The Troglobitic Halocyprid Ostracoda of Anchialine Caves in Cuba

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ABSTRACT

Kornicker, Louis S., and Jill Yager. The Troglobitic Halocyprid Ostracoda of Anchialine Caves in Cuba. *Smithsonian Contributions to Zoology*, number 580, 16 pages, 9 figures, 1 table, 1996.—*Spelaeoecia cubensis*, a new species of troglobitic halocyprid ostracode in the subfamily Deeveyinae, from two anchialine caves in southern Matanzas Province, Cuba, is described and illustrated. The localities in Cuba of troglobitic halocyprid ostracodes in the family Thaumatocyprididae, *Danielopolina orghidani* and *Danielopolina* sp., are reviewed.

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Contents

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Introduction

The new species described herein increases to two the known genera of troglobitic ostracodes in the Halocypridoidea from Cuba. *Spelaeoecia cubensis*, which is in the family Halocyprididae, was collected in both Cueva de los Carboneros and Casimba Susana, southern Matanzas Province. The previously described species, *Danielopolina orghidani* (Danielopol, 1972), which is in the family Thaumatocyprididae, was collected in Grieta Punta de Guana Matanza (also called Grieta du Phare de Seboruca) (Danielopol, 1976:10) and Grieta du Phare de Seborucal, Matanzas (Kornicker and Sohn, 1976:94), which is in northern Matanzas Province (Figure 1). Also, *Thaumatocypris* sp. [= *Danielopolina* sp.] was reported from Cueva del Aqua, Oriente Province, by Orghidan et al. (1977:30) (Figure 1). The localities from which species of *Danielopolina* have been collected are reviewed herein.

DESCRIPTIONS OF CAVES.—Cueva de los Carboneros and Casimba Susana (also known as Cueva Susana) are anchialine caves on the southern coast of Matanzas Province, Cuba. Cueva de los Carboneros is located in the town of Playa Giron. It is due north of the Hotel Playa Giron and less than one-half kilometer east on the first paved road. Casimba Susana is approximately 17 kilometers west of Playa Giron and less than one kilometer north of the coast, and it is reached by a barely passible track in the forest paralleling the main road west. The caves are completely submerged; their entrances begin in limestone-ringed ponds in the pine forest about one kilometer inland from the Caribbean Sea. Both caves have distinct density interfaces at depth, defining a change in salinity as well as dissolved oxygen, temperature, and pH (Table 1). *Spelaeoecia cubensis* is found beneath the density interface in a community of troglobitic invertebrates dominated by crustaceans, including thermosbaenaceans, amphipods, isopods, and several species of shrimp. In Cueva de los Carboneros, a new species of remipede was discovered (Yager, 1994:752).

Cueva de los Carboneros was first explored by Yager and other cave divers in September 1992 during a joint Cuban-USA scientific cave diving expedition. Prior to that, the surface pool was used only occasionally by several charcoal makers to keep cool while working. On a retum trip in 1994, Yager found that the surface pool had been "discovered" and turned into a local swimming hole. However, despite the disturbance, the cave water at depth remains stable and water chemistry data from both years are nearly identical.

DISPOSITION OF SPECIMENS.—All specimens examined by the senior author have been deposited in the National Museum of Natural History, Smithsonian Institution, and have been assigned USNM catalog numbers. Specimens seen only by the junior author have been deposited with the Instituto de Ecología y Sistemática, Academia de Ciencias de Cuba.

TABLE 1.—Water chemistry at various depths for two anchialine caves in Cuba. Data obtained with YSI 6000 Sonde, June, 1994.

Parameter	Casimba Susana	Cueva de los Carboneros
Depth: 0.6 m		
Dissolved oxygen	5.8 mg/l	4.9 mg/l
Salinity	11.0 ppt	5.4 ppt
Temperature	28.2°C	29.3°C
pH	8.1	7.6
Depth: 16 m		
Dissolved oxygen	0.11 mg/l	0.16 mg/l
Salinity	35.7 ppt	32.5 ppt
Temperature	26.6°C	25.8°C
pH	7.5	7.4
Depth: 26 m		
Dissolved oxygen	0.10 mg/l	1.49 mg/l
Salinity	35.6 ppt	36.0 ppt
Temperature	26.4°C	26.7°C
pH	7.5	7.6

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FIGURE 1.—Map of Cuba showing locations of Casimba Susana, Cueva de los Carboneros, and anchialine species of Halocypridina.

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 indicate anterior. All measurements are in millimeters unless otherwise noted.

The following abbreviations are used in the illustrations and legends.

am	central adductor muscle attachments
ant	antenna
bas	basale
Bo	Bellonci organ
co	copulatory organ
cx	coxale
e	valve edge
end	endopodite
epip	epipodite
esop	esophagus
ex	exopodite
fu	furca
gang	ganglion
gen	genitalia
gl	gland
gp	glandular process
im	inner margin of infold
lft	left valve
lv	lateral view
mnd	mandible
mo	mouth
mv	medial view
precx	precoxale
prot	protopodite
rt	right valve
ul	upper lip
up	unpaired bristle of furca

ACKNOWLEDGMENTS.—Specimens from Cueva de los Carboneros were collected by Jill Yager, and those from Casimba Susana were collected by Dennis W. Williams. The research expedition was a collaboration between members of Island Caves Research Center, Melbourne, Florida, and the Sociedad de Cuba. Special thanks go to cave divers Jeff Bozanic, Eduardo Nieto, Judy Ormeroid, Steve Ormeroid, Angel Roca, and Dennis W. Williams. We thank Jack R. Schroeder for inking camera lucida drawings of carapaces and appendages. This is Contribution number 10 of the Island Caves Research Center, Melbourne, Florida. We thank Elizabeth Harrison-Nelson for assistance in preparing the manuscript. We are grateful to Martin V. Angel and Dan L. Danielopol for reviewing the manuscript. We also thank Diane M. Tyler, Smithsonian Institution Press, for editing and preparing the manuscript.

Order HALOCYPRIDA Dana, 1853

Suborder HALOCYPRIDINA Dana, 1853

COMPOSITION.—The suborder comprises the superfamilies Halocypridoidea Dana, 1853, and Thaumatocypridoidea Müller, 1906. Only the former is represented in the collections reported upon herein.

Superfamily HALOCYPRIDOIDEA Dana, 1853

COMPOSITION.—Includes the single family Halocyprididae Dana, 1853.

Family HALOCYPRIDIDAE Dana, 1853

COMPOSITION.—The family comprises five subfamilies of which only the Deeveyinae Kornicker and Iliffe, 1985, is represented in the present collections.

Subfamily DEEVEYINAE Kornicker and Iliffe, 1985

COMPOSITION.—The subfamily comprises the genera *Deeveya* Kornicker and Iliffe, 1985, and *Spelaeoecia* Angel and Iliffe, 1987, of which only the latter is represented in the present collections.

Spelaeoecia Angel and Iliffe, 1987

Spelaeoecia Angel and Iliffe, 1987:545, figs. 2–6.

TYPE SPECIES.—*Spelaeoecia bermudensis* Angel and Iliffe, 1987:545.

COMPOSITION AND DISTRIBUTION.—The genus includes six species from anchialine caves: BERMUDA: *Spelaeoecia bermudensis* Angel and Iliffe, 1987; BAHAMAS: *Spelaeoecia capax, S. sagax, S. styx* Kornicker (in Kornicker et al., 1990); JAMAICA: *Spelaeoecia jamaicensis* Kornicker and Iliffe, 1992; CUBA: *S. cubensis,* new species.

Spelaeoecia cubensis, new species

FIGURES 2–9

ETYMOLOGY.—The specific name, *cubensis,* is for the island where the species was collected.

HOLOTYPE.—USNM 194208, undissected adult male in alcohol.

TYPE LOCALITY.—Cueva de los Carboneros, Playa Giron, Matanzas Province, Cuba.

PARATYPES.—Cueva de los Carboneros: USNM 194306, adult male on slide and in alcohol; USNM 194307, partly dissected adult female in alcohol; USNM 194309, undissected adult female in alcohol; USNM 194310, 1 A–4 instar (instar III?) (sex unknown) with whole mount of body on slide and shell in alcohol; USNM 194311, 1 undissected A–1 female in alcohol; USNM 194313a–g, 7 undissected specimens (2 A–1 females, 1 A–1 male, 1 adult female, 3 adult males) in alcohol. Casimba Susana: USNM 194312, 1 partly dissected A–1 male in alcohol; USNM 194314a–d, 4 undissected specimens (2 adult females, 2 adult males) in alcohol; USNM 194315, 1 undissected unmeasured adult female in alcohol (specimen unintentionally dried, then reconstituted).

