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STUDIES ON THE CAVES AND CAVE FAUNA OF THE YUCATAN PENINSULA

ASSOCIATION FOR MEXICAN CAVE STUDIES

BULLETIN 6

REPRINT

EDITED BY

JAMES R. REDDELL

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This volume is dedicated to

JOANN M. ANDREWS

for her dedication to and
support of Yucatán studies

PREFACE

This volume includes the first results of an intensive study of the cavernicole and related endogean fauna of the Yucatán Peninsula. Also included are accounts of species from other parts of México, Guatemala, and Belize.

The cave fauna of the Yucatán Peninsula was the first subterranean fauna to be investigated in México, yet it remains poorly known. The work of A. S. Pearse and colleagues in 1932 and 1936 was devoted largely to open-air cenotes and easily accessible, well-known caves. Furthermore, their collections were restricted to the northern part of the state of Yucatán. There are essentially no records of species from caves in Quintana Roo and Campeche.

The studies which largely comprise this volume are based on material obtained during four expeditions. The first was conducted by Mary Butterwick, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell from February until May 1973. Emphasis was placed on the re-collection of species described in the volumes edited by Pearse, and the mapping of representative caves in northern Yucatán. A brief expedition was conducted by Robert W., Rexell, Robert W. Jr., Scott, and Sharon Mitchell, Deborah Denson, Masaharu Kawakatsu, J. Mark Rowland, and James Reddell in July 1973. This expedition again emphasized northern Yucatán. The third expedition was conducted by David McKenzie, James Reddell, and Suzanne Wiley and extended from September until December 1974. Collections and additional surveys were made in northern Yucatán, and the area of interest was extended to the less accessible regions of Yucatán and to the state of Campeche. A fourth expedition in the summer of 1975 extended the area of study into Quintana Roo and southern Campeche, but most of the material obtained on this expedition will be reported on at a later date. The personnel on this expedition were Andrew Grubbs, David McKenzie, James Reddell, and Suzanne Wiley.

The contributions in this volume include descriptions of new species and new records of earthworms, copepods, amphipods, isopods, mysids, scorpions, schizomids, pseudoscorpions, phalangids, ricinuleids, spiders, millipeds, and leiodid beetles. Extensive collections of other groups are still under study. Included also are a brief description of the geology and physiography of Yucatán, a history of cave studies in the Peninsula, and brief descriptions of all caves which have been biologically investigated in the Mexican part of the Peninsula. Detailed descriptions and maps of the caves will be published upon completion of the study.

It is appropriate here to acknowledge the assistance of many people during the course of study in Yucatán. The Museum, Texas Tech University, and The National Geographic Society provided much of the financial assistance essential to this study.

Special thanks are extended to Dr. Robert W. Mitchell for his enthusiastic support, not only of the work in the Yucatán Peninsula, but for his continuing assistance during all phases of study in México. I must also thank all of the members of the above-mentioned expeditions for their assistance under sometimes very trying conditions.

My appreciation is also expressed to the following for their assistance in the field: Frances Abernethy, Ed Alexander, Linda Elliott, Charles Loving, Jeannie Loving, and Marsha Meredith. Reynaldo Solis of Mérida and Eleuterio Gonzalez and Manuel Ay Canul of Muna not only helped in making field collections but assisted in many other ways as well. Mrs. Joann Andrews of Mérida gave freely of her time and hospitality and access to her superb library. Sr. Norberto Gonzalez of the Instituto Nacional de Archeológico e Historia very kindly provided the necessary permission to work unhampered in Grutas de Balankanche and other archeological zones.

I wish to thank Jan Lewis, Martha Helen McKenzie, Terry Raines, and Carmen Soileau for their help in the publication of this volume. I also am grateful to David McKenzie and Robert W. Mitchell for permission to use their photographs.

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ON SOME EARTHWORMS FROM NORTH AMERICAN CAVES

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The report herewith deals with no new species and with but two endemics, one of which has been known only from the original description of six specimens. Nevertheless, the data presented are of interest because of their demonstration that since 1492 A. D., accidentally imported species have penetrated into many widely separated caves that are more or less away from areas into which the exotic forms were most likely to be introduced.

ACANTHODRILIDAE

Balanteodrilus pearsei Pickford

Balanteodrilus pearsei Pickford, 1938. Carnegie Inst. Washington Publ., 491:79-95, fig. 7-14, pl. 1-3. (Type locality, Gongora Cave, Oxkutzcab, Yucatán, México. Also from San Isidro Cave, Mérida, Yucatán.)

Material.–Actún Loltún, 7 km SSW Oxkutzcab, Yucatán, México, 25-26 July 1975, 0-3-3, J. Reddell, A. Grubbs, D. McKenzie, S. Wiley.

External characteristics.–Size, 66-85 by 3-3.5 mm (gizzard or clitellar region). Segments, 106 (posterior amputee?), 143, 165 (aclitellates), 152, 158, 164. Prostomium, tanylobous or almost perfectly so (6 specimens). Setae, closely paired, retracted, unrecognizable externally except for the penial and copulatory setae or those of the posterior segments (and then only with difficulty), *AB* probably = *CD, BC* seemingly $<$*AA* in preclitellar segments but *ca.* = *AA* posteriorly, *a,b* follicle apertures of viii may be enlarged and in a quite obvious tumescence on each side of the body. Nephropores, certainly inconspicuous, unrecognized anywhere. First dorsal pore, at 12/13 (2 aclitellates and 1 clitellate), on the other specimens recognized only behind the clitellar region.

Spermathecal pores, obvious transverse slits with tumescent margins, in region of *AB* at 7/8. Female pores, in *AA*/xiv, in a transversely placed area seemingly as thick as the clitellum. The latter, dark red, xiii/n-xviii/n (n = 1/4 to all of each segment), tumescence probably maximal, definitely saddle-shaped (3) but with its modified epidermal thickening extending well into *AA* so as to leave, at mV, a deep median groove. Clitellar glandularity and all color is lacking in a triangular area of xvii about as wide as *AA* at 17/18. That triangle is continued forward from 16/17 at mV to eq/xiv as a narrow but definite, uncolored band that is almost linear and at bottom of the median groove. Genital markings, unpaired and median, postsetal, in xi-xii (2), xi-xiii (2), xii (1), xii-xiii (1), obviously always present in xii. Each of those markings is circular, protuberant, sharply defined, obviously (and mainly?) postsetal. Whether posterior intersegmental furrows are crossed or slightly dislocated was not determinable. Two additional genital markings, also median, but slightly elongated anteroposteriorly are in contact with each other but not united. Exact location was not determinable but a postsetal origin in xviii and in xix is suspected. A very slight furrow, presumably seminal, between the minute male pore and the larger atrial slit (through which penial setae may protrude), much as shown by Pickford (p. 80), was detected. The furrows are so light (less obvious than on smaller dichogasters) that they were,

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on first inspection, overlooked.

Internal anatomy.—Pigment is lacking in the body wall, the brown appearance of undissected worms being due to the dark ingesta in the gut as seen through the various digestive and parietal tissues. Septa, 5/6-6/7, both transparent and very delicate, were recognized in most specimens. Gizzard, large definitely in vi (4). The esophagus is slightly moniliform in vii-xi but the portion in vii did not seem any larger than those of the succeeding segments. Nor were calciferous lamellae recognized (6). Intestinal origin, in xiv (6). The gut, much compressed through xiv-xix or xx, gradually widens to normal intestinal width only through xxi-xxii. Typhlosole, with a rudiment recognizable even from xiv or xv, becomes higher and obviously bifid from xvi or xvii. The termination may be abrupt and in the 115'th (of 152) or the 124'th (of 158) segments, respectively leaving 37 or 34 intestinal segments atyphlosolate. Or the bifurcation may be lacking as the typhlosole gradually disappears through several segments, as follows: the last fourteen (of a posterior amputee), cxiii-cxxii (of 143), cxv-cxxiii (of 164), cxviii-cxxii (of 165) segments.

Blood, as well as many blood vessels, was unrecognizable in most of the worms. Last hearts, in xii (6). The posterior lateroparietal trunks pass upwards to the gut in xiii.

Nephridia: Behind the clitellum, each nephridium seems to be centered transversely on the parietes about at *CD* but reaches well into *DD* and *BC.* A bladder obviously is lacking. Funnels and ducts were not recognized. An oval disc, on each side of the body in the region of ii-iv, obviously is of a closely compacted tubular structure. Duct and funnel again were not found but each mass does seem to be composed of a single, thickened and much elongate tubule.

Holandric. Seminal vesicles, lobed, two pairs, in xi and xii (6). The male deferent ducts are superficial (not concealed within the body wall) but do pass under such diagonal muscles as may be present in xvii. Prostates, much coiled in xix-xx. Their ducts are 4-10 mm long and ectally at least with muscular sheen. When longer than 4-5 mm, the ental half is slenderer. Strong, diagonal muscles are present in xviii-xix, sometimes even in xvii and xxi. Spermathecal duct shorter than ampulla, slightly barrel-shaped, with slight muscular sheen, with a rather thick wall. The lumen is transversely slit-like in cross section but with low, longitudinal ridges. The diverticulum, much shorter (as is) than the main axis, emerges from the anterior face of the duct near the parietes. It is at very first quite slender but seemingly becomes gradually thicker, with its surface variously knobbed and with slightly incised margins. Actually, the proximal portion of the diverticulum is a very slender and quite long stalk, zigzag-looped or variously coiled within an opaque, connective tissue sac. The seminal chamber at distal end of the sac may contain two or three, more or less distinct masses but without visible partitions between them. Pseudovesicles (?) small, spheroidal, on the posterior face of 12/13, were above the ovaries. The latter were fan-shaped, as usual in megascolecoids, but egg strings were very short. Ovisacs were not found.

Reproduction.—Slight iridescence was recognized on male funnels and in spermathecal seminal chambers of the clitellates. In absence of any contra-indication, reproduction is assumed, for the present, to be amphimictic.

Distribution.—Known only from the three Yucatán caves. Pickford suggested (1938, p. 71) that *B. pearsei,* like *Eodrilus oxkutzcabensis* (described and named in the same article), had merely wandered into the caves from the adjacent regions. Little is known about the native earthworms of any Mexican region.

Remarks.—The various differences from Pickford's account of the species probably are unimportant systematically. The transverse, superficial grooves and marginal incisions of an ectal portion of the spermathecal diverticulum, as shown in her figs. 9-10 (p. 83) are just what might be expected if nearly opaque connective tissue more closely and tightly bound the diverticular stalk than in the present specimens. However, the zigzag looping suggested by those figures seems more regular and extensive than was usually encountered in the present worms. The posterior of two pairs of seminal vesicles is unlikely to be in xi of any holandric species. Their "depending" from 10/11 into xi (p. 82) is believed to be a *lapsus calami* which is repeated (on p. 85) as well as partially on p. 73 where the septum that should be involved (11/12) probably is correctly stated. Conditions of the new specimens was not as good as desired which may explain present inability to recognize calciferous lamellae. Probably they are small.

Diplocardia Garman, 1888

Diplocardia sp.

Specimens.—MEXICO. *San Luis Potosí*: Cueva de la Selva, Xilitla, November 1963, 0-0-1 (macerated and lacking some anterior segments), T. Raines.

TEXAS. *Travis County:* Cave X, 6 mi S Austin, 200-300 ft from entrance in silt and trash, September 18, 1962, 1-0-0, S. Woolsey, B. Bell. Tooth Cave, in silt and guano of entrance room, February 20, 1963, 1-0-0, D. McKenzie, B. Russell, per J. Reddell. *Uvalde*

County: Picture Cave, 22 mi NW Uvalde, in dirt and trash at bottom of 60 ft entrance drop, November 3, 1962, 1-0-0, J. Reddell.

MISSOURI. *Franklin County:* Fisher Cave, February 8, 1968, 1-0-0, ? Hawksley. *Boone County:* Devil's Ice Box Cave, December 1957, 8-0-0, ? Higgins.

LUMBRICIDAE

Allolobophora Eisen, 1874

Allolobophora chlorotica (Savigny, 1826)

Specimens.–VIRGINIA. *Rockbridge County:* Showalter's Cave, under rotten boards and in mud, May 27, 1961, 0-1-3, J. R. Holsinger.

NEW YORK. *Schoharie County:* McFails Cave, polluted stream, October 19, 1966, 5-1-0, S. Peck.

Aporrectodea Oerley, 1885

Aporrectodea longa (Ude, 1885)

Specimens.–NEW YORK. *Jefferson County:* Weninger Cave, 2 mi N Brownsville, October 16, 1966, 0-2-3, S. Peck. (The collector reported that these worms were present "by hundreds in pools at cave entrance.")

Aporrectodea rosea (Savigny, 1826)

Specimens.–NEW YORK. *Jefferson County:* Labyrinth Cave, Glen Park, 3 mi W Watertown, debris, October 15, 1966, 1-0-0, S. Peck.

Dendrodrilus Omodeo, 1956

Dendrodrilus rubidus (Savigny, 1826)

Specimens.–MEXICO. *Veracruz:* Cueva del Volcancillo, 5 km SE Las Vigas, January 8, 1974, 0-1-2, J. Reddell, R. Jameson. *Nuevo León:* Sótano de Rancho Nuevo No. 2, August 1973, 0-1-1, R. Jameson, D. McKenzie.

MISSOURI. *St. Genevieve County:* Kohn's Cave, St. Genevieve, May 14, 1960, 0-0-9 (along with *Diplocardia verrucosa),* S. Peck.

KENTUCKY. *Rockcastle County:* Bat Cave, Carter Caves State Park, March 10, 1967, 0-0-1, J. Reddell.

WEST VIRGINIA. *Pocahontas County:* Cass Cave, mud bank about 700 ft from entrance, October 14, 1961, 0-0-1, J. R. Holsinger.

VIRGINIA. *Russell County:* Jessie Cave, *ca.* 1 mi W Honaker and just off Route 80, organic debris about 1,000 ft from entrance, May 12, 1961, 0-2-1, J. R. Holsinger.

MARYLAND. *Alleghany County:* Devil's Hole Cave near Flintstone, pulpy wood 80 ft inside, April 26, 1919, 1-2-0. Horse Cave, near Flintstone, pulpy wood near entrance at bottom of sinkhole, April 16, 1969, 0-1-0, R. Franz. *Washington County:* Snively Caves, near Keedysville, September 12, 1968, 1-0-0. Cave No. 2 near Eakles Hill, May 3, 1969, 1-2-0. McMahon's Mill, under small log at edge of pool, 100 ft inside, March 16, 1969, 1-1-2. Round Top Caves, 3 mi N Hancok, very wet, pulpy log 40 ft inside, October 13, 1968, 1-0-0, R. Franz.

Remarks.–Mexican worms were of a male-sterile, athecal morph with obvious bilobed tubercula pubertatis in xxix-xxx and seminal vesicles only in xi-xii, with well developed atrial glands but without TP and GS glands.

Eiseniella Michaelsen, 1900

Eiseniella tetraedra (Savigny, 1826)

Specimens.–VIRGINIA. *Russell County:* Rock House Cave, April 20, 1962, 0-1-3, J. R. Holsinger.

NEW YORK. *Albany County:* Ward Gregory Cave, Clarkesville, stream, October 9, 1966, 0-1-3. *Schoharie County:* McFail's Cave, polluted stream, October 29, 1966, 4-0-3, S. Peck.

MEGASCOLECIDAE

Pheretima Kinberg, 1866

Pheretima diffringens (Baird, 1869)

Specimens.–MEXICO. *Puebla:* Cueva de Xocoyolo, 6 km SW Cuetzalan, December 27, 1973, 0-0-3, J. Reddell, D. McKenzie, R. Jameson, W. Elliott. (Each specimen is of a different parthenogenetic morph.) *Veracruz:* Sótano de las Golondrinas, Manzanilla, 11 km N Potrero, January 8, 1977, 0-1-1, A. Grubbs.

Remarks.–The mature Veracruz specimen was of a male sterile morph with fairly well developed prostatic ducts showing a muscular sheen. No traces of any prostate glands nor of genital markings and their glands were recognized. Each seminal chamber of the characteristic spermathecal diverticula was filled with an opaque, white coagulum in which no spermatozoal iridescence was recognized.

Pheretima hawayana (Rosa, 1891)

Specimens.–MEXICO. *Puebla:* Sumidero de Cuetzaltemanes, 3 km NW Xochitlán, December 29, 1973, 0-0-3, R. Jameson, W. Elliott.

OCTOCHAETIDAE

Dichogaster Beddard, 1888

Dichogaster bolaui (Michaelsen, 1891)

Specimens.–MEXICO. *Tabasco:* Grutas del Coconá, Teapa, August 26, 1972, -2-5, J. Cooke, W. Russell, R. Mitchell.

Trigaster Benham, 1886

Trigaster sp.

Specimen.–MEXICO. *San Luis Potosí:* Sótano de Yerbaniz, 22.5 km N Ciudad Valles, January 9, 1970, 0-0-1, S. Wiley.

External characteristics.–Size, 124 by 10 mm, but for 45 mm behind iii the worm is macerated (cuticle separated from the epidermis throughout). Posterior end widened, bulbous but the anal metamere is much smaller than the preceding segment and almost only a small posterior knob. Prostomium, broad, slightly proepilobous. Setae, present from ii, widely paired, $AB =$ or $< CD < BC < AA$. Longitudinal setal meridians, in macerated portion, indicated by thick, white lines quite obvious against the transparency of the adjacent body wall. Each line is widened segmentally into a slightly spindle-shape with a follicle aperture at its center.

Spermathecal pores, at *A* and 7/8-8/9. Female pores, in *AA*/xiv. Clitellum, annular, xiii-xviii. Male and prostatic pores, not seen but presumably in seminal grooves that are concave mesially. Genital markings unpaired in *BB*, perhaps primarily presetal and in xxii and xxiii.

Internal anatomy.–Septa, 5/6-11/12 muscularized and opaque, unrecognized behind 11/12 where the internal organs are macerated (alcoholic preservation). Gizzards, well developed, in v-vi, separated from each other by a thin-walled, equisized segment of the esophagus. Nephridia, in two large parietal masses that reach seemingly through several of the most anterior segments, not certainly distinguishable posteriorly.

Holandric, seminal vesicles in ix and xii. Male gonoducts unrecognized (buried in parietes?). Prostates, rather broad, transversely elliptical in cross section. No lumen was recognized in free-hand cross sections. Ducts, slender, no sheen, straight, much shorter than the glands. Penial setae, 1+ mm long, yellow, without visible ornamentation, straight but gradually narrowing ectally, tips deformed and wrinkled. Spermathecae, adiverticulate, ellipsoidal discs flattened against posterior faces of 7/8 and 8/9, *ca.* 2 mm long, wall rather thick, lumen empty, not delimited into duct and ampullary portions. GM glands, lacking.

Reproduction.–Although the clitellum is well developed no sperm were found anywhere. The specimen certainly was male sterile.

Parasites.–Cysts, *ca.* 0.25 mm thick, are present in all (?) segments from xvii posteriorly, in transverse segmental rows on the body wall. Often, if not also usually, at least 30 were counted in a segment, with a possibility of 5-6,000 having been present in macroscopically recognizable form. Whether the male sterility may be genetic or spasmodic and then as a result of the parasitism remains to be determined.

Remarks.–Segments could not be counted in the clitellar region and just posterior to it, either externally or internally and, except for follicle apertures in the translucent body wall, metamerism was not distinguishable posteriorly. A red color, indicating presence of blood, was seen only in the distended hearts of xii-xiii.

Systematics.–Similarities to *T. reddelli* Gates, 1971 are obvious and important, but even if no differences had been recognized such an identification could only have been tentative. Absence of spermathecal differentiation at least into duct and ampulla might be attributable to a parthenogenetically allowed deformation.

MESOCYCLOPS ELLIPTICUS KIEFER FROM A MEXICAN CAVE

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In November 1973, Mr. James Reddell of Texas Tech University, Lubbock, sent the author 2 collecctions of copepods from Grutas de Xtacumbilxunam, Campeche, México, for identification. All the specimens proved to be *Mesocyclops ellipticus*, reported previously from Brazil and Venezuela.

In 1932, Dr. A. S. Pearse collected plankton from Yucatán cenotes and sent the material to C. B. Wilson, who identified and published a report on the copepods and cladocerans (1936). He reported *Mesocyclops leuckarti* (Claus) to be the most common copepod in these cenotes. He also reported *Mesocyclops tenuis* Marsh in many collections. His description of the slender abdominal segments of *M. tenuis* indicates that these specimens were either that species or *M. inversus* Kiefer, but his *M. leuckarti* specimens may have been *M. ellipticus*, which was not described until 1936. Pending recollecting from the Yucatán cenotes, a complete description of the female *M. ellipticus* is given herein to facilitate identification of this little known species.

The author wishes to thank Mr. James Reddell for the opportunity to study and redescribe this species.

The specimens on which this redescription is based have been deposited in the Texas Tech Museum and in my private collection at Sewanee, Tennessee.

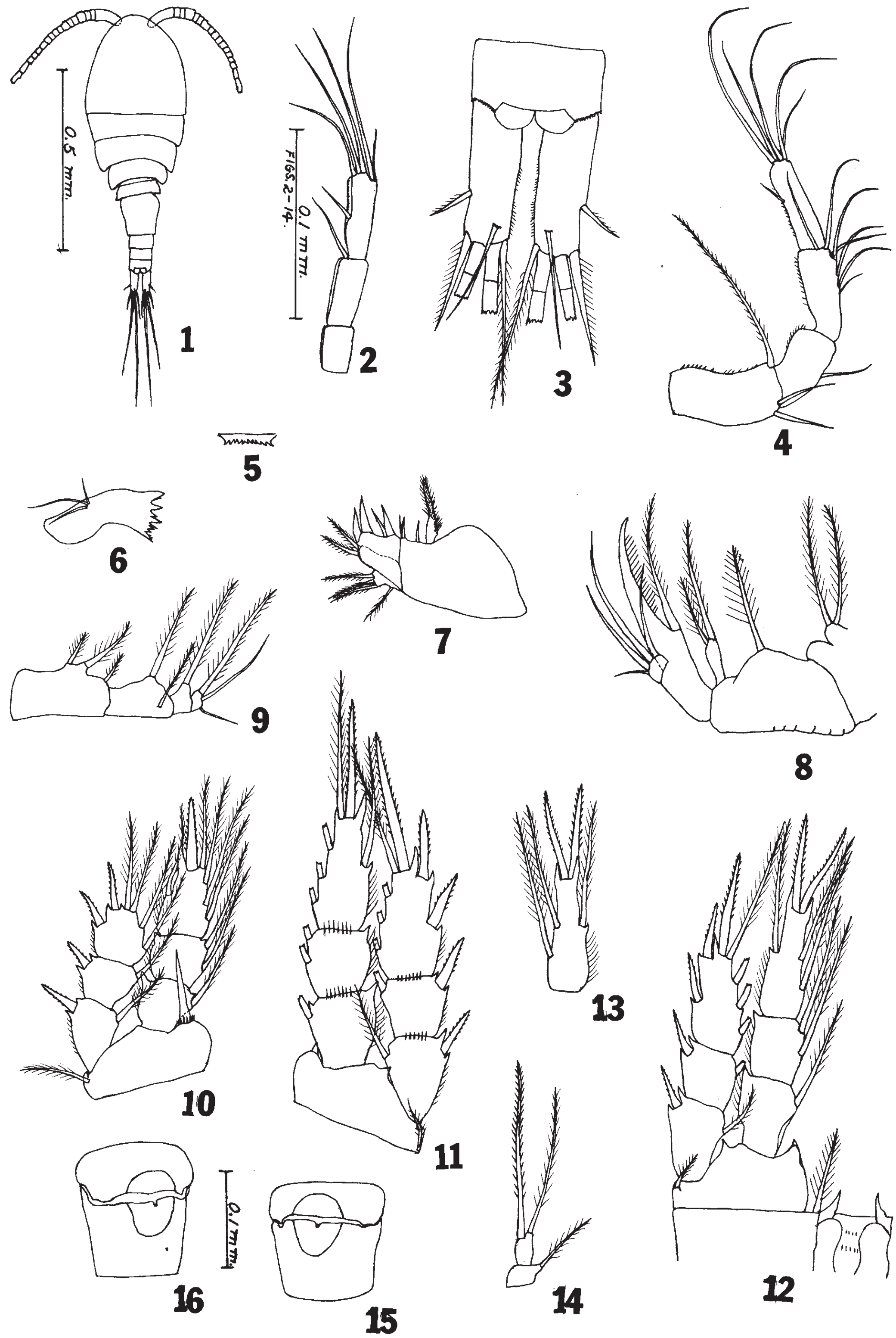
Mesocyclops ellipticus Kiefer, 1936

Redescription.—Twenty-five females taken from a small pool at the top of the second series of drops in Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, Campeche, México, on 13 May 1973 by James Reddell, David McKenzie, Martha Helen McKenzie, and Mary Butterwick. This species was also collected from the same pool on 29-30 July 1973 by Deborah Denson, Masaharu Kawakatsu, R. W. Mitchell, R. W. Mitchell, Jr., S. A. Mitchell, and S. R. Mitchell. These specimens were immature, few in number, and were not used in this description.

The adult females varied in body length from 0.79 mm to 0.92 mm, but most were 0.80 mm. The anterior part of the body is egg-shaped and the posterior part is cylindrical (Fig. 1). The anal operculum extends far posteriorly (Fig. 3).

Caudal rami are 3 times longer than broad and bear fine hairs on the distal part or along most of the inner margin (Fig. 3). The lateral caudal seta is attached at a point about 2/3 the distance from base to apex of the ramus. The innermost terminal seta is longer than the ramus and outermost terminal seta. The dorsal, subterminal seta is about the same length as the outermost seta. Of the two well-developed terminal setae, the outer is a little shorter than the abdomen and the inner is a little longer than the abdomen (Fig. 1).

The first antennae are 17-segmented and extend, when alongside the body, to the posterior margin of the first body segment. The last antennal segment bears an inconspicuous serrate membrane (Fig. 1). The 16th segment and sometimes the 15th bear a smooth, low membrane. The second antenna (Fig. 4), labrum (Fig. 5), mandible (Fig. 6), first maxilla, and maxilliped (Fig. 9) are typical for cyclopoid copepods. The large second segment of the second maxilla is crenulated on the posterior margin (Fig. 8), as in



Figs. 1-16.–*Mesocyclops ellipticus* Kiefer, females: 1, dorsal view; 2, last three segments of first antenna; 3, last abdominal segment and caudal rami, dorsal view; 4, second antenna; 5, labrum; 6, mandible; 7, first maxilla; 8, second maxilla; 9, maxilliped; 10, first leg; 11, third leg, some setae cut short; 12, fourth leg with some setae cut short and connecting plate between fourth legs; 13, terminal endopod segment of fourth leg; 14, fifth leg; 15-16, genital segment with seminal receptacle.

Mesocyclops leuckarti (Claus, 1857), but not so conspicuously.

Inner and outer rami of the swimming legs are 3-segmented. Spine formula of the terminal segments of exopods is 2, 3, 3, 3 and setal formula of these segments is 4, 4, 4, 4. Unlike *Mesocyclops leuckarti,* the basal segment bears a spine on its inner corner. The inner corner of the basal segment of the other legs bears a pointed, nipple-like projection (Fig. 11-12). The second and third legs are alike in shape and armature. The terminal segment of the endopod of the fourth leg is about 2-1/2 times longer than its width, taken equidistant from the ends (Figs. 12-13). The outer terminal spine of this segment is slightly longer than the divergent, inner terminal spine (Fig. 13). The connecting plate between the fourth legs is armed with two long teeth on each side (Fig. 12).

The fifth leg is 2-segmented. The basal segment bears an outer seta, and the distal segment bears a long inner, subterminal spine, that is usually longer than the terminal seta (Fig. 14).

The seminal receptacle is egg-shaped or elliptical (hence the specific name). The anterior part is larger than that of *Mesocyclops meridianus* Kiefer, 1926. The 2 lateral canals from the receptacle are narrow and not inflated as in *Mesocyclops longisetus* (Thiebaud, 1893). Coker's key (1943) makes use of this difference.

Discussion.–*M. ellipticus* is very similar to *M. longisetus,* but the shape of the seminal receptacles is quite different (see above description). The hairs on the inner margins of the caudal rami and the serrations of the terminal antennal membrane are much more conspicuous in *M. longisetus.*

Only females were taken in the Campeche collections. Why no males were taken cannot be determined at present. Kiefer (1936) and Herbst (1963) had males and females. The species has been reported from Brazil (Kiefer, 1936); Lake Maracaibo, Venezuela (Kiefer, 1956); and Lago Irucanga, Amazon region (Herbst, 1962). The Mexican collection is the first record of its occurrence in a cave.

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TWO BLIND SPECIES, ONE NEW, OF TERRESTRIAL ISOPOD CRUSTACEANS (ONISCOIDEA: PHILOSCIIDAE) FROM YUCATAN AND GUATEMALA

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Species of blind isopod crustaceans of the family Philosciidae from the New World have been discussed by Schultz (1973). The two described here are in two genera, *Troglophiloscia* Brian (1929) and *Colombophiloscia* Vandel (1968).

Troglophiloscia Brian

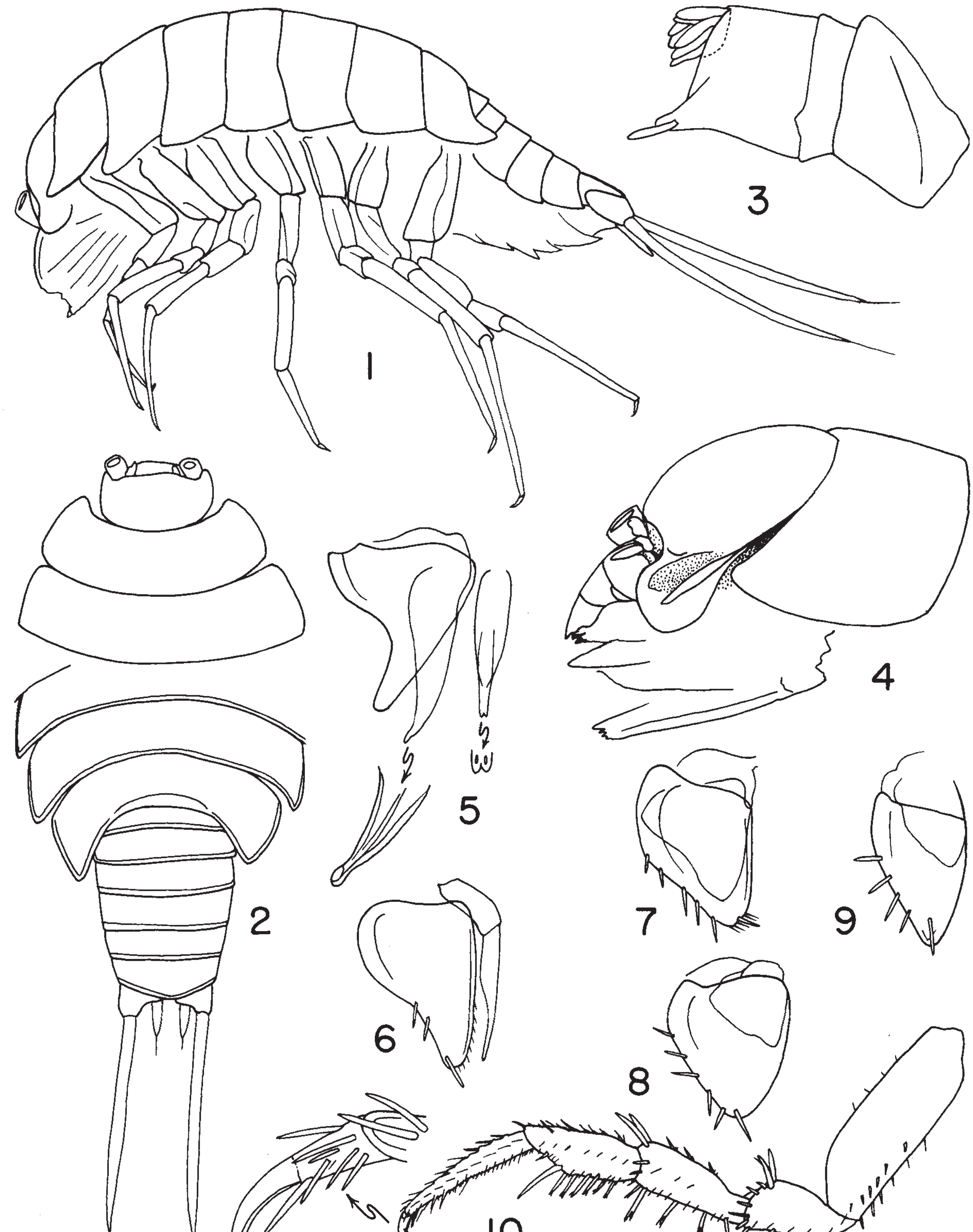
The genus is well defined by Brian (1929), and the only major difference is that the new species described here lacks the obvious scales which are included in the generic definition by Brian. The type-species of the genus, *T. silvestrii* Brian, was described from Grotta Bellamar, near Matanzas, Cuba.

Troglophiloscia laevis, new species
Figs. 1-18

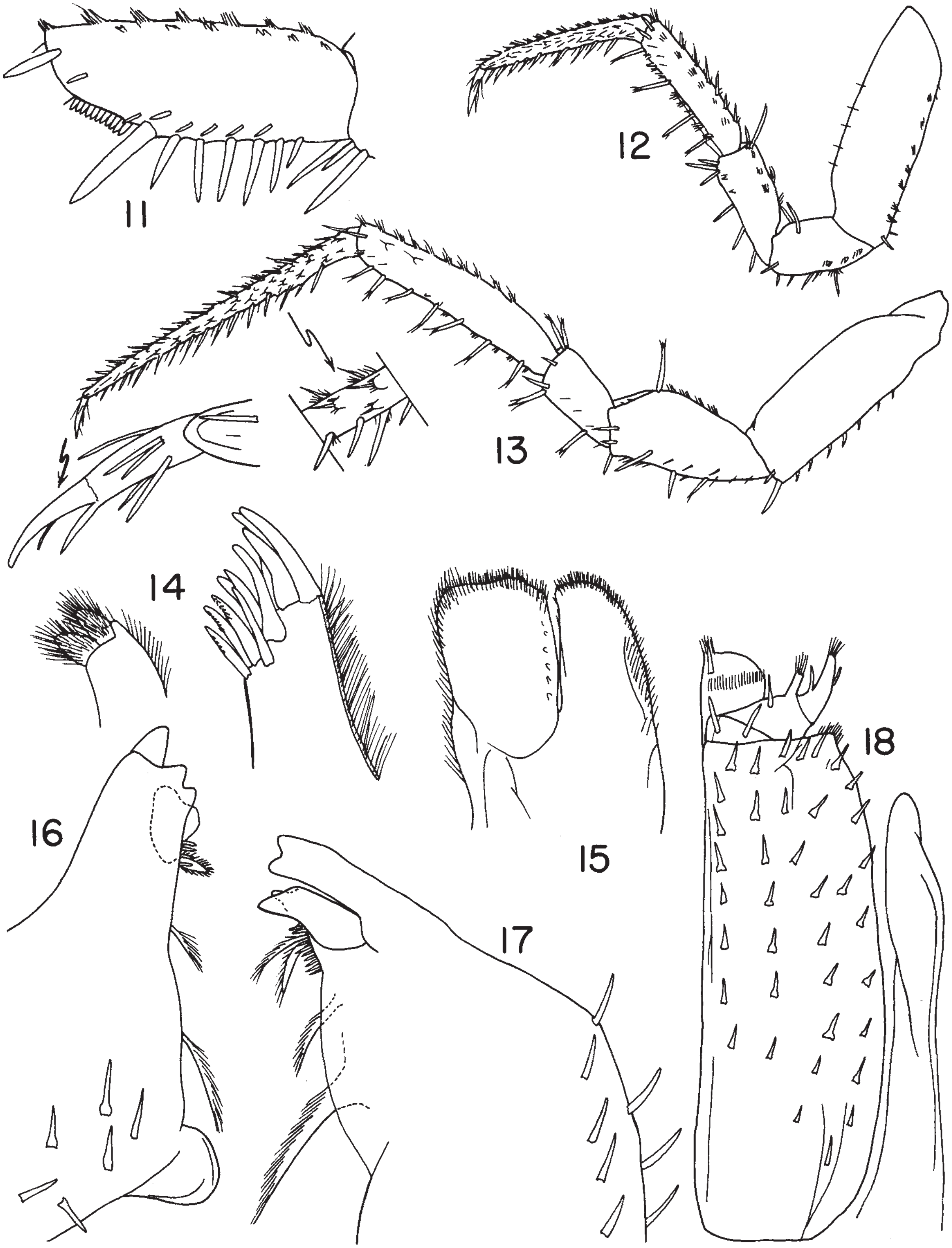
Blind. Dorsum smooth. Cephalon narrow, smooth, closely set into peraeonal segment I. Anterior part of elongate, ovate body narrow peraeonal segment I narrowest and peraeonal segment II wider. Peraeonal segments III to V widest and peraeonal segments VI and VII narrow with peraeonal segment VII the most narrow. Pleotelson with lateral margins of segments pressed against sides and not visible in dorsal view. Lateral view shows pleonal segments 3, 4 and 5 with posteriolateral corners pointed. Pleonal segments I and 2 and part of 3 included within margins of posterior extensions of peraeonal segment VII. Pleotelson also with edges closely pressed to sides; posterior margin broadly rounded. Uropods with elongate exopods about four times as long as normal endopods.

Antenna 1 with terminal segment about same diameter as segments 1 and 2; tipped with set of aesthetacs; one isolated aesthetac on small apical process. Antennae 2 missing. Right mandible with broad teeth on incisor process; lacinia mobilis definite with one long seta and several small setae nearby; only two setae in setal row. Left mandible with short toothed incisor process; lacinia mobilis with two teeth, two long and many short setae nearby; two setae in setal row. Maxilla 1 with two penicillate setae on endopod; exopod with at least 10 teeth with small teeth on inner ones. Maxilla 2 with rectangulate tip; fringed distally with short setae. Maxilliped with many scales on outer surface. Sensory edges with few sensory setae; palp with two long setae on basal article; next article with tuft of setae on inner margin; tuft on apical article; other marginal setae present on palp. Exopod of maxilliped long, thin and apically rounded.

Peraeopod I about two-thirds length of peraeopod VII. Ischium of peraeopod I male (female unknown) with scale-like setae and one large seta at distal inner margin. At least six other long setae on inner margin of ischium. Many short scale-like setae over propodal segments of all peraeopods; lesser amounts of scale-like setae on other segments of other peraeopods. Exopod of male pleopod I with narrow elongate medial margin; endopod slightly longer than exopod with small bulb-like expansion distally. Exopod of pleopod 2 moderately elongate with three long setae on inner medial margin. Pleopods 3 to 5 triangulate, with seve-



Figs. 1-10.–*Troglophiloscia laevis* sp. nov., holotype male 5 mm long: 1, lateral view; 2, dorsal view anterior and posterior parts; 3, antenna 1; 4, lateral view cephalon; 5, male pleopod 1; 6, male pleopod 2; 7, pleopod 3; 8, pleopod 4; 9, pleopod 5; 10, male peraeopod I.



Figs. 11-18.–*Troglophiloscia laevis* sp. nov.: 11, detail ischium male peraeopod I; 12, male peraeopod II; 13, male peraeopod VII; 14, maxilla 1; 15, maxilla 2; 16, right mandible; 17, left mandible; 18, maxilliped.

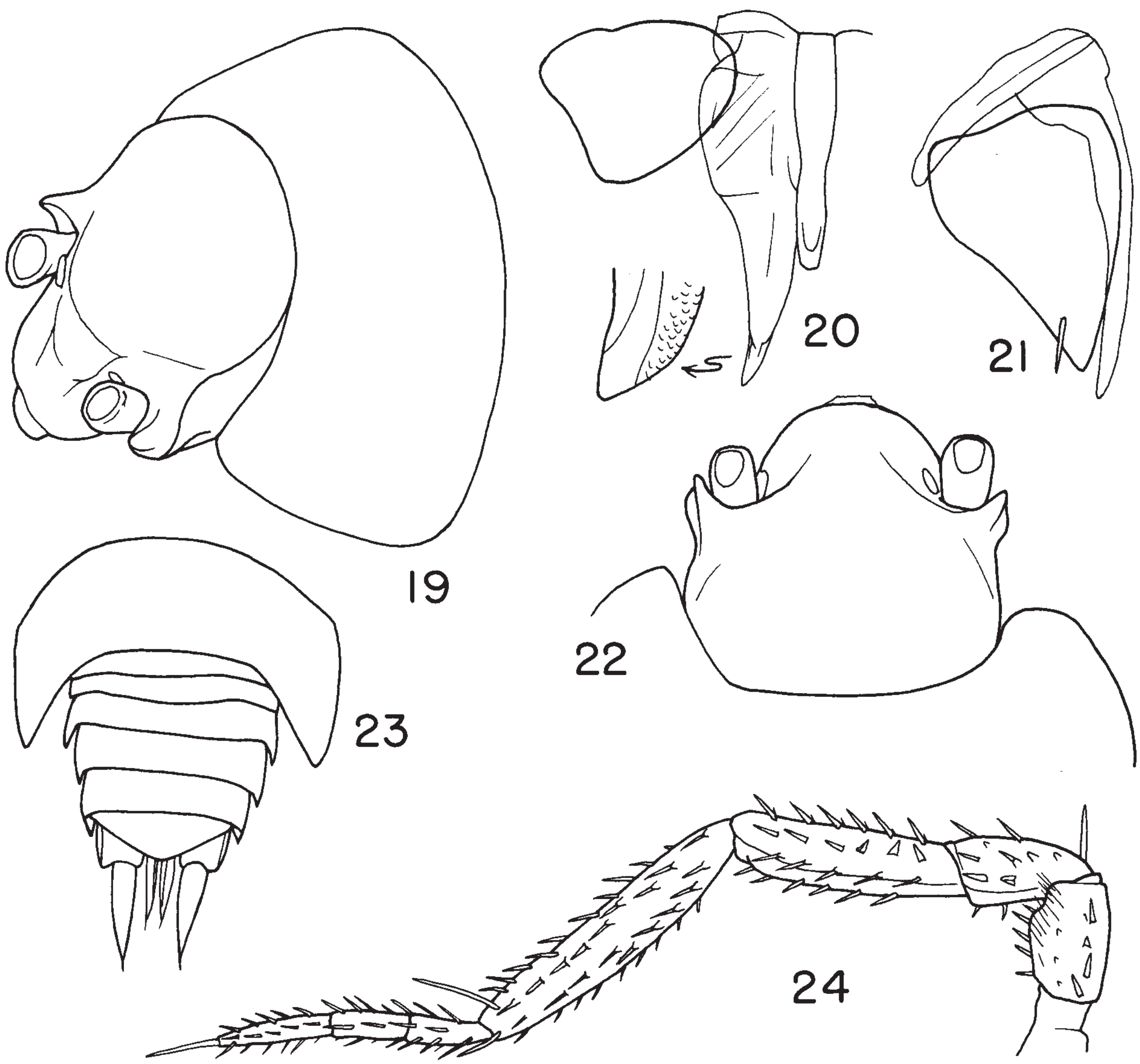
ral long setae on medial margins.

The species name *laevis* from the Latin means "smooth" and refers to the smooth dorsum of the specimen. The type-species is deposited in the collection of the National Museum of Natural History (Smithsonian Instituion) (USNM 152296).

One male 5.0 mm long was collected at Actún Xpukil, 3 km S of Calcehtok, Yucatán, México, by J. Reddell, S. Murphy, D. McKenzie, M. McKenzie and M. Butterwick. The specimen was taken March 18, 19, 1972, in a cave. The species differs from *T. silvestrii* Brian, the type and only other species in the genus, in that the new species lacks scales on the dorsum. *T. silvestrii* has a much more elongate endopod of male pleopod 2 when compared to that same structure in the new species. The two species resemble each other very closely in many structures as comparison of Brian's extensive diagrams with those here will show.

Colombophiloscia Vandel

The genus was established by Vandel (1968), who



Figs. 19-24.–*Colombophiloscia cavernicola* Vandel, male 5.5 mm long: 19, oblique view cephalon and peraeonal segment I; 20, male pleopod 1; 21, male pleopod 2; 22, dorsal view cephalon; 23, dorsal view pleotelson; 24, antenna 2.

described *C. alticola* first, so it must be considered to be type-species of the genus. The type-species has eyes and was described from humus in a cave at Baños, Ecuador. Two species of the genus are blind, and were also described by Vandel—*C. cavernicola* from Cueva de Quijano and Cueva de Guachara in northeastern Venezuela and *C. naevigesta* from a deep crevasse on the Isla de Santa Cruz of the Galapagos Islands. *Colombophiloscia cavernicola* was found in Guatemala and is included here.

Colombophiloscia cavernicola Vandel
Figs. 19-24

Colombophiloscia cavernicola Vandel, 1968, p. 102, figs. 30 a-c, 31, 32 a-c.

The species is reillustrated here based on one male 5.5 mm long from Cueva de Santa Eulalia, Huehuetenango, Guatemala, collected by David McKenzie in November 1967. Even though there was only a single specimen, the parts illustrated here correspond so well with the same parts illustrated by Vandel that there is little doubt about its identity. Antenna 2 has elongate scale-like spines. The pleotelson is short, but broad (when compared to *T. laevis)*, and which, according to Vandel, is one of the characters which helps to set the species of *Colombophiloscia* apart from species of *Troglophiloscia*. The configuration of the exopods of pleopods 1 and 2 correspond, including the placement of the spine on the exopod of pleopod 2. The only difficulty is that the endopod of male pleopod 2 is more elongate (much longer than the exopod) in *C. cavernicola* as illustrated by Vandel (1968, p. 103, fig. 32 c) than in that structure as illustrated here (Fig. 21).

The configuration of the cephalon is unique. The peculiar narrow anteriolateral extensions ("tubercule antennaire" of Vandel, fig. 30 a) and the general extended frontal margin of the cephalon cannot be mistaken. The configuration of the molar process of the mandible, a character which, according to Vandel, sets the genus apart from *Troglophiloscia*, was not examined nor was the shape of antenna 1 illustrated here. The correspondence between the two sets of illustrations, those of Vandel and those here, leave little doubt that the specimens described here are of the same species, and that in the caves between northeastern Venezuela and Guatemala there must be many specimens of the species.

The specimen is deposited in the collection of the National Museum of Natural History (USNM 152294).

ACKNOWLEDGMENT

The author would like to thank James Reddell, Department of Biological Sciences, Texas Tech University, Lubbock, Texas, for the opportunity to see and describe the specimens.

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

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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 Vigna-Taglianti (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* group[1] 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. cenoticola,* 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, flagelgellum 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

[1]While 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.

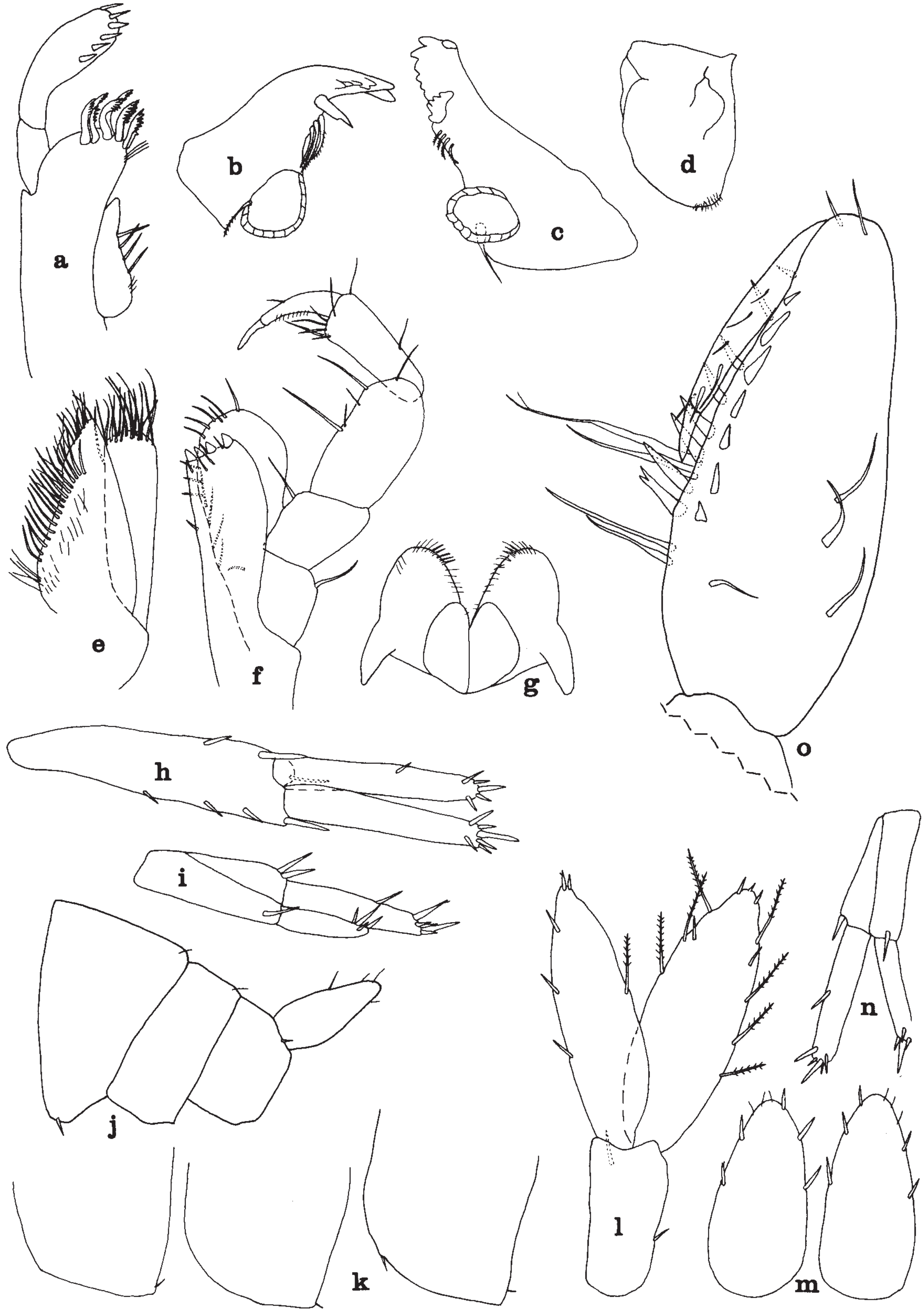

Fig. 1.–*Mayaweckelia yucatanensis*, new species. Female paratype (3.0 mm): *a*, maxilla 1; *b*. left mandible; *c*, right mandible; *d*, upper lip; *e*, maxilla 2; *f*, maxilliped; *g*, lower lip; *h,i*, uropods 1 and 2; *j*, uronites; *k*, pleonal plates; *l*, uropod 3; *m*, telson; *n*, uropod 2 (from 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; distoposterior 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 outisde and 1 short spine on inside; posterior margin convex, with 1 set of 2 long setae; medial setae few in number; 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 cenoticola, 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 unnotched 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-

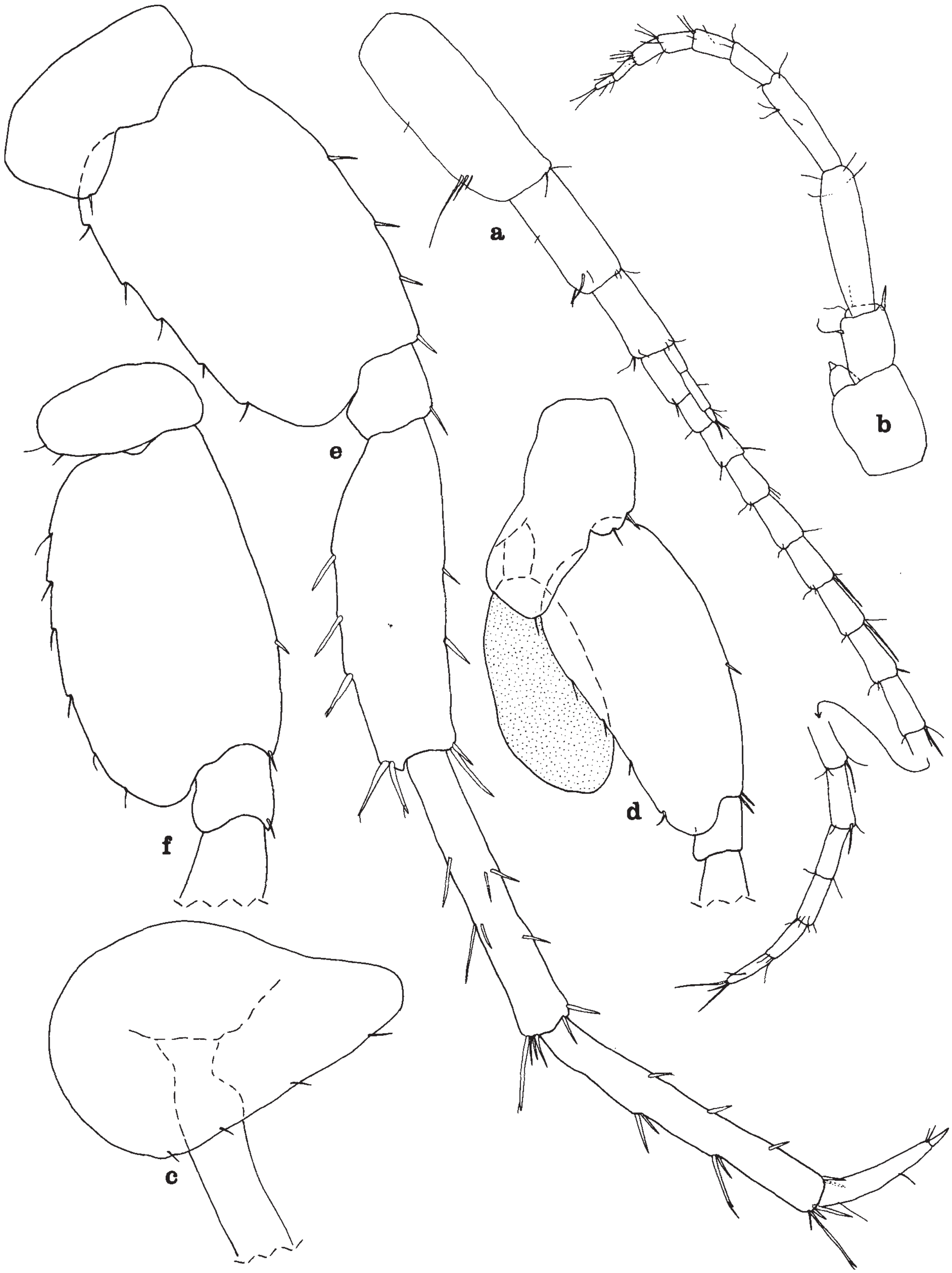

Fig. 3.–*Mayaweckelia yucatanensis,* new species. Female paratype (3.0 mm): *a,b,* antennae 1 and 2; *c,* upper part of pereopod 4; *d,* upper part of pereopod 5; *e,* pereopod 6; *f,* upper part of pereopod 7.

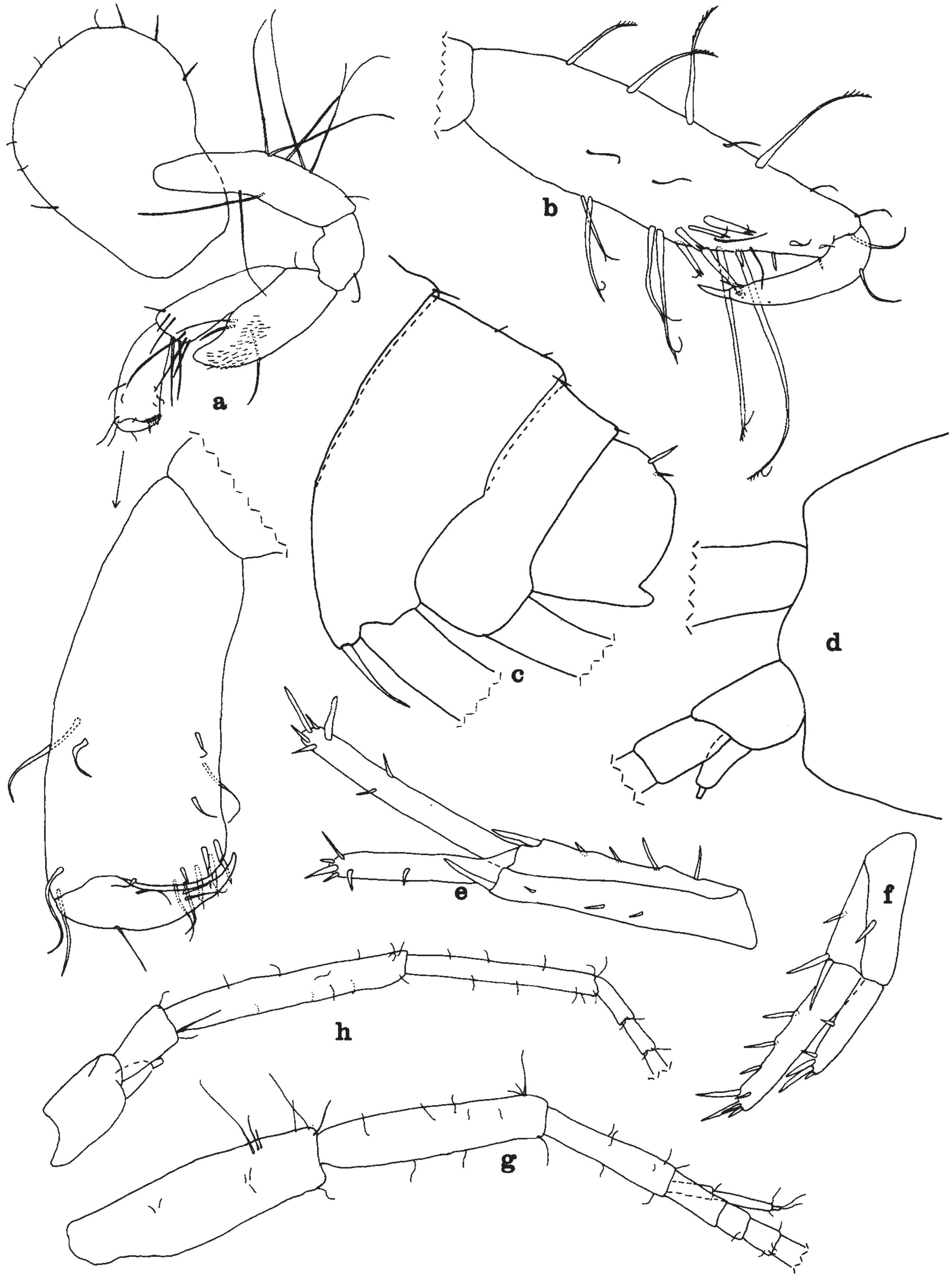

Fig. 4.–*Mayaweckelia cenoticola*, new species. Male paratype (4.0 mm), Cueva de Orizaba: *a*, gnathopod 1; *b*, gnathopodal propod 2; *c*, uronites; *d*, head; *e,f*, uropods 1 and 2; *g,h*, antennae 1 and 2.

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

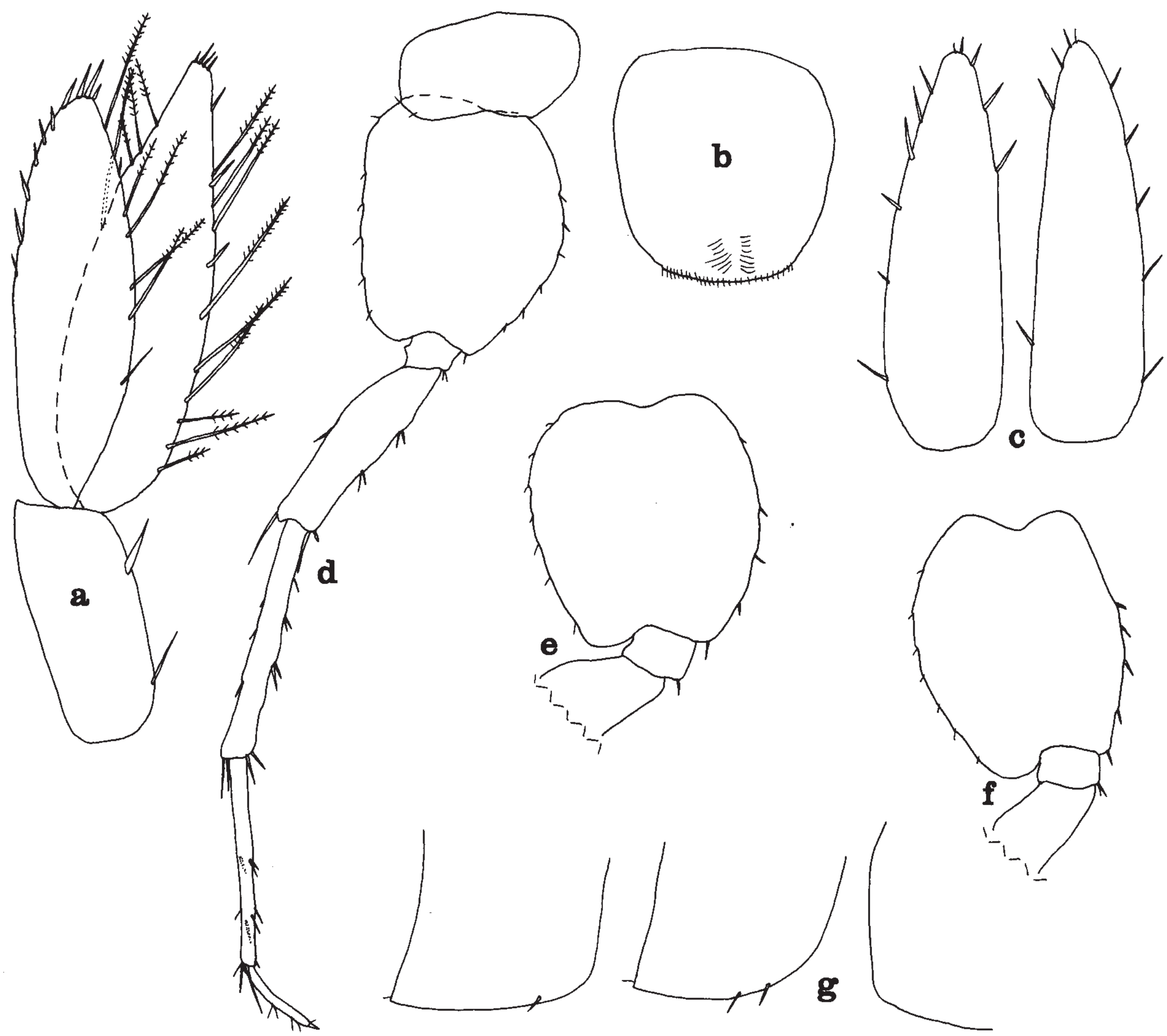

Fig. 5.–*Mayaweckelia cenoticola,* new species. Female paratype (5.0 mm), Cenote Xtacabihá: *a,* uropod 3; *b,* upper lip; *c,* telson; *d,* pereopod 5; *e,f,* upper part of pereopods 6 and 7; *g,* pleonal plates.

