about same size as medial eye, with 12 small widely separated amber-colored ommatidia and without pigment between ommatidia (Figures 120a,i-k, 121b).

Lips (Figure 120l): Upper lip comprising 2 hirsute lobes, 1 on each side of saddle. Lower lip comprising lateral hirsute flap on each side of mouth.

Genitalia: Absent.

Posterior of Body (Figure 121a): Posterior margin spinous; posterodorsal corner rounded and with long spines; long hairs in lateral row near posterior end of girdle with tips extending well past posterior edge of body; row of short lateral spines ventral to long hairs.

Y-Sclerite (Figure 121a): Proximal part fused to ventral end of girdle.

Gills (Figure 121a): 7 narrow gills on each side of body.

Heart (Figure 120k): Well developed.

DESCRIPTION OF INSTAR II (sex unknown) (Figure 122).—Carapace similar in shape to that of adult female (Figure 122a). Patches of closely packed globules present as in adult shell.

Carapace Size: USNM 193772, length 0.72 mm, height 0.43 mm; height 60% of length. USNM 193773, carapace with anterior missing, not measured.

First Antenna (Figure 122b): 1st joint with medial and lateral spines. 2nd joint with spinous dorsal bristle and row of small lateral spines in distal dorsal corner. 3rd joint with small bare ringed bristle on short ventral margin, and stout spinous ringed bristle (proximal spines stouter and longer than those on dorsal bristle of 2nd joint) on long dorsal margin; suture between 3rd and 4th joints weakly developed; combined 3rd and 4th joints slightly wider than long. 4th joint with spinous dorsal bristle on short dorsal margin; suture between 4th and 5th joints concave. Sensory bristle of 5th joint with short proximal filament and 5 long terminal filaments. 5th and 6th joints fused; medial bristle of 6th joint long, ringed, spinous. 7th joint: a-bristle claw-like, bare; b-bristle longer than a-bristle, with 1 long distal filament; c-bristle about same length as sensory bristle of 5th joint, with 5 marginal filaments and minute terminal papilla. 8th joint: d-bristle represented by minute lateral peg proximal to base of e-bristle; e-bristle shorter than b-bristle, bare, with minute terminal papilla; f-bristle bent dorsally, with 4 short filaments; g-bristle with 5 short filaments.

Second Antenna: Protopodite and endopodite similar to that of adult female (Figure 122c). Exopodite: 9th joint with 3 bristles (short dorsal bristle and medium middle bristle with few short hairs; long ventral bristle with few small proximal ventral spines and distal natatory hairs); branch otherwise similar to that of adult female.

Mandible: Coxale endite similar to that of adult female. Basale endite projecting backward, with 3 spinous end bristles, glandular peg, 1 slender dwarf bristle, and 2 triaenid bristles with 2–4 pairs of spines proximal to terminal pair (Figure 122d). Basale: ventral margin near endite with 1 bristle (with slender ringed distal part with few spines (?incipient triaenid bristle)) proximal to U-shape boss; dorsal margin with short terminal bristle; lateral side with minute spines forming few rows. Exopodite about same length as dorsal margin of 1st

endopodial joint, hirsute distally and with 2 short ringed terminal bristles. 1st endopodial joint with 3 long ventral bristles (2 with both short and long spines, 1 with only short spines). 2nd endopodial joint: ventral margin with 3 spinous terminal bristles; dorsal margin with few proximal spines, 3 long spinous bristles (interpreted here to be a-, c-, and d-bristles; c- and d-bristles stouter than a-bristle), medial side with 1 unringed spinous cleaning bristle adjacent to c-bristle, and 1 short ringed spinous bristle (reaching distal edge of 3rd endopodial joint) just distal to d-bristle; lateral side with long slender spinous ringed bristle between c- and d-bristles. 3rd endopodial joint with straight dorsal claw with slender ventral teeth, and 5 spinous bristles (2nd bristle along distal edge with tip broken off on both USNM 193772 and 193773 (Figure 122e)).

Maxilla (Figure 122f): Epipodite with long slender pointed tip. Endite I of left limb of USNM 193772 with 2 bristles (1 long, 1 short) (endite missing on right limb); endite II with 3 long bristles. Basale: dorsal margin with 2 bristles with bases on medial side (1 proximal, 1 distal); ventral margin with 1 backward pointing proximal bristle, 1 short distal bristle, and 1 long spinous terminal bristle; lateral side with 1 proximal bristle near base of epipodite (broken on illustrated limb). Endopodite similar to that of adult female.

Fifth Limb (Figure 122g): Epipodite with about 49 bristles. Exopodial bristles similar to those of adult female. Ventral margin of comb with about 11 spinous bristles.

Sixth Limb (Figure 122h): Differs from limb of instar I in having anterior endite bristle.

Seventh Limb: Not present on 2 specimens examined (USNM 193772, 193773).

Furca (Figure 122i): Differs from adult in having only 5 claws; claws 4 and 5 ringed, bristle-like (claw 4 straight, claw 5 bending posteriorly); claws 1–3 with minute teeth and few longer teeth along posterior edge (not shown); claw 5 with spines along anterior edge; right lamella anterior to left by width of claw 1. Lamellae following claws with minute spines.

Bellonci Organ (Figure 122k), *Lips* (Figure 122j), *Posterior of Body* (Figure 122i,m), *Y-Sclerite* (Figure 122i,l), and *Gills* (Figure 122m): Similar to those of adult female.

Eyes: Medial eye without pigment (Figure 122k). Lateral eye with about 13 amber-colored ommatidia and without pigment between ommatidia (Figure 122a,b).

Genitalia: Absent.

DESCRIPTION OF INSTAR III (sex unknown) (Figure 123).—Carapace similar in shape to that of adult female (Figure 123a). Patches of closely packed globules present as in adult shell.

Carapace Size: USNM 193774, length 0.88 mm, height 0.54 mm; height 61% of length.

First Antenna (Figure 123b,e): 1st joint with medial and lateral spines. 2nd joint with slender bare dorsal bristle. 3rd joint with small ventral bristle and 2 dorsal bristles. 4th joint with 2 bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 6 long terminal filaments (proximal filament more slender than others and with base some distance from 2nd filament). Medial bristle of 6th joint spinous. 7th joint: a-bristle claw-like;

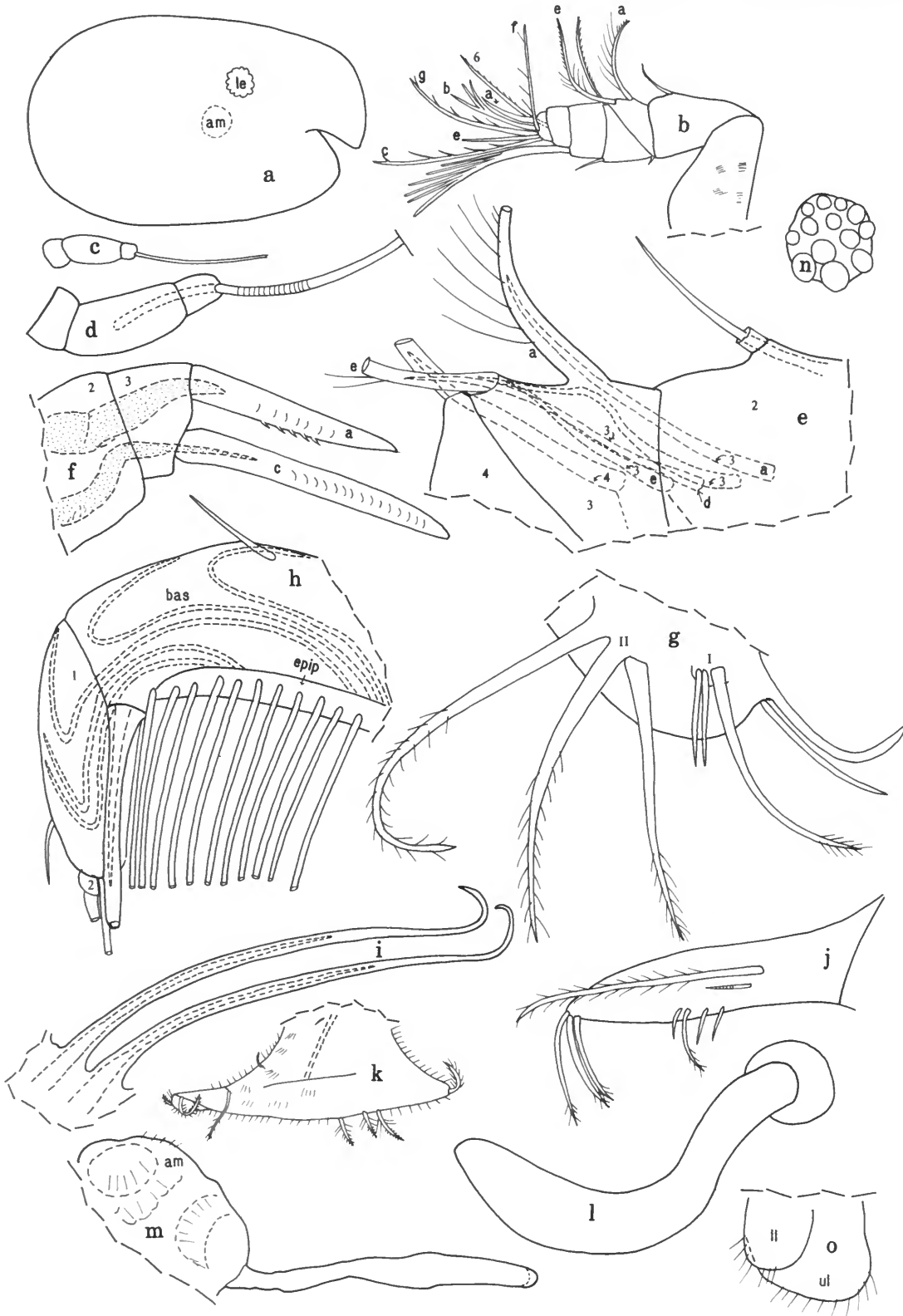


FIGURE 123 (opposite page).—*Synasterope calix*, new species, instar III (sex unknown), paratype with appendages of instar IV visible within, USNM 193774: *a*, complete specimen from right side, length 0.88 mm; *b*, left 1st antenna (d-bristle not shown), lv; *c, d*, endopodites of left and right 2nd antennae (dashed bristle in *d* is from instar IV within, mv; *e*, part of left 1st antenna (dashed lines represent bristles of instar IV within), lv; *f*, tip of right mandible showing only a- and c-bristles (bristles of instar IV within stippled), lv; *g*, endites of right maxilla, mv; *h*, part of left maxilla (dashed lines represent bristles of instar IV within), lv; *i*, 2 epipodial bristles of 5th limb (dashed lines represent bristles of instar IV within); *j*, comb of left 5th limb, lv; *k*, right 6th limb, mv; *l*, left 7th limb, anterior to bottom, lv; *m*, medial eye and Bellonci organ, anterior to right, lv; *n*, right lateral eye, anterior to right, lv; *o*, upper and lower lips from right side, anterior to right, lv.

b-bristle with 2 distal marginal filaments; c-bristle with 5 short filaments. 8th joint: d-bristle represented by minute peg (not shown); e-bristle about $\frac{1}{2}$ length of c-bristle, bare with blunt tip; f-bristle bent dorsally, with 4 marginal filaments; g-bristle with 5 marginal filaments. Slender bare bristle of 2nd joint in Figure 123e belongs to internal instar III (bristle of instar II broken off).

Second Antenna (Figure 123c,d): Protopodite, endopodite, and exopodite similar to those of adult female except 9th joint with only 3 bristles (long ventral bristle with few stout proximal ventral spines and distal natatory hairs; middle bristle about $\frac{1}{2}$ length of ventral, with short slender marginal spines; dorsal bristle short bare).

Mandible (Figure 123f): Coxale endite similar to that of instar II. Basale endite with 4 end bristles, glandular peg, 1 fairly long dwarf bristle, and 2 triaenid bristles with 4 pairs of spines proximal to fairly large terminal pair. Basale: ventral margin near endite with 1 triaenid bristle (with 2 pairs of spines proximal to fairly large terminal pair) proximal to U-shape internal boss: dorsal margin with 1 or 2 terminal bristles. Exopodite about same length as dorsal margin of 1st endopodial joint, hirsute distally, with 2 small terminal bristles. 1st endopodial joint with 3 long ventral bristles (1 with short spines, 2 with both long and short spines). 2nd endopodial joint: ventral margin with 3 terminal bristles; dorsal margin with stout a-, b-, c-, and d-bristles similar to those of adult female, 1 long spinous lateral bristle between c- and d-bristles, 2 spinous unringed medial cleaning bristles between bases of c- and d-bristles, and 1 spinous medial bristle (reaching just past distal end of 3rd joint) just distal to base of d-bristle. 3rd endopodial joint with 1 straight dorsal claw with few ventral teeth, and 5 bristles (c-bristle on both limbs of USNM 193774 with slender distal part missing (Figure 123f)). Figure 123f shows a-claw and c-bristle (stippled) of 3rd joint of internal instar IV within a-claw and c-bristle of instar III (USNM 193774).

Maxilla: Epipodite similar to that of adult female. USNM 193774, right limb (Figure 123g): endite I with 1 long and 2 short bristles; endite II with 3 long bristles. Left limb: endite I with 1 short and 2 long bristles; endite II with 2 long bristles. Basale and endopodite of USNM 193774 similar to those of adult female except without bristle at midlength of dorsal

margin of basale. Figure 123h shows epipodial bristles (dashed) of internal instar IV within basale and 1st endopodial joint of instar III (USNM 193774).

Fifth Limb (Figure 123i,j): Epipodite with about 53 bristles. Exopodial bristles of comb similar to those of adult female. Ventral margin of comb with about 22 bristles (not all shown).

Sixth Limb: Small ringed medial bristle near proximal anterior corner (bristle closer to anterior edge on left limb of USNM 193774 than on right (Figure 123k)). Endite bristles similar to those of adult female. Skirt: anterior end with 1 hirsute ventral bristle and 1 hirsute bristle on anterior end of lateral flap. Ventral margin at midlength with 3 bristles with long proximal and short distal spines; posterior end narrowly rounded, with 1 spinous bristle. Hairs and spines on medial and lateral surfaces similar to those of adult female.

Seventh Limb (Figure 123l): Easily visible, elongate, without bristles or terminal comb.

Furca: Each lamella with 6 claws; claws 5 and 6 ringed, bristle-like; claw 6 bent posteriorly.

Bellonci Organ (Figure 123m): Broader in distal $\frac{2}{3}$, with broadly rounded tip. In Figure 123m tip of organ of instar IV shown dashed inside organ of instar III (USNM 193774).

Eyes: Medial eye without pigment, with few indistinct proximal dorsal hairs (Figure 123m). Lateral eye smaller than medial eye, with 14 amber-colored ommatidia, without pigment between ommatidia (Figure 123a,n).

Lips (Figure 123o), **Posterior of Body**, **Y-Sclerite**, and **Gills:** Similar to those of adult female.

Genitalia: Absent.

Remarks: When appendages of the next instar are visible inside appendages of the present instar, bristles of appendages of the next instar usually project part way inside bristles of the present instar. This does not appear to occur in the bristles of the epipodite of the maxilla, which develop in a curled position inside the "fleshy" parts of the basale and 1st endopodial joint (bristles dashed in Figure 123h). The bristles develop in the usual way in the epipodite of the 5th limb (inner bristles dashed in Figure 123i).

DESCRIPTION OF INSTAR IV FEMALE (Figure 124).—Carapace similar in shape to that of adult female. Patches of closely spaced globules similar to those in adult female shell.

Carapace Size: Sta 106-R: USNM 193775, length 0.97 mm, height 0.59 mm; height 61% of length.

First Antenna (Figure 124k): 1st joint with few lateral and medial spines. 2nd joint with spinous dorsal bristle. 3rd joint with small ventral bristle and 4 long spinous dorsal bristles. 4th joint with 3 bristles (1 dorsal, 2 ventral). Sensory bristle of 5th joint with 6 long terminal filaments. Medial bristle of 6th joint spinous. 7th joint: a-bristle claw-like; b-bristle with 2 marginal filaments; c-bristle with 5 marginal filaments. 8th joint: d-bristle represented by minute peg (not shown); e-bristle bare with blunt tip; f-bristle bent dorsally, with 4 marginal filaments; g-bristle with 5 marginal filaments.

Second Antenna (Figure 124a): 9th exopodial joint with 3

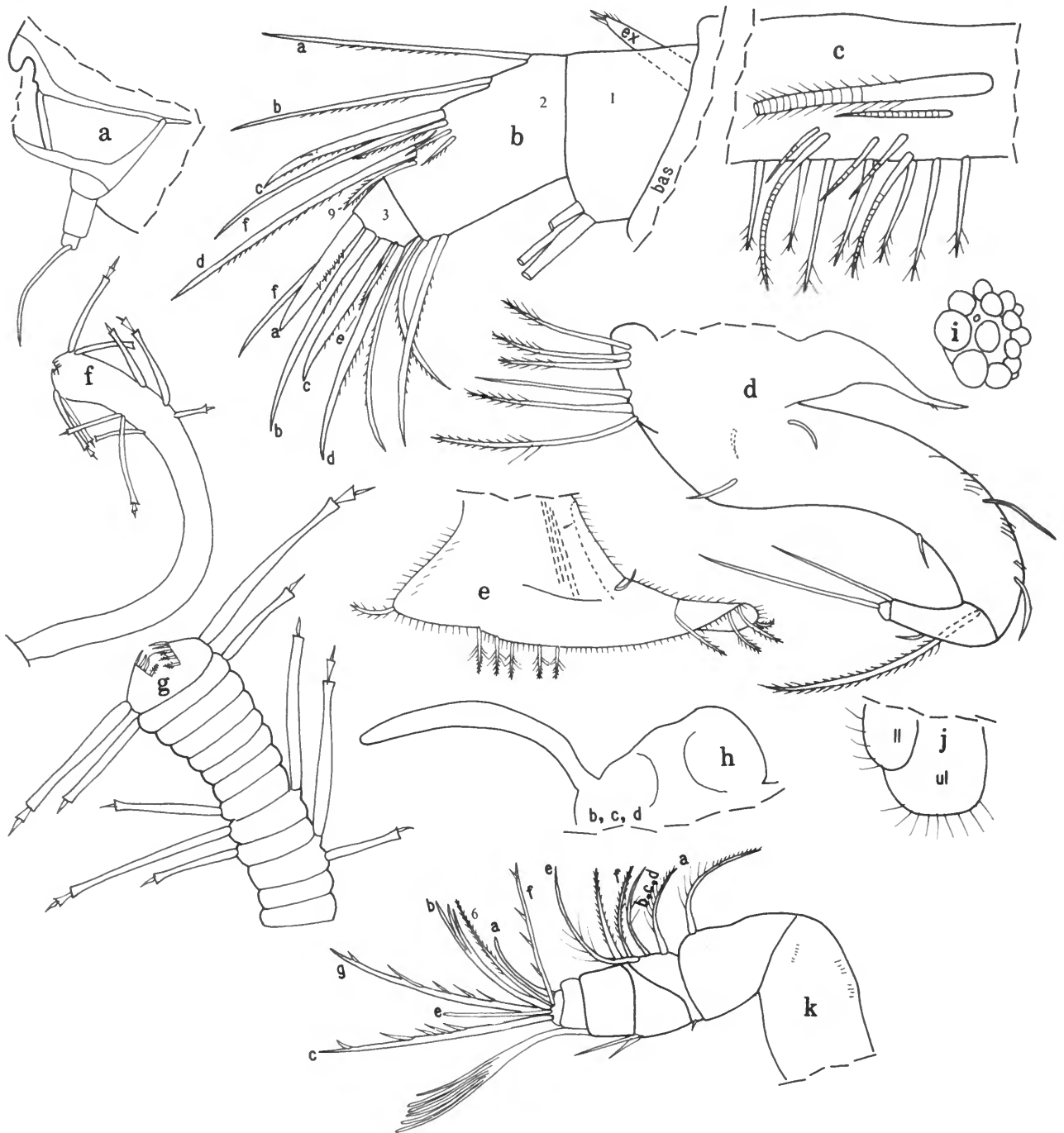


FIGURE 124.—*Synasterope calix*, new species, instar IV female, paratype, USNM 193775: *a*, protopodite and endopodite of right 2nd antenna, mv; *b*, part of right mandible, mv; *c*, part of comb of left 5th limb, lv; *d*, left maxilla, mv; *e*, left 6th limb, mv; *f*, right 7th limb, lv; *g*, tip of 7th limb; *h*, medial eye and Bellonci organ, anterior to left, lv; *i*, right lateral eye, anterior to bottom, lv; *j*, upper and lower lips from right side, anterior to right, lv; *k*, left 1st antenna (d-bristle not shown), lv.

bristles; limb otherwise similar to that of adult female.