NONTYPES.—Additional specimens were deposited with the Instituto de Ecología y Sistemática, Academia de Ciencias de Cuba.

DISTRIBUTION.—Cuba, Matanzas Province, Playa Giron: Cueva de los Carboneros, 14 Sep 1992, about 21 m depth; Casimba Susana, 11 Sep 1992, 24.4 m depth, 35 ppt salinity.

DESCRIPTION OF ADULT MALE (Figures 2–6).—Carapace uncalcified, flexible, elongate; dorsal margin straight, ventral margin broadly rounded; anterior incisur dorsal to midheight (Figure 2*a–c*). Anterior of valve viewed from inside with edge of valve sinuate (Figure 2*d*); anterior outer part of rostrum broadly overreaching edge of valve and with rounded tip (Figure 2*b,d*); in lateral view posterodorsal corner of each valve with obtuse angle, with minute glandular process with terminal pore on posterodorsal corner of left valve, and with minutely digitate row of glandular openings at posterior end of dorsal margin of right valve (Figure 2*c,f*). Section of edge of right valve of USNM 194306 anterior to anterior juncture with single row of minute teeth (Figure 2*d,e*); USNM 194314b with similar teeth but not as well developed.

Ornamentation: Surface with long bristles inward from shell edge and minute bristles along valve edge. Surface of most specimens in collection appearing smooth but a few with indistinct remnants of striations (Figure 2*b,c*).

Infold: Broad infold especially along posterior margin. Narrow posterior list forming narrow bar posterior to posterior juncture of hinge, then extending ventrally as narrow ridge intersecting posterior edge of valve (at midheight) in broad curve projecting posteriorly just past edge of that part of valve located dorsal to intersection (Figure 2*f*). Narrow anteroventral, ventral, and posterior list at midwidth of infold (Figure 2*d*); list terminates at about midheight of posterior margin (Figure 2*f*).

Central Adductor Muscle Attachments (Figure 2*a,g*): 11 to 17 small closely spaced oval attachments; large translucent mandibular oval present anterior to attachments.

Glands: Posterodorsal corner of right valve with numerous minute glandular openings and one minute bristle (Figure 2*a,d,f*). Posterodorsal corner of left valve with minute glandular process with central depression (Figure 2*c,f*). Short glandular ducts along ventral edge of valve and also inward from valve edge along anterior (Figure 2*d*) and posterior margins (Figure 2*f*).

Carapace Size (in mm): Cueva de los Carboneros: USNM 194208, holotype, length 2.29, height 0.99; USNM 194306, length 2.07, height 0.94; USNM 194313d, length 2.24, height 1.03; USNM 194313e, length 2.05, height 0.92; USNM 194313g, length 2.18, height 1.02; length range 2.05–2.29. Casimba Susana: USNM 194314a, length 1.90, height 0.89; USNM 194314b, length 1.84, height 0.87; length range 1.84–1.90.

First Antenna (Figure 3*a–d*): With 8 well-defined joints: 1st joint with abundant minute distal and dorsal spines and terminal ventral lobe with numerous short spines, mostly lateral; 2nd joint with distal medial spinules and long spinous dorsal bristle; 3rd joint bare, about twice length of 4th joint; 4th joint with distal lateral and medial spines, long spinous dorsal bristle, and minute translucent terminal ventral bristle (latter present on USNM 194306, but not on USNM 194314b); 5th joint with distal lateral and medial spines and with long ventral filament with minute indistinct widely separated marginal spines and a terminal papilla; 6th joint with distal lateral and medial spines, oblique distal margin, and convex distal ventral corner; 7th joint with short spinous ringed dorsal a-bristle, ventral medial b-bristle about $^2/_3$ length of stouter ventral lateral c-bristle, both with minute widely separated marginal spines

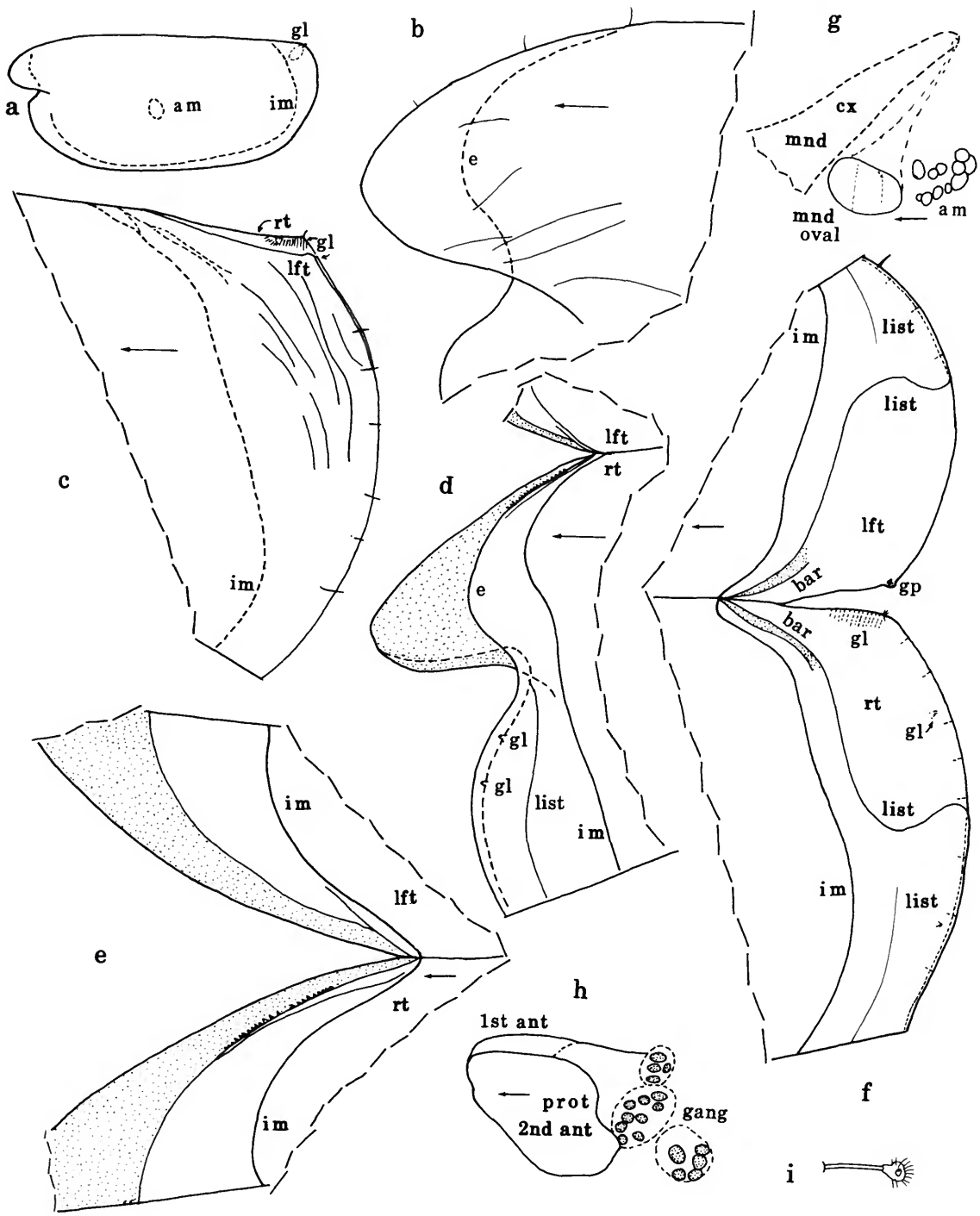

FIGURE 2.—*Spelaeoecia cubensis*, new species, paratype, USNM 194306, adult male: *a*, complete specimen from left side, length 2.07 mm; *b*, detail from *a* showing lineations on shell surface; *c*, detail from *a* (note lineations on shell surface); *d*, anterior right valve, iv; *e*, detail from hinge area in *d*; *f*, posterior of open valves, iv; *g*, adductor muscles and mandibular oval of left valve, ov; *h*, anterior of dorsal part of body from left side (not under cover slip, brown cells in ganglia stippled); *i*, protistan attached to posterior edge of right valve.