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

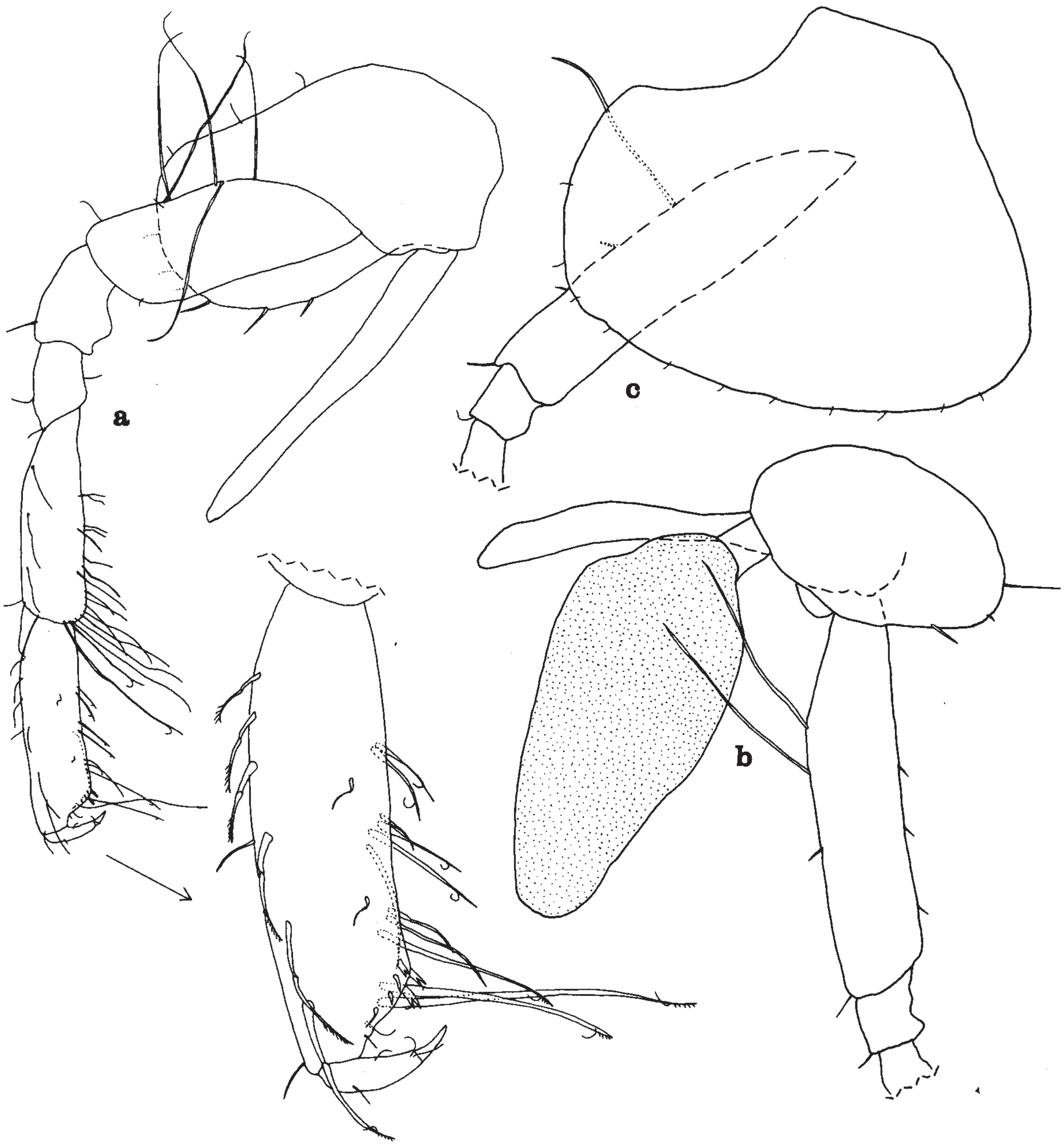

Fig. 6.–*Mayaweckelia cenoticola*, new species. Female paratype (5.0 mm), Cenote Xtacabihá: *a*, gnathopod 2; *b,c*, upper parts of pereopods 3 and 4.

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

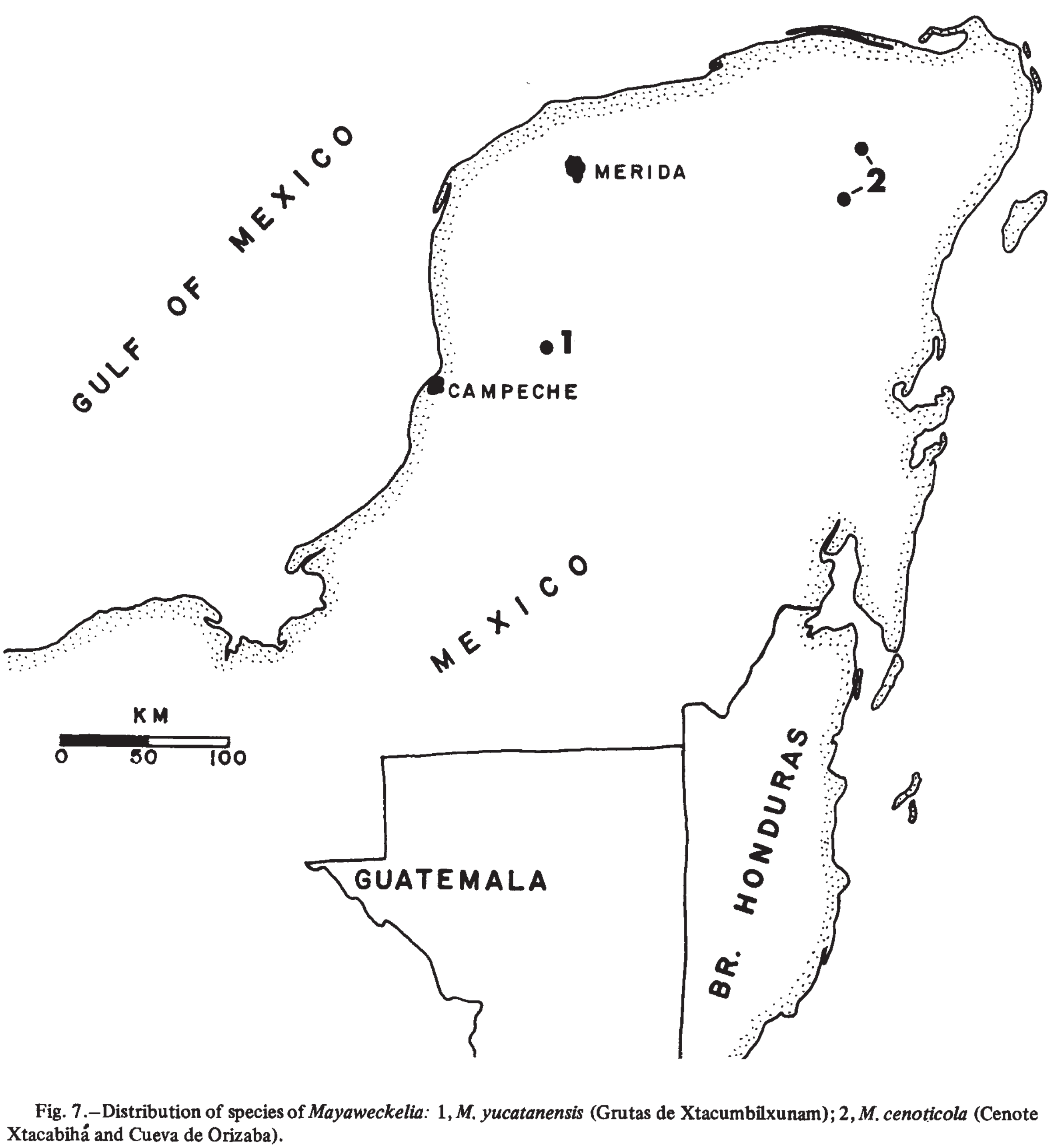

Fig. 7.–Distribution of species of *Mayaweckelia:* 1, *M. yucatanensis* (Grutas de Xtacumbilxunam); 2, *M. cenoticola* (Cenote Xtacabihá and Cueva de Orizaba).

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 Xtacabihá 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 Cúba 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).

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

A REVIEW OF THE GENUS *ANTROMYSIS* (CRUSTACEA: MYSIDACEA), INCLUDING NEW SPECIES FROM JAMAICA AND OAXACA, MEXICO, AND A REDESCRIPTION AND NEW RECORDS FOR *A. CENOTENSIS*

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INTRODUCTION

The small blind mysid, *Antromysis cenotensis,* was one of the interesting crustaceans from Yucatán, México, described by Creaser (1936). *A. cenotensis* was found in 2 caves, Balam Canche Cave, SE of Chichén Itzá, and San Isidro Cave, near Mérida. A second species of Creaser's new genus, *A. anophelinae,* was reported from Costa Rica, in the burrows of the land crab *Cardisoma crassum* by Tattersall (1950). Tattersall's species was not blind, but had reduced eyes, fused medially. A third species, *A. cubanica,* completely blind, was recently described by Bacescu and Orghidan (1971) from Juanella Piedra Cave, south of Havana, Cúba.

During the spring of 1973, James Reddell and his colleagues (Mary Butterwick, David McKenzie, Martha Helen McKenzie, and Stuart Murphy) collected more than 100 specimens of *Antromysis cenotensis* from 14 localities in Yucatán. This fine collection has enabled me to clarify some of the points raised by Tattersall in commenting on probable errors in Creaser's account.

Also included herein are the descriptions of 2 more blind cavernicolous species from Jamaica and Oaxaca, México.

Finally, the number of species of *Antromysis* is increased to 9 by transferring to it 3 species: *Parvimysis bahamensis* Brattegard and *P. almyra* Brattegard, and *Diamysis americana* Tattersall.

Antromysis (Antromysis) cenotensis Creaser
Figs. 1-4

Antromysis cenotensis Creaser, 1936, pp. 121-123, figs. 13-24; Tattersall, 1950, p. 234.

Antromysis (Antromysis) coenotensis Creaser: Bascescu and Orghidan, 1971, p. 4 (in key; misspelling).

Material examined.—More than 100 specimens from caves and cenotes of the state of Yucatán. For details of localities see Figure 1.

Supplemental description.—A small blind, unpigmented mysid, 3-4 mm in length (from tip of rostrum to end of telson). Rostrum rounded, not "acutely pointed" as stated by Creaser, covering small part of eyestalk base. Cervical groove well developed. Eyestalks suboval; medial margins almost in contact, in contrast to *A. cubanica* in which eyestalks are widely separated. Ommatidia completely absent. Telson nearly as long as width at base, gradually narrowing posteriorly; apex very slightly concave, armed with robust spine at each corner and pair of short spines in center.

Antenna 1: Peduncle segment 3 distinctly shorter than segment 1; segment 1 with anterolateral lobe; segment 2 with group of 4 setae on anterodorsal margin; segment 3 with rounded middorsal lobe and non-setose male lobe. Antenna 2: Scale about 4 times as long as wide, 2-merous, not unsegmented as shown by Creaser.

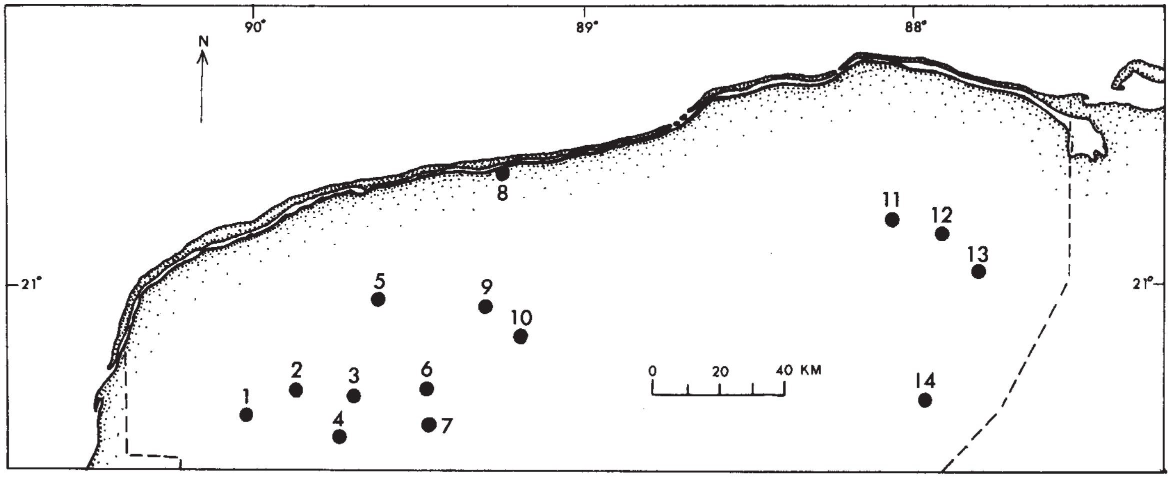


Fig. 1.—Northern Yucatán, showing localities where *Antromysis cenotensis* was collected: 1, Cenote Calchum; 2, Cenote de las Abejas; 3, Cenote de Sihunchén; 4, Cenote de la Culebra; 5, Cueva de San Isidro; 6, Grutas de Tzab-Nah; 7, Cenote Chen Mul; 8, Pozo de Santa Elena; 9, Cenote G, Ruinas de Aké; 10, Cenote (=Cueva) de Hoctún; 11, Cenote de Sodzil; 12, Cenote de Orizaba, Cueva de Orizaba; 13, Cenote Aká Chen; 14, Cenote de Xtacabihá.

Mandible: Palp 3-merous, not 2-merous as stated by Creaser. Left incisor with 4-cuspate incisor and 5-cuspate lacinia; right incisor 3-cuspate. Spine row with 3 spines; those in left mandible similar, arched and plumose; those in right mandible of 3 different types as shown in Figure 3D. Molar with ridged surface.

Maxilla 1: Outer lobe with about 12 short terminal spines arranged in 2 rows and 4 surface setae. Inner lobe with 8 terminal setae and spines. Maxilla 2: Proximal endite with 6 terminal and 2 inner setae; inner surface with curved row of close-set broad-based setae. Distal endite bifid. Endopod 2-merous; distal segment a fourth longer than proximal segment. Exopod short, armed with only 2 distal setae.

Maxilliped: Inner lobes of segments 3 and 4 only moderately developed. Claw of dactyl slender.

Pereopods 2-7 (thoracic endopods 3-8): Carpopropus divided into 2 segments.

Pleopods: Short, unsegmented except male pleopod 4. Latter with bilobed endopod; exopod bisegmental, with long terminal seta.

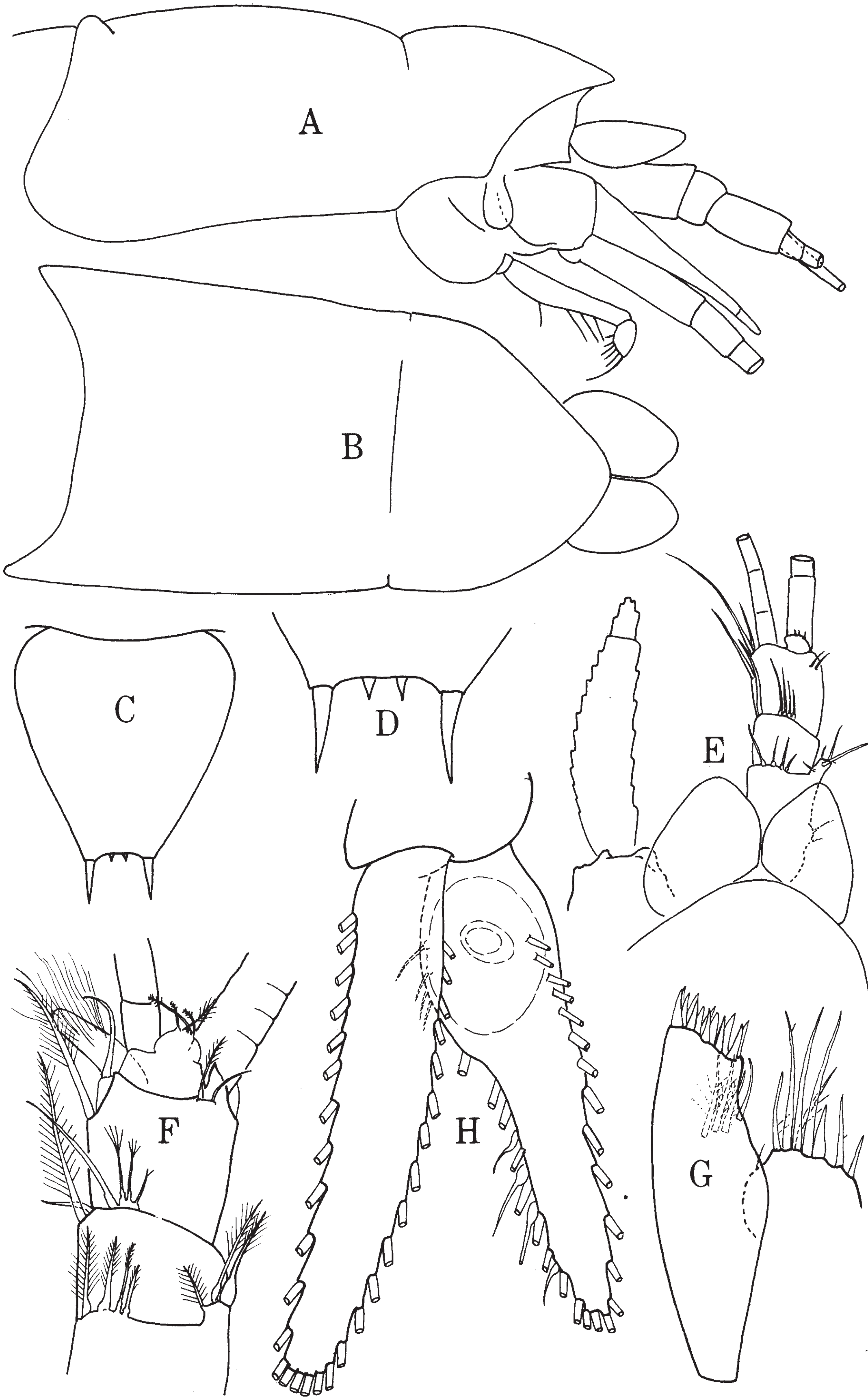
Uropods: Exopod slightly longer than endopod. Lateral margin of endopod with basally swollen setae in addition to usual plumose setae.

Comparison with original description by Creaser.—Tattersall (1951) listed some apparent errors in Creaser's description and illustrations. Creaser described the mandibular palp as 2-merous and so illustrated it in his figure 22, but his figure 15, labeled "first thoracic appendage (gnathopod)," is a drawing of a 3-merous mandibular palp and matches my illustrations of this structure except for minor differences in the numbers of setae. Tattersall pointed out other discrepancies; for example, maxilliped labeled "second thoracic appendage (maxilliped)," and pereopod 1 labeled "third thoracic appendage (first true leg)."

The most serious error in Creaser's account is his description of the taxonomically important male pleopod 4. Creaser described and illustrated both rami as having 2 segments, but the sutures he drew are nonexistant in specimens of the present collection and are probably creases in the integument. In the 1973 specimens the segmentation agrees with that of *Antromysis anophelinae* as shown by Tattersall (1951, Fig. 98F). The sutures of the exopod are difficult to see and are easily overlooked. It would be interesting to reexamine the exopod of the male pleopod 4 of *A. cubanica,* shown by the authors as unsegmented (Bacescu and Orghidan, 1973, Fig. 1D).

Distribution.—Widespread in the Yucatán Peninsula (Fig. 1). I have seen no obvious differences among specimens from the various localities; this morphological uniformity is to be expected in view of the widespread intercommunication in groundwaters of the Yucatán karst system.

→ Fig. 2.—*Antromysis cenotensis:* A, head and carapace, lateral; B, same, dorsal; C, telson, dorsal; D, apex of telson; E, anterior end, dorsal; F, antenna 1, male, dorsal; C, maxilla 1; H, uropod, dorsal.


A
B
C
D
E
F
G
H

After a draft of the present manuscript was completed, I received additional specimens collected by Mr. Reddell in Yucatán and Quintana Roo during the summer of 1975. The localities are listed below.

Quintana Roo: Actún Ha, Cobá; Cenote de Juan Coh, Felipe Carrillo Puerto; Cenote de Las Ruinas, 6 km N Polyuc; Cenote de San Martín, 3 km E Pamul; Cenote de Santo Domingo, 5 km ENE Kilometer 50. *Yucatán:* Cenote de Kankirixché, 10 km NW Muna; Cenote Nohchén, Sacalum; Cenote de San Diego, 2 km W Cocoyol; Cenote de Xtacabihá, 9 km NNE Tikuch.

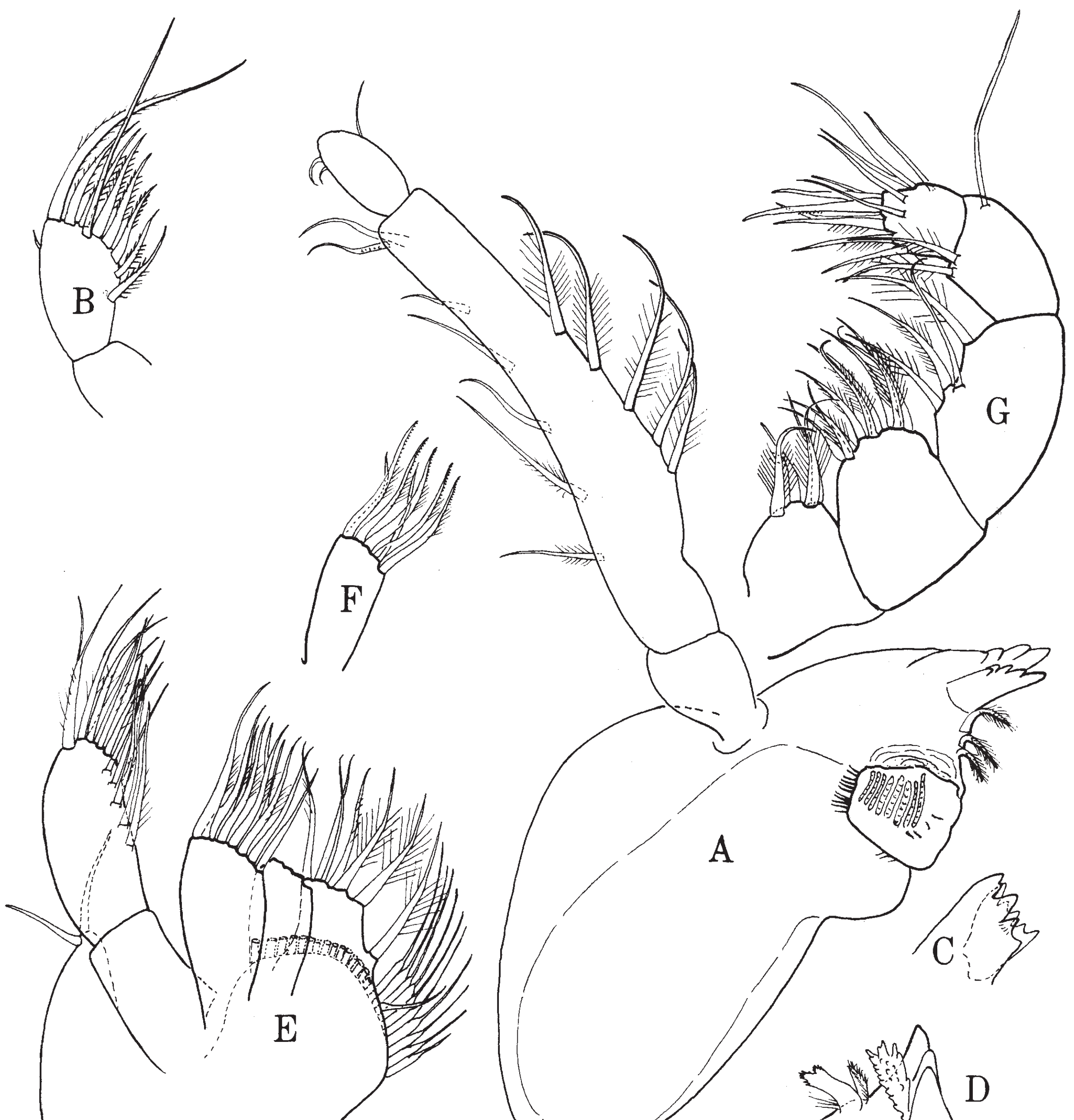


Fig. 3.–*Antromysis cenotensis:* A, left mandible; B, mandibular palp, distal segment, surface view; C, incisor and lacinia of left mandible; D, incisor and spine row of right mandible; E, maxilla 2; F, medial lobe of 2nd endite of maxilla 2; G, maxilliped, distal segments.

Fig. 4.–*Antromysis cenotensis:* A, pereopod 5; B-F, right pleopods 1-5, male, ventral view.

Antromysis peckorum, new species
Figs. 5-6

Material examined.–JAMAICA. Clarendon Parish (southern part, near Portland Point), Jackson Bay Cave: 21-22 December 1972, from pool of slightly brackish water that is subject to tidal fluctuation, collected by Jarmila and Stewart Peck; holotype (USNM 155657) and 1 male and 3 female paratypes (USNM 155658), 15 August 1974, from beach passage pools, collected by Stewart Peck; 7 female paratypes (USNM 155659).

Etymology.–Named for the collectors.

Description.–Small, blind, unpigmented, up to 3.0 mm in length. Rostrum broadly rounded, covering small part of eyestalk base. Cervical groove well developed. Eyestalks suboval, similar in shape to those of *A. cenotensis,* but slightly broader distally; medial margins narrowly separated. Telson slightly wider than long (range of width: length for 7 specimens 1.05-1.15, mean 1.10); apex slightly concave, armed with robust spine at each corner; 1 or 2 short spines may be present between corner spines; other variations include an extra robust spine between corner spines, and a short spine proximal to corner spine.

Antenna 1: Peduncle segments 1 and 3 subequal in length; segment 1 with anterolateral lobe, segment 3 with rounded middorsal lobe. Antenna 2: Scale about 4 times as long as wide; distal segment nearly twice as long as wide.

Mandible: Palp 3-merous, armed as in Fig. 5F. Right incisor 3-cuspate. Maxilla 1: Outer lobe with 10 terminal spines and 3 surface setae. Inner lobe with 8 terminal setae and spines. Maxilla 2: Proximal endite with 6 terminal and 2 inner setae; inner surface with curved row of close-set broad-based setae (omitted from Fig. 5H). Distal endite bifid, each ramus with 5 terminal setae. Endopod 2-merous; distal segment 2/3 longer than proximal segment, bearing 4 terminal and 7 inner setae. Exopod reaching end of 1st endopod segment, with 2 distal setae. Maxilliped as in Fig. 5I.

Pereopods 2-7: Slender; carpropopus divided into 2 segments.

Male pleopod 4: Endopod bilobed, unisegmental, Exopod consisting of 2 subequal segments and long terminal seta.

Uropods: Exopod slightly longer than endopod.

Relationships.–*Antromysis peckorum* is very similar to *A. cenotensis* and *A. cubanica.* It differs from *A. cenotensis* most clearly by the shorter telson, which usually lacks the central apical spinules, and by the long 2nd protopod segment of the male pleopod 4. From *A. cubanica* it is distinguished by the shorter telson with longer and less widely separated apical spines, by the relatively longer distal segment of the scale of antenna 2, and by the widely separated eyestalks in *A. cubanica.*

Distribution.–At present known only from its type-locality, Jackson Bay Cave (or Jackson's Bay Great Cave). The cave has 5 entrances and consists of a series of chambers with connecting passages (Ashcroft, 1959). Other crustaceans collected by the Pecks in this cave include the recently described mysidacean *Stygiomysis peckorum* Bowman (1976), the amphipod *Hadzia jamaicae* Holsinger (1974), and the brachyuran crab *Cardisoma guanhumi* Latreille (identified by Horton H. Hobbs, Jr.).

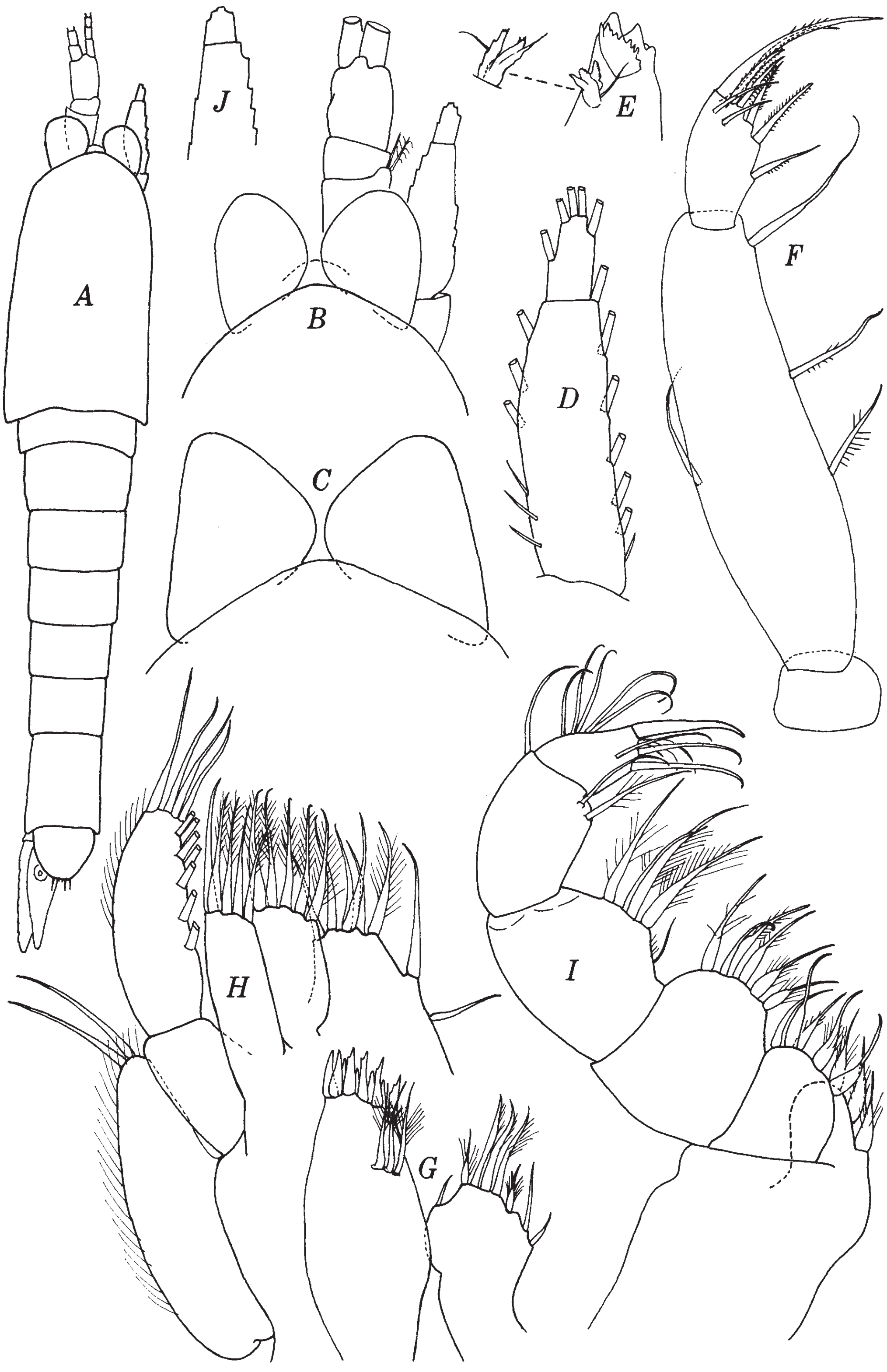


Fig. 5.—A-I, *Antromysis peckorum:* A, habit, dorsal; B, anterior end, dorsal; C, eyestalks, dorsal; D, scale of antenna 2, dorsal; E, incisor of right mandible; F, mandibular palp; G, maxilla 1; H, maxilla 2 (curved row of setae on inner surface omitted); I, maxilliped. J, *Antromysis cubanica,* apex of scale of antenna 2 (copied from Bacescu & Orghidan, 1971).

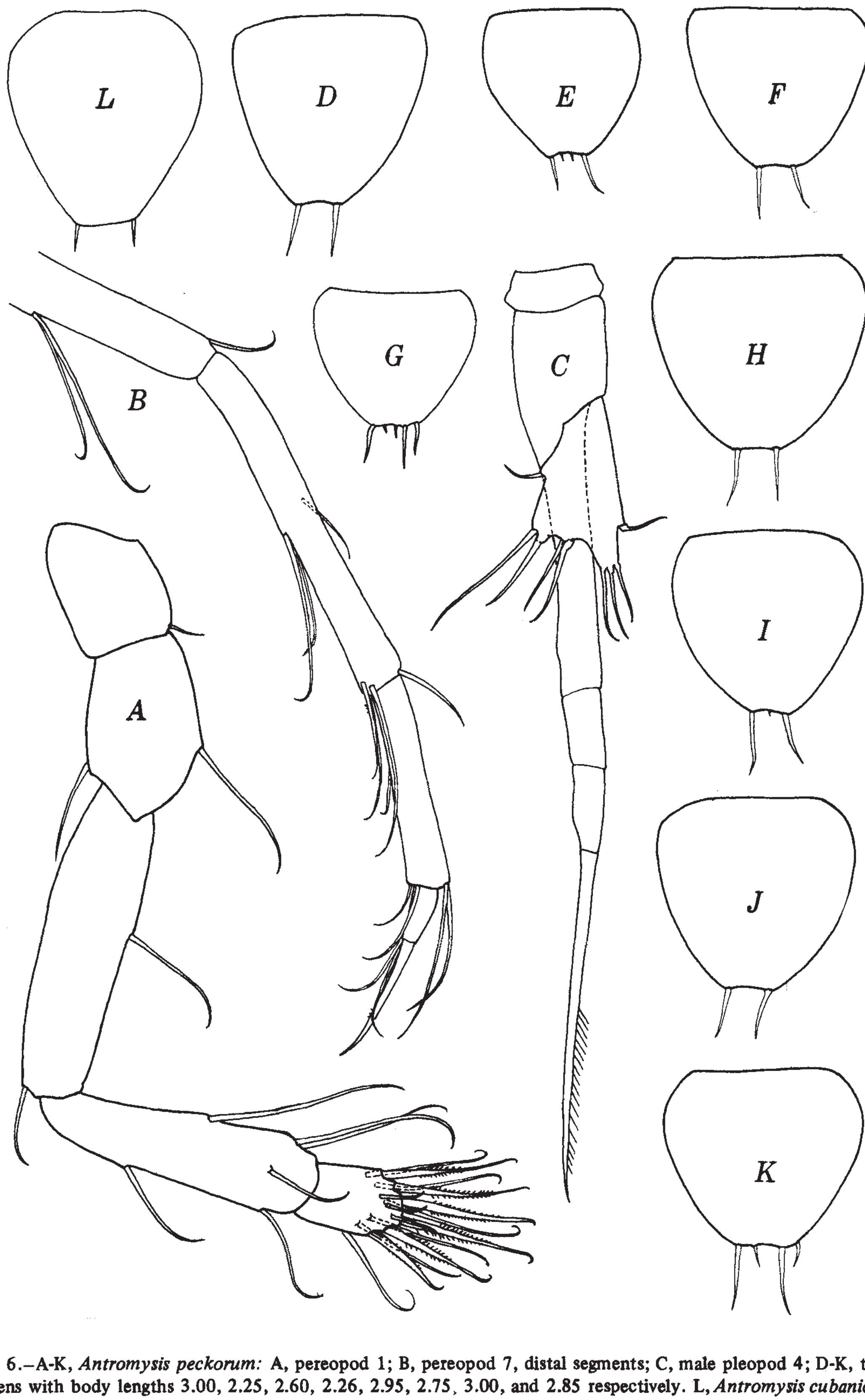


Fig. 6.–A-K, *Antromysis peckorum:* A, pereopod 1; B, pereopod 7, distal segments; C, male pleopod 4; D-K, telsons of specimens with body lengths 3.00, 2.25, 2.60, 2.26, 2.95, 2.75, 3.00, and 2.85 respectively. L, *Antromysis cubanica,* telson (copied from Bacescu & Orghidan, 1971).

Antromysis reddelli, new species
Fig. 7

Material examined.–MEXICO. *Oaxaca:* Cueva de las Maravillas, 6 km S Acatlán, 29 December 1976, from standing pools also inhabited by blind crayfish, shrimp, and catfish. Collected by James Reddell, Andy Grubbs, Carmen Soileau, and David McKenzie: male holotype (USNM 169232) and 3 male, 1 female paratypes (USNM 169223).

Etymology.–Named for James Reddell, in recognition of his many contributions to biospeleology.

Description.–Small, blind, unpigmented, up to 4.0 mm in length. Rostrum broadly rounded, covering small part of eyestalk base. Eyestalks suboval, shorter than those of *A. cenotensis* and *A. peckorum,* about 3/5 as long as wide; medial margins in contact. Telson about as long as wide, subquadrate; apex truncate, armed with 4 short central spines flanked by 4-5 longer spines decreasing in length proximally and extending to distal third of lateral margins.

Antenna 1: Peduncle segments 1 and 3 subequal; segment 1 with anterolateral lobe; segment 3 with rounded middorsal lobe bearing 3 short setae and 1 longer seta. Antenna 2: Scale about 3-1/4 times as long as wide; distal segment about 1.3 times as long as wide.

Mandible: Palp 3-merous, armed as in Fig. 7F. Left mandible with 3-cuspate incisor and 5-cuspate lacinia; spine-row with 3 spines; right mandible not examined. Maxilla 1: Outer lobe with 10 terminal spines and 3 surface setae. Inner lobe with 8 terminal setae. Maxilla 2: Proximal endite with 6 terminal and 2 inner setae; inner surface with curved row of close-set broad-based setae (omitted from Fig. 7H). Distal endite bifid, each ramus with 10 terminal setae. Endopod 2-merous; distal segment 1/6 longer than proximal segment, bearing 16 setae. Exopod with 3 distal setae. Maxilliped: More setose than in *A. peckorum;* posterodistal setae of propus very long. Terminal spines of dactyl subequal; none enlarged as "claw."

Pereopods 2-6: Slender, carpopropus divided into 2 segments.

Male pleopod 4: Segmentation indistinct. Endopod like that of *A. peckorum,* but setation slightly different. Exopod with very long barbed terminal spine.

Uropods: Exopod slightly longer than endopod.

Relationships.–Aside from the telson, which is somewhat similar to that of *A. anophelinae, A. reddelli* shares with *A. cubanica* an antennal scale with a relatively short distal segment, and with *A. cenotensis* the contact or slight separation of the eyestalks.

DISCUSSION

Bacescu and Orghidan (1971) divided *Antromysis* into 2 subgenera: *A. (Antromysis)*–blind, eyestalks separate, carpropropus 2-merous *(A. cenotensis, A. cubanica, A. peckorum, A. reddelli); A. (Anophelina)*–ommatidia present, eyestalks fused, carpopropus 3-merous *(A. anophelinae).* I propose the addition of 2 more subgenera. The first, *Parvimysis,* was established by Brattegard (1969) for a new marine species, *P. bahamensis,* originally described from the Bahamas, but later reported from Puerto Rico (Brattegard, 1970) and the Caribbean coast of Columbia (Brattegard, 1973). *Parvimysis bahamensis* has well developed separate eyes and a 2-merous carpopropus. The telson is emarginate, but in specimens from the Florida Keys (Brattegard, 1973) and in the recently described *P. almyra* Brattegard (1977) the emargination is slight and rather similar to that in *A. cenotensis.*

Parvimysis fits without difficulty into the genus *Antromysis,* and including it there has the advantage of focussing attention on its similarities to other species of *Antromysis.* The mandible and maxilla 2 are very similar to those of *A. cenotensis,* and the pereopods, male pleopods, and short telson provide further evidence for placing *Parvimysis* in *Antromysis.* Because of its well developed eyes, large exopod of maxilla 2, and 3-merous exopod of the male pleopod 4, *Parvimysis* is retained as a subgenus of *Antromysis.*

The second additional subgenus, *Surinamysis,* is proposed for *Diamysis americana* Tattersall (1951). Reasons for proposing this new subgenus are given below.

In an attempt to elucidate the relationships of the 9 species included herein in *Antromysis,* I have used Hennig's phylogenetic analysis (Hennig, 1966; Kavanaugh, 1972). In Hennig's method, character states are classified as primitive (plesiomorphic) or derived (apomorphic); species with the same derived character states are grouped together, and a cladogram is constructed to show the relationships graphically.

I have used the following 7 characters in my analysis of *Antromysis:*

No.	Character	Character State: Primitive	Derived
1	Carpopropus of pereopods 2-6	3-merous	2-merous
2	Male pleopod 4, no. of exopod segs.	3	2
3	Maxilla 2 exopod	large	small
4	Spines of telson	normal	reduced
5	Eyestalks	separate	fused
6	Eyes	present	absent
7	Pereopod 7	normal	modified

Fig. 7.–A-L, *Antromysis reddelli:* A, anterior part of head, dorsal; B, antenna 1, distal end of peduncle, dorsal; C, antenna 2, scale, dorsal; D, telson, dorsal; E, left mandible, lacinia and incisor; F, left mandible, palp; G, maxilla 1; H, maxilla 2; I, maxilliped; J, one of pereopods (all detached), distal segments; K, male pleopod 4; L, uropod. M, *Antromysis anophelinae,* exopod of maxilla 2.

In general, the character states classified as derived show a loss, reduction, fusion, or modification of parts compared to the states of the same characters considered to be more primitive.

A phylogeny arrived at by Hennigian analysis is shown in Fig. 8. The subgeneric divisions of *Antromysis* by Bacescu and Orghidan emerge clearly. *Antromysis* sp. Brattegard (1977) is known only from a single female, and I have arbitrarily assumed that it is apomorphic in characters 2 and 3. If this assumption is correct, *Antromysis* sp. has affinities with *Diamysis americana* rather than with *A. (Antromysis).* Nouvel (1957, 1965) doubted that *D. americana* was a *Diamysis,* but Brattegard (1977) did not feel that the reduced exopod of maxilla 2 was clearly of generic significance, and he retained *Diamysis americana* in *Diamysis. Diamysis americana* fits nicely into *Antromysis* as defined herein, but a new subgenus is required for it, *Surinamysis* (see diagnosis below).

The Hennigian cladogram does not show clearly the taxonomic position of *Parvimysis* because it has primitive character states for 6 of the 7 characters selected. Hence its branch is drawn with a dashed line.

An emended diagnosis of *Antromysis,* diagnoses of its subgenera, and a key to the species are given below.

Antromysis Creaser, 1936

Small mysids, from 2.5-5.5 mm in length, with moderately slender body. Eyes well developed, reduced, or absent. Eyestalks separate or fused. Scale of antenna 2 oval to lanceolate, setose all around, with distal segment. Mandibles with well developed incisor, lacinia, and molar; palp 3-merous. Maxilla 2 exopod without marginal setae, with only 2 or 3 terminal setae. Pereopods 2-7 with 2- or 3-merous carpopropus. Male pleopod 4 with 1-merous endopod and 2-3-merous exopod with long barbed apical spine sometimes flanked by 1-3 spinules. Other male pleopods rudimentary as in the female. Uropods setose all around, without spines; exopod usually only slightly longer than endopod. Telson short; apex rounded to shallowly cleft; marginal spines few. Type-species by monotypy, *Antromysis cenotensis* Creaser, 1936. Gender feminine.

subgenus *Antromysis* Creaser, 1936

Eyestalks reduced; ommatidia absent. Maxilla 2 with small exopod. Carpopropus of pereopods 2-7 2-merous. Exopod of male pleopod 4 2-merous. Telson without spines on lateral margin. Type-species, *Antromysis cenotensis* Creaser, 1936.

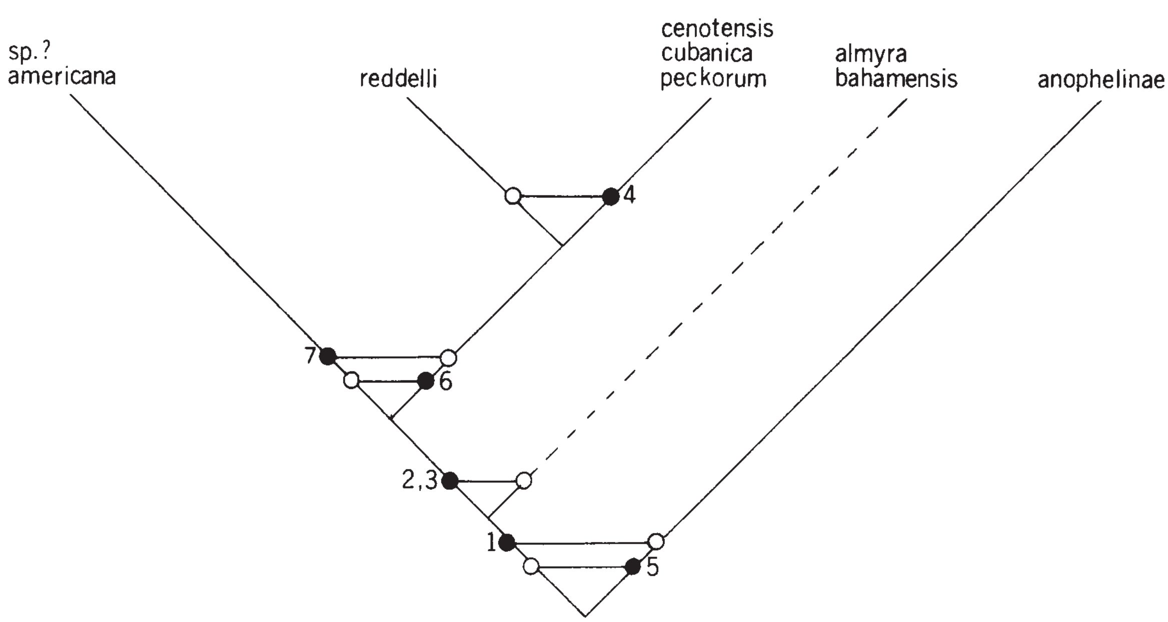


Fig. 8.–Proposed phylogeny of *Antromysis.* Numbers refer to characters listed in table. Solid circles, derived (apomorphic) character states; open circles, primitive (plesiomorphic) character states.

KEY TO THE SPECIES OF *ANTROMYSIS*

1a. Eyestalks fused. Carpopropus of pereopods 2-6 3-merous .... *A. (Anophelina) anophelinae* Tattersall
1b. Eyestalks separated. Carpopropus of pereopods 2-7 2-merous 2

2a. Eyes normal, with pigmented ommatidia. Telson with spines on lateral margins 3
2b. Eyestalks without ommatidia or pigment. Telson without spines on lateral margins . . *A. (Antromysis)* 4

3a. Pereopod 7 sexually dimorphic; ischium and merus elongate, subequal .... *A. (Surinamysis) americana* (Tattersall)
3b. Pereopod 7 not sexually dimorphic; merus much longer than ischium .... *A. (Parvimysis)* 7

4a. Telson with 4 central apical spinules .... *A. (A.) reddelli* Bowman
4b. Telson with 0-2 central apical spinules 5

5a. Eyestalks close together; medial margins almost touching 6
5b. Eyestalks widely separated .... *A. (A.) cubanica* Bacescu & Orghidan

6a. Telson slightly longer than wide, with 2 unarticulated central apical spinules . . *A. (A.) cenotensis* Creaser
6b. Telson slightly wider than long; central apical spinules usually absent, but articulated if present .... *A. (A.) peckorum* Bowman

7a. Rostrum pointed. Lateral margins of telson with 3-4 spines. Distal exopod segment of male pleopod 4 much shorter than preceding segment .... *A. (P.) bahamensis* Brattegard
7b. Rostrum rounded. Lateral margins of telson with 4-8 spines. Distal exopod segment of male pleopod 4 subequal to preceding segment .... *A. (P.) almyra* Brattegard

subgenus *Anophelina* Bacescu & Orghidan, 1971

Eyestalks fused medially to form an ocular plate; ommatidia reduced to narrow band. Maxilla 2 with small exopod. Carpopropus of pereopods 2-6 3-merous; that of pereopod 7 2-merous, proximal subsegment expanded. Exopod of male pleopod 4 3-merous. Telson with 2 spines on each lateral margin. Type species, by monotypy, *Antromysis anophelinae* Tattersall, 1951.

subgenus **Surinamysis**, new subgenus

Eyes and eyestalks normal. Maxilla 2 with small exopod. Carpopropus of pereopods 2-7 2-merous; pereopod 7 with elongate ischium and merus. Exopod of male pleopod 4 2-merous. Telson cleft apically, with spines on lateral margins and in cleft. Type species, by monotypy and present designation, *Diamysis americana* Tattersall, 1951.

Etymology.—A combination of Surinam and *Mysis.*

subgenus *Parvimysis,* Brattegard, 1969, new rank

Eyes and eyestalks normal. Maxilla 2 with large exopod. Carpopropus of pereopods 2-7 2-merous. Exopod of male pleopod 4 3-merous. Telson emarginate to moderately cleft apically, with spines on lateral margins and in cleft. Type-species, by monotypy, *Parvimysis bahamensis* Brattegard, 1969.

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DESCRIPTIONS OF *CENTRUROIDES* MARX FROM THE YUCATAN PENINSULA (ARACHNIDA, SCORPIONIDA, BUTHIDAE)

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Chamberlin and Ivie (1938) described *Centrurus yucatanus (=Centruroides yucatanus)* on the basis of an immature and an adult male specimen from Actún Loltún, Oxkutzcab, Yucatán. Unfortunately, the original description of *C. yucatanus* is inadequate for comparison with other specimens of the genus *Centruroides* Marx from Yucatán, and the position and relationships of this species need to be re-examined. In this article I discuss the status of *C. yucatanus* and describe the species of *Centruroides* known from the Yucatán Peninsula.

STATUS OF *CENTRURUS YUCATANUS*

The number of rows of granules on the pedipalp chelal moveable finger has been used by several authors as a key character, or in diagnoses, for species of *Centruroides.* This character, however, may be difficult to determine since a short apical row of 3-5 granules, which may be absent, is not counted, and the basal two rows may be united into a single row. The adult male holotype of *Centrurus yucatanus* has a count of 8 rows plus the short apical row, which Chamberlin and Ivie interpreted as 9 rows of granules. This error, when combined with a generally inadequate description obscured the identity of this species, and may have been responsible for Chamberlin and Ivie's suggestion that *yucatanus* is closest to *Centruroides gracilis* (Latreille). After comparison of the type with other specimens of *Centruroides* from the Peninsula, however, I found that *C. yucatanus* is conspecific with, and hereby synonymized under, *Centruroides ochraceus* (Pocock).

Chamberlin and Ivie's error in determining the number of rows of granules on the pedipalp moveable finger, along with the variability of the uncounted apical row (present or absent) and basal rows (united or not), points out the questionable reliability of this character as a diagnostic aid. I have found in specimen series of *C. gracilis* and *C. ochraceus* from the Yucatán Peninsula that the number of rows of granules on the pedipalp fixed finger is a much more reliable character (Table 1), and have confirmed this in the following species of the genus *Centruroides: C. margaritatus* (Gervais), *C. sculpturatus* Ewing, *C. elegans* (Thorell), *C. vittatus* (Say), *C. infamatus* (Koch), *C. exilicauda* (Wood), *C. pallidiceps* Pocock, and *C. limbatus* (Pocock). The number of rows on the fixed finger is easier to use since all rows are counted, including the controversial apical row. In addition, the basal rows on the fixed finger never unite into a single row, and so the other major drawback of the moveable finger rows is avoided. The only difficulty I encountered is counting rows in some *C. margaritatus* specimens having only 4 granules (6 or 7 is more common) in the apical row of the fixed finger, but even in these cases, the apical row is always present and distinct. I, therefore advocate the use of the fixed finger in counting rows of granules.

Table 1.—Rows of granules on pedipalp fingers of *Centruroides ochraceus* Pocock and *Centruroides gracilis* (Latreille).

n	Fixed finger	Moveable finger	Moveable finger apical row
C. ochraceus			
19	8-8	8-8	P-P
3	8-8	7-8	P-P
1	8-8	7-8	A-P
C. gracilis			
49	9-9	9-9	P-P
3	9-9	9-9	A-P
10	9-9	8-9	P-P
1	9-9	8-9	A-P
3	9-9	8-8	P-P
1	9-9	6-9	P-P
1	9-9	9-9	A-A
1	9-9	8-9	A-A

A=absent, P=present

Centruroides ochraceus (Pocock)
Figs. 1-11

Centrurus ochraceus Pocock, 1898:386 (type locality: Yucatán). Kraepelin, 1899:94. Bequaert, 1933: 548. Pearse, 1945:54. Díaz Nájera, 1966:113.

Centruroides ochraceus: Pocock, 1902:21, 29. Herrera, 1917:271. Hoffmann, 1932:24, 266; 1939:318. Díaz Nájera, 1964:20, 27, 28. Bücherl, 1971:327. Díaz Nájera, 1975:3, 30, 34.

Centrurus flavopictus: Bequaert, 1933:548 (misidentification). Pearse, 1945:153. *(nec flavopictus* Pocock, 1898)

Rhopalurus testaceus ochraceus: Meise, 1934:32, 34, 35.

Centrurus yucatanus Chamberlin and Ivie, 1938:102 (type locality: Actún Loltún, Oxkutzcab, Yucatán). Pearse, 1945:154. Vandel, 1964:106. Reddell, 1971:26. NEW SYNONYMY.

Centruroides yucatanus: Díaz Nájera, 1975:4, 34.

Type data.—Lectotype female, herewith designated, and paralectotype females and male of *C. ochraceus* from Yucatán, BMNH, examined. Holotype male of *C. yucatanus* from Actún Loltún, AMNH, examined.

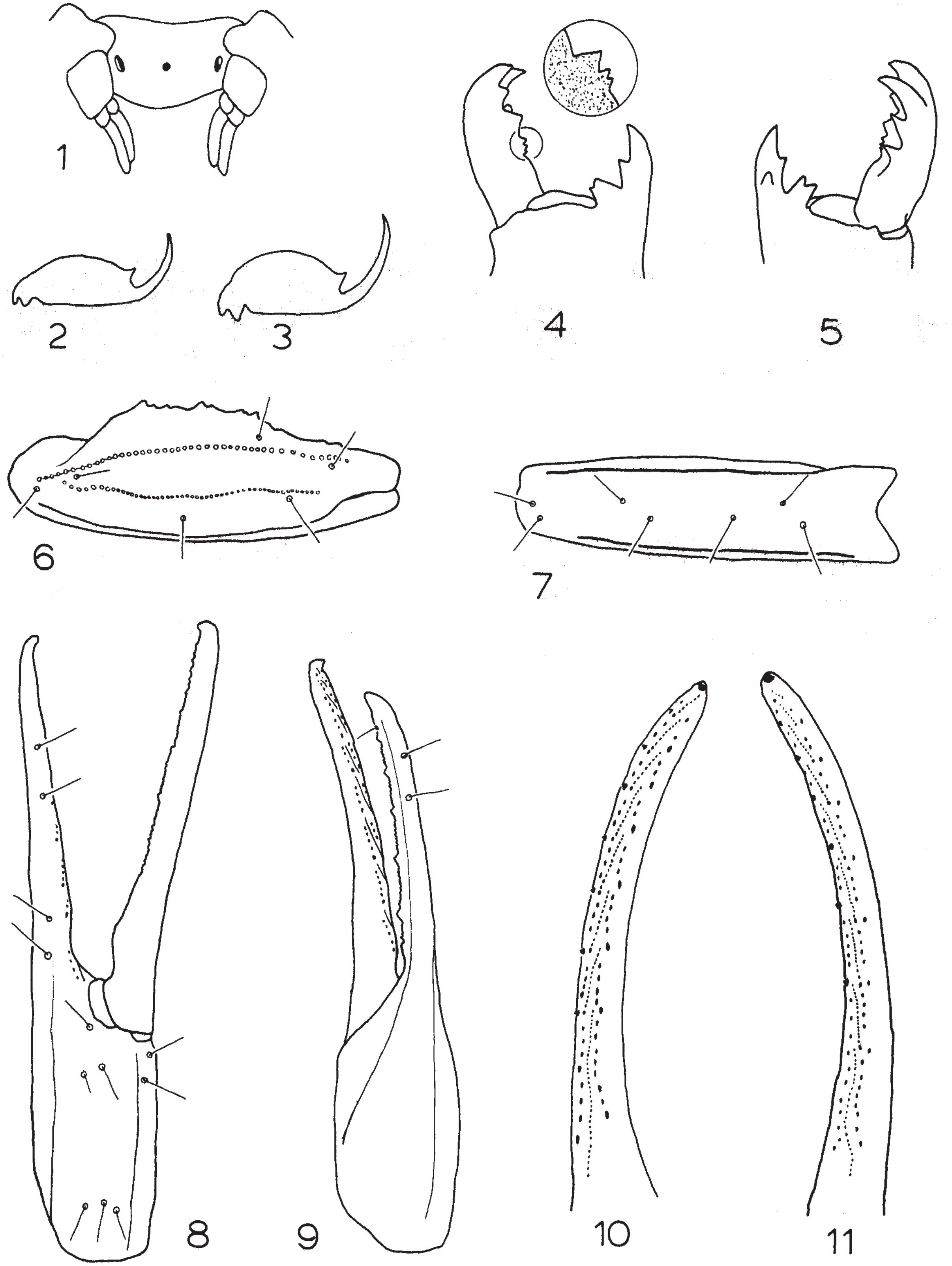
Diagnosis.—Adults 45-73 mm total length; ochreous to fusco-ferrugineous without darker stripes or variegations on prosoma or mesosoma (juveniles may be variegated); tergite VII median keel obsolete to moderate; pectinal basal piece subrectangular, with central depression or shallow hole in female; pectinal tooth count in males 27-30 (mode=29), females 25-28 (mode=27); all four sternite VII carinae smooth; metasomal segment V pentacarinate, carinae never granulose, ventral median keel weak to moderate, dorsal lateral carinae vestigial; telson vesicle of male distinctly elongate; subaculear tooth spiniform, strong; pedipalp chela carinae obsolete to vestigial and smooth, fingers either same color or darker than hand, fixed finger with eight rows of granules.

Description.—Measurements of *ochraceus* lectotype and *yucatanus* holotype given in Table 2. Based on female (male differences given in parentheses).

Prosoma. Carapace: ochreous fuscescent to testaceous, sparsely and weakly granulose; anterior margin smooth, feebly emarginate; anterior submargin moderately granulose; posterior margin moderately granulose (weakly granulose); anterior median furrow very shallow, wide; posterior median furrow very shallow and moderately wide on proximal one-half, distally abruptly much deeper (gradually slightly deeper) and narrow; superciliary carinae well developed, strongly granose (smooth to weakly granose), infuscate; posterior submedian carinae subparallel, moderately developed, moderately granulose (weakly granulose). Venter ochreous to ochreous fuscescent.

Mesosoma. Tergites: ochreous fuscescent to fusco-ferrugineous, shagreened; posterior margins moderately granulose, submargin weakly to moderately granulose (not granulose). Median keel on tergite I vestigial (obsolete), subcrenate; II vestigial, subcrenate; III-IV weak, crenate; V moderate (weak), serrate (crenate); VI moderate, serrate (crenate). Tergite VII: median keel present on median one-third (proximal one-half), moderate (obsolete to weak), serrate (crenate); submedian and lateral carinae present on distal two-thirds, strong (moderately strong), serrate, ferrugineous to testaceous. Genital operculi ochroleucus, paraboloid (campaniform). Pectinal basal piece (Fig. 1) ochroleucus, subrectangular with feeble anteriomedian notch, with a median depression or shallow hole (smooth); 25-28 (27-30) pectinal teeth. Sternites ochreous to ferrugineous, shagreened; stigmata elongate, four times longer than wide. Sternite VII submedian carinae present on distal two-thirds (three-fourths), vestigial, smooth; lateral carinae present on median one-half (two-thirds), vestigial (obsolete to vestigial), smooth.