Mandible (Figure 124b): Coxale endite: ventral branch with 3 oblique rows of spines, otherwise similar to that of adult female; dorsal margin of dorsal branch with long subterminal bristle; ventral margin of dorsal branch with paired pointed teeth followed by 2 single pointed teeth, then 3 low rounded teeth, dorsal branch otherwise similar to that of adult female. Basale endite with 3 triaenid bristles with 2, 4, and 5 pairs of spines proximal to terminal pair, otherwise endite similar to that of adult female. Basale similar to that of adult female; single proximal ventral triaenid bristle with 2 pairs of spines proximal to terminal pair. Exopodite similar to that of adult female. 1st endopodial joint with 3 ventral bristles (2 with long spines, 1 with short spines). 2nd endopodial joint: bristles of ventral margin similar to those of adult female; dorsal margin with a-, b-, c-, and d-bristles similar to those of adult male; medial side with 3 cleaning bristles adjacent to c-bristle, and 1 short spinous bristle just distal to d-bristle; lateral side with 1 long spinous bristle between c- and d-bristles. 3rd endopodial joint similar to that of adult female.

Maxilla (Figure 124d): Endite I with 0 or 1 short slender bristle and 3 long stout bristles; endite II with 3 long stout bristles. Epipodite and exopodite similar to those of adult female.

Fifth Limb (Figure 124c): Epipodite with about 54 bristles. Comb with long stout spinous exopodial bristle reaching past distal end of comb, 1 slender bristle just ventral to stout bristle, 2 pairs of small bristles near ventral margin, and 1 bristle (near proximal pair) with base almost on ventral margin. Ventral margin of comb with 22–25 bristles.

Sixth Limb (Figure 124e): Small medial bristle near proximal anterior corner. Endite bristles similar to those of adult female. Skirt: anterior end with 2 hirsute ventral bristles and 1 hirsute bristle on anterior end of lateral flap; ventral margin at midlength with 4 or 5 bristles with long proximal and short distal spines; posterior end angular, with 1 spinous bristle. Spines and hairs on limb similar to those of adult female.

Seventh Limb (Figure 124f,g): Limb long (Figure 124f). Proximal group with 6 tapered bristles (3 on each side), each with 1 or 2 bells. Distal group with 4 tapered bristles, 2 on each side (2 on terminus, 2 on segment proximal to terminus), each with 1 or 2 bells. Terminus with opposing combs: one with 9 or 10 spinous teeth, other with 7 (not all spines of teeth shown on illustrated limb).

Furca: Each lamella with 7 claws; claws 5–7 ringed, bristle-like; claw 5 slightly curved; distal part of claw 6 curving posteriorly; claw 7 bending posteriorly; right lamella anterior to left by width of claw 1. Lamellae following claws with small spines.

Bellonci Organ (Figure 124h): Similar to that of adult female.

Eyes: Medial eye without pigment (Figure 124h). Lateral eye smaller than medial eye, with 15 amber-colored ommatidia,

no pigment between ommatidia (Figure 124i).

Lips (Figure 124j): Similar to those of adult female.

Genitalia: Absent.

Posterior of Body, Y-Sclerite, and Gills: Similar to those of adult female.

DESCRIPTION OF INSTAR IV MALE (Figures 125, 126).—Carapace similar to that of adult female (Figures 125a, 126a).

Carapace Size: Sta 106-R: USNM 193776, length 1.00 mm, height 0.60 mm; height 60% of length. Sta 50-S: USNM 193779, length 1.10 mm, height 0.66 mm; height 60% of length. 2 unnumbered specimens from sta 106-R: length 1.08 mm, height 0.64 mm; height 59% of length; length 1.10 mm, height 0.67 mm; height 61% of length. Un-numbered specimen from sta 50-S: length 1.10 mm, height 0.66 mm; height 60% of length.

First Antenna (Figures 125c, 126d,e): Joints 1–6 similar to those of instar IV female. 7th joint: a-bristle claw-like; b-bristle with 3 marginal filaments; c-bristle with 6 marginal filaments. 8th joint: d- and e-bristles similar to instar IV female; f- and g-bristles each with 6 filaments.

Second Antenna: Protopodite with small distal ringed medial bristle and minute unringed lateral spine near base of endopodite (Figures 125d,e, 126b,c); spine partly obscured on limbs mounted with medial side uppermost. Except for 9th exopodial joint having 4 bristles (ventral bristle as long as bristle of 8th joint, other bristles shorter), exopodite similar to that of instar IV female. Endopodite 3-jointed (Figures 125d,e, 126b,c): 1st joint bare; 2nd joint with small distal bristle; 3rd joint shorter than 2nd, with long proximal filament, and small bulge on tip.

Mandible (Figure 125f): Except for left limb of USNM 193776 having short slender medial cleaning bristle between b- and c-bristles in addition to the 3 adjacent to c-bristle, mandible similar to that of instar IV female.

Maxilla: Similar to that of instar IV female.

Fifth Limb: Epipodite with 52 bristles. Comb similar to that of instar IV female, but ventral bristles not counted.

Sixth Limb: Ventral margin of skirt with 6 bristles at midlength; limb otherwise similar to that of instar IV female.

Seventh Limb (Figure 126f,g), **Furca** (Figure 125h), **Bellonci Organ**, **Lips** (Figure 125j), **Posterior of Body, Y-Sclerite, and Gills**: Similar to those of instar IV female.

Eyes: Medial eye similar to that of instar IV female. Lateral eye larger than that of instar IV female, with 14–17 amber-colored ommatidia, no pigment between ommatidia (Figures 125i, 126a,h).

Genitalia: None observed.

DESCRIPTION OF INSTAR V MALE (Figures 127, 128a–h).—Shape of carapace similar to that of adult female (Figures 127a, 128a).

Carapace Size: Sta 111-S: USNM 193692, length 1.33 mm, height 0.79 mm; height 59% of length. Sta 50-S: USNM 193699, length 1.46 mm, height 0.83 mm; height 57% of length. Sta 116-S: USNM 193777, length 1.29 mm, height 0.77

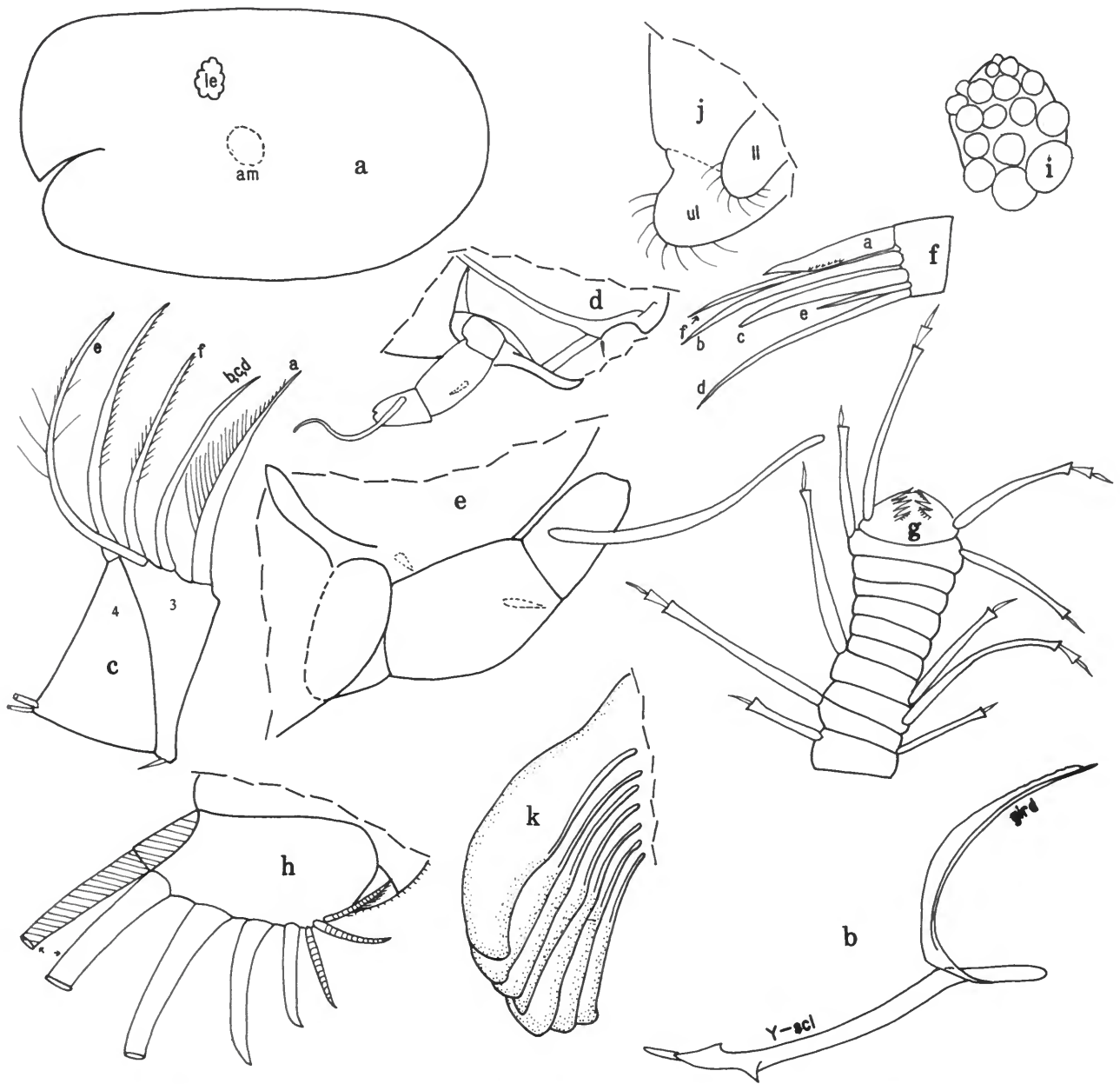


FIGURE 125.—*Synasterope calix*, new species, instar IV male, paratype, USNM 193776: a, complete specimen from left side, length 1.00 mm; b, left Y-sclerite and girdle, anterior to left, lv; c, joints 3 and 4 of left 1st antenna, lv; d, e, protopodites and endopodites of left and right 2nd antennae, mv; f, 3rd endopodial joint of right mandible, mv; g, tip of 7th limb; h, left furcal lamella and claw 1 of right lamella (striated), anterior to left; i, left lateral eye, anterior to left, lv; j, upper and lower lips from left side, anterior to left, lv; k, gills from right side, anterior to right, lv.

mm; height 60% of length. USNM 193778, length 1.25 mm, height 0.76 mm; height 61% of length.

First Antenna (Figures 127b,c, 128b): Joints 1–4 and 6

similar to those of adult female. Sensory bristle of 5th joint differs from that of adult female in having small proximal filament. 7th joint: a- and b-bristles similar to those of adult

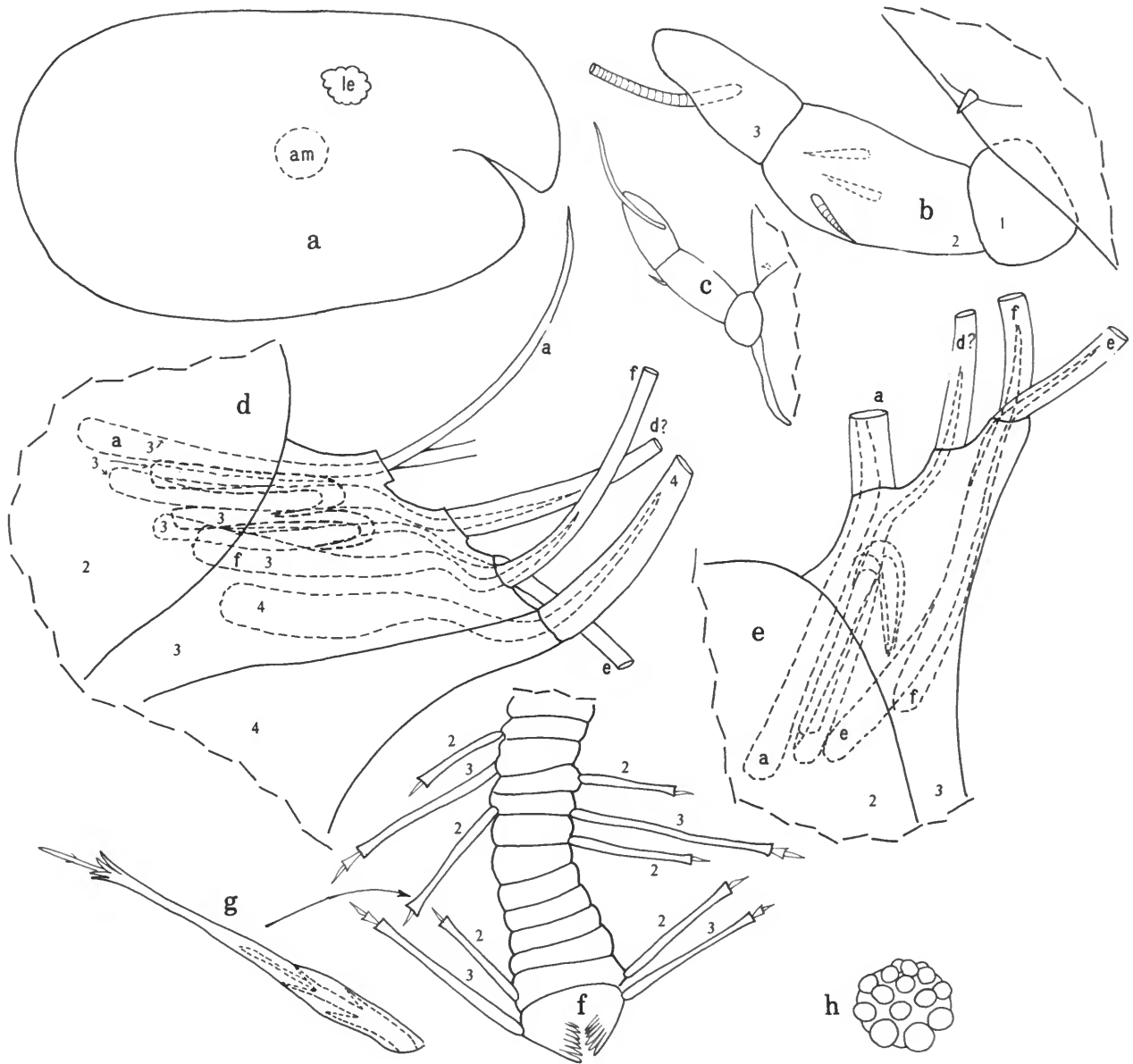


FIGURE 126.—*Synasterope calix*, new species, instar IV male, paratype with instar V appendages within, USNM 193779: a, complete specimen from right side, length 1.10 mm; b, protopodite and endopodite of right 2nd antenna (2 dashed bristles of joint 2 of endopodite belong to instar V within), lv; c, protopodite and endopodite of left 2nd antenna, mv; d, dorsal bristles of 3rd joint of left 1st antenna (bristles of instar V within dashed), lv; e, dorsal bristles of 3rd and 4th joints of right 1st antenna (bristles of instar V within dashed), mv; f, tip of 7th limb (numbers next to each bristle indicates number of bells on internal bristle (not shown) of instar V); g, detail of bristle in f showing internal bristle of instar V (dashed); h, right lateral eye, anterior to right, lv.

female; c-bristle with 5 proximal and 1 distal filament. 8th joint: d-bristle represented by minute peg; e-bristle almost twice length of a-bristle, about same length as b-bristle, bare

with blunt tip; f-bristle bent dorsally, with 8-11 short filaments; g-bristle same length as c-bristle, with 4 marginal filaments.

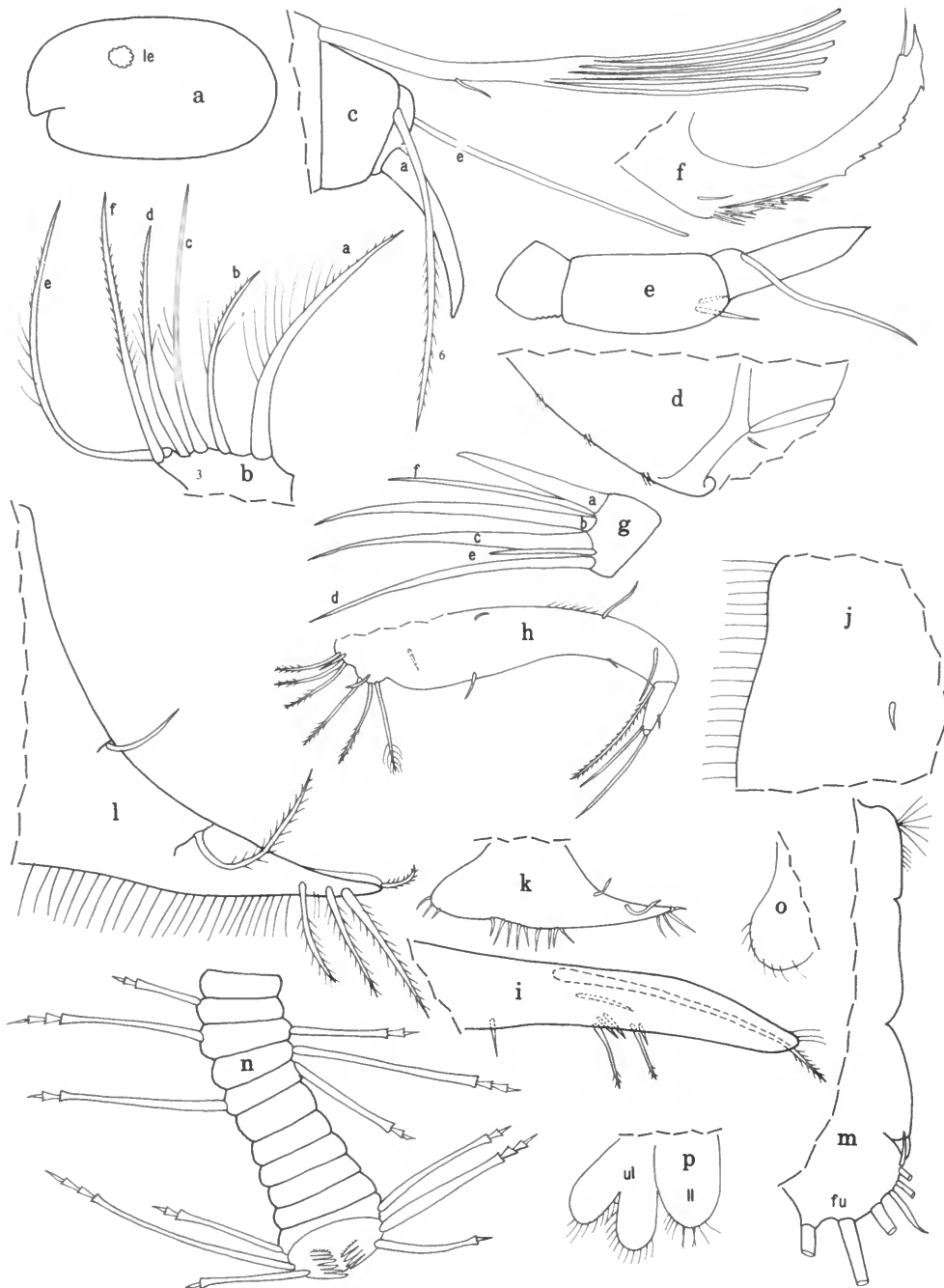


FIGURE 127.—*Synasterope calix*, new species, instar V male, paratype, USNM 193699: *a*, complete specimen from left side, length 1.46 mm; *b*, dorsal margin of 3rd joint of left 1st antenna, mv; *c*, tip of right 1st antenna (not all bristles of 7th and 8th joints shown), mv; *d*, protopodite of right 2nd antenna, mv; *e*, endopodite of right 2nd antenna, mv; *f*, coxale endite of right mandible, mv; *g*, 3rd endopodial joint of right mandible, mv; *h*, left maxilla (epipodite not shown), mv; *i*, comb of left 5th limb, mv; *j*, anterodorsal corner of right 6th limb, anterior to left, mv; *k*, left 6th limb (spines of bristles not shown), mv; *l*, detail of anterior of left 6th limb, mv; *m*, posterior of body with left furcal lamella, anterior to left, lv; *n*, tip of 7th limb; *o*, upper lip from left side, anterior to left, lv; *p*, posterior view of left and right lobes of upper lip and right lower lip.