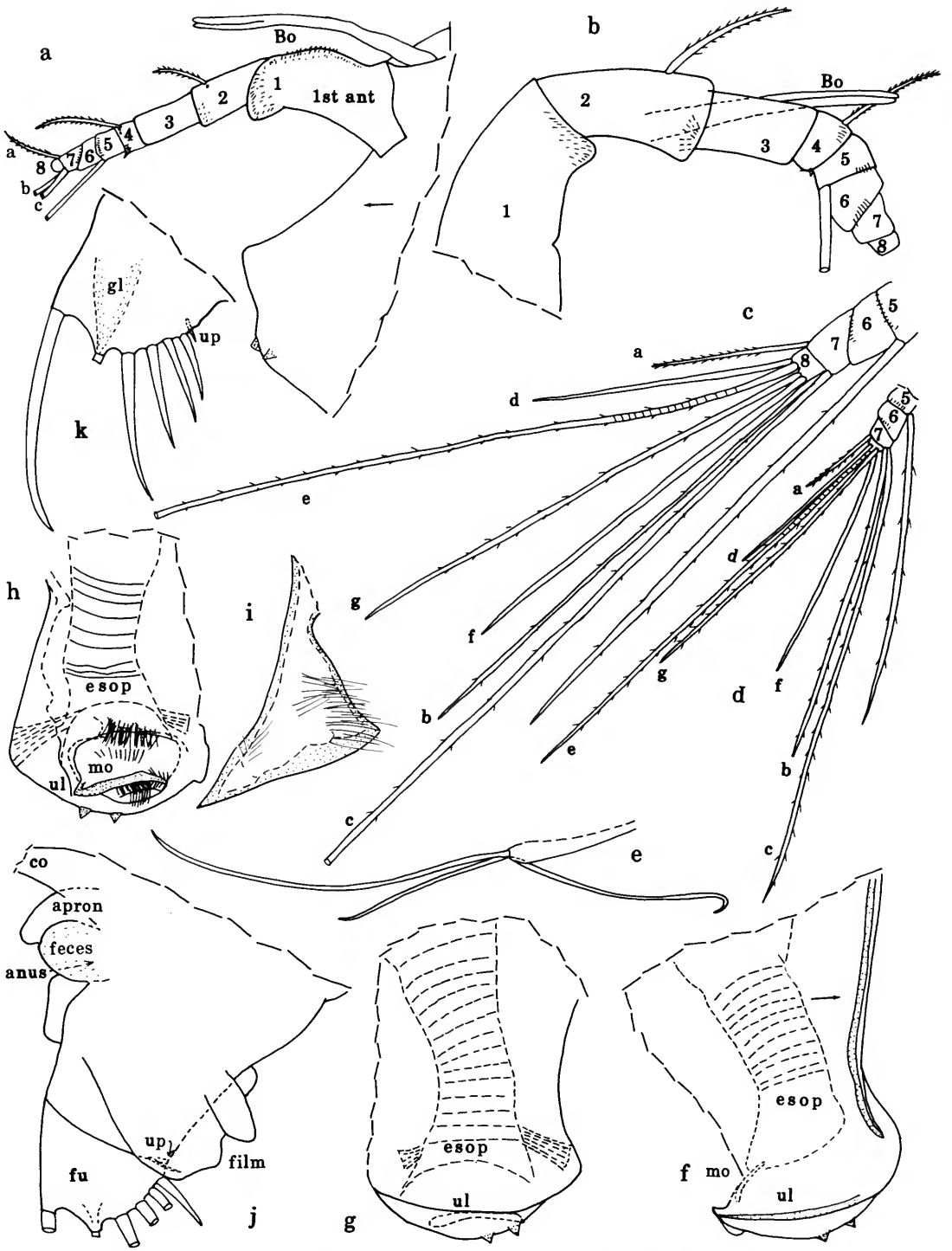

FIGURE 3.—*Spelaeoecia cubensis*, new species, paratype, USNM 194306, adult male: *a*, part of anterior of body from left side (bristles of joint 8 not shown); *b*, right 1st antenna, lv (bristles of joints 7 and 8 not shown); *c,d*, tip of left 1st antenna, lv; *e*, left 7th limb; *f–h*, anteroventral part of body from right side, anterior, and posterior, respectively; *i*, part of lower lip; *j*, part of posterior of body from left side; *k*, left furcal lamella, lv.

and terminal papillae; 8th joint small with 4 bristles (dorsal medial d-bristle about twice length of a-bristle, filament-like with terminal papilla; long lateral e-bristle about same length as c-bristle, stout with indistinct rings, minute widely separated marginal spines, terminal papilla, and filament-like, especially distally; medial f-bristle narrower and about 1/2 length of e-bristle, oriented obliquely ventrally, and filament-like with terminal papilla; g-bristle lateral to f-bristle, ventral to e-bristle and about 2/3 its length, filament-like with terminal papilla).

Second Antenna: Protopodite bare (Figure 4*a*). Endopodite 3-jointed (Figure 4*a–e*): 1st joint elongate with long slender spinous a- and b-bristles; 2nd joint with 2 short stout spinous ringed c- and d-bristles, 2 terminal filament-like f- and g-bristles with terminal papillae and minute indistinct widely separated marginal spines (g-bristle longer and stouter than f-bristle and weakly ringed proximally), and 2 indistinct small

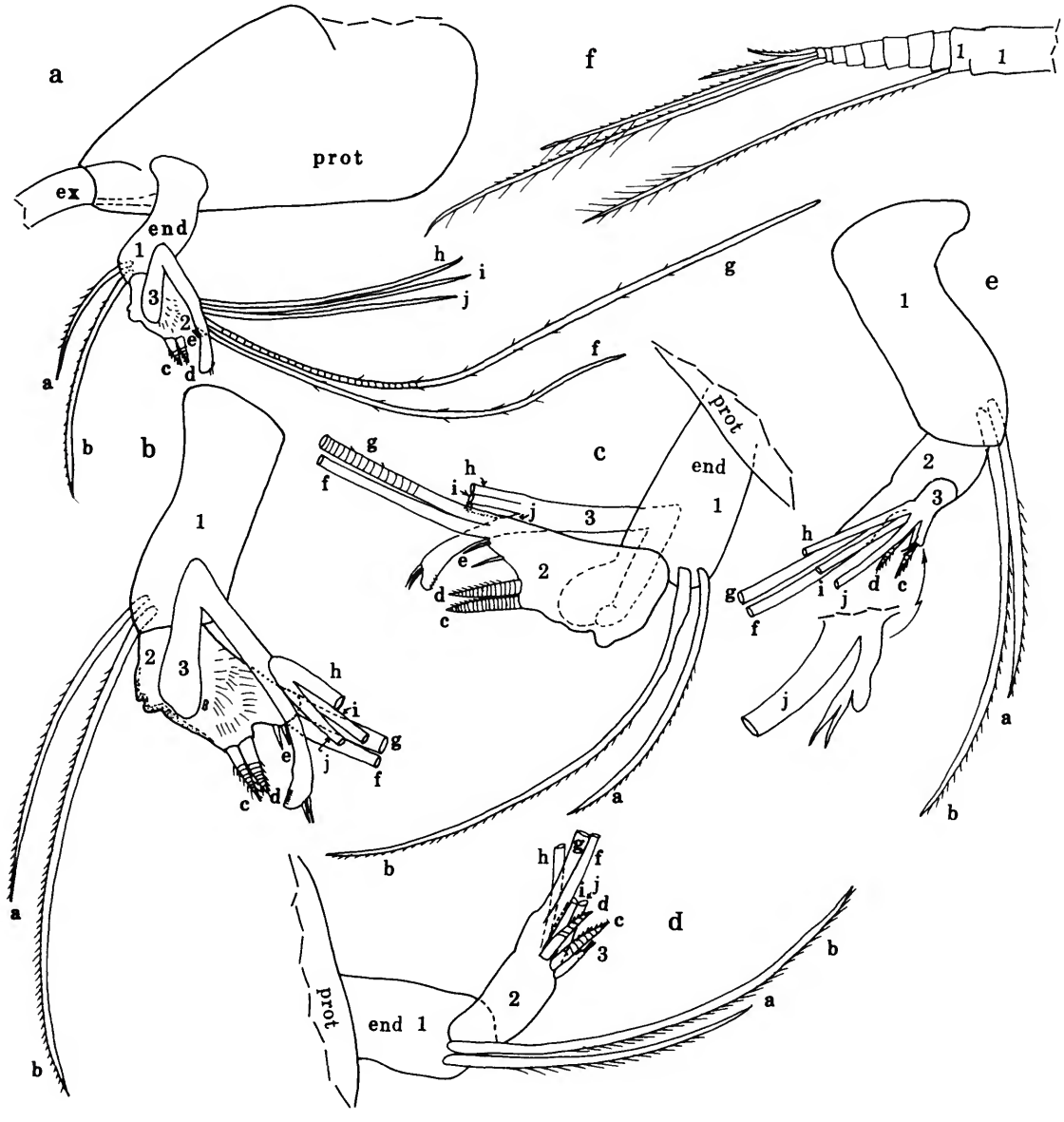

FIGURE 4.—*Spelaeoecia cubensis*, new species, paratype, USNM 194306, adult male: *a*, right 2nd antenna, mv; *b,c*, endopodite of right 2nd antenna, medial and lateral views, respectively; *d,e*, endopodite of left 2nd antenna, lateral and medial views, respectively; *f*, exopodite of left 2nd antenna (bristles of joints 2–7 not shown).

