

A NEW GENUS AND TWO NEW SPECIES OF SUBTERRANEAN
AMPHIPOD CRUSTACEANS (GAMMARIDAE S. LAT.)
FROM THE YUCATAN PENINSULA IN MEXICO

John R. Holsinger

Dept. of Biological Sciences, Old Dominion University
Norfolk, Virginia 23508

INTRODUCTION

Although a number of caves in the Yucatán Peninsula of México were biologically explored in the 1930's (Pearse, 1938), subterranean amphipod crustaceans were not discovered there until the spring of 1973. During April and May, 1973, Mr. James Reddell and members of the Association for Mexican Cave Studies collected blind, unpigmented amphipods from two caves in the state of Yucatán and one cave in the neighboring state of Campeche. These specimens represent a new genus and two new species which are described below.

The discovery of these new species brings the number of subterranean amphipod genera recorded from México to three and the number of species to eight. *Mexiweckelia* was described by Holsinger and Minckley (1971) on the basis of two species (*M. colei* and *M. particeps*) collected from groundwater habitats in the Bolsón de Cuatro Ciénegas in central Coahuila. *M. mitchelli* was described more recently from Cueva de la Siquita in northeastern Durango (Holsinger, 1973). *Bogidiella tabascensis* was described from Grutas del Coconá in Tabasco by Villalobos (1960), and the description of *B. sbordonii* from Cueva de Cerro Brujo in Chiapas and *B. arganoi* from a well in Veracruz were recently published by Ruffo and Vignataglianti (1973).

I am grateful to Mary Butterwick, David and Martha McKenzie, Stuart Murphy and James Reddell for collecting specimens of the new species. Further

thanks are due Mr. Reddell who sent the specimens to me for study and who provided other helpful suggestions.

Mayaweckelia, new genus

Diagnosis.—Without eyes or pigment; of subterranean facies. Antenna 1 longer than antenna 2, at least 50 percent length of body, some flagellar segments with aesthetascs; accessory flagellum with 3 segments. Antenna 2, peduncular segment 4 a little longer than segment 5, without spines. Interantennal lobe not much produced, rounded anteriorly. Upper lip symmetrical, rounded apically. Mandible incisor and lacinia mobilis well developed; molar triturative; palp absent. Maxilla 1: inner plate with long, apical setae; outer plate with 9 apical, serrate spines; palpal segment 2 with spines on inner margin. Maxilla 2: inner plate with row of long, obliquely-placed setae on inner margin; apexes of inner and outer plates with numerous coarse setae. Maxilliped: inner plate with thick spines and coarse setae apically; outer plate broadly rounded apically, reaching about one-half length of segment 2 of palp, with stiff setae apically. Lower lip: outer lobes well developed; lateral processes moderately long; inner lobes small to vestigial. Gnathopodal propod 1 proportionately small, palm armed with a few spine teeth and several setae. Segment 4 of gnathopod 1 with prominent ventral lobe, inner margin partly pubescent. Gnathopodal propod 2 longer than first propod, rather narrow;

palm armed with spine teeth, some of which may be distally-notched near defining angle. Propod palm of male gnathopod 2 longer and with more spine teeth than female. Pereopods 3 and 4 subequal except coxal plate 4 broader and with more marginal setae. Pereopod 6 a little longer than pereopod 7, significantly longer than pereopod 5, at least 50 percent length of body. Coxal gills large, pedicellate. Sternal processes absent. Brood plates small and narrow in sexually mature females.

Posterior margin and corners of pleonal plates not produced. Peduncles of pleopods each with 2 coupling hooks on inner margins distally. Uronites free; uronites 1 and 2 each with 2 stiff setae distodorsally; uronite 3 with 2 small spines distodorsally. Uropods 1 and 2 unmodified; peduncle of 1 lacking anterolateral (basofacial) spine(s). Uropod 3 comparatively long, biramous; rami 1-segmented, subequal in length, bearing plumose setae and spines marginally. Telson cleft to base, lobes distally rounded and bearing a few short spines on inner and outer margin.

Gender feminine. Type-species, *Mayaweckelia yucatanensis*, new species.

Etymology.—The generic name is derived by combination of “*Maya*,” erected in honor of the Mayan people who inhabit the Yucatán Peninsula, and “*Weckelia*,” the name of a related, Greater Antillean genus.

Affinities.—*Mayaweckelia* is related to both *Mexiweckelia* and *Hadzia* but differs from these genera in the following important ways: accessory flagellum of antenna 1 with 3 segments, absence of spines on inner margin of outer plate of maxilliped, presence of large, ventrally-produced lobe on segment 4 of gnathopod 1, and absence of dorsal spines on uronites 1 and 2. In addition, *Mayaweckelia* differs from *Mexiweckelia* in having pereopod 6 longer than 7 and in having the telson cleft to the base. *Mayaweckelia* is further distinguished from *Hadzia* by the absence of a mandibular palp, absence of a second segment on the outer ramus of uropod 3, and in the shape of the telson which has distally-rounded lobes and shorter marginal spines.

Mayaweckelia resembles *Mexiweckelia* by the absence of a mandibular palp and in the similarity of the third uropod. It resembles *Hadzia* by having the telson cleft to the base. The overall structure of the mouthparts (excluding the mandibular palp and the outer plate of the maxilliped), gnathopodal propods, pereopods, coxal gills and brood plates is generally similar in all three genera. Because of its obvious affinities, *Mayaweckelia* is assigned to the *Hadzia* group¹ of the family Gammaridae.

Mayaweckelia yucatanensis, new species

Figs. 1-3

Material examined.—MEXICO. *Campeche*: Grutas de Xtacumbilxunam, 2 km SW of Bolonchenticul, holotype female and 25 paratypes collected by James Reddell, David and Martha McKenzie and Mary Butterwick, 13 May 1973. The holotype is deposited in the National Museum of Natural History (Smithsonian Institution) (USNM 151180) and 23 paratypes are deposited in the Museum of Texas Tech University; slide mounts of 2 paratypes are in the author's collection.

Diagnosis.—A small, cavernicolous species distinguished from *M. cenotocola*, to which it is closely related, by shorter antenna 1 which is only 50 percent as long as body, proportionately shorter and broader gnathopodal propods, smaller and more shallow coxal plate of pereopod 4, more narrow bases of pereopods 5-7, fewer spines on the uropods and shorter telson with fewer spines. Largest females, 3.0 mm; largest males, 2.5 mm.