Second Antenna: Protopodite and exopodite similar to those of adult female (Figure 127d). Endopodite 3-jointed: 1st joint short; 2nd joint elongate with 2 small distal bristles; 3rd joint elongate, with 1 long proximal filament and tapered tip (Figures 127e, 128c,e,g).

Mandible (Figures 127f,g, 128f): Except for having 3 instead of 2 or 3 triaenid bristles on the basale endite and 4 instead of 5 cleaning bristles forming oblique row between c- and d-bristles of 2nd endopodial joint, mandible similar to that of adult female.

Maxilla (Figure 127h): Similar to that of adult female. Endites I and II each with 4 bristles (3 long, 1 short). Distal bristles of dorsal margin of basale same length (proximal bristle broken off on adults studied). (Endite II of USNM 193692 differed from others in having only 3 bristles, each long.)

Fifth Limb (Figure 127i): Epipodite with 55–58 bristles. Comb with 31 ventral bristles, otherwise similar to that of adult female.

Sixth Limb (Figure 127j-l): Skirt: ventral margin at midlength with 8 or 9 bristles and posterior end with 2 or 3 bristles. Limb otherwise similar to that of adult female.

Seventh Limb (Figure 127n): Proximal group with 6 bristles (3 on each side), each with 2 or 3 bells. Distal group with 6 bristles, 3 on each side (4 on terminal segment, 2 on segment proximal to terminal segment), each with 1–3 bells. Some of the shorter bristles slightly more tapered than those on adult limb. Terminus with opposing combs: one with 11 spinous teeth, other with about 8.

Furca (Figure 127m): Each lamella with 7 or 8 claws; posterior 1 of 2 claws bristle-like and bending posteriorly.

Bellonci Organ: Similar to that of adult.

Eyes: Medial eye similar to that of adult male. Lateral eye with 18 or 19 amber-colored ommatidia; some specimens with dark reddish brown pigment between ommatidia (Figures 127a, 128a,h).

Lips (Figure 127o,p), **Posterior of Body** (Figure 127m), **Y-Sclerite**, and **Gills:** Similar to those of adult female.

DESCRIPTION OF INSTAR V FEMALE (Figure 128i-r).—Carapace with shape similar to that of adult female and with clusters of minute globules (Figure 128i,j).

Carapace Size: Sta 106-R: MNHN Os 477, holotype, length 1.36 mm, height 0.85; height 63% of length. USNM 193780, length 1.34 mm, height 0.81 mm; height 60% of length.

First Antenna: Joints 1–6 similar to those of adult female. 7th joint: a- and c-bristles similar to those of adult female; b-bristle with 4 marginal filaments. 8th joint: d- and f-bristles similar to those of adult female; e-bristle about same length as b-bristle; g-bristle 1½ times length of b-bristle, with 5 marginal filaments.

Second Antenna (Figure 128k): Similar to that of adult female.

Mandible: Coxale endite not examined. Basale, exopodite, and endopodite similar to those of adult female, except 3rd

endopodial joint with 2 bristles claw-like (Figure 128l).

Maxilla: Not examined.

Fifth Limb: Epipodite with about 60 bristles. Ventral margin of comb with about 32 bristles. Exopodial bristles not examined.

Sixth Limb (Figure 128m): With 2 endite bristles similar to those of adult female. Anteroventral corner with 4 hirsute ventral bristles and 1 hirsute anterior bristle on lateral flap; ventral margin at midlength with 9 spinous bristles; posterior end rounded, with 2 spinous bristles. Small medial bristle obscured (usually present in anterodorsal corner of limb).

Seventh Limb (Figure 128n): Similar to that of adult female.

Furca: Similar to that of adult female (with 9 claws on each lamella).

Bellonci Organ (Figure 128o), **Lips**, **Posterior of Body**, and **Gills:** Similar to those of adult female.

Eyes: Medial eye similar to that of adult female (Figure 128o). Lateral eye with 16 or 17 light amber-colored ommatidia and without pigment between ommatidia (Figure 128o,p).

Genitalia (Figure 128r): Fairly well-defined oval with indistinct tube leading to area occupied by small eggs. Brush organ not observed.

Y-Sclerite (Figure 128q,r): Similar to that of adult female (with small distal ventral branch, and with curved sclerite attached to anterior end).

COMPARISONS.—*Synasterope calix* has many characters similar to those of *S. oculata* (Brady, 1902), and they could be conspecific. The male *S. calix* differs from the male *S. oculata* (Brady, 1902) from Sri Lanka described by Skogsberg (1920:523) in having not more than 1 compared to as many as 7 minute bristles between adjacent flap-like bristles on the broad posterior shell list, in having 1 instead of 2 dwarf bristles on the mandible, and in not having a lateral bristle on the 2nd joint of the 1st antenna. The 6th limb may also differ. The male *S. calix* is very close to the males from the Red Sea referred to *S. oculata* (Brady, 1902) by Poulsen (1965:413). The differences between the males of the two species, which I believe may warrant their separation, are listed below. In addition, the coxale endite of the mandible of *S. oculata* is without a proximal bristle, whereas, one is present on the A-1 male, adult female, and probably also on the adult male of *S. calix*. (For additional discussion of *S. oculata* see "Remarks Concerning *Synasterope oculata*," p. 222.)

	<u><i>S. calix</i></u>	<u><i>S. oculata</i></u>
Small bristles on broad posterior shell list	9–11	30
Bristles between broad posterior list and posterior edge of valve	15 or 16	7–9
Short distal ventral bristles on basale of maxilla	1	0
Distal endite bristle of 6th limb same length (S) or longer than (L) proximal endite bristle	L	S

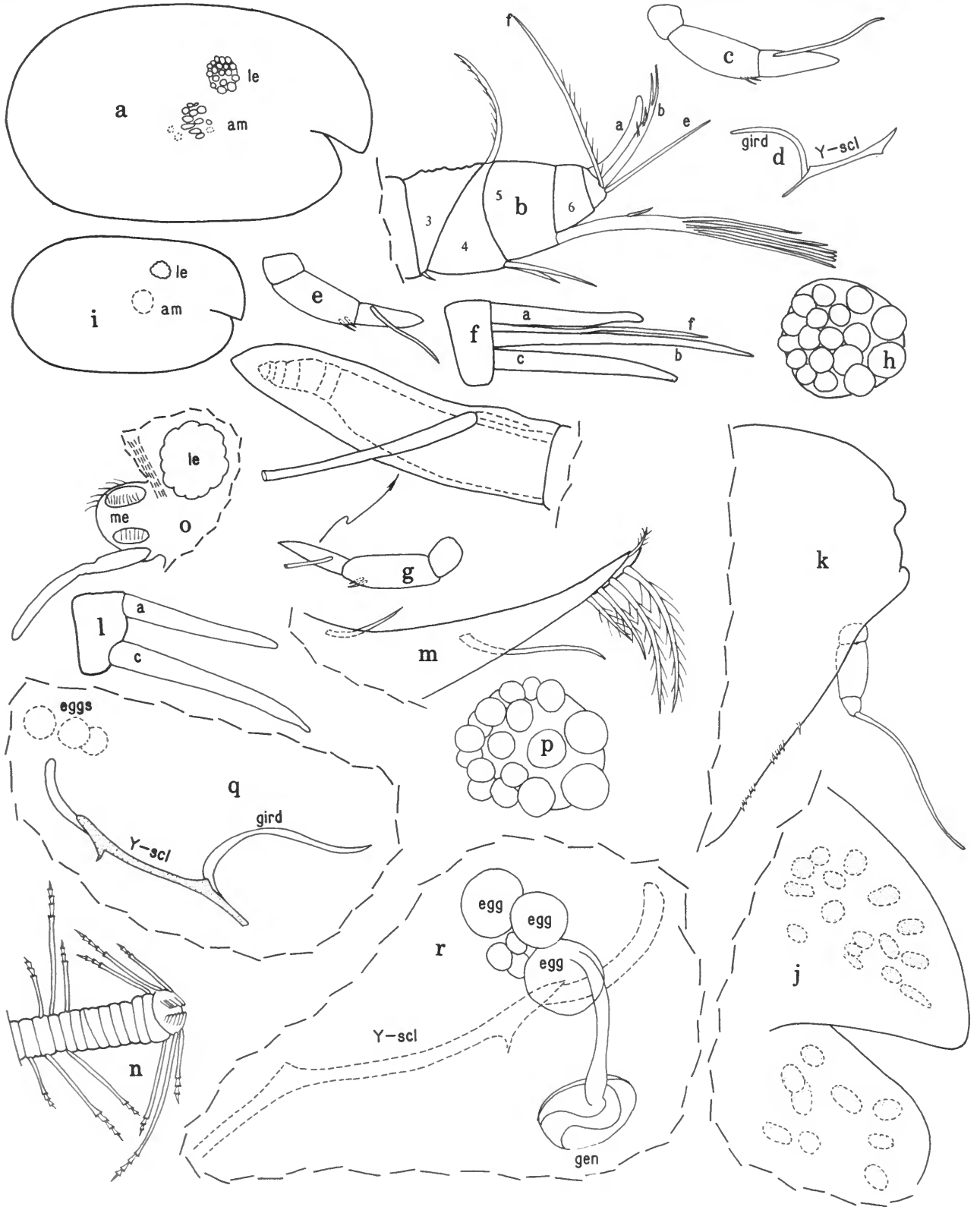


FIGURE 128 (opposite page).—*Synasterope calix*, new species, instar V: male, paratype, USNM 193692: *a*, complete specimen from right side, length 1.33 mm; *b*, distal part of right 1st antenna (6 dorsal bristles of 3rd joint not shown; not all bristles of joints 7 and 8 shown), lv; *c*, endopodite of right 2nd antenna, mv; *d*, right Y-sclerite and girdle, anterior to right, lv. Male, paratype, USNM 193778: *e*, endopodite of right 2nd antenna, mv; *f*, 3rd endopodial joint of mandible (2 ventral bristles not shown). Male, paratype, with adult appendages within, USNM 193777: *g*, endopodite of left 2nd antenna and detail of tip of 3rd joint showing part of adult 3rd joint within dashed, mv; *h*, left lateral eye, anterior to bottom, lv. Female, holotype, MNHN Os 477: *i*, complete specimen from right side, length 1.36 mm; *j*, anterior end of right valve, ov. Female, paratype, USNM 193780: *k*, protopodite and endopodite of right 2nd antenna, lv; *l*, a- and c-bristles of 3rd joint of right mandible, lv; *m*, anterior end of right 6th limb, lv; *n*, tip of 7th limb; *o*, left lateral eye (outline), medial eye, and Bellonci organ; *p*, left lateral eye; *q*, posterior of body from left side showing unextruded eggs, right Y-sclerite, and girdle, anterior to left, lv; *r*, posterior of body from right side showing unextruded eggs, right genitalia, and right Y-sclerite (dashed), anterior to right, lv.

DISCUSSION OF IDENTIFICATION.—*Relating Adult Males and Females:* A character used in identifying many genera in the Cylindroleberidinae is the sensory bristle of the adult female 5th limb, i.e., whether it has 6 or more long terminal filaments, and whether it has a small proximal filament. Unfortunately, the sensory bristle of the adult male has abundant filaments and cannot be related directly to that of the female. (Some filaments at the very tip of the male bristle are slightly stouter than more proximal filaments and, possibly, further study of them may allow separation of species having females with 6 filaments from those having more than 6.) Also useful, mainly in identifying species, is the development of the female 2nd antenna: in some species the endopodite is distinctly 3-jointed, whereas in others it is 2-jointed or only weakly 3-jointed; however, the endopodite of the adult male is always distinctly 3-jointed with the 3rd joint reflexed. Also useful in identifying species is the presence or absence of a dorsal bristle near midlength of the dorsal margin of the mandibular basale, but on some species a bristle is absent in the female but present in the male.

Relating Adults and Juveniles: As mentioned above, a character used in identifying genera is the presence or absence of a small proximal filament on the sensory bristle of the adult female 1st antenna. Unfortunately, some species that do not have the proximal filament in the adult female do have it in the A-1 male; *S. calix* is one of these. Another character used in identifying genera is the presence or absence of a long lateral bristle between the b- and c-bristles on the dorsal margin of the 2nd endopodial joint of the mandible. The lateral bristle present in adults and late instars may be absent in early instars (Cohen, 1987:601). The lateral bristle is absent in all instars of *S. calix*.

The adult female and all juveniles of *S. calix* studied herein are without a dorsal bristle near midlength of the dorsal margin of the mandibular basale, but the dorsal bristle is present in 3 of 4 adult males. The adult males appear identical in other characters and are tentatively considered herein to be conspecific, but it is possible that they are not. One of the males (USNM

193696), which was collected with the only adult female in the collection, has a dorsal bristle. The other 3 adult males were collected at 3 different stations (1-S, 18-S, 51-S) and no additional specimens of *S. calix* are in those samples.

NUMBER OF INSTARS.—In the Cylindroleberidinae instars I–III, the adult male, and the adult female (if ovigerous, or with well-developed genitalia) are readily recognized, but whether 2 or 3 juvenile instars exist between instar III and the adult is difficult to determine with certainty, because the development of appendages in these instars is gradual, and recognizing subdivisions may be subjective. The 7th limb of instar IV, unlike that of instar III, bears bristles; the shorter bristles tend to strongly taper distally between the base and 1st bell (outline similar to that of a bowling pin, but much thinner), and many short bristles have only 1 bell (Figures 124g, 125g). The 7th limb of later instars generally has more bristles with more bells, and short bristles are less tapered. The endopodite of the male 2nd antenna is useful in identifying instars existing between instars III and the adult, but discrimination is based mainly on the relative lengths of the 3rd joint (Figures 125d,e, 126b,c, 127e, 128c,e,g), so that it is difficult to be certain all instars are represented in a sequence. The A-1 male may be identified with certainty if appendages of the adult male are visible within its appendages; for example, if the endopodite of the adult 2nd antenna is visible (Figure 128g). This establishes that the species has at least 5 instars. Then, it is necessary to examine endopodites of juvenile males smaller than the A-1 male to estimate whether 1 or 2 instars occur between the A-1 male and instar III. Given enough specimens it is probably possible to separate instar III males and females. The 3rd joint of the endopodite of the male 2nd antenna would be slightly larger than that of the female, and the bristle of the 3rd joint would be farther from the tip of the joint. However, in practice, this cannot always be done with certainty. The relative dimensions of the carapaces should be useful in supporting decisions as to the number of instars between instar III and the A-1 male, but because of variability within each instar size this criterion must be used with caution.

In the present study 1 instar III (USNM 193774) and 1 instar IV male (USNM 193779) that have appendages of the next instar visible within appendages of the present instar were examined to determine whether the characters of the inner appendage agreed with those of the instars tentatively identified as instars IV and V, respectively. The 3rd joint of the 1st antenna bears 2 dorsal bristles on instar III and 4 on instar IV. The inner appendage of instar III has 4 bristles indicating, but not proving, that instar IV was correctly identified. The 3rd joint of the 1st antenna of instar V male bears 6 dorsal bristles. The inner appendage of instar IV also has 6 bristles, indicating that instar V may be correctly identified. The inner 7th limb of the instar IV male has precisely the same number of bristles and bells as that of the instar V male, supporting the identification of the instar V male.

ONTOGENY AND SEXUAL DIMORPHISM.—Except for the

inferior corner of the rostrum being slightly more rounded on some 1st instars, the shape of juveniles are similar to that of the adult female.

The order of appearance of appendages is similar to that reported for many mydocopids (Kornicker, 1989:19) except the 7th limb is absent on instar II (2 specimens examined). Genitalia were observed on the instar V female and adults.

First Antenna (Table 18): All stages are without bristles on joint 1. Joint 2 of instar I is without bristles and later stages have 1 dorsal bristle. Joint 3 has a small ventral bristle on all stages, and the dorsal margin has 1 bristle on instars I and II, 2 bristles on instar III, 4 bristles on instar IV and 6 bristles on later stages. Joint 4 has no bristles on instar I, 1 dorsal bristle on later stages, and the ventral margin has no bristles on instar II, 1 bristle on instar III, and 2 bristles on later stages. The sensory bristle of the 5th joint is without filaments on instar I, 1 small proximal and 5 long distal filaments on instar II, and 6 long distal filaments and no proximal filaments on later stages, except for that of the adult male that bears abundant thin filaments. The 6th joint has 1 medial bristle on all stages. The b- and c-bristles of the 7th joint and the f- and g-bristles of the 8th joint are without filaments on instar I and have filaments in later stages. The d-bristle is represented by a minute peg barely visible at high magnification ($\times 100$ oil immersion objective, $\times 15$ ocular).

Second Antenna (Table 18): The protopodite bears 1 small medial bristle and spines on all stages. The 9th exopodial joint bears 2 bristles on instar I, 3 bristles on instars II, III, and female instar IV, and 4 bristles on male instar IV and later stages of both sexes (the sex of instars I, II, and III was not identified). The endopodite of instars I–III is 3-jointed with a long terminal filament, similar to that of later females. Male instar IV has 1 small bristle on the 2nd joint and 1 long proximal filament on the 3rd joint; male instar V differs in have 2 small bristles on the 2nd joint, and the adult male has 3 small bristles on the 2nd joint and a reflexed 3rd joint with terminal ridges.

Mandible (Table 18): The coxale endite is well developed in all stages. The basale endite of instar I differs from later stages in not projecting backward. The number of end bristles on the endite increases from 2 on instar I to 3 on instar II and 4 on later stages. The number of triaenid bristles increases from 1 on instar I to 2 on instars II and III and 3 on later stages (only 2 were on one of the limbs of an adult male studied). The ventral margin of the basale is without a bristle on instar I, has 1 ringed spinous bristle (incipient triaenid bristle) on instar II, and 1 triaenid bristle on later stages. The dorsal margin of the basale bears a backward pointing bristle about $\frac{2}{3}$ joint length on 2 of 3 adult males in the collection. The bristle is not present on the adult female or earlier instars. The 1st endopodial joint has 2 bristles on instar I and 3 on later stages. The 2nd endopodial joint has 1 ventral bristle on instar I and 3 on later stages. The number of bristles on or near the dorsal margin (including cleaning bristles) increases from 5 on instar I to 13

on the adult female and 15 on the adult male. The 3rd endopodial joint has a total of 4 claws and bristles on instar I and 6 on later stages.

Maxilla and Fifth Limb (Table 18): See descriptions.

Sixth Limb (Table 18): The flat limb has an angular posteroventral corner in instars I–IV and the corner is broadly rounded in instar V and the adult. The posteroventral corner in instars I and II bears a broad diaphanous, hirsute, triangular, unringed, nonarticulated, incipient bristle, which becomes a normal slender ringed bristle in instar III. Instar II bears 1 endite bristle and later stages bear 2.

Seventh Limb (Table 18): As in many other mydocopids, instar I is without a 7th limb. On most mydocopids instar II bears a small thumb-like 7th limb, but none were observed on instar II of *S. calix* (2 specimens examined and view unobstructed). Instar III has the usual elongate limb without bristles. The limb of instars IV, V, and the adult bears 10, 12, and 12 bristles, respectively. The bristles on instar IV are broad proximally and, in 1 specimen (USNM 193779) in which the bristles of instar V are visible within, the broad proximal part is seen to accommodate the bells on the bristles of instar V. The bristles of instar IV bear 1 or 2 bells, those of instar V male bear 1–3 bells, the bristles of female instar V and the adult female bear 3 or 4 bells, and those of the adult male bear 2–4 bells.

Furca (Table 18): The 2 posterior claws of instar I are nonarticulated; all claws in later stages are articulated. The number of claws on each lamella increases from 3 in instar I to 5, 6, and 7, in instars II, III, and IV, respectively. Each lamella of the furcae in female instar V and the adult female has 9 claws, whereas that of instar V male has 7 or 8 claws, and the adult male has 8.

Lateral Eyes (Tables 18, 19; Figures 129, 130): In general lateral eyes are larger and have more ommatidia in later stages. The data also suggest that female eyes in later instars (instar V and adult) are smaller and have fewer ommatidia than the eyes of the male. Ommatidia counts in early juveniles must be considered approximate because of difficulty in separating ommatidia from minute cells that may be unrelated to ommatidia. Pigment in later stages tends to obscure those ommatidia not along the periphery. In those *Cylindrolebridinae* having many ommatidia, 2 in the ventral or posteroventral position are generally much larger than others, and a row of small ommatidia are along the dorsal edge (some minute ommatidia are medial to that row, and are easily overlooked). In repeated counts of ommatidia in the same eye of late juveniles and adults the number varied by as many as 3 because of difficulty in seeing hidden small ommatidia. Most eye measurements and ommatidial counts in Tables 18 and 19 were obtained using a $\times 20$ or $\times 40$ objective and $\times 15$ ocular, and are from specimens in a drop of glycerine not compressed by a cover glass.