e-bristles near base of f-bristle (e-bristles present but not shown in illustrated left limb); 2nd joint of right limb with abundant medial spines and 2 distinct proximal dorsal nodes; 3rd joint with equilength filament-like bare h-, i-, and j-bristles (with terminal papillae), all about 1/2 length of g-bristle; clasper of left limb short straight with subterminal bifurcate bristle (Figure 4*e*); clasper of right limb bent to form acute angle, with 2 minute subterminal hair-like bristles on outer edge, and row of minute teeth near tip of inner edge (Figure 4*c,d*). Exopodite with 9-joints (Figure 4*f*, not all bristles shown): 1st joint divided into long proximal and short distal parts, with long bristle with proximal ventral spines and natatory hairs; bristle of 2nd joint with natatory hairs and ventral spines longer than those of bristle of 1st joint; bristles of joints 3–7 with natatory hairs, no spines; bristle of 8th joint with dorsal spines and natatory hairs; 9th joint with 3 bristles (1 short dorsal, 1 medium middle, 1 long ventral) with dorsal spines, only long ventral bristle also with natatory hairs; all long bristles with 1 or 2 long proximal segments followed by closely spaced rings.

Mandible: Coxale endite with proximal and distal sets of teeth separated by gap (Figure 5*a,b*): proximal set comprising 4 broad cusps plus small posterior triangular tooth (Figure 5*a*); surface between cusps and just proximal to cusps with slender spines; 1 minute indistinct spinous bristle on corner just anterior to anterior cusp and posterior to posterior cusp; 3 spinous bristles adjacent to triangular tooth (exact number of bristles difficult to resolve, could be only 2); distal set of teeth comprising 2 flat teeth, each with 7 or 8 cusps (Figure 5*b*); 1 stout curved spinous process and 1 adjacent bristle proximal to flat teeth (Figure 5*a*). Basale (Figure 5*c,d*): distal edge with 5 triangular cusps and 1 smaller posterior cusp (Figure 5*c*); lateral surface near distal edge with sharp tooth near midwidth; lateral surface distal to midlength with 2 minute and 4 longer bristles (anterior pair entwined with 2 crossing points (Figure 5*c*); 1 of the bristles broken off on left limb of USNM 194306, but socket present); anterior margin with 1 long bristle distal to midlength; posterior margin hirsute, with 2 short distal ringed bristles (proximal with pointed tip, distal tubular); proximal medial surface with transparent plumose bristle on hirsute protuberance (short medial bristle usually near endopodite of other species of genus absent); 2 transparent plumose bristles on or close to dorsal margin (Figure 5*d*); lateral surface near insertion of endopodite with long bare bristle (Figure 5*d*). Endopodite (Figure 5*e,f*): 1st joint with 3 bare distal bristles (1 long dorsal, 1 short ventral, 1 long medial near midwidth); 2nd joint widening distally, with medial hairs, 3 bare terminal dorsal bristles (1 long stout unringed claw-like, 2 shorter ringed (1 lateral, 1 medial)), and 1 long terminal ventral bristle; 3rd joint with 2 long stout claw-like spinous bristles, 4 short ringed bristles (ventral with short spines, others bare) forming medial row near terminal edge, and 1 longer ringed bristle (with few spines) on terminal lateral edge (Figure 5*f*); anterior margin and medial surface of joint hirsute.

Maxilla: Endite I with 2 proximal and 11 terminal bristles (5 tubular) (Figure 5*g*); endite II with 2 proximal and about 8 terminal bristles (Figure 5*h*); endite III with 1 proximal and 5 terminal bristles (2 tubular) (Figure 5*h*). Coxale with stout plumose dorsal bristle (Figure 5*h–j*). Basale with 3 bristles along distal margin (1 ventral, 2 closer to dorsal margin) (Figure 5*i,j*). Endopodite (Figure 5*i,j*): 1st joint with 9 bristles; 2nd joint with anterior hairs, 2 stout claw-like bristles, and 5 slender ringed bristles (Figure 5*i,j*).

Fifth Limb (Figure 6*a–d*, not all bristles shown in Figure 6*a*): Epipodite with plumose bristles forming 3 groups (ventral group with 5 bristles, middle group with 6 bristles, dorsal group with 5 bristles (4 long, 1 short dorsal). Protopodite with lateral glandular process and 2 ventral endites (Figure 6*b,c*): endite I with cluster of minute medial spines and with 3 bristles closer to ventral margin (2 with long spines and 1 smaller tubular); endite II with 1 proximal medial bristle with short spines (bristle could be on endite I) and 3 bristles closer to ventral margin (1 with long spines, 2 tubular either bare or with short spines). Basale with medial hairs and spines, 1 long lateral anterior bristle with long spines, 1 ventral endite with 1 proximal medial bristle with short spines (short spines and hairs dorsal to base of bristle), and 4 bristles close to ventral margin (1 claw-like pectinate along both margins, 1 pointed with short spines, 2 tubular either bare or with short spines) (Figure 6*b,c*). Endopodite with 1 proximal medial bristle with short spines, and 9 additional bristles (1 short tooth-like medial subventral, 1 pointed, long, bare, lateral, subventral, 1 short lateral proximal, 2 tubular ventral (either bare or with short spines), 2 claw-like unringed ventral, and 2 anterior long with long spines); pad of short medial spines just dorsal to tooth-like bristle. Exopodite (Figure 6*a,d*): 1st joint (Figure 6*a*) with dorsal margin with 1 long subterminal bristle and 1 plumose bristle; ventral margin divided into broad proximal and more slender distal parts, proximal part of ventral margin with 3 slender ventral bristles (bare or with short spines), 1 long plumose lateral bristle near midwidth, and 1 short medial bristle near ventral margin; distal part of ventral margin with 3 bare subterminal ventral bristles, and with 2 distal plumose lateral bristles near midwidth. 2nd joint (Figure 6*a*) with 1 distal bristle on dorsal margin; ventral margin with 3 slender distal bristles. 3rd joint with 2 stout claw-like bristles (dorsal with oblique lines, both with minute ventral spines), 1 slender ringed bare ventral bristle, and 1 minute spine-like medial bristle (Figure 6*a,d*).

Sixth Limb (Figure 6*e,f*): Epipodite with plumose bristles forming 3 groups (ventral and middle group each with 5 bristles, dorsal group with 6 bristles) (spines on bristles not shown). Protopodite separated from basale by suture and divided by indistinct suture into 2 parts interpreted to be precoxale and coxale, both with long medial hairs: precoxale with 3 bristles (2 with long spines, 1 with short spines); coxale with 5 bristles (2 with long spines). Basale with long proximal medial hairs near ventral margin, and with 7 plumose bristles (6 on or near ventral margin, 1 distal lateral near dorsal margin).

FIGURE 5.—*Spelaeoecia cubensis*, new species, paratype, USNM 194306, adult male: *a*, coxale endite of left mandible (not under cover slip), mv; *b*, part of coxale endite of left mandible, mv; *c*, distal part of basale of right mandible (not under cover slip), lv; *d*, part of left mandible (not under cover slip), lv; *e*, endopodite of right mandible, (not under cover slip), lv; *f*, tip of left mandible, mv; *g*, endite I maxilla (not under cover slip); *h*, part of maxilla (not under cover slip, not all bristles shown); *i*, part of right maxilla (not under cover slip), lv; *j*, part of left maxilla (not under cover slip), mv.