Female.—Antenna 1, 50 percent as long as body, about 50 percent longer than antenna 2; primary flagellum with 15 to 18 segments, some with small, slender calceoli; some segments with aesthetascs; accessory flagellum with 3 segments. Antenna 2, flagellum with 15 to 18 segments, some with aesthetascs; accessory flagellum with 3 segments. Antenna 2, flagellum with 6 segments. Mandibles subequal; molar with seta; spine row with 3 or 4 plumose spines; palp lacking. Maxilla 1: inner plate with 4 apical setae; outer plate with 9 apical, serrate spines; palpal segment 2 with 6 or 7 spines on inner margin. Maxilla 2: inner plate with 17 or 18 obliquely-placed setae on inner margin. Maxilliped: inner plate with 4 or 5 short, thick spines and several coarse setae apically; outer plate with 5 or 6 stiff setae apically; palpal segments 2-4 only lightly setose. Lower lip: outer lobes narrowly rounded; lateral process rather prominent; inner lobes small.

Gnathopod 1: propod small, about as long as segment 5; palm nearly straight, armed with only few stiff setae or slender spines; defining angle distinct, armed with 2 distally-notched spine teeth on inside and 3 distally-notched spine teeth on outside; posterior margin without setae; medial setae few in number; dactyl nail rather long. Segment 5 of gnathopod 1 with 5 thick, plumose setae medially; segment 4 as

¹While this manuscript was in press, Barnard (1976) suggested that the weckeliid genera (excluding *Paraweckelia*) of the Caribbean region be placed in a group separate from other hadziids. Based on its morphological affinities, *Mayaweckelia* should also be included in this group.

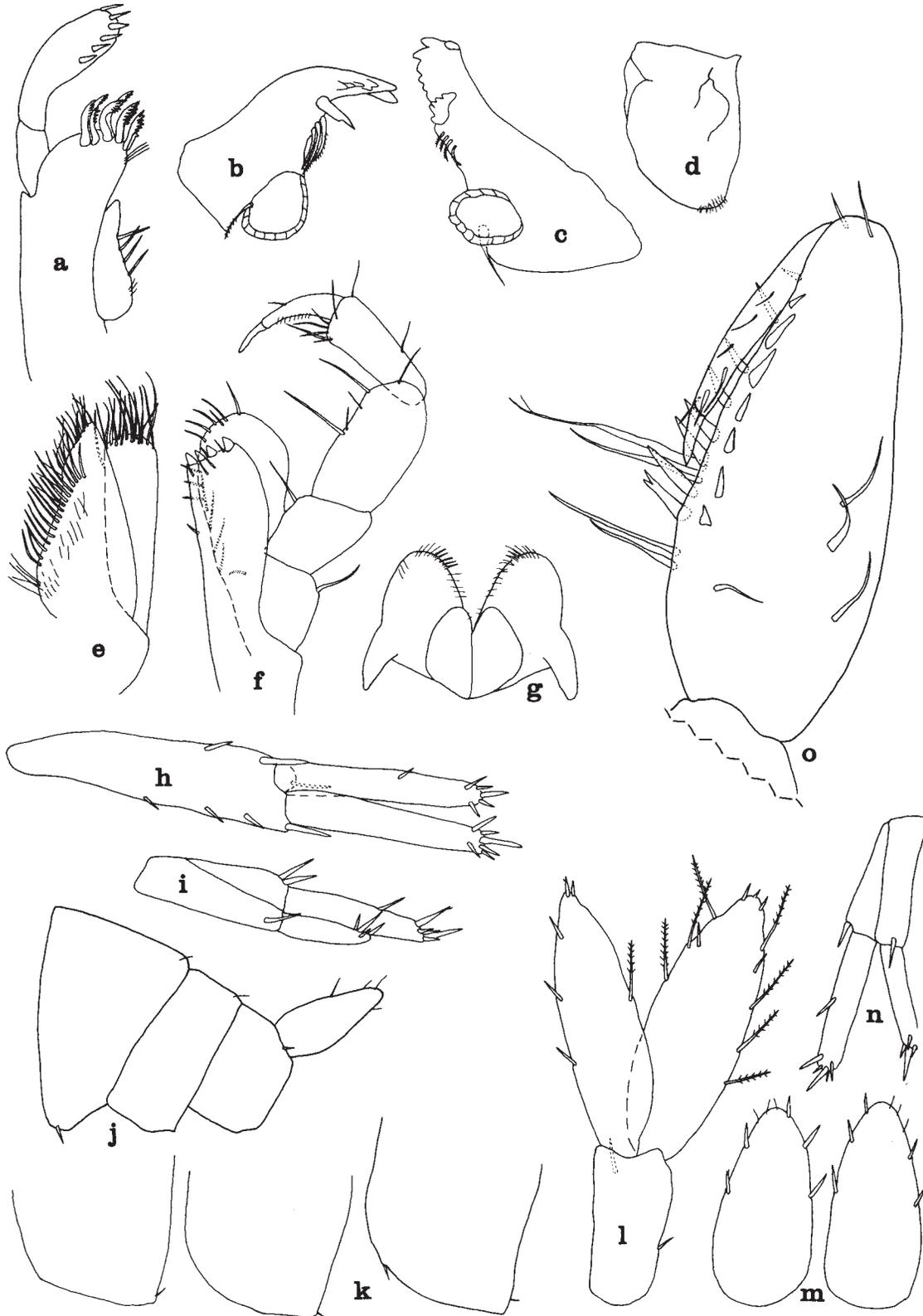


Fig. 1.—*Mayaweckelia yucatanensis*, new species. Female paratype (3.0 mm): a, maxilla 1; b, left mandible; c, right mandible; d, upper lip; e, maxilla 2; f, maxilliped; g, lower lip; h, i, uropods 1 and 2; j, uronites; k, pleonal plates; l, uropod 3; m, telson; n, uropod 2 (from another specimen). Male paratype (2.75 mm): o, gnathopodal propod 2.