Genitalia: Genitalia are usually visible in instar V but may be obscured, especially by the epipodite of the 5th limb, and removing the epipodite sometimes fragments the genitalia. In

TABLE 18.—Distribution of selected characters on growth stages of *Synasterope calix* (d = dorsal, di = distal, F = female, M = male, na = not applicable, nd = no data, pr = proximal, U = sex unknown, v = ventral, + = present, - = absent).

Character	I	II	III	IV		V		Adult	
	U	U	U	F	M	F	M	F	M
Carapace									
length (avg. mm)	0.63	0.72	0.88	0.97	1.00	1.35	1.33	1.52	1.46
Height as % of length	59	60	61	61	60	62	59	60	55
First antenna									
1st joint: bristles	0	0	0	0	0	0	0	0	0
2nd joint: bristles	0	1	1	1	1	1	1	1	1
3rd joint bristles (v/d)	1/1	1/1	1/2	1/4	1/4	1/6	1/6	1/6	1/6
4th joint (v/d)	0/0	0/1	1/1	2/1	2/1	2/1	2/1	2/1	2/1
5th joint (filaments of sensory bristle (pr/di))	0/0	1/5	0/6	0/6	0/6	0/6	1/6	0/6	many
6th joint: bristles	1	1	1	1	1	1	1	1	1
7th joint: bristles	3 ^a	3	3	3	3	3	3	3	3
8th joint: bristles	4 ^b	4	4	4	4	4	4	4	4
Second antenna									
Endopodite: bristles	1	1	1	1	2	1	3	1	4
Exopodite, 9th joint bristles	2	3	3	3	4	4	4	4	4
Mandible									
Basale endite									
Projecting back	no	yes	yes	yes	yes	yes	yes	yes	yes
End bristles	2	3	4	4	4	4	4	4	4
Triaenid bristles	1	2	2	3	3	3	3	3	2-3
Dwarf bristles	1	1	1	1	1	1	1	1	1
Basale bristles (v/d)	0/2	1/1	1/1-2	1/2	1/2	1/2	1/2	1/2	1/2-3
Endopodite, 1st joint bristles	2	3	3	3	3	3	3	3	3
Endopodite, 2nd joint									
ventral bristles	1	3	3	3	3	3	3	3	3
Dorsal bristles									
a-bristle	-	+	+	+	+	+	+	+	+
b-bristle	-	-	+	+	+	+	+	+	+
c-, d-bristle	+	+	+	+	+	+	+	+	+
e-bristle	-	-	-	-	-	-	-	-	-
f-bristle	+	+	+	+	+	+	+	+	+
g-bristle	+	+	+	+	+	+	+	+	+
Proximal bristles	0	0	0	0	0	1	1	1	2
Cleaning bristles	1	1	2	3	3-4	6	5	6	6
Endopodite, 3rd joint									
a-, c-, d-, f-bristles	+ ^c	+ ^d	+ ^d	+ ^d	+ ^d	+ ^d	+ ^e	+	+
b-, e-bristles	-	+	+	+	+	+	+	+	+
Fifth limb									
ventral bristles (avg.)	7	11	22	23	nd	32	31	43	nd
Sixth limb									
Endite bristles	0	1	2	2	2	2	2	2	2
Skirt bristles (avg.)	1 ^f	1 ^f	6	8-9	10	16	15	19-20	16
Seventh limb									
Bristles (pr/di)	-	-	+	+	+	+	+	+	+
Bells on bristles	na	na	0/0	10	10	12	12	12	12
Bells on bristles	na	na	na	1-2	1-2	3-4	1-3	3-4	2-4
Furca									
claws	3 ^g	5	6	7	7	9	7-8	9	8
Lateral eyes									
ommatidia	12	13	14	15	15	17	18 ^h	17	20 ^h
Y-sclerite fused to girdle	+	-	-	-	-	-	-	-	-

^a b- and c-bristles without filaments.

^b f- and g-bristles without filaments.

^c f-bristle dorsal.

^d c-bristle broken.

^e c-bristle broken on some specimens.

^f Bristle diaphanous nonarticulated.

^g Claws 2 and 3 nonarticulated.

^h Some specimens with reddish brown pigment between ommatidia.

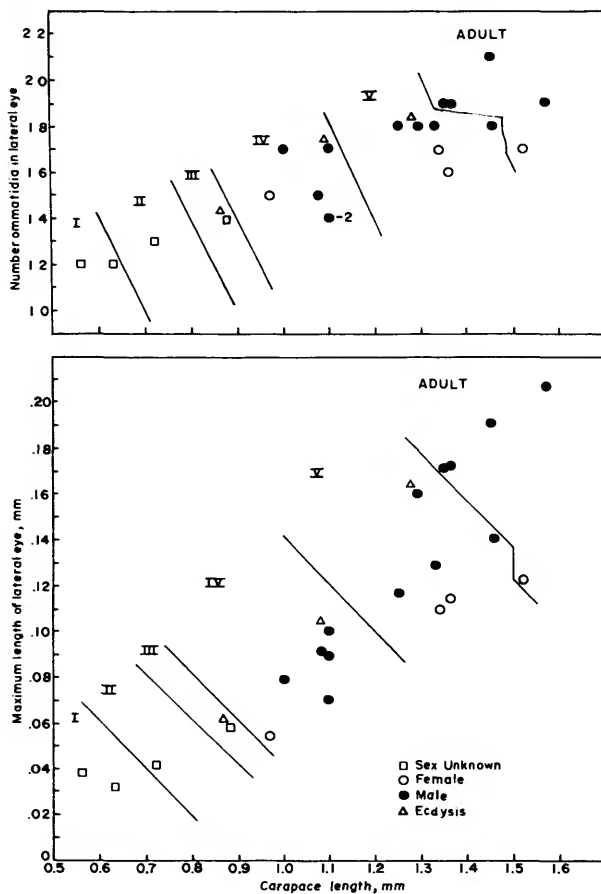


FIGURE 129.—Relationship between carapace length and number of ommatidia in lateral eyes (top graph), and carapace length and maximum length of lateral eyes (bottom graph) of *Synasterope calix*. (A small triangle adjacent to a datum point in the top graph indicates that the specimen is in a late stage of ecdysis; roman numerals indicate maturity of instars.)

the present study of instar V the genitalia of the female but not of the male were observed.

ORDER OF BRISTLE ADDITIONS.—The order in which bristles are added on appendages during ontogeny is potentially useful in discriminating closely related species that may differ in how bristles are added, and in estimating directionality of character states.

First Antenna: The dorsal margin of the 3rd joint bears 6 bristles on adults of most species of *Cylindroleberidinae*. For the purpose of this discussion of *S. calix* the bristles are lettered as follows (Figure 115g): a-bristle = proximal bristle usually stouter than others and bearing stout spines along the dorsal margin; b-, c-, and d-bristles = following 3 bristles, usually similar in having a few long spines near midlength and short spines distally; e-bristle = following bristle with base lateral, and which on the adult female and juveniles has proximal part

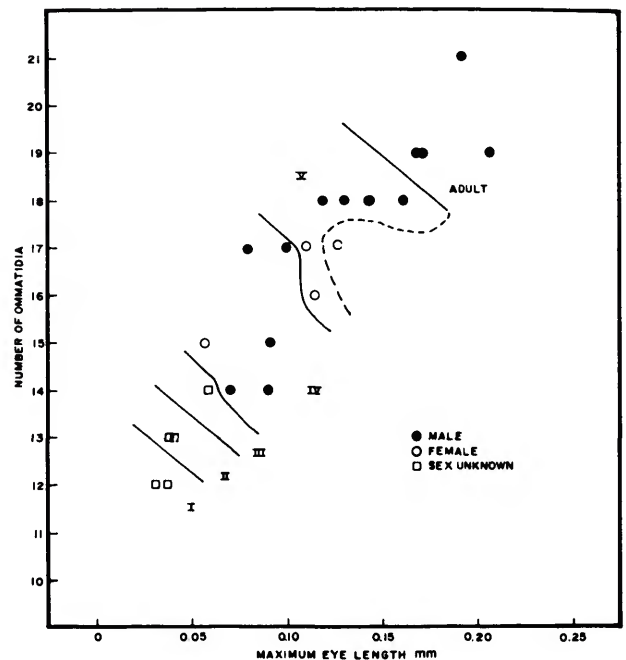


FIGURE 130.—Relationship between maximum length of lateral eyes and number of ommatidia in eyes of *Synasterope calix*. (Roman numerals indicate maturity of instars.)

bent anteriorly, and on both sexes has few long spines at midlength and short spines distally (on the adult female and juveniles this bristle is slightly proximal to the f-bristle, but on adult males it is slightly distal); f-bristle = bristle with base medial to e-bristle and with only short marginal spines on the adult male.

Instars I and II of *S. calix* each bear on the dorsal margin of the 3rd joint of the 1st antenna only 1 stout bristle identified by its stoutness and long dorsal spines as the a-bristle (Figures 120b, 122b). Instar III bears in addition to the a-bristle the e-bristle, identified by its base bending anteriorly (Figure 123b). Instar IV in addition to the a- and e-bristles bears the f-bristle identified by its location relative to the e-bristle, and 1 additional bristle (either the b-, c-, or d-bristle) (Figures 124k, 125c). (The 1st antennae of instar IV (USNM 193779) (Figure 126d,e), within which the limb of instar V is visible, was studied in an attempt to identify the additional bristle on instar IV; it is probably the d-bristle, but this could not be determined with certainty because the bases of the 3 bristles are close together. If the appendage had been cleared first in lactic acid the relationship may have been more apparent.) Instar V has 6 bristles similar to those of the adult female (Figure 127b). The adult male of *S. calix* has 6 bristles along the dorsal margin of the 3rd joint, but they differ somewhat from those of those of instar V males and females and the adult female (Figure 117e):

TABLE 19.—Maximum length of the lateral eye and number of ommatidia for selected specimens of *Synasterope calix*.

Specimen, carapace length (mm)	Maximum eye length (mm)	Number of ommatidia
Instar I (sex unknown)		
USNM 193770, 0.56	0.037	12
USNM 193771, 0.63	0.031	~12
Instar II (sex unknown)		
USNM 193772, 0.72	0.042	13
USNM 193773, nd	0.039	~13
Instar III (sex unknown)		
USNM 193774*, 0.88	0.058	14
Instar IV (female)		
USNM 193775, 0.97	0.055	15
Instar IV (male)		
USNM 193776, 1.00	0.078	17
USNM 193779*, 1.10	0.100	17
From sta 106-R, 1.08	0.092	15
From sta 50-S, 1.10	0.090	14
From sta 106-R, 1.10	0.070	14
Instar V (female)		
Holotype, 1.36	0.115	16
USNM 193780, 1.34	0.110	17
Instar V (male)		
USNM 193692, 1.33	0.128	18
USNM 193699, 1.46	0.141	18
USNM 193777*, 1.29	0.160	18
USNM 193778, 1.25	0.118	18
Adult (female)		
USNM 193693, 1.52	0.122	17
Adult (male)		
USNM 193696, 1.57	0.207	19
From sta 1-RS, 1.35	0.171	19
From sta 18-S, 1.36	0.172	19
From sta 51-S, 1.45	0.191	21

* Undergoing ecdysis (new appendages visible within old).

the a-bristle is only slightly stouter than the b-bristle; the c-bristle is short, and its long proximal spines are slenderer than those on other bristles, and the base of the bristle is lateral; in the adult female and juveniles the e-bristle is slightly proximal to the f-bristle, whereas in the male it is slightly distal, and the orientations of both bristles are similar, and both have long and short spines; the e-bristle (on some specimens also the f-bristle) is shorter than the a-, b-, and d-bristles.

Mandible (Table 18): For the purpose of this description the bristles on or near the dorsal margin of the 2nd endopodial joint are as follows (Figure 115i): the 4 stout bristles along the dorsal margin are the a- (proximal), b-, c-, and d-bristles (same lettering proposed by Poulsen (1965:313) and used in descriptions herein), e-bristle = lateral bristle between b- and c-bristles (not present on species of *Cylindroleberis*, *Synasterope*, and *Prionotoleberis*); f-bristle = lateral bristle between c- and d-bristles; g-bristle = medial bristle adjacent (usually just distal) to d-bristle. Cleaning bristles = spinous bristles on medial side near dorsal margin. Proximal bristles = short

bristles on dorsal margin just proximal to a-bristle.

Instar I bears the c-, d-, f-, and g-bristles and 1 cleaning bristle (the c-bristle is identified by its stoutness and shortness relative to the d-bristle, a relationship characteristic of the adult) (Figure 120e). On instar II the a-bristle is added (the a-bristle is tentatively identified by the relatively long space between it and the c-bristle, but it could be the b-bristle) (Figure 122e). On instar III the b-bristle and an additional cleaning bristle (total 2) is added. On instar IV an additional cleaning bristle (total 3) is added in the female (Figure 124b) and 1 or 2 (total 3 or 4) in the male. On instar V 1 short proximal bristle is added in both the male and female, and the male has 5 and the female 6 cleaning bristles. On the adult 1 proximal bristle is added in the male (Figures 115i, 118c). Both the adult male and female have 6 cleaning bristles.

COMPARATIVE ONTOGENY.—Excluding the work of Cohen (1987:587) on 2 species of *Parasterope*, which is not yet published, and therefore will not be discussed here, although cited elsewhere to credit some of her observations supported by the present work, the only species of *Cylindroleberidinae* for which the ontogeny has been studied in detail is *Bathyleberis yamadai* Hiruta, 1979 (Hiruta, 1979b:99). Compared below are selected characters for each stage of *B. yamadai* and *S. calix* that may be significant (generic differences not included).

Instar I: 1st antenna: distribution of bristles and lack of filaments on bristles of end joint similar in both species. 2nd antenna: similar in both species, including 2 bristles on 9th exopodial joint. Mandible: exopodite well developed in *S. calix* but not observed in *B. yamadai* by Hiruta (1979b:111) (the adult *S. calix* has a well-developed exopodite, whereas the exopodite of the adult *B. yamadai* is minute); ventral margin of 2nd endopodial joint with 1 terminal bristle in both species; based on illustration of mandible of *B. yamadai* by Hiruta (1979b, fig. 10:1) the bristles of the 3rd endopodial joint seem similar to those of *S. calix*. 6th limb similar for both species. 7th limb absent in both species. Furca: Hiruta (1979b:111) describes the furca as "lamellae with total of 5 claws and a hairy process on proximal margin," and the illustration shows 3 claws on 1 lamella and 2 on the other, all articulated (Hiruta, 1979b, fig. 10:5). The furca of *S. calix* differs mainly in having some claws nonarticulated.

Instar II: 1st antenna similar for both species excluding sensory bristle and d-bristle, which have differences that could be generic. 2nd antenna similar for both species. Mandible: Exopodite well developed in *S. calix* but not observed for *B. yamadai*; the 3rd endopodial joint bears an additional small bristle on *S. calix*, and one of the stout bristles (c-bristle) is broken. 6th limb similar for both species. 7th limb absent in *S. calix* and represented by small thumb-like process in *B. yamadai*. Furca: Lamellae with 4 and 5 claws in *B. yamadai* and 5 claws on each lamella of *S. calix*, all claws articulated in both species.

Instar III: In general, 1st and 2nd antennae, mandible, 6th

and 7th limbs, and furca similar for both species. The c-bristle of 3rd endopodial joint of mandible broken in *S. calix*.

Instar IV: Female: In general, 1st and 2nd antennae, mandible, and 6th and 7th limbs similar for both species. Each lamella of furca with 8 or 9 claws in *B. yamadai* and with 7 claws in *S. calix*. Male: 1st antenna with 5 dorsal bristles on 3rd joint in *B. yamadai* and 4 in *S. calix*. 2nd antenna, mandible, and 6th limb similar for both species. 7th limb with 12 bristles each with 1 to 3 bells in *B. yamadai* and 6 bristles with 1 or 2 bells in *S. calix* (same as in adult female). Each lamella of furca with 7 or 8 claws in *B. yamadai* and 7 in *S. calix*.

Instar V: Female: 1st and 2nd antennae, mandible, and 6th and 7th limbs similar for both species. Each lamella of furca with 8 or 9 claws for *B. yamadai* and 9 for *S. calix*. Hiruta (1979b:117, fig. 17:4) reported a brush-like organ not observed in *S. calix*. Male: 1st and 2nd antennae, mandible, and 6th limb similar for both species. 7th limb: bristles with 3 or 4 bells in *B. yamadai* and 1–3 bells in *S. calix*.

DISCUSSION OF BRISTLES OF THE THIRD ENDOPODIAL JOINT OF MANDIBLE (Table 20).—For the purpose of this discussion the claws and bristles are lettered as follows (Figure 124b): a-claw = claw-like bristle on distal edge of joint at dorsal end; b-, c- (stouter than others), and d-bristles = 3 following bristles along the edge of joint; e-bristle = short slender bristle with base on medial side slightly proximal to base of c-bristle; f-bristle = slender bristle with base on lateral side slightly proximal to bases of a-claw and b-bristle. The f-bristle in instar I is not lateral as described above but is on dorsal edge of joint; however, it is lateral in later stages; also, the b- and e-bristles are not present in instar I. (A dorsal occurrence of the f-bristle on instar I has been reported previously (Cohen, 1987:603) for 2 species of *Parasterope*.) The b- and c-bristles are stouter than

the d-, e-, and f-bristles, and are about the same width at base as the a-claw. It was observed that the c-bristle is claw-like and slightly longer than the a-claw on both mandibles in many specimens of *S. calix*. The tip of the claw-like c-bristle on instar II (USNM 193772) is flat suggesting that it is broken (Figure 122e), but on instars III–V the tip of the claw-like c-bristle is rounded and not obviously broken (Figures 123f, 124b). The c-bristles on instar I and the adult are long and tapered, but on instars II–V the c-bristles are claw-like on most specimens (11 of 13) for which this character was noted (Table 20). Two specimens (USNM 193774, instar III; USNM 193777, instar V male) with claw-like c-bristles have the appendages of the next instar visible within the appendages of the present instar (Figure 123f); in both specimens a normally tapering c-bristle of the next instar is visible within each claw-like c-bristle. One specimen (USNM 193779, instar IV male) with a tapering c-bristle on the right mandible and a claw-like c-bristle on the left also has appendages of the next instar visible within present appendages; a normally tapering bristle is visible within each c-bristle. Does a specimen with claw-like c-bristles have them from inception, or are the tapered tips broken off during or after molting leaving a claw-like stump? It is not possible to answer this with certainty, but the presence of 3 specimens in the late stages of ecdysis having tapering c-bristles on the mandible of the about-to-emerge instar suggests that claw-like c-bristles are stumps because, if most postmolting specimens have claw-like c-bristles, most premolting specimens also should have them. If they are stumps, it is not known whether their rounded end is left when the tip breaks off, or whether it is caused by later wear.

REMARKS CONCERNING *Synasterope oculata*.—Brady (1902:179) described the species from specimens collected near Trincomalee, Sri Lanka, and Cruz Bay, St. Johns, West Indies. Brady (1902:180) states: "Among a considerable number of specimens one female only could be found, and this occurred with only one or two males in the collection from Cruz Bay. I figure here in outline an example of both sexes from this locality." In addition to a lateral and dorsal view of a male carapace (presumably from Cruz Bay, but a shaded drawing rather than an outline), Brady (1902, pl. XXI: figs. 10–12) illustrated 3 male appendages (endopodite of the 2nd antenna, mandible, and furcal lamella). Whether the appendages are from a specimen from Trincomalee or Cruz Bay is not specified. Skogsberg (1920:523) described the male *S. oculata* based on a study of 2 specimens from Trincomalee that he obtained from the Zoological Museum of Sweden, and which had been designated type specimens by Brady (Skogsberg, 1920:525). Of possible significance is the presence of a dorsal bristle at midlength of the mandibular basale on Skogsberg's specimens but not on the male mandible illustrated by Brady. Unless overlooked by Brady, the absence of the bristle might indicate that the limb illustrated is from a specimen from Cruz Bay. In a synonymy to the species Skogsberg listed Brady's specimens as "part," and stated (p. 525) that he excluded the

TABLE 20.—Distribution of selected specimens of *Synasterope calix* having either claw-like or normally tapering c-bristles on the 3rd endopodial joint of the mandible (C = c-bristle claw-like, T = c-bristle normally tapering, * = specimen exhibiting ecdysis).