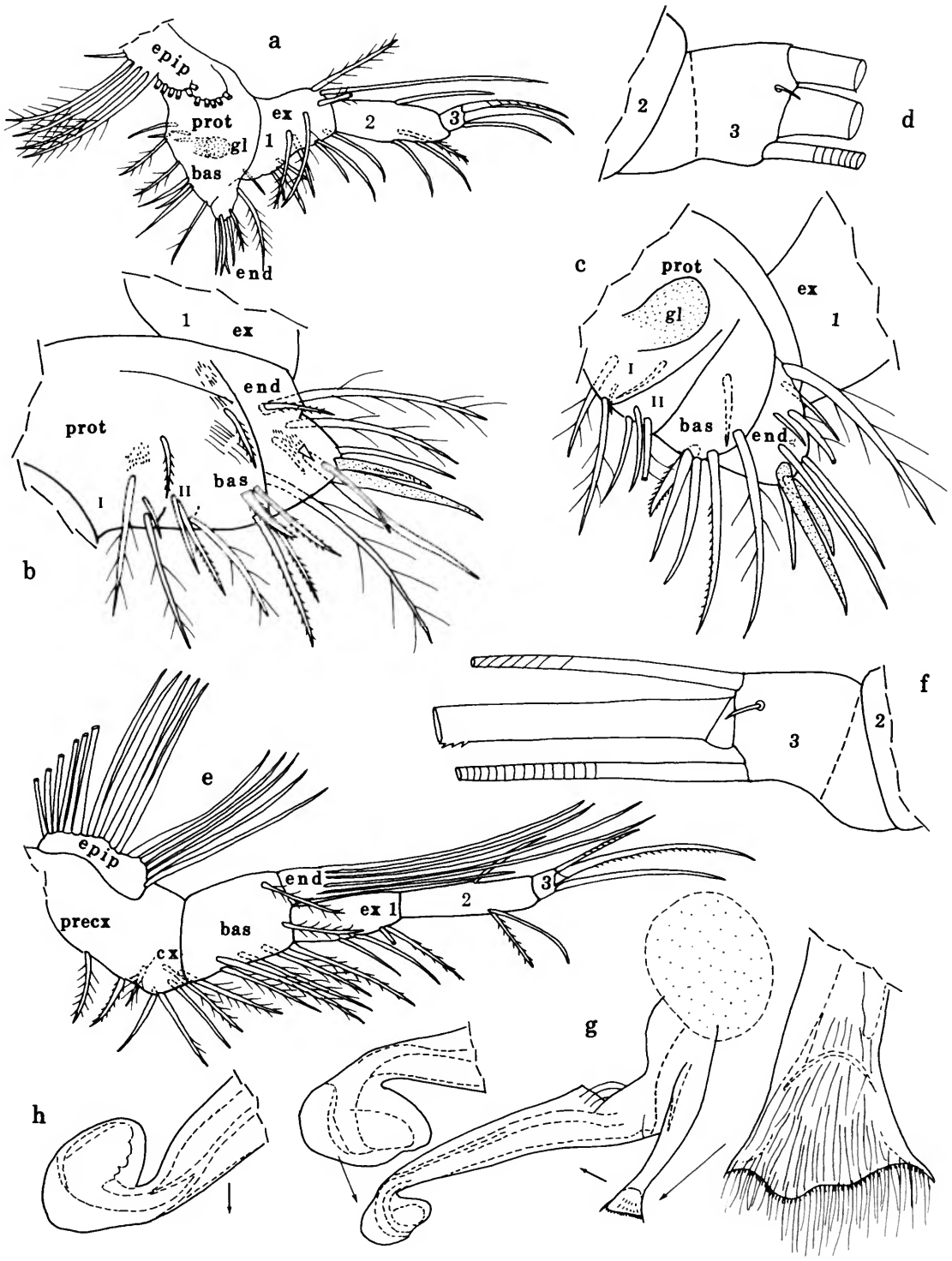

FIGURE 6.—*Spelaeoecia cubensis*, new species, USNM 194306, adult male: *a*, left 5th limb (not under cover slip), lv; *b*, proximal part right 5th limb, mv; *c*, proximal part left 5th limb, lv; *d*, tip of right 5th limb, mv; *e*, left 6th limb, lv; *f*, tip of left 6th limb, mv; *g*, copulatory limb, lv; *h*, tip of anterior branch of copulatory limb, mv.

Endopodite well developed with 5 long bristles (3 medial plumose, 2 lateral with widely separated minute spines) (spines on bristles not shown). Exopodite 3-jointed: 1st joint with 3 or 4 ventral bristles (bare or with short spines); 2nd joint with 3 bristles (bare or with short spines) (2 ventral, 1 dorsal); 3rd joint with 3 long terminal bristles (middle bristle claw-like with ventral spines; dorsal bristle slender somewhat claw-like with oblique rings; ventral bristle slightly broader than dorsal bristle, ringed, bare) and 1 minute medial spine-like bristle (Figure 6*f*).

Seventh Limb (Figure 3*e*): Elongate with 3 terminal bristles (1 longer than others).

Furca (Figure 3*j,k*): Each lamella with 5 claws with minute teeth along posterior edges (teeth not shown); claws 1 and 2 without transverse sutures; claws 3–5 with thin, closely spaced transverse lines (not shown); stout glandular process between claws 1 and 2; medial surface of lamellae with small spines (not shown); short single unpaired bristle just posterior to furca. Apron anterior to furca not well defined on USNM 194306 (Figure 3*j*).

Bellonci Organ (Figure 3*a,b*): Branching distally, each branch with bare, broadly rounded tip.

Lips: 2 small triangular processes (1 on each side) proximally on anterior margin (Figure 3*a,f–h*). Upper lip terminating posteriorly in spinous bar (Figure 3*h*). Lower lip a triangular process (with long spines) on each side of mouth (Figure 3*i*).

Genitalia (Figure 6*g,h*): Posterior rod-shaped branch short with expanding blunt tip bearing abundant short spines and longer hairs (Figure 6*g*). Anterior branch with broad knob-like tip with internal configurations but without external spines, tubes, or teeth (Figure 6*g,h*).

Ganglion (Figure 2*h*): 2 or 3 ovals containing round brown cells (stippled) present posterior to 2nd antennae.

Gut Content: Gut of USNM 194306 with setae and fragments that appear to be crustacean but could not be identified further.

Epizoa: Outer surface of posterior edge of carapace of USNM 194306 with many protistans each with long slender stem terminating in ovoid usually bearing numerous short filaments and internal nucleus (Figure 2*i*).

DESCRIPTION OF ADULT FEMALE (Figures 7, 8).—Carapace similar to that of adult male including ornamentation, infold, central adductor muscle attachments, and glands (Figures 7*a*, 8*e*). Minute row of teeth on section of edge of right valve anterior to anterior juncture observed on male USNM 194306 absent on female USNM 194307.

Carapace Size (in mm): Cueva de los Carboneros: USNM 194307, length 2.31, height 1.09; USNM 194309, length 2.27, height 1.05; USNM 194313c, length 2.26, height 1.01; length range 2.26–2.31. Casimba Susana: USNM 194314c, length 2.01, height 0.90; USNM 194314d, length 1.98, height 1.00; length range 1.98–2.01.

First Antenna (Figure 7*b*): Differs from adult male in that suture separating 3rd and 4th joints not well defined; spinosity of joints and bristles not examined in detail.

Second Antenna: Protopodite and exopodite similar to those of adult male. Endopodite 3-jointed but 2nd and 3rd joint fused (Figure 7*c*): 1st joint with long slender spinous a- and b-bristles; 2nd joint with minute medial c-bristle near base of j-bristle of 3rd joint, long f-bristle, longer and stouter g-bristle (both f- and g-bristles filament-like with terminal papillae), and 2 minute lateral bristles (e-bristles ?) near base of f-bristle; 3rd joint with filament-like h-, i-, and j-bristles.

Mandible (Figure 7*d–g*): Similar to that of adult male.

Maxilla (Figure 8*a*): Not examined in detail but, in general, similar to that of adult male.