Metasoma. Ochreous fuscescent (ochreous fuscescent to ferrugineous), carinae ferrugineous to testa-



Figs. 1, 3-11.–*Centruroides ochraceus* Pocock, lectotype female: 1, pectinal basal piece; 3, lateral aspect of telson; 4, dorsal aspect of chelicera, inset of basal teeth of moveable finger; 5, ventral aspect of chelicera; 6, dorsal aspect of pedipalp tibia; 7, external aspect of pedipalp tibia; 8, ventroexternal aspect of pedipalp chela; 9, dorsointernal aspect of pedipalp chela; 10, ventral aspect of pedipalp chela fixed finger; 11, dorsal aspect of pedipalp chela moveable finger.

Fig. 2.–*Centruroides ochraceus* Pocock, holotype male of *C. yucatanus:* lateral aspect of telson.

ceous. Ventral submedian carinae on I vestigial to weak, smooth, subparallel; II weak, smooth to subcrenate, subparallel; III weak to moderate, subcrenate, subparallel; IV moderate, crenate, subparallel. Ventral lateral carinae on I vestigial to weak, smooth to subcrenate, subparallel; II moderate (weak), subcrenate to crenate, subparallel; III moderate, crenate, subparallel; IV moderately strong (moderate), serrate (crenate), subparallel. Lateral inframedian carinae on I moderately strong (moderate), serrate; II-IV obsolete. Lateral supramedian carinae on I-IV moderate to strong, serrate with distal end granulose (I-II crenate, III-IV serrate, without granulose distal end). Dorsal lateral carinae on I-II strong (I moderate, II strong), complete, serrate with distal end granulose (I crenate, II crenate to serrate, without granulose distal end); III-IV strong (III moderate, IV weak), distally obsolete, serrate with distal end granulose (III subcrenate to crenate, IV smooth to subcrenate, without granulose distal end). Segment V ventral median keel moderate (weak), subcrenate to smooth; lateral median carinae moderate (vestigial to weak), crenate (subcrenate to smooth); dorsal lateral carinae vestigial, subcrenate (smooth). Telson (Figs. 2-3) ochreous fuscescent to ferrugineous, vesicle with median ferrugineous to testaceous stripe; vesicle bulbous (elongate bulbous), sparsely setate; subaculear tooth well developed, spiniform; aculeus elongate, sharply curved, distal one-half (two-thirds) fusco-ferrugineous to testaceous.

Chelicera. Ochreous to ochreous fuscescent sometimes with vestigial fuscosity dorsally. Dentition typical, but moveable finger dorsally having either 2 basal teeth, 1 single and 1 bifid basal tooth, or 3 basal teeth (Figs. 4-5).

Pedipalp. Orthobothriotaxia A, a. Femur ochreous to ochreous fuscescent; internal surface sparsely, strongly granulose, with some large subconical granules proximally; other surfaces smooth; dorsal internal keel moderately strong (moderate), crenate to serrate; ventral internal keel moderately strong to strong, granulose; dorsal external keel moderate (obsolete to vestigial), crenate (smooth); external keel vestigial to moderate, irregularly granulose. Tibia (Figs. 6-7) ochreous to ochreous fuscescent; dorsal internal keel moderate (weak), serrate; dorsal median keel weak, smooth to subcrenate; dorsal external keel moderate (weak), smooth to subcrenate; external keel vestigial to weak, smooth; ventral external keel weak to obsolete, smooth to subcrenate; internal keel vestigial to moderate, irregularly granulose with large and small subconical granules (subcrenate distally, granulose proximally, without subconical granules). Chela (Figs. 8-9): ochreous to ferrugineous, moderately setate; carinae vestigial to obsolete, their presence suggested by "facets"; fingers ochreous fuscescent to testaceous sometimes with basal three-fourths infuscate, fixed finger (Fig. 10) with 8 rows of granules, moveable finger (Fig. 11) with 8, 7 if basal two rows united, rows of granules plus a short apical row of three to five granules.

Legs. Ochreous to ochreous fuscescent, with spurs typical of genus.

Variability.–Coloration is highly variable in this species, the general body coloration ranging from ochraceous fuscescent to testaceous. Tergite VII may be lighter than the other tergites, and Díaz Nájera (1966) used this as a key character for *C. ochraceus.* This coloration, however, is variable, some specimens having tergite VII the same color as the other tergites, and this character is not reliable. Similarly, pedipalp chelal fingers may be the same color as, or darker than, the hand, and metasoma segment V may be the same color as, slightly lighter than, or slightly darker than, the rest of the metasoma.

While most specimens have either a bifid and normal basal tooth, or three basal teeth on the cheliceral moveable finger, some specimens have only the two basal teeth typical of buthid scorpions, and other specimens are intermediate between the various conditions. This character is, consequently, of limited value systematically.

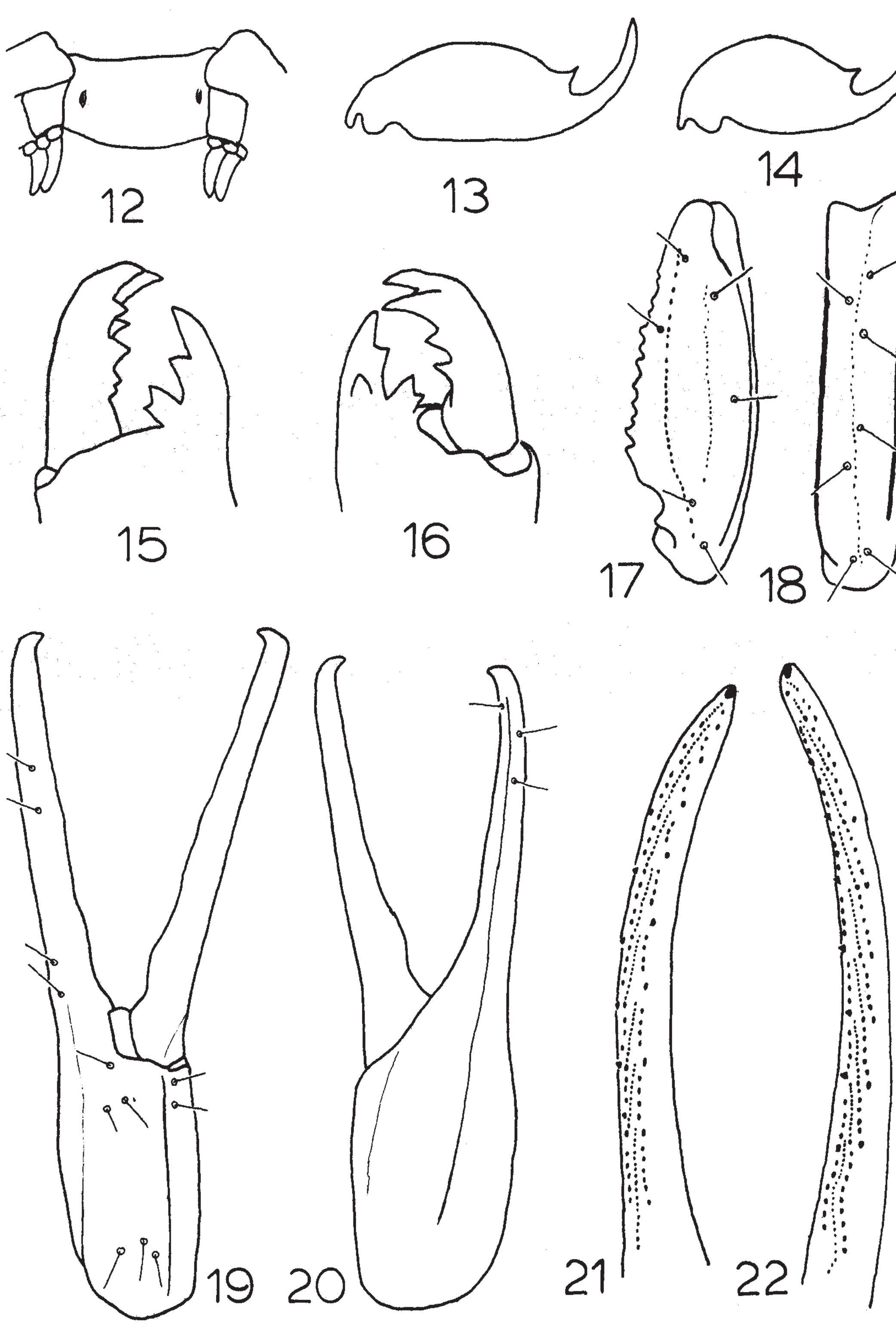
Pectinal tooth counts vary from 25-28 in the females examined, with 27 the most common count; males vary from 28-30, with 29 most common.

Comparisons and comments.–While superficially similar to several species of Mexican and Central American *Centruroides, C. ochraceus* may be fairly easily distinguished from these species and is apparently not closely related to any of them. *C. margaritatus* is a much larger scorpion than *C. ochraceus,* adults being from 85 to 110 mm long. This species also differs from *ochraceus* in having pedipalp chelal carinae and metasomal segment V carinae granulose. *Centruroides bertholdi* (Thorell) may be distinguished from *C. ochraceus* by the granulose pedipalp chelal, and metasomal segment V, carinae. In addition, sternite VII carinae are crenate to serrate (smooth in *ochraceus),* and the pectinal tooth counts are lower (21-23 in females, 24-26 in males).

While the affinities of this species, on zoogeographical grounds, might be expected to lie with Caribbean forms, it is also readily distinguishable from the species known from that region and apparently not closely related to any of them either. *C. ochraceus* may represent a relict species long isolated in the Yucatán Peninsula, with its closest relative, if extant, unknown or hidden in the variability of the species

Table 2.–Measurements (in millimeters) of *Centruroides ochraceus* Pocock, and *Centruroides gracilis* (Latreille).

	C. ochraceus		*C. gracilis*	
	Lectotype ♀	Holotype ♂ (*C. yucatanus*)	♀	♂
Total length	45.80	72.85	91.70	120.20
Carapace length	5.20	6.60	9.30	9.80
Anterior width	3.15	3.90	6.40	6.50
Posterior width	5.10	6.00	9.60	9.10
Mesosoma length	11.90	17.20	25.40	27.60
Metasoma length	28.70	49.05	57.00	82.60
I length	3.70	6.70	7.60	10.80
width	2.85	3.50	4.20	4.00
II length	4.25	7.95	8.80	13.30
width	2.80	3.00	4.10	3.80
III length	4.50	8.10	9.70	14.00
width	2.70	2.85	4.00	3.80
IV length	4.90	8.90	10.20	14.50
width	2.60	2.75	4.00	3.70
V length	6.05	10.40	11.70	15.60
width	2.45	2.50	3.80	4.00
Telson length	5.20	7.00	9.00	10.30
Vesicle length	3.25	5.10	6.00	7.80
width	1.50	2.00	3.30	4.10
depth	1.60	1.95	3.30	3.50
Pedipalp length	18.05	24.30	32.40	40.40
Femur length	4.60	6.10	8.00	10.50
width	1.40	1.60	2.00	2.20
depth	1.20	1.25	2.10	2.00
Tibia length	5.80	7.00	9.20	11.50
width	1.80	2.25	3.10	3.20
depth	1.40	1.70	2.50	2.20
Chela length	8.15	11.20	15.20	18.40
width	1.90	2.65	3.00	3.80
depth	1.85	2.60	3.30	3.70
Moveable finger length	5.20	6.75	10.30	11.50
Fixed finger length	4.60	5.80	9.40	10.10
Chelicera length	2.30	2.95	4.30	5.55
Chela length	1.70	2.20	3.20	4.10
width	1.20	1.60	2.35	2.60
Fixed finger length	0.60	0.75	1.10	1.45
Moveable finger length	1.00	1.30	1.90	2.20



Figs. 12, 14-22.–*Centruroides gracilis* (Latreille), female from X-can, Yucatán: 12, pectinal basal piece; 14, lateral aspect of telson; 15, dorsal aspect of chelicera; 16, ventral aspect of chelicera; 17, dorsal aspect of pedipalp tibia; 18, external aspect of pedipalp tibia; 19, ventroexternal aspect of pedipalp chela; 20, dorsointernal aspect of pedipalp chela; 21, ventral aspect of pedipalp chela fixed finger; 22, dorsal aspect of pedipalp chela moveable finger.

Fig. 13.–*Centruroides gracilis* (Latreille), male from X-can, Yucatán: lateral aspect of telson.

of this genus. At this time, without knowledge of the variability of many species of *Centruroides*, the relationships of *C. ochraceus* remain undetermined.

Although this species exhibits no cave-adapted features, specimens of this species, in addition to the type of *C. yucatanus*, have been collected from Yucatán caves. *C. ochraceus*, however, is most commonly found in caves only in the entrance area (Reddell, per. comm.), and any occurrence farther into a cave is probably accidental.

Distribution.–*Centruroides ochraceus* is known from the following localites in México (museum abbreviations indicate specimens examined).

Campeche: Cd. Campeche (Hoffmann, 1932); 16 km N Bolonchenticul (TTU).

Quintana Roo: Cancún, Felipe Carrillo Puerto, Kantunilkin, Xel-há (Díaz Nájera, 1975); Posada Pamul (TTU).

Yucatán: Chichén Itzá (Bequaert, 1933); Hda. Temazón de Mena, Ilcantún, Ixcantum, Kimbilá, Maxcanú, Peto, Tixkokob, Uayalcech, Xainya, Xikteil (Díaz Nájera, 1975); Actún Kaua, Actún Tucil, Actún Xpukil, Cenote Xtacabihá, 3 km S Calcehtok, Pyramid at Izamal, 6.3 km E Kantunil, 3 km S Libre Unión, 3 km S Tecoh (TTU); Actún Loltún (holotype of *Centrurus yucatanus*, AMNH); 7 km S Oxkutzcab (AMNH); no specific locality (types of *Centrurus ochraceus*, BMNH).

Centruroides gracilis (Latreille)
Figs. 12-22

Scorpio gracilis Latreille, 1804:127 (type locality: "America").

Centrurus gracilis: Karsch, 1879:18. Bequaert, 1933: 548. Pearse, 1945:154. Díaz Nájera, 1966:112.

Centruroides gracilis: Pocock, 1902:21, 32. Herrera, 1917:271. Hoffmann, 1932:294; 1939:323. Díaz Nájera, 1964:28; 1975:33.

Centrurus nigrescens: Bequaert, 1933:548 (misidentification). Pearse, 1945:154. (*nec nigrescens* Pocock, 1898).

Rhopalurus gracilis: Meise, 1934:30 (in part).

Note: The above synonymy reflects only first usage of names applied to Yucatán specimens and Yucatán records.

Diagnosis.–Adults 90-135 mm total length; ferrugineous to fuscotestaceous without darker stripes or variegations on prosoma or mesosoma (juveniles may be striped); tergite VII median keel weak to moderately strong; pectinal basal piece (Fig. 12) subrectangular, without central hole or depression in female; pectinal tooth count in males 27-38 (mode=34), females 24-31 (mode=28); sternite VII lateral carinae subcrenate, submedian carinae smooth; metasomal segment V pentacarinate, all carinae granulose in female and smooth in male, ventral median keel moderate in females and vestigial in males, dorsal lateral carinae weak in females and obsolete in males; telson vesicle (Figs. 13-14) of male slightly elongate; subaculear tooth, spiniforma and strong, with the point directed away from the aculeus and the base not near the aculeus base; chelicera (Figs. 15-16) of common buthid type; pedipalp tibia (Figs. 17-18) hexacarinate, carinae moderate to strong; pedipalp chela (Figs. 19-20) carinae obsolete to vestigial and sometimes weakly granulose in male, fixed finger (Fig. 21) with nine rows of granules, moveable finger (Fig. 22) with eight or nine rows of granules plus a short apical row. Measurements of male and female from X-can, Yucatán, are given in Table 2.

Comparisons and comments.–I have seen specimens from many parts of the range of *C. gracilis*, and although specimens from the Yucatán Peninsula are rather uniform morphologically, specimens from other parts of the range may vary considerably from the Yucatán population. Some of this variation is apparently useful systematically, but with distributional gaps in specimens studied, and without examining types of any species referred to the synonymy of *gracilis*, taxonomic conclusions would be premature. In addition, other closely related species, such as *C. limbatus*, *C. bicolor* (Pocock), *C. rubricauda* (Pocock), *C. nigrescens* (Pocock), *C. nigrimanus* (Pocock), and *C. fulvipes* (Pocock), would have to be considered for the results to be meaningful. I have not made such a study, so to describe only the Yucatán population, or a population from any part of the range, under the name *C. gracilis* would be unwise and only add to the confusion in this already perplexing species. For these reasons I have given only a broad diagnosis, which will serve to distinguish *C. gracilis (sensu lato)* from other species, and have omitted a complete, detailed description.

C. gracilis may be consistently distinguished from *C. nigrimanus*, *C. nigrescens*, and *C. fulvipes* only by the subaculear tooth pointing away from, and not close to the base of, the aculeus. Characters of carinal development and ornamentation which other authors have used are, as demonstrated by specimens of *gracilis*, *nigrescens*, and *nigrimanus* from Oaxaca and Guerrero, apparently of little value. In passing I would also like to point out that the coloration and carinal characters presently used to separate *nigrescens*, *nigrimanus*, and *fulvipes* are highly variable in some specimens and all three forms may be conspecific.

C. bicolor, C. limbatus and *C. rubricauda* are similar to *C. gracilis* in the form of the subaculear tooth, but differ in other characters. *C. bicolor* differs from *gracilis* only in having the last tergite ochreous and contrasting with the coloration of the remainder of the mesosoma and the metasoma. *C. limbatus* has a generally lighter coloration, and the carinae (especially of the metasoma) weaker and less granulose than *C. gracilis. C. rubricauda* is the most easily distinguished from *C. gracilis* of these three species, differing in general coloration, in having stronger, more granulose carinae, and lower pectinal tooth counts.

Distribution.–*Centruroides gracilis* is known from the following localities in the Yucatán Peninsula (museum abbreviations indicate specimens examined).

BELIZE: Columbia Forest, mile 62 of Monteres highway (AMNH).

GUATEMALA: *El Petén:* Altar de los Sacrificios, La Libertad, Santo Toribio, Sojio (AMNH).

MEXICO: *Campeche:* Cd. Campeche, Cd. del Carmen, Dzibalché, Tenabó (Díaz Nájera, 1975); 8 km W Escárcega (TTU); San Dimas (AMNH).

Quintana Roo: Cancún, Felipe Carrillo Puerto (Días Nájera, 1975); 44.3 km SW Akumal, 50.4 km NE Felipe Carrillo Puerto, 11.3 km N Linores, Playa del Carmen (LSUMZ); Posada Pamul (TTU); Puerto Morales (AMNH).

Tabasco: Boca del Cerro, Puente Usamacinta, Tenosique (AMNH).

Yucatán: Abalá, Conkal, Chocholá, Hunucmá, Izamal, Kini, Progreso, Seyé, Sitilpech, Sotuta, Tixkokob, Tixpehual, Uayalcech, Valladolid, Xanabá (Díaz Nájera, 1975); Mérida (Hoffmann, 1932; AMNH; TTU); X-can (TTU); Chuminopolis, Cordillera Mayapán, Colonia Yucatán, 7 km S Oxkutzcab (AMNH); Lago de Chalco, Temax (Herrera, 1917); Chichén Itzá (Bequaert, 1933).

Comparative material of *C. gracilis* was also examined from the following localities:

COSTA RICA: *Guanacaste:* Tilarán (UCR). *San José:* Río Virilla (UCR).

CUBA: *La Habana:* Habana (AMNH). *Las Villas:* 2 km N Cruces, Montero (AMNH). *Oriente:* Las Vegas (AMNH). *Matanzas:* 8 km S Jovellanos (AMNH). *Pinar del Río:* Cabañas, Sierra de Anafe (AMNH).

ECUADOR: Near Baños (AMNH).

HONDURAS: La Ceiba (AMNH).

MEXICO: *Chiapas:* Chapultenango (AMNH); 1 km N Palenque (TTU). *Hidalgo:* Huchuetla (AMNH). *Oaxaca:* Palomares, Tolosa (AMNH). *San Luis Potosí:* vicinity of Cueva de Los Sabinos, Palictla, Pujal, Tamazunchale (AMNH). *Tamaulipas:* km 7 of Gómez Farías highway (TTU); El Venadito, near Gómez Farías, Tampico (AMNH). *Veracruz:* 30 km S Jesús Carranza, 4 mi N Coyame, Ferrocarril del Sureste, Puerto México, near Santa Rosa (AMNH).

NICARAGUA: Bonayga highland tramline station (AMNH).

UNITED STATES: *Florida:* Big Pine Key, Fort Lauderdale, Lower Malacumba Key (TTU); Miami (AMNH, LSUMZ, TTU); Carol City, Key Largo (LSUMZ); Homestead, Kendall, Key West, Miami Beach, St. Petersburg, W of Fort Lauderdale (AMNH).

VENEZUELA: *Dept. Vargas:* Estanque de Puerta de Mulatos (AMNH).

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THE GENUS *DIPLOCENTRUS* IN THE YUCATAN PENINSULA WITH DESCRIPTION OF TWO NEW TROGLOBITES (SCORPIONIDA, DIPLOCENTRIDAE)

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The scorpions of the genus *Diplocentrus* Peters from the Yucatán Peninsula are poorly known. Caporiacco (1938) described *Didymocentrus taibeli* from a single adult male collected at Flores, Guatemala, and identified two additional specimens from the same locality as *Didymocentrus whitei* [=*Diplocentrus whitei* (Gervais)]. Furthermore, Caporiacco reversed the genera *Diplocentrus* and *Didymocentrus* Kraepelin, creating further confusion in the family Diplocentridae. The only other literature record of diplocentrid scorpions from the Yucatán Peninsula is Días Nájera (1964), who mentions *Diplocentrus* sp. from Felipe Carrillo Puerto, Quintana Roo.

I have been unable to locate the holotype of *Diplocentrus taibeli* (Caporiacco), but have studied one of the additional specimens (a partly cannibalized female) collected at the type locality by the same collector. This specimen agrees with Caporiacco's description in most respects, enabling me to redescribe the species. My attempts to borrow Días Nájera's specimens from Quintana Roo have been unsuccessful, and although they may represent an undescribed species, they remain unstudied.

In this contribution *D. taibeli* is redescribed and four new species from the Yucatán Peninsula are described, including the first two troglobites of the family Diplocentridae.

Diplocentrus taibeli (Caporiacco)
Figs. 1-9

Didymocentrus taibeli Caporiacco, 1938:252; Stahnke, 1967:173.
Diplocentrus taibeli: Francke, 1977:168.
Didymocentrus whitei: Caporiacco, 1938:252 (misidentification).

Type data.–Holotype male from Flores, Petén, Guatemala, June 1932 (A. Taibel); depository unknown, not examined.

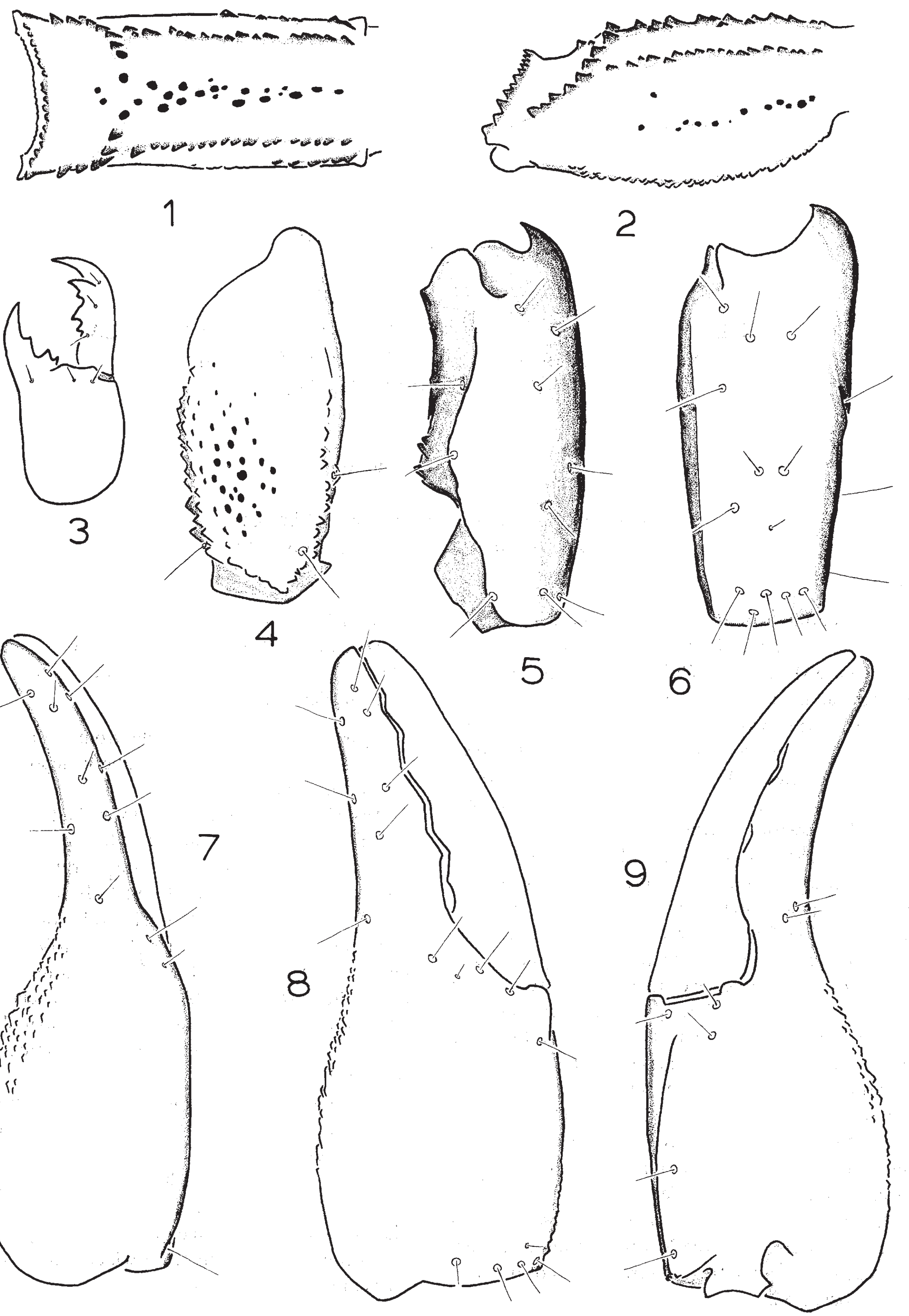
Distribution.–Known only from the type locality.

Diagnosis.–Large, adults 85-90 mm long. Adults rufobrunneous, immatures ochreous rufescent. Carapace minutely granulose. Tergite VII acarinate, sternite VII tetracarinate. Pectinal tooth count in male and female 15. Metasomal segments I-IV distinctly decacarinate. Cheliceral fixed finger shorter than chela width, movable finger shorter than chela length. Pedipalp: femur wider than deep; chelal digital carina very weak, movable finger longer than carapace. Tarsomere II spine formula 5/5:5/5:6/6:6/6.

Description.–Based on immature female; measurements of holotype (from original description) and specimen described here in Table 1.

Prosoma. Carapace: ochreous rufescent, eyes infuscate; lustrous, with moderately dense minute granulation; moderately emarginate anteriorly, median notch rounded and four times wider than deep. Venter ochreous, sparsely setate.

Mesosoma. Tergites: ochreous rufescent, lustrous with sparse minute granulation; VII vestigially bilobed posterolaterally, submedian and lateral carinae indistinct in granular disc. Genital operculi ochroleucus with six pairs of posterior submarginal setae. Pectinal



Figs. 1-9.–*Diplocentrus taibeli* Caporiacco, immature female from Flores, Guatemala: 1, ventral aspect of metasomal segment V; 2, lateral aspect of metasomal segment V; 3, dorsal aspect of chelicera; 4, dorsal aspect of pedipalp femur; 5, dorsal aspect of pedipalp tibia; 6, external aspect of pedipalp tibia; 7, dorsal aspect of pedipalp chela; 8, external aspect of pedipalp chela; 9, ventrointernal aspect of pedipalp chela.

tooth count on right comb 15, left comb missing. Sternites: ochreous, lustrous; stigmata elongate; VII with submedian keels present on distal one-third and lateral keels present on distal two-thirds, weak and crenato-serrate.

Metasoma. Ochreous rufescent. Segments I-IV decacarinate, keels weak to moderately strong, finely crenato-serrate; sparsely setate; intercarinae smooth to sparsely, vestigially granulose. Segment V (Figs. 1 and 2) moderately setate; ventral median, ventral lateral, ventral transverse, anal subterminal, and dorsal lateral carinae moderately strong, with medium granules; lateral median keels present on basal one-half, weak, granulose; anal terminal keel vestigial, smooth. Telson moderately setate, vesicle sparsely granulose basally on ventral face.

Chelicera. Ochreous, dentition (Fig. 3) characteristic of genus.

Pedipalp. Ochreous rufescent, orthobothriotaxia "C". Femur (Fig. 4): dorsal internal and ventral internal carinae strong, granulose; dorsal external keel basally strong and granulose, medially weak and subgranose, distally obsolete; ventral external keel obsolete; internal face and anterior one-half of dorsal face moderately to densely granulose, other faces smooth; sparsely setate. Tibia (Figs. 5 and 6): dorsal internal keel obsolete, basal tubercle weak, with three large granules; dorsal median keel moderately strong, smooth; dorsal external, external, and ventral median keels obsolete; ventral external keel weak to vestigial, smooth; ventral internal keel weak, granose; internal face shagreened, other faces smooth; sparsely setate. Chela (Figs. 7-9): dorsal margin acarinate and rounded, moderately granulose distally; digital keel weak to vestigial and smooth at fixed finger base, obsolete on manus; dorsal, external, ventral external, and ventral internal keels obsolete; ventral median keel moderate, smooth; internal face acarinate; dorsal submargins vestigially reticulate and sparsely to moderately setate, other faces smooth and bare. Fingers shallowly arcuate, moderately setate; dentate margins broadly subserrate.

Legs. Ochreous, tarsomere II spine count 5/5 4/5: 5/5 */*:5/6 */*:6/6 */*.

Comparisons.–*D. taibeli* resembles *Diplocentrus ochoterenai* Hoffmann, from Oaxaca, México, in size, coloration, pedipalp femur and cheliceral proportions, in having the movable finger of the pedipalp chela longer than the carapace and metasomal segments I-IV decacarinate. *D. ochoterenai* differs in having a higher pectinal tooth count of 17-19 in males and 16 in females, and a higher tarsomere II spine formula of 6/7:7/7:7/8:7-8/8.

Diplocentrus maya, new species
Figs. 10-18

Type data.–Holotype female from Columbia Forest, Toledo District, Belize, 4 June (Goodnight); AMNH. Paratype subadult (?) male from km 200 on road from Guatemala City to Flores, Guatemala, 26 July 1974 (no collector); AMNH.

Etymology.–Named after the inhabitants of the Yucatán Peninsula.

Distribution.–Known only from the two specimens indicated above.

Diagnosis.–Medium, adults 50-55 mm long. Adult fuscorufous, subadult and immatures (?) ochreous fuscescent, with distinct variegated fuscosity. Carapace sparsely granose laterally, smooth otherwise. Tergite VII acarinate, sternite VII bicarinate. Pectinal tooth count in female 11-12, in male 13. Metasomal segments I-III decacarinate, IV octocarinate. Cheliceral fixed finger shorter than chela width, movable finger shorter than chela length. Pedipalp: femur wider than deep; chelal digital keel weak to vestigial, smooth; movable finger shorter than carapace in female, slightly longer in male. Tarsomere II spine formula 4/4:4/4:5/5:5/5.

Description.–Based on holotype female (male differences in parenthesis). Measurements of female and male in Table 1.

Prosoma. Carapace: fuscorufous with moderately dense variegated fuscosity; lustrous, smooth except for sparse small granules at lateral submargins (sparsely granulose throughout); moderately emarginate anteriorly, median notch rounded (subangulose) and four times wider than deep. Venter brunneous, sparsely to moderately setate.

Mesosoma. Tergites: fuscorufous with dense variegated fuscosity; lustrous, with sparse (moderately dense) small granulation; VII weakly bilobed posterolaterally, carinae indistinct in moderately dense granules of disc. Genital operculi ochreous fuscescent, with three pairs of posterior submarginal setae. Pectinal tooth count 11-12 (13-13). Sternites brunneous, smooth, lustrous; stigmata elongate; VII with submedian keels vestigial to obsolete and smooth, lateral keels present on distal one-half, weak to vestigial and subgranose.

Metasoma. Rufofuscous. Ventral submedian carinae on I weak, finely subgranose; II-III weak, sparsely subgranose; IV vestigial, sparsely subgranose. Ventral lateral carinae moderately strong, on I finely granulose, II-IV sparsely subgranose. Lateral inframedian keels on I moderately strong, moderately granulose; II weak, sparsely granose; III vestigial, sparsely gra-

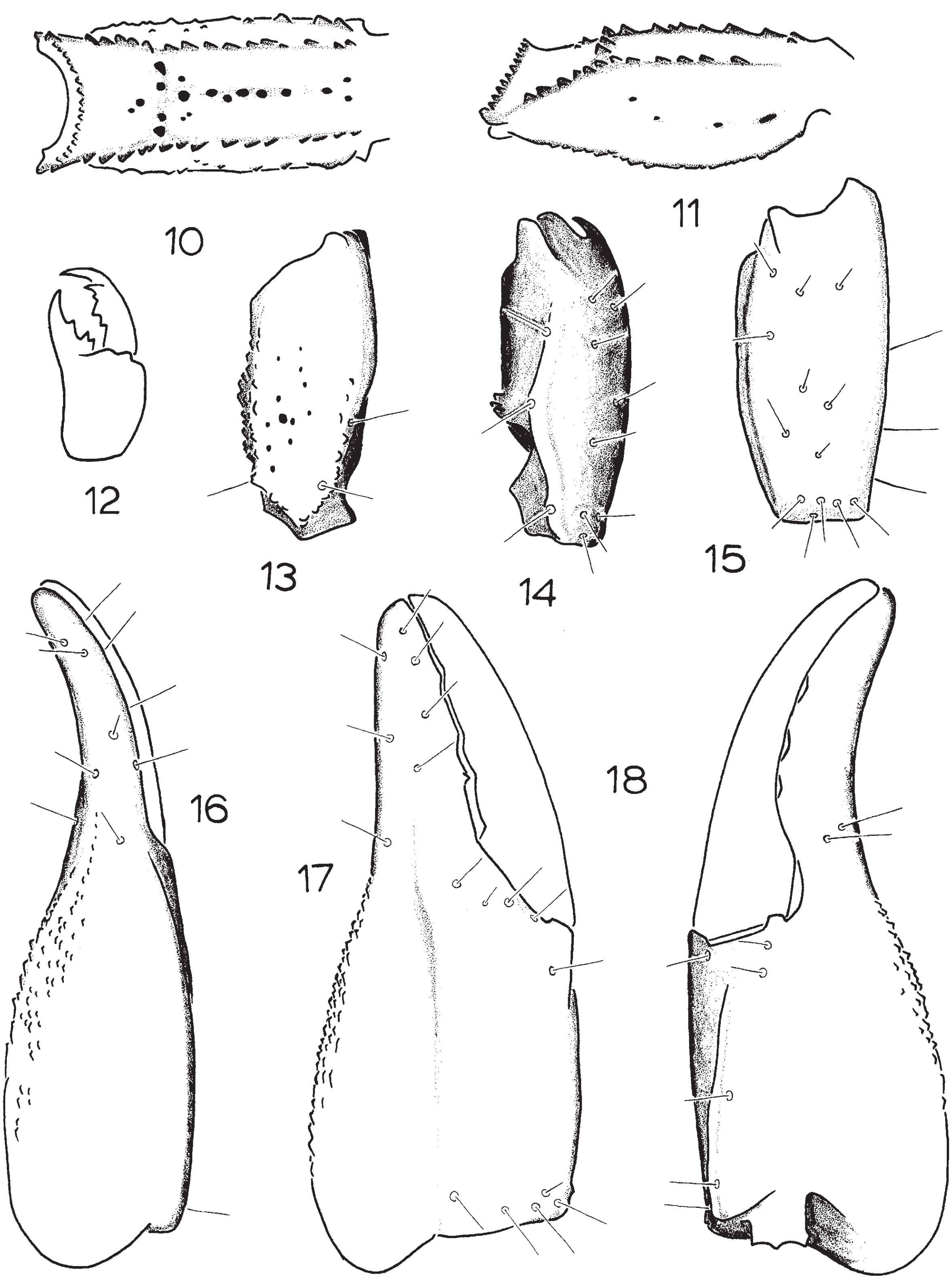
Table 1.–Measurements (in millimeters) of *Diplocentrus taibeli* (Caporiacco) and *Diplocentrus maya*, n. sp. (of *D. taibeli* holotype from original description).

	D. taibeli		*D. maya*	
	Holotype ♂	Topotype ♀	Holotype ♀	Paratype ♂
Total length	87.00	47.75	51.40	45.35
Carapace length	10.50	6.60	6.80	6.20
Posterior width	11.00	6.40	6.60	5.90
Mesosoma length	34.00	15.90	17.70	14.20
Metasoma length	43.25	25.25	26.90	24.95
I length	5.00	3.10	3.30	3.15
width	5.25	3.50	3.50	3.50
II length	6.50	3.45	3.70	3.40
width	5.25	3.10	3.30	3.20
III length	6.50	3.70	3.90	3.60
width	4.90	2.90	3.20	2.90
IV length	7.00	4.20	4.50	4.20
width	4.50	2.60	3.00	2.80
V length	9.50	5.50	5.90	5.40
width	4.20	2.30	2.70	2.60
Telson length	8.75	5.30	5.60	5.20
Vesicle length	––	4.20	4.60	4.30
width	4.75	2.90	3.10	3.00
depth	3.80	2.30	2.60	2.40
Pedipalp length	39.50	24.00	23.60	21.40
Femur length	9.00	5.60	5.50	5.10
width	––	2.50	2.30	2.20
depth	––	1.90	2.00	1.75
Tibia length	11.00	6.00	6.00	5.50
width	––	2.45	2.30	2.10
Chela length	19.50	12.40	12.10	10.80
width	8.50	4.90	5.00	4.50
depth	––	3.20	3.20	3.00
Movable finger length	12.00	7.20	6.50	6.40
Fixed finger length	8.50	5.40	4.40	4.50
Chelicera length	––	3.20	3.55	3.15
Chela length	––	2.10	2.15	2.00
width	––	1.60	1.50	1.30
Movable finger length	––	1.90	2.00	1.80
Fixed finger length	––	1.10	1.40	1.15

nose; IV obsolete, sparse granules indicating their position. Lateral supramedian and dorsal lateral carinae on I-IV moderately strong, moderately granulose. Segment V (Figs. 10 and 11): ventral median, ventral transverse, and ventral lateral carinae moderately strong with well spaced medium and large granules; anal subterminal keel weak to moderate, with dense small granules; anal terminal keel vestigial, smooth; lateral median carinae vestigial to obsolete, represented by small, scattered granules on basal one-half of segment; dorsal lateral keels weak, with moderately dense small granules. Telson moderately setate, vesicle smooth.

Chelicera. Brunneous, dentition (Fig. 12) characteristic of genus.

Pedipalp. Fuscorufous, orthobothriotaxia "C". Femur (Fig. 13): dorsal internal and ventral internal carinae moderately strong, granulose; dorsal external keel basally moderately strong and granulose, distally obsolete and smooth; ventral external keel obsolete; ventral and external faces smooth, dorsal and internal faces sparsely granulose; sparsely setate. Tibia (Figs. 14 and 15): dorsal internal keel obsolete, basal tubercle weak and with three medium granules; dorsal median keel weak, smooth; ventral internal keel weak, with well spaced granules; all other carinae obsolete; internal face with moderately dense minute granulation, other faces lustrous and smooth; sparsely setate. Chela (Figs. 16-18): dorsal margin acarinate and rounded, with dense small granulation; digital keel weak to vestigial, smooth; ventral median keel moderate, smooth, directed towards midpoint of movable finger articulation; all other carinae obsolete; chelal faces smooth, lustrous; dorsal submargin moderately



Figs. 10-18.–*Diplocentrus maya,* new species, holotype female from Toledo District, Belize: 10, ventral aspect of metasomal segment V; 11, lateral aspect of metasomal segment V; 12, dorsal aspect of chelicera; 13, dorsal aspect of pedipalp femur; 14, dorsal aspect of pedipalp tibia; 15, external aspect of pedipalp tibia; 16, dorsal aspect of pedipalp chela; 17, external aspect of pedipalp chela; 18, ventrointernal aspect of pedipalp chela.

to densely setate, other areas sparsely setate to bare. Fingers shallowly arcuate, moderately setate; dentate margins broadly subserrate.

Legs. Brunneous, with diffuse uniform fuscosity; femora sparsely granulose.

Variability.—The base coloration in the subadult male paratype is ochreous fuscescent rather than fuscorufous. Tarsomere II spine count on third pair of legs is 5/5 5/4 for holotype and 4/5 5/5 for paratype.

Comparisons.—*D. maya* appears most closely related to *D. taibeli,* from which it can be easily separated by size, coloration, lower pectinal tooth counts and tarsomere II spine formula, genital operculi setation, and the disposition and ornamentation of the metasomal carinae.

Diplocentrus reddelli, new species
Figs. 19-28

Type data.—Holotype male and one juvenile male paratype from Actún Xpukil (Ent. sink), Yucatán, México, 3 August 1973 (J. Reddell); AMNH.

Etymology.—Named after Mr. James R. Reddell in recognition of his outstanding contributions to Mexican biospeleology.

Distribution.—Known only from the type locality.

Diagnosis.—Small, adults 25-30 mm long. Ochreous fuscescent, with moderately dense fuscosity. Carapace shagreened. Tergite VII vestigially tetracarinate, sternite VII tetracarinate. Pectinal tooth count 11-12 in males, female unknown. Metasomal segments I-IV decacarinate. Cheliceral fixed finger shorter than chela width, movable finger shorter than chela length. Pedipalp: femur wider than deep; chelal digital carina very strong, smooth; movable finger shorter than carapace. Tarsomere II spine formula 5/5:5/5:6/6:7/7.

Description.—Based on male. Measurements of holotype in Table 2.

Prosoma. Carapace (Fig. 19): ochreous fuscescent with moderately dense variegated fuscosity, shagreened; anteriorly moderately emarginate, median notch rounded, five times wider than deep. Venter ochroleucus, sparsely setate.

Mesosoma. Tergites ochreous fuscescent with moderately dense fuscosity; shagreened, posterior submargins granulose; VII vestigially bilobed posterolaterally, submedian and lateral carinae vestigial and granulose. Genital operculi ellipsoidal, with two pairs of posterior submarginal setae. Pectinal tooth count 11-12. Sternites ochroleucus, sparsely setate, lustrous to sparsely punctate; stigmata elongate; VII with submedian keels vestigial and smooth, lateral keels moderately strong and smooth.

Metasoma. Ochreous fuscescent with carinae and ventrodistal intercarinae uniformly infuscate; I-IV sparsely setate, V and telson moderately setate. Ventral submedian carinae weak, on I-II subcrenate, III-IV subgranose to granulose. Ventral lateral carinae moderately strong, on I-III subcrenate, IV crenatogranulose. Lateral inframedian carinae on I-IV moderate, crenate. Lateral supramedian carinae on I-IV strong, crenatogranulose. Dorsal lateral carinae on I-IV moderate, sparsely granulose. Intercarinae on I-IV shagreened. Segment V (Figs. 20 and 21): ventral median, ventral transverse, and ventral lateral carinae strong, coarsely granose; anal subterminal keel moderate to strong, granulose; anal terminal keel vestigial to obsolete, smooth; lateral median carinae present on basal one-half to two-thirds, weak to moderate, granulose; dorsal lateral keels moderate, with dense small granulation. Vesicle smooth.

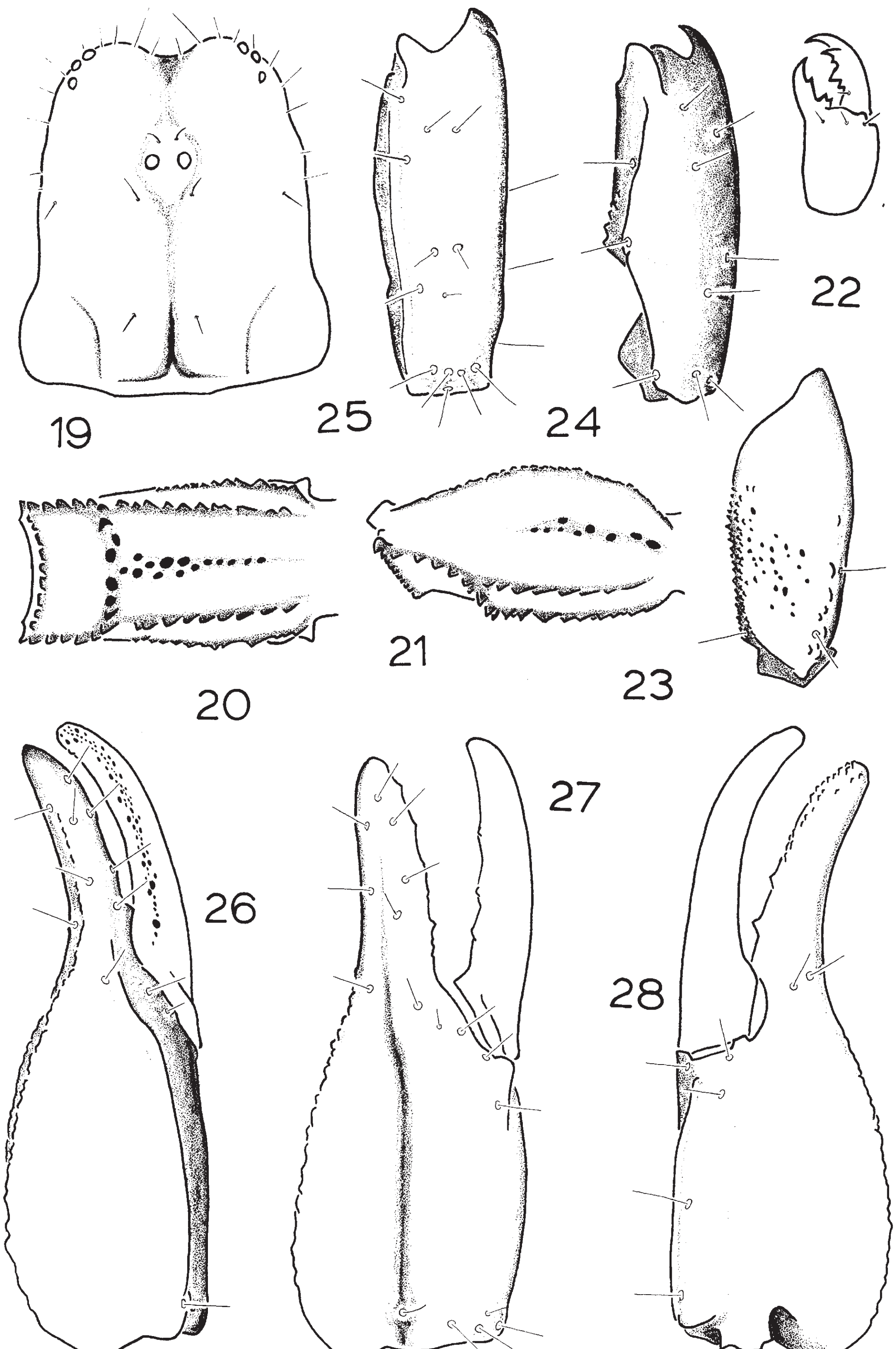
Chelicera. Ochreous, with variegated fuscosity dorsally on chela and movable finger; dentition (Fig. 22) characteristic of genus.

Pedipalp. Ochreous fuscescent with sparse to moderately dense variegated fuscosity, orthobothriotaxia "C". Femur (Fig. 23): dorsal internal and ventral internal carinae moderately strong, granulose; dorsal external keel weak to vestigial, granulose; ventral external keel obsolete; dorsal and internal faces minutely granulose, external and ventral faces smooth; sparsely setate. Tibia (Figs. 24 and 25): dorsal internal keel obsolete, basal tubercle weak and granulose; dorsal median keel strong, smooth; dorsal external keel vestigial, smooth; external and ventral median keels obsolete; ventral external keel weak, smooth; ventral internal carina weak, granose to subgranose; internal face minutely granulose, other faces smooth; sparsely setate. Chela (Figs. 26-28): dorsal margin weakly to moderately carinate, subgranose; digital keel very strong, smooth; dorsal and external keels obsolete; ventral median keel strong, smooth, directed towards midpoint of movable finger articulation; internal face with keels vestigial to obsolete; intercarinae sparsely setate, weakly reticulate. Fingers moderately setate, moderately arcuate.

Legs. Ochreous, with diffuse uniform fuscosity; femora and tibiae shagreened.

Variability.—Pectinal tooth count in holotype is 11-12, in paratype 11-11; juvenile paratype with pedipalp chela carinae weaker, less developed; deviations from tarsomere II spine formula in third leg of holotype at 5/6 on one side, and on first leg of paratype at 4/5 on one side.

Comparisons.—*D. reddelli* is the smallest epigean species in the genus, and has some unique features that make it difficult to relate to other described



Figs. 19-28.–*Diplocentrus reddelli,* new species, holotype male from Actún Xpukil, Yucatán, México: 19, carapace; 20, ventral aspect of metasomal segment V; 21, lateral aspect of metasomal segment V; 22, dorsal aspect of chelicera; 23, dorsal aspect of pedipalp femur; 24, dorsal aspect of pedipalp tibia; 25, external aspect of pedipalp tibia; 26, dorsal aspect of pedipalp chela; 27, external aspect of pedipalp chela; 28, ventrointernal aspect of pedipalp chela.

Table 2.–Measurements (in millimeters) of *Diplocentrus reddelli*, n. sp., *Diplocentrus anophthalmus*, n. sp., and *Diplocentrus mitchelli*, n. sp.

	D. reddelli	*D. anophthalmus*		*D. mitchelli*
	Holotype ♂	Holotype ♀	Paratype ♀	Holotype ♂
Total length	27.70	17.00	13.95	13.75
Carapace length	3.80	2.45	2.00	2.10
Posterior width	3.40	1.90	1.70	1.60
Mesosoma length	9.05	6.00	5.20	5.15
Metasoma length	14.85	8.55	6.75	6.50
I length	1.80	1.10	0.85	0.75
width	2.40	1.05	0.90	0.90
II length	2.00	1.15	0.90	0.90
width	2.20	0.90	0.75	0.80
III length	2.15	1.20	0.95	0.95
width	2.10	0.85	0.70	0.70
IV length	2.50	1.35	1.10	1.05
width	1.95	0.80	0.65	0.70
V length	1.80	0.80	0.70	0.65
Telson length	3.10	1.85	1.50	1.45
Vesicle length	2.45	1.45	1.15	1.10
width	1.55	0.95	0.75	0.70
depth	1.20	0.80	0.60	0.60
Pedipalp length	13.40	9.25	7.30	7.10
Femur length	3.20	2.20	1.70	1.70
width	1.25	0.80	0.60	0.60
depth	1.10	0.55	0.50	0.40
Tibia length	3.80	2.40	1.95	1.90
width	1.30	0.85	0.65	0.65
Chela length	6.40	4.65	3.65	3.50
width	2.50	1.40	1.05	0.95
depth	1.70	1.00	0.80	0.75
Movable finger length	3.50	2.50	1.95	1.75
Fixed finger length	2.60	1.95	1.50	1.40
Chelicera length	1.70	1.10	0.85	0.90
Chela length	1.15	0.75	0.60	0.60
width	0.80	0.50	0.40	0.45
Movable finger length	1.00	0.60	0.50	0.50
Fixed finger length	0.55	0.35	0.25	0.30
length	3.30	1.90	1.45	1.40
width	1.80	0.80	0.70	0.65

species. Its decacarinate metasomal segments I-IV, pedipalp chela digital carina, and cheliceral proportions are characters associated with medium to large (over 55 mm long) species in southern México (*Diplocentrus mexicanus* Peters, *D. ochoterenai*, and an undescribed species from Oaxaca) and Guatemala (*D. taibeli*). The characters indicated above, its small size, and its tarsomere II spine formula suffice to separate *D. reddelli* from all other described species.

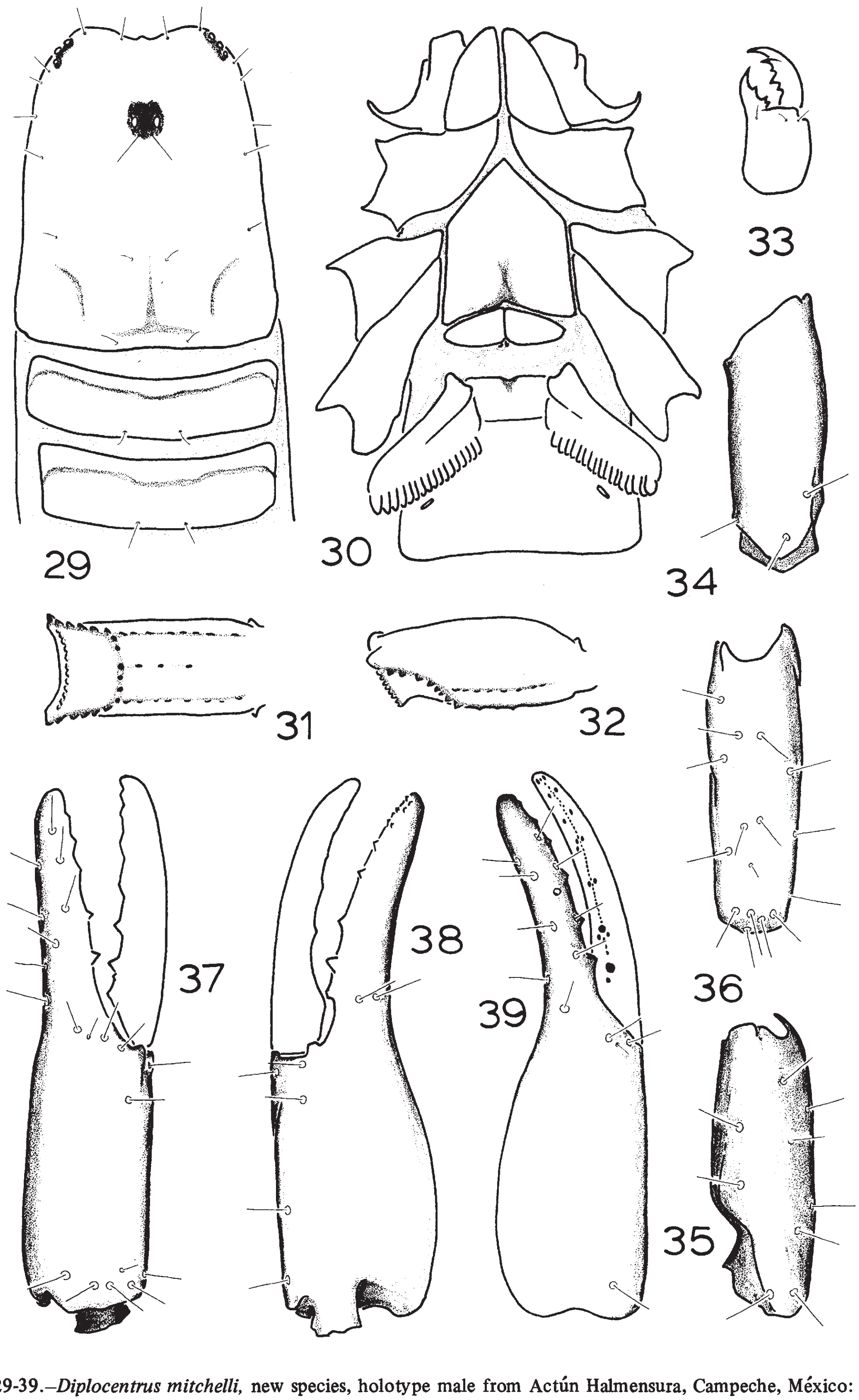
Diplocentrus mitchelli, new species
Figs. 29-39, 53

Type data.–Holotype male (juvenile) from Actún Halmensura, Campeche, México, 31 October 1974 (J. Reddell, D. McKenzie, S. Wiley); AMNH.

Etymology.–Named after Dr. Robert W. Mitchell in recognition of his contributions to Mexican biospeleology.

Distribution.–Known only from type locality (see remarks).

Diagnosis.–Troglobite, known only from holotype 14 mm long. Ochroleucus throughout. Eyes underlaid with dense piceous pigment; median eyes reduced, subequal in size to three pairs of lateral eyes. Carapace smooth, median ocular tubercle vestigial. Tergite VII and sternite VII acarinate. Pectinal tooth count 17. Metasomal segments I-IV weakly octocarinate. Cheliceral fixed finger shorter than chela width, movable finger shorter than chela length. Pedipalp acarinate, femur wider than deep; chelal movable finger shorter than carapace. Tarsomere II spine formula 5/5:5/5-6:6/6:6/6.



Figs. 29-39.–*Diplocentrus mitchelli,* new species, holotype male from Actún Halmensura, Campeche, México: 29, dorsal aspect of carapace and tergites I-II; 30, ventral aspect of prosoma and anterior regions of mesosoma; 31, ventral aspect of metasomal segment V; 32, lateral aspect of metasomal segment V; 33, dorsal aspect of chelicera; 34, dorsal aspect of pedipalp femur; 35, dorsal aspect of pedipalp tibia; 36, external aspect of pedipalp tibia; 37, dorsal aspect of pedipalp chela; 38, external aspect of pedipalp chela; 39, ventrointernal aspect of pedipalp chela.

Description.—Based on immature male, measurements in Table 2.

Prosoma. Carapace (Fig. 29): ochroleucus, smooth, lustrous; anteriorly shallowly emarginate, median notch rounded and about 10 times wider than deep, with feeble median apophysis; three pairs of subequal, densely pigmented lateral eyes; median ocular tubercle vestigial and densely pigmented, median eyes slightly larger than lateral eyes. Venter (Fig. 30) ochroleucus, lustrous, sparsely setate; sternum very large, pentagonal and as long as wide, posteromedian furrow vestigial.

Mesosoma. Tergites ochroleucus, smooth, lustrous, bare; VII acarinate, vestigially shagreened posterolaterally. Genital operculi ovovate, with six pairs of posterior submarginal setae. Pectines ochroleucus, tooth count 17-17. Sternites ochroleucus, smooth, lustrous, sparsely setate; stigmata elongate, small (Fig. 30); VII acarinate.

Metasoma. Ochroleucus, moderately setate. Segments I-IV with ventral submedian, ventral lateral, lateral supramedian, and dorsal lateral carinae weak to vestigial, subcrenate; lateral inframedian carinae obsolete. Segment V((Figs. 31 and 32): ventral median, ventral lateral, ventral transverse, anal subterminal, and dorsal lateral carinae weak to vestigial, subgranose; lateral median and anal terminal keels obsolete. Telson smooth, moderately setate.

Chelicera. Ochroleucus, dentition (Fig. 33) characteristic of genus.

Pedipalp. Ochroleucus, orthobothriotaxia "C". Femur (Fig. 34): carinae vestigial to obsolete, agranular; faces smooth, lustrous; sparsely setate. Tibia (Figs. 35 and 36); acarinate, smooth, sparsely setate. Chela (Figs. 37-39): acarinate, smooth, sparsely setate; fixed finger feebly arcuate.

Legs. Ochroleucus, smooth. Prolateral pedal spurs present on all legs.

Remarks.—I consider the holotype of *D. mitchelli* to be a young instar (second or third) on the basis of its very small size (Table 2), anteromedian carapacial apophysis (Fig. 29), relatively large prosomal sternum (Fig. 30), and high pectinal tooth count. Adult size in *D. mitchelli* is difficult to predict, but it very likely is a rather large species. In my collection I have a partly damaged left pedipalp chela collected deep in the cave of Actún Xkyc, 1 km S Calcehtok, Yucatán. México, 1 May 1973 (J. Reddell, D. McKenzie, E. Alexander, M. Butterwick) with the following dimensions: chela length 24.6 mm, width 9.9 mm, depth 6.1 mm; movable finger length 14.5 mm, fixed finger length 10.8 mm. Whether this chela belongs to *D. mitchelli* or a closely related species is not known, but the specimen to which it belonged was probably over 90 mm in total length, since in *D. ochoterenai*, the largest species in the genus, a 75 mm female has a chela 18.2 mm long and a 86 mm male has a chela 20.2 mm long. Thus, the robust chela from Actún Xkyc belongs to a large species, perhaps the largest in the genus.

Comparison of *D. mitchelli* with young instars of other species have led to my interpretation that it is a troglobitic species. In young *Diplocentrus* spp. the diameter of the median eyes is two to three times the diameter of the lateral eyes; in *D. mitchelli* the diameter of the median eyes is only slightly greater than that of the lateral eyes, indicating that a reduction in the median eye diameter has probably evolved in response to the cave environment. In second instar *Diplocentrus* spp. (about 13-15 mm long), metasomal segment II is distinctly wider than long, III is approximately as long as wide, and the length of V is less than twice its width; in *D. mitchelli* segment II is longer than wide, III distinctly so, and the length of V is over twice its width. These metasomal proportions exemplify the overall attenuation of structures in *D. mitchelli*, a phenomenon commonly observed in troglobites.

Comparisons.—*D. mitchelli* appears to be most closely related to *D. taibeli* and *D. maya* on account of its predicted larger size and high pectinal tooth count. It further resembles *D. taibeli* in tarsomere II spine counts and in the setation of the genital operculum; and differs from it in carinal development on sternite VII, metasomal segments I-IV, and pedipalp, and in the relative proportions of the pedipalp chela movable finger versus the carapace. *D. mitchelli* differs from *D. maya* in pectinal tooth counts, tarsomere II spine formula, carinal development, and genital operculi setation.

