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ENANTIOSIS CAVERNICOLA, A NEW GENUS AND SPECIES OF DEMERSAL COPEPOD (CALANOIDA: EPACTERISCIDAE) FROM SAN SALVADOR ISLAND, BAHAMAS

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Abstract.— *Enantiosis cavernicola,* is described from Lighthouse Cave, San Salvador Island, Bahamas. The main diagnostic characters are the specialized mouthparts, primitive swimming legs, and structure of the male fifth legs. Distribution of the family Epacteriscidae is discussed.

Demersal calanoid copepods occupy restricted habitats on or near the bottom, and their investigation often requires special collection methods. Esterly (1911), for example, collected *Ridgewayia marki* from a cave on Agar's Island, Bermuda, using a net fastened to a pole. More recent workers have employed diver-held nets (Bowman and González 1961), Ockelmann detritus sledges (Fosshagen 1968a, b, 1970a, b, 1972, 1973), and suction devices (Humes and Smith 1974). Nine genera of demersal calanoids have been described from shallow-water habitats in the western tropical North Atlantic. The new genus described below was collected with a hand-held net from a marine cave on San Salvador Island, Bahamas.

San Salvador Island (24°N, 74°W) is located on the eastern edge of the Bahama Platform, about 550 km east of Miami, Florida. Lighthouse Cave, near Dixon Hill Lighthouse on the northeastern end of the island, 800 m inland, has water-filled passages up to 2 m in depth. There is a tidal fluctuation of up to 60 cm in the cave, and the salinity of the water is approximately 35‰. Biological expeditions to Lighthouse Cave since the mid-1970's have resulted in the description of two isopods, *Bahalana geracei* Carpenter, 1981 and *Neostenetroides stocki* Carpenter and Magniez, 1982; three sponges (Van Soest and Sass 1981); and a terrestrial pseudoscorpion, *Paraliochthonius carpenteri* (Muchmore, in press).

Plankton collections from the cave in January–February 1981 and May–June 1982 included three genera of demersal calanoids: *Ridgewayia, Stephos,* and a new genus belonging to the family Epacteriscidae. This family presently contains only a single species, *Epacteriscus rapax* Fosshagen, 1973, described from Florida and Colombia.

Family Epacteriscidae Fosshagen, 1973 (emended)

Prosome with all 5 pedigers free. Urosome 3-segmented in female, 4-segmented in male. Female genital segment produced ventrally, openings close together. First antenna of female 24–25-segmented, right antenna geniculate in male. Rostrum broad, bilobed, bearing filaments. Mouthparts with reduced numbers of setae. Mandibular endopod vestigial or absent; gnathobasis may bear ventral serrate process. Second maxilla and maxilliped with strong spinous endopodal setae. All swimming legs except male fifth pair primitive, with 3-segmented rami. Male fifth

legs only slightly modified (*Epacteriscus*) or transformed into complex grasping organ (*Enantiosis*).

Enantiosis, new genus

Diagnosis.—Both female and male left antenna 25-segmented, reaching end of prosome; male right antenna geniculate, 22-segmented. Each lobe of rostrum angular, bearing single filament.

Labrum broadly truncate, distomedial margin of oral surface bearing 6 strong teeth. Labium bifid, each lobe cuspidate medially. Mandibular gnathobasis with bicuspid molars; palp with weakly segmented exopod, endopod vestigial. First maxilla with well developed lobes but reduced number of setae. Female fifth legs not reduced. Male fifth legs prehensile, all rami 3-segmented.

Type-species.—*Enantiosis cavernicola.*

Etymology.—From *Enantiosis* (G.), meaning contradiction, referring to the advanced male fifth legs, as opposed to the primitive fifth pair in other members of the Epacteriscidae. Gender feminine.

Enantiosis cavernicola, new species

Material.—Male holotype 1.20 mm (USNM 195388), and female allotype 1.37 mm (USNM 195389) collected 5 June 1982 from Lighthouse Cave, San Salvador Island, Bahamas. 6 female and 2 male paratypes (USNM 195390) collected on same date from same locality.