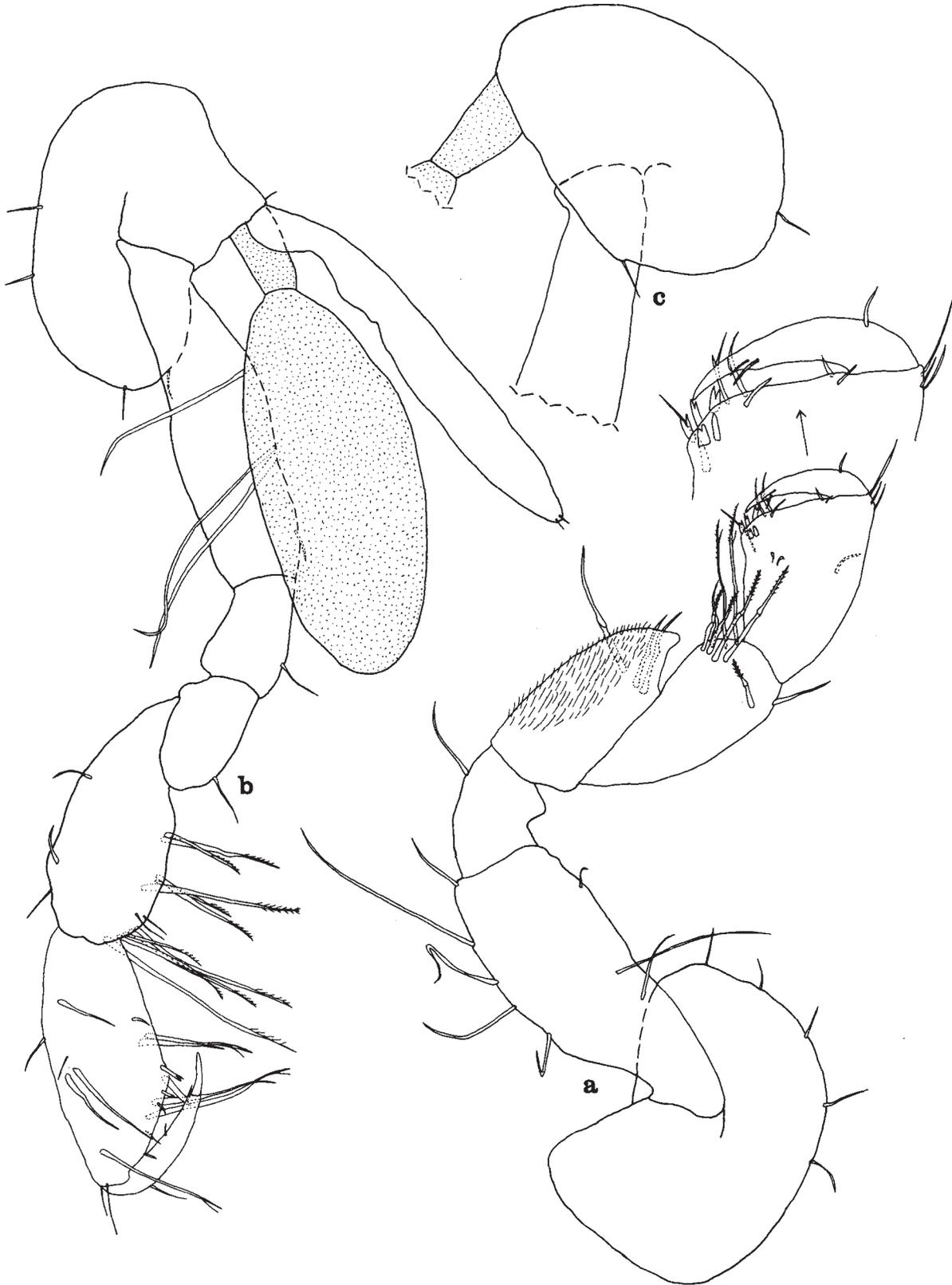


Fig. 2.—*Mayaweckelia yucatanensis*, new species. Female paratype (3.0 mm): *a,b*, gnathopods 1 and 2; *c*, upper part of pereopod 3.

large as segment 5, with a large, ventral lobe, inner margin pubescent posteriorly. Coxal plate longer than broad, margin with 5 rather long setae. Gnathopod 2: propod little longer and narrower than first propod; palm straight, armed with 2 or 3 slender spines on inside and 2 long, thick setae on outside; defining angle with 2 distally-notched spine teeth on outside; posterior margin rather long, with 1 set of 2 long, distally-split setae; superior medial setae few in number, singly and doubly inserted; dactyl nail rather long and curved, reaching well beyond defining angle. Segment 5 of gnathopod 2 as long as propod, with 3 sets of long, comblike setae on posterior margin. Coxal plate 2 longer than broad, with 3 rather long setae on margin. Coxal plate 3 rather shallow, margin with 2 rather long setae. Coxal plate 4 shallow, broader distally than proximally, margin with 4 rather short setae. Pereopod 6, 55 to 60 percent length of body, a little longer than pereopod 7, about 35 percent longer than pereopod 5. Posterior margins of bases of pereopods 5-7 nearly straight to slightly convex; disto-posterior lobes well developed, broadly rounded. Dactyls of pereopods 6 and 7 nearly 50 percent as long as corresponding propods. Coxal gills large, oblong, pedicellate, present on pereopods 2-6.

Pleonal plates: posterior margins nearly straight; posterior corners indistinct; ventral margins of plates 1 and 2 without spines, that of 3 with 1 small spine. Uronite 1 with 2 stiff setae distodorsally and 2 spines ventrally; uronite 2 with 2 stiff setae distodorsally; uronite 3 with 2 small spines distodorsally. Uropod 1: inner and outer rami subequal in length, about 75 percent as long as peduncle; peduncle with 7 spines; rami each with 6 spines. Uropod 2: outer ramus 65 to 75 percent as long as inner ramus, shorter than peduncle; peduncle with 2 or 3 spines; inner ramus with 6 spines; outer ramus with 4 spines. Uropod 3, 15 to 20 percent as long as body; rami subequal in length; inner ramus a little broader than outer ramus, margins with plumose setae, apex with 3 short spines; outer ramus with 3 spines on outer margin, 2 spines on apex and 1 plumose seta on inner margin; peduncle with 2 spines. Telson about as broad as long, cleft to base; each lobe bearing 3 spines on inner margin and 2 spines on outer margin.

Male.—Differing from female only by structure of gnathopodal propod 2 as follows: propod rather long, broadest proximally; palm long, straight, oblique, armed with double row of 6 peglike spine teeth and 2 long setae just beyond defining angle; defining angle with 1 long, distally-notched spine tooth on outside and 1 short spine on inside; posterior margin convex, with 1 set of 2 long setae; medial setae few in num-

ber; dactyl rather short, nail not reaching to defining angle.