Growth stage	c-bristle	Growth stage	c-bristle
Instar I		Instar V female	
USNM 193770 ^a	T	USNM 193780 ^a	C
USNM 193771 ^a	T	Holotype ^a	C
Instar II		Instar V male	
USNM 193772 ^a	C	USNM 193692 ^c	C
USNM 193773 ^a	C	USNM 193777 ^d	C*
Instar III		USNM 193778 ^d	C
USNM 193774 ^a	C*	USNM 193699 ^b	T
Instar IV female		Adult female	
USNM 193775 ^a	C	USNM 193693 ^b	T
Instar IV male		Adult male	
USNM 193776 ^a	C	Unnumbered ^e	T
Unnumbered ^a	C	USNM 193696 ^b	T
USNM 193779 ^b	CT*	Unnumbered ^f	T

^a From sta 106-R.

^c From sta 111-S.

^e From sta 18-S.

^b From sta 50-S.

^d From sta 116-S.

^f From sta 51-S.

female described by Brady. Because of the great distance between Brady's two collections (Sri Lanka and West Indies), it is reasonable to also exclude males from the West Indies from *S. oculata*, and therefore, I recognize as *S. oculata* only that part of the type series collected in Trincomalee. The shape of the female from Cruz Bay illustrated by Brady (1902, pl. XXI: fig. 8) suggests that it probably is a species in the genus *Parasterope*.

Poulsen (1965:413) referred males from the Red Sea to *S. oculata*, and presented a supplementary description of the species based on Red Sea specimens. According to Poulsen (1965:417) the Red Sea males differ in a number of characters from the males from Sri Lanka described by Skogsberg. An important character difference is the presence of a lateral bristle on the 2nd joint of the 1st antenna of the Trincomalee specimen and its absence on the Red Sea specimens. However, the Trincomalee males should be reexamined to verify the presence of the bristle because it was not specifically mentioned by Skogsberg, who stated that the 1st antenna was similar to that of *A. grimaldi* (*A. grimaldi* has a lateral bristle on the 2nd joint (Skogsberg, 1920, fig. XCIX:10)). A lateral bristle is absent on the specimens described by James (1976:611) from the Gulf of Mannar.

James (1976:613) stated under remarks: "The original description of *Synasterope oculata* was based on the material obtained from Trincomalee and Cruz Bay along the east coast of Ceylon by Brady (1902)." I have been unable to locate a "Cruz Bay" in Sri Lanka and, therefore, follow Skogsberg (1920:527), who placed Cruz Bay at St. Johns, Lesser Antilles. Adult males from the Gulf of Mannar (off the southeast coast of India) referred to *S. oculata* by James (1976:611) differ slightly from specimens from Sri Lanka referred to the species by Skogsberg (1920:523) and from specimens from the Red Sea referred to the species by Poulsen (1965:410). The lengths of the carapaces of adult males appear to differ somewhat geographically, e.g., Sri Lanka: 1.35 mm (Brady, 1902:179), 1.35–1.38 mm (Skogsberg, 1920:523); Red Sea: 1.44–1.56 mm (Poulsen, 1965:414); southeast coast of India (Gulf of Mannar): 1.6 mm (James, 1976:611).

CYCLASTEROPINAE Poulsen, 1965

DISTRIBUTION.—Widespread in shelf waters from about 46°S in the vicinity of New Zealand to about 42°N in the Mediterranean. Members of the subfamily generally collected on the continental shelf and upper slope (Kornicker, 1981a:72).

COMPOSITION.—The Cyclasteropinae include 3 tribes: Cycloleberidini Hartmann, 1974, Cyclasteropini Poulsen, 1965, and Tetraleberidini Kornicker, 1981a. Only the first is represented in the present collection.

CYCLOLEBERIDINI Hartmann, 1974

DISTRIBUTION.—Mediterranean Sea, Atlantic Ocean, western Indian Ocean, and in the vicinity of Australia and New

Zealand. Generally collected on the continental shelf (Kornicker, 1981a:78).

COMPOSITION.—The Cycloleberidini include 3 genera: *Cycloleberis*, *Alphaleberis*, and *Leuroleberis*. Only *Cycloleberis* is in the present collection.

Cycloleberis Skogsberg, 1920

TYPE SPECIES.—*Cylindroleberis lobiancoi* Müller, 1894.

DISTRIBUTION.—Mediterranean Sea, and Atlantic and Indian oceans in the vicinity of Africa. Known depth range intertidal to 96 m (?1100 m) (Kornicker, 1981a:30, 79).

COMPOSITION.—The genus includes 4 species: *Cycloleberis lobiancoi* (Müller, 1894), *C. squamiger* (Scott, 1894), *C. galathea* Poulsen, 1965, and *C. christiei* Kornicker and Maddocks, 1977.

Cycloleberis galathea Poulsen, 1965

FIGURE 131

HOLOTYPE.—A-1 female in the collections of the Zoological Museum of the University of Copenhagen, Denmark.

TYPE LOCALITY.—False Bay, South Africa, *Galathea* sta 169, 20 m.

MATERIAL.—Sta 1-S, western side of Leven Bank: USNM 193733, partly dissected female in alcohol; MNHN Os 485, 3 undissected juveniles in alcohol.

DISTRIBUTION.—The species has been reported previously from the Atlantic side of South Africa and in the western Indian Ocean in the vicinity of Madagascar (Kornicker, 1981a:81). The specimens reported herein (sta 1-S, western side of Leven Bank, depth 42 m) are within the previously known range. Known depth range 0–42 m.

SUPPLEMENTARY DESCRIPTION OF JUVENILE FEMALE.—Probably an A-1 instar (Figure 131).

Carapace Size: USNM 193733, length 3.4 mm, height 2.6 mm (Figure 131).

First Antenna: Sensory bristle of 5th joint with 3 short proximal filaments and about 10 long terminal filaments (distal of the short proximal filaments with base close to proximal of the long terminal filaments).

Second Antenna: Endopodite of right limb: 1st joint with 4 proximal and 5 distal bristles; 2nd joint without bristles; 3rd joint with long terminal filament.

Maxilla: Dorsal margin of basale of right limb with 1 long and 3 short distal bristles.

ASTEROPTERONINAE Kornicker, 1981

This subfamily includes 7 genera of which only *Asteropterygion* is represented in the collections.

Asteropterygion Kornicker, 1981

TYPE SPECIES.—*Asteropterygion thomassini* Kornicker, 1981a:282.

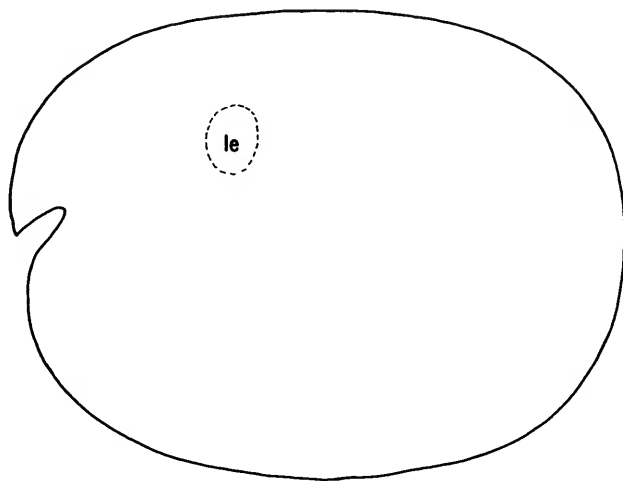


FIGURE 131.—*Cycloleberis galathea* Poulsen, female (probably A-1 instar), USNM 193733, complete specimen in lateral view, length 3.4 mm.

DISTRIBUTION.—Circumglobal between about 34°N and 41°S at depths of 0–100 m (?1100 m) (Kornicker 1981a, fig. 131).

COMPOSITION.—The genus was divided into 2 groups by Kornicker (1981a:285, 320) based on the morphology of the a-bristle of the 1st antenna: *A. thomassini* Group (9 species) and *A. dayi* Group (4 species). One species, *A. liguria* (Granata, 1915:30) is not sufficiently known to refer it to either group (Kornicker, 1981a:284). Only 2 specimens of a single species are in the present collection. The species is a member of the *A. thomassini* Group, but could not be further identified. Several species in the group have been collected in the vicinity of Africa (Kornicker, 1981a, fig. 131).

Astropterygion species indeterminate

FIGURE 132

MATERIAL.—Sta 106-R: USNM 193756, 1 instar I on slide and in alcohol. Sta 124-S: MNHN Os 487, 1 specimen in poor condition in alcohol.

DISTRIBUTION.—Sta 106-R, Zelee Bank, south border, 12°25'30"S, 46°16'18"E, depth 18–24 m. Sta 124-S, Mozambique Channel, SE Glorioso Islands, 11°32'06"S, 47°23'06"E, depth 24 m. Known depth range 18–24 m.

DESCRIPTION OF INSTAR I (Figure 132).—Carapace in poor condition, with many calcareous concretions and tears; approximate outline and surface nodes illustrated in Figure 132a.

Carapace Size: USNM 193756, length 1.09 mm, height 0.83 mm.

First Antenna (Figure 132b,c): 1st joint with rows of

lateral and medial spines. 2nd joint with rows of long spines on medial surface, and ventral and dorsal margins. 3rd joint with 1 short bristle (with few minute spines) on short ventral margin and 1 longer proximal spinous bristle on long dorsal margin. 4th joint bare. Long 5th joint with long sensory bristle without filaments. Short 6th joint with small spines forming lateral row near dorsal margin (Figure 132b) and small bare medial bristle near midwidth (Figure 132c). 7th joint: bare a-bristle claw-like with rounded tip; b- and c-bristles without marginal filaments but with minute terminal papilla. 8th joint: long, bare d- and e-bristles (distal part of e-bristle missing on both limbs) on small pedestal (lateral side of pedestal with minute pore or papilla); long f- and g-bristles without filaments (tip of g-bristle missing on both limbs); f-bristle bent dorsally.

Second Antenna: Protopodite with long distal medial bristle with short marginal spines and minute papilla at tip (Figure 132e). Endopodite (Figure 132d,e): 1st joint short, bare; 2nd and 3rd joints fused, with long terminal filament (base of filament slightly proximal to tip of joint). Exopodite 9-jointed (Figure 132d: 1st joint long with minute terminal medial bristle (Figure 132f); joints 2–8 decrease in size distally; joint 9 narrower and slightly longer than joint 8. Bristle of 2nd joint: ventral margin with numerous slender spines and distal natatory hairs; dorsal margin with proximal natatory hairs followed by numerous slender spines and distal natatory hairs. Bristles of joints 3–8 long, with natatory hairs; 9th joint with 1 short slender medial spine-like bristle and 2 terminal bristles (dorsal short with marginal spines; ventral long with natatory hairs (marginal spines and hairs not shown in Figure 132g)). Joints 2–8 without spines.

Mandible (Figure 132h): Coxale endite well developed (not in natural location in Figure 132h): small slender bristle near base of ventral branch; ventral branch with spines and hairs forming about 10 oblique rows (tip of branch obscured); dorsal branch with 4 nodes along ventral margin (tip obscured). Basale: endite with 2 spinous end bristles, 1 small slender bare bristle with prolonged tip, 1 long bristle with long marginal spines, and 1 triaenid bristle (a proximal pair of marginal spines very long) (the last 2 bristles could be interpreted to be on basale near endite; 3 bristles shown in Figure 132h near dorsal margin of endite would be along ventral margin if endite were in natural position); medial surface of basale with few rows of short spines near dorsal margin; dorsal margin with 1 short bare subterminal and 2 long spinous terminal bristles. Exopodite long spinous with 2 long bare subterminal bristles (distal bristle shorter). 1st endopodial joint with 2 long stout spinous ventral bristles. 2nd endopodial joint: medial surface with rows of spines; ventral margin with 1 terminal bristle; dorsal margin with 6 distal bristles, most with spines. 3rd joint with 2 claws (broken on USNM 193756) and 2 bristles. (Left mandible missing on USNM 193756.)

Maxilla (Figure 132i): Endites somewhat obscured, with total of at least 6 long bristles. Epipodite elongate with narrow tip, hirsute. Basale: ventral margin with 3 short distal bristles

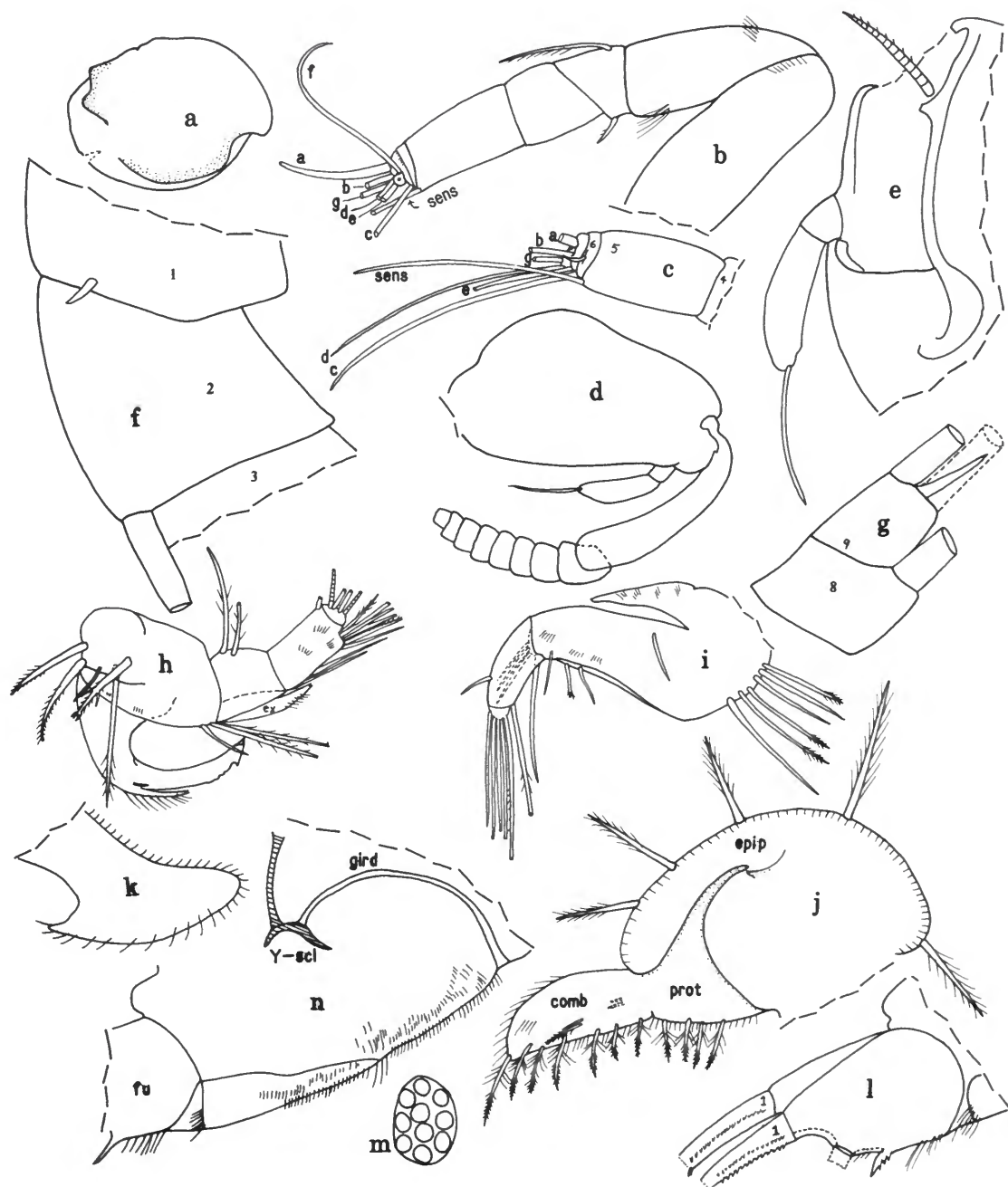


FIGURE 132.—*Asteropterygion* species indeterminate, instar I (sex unknown), USNM 193756: *a*, complete specimen from right side, length 1.09 mm; *b*, left 1st antenna, lv; *c*, tip of right 1st antenna (e-bristle broken; f-bristle missing); *d*, right 2nd antenna (exopodial bristles not shown), lv; *e*, protopodite and endopodite of right 2nd antenna, mv; *f*, exopodial joints 1 and 2 of right 2nd antenna, mv; *g*, exopodial joints 8 and 9 of right 2nd antenna, mv; *h*, right mandible, mv; *i*, right maxilla, mv; *j*, left 5th limb (not all epipodial bristles shown; comb shown in lateral view, and epipodite and protopodite in medial view); *k*, right 6th limb, lv; *l*, left furcal lamella and claws 1 and 2 (dashed) of right lamella (claw 2 of both lamellae broken); *m*, lateral eye; *n*, posterior of body from left side, anterior to upper left, lv.

(middle bristle with base closer to ventral margin and with brush-like tip), and 1 long spinous terminal bristle; medial surface with 1 proximal bristle near dorsal margin. Exopodite narrow with 3 bristles. Endopodite: 1st joint with 1 short anterior bristle and 1 long spinous beta-bristle; 2nd joint with 5 long bristles, some with spines.

Fifth Limb (Figure 132j): Epipodite with 61 plumose bristles. Anterior margin of protopodite proximal to comb with 4 bristles with long proximal and short distal hairs. Comb: dorsal margin hirsute but without bristles; 7 bristles (with long proximal and short distal hairs) with bases on or just lateral to ventral margin; lateral side with 2 distal adjacent bristles (1 short bare, 1 longer with long proximal and short distal hairs); 2 small bare adjacent proximal bristles appear to be beneath lateral surface of comb; ventral margin of comb spinous. (On illustrated left limb protopodite and epipodite are viewed medially and comb laterally.)

Sixth Limb (Figure 132k): Limb hirsute and spinous, without bristles.

Seventh Limb: Absent.

Furca (Figure 132l): Each lamella with 3 claws; posterior claw nonarticulated.

Bellonci Organ: Not observed.

Eyes: Medial eye obscured. Lateral eye with about 10 divided amber-colored ommatidia (Figure 132m); no black pigment between ommatidia.

Upper Lip: Hirsute.

Genitalia: Absent.

Posterior of Body (Figure 132n): Hirsute, with spinous thumb-like dorsal process (folded over body on USNM 193756; not shown).

Y-Sclerite (Figure 132n): Differs from adults of genus in having ventral branch. (A similar Y-sclerite is present on the 1st instar of *Asteropteron fuscum* (Hiruta, 1979a, fig. 8:3).)

Gills: Well developed.

DISCUSSION.—The specimen described herein has a 1st antenna, endopodite of 2nd antenna, 6th limb, and furca similar to those of the 1st instar of *Asteropteron fuscum* (Müller, 1890), which has been described by Hiruta (1979a:23). Hiruta (1979a:23) did not observe a 7th limb, and the limb is absent on the present specimen. Remaining appendages differ only in small details.

Poulsen (1965:199) described a juvenile of *Asteropterygion thailandicum*, which he interpreted to be a 2nd instar (Poulsen, 1965, table 22). Hiruta (1979a:29) interpreted it to be a 1st instar. Kornicker (1981a:37) accepted Poulsen's interpretation of it being a 2nd instar, but I now concur with Hiruta. The 1st antenna and furca of Poulsen's specimen are similar to those appendages of the 1st instar of both *A. fuscum* and the present specimen. The endopodite of the 2nd antenna of *A. thailandicum* differs in having 2 instead of no bristles on the 1st joint (Poulsen, 1965, table 13). The number of bristles on the 6th limb of the 1st instar of *A. thailandicum* is not known with certainty. In the description of the youngest specimen in his collection Poulsen (p. 200) stated: "The first stage in the table [table 13], stage A, must not be confused with the actual first larval stage (not known for this species), it is shown by the rather complete development of the 6th limb (with bristles) already a later larval stage." However, in the description of the specimen Poulsen (p. 200) stated: "The 6th limb has only hairs along the ventral margin." Kornicker (1981a:37) attempted to reconcile Poulsen's statements by interpreting them to mean that the 6th limb of his youngest specimen has bristles on the anterior margin but not on the ventral margin, a characteristic of the 6th limbs of the 2nd instar of many myodocopids (Kornicker, 1981a, table 9; Hiruta, 1983, fig. 5), but the interpretation may be incorrect. The 7th limb of Poulsen's specimen is a "short, thumb-like bare process" (Poulsen, 1965:200), which is probably similar to the 7th limb of the 2nd instar of *A. fuscum* (Hiruta, 1979a, fig. 11:3).