Description.—Female (Fig. 1a, b): average length 1.37 mm, range 1.29–1.46 mm, length/width ratio 2.73. Prosome oval in dorsal view, rounded posteriorly. Anal segment slightly longer than preceding segment, posterior margin dentate dorsally. Caudal ramus with 1 dorsal, 1 lateral, and 4 apical setae. Second-from-innermost seta longest, longer on left side than corresponding right seta. Left innermost seta hirsute at base, corresponding right seta bare at base. Of the apical setae, only left innermost without breaking plane near base.

First antenna (Fig. 1e) reaching genital segment, setae and esthetes concentrated proximally. Segments 3, 7, 12, 14, and 24 each with especially long seta.

Second antenna (Fig. 2a) with basipods 1 and 2 weakly separated, bearing 1 and 2 setae, respectively. Exopod 7-segmented, carrying 2 proximal, 5 medial and 3 terminal setae. Endopod 2-segmented, segment 1 with 2 medial setae, segment 2 with 3 medial and 6 terminal setae.

Labrum (Fig. 1f) broadly truncate. Distomedial margin of oral surface bearing 6 strong teeth, 2 outer teeth larger than 4 equal central teeth; distolateral corners each with row of stout bristles. Remainder of oral surface beset with various patches of hairs oriented in different directions. Posterior half of aboral surface with single row of long, slender spines extending just beyond distal margin.

Labium (Fig. 1g) deeply cleft; medial margins of labial lobes cuspidate, distal tooth largest, denticulate along posterior edge. Lamina labialis trilobed, central lobe angular, lateral lobes truncate. Lamina labialis flanked on both sides by 6 prominent spines (serrula sexdentata). Remainder of oral surface with reduced number of hairs.