Distribution and ecology.—This species is at present known only from its type-locality, Grutas de Xtacumbilxunam near Bolonchenticul. According to James Reddell (in litt.), the type-series was collected from the first pool in the left-hand branch of the cave. The pool is covered with bat guano on the bottom and, in addition to the amphipods, is inhabited by ostracods and shrimps in large number.

Mayaweckelia cenotocola, new species

Figs. 4-6

Material examined.—MEXICO. *Yucatán*: Cenote Xtacabihá, female holotype and 2 female paratypes, James Reddell, Martha McKenzie and Stuart Murphy, 11 April 1973; Cueva de Orizaba, 2 male and 1 juvenile paratypes, J. Reddell et al., 1 April 1973. The holotype is deposited in the National Museum of Natural History (Smithsonian Institution) (USNM 151181) and 3 paratypes are deposited in the Museum of Texas Tech University; slide mounts of 2 paratypes are in the author's collection.

Diagnosis.—A small to medium-sized cavernicolous species easily distinguished from *M. yucatanensis* by antenna 1 which is as long or slightly longer than the body, long narrow fifth and sixth segments of gnathopod 2, deep and broadly expanded coxal plate of pereopod 4, convex anterior margins of bases of pereopods 5-7, more spinose and setose rami of uropod 3, and relatively long, narrow lobes of the telson, each of which possesses 9 or 10 spines. Largest females, 5.5 mm; largest males, 4.0 mm.

Female.—Antenna 1 as long as or a little longer than body; about 65 percent longer than antenna 2; primary flagellum with 37 to 41 segments, some with aesthetascs; accessory flagellum with 3 segments. Antenna 2, flagellum with 11 or 12 segments. Mouthparts like those of *M. yucatanensis* except as noted. Mandible with 5 plumose spines in spine row. Maxilla 1, inner plate with 5 or 6 long, apical setae; palpal segment 2 with 7 to 9 spines and 1 seta on inner margin. Maxilla 2 with inner plate bearing 28 long, obliquely-placed setae on inner margin.

Gnathopod 1: propod small, elongate, narrow, only about two-thirds length of segment 5; palm short, slightly convex, armed with double row of 3 un-notched spine teeth; defining angle rounded, indistinct; posterior margin long, with 1 seta; medial setae few in number; dactyl rather thick, nail long and curved. Segment 4 of gnathopod 1 large, as long as but broader than segment 5, ventral one-third pro-

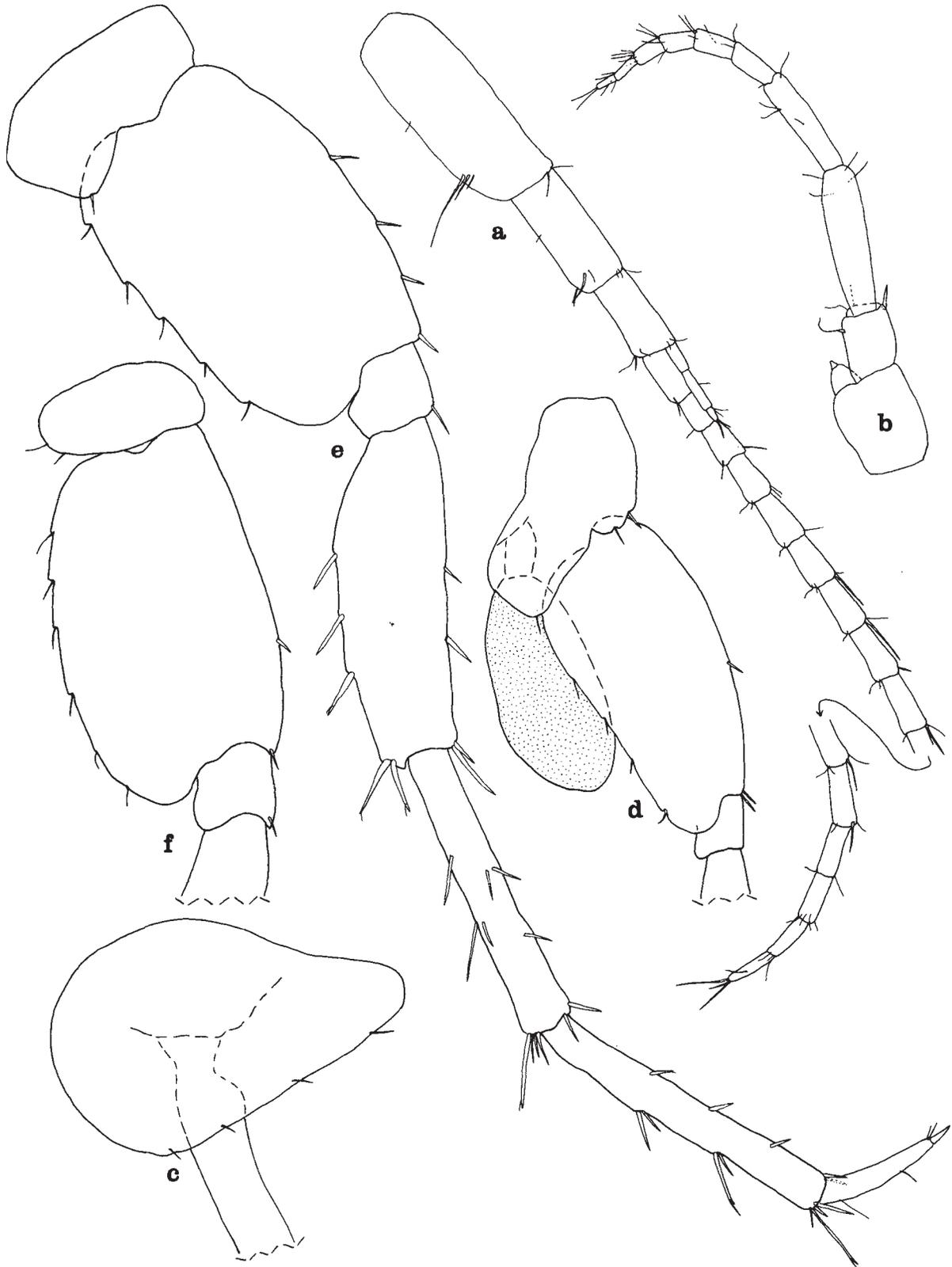


Fig. 3.—*Mayaweckelia yucatanensis*, new species. Female paratype (3.0 mm): *a, b*, antennae 1 and 2; *c*, upper part of pereopod 4; *d*, upper part of pereopod 5; *e*, pereopod 6; *f*, upper part of pereopod 7.