Appendix 1

Station Data with Specimens Examined: Benthédi Expedition, R/V *Suroît*

(In chronological order)

- Sta 1-S; 18 Mar 1977; western side of Leven Bank; 42 m.
Synasterope calix: Paris, 1 adult male.
Cycolleberis galathea: USNM 193733, 1 female; MNHN Os 485, 3 juveniles.
- Sta 5-DR; 18 Mar 1977; W Leven Bank; 12°32'S, 47°40'12"E; 35–150 m.
Paradoloria vanhoeffeni: USNM 193748, 1 adult female.
Metasarsiella benthedi: MNHN Os 89, holotype, 1 ovigerous female.
- Sta 8-DR; 19 Mar 1977; W Glorioso Islands; 11°29'12"S, 47°18'12"E; 250 m.
Codonocera phoenix: MNHN Os 432, holotype, 1 adult female; USNM 193704, 1 adult female; USNM 193705, 1 adult female; USNM 193706, 1 adult male; USNM 193707, 1 adult female; USNM 193708, 1 adult female; Paris, 2 adult females.
Skogsbergia iota: USNM 193746, 1 adult male.
Eusarsiella falx: MNHN Os 454, holotype, 1 adult female; Paris, 3 adult females.
Dantya benthedi: Paris, holotype, 1 adult female; USNM 158580, 1 ovigerous female; USNM 193009, 20 specimens including ovigerous females; Paris, 28 specimens. Reported in Kornicker (1983c:11).
- Sta 18-S; 22 Mar 1977; S Îlot Gombé Doumé, Mayotte; 12°45'S, 45°15'54"E; 15 m.
Cypridina nex: Paris, 8 specimens (adult males, female, and juveniles).
Synasterope calix: Paris, 1 adult male.
- Sta 23-S; 23 Mar 1977; Vatou Islet, Mayotte; 12°46'12"S, 45°15'30"E; 6 m.
Skogsbergia plax: Paris, 1 adult male.
Heptonema latex: Paris, 1 adult female.
Cylindroleberis vix: Paris, 1 ovigerous female, 1 early instar.
Cylindroleberis vibex: MNHN Os 470, holotype, 1 ovigerous female; Paris, 1 adult female.
- Sta 24-S; 24 Mar 1977; M'Zamboro Pass, Mayotte; 12°37'18"S, 45°09'54"E; 16–18 m.
Eurypylus chavturi: USNM 158147, 2 ovigerous females; 1 juvenile.
- Sta 32-S; 25 Mar 1977; N Pamanzi Island, Mayotte; 12°45'06"S, 45°17'54"E; 15–20 m.
Cypridina segrex: Paris, 1 instar IV; USNM 193764, 1 adult female.
Eurypylus chavturi: USNM 193781, 1 instar III male.
Cylindroleberis vix: MNHN Os 467, holotype, 1 ovigerous female; USNM 193751, 1 adult female; USNM 193752, 1 adult female; Paris, 1 A-1 instar, 1 A-2 instar, 1 early instar.
Cylindroleberis vibex: Paris, 1 A-1 female; USNM 193769, 1 A-2 female; USNM 193753, 1 ovigerous female.
- Sta 40-D; 26 or 27 Mar 1977; Mayotte Island slope, east of Bandele Reef; 1300–1480 m.
Tetragonodon currax: MNHN Os 453, holotype, 1 female; USNM 193731, 1 ovigerous female; USNM 193732, 1 adult female.
- Sta 46-S; 27 Mar 1977; south of barrier reef, Mayotte; 13°04'06"S, 45°08'54"E; 33 m.
Eurypylus chavturi: MNHN Os 86, 1 female.
- Sta 50-S; 28 May 1977; Bouéni Reef, Mayotte; 12°54'30"S, 44°58'30"E; 32 m.
Cypridina nex: MNHN Os 423, holotype, 1 adult male; USNM 193698, 1 adult male; USNM 193700, 1 adult female; Paris, 1 adult male; USNM 193701, 1 instar V female; USNM 193702, 1 instar V female.
Neomuelleriella mayottensis: MNHN Os 88, holotype, 1 adult male.
Heptonema latex: MNHN Os 463, holotype, 1 ovigerous female; USNM 193695, 1 ovigerous female; USNM 193694, 1 adult male; USNM 193697, 2 adult females, 1 juvenile male; Paris, 1 adult male, 4 adult females.
Synasterope calix: Paris, 1 instar IV male; USNM 193699, 1 instar V male; USNM 193779, 1 instar IV male; USNM 193693, 1 adult female; USNM 193696, 1 adult male.
- Sta 51-S; 28 Mar 1977; Bouéni faro, Mayotte; 12°54'30"S, 44°58'12"E; 15 m.
Synasterope calix: Paris, 1 adult male.
- Sta 65-S; 29 Mar 1977; M'Sanga Tsohole Reef, Mayotte; 12°41'54"S, 44°59'18"E; 38 m.
Cypridina segrex: MNHN Os 426, holotype, 1 instar V male; Paris, 1 instar IV; USNM 193767, 1 instar III male.
Codonocera phoenix: USNM 193760, 1 instar IV female.
Heptonema latex: Paris, 1 ovigerous female.

- Sta 71-DS; 30 Mar 1977; NE north reef, Mayotte; 12°29'54"S, 45°02'E; 450 m.
Harbansus ferox: MNHN Os 450, holotype, 1 adult female; USNM 193768, 1 adult female.
- Sta 72-DS; 30 Mar 1977; NNE north reef, Mayotte; 12°31'S, 45°02'18"E; 300–350 m.
Codonocera phoenix: Paris, 2 adult females; USNM 193762, 1 instar V female.
Eusarsiella falx: USNM 193782, 1 A-1 male; USNM 193783, 1 A-1 female; USNM 193784, 1 ovigerous female; Paris, 3 adult females.
Prionotoleberis lux: MNHN Os 476, holotype, 1 adult female; USNM 193754, 1 adult female; Paris, 1 adult female.
- Sta 75-R; 30 Mar 1977; N Dzaoudzi (anchorage), Mayotte; 12°46'24"S, 45°15'18"E; 20 m.
Harbansus thrix: MNHN Os 448, holotype, 1 A-1 female; Paris, 1 A-1 male.
- Sta 79-S; 31 Mar 1977; L'Iris Bank, Mayotte; 12°33'30"S, 44°56'24"E; 25 m.
Eurypylus chavturi: MNHN Os 85, 4 females.
- Sta 87-CH; 3 Apr 1977; SE Glorioso Islands; 11°44'S, 47°35'E; 3716 m.
Igene bryx: MNHN Os 451, holotype, 1 adult female; USNM 193749, 1 ovigerous female; USNM 193750, 1 adult female; Paris, 1 juvenile.
- Sta 101-DS; 8 Apr 1977; NW Île du Lys, Glorioso Islands; 11°25'42"S, 47°19'30"E; 26 m.
Skogsbergia calyx: MNHN Os 437, holotype, 1 adult female; USNM 193703, 1 juvenile.
Rutiderma arx: MNHN Os 272, holotype, 1 ovigerous female; USNM 193410, 2 adult females, 1 ovigerous female; USNM 193411, 1 adult female; USNM 193409, 1 adult male; USNM 193412, 1 instar II; USNM 193413, 1 instar III male; USNM 193414, 1 instar IV male; MNHN Os 274, 1 instar II; MNHN Os 273, 8 instar IV; MNHN Os 275, 1 adult male.
Rutiderma rex: MNHN Os 277, holotype, 1 ovigerous female; USNM 193415, 1 ovigerous female; MNHN Os 278, 1 adult female.
Chelicopia obex: MNHN Os 462, holotype, 1 instar IV male; USNM 193713, 1 instar IV male.
Eurypylus chavturi: MNHN Os 80, holotype, 1 ovigerous female; MNHN Os 81, 25 specimens; USNM 193162, 10 females.
- Sta 104-DR; 8 Apr 1977; N Île du Lys, Glorioso Islands; 11°26'24"S, 47°22'18"E; 330–550 m.
Vargula arx: Paris, 1 instar IV.
Eusarsiella falx: Paris, 2 specimens.
Dantya benthedi: USNM 158579A,B, 1 adult female and 1 A-1 male, respectively. Reported in Kornicker (1983c:12).
- Sta 106-R; 9 Apr 1977; Zelee Bank, south border; 12°25'30"S, 46°16'18"E; 18–24 m.
Cypridina segrex: Paris, 1 instar IV female.
Codonocera phoenix: USNM 193758, 1 instar I; Paris, 4 instar I.
Skogsbergia plax: Paris, 1 adult male, 1 instar II, 1 instar IV or V.
Vargula sagax: MNHN Os 447, holotype, 1 instar V (sex unknown); USNM 193757, 1 instar I.
Chelicopia radix: USNM 193712, 1 instar IV male; Paris, 1 instar IV ? female.
Eurypylus chavturi: USNM 158612, 2 adult females, 2 juveniles.
Synasterope calix: MNHN Os 477, holotype, 1 instar V female; Paris, 2 instar IV males, 18 juveniles; USNM 193772, 1 instar II; USNM 193773, 1 instar II; USNM 193774, 1 instar III; USNM 193775, 1 instar IV female; USNM 193770, 1 instar I; USNM 193771, 1 instar I; USNM 193776, 1 instar IV male; USNM 193780, 1 instar V female.
Asteropterygion species indeterminate: USNM 193756, 1 instar I.
- Sta 109-R; 10 Apr 1977; S Zelee Bank, on step of outer slope; 12°25'30", 46°16'12"; 50 m.
Paradoloria vanhoeffeni: MNHN Os 436, 1 instar V female.
- Sta 110-S; 10 Apr 1977; S Zelee Bank; 12°25'30"S, 46°16'12"E; 24 m.
Cypridina segrex: USNM 193766, 1 instar IV female.
Eurypylus chavturi: MNHN Os 82, 1 adult female.
Dantya fossula: Paris, holotype, 1 adult female. Reported in Kornicker (1983c:2).
- Sta 111-S; 10 Apr 1977; S Zelee Bank; 12°25'36"S, 46°16'12"E; 24 m.
Synasterope calix: USNM 193692, 1 instar V male.
- Sta 116-S; 11 Apr 1977; Geyser Bank, southern part of lagoon; 13 m.
Harbansus thrix: USNM 193691, 1 ovigerous female.
Eurypylus chavturi: MNHN Os 83, 13 specimens including 1 instar IV male.
Synasterope calix: Paris, 7 juveniles; USNM 193777, 1 instar V male; USNM 193778, 1 instar V male.
- Sta 117-S; 11 Apr 1977; Geyser Bank, southern part of lagoon; 3–8 m.
Cypridina segrex: Paris, 1 instar IV male.
Codonocera phoenix: USNM 193761, 1 instar III female.
Eurypylus chavturi: USNM 158614, 1 adult male; USNM 158613, 1 adult female; MNHN Os 84, 1 female.
- Sta 120-DS; 12 Apr 1977; SE Glorioso Islands; 11°30'S,

47°24'42"E; 335–390 m.

Vargula arx: MNHN Os 445, holotype, 1 instar V female; USNM 193755, 1 instar V female.

Eusarsiella falx: USNM 193710, 2 adult females, 1 juvenile.

Prionotoleberis lux: Paris, 1 adult female.

Dantya benthedi: USNM 193008, 1 A-1 male, 5 juveniles. Reported in Kornicker (1983c:12).

Sta 124-S; 12 Apr 1977; Mozambique Channel, SE Glorioso Islands; 11°32'06"S, 47°23'06"E; 24 m.

Cypridina segrex: Paris, 2 juveniles; USNM 193765, 1 instar V male.

Codonocera phoenix: USNM 193763, 1 instar V male.

Skogsbergia iota: MNHN Os 438, holotype, 1 adult female; USNM 193739, 1 ovigerous female; USNM 193741, 1 adult male; USNM 193743, 4 ovigerous females; USNM 193744, 6 adult males; Paris, 209 specimens (including adult males and females and juveniles).

Skogsbergia plax: MNHN Os 440, holotype, 1 adult male; USNM 193738, 1 adult male; USNM 193740, 1 adult female; USNM 193742, 1 instar ?V female; USNM 193745, 1 instar II; Paris, 9 adult males, 1 juvenile.

Ruiderma arx: USNM 193417A,B,C, 3 instar I; USNM 193418, 3 instar II, 2 instar III; USNM 193419, 4 adult females, 4 instar IV, 2 instar III; MNHN Os 279, 6 adult females, 7 instar IV, 10 instar III.

Eurypylus chavturi: MNHN Os 87, 75 specimens.

Chelicopia radix: MNHN Os 459, holotype, 1 instar IV female; USNM 193711, 1 instar IV female; Paris, 1 instar IV female.

Heptonema latex: Paris, 1 ovigerous female.

Cylindroleberis vibex: Paris, 1 ovigerous female and 3 specimens.

Synasterope calix: Paris, 45 specimens.

Asteropterygion species indeterminate: MNHN Os 487, 1 specimen in poor condition.

Appendix 2

Number of Ommatidia in Lateral Eyes of Selected Species of Cypridinini, Cylindroleberidinae, Sarsiellidae, and Philomedidae