Mandibular endopod (Fig. 1h) bearing 2 short setae. Exopod composed of 3

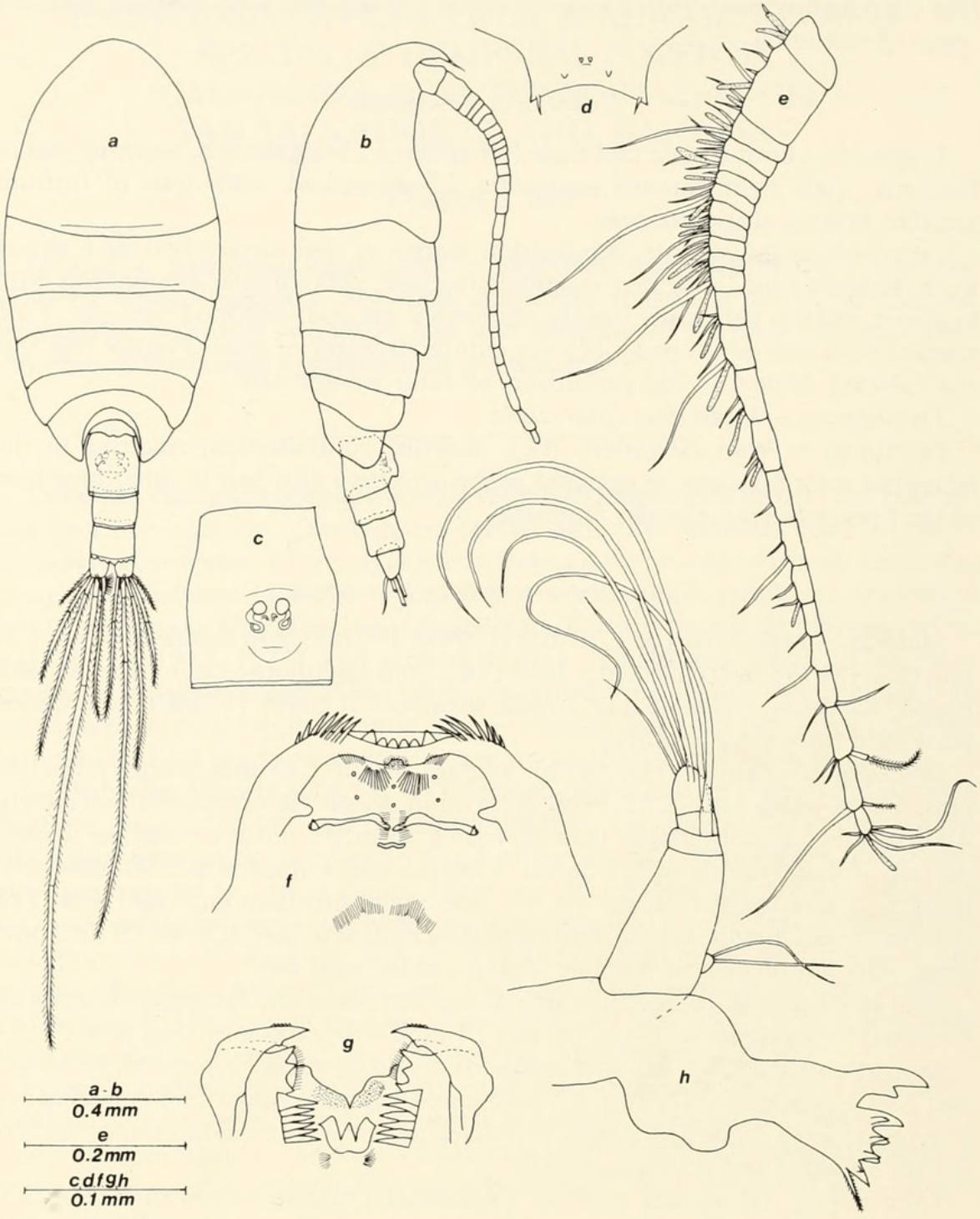

Fig. 1. *Enantiosis cavernicola,* female: a, Habitus, dorsal; b, Habitus, lateral; c, Genital segment, ventral; d, Rostrum; e, First antenna; f, Labrum; g, Labium; h, Mandible.

poorly defined segments, carrying 3 medial and 3 terminal setae. Gnathobasis with 5 bicuspid teeth, ventral tooth largest, set off from remaining teeth by deep incision.

Basipod of first maxilla (Fig. 2b) with 1 outer and 2 inner lobes. Outer lobe with 6 long setae. First inner lobe bears 13 spinous setae; second inner lobe small, with 2 unequal setae. Basipod 2 with small distal seta and proximal endite bearing