Fifth Limb (Figure 8*b*): Epipodite: ventral group with 4 or 5 bristles; middle group with 5 or 6 bristles; dorsal group with 6 bristles. Except for absence of glandular process on protopodite, remaining part of appendage similar to that of adult male.

Sixth Limb (Figure 8*c,d*), *Seventh Limb* (Figure 8*f*), *and Ganglion* (Figure 8*i*): Similar to those of adult male.

Furca (Figure 8*g*): Similar to that of adult male except internal gland proximal to process between claws 1 and 2 better defined.

Bellonci Organ (Figure 7*h*): Similar to that of adult male except tips more pointed.

Lips: Anterior face similar to that of adult male (Figure 8*h*). Lips not examined in detail, but similar to those of adult male.

Genitalia (Figure 8*f*): Small process with terminal spine adjacent to small bristle, both in vicinity of narrow internal tube.

DESCRIPTION OF A–1 MALE (Figure 9*a–g*).—Carapace similar to that of adults. Shell of USNM 194312 smooth; USNM 194313f appearing indistinctly reticulate but reticulate structure could be internal (Figure 9*a,g*).

Carapace Size (in mm): Cueva de los Carboneros: USNM 194313f, length 1.67, height 0.74. Casimba Susana: USNM 194312, length 1.55, height 0.76.

Second Antenna: Protopodite and exopodite similar to those of adult male (exopodite with 9 joints and 3 terminal bristles on 9th joint). Endopodite 3-jointed but 2nd and 3rd joints fused; left (Figure 9*b*) and right (Figure 9*c*) limbs similar: 1st joint with a- and b-bristles similar to those of adult male and female; 2nd joint similar to that of adult male but without either proximal dorsal nodes or medial spines on right limb; 3rd joint with h-, i-, and j-bristles and 2 minute spine-like lateral bristles at base of j-bristle (shown as dashed lines in detail in Figure 9*b*), but without clasper on either limb.

Mandible: Paired lateral bristles of basale entwined with 2 crossing points (Figure 9*d*).

Fifth Limb: Except for lacking glandular process, similar to that of adult male.

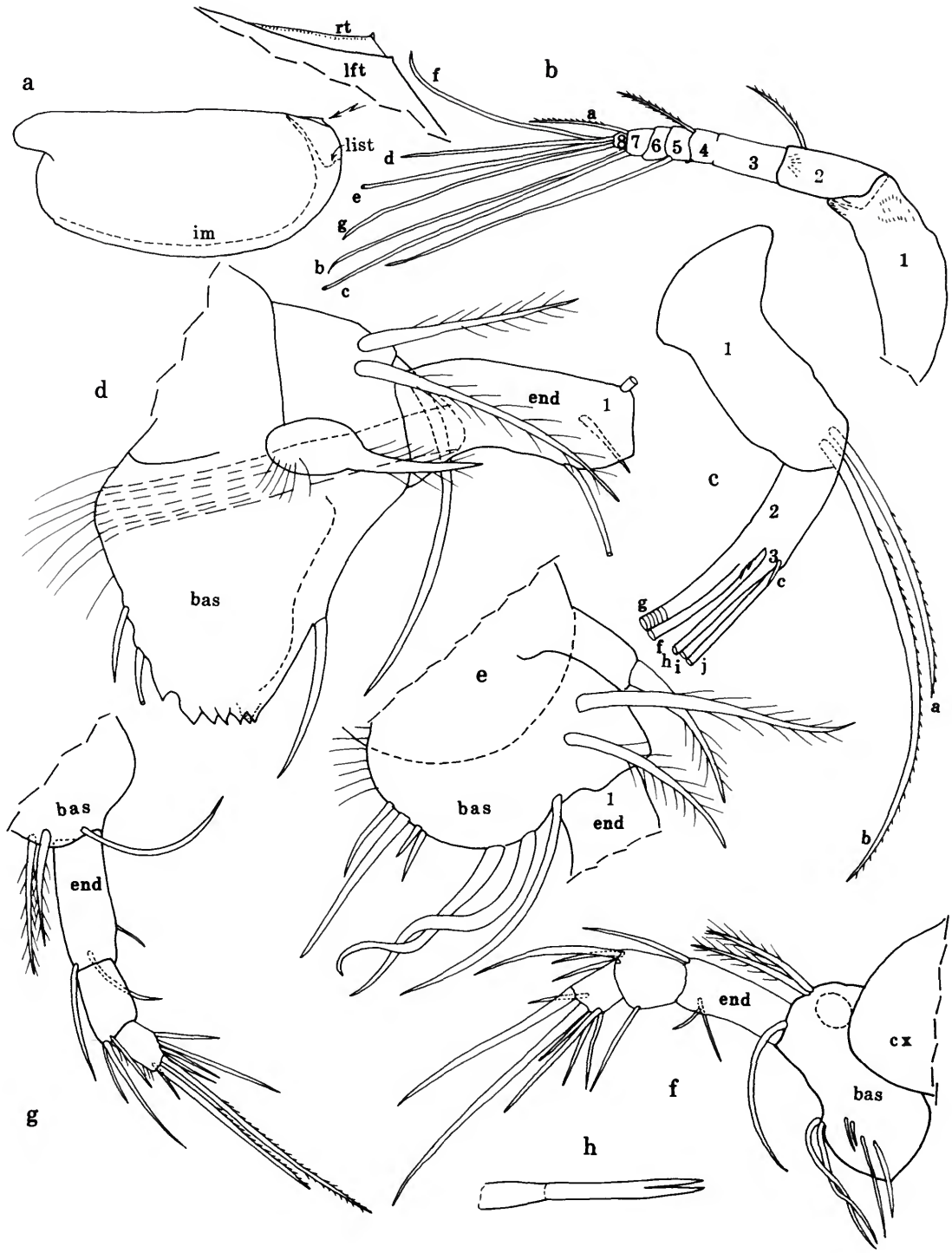

FIGURE 7.—*Spelaeoecia cubensis*, new species, paratype, USNM 194307, adult female: *a*, complete specimen from left side, length 2.31 mm; *b*, left 2nd antenna, lv; *c*, endopodite left 2nd antenna, mv; *d*, part of left mandible (not under cover slip), mv; *e*, part of right mandible (drawn while attached to body), lv; *f*, part of left mandible (drawn while attached to body), lv; *g*, part of left mandible (drawn while attached to body), lv.