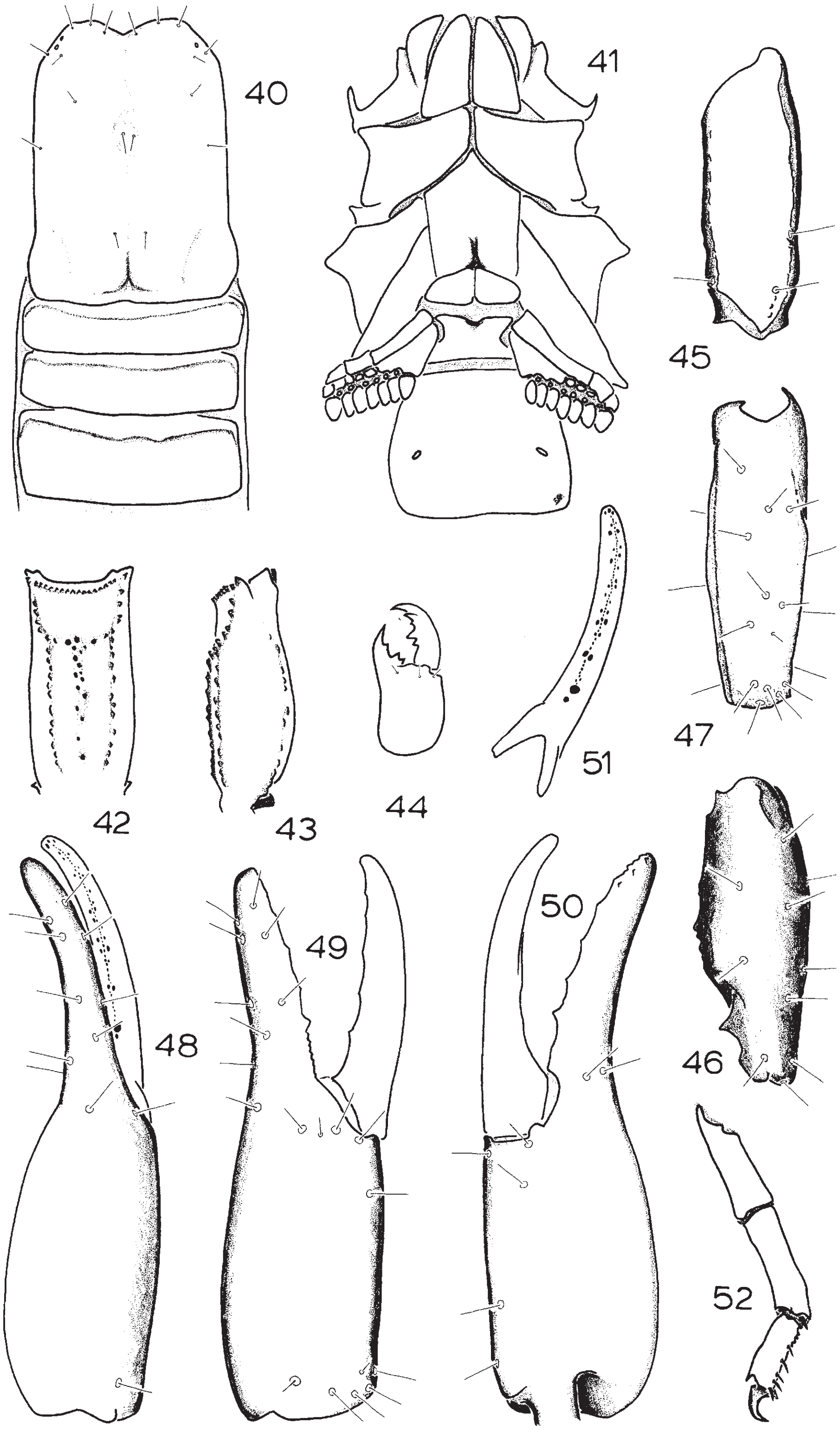
Diplocentrus anophthalmus, new species
Figs. 40-52, 54

Type data.—Holotype female and paratype female (maintained alive) from Actún Chukum, Yucatán, México, 29 November 1974 (J. Reddell, D. McKenzie, S. Wiley, R. W. Mitchell); AMNH and TTU respectively. Paratype female, same locality, 17 October 1974 (J. Reddell, R. Solis, D. McKenzie, S. Wiley); AMNH.

Etymology.—Specific name from Greek, meaning "without eyes," a descriptive name making reference to the absence of median eyes.

Distribution.—Known only from the type locality.

Diagnosis.—Troglobite; small, adults (?) 25-30 mm long. Ochroleucus throughout. Carapace smooth; lateral eyes small, unpigmented, variable in number; me-



Figs. 40-52.–*Diplocentrus anophthalmus,* new species, holotype female from Actún Chukum, Yucatán, México: 40, dorsal aspect of carapace and tergites I-III; 41, ventral aspect of prosoma and anterior regions of mesosoma; 42, ventral aspect of metasomal segment V; 43, lateral aspect of metasomal segment V; 44, dorsal aspect of chelicera; 45, dorsal aspect of pedipalp femur; 46, dorsal aspect of pedipalp tibia; 47, external aspect of pedipalp tibia; 48, dorsal aspect of pedipalp chela; 49, external aspect of pedipalp chela; 50, ventrointernal aspect of pedipalp chela; 51, dentate margin of movable finger of pedipalp chela; 52, prolateral aspect of third leg on right side.

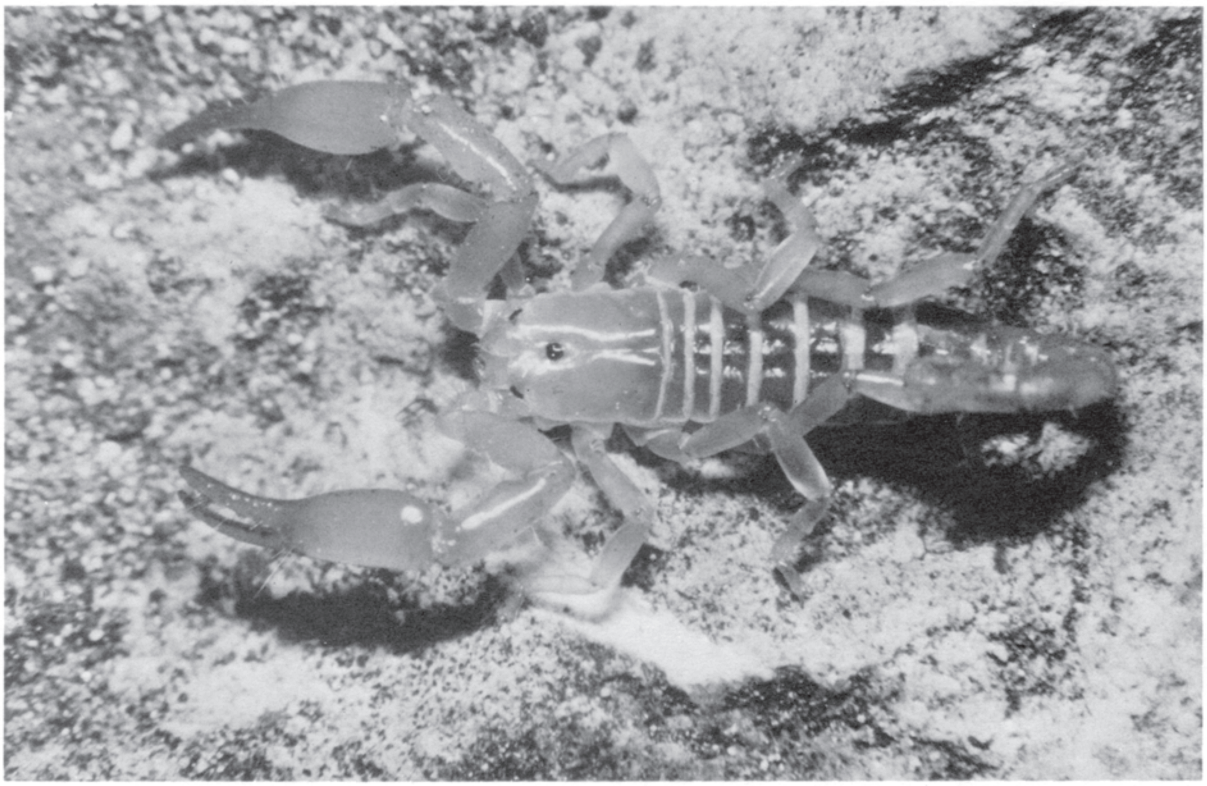


Fig. 53.–*Diplocentrus mitchelli*, new species, holotype in life (photograph courtesy of Robert W. Mitchell).

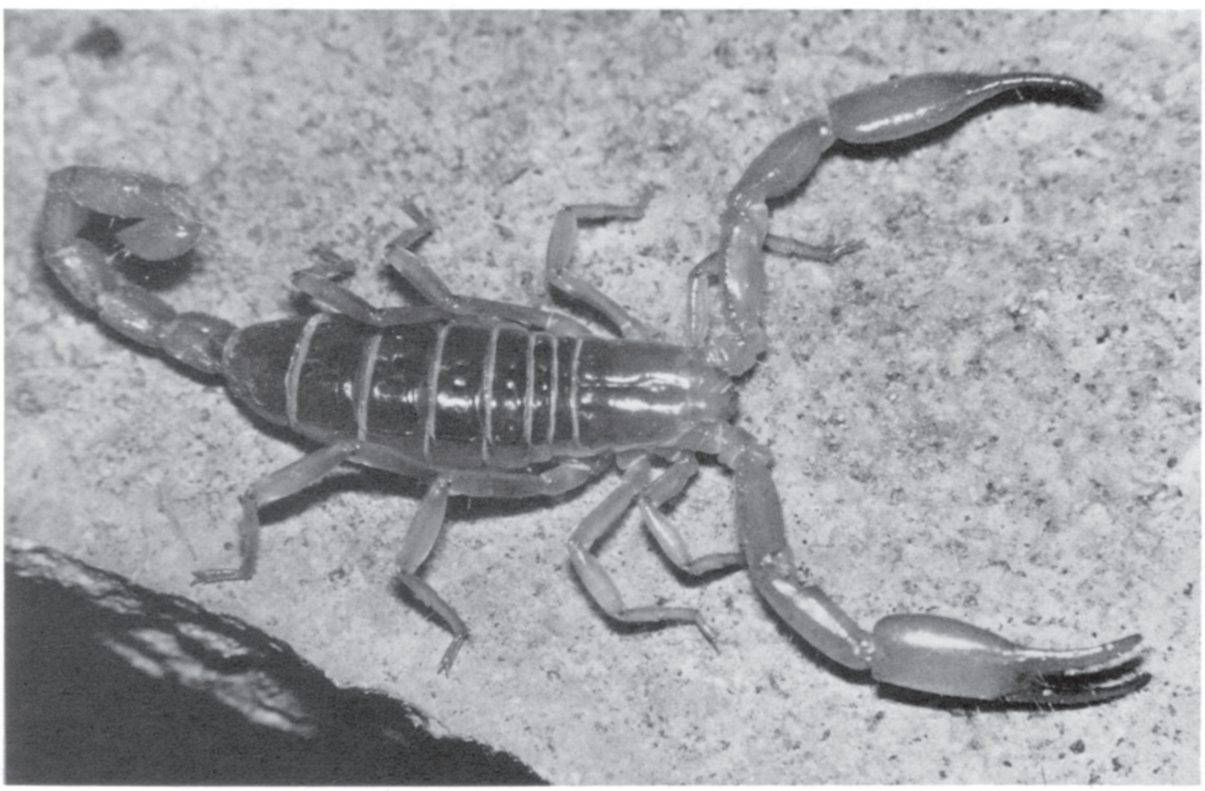


Fig. 54.–*Diplocentrus anophthalmus*, new species, holotype in life (photograph courtesy of Robert W. Mitchell).

dian eyes and ocular tubercle absent. Tergite VII and sternite VII acarinate. Pectinal tooth counts in females 7, males unknown. Metasomal segments I-IV vestigially tetracarinate. Cheliceral fixed finger shorter than chela width, movable finger shorter than chela length. Pedipalp: femur wider than deep; chela acarinate, movable finger about as long as carapace. Tarsomere II spine formula 4/4:4/4-5:5/5:5/5.

Description.—Based on female, male unknown. Measurements of holotype and paratype in Table 2.

Prosoma. Carapace (Fig. 40) ochroleucus, smooth, lustrous; anteriorly shallowly emarginate, median notch subangulose and about six times wider than deep; lateral eyes vestigial, unpigmented; ocular tubercle and median eyes absent; sides subparallel. Venter (Fig. 41): ochroleucus, lustrous, sparsely setate; sternum subpentagonal and slightly longer than wide, posteromedian furrow deep.

Mesosoma. Tergites ochroleucus; I-VI smooth, lustrous, bare; VII acarinate, shagreened to feebly rugose posterolaterally. Genital operculi ovovate (Fig. 41), with two pairs of posterior submarginal setae. Pectinal tooth count 7. Sternites ochroleucus, smooth, lustrous, sparsely setate; stigmata very small, elongate; VII acarinate.

Metasoma. Ochroleucus, moderately setate. Segments I-IV with ventral submedian, ventral lateral, and lateral inframedian carinae vestigial to obsolete; lateral supramedian and dorsal lateral carinae weak, subgranose. Segment V (Figs. 42 and 43); ventral median, ventral transverse, ventral lateral, and dorsal lateral carinae weak to moderate, granulose; lateral median keels obsolete; anal keels weak, minutely granulose. Telson smooth, moderately setate.

Chelicera. Ochroleucus, dentition (Fig. 44) characteristic of genus.

Pedipalp. Ochroleucus, orthobothriotaxia "C". Femur (Fig. 45): dorsal external, dorsal internal, and ventral internal carinae vestigial and subgranose basally, obsolete distally; ventral external keel obsolete; faces smooth. Tibia (Figs. 46 and 47): dorsal internal and ventral internal carinae weak to vestigial, subgranose; other carinae obsolete; internal face sparsely shagreened, other faces smooth. Chela (Figs. 48-50): acarinate, smooth, sparsely setate. Fixed finger moderately arcuate, shorter than underhand length; movable finger dentition (Fig. 51) characteristic of genus.

Legs. Ochroleucus, smooth, lustrous; prolateral pedal spurs present on all legs (Fig. 52).

Variability.—The holotype and preserved juvenile female paratype differ in size and in the spination of tarsomere II on the second pair of legs: on the holotype the partial formula is 4/5 4/4, while on the paratype it is 4/4 5/5. The adult (?) female paratype maintained alive in captivity since 29 November 1974 is slightly larger than the holotype; carapace 3.4 mm long, pedipalp chela 6.9 mm long. The variation in the number of lateral eyes is as follows: holotype with two on right side and one on left, preserved paratype with two on each side, and live paratype with three on right side and two on left side.

Comparisons.—*D. anophthalmus* appears to be most closely related to *D. reddelli* in terms of geographical proximity, setation of the genital operculi, and small size. The troglobitic traits of *D. anophthalmus,* particularly the attenuation of the appendages and the reduction in carinal development, however, make it difficult to compare and contrast this species with its epigean congeners.

ACKNOWLEDGMENTS

I thank Dr. Robert W. Mitchell for allowing me to describe the troglobitic species and for providing photographs of them. Dr. Benedetto Lanza and Dr. Marta Bucciarelli Poggesi of the Museo Zoologico de "La Specola," Firenze, kindly loaned me the specimen of *D. taibeli* used to redescribe the species. Dr. Norman I. Platnick, American Museum of Natural History (AMNH), New York, has allowed me to examine the Diplocentridae under his care, and I am most grateful to him. Finally, Mr. James R. Reddell and Mr. Frederick Wagner read the manuscript and made helpful suggestions.

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PRELIMINARY LIST OF THE PSEUDOSCORPIONS OF THE YUCATAN PENINSULA AND ADJACENT REGIONS, WITH DESCRIPTIONS OF SOME NEW SPECIES (ARACHNIDA: PSEUDOSCORPIONIDA)

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Heretofore, about 15 species of pseudoscorpions have been recorded from the Yucatán Peninsula and adjacent regions, based mainly upon sporadic collections made before 1950. However, as a result of recent collecting by a number of people, it has become clear that much higher numbers of species exist there, including some representatives of new and unusual genera. The present report lists the species already recorded from the area and adds some new records including several new species. It does not, however, include all of the new material available, for much of this, especially in the Chernetidae, is difficult or impossible to assign satisfactorily at the present time. Future reports will bring the list up to date.

Material reported upon here has been obtained from the following individuals and institutions: C. H. Alteri, C. & M. Goodnight, S. B. Peck, and J. R. Reddell; American Museum of Natural History [AMNH], Canadian National Collections of Insects, Arachnids and Nematodes [CNC], Florida State Collection of Arthropods [FSCA], Museum of Comparative Zoology at Harvard University [MCZ], National Museum of Natural History [NMNH], and The Museum, Texas Tech University [MTTU]. Specimens not otherwise attributed are in the collection of the author.

FAMILY TRIDENCHTHONIIDAE BALZAN

Tridenchthonius mexicanus Chamberlin and Chamberlin

T. mexicanus Chamberlin and Chamberlin, 1945, p. 57.

Described on basis of numerous types from Veracruz and La Esperanza, Chiapas.

New record.—One female from under bark of tree in rain forest near Palenque, Chiapas, on 29 March 1974, by C. H. Alteri.

FAMILY CHTHONIIDAE HANSEN

Mundochthonius mexicanus Muchmore

M. mexicanus Muchmore, 1973b, p. 48.

Described from numerous males and females from Chipinque Mesa, Monterrey, Nuevo León, and one female from Crystal Cave, Rancho del Cielo, near Gómez Farías, Tamaulipas.

New record.—One male sifted from leaf litter along Highway 29, 9 miles SE Teopisca, Chiapas, on 31 May 1969, by J. M. Campbell [CNC]. Though this specimen is slightly larger than the measured males in the type collection, it does not differ from them in proportions or morphological details.

Aphrastochthonius verapazanus Muchmore

A. verapazanus Muchmore, 1972b, p. 438.

Described from a single female found in Cueva Sepacuite No. 2, Alta Verapaz, Guatemala. No other specimens are known.

Aphrastochthonius alteriae, new species
Figs. 1-3

Material.—Holotype female (WM 3543.01001) and paratype female from rotted stump litter in the Group IV ruins at Palenque, Chiapas, México, on 6 April 1974; paratype female and paratype tritonymph from same location on 3 April 1974 (all taken by C. H. Alteri) [AMNH].

Diagnosis.—A very small, epigean species of the genus, with palpal femur less than 0.30 mm and chela less than 0.45 mm long.

Description of female.—With the characters of the genus (see Muchmore, 1972, p. 433). Carapace about as long as broad; anterior margin with about 10 small denticles at middle; no eyes present. Carapace with 16 long stout setae and a microseta at each side of anterior margin (m4m-4-4-2-2). Coxal area typical; chaetotaxy 1+m-2-1-(2m):3m-3-1-CS:3-2-CS:2-5:2-5; maxilla with two microsetae (2m) on dorsolateral surface; each coxa I with 3-4 and coxa II with 6 flat, parallel-rayed spines (Fig. 1); small, bisetose intercoxal tubercle present. Abdomen typical. Tergal chaetotaxy 4:4:4:6:6:6:6:6:4:T2T:0; sternal chaetotaxy 5:(4)10(3):(3)11(3):11:11:12:11:11:3T1T3:0:2.

Chelicera about three-fourths as long as carapace; hand with six setae; fixed finger with seven teeth decreasing in size from tip to base; movable finger with about 12 small teeth of equal size; galea a low elevation; flagellum of about seven pinnate setae.

Palps less attenuate than in the cave-dwelling species, femur about 1.2 and chela about 1.75 times as long as carapace. Proportions of palpal segments (Fig. 2): trochanter 1.8, femur 4.65-4.9, tibia 2.0, and chela 4.4-4.6 times as long as broad; hand 2.2-2.25 times as long as deep; movable finger 1.17-1.24 times as long as hand. Trichobothria as shown in Fig. 3. Movable chelal finger with 6-7 spaced, acute teeth; fixed finger with 10-11 similar teeth and one small accessory tooth on external surface at distal end. Typical sensory pit proximal to last marginal tooth and presumed bipolar neuron associated with terminal tooth in movable finger.

Legs typical. Leg IV with entire femur 2.2-2.35 and tibia 3.4-3.6 times as long as deep.

Male.—Unknown.

Tritonymph.—Smaller than adults and with reduced chaetotaxy, but otherwise without notable features.

Measurements (mm).—Females: Body length 0.72-0.815. Carapace length 0.235-0.245. Palpal trochanter 0.09 by 0.05; femur 0.28-0.30 by 0.06-0.065; tibia 0.11-0.12 by 0.06-0.065; chela 0.41-0.42 by 0.09-0.095; hand 0.19-0.20 by 0.085-0.095; movable finger 0.235 long. Leg IV: entire femur 0.23-0.235 by 0.10-0.105; tibia 0.155-0.17 by 0.045-0.05; metatarsus 0.08 by 0.04; telotarsus 0.17 by 0.025.

Etymology.—The species is named for Charlotte H. Alteri, who collected the specimens.

Remarks.—This is the first known surface dwelling form of *Aphrastochthonius,* all other described species being cavernicolous (see Muchmore, 1972b).

Genus *Pseudochthonius* Balzan

Chthonius (Pseudochthonius) Balzan, 1891, p. 546.
Pseudochthonius: Chamberlin, 1929, p. 173; Hoff, 1963, p. 6.

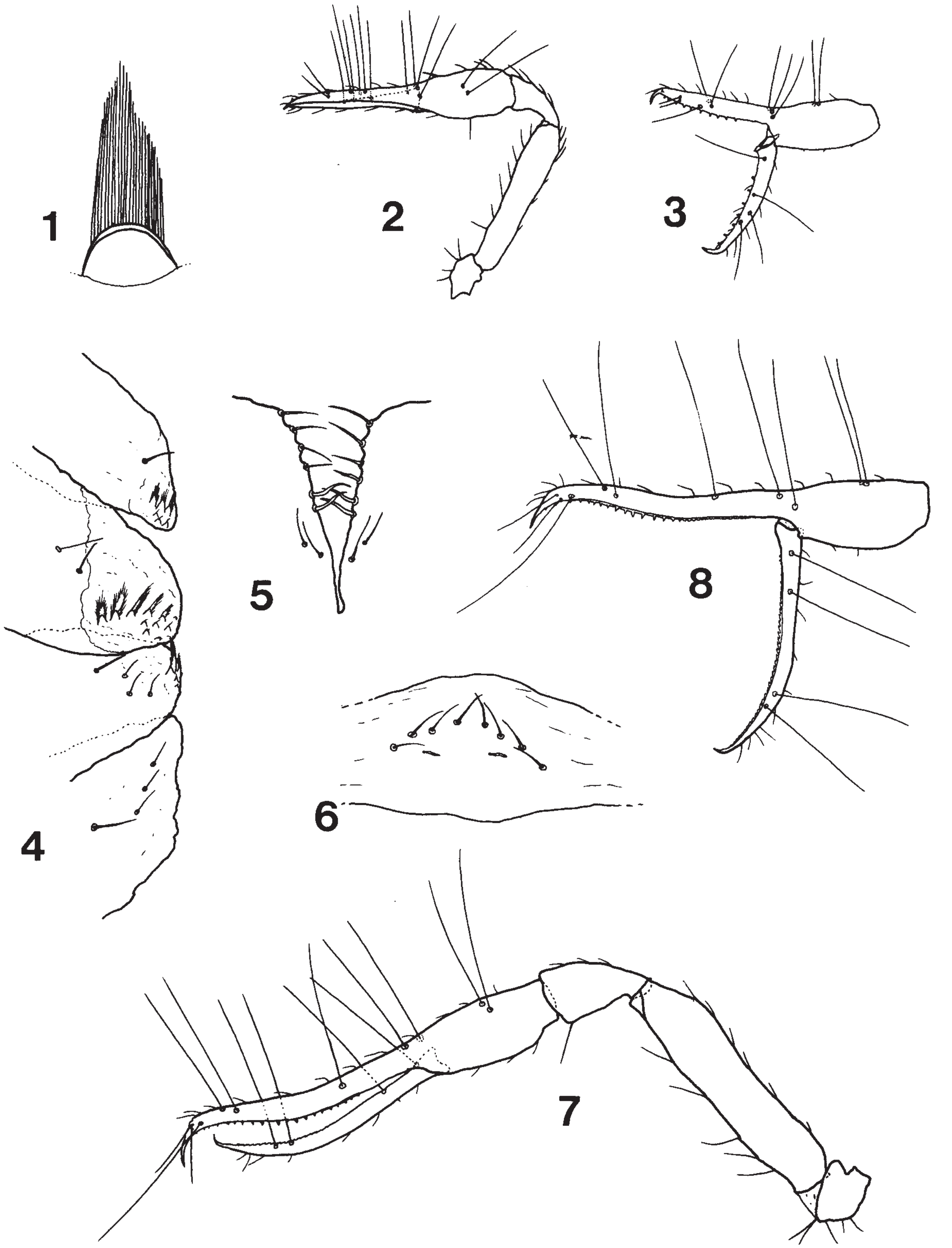
Diagnosis (emended).—In this genus have been placed the chthoniid pseudoscorpions with trichobothria *ib* and *isb* transversely paired on dorsum of chelal hand, no intercoxal tubercle, coxal spines on pedal coxae I and II, teeth of fixed chelal finger well developed and spaced while those of movable finger often reduced, two eyes or none. Based upon species described below, the diagnosis must be extended to include forms with coxal spines on coxa III in addition to coxae I and II.

Pseudochthonius moralesi, new species
Figs. 4-8

Material.—Holotype male (WM 3546.01001) and four paratypes (2 males, 2 females) from litter in woods at La Cañada, Palenque, Chiapas, México, 27 March 1974; one paratype male from ground litter among the Palenque Ruins, Chiapas, México, 3 April 1974 (all collected by C. H. Alteri [AMNH].

Diagnosis.—Small seta on carapace anterior to each eye about 1/2 as long as the other setae on carapace; distinct coxal spines on coxae III as well as on coxae I and II; sensory pit on margin of movable chelal finger at level of trichobothrium *sb;* posterior genital operculum of male with four simple setae and two S-curved setae on each lateral lip; anterior genital operculum of female with a curved row of eight setae.

Description.—Males and females very similar but females distinctly larger. Most parts light in color, but with a central darker area on tergites 3-6, and lateral dark areas on sternites 4-7, giving a distinctly spotted appearance. Carapace about as long as broad; no distinct epistome, but entire anterior margin denticulate; two good eyes with flat corneas; chaetotaxy 6-4-4-2-2=18, lateral setae on anterior margin 1/2 as long as the others. Coxa I without anterior projection; coxal chaetotaxy 2-2-1:m-2-1-CS:2-1-CS:2-4-CS:2-6;



Figs. 1-3.–*Aphrastochthonius alteriae,* new species: 1, coxal spine; 2, dorsal view of right palp; 3, lateral view of left chela.
Figs. 4-8.–*Pseudochthonius moralesi,* new species: 4, left coxae 1-4; 5, central area of posterior genital operculum of male; 6, anterior genital operculum of female; 7, dorsal view of right palp; 8, lateral view of left chela.

apical setae of palpal coxa subequal in size; each coxa I with 2-3 long, pinnate spines (Fig. 4), each coxa II with 4-5 similar spines, and each coxa III with 1-2 short pinnate spines; in addition to the distinct coxal spines, each coxa with one or more small non-pinnate scales. Abdomen elongate; tergites and sternites entire; pleural membranes smooth, but with very fine granules scattered over surface. Tergal chaetotaxy 4:4:4:4:6:6:6:2TT2:1TTTT1:4:T2T:0. Sternal chaetotaxy of males 8:[3-3]:(3)$\frac{6\text{-}6}{6\text{-}6}$(3):(3)10(3):8:8:8:7:6:1T1T1:0:2; setae of anterior operculum along edge of posterior margin; internal setae or gland openings [3-3] inconspicuous; lateral lips of posterior operculum each with four simple setae and two heavier, S-curved setae (Fig. 5). Sternal chaetotaxy of female as in male except for genital opercula; anterior operculum with slightly curved row of eight setae (Fig. 6), and posterior operculum with single row of 9-10 setae between spiracular plates.

Chelicera about 3/4 as long as carapace; hand with five setae; flagellum of seven pinnate setae; fingers with 7-9 marginal teeth; galea of female a truncated conical papilla with 2-3 obvious ducts, that of male entirely lacking; outer margin of movable finger of male with several small scale-like denticles.

Palps generally typical of genus, fairly slender (Fig. 7); femur 1.2-1.3 and chela 1.8-1.95 times as long as carapace. Trochanter 1.6-1.7, femur 4.0-4.35, tibia 1.9-2.05 and chela 5.95-6.25 times as long as broad; hand 1.95-2.1 times as long as deep; movable finger 1.67-1.88 times as long as hand. Trichobothria of chela as shown in Fig. 8. Fixed finger distinctly curved; with 31-36 marginal teeth, about 20 in the distal half of finger acutely cusped, the more proximal ones low and rounded; the longest teeth are in the center of the row, where the distance between the closed fingers is greatest. Movable finger curved in distal half; with 30-37 small marginal teeth, all low and retrorse, except proximal 3-5 taller and cusped; a conspicuous sensillum occurs on external surface of finger near dental row at or just distad of level of trichobothrium *sb.* There is no accessory tooth on the fixed finger to act as a stop for the tip of the closing movable finger; instead, it appears that the movable finger is limited in its closure by the apposition of the basal teeth of the two fingers.

Legs without unusual features; entire femur 2.6-2.7 and tibia 3.6-4.0 times as long as deep. Tactile setae on tibia, metatarsus and telotarsus.

Measurements (mm).—Ranges for males given first, followed in parentheses by ranges for females. Body length 1.18-1.22(1.45-1.71). Carapace length 0.405-0.42(0.435-0.475). Chelicera 0.28-0.29(0.335-0.355) long. Palpal femur 0.48-0.51(0.56-0.60) by 0.11-0.125 (0.135-0.15); tibia 0.19-0.215(0.245-0.26) by 0.10-0.11(0.12-0.13); chela 0.73-0.75(0.85-0.92) by 0.12 (0.14-0.155); hand 0.245-0.26(0.28-0.32) by 0.12-0.125(0.14-0.16); movable finger 0.435-0.46(0.50-0.53) long. Leg IV: entire femur 0.40-0.415(0.46-0.48) by 0.155-0.16(0.17-0.185); tibia 0.235-0.265 (0.29-0.30) by 0.065-0.075(0.075-0.08); metatarsus 0.15-0.155(0.175-0.185) by 0.04-0.05(0.05-0.06); telotarsus 0.235-0.265(0.275-0.28) by 0.03(0.04).

Etymology.—The species is named for Mr. Moises Morales, proprietor of La Cañada, where the specimens were found.

Remarks.—This species is somewhat similar to *P. clarus* Hoff (1963) from Jamaica, but is a bit larger, shows a conspicuous spotting of the abdomen, has the setae on the anterior genital operculum of the female in a single row and possesses coxal spines on coxa III as well as I and II. It is the first species of the genus to be described from México.

Pseudochthonius yucatanus, new species
Figs. 9-11

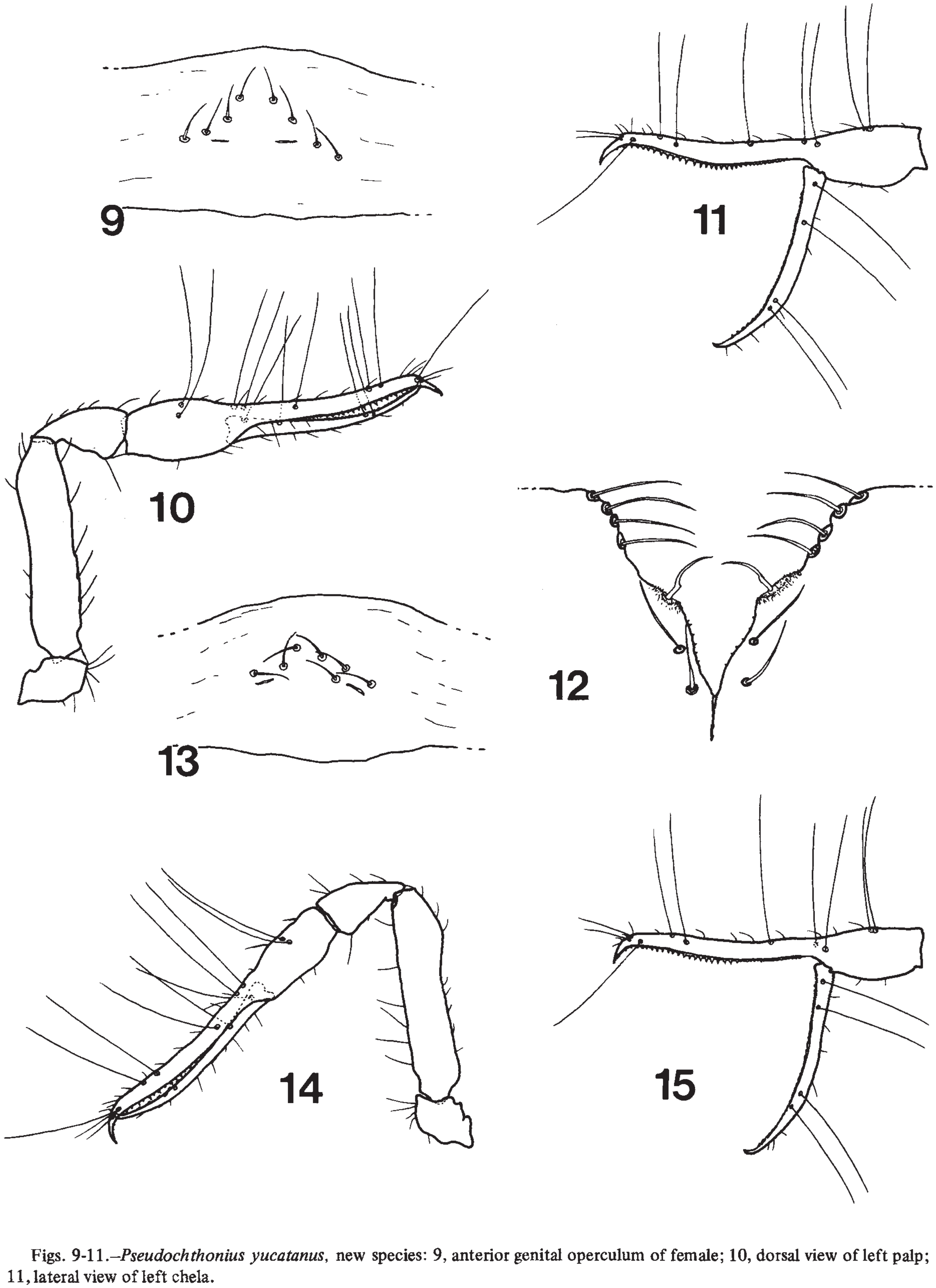
Material.—Holotype female (WM 3409.01001) and one female paratype from leaf litter, 7 km SW Oxkutzcab, Yucatán, México, 31 July 1973 (R. W. Mitchell and J. Reddell) [AMNH].

Diagnosis.—Carapace with four large setae on anterior margin and a microseta between each eye and the margin; coxal spines on coxae I and II, and coxae III with scales and scale-like spines medially; sensory pit on margin of movable chelal finger at level of trichobothrium *sb;* (male genitalia unknown); anterior genital operculum of female with eight setae in strongly curved row.

Description of female.—Generally similar in morphology to *P. moralesi* but smaller; spots on tergites and sternites not as evident as in *P. moralesi.* Carapace with a low dentate epistome and a few denticles laterad of this; eyes well developed, corneate; chaetotaxy m4m-4-4-2-2=18, the microsetae situated between the eyes and the margin. Coxal chaetotaxy 2-2-1:1-3-1-CS:2-3-CS:2-5-CS:2-6; apical seta of coxa I small but not micro; two pinnate coxal spines on coxa I, four on coxa II, and two small, fringed, scale-like spines on coxa III; each coxa with additional small scales. Tergal and sternal chaetotaxy essentially as in *P. moralesi,* but anterior operculum of female with eight setae in strongly, curved row (Fig. 9).

Chelicera as in *P. moralesi.*

Palps typical but more robust than in *P. moralesi* (Figs. 10-11). Femur about 1.05 and chela about 1.5 times as long as carapace. Trochanter 1.55, femur



Figs. 9-11.–*Pseudochthonius yucatanus*, new species: 9, anterior genital operculum of female; 10, dorsal view of left palp; 11, lateral view of left chela.

Figs. 12-15.–*Pseudochthonius falcatus*, new species: 12, central area of posterior genital operculum of male; 13, anterior genital operculum of female; 14, dorsal view of right palp; 15, lateral view of left chela.

4.1-4.3, tibia 2.0-2.1, and chela 5.3-5.35 times as long as broad; hand 1.7 times as long as deep; movable finger 1.95-2.0 times as long as hand. Placement of trichobothria typical and teeth quite similar to those of *P. moralesi.* Sensillum on movable finger at level of trichobothrium *sb.*

Legs more robust than in *P. moralesi;* leg IV with entire femur 2.3 and tibia 3.3 times as long as deep.

Male.–Unknown.

Measurements (mm).–Body length 1.23-1.28. Carapace length 0.38-0.40. Chelicera 0.27 long. Palpal femur 0.41 by 0.095-0.10; tibia 0.18-0.19 by 0.09; chela 0.58-0.59 by 0.11; hand 0.19-0.11; movable finger 0.37-0.38 long. Leg IV: entire femur 0.36-0.37 by 0.155-0.16; tibia 0.23 by 0.07.

Etymology.–The species is named for the state of Yucatán.

Remarks.–This species bears some resemblance to *P. mundanus* Hoff from Jamaica, but has larger carapace, chelicera and legs, with well developed, corneate eyes and with small, but distinct, spines on coxa III as well as I and II.

Pseudochthonius falcatus, new species
Figs. 12-15

Material.–Holotype male (WM 3066.01002) and nine paratypes (6 males, 3 females) from sifted litter under broken termite nests at Belmopan, Belize; numerous paratypes from limestone forest 2.5 miles S Belmopan, from high canopy forest at Caves Branch, from secondary forest near Belmopan, and from gallery forest stream drift at Belmopan Riviera; all specimens obtained by Berlese separation of ground litter during 1-15 August 1972 by S. & J. Peck [AMNH].

Diagnosis.–Carapace with four large setae on anterior margin and a microseta between each eye and the margin; coxal spines on coxae I and II, and coxae III with 0-2 tiny scales medially; sensory pit on margin of movable chelal finger far distad of trichobothrium *sb;* posterior genital operculum of male with four simple setae and one falcate seta on each lateral lip; anterior genital operculum of female with eight setae somewhat grouped together.

Description.–Males and females much alike but females slightly larger. Generally similar in morphology to *P. moralesi* described above; with same spotted coloration of abdomen. Carapace with a small dentate epistome and denticles along anterior margin; eyes small; chaetotaxy m4m-4-4-2-2=18, the microsetae situated between the eyes and the margin. Coxal chaetotaxy 2-2-1:1-2-2-CS:2-3-CS:2-5:2-6; apical seta of coxa I small but not micro; usually two pinnate coxal spines on coxa I and four on coxa II; coxa III at most with 1-2 tiny scales medially. Tergal chaetotaxy 4:4:4:4:6:6:6:2TT2:1TTTT:4:T2T:0. Numbers of setae on sternites and placement of setae on anterior genital operculum of male essentially as in *P. moralesi;* lateral lips of posterior operculum of male each with four simple setae and one falcate seta set in an enlarged areole (Fig. 12); anterior operculum of female with eight setae not in a single line but grouped toward middle (Fig. 13).

Chelicerae of both male and female as in *P. moralesi.*

Palps typical (Fig. 14-15), somewhat variable in size and proportions, chela of female usually larger and heavier than that of male. Femur 1.05-1.2 and chela 1.5-1.75 times as long as carapace. Trochanter 1.45-1.7, femur 4.0-4.3, tibia 1.7-2.0 and chela 5.35-6.2 times as long as broad; hand 1.75-2.0 times as long as deep; movable finger 1.75-2.1 times as long as hand. Placement of trichobothria typical and teeth quite similar to those of *P. moralesi.* Sensillum on movable finger located far distad of trichobothrium *sb.*

Legs more robust than in *P. moralesi;* leg IV with femur 2.05-2.2 and tibia 3.0-3.15 times as long as deep.

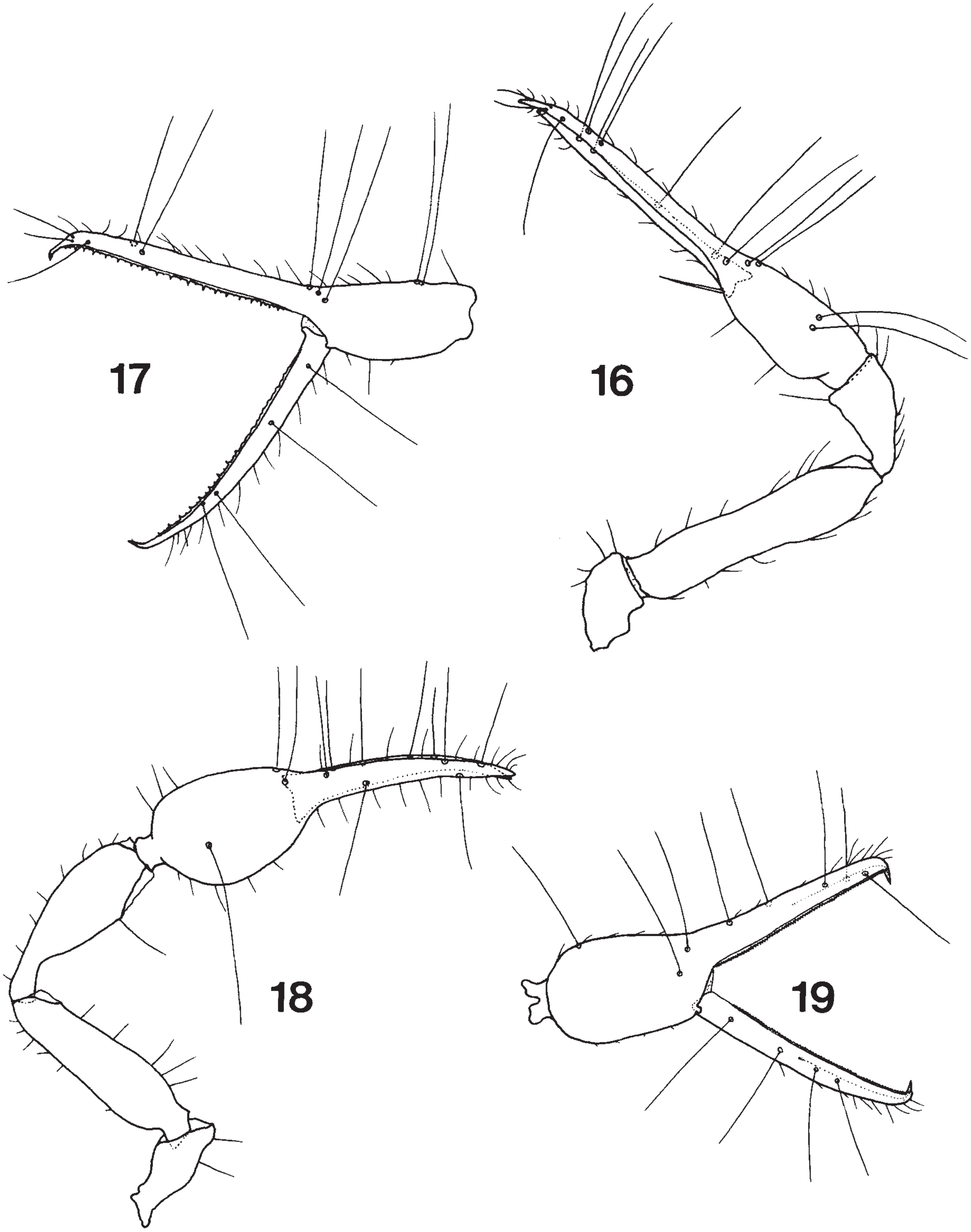
Measurements (mm).–Ranges for males given first, followed in parentheses by ranges for females. Body length 0.96-1.00(1.08-1.27). Carapace length 0.34-0.37(0.34-0.39). Chelicera 0.23-0.245(0.26-0.29) long. Palpal femur 0.36-0.39(0.40-0.465) by 0.09-0.095 (0.095-0.105); tibia 0.15-0.16(0.16-0.185) by 0.08-0.09(0.09-0.105); chela 0.53-0.57(0.58-0.64) by 0.09-0.095(0.105-0.12); hand 0.16-0.19(0.19-0.22) by 0.09-0.10(0.105-0.125); movable finger 0.34-0.38 (0.37-0.415) long. Leg IV: entire femur 0.33-0.35 (0.35-0.38) by 0.16(0.16-0.18); tibia 0.20-0.22(0.21-0.23) by 0.07(0.07-0.075).

Etymology.–The species is named *falcatus* for the unusual falcate seta on either lip of the posterior genital operculum of the male.

Remarks.–Apparently much like *P. doctus* Hoff (1963) from Jamaica, lacking coxal spines on coxa III and with setae of anterior genital operculum of female grouped toward middle; however, the posterior operculum of male is quite different in *P. falcatus* in the possession of a single falcate seta in place of two weakly S-shaped setae.

Tyrannochthonius volcanus, new species
Figs. 16-17

Material.–Holotype male (WM 3043.01004) and five paratypes (2 males, 1 female, 2 tritonymphs) in deciduous leaf litter on Volcán Tzontehuitz, 8 mi NE



Figs. 16-17.–*Tyrannochthonius volcanus,* new species: 16, dorsal view of right palp; 17, lateral view of left chela.
Figs. 18-19.–*Mexobisium ruinarum,* new species: 18, dorsal view of left palp; 19, lateral view of right chela.

San Cristóbal de las Casas, Chiapas, México, 14 May 1969 (J. M. Campbell) [CNC].

Diagnosis.–The species is distinguished by its moderate size, the palpal femur being greater than 0.45 mm in length; by the lack of a small seta between the anterior eye and the carapacial margin; by the virtual absence of an epistome; and by the chaetotaxy of the anterior tergites - 2:2:4:6:6:6.

Description.–Male and female are very similar, though the female is larger and has a more robust palp. All parts well sclerotized, light brown. Carapace about as long as broad; epistome no more than a slight elevation at middle of anterior margin; four well developed, corneate eyes; chaetotaxy 2-4-2-4-2-2=16. Coxal area typical; chaetotaxy 2-2-1:3-0:2-2-CS:2-3:2-3; lateral seta on apex of palpal coxa half as long as medial one; coxa I with prominent apical projection; each coxa II with a row of eight or nine incised spines. Abdomen typical; tergal chaetotaxy 2:2:4:6:6:6:6:6:7:4:T2T:0; sternal chaetotaxy of male about 10:[4-4]:(3)$\frac{10\text{-}10}{7\text{-}7}$(3):(3)6(3):9:9:9:9:9:2T1T2:0:2; anterior genital operculum of female with 10 setae in a curved row, posterior operculum with a row of seven setae between the spiracular plates.

Chelicera typical, about 0.9 as long as carapace; hand with five setae; fixed finger with about 13 teeth, graded from large to tiny toward the base; movable finger with about 17 medium sized, subequal teeth; no galea evident in male, that of female only a small, rounded elevation of the finger margin; flagellum of eight pinnate setae.

Palps typical in shape and proportions (Figs. 16-17); femur about 1.15 and chela about 1.85 times as long as carapace. Proportions of segments in male: trochanter 1.55-1.65, femur 4.25-4.7, tibia 1.6-1.85, and chela 5.55-5.7 times as long as broad; hand 1.9-2.0 times as long as deep; movable finger 1.79-1.85 times as long as hand; female similar except chela more robust, with entire chela 4.7 times as long as broad and hand 1.55 times as long as deep. Placement of trichobothria and the spinelike seta on inner side of fixed finger typical. Fixed finger with about 20 acute macrodenticles and 12 microdenticles alternating at distal end of row; movable finger with 11 macrodenticles and 10 alternating microdenticles in distal half and 10-12 low, retroconical denticles proximally; sensillum on movable finger alongside dental margin about midway between *st* and *sb*.

Legs typical; leg IV with entire femur 2.4-2.5 and tibia 3.95-4.15 times as long as deep. Tactile setae as usual on tibia, metatarsus and telotarsus of leg IV.

Measurements (mm).–Ranges for three males given first, followed in parentheses by figures for the female. Body length 1.25-1.27(1.46). Carapace length 0.42-0.43(0.45). Chelicera 0.35-0.37(0.40) by 0.17-0.185(0.18). Palpal femur 0.47-0.52(0.525) by 0.11 (0.12); tibia 0.19-0.21(0.22) by 0.115-0.12(0.13); chela 0.76-0.78(0.84) by 0.135-0.145(0.18); hand 0.27-0.28(0.295) by 0.135-0.145(0.19); movable finger 0.49-0.50(0.52) long. Leg IV: entire femur 0.43-0.465(0.46) by 0.18-0.185(0.185); tibia 0.295-0.31 (0.31) by 0.075(0.075); metatarsus 0.14-0.15(0.15) by 0.06(0.06); telotarsus 0.31-0.34(0.32) by 0.04 (0.04).

Etymology.–The species is named for Volcanus, the Roman god of fire and volcanoes.

Remarks.–*Tyrannochthonius volcanus* is easily distinguished from *T. centralis* Beier from Costa Rica by its larger size and the occurrence of two rather than four setae on tergites 1 and 2. It is similar in size to *T. lautus* Hoff from Jamaica, but differs from that species also in the tergal chaetotaxy and in the lack of a small seta in front of each anterior eye (see Hoff, 1969).

Mexichthonius unicus Muchmore

M. unicus Muchmore, 1975, p.

Described from a single female from under a rock near Ich-Ek, Campeche. No other specimens are known.

FAMILY SYARINIDAE CHAMBERLIN

Subfamily Chitrellinae Beier

Pachychitra maya Chamberlin

P. maya Chamberlin, 1938, p. 111; Hummelinck, 1948, p. 71.

Described from a single female and two nymphs from the "first cave on San Roque Road," Oxkutzcab, Yucatán.

According to Hummelinck (1948, p. 71 and Fig. 27C) the cheliceral flagellum of this species does not have the proximal seta shorter than the others. Thus the key in Muchmore, 1972 (p. 266) is in error in placing *P. maya* with those species having a short proximal seta.

Pachychitra grandis Muchmore

P. grandis Muchmore, 1972b, p. 266.

Described from a single female from Cueva del Tío Ticho, near Comitán, Chiapas. No other specimens have been found.

FAMILY HYIDAE CHAMBERLIN

Subfamily Leucohyinae Chamberlin

Troglohya mitchelli Muchmore

T. mitchelli Muchmore, 1973a, p. 55.

Described from a single female from Grutas de Zapaluta, near La Trinitaria, Chiapas. No other specimens have been found.

Mexobisium maya Muchmore

M. maya Muchmore, 1973b, p. 67.

Described from one female and one tritonymph from Grutas del Coconá, near Teapa, Tabasco. Three additional specimens (one male, one female and one tritonymph) were found at the type locality on 24 July 1974 by J. R. Reddell and J. M. Rowland.

The female and tritonymph are very much like the holotype and paratype described earlier. The male is generally similar to the female; however, because males are known for only one other species of *Mexobisium (M. pecki)* it seems appropriate to give here a brief description of this specimen.

Male.–Carapace, as in female, with distinct transverse furrow; with 30 vestitural setae. Genital opercula similar to those of *M. pecki* (Muchmore, 1973, Fig. 2); anterior operculum with six setae, two pairs of small setae interiorly, 12 setae on posterior operculum. Palpal trochanter 2.3, femur 4.2, tibia 3.1 and chela (without pedicel) 3.75 times as long as broad; hand (without pedicel) 1.7 times as long as deep; movable finger 1.40 times as long as hand. Fixed finger with 112 and movable finger with 109 marginal teeth. Leg IV with entire femur 3.7 and tibia 6.95 times as long as deep.

Mexobisium guatemalense Muchmore

M. guatemalense Muchmore, 1973b, p. 67.

Described from two females found in Cueva Lanquín, Alta Verapaz, Guatemala. No other specimens are known.

Mexobisium goodnighti Muchmore

M. goodnighti Muchmore, 1973b, p. 69

Described from a single female from a cave near Augustine, Belize. No further specimens have been found.

Mexobisium ruinarum, new species

Figs. 18-19

Material.–Holotype female (WM 3400.02001) and paratype female from the Palenque Ruins, Chiapas, México, on 25 July 1973 (J. R. Reddell) [AMNH].

Diagnosis.–Generally similar to *M. maya* from Tabasco, but smaller, with stouter appendages and lacks setae on ventral anal plate. Shares the latter character with *M. pecki* from Oaxaca, but is nearly twice as large as this species.

Description.–With the general characters of the genus (see Muchmore, 1973b, p. 63). Fairly well sclerotized, with carapace, chelicerae and palps light brown and other parts lighter. Carapace 1.2 times as long as broad; no epistome and no eyes; transverse membranous furrow near posterior edge broad and distinct; vestitural setae about 8-6-2-4-6-6=32. Coxal area typical. Abdomen typical in general structure. Tergal chaetotaxy 9:9:9:9:9:9:9:9:9:7:T1T:2; sternal chaetotaxy 4:(3)6(3):(3)12(3):15:15:14:15:12:11:T1T1T1T:0.

Chelicera about half as long as carapace; hand with five setae; flagellum of two, small, close-set setae; distal half of movable finger with irregularly dentate margin having about 10-12 cusps; distal quarter of dental margin of fixed finger finely serrate, followed by an irregularly dentate ridge having about 10 cusps.

Palps only moderately slender (Fig. 18); femur about equal to and chela about 1.7 times as long as carapace. Trochanter, 2.55-2.6, femur 3.6, tibia 3.0, and chela (without pedicel) 3.4-3.5 times as long as broad; hand (without pedicel) 1.4 times as long as deep; movable finger 1.60-1.62 times as long as hand. Trichobothria as shown in Fig. 19. Fixed finger with 86-90 and movable finger with 73-75 contiguous, marginal teeth. Venom apparatus well developed in both fingers.

Legs moderately slender; leg IV with entire femur 3.9 and tibia 6.8 times as long as deep. Tarsal spines long, sharp on telotarsi I, II and III, reduced to low, rounded projections on telotarsi IV. Subterminal tarsal setae often simple, at most with tiny lateral denticle. Leg IV with tactile setae on tibia and both tarsal segments.

Male.–Unknown.

Measurements (mm).–Body length 2.85-2.89. Carapace length 0.815-0.87. Chelicera 0.385-0.40 by 0.185-0.19. Palpal trochanter 0.44-0.48 by 0.17-0.185; femur 0.76-0.85 by 0.21-0.235; tibia 0.73-0.815 by 0.245-0.27; chela (without pedicel) 1.345-1.48 by 0.385-0.435; hand (without pedicel) 0.53-0.585 by 0.37-0.415; pedicel 0.10 long; movable finger 0.86-0.94 long. Leg IV: entire femur 0.74 by

0.19; tibia 0.68-0.10; metatarsus 0.15 by 0.065; telotarsus 0.385 by 0.075.

Etymology.–The species is named *ruinarum* for the Mayan ruins at Palenque where it is found.

FAMILY VACHONIIDAE CHAMBERLIN

Vachonium boneti Chamberlin

V. boneti Chamberlin, 1947, p. 6.

Described from a single female from Cueva de Sabacá, Yucatán. No other specimens are known.

Vachonium maya Chamberlin

V. maya Chamberlin, 1947, p. 8.

Described from a single female from Cueva de Balaam Canche [=Grutas de Balankanche], Chichén Itzá, Yucatán. No other specimens are known.

Vachonium kauae Muchmore

V. kauae Muchmore, 1973a, p. 57.

Described from a single female from Cueva de Kaua, Yucatán. No other specimens have been found.

Vachonium belizense Muchmore

V. belizense Muchmore, 1973a, p. 58.

Described from a single tritonymph from Mountain Cow Cave, Caves Branch, Belize. No other specimens have been found.

Vachonium cryptum, new species
Figs. 20-21

Material.–Holotype female (WM 3419.01001) from Actún Xkyc, 1 km S Calcehtok, Yucatán, México, on 1 May 1973; found on underside of ancient Mayan water dish by J. R. Reddell [AMNH].

Diagnosis.–Similar in many respects to *V. maya* Chamberlin and *V. kauae* Muchmore, but slightly larger and with larger numbers of setae on the carapace, the tergites and the sternites.

Description of female.–Well sclerotized and with all parts well colored, brown. Carapace about one-third longer than broad; without an epistome and without eyes; surface reticulated, about 30 vestitural setae including eight along anterior margin, five near posterior margin, and three small setae laterally on each side. Coxal area typical.

Abdomen much as in other species. Tergal chaetotaxy 6:7:6:6:7:7:7:7:6:6:TTTT:2; sternal chaetotaxy 18:(3)20(3):(3)9(3):12:6mm5:5mm6:6mm5:12:11:1T1T1:2.

Chelicera little more than half as long as carapace. Hand with 10 setae, two in position of *es;* flagellum of five setae, all sparsely denticulate, the proximal one about two-thirds as long as the distal four; galea a thin, curved stylet reaching to tip of finger.

Palps generally typical (Fig. 20), all segments completely, but not evenly, covered with distinct granules. Femur 1.67 and chela 2.78 times as long as carapace. Trochanter 2.0, femur 7.9, tibia 7.0 and chela (without pedicel) 7.0 times as long as broad; hand (without pedicel) 2.6 times as long as deep; movable finger 1.71 times as long as hand. Femoral tubercle well developed. Trichobothria on chela as shown in Fig. 21. Movable finger with venedens and well developed venom apparatus, and with 115 rounded and flattened, contiguous marginal teeth. Fixed finger blunt at tip, with no venedens or trace of venom duct; end of finger broadened and bearing eight heavily sclerotized denticles in a double row, which is continuous with marginal row of 141 sharply conical, contiguous teeth; and with a prominent accessory tooth on internal side at level of 21st marginal tooth.

Legs quite slender; leg IV with femur 6.4 and tibia 10.0 times as long as deep. Structure of legs as in other species.

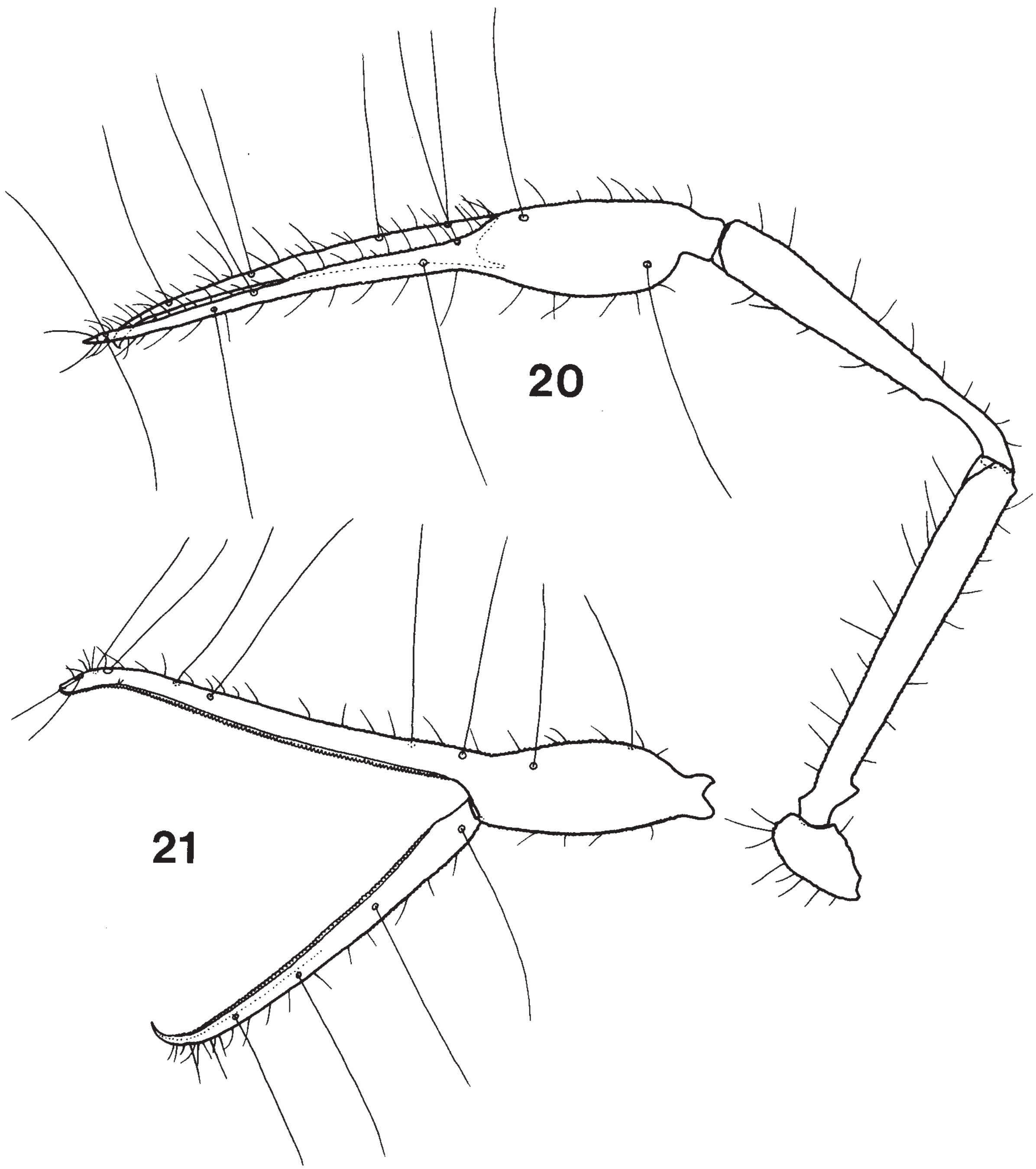
Male.–Unknown.