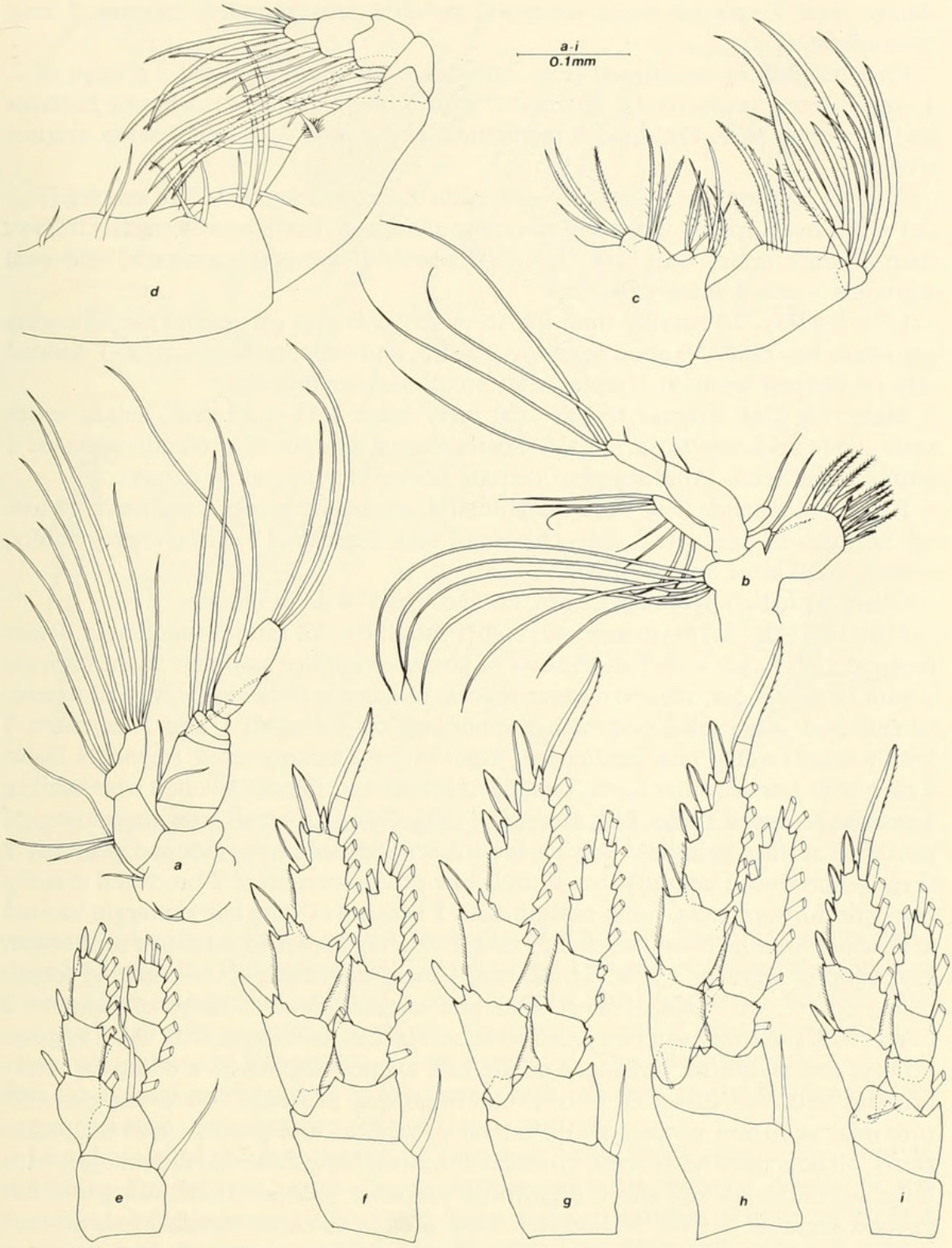

Fig. 2. *Enantiosis cavernicola,* female: a, Second antenna; b, First maxilla; c, Second maxilla; d, Maxilliped; e, Leg 1; f, Leg 2; g, Leg 3; h, Leg 4; i, Leg 5.

1 seta. Endopod 1-segmented, carrying 1 proximal, 1 medial and 4 terminal setae. Exopod 1-segmented, with 4 outer and 3 terminal setae.

Basipod 1 of second maxilla (Fig. 2c) with 4 endites bearing 4, 3, 3, and 3 setae, respectively. Basipod 2 with group of 4 medial setae and distal endite carrying 1

slender and 3 spinous setae. Endopod reduced, unsegmented, bearing 7 long spinous setae.

First basipod of maxilliped (Fig. 2d) with 1 proximal seta and 3 groups of 2, 4, and 3 setae, respectively. Basipod 2 with 3 medial setae, central one bulbous and hirsute at base. Endopod 4-segmented, carrying 4, 4, 3, and 7 setae, respectively.

All 5 swimming legs essentially unmodified. Exopod segment 3 of first leg (Fig. 2e) with 2 outer spines; long terminal spine unflanged, flexible, only slightly thicker than 4 inner setae. Legs 2–4 (Fig. 2f–h) with distomedial corner of endopod segments 1 and 2 acutely pointed.

Fifth leg (Fig. 2i) smaller than fourth, with 1 less seta on each of the following segments: basipod 1, exopod segments 1 and 3, and endopod segments 2–3. Medial seta on exopod segment 1 replaced by small angular process.

Male (Fig. 3a): average length 1.20 mm, range 1.15–1.23 mm, length/width ratio 2.54. Prosome as in female. Posterodorsal margin of urosome segment 1 with 4 small teeth. Anal segment dentate posterodorsally as in female.

Right first antenna (Fig. 3b) 22-segmented, geniculate between segments 18 and 19. Segment 18 excavate distally, bearing 1 seta. Segment 19 excavate proximally, with 2 small setae and 1 esthete.