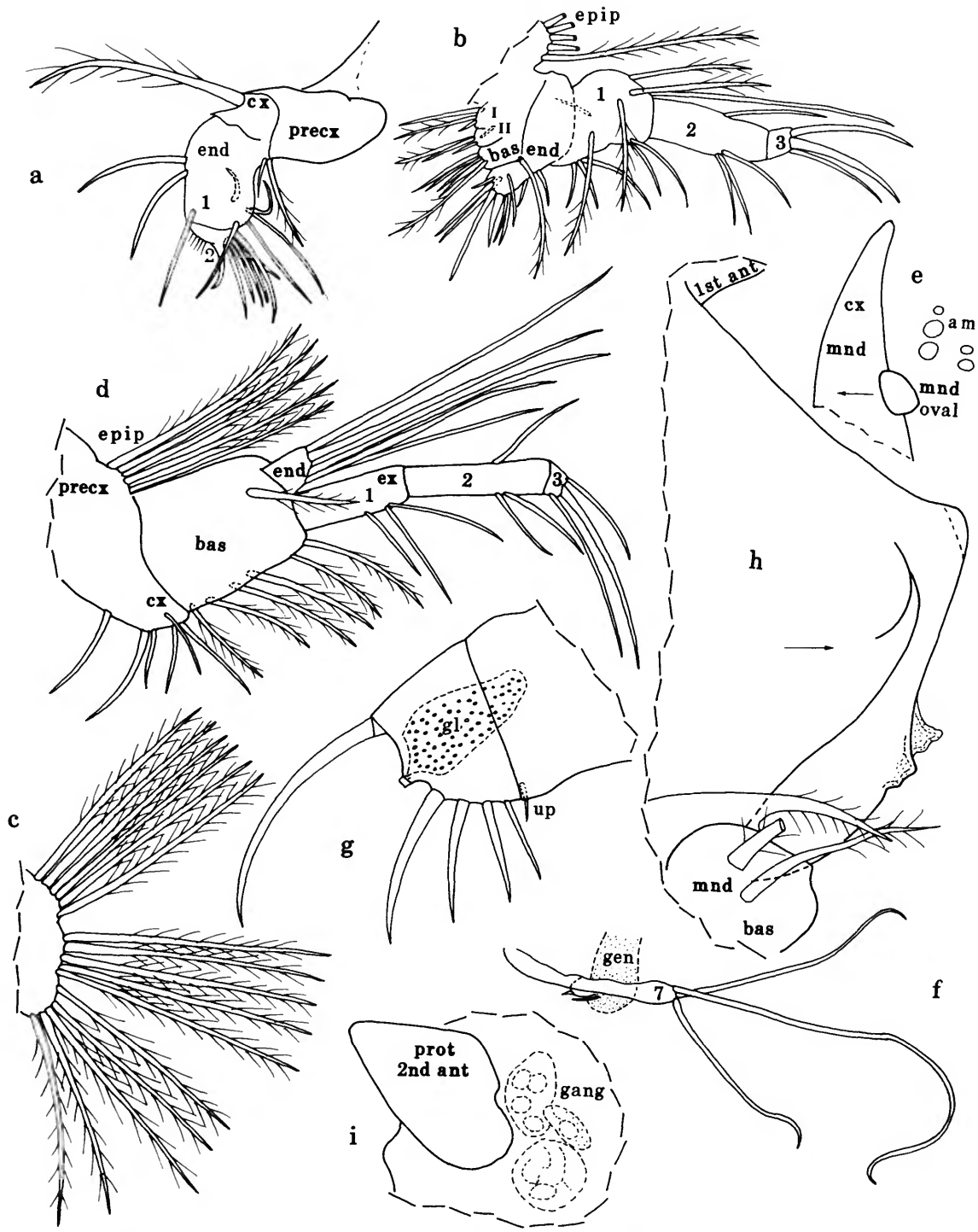

FIGURE 8.—*Spelaeoecia cubensis*, new species, paratype, USNM 194307, adult female: *a*, left maxilla (drawn while attached to body), lv; *b*, left 5th limb, lv; *c*, epipodite left 6th limb; *d*, part of left 6th limb, lv; *e*, part of central adductor muscle attachments and mandibular oval of left valve, ov; *f*, left 7th limb and genitalia, lv; *g*, left furcal lamella, lv; *h*, anterior of body from right side; *i*, anterodorsal part of body from left side.

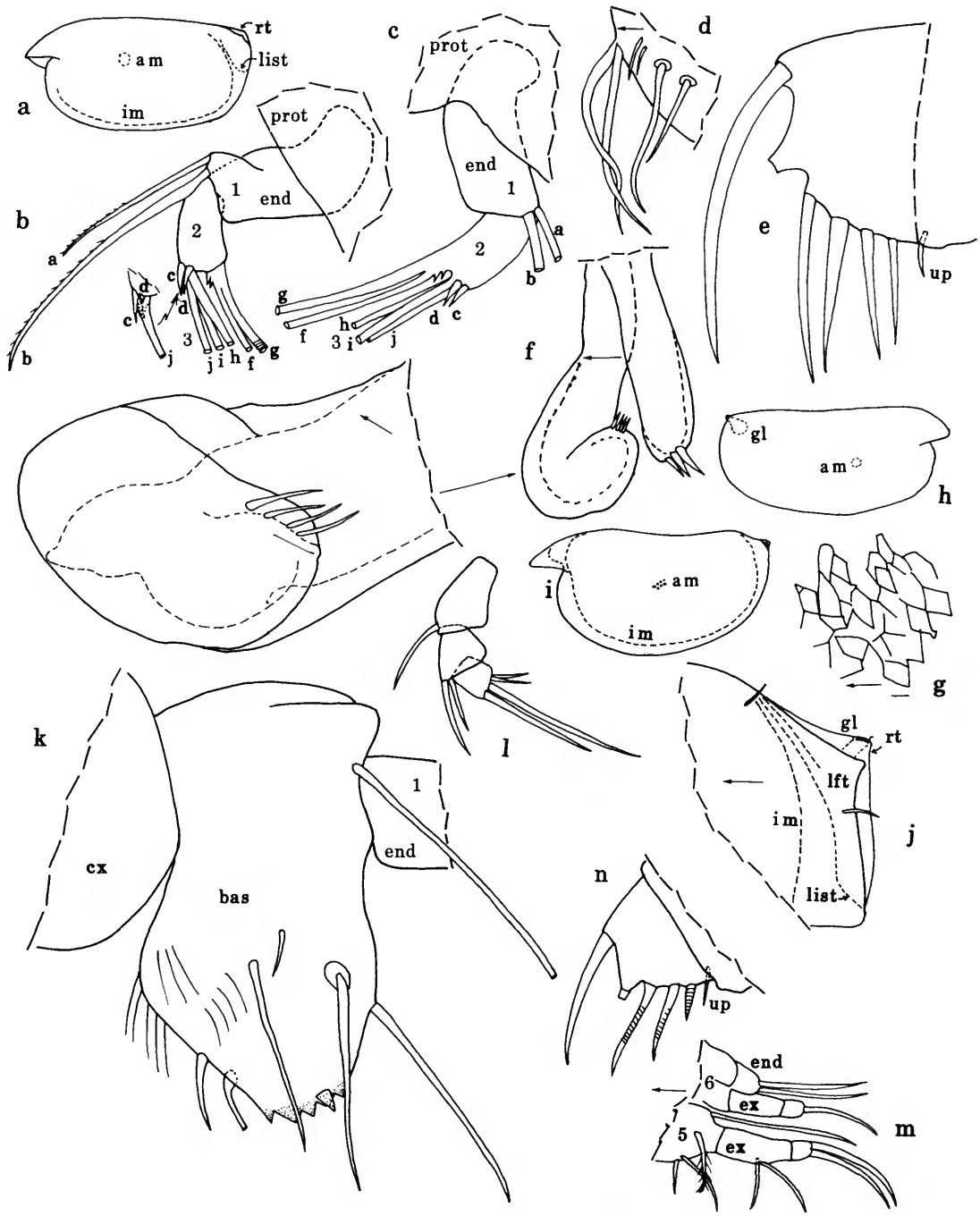

FIGURE 9.—*Spelaeoecia cubensis*, new species. USNM 194312, A–1 male, paratype: *a*, complete specimen from left side, length 1.55 mm; *b,c*, endopodites of left and right 2nd antennae, respectively, lv; *d*, part of basale of left mandible (drawn attached to body), lv; *e*, left furcal lamella, lv; *f*, distal part of copulatory organ. *g*, USNM 194313f, A–1 male, paratype, length 1.67 mm, indistinct surface reticulations near middle of left valve. *h*, USNM 194311, A–1 female, paratype, complete specimen from right side, length 1.62 mm. USNM 194310, A–4 instar (sex unknown), paratype: *i*, complete specimen from left side, length 0.67 mm; *j*, detail from *i*; *k*, part of right mandible, lv; *l*, part of left mandible, lv; *m*, distal parts of left 5th and 6th limbs (drawn attached to body), lv; *n*, left furcal lamella, lv.

Sixth and Seventh Limbs: Not examined in detail but, in general, similar to those of adult male.

Furca (Figure 9*e*): Similar to that of adult male.

Genitalia (Figure 9*f*): Posterior part elongate with broadly rounded tip bearing 3 short bristles. Anterior part extending past posterior part; tip with broadly rounded posterior projection with 4 minute slender bristles. Both anterior and posterior parts unsclerotized.

DESCRIPTION OF A–1 FEMALE (Figure 9*h*).—Carapace similar to that of adults. Carapace smooth without ornamentation. (Shell fairly transparent and descriptions are based on observations through unopened valves.)

Carapace Size (in mm): Cueva de los Carboneros: USNM 194311, length 1.62, height 0.73; USNM 194313a, length 1.60, height 0.70; USNM 194313b, length 1.83, height 0.96; length range 1.60–1.83.

Appendages: Not examined in detail but, in general, similar to those of adult female. Furca with 5 claws on each lamella similar to those of adults.

Genitalia: None observed.

DESCRIPTION OF A–4 INSTAR (sex unknown) (Figure 9*i–n*).—Carapace similar to that of adults except posterior end of dorsal margin depressed (Figure 9*i,j*). Carapace smooth without ornamentation.

Infold: Similar to that of adults except anteroventral and ventral lists not observed; posterodorsal list present (Figure 9*j*).