Measurements (mm).–Body length 4.18. Carapace length 1.46. Chelicera 0.815 by 0.37. Palpal trochanter 0.81 by 0.41; femur 2.44 by 0.31; tibia 2.31 by 0.33; chela (without pedicel) 4.06 by 0.58; pedicel 0.16 long; hand (without pedicel) 1.45 by 0.56; movable finger 2.48. Leg I: basifemur 1.41 by 0.185; telofemur 0.50 by 0.165; tibia 1.09 by 0.11; metatarsus 0.21 by 0.095; telotarsus 0.91 by 0.08. Leg IV: entire femur 1.80 long; basifemur 0.38 by 0.25; telofemur 1.52 by 0.28; tibia 1.60 by 0.16; metatarsus 0.16 by 0.13; telotarsus 1.19 by 0.10.

Etymology.–The species is named *cryptum* from the concealed position of the type specimen when it was found.

Vachonium species

A single tritonymph was found in Actún Xpukil, Yucatán, on 18 March 1973 by J. R. Reddell. It bears considerable resemblance to *V. boneti* from Cueva de Sabacá, but cannot now be placed with confidence into that species.



Figs. 20-21.–*Vachonium cryptum,* new species: 20, dorsal view of right palp; 21, lateral view of left chela.

FAMILY OLPIIDAE CHAMBERLIN

Subfamily Olpiinae Banks

Olpiolum paucisetosum, new species
Figs. 22-23

Material.–Holotype female (WM 3406.01001) and two paratype females found under rocks 1 km S Muna, Yucatán, México, 1 August 1973 (J. Reddell) [AMNH].

Diagnosis.–A medium sized species of the genus characterized by the occurrence of only two setae at the posterior margin of the carapace and on tergite 1 and of only four setae on tergite 2.

Description of female.–With the general characters of the genus (see Hoff, 1964, p. 19). All parts well sclerotized; carapace, palps and tergites dark brown, other appendages and sternites a little lighter. Carapace a little longer than broad, surface mostly smooth, but with some reticulations laterally; with four large, corneate eyes of nearly equal size; a total of about 32 setae, with six at anterior margin and two near posterior. Abdomen long ovate; tergites and sternites entire; pleural membranes longitudinally, smoothly striate. Tergal chaetotaxy of holotype 2:3:6:6:6:6:6:1T1T2T1T1:1T1T2T1T1:2T4T2:2; both paratypes with four setae on tergite 2, one paratype with three setae on tergite 1. Sternal chaetotaxy of holotype 7:(0)6(0):(0)8(0):10:7:7:6:6:T1T2T1T:2TT2:2; paratypes generally similar. Internal genitalia with a central group of 6-8 cribriform plates of different sizes and a larger cribriform plate on each side.

Chelicera less than half as long as carapace; palm with five setae; flagellum of three setae, all denticulate along one side; fixed finger with 5-6 retrorse teeth; movable finger with prominent, rounded subapical lobe; galea long, slender and with three small curved rami at end.

Palps generally typical; all surfaces smooth except a few small granules on flexor surfaces of femur and chela at base of fingers; femur about 0.9 and chela about 1.5 times as long as carapace; proportions of segments as shown in Fig. 22; trochanter 1.7-1.85; femur 2.8-2.95, tibia 2.2-2.4, and chela (without pedicel) 2.55-2.75 times as long as broad; hand (without pedicel) 1.45-1.51 times as long as deep; movable finger 0.90-0.92 times as long as hand. Trichobothrium on femur about 0.2 distance from proximal end; trichobothria of chela as shown in Fig. 23. Fixed finger with 34-39 and movable finger with 39-41 contiguous marginal teeth; each finger with a venedens and venom apparatus, the ducts short.

Legs typical. Leg I with telofemur distinctly shorter than basifemur; leg IV with entire femur 2.5-2.6 and tibia 3.5-3.8 times as long as deep; metatarsus of leg IV with a long tactile seta very near the proximal end; arolia longer than tarsal claws.

Male.–Unknown.

Measurements (mm).–Body length 3.03-3.71. Carapace length 0.79-0.86. Chelicera 0.32-0.33 by 0.19. Palpal trochanter 0.42-0.46 by 0.245-0.26; femur 0.67-0.74 by 0.24-0.265; tibia 0.67-0.76 by 0.30-0.34; chela (without pedicel) 1.19-1.28 by 0.44-0.50; hand (without pedicel) 0.63-0.71 by 0.43-0.47; movable finger 0.58-0.64 long. Leg I: basifemur 0.325-0.355 by 0.125-0.13; telofemur 0.21-0.22 by 0.11-0.13; tibia 0.27-0.295 by 0.09-0.095; metatarsus 0.18-0.185 by 0.065; telotarsus 0.16-0.18 by 0.05-0.055. Leg IV: entire femur 0.69-0.77 by 0.27-0.30; tibia 0.50-0.53 by 0.13-0.15; metatarsus 0.26-0.28 by 0.10; telotarsus 0.20-0.21 by 0.07.

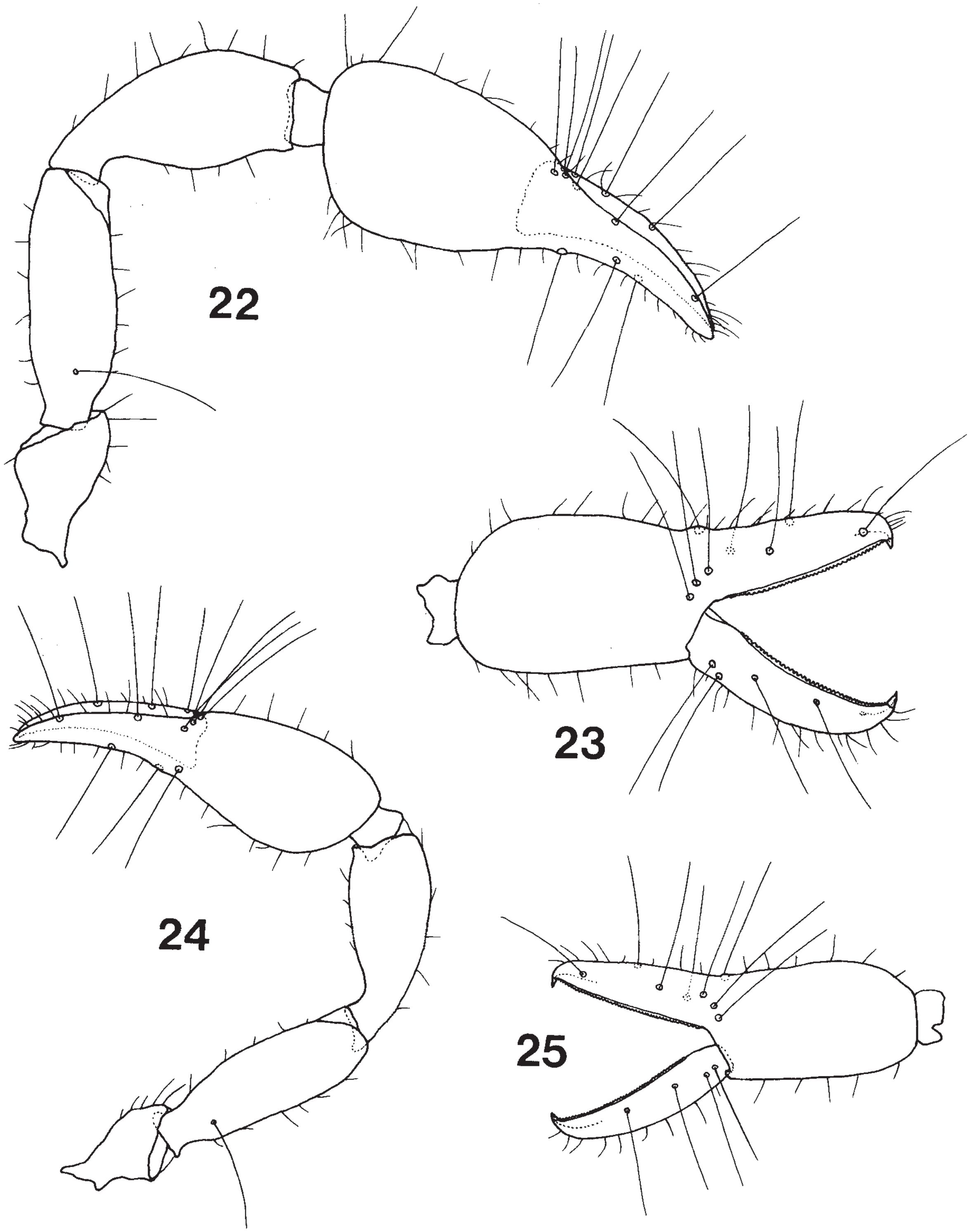
Etymology.–The name *paucisetosum* refers to the small number of setae at the posterior end of the carapace and on the anterior tergites.

Olpiolum fuscipalpum, new species
Figs. 24-25

Material.–Holotype male (WM 3067.04001) and two paratypes (1 male, 2 female) from litter in limestone forest 2 mi S Belmopan, Belize, 4 August 1972 (S. and J. Peck); four paratypes (2 males, 1 female, 1 tritonymph) from litter in an old plantation at Silkgrass, Belize, 3 August 1972 (Charles and Marie Goodnight); three paratypes (2 males, 1 female) from litter in high canopy forest at Caves Branch, Belize, 9 August 1972 (S. and J. Peck); two female paratypes 27 mi NW Stann Creek, Belize, 19 August 1972 (S. and J. Peck) [AMNH].

Diagnosis.–A medium sized species of the genus with distinctly dark, dusky brown, palps; and with palpal segments, a little more slender than in most species, the length/breadth ratio of the chela being 3.2-3.5.

Description.–Male and female much alike, but female a little larger and with slightly more robust palps. All parts well sclerotized; palps dark, blackish brown, carapace, tergites and chelicerae smoky brown, other parts lighter. Carapace longer than broad; surface smooth, but with few reticulations laterally; four large, corneate eyes of nearly equal size; usually a total of 28 setae, with six at anterior margin and four near posterior. Abdomen long, ovate; tergites and sternites entire; pleural membranes longitudinally, smoothly striate. Tergal chaetotaxy of holotype male 4:5:7:8:9:9:10:10:10:T6T:2T5T2:2; some male paratypes with five setae on tergite 1,



Figs. 22-23.–*Olpiolum paucisetosum,* new species: 22, dorsal view of left palp; 23, lateral view of right chela.
Figs. 24-25.–*Olpiolum fuscipalpum,* new species: 24, dorsal view of right palp; 25, lateral view of left chela.

with four on tergite 2, with six or eight on tergite 3, etc.; females usually with one or two more setae per tergite than males. Sternal chaetotaxy of holotype $9{:}(0)\frac{2\text{-}2}{3}(0){:}(0)6(0){:}10{:}9{:}8{:}9{:}9{:}8{:}1TT1{:}2$; other male paratypes generally similar; females with six setae on anterior genital operculum and two setae on posterior operculum, and usually with one or two more setae per sternite than males. Internal genitalia of females as in *O. paucisetosum.*

Chelicera about 0.4 as long as carapace; hand with five setae; flagellum of three setae, each distinctly dentate along one side in distal third; fixed finger with 6-8 low, retrorse, scale-like teeth; movable finger with prominent subapical lobe, rounded or slightly divided terminally; galea of male small, thin and with 1-2 subterminal rami or denticles; galea of female large, sturdy and with three prominent rami in distal half.

Palps generally typical; all surfaces entirely smooth; femur about 0.9 and chela about 1.5 times as long as carapace. Proportions of male chela as shown in Fig. 24; trochanter 1.75-1.85, femur 3.1-3.35, tibia 2.5-2.8, and chela (without pedicel) 3.2-3.5 times as long as broad; hand (without pedicel) 1.65-1.85 times as long as deep; movable finger 0.93-1.00 times as long as hand. Proportions of female palps: trochanter 1.65-1.75, femur 2.75-2.95, tibia 2.35-2.55, and chela (without pedicel) 2.85-3.1 times as long as broad; hand (without pedicel) 1.5-1.65 times as long as deep; movable finger 0.93-0.98 times as long as hand. Trichobothrium on femur about 0.25 length of segment from proximal end; trichobothria of chela as shown in Fig. 25. Fixed finger with 41-48 and movable finger with 40-46 contiguous marginal teeth; each finger with well developed venedens and venom apparatus, the ducts short.

Legs typical; leg I with telofemur distinctly shorter than basifemur; leg IV with entire femur of male 2.4-2.55 times as long as deep, slightly more slender in female; metatarsus of leg IV with a long tactile seta very near proximal end; arolia entire, though occasionally they may appear to be divided.

Measurements (mm).–Ranges for males given first, followed in parentheses by ranges for females. Body length 1.84-2.35(2.26-2.67). Carapace length 0.615-0.71(0.665-0.75). Chelicera 0.245-0.26(0.265-0.295) long. Palpal trochanter 0.325-0.38(0.355-0.385) by 0.185-0.21(0.215-0.22); femur 0.56-0.65(0.605-0.65) by 0.18-0.21(0.205-0.235); tibia 0.54-0.65(0.56-0.665) by 0.21-0.235(0.23-0.26); chela (without pedicel) 0.94-1.07(1.01-1.14) by 0.29-0.32(0.33-0.38); hand (without pedicel) 0.48-0.58(0.525-0.605) by 0.29-0.32(0.33-0.38); movable finger 0.48-0.54(0.52-0.57) long. Leg I: basifemur 0.26-0.31(0.295-0.325) by 0.095-0.11(0.105-0.22); telofemur 0.16-0.185 (0.185) by 0.095-0.105(0.10-0.11). Leg IV: entire femur 0.54-0.62(0.615-0.65) by 0.21-0.245(0.22-0.25); tibia 0.38-0.445(0.42-0.445) by 0.105-0.12 (0.11-0.125); metatarsus 0.21-0.245(0.245) by 0.065-0.075(0.075-0.085); telotarsus 0.16-0.18(0.18-0.185) by 0.05-0.055(0.06).

Etymology.–The species is named *fuscipalpum* for the distinctively dark palps.

Remarks.–*O. fuscipalpum* bears some resemblance to *O. monae* (Hoff) from Jamaica and Mona Island, but is slightly smaller, is darker in color and has entirely smooth palpal segments.

Subfamily Garypininae Daday

Serianus gratus Hoff

S. gratus Hoff, 1964, p. 36.

Described from numerous specimens from Jamaica.

New record.–One male, two females and one tritonymph from Landivar, Belize, 2 and 4 February 1970 (D. Simberloff) [FSCA].

FAMILY GARYPIDAE HANSEN

Subfamily Garypinae Simon

Planctolpium arboreum Hoff

P. arboreum Hoff, 1964, p. 41.

Described on basis of many individuals from Jamaica.

New records.–One male from leaf litter, 7 km SW Oxkutzcab, Yucatán, on 31 July 1973; one female from under rock at Oxkutzcab, Yucatán, on 31 July 1973; one female, 1 km S Muna, Yucatán, on 4 August 1973; one female from under rock, 3 km S Calcehtok, Yucatán, on 16 April 1973 (all taken by J. Reddell).

FAMILY ATEMNIDAE CHAMBERLIN

Paratemnus elongatus (Banks)

Atemnus elongatus Banks, 1895, p. 10.
Paratemnus elongatus, Hoff, 1946, p. 110; 1964, p. 2.

This species is common in Florida and has been recorded from Alabama (Hoff, 1964). It is likely that the *Paratemnus* found in the Virgin Islands (unpublished) belong to this species as well.

New records.–Many specimens found under the bark of living trees in and near Palenque, Chiapas, in March 1974, and at Tikal, El Petén, Guatemala, 6 April 1973 (C. H. Alteri).

FAMILY CHERNETIDAE MENGE

Lustrochernes communis (Balzan)

Chelifer communis Balzan, 1890, p. 416.
Lustrochernes communis, Beier, 1932, p. 90; Hoff, 1944, p. 3.

Originally described from Paraguay, Argentina and Brazil, this species has been recorded from Chiapas by Hoff (1944). However, because of the great uncertainties concerning the species within this and related genera, that record must be regarded with some caution.

Lustrochernes minor Chamberlin

L. minor Chamberlin, 1938, p. 114.

Described from 8 males, 10 females and 6 nymphs from Gongora Cave, Oxkutzcab, and Xkyc Cave, Calcehtok, both in Yucatán. No other specimens have been found.

Parachernes melanopygus Beier

P. melanopygus Beier, 1959, p. 213.

Described on basis of a single male from an undesignated locality in Ecuador.

New record.–One male taken from under bark of living tree at Palenque, Chiapas, on 15 April 1972 by C. H. Alteri.

Parazaona cavicola Chamberlin

P. cavicola Chamberlin, 1938, p. 118.

Described from two females and one nymph from San Bulha Cave and Kaua Cave, Yucatán. No other specimens have been found.

Hesperochernes inusitatus Hoff

H. inusitatus Hoff, 1946, p. 6.

Described from a single male from near Catharinas, Chiapas. No other specimens have been recognized.

FAMILY WITHIIDAE CHAMBERLIN

Parawithius (Victorwithius) rufeolus Beier
P. rufeolus Beier, 1959, p. 221.

Described on basis of three males and two females from Los Ríos, Pichilinque, Ecuador.

New record.–One male taken from stump litter at Palenque, Chiapas, on 6 April 1974 by C. H. Alteri.

Cacodemonius quartus Hoff

C. quartus Hoff, 1946, p. 18.

This species was originally described from one male and two females from Zacualpa, Chiapas.

New record.–One male and four females from 7 km SW Oxkutzcab, Yucatán, on 31 July 1973, by J. Reddell, D. Denson, M. Kawakatsu, and R. W., D. R., R. W. Jr., S. A. and S. R. Mitchell.

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A REVIEW OF THE CAVERNICOLE SCHIZOMIDA (ARACHNIDA) OF MEXICO, GUATEMALA, AND BELIZE

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INTRODUCTION

Members of the order Schizomida have been a neglected element of the soil and litter fauna of tropical and sub-tropical areas worldwide. In Central and North America schizomids are known from Panama north to the southern United States. The distribution in México appears to be limited to southern México and along the eastern edge of the Sierra Madre Oriental into Nuevo León. Isolated populations have been collected in caves and other moist habitats north and east from Nuevo León into southern Texas. Isolated relict species only distantly related to the Mexican and Texas forms are known from California and Arizona. *Schizomus portoricensis* (Chamberlin) from Florida and *S. mulaiki* Gertsch from Texas are the only species north of México with close relationship to the Mexican fauna.

Epigean schizomids are most frequently found beneath rocks and in leaf litter, but they are also found in rotting wood and in other organic debris. In caves they are also found occasionally running over silt banks and have been collected by berlese sifting of bat guano.

The order Schizomida includes two families. The entirely Mexican Protoschizomidae is represented by one epigean genus with one species from Tamaulipas and one from Colima, and another genus with three troglobitic species, two from San Luis Potosí and one from Hidalgo. The worldwide family Schizomidae is represented by a single genus containing about 30 species in North America.

Twenty-two described and 10 undescribed species of schizomids are known from México south of the Tropic of Cancer (Figs. 2-3). The endogean fauna of vast areas of southern México has not been sufficiently collected to speculate on the actual number of species in this area.

Schizomids lack true eyes, although some possess distinct "eyespots." These pale areas, one on each side of the anteriolateral portion of the carapace, presumably have some sensory function and probably serve as photoreceptors. In many species inhabiting caves, however, the eyespots are absent or are indistinct. The endogean nature of schizomids perhaps allows for their introduction into caves passively by flooding, or actively via moist, litter-filled entrance areas. They apparently are intolerant of low humidities and most species occur in areas with relatively high temperatures. In semi-tropical and temperate areas they probably survive low temperatures and humidity by retreating into the soil or into small crevices in the bedrock.

Epigean species compared to troglobitic species tend to be more robust with comparatively shorter appendages, and the color is usually darker (ranging from orange-brown to dark green). Cavernicoles are not necessarily troglobites and range from very dark, robust forms to elongate, pale forms. Those cavernicole species which have reduced pigment, slender elongate appendages, and lack eyespots are presumed to be restricted to the cave habitat.

Cavernicole species have been reported throughout the range of the order, there being relatively no more cavernicoles in temperate areas than in tropical areas. Fourteen described species other than those included in this report have been reported from caves. An additional nine species have been reported from caves in North and South America, but await formal description (Rowland, 1975a; unpublished data). The following is a list of the 50 cave-inhabiting schizomids together with distributional and bibliographic information:

Agastoschizomus huitzmolotitlensis Rowland, 1975b—Sótano de Huitzmolotitla, San Luis Potosí, México.
A. lucifer Rowland, 1971a—three caves near Valles, San Luis Potosí, México.
A. sp.—two caves in Hidalgo, México.
Schizomus arganoi Brignoli, 1973—Cueva de la Golondrina, Chiapas, México.
S. bartolo Rowland, 1973a—Grutas de San Bartolo, Nuevo León, México.
S. cavernicola Gravely, 1912—Farm Caves, Burma.
S. cookei Rowland, 1971b—Sótano de la Tinaja and Sótano de Yerbaniz, San Luis Potosí, México.
S. firstmani Rowland, 1973a—Grutas de Atoyac, Vera-Cruz, and possibly three caves near Acatlán, Oaxaca, México.
S. hanseni Mello-Leitao, 1931—Grottes B and C of Kulumuzi-Kiomoni, tropical East Africa, and Grotte de Hitajiva, Zanzibar (Hansen, 1926).
S. lanceolatus Rowland, 1975b—Cueva del Diablo, Veracruz, México.
S. lukensi Rowland, 1973c—Cueva del Agua and Cueva de la Virgen de Guadalupe, Tamaulipas, México.
S. machadoi Lawrence, 1958b—cave Ilunga-Nhongolo, Belgian Congo.
S. mexicanus Rowland, 1971b—16 caves in the Sierra de El Abra, San Luis Potosí and Tamaulipas, and the Sierra de Guatemala, Tamaulipas, México.
S. mitchelli Rowland, 1971b—3 caves in the northern Sierra de El Abra, Tamaulipas, México.
S. montanus Hansen, 1910—caves at Thysville and a cave at M'Boma, Belgian Congo (Lawrence, 1952).
S. moisii Rowland, 1973c—Grutas de Monteflor, Oaxaca, México.
S. negreai Dumitrescu, 1973—5 caves in Cuba.
S. pallidus Rowland, 1975b—Cueva Macinga, Veracruz, México.
S. parvus (Hansen), 1921—Cave 2, south of Pahu, French Equatorial Africa (Lawrence, 1958a; Strinati, 1960).
S. pecki Rowland, 1973a—Grutas del Coconá and Resumidero del Coconá, Tabasco, México.
S. pileti Brignoli, 1974b—Batu Caves, Kuala Lumpur, Malaysia.
S. portoricensis (Chamberlin), 1922—caves in Belize, Guatemala, Cuba, Jamaica, and Puerto Rico, and in Campeche, Chiapas, Oaxaca, Quintana Roo, Veracruz, and Yucatán, México.
S. reddelli Rowland, 1971b—Cueva de Tres Manantiales and Cueva de los Vampiros, Tamaulipas, México.
S. rowlandi Dumitrescu, 1973—Cueva de las Columnas and Cueva La Majana, Cúba.
S. sauteri Kraepelin, 1912—3 caves in the Ryukyu Islands (Yamasaki and Shimojana, 1974).
S. sbordonii Brignoli, 1973—Cueva del Ojo de Agua Grande and possibly Grutas de Atoyac, Veracruz, México.
S. schoutedeni (Roewer), 1954—4 caves at Thysville and 1 cave at Tiasi, Belgian Congo.
S. shoshonensis (Briggs and Hom), 1972—Upper Shoshone Cave, California, U. S. A.
S. siamensis (Hansen, in Hansen and Sõrensen), 1905—4 caves in the Ryukyu Islands and Yin-chuan-tsang-hsia-tung Cave, Taiwan (Yamasaki and Shimojana, 1974).
S. sijuensis Gravely, 1924—Siju Caves, Assam.
S. silvino n. sp.—Gruta de Silvino, Izabal, Guatemala.
S. stewarti Rowland, 1973c—Cueva del Guayabo, Oaxaca, México.
S. tenuipes Lawrence, 1969—Cavernes Patates, Island of Rodriguez.
S. trilobatus Rowland, 1975b—Grutas del Coconá, Tabasco, México.
S. sp. 1—Grutas de Cacahuamilpa, Guerrero, México (Rowland, 1975a).
S. sp. 2—Cueva de los Cuarteles, Tamaulipas, México.
S. sp. 3—3 caves near Comitan, Chiapas, México (Rowland, 1975a).
S. sp. 4—St. Herman's Cave, Belize (Rowland, 1975a).
S. sp. 5—Grutas de Monteflor, Oaxaca, México (Rowland, 1975a).
S. sp. 6—3 caves near Cuetzalan, Puebla, México.
S. sp. 7—Cueva del Rancho Santa María, Veracruz, México.
S. sp. 8—Cousin's Cove Cave No. 1, Jamaica (Rowland, 1975a).
S. sp. 9—Oxford Cave and St. Claire Cave, Jamaica (Rowland, 1975a).
S. sp. 10—Windsor Great Cave and Mosley Hall Cave, Jamaica (Rowland, 1975a).
S. sp. 11—17 caves in Jamaica (Rowland, 1975a).
S. sp. 12—Jackson Bay Cave, Jamaica (Rowland, 1975a).
S. sp. 13—3 caves on Mona Island, Puerto Rico (Rowland, 1975a).
S. sp. 14—Grotte de Baños, Ecuador (Rowland, 1975a).

S. sp. 15–Main Cave, Los Tayos, Ecuador.
S. sp. 16–Main Cave and Shovel Pot, Los Tayos, Ecuador.

This report includes all literature citations and locality records (published and unpublished) for the cavernicole schizomids of México, Belize, and Guatemala. In addition, *Schizomus portoricensis* is redescribed and *S. silvino,* new species, from Guatemala is described. Records for eight undescribed species and all records of unidentified schizomids are given. The terminology used in the descriptions follows that of Rowland (1975a).

The following abbreviations are used for institutions in which material is deposited: American Museum of Natural History, New York (AMNH); Institut royal des Sciences naturelles de Belgique, Brussells (ISB); Instituto de Zoología, Academia de Ciencias, La Habana, Cúba (IZC); Istituto di Zoologia dell'Università di Roma (IZR); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ); The Museum, Texas Tech University, Lubbock, Texas (TTU).

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FAMILY PROTOSCHIZOMIDAE

Agastoschizomus Rowland

Agastoschizomus Rowland, 1971a:13. Type: *Agastoschizomus lucifer* Rowland, 1971a (monotypy); Rowland, 1973a:202; Rowland, 1975a:28; Rowland, 1975b:5.

Agastoschizomus lucifer Rowland

Agastoschizomus lucifer Rowland, 1971a:15, 17, fig. 1-8; Reddell and Mitchell, 1971a:145, fig. 3-4; Dumitrescu, 1973:282; Rowland, 1973a:10; Rowland, 1973b; 197, 202, fig. 2, 4; Rowland, 1973c: 136; Reddell, 1973:33, 38; Reddell and Elliott, 1973a:171; Brignoli, 1974a:150; Rowland, 1975a: 8-9, 14-15, 27, 28, 43-45, 46-47, 48-49, 50, 167-168, 181, 211, fig. 1, 8, 13, 16, tab. 2, map 3; Rowland, 1975b:6, 8, 9, 10, fig. 4.
Agastochizomus lucifer: Rowland, 1971a:15 [*lapsus calami*].

Distribution.–Known only from three caves in the southern Sierra de El Abra near Ciudad Valles, San Luis Potosí, México (Fig. 1).

Remarks.–Members of the genus *Agastoschizomus* are troglobites and are the largest members of the order. This species is often found on silt banks and on walls in Sótano de la Tinaja and Sótano de Yerbaniz.

Records.–*San Luis Potosí:* Sótano de Matapalma, 21 km N Ciudad Valles, 29 May 1969, R. Mitchell, F. Abernathy, T. Albert, 1 immature (AMNH); 30 December 1972, R. Fieseler, 1 immature (AMNH). Sótano de la Tinaja, 10 km NNE Ciudad Valles, 9 April 1966, J. Fish, D. McKenzie, 1 male (holotype AMNH), 1 female (paratype, AMNH), 1 immature (AMNH); 7 January 1970, R. W. Mitchell, 1 female, 1 immature (AMNH); 18 February 1970, J. A. L. Cooke, 2 males, 1 female, 4 immatures (AMNH); 18 February 1970, R. W. Mitchell, 2 females, 1 immature (TTU); 16 March 1972, D. Kiser, 1 immature (TTU); 29 May 1974, J. Prentice, 1 female (TTU). Sótano de Yerbaniz, 22.5 km N Ciudad Valles, 7 January 1970, S. Wiley, 1 female, 4 immatures (TTU); 7 January 1970, W. Elliott, 1 male, 1 female (TTU); 9 January 1970, W. Elliott, S. Wiley, 1 female, 1 immature (TTU); 17 February 1970, R. W. Mitchell, 1 female, 9 immatures (TTU); 28 March 1970, W. Elliott, 1 female (allotype, AMNH), 4 immatures (TTU); 8 January 1971, W. Elliott, 1 male (paratype, AMNH), 1 immature (TTU).

Agastoschizomus huitzmolotitlensis Rowland

Agastoschizomus huitzmolotitlensis Rowland, 1975b: 6, 8-10, fig. 3; Rowland, 1975a:28, 44, 45, 46-47, 48-49, 50, 167-168, fig. 17, tab. 2, map 3.
Schizomus sp.: Reddell, 1967c:106; Reddell, 1971b: 28 [Sótano de Huitzmolotitla record only].

Distribution.–This species is known only from Sótano de Huitzmolotitla, San Luis Potosí, México (Fig. 1).

Remarks.—This species is somewhat smaller and appears to be more cave-adapted than *A. lucifer.*

Records.—*San Luis Potosí:* Sótano de Huitzmolotitla, 2 km SW Tlamaya, and approximately 10 km N Xilitla, 24 January 1964, T. Raines, T. Phillips, 1 male (holotype, AMNH).

Agastoschizomus sp.

Distribution.—This species is known from two caves in northern Hidalgo (Fig. 1).

Remarks.—This troglobite remains undescribed due to the lack of a male. It is approximately the same size as *A. lucifer.*

Records.—*Hidalgo:* Sótano del Hondo de Pinalito, Hwy 85, 1 January 1976, C. Soileau, P. Strickland, 1 female, 1 immature (TTU). Cueva Piedra Ancha, 19 August 1965, J. Reddell, J. Fish, 1 immature (TTU).

Fig. 1.—Map showing distribution of cave-inhabiting *Agastoschizomus* in México: ● *A. lucifer;* ♦ *A. huitzmolotitlensis;* ★ *A.* sp.

FAMILY SCHIZOMIDAE

Schizomus Cook

Nyctalops Cambridge, 1872:410 (jun. hom.). Type: *N. crassicaudata* (sub. des., Cook, 1899).
Schizonotus Thorell, 1888:358 (jun. hom.) nom. subst. pro *Nyctalops* (non *Nyctalops* Wagler, 1832); Kraepelin, 1897:50; Kraepelin, 1899:233.
Tripeltis Thorell, 1889:554 (jun. hom.). Type: *T. grassii* (orig. des.).
Trithyreus Kraepelin, 1899:234, nom. subst. pro *Tripeltis* (non *Tripeltis* Cope, 1887) in part.
Triplomus Cook, 1899:250 (jun. obj. syn.) nom. subst. pro *Tripeltis* (non *Tripeltis* Cope, 1887).
Hubbardia Cook, 1899:250 (jun. subj. syn.). Type: *H. pentapeltis* Cook (monotypy).
Artacarus Cook, 1899:254 (jun. subj. syn.). Type: *A. liberiensis* Cook (monotypy).
Schizomus Cook, 1899:249. nom. subst. pro *Schizonotus* (non *Schizonotus* Ratzeburg, 1852).
Stenochrus Chamberlin, 1922:11 (jun. subj. syn.). Type: *S. portoricensis* Chamberlin (monotypy).
Heteroschizomus Rowland, 1973a:1 (jun. subj. syn.). Type: *H. goodnightorum* Rowland (monotypy). NEW SYNONYMY.

Remarks.–*Heteroschizomus* was erected for a species with greatly attenuated abdominal segments in the male (Rowland, 1973a). The discovery of other species with attenuation of distal abdominal segments necessitates the placement of this genus in the synonymy of *Schizomus.*

Schizomus stewarti Rowland

Schizomus stewarti Rowland, 1973c:136, 139-140, fig. 3; Rowland, 1975a:34, 128, 129-130, 131-132, 133-134, 152-153, 154-155, 160-161, 361-362, 363-364, 387, fig. 119, 130, 291, tab. 7-8, 28, map 7.

Distribution.–This species is known only from Cueva del Guayabo, Oaxaca, México (Fig. 3).

Remarks.–*S. stewarti* is related to a group of species which ranges from South America to southern México. It is darkly pigmented and possesses distinct eyespots and so may be expected from the surface in the vicinity of Valle Nacional.

Records.–*Oaxaca:* Cueva del Guayabo, 12 km NE Valle Nacional, 29 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 male (holotype, AMNH), 1 immature (paratype, AMNH).

Schizomus trilobatus Rowland

Schizomus trilobatus Rowland, 1975b:6, 7, 11-13, fig. 5; Rowland, 1975a:34, 128, 129-130, 131-132, 134-135, 136, 151, 152-153, 154-155, 158-159, 160-161, 209, 241, 361-362, 363-364, 387, figs. 120, 131, 146, 291, tab. 7-8, 28, map 7.

Distribution.–This species is known only from Grutas del Coconá, Tabasco, México (Fig. 3).

Remarks.–This green species possesses distinct eyespots. It was taken from washed-in litter in the twilight zone of Grutas del Coconá and may appear in surface collections from the general vicinity of Teapa. The troglobitic *S. pecki* inhabits the dark zone of Grutas del Coconá. *S. trilobatus* belongs to the group of species to which *S. stewarti* belongs. The other Mexican representative of this group is the epigean *S. lacandonus* Rowland from Ruinas de Palenque, Chiapas.

Records.–*Tabasco:* Grutas del Coconá, 3 km NE Teapa, 24 July 1973, J. Rowland, J. Reddell, 1 male (holotype, AMNH), 1 male (paratype, TTU), 1 female (allotype, AMNH), 5 females (paratypes, TTU).

Schizomus bartolo Rowland

Schizomus bartolo Rowland, 1973a:13-16, 18, figs. 11-13, tab. 1; Rowland, 1973c:135, 137; Rowland, 1975a:34, 166, 169, 173-174, 176, 177, 214-215, 218-219, 222-223, 228-229, 366-367, 368-369, 394, figs. 158, 174, 193, 292, tab. 9, 11, map 5.
Schizomus sp.: Reddell, 1967a:25; Reddell, 1971b: 28 [Grutas de San Bartolo record only].

Distribution.–This species is known only from Grutas de San Bartolo and Gruta Sur de San Bartolo, Nuevo León, México (Fig. 2).

Remarks.–This troglobite lacks eyespots, is pale, and has unusually elongate appendages; it is now isolated in Grutas de San Bartolo by the surrounding desert. It joins *S. davisi* Gertsch, *S. mulaiki* Gertsch, *S. lukensi* Rowland, *S. mexicanus* Rowland, and *S.* sp. 2 as relicts of a once widely-distributed common ancestor. Grutas de San Bartolo is a name which refers to two nearby caves which are distinguished from each other by use of Sur and Norte. It is not known from which cave the type specimens were collected.

Records.–*Nuevo León:* Grutas de San Bartolo, 16 km SW Monterrey, 21 June 1969, S. and J. Peck, 1 male (holotype, AMNH), 1 female (allotype, AMNH), 8 immatures (paratypes, AMNH); September 1971, T. Raines, 4 females (paratypes, TTU). Gruta Sur de San Bartolo, 16 km SW Monterrey, February 1966, B. Russell, 4 females, 4 immatures (AMNH).

Schizomus lukensi Rowland

Schizomus lukensi Rowland, 1973c:136-137, figs. 1, 4; Rowland, 1975a:34, 166, 169, 174, 175-176, 177, 214-215, 218-219, 222-223, 228-229, 366-

367, 368-369, 394, figs. 160, 173, 191-192, 292, tab. 9, 11, 30, map 5; Rowland, 1975b:19, 20.

Distribution.–This species is known from two caves in the Sierra de Tamaulipas southwest of Soto la Marina, Tamaulipas, México (Fig. 2).

Remarks.–This pale species lacks eyespots and thus appears to be a troglobite. It is apparently restricted to the cave habitat, as is its close relative *S. bartolo,* by the surrounding desert. Rowland (1975a) tentatively identified a female from Cueva de los Cuarteles, 10 km SW Aldama, Tamaulipas, as *S. lukensi.* A recent collection containing males from this cave indicates, however, that the Cueva de los Cuarteles population is best treated as a separate species (see Species 2, below).

Records.–*Tamaulipas:* Cueva del Agua, 48 km SW Soto la Marina, 31 October 1970, W. Russell, G. Ediger, J. Ediger, 3 males (holotype, paratypes, AMNH),

Fig. 2.–Map showing distribution of troglobitic *Schizomus* in México and Belize: ◇ *S. pecki;* ● *S. cookei;* ▲ *S. firstmani;* ◆ *S. lukensi;* ϕ *S. pallidus;* ★ *S. mitchelli;* ♠ *S. bartolo;* ⊕ *S. reddelli;* ○ *S.* sp. 1; □ *S.* sp. 2; ☆ *S.* sp. 4; ■ *S.* sp. 6.

3 females (allotype, paratypes, AMNH). Cueva de la Virgen de Guadalupe, 48 km SW Soto la Marina, 31 October 1970, W. Russell, G. Ediger, J. Ediger, 1 female (TTU).

Schizomus reddelli Rowland

Schizomus reddelli Rowland, 1971b:123, 124, 126, figs. 13-15, tab. 5; Reddell and Mitchell, 1971b: 185; Rowland, 1973a:21; Rowland, 1973c:135; Reddell, 1973:38; Brignoli, 1974a:147, 149; Rowland, 1975a:34, 166, 169, 177, 178-179, 181, 214-215, 218-219, 220-221, 228-230, 366-367, 368-369, 394, figs. 159, 175, 189-190, 292, tab. 9, 11, 30, map 5.

Schizomus mexicanus: Reddell and Mitchell, 1971b: 185 [misidentification]; Vomero, 1974:341 [misidentification].

Distribution.—This species is known from two caves in the Sierra de Guatemala, north of Chamal, Tamaulipas, México (Fig. 2).

Remarks.—Eyespots in this species are either indistinct or lacking and it is probably a troglobite. *S. reddelli* is most closely related to, and morphologically most similar to *S. mexicanus.*

Records.—*Tamaulipas:* Cueva de Tres Manantiales, 8 km NNE Chamal, 27 May 1968, J. Reddell (holotype, AMNH); January 1972, W. Russell, 1 female, 1 immature (TTU). Cueva de los Vampiros, 10 km NNE Chamal, 27 May 1968, J. Reddell, 1 male, 3 females, 5 immatures (TTU).

Schizomus mexicanus Rowland

Schizomus mexicanus Rowland, 1971b:117-119, figs. 1-3, 16; Reddell and Mitchell, 1971a:145; Rowland, 1973a:10, 21, 22, figs. 20, 22; Rowland, 1973b:200-201, fig. 1; Rowland, 1973c:135, 137; Brignoli, 1973:6; Reddell, 1973:38; Reddell and Elliott, 1973b:183; Brignoli, 1974a:143, 146-147, 149, 151, fig. 1c; Vomero, 1974:341, 345; Rowland, 1975a:10-11, 33, 166, 169, 177, 179, 180-184, 211, 213, 214-215, 218-219, 220-221, 224-225, 228, 230, 366-367, 368-369, 394, figs. 2, 171-172, 185-187, 207-210, 292, tab. 9, 11, 30, map 5; Rowland, 1975b:15, 19, 20.

Schizomus sp.: McKenzie, 1965:35, 37; Reddell, 1967b:82; Reddell, 1971b:28 [Cueva Grande and Ventana Jabalí records only]; Reddell and Mitchell, 1971a:145; Reddell and Elliott, 1973b:183.

Distribution.—This species is known from cave and epigean localities in the Sierra de El Abra, San Luis Potosí and Tamaulipas; and from the Sierra de Guatemala, Tamaulipas, México (Fig. 3).

Remarks.—This troglophile ranges throughout the Sierra de El Abra both within caves and on the surface. It also occurs in lowland caves and surface localities in the southern Sierra de Guatemala. *S. mexicanus* occurs sympatrically with *A. lucifer* and *S. cookei,* both troglobites, in Sótano de la Tinaja. Another troglobitic species, *S. mitchelli,* apparently excludes *S. mexicanus* from Cueva de la Florida and Cueva de El Pachón. *S. mexicanus* can co-exist with *S. cookei* in Sótano de la Tinaja, but not with the extremely similar *S. mitchelli* in Cueva de la Florida and Cueva de El Pachón. This is probably due to the nature of the caves rather than to grossly different adaptive strategies in the two situations. The former is an immense cavern which receives frequent and enormous input of materials via surface drainage, while the latter caves receive much less insurgence of materials. Considerable input of leaf litter in Sótano de la Tinaja may create the necessary dimensions which allow *S. mexicanus* and *S. cookei* to co-exist.

Records.—*San Luis Potosí:* Sótano del Arroyo, 10 km NE Ciudad Valles, 25 November 1962, J. Reddell, 1 female, 1 immature (AMNH). Cueva Chica, 16 km SE Ciudad Valles, 28 March 1967, R. Mitchell, 1 immature (TTU); 5 June 1967, R. Mitchell, 2 males, 5 females, 5 immatures (TTU); 31 January 1968, J. Reddell, J. George, 2 males, 3 females (TTU); 30 January 1969, J. Reddell, 1 male, 5 females, 6 immatures (TTU); 23 May 1971, W. Elliott, 1 female (TTU). Cueva Grande, 14 km SE Valles, 6 September 1967, J. Reddell, D. McKenzie, 1 female (AMNH). Cueva de los Monos, 14 km NE Ciudad Valles, 29 July 1970, J. Fish, 1 female (TTU). Sótano de Pichijumo, 11 km NE Ciudad Valles, 1 June 1968, J. Reddell, 2 females, 6 immatures (TTU); 26 January 1969, J. Reddell, T. Mollhagen, A. Smith, 2 males, 1 female, 1 immature (TTU); 29 November 1969, V. Sbordoni, 1 immature (Brignoli, 1974a). Cueva Pinta, 12 km NE Ciudad Valles, 31 January 1969, J. Reddell, W. Russell, 1 female (TTU). Sótano de las Piedras, 7.5 km NE Ciudad Valles, 28 March 1970, W. Elliott, 2 females, 5 immatures (TTU). Cueva de Los Sabinos, 12 km NE Ciudad Valles, 27 January 1969, J. Reddell, 1 male, 3 females, 5 immatures (TTU). Cueva de Taninul No. 1, 13 km SE Ciudad Valles, 27 March 1967, R. Mitchell, 2 males, 4 females, 4 immatures (TTU); 5 June 1967, R. Mitchell, 2 females, 3 immatures (TTU); 28 November 1969, R. Argano, V. Sbordoni, 1 male, 9 females, 6 immatures (Brignoli, 1974a); 29 March 1970, W. Elliott, 4 females, 3 immatures (TTU). Cueva de Taninul No. 4, 11 km SE Ciudad Valles, 11 July 1969, S. Peck, J. Peck, 1 female (TTU). Sótano del Tigre, 16 km NE Ciudad Valles, 1 February 1968, J. Reddell, R. Mitchell, 3 males, 3 females, 4 immatures (TTU). Sótano de la Tinaja, 10.5 km NE Ciudad Valles, 6 June 1967, J. Reddell, D. McKenzie, L. Manire, 1 male, 2 females (AMNH); 13 March 1969, J. Reddell, 1 male, 5 females, 8 immatures (TTU); 18 February 1970, J. A. L. Cooke, 2 males (holotype, paratype, AMNH), 3 males (AMNH), 2 females (allotype, paratype, AMNH), 6 females, 6 immatures (AMNH); 8 January 1971, W. Elliott, R. Shepperd, 7 immatures (TTU); 24 May 1971, M. Brownfield, 1 female, 2 immatures (TTU); 16 March 1972, G. Campbell, 1 male, 2 immatures (TTU); 16 March 1972, R. Mitchell, 1 female, 1 immature (TTU); 16 March 1972, D. Kiser, M. Brownfield, 1 female, 2 immatures (TTU); 20 February 1973, W. Graham, 2 females, 4 immatures (TTU); 20 February 1973, T. Mollhagen, 1 immature (TTU); 2 January 1975, C. Soileau, P. Strickland, 1 female (TTU). Ventana Jabalí, 10 km NW Tamuín, 26 March 1964, T. Raines, D.

Fig. 3.–Map showing distribution of troglophile *Schizomus* in México, Belize, and Guatemala: ♠ *S. arganoi;* ⊕ *S. mexicanus;* ★ *S. moisii* and *S.* sp. 5; ■ *S. sbordonii;* ☆ *S. stewarti;* ◆ *S. trilobatus;* ● *S. lanceolatus;* ◇ *S. silvino;* ▲ *S.* sp. 3; □ *S.* sp. 7.

McKenzie, B. Bell, 1 female (AMNH). Valles, 19 July 1956, W. Gertsch, V. Roth, 3 immatures (AMNH). 12 km N Valles, 28 November 1964, J. Reddell, 1 male (AMNH).

Tamaulipas: Sótano de Jineo, 1 km NW Gómez Farías, 17 May 1971, W. Elliott, 1 female (TTU). Cueva del Nacimiento del Río Frío, 6 km S Gómez Farías, 15 February 1970, R. Mitchell, 1 female (TTU); 16 February 1970, S. Wiley, 1 male, 1 female, 1 immature (TTU); 15 March 1972, R. Mitchell, 1 female (TTU). Arroyo del Nacimiento del Río Frío, 16 February 1970, J. Reddell, 4 females, 4 immatures (TTU). Surface, near Cueva de la Florida, 16 km SSW Ciudad Mante, 20 July 1973, J. Rowland, J. Reddell, 3 males, 1 immature (TTU).

Schizomus pallidus Rowland

Schizomus pallidus Rowland, 1975b:7, 13-15, 17, fig. 6; Rowland, 1975a:34, 166, 167-168, 169, 184-186, 188, 216-217, 218-219, 222-223, 228, 230, 280, 366-367, 368-369, figs. 166, 179, 196, 292, tab. 9, 11, 30, map 5.

Distribution.—This species is known only from Cueva Macinga, Veracruz, México (Fig. 2).

Remarks.—This pale species with elongate appendages is probably a troglobite despite the presence of indistinct eyespots. It is the largest species of those related to *S. mexicanus,* and has been collected from under rocks on silt in a side passage to the cave.

Records.—*Veracruz:* Cueva Macinga, Tlilapan, 5 March 1973, J. Reddell, 1 male (holotype, AMNH), 1 male (TTU), 1 female (allotype, AMNH), 2 females, 2 immatures (TTU); 9 January 1977, J. Reddell, A. Grubbs, D. McKenzie, C. Soileau, 1 female, 3 immatures (TTU).

Schizomus portoricensis (Chamberlin)
Figs. 4-18

Stenochrus portoricensis Chamberlin, 1922:11-12; Mello-Leitão, 1931:19; Giltay, 1935:8; Werner, 1935:469; Takashima, 1943:93; Rowland, 1973b: 195, 197, 200; Brignoli, 1974a:145.

Schizomus antilus Hilton, 1933:91-92; Giltay, 1935:6; Takashima, 1943:94. SUGGESTED SYNONYMY. Female types from Corall [=Corral] Nuevo (1500 ft.), and near Havana, Cuba, reportedly deposited in the Pomona College (California) collection, not examined.

Schizomus cavernicolens Chamberlin and Ivie, 1938: 102, 103, figs. 4-7; Gertsch, 1940:4; Takashima, 1943:94; Pearse, 1945:153; Cárdenas Figueroa, 1950:154; Nicholas, 1962:181; Vandel, 1964:116; Vandel, 1965:93; Reddell, 1971b:28; Rowland, 1971b:117; Brignoli, 1974a:149, NEW SYNONYMY. Female holotype from Xkyc Cave (=Actún Xkyc), Yucatán, México, deposited in the American Museum of Natural History, examined.

Schizomus probably *latipes* Hansen and Sõrensen: Cloudsley-Thompson, 1949:261 [misidentification].

Schizomus floridanus Muma, 1967:18-20, figs. 13-15; Rowland, 1971c:304. NEW SYNONYMY. Female holotype from Ross and Castellow Hammock, Dade County, Florida, United States, deposited in the American Museum of Natural History, examined.

Schizomus longimanus Rowland, 1971b:119-120, figs. 4-6, 17; Reddell, 1973:38; Rowland, 1973a:13, fig. 21; Rowland, 1973c:135, 137; Brignoli, 1973: 6, 7, 8, 9, figs. 1-2; Brignoli, 1974a:143, 144, 146, 147, 151, fig. 1b; Rowland, 1975b:15, 17, 19, 20. NEW SYNONYMY. Male holotype and female allotype from Cueva Cerro Hueco, 3 km SE Tuxtla Gutiérrez, Chiapas, México, deposited in the American Museum of Natural History, examined.

Holotype.—An adult female taken in November, 1899, at Coamo Springs, Puerto Rico, and deposited in the Museum of Comparative Zoology, examined.

Paratypes.—Several females taken with the holotype, and deposited in the Museum of Comparative Zoology, examined.

Description of a male and female from 1 km S Muna, Yucatán, México.—Male, Color brownish green. Carapace with two pairs of dorsal and two apical setae. Eyespots distinct, vaguely triangular. Anterior sternum with nine bifid setae, posterior sternum with bifid setae. Abdominal terga I-VII with two setae, terga VIII-IX with four setae, segment XII with no evidence of posterodorsal process. Vestigial stigmata slightly darker than sterna. Flagellum ovoid, with a pair of median depressions. Pedipalpal trochanter produced distally, other segments slightly elongate. Tarsal-basitarsal spurs about 1/7, claw about 1/3 length of tarsus-basitarsus. Tarsal-basitarsal segments of leg I of the following approximate proportions: 49-6-8-8-8-8-18. Other leg segment measurements given in Table 1.

Female. Females differ from the males in the following respects: flagellum with 3 sections; pedipalps not elongate; first legs noticeably shorter; eyespots less distinct; color less greenish. Spermathecae with median and lateral lobes outwardly divergent; medians heavily sclerotized along entire length; laterals much reduced and weakly sclerotized.

Comparisons.—*S. portoricensis* is most similar and cladistically most proximal to *S. pallidus* (Rowland, 1975a). The flagellum is similar in males of the two species, but is longer in *S. pallidus* (0.53 mm) than in *S. portoricensis* (0.42 mm). The females are separable on the basis of the flagella also, which is longer in *S. pallidus* (0.45 mm) than in *S. portoricensis* (0.30 mm). The carapacial length in both sexes of *S. pallidus* is about 1.4 mm while that of *S. portoricensis* is about 1.25 mm at largest, and is usually about 1.05 mm. *S. pallidus* has three pairs of dorsal carapacial setae, whereas *S. portoricensis* has two pairs.

Within its range in México *S. portoricensis* can always be distinguished by its two pairs of dorsal carapacial setae and small size. The only other Mexican species with only two pairs of dorsal setae (*S. pecki* Rowland and an undescribed species from Las Ruinas de Palenque, Chiapas) are large, over 1.5 mm carapacial length. Elsewhere, *S. portoricensis* occurs with two other species that also have two pairs of dorsal carapacial setae. These species are *S. rowlandi* Dumitrescu, a troglobite, and an undescribed species related

Fig. 4.–Map showing distribution of *Schizomus portoricensis* in México, Belize, and Guatemala: ◆ epigean collections; ● cave collections. Inset shows general distribution of *S. portoricensis*.

to the latter, both from Cúba. These species, however, are much larger with carapacial lengths of about 1.7 mm. Females of *S. portoricensis* can be distinguished from females of all other species within its range having two pairs of dorsal setae by the long flagella in the other species, which are about 0.40 mm or longer.

The form of the spermathecae, though relatively constant, may not, considering the variability of this character in other species, be safely distinguished from that of *S. silvino* n. sp., *S. pallidus,* and a specimen from Grutas de Atoyac, Veracruz (which is perhaps referable to *S. sbordonii).*

The median spermathecal lobes of this, and a few other species, are heavily sclerotized and are visible without dissection through the genital sternite. Fig. 18 illustrates the spermatheca as it generally appears through the genital sternite in *S. portoricensis.*

Variation.—This widespread species has several geographic isolates. Females from three widely separated localities have been measured and the descriptive statistics are given in Table 1.

The sexual population from Cueva Cerro Hueco, Chiapas, differs from the widespread sexual individuals encountered at lower elevations in Chiapas and in the Yucatán Peninsula by the consistently greater size. In particular, the males from Cueva Cerro Hueco always have greatly elongate first legs. However, the discovery of a single male at Ciudad del Carmen, Campeche, and another from the entrance of Cenote (=Cueva) de Hoctún, Yucatán, with the first legs and carapacial lengths only slightly shorter than those of males from Cueva Cerro Hueco, shows that these character states are not unique to the latter population. Females from different populations are not easily distinguished, even from widely separated localities. It will be noted in Table 1, however, that the measurements differ somewhat from locality to locality. A single classification analysis of variance, for example, shows that there is a significant ($p < .025$) added variance component among populations from Yucatán, Florida, and the Galapagos Islands for length of the patella of the first leg. Gabriel's (1964) sum of squares simultaneous test procedure (SS-STP), however, shows that the Florida and Yucatán populations, when tested at a .05 critical level, form a homogeneous set in regard to the same character.

The morphology of the spermatheca is unusually consistent throughout the range of *S. portoricensis.* No other species studied shows this much consistency, even at a single locality. The lateral tubes, however, seem to be much larger in the Cueva Cerro Hueco population.

Remarks.—Males of *S. portoricensis* are known from Nicaragua, Guatemala, Puerto Rico, and Chiapas, Campeche, and Yucatán, México. Well-collected locations in which males are unknown are Florida, Jamaica, and the Galapagos Islands. These populations probably represent, at least in part, parthenogenetic clones, and we suspect that, since evidence of males from outside nuclear Central America is limited to a single specimen from Puerto Rico, outlying populations are generally parthenogenetic. We have found no consistent morphological difference between parthenogenetic and sexual females, and so it is not yet possible, short of rearing them, to determine the reproductive nature of populations in question.

Collections suspected to represent parthenogenetic clones come from Yucatán, Florida, Bermuda, Cúba, St. Croix (Virgin Islands), Puerto Rico, Jamaica, Ecuador, Colombia, and the Galapagos Islands. An introduced population represented only by females at the Cambridge University Botanical Gardens (Cloudsley-Thompson, 1949) is probably also parthenogenetic. Populations from Oaxaca and Veracruz, which are represented in collections only by females, are questionable with respect to sexuality.

In Yucatán there exists a remarkable difference in the sex ratios of collections from epigean and cave situations. Fifteen collections from surface localities have yielded 25 males, 9 females, and 13 immature individuals, while 53 collections from caves have yielded 6 males, 122 females, and 98 immature individuals. A contingency table analysis of the above data shows that there is a significant ($p < .001$) difference in the data sets. This striking paucity of males leads us to believe that most caves contain parthenogenetic clones. It is highly unlikely, considering the nonvagile nature of schizomids, that females seek out cave habitats and that males, born to a cave environment, seek epigean habitats. It seems far more likely that some populations of *S. portoricensis* are parthenogenetic.

The distribution of sexual populations in epigean habitats and parthenogenetic clones in caves raises interesting questions about the reproductive biology of this species which unfortunately cannot be adequately answered with available information. Some important questions to answer are: (1) are the parthenogenetic clones, both on the Peninsula and elsewhere, of polyphyletic origin; (2) are parthenogenetic females able to back cross to the sexual populations given the opportunity; and (3) is there a behavioral difference between males and females such that females are suited, and males unsuited, to a cavernicolous existence. *S. portoricensis* would seem most likely to be facultatively parthenogenetic and the various clones, both local and widespread, to have polyphyletic origins. This being the case, parthenogenetic females may further be able to back cross to the sexual population.

The parthenogenetic nature of cave populations may be due to an unsuitability of males to cavernicolous environments. Males and females of most species, as in *S. portoricensis,* are dimorphic, which probably allows some degree of niche separation. Perhaps the behavioral differences between the sexes are so great in this species that, while the female is suited to cavernicolous life, the male is less suited.

Most areas outside the Yucatán Peninsula are apparently occupied by parthenogenetic clones, but this observation may be an artifact of collecting. *S. portoricensis* may simply be rarer in epigean habitats, and a bias for cave collecting in the Antilles may be the reason for the apparent rarity of males. The Antilles are represented by 26 cave collections totalling one mature male and 102 mature females, and 13 surface collections totalling 24 mature females. The peninsula of Florida is represented, however, by 30 surface collections totalling 49 mature females and Santa Cruz Island, Galapagos Islands, is represented by two surface collections totalling 25 mature females. Moreover, the segregation of parthenogenetic and sexual populations may occur at cave entrances in the Antilles as it does in Yucatán. The relatively large surface collections from Florida and the Galapagos, however, suggest that these populations may be totally parthenogenetic.

Males may appear in outlying populations by dispersal from sexual populations, or may arise through some genetic mechanism from a parthenogenetic parent. Apparently the most common means of maintaining thelytokous parthenogenesis is by reunion of haploid meiotic nuclei in pairs (White, 1970). In this case males may occasionally be produced, but these males are usually rare and sterile. Such a paucity of information is available on the distribution of males in outlying areas that determination of their role in population dynamics is impossible. Cytological studies on individuals from parthenogenetic clones in Florida and Yucatán, and individuals from sexual populations in Yucatán might give evidence of the relationships of the sexual and asexual populations and further clarify the status of males in outlying areas.

Distribution.—*S. portoricensis* is known from Bermuda, Florida, Campeche, Chiapas, Oaxaca, Veracruz, Yucatán, Quintana Roo, Belize, Guatemala, Nicaragua, Cúba, Dominica, Jamaica, Puerto Rico, Virgin Islands, Colombia, Ecuador, Galapagos Islands, and England (introduced). The ancestral populations of *S. portoricensis* probably arose in nuclear Central America sometime before the appearance of the greatest part of the Yucatán Peninsula (Late Pliocene). After emergence of the Yucatán shelf its ancestors, probably along with progenitors of *S. goodnightorum* (Rowland), moved northward into the Peninsula, up to and then beyond the Isthmus of Tehuantepec, and west of the Chiapas Highlands to the Chiapa Depression. Once established and widespread on the Peninsula the sexual species probably began giving rise to parthenogenetic clones. From Yucatán the parthenogenetic females may have rafted onto the Greater Antillean Islands and Florida. From Florida, or perhaps directly from Yucatán, they have also reached Bermuda. Overland dispersal to the south probably occurred more slowly, but dispersal through Central America probably was accomplished in the Pliocene when many faunal elements were dispersing toward South America. Arrival and proliferation in South America probably antedated arrival and colonization of the Galapagos Islands. See Fig. 4 for the distribution of *S. portoricensis.*

Records.—*Bermuda:* Pembroke, 24 July 1915, P. H. Pope, from stomach contents of toad, 1 female (MCZ).

UNITED STATES: Florida: *Dade County:* Ross and Castellow Hammock, 4 January 1958, H. V. Weems, Jr., under bark, 1 female (AMNH). Station No. 1, 28 January 1959, R. E. Woodruff, 2 females, 8 immatures (AMNH). Matheson Hammock, 12 September 1959, H. V. Weems, Jr., under bark, 5 females, 2 immatures (AMNH); 29 August 1961, H. V. Weems, Jr., under bark, 1 immature, in leaf mold, 1 female (AMNH); 12 September 1959, R. E. Woodruff, 4 females, 4 immatures (AMNH); 12 September 1959, H. A. Denmark, 12 females, 6 immatures (AMNH). Royal Palm State Park, 27-29 December 1940, A. F. Archer, 1 female (AMNH). Miami Brickell Hammock, 30 November 1961, F. W. Mead, 1 immature (AMNH). Miami, 1 June 1940, E. M. Miller, rotten wood, 2 immatures (AMNH); 10 February 1961, R. E. Woodruff, 1 female (AMNH). 2-5 mi S Florida City, 1 April 1957, R. Forster, W. J. Gertsch, 14 females, 6 immatures (AMNH). Everglades National Park, 11 March 1968, Chickering, 1 immature (MCZ); 1 March 1952, M. H. Muma, under stones, 4 immatures (AMNH); Everglades National Park, W81, N25, 28 January 1959, H. A. Denmark, 3 immatures (AMNH). Everglades W Homestead, W81.35, N25.20, 17 December 1962, W. Ivie, 1 immature (AMNH). Homestead, W Mowry St., avocado groves, March 1968, 1 female (AMNH).