Other cephalic appendages, rostrum and legs 1–4 as in female.

Fifth legs (Fig. 3c) asymmetrical, highly modified. All rami 3-segmented. Right basipod 1 (Fig. 3d) with 2 short rows of posterior surface spinules. Right basipod 2 with long, slender, recurved inner process and dense pubescence medial to base of endopod. Right endopod with 1 inner seta on segments 1 and 2; segment 3 with 6 setae jointed near midlength. Right exopod lacking setae; segments 1 and 2 each with 1 small outer spine; segment 3 prehensile, falcate, swollen base bearing 1 medial recurved spine. Left basipod 1 (Fig. 3d) with small irregular cluster of posterior surface spinules. Left basipod 2 unmodified. Left endopod segment 1 (Fig. 3e) produced laterally into thumb-like process; segment 2 produced distally into spiniform process, outer margin with 2 brushes of long hairs, margin incised at base of proximal brush; segment 3 broad, bearing 6 setae jointed near midlength. Left exopod segment 1 (Fig. 3f) bearing 1 long, unflanged spine reaching length of segment 2, with pair of short setae and angular spine at its base. Segment 2 ovate, with proximal anterior protuberance, outer distal margin with small angular process and styliform, unflanged spine. Left exopod segment 3 a complex membranous structure, dissected into several finger-like processes. Outer margin with proximal styliform process and 2 lateral processes: first process inserted posteriorly, slender; second process attached anteriorly, spatulate. Medial margin with bulge at midlength and short, digitiform, posterior process. Distal margin of left exopod segment 3 with 5 processes from medial to outer margin: first process spatulate, curving medially; second process styliform, recurved into triangle at base; third process styliform, sinous; fourth process with lobe near midlength and acute apex; fifth, outermost process, styliform.

Etymology.—The specific name, *cavernicola,* is a composite of *caverna* (L.) meaning cave and *cola* (L.) meaning dweller.

Discussion.—*Enantiosis cavernicola* is considered to be a bottom-dwelling copepod because of the robust spines on the exopods of the swimming legs and morphology of the male fifth legs. Though several families of demersal calanoids have morphological features in common, their phylogenetic relationships remain