(Within each family, table arranged alphabetically by genus and species. Data mostly from adults,
but late juveniles indicated by *; X = lateral eyes absent; nd = no data.)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
CYPRIDININI			
<i>Codonocera phoenix</i> (5–325)‡	29	29	Kornicker (herein)
<i>Cypridina dentata</i> (5–8)	15*	16*	Kornicker (1991:29)
<i>Cypridina nex</i> (15–32)	14	13–15	Kornicker (herein)
<i>Cypridina segrex</i> (3–38)	15	nd	Kornicker (herein)
<i>Cypridina spina</i> (1–8)	15	15	Kornicker (1991:35)
<i>Cypridina spinula</i> (5–8)	17	17	Kornicker (1991:56)
<i>Cypridinodes asymmetrica</i> (0–100)	nd	15	Kornicker (1975a, table 17)
<i>Cypridinodes concentrica</i> (384)	2†	nd	Kornicker (1979b:22)
<i>Cypridinodes galathea</i> (20)	nd	15	Kornicker (1975a, table 17)
<i>Cypridinodes inermis</i> (86)	20	nd	Kornicker (1975a, table 17)
<i>Cypridinodes plax</i> (surface)	16	nd	Kornicker (1991:18)
<i>Cypridinodes poulsenii</i> (50–100)	15–20	15–20	Kornicker (1975a, table 17)
<i>Cypridinodes reticulata</i> (610)	X	nd	Kornicker (1975a, table 17)
<i>Doloria levinsoni</i> (2818)	X	5–6	Kornicker (1975a, table 17)
<i>Doloria levis</i> (6–320)	25	25	Kornicker (1975a, table 17)
<i>Doloria mawsoni</i> (69)	18	nd	Kornicker (1975a, table 17)
<i>Doloria pectinata</i> (21–434)	25	25	Kornicker (1975a, table 17)
<i>Doloria sarsi</i> (183)	20	nd	Kornicker (1987c:888)
<i>Doloria septenaria</i> (434)	27	nd	Kornicker (1975a, table 17)
<i>Hadacypridina biscayensis</i> (3250–4550)	X	nd	Kornicker (1989:27)
<i>Hadacypridina bruuni</i> (5340–6000)	X	X	Kornicker (1975a, table 17)
<i>Metavargula adinotrix</i> (1796–3775)	3–4	nd	Kornicker (1975a, table 17)
<i>Metavargula ampla</i> (1927–1997)	5	nd	Kornicker (1970b:9; 1975a, table 17)
<i>Metavargula bilix</i> (1560–2147)	5–9	4	Kornicker (1989:36, 40)
<i>Metavargula bradfordae</i> (1375)	nd	X	Kornicker (1979b:13)
<i>Metavargula hex</i> (4203–4240)	X	X	Kornicker (1989:42, 45)
<i>Metavargula iota</i> (117)	3–4	nd	Kornicker (1975a, table 17)
<i>Metavargula mazeri</i> (384)	2–3	nd	Kornicker (1979b:16)
<i>Metavargula optilus</i> (1100)‡	5	nd	Kornicker (1968:448; 1975a, table 17)
<i>Metavargula quintuplex</i> (1845–3742)	X	X	Kornicker (1989:31, 33)
<i>Paracypridina floridaensis</i> (50–91)	17	nd	Kornicker (1984b:13)
<i>Paradoloria australis</i> (1350)	nd	X	Kornicker (1975a, table 17)
<i>Paradoloria lippa</i> (1031–2210)	3–4	3–4	Kornicker (1989:17, 20)
<i>Paradoloria magna</i> (1560–2147)	3*	nd	Kornicker (1989:23)
<i>Paradoloria vanhoeffeni</i> (20–93)‡	26	nd	Kornicker (herein)
<i>Paravargula digitata</i> (1–2)	nd	31*	Kornicker (1970a:9)
<i>Paravargula nanipollex</i> (1–2)	28	nd	Kornicker (1970a:6)
<i>Paravargula trifax</i> (5)	36	nd	Kornicker (1991:6)
<i>Pterocypridina alata</i> (10–20)	nd	15–20	Kornicker (1975a, table 17)
<i>Pterocypridina dedeckeri</i> (43)	20	nd	Kornicker (1983b:9)
<i>Pterocypridina excreta</i> (60–90)	12–15	nd	Kornicker (1975a, table 17)
<i>Pterocypridina sex</i> (6–39 m)	19	nd	Kornicker (1984b:14)
<i>Rheina prex</i> (4125–4825)	X	X	Kornicker (1989:50, 53)
<i>Siphonastrea hallex</i> (?15)	25	25	Kornicker (1975a, table 17)
<i>Skogsbergia calyx</i> (26)	28	nd	Kornicker (herein)
<i>Skogsbergia iota</i> (24–250)	27	25	Kornicker (herein)
<i>Skogsbergia lernerii</i> (1–130)	27	nd	Kornicker (1984b:19)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
<i>Skogsbergia menezis</i> (1)	nd	32	Kornicker (1970a:13)
<i>Skogsbergia plax</i> (6-24)	29	28-32	Kornicker (herein)
<i>Skogsbergia squamosa</i> (40-60)	29-34	nd	Müller (1894:207); Kornicker (1974b:8)
<i>Skogsbergia strophinx</i> (5-8)	27	27-30	Kornicker (1991:12)
<i>Vargula antarctica</i> (193-650)	4	4	Kornicker (1975a, table 17)
<i>Vargula arx</i> (360-363)	X*	nd	Kornicker (herein)
<i>Vargula ascensus</i> (549)	4	nd	Kornicker (1979b:20)
<i>Vargula ?bullae</i> (27-45)	16	16	Kornicker (1984b:25)
<i>Vargula contragula</i> (4-10)	16	16	Cohen and Morin (1986:21)
<i>Vargula dentata</i> (429-1978)	X	X	Kornicker (1975a, table 17)
<i>Vargula graminicola</i> (3-5)	12	12	Cohen and Morin (1986:7, 8)
<i>Vargula hamata</i> (429-1212)	16	16	Kornicker (1975a, table 17)
<i>Vargula ignitula</i> (2-5)	16	16	Cohen and Morin (1989:331)
<i>Vargula lucidella</i> (0-2)	16	16	Cohen and Morin (1989:331)
<i>Vargula lusca</i> (912)	X	nd	Kornicker (1975a, table 17)
<i>Vargula magna</i> (160-202)	16	nd	Kornicker (1984b:34)
<i>Vargula micamacula</i> (0-4)	16	16	Cohen and Morin (1989:331)
<i>Vargula noropsela</i> (4-22)	16	16	Cohen and Morin (1989:331)
<i>Vargula norvegica</i> (150-200)§	9-10	14-16	Kornicker (1975a, table 17)
<i>Vargula psammobia</i> (2-10)	16	16	Cohen and Morin (1989:331)
<i>Vargula sagax</i> (18-24)	16* ⁱ	nd	Kornicker (herein)
<i>Vargula scintilla</i> (3-10)	16	16	Cohen and Morin (1989:331)
<i>Vargula sekiguchii</i> (520)	0	20*	Hiruta (1984:55)
<i>Vargula shulmanae</i> (6-15)	14	14	Cohen and Morin (1986:12, 13)
<i>Vargula stathme</i> (117)	4-5	nd	Kornicker (1975a, table 17)
<i>Vargula subantarctica</i> (119-611)	14-16	14-16	Kornicker (1975a, table 17)
<i>Vargula sutura</i> (3431)	X	nd	Kornicker (1975a, table 17)
<i>Vargula tsujii</i> (17-931)	19	16	Kornicker and Baker (1977:226, 230)
CYLINDROLEBERIDINAE			
<i>Archasterope bulla</i> (279)	X	X*	Kornicker (1975a, table 17)
<i>Archasterope dentata</i> (180)	8-12	nd	Kornicker (1975a, table 17)
<i>Bathyleberis californica</i> (9-401)	8	8	Baker (1979:291); Kornicker (1986b:63)
<i>Bathyleberis garthi</i> (15-401)	5-6	nd	Baker (1979:294); Kornicker (pers. obs.)
<i>Bathyleberis grossmani</i> (3431-4303)	X	nd	Kornicker (1975a, table 17)
<i>Bathyleberis hancocki</i> (9-401)	X	nd	Baker (1979:301)
<i>Bathyleberis kurilensis</i> (7-20)	X	nd	Chavtur (1978:157)
<i>Bathyleberis monothrix</i> (71-601)	X	nd	Kornicker (1975a, table 17)
<i>Bathyleberis oculata</i> (110)	18	nd	Kornicker (1975a, table 17)
<i>Bathyleberis thrix</i> (53-92)	3-5*	nd	Kornicker (1988:32)
<i>Bathyleberis toxotes</i> (50-58)	6	nd	Kornicker (1986b:67)
<i>Bathyleberis yamadai</i> (3-5)	16	16	Hiruta (1979b:103, 109)
<i>Cylindroleberis bacescui</i> (30-52)	9	18	Kornicker and Carion (1974:34, 36)
<i>Cylindroleberis variabilis</i> (1-2)	19	19	Kornicker (1970a:19; 1991:111)
<i>Cylindroleberis vibex</i> (15-20)	19	nd	Kornicker (herein)
<i>Cylindroleberis vix</i> (15-20)	17	nd	Kornicker (herein)
<i>Diasterope grisea</i> (11)	18	22	Kornicker (1975a, table 17)
<i>Diasterope schmitti</i> (28-266)	8	9*	Kornicker (1975a, table 17)
<i>Empoulsenia antarctica</i> (230)	3	nd	Kornicker (1975a, table 17)
<i>Empoulsenia monothrix</i> (101)	0	nd	Kornicker (1988:27)
<i>Empoulsenia pentathrix</i> (40-1212)	3	nd	Kornicker (1975a, table 17)
<i>Empoulsenia quinquesetae</i> (237-281)	9-10	nd	Kornicker (1975a, table 17)
<i>Empoulsenia weddellensis</i> (650)	3	nd	Kornicker (1975a, table 17)
<i>Heptonema homelix</i> (5)	18	nd	Kornicker (1991:118)
<i>Heptonema latex</i> (32)	16	21	Kornicker (herein)
<i>Heptonema latum</i> (110-239)	3-4	4	Kornicker (1986b:59, 61)
<i>Homasterope maccaini</i> (6-24)	20	20	Kornicker (1975a, table 17)
<i>Homasterope micra</i> (110)	10-11	nd	Kornicker (1975a, table 17)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
<i>Monasterope bex</i> (3-7)	16	nd	Kornicker (1991:125)
<i>Parasterope alpha</i> (560)	12-13	nd	Kornicker and Caraion (1974:14)
<i>Parasterope anomata</i> (426-572)	X	nd	Kornicker (1975a, table 17)
<i>Parasterope antyx</i> (1560)	X	X*	Kornicker (1989:100, 101)
<i>Parasterope barnesi</i> (6-401)	17-18	22	Baker (1978:144, 145)
<i>Parasterope corrugata</i> (18)	nd	20	Kornicker (1975a, table 17)
<i>Parasterope crinita</i> (51)	16	nd	Kornicker (1975a, table 17)
<i>Parasterope hulingsi</i> (4-401)	15	22	Kornicker (1986b:44, 47)
<i>Parasterope jenseni</i> (180-500)	10	nd	Kornicker (1975a, table 17)
<i>Parasterope longiseta</i> (71-108)	16	nd	Kornicker (1975a, table 17)
<i>Parasterope longungues</i> (900)	X	nd	Kornicker (1975a, table 17)
<i>Parasterope mauritania</i> (52-96)	12-13	20*	Kornicker and Caraion (1974:18, 21)
<i>Parasterope mckenziei</i> (1)	18	nd	Kornicker (1975a, table 17)
<i>Parasterope micromnata</i> (93-118)	3	nd	Kornicker (1975a, table 17)
<i>Parasterope muelleri</i> (1-175)	17-18	19-20	Kornicker and Caraion (1974:11); Kornicker (1981c:11; 1986b:28)
<i>Parasterope nana</i> (18)	10-12	18	Kornicker (1975a, table 17)
<i>Parasterope ohlani</i> (22-369)	9-11	nd	Kornicker (1975a, table 17)
<i>Parasterope pectinata</i> (100)	10-12	nd	Kornicker (1975a, table 17)
<i>Parasterope pollex</i> (1-34)	5-6	16-17	Bowman and Kornicker 1967:15; Kornicker (1986b:36, 37)
<i>Parasterope proluxa</i> (20-40)	16	nd	Kornicker (1975a, table 17)
<i>Parasterope pseudoquadrata</i> (28-266)	9	20	Kornicker (1975a, table 17)
<i>Parasterope quadrata</i> (11)	17*	17*	Kornicker (1975a, table 17)
<i>Parasterope sohni</i> (480-534)	0	0*	Kornicker and Caraion (1974:17)
<i>Parasterope styx</i> (3250-4303)	X	X	Kornicker (1975a, table 17; 1989:93, 97)
<i>Parasterope thrix</i> (270)	17	nd	Kornicker and Caraion (1974:23)
<i>Parasterope zamboangae</i> (1-2)	19	nd	Kornicker (1975a, table 17)
<i>Parasterope zeta</i> (58)	15	19	Kornicker (1986b:51, 53)
<i>Polyleberis mackenziei</i> (20-480)	18	nd	Kornicker and Caraion (1974:45)
<i>Postasterope messingi</i> (2-4)	20	nd	Kornicker (1986b:105)
<i>Prionotoleberis gyion</i> (55)	19*	19*	Kornicker (1974b:48)
<i>Prionotoleberis lux</i> (300-350)	X	nd	Kornicker (herein)
<i>Prionotoleberis pax</i> (96-338)	18	nd	Kornicker and Caraion (1974:41)
<i>Prionotoleberis rex</i> (1845-1913)	X	nd	Kornicker (1989:122)
<i>Prionotoleberis salomani</i> (2-13)	10	20	Kornicker (1986b:93, 96)
<i>Skogsbergiella macrothrix</i> (70-1173)	2-6	3-6	Kornicker (1975a, table 17)
<i>Skogsbergiella pax</i> (1475)	X	nd	Kornicker (1975a, table 17)
<i>Skogsbergiella plocus</i> (112)	19	19	Kornicker (1975a, table 17)
<i>Skogsbergiella scottii</i> (6-300)	23	nd	Kornicker (1975a, table 17)
<i>Skogsbergiella skogsbergi</i> (274)	18	nd	Kornicker (1975a, table 17)
<i>Skogsbergiella spinifera</i> (60-663)	5-6	nd	Kornicker (1975a, table 17)
<i>Synasterope arnaudi</i> (50)	X	X*	Kornicker (1975a, table 17)
<i>Synasterope bassana</i> (180)	10-12	nd	Kornicker (1975a, table 17)
<i>Synasterope bathyalis</i> (650)	nd	X	Chavtur (1983:84)
<i>Synasterope bensoni</i> (14-270)	7-12	20	Kornicker and Caraion (1974:28, 29)
<i>Synasterope brachythrix</i> (78-425)	X	nd	Kornicker (1975a, table 17)
<i>Synasterope calix</i> (18-24)	17	19-21	Kornicker (herein)
<i>Synasterope cushmani</i> (11-36)	X	X	Kornicker (1974a:17, 18)
<i>Synasterope dimorpha</i> (112-2563)	X	X	Kornicker (1975a, table 17)
<i>Synasterope duplex</i> (378)	X	nd	Kornicker (1975a, table 17)
<i>Synasterope empulseni</i> (12-110)	15	nd	Kornicker (1975a, table 17)
<i>Synasterope helix</i> (2165-2430)	X	nd	Kornicker (1989:113)
<i>Synasterope hirpex</i> (4125-4715)	X	X	Kornicker (1989:106, 111)
<i>Synasterope index</i> (2906)	nd	X*	Kornicker (1989:118)
<i>Synasterope mystax</i> (2747-4006)	X	X	Kornicker (1975a, table 17)
<i>Synasterope phalanx</i> (2147)	nd	X	Kornicker (1989:105)
<i>Synasterope polythrix</i> (4008)	X	nd	Kornicker (1975a, table 17)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
<i>Synasterope quadrisetosa</i> (1)	nd	15	Kornicker (1975a, table 17)
<i>Synasterope serrata</i> (50)	15	nd	Kornicker (1975a, table 17)
<i>Synasterope williamsae</i> (55)	X	nd	Kornicker (1986b:84)
SARSIELLIDAE			
<i>Adelta theta</i> (15)	4	nd	Kornicker (1975a, table 17)
<i>Ancohenia hawaiiensis</i> (1)	4-5	7-9	Kornicker (1976a:11, 15)
<i>Ancohenia robusta</i> (3-8)	4*	8-9	Kornicker (1991:85)
<i>Anscottiella tumidicosta</i> (2)	3	nd	Hall (1987:762)
<i>Anscottiella vertex</i> (1-8)	4	10-12	Kornicker (1991:98)
<i>Chelicopa arostrata</i> (1-4)	5	nd	Kornicker (1986a:33)
<i>Chelicopia lorica</i> (18)	2-3	nd	Hall (1985:509)
<i>Chelicopia obex</i> (26)	nd	10*	Kornicker (herein)
<i>Chelicopia radix</i> (18-24)	5*	5*	Kornicker (herein)
<i>Chelicopia tasmanensis</i> (650)‡	3*	nd	Kornicker (1981b:388)
<i>Cymbicopia brevicosta</i> (10)	2	nd	Kornicker (1975a, table 17)
<i>Cymbicopia hanseni</i> (10)	2	2	Kornicker (1975a, table 17)
<i>Dantya benthedi</i> (250-440)	4	nd	Kornicker (1983c:16)
<i>Dantya ferox</i> (2)	5	nd	Kornicker and Iliffe (1989c:902)
<i>Dantya fossula</i> (24)	5	nd	Kornicker (1983c:7)
<i>Dantya magnifica</i> (9)	4-5*	nd	Kornicker and Cohen (1978:499)
<i>Dantya piercei</i> (65)‡	5	nd	Kornicker (1983c:11)
<i>Ewrypylus chavturi</i> (3-33)	5	8	Kornicker (herein)
<i>Ewrypylus pulcher</i> (18)	4-5	nd	Hall (1985:505)
<i>Ewrypylus rousei</i> (11-29)	5	nd	Kornicker (1986a:38)
<i>Eusarsiella absens</i> (1)§	5	9-10	Kornicker (1981c:5); Kornicker and Iliffe (1989b:32)
<i>Eusarsiella africana</i> (560-1120)	X	5	Kornicker and Caraion (1978:26, 30)
<i>Eusarsiella alata</i> (5)	5*	nd	Kornicker (1975a, table 17)
<i>Eusarsiella armata</i> (9-18)	4	4	Kornicker (1975a, table 17)
<i>Eusarsiella asciformis</i> (1)	5	nd	Hall (1987:759)
<i>Eusarsiella athrix</i> (2)	5	nd	Kornicker (1986a:168)
<i>Eusarsiella augusta</i> (41)	5	nd	Kornicker (1975a, table 17)
<i>Eusarsiella bakeri</i> (52-91)	8	nd	Kornicker (1986a:154)
<i>Eusarsiella capillariss</i> (1-23)	nd	5	Kornicker (1986a:58)
<i>Eusarsiella chessi</i> (3-7)	nd	7	Kornicker (1991:92)
<i>Eusarsiella childi</i> (1-13)	3	nd	Kornicker (1986a:139)
<i>Eusarsiella claviformis</i> (1)	3-4	nd	Hall (1987:743)
<i>Eusarsiella cornuta</i> (5)	4-6	nd	Kornicker (1975a, table 17)
<i>Eusarsiella costata</i> (1-5)	5	7-11	Kornicker (1986a:64, 67)
<i>Eusarsiella cresseyi</i> (1-3)	5	5-6	Kornicker (1986a:145, 147)
<i>Eusarsiella culteri</i> (56-88)	4	nd	Kornicker (1986a:171)
<i>Eusarsiella dentifera</i> (35-40)	4	nd	Kornicker (1975a, table 17)
<i>Eusarsiella dispar</i> (58)	5	nd	Kornicker (1986a:123)
<i>Eusarsiella disparalis</i> (1-88)	5-6	4	Kornicker (1975a, table 17; 1986a:89, 90)
<i>Eusarsiella donabboti</i> (1.5-25)	nd	7	Cohen (1989:309)
<i>Eusarsiella dornellasae</i> (52-96)	4	9	Kornicker and Caraion (1978:35, 38)
<i>Eusarsiella elofsoni</i> (53-82)	5	nd	Kornicker (1986a:150)
<i>Eusarsiella falx</i> (250)	4-5	nd	Kornicker (herein)
<i>Eusarsiella georgiana</i> (81)	nd	10	Kornicker (1975a, table 17)
<i>Eusarsiella gettlesoni</i> (53)	4	8	Kornicker (1986a:131, 132)
<i>Eusarsiella gigacantha</i> (1-25)	nd	10	Kornicker (1986a:70)
<i>Eusarsiella gomoii</i> (170-270)	4	4	Kornicker and Caraion (1978:40, 43)
<i>Eusarsiella greyi</i> (25-52)	5	nd	Kornicker (1975a, table 17; 1986a:85, 88)
<i>Eusarsiella gutata</i> (1-17)	4	4	Kornicker (1975a, table 17)
<i>Eusarsiella janiceae</i> (1)	5	nd	Kornicker (1976a:6)
<i>Eusarsiella longipenna</i> (18)	3*	nd	Kornicker (1975a, table 17)
<i>Eusarsiella lunata</i> (179)	6	6	Kornicker (1975a, table 17)
<i>Eusarsiella magna</i> (70-100)	4	nd	Kornicker (1975a, table 17)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
<i>Eusarsiella maura</i> (1)	5	nd	Kornicker (1977:684)
<i>Eusarsiella nana</i> (10-20)	4-6	nd	Kornicker (1975a, table 17)
<i>Eusarsiella neapolis</i> (82-534)	4	nd	Kornicker and Caraion (1978:19)
<i>Eusarsiella nodimarginis</i> (30-114)	5	nd	Kornicker (1975a, table 17; 1986a:97, 101)
<i>Eusarsiella ocula</i> (270)	4	7	Kornicker and Caraion (1978:33, 34)
<i>Eusarsiella ovalis</i> (50)	4-5	4-5	Kornicker (1975a, table 17)
<i>Eusarsiella ozotothrix</i> (1-44)	4-5	nd	Kornicker and Bowen (1976:501); Kornicker, (1986a:120)
<i>Eusarsiella paniculata</i> (23-59)	5	nd	Kornicker (1986a:61)
<i>Eusarsiella pūipollicis</i> (40-114)	4-5	nd	Kornicker (1975a, table 17; 1986a:101, 104)
<i>Eusarsiella radiicosta</i> (14-134)	4-6	12	Kornicker (1975a, table 17; 1986a:104, 109, 113, 115)
<i>Eusarsiella rudescui</i> (534)	X	nd	Kornicker and Caraion (1978:47)
<i>Eusarsiella rugosa</i> (9)	nd	6	Kornicker (1975a, table 17)
<i>Eusarsiella serrata</i> (5)	6	nd	Hall (1987:746)
<i>Eusarsiella spicata</i> (50)	5-6	nd	Kornicker (1975a, table 17)
<i>Eusarsiella spinosa</i> (1-58)	3	7-8	Kornicker (1986a:75, 76)
<i>Eusarsiella springthorpei</i> (3)	5	nd	Hall (1987:754)
<i>Eusarsiella styx</i> (12-23)	5	7-8	Kornicker and Iliffe (1989b:36, 39)
<i>Eusarsiella texana</i> (1-40)	3	4-5	Kornicker (1986a:83, 84)
<i>Eusarsiella thominx</i> (12-119)	5	nd	Kornicker (1987a:139)
<i>Eusarsiella tubipora</i> (33-39)	5	nd	Kornicker (1975a, table 17; 1986a:123, 127)
<i>Eusarsiella uncus</i> (2-20)	5	nd	Kornicker (1986a:136)
<i>Eusarsiella vema</i> (42)	5	nd	Kornicker (1986a:158)
<i>Eusarsiella zostericola</i> (1-45)	6-7	6	Kornicker (1975a, table 17)
<i>Junctichela margalefi</i> (25-39)	4	4	Kornicker and Caraion, (1978:50, 52)
<i>Metasarsiella benthedi</i> (100)‡	4-5	nd	Kornicker (herein)
<i>Metasarsiella vibex</i> (3-7)	5	8*	Kornicker (1991:105)
<i>Nealella monothrix</i> (24)	4	12	Kornicker and Caraion (1980:8, 11)
<i>Nealella muelleri</i> (75)§	5	nd	Kornicker and Caraion (1980:15); Kornicker (1983c:17)
<i>Neomuelleriella hispida</i> (10)	2	2	Kornicker (1975a, table 17)
<i>Neomuelleriella mayottensis</i> (32)	nd	4	Kornicker (herein)
<i>Neomuelleriella zealandica</i> (10)	4	nd	Kornicker (1975a, table 17)
<i>Sarsiella anommata</i> (534)	X	nd	Kornicker and Caraion (1978:22)
<i>Sarsiella capsula</i> (52-270)	4	4	Kornicker and Caraion (1978:11, 13)
<i>Sarsiella maculata</i> (9-27)	5-6	5-6	Kornicker (1975a, table 17)
<i>Sarsiella multispinosa</i> (7-18)	4-5	4-5	Kornicker (1975a, table 17)
<i>Sarsiella parvispinosa</i> (10-20)	5	5	Kornicker (1975a, table 17)
<i>Sarsiella verae</i> (78-18)	3-5	4-6	Kornicker (1975a, table 17)
<i>Spinacopia antarctica</i> (216)‡	X	X*	Kornicker (1970b:20)
<i>Spinacopia bisetula</i> (1622)	X	nd	Kornicker (1969:21)
<i>Spinacopia mastix</i> (3035)	X	X	Kornicker (1975a, table 17)
<i>Spinacopia menziesi</i> (2818-3500)	X	nd	Kornicker (1969:9; 1975a:585)
<i>Spinacopia octo</i> (3495-4758)	X	X*	Kornicker (1970b:24; 1975a:598)
<i>Spinacopia sandersi</i> (1144)‡	X	X	Kornicker (1969:23)
<i>Spinacopia torus</i> (4179)‡	X	nd	Kornicker (1970b:26)
<i>Spinacopia variabilis</i> (135-1475)	X	X*	Kornicker (1969:13; 1975a:592)
PHILOMEDIDAE			
<i>Anarthron chilensis</i> (100-112)	2	18	Kornicker (1975a, table 17)
<i>Anarthron dührx</i> (71-1173)	2	18	Kornicker (1975a, table 17)
<i>Anarthron evexum</i> (79-284)	2	nd	Kornicker (1975a, table 17)
<i>Anarthron pholion</i> (82-284)	2	nd	Kornicker (1975a, table 17)
<i>Anarthron reticulata</i> (139-260)	2-3	20	Kornicker (1975a, table 17)
<i>Angulorostrum costatum</i> (210-218)	X	nd	Kornicker (1981e:13)
<i>Angulorostrum monothrix</i> (975)‡	X	X	Kornicker (1981e:7, 10)
<i>Angulorostrum segonzaci</i> (700-800)	X	nd	Kornicker (1981e:17)
<i>Euphilomedes agilis</i> (0-3)	nd	9*	Kornicker (1975a, table 17)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
<i>Euphilomedes asper</i> (30-187)	3-4	13-16	Kornicker (1975a, table 17); Kornicker and Caraion (1977:23)
<i>Euphilomedes carcharodonta</i> (6-7)	X	nd	Kornicker (1975a, table 17)
<i>Euphilomedes ferox</i> (70-100)	X	nd	Kornicker (1975a, table 17)
<i>Euphilomedes longiseta</i> (1-90)	X	20	Kornicker (1975a, table 17)
<i>Euphilomedes nodosa</i> (2)	X	20	Kornicker (1975a, table 17)
<i>Euphilomedes producta</i> (20)	X	nd	Kornicker (1975a, table 17)
<i>Euphilomedes sinister pentathrix</i> (250)	1	nd	Kornicker and Caraion (1977:27)
<i>Euphilomedes smithi</i> (9)	X	nd	Kornicker (1975a, table 17)
<i>Harbansus barnardi</i> (2)	3	9*	Kornicker (1978:48)
<i>Harbansus bowenae</i> (42-196)	X	X	Kornicker (1978:43; 1984a:76)
<i>Harbansus bradmyersi</i> (11-27)	5-6	13	Kornicker (1978:27; 1979a:1007)
<i>Harbansus dayi</i> (136-196)	X	5	Kornicker (1978:36, 38; 1984a:76; herein)
<i>Harbansus ferox</i> (450)	X	nd	Kornicker (herein)
<i>Harbansus magnus</i> (460)	X*	nd	Kornicker (1984a:73)
<i>Harbansus mayeri</i> (8)	4	nd	Kornicker (1978:31)
<i>Harbansus paucichelatus</i> (1-135)	5	12	Kornicker (1978:21, 23; 1984a:60)
<i>Harbansus rhabdion</i> (991-1015)	X	nd	Kornicker (1970b:36)
<i>Harbansus schornikovii</i> (260)	0?*	0?*	Kornicker and Caraion (1977:31, 32)
<i>Harbansus slatteryi</i> (2-12)	2	7	Kornicker (1983a:184, 188)
<i>Harbansus thrix</i> (13-20)	5	nd	Kornicker (herein)
<i>Harbansus vix</i> (3-7)	5	nd	Kornicker (1991:74)
<i>Igene bryx</i> (3716)	X	nd	Kornicker (herein)
<i>Igene walleni</i> (3702-4303)	X	X*	Kornicker (1975a, table 17)
<i>Paramekodon poulsenii</i> (1100)	X	nd	Kornicker (1968:469)
<i>Philomedes albatross</i> (18-448)	5	nd	Kornicker (1982:23)
<i>Philomedes assimilis</i> (9-876)	2	nd	Kornicker (1975a, table 17)
<i>Philomedes brenda</i> (1-1926)	0*	20	Kornicker (1982:11, 13; 1988:1)
<i>Philomedes charcoti</i> (14-92)	2	20	Kornicker (1975a, table 17)
<i>Philomedes cubitum</i> (21-28)	2	2*	Kornicker (1975a, table 17)
<i>Philomedes curvata</i> (-900)	X	nd	Kornicker (1975a, table 17)
<i>Philomedes duplex</i> (49-134)	2	13	Kornicker (1984a:19, 23)
<i>Philomedes eugeniae</i> (20-270)	2	nd	Kornicker (1975a, table 17)
<i>Philomedes heptathrix</i> (250-270)	2-3	23	Kornicker (1975a, table 17)
<i>Philomedes keslingi</i> (123)	4†	nd	Kornicker (1984a:26)
<i>Philomedes lilleborgii</i> (50-2147)	0?	27	Kornicker (1989:69, 74)
<i>Philomedes lofthousae</i> (25-130)	2-3	nd	Kornicker (1975a, table 17)
<i>Philomedes minys</i> (31-108)	2-3	nd	Kornicker (1975a, table 17)
<i>Philomedes orbicularis</i> (15-405)	1-3	20	Kornicker (1975a, table 17)
<i>Philomedes pentathrix</i> (1560-3480)	0?	20	Kornicker (1989:78, 80)
<i>Philomedes ramus</i> (3219)	2†	nd	Kornicker (1975a, table 17)
<i>Philomedes rotunda</i> (69-237)	2	15*	Kornicker (1975a, table 17)
<i>Philomedes subantarctica</i> (129-572)	3	42	Kornicker (1975a, table 17)
<i>Philomedes tetradens</i> (173-480)	X	nd	Kornicker and Caraion (1977:19)
<i>Philomedes tetrathrix</i> (566-3382)	2-3	20	Kornicker (1975a, table 17)
<i>Pleoschmisma moroides</i> (1)	4	13	Kornicker (1981d:9, 10)
<i>Pseudophilomedes ambon</i> (49-110)	0-3	20	Kornicker (1984a:41, 46)
<i>Pseudophilomedes angulatus</i> (257-534)‡	0?	2	Kornicker and Caraion (1977:51, 54)
<i>Pseudophilomedes darbyi</i> (11-190)	3	nd	Kornicker (1984a:34); Kornicker and Bliffe (1989b:9)
<i>Pseudophilomedes polyancistrus</i> (15-147)	3	11	Kornicker (1984a:50, 53)
<i>Pseudophilomedes tetrathrix</i> (150-187)	4-6	12*	Kornicker and Caraion (1977:67)
<i>Pseudophilomedes thalassa</i> (257-270)	3-5	19	Kornicker and Caraion (1977:59, 63)
<i>Pseudophilomedes zeta</i> (14)	3	nd	Kornicker (1984a:57)
<i>Scleroconcha appelloefi</i> (75-250)	2-4	nd	Kornicker (1975a, table 17)
<i>Scleroconcha arcuata</i> (6-146)	2-3	23	Kornicker (1975a, table 17)
<i>Scleroconcha flexilis</i> (6-26)	2	nd	Kornicker (1975a, table 17)
<i>Scleroconcha folinii</i> (20-932)	2	nd	Kornicker and Caraion (1977:46)
<i>Scleroconcha frons</i> (957-1226)	nd	0-4*†	Kornicker (1975a, table 17)