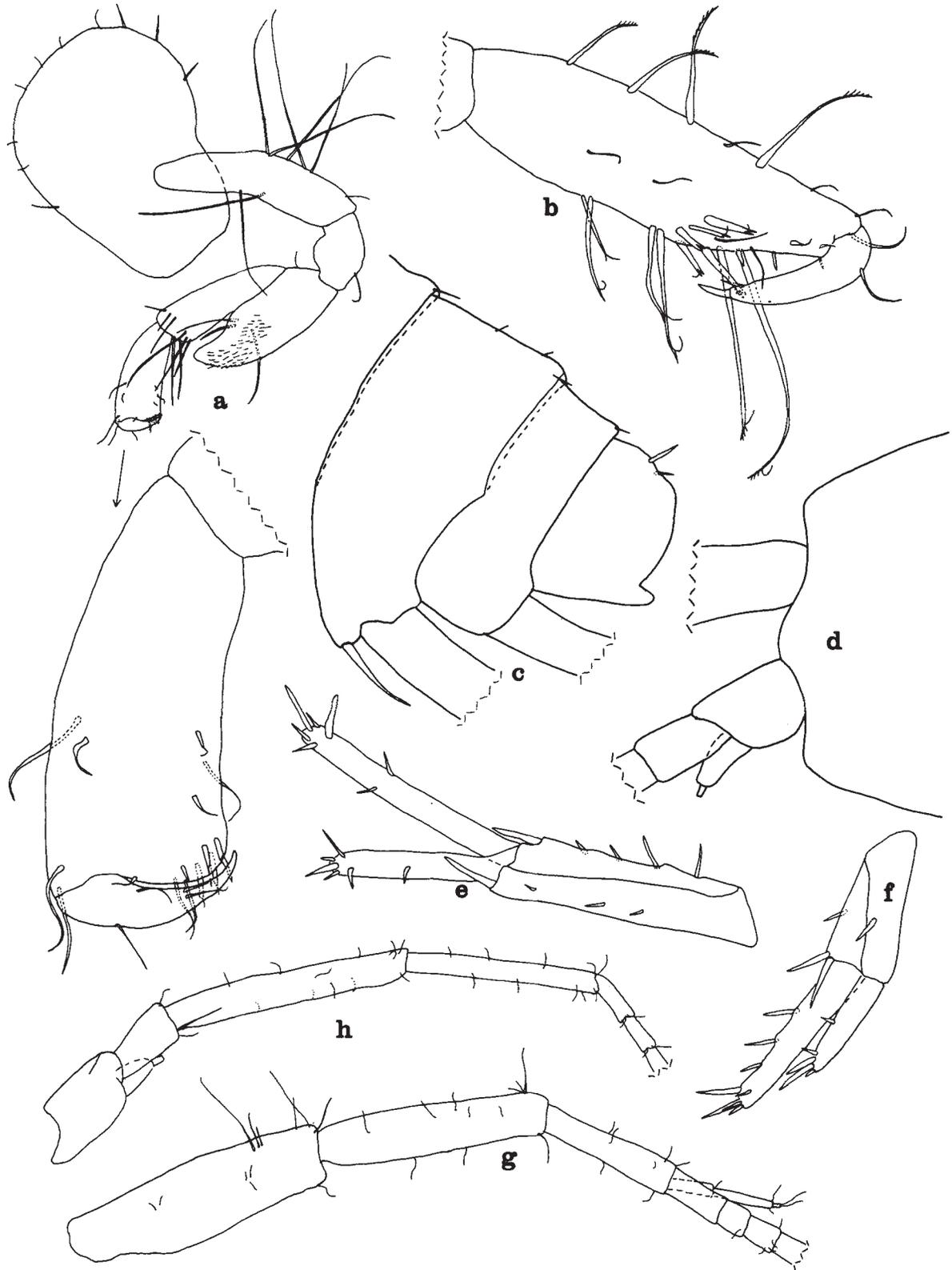


Fig. 4.—*Mayaweckelia cenotocola*, new species. Male paratype (4.0 mm), Cueva de Orizaba: a, gnathopod 1; b, gnathopodal propod 2; c, uronites; d, head; e, f, uropods 1 and 2; g, h, antennae 1 and 2.

duced into conspicuous lobe, ventral one-half of inner margin pubescent. Coxal plate 1 large, deep, longer than broad, broadly rounded ventrally, margin with 3 or 4 slender spines and 6 setae. Gnathopod 2: propod proportionately longer than first propod, narrow, subrectangular, equal in length to segment 5; palm short, armed with 2 distally-notched spine teeth and 2 long, thick setae on outside, 3 or 4 spines (1 distally-notched) on inside; posterior margin very long, with 3 sets of long, distally-split setae; superior medial setae coarse, comblike, singly inserted; dactyl short. Coxal plate 2 deep, more than 50 percent longer than broad, margin with 3 or 4 slender spines and 6 setae. Coxal plate 3 rather small and shallow, margin with 2 long, stiff setae. Coxal plate 3 rather small and shallow, margin with 2 long, stiff setae.

Coxal plate 4 large and deep, extending more than one-half length of segment 2, broadest ventrally; margin with 11 short setae. Bases of pereopods 5-7 broad, anterior and posterior margins convex. Segments 5-7 of pereopods 6 and 7 missing from specimens studied. Dactyl of pereopod 5 nearly 50 percent length of corresponding propod; ventral margin with 4 fine setae. Coxal gills large, oblong, pedicellate, present on pereopods 2-6.