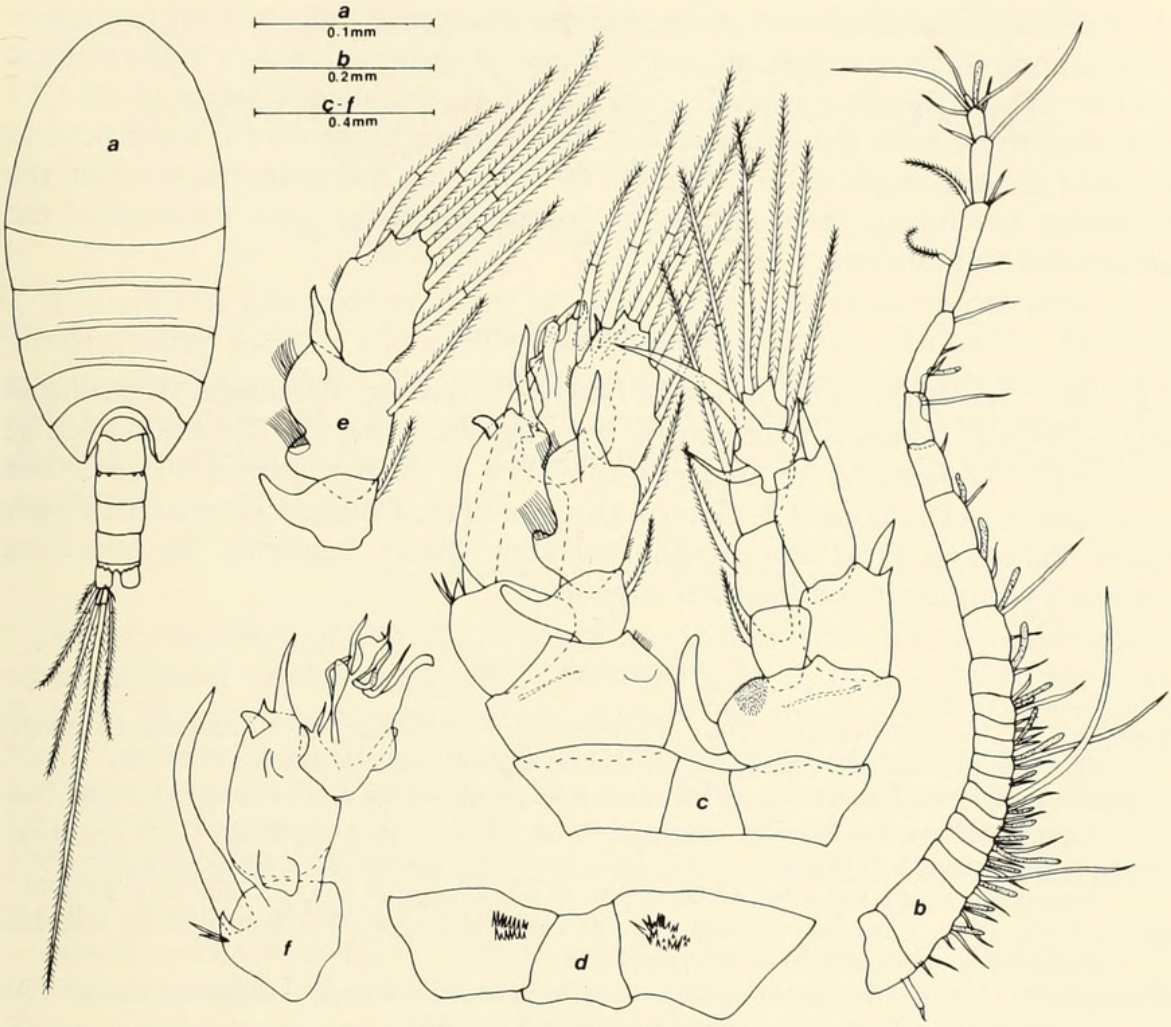

Fig. 3. *Enantiosis cavernicola,* male: a, Habitus, dorsal; b, Right first antenna; c, Fifth legs, anterior; d, First basipods, fifth legs, posterior; e, Left fifth endopod; f, Left fifth exopod.

unclear. *Enantiosis,* based on the structure of the male fifth legs, seems most closely allied to the Ridgewayiidae. The left exopod resembles *Ridgewayia,* bearing a long spine on segment one and a membranous third segment. The male fifth endopods are trimerous in *Enantiosis, Epacteriscus,* and *Exumella* (Ridgewayiidae), while those of *Ridgewayia* are unsegmented. The Epacteriscidae, however, lack the typical modification of the female fifth legs seen in the Ridgewayiidae, suggesting that these families are not closely related.

Morphology of the mouthparts of *Enantiosis* indicates a predaceous lifestyle similar to *Epacteriscus rapax.* The vestigial mandibular endopod, deeply incised mandibular gnathobasis with pointed cusps, reduced number of setae on the first maxillae, and spinous setae of the second maxillae and maxillipeds, all suggest that *E. cavernicola* is not a filter-feeding copepod. The absence of a serrate mandibular process, however, implies that *E. cavernicola* may be less voracious than *E. rapax.*

In addition to the type-locality, an *Enantiosis* species has been collected from several caves among the Bermuda Islands (Fosshagen, pers. comm.). The family Epacteriscidae, however, apparently has a circumtropical distribution. An undescribed *Epacteriscus* and four females of *Enantiosis* were recently collected during a study of reef-associated zooplankton at Quezon, Philippines (Walter *et*

al. 1982). These animals were collected with emergence traps secured in shallow water among corals, a habitat similar to that of *Epacteriscus rapax* in the tropical Atlantic. The Philippine specimens of *Enantiosis* are slightly larger (1.50–1.59 mm) than those from the Bahamas and their first antennae do not reach beyond the third pediger. Because these females are otherwise indistinguishable from the Bahamian specimens, their description has been deferred until the male of the species can be examined.

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