Monroe County: No Name Key, Hardwood litter,

Table 1.–Descriptive statistics for 12 females of *S. portoricensis* from each of the following localities: 1, Actún Xkyc, Yucatán; 2, Matheson Hammock, Dade County, Florida; 3, Santa Cruz Island, Galapagos Islands; and 4, nine males from Hoctún and Tixcocob, Yucatán. SD, standard deviation, CV, coefficient of variation. 1, length of carapace; 2, length of flagellum; 3, width of flagellum; 4, length of femur I; 5, length of patella I; 6, length of tibia I; 7, length of tarsus-basitarsus I; 8, length of femur II; 9, length of patella II; 10, length of tibia II; 11, length of basitarsus II; 12, length of femur III; 13, length of patella III; 14, length of tibia III; 15, length of basitarsus III; 16, length of femur IV; 17, length of patella IV; 18, length of tibia IV; 19, length of basitarsus IV.

	1				2				3				4			
n	Range	Mean	SD	CV	Range	Mean	SD	CV	Range	Mean	SD	CV	Range	Mean	SD	CV
1	1.01-1.12	1.067	.036	3.37	1.00-1.08	1.048	.023	2.19	1.00-1.10	1.048	.027	2.58	1.02-1.26	1.096	.081	7.37
2	0.25-0.27	0.262	.008	3.05	0.24-0.27	0.255	.099	3.53	0.25-0.28	0.266	.008	3.01	0.32-0.36	0.350	.015	4.29
3	-	-	-	-	-	-	-	-	-	-	-	-	0.21-0.25	0.24	.016	6.62
4	0.92-1.10	0.972	.054	5.56	0.89-1.00	0.949	.036	3.79	0.91-1.05	0.986	.043	4.36	1.18-1.64	1.313	.167	12.70
5.	1.01-1.26	1.109	.069	6.22	0.99-1.19	1.109	.050	4.51	1.06-1.22	1.148	.044	3.83	1.42-2.10	1.659	.237	14.28
6	0.72-0.84	0.781	.037	4.74	0.69-0.83	0.773	.034	4.40	0.75-0.87	0.802	.033	4.11	1.04-1.48	1.205	.177	14.69
7	0.68-0.76	0.711	.030	4.22	0.62-0.74	0.692	.036	5.20	0.69-0.75	0.727	.019	2.61	0.80-0.99	0.895	.067	7.48
8	0.68-0.78	0.715	.028	3.92	0.63-0.74	0.694	.030	4.32	0.65-0.76	0.732	.028	3.87	0.70-0.92	0.763	.080	10.46
9	0.36-0.44	0.398	.020	5.03	0.34-0.41	0.394	.021	5.33	0.38-0.43	0.408	.016	3.92	0.41-0.54	0.456	.054	11.84
10	0.42-0.50	0.451	.028	6.21	0.39-0.46	0.431	.024	5.57	0.41-0.46	0.443	.018	4.06	0.44-0.65	0.518	.080	15.40
11	0.38-0.44	0.406	.022	5.42	0.36-0.42	0.393	.019	4.83	0.38-0.45	0.419	.021	4.01	0.42-0.53	0.456	.042	9.22
12	0.59-0.70	0.645	.033	5.12	0.56-0.66	0.618	.028	4.53	0.59-0.68	0.638	.034	5.33	0.61-0.83	0.676	.070	10.39
13	0.26-0.33	0.294	.018	6.12	0.26-0.31	0.289	.020	6.92	0.28-0.33	0.306	.015	4.90	0.29-0.39	0.317	.034	10.71
14	0.33-0.39	0.355	.018	5.07	0.30-0.38	0.338	.025	7.40	0.32-0.39	0.362	.021	5.80	0.33-0.46	0.371	.046	12.53
15	0.40-0.46	0.434	.020	4.61	0.40-0.46	0.428	.020	4.67	0.41-0.48	0.444	.019	4.28	0.42-0.55	0.460	.041	8.96
16	0.98-1.14	1.040	.046	4.42	0.94-1.06	1.012	.032	3.16	0.97-1.11	1.051	.041	3.90	1.02-1.40	1.146	.123	10.70
17	0.40-0.50	0.454	.027	5.95	0.42-0.48	0.454	.018	3.96	0.42-0.50	0.469	.028	5.97	0.45-0.71	0.546	.078	14.25
18	0.68-0.83	0.734	.041	5.59	0.68-0.76	0.728	.028	3.85	0.69-0.78	0.747	.029	3.88	0.73-1.10	0.858	.124	4.48
19	0.52-0.65	0.600	.036	6.00	0.55-0.62	0.593	.021	3.54	0.57-0.67	0.631	.027	4.28	0.59-0.73	0.630	.049	7.78

Ber 222, 5 August 1972, S. Peck, 1 female, 1 immature (MCZ). Upper Matacombe Key, Islamadora, Ber 225, 8 August 1971, S. Peck, 1 female, 3 immatures (MCZ). Islamadora, Upper Matacombe Key, 6 May 1961, H. V. Weems, Jr., under rock, 1 female (AMNH). Everglades National Park, Gumbo Limbo Trail, 8 April 1969, No. 480 litter, C. Alteri, 3 immatures (AMNH). Key Vaca, Marathon, palm-hardwood litter, Ber 223, 7 August 1972, S. B. Peck (MCZ). Stock Island, 12 May 1961, H. V. Weems, Jr., under rock in hammock, 1 female (AMNH). Marathon, 15 March 1968, S. Peck, Ber 111, litter and soil in scrubforest solution pocket, 1 female, 4 immatures (MCZ); 18 March 1968, S. Peck, palm litter, 7 immatures (MCZ); 18 March 1968, scrubforest, 2 females, 3 immatures (AMNH). Lignum Vitae Key, Islamorada, 14 March 1968, S. Peck, B109, hardwood scrub litter, 2 immatures (MCZ). Key Largo Key, 30 January 1959, H. V. Weems, Jr., under rock, 3 immatures (AMNH). Little Duck Key, W81.15, N24.40, 28 December 1963, J. and W. Ivie, 1 female (AMNH).

St. Lucie County: Ft. Pierce, rotten limb of Brazilian Pepper, 1 January 1965, M. H. Muma, H. L. G. 1 immature (AMNH).

MEXICO: *Campeche:* Ciudad del Carmen, 28 July 1948, C. J. and M. L. Goodnight, 1 male (AMNH). Cenote de Cantemo, 1 km N Cantemo, 18 December 1974, J. Reddell, D. McKenzie, L. Elliott, 4 females, 3 immatures (TTU); 31 July 1975, J. Reddell, A. Grubbs, D. McKenzie, 1 female, 1 immature (TTU). Actún Chen, Cumpich, 1 November 1974, J. Reddell, S. Wiley, 2 immatures (TTU); Actún Halmensura, 5 km E Cumpich, 31 October 1974, J. Reddell, D. McKenzie, S. Wiley, 1 female, 3 immatures (TTU). 10 km N Hopelchen, 27 July 1973, J. M. Rowland, J. R. Reddell, 2 males, 4 immatures (TTU). 5 km SSW Ich-Ek, 27 July 1973, J. M. Rowland, J. R. Reddell, 1 male (TTU). Grutas de San Antonio, 10 km ENE Bolonchenticul, 3 November 1974, J. Reddell, D. McKenzie, S. Wiley, 3 females, 3 immatures (TTU); 23-24 November 1974, J. Reddell, D. McKenzie, S. Wiley, 12 females, 10 immatures (TTU). Grutas de Xkalumkín, 5 km W Cumpich, 20 June 1975, J. Reddell, A. Grubbs, D. McKenzie, S. Wiley, 1 immature (TTU). Grutas de Xtacumbilxunam, 5 km SW Bolonchenticul, 19 April 1973, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, M. Butterwick, 5 females, 3 immatures (TTU); 29-30 July 1973, R. W. Mitchell, 1 female (TTU); 25 November 1974, J. Reddell, D. McKenzie, S. Wiley, 1 female (TTU).

Chiapas: Cacahoatán, 10 km NE Tapachula, 8 September 1950, C. J. and M. L. Goodnight, 1 female, 1 immature (AMNH). Cueva Cerro Hueco, 3 km SE Tuxtla Gutiérrez, 18 August 1967, J. Reddell, J. Fish, M. Tandy, 3 males, 4 females, 7 immatures (AMNH); 16 February 1971, R. Argano, V. Sbordoni, 3 males, 2 females (Brignoli, 1974a). Hoyo de Don Nicho, 13 km W Ocozocoautla, 16 August 1967, J. Reddell, J. Fish, T. Evans, 1 female (TTU). Ocosingo Valley, 1-7 July 1950, C. J. and M. L. Goodnight and Stannard, 1 female (AMNH). 0.8 km N Ruinas de Palenque, 25 July 1973, J. Reddell, R. W. Mitchell, 3 males, 5 females, 3 immatures, berlese of litter (TTU). Ruinas de Palenque, 25 July 1973, J. Reddell, J. M. Rowland, 2 males, 2 females, 5 immatures (TTU). El Real, on hill 27 mi E Ocosingo, 3 July 1950, C. J. and M. L. Goodnight and Stannard, 1 male, 3 females, 2 immatures (AMNH). Between San Antonio and El Real, 9 July 1950, C. J. Goodnight and Stannard, 2 females (AMNH). San Antonio, 12 mi E Ocosingo, 29-30 June 1950, C. J. and M. L. Goodnight and Stannard, 2 females, 2 immatures (AMNH). Cueva del Tempisque, 13 km W Ocozocoautla, 17 August 1967, J. Reddell, T. R. Evans, 6 females, 8 immatures (TTU).

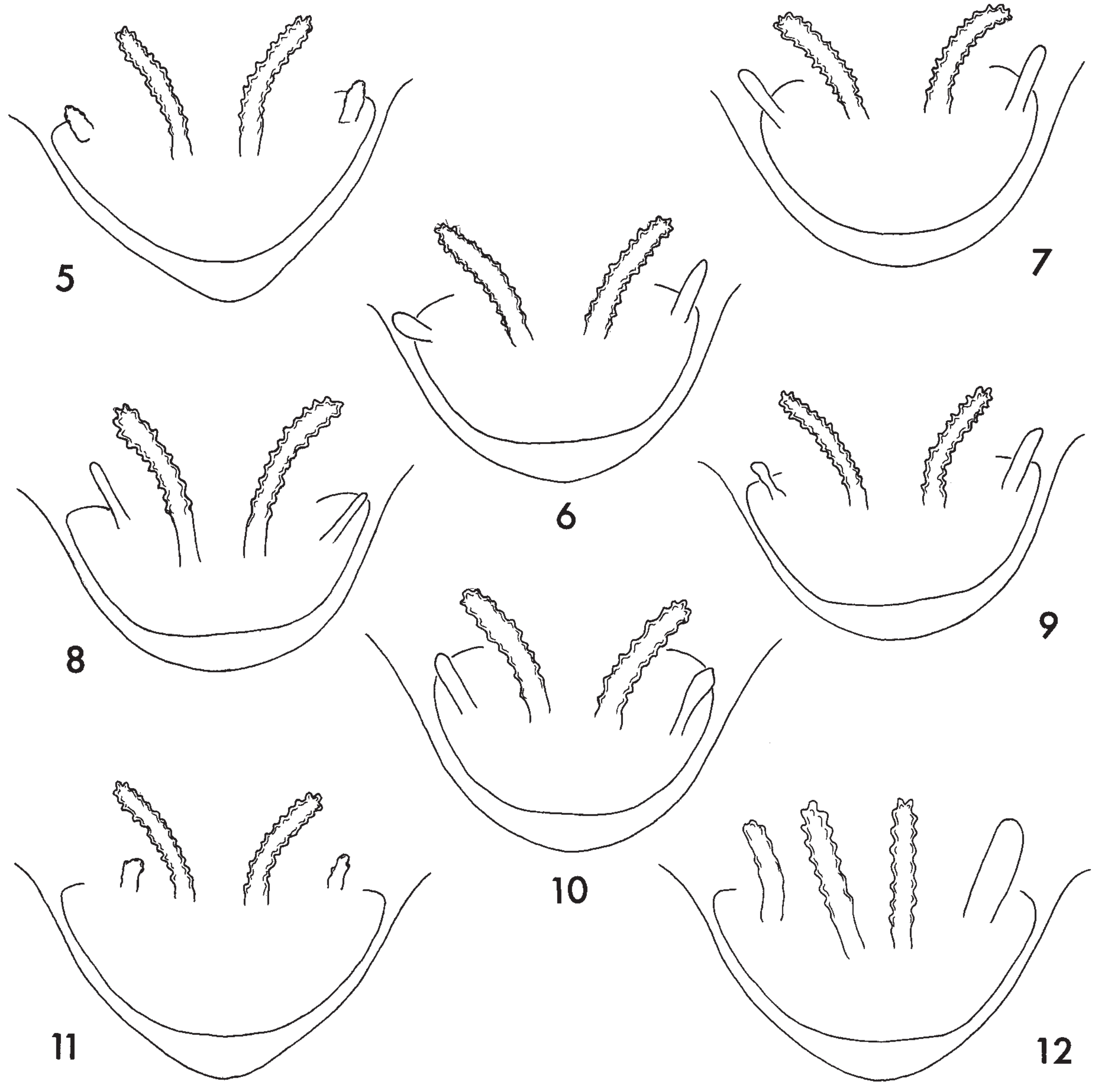
Oaxaca: Cueva de Juan Sanchez, 12 km NW Acatlán, 6-7 January 1976, D. Barnes, M. Cassey, T. Byrd, A. Grubbs, T. Sayther, 4 females (TTU); 26 December 1976, J. Reddell, A. Grubbs, C. Soileau, 7 females, 6 immatures (TTU). 16 km S Tomellin, 14 August 1967, J. Reddell, J. Fish, T. Evans, 1 female (AMNH).

Quintana Roo: Cenote de Juan Coh, Felipe Carrillo Puerto, 4 July 1975, J. Reddell, A. Grubbs, D. McKenzie, 5 females, 6 immatures (TTU). Cueva de Kopoil, Kopoil, 3 July 1975, J. Reddell, A. Grubbs, 1 female (TTU). Cenote de Las Ruinas, 8 km NW Polyuc, 29 July 1975, J. Reddell, A. Grubbs, S. Wiley, D. McKenzie, 4 females, 1 immature (TTU). Cenote de Santo Domingo, 5 km NE Km. 50, 29 July 1975, J. Reddell, A. Grubbs, D. McKenzie, 1 female (TTU). Cueva de Tancah, Tancah, 1 July 1975, J. Reddell, A. Grubbs, S. Wiley, 1 immature (TTU).

Veracruz: Penuela, W96.48, N18.53, 26 April 1963, W. J. Gertsch and W. Ivie, 1 female, 1 immature (AMNH). Cueva de Sala Seca, 5 km N Cuitlahuac, 4 January 1976, J. Reddell, A. Grubbs, C. Soileau, D. McKenzie, 1 female (TTU).

Yucatán: Cenote de Acanceh, Acanceh, 8 October 1974, J. Reddell, 1 female (TTU). Cueva de Aguacate, 2 km S Maxcanú, 17 October 1974, J. Reddell, R. Solis, D. McKenzie, S. Wiley, 2 females (TTU). Grutas de Balankanche (=Cueva Bolonchén), 4 km E Chichén Itzá, July 1948, C. J. Goodnight, 1 female (AMNH); 10-12 December 1974, J. Reddell, D. McKenzie, S. Wiley, 2 females, 3 immatures (TTU). Becanchén, 1

August 1973, J. Reddell, 1 male, 1 immature (TTU). Chac Mol Cave, Tohil, 1 specimen taken June 27, [1936], under stones at top (Chamberlin and Ivie, 1938). Actún Chacaljas, 3 km S Calcehtok, entrance sink, 3 August 1973, J. Reddell, 1 male (TTU). Actún Chunup, 2 km E Maxcanú, 16 October 1974, D. McKenzie, S. Wiley, 1 female (TTU). Dry Cenote (=Cenote Seco), Chichén Itzá, 10 July 1948, C. J. Goodnight, 1 male, 1 female (AMNH). Actún Góngora (=Gongora Cave), Oxkutzcab, lots 109 and 111, A. S. Pearse, 2 females, 1 immature (AMNH). Cenote (=Cueva) de Hoctún, Hoctún, 16 March 1973, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, M. Butterwick, 2 males, 1 female, 1 immature (TTU); entrance area, 12 August 1973, J. Reddell, 1 male (TTU). Hoctún, 12 August 1973, J. Reddell, 1 male (TTU). Cenote Hunto Chac (Cueva del Pozo), 12 April 1973, J. Reddell, M. McKenzie, 1 female (TTU). Tres Linteles, Chichén Itzá, 6 July 1948, C. J. Goodnight, 2 males (AMNH). Chichén Itzá, C. J. Goodnight, 1 fe-



Figs. 5-12.–Female spermathecae of *S. portoricensis* from various localities: 5, the type locality; 6, Cueva Bellamar, Cuba; 7. St. Catherine Parish, Jamaica; 8, Dade County, Florida; 9, Guayaquil, Ecuador; 10, Santa Cruz Island, Galapagos Islands; 11, Actún Xkyc, Yucatán; 12, Cueva Cerro Hueco, Chiapas. Scale: 1 cm = .04 mm.

male (AMNH); 8 August 1973, J. Reddell, 3 males, 2 females, 1 immature (TTU). Pyramid, Izamal, 10 August 1973, J. Reddell, 1 male, 1 female, 1 immature (TTU). Actún (=Cueva de) Kaua, 1 km S Kaua, at mouth, one specimen, June 16, 1936 (Chamberlin and Ivie, 1938); 8 January 1973, D. McKenzie, 2 females (TTU); 9-10 October 1974, J. Reddell, D. McKenzie, S. Wiley, 1 female (TTU). Cenote Kabahchén, Maní, 5 October 1974, J. Reddell, D. McKenzie, S. Wiley, 2 females, 2 immatures (TTU). Actún Kiuick, Kiuick, 13 November 1974, J. Reddell, D. McKenzie, S. Wiley, 1 female, 1 immature (TTU). Actún (=Grutas de) Loltún, 7 km SSW Oxkutzcab, 1 January 1972, D. McKenzie, 1 male, 1 female (TTU); 25-26 July 1975, J. Reddell, A. Grubbs, D. McKenzie, S. Wiley, from washed-in leaf litter, 12 males, 5 females, 6 immatures (TTU). Cenote (=Cueva) Luchil, 3 km S Mérida, October 1974, J. Reddell, S. Wiley, 1 immature (TTU). Ruinas de Mayapán, 14 August 1973, J. Reddell, 4 males, 1 female, 1 immature (TTU). 1 km S Muna, 31 July-4 August 1973, J. Reddell, 2 males, 1 female, 2 immatures (TTU). Cenote Nohchén, Sacalum, 18 June 1975, J. Reddell, A. Grubbs, D. McKenzie, 1 immature (TTU). Cueva de Orizaba, Orizaba, 6 km S Buena Ventura, 1 April 1973, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, M. Butterwick, 2 females, 3 immatures (TTU). Cenote de Orizaba, Orizaba, 6 km S Buena Ventura, 1 August 1973, J. Reddell, S. Murphy, 1 immature (TTU). 7 km S Oxkutzcab, berlese, 31 July 1973, R. W. Mitchell, J. R. Reddell, 1 male (TTU). Cenote de la Paca, 7 km E Tikuch, 11 April 1973, S. Murphy, 1 female, 1 immature (TTU). Actún Sabacá, 6 km S Tekax, 4 December 1974, J. Reddell, D. McKenzie, S. Wiley, J. Andrews, R. W. Mitchell, 4 females, 3 immatures (TTU). Cueva de Sabacan (=Actún Sabacá), March 1947, B. F. Osorio Tafall (Cárdenas Figueroa, 1950). Cenote de Sambulá, Kopomá, 15 October 1974, J. Reddell, D. McKenzie, S. Wiley, 1 female (TTU). Cenote de Sambulá (=San Bulha Cave), Mérida, two specimens taken in debris on floor, July 13, [1936], Lot 106 (Chamberlin and Ivie, 1938). Cenote de Sambulá, Motul, 28 March 1973, J. Reddell, S. Murphy, 5 females, 3 immatures (TTU). Cenote de San Diego, 12 km E Catzín, 5 July 1975, J. Reddell, A. Grubbs, 2 females, 3 immatures (TTU). Cueva de San Isidro (=San Isidro Cave), Mérida, one specimen, July 4, [1936], in hole by inner pool (Chamberlin and Ivie, 1938); 21 March 1973, J. Reddell, S. Murphy, 1 immature (TTU). Cenote de San José, Mérida, 6 October 1974, J. Reddell, D. McKenzie, 1 female (TTU). Sazich Cave, Calcehtok, three young specimens and one adult "near b" (Lot 182), August 6, [1936] (Chamberlin and Ivie, 1938). Cenote de Sihunchén, Sihunchén, 23 March 1973, J. Reddell, M. McKenzie, S. Murphy, 1 female, 3 immatures (TTU); 23 March 1973, J. Reddell, berlese of litter, 1 immature (TTU). Cueva Sodzil, 5 km W Sucopo, 31 March 1973, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 4 females (TTU). Cenote Sucopo, Sucopo, 13 March 1973, J. Reddell, S. Murphy, 1 female, 5 immatures (TTU). Cueva de Tecoh, Mérida, 6 October 1974, J. Reddell, D. McKenzie, 1 immature (TTU); October 1974, J. Reddell, S. Wiley, 1 female, 1 immature (TTU). Tixcocob, 12 August 1973, J. Reddell, 5 males (TTU). Actún Tucil, 2 km S Muna, 12 July 1975, J. Reddell, A. Grubbs, 1 female (TTU). Grutas de Tzab-Nah, 2 km S Tecoh, 26 April 1973, J. Reddell, M. McKenzie, 5 females, 2 immatures (TTU); 22 April 1973, J. Reddell, D. McKenzie, M. McKenzie, 1 female, 1 immature (TTU); 10 October 1974, J. Reddell, D. McKenzie, S. Wiley, 11 females, 14 immatures (TTU). Actún Xkyc (=Xkyc Cave), Calcehtok, 6 August 1936, A. S. Pearse, 1 female (AMNH). Actún Xpukil, 4-5 April 1973, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 female (TTU); 18-19 March 1973, J. Reddell, S. Murphy, D. McKenzie, M. McKenzie, M. Butterwick, 3 females, 4 immatures (TTU); entrance sink, 3 August 1973, J. Reddell, 10 females, 9 immatures (TTU); 18-19 March 1973, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, M. Butterwick, 4 females, 7 immatures (TTU). Xtoloc Cenote Cave, Chichén Itzá, one specimen taken under stone, June 24, [1936] (Chamberlin and Ivie, 1938). Actún Ziz, Oxkutzcab, 3 December 1973, J. Reddell, A. Gamboa, D. McKenzie, S. Wiley, R. W. Mitchell, 1 male, 1 immature (TTU).

BELIZE: Augustine, 1500 ft, Rio Frio Cave A, 20 July 1972, S. Peck, 1 female, 1 immature (AMNH). Augustine, 1500 ft, Rio Frio Cave B, 30 July 1972, 20 August 1972, S. and J. Peck, 1 female, 1 immature (AMNH). Cave near Augustine, July 1972, C. Goodnight, 1 female, 1 immature (AMNH). Near Augustine, Rio Frio, 20 July 1972, C. and M. Goodnight, 1 female (AMNH). Belmopan, 13 August 1972, S. and J. Peck, 1 female (AMNH); 7 August 1972, S. Peck, 1 female, several eggs (AMNH). Caves Branch, 4-14 August 1972, S. and J. Peck, 1 immature (AMNH). Caves Branch, Buck's Bypass Cave, 14 August 1972, S. Peck, 1 female (AMNH). Hummingbird Highway, 2 August 1972, C. J. Goodnight, 1 female (AMNH).

GUATEMALA: *Alta Verapaz:* Cueva Lanquin, Lanquin, June 1959, W. W. Varnedo, 2 females (AMNH); 28 August 1969, S. and J. Peck, 10 females (AMNH). *El Petén:* Cueva Najohnaj Cohultunich, 25 August

1972, S. and J. Peck, 4 males, 8 females, 6 immatures (AMNH). Cueva del Tepescuintle, 240 m, Río Usumacinta, vicinity of Yaxchilán, 13 March 1971, R. Argano, V. Sbordoni, 6 females, 5 immatures (Brignoli, 1974a). Cueva de Yaxchilán, 100 m, Río Usumacinta, vicinity of Yaxchilán, 9 March 1971, R. Argano, V. Sbordoni, 4 females, 3 immatures (Brignoli, 1974a).

NICARAGUA: Musawas, 1-4 November 1955, B. Malkin, 1 female (AMNH). Musawas, Waspic River, 10 October 1957, B. Malkin, 1 female, 1 immature (AMNH).

CUBA: Cueva Bellamar, Matanzas, 800 ft from entrance, January 1878, 1 female (MCZ). Cienfuegos, central Soledad, 2 July 1957, 1 female (MCZ). S. A. Baños, Habana, 11 August 1971, L. F. de Armas, 1 female, 2 immatures (IZC).

DOMINICA: Roseau, botanical gardens, 2 February 1968, B. Malkin, 7 females (AMNH). Salibia, under rotten banana leaves, 28-29 January 1968, B. Malkin, 1 female (AMNH).

JAMAICA: St. Andrews Ferry, 0.9 mi W Red Hills, 1 female (MCZ).

Manchester Parish: Oxford Cave, Auchtembeddie, 27 August 1974, S. Peck, 1 female, 5 immatures (AMNH).

St. Ann Parish: Falling Cave, Douglas Castle, 3 November 1973, R. Norton, 1 female (AMNH). Hutchinson Hole Cave, 27 March 1973, R. Norton, R. Zimmerman, 1 female (AMNH). "Rambriber" Cave, Douglas Castle, 20 December 1972, S. and J. Peck, 1 female (AMNH).

St. Catherine Parish: 1.5 mi SW Ewarton, 1000 ft, 7 April 1968, S. Peck, A. Fisher, 2 females, 4 immatures (AMNH). Guanaboa, 28 February 1957, Chickering, 1 female (MCZ); 4 December 1957, Chickering, 2 females (MCZ). St. Claire Cave, Ewarton, 27 December 1972, S. and J. Peck, 1 female (AMNH).

St. Elizabeth Parish: Wallingford Caves, Wallingford, 27 August 1974, S. Peck, 3 females (MCZ).

St. James Parish: Brandon Hill Cave, Montego Bay, 1 September 1974, S. Peck, 3 females, 7 immatures (MCZ). Maldon School Cave, Maldon, 2 September 1974, S. Peck, 1 female, 2 immatures (MCZ).

St. Mary Parish: Luck Hill Cave, 31 March 1973, R. Zimmerman, 2 females (MCZ).

Trelawny Parish: Carambie Cave, Spring Garden, 4 September 1974, S. Peck, 14 females, 3 immatures (MCZ). Deeside Cave, Deeside, 28 August 1974, S. Peck, 10 females, 3 immatures (MCZ). Dromilly Cave, 2 mi NE Deeside, 28 August 1974, S. Peck, 14 females, 8 immatures (AMNH). Harties Cave, Spring Garden, 4 September 1974, S. Peck, 2 females, 2 immatures (MCZ). Printed Circuit Cave, 30 March 1973, R. Norton, R. Zimmerman, 3 females, 3 immatures (AMNH).

Westmorland Parish: Roaring River Cave, 7 mi NE Savannala Mar, 29 August 1974, S. Peck, 7 females, 11 immatures (AMNH).

PUERTO RICO: Aguas Buenas Cave, Aguas Buenas, 30 December 1966, S. Peck, 2 females, 2 immatures (AMNH); Ent. Caguitas, 0-500 ft, 14 May 1973, S. Peck, 1 female (MCZ); near Hoyo Petroglyph, 250 m, 15 May 1973, S. Peck, 1 female (AMNH); Aguebana, 250 m, 7-17 May 1973, S. Peck, 1 female (MCZ). Cueva de los Alferos, Barrio Moza, near Isabela, 29 December 1966, S. Peck, 2 females (AMNH). Cueva Los Chorros, 15 km S Arecibo, 31 May 1974, S. and J. Peck, 10 females, 4 immatures (MCZ). Coamo Springs, 1899, several females (MCZ); 24 March 1906, W. M. Wheeler, 5 females (MCZ). Cueva El Convento, Guayanilla, 12 June 1974, S. and J. Peck, 12 females, 11 immatures (AMNH); guano berlese, 12 June 1974, S. Peck, 7 females, 15 immatures (MCZ). Cueva de Corozal, Corozal, 4 January 1967, S. Peck, 1 female (AMNH); Guajataca Forest near Publito de Ponce, 4 July 1958, Sanderson, 1 female (MCZ). Mayaquez, 17 January 1964, Chickering, 1 female (MCZ); 16 January 1964, Chickering, 1 female (MCZ). Cueva Tuna, 3.5 km S Cabo Rojo, 13 June 1974, S. and J. Peck, 1 male, 3 females, 1 immature (AMNH).

VIRGIN ISLANDS: *St. Croix:* Christiansted, 1940, H. A. Beatty, 1 female (MCZ).

COLOMBIA: Near Cali, 1000 m, 2 October 1969, W. Eberhard, 1 female (MCZ).

ECUADOR: Guayaquil, 31 October 1942, 2 females (AMNH). Galapagos Islands, Isla Santa Cruz, Horneman Ranch, 16 February 1964, D. Q. Cavagnaro, R. O. Schuster, 3 females, 1 immature (CAS). Santa Cruz Island (Indefatigable), November 1964, J. and N. Leleup, 22 females, 6 immatures (ISB).

ENGLAND: Cambridge, University Botanical Gardens, Cloudsley-Thompson, 3 females (AMNH).

Schizomus moisii Rowland

Schizomus moisii Rowland, 1973c:136, 137-139, 140, figs. 2, 5; Rowland, 1975a:34, 133, 166, 167-168, 169, 207, 208-210, 214-215, 218-219, 222-223, 228, 230, 255, 366-367, 368-369, 394, figs. 163, 176, 197, 292, tab. 9, 11, 30, map 5.

Distribution.–This species is known only from Grutas de Monteflor, Oaxaca, México (Fig. 3).

Remarks.–While this species is known only from a cave, its dark pigmentation suggests that it is a facultative cave inhabitant and might be found in epigean situations in the area of the cave. This cave is also inhabited by an undescribed species (Species No. 5) which appears to be a troglobite, a situation comparable to that observed in Grutas del Coconá, Tabasco, where the troglobitic *S. pecki* and the troglophilic *S. trilobatus* are found.

Records.–*Oaxaca:* Grutas de Monteflor, 6 km NE Valle Nacional, 28 December 1972, J. Reddell, D. McKenzie, S. Murphy, 6 males (holotype, paratypes, AMNH), 6 females (allotype, paratypes, AMNH), 1 immature (paratype, AMNH).

Schizomus cookei Rowland

Schizomus cookei Rowland, 1971b:122-123, figs. 10-12, 19; Reddell and Mitchell, 1971a:145; Dumitrescu, 1973:291; Reddell, 1973:38; Rowland, 1973c:135; Brignoli, 1974a:146; Rowland, 1975a: 34, 166, 167-168, 169, 181, 182, 210-211, 212, 213, 216-217, 218-219, 220-221, 228, 231, 366-367, 368-369, 395, figs. 165, 180, 183-184, 292, tab. 9, 11, 30, map 5.

Distribution.–This species is known only from Sótano de la Tinaja and Sótano de Yerbaniz, near Ciudad Valles, San Luis Potosí, México (Fig. 2).

Remarks.–This troglobitic species occurs sympatrically with *S. mexicanus* and *A. lucifer.* It is most closely related to *S. mitchelli.*

Records.–*San Luis Potosí:* Sótano de la Tinaja, 10 km NNE Ciudad Valles, 19 February 1970, J. A. L. Cooke, 2 males (holotype, paratype, AMNH), 2 females (allotype, paratype, AMNH). Sótano de Yerbaniz, 22.5 km N Ciudad Valles, 8 January 1971, W. Elliott, 1 female (TTU).

Schizomus mitchelli Rowland

Schizomus mitchelli Rowland, 1971b:121-122, figs. 7-9, 18; Reddell and Mitchell, 1971a:145; Brignoli, 1973:6; Reddell, 1973:38; Rowland, 1973c: 135; Brignoli, 1974a:145-146, fig. 1a, 2e; Rowland, 1975a:34, 166, 167-168, 169, 181, 182, 211-213, 216-217, 228, 231, 366-367, 368-369, 395, figs. 164, 182, 188, 212-215, 292, tab. 9, 11, 30, map 5.

Schizomus sp.: Mitchell, 1970:65.

"schizomids": Rowland, 1973b:73.

Distribution.–This species is known only from three caves in the northern Sierra de El Abra, Tamaulipas, México (Fig. 2).

Remarks.–This apparent troglobite is most closely related to *S. cookei.*

Records.–*Tamaulipas:* Cueva de la Florida, 8 km NE Antiguo Morelos, 28 May 1968, J. Reddell, 1 male, 5 females, 5 immatures (TTU); 10 March 1969, J. Reddell, S. Fowler, B. Cook, 5 males, 6 females, 7 immatures (TTU); 16 February 1970, J. Cooke, 2 immatures (AMNH); 16 February 1970, collector unknown, 1 immature (TTU); 20 May 1971, J. Cooke, M. Brownfield, 1 male, 4 females, 4 immatures (TTU); 19 February 1973, S. Wiley, 1 male (TTU). Cueva de El Pachón, 15 km SSW Ciudad Mante, 6 June 1967, R. Mitchell, 1 male (partaype, AMNH), 2 females (allotype, paratype, AMNH), 1 immature (TTU); 8 June 1967, J. Reddell, 1 male (AMNH); 25 November 1967, J. Reddell, S. Fowler, 1 male (holotype, AMNH), 2 females (TTU); 12 March 1969, J. Reddell, S. Fowler, 1 male, 3 females, 5 immatures (TTU); 10 July 1969, S. and J. Peck, R. Norton, 1 male, 4 females, 6 immatures (TTU). Grutas de Quintero, Quintero, 6 July 1969, S. Peck, R. Norton, 3 males, 1 female, 1 immature (TTU); 26 November 1969, R. Argano, V. Sbordoni, 6 males, 8 females, 2 immatures (Brignoli, 1974); 1 June 1972, W. Peck, 1 male, 1 female (MCZ).

Schizomus sp. 1

Schizomus sp.: Reddell, 1971a:219 [Grutas de Cacahuamilpa record only].

Schizomus sp., OTU No. 1: Rowland, 1975a:166, 169, 170-171, 172, 228-229, 366-367, 368-369, figs. 198, 292, tab. 9, 11, 30, map 5.

Distribution.–This species is known only from the innermost room of Grutas de Cacahuamilpa, Guerrero, México (Fig. 2).

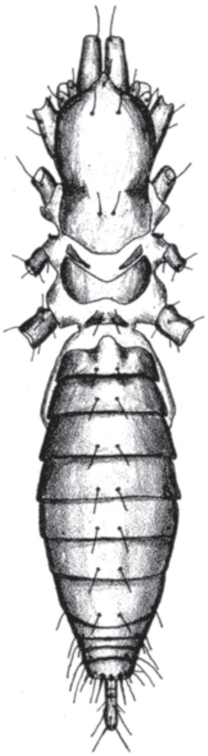
Remarks.–In the absence of males it is considered best not to formally describe this species. It is a probable troglobite related to *S. mexicanus* and its associated species.

→ Fig. 13.–Dorsal view of female *S. portoricensis,* legs and pedipalps past the trochanter omitted. Scale: 1 cm = .4 mm.

Figs. 14-15.–Male flagellum of *S. portoricensis* from Cueva Cerro Hueco, Chiapas: 14, dorsal view; 15, lateral view. Scale: 1 cm = .06 mm.

Figs. 16-18.–Female *S. portoricensis:* 16, lateral view of right pedipalp; 17, lateral view of flagellum; 18, ventral view of abdominal sterna II and III, showing spermathecae through the integument. Scale: Figs. 16-17, 1 cm = .06 mm; Fig. 18, 1 cm = .2 mm.

Figs. 19-21.–*Schizomus silvino:* 19, lateral view of male flagellum; 20, dorsal view of male flagellum; 21, female spermathecae.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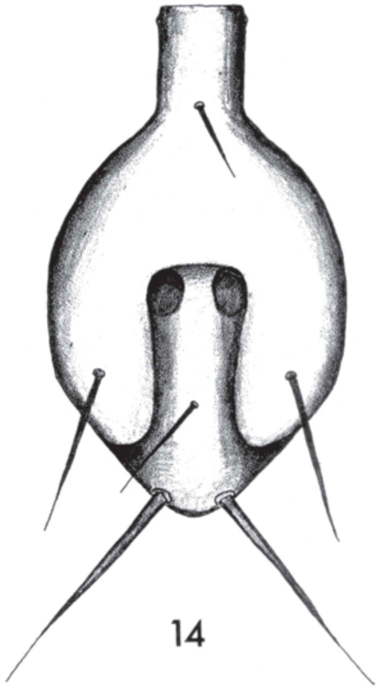
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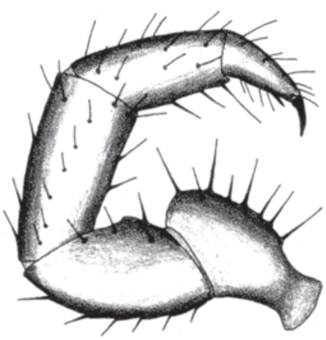
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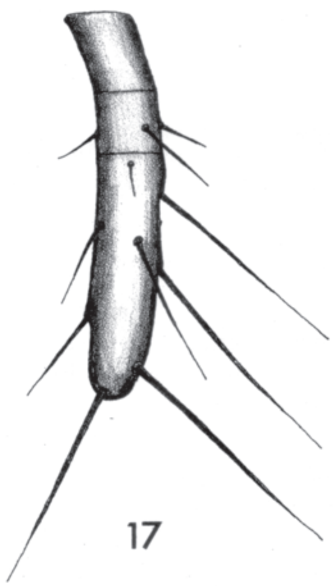
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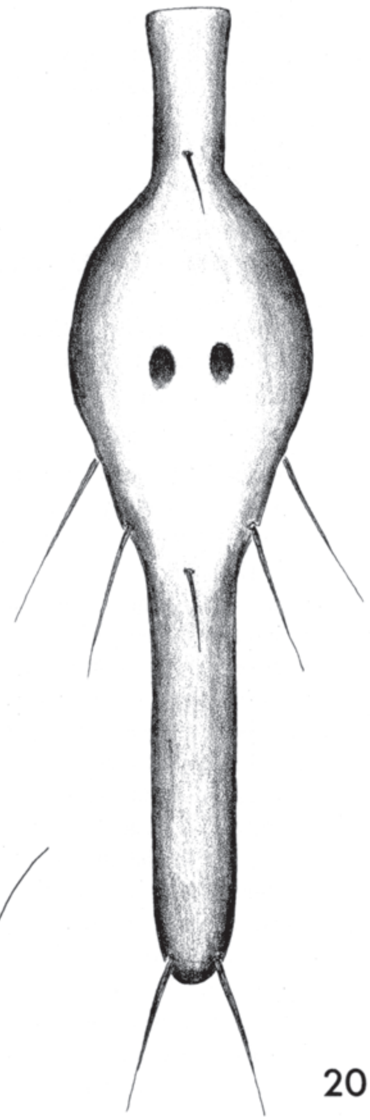
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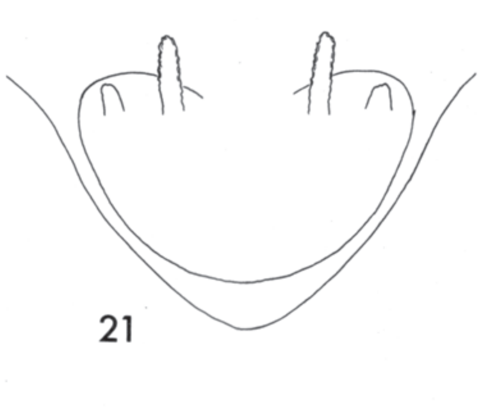
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Records.—*Guerrero:* Grutas de Cacahuamilpa, 15 August 1966, J. Fish, J. Reddell, 1 female, 1 immature (TTU).

Schizomus sp. 2

Schizomus lukensi [in part]: Rowland, 1975a:175-176, 222-223, fig. 192.

Distribution.—This species is known only from Cueva de los Cuarteles, Tamaulipas, México (Fig. 2).

Remarks.—The discovery of males of this species reveals sufficient differences in the male flagellum to verify that it is a distinct species from *S. lukensi,* although originally treated as conspecific by Rowland (1975a). This probable troglobite is isolated on a small limestone hill at the base of the Sierra de Tamaulipas. Specimens were collected from beneath rocks in a small moist inner room of the cave.

Records.—*Tamaulipas:* Cueva de los Cuarteles, 10 km SW Aldama, 23 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 female, 1 immature (TTU); 11 January 1977, J. Reddell, A. Grubbs, 2 males, 7 females, 1 immature (TTU).

Schizomus firstmani Rowland

Schizomus firstmani Rowland, 1973a:16-19, figs. 14-16, tab. 1; Rowland, 1973c:136; Rowland, 1975a: 34, 167-168, 232, 234, 235-237, 238, 239-240, 243, 246-247, 248-249, 252-253, figs. 217, 219-220, 226-227, tab. 12-13, map 4.

Schizomus sp.: Reddell, 1971a:219 [Grutas de Atoyac record only].

Distribution.—This species is known with certainty only from Grutas de Atoyac, Veracruz. Females from near Acatlán, Oaxaca, are tentatively identified as this species (Fig. 2).

Remarks.—This large species belongs to a complex of species ranging from Belize and Guatemala north into Veracruz, Oaxaca, Tabasco, and Chiapas, México. It lacks eyespots and is apparently a troglobite. It inhabits Grutas de Atoyac with a species here tentatively identified as *S. sbordonii,* an apparent troglophile. Three collections from near Acatlán, Oaxaca, about 30 km south of Atoyac, are tentatively identified as *S. firstmani,* but in the absence of males these identifications should be considered with reservation.

Records.—*Oaxaca:* Cueva Desapareciendo, 2 km W Acatlán, 5 January 1976, A. Grubbs, 1 female (TTU). Cueva de la Finca, 10 km SW Acatlán, 31 December 1976, J. Reddell, A. Grubbs, D. McKenzie, 1 female (TTU). Cueva del Nacimiento del Río San Antonio, 10 km S Acatlán, 26 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 female, 3 immatures (TTU).

Veracruz: Grutas de Atoyac, 2 km E Atoyac, 22 August 1965, J.. Reddell, J. Fish, W. Bell, 1 female (paratype, AMNH), 3 immatures (paratypes, AMNH); 6 August 1969, S. and J. Peck, 3 females (allotype, paratypes, AMNH), 3 immatures (paratypes, AMNH); 24 December 1971, D. McKenzie, 1 male (holotype, AMNH), 1 immature (paratype, AMNH); 6 January 1977, J. Reddell, 2 females, 1 immature (TTU).

Schizomus sbordonii Brignoli

Schizomus sbordonii Brignoli, 1973:7, 8, 9, fig. 4; Rowland, 1973c:135, 136; Brignoli, 1974a:146, 147, 149, fig. 1e, 2c-d; Rowland, 1975a:34, 167-168, 189, 232, 234, 236, 238-240, 248-249, 252-253, fig. 225, tab. 12-13, map 4.

Schizomus sp. cf. *sbordonii:* Rowland, 1975a:167-168, 232, 234, 238-240, 248-249, 252-253, fig. 225, tab. 12-13, map 4.

Distribution.—This species is known with certainty only from Cueva de Ojo de Agua Grande, Veracruz. A collection from Grutas de Atoyac is tentatively considered as representative of this species (Fig. 3).

Remarks.—Specimens from Grutas de Atoyac may well belong to this species but the description by Brignoli (1974a) is inadequate to make a positive identification. The close geographic proximity and probable epigean nature of these populations, however, suggest that they are conspecific. The troglobitic *S. firstmani* also inhabits Grutas de Atoyac but has only been found in the more remote areas of the cave.

Records.—*Veracruz:* Cueva de Ojo de Agua Grande, near Córdoba, 5 November 1969, V. Sbordoni, 1 female (holotype), 1 immature (Brignoli, 1974a). Grutas de Atoyac, 2 km E Atoyac, 6 August 1969, S. and J. Peck (TTU).

Schizomus pecki Rowland

Schizomus pecki Rowland, 1973a:19-23, figs. 17-19, tab. 1; Rowland, 1973c:136; Sbordoni, Argano, and Zullini, 1974:14-15; Rowland, 1975a:34, 136, 167-168, 188, 209, 232, 234, 240-241, 242, 243, 244, 246-247, figs. 216, 218, 221, 231, tab. 12-13, map 4.

Distribution.—This species is known only from two caves near Teapa, Tabasco, México (Fig. 2).

Remarks.—This large troglobitic species is abundant on silt under rotten wood in the more remote sections of Grutas del Coconá. A dark robust species, *S. trilobatus,* inhabits litter near the cave entrance. *S. pecki* is closely related to *S. firstmani, S. guatemalensis* Chamberlin (an epigean species known only from Guatemala), and undescribed species from Chiapas and Belize.

Records.—*Tabasco:* Grutas del Coconá, 3 km NE Teapa, 1 August 1948, C. Goodnight, 1 male (holotype, AMNH); 29 November 1971, D. McKenzie, 2 females (allotype, paratype, AMNH); 24 July 1973, J. Reddell, J. Rowland, 3 females, 3 immatures (TTU). Resumidero del Coconá, 3 km NE Teapa, 14 June 1975, J. Reddell, A. Grubbs, 1 immature (TTU).

Schizomus sp. 3

Schizomus sp., OTU No. 2: Rowland, 1975a:167-168, 232, 234, 237-238, 248-249, 250-251, 252-253, figs. 222-223, 229, 234, tab. 12-13, map 4.

Distribution.—This species is known only from three caves near Comitán, Chiapas, México (Fig. 3).

Remarks.—This species is most closely related to *S. pecki,* but does not show the troglobitic facies of that species. Although these specimens apparently represent an undescribed species it is considered best not to name it until males become available.

Records.—*Chiapas:* Sumidero del Camino, 16 km NE Comitán, 22 August 1967, J. Reddell, J. Fish, 1 female, 1 immature (TTU). Cueva Chica de Hun Chabin, near Comitán, 21 August 1967, J. Reddell, 1 immature (TTU). Grutas de Zapaluta, 6 km SE Zapaluta, 19 July 1950, C. and M. Goodnight, 1 female (AMNH); 20 August 1967, J. Reddell, J. Fish, T. Evans, 1 female (TTU); 28 August 1972, J. Cooke, W. Russell, 3 females, 6 immatures (TTU).

Schizomus sp. 4

Schizomus sp., OTU No. 6: Rowland, 1975a:167-168, 234, 243, 250-251, 252, 254, fig. 232, tab. 12-13, map 4.

Distribution.—This species is known only from St. Herman's Cave, Belize (Fig. 2).

Remarks.—In the absence of males it is considered best to defer naming this undescribed species. The very light pigmentation and lack of eyespots suggest that it is a probable troglobite. It is most closely related to *S. pecki, S. firstmani,* and their associated species (see Rowland, 1975a).

Records.—BELIZE: *Cayo District:* St. Herman's Cave, 400 ft, Caves Branch, between 23 July and 21 August 1972, S. and J. Peck, 1 female (AMNH).

Schizomus sp. 5

Schizomus sp., OTU No. 8: Rowland, 1975a:209, 232, 234, 243, 245, 250-251, 252, 254, 255, fig. 233, tab. 12-13, map 4.

Distribution.—This species is known only from Grutas de Monteflor, Oaxaca, México (Fig. 3).

Remarks.—This species inhabits Grutas de Monteflor with *S. moisii,* a troglobite. It does not, however, show any sign of adaptation for a cavernicole existence and will probably be found in an epigean environment. It is most closely related to *S. pecki.*

Records.—*Oaxaca:* Grutas de Monteflor, 6 km N Valle Nacional, 28 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 female, 1 immature (TTU).

Schizomus sp. 6

Distribution.—This species is known from three caves near Cuetzalan, Puebla, México (Fig. 2).

Remarks.—This pale species lacks eyespots and is presumably a troglobite. In the absence of males it is considered best not to describe it at this time. Its large body, pedipalpal claw size, and the shape of the flagellum suggest that it is most closely related to *S. pecki.*

Records.—*Puebla:* Grutas de Atepolihuit, 5 km SW Cuetzalan, 18 December 1976, J. Reddell, D. McKenzie, C. Soileau, 1 female (TTU). Grutas de Jonotla, 6 km SW Cuetzalan, 26 December 1973, J. Reddell, R. Jameson, D. McKenzie, W. Elliott, 1 immature (TTU). Cueva de Tasalolpan, 5 km SW Cuetzalan, 22 December 1976, J. Reddell, A. Grubbs, C. Soileau, D. McKenzie, 1 immature (TTU).

Schizomus lanceolatus Rowland

Schizomus lanceolatus Rowland, 1975b:7, 15-16, 17, fig. 7; Rowland, 1975a:34, 257, 258, 261-262, 263-264, 265-266, 267-268; figs. 235, 243, tab. 14-15, map 4.

Distribution.—This species is known only from Cueva del Diablo, Veracruz, México (Fig. 3).

Remarks.—This species possesses distinct eyespots and will probably be found in an epigean environment. It is most closely related to *S. goodnightorum, S. silvino* n. sp., and *S. orthoplax* Rowland (an epigean species from Chiapas).

Records.—*Veracruz:* Cueva del Diablo, near Ciudad Mendoza, 7 March 1973, J. Reddell (holotype, AMNH).

Schizomus silvino, new species
Figs. 3, 19-21

Holotype.—Adult male, taken in Gruta de Silvino, 34 km W Puerto Barios, Izabal, Guatemala, 20-22 August 1969, by S. and J. Peck (AMNH).

Allotype.—Adult female, taken with the holotype (AMNH).

Paratypes.—Three adult males, six adult females, and six immatures, taken with the holotype (AMNH).

Description.—Male. Color brownish, pale. Carapace with four pairs of dorsal and two apical setae. Eyespots distinct, irregular. Anterior sternum with 10 bifid setae. Abdominal terga I-VII with two setae, terga VIII-IX with four setae, segments VIII-XII attenuate, segment XII with no evidence of posterodorsal process. Vestigial stigmata lighter than sterna. Flagellum extremely elongate, with a pair of median pits on otherwise flat dorsal surface (Figs. 19-20). Pedipalpal trochanter produced distally, tarsal-basitarsal spurs about 1/5, claw about 2/5 length of tarsus-basitarsus. Tarsal-basitarsal segments of leg I of the following approximate proportions: 44-6-8-7-8-8-18. Other leg segment measurements given in Table 2.

Female. Flagellum composed of three articles. Median spermathecae two to three times longer than laterals, with both very slightly divergent, but neither expanded distally; medians sclerotized slightly on apical half (Fig. 21).

Comparisons.—This species may be distinguished from all described Mexican species, with the exception of *S. lanceolatus* and *S. orthoplax*, by the presence of 4 pairs of dorsal carapacial setae. It may further be distinguished from *S. goodnightorum* by having a pair of dorsal flagellar depressions rather than 1 as in *S. goodnightorum.* The median spermathecae of *S. silvino* are also much shorter than are those of *S. goodnightorum. S. silvino* may be distinguished from *S. lanceolatus* and *S. orthoplax* on the basis of the male flagella and the carapacial lengths. The flagellum is by far the longest in *S. lanceolatus,* by far the shortest in *S. orthoplax,* and is intermediate in *S. silvino.*

Distribution.—This species is known only from Gruta de Silvino, Izabal, Guatemala (Fig. 3).

Etymology.—The specific name is a noun in apposition.

Remarks.—While this species is known only from a cave and is somewhat paler than many species, the presence of distinct eyespots indicates that it is probably a facultative troglophile.

Table 2.—Measurements (in millimeters) of *S. silvino.* See legend for Table 1 for identification of characters.

n	2 males	2 females
1	1.11-1.14	1.00-1.05
2	0.70-0.79	0.29-0.31
3	0.20-0.20	-
4	1.45-1.62	1.05-1.14
5	1.80-2.01	1.26-1.36
6	1.02-1.36	0.86-0.91
7	0.97-0.99	0.76-0.77
8	0.82-0.92	0.71-0.75
9	0.48-0.51	0.40-0.41
10	0.53-0.59	0.40-0.45
11	0.49-0.53	0.38-0.43
12	0.71-0.79	0.61-0.65
13	0.33-0.36	0.29-0.31
14	0.41-0.44	0.34-0.36
15	0.50-0.55	0.40-0.47
16	1.17-1.31	1.01-1.07
17	0.51-0.52	0.44-0.46
18	0.77-0.86	0.66-0.71
19	0.70-0.77	0.58-0.64

Schizomus sp. 7

Distribution.—This species is known only from Cueva del Rancho Santa María, Veracruz, México (Fig. 3).

Remarks.—This distinctive species possesses four pairs of dorsal carapacial setae indicating that it is probably related to *S. lanceolatus, S. silvino,* and *S. orthoplax.* The possession of distinct eyespots and dark pigmentation indicates that it is a troglophile. Its description must await the discovery of males.

Records.—*Veracruz:* Cueva del Rancho Santa María, 6 km N Potrero, 6 January 1977, J. Reddell, 1 female (TTU).

Schizomus arganoi Brignoli

Schizomus arganoi Brignoli, 1973:8, fig. 3; Rowland, 1973c:135, 136; Brignoli, 1974a:144-145, fig. 1d, 2a, f; Rowland, 1975a:34.

Distribution.—This species is known only from Cueva de la Golondrina, Chiapas, México (Fig. 3).

Remarks.—This poorly described species is known only by a single damaged female. It is not possible to speculate on the relationships of this species with other members of the genus.

Records.—*Chiapas:* Cueva de la Golondrina, Bochil, 1440 m, 27 March 1971, R. Argano, 1 female (Brignoli, 1974a).

Schizomus sp.

Remarks.—All of the records included below represent specimens which are immature or otherwise inadequate for identification. Their reliable determination must await the collection of additional material.

Records.—MEXICO: *Oaxaca:* Cueva Bonita del Presidente, 2 km N Huautla de Jiménez, 12 August 1967, J. Reddell, J. Fish, 1 immature (TTU). Cueva del Guano, 8 km N Valle Nacional, 28 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 immature (TTU). Cueva de las Maravillas, 6 km S Acatlán, 29 December 1976, J. Reddell, A. Grubbs, C. Soileau, D. McKenzie, 1 female, 4 immatures (TTU). Grutas de San Sebastian, 55 km S Oaxaca, September 1971, W. Russell, 1 immature (TTU); 31 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 1 female, 2 immatures (TTU).

Tabasco: Grutas del Coconá, 3 km NE Teapa, 7 April 1971, V. Sbordoni, 1 immature (Brignoli, 1974a); 28 September 1974, J. Reddell, 1 female (TTU).

Tamaulipas: Cueva de San Rafael de los Castros, 10 April 1966, J. Fish, D. McKenzie, 1 immature (TTU).

Veracruz: Cueva del Ojo de Agua Grande, 10 km N Potrero Viejo, 4 January 1974, J. Reddell, D. McKenzie, R. Jameson, W. Elliott, 1 immature (TTU). Cueva de Sala de Agua, 5 km N Cuitlahuac, 4 January 1977, J. Reddell, A. Grubbs, C. Soileau, D. McKenzie, 1 female, 2 immatures (TTU). Cueva de Ungurria, 31 December 1972, J. Reddell, D. McKenzie, M. McKenzie, S. Murphy, 2 immatures (TTU).

GUATEMALA: *Izabal:* Cueva de la Coche, 1.5 mi W Livingston, 21 August 1969, S. and J. Peck, 3 immatures (TTU).

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REPORT ON CAVERNICOLE AND EPIGEAN SPIDERS FROM THE YUCATAN PENINSULA

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INTRODUCTION

Up to the present the principal work on Yucatán cave spiders has been that of Chamberlin and Ivie (1938), who recorded 25 species as part of a volume by A. S. Pearse on The Cave Fauna of Yucatan. Two of these spiders, *Wanops coecus* and *Anopsicus pearsei,* were the first blind troglobites to be found in México. The dominant family in that report was the Pholcidae with seven species placed in five genera. The present systematic study supplements that of Chamberlin and Ivie with consideration of important new material from a wider region, the Yucatán Peninsula, comprising the area originally occupied by the Mayan people. In addition to records for 35 cavernicoles, 13 species presently known from epigean habitats are included because of their close relationship to those from caves and the likelihood that they also live in caves as troglophiles.

The typical cave fauna comprehends a graduated spectrum of taxa ranging from accidental visitors finding temporary refuge to the extreme of those that now are so committed to specific cave habitats that they seemingly cannot exist outside them. All of these categories are found in the present collection. A big-eyed, diurnal jumping spider, *Corythalia* sp., was found in the entrance sink of Cueva (Actún) Xpukil. Cribellate species of *Uloborus* and *Goeldia* and the related ecribellate agelenids, such web spinners as the theridiids and linyphiids, and various wandering clubionids favor the duskiness of cave entrances and often penetrate into the superficial zones. Many other species are troglophiles that seem to live and reproduce with equal comfort inside or outside of caves. In this category are most of the species of the present paper, notably the Pholcidae, Oonopidae, Ochyroceratidae, and others, all of which shun the light and live on cave walls or in ground detritus. Two new eyeless cavernicoles occur in the present collection and some others have the eyes reduced in size.

Analysis of the relationships of the new material from the Yucatán Peninsula brings out the following data. Four of the species, *Scytodes fusca* Walckenaer, *Physocyclus globosus* (Taczanowski), *Uloborus geniculatus* Olivier, and *Theridion rufipes* Lucas, are widespread tropicopolitan types presumably transplanted from outside faunas. *Ariadna pilifera* O. Pickard-Cambridge ranges from the southwestern United States to the Isthmus of Tehuantepec in México. Most of the other species are restricted to the Yucatán Peninsula or range little beyond its western limits. The dominant family is the Pholcidae with 18 species; of these *Metagonia chiquita* is an eyeless troglobite from Cenote Chen Mul in Yucatán. New descriptions and figures are provided for the pholcid species of Chamberlin and Ivie. The blind *Wanops coecus* Chamberlin and Ivie of the family Oonopidae, now known from the female, is transferred to the widespread genus *Oonops* in the belief that it represents only an eyeless congener of that group; four additional species are described in *Oonops.* The family Ochyroceratidae is represented by four new species,

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three belonging to the genus *Theotima* and a fourth assigned to the genus *Speocera.* Especially notable is an eyeless agelenid of the genus *Cicurina* from Cueva (Actún) Tucil, Yucatán, which is matched by similar species from Texas and Coahuila. Finally can be mentioned a new genus, *Tixcocoba,* proposed for a small clubionid from Yucatán and Campeche.

SYSTEMATIC SECTION

SUBORDER MYGALOMORPHAE

Family Theraphosidae

Discussion.–Identification of theraphosids poses difficult generic and specific problems even with mature examples of both sexes available. Because most of the material listed below is immature, its referal to genera is not at present possible.

Records.–*Campeche:* Quarried cave, N of Champotón, 22 August 1972, W. Russell, J. Cooke, R. W. Mitchell.

Yucatán: Cenote Hunto Chac (Cueva del Pozo), 12 April 1973, J. Reddell, M. McKenzie. Cenote Xtoloc, Chichén Itzá, 8 August 1973, R. W. Mitchell. Cenote Amil, 6 km S Abalá, 28 March 1973, J. Reddell. Cenote (Cueva) de Hoctún, 16 March 1973, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick. Cueva (Actún) Xpukil, 3 km S Calcehtok, 3 August 1973, J. Reddell; 18-19 March 1973, J. Reddell, S. Murphy, D. and M. McKenzie, M. Butterwick.

SUBORDER ARANEOMORPHAE

Family Scytodidae

Scytodes fusca Walckenaer

Scytodes fusca Walckenaer, 1837, p. 272. Chamberlin and Ivie, 1938, p. 126.

Records.–*Yucatán:* Loltún Cave, near Nakab mouth, 16 July (Chamberlin and Ivie, 1938). Cenote de San Luis, San Luis, 14 km S Buenaventura, 2 April 1973, J. Reddell, female. Cenote Chen Mul, Ruinas de Mayapán, 24, 26 April 1973, J. Reddell, D. and M. McKenzie, M. Butterwick, two females, immature.

Scytodes meridana Chamberlin and Ivie

Scytodes meridana Chamberlin and Ivie, 1938, p. 126, figs. 4-5. Bonnet, 1958, p. 3987.

Records.–*Yucatán:* San Bulhá Cave, Mérida, 13 July, female holotype, male, immature (Chamberlin and Ivie, 1938, p. 128). Cueva (Actún) Xpukil, 3 km S Calcehtok, 3 August 1973, J. Reddell, female and egg sac from entrance sink. 1 km S Muna, 21 July, 4 July 1973, M. Ay Canul, E. Gonzalez, female. Pyramid, Izamal, 10 August 1973, J. Reddell, immature. Ruinas de Mayapán, 14 August 1973, J. Reddell, two females. Surface at Cueva (Actún) Kaua, 23 August 1972, J. Cooke, W. Russell, female. Cueva de Cenote Xtolok, Chichén Itzá, 8 August 1973, J. Reddell, immature. 3 km S Calcehtok, 3 August 1973, J. Reddell, immature.

Chiapas: Ruinas de Palenque, 25 July 1973, J. Reddell, J. M. Rowland, immature.

Campeche: 2 km N Hopelchen, 23 August 1972, J. Cooke, W. Russell, male.

Loxosceles yucatana Chamberlin and Ivie

Loxosceles yucatana Chamberlin and Ivie, 1938, p. 126, fig. 3. Gertsch, 1973, p. 161.