Carapace Size (in mm): Cueva de los Carboneros: USNM 194310, length 0.67, height 0.35.

Mandible: Basale with only 3 distal lateral bristles (Figure 9*k*) (one of the bristles entwined on later instars absent on this instar). Endopodite shown in Figure 9*l*.

Fifth and Sixth Limbs (Figure 9*m*): Both developed but 6th limb with about same posterior extension as 5th limb, or slightly less.

Seventh Limb: Absent.

Furca (Figure 9*n*): Each lamella with 4 claws; 4th claw differs from others in having anterior and posterior edges more parallel proximal to pointed tip and appearing less sclerotized. Claws 2–4 indistinctly striated. Unpaired bristle present. Apron small (not shown).

Age of Specimen: USNM 194310 is estimated to be an A–4 instar (probably instar III) because of the presence of 6th limbs (which do not extend posteriorly past the 5th limbs) and the absence of 7th limbs.

REMARKS.—The specimens collected herein from Cueva de los Carboneros are slightly larger than those from Casimba Susana.

	Cueva de los Carboneros (length in mm)	Casimba Susana (length in mm)
Adult female	2.26–2.31	1.98–2.01
Adult male	2.05–2.29	1.84–1.90
A–1 male	1.67	1.55

COMPARISONS.—The adult *Spelaeoecia cubensis* differs from previously described species in having only five furcal claws on each lamella; other species have six to eight. The adult male differs from those previously described in having on the endopodite of the right 2nd antenna a clasper that forms an acute angle; on other species the clasper is either straight or slightly curved. The posterior branch of the male copulatory organ, unlike those described previously in the genus, has an expanding blunt tip. Two lateral bristles on the mandibular basale, unlike other species of *Spelaeoecia* for which they are known, are entwined; however, bristles are entwined on known species of the genus *Deeveya*.

Superfamily THAUMATOCYPRIDOIDEA Müller, 1906

COMPOSITION.—Includes the single family Thaumatocypridididae Müller, 1906.

Family THAUMATOCYPRIDIDAE Müller, 1906

COMPOSITION.—Includes two fossil genera and three extant genera (Kornicker and Iliffe, 1989a:2, fig. 1).

Danielopolina Kornicker and Sohn, 1976

TYPE SPECIES.—*Danielopolina carolynae* Kornicker and Sohn, 1976.

COMPOSITION AND DISTRIBUTION (Figure 1).—Includes six species from anchialine environments and one species from abyssal depths: MID-ATLANTIC (3459 m): *Danielopolina carolynae* Kornicker and Sohn, 1976; CUBA: *D. orghidani* (Danielopol, 1972); CANARY ISLANDS: *D. wilkensi* Hartmann, 1985, and *D. phalanx* Kornicker and Iliffe, 1995; BAHAMA ISLANDS: *D. bahamensis* Kornicker and Iliffe, 1989a; MEXICO: *D. mexicana* Kornicker and Iliffe, 1989a; GALAPAGOS ISLANDS: *D. styx* Kornicker and Iliffe, 1989b. In addition, a species of *Danielopolina* (left in open nomenclature) has been reported from Western Australia (Baltanás and Danielopol, 1995:317, table 1).

Danielopolina orghidani (Danielopol, 1972)

Thaumatocypris orghidani Danielopol, 1972:1390, figs. A–D; 1976:9.—Silva, 1986:45, 93 [list].

Taumatocypris orghidani.—Botosaneanu et al., 1973:1, 14.—Orghidan, 1973:48; 1973:99 [photo legend].—Juberthie et al., 1977:44.

Danielopolina orghidani (Danielopol).—Kornicker and Sohn, 1976:94, figs. 71–73.—Hartmann, 1985:256, 257.—Danielopol and Hartmann, 1986:278.—Kornicker and Iliffe, 1989a:4 [key]; 1992:12 [key].—Kornicker et al., 1990:2 [list].—Danielopol, 1990:138, 140, fig. 1.—Baltanás and Danielopol, 1995:318 [cladistic analysis].

HOLOTYPE.—*Thaumatocypris orghidani,* unique female (Danielopol, 1972:1390).

TYPE LOCALITY.—Grotto in Matanzas, Cuba, 1.5 km from Atlantic Ocean. Collected in 1970.

Discussion of Type Locality: In the description of the

species, Danielopol (1972:1390) gave the type locality as a grotto on Cape Matansas, 1.5 km from the Atlantic coast. In a supplementary description of the species, Danielopol (1976:10) expanded the description of the type locality as being "Grieta Punta de Guana Matanza at Cap Matanzas." Danielopol (1976:10) stated that the name of the cave is that given by Juberthie et al. (1976 [1977]), and that "Dr. Orghidan also referred to this cave as 'Grietas du Phare de Sebdruca.'" Kornicker and Sohn (1976:94) reported presumable topotypes received from Francisca Caraion and collected in 1973 from "Matanzas Grieta Du Phare De Seborucal." Because of several names having been reported for the type locality, the presence of other caves in the vicinity that did not have the species, and the importance of knowing the location of the type locality as precisely as possible, the literature describing the cave was reexamined.

Orghidan (1973:48) stated in Spanish the following:

> On 7 Nov 1970 "*Taumatocypris*" *orghidani* was collected in a "Grieta" near the lighthouse north of Matanzas (about 14 km North from the town). In going from Matanzas towards the Grotto Cueva la Pluma, one arrives in the vicinity of Seboruco lighthouse. In this spot—about 2 km before the entrance to the grotto—and very close to the path or road, on the left, an opening of small size (about 1 m wide) gives access to the little lake at the bottom of this fissure. The lake is 7 m long and 2 m wide. The bottom of the opening is reached by a ladder about 4 m long.

Apparently, Danielopol's reference (1976:10) to "Sebdruca" should have been "Seboruca" (possibly a typographical error). According to Orghidan (1973:48), Grotto Cueva la Pluma contains a phreatic lake covered with thick organic detritus composed mostly of guano. To reach this lake one must descend 52 m. Two species of blind fish are found there. According to Cuban colleagues of Orghidan (1973:48), the level of the lake is at the level of the Atlantic. The location of Cueva de los Pluma is shown in a 1989 atlas of Cuba (Academy of Sciences of Cuba: map 5:1).

Juberthie et al. (1977:44) noted that "*Taumatocypris*" *orghidani* was collected in November 1970 from "Station 5, Grieta Punta de Guana, Matanzas," and stated that this is a fissure about 25 m long situated at the edge of the path or road from Matanzas, along the ocean, and is on a Recent marine terrace called Seboruco, which is bordered by a rocky ledge or lip about 0.5–1 m high. The fissure has two enlargements, one of which gives access to "A" at a shallow water level where "*Taumatocypris*" *orghidani* was collected. The other enlargement opens to "B" where one can see subterranean fish swimming at the surface. Juberthie et al. (1977:43, fig. 1; 44, fig. 2) presented a map showing the location of station 5 (fig. 1), and a plan view of the grotto showing the locations of "A" and "B" (fig. 2). Danielopol (1976:10) stated that in a letter of 17 Nov1975 from C. Juberthie he was informed that "the cave is located at about 500 m from the sea shore; there is no information on a direct underground connection between this cave and the sea." Silva (1986:45, 92) listed *Thaumatocypris orghidani* Danielopol as being collected in Grieta de Punta de Guana, Corral Nueva, Matanzas.

The Gazetteer of Cuba (Defense Mapping Agency, 1991) does not list "Cap Matanzas" or any of the cave or grotto names given above in cave descriptions. Several "Seboruca," "Seboruco," and "Seborucal" in the general area of the cave are listed in the Gazetteer (p. 865).

No additional information about the location of "Matanzas Grieta du Phare de Seborucal" from which specimens were collected in 1973 was found (Kornicker and Sohn, 1976:94), but presumably it is the type locality. Orghidan and Jiménez (1977:12) stated that the Cuban ostracodes collected in 1973 were given to Francisca Caraion, Institute of Biologie, Bucharest, Romania.

Orghidan et al. (1977:30) listed "*Taumatocypris*" sp. at "Cueva del Agua, Provinci de Oriente, Municipio de El Caney, en bas de Cueva Atabex (St. 41)." The collections were made on 15, 23, and 29 March 1973. Silva (1986:59, 93) lists that locality as having *Thaumatocypris* sp. The specimens, which we herewith refer to *Danielopolina* species, if extant, need further study for specific determination.

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