Pleonal plate 1: posterior margin slightly convex; posterior corner rounded, indistinct; ventral margin without spines. Pleonal plate 2: posterior margin straight; posterior corner tiny but distinct; ventral margin with 2 spines. Pleonal plate 3: posterior margin slightly concave; posterior corner tiny, bluntly rounded; ventral margin with 1 spine. Uronite 1 with

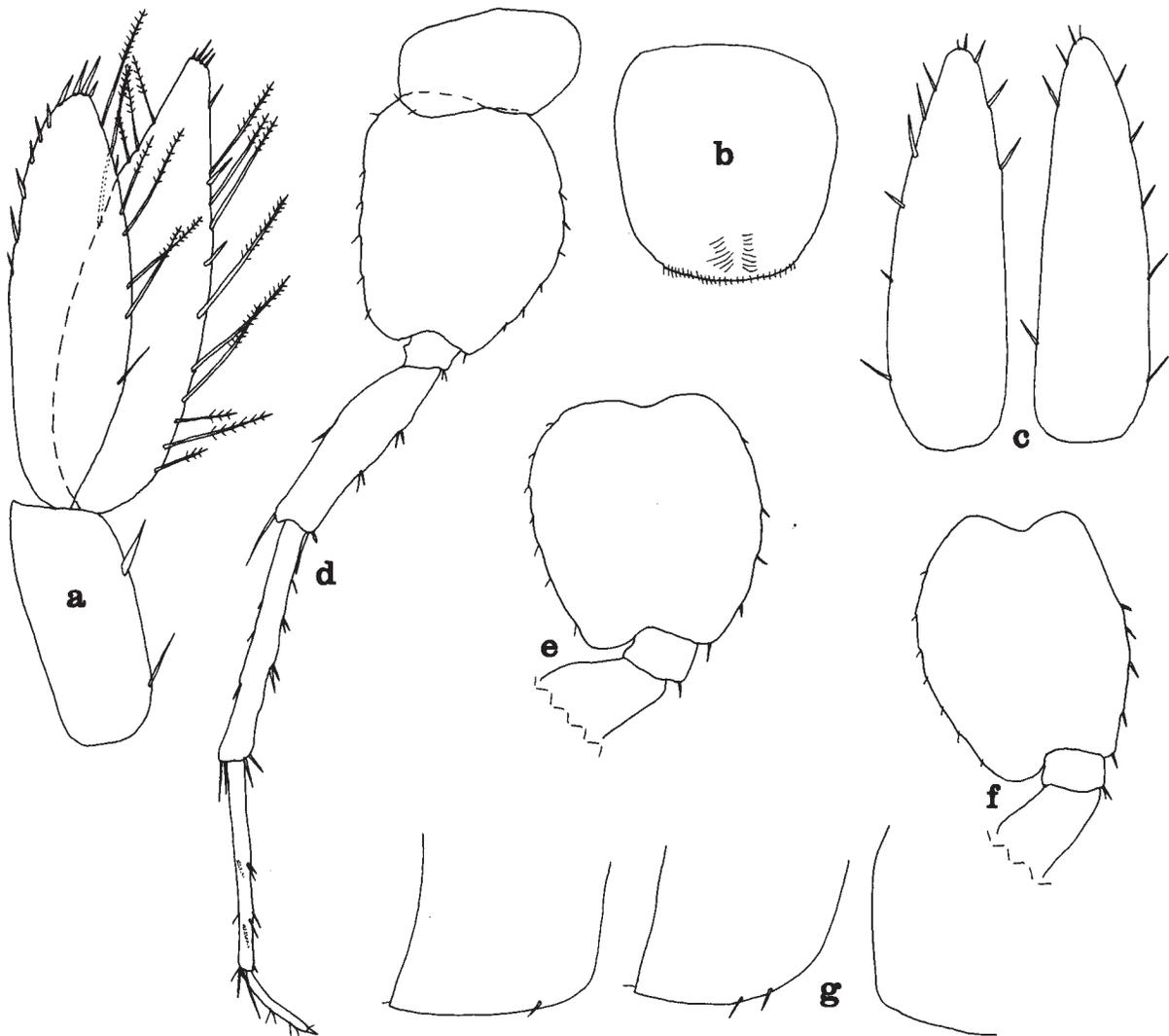


Fig. 5.—*Mayaweckelia cenoticola*, new species. Female paratype (5.0 mm), Cenote Xtacabihá: a, uropod 3; b, upper lip; c, telson; d, pereopod 5; e, f, upper part of pereopods 6 and 7; g, pleonal plates.

several short, stiff setae mid-dorsally, 2 short, stiff setae distodorsally and 2 long spines ventrally; uronite 2 with 2 short, stiff setae distodorsally; uronite 3 with 2 spines mid-dorsally. Uropod 1: outer ramus about 25 percent longer than inner ramus, subequal in length to peduncle; peduncle with 9 spines; rami each with 7 spines. Uropod 2: outer ramus about 40 percent longer than inner ramus, about 25 percent longer than peduncle; peduncle with 4 spines; inner

ramus with 5 spines; outer ramus with 8 spines. Uropod 3, 15 to 20 percent as long as body; inner ramus slightly longer than outer ramus, margins with long, singly-inserted, plumose setae and few short spines, apex with 4 short spines; outer ramus with long, plumose setae on inner margin and short spines on outer margin toward distal end, apex with 4 spines; peduncle with 2 spines. Telson about 25 percent longer than broad, cleft to base; lobes each with 5 or 6