Distribution.–Common species of Yucatán Peninsula caves and suitable surface stations, ranging southward into Belize and Guatemala.

Records.–*Yucatán:* Cenote Hunto Chac (Cueva del Pozo), 12 April 1973, J. Reddell, M. McKenzie, female, immature. Cenote Hunto Chac (Cueva Mamey), 12 April 1973, D. McKenzie, S. Murphy, two females. Cueva Sodzil, 5 km W Sucopo, 31 March 1973, J. Reddell, D. and M. McKenzie, S. Murphy. Cenote Sabacah, 1 km W Sucopo, 31 March 1973, J. Reddell, two males, female, immature. Cueva (Actún) Xpek, 1 km S Muna, 2 August 1973, R. W. Mitchell, J. Reddell. Cueva (Actún) Ziizhá, 2 km S Muna, 3 August 1973, M. Ay Canul, E. Gonzalez, F. Abernethy, R. W. Mitchell and group, female. Cueva de Santa Elena (=Cueva de los Camarones), 5 km S Telchac Puerto, 22 March 1973, J. Reddell, immature. Cueva (Actún) Chom, 1 km S Calcehtok, 1 May 1973, J. Reddell, female. Cueva de Cenote Xtolok, Chichén Itzá, 8 August 1973, J. Reddell, immature. Cenote de Tixcancal, Tixcancal, 2 April 1973, S. Murphy. immature. Cenote de Sihunchén, Sihunchén, 23 March 1973, J. Reddell, S. Murphy, M. McKenzie, M. Butterwick, male, females, immature. Grutas de Tzab-Nah, 2 km S Tecoh, 26 April 1973, J. Reddell, M. McKenzie, immature. Cenote Chan si kin (Norte), 1 km E Ruinas de Mayapán, 24 April 1973, J. Reddell, female. Cenote Chen Mul, Ruinas de Mayapán, 2 May 1973, J. Reddell, R. W. Mitchell, female, immature. Cenote Xtacabihá, 1 km SW Xalau, 11 April 1973, J. Reddell, M. McKenzie, S. Murphy, immature. Cueva (Actún) Xkyc, 1 km S Calcehtok, 1 May 1973, J. Reddell, D. McKenzie, E. Alexander, M. Butterwick, male, females, immature. Cueva (Actún) Tucil, 2 km S Muna, 27 March 1973, J. Reddell, female, immature; 3 August 1973, M. Ay Canul, E. Gonzales, F. Abernethy, R. W. Mitchell and group, immature. Cueva (Actún) Kaua, Kaua, 23 August 1973, R. W. Mitchell, J. Cooke, females. Cueva (Actún) Xpukil, 3 km S Calcehtok, 18-19 March 1973, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick, female, immature, from entrance sink; 4-5 April 1973, J. Reddell, S. Murphy, D. and M. McKenzie, females; 18-19 March 1973, J. Reddell, S. Murphy, D. and M. McKenzie, M. Butterwick, females, immature.

Campeche: 10 km N Hopelchen, 27 July 1973, J. Reddell, J. M. Rowland, immature.

Family Pholcidae

The members of this family have undergone a remarkable adaptive radiation in North America in terms of the large number and variety of the taxa. Most of the Mexican and Central American species occur in quite narrow geographic zones and few have wide ranges. Almost every Mexican state has representatives exclusive to it and this is also true for the Yucatán Peninsula, where few of the species occur outside its limits.

Genus *Metagonia*

The genus *Metagonia* is well represented in the area under consideration with all but one of the species seemingly exclusive to it. All share the prime characters of the genus as defined by me in another place (Gertsch, 1971, p. 82) and consist of surface forms, notably *caudata* and *goodnighti,* and various cavernicoles. The former are yellowish spiders with sparse dark spotting of their bodies and narrow dark rings of the legs. The cave dwellers are pallid types with little dark pattern; these have longer legs and smaller eyes. Only one of the species, *chiquita,* is eyeless, but some of the others are probable troglobites.

The principal structural features of the several species are the following, which will not be repeated in the descriptions. The subround carapace is convex with the prominent downwardly projecting clypeus equal in height to about three diameters of an anterior lateral eye, with the pars cephalica moderately elevated and delimited by shallow cephalic grooves and a linear cervical groove. The six eyes on two separated triads are quite prominent but rest on low connate tubercles little elevated above the pars cephalica. The suboval eyes are subequal in size and in cavernicoles are about 0.12 mm in long diameter, somewhat larger in surface forms. The posterior eye row is recurved with the triads of eyes moderately separated in surface forms and more widely separated in cavernicoles. The chelicerae of the males may or may not have distinctive patches of spines, but in one species, *torete,* small horns are present. The legs are very long, the first one sometimes exceeding thirty times the length of the carapace in males, and the femora are only slightly heavier than succeeding segments. The abdomen is similar in both sexes, usually suboval and as high as broad, bluntly rounded behind or produced to a conical or elongated caudal projection.

With relatively few distinctive characters available from coloration or general morphology, reliance for separation of the species rests largely on the genitalia. The male palpi of *Metagonia* are remarkably developed organs exceeding in complexity those of most other pholcid genera. The complicated tarsus consists of a hinged process distinctive in length and shape for each species and a principal process forming an apical fringe which bears a series of spurs, membranes and teeth on each lateral surface.

The epigyna of the females have proved to be far more complicated than suggested by superficial study of these organs. The patterns of external details, with emphasis on the sclerotized plaques and special features in front and behind the orifice, are still in most cases clearly diagnostic. The epigynum (used by me in the broad sense to designate both external and internal features of this secondary reproductive system) is often borne on an inflatable or erectile appendage, probably lying flat against the integument most of the time but inflated by the female during courtship or mating. In the *maya* group (see Figs. 10-18) a distinct central tongue or lobe, flanked by lateral lobes bearing several setae, is present, and in front of this is a transverse blind atrium possibly serving as an anchoring point for a process of the tarsus of the male palpus. The orifice of the epigynum is a wide transverse groove which opens into a voluminous chamber covered by dorsal and ventral concave valves bearing more or less well defined sclerotized receptacles and tubules. The pattern of these units is still enigmatic in terms of conventional nomenclature. The lower or outer valve probably bears the receptacles and orifices to receive the emboli of the male palpus whereas the inner or upper valve features ridges and grooves to aid as a guide for the bulbs and emboli during mating. The patterns of these valves are diagnostic for each species.

Metagonia caudata O. Pickard-Cambridge
Figs. 1-4, 7-8, 19-20

Metagonia caudata O. Pickard-Cambridge, 1895, p. 150, pl. 21, figs. 8, 8a-d; 1898, p. 246, pl. 31, figs. 7, 7a-c. F. Pickard-Cambridge, 1902, p. 370, pl. 35, figs. 5, 5a. Bonnet, 1957, p. 2808.

Diagnosis.–Large caudate species of surface habitats with brown spotting on carapace (Figs. 1, 3) and legs and brown sternum of female, readily recognized by distinctive genitalia of both sexes as illustrated.

Discussion.–Although there is not too much correspondence among the genitalic figures provided by the two Pickard-Cambridges, there is little doubt that this is the *caudata* of O. Pickard-Cambridge.

Female.–Total length 5 mm. Carapace 1.3 mm long, 1.1 mm wide. Abdomen 3.7 mm long, 2 mm wide.

Carapace (Fig. 1) white with brown spot on each side of cervical groove and eye tubercles brown; sternum dusky brown with numerous small pale flecks. Legs yellow with conspicuous brown patellae and dark rings at apex of tibiae. Abdomen (Fig. 1) white with few scattered bluish spots on dorsum.

Structure typical of *tinaja* group. Ocular tubercle of medium height with eyes large (Fig. 3); ratio of eyes: ALE:PLE:PME = 18:15:16. Anterior lateral eyes separated by two diameters. Posterior median eyes separated by about one long diameter. Abdomen (Fig. 1) much longer than broad with apically narrowly rounded caudal appendage half as long as abdomen. First leg: femur 7 mm, patella 0.55 mm, tibia 6.7 mm, metatarsus 11 mm, tarsus 1.8 mm; total length 27.05 mm; first leg about 20 times, first femur 5.4 times as long as carapace.

Epigynum (Figs. 7-8) suboval plaque with external and internal features as shown.

Male.–Total length 3.8 mm. Carapace 1.5 mm long, 1.3 mm wide. Abdomen 2.35 mm long, 1.15 mm wide.

Carapace (Fig. 4) yellow with pars cephalica brown and this color extending over half of clypeus, with eye tubercles dark brown; sternum plain yellow. Legs yellow with patellae brown and brown rings at end of tibiae. Abdomen (Fig. 4) dull yellow with heavy blue flecks on dorsum, fewer in some specimens.

Structure like that of female. Clypeus equal in height to little more than four diameters of anterior lateral eye. Ocular tubercle well elevated and eyes larger than those of female (Fig. 2); ratio of eyes: ALE:PLE:PME = 20:18:20. Anterior lateral eyes separated by more than two long diameters (20/44). Posterior median eyes separated by more than long diameter (20/21). Abdomen (Fig. 4) narrower than that of female. Outer face of chelicera with small patch of about nine spinules in apical third of segment. First leg: femur 10.5 mm, patella 0.7 mm, tibia 10.2 mm, metatarsus 18 mm, tarsus 2 mm; total length 41.4 mm; first leg 27.6 times, first femur seven times as long as carapace.

Male palpus (Figs. 19-20) with stout segments; accessory process of tarsus about as long as principal segment.

Type data.–Female type from Teapa, Tabasco, México.

Distribution.–Yucatán Peninsula to San Luis Potosí in México.

Records.–*Tabasco:* Teapa, 16 July 1947, C. and M. Goodnight, male from along river.

Chiapas: Pichacales, 18 July 1947, C. and M. Goodnight, immature. 1 km N Palenque, 25 July 1973, J. Reddell, R. W. Mitchell, and group, female.

San Luis Potosí: Tamazunchale, 26 June 1947, B. Malkin, immature; 20 May 1952, W. J. Gertsch, immature; 19 April 1963, W. J. Gertsch, W. Ivie, three males, two females.

Texas: Edinburg, 1 April 1936, S. Mulaik, one female from Mexican banana bunch.

Metagonia goodnighti, new species

Figs. 5-6, 27-28

Diagnosis.–Small epigean species with caudate projection of abdomen, distinguished by details of the epigynum and male palpus as illustrated.

Etymology.–Named for Dr. Clarence Goodnight of Western Michigan University.

Female.–Total length 2.3 mm. Carapace 0.8 mm long, 0.7 mm wide. Abdomen 1.5 mm long, 0.75 mm wide.

Carapace yellowish with brown streaks at sides and middle of pars cephalica and few radiating from cervical groove; eyes fairly large and eye tubercles black; legs yellowish, first with dusky patella and dusky ring at end of tibia. Abdomen dull yellow.

Clypeus precipitous, equal in height to nearly two diameters of anterior lateral eyes. Ocular tubercle of medium height; ratio of eyes: ALE:PLE:PME = 15:12:13. Anterior lateral eyes separated by less than two long diameters (15/25). Posterior median eyes separated by long diameter. Abdomen longer than broad, produced behind into triangular projection third as long as abdomen. First leg: femur 3.8 mm, patella 0.34 mm, tibia 3.8 mm, metatarsus 6.2 mm, tarsus 1.2 mm; total length 15.34 mm; first leg 19 times, first femur 4.7 times as long as carapace.

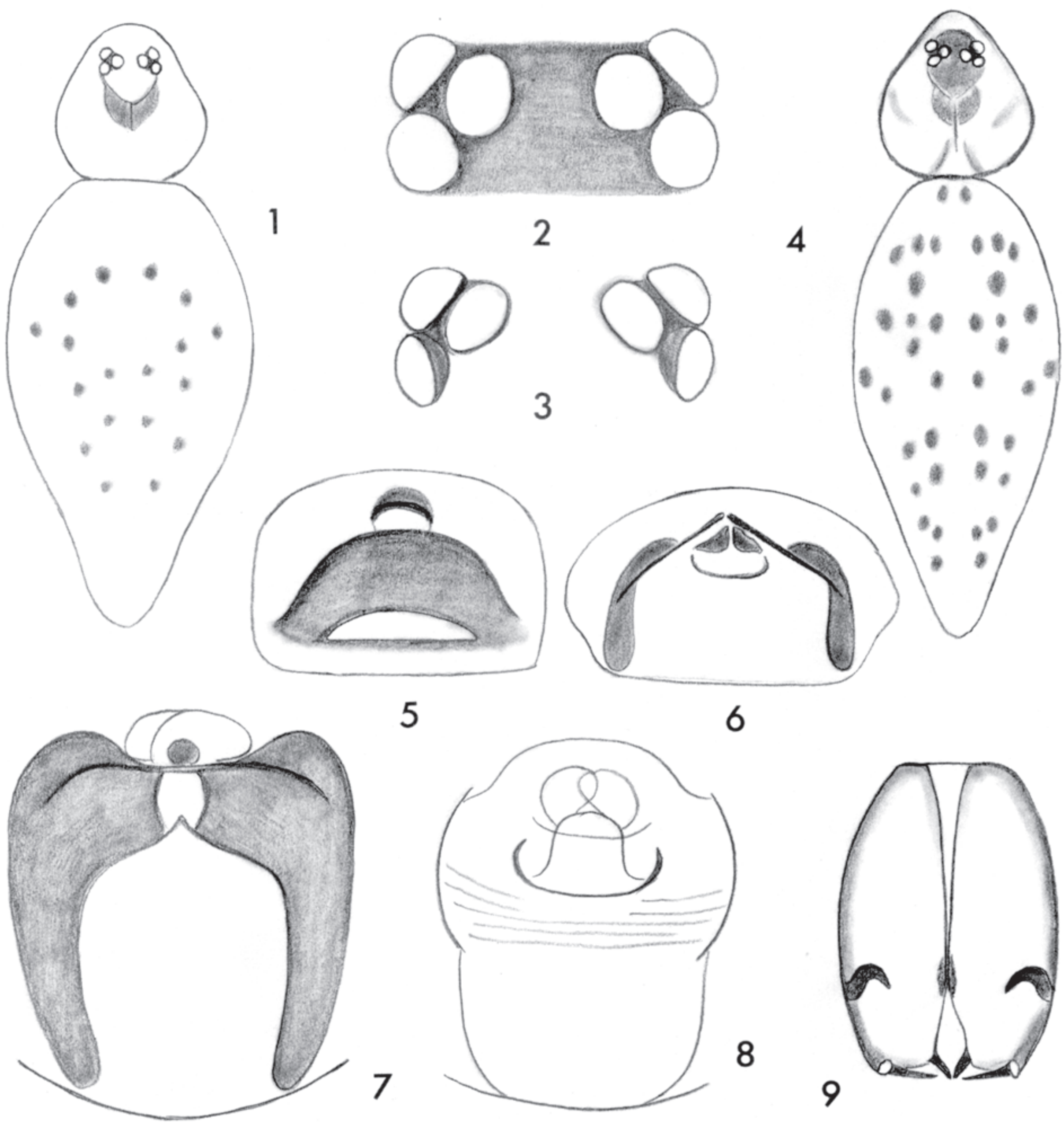
Epigynum (Figs. 5-6) small transverse plaque with few external and internal features as shown.

Male.–Total length 2.1 mm. Carapace 0.9 mm long, 0.75 mm wide. Abdomen 1.2 mm long, 0.85 mm wide.

Carapace yellow with dusky brown pars cephalica and pair of brown streaks on posterior declivity; eye tubercles black; legs yellowish with brown patellae and small brown ring at end of tibiae. Abdomen dull yellowish with ten small dusky spots on dorsum.

Clypeus produced forward, equal in height to two and one-half diameters of anterior lateral eye. Ocular tubercle of medium size with eyes large; ratio of eyes: ALE:PLE:PME = 15:15:15. Anterior lateral eyes separated by two diameters. Posterior median eyes separated by less than long diameter (13/15). Chelicerae without distinctive spines or modifications. Abdomen subtriangular with well developed caudal projection. First legs missing; fourth leg: femur 3.7 mm, patella 0.25 mm, tibia 3.1 mm, metatarsus 4.35 mm, tarsus 0.5 mm; total length 11.9.

Palpus (Figs. 27-28) with thin accessory process



Figs. 1-4.–*Metagonia caudata* O. Pickard-Cambridge: 1, carapace and abdomen of female, dorsal view; 2, eyes of male; 3, eyes of female; 4, carapace and abdomen of male, dorsal view. Figs. 5-6.–*Metagonia goodnighti,* epigynum: 5, ventral view; 6, dorsal view. Figs. 7-8.–*Metagonia caudata* O. Pickard-Cambridge, epigynum: 7, ventral view; 8, dorsal view. Fig. 9.–*Metagonia torete,* male chelicerae, frontal view.

of tarsus about as long as principal element.

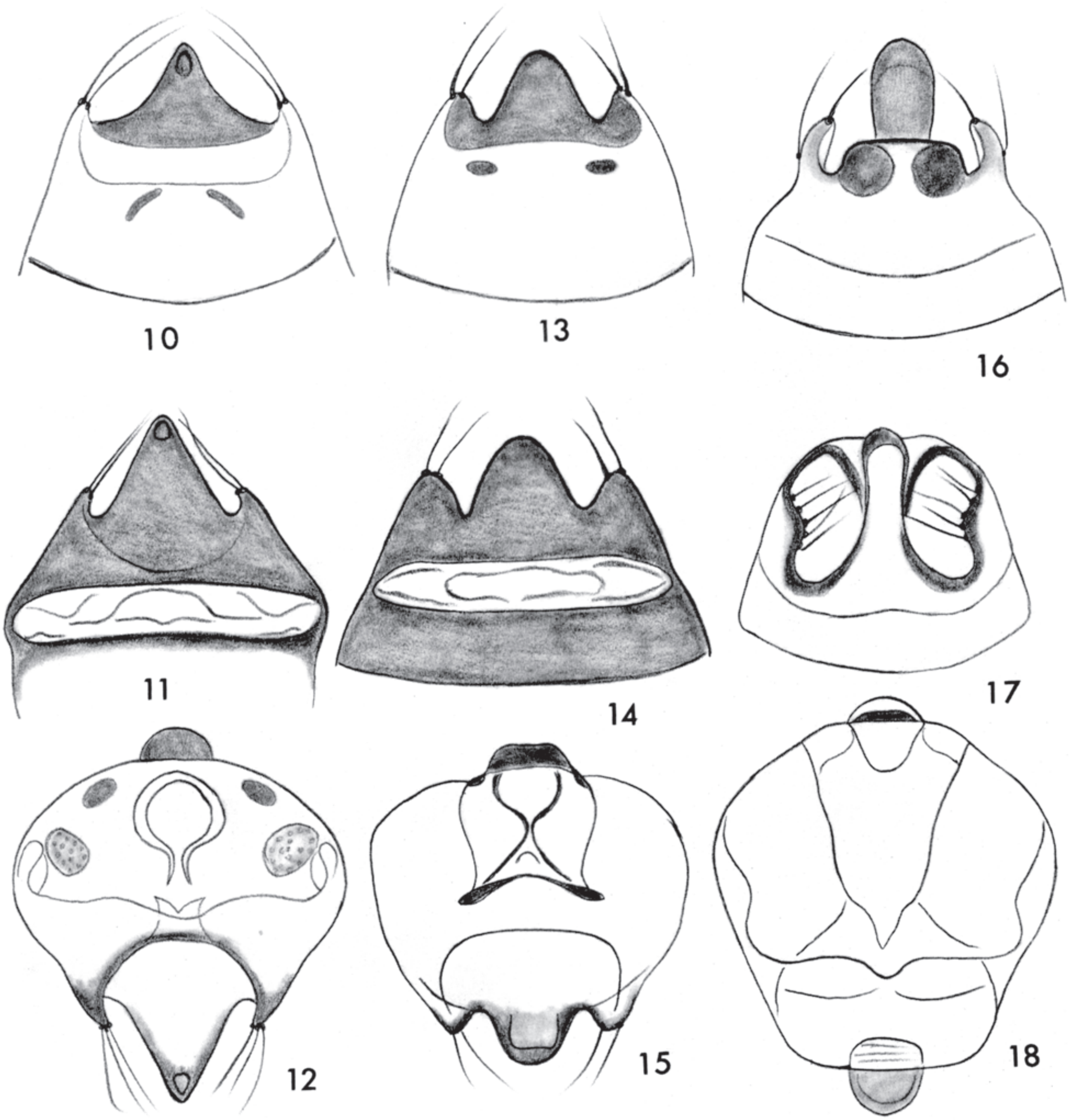
Type data.–Male holotype from Finca Cuahtemoc, Cacahuatán, Chiapas, 5 August 1050, C. and M. Goodnight.

Distribution.–Known only from male holotype and female.

Record.–*Chiapas:* Cacahuatán, 9 August 1950, C. and M. Goodnight, female.

Metagonia torete, new species
Figs. 9, 25-26, 29-30

Diagnosis.–Small species with evanescent eyes and long legs, probable troglobite, readily identified in male by incurved cheliceral horns (Fig. 9) unique in genus, and by details of genitalia of both sexes as illustrated.



Figs. 10-18.–Epigyna of species of *Metagonia:* Figs. 10-12.–*M. yucatana* Chamberlin and Ivie: 10, frontal view; 11, posterior view; 12, dorsal view. Figs. 13-15.–*M. maya* Chamberlin and Ivie: 13, frontal view; 14, posterior view; 15, dorsal view. Figs. 16-18.–*M. iviei:* 16, frontal view; 17, posterior view; 18, dorsal view.

Etymology.—Specific name from Spanish *torete,* a small bull.

Female from Grutas de Tzab-Nah.—Total length 2 mm. Carapace 0.7 mm long, 0.7 mm wide. Abdomen 1.3 mm long, 0.9 mm wide.

Base color of cephalothorax and appendages pale yellow except for duskiness at junctures of leg segments; abdomen whitish.

Eyes relatively small, evanescent, faintly margined with dusky; eye triads separated by width of one; ratio of eyes: ALE:PLE:PME = 10:10:10. Anterior lateral eyes separated by two and one-half diameters. Posterior median eyes separated by one and one-half diameters. Abdomen elevated, broadly subconical at apex. First leg: femur 3.4 mm, patella 0.35 mm, tibia 3.7 mm, metatarsus 5.4 mm, tarsus 1.15 mm; total length 14 mm; first leg 20 times, first femur nearly five times as long as carapace.

Epigynum (Figs. 29-30) broadly lobed behind.

Male holotype from Cueva Sodzil.—Total length 1.8 mm. Carapace 0.68 mm long, 0.68 mm wide. Abdomen 1.1 mm long, 0.65 mm wide.

Coloration and structure like those of female unless otherwise noted. Chelicera smooth, without spinules but armed on outer side beyond middle with small incurved horn. First leg: femur 4.4 mm, patella 0.3 mm, tibia 4.65 mm, metatarsus 7.2 mm, tarsus 1.25 mm; total length 17.8 mm; first leg 26 times, first femur 6.5 times as long as carapace.

Male palpus (Figs. 25-26) with thin curved accessory process of tibia about as long as principal segment.

Type data.—Male holotype, two females and immature from Cueva Sodzil, 5 km W Sucopo, Yucatán, 31 March 1973, J. Reddell, D. and M. McKenzie, S. Murphy.

Distribution.—Yucatán.

Records.—*Yucatán:* Grutas de Tzab-Nah, 2 km S Tecoh, 26 April 1973, J. Reddell, M. McKenzie, male, three females; 23 April 1973, J. Reddell, D. McKenzie, male, immature. Cenote de Orizaba, 8 km S Buenaventura, April 1973, J. Reddell, S. Murphy, female.

Metagonia chiquita, new species
Figs. 31-32

Diagnosis.—Small eyeless troglobite with legs of medium length, distinguished by subtriangular dusky epigynal structure (Figs. 31-32).

Etymology.—Specific name from Spanish *chiquita,* very small.

Female.—Total length 1.3 mm. Carapace 0.78 mm long, 0.7 mm wide. Abdomen 0.6 mm long, 0.6 mm wide.

Base color of cephalothorax and appendages whitish with some duskiness at junctures of segments and sclerites and chelicerae dusky; abdomen whitish, darker below, with spinnerets and epigynal sclerites dusky.

Carapace about as broad as long; pars cephalica weakly elevated and ocular tubercles obsolete, without trace of eyes. Abdomen suboval, higher than broad, broadly rounded behind. First leg: femur 2.8 mm, patella 0.3 mm, tibia 3 mm, metatarsus 3.8 mm, tarsus 0.8 mm; total length 10.7 mm; first leg 14 times, first femur nearly four times as long as carapace.

Epigynum (Figs. 31-32) inflated tubular appendage, subtriangular in ventral view.

Type data.—Female holotype from Cenote Chen Mul, Ruinas de Mayapán, Yucatán, 2 May 1973, J. Reddell, R. W. Mitchell.

Metagonia maya Chamberlin and Ivie
Figs. 13-15, 23-24

Metagonia maya Chamberlin and Ivie, 1938, p. 132, figs. 23, 24. Bonnet, 1957, p. 2808.

Diagnosis.—Small whitish, long-legged species with reduced, evanescent eyes, possible troglobite, separated from related species by details of genitalia as illustrated.

Etymology.—Named for the Maya of Yucatán.

Female from Cenote Xtacabihá.—Total length 1.8 mm. Carapace 0.8 mm long, 0.6 mm wide. Abdomen 1 mm long, 0.74 mm wide.

Base color and cephalothorax and appendages whitish to pale yellow, without contrasting markings except for duskiness at junctures of leg segments; abdomen dull white.

Eyes relatively small, evanescent, without pigment; triads of eyes separated by about width of one; ratio of eyes: ALE:PLE:PME = 8:6:6. Anterior lateral eyes separated by three diameters. Posterior median eyes separated by three diameters, nearly touching lateral eyes. Abdomen suboval, as long as broad, produced behind but broadly rounded. First leg: femur 4.7 mm, patella 0.45 mm, tibia 4.7 mm, metatarsus 7.5 mm, tarsus 1.3 mm; total length 18.65 mm; first leg 23.2 times, first femur about six times as long as carapace.

Epigynum (Figs. 13-15) with small rounded lobe not much longer than lateral lobes.

Male from Cenote Xtacabihá.—Total length 2.2 mm. Carapace 0.8 mm long, 0.7 mm wide. Abdomen 1.3 mm long, 0.9 mm wide.

Coloration and structure in close agreement with those of female unless otherwise noted. Ratio of eyes: ALE:PLE:PME = 10:8:8. Eyes closer together; posterior median eyes separated by less than three diameters (20/8). Chelicerae smooth, without trace of distinctive spinules. First leg: femur 6 mm, patella 0.4 mm, tibia 6.8 mm, metatarsus 11.4 mm, tarsus 1.5 mm; total length 26.1 mm; first leg 32.6 times, first femur nearly eight times as long as carapace.

Male palpus (Figs. 23-24) with pointed accessory process of tarsus much longer than principal lobe.

Type data.–Male holotype from Chac Mol Cave, Tohil, Yucatán, in American Museum of Natural History (University of Utah collection).

Distribution.–Yucatán.

New records.–*Yucatán:* Cueva (Actún) Kaua, Kaua, 9, 12 April 1973, J. Reddell, M. McKenzie, three females. Cenote Xtacabihá (=Cenote Xalau), 1 mi SW Xalau, 11 April 1973, J. Reddell, M. McKenzie, S. Murphy, male, female, immature. Grutas de Balankanche (=Cueva Bolonchén), Chichén Itzá, July 1948, C. Goodnight, male, eight females. Cueva de las Derrumbes, 0.5 km E Tixcancal, 2 April 1973, J. Reddell, female. Pozo (Cenote) Santa Elena, 5 km S Telchac Puerto, 22 March 1973, S. Murphy, female.

Metagonia yucatana Chamberlin and Ivie
Figs. 10-12, 21-22

Metagonia yucatana Chamberlin and Ivie, 1938, p. 132, fig. 21 (not female, figs. 19, 20).

Metagonia yucatanensis Bonnet, 1957, p. 2808 (emendation).

Metagonia viabilis Chamberlin and Ivie, 1938, p. 133, fig. 22. Bonnet, 1947, p. 2808 (New Synonymy).

Discussion.–The species *yucatana* was based on a male holotype from Loltún Cave at Oxkutzcab, Yucatán. The male palpus is especially diagnostic in the length and shape of the large spatuliform accessory process of the tarsus, which also bears other distinctive spurs. This male was found associated with females of *viabilis* in Cueva (Actún) Xpukil and seems to be properly assigned to that female. The female placed with *yucatana* is a sibling relative known from few specimens and is presumed to represent a new species so far known only from that sex. Its association with the male *yucatana* in Loltún Cave is presumed to be accidental or erroneous and unusual in that only rarely are such closely related species found together in the same cave.

Diagnosis.–Pale troglophile with very long legs, distinguished in both sexes by distinctive genitalia which are figured.

Female from Cueva (Actún) Xpukil.–Total length 2.8 mm. Carapace 1.1 mm long, 1 mm wide. Abdomen 1.7 mm long, 1.35 mm wide.

Cephalothorax and appendages whitish to pale yellow; eye tubercles dusky and dusky smudge on posterior declivity of pars cephalica; legs with dusky patellae and rings at ends of tibiae; abdomen whitish.

Clypeus equal in height to three diameters of anterior lateral eye; ratio of eyes: ALE:PLE:PME = 12:11:11; eyes broadly oval in shape and averaging about 0.12 mm in long diameter. Abdomen longer than broad, produced behind into broadly rounded apical projection, rarely more pointed. First leg: femur 5.5 mm, patella 0.45 mm, tibia 5.75 mm, metatarsus 9 mm, tarsus 1.6 mm; total length 22.3 mm; first leg 20 times, first femur five times as long as carapace.

Epigynum (Figs. 10-12) with triangular median lobe flanked by small setose lobes on each side.

Male from Cueva (Actún) Xpukil.–Total length 2.1 mm. Carapace 0.85 mm long, 0.82 mm wide. Abdomen 1.3 mm long, 0.9 mm wide.

Structure like that of female; eyes subequal in size. Anterior lateral eyes separated by less than three diameters (30/12). Posterior median eyes separated by more than long diameter (12/16). Eyes of male from Ruinas de Palenque larger with posterior median eyes separated by full diameter. Chelicera without spines or secondary sexual features. Abdomen broadly pointed behind. First leg: femur 6.8 mm, patella 0.35 mm, tibia 6.8 mm, metatarsus 12 mm, tarsus 1.7 mm; total length 27.65 mm; first leg 32.5 times, first femur eight times as long as carapace.

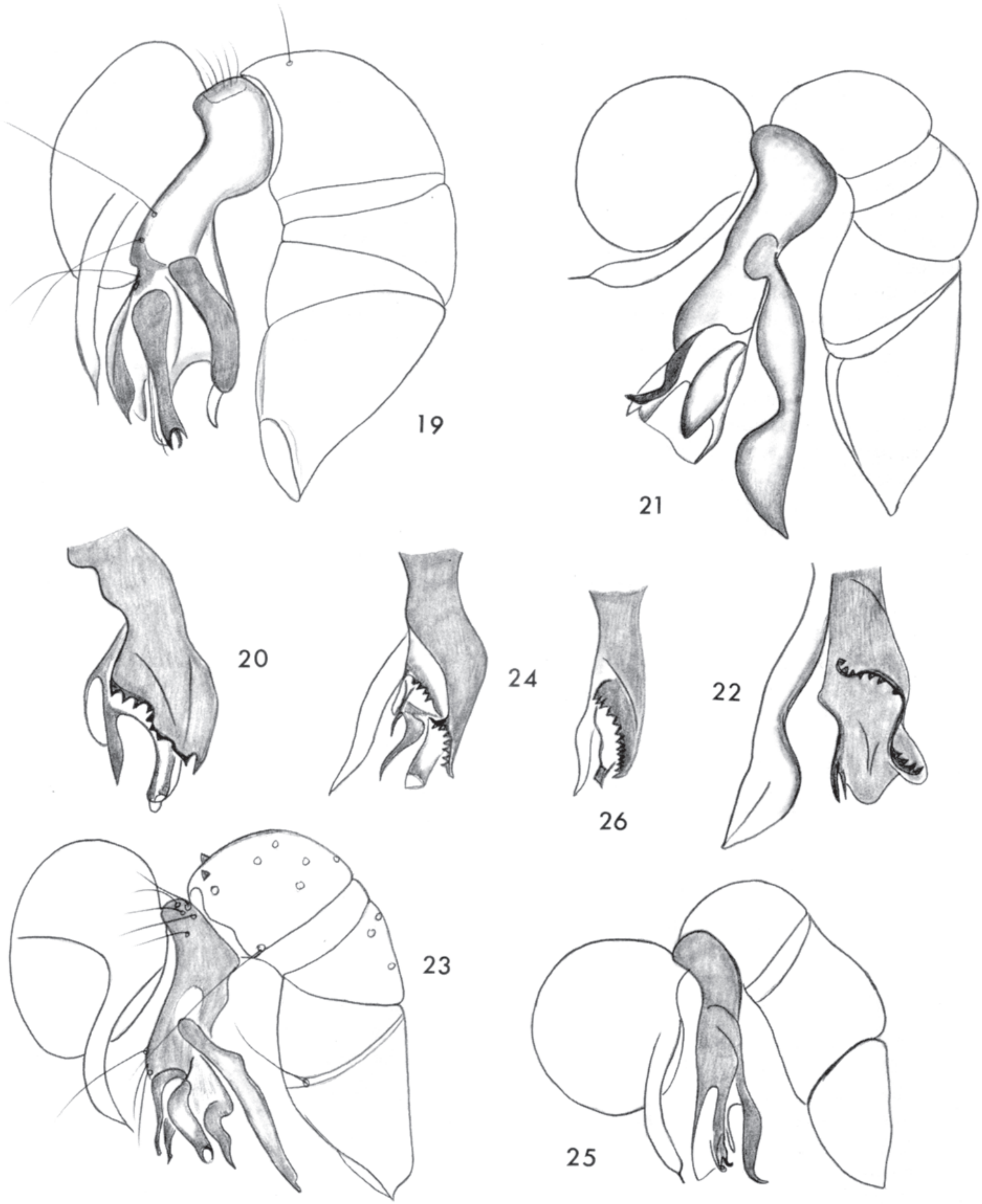
Male palpus (Figs. 21-22) with heavy spatulate accessory process of tarsus and subtruncate principal element.

Type data.–Male holotype from Loltún Cave, near Nakab Mouth, Oxkutzcab, Yucatán, 26 July, A. S. Pearse, in American Museum of Natural History (University of Utah collection).

Distribution.–Yucatán and Chiapas.

New records.–*Yucatán:* Cueva (Actún) Ziizhá, 2 km S Muna, 3 August 1973, R. W. Mitchell and group, male. Chichén Itzá, 6 July 1948, C. J. Goodnight, female. Cueva (Actún) Xpukil, 18-19 March 1973, S. Murphy, M. McKenzie, M. Butterwick, male, three females; 4-5 April 1973, J. Reddell, S. Murphy, M. McKenzie, four females; 30 April 1973, J. Reddell, R. W. Mitchell, female; 15 April 1973, J. Reddell, three females. Cueva (Actún) Chom, 1 km S Muna, 1 May 1973, J. Reddell, female. Oxkutzcab (in cave) July 1936, A. S. Pearse, fragments of male.

Chiapas: Las Ruinas de Palenque, July 1948, C. and M. Goodnight, male.



Figs. 19-20.–*Metagonia caudata* O. Pickard-Cambridge, left male palpus: 19, retrolateral view; 20, prolateral view of end of tarsal process. Figs. 21-22.–*Metagonia yucatana* Chamberlin and Ivie, left male palpus: 21, retrolateral view; 22, prolateral view of end of tarsal process. Figs. 23-24.–*Metagonia maya* Chamberlin and Ivie, left male palpus: 23, retrolateral view; 24, prolateral view of end of tarsal process. Figs. 25-26.–*Metagonia torete,* left male palpus: 25, retrolateral view; 26, prolateral view of end of tarsal process.

Metagonia iviei, new species
Figs. 16-18

Metagonia yucatana (misidentification): Chamberlin and Ivie, 1938, p. 132, figs. 19-20 (female only).

Diagnosis.–Pale long-legged species with caudate abdomen, related to *maya* and *yucatana* and readily identified by long basally thin lobe or tongue of epigynum; male unknown.

Etymology.–Named for the late Wilton Ivie.

Female from Quarried Cave.–Total length 2.5 mm. Carapace 0.8 mm long, 0.7 mm wide. Abdomen 1.7 mm long, 1.3 mm wide.

Cephalothorax and appendages whitish to pale yellow; eye tubercles and posterior declivity of carapace with slight duskiness; legs dusky at patellae and at ends of tibiae. Eyes and eye tubercles of medium size and clypeus as high as three diameters of anterior lateral eye; ratio of eyes: ALE:PLE:PME = 12:10:11. Anterior lateral eyes separated by two and one-half diameters. Posterior median eyes separated by more than diameter (15/10). Abdomen longer than broad, produced behind into bluntly conical projection. First leg: femur 5 mm, patella 0.35 mm, tibia 5 mm, metatarsus 7.7 mm, tarsus 1.5 mm; total length 19.55 mm; first leg 24.3 times, first femur 6.2 times as long as carapace.

Epigynum (Figs. 16-18) with basally thin, curved tongue much longer than the lobes of *yucatana* and *maya*, and prominent lateral lobe on each side set with few setae; ventral and dorsal valves with distinctive details as shown.

Type data.–Female holotype and female from Quarried Cave, N of Champotón, Campeche, 27 August 1972, R. W. Mitchell, W. Russell, J. Cooke.

Distribution.–Yucatán and Campeche.

Records.–*Yucatán:* Chichén Itzá, 6 July 1948, C. J. Goodnight, female. Loltún Cave, Oxkutzcab, 26 July 1936, A. S. Pearse, female paratype of *yucatana*.

Genus *Pholcophora*

In an earlier paper (Gertsch, 1971, p. 76) I proposed and continue to use here the name *Pholcophora* Banks for the shorter-legged pholcids closely allied to *Psilochorus*. The genotype of *Pholcophora*, based on *americana* Banks of the western United States, is a fairly large species with eight eyes. Two similar species occur in eastern México along with a series of very small ones, all undescribed, with even shorter legs, that range from Texas deep into Mexico. A new species from Yucatán, herein named *Pholcophora maria* (Fig. 35), belongs in this series. All the other *Pholcophora* so far described by me from México show no trace of the anterior median eyes, although they otherwise differ in no important respects from *Pholcophora*. If this six-eyed series (Fig. 52) were to be given full generic rank, the name *Anopsicus*, based on the eyeless species *pearsei* of Oxolodt Cave, Yucatán, should be used inasmuch as it antedates *Pholcophorina* (Gertsch, 1939, p. 1). New descriptions and illustrations are given for the species now regarded as *placens* O. Pickard-Cambridge and for *pearsei* and *speophila* of Chamberlin and Ivie, described from Yucatán. Four more species are described as new.

The species of *Pholcophora* herein described are similar in size, coloration and general appearance and share structural features which are not repeated in the following descriptions. Most are small, under 2 mm in total length, with pale yellow to dusky brown cephalothoraces and appendages and pale blue, greenish or gray abdomens, these colors fading in preserved specimens. The cephalothorax is subround, convex, with a moderately elevated pars cephalica flanked by weak cephalic grooves but with the cervical groove a distinct linear depression. The wide clypeus protrudes downward, is narrowed and rounded in front and equal in height to four or five diameters of an anterior lateral eye. The fairly large suboval eyes form two triads (Fig. 52) and a smaller anterior median pair of eyes may be present or absent. The three eyes of each triad rest on connate tubercles of medium height, are subequal in size and subcontiguous. The eyes are reduced in size in cavernicoles and sometimes missing. The posterior eye row is gently to moderately procurved. The chelicerae of the males bear horns of differing length and position for each of the species. The abdomen of all species is subglobose, as high as long and broadly rounded behind.

The specific characters are largely centered in the genitalia. The male palpi feature short, apically rounded or truncated tarsal appendages and have a femoral spur near the end of that segment. The epigynum is a simple transverse band or an elevated lobe of distinctive shape from ventral view and presents sclerotized features in posterior and internal views differing among the species. A dorsal view of the epigynum (Fig. 41) of *Pholcophora quieta* (Gertsch, 1973, p. 148) from Gruta de Silvino, Izabal, Guatemala, is included for comparison with the species from the Yucatán Peninsula.

Pholcophora maria, new species
Figs. 33-35

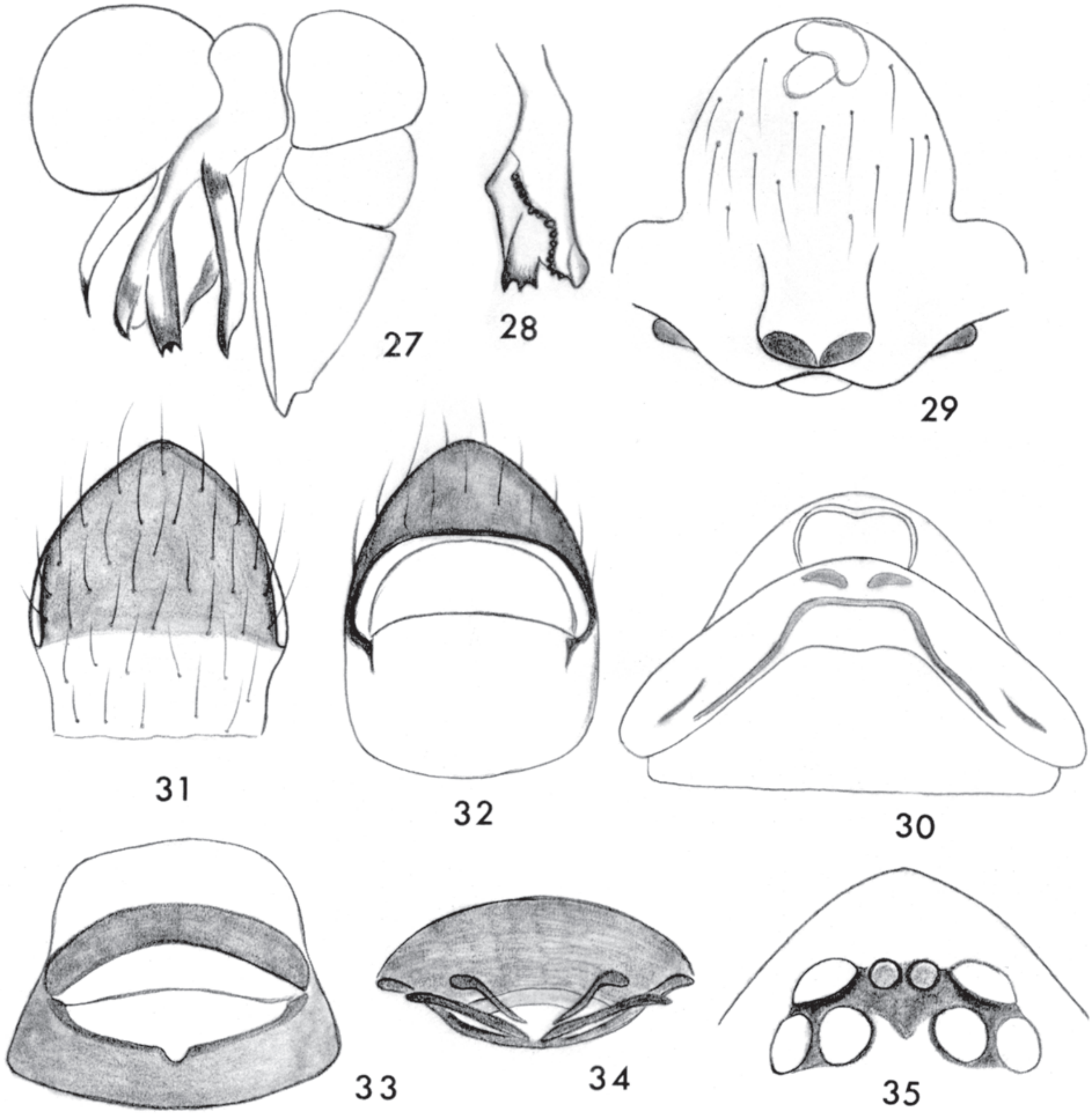
Diagnosis.–Small dusky species with smooth carapace largely devoid of cephalic sutures and with eight eyes present (Fig. 35), related to *texana* Gertsch of southeastern Texas and adjacent México, with longer legs and distinctive epigynal structure as shown in the figures.

Etymology.–Named for Mary Butterwick.

Female.–Total length 1.65 mm. Carapace 0.74 mm long, 0.6 mm wide. Abdomen 0.9 mm long, 0.7 mm wide.

Cephalothorax and appendages dusky yellow; eye tubercles black; legs with rows of black hairs; abdomen gray with faint median pale stripe on dorsum.

Carapace suboval, convex, without traces of cephalic or cervical grooves, produced in front of eyes into bluntly rounded clypeal lobe 0.15 mm high. Eyes eight, surrounded by black pigment; ratio of eyes: ALE:AME:PLE:PME = 7:5:7:7. Anterior eye row moderately procurved; median eyes subcontiguous and nearly touching lateral eyes. Posterior eye row slightly recurved; median eyes separated by nar-



Figs. 27-28.–*Metagonia goodnighti,* left male palpus: 27, retrolateral view; 28, prolateral view of end of tarsal process. Figs. 29-30.–*Metagonia torete,* epigynum: 29, ventral view; 30, dorsal view. Figs. 31-32.–*Metagonia chiquita,* epigynum: 31, ventral view; 32, posterior view. Figs. 33-35.–*Pholcophora maria,* female: 33, epigynum, ventral view; 34, epigynum, dorsal view; 35, eyes, dorsal view.

row diameter. Median ocular quadrangle broader than long (21/13), narrowed in front (21/11). First leg: femur 1.05 mm, patella 0.32 mm, tibia 0.93 mm, metatarsus 1.08 mm, tarsus 0.43 mm; total length 3.81; first leg five times, first femur 1.4 times as long as carapace.

Epigynum (Figs. 33-34) small convex elevation without distinctive external sclerites but presenting lateral sclerites and two small spermathecae in internal view.

Type data.–Female holotype from Cueva (Actún) Xpukil, 18-19 March 1973, J. Reddell, S. Murphy, D. and M. McKenzie, M. Butterwick.

Pholcophora placens (O. Pickard-Cambridge)
Figs. 36-38

Spermophora placens O. Pickard-Cambridge, 1896, p. 222, pl. 27, fig. 10. F. Pickard-Cambridge, 1902, p. 370, pl. 35, fig. 4. Bonnet, 1958, p. 3606.
Pholcophorina placens (misidentification): Gertsch, 1939, p. 3.

Discussion.–O. Pickard-Cambridge's *Spermophora placens* was based on a single six-eyed female from Teapa, Tabasco, México, and cannot be identified on the basis of the verbal descriptions or illustrations of that author or those later supplied by F. Pickard-Cambridge. In 1939 the species was transferred by me to the new genus *Pholcophorina* and this position among the cited species is still regarded as the proper assignment. However, the species called *placens* by me is now clearly not the one described by O. Pickard-Cambridge, which will eventually receive another name. Three females from Teapa are here assigned to *placens* with reasonable confidence. Details of the epigynum clearly distinguish this species from others from the Yucatán Peninsula.

Female.–Total length 2.3 mm. Carapace 0.8 mm long, 0.77 mm wide. Abdomen 1.5 mm long, 1.1 mm wide.

Carapace and appendages dusky yellowish brown; eye tubercles black; abdomen gray.

Structure typical with cephalic and linear cervical grooves deeply impressed; ratio of eyes: ALE:PLE: PME = 11:10:10. Anterior lateral eyes separated by nearly diameter (11/10). Posterior eye row moderately procurved; posterior median eyes separated by full diameter. First leg: femur 2.7 mm, patella 0.3 mm, tibia 3 mm, metatarsus 3.5 mm, tarsus 0.85 mm; total length 10.35 mm; first leg about 13 times, first femur 3.3 times as long as carapace.

Epigynum (Figs. 36-38) transverse elevation with broad sclerotized band in front of genital groove, and presenting in posterior and internal views two dark sclerites separated by their width, presumed to be guides to internal receptacles.

Type data.–Female type from Teapa, Tabasco, México.

Distribution.–Tabasco and Chiapas.

Records.–*Tabasco:* Teapa, 16 July 1947, C. and M. Goodnight, three females.

Chiapas: Pichuacalco, 18 July 1947, C. and M. Goodnight, female.

Pholcophora speophila (Chamberlin and Ivie)
Figs. 42-44

Spermophora speophila Chamberlin and Ivie, 1938, p. 130, figs. 15-16. Bonnet, 1958, p. 4115.
Pholcophora speophila: Gertsch, 1971, pp. 76-77.

Diagnosis.–Small pale cavernicole and epigean species known only from females, readily identified by distinctive epigynum.

Etymology.–Specific name from Latin *spelaeum,* cave, living in cave.

Female from Grutas de Tzab-Nah.–Total length 1.7 mm. Carapace 0.7 mm long, 0.6 mm wide. Abdomen 1 mm long, 0.75 mm wide.

Cephalothorax whitish to dusky yellow; abdomen light gray.

Carapace with faintly indicated cephalic and linear cervical grooves; eyes six, small, set on weakly developed ocular elevation; ratio of eyes: ALE:PLE: PME = 5:5:5. Anterior lateral eyes separated by more than diameter (5/7). Posterior median eyes separated by about two diameters. First leg: femur 1.5 mm, patella 0.23 mm, tibia 1.45 mm, metatarsus 1.62 mm, tarsus 0.55 mm; total length 5.35 mm; first leg 7.65 times, first femur 2.1 times as long as carapace.

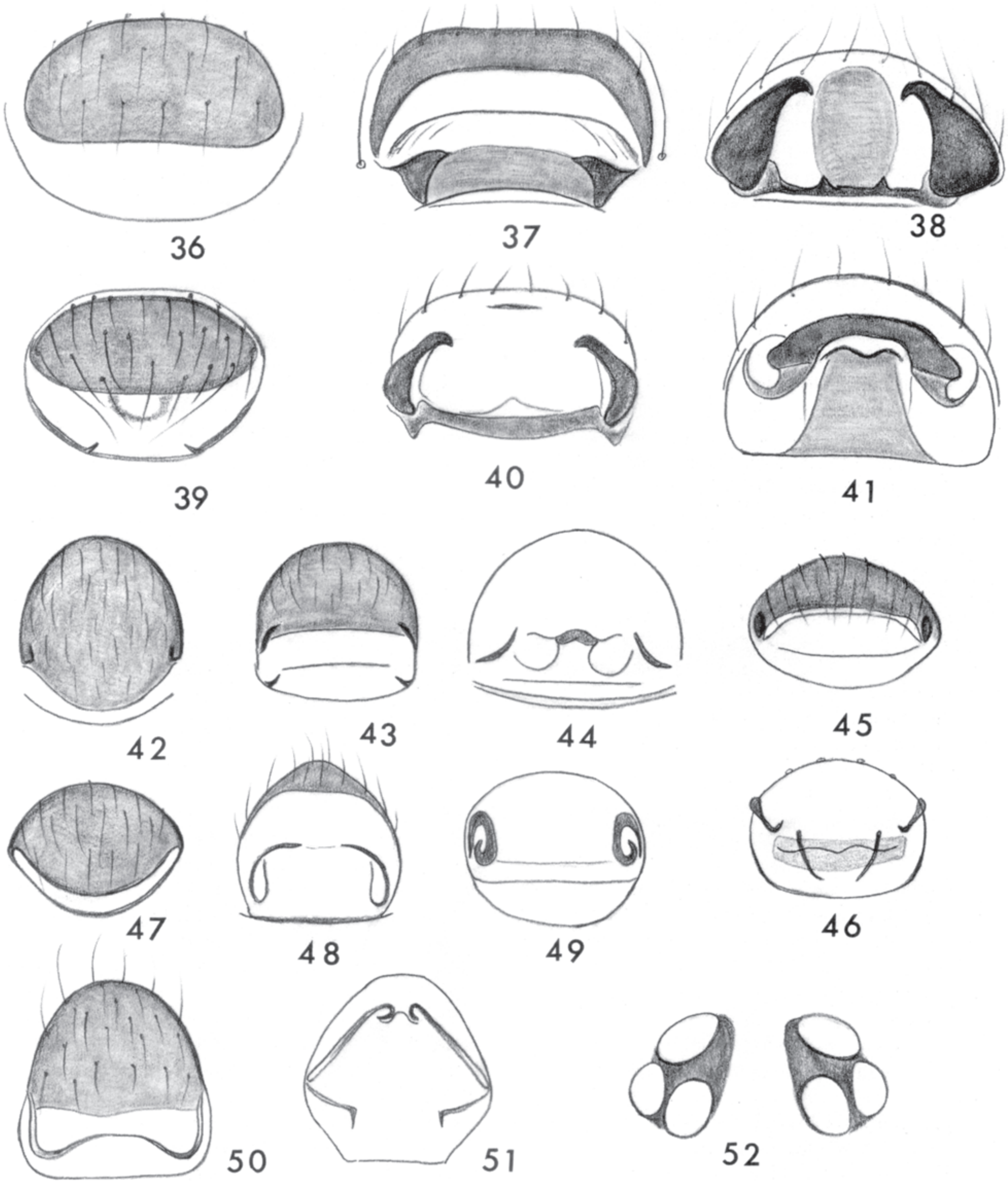
Epigynum (Figs. 42-44) small suboval elevation with distinctive sclerites shown in posterior and internal views.

Type data.–Female holotype from Chac Mol Cave, Tohil, Yucatán, 27 June, A. S. Pearse, in American Museum of Natural History (University of Utah collection).

Distribution.–Yucatán and Campeche.

Records.–*Campeche:* Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 13 May 1973, J. Reddell, D. and M. McKenzie, M. Butterwick, female; 19 April 1973, immature. 5 km SSW Ich-Ek, 27 July 1973, J. Reddell, J. M. Rowland, female. 10 km N Hopelchen, 27 July 1974, J. Reddell, J. M. Rowland, female.

Yucatán: Grutas de Tzab-Nah, 2 km S Tecoh, 22 April 1973, J. Reddell, D. McKenzie, female. Tixcocob, 12 August 1973, J. Reddell, female.



Figs. 36-51.–Epigyna of species of *Pholcophora:* Figs. 36.38.–*P. placens* (O. Pickard-Cambridge): 36, ventral view; 37, posterior view; 38, dorsal view. Figs. 39-40.–*P. jeanae:* 39, ventral view; 40, dorsal view. Fig. 41.–*P. quieta* Gertsch, epigynum, dorsal view. Figs. 42-44.–*P. speophila* (Chamberlin and Ivie): 42, ventral view; 43, posterior view; 44, dorsal view. Figs. 45-46.–*P. debora:* 45, ventral view; 46, subventral view. Figs. 47-49.–*P. pearsei* (Chamberlin and Ivie): 47, ventral view; 48, posterior view; 49, dorsal view. Figs. 50-51.–*P. palenque:* 50, ventral view; 51, dorsal view. Fig. 52.–*Pholcophora palenque,* eyes of female, dorsal view.

Pholcophora pearsei (Chamberlin and Ivie)
Figs. 47-49

Anopsicus pearsei Chamberlin and Ivie, 1938, p. 130, figs. 17-18. Bonnet, 1955, p. 330.
Pholcophora pearsei: Gertsch, 1971, pp. 48, 76-77.

Diagnosis.—Essentially eyeless troglobite with long legs, known only from females, readily identified by distinctive epigynum as illustrated.

Female from Cueva (Actún) Kaua.—Total length 1.5 mm. Carapace 0.73 mm long, 0.7 mm wide. Abdomen 0.8 mm long, 0.7 mm wide.

Cephalothorax and legs dusky yellow; abdomen gray.

Carapace about as broad as long, with sutures fairly distinct; pars cephalica subtraingular with low eye tubercle and declining steeply to clypeus. Eyes essentially obsolete, visible as well separated corneal vestiges. First leg: femur 2.6 mm, patella 0.3 mm, tibia 2.7 mm, metatarsus 3.25 mm, tarsus 0.9 mm; total length 9.75 mm; first leg about 13 times, first femur 3.6 times as long as carapace.

Epigynum (Figs. 47-49) transversely suboval elevation with sclerotized lateral guides to orifices as shown.

Type data.—Female holotype, female paratype and immature from Oxolodt Cave, Kaua, Yucatán, 18 June, A. S. Pearse, in American Museum of Natural History (University of Utah collection).

Distribution.—Caves near Kaua, Yucatán.

Record.—*Yucatán:* Cueva (Actún) Kaua, 23 August 1972, R. W. Mitchell, J. Cooke, female.

Pholcophora palenque, new species
Figs. 50-54

Diagnosis.—Epigean species with triads of eyes close together, legs of medium length, distinctive in genitalia of both sexes: epigynum longer than broad; tarsus of male palpus bent and enlarged at apex.

Etymology.—Named for the famous type locality, Ruinas de Palenque.

Female.—Total length 1.6 mm. Carapace 0.8 mm long, 0.7 mm wide. Abdomen 0.85 mm long, 0.75 mm wide.

Cephalothorax and appendages dusky yellow; carapace with dusky lines and shadings and eye tubercles black; abdomen with bluish cast and faint pale linear marking above running back from base.

Eyes six (Fig. 52) in close-set triads; ratio of eyes: ALE:PLE:PME = 10:10:9. Anterior lateral eyes separated by nearly diameter. Posterior eye row gently procurved; median eyes separated by long diameter. First leg: femur 1.8 mm, patella 0.26 mm, tibia 2.1 mm, metatarsus 2.45 mm, tarsus 0.63 mm; total length 7.34 mm; first leg 9.2 times, first femur 2.4 times as long as carapace.

Epigynum (Figs. 50-51) elevated tubercles longer than broad with distinctive internal sclerites as shown.

Male.—Total length 1.25 mm. Carapace 0.7 mm long, 0.6 mm wide. Abdomen 0.65 mm long, 0.55 mm wide.

Coloration and structure like those of female unless otherwise indicated. Anterior lateral eyes separated by less than diameter (8/10). Chelicera (Fig. 54) armed with sharp spur placed high up on segment. First leg: femur 1.92 mm, patella 0.27 mm, tibia 2.1 mm, metatarsus 2.5 mm, tarsus 0.8 mm; total length 7.59 mm; first leg 10.8 times, first femur 2.74 times as long as carapace.

Male palpus (Fig. 53) with sharp femoral spur at apex; tarsal appendage strongly bent and enlarged at apex, bearing thin lobe with curved spine.

Type data.—Male holotype, two males, three females and immature from 0.8 km N Ruinas de Palenque, 25 July 1973, J. Reddell, R. W. Mitchell from Berlese of litter.

Distribution.—Known only from Palenque region.

Records.—*Chiapas:* Ruinas de Palenque, 13, 16 July 1947, C. J. Goodnight, two males, two females, immature. 1 km N Palenque, 25 July 1973, J. Reddell, R. W. Mitchell and group, male, three females.

Pholcophora jeanae, new species
Figs. 39-40, 55-56

Diagnosis.—Long-legged epigean species with long cheliceral horns in male and distinctive genitalia; female epigynum broader than long with widely separated sclerotized guides; tibia of male palpus enlarged and tarsal appendage subtruncate at apex.

Etymology.—Named for the late Jean Ivie.

Female.—Total length 2.2 mm. Carapace 0.8 mm long, 0.77 mm wide. Abdomen 1.3 mm long, 1.1 mm wide.

Cephalothorax and appendages dusky yellow to brown with dark shadings on sutures and brownish clypeus and chelicerae; abdomen gray with bluish markings on dorsum.

Carapace with deeply impressed cephalic and cervical grooves; pars cephalica well elevated with triads of eyes set on slightly raised ocular tubercles; ratio of eyes: ALE:PLE:PME = 12:11:11. Anterior lateral eyes separated by about full diameter. Posterior median eyes separated by more than diameter (11/14). First leg: femur 2.2 mm, patella 0.3 mm, tibia 2.3 mm, metatarsus 2.75 mm, tarsus 0.65 mm; total length 8.2 mm; first leg 10 times, first femur 2.75

times as long as carapace.

Epigynum (Figs. 39-40) transverse elevation much broader than long, presenting in subventral view conspicuous lateral brown sclerites, presumed guides to internal receptacles.

Male.—Total length 1.75 mm. Carapace 0.85 mm long, 0.8 mm wide. Abdomen 0.9 mm long, 0.7 mm wide.

Structure like that of female. Chelicera (Fig. 55) with long curved spur just below clypeal margin. First leg: femur 2.3 mm, patella 0.3 mm, tibia 2.45 mm, metatarsus 3.3 mm, tarsus 0.8 mm; total length 9.5 mm; first leg 10.7 times, first femur 2.7 times as long as carapace.

Male palpus (Fig. 56) with enlarged tibial segment; femoral spur stout long appendage below at apex; tarsal spur apically enlarged, subspatulate; short spine near apex of bulb below.

Type data.—Male holotype, two females from La Venta, Villahermosa, Tabasco, 13 August 1965, Jean and Wilton Ivie.

Pholcophora debora, new species
Figs. 45-46, 57-59

Diagnosis.—Small epigean species with short legs and distinctive genitalia: epigynum small transverse elevation; palpus with short truncated tarsal appendage.

Etymology.—Named for Deborah Denson.

Female.—Total length 1.8 mm. Carapace 0.77 mm long, 0.7 mm wide. Abdomen 1 mm long, 0.73 mm wide.

Cephalothorax and appendages dusky yellow to brown; abdomen bluish.