Taxon (depth range m)	Number of ommatidia		Reference
	♀	♂	
<i>Scleroconcha gallardoi</i> (33-1180)	2	12*	Kornicker (1975a, table 17)
<i>Scleroconcha ruffi</i> (35-189)	2	19	Kornicker (1988:21, 22)
<i>Tetragonodon ctenorynchus</i> (636-2995)	X	X	Kornicker and Caraion (1977:35, 40)
<i>Tetragonodon currax</i> (1480)	X	nd	Kornicker (herein)
<i>Tetragonodon pellax</i> (1980-2006)	X	X	Kornicker (1989:88, 89)
<i>Tetragonodon rhamnoides</i> (1100)	X	nd	Kornicker (1968:460)
<i>Zeugophilomedes arostratus</i> (0-1)	X	19	Kornicker (1975a, table 17)
<i>Zeugophilomedes multichelatus</i> (1)	X	17	Kornicker (1975a, table 17)
<i>Zeugophilomedes oblongus</i> (20-91)	X	nd	Kornicker (1975a, table 17)
<i>Zeugophilomedes polae</i> (1)	X	19	Kornicker (1975a, table 17)

† Ommatidia poorly defined.

‡ When depth varied during sampling, average depth used here.

§ Range probably incomplete.

! Sex unknown.

Appendix 3

Number of Bristles on the Ninth Joint of the Exopodite of the Second Antenna of Selected Species of the Cypridinidae

(- = no data).

Species	Growth stage						Source
	I	II	III	IV	V	Adult	
AZYGOCYPRIDININAE							
<i>Azygocypridina imperator</i>	-	-	-	-	-	7	Kornicker (1970b:19)
<i>Azygocypridina imperialis</i>	2	3	4	5	6	7	Athersuch (1980:157), Kornicker (1989:55)
<i>Azygocypridina lowryi</i>	-	-	-	-	-	7	Kornicker (1985b:700)
<i>Azygocypridina ohtai</i>	-	-	-	-	-	7	Hiruta (1981a:53)
<i>Azygocypridina rudjakovi</i>	-	-	-	-	-	7	Kornicker (1970b:11)
<i>Azygocypridina tanseimaruae</i>	-	-	-	-	-	7	Hiruta (1981b:29)
<i>Isocypridina quatuorsetae</i>	-	-	-	-	-	8	Kornicker (1975a:211)
CYPRIDININAE							
CYPRIDININI							
<i>Amphisiphonostira naviformis</i>	-	-	-	-	-	4	Poulsen (1962:251)
<i>Bathyvargula parvispinosa</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Bathyvargula walfordi</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Codonocera cruenta</i>	-	-	-	-	-	4	Poulsen (1962:308)
<i>Codonocera cuspidata</i>	-	-	-	4	4	4	Kornicker (1986d:124)
<i>Codonocera elongata</i>	-	-	-	-	-	4	Poulsen (1962:308)
<i>Codonocera goniacantha</i>	-	-	-	-	-	4	Poulsen (1962:314)
<i>Codonocera mortenseni</i>	-	-	-	-	-	4	Poulsen (1962:308)
<i>Codonocera phoenix</i>	2	-	3	4	4	4	Herein
<i>Codonocera polygonia</i>	-	-	-	-	-	4	Poulsen (1962, fig. 143e)
<i>Codonocera stellifera</i>	-	-	-	-	-	4	Poulsen (1962:308)
<i>Codonocera suenisoni</i>	-	-	-	-	-	4	Poulsen (1962, fig. 144e)
<i>Codonocera weberi</i>	-	-	-	-	-	4	Poulsen (1962:308)
<i>Codonocera species A</i>	2	-	-	-	-	-	Kornicker (1991:24)
<i>Cypridina acuminata</i>	-	-	-	-	-	3	Poulsen (1962, table 24)
<i>Cypridina americana</i>	-	-	-	-	-	3	Kornicker (1987b:176)
<i>Cypridina dentata</i>	-	-	-	-	-	3	Poulsen (1962, table 24)
<i>Cypridina multipilosa</i>	-	-	-	-	-	3	Poulsen (1962, table 24)
<i>Cypridina nana</i>	-	-	-	-	-	3	Poulsen (1962:269)
<i>Cypridina nex</i>	-	-	-	-	3	3	Herein
<i>Cypridina segrex</i>	-	-	3	3	3	3	Herein
<i>Cypridina serrata affirmans</i>	-	-	-	-	-	3	Skogsberg (1920:320)
<i>Cypridina sinuosa</i>	-	-	-	-	-	3	Poulsen (1962, table 24)
<i>Cypridina spina</i>	-	3	3	3	3	3	Kornicker (1991:35)
<i>Cypridina spinula</i>	-	3	3	3	3	3	Kornicker (1991:56)
<i>Cypridinodes asymmetrica</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Cypridinodes concentrica</i>	-	-	-	-	-	4	Kornicker (1979b:21)
<i>Cypridinodes favus</i>	2*	-	-	-	-	4	Poulsen (1962:286, table 24)
<i>Cypridinodes galathea</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Cypridinodes inermis</i>	-	-	-	-	-	4	Poulsen (1962:292)
<i>Cypridinodes minuta</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Cypridinodes plax</i>	-	-	-	-	-	4	Kornicker (1991:18)
<i>Cypridinodes reticulata</i>	-	-	-	-	-	4	Poulsen (1962:287)
<i>Cypridinodes sp.</i>	-	-	-	4	-	-	Kornicker (1970b:15)
<i>Doloria isaacsi</i>	-	-	-	-	-	4	Kornicker (1975a:121)
<i>Doloria levinsoni</i>	-	-	-	-	-	4	Kornicker (1975a:110)
<i>Doloria levis</i>	-	-	-	-	-	4	Skogsberg (1920:227)
<i>Doloria mawsoni</i>	-	-	-	-	-	4	Kornicker (1975a:122)

Species	Growth stage					Adult	Source
	I	II	III	IV	V		
<i>Doloria pectinata</i>	-	-	-	-	-	4	Skogsberg (1920:238)
<i>Doloria sarsi</i>	-	-	-	-	-	4	Kornicker (1987c:885)
<i>Doloria septenaria</i>	-	-	-	-	-	7	Kornicker (1975a:115)
<i>Hadacypridina biscayensis</i>	-	-	3	-	-	4	Kornicker (1989:24)
<i>Hadacypridina bruuni</i>	-	-	-	-	-	4	Poulsen (1962:231)
<i>Macrocypridina castanea</i>	-	-	3	4	-	4	Skogsberg (1920:286), Poulsen (1962:131, 132)
<i>Macrocypridina rotunda</i>	-	-	-	-	-	4	Poulsen (1962:143)
<i>Melavargula japonica</i>	-	-	-	-	-	2	Poulsen (1962:226)
<i>Melavargula nana</i>	-	-	-	-	-	2	Poulsen (1962, table 24)
<i>Melavargula adinothrix</i>	-	-	-	-	-	4	Kornicker (1975a:134)
<i>Melavargula ampla</i>	-	-	-	-	-	4	Kornicker (1970b:8)
<i>Melavargula bilix</i>	-	-	-	-	-	4	Kornicker (1989:35)
<i>Melavargula bradfordae</i>	-	-	-	-	-	4	Kornicker (1979b:12)
<i>Melavargula hex</i>	-	-	-	-	-	4	Kornicker (1989:40)
<i>Melavargula iota</i>	-	-	-	-	-	4	Kornicker (1975a:138)
<i>Melavargula optilus</i>	-	-	-	-	-	4	Kornicker (1968:445)
<i>Melavargula quintuplex</i>	-	-	-	-	-	4	Kornicker (1989:29)
<i>Monopia flaveola</i>	-	-	-	-	-	4	Poulsen (1962:275)
<i>Paracypridina aberrata</i>	-	-	-	-	-	3†	Poulsen (1962:247)
<i>Paracypridina floridaensis</i>	-	-	-	-	-	3	Kornicker (1984b:11)
<i>Paradoloria angulata</i>	-	-	3	-	-	-	Poulsen (1962:157)
<i>Paradoloria australis</i>	-	-	-	-	-	4	Poulsen (1962:155)
<i>Paradoloria dorsoserrata</i>	-	-	-	-	-	4	Poulsen (1962:150)
<i>Paradoloria lippa</i>	-	-	-	-	-	4	Kornicker (1989:14)
<i>Paradoloria nuda</i>	-	-	-	-	-	4	Poulsen (1962:152)
<i>Paradoloria pellucida</i>	-	-	-	-	-	4	Hanai (1974:120)
<i>Paradoloria vanhoeffeni</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Paravargula digitata</i>	-	-	-	-	4	-	Kornicker (1970a:9)
<i>Paravargula ensifera</i>	-	-	-	-	-	4	Poulsen (1962:211)
<i>Paravargula hirsuta</i>	-	-	-	-	-	4	Poulsen (1962:206)
<i>Paravargula nanipollex</i>	-	-	-	-	-	4	Kornicker (1970a:6)
<i>Paravargula trifax</i>	-	-	-	-	-	4	Kornicker (1991:6)
<i>Pterocypridina alata</i>	-	-	-	-	-	2	Poulsen (1962:237)
<i>Pterocypridina birostrata</i>	-	-	-	-	-	4	Poulsen (1962:243)
<i>Pterocypridina dedeckeri</i>	-	-	-	-	-	3	Kornicker (1983b:6)
<i>Pterocypridina excreta</i>	-	-	-	-	-	4	Poulsen (1962, table 24)
<i>Pterocypridina sex</i>	-	-	-	-	-	3	Kornicker (1983b:13)
<i>Rheina prex</i>	-	-	-	-	-	4	Kornicker (1989:46)
<i>Rugosidoloria serrata</i>	-	-	-	-	-	4	Kornicker (1975a:201)
<i>Sheina orri</i>	-	-	-	-	-	4	Kornicker (1986c:640)
<i>Siphonostra hallex</i>	-	-	-	-	-	3	Kornicker (1975a:146, 153)
<i>Siphonostra spinifera</i>	-	-	-	-	-	3	Skogsberg (1920:305)
<i>Skogsbergia calyx</i>	-	-	-	-	-	4	Herein
<i>Skogsbergia costai</i>	-	-	-	-	-	4	Kornicker (1974b:11)
<i>Skogsbergia curvata</i>	-	-	-	-	-	4	Poulsen (1962:169)
<i>Skogsbergia galapagensis</i>	2	3	3	3	4	4	Kornicker and Iliffe (1989a, table 5)
<i>Skogsbergia iota</i>	-	-	-	-	-	4	Herein
<i>Skogsbergia lernerii</i>	2	3	3	3	4	4‡	Poulsen (1962, table 24), Cohen (1983, table 1), Kornicker (1984b:18)
<i>Skogsbergia menezii</i>	-	-	-	-	-	4	Kornicker (1970a:11)
<i>Skogsbergia minuta</i>	-	-	-	-	-	3	Poulsen (1962:166)
<i>Skogsbergia plax</i>	-	3	-	-	4	4	Herein
<i>Skogsbergia squamosa</i>	-	-	-	-	-	4	Kornicker (1974b:6)
<i>Skogsbergia strophinx</i>	-	-	-	-	-	4	Kornicker (1991:12)
<i>Vargula arx</i>	-	-	-	3	3	-	Herein
<i>Vargula ascensus</i>	-	-	-	-	-	4	Kornicker (1979b:17)
<i>Vargula bullae</i>	-	-	-	-	-	4	Poulsen (1962:184)
<i>Vargula contragula</i>	-	-	-	-	-	4	Cohen and Morin (1986:19)
<i>Vargula? danae</i>	-	-	-	-	-	4	Kornicker (1975a:183)

Species	Growth stage						Source
	I	II	III	IV	V	Adult	
<i>Vargula dentata</i>	-	-	-	-	-	4	Kornicker (1975a:185)
<i>Vargula graminicola</i>	-	-	-	-	-	4	Cohen and Morin (1986:6)
<i>Vargula hamata</i>	-	-	-	-	-	4	Kornicker (1975a:158)
<i>Vargula harveyi</i>	-	-	-	-	-	4	Kornicker and King (1965, fig. 13)
<i>Vargula hilgendorffii</i>	2	3	-	-	-	4	Hiruta (1980:147-151)
<i>Vargula ignitula</i>	-	-	-	-	-	4	Cohen and Morin (1989:321)
<i>Vargula kuna</i>	-	-	-	-	-	4	Morin and Cohen (1988:634)
<i>Vargula lucidella</i>	-	-	-	-	-	4	Cohen and Morin (1989:321)
<i>Vargula lusca</i>	-	-	-	-	-	4	Kornicker (1975a:190)
<i>Vargula magna</i>	-	-	-	-	-	4	Kornicker (1984b:33)
<i>Vargula megalops</i>	-	-	-	-	-	4	Skogsberg (1920:270)
<i>Vargula micamacula</i>	-	-	-	-	-	4	Cohen and Morin (1989:321)
<i>Vargula mizonomma</i>	-	-	-	-	-	4	Morin and Cohen (1988:634)
<i>Vargula noropsela</i>	-	-	-	-	-	4	Cohen and Morin (1989:321)
<i>Vargula norvegica</i>	-	-	-	-	-	4	Skogsberg (1920:251)
<i>Vargula plicata</i>	-	-	-	-	-	4	Poulsen (1962:191)
<i>Vargula psammobia</i>	-	-	-	-	-	4	Cohen and Morin (1989:321)
<i>Vargula pupis</i>	-	-	-	-	-	4	Poulsen (1962:188)
<i>Vargula sagax</i>	2	-	-	-	4	-	Herein
<i>Vargula scintilla</i>	-	-	-	-	-	4	Cohen and Morin (1989:321)
<i>Vargula sekiguchii</i>	-	-	-	-	-	4	Hiruta (1984:57)
<i>Vargula shulmanae</i>	-	-	-	-	-	4	Cohen and Morin (1986:11)
<i>Vargula spinosa</i>	-	-	-	-	-	4	Poulsen (1962:194)
<i>Vargula spinulosa</i>	-	-	-	-	-	4	Poulsen (1962:197)
<i>Vargula stathme</i>	-	-	-	-	-	4	Kornicker (1975a:195)
<i>Vargula subantarctica</i>	-	-	-	-	-	4	Kornicker (1975a:173)
<i>Vargula sutura</i>	-	-	-	-	-	4	Kornicker (1975a:169)
<i>Vargula tsujii</i>	-	-	-	-	-	4	Kornicker and Baker (1977:222)
<i>Vargula tubulata</i>	-	-	-	-	-	4	Poulsen (1962:198)
GIGANTOCYPRIDININI[§]							
<i>Gigantocypris agassizi</i>	2	-	3	4	4	4	Poulsen (1962, table 5)
<i>Gigantocypris australis</i>	-	-	-	4	4	4	Poulsen (1962, table 15)
<i>Gigantocypris danae</i>	2	3-4	-	4	4	4	Poulsen (1962, table 13)
<i>Gigantocypris muelleri</i>	2	3	3	4	4	4	Poulsen (1962, table 9)

* According to Poulsen (1962:286) the 9th joint has, in addition to 2 bristles, a dorsal spine equivalent to the short dorsal bristle on adults.

† Poulsen (1962:247) stated that the 9th joint has 3 bristles but he listed 4 bristles in his table 24.

‡ Cohen (1983, table 1) listed 5 bristles on the adult; my observation on a different specimen (USNM 158181) was 4 bristles (Kornicker, 1984b:18), the same number Poulsen (1962, table 24) observed on *S. crenulata*, which was referred to *S. lernerii* by Kornicker (1984b:14).

§ It is assumed that members of the subfamily have 5 juvenile instars.

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