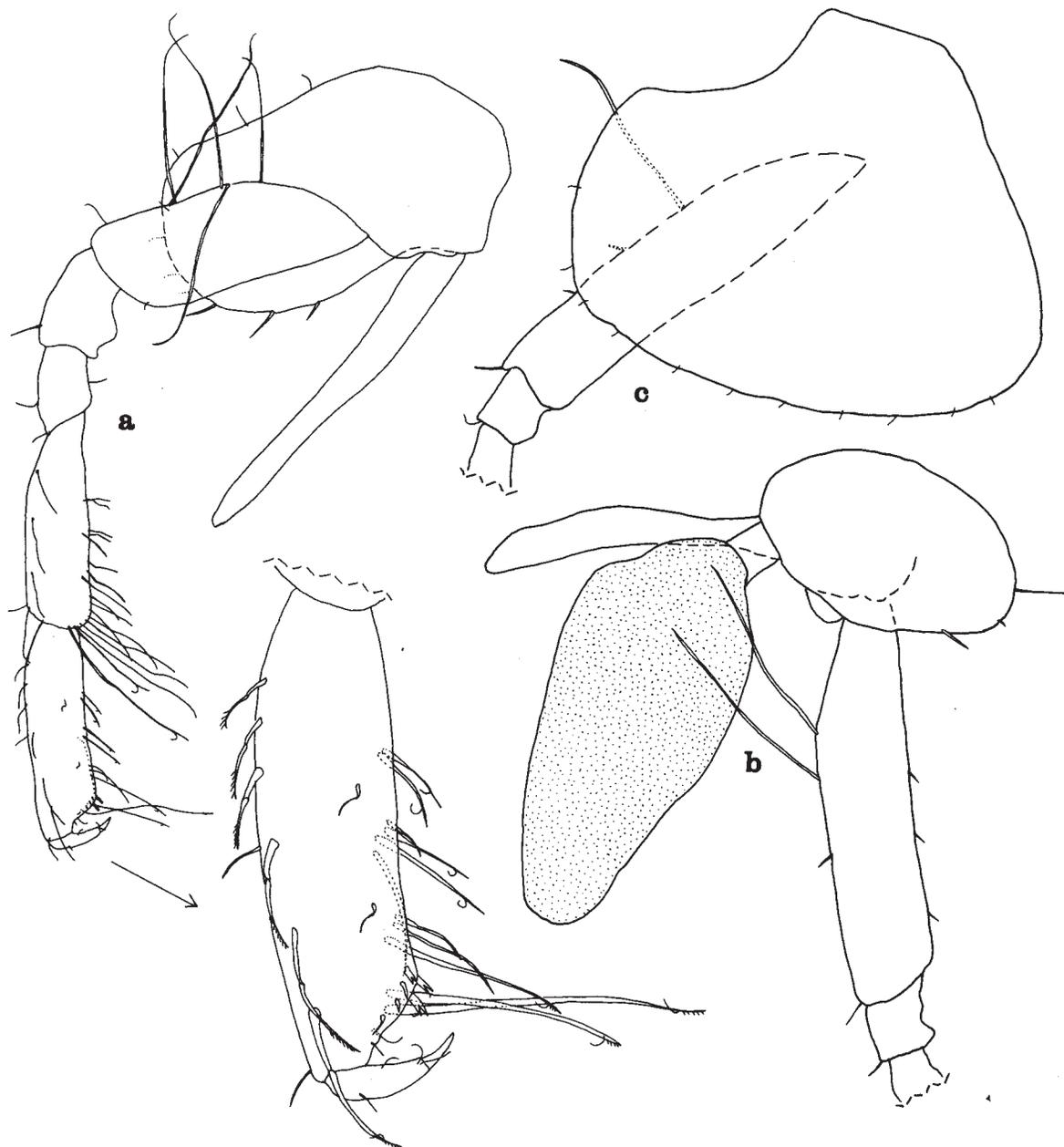


Fig. 6.—*Mayaweckelia cenoticola*, new species. Female paratype (5.0 mm), Cenote Xtacabihá: a, gnathopod 2; b,c, upper parts of pereopods 3 and 4.

spines on outer margin and 3 spines on inner margin.

Male.—Differing from female by structure of gnathopodal propod 2 as follows: palm longer and more oblique, armed with 2 distally-notched and 1 un-notched spine teeth on inside, 1 distally-notched and 2 un-notched spine teeth and 2 long, thick setae on outside; defining angle with 2 distally-notched spine teeth; posterior margin with 2 sets of long, distally-split setae.

Distribution and ecology.—This species is known from two caves in the state of Yucatán. The caves are located approximately 33 km apart. In the type-

locality (Cenote Xtacabihá), amphipods were collected from a small side pool partly isolated from the main body of water in the cave (J. Reddell, in litt.). In Cueva de Orizaba, amphipods were collected from a small pool that appeared to have been isolated by a lowering of the water level in the cave.

DISCUSSION

The northern part of the Yucatán Peninsula is a relatively low, rolling, tropical karst plain characterized by numerous caves, sinkholes and absence of

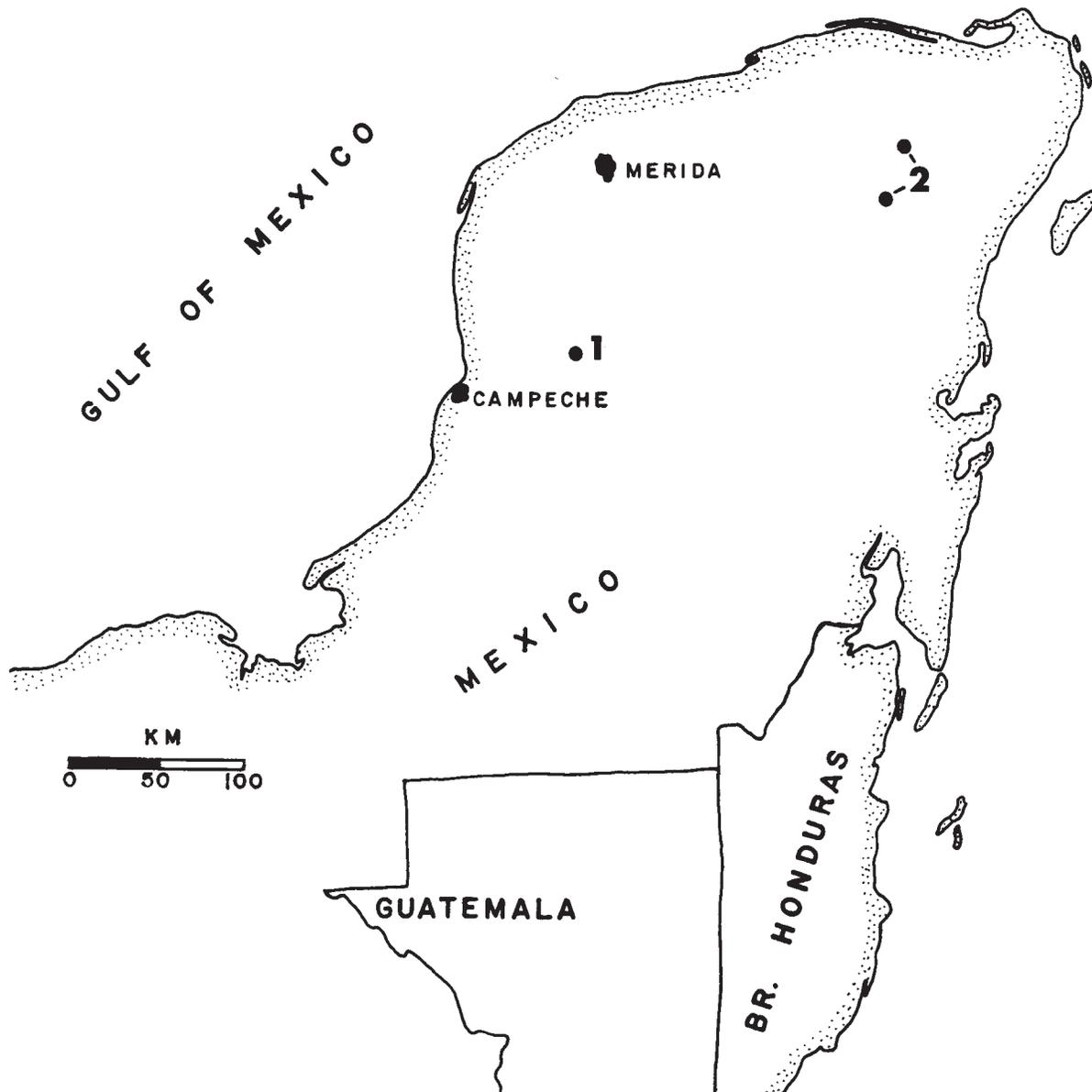


Fig. 7.—Distribution of species of *Mayaweckelia*: 1, *M. yucatanensis* (Grutas de Xtacumbilxunam); 2, *M. cenotícola* (Cenote Xtacabihá and Cueva de Orizaba).

surface drainage. The karst topography is developed on limestones that range in age from middle to late Tertiary. Many of the caves and deep, water-filled sinks of the region are known locally as *cenotes*. Grutas de Xtacumbilxunam is developed in the Chichén Itzá Formation of Eocene age, whereas Cenote Xtabihá and Cueva de Orizaba are developed in the Carillo Puerto Formation of Miocene or Pliocene age (Butterlin and Bonet, 1963).

Colonization of the caves of the Yucatán Peninsula by ancestral freshwater amphipods probably occurred as the region was being freed of marine waters toward the end of the Tertiary. The origin of other Caribbean, freshwater, subterranean genera of the *Hadzia* group, closely related to *Mayaweckelia*, has been discussed in previous papers by Holsinger and Peck (1968), Holsinger and Minckley (1971) and Holsinger (1973). These genera include *Mexiweckelia* from northern México and south-central Texas. *Weckelia* and *Paraweckelia* from Cuba and *Alloweckelia* from Puerto Rico. The origin of these subterranean genera is believed to have resulted from the invasion of newly opened, freshwater niches by interstitial, brackish water *Hadzia*-like ancestors during Late Cretaceous and Tertiary times (Holsinger, 1973, 1974). Presumably, *Mayaweckelia* had a similar origin during the late Tertiary. Speciation in the genus has probably resulted from the isolation of populations in caves developed in different stratigraphic units. The ranges of the two species of *Mayaweckelia*, as presently known, are also separated by a distance of approximately 210 km (Fig. 7).

LITERATURE CITED

- Barnard, J. L. 1976. Affinities of *Paraniphargus lelouparum* Monod, a blind anchialine amphipod (Crustacea) from the Galapagos Islands. Proc. Biol. Soc. Washington, 89: 421-432.
- Butterlin, J., and F. Bonet. 1963. Mapas geológicos de la Península de Yucatán. I. Las formaciones cenozoicas de la parte mexicana de la Península de Yucatán. Ingeniería Hidráulica en México, 17:63-71.
- Holsinger, J. R. 1973. Two new species of the subterranean amphipod genus *Mexiweckelia* (Gammaridae) from México and Texas, with notes on the origin and distribution of the genus. Assoc. Mexican Cave Stud. Bull., 5:1-12.
- Holsinger, J. R. 1974. Zoogeography of the subterranean amphipod crustaceans (Gammaridae, *Hadzia* group) of the greater Caribbean region. Virginia J. Sci., 25:64 (abstract).
- Holsinger, J. R., and S. B. Peck. 1968. A new genus and species of subterranean amphipod (Gammaridae) from Puerto Rico, with notes on its ecology, evolution and relationship to other Caribbean amphipods. Crustaceana, 15:249-262.
- Holsinger, J. R., and W. L. Minckley. 1971. A new genus and two new species of subterranean amphipod crustaceans (Gammaridae) from northern Mexico. Proc. Biol. Soc. Washington, 83:425-444.
- Pearse, A. S. 1938. Introduction, pp. 1-15. In: A. S. Pearse, Fauna of the caves of Yucatan. Carnegie Inst. Washington Publ., 491:1-304.
- Ruffo, S., and A. Vigna-Taglianti. 1973. Three new subterranean *Bogidiella* from Mexico and Guatemala (Crustacea, Amphipoda). Subterranean fauna of Mexico, Part II. Acc. Naz. Lincei, Prob. Att. Sci. e Cultura, 171:105-133.
- Villalobos F., A. 1960. Un anfípodo cavernícola nuevo de México: *Bogidiella tabascensis* n. sp. Anal. Inst. Biol., México, 31:317-334.

ADDENDUM

Subsequent to the completion of the manuscript, James Reddell and his associates returned to the Yucatán Peninsula of southern México for additional field work. During the summer of 1975 seven new localities for *Mayaweckelia cenotocola* were recorded, considerably extending the range of this species (see below). In addition to the new distributional data, the study of this material has revealed several morphological features of the species omitted in the above description.

Additional descriptive data.—Antenna 1 variable in length, varying from just slightly longer than the body in some populations to 35 percent longer in others. Brood plates of ovigerous female rather long and narrow (sublinear), with numerous long, marginal setae. Pereopod 6 and 7 subequal in length, 70 to 75 percent as long as body. Telson large and conspicuous, 75 to 80 percent as long as uropod 3.

New localities.—MEXICO. *Campeche*: Volcán de los Murciélagos, J. Reddell, A. Grubbs and D. McKenzie, 31 July 1975. *Quintana Roo*: Cenote de Las Ruinas, J. Reddell, A. Grubbs and S. Wiley, 29 July 1975; Cenote de San Martín, J. Reddell and A. Grubbs, 3 July 1975; Cenote de Santo Domingo, J. Reddell, A. Grubbs and D. McKenzie, 29 July 1975; Cueva de Tanchah, J. Reddell, A. Grubbs and S. Wiley, 1 July 1975. *Yucatán*: Cenote Nohchén, J. Reddell, A. Grubbs and D. McKenzie, 18 June 1975; Grutas de Tzab-Nah, A. Grubbs, 26 June 1975.

Comments.—Except for Cueva de Tanchah in Quintana Roo, all other populations of *M. cenotocola* were found in freshwater. In Cueva de Tanchah, however, the water was slightly brackish and also contained a population of another amphipod crustacean, *Quadri-visio lutzi* (Shoemaker). This cave is located less than 1 km from the sea (J. Reddell, in litt.).