Eyes of medium size; ratio of eyes: ALE:PLE:PME = 10:9:9. Anterior lateral eyes separated by more than long diameter (9/11). First leg: femur 1.35 mm, patella 0.25 mm, tibia 1.33 mm, metatarsus 1.55 mm, tarsus 0.55 mm; total length 5.03 mm; first leg 6.5 times, first femur 1.76 times as long as carapace.

Epigynum (Figs. 45-46) small transverse elevation with narrow bands in front and behind genital groove, with distinctive pattern of elements in subventral view as shown.

Male.—Total length 1 mm. Carapace 0.63 mm long, 0.6 mm wide. Abdomen 0.4 mm long, 0.35 mm wide.

Chelicera (Figs. 58-59) with sharp spur at about middle of outer face of segment. First femur 1.2 mm long, 1.9 times as long as carapace.

Male palpus (Fig. 57) with all elements short; femoral spur close to apex below; tarsal appendage broad, apically subtruncate; embolus small curved spine at end of suboval bulb.

Type data.—Male holotype and four females from Finca El Real, Ocosingo Valley, Chiapas, 1-7 July 1950, C. and M. Goodnight, L. J. Stannard, from floodplain debris.

Distribution.—Chiapas.

Records.—*Chiapas:* Monte Libano, 20 km E El Real, 4-5 July 1950, C. and M. Goodnight, L. Stannard, two females. 5 mi NE Chiapa, 22 August 1966, J. and W. Ivie, three females probably this species.

Genus *Modisimus*

The following three species from the Yucatán Peninsula area have restricted ranges on the basis of known specimens and are of especial interest. The recently described *Modisimus iviei* Gertsch has small enlargements armed with spinules at the base of the chelicerae, a condition found in some other members of the genus. The two newly described species below have developed distinctive horns in that position and these are not matched in any other known species of the genus.

Modisimus palenque, new species
Figs. 61-63

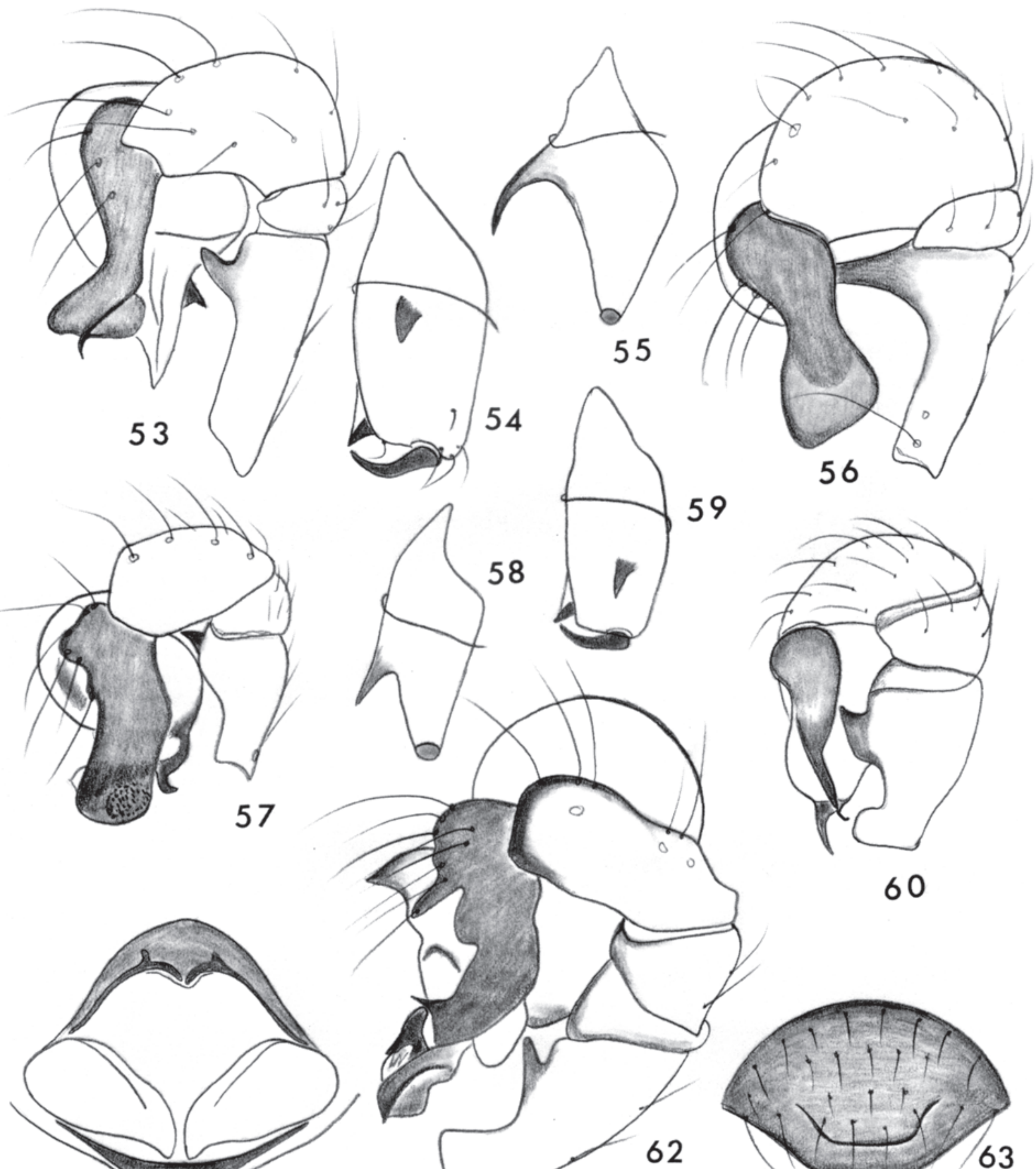
Diagnosis.—Small epigean species lacking anterior median eyes, distinguished by epigynum (Fig. 63) and curved, toothed tarsus of male palpus (Fig. 62).

Etymology.—Named for the type locality, Ruinas de Palenque.

Female.—Total length 2.1 mm. Carapace 0.8 mm long, 0.83 mm wide. Abdomen 1.5 mm long, 0.9 mm wide.

Carapace whitish with central dusky band on clypeus and running back through eye region to posterior declivity; eye tubercles black; sternum dusky brown with faint central streak; legs dusky brown without darker markings. Abdomen pale blue with dark blue spots covering most of dorsum but venter paler except for small blue spot at center.

Clypeus 0.3 mm long, precipitous, as high as not fully three diameters of anterior lateral eye. Ocular tubercle prominently elevated and large round eyes in following ratio: ALE:PLE:PME = 16:15:14; anterior median eyes obsolete except for tiny black fleck. Anterior lateral eyes separated by less than diameter (16/13). Posterior eye row gently recurved; posterior median eyes separated by about diameter, third as far from lateral eyes. Abdomen longer than broad, pointed behind. Front legs missing; second leg: femur 3.25 mm, patella 0.3 mm, tibia 2.9 mm,



Figs. 53-54.–*Pholcophora palenque:* 53, left male palpus, retrolateral view; 54, left chelicera, retrolateral view. Figs. 55-56.–*Pholcophora jeanae:* 55, left male chelicera, retrolateral view; 56, left male palpus, retrolateral view. Figs. 57-59.–*Pholcophora debora:* 57, left male palpus, retrolateral view; 58, left male chelicera, retrolateral view; 59, left male chelicera, frontal view. Fig. 60.–*Modisimus chiapa,* left male palpus, retrolateral view. Figs. 61-63.–*Modisimus palenque:* 61, epigynum, dorsal view; 62, left male palpus, retrolateral view; 63, epigynum, ventral view.

metatarsus 4.35 mm, tarsus 1.25 mm; total length 12.05 mm; second femur four times as long as carapace.

Epigynum (Figs. 61, 63) transverse plaque with elevated ridge and distinctive internal sclerites.

Male.—Total length 2.5 mm. Carapace 0.95 mm long, 0.9 mm wide. Abdomen 1.6 mm long, 1 mm wide.

Coloration and structure like those of female except as follows: Clypeus 0.48 mm long, as high as four diameters of anterior lateral eye; ratio of eyes: ALE:PLE:PME = 18:18:15. Anterior lateral eyes separated by less than diameter (18/14). Posterior eye row essentially straight; posterior median eyes separated by less than diameter (15/12). Chelicera with small tubercular spur near base set with several spinules. Legs fragmented; first femur 6.25 mm long, 6.6 times as long as carapace.

Male palpus (Fig. 62) with robust segments; tarsus curved, with slender projection near base and bluntly pointed at apex.

Type data.—Male holotype from 1 km N Palenque, Chiapas, 25 July 1973, J. Reddell, R. W. Mitchell and group.

Distribution.—Known only from Palenque area.

Records.—*Chiapas:* Ruinas de Palenque, 25 July 1973, J. Reddell, J. M. Rowland, female.

Modisimus chiapa, new species
Fig. 60

Diagnosis.—Minute short-legged species with eye triads very close together and small horns at base of chelicerae longer than those of *palenque;* tarsus of male palpus ending in a thin spine.

Etymology.—Specific name from type locality area, Chiapa.

Male.—Total length 0.95 mm. Carapace 0.46 mm long, 0.44 mm wide. Abdomen 0.5 mm long, 0.4 mm wide.

Base color of cephalothorax and appendages pale yellow; carapace with dusky smudge on posterior declivity, duskiness on clypeus and eye tubercles black; sternum whitish; legs without dark markings. Abdomen greenish with faint pale dorsal stripe down middle.

Clypeus 0.24 mm long, sloping forward, equal in height to four diameters of anterior lateral eye. Ocular tubercle moderately elevated with six large eyes close together and no trace of anterior median eyes; ratio of eyes: ALE:PLE:PME = 8:8:7. Anterior lateral eyes subcontiguous, separated at most by half radius. Posterior eye row procurved, line along posterior edges of lateral eyes cutting near middle of medians; posterior median eyes separated by about radius, subcontiguous with lateral eyes. Chelicera armed with small, bluntly pointed horn near base. Abdomen suboval, rounded behind. First leg: femur 1.3 mm, patella 0.15 mm, tibia 1 mm, metatarsus 1.15 mm, tarsus 0.4 mm; total length 3.64 mm; first leg eight times, femur 2.8 times as long as carapace.

Male palpus (Fig. 60) with apically thin tarsus and stout femoral spur.

Type data.—Male holotype from hillside 5 mi NE Chiapa, Chiapas, 22 August 1966, Jean and Wilton Ivie.

Modisimus iviei Gertsch

Modisimus inornatus Chamberlin and Ivie, 1938, p. 133 (Not *inornatus* O. Pickard-Cambridge).
Modisimus iviei Gertsch, 1973, p. 149, figs. 12-14.

Diagnosis.—Small troglophile and surface species of Yucatán Peninsula lacking anterior median eyes, separable from other Mexican species by details of the genitalia.

Type data.—Female holotype and male from Xmahit Cave, Tekax, Yucatán, 31 July 1936, A. S. Pearse, in American Museum of Natural History (University of Utah collection).

Distribution.—Yucatán and Campeche.

New records.—*Yucatán:* Mine 5 km N Valladolid, 11 April 1973, J. Reddell, female. Cenote Chac si kin (Norte), 1 km E Ruinas de Mayapán, 24 April 1973, J. Reddell, female. Cueva (Actún) Tucil, 2 km S Muna, 27 March 1973, J. Reddell, female. Cueva (Actún) Xpukil, 3 km S Calcehtok, 18-19 March 1973, J. Reddell, S. Murphy, D. and M. McKenzie, M. Butterwick, male, three females. Chichén Itzá, 8 August 1973, J. Reddell, two males. Hoctún, 12 August 1973, J. Reddell, male, four females. Tixcocob, 12 August 1973, J. Reddell, female, immature. Oxkintok, 3 August 1973, J. Reddell, female. 1 km S Muna, 31 July, 1 August 1973, E. Gonzalez, M. Ay Canul, three females. Pyramid, Izamal, 19 August 1973, J. Reddell, female. Ruinas de Mayapán, 14 August 1973, J. Reddell, male, three females.

Campeche: 10 mi N Hopelchen, 27 July 1973, J. Reddell, J. M. Rowland, two males. 5 km SSW Ich-Ek, 27 July 1973, J. Reddell, J. M. Rowland, female, immature.

Genus *Physocyclus*

Physocyclus globosus (Taczanowski)

Pholcus globosus Taczanowski, 1873, p. 105.
Physocyclus globosus: F. Pickard-Cambrdige, 1902, p. 368. Chamberlin and Ivie, 1938, p. 130.

Discussion.—This widespread tropicopolitan species, especially common in tropical México, Central America and the West Indies, is found in Yucatán and was reported from San Bulhá Cave, Mérida, by Chamberlin and Ivie in 1938.

Records.—*Yucatán:* Cueva (Actún) Xpek, 1 km S Muna, 2 August 1973, J. Reddell, R. W. Mitchell, male, female, immature. Artificial cave, Calle 24 x 19, Mérida, 20 March 1973, J. Reddell, female, immature. Cenote de Sihunchén, Sihunchén, 23 March 1973, J. Reddell, S. Murphy, M. McKenzie, M. Butterwick, male. Cueva (actún) Xpukil, 3 km S Calcehtok, 18-19 March 1973, J. Reddell, D. McKenzie, S. Murphy, M. Butterwick, female from entrance sink.

Family Oonopidae

Genus *Oonops*

The oonopids are generalized six-eyed spiders that shun the light and live mostly under stones or in ground detritus. There are many Mexican species and some of these occur in cave habitats. Most notable of these is the blind *Wanops coecus* of Chamberlin and Ivie, an eyeless species of Yucatán caves that is herein placed in the widespread genus *Oonops* in the belief that it represents only a derivative of that group. Eyeless species are also known from termite galleries in Africa, from ground detritus in the Bahama Islands and México, and also from a cave in the Hawaiian Islands. The present material, comprising cavernicoles and surface forms, is all referred to the genus *Oonops* as understood by American students.

Oonops coecus (Chamberlin and Ivie)
Figs. 64-66

Wanops coecus Chamberlin and Ivie, 1938, p. 125, figs. 1-2. Bonnet, 1959, p. 4816. Gertsch, 1971, pp. 48, 56.

Diagnosis.—Eyeless troglobite with fairly long legs (longer in female from Grutas de Tzab-Nah) and distinctive internal epigynum (Fig. 66).

Female from Grutas de Tzab-Nah.—Total length 1.9 mm. Carapace 0.8 mm long, 0.67 mm wide. Abdomen 1 mm long, 0.55 mm wide.

Cephalothorax and appendages pale yellowish; abdomen white; hairs and spines of body dusky.

Carapace (Fig. 64) smooth, shiny, highest between third coxae, declining evenly to narrow clypeus, with few weak setae on pars cephalica, mostly rubbed off; pars cephalica weakly elevated, convex, only faintly marked by cephalic grooves and with trivial linear cervical groove barely apparent; width of pars cephalica in front less than half greatest width. Eyes completely obsolete. Sternum (Fig. 65) 0.5 mm long, 0.4 mm wide, suboval, with blunt rounded lobe between posterior coxae. Labium 0.1 mm long, 0.14 mm wide, rounded apically. Endites 0.4 mm long, 0.18 mm wide, with bluntly pointed angle at apex. Chelicera projecting forward, narrowed at apex, with long claw but keel on margin smooth, without true teeth, with thin line of curved hairs on inner margin. Abdomen suboval, evenly covered on all surfaces with inconspicuous dusky hairs.

Epigynum (Fig. 66) presenting small inverted T-shaped structure as shown.

	I	II	III	IV
Femur	0.80	0.70	0.63	0.90
Patella	0.55	0.40	0.26	0.40
Tibia	0.80	0.66	0.55	0.82
Metatarsus	0.70	0.52	0.50	0.72
Tarsus	———	0.30	0.26	0.30
Total	———	2.68	2.20	3.14

Leg formula probably 1423 but first and fourth legs subequal; first leg probably about four times as long as carapace, first femur as long. Legs moderately spinose; first femur with five ventral pairs of long spines in basal two-thirds, without apical spines; first metatarsus with two similar pairs.

Female from Cenote Chen Mul.—Total length 1.5 mm. Carapace 0.68 mm long, 0.45 mm wide. Abdomen 0.8 mm long, 0.5 mm wide.

	I	II	III	IV
Femur	0.52	0.47	0.42	0.61
Patella	0.35	0.28	0.20	0.32
Tibia	0.55	0.38	0.31	0.56
Metatarsus	0.39	0.30	0.33	0.50
Tarsus	0.23	0.21	0.20	2.24
Total	2.04	1.73	1.46	2.23

Leg formula 4123; legs proportionately shorter and stouter than those of female from Grutas de Tzab-Nah but with same spination; first leg three times as long, first femur shorter than carapace.

Type data.—Male holotype from Balaam Canche Cave, Chichén Itzá, Yucatán, 10 June, A. S. Pearse from under laundry stone 95 meters from mouth, in American Museum of Natural History (University of Utah collection).

Distribution.—Yucatán caves.

Records.—*Yucatán:* Grutas de Tzab-Nah, 2 km S Tecoh, 17 April 1973, J. Reddell, M. McKenzie, female. Cenote Chen Mul, Ruinas de Mayapán, 24, 26 April 1973, J. Reddell, D. and M. McKenzie, M. Butterwick, three females.

Oonops reddelli, new species
Figs. 68, 73-74, 77

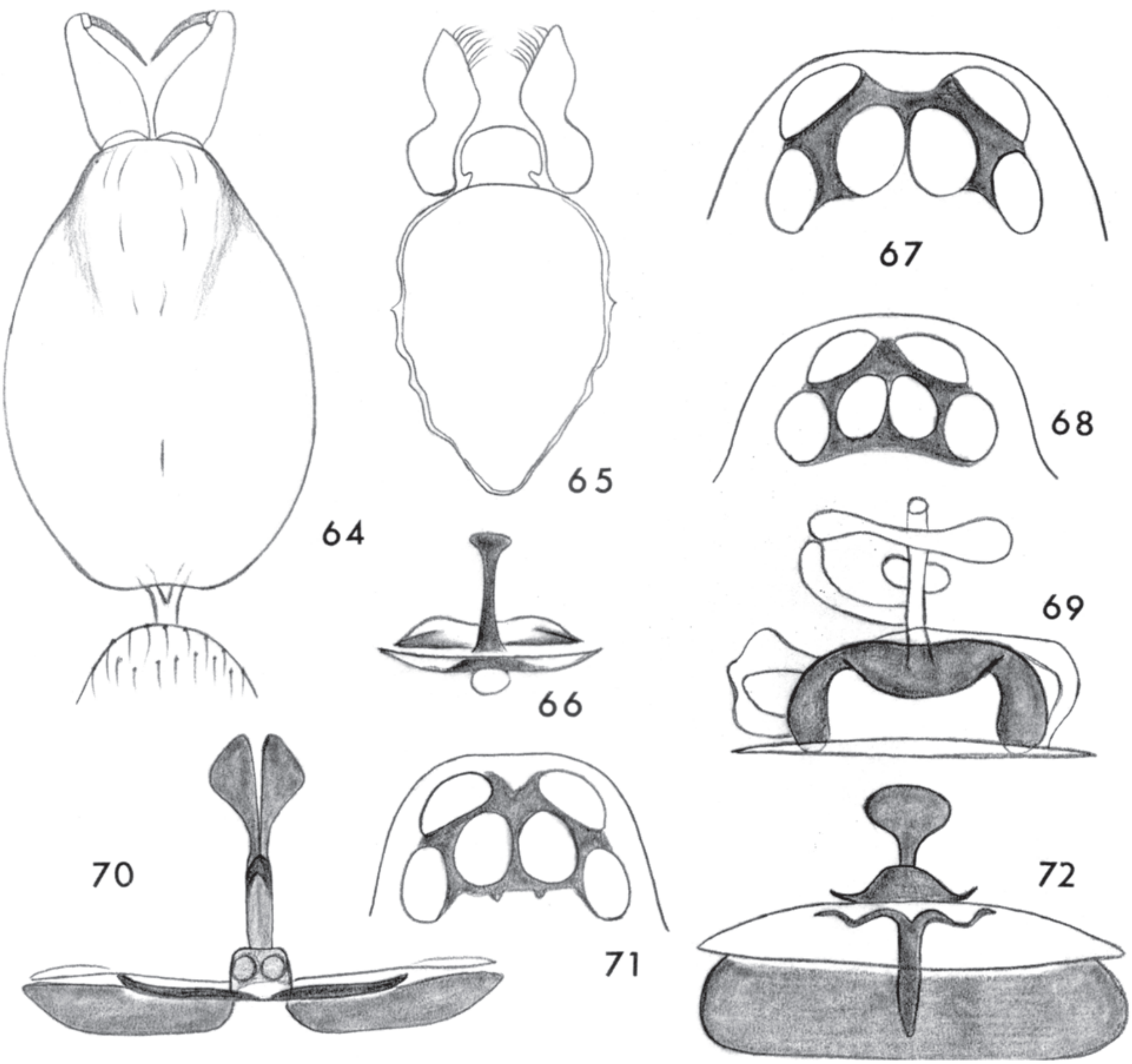
Diagnosis.—Troglophile species with short legs and eye triads subcontiguous, distinguished by transverse epigynum (Fig. 77) and embolus of male palpus (Figs. 73-74).

Etymology.—Named for James Reddell.

Female.—Total length 1.4 mm. Carapace 0.6 mm long, 0.43 mm wide. Abdomen 0.7 mm long, 0.43 mm wide.

Cephalothorax and appendages orange brown; eye tubercles and eye space black; abdomen white with pair of dark subintegumental spots in front of spinnerets; hairs and spines of body dusky.

Carapace smooth, evenly convex, with few weak setae on pars cephalica, equal in height from eyes to obsolete cervical groove, declining quite abruptly on posterior declivity; clypeus narrow, equal to about radius of anterior eye. Eyes (Fig. 68) six in two triads; eyes subequal in size; front eye row (anterior lateral) nearly touching, much narrower than posterior row; posterior eye row faintly recurved, essentially straight, eyes nearly touching. Sternum 0.4 mm long,



Figs. 64-72.—Species of *Oonops:* Figs. 64-66.—*O. coecus* (Chamberlin and Ivie): 64, carapace; 65, sternum, labium and endites, ventral view; 66, epigynum, ventral view. Fig. 67.—*O. mckenziei,* eyes of female, dorsal view. Fig. 68.—*O. reddelli,* eyes of female, dorsal view. Fig. 69.—*O. rowlandi,* epigynum, ventral view. Fig. 70.—*O. mckenziei,* epigynum, ventral view. Fig. 71.—*O. rowlandi,* eyes of female, dorsal view. Fig. 72.—*O. mitchelli,* epigynum, ventral view.

0.35 mm wide, with thin covering of setae. Labium 0.07 mm long, 0.1 mm wide; endite 0.2 mm long, 0.09 mm wide. Abdomen suboval, broader than high. First leg: femur 0.4 mm, patella 0.21 mm, tibia 0.27 mm, metatarsus 0.23, tarsus 0.14 mm; total length 12.5 mm; first leg twice as long, first femur much shorter than carapace.

Epigynum (Fig. 77) transverse structure lacking median stem of other species.

Male.—Total length 1.45 mm. Carapace 0.6 mm long, 0.46 mm wide. Abdomen 0.8 mm long, 0.45 mm wide.

Coloration and structure like those of female. First leg: femur 0.4 mm, patella 0.23 mm, tibia 0.26 mm, metatarsus 0.24 mm, tarsus 0.15 mm; total length 1.28 mm; first leg twice as long, first femur much shorter than carapace.

Male palpus (Figs. 73-74) with relatively thick embolus with round end enclosing short projection.

Type data.—Male holotype from Cenote de Sihunchén, Sihunchén, Yucatán, 23 March 1973, J. Reddell, S. Murphy, M. McKenzie, M. Butterwick.

Distribution.—Yucatán.

Record.—*Yucatán:* Cueva (Actún) Tucil, 2 km S Muna, 26 March 1973, J. Reddell, male and two females from Berlese of swallow guano.

Oonops mitchelli, new species
Figs. 72, 75-76

Diagnosis.—Troglophile species similar to *reddelli* with short legs, eyes in close-set group but front eyes separated by about radius, with distinctive epigynum (Fig. 72) and male palpus with embolus forming a coil (Figs. 75-76).

Etymology.—Named for Dr. R. W. Mitchell.

Female.—Total length 1.8 mm. Carapace 0.77 mm long, 0.57 mm wide. Abdomen 1 mm long, 0.6 mm wide.

Cephalothorax and appendages yellowish; sides of carapace with thin covering of dusky procumbent hairs and eye area black; abdomen whitish, thickly covered with dusky hairs, with or without pair of dark spots in front of epigynum.

Structure typical, like that of *reddelli;* clypeus equal in height to radius of anterior eye, with eight long bristles on margin. Eyes subequal in size, close together; anterior eyes separated by nearly radius of one; posterior eye row moderately recurved; posterior median eyes touching, slightly separated from lateral eyes. Sternum 0.48 mm long, 0.4 mm wide. Labium 0.1 mm long, 0.12 mm wide. Abdomen suboval. First leg: femur 0.51 mm, patella 0.34 mm, tibia 0.42 mm, metatarsus 0.35 mm, tarsus 0.21 mm; total length 1.84 mm; first leg 2.4 times, first femur shorter than carapace.

Epigynum (Fig. 72) much broader than long, with small rounded stem projecting forward.

Male.—Carapace 0.55 mm long, 0.55 mm wide. Abdomen missing. First leg: femur 0.42 mm, patella 0.3 mm, tibia 0.34 mm, metatarsus 0.3 mm, tarsus 0.17 mm; total length 1.53 mm; first leg nearly three times, first femur shorter than carapace.

Male palpus (Figs. 75-76) with moderately long embolus forming a short coil.

Type data.—Female holotype from Cueva (Actún) Xpukil, Yucatán, 18-19 March 1973, J. Reddell.

Distribution.—Yucatán.

Records.—*Yucatán:* Cueva (Actún) Xpukil, 18-19 March 1973, J. Reddell, S. Murphy, D. and M. McKenzie, M. Butterwick, two females. Hoctún, 12 August 1973, J. Reddell, female. Pyramid, Izamal, 10 August 1973, J. Reddell, female. 1 km S Muna, 31 July-4 August 1973, M. Ay Canul, R. Gonzalez, male probably this species.

Oonops rowlandi, new species
Figs. 69, 71

Diagnosis.—Small epigean species with blackish abdomen, distinguished by its narrow head and distinctive epigynum (Fig. 69).

Etymology.—Named for J. Mark Rowland.

Female.—Total length 1.65 mm. Carapace 0.63 mm long, 0.57 mm wide. Abdomen 1 mm long, 0.63 mm wide.

Cephalothorax and appendages yellow to orange; eye area black; abdomen purplish black above and on sides, white on center.

Structure typical; carapace rubbed nearly smooth, with few scattered hairs outlining pars cephalica; pars cephalica narrow, less than half width of carapace at second eye row (25/57); clypeus equal in height to radius of anterior eye. Eyes (Fig. 71) in close-set triads occupying most of width of pars cephalica; eyes equal in size; front eyes separated by about two-thirds diameter; posterior eye row moderately recurved, with line along posterior edges of median eyes cutting middle of lateral eyes, with contiguous median eyes slightly separated from lateral eyes. Sternum 0.43 mm long, 0.36 mm wide. Labium 0.07 mm long, 0.1 mm wide. Abdomen suboval. First leg: femur 0.5 mm, patella 0.22 mm, tibia 0.37 mm, metatarsus 0.32 mm, tarsus 0.27 mm; total length 1.68 mm; first leg 2.6 times, first femur shorter than carapace.

Epigynum (Fig. 69) of inverted T-shaped form, with thin stem and series of transverse tubules.

Type data.—Female holotype from Ruinas de Palenque, Chiapas, 25 July 1973, J. Reddell, J. M. Rowland.

Oonops mckenziei, new species
Figs. 67, 70

Diagnosis.—Close relative of *mitchelli* but with front eyes more widely separated by full diameter and with distinctive epigynum (Fig. 70).

Etymology.—Named for David McKenzie.

Female.—Total length 1.9 mm. Carapace 0.77 mm long, 0.6 mm wide. Abdomen 1.1 mm long, 0.7 mm wide.

Cephalothorax and appendages golden yellow; eye tubercles black and eye area mostly dark; abdomen whitish, with pair of dusky marks in front of spinnerets. Carapace mostly rubbed but with erect setae in ocular area; pars cephalica of average width, equal at second eye row to half greatest width of carapace (30/60); clypeus equal in height to radius of front eye. Eye rows of about equal width and eyes (Fig. 67) subequal in size, mostly subcontiguous; anterior eyes separated by full diameter; posterior eye row moderately recurved, line along posterior edges of median eyes cutting through middle of lateral eyes; posterior median eyes contiguous, separated from lateral eyes by third narrow diameter of median. Sternum 0.45 mm long, 0.4 mm wide. Labium 0.1 mm long, 0.16 mm wide. Abdomen suboval. First leg: femur 0.61 mm, patella 0.34 mm, tibia 0.47 mm, metatarsus 0.44, tarsus 0.24 mm; total length 2.10 mm; first leg 2.7 times, first femur shorter than carapace.

Epigynum (Fig. 70) with thin columnar projection with bifid enlargement at apex.

Type data.—Female holotype from surface near Grutas del Coconá, Tabasco, 25 August 1972, J. Cooke, R. W. Mitchell, W. Russell.

Family Tetrablemmidae

This small family, the few representatives of which are often assigned to the Oonopidae as an aberrant subfamily, has several species in México. The most interesting of these is the blind troglobite *Tetrablemma sbordonii* Brignoli from Cueva de Ojo de Agua de Tlilapan in the state of Veracruz. A detailed discussion of the status of the family was given by Brignoli (1972, p. 132) with good reasons for assigning the species to *Tetrablemma*. The present material from Yucatán is tentatively assigned to the Cuban species *cambridgei* but study of the type material is necessary to make the assignment explicit.

Tetrablemma cambridgei Bryant

Tetrablemma cambridgei Bryant, 1940, p. 269, figs. 8-10, 13.

Records.—*Yucatán:* Cueva (Actún) Xpukil, 3 km S Calcehtok, 18-19 March 1973, J. Reddell, S. Murphy, S. and M. McKenzie, M. Butterwick, two females. Chichén Itzá, 8 August 1973, J. Reddell, female. Pyramid, Izamal, 10 August 1973, J. Reddell, female. 3 km S Calcehtok, 16 April 1973, J. Reddell, male. Ruinas de Mayapán, 14 August 1973, J. Reddell, female.

Family Dysderidae

Ariadna pilifera O. Pickard-Cambridge

Ariadna pilifera O. Pickard-Cambridge, 1898, p. 235, pl. 32, figs. 9, 9a-c. Beatty, 1970, p. 41, figs. 20, 31, 36-37, 40-41, map.

Records.—*Yucatán:* Cueva (Actún) Xkyc, 1 km S Calcehtok, 1 May 1973, J. Reddell, D. McKenzie, E. Alexander, S. Butterwick, female. Cueva (Actún) Tucil, 2 km S Muna, 27 March 1973, J. Reddell, immature.

Family Symphytognathidae

Maymena mayana (Chamberlin and Ivie)

Nesticus mayanus Chamberlin and Ivie, 1938, p. 134, figs. 12-13.
Maymena mayana: Gertsch, 1971, p. 92; 1973, p. 163.

Records.—*Yucatán:* Cenote Chen Mul, Ruinas de Mayapán, 24, 26 April 1973, J. Reddell, D. and M. McKenzie, M. Butterwick, two females, 3 immatures. Cenote Aká Chen, 1 km NE Tixcancal, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick, female.

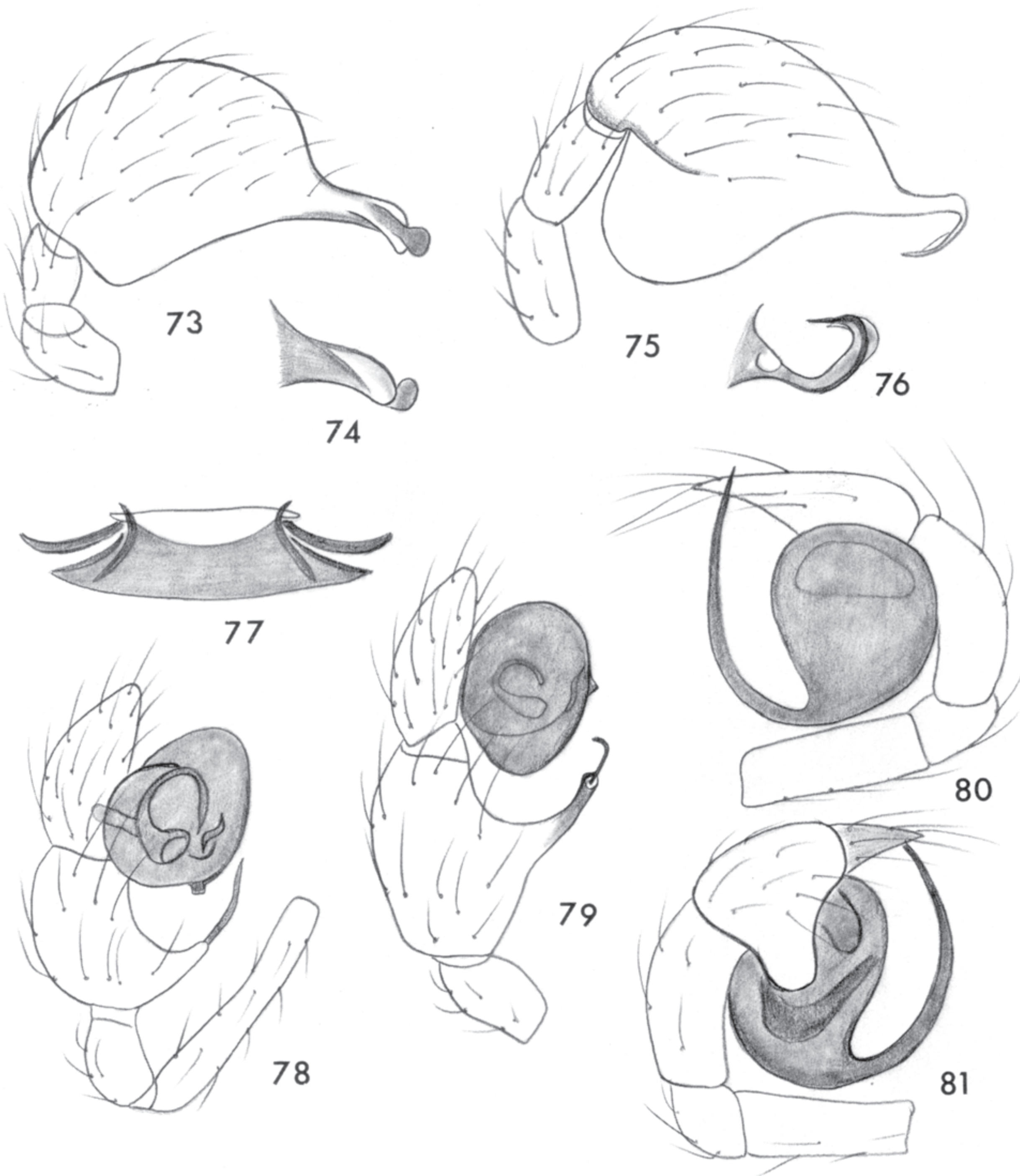
Campeche: Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 29-30 July 1973, D. Denson, M. Kawakatsu, R.W. Mitchell and group, female; 13 May 1973, J. Reddell, D. and M. McKenzie, M. Butterwick, two females, immature.

Family Nesticidae

Eidmannella suggerens (Chamberlin)

Nesticus suggerens Chamberlin, 1924, p. 15, pl. 4, figs. 19-31.
Nesticus (Gondwanonesticus) dragani Dumitrescu, 1973, p. 295.

Discussion.—All the material from Yucatán is referred to *suggerens,* a sibling species related to *pallida,*



Figs. 73-74.–*Oonops reddelli,* left male palpus: 73, prolateral view; 74, tip of embolus, retrolateral view. Figs. 75-76.–*Oonops mitchelli,* left male palpus: 75, prolateral view; 76, tip of embolus, subventral view. Fig. 77.–*Oonops reddelli,* epigynum, ventral view. Fig. 78.–*Theotima ruina,* left male palpus, prolateral view. Fig. 79.–*Theotima elva,* left male palpus, prolateral view. Figs. 80-81.–*Speocera machadoi,* left male palpus: 80, retrolateral view; 81, prolateral view.

which occurs in the southeastern United States, northeastern México and the West Indies. It seems to be the only species of *Eidmannella* found in the West Indies and has in the past been reported from many of the islands as *Nesticus pallidus* Emerton. Although *pallida* seems not to be present in the state of Yucatán, it is the dominant species west of there and widespread in México and the United States.

Records.—*Yucatán:* Cenote (Cueva) Luchil, 8 km SSE Mérida, 21 March 1973, J. Reddell, female. Artificial cave, Calle 24 x 19, Mérida, 20 March 1973, J. Reddell, female. Cenote de Sihunchén, Sihunchén, 23 March 1973, J. Reddell, S. Murphy, M. McKenzie, M. Butterwick, three females. Cenote G, Ruinas de Aké, 26 March 1973, J. Reddell, M. McKenzie, M. Butterwick, female, four immatures. Cenote Tekom, Tekom, 11 April 1973, J. Reddell, female, immature. Cenote de Sambulá, Motul, 28 March 1973, J. Reddell, S. Murphy, immature male.

Family Ochyroceratidae

The lucifugous spiders of this family live in ground detritus of mesic habitats and many occur in caves as troglophiles. A blind species and presumed troglobite, *Theotima pura* Gertsch (1973, p. 155), has been described from Cueva de los Vampiros in Tamaulipas. The species herein assigned to the genus *Theotima* represent a group widespread in México, especially in tropical areas, but they have so far been little mentioned in the literature. The three following species, and a fourth tentatively placed in *Speocera* on the basis of male genitalic characters, share several common features. The carapace is elevated, convex, highest just behind the middle, and the cephalic and cervical grooves are obsolete. The six nocturnal eyes are subequal in size, are subcontiguous, and lie in two rows, a front one comprising the anterior lateral and posterior median eyes in a transverse row and a posterior one consisting only of the posterior lateral eyes. The subtriangular labium has a small rounded emargination at its apex. The quite robust chelicerae have a series of seven teeth on the promargin, the largest innermost one being essentially a keel, and two denticles on the retromargin near the base of the fang. The leg formula is 4123, of which the first and fourth pairs are essentially subequal in length, and the first femur is about equal to the carapace in length. The elongate to subglobose abdomens of the females have the epigastric area swollen and at least lightly sclerotized in front of the genital furrow. The atriobursal orifices have migrated to a position on the abdomen just above the pedicel and are faintly evident as trivial sclerotized rings. The male palpi have an unusual feature of the tibia and tarsus and have an oval bulb with or without prominent embolar development.

Genus *Theotima*

Theotima ruina, new species
Fig. 78

Diagnosis.—Minute epigean species similar to the genotype *radiata* of St. Vincent Island and adjacent Venezuela, with dusky pattern on carapace and abdomen and well developed eyes on black patch; legs of medium length, first femur being as long as carapace; best recognized by male palpus with long spine below enlarged tibia.

Etymology.—Named for Ruinas de Palenque.

Female.—Total length 0.94 mm. Carapace 0.44 mm long, 0.34 mm wide. Abdomen 0.5 mm long, 0.4 mm wide.

Carapace dull yellowish with series of pale brown chevrons radiating from center to sides and with narrow marginal brown seam around pars thoracica; eyes enclosing black area; sternum, labium and endites dusted with brown; legs dull yellowish with faint brown striping. Abdomen pale brown with purplish tinge, darker below.

Pars cephalica 0.2 mm wide at eyes; clypeus narrow, about equal to diameter of anterior lateral eye. Eyes occupying two-thirds width of head; front eye row faintly procurved, eyes subequal in size; posterior lateral eyes separated by two diameters. Sternum 0.26 mm long and wide. First leg: femur 0.4 mm, patella 0.09 mm, tibia 0.36 mm, metatarsus 0.23 mm, tarsus 0.2 mm; total length 1.28 mm; first leg about three times, first and fourth femora about as long as carapace.

Male.—Total length 0.82 mm. Carapace 0.4 mm long, 0.32 mm wide. Abdomen 0.42 mm long, 0.36 mm wide.

Coloration like that of female but brownish pattern less distinct. Structure similar except as noted; carapace narrowed with pars cephalica 0.2 mm wide at eyes. Eyes occupying little more than half width of head; eye relations same but front middle eyes more elongate and posterior lateral eyes separated by one and one-half diameters. First leg: femur 0.4 mm, patella 0.11 mm, tibia 0.39 mm, metatarsus 0.27 mm, tarsus 0.2 mm; total length 1.37 mm; first leg about 3.4 times, first and fourth femora as long as carapace.

Male palpus (Fig. 78) with oval bulb, short embolus, and long spine borne on small spur below enlarged tibia.

Type data.—Male holotype, three females and immature from 0.8 km N Ruinas de Palenque, Chiapas, 23 July 1973, J. Reddell, R. W. Mitchell, from Berlese of litter.

Theotima martha, new species

Diagnosis.–Pale yellow cavernicole relative of *ruina* with reduced eyes and longer legs, fourth femur being longer than carapace.

Etymology.–Named for Martha Helen McKenzie.

Female.–Total length 1.05 mm. Carapace 0.5 mm long, 0.36 mm wide. Abdomen 0.55 mm long, 0.4 mm wide.

Cephalothorax and appendages pale yellowish without darker pattern; eye tubercles narrowly ringed with black; abdomen whitish.

Structure like that of *ruina* but carapace less elevated; pars cephalica 0.2 mm wide at eye group; clypeus twice as high as diameter of anterior lateral eye. Eyes reduced in size, evanescent, occupying half width of head; eyes of front row subequal in size and in essentially straight row; posterior lateral eyes separated by two and one-half diameters. Sternum 0.3 mm long and wide, nearly round. Legs mostly missing; fourth leg: femur 0.55 mm, patella 0.14 mm, tibia 0.53 mm, metatarsus 0.4 mm, tarsus 0.27 mm; total length 1.89 mm long; fourth leg 3.8 times, fourth femur slightly longer than carapace.

Type data.–Female holotype from Cueva Sodzil, 3 km W Sucopo, Yucatán, 31 March 1973, J. Reddell, D. and M. McKenzie, S. Murphy.

Theotima elva, new species
Fig. 79

Diagnosis.–Pale epigean species related to *ruina* but with tibial spur of male palpus longer and bearing short curved spine.

Etymology.–Specific name from Elva, a girl's name.

Male.–Total length 0.84 mm. Carapace 0.4 mm long, 0.34 mm wide. Abdomen 0.44 mm long, 0.35 mm wide.

Cephalothorax and appendages yellow without darker pattern; eye group enclosing black patch. Abdomen yellowish, lightly shaded with dusky.

Structure like that of *ruina* except as noted; pars cephalica 0.2 mm wide at eye group; clypeus equal in height to two diameters of anterior lateral eye. Front eyes in slightly procurved row with oval middle eyes twice as long as broad; suboval posterior lateral eyes separated by little more than long diameter. Sternum 0.28 mm long, 0.25 mm wide. Legs mostly missing.

Male palpus (Fig. 79) with oval bulb, inconspicuous embolus, and with elongated tibial spur bearing short curved spine.

Type data.–Male holotype from 6 miles S Tuxtla Gutiérrez, Chiapas, 21 August 1966, Jean and Wilton Ivie.

Genus *Speocera*

Speocera machadoi, new species
Figs. 80-81

Diagnosis.–Small epigean species with strongly marked black pattern on carapace and abdomen, with large eyes, protruding clypeus, and especially distinct male palpus with long curved embolus on the bulb.

Etymology.–Named for Dr. G. Barros Machado, now of Lisbon, Portugal, who has contributed much information on this group of spiders.

Female.–Cephalothorax and appendages yellowish; carapace with distinct pattern of broken black chevrons and narrow marginal black seam; eye group enclosing black patch; sternum, labium and endites dusted with tiny black flecks. Abdomen uniform dusky gray.

Structure much like that of *ruina;* pars cephalica moderately elevated, 0.26 mm wide at eye group; clypeus produced forward, equal in height to two diameters of anterior lateral eye. Eyes close together, group occupying two-thirds width of head; front eye row essentially straight, lateral eyes little larger; oval posterior eyes separated by two full diameters. Sternum 0.36 mm long, 0.33 mm wide. First leg: femur 0.6 mm, patella 0.14 mm, tibia 0.6 mm, metatarsus 0.55 mm, tarsus 0.27 mm; total length 2.16 mm; first leg four times, first and fourth femora slightly longer than carapace.

Male.–Total length 1.18 mm. Carapace 0.48 mm long, 0.43 mm wide. Abdomen 0.7 mm long, 0.57 mm wide.

Coloration like that of female but abdomen with inconspicuous dorsal chevron on dorsum and several pale spots on venter. Structure similar except as noted. Carapace proportionately broader; pars cephalica 0.23 mm wide at eye group; clypeus equal to one and one-half diameters of anterior lateral eye. Eyes occupying two-thirds width of head; front row gently procurved with oval medians and round lateral eyes subequal and subcontiguous; posterior lateral eyes separated by somewhat more than two diameters. Sternum 0.35 mm long, 0.32 mm wide. First leg: femur 0.58 mm, patella 0.17 mm, tibia 0.57 mm, metatarsus 0.44 mm, tarsus 0.3 mm; total length

2.06 mm; first leg four times, first and fourth femora slightly longer than carapace.

Male palpus (Figs. 80-81) with unmodified tibia, tarsus drawn to a point, and round bulb with long curved embolus.

Type data.—Male holotype, male, females and immature from 4 mi SE San Cristóbal, Chiapas, 23 August 1966, Jean and Wilton Ivie.

Family Uloboridae

Uloborus signatellus Bonnet

Uloborus signatus O. Pickard-Cambridge, 1898, p. 264. Chamberlin and Ivie, 1938, p. 130.
Uloborus signatellus Bonnet, 1959, p. 4769, footnote. (New name for *signatus,* preoccupied.)

Records.—*Yucatán:* Cenote Sabacah, 1 km W Sucopo, 31 March 1973, J. Reddell, three males. Cueva de Cenote Xtolok, Chichén Itzá, 8 August 1973, J. Reddell, four males, female, immature. Cenote de San Luis, San Luis, 14 km S Buenaventura, 2 April 1973, J. Reddell, female.

Uloborus geniculatus (Olivier)

Uloborus geniculatus: Muma and Gertsch, 1964, p. 37, figs. 82-86.

Records.—*Yucatán:* Artificial cave, Calle 24 x 19, Mérida, 20 March 1973, J. Reddell, female.

Family Theridiidae

Thymoites spukilum (Chamberlin and Ivie)

Spelobion spukilum (Chamberlin and Ivie), 1938, p. 133, fig. 11.

Record.—*Campeche:* Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 19 April 1973, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick, male, females.

Theridion rufipes Lucas

Theridion rufipes: Levi, 1957, p. 56, figs. 188-193, map 18.

Records.—*Yucatán:* Cenote Sodzil, 5 km W Sucopo, 31 March 1973, J. Reddell, two females. Cenote de Tixcancal, Tixcancal, 2 April 1973, S. Murphy, male, immature.

Theridion hispidum O. Pickard-Cambridge

Theridion hispidum O. Pickard-Cambridge, 1898, p. 253, pl. 35, fig. 5.

Record.—*Yucatán:* Cenote de la Paca, 7 km E Tikuch, 11 April 1973, S. Murphy, immature male probably this species described from Teapa, Tabasco.

Theridion sp.

Record.—*Yucatán:* Cueva (Actún) Coch Leb, 3 km S Calcehtok, 16 April 1973, J. Reddell, male, female.

Family Linyphiidae

Eperigone sp.

Record.—*Campeche:* Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 29-30 July 1973, D. Denson, M. Kawakatsu, R. W. Mitchell and group.

Meioneta sp.

Record.—*Yucatán:* Cenote de la Paca, 7 km E Tikuch, 11 April 1973, S. Murphy, female.

Family Amaurobiidae

Goeldia tizamina (Chamberlin and Ivie)

Titanoeca tizamina Chamberlin and Ivie, 1938, p. 129, figs. 8-9.
Goeldia tizamina: Leech, 1972, p. 104.

Records.—*Yucatán:* Cenote de Orizaba, Orizaba, 8 km S Buenaventura, 1 April 1973, J. Reddell, female. Cueva (Actún) Coch Leb, 3 km S Calcehtok, 16 April 1973, J. Reddell, female. Cueva (Actún) Kaua, Kaua, 23 April 1973, R. W. Mitchell, J. Cooke, immature. Cueva (Actún) Xpukil, 3 km S Calcehtok, 18-19 1973, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick, three females, two immature from entrance sink.

Family Agelenidae

Cicurina maya, new species
Fig. 86

Diagnosis.—Small eyeless species of subgenus *Cicurella* related to *buwata* Chamberlin and Ivie and other eyeless and six-eyed species of Texas, readily distinguished by broad epigynum with heavy bilobed spermathecae (Fig. 86).

Etymology.—Named for the Maya people of the Yucatán Peninsula.

Female holotype.—Total length 3.6 mm. Carapace 1.66 mm long, 1.08 mm wide. Abdomen 1.9 mm long, 1.1 mm wide.

Base color of cephalothorax and appendages bright orange, with covering of dusky hairs and spines; chelicerae, labium and endites somewhat darker. Abdomen gray, covered evenly with dusky hairs.

Carapace typical in shape, smooth and shining, evenly convex, highest about at middle, truncated in front; pars cephalica 0.8 mm broad in front, about three-fourths of carapace length, with only faint indication of cephalic sutures and cervical groove distinct longitudinal linear depression. Eyes obsolete, their former position shown as indistinct whitish subintegumental spots. Clothing of carapace sparse with median and lateral rows of few suberect bristles on pars cephalica and several on clypeal middle. Sternum 0.9 mm long, 0.7 mm wide, produced behind into narrow band between close-set posterior coxae, thinly covered with suberect setae. Chelicerae moderately geniculate, with toothed margins: promargin with three unequal teeth and thin keel; retromargin with eight denticles in close-set row. Legs short: tibia and patella of first leg 1.5 mm long, of fourth leg 1.7 mm long.

Epigynum (Fig. 86) of typical pattern but proportionately wider than those of other species; atrium narrow transverse opening; connecting canals forming oval loops lying close to short suboval spermathecum with accessory sac.

Type data.—Female holotype and subadult male from Cueva (Actún) Tucil, 2 km S Muna, Yucatán, 27 March 1973, J. Reddell.

Family Clubionidae

Tixcocoba, new genus

Diagnosis.—Genus of subfamily Clubioninae without known close relatives, much smaller (about 3.3 mm) than taxa of *Clubiona, Lauricius,* etc., distinguished by combination of characters cited below and by details of genitalia of both sexes.

Etymology.—Generic name based on City of Tixcocob of Yucatán, used in feminine gender.

Description.—Carapace (Fig. 82) with trivial linear cervical groove. Eyes eight, close together in two transverse rows with narrow clypeus; anterior row slightly procurved in essentially straight line, with anterior median eyes smaller; posterior row slightly recurved with smaller median eyes closer together than distance to lateral eyes; median ocular quadrangle slightly broader than long. Labium longer than broad, about half as long as endites. Cheliceral margins toothed; promargin with three teeth of medium size, retromargin with two smaller teeth. Legs short: first leg of both sexes about 2.6 times as long as carapace; first tibia with 2-1-1-0 weak ventral spines. Posterior spinnerets with trivial conical segment at apex. Epigynum with small curved fovea in front. Male palpus simple, with embolus a thin curved spine and tibial apophysis subdorsal in position.

Type of genus.—*Tixcocoba maya,* new species.

Tixcocoba maya, new species
Figs. 82-85

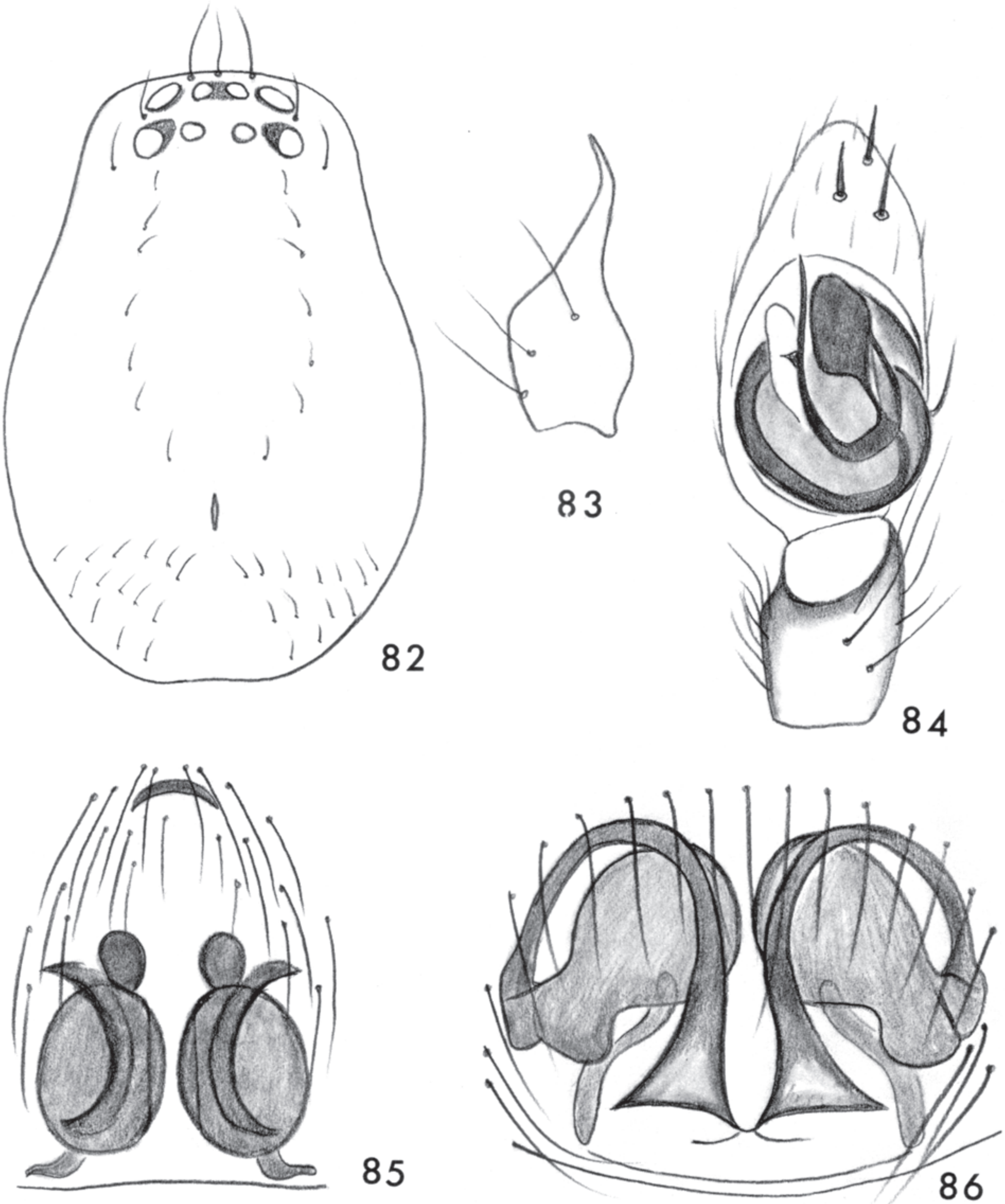
Diagnosis.—Small cavernicole and epigean species of Yucatán and Campeche, without close relatives among American genera, readily distinguished by distinctive genitalia as illustrated.

Etymology.—Named for the Maya people of the Yucatán Peninsula.

Female from Cenote Hunto Chac.—Total length 3.3 mm. Carapace 1.35 mm long, 1.03 mm wide. Abdomen 1.8 mm long, 1 mm wide.

Cephalothorax and appendages quite uniform pale orange yellow; eye tubercles tinged with black; chelicerae, labium and endites slightly darker; few hairs and spines dusky. Abdomen whitish with inconspicuous dusky hairs.

Carapace (Fig. 82) of medium stoutness, relatively short and low, evenly convex, smooth and shiny, truncated in front; pars cephalica 0.65 mm wide at eyes, comprising more than two-thirds total carapace length, without obvious cephalic sutures but with trivial linear cervical groove; clothing of carapace sparse with few erect setae of which five are on clypeus. Eyes eight in two close-set transverse rows near clypeal edge, occupying about four-seventh width of front. Ratio of eyes: ALE:AME:PLE:PME = 12:6:10:5. Anterior eye row straight from above, slightly procurved from in front; anterior median eyes separated by nearly radius, about half as far from larger lateral eyes. Posterior eye row slightly recurved but front edges of four eyes form straight line; median eyes separated by about diameter, one and one-half diameters from larger lateral eyes. Median ocular quadrangle slightly broader than long (21/18), narrowed in front (21/10). Sternum 0.8 mm long, 0.67 mm wide, rounded behind at front edges of moderately separated posterior coxae, clothed sparsely with weak setae more numerous around margins. Labium 0.27 mm long, 0.23 mm wide, slightly narrowed and truncated at apex, with few setae. Endite 0.5 mm long, 0.25 mm wide, evenly rounded at apex, with few setae. Chelicerae inclined forward, geniculate at middle, with toothed margins: promargin with three teeth and thin inner carina; retromargin with two smaller teeth. Legs short with few hairs and weak spines. First leg: femur 1.05 mm, patella 0.56 mm, tibia 0.81 mm, metatarsus 0.72 mm, tarsus 0.47 mm; total length 3.61 mm. Tibia and patella of fourth leg



Figs. 82-85.–*Tixcocoba maya:* 82, carapace of female; 83, tibia of right male palpus, dorsal view; 84, right male palpus, ventral view; 85, epigynum, ventral view. Fig. 86.–*Cicurina maya,* epigynum, ventral view.

1.6 mm long. First tibia with 2-1-2-0 weak ventral spines; first metatarsus with pair of ventral spines beyond base; posterior legs with numerous spines on most surfaces. Abdomen longer than broad, without dorsal sclerite, covered evenly with fine hairs. Spinnerets in close-set group; front pair moderately separated; posterior pair with small conical apical segment.

Epigynum as shown in Fig. 84.

Male from Cenote de Sihunchén.—Total length 3.2 mm. Carapace 1.5 mm long, 1.1 mm wide. Abdomen 1.5 mm long, 0.9 mm wide.

Coloration and structure like those of female except as noted. First leg: femur 1.1 mm, patella 0.52 mm, tibia 0.91 mm, metatarsus 0.74 mm, tarsus 0.55 mm; total length 3.82. Tibia and patella of fourth leg 1.5 mm long.

Right male palpus (Figs. 83-84) small with features difficult to evaluate; cymbium with band of scopular hairs above in distal half; embolus originating on prolateral side, coiled to apical position as thin inconspicuous spine; tibial apophysis thin apically narrowed spine on dorsum.

Type data.—Female holotype from Cenote Hunto Chac (Cueva del Pozo), Yucatán, 12 April 1973, J. Reddell.

Distribution.—Yucatán and Campeche.

Records.—*Yucatán:* Cenote de Sihunchén, Sihunchén, 23 March 1973, J. Reddell, S. Murphy, M. McKenzie, M. Butterwick, two males, female. Cenote (Cueva) de Hoctún, Hoctún, 16 March 1973, J. Reddell, S. Murphy, M. McKenzie, M. Butterwick, one immature. Grutas de Tzab-Nah, 2 km S Tecoh, 23 April 1973, J. Reddell, D. McKenzie, female. Tixcocob, 12 August 1973, J. Reddell, female. Chichén Itzá, 8 August 1973, J. Reddell, female.

Campeche: 5 km SSW Ich-Ek, 27 July 1973, J. Reddell, J. M. Rowland, female.

Corinna saga F. Pickard-Cambridge

Corinna saga F. Pickard-Cambridge, 1899, pp. 65, 72.

Records.—*Yucatán:* Grutas de Tzab-Nah, 2 km S Tecoh, 22 April 1973, J. Reddell, two immature. Cenote Amil, 6 km S Abalá, 28 March 1973, J. Reddell, two immature. Cueva (Actún) Xpukil, 3 km W Calcehtok, 18-19 March 1973, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick, one immature from entrance sink. Oxkintok, 3 August 1973, J. Reddell, male. Ruinas de Mayapán, 14 August 1973, J. Reddell, four females.

Family Salticidae

Corythalia sp.

Records.—*Yucatán:* Cueva (Actún) Xpukil, 3 August 1973, J. Reddell, male, female; 18-19 March 1973, J. Reddell, S. Murphy, D. and M. McKenzie, M. Butterwick, immature female from entrance sink.

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ON TWO RICINULEIDS FROM THE YUCATAN PENINSULA (ARACHNIDA: RICINULEI)

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New York, New York

INTRODUCTION

The first cave ricinuleid from México, based on a male and female discovered in Yucatán by A. S. Pearse in 1936, was given the name *Cryptocellus pearsei* by Chamberlin and Ivie (1938). The presence of *pearsei* in large numbers in Kaua Cave, Yucatán, was first made known by Ivan T. Sanderson (1941) in his book *Living Treasure.* Recent collections in Yucatán by James Reddell and his associates of Texas Tech University in Lubbock, Texas, to whom I am grateful for the opportunity to study this fine material, have shown this species to be present in about a dozen caves, often in large numbers.

The cave ricinuleids of México, numbering so far about eight, form a uniform series presumably derived from a single line of ancestors. Most are found only in cave habitats and these differ from their surface relatives in having thinner bodies and longer legs. The seeming absence of the cavernicoles from epigean habitats suggests that many of them will ultimately be classified as troglobites when fuller information becomes available. Specific characters of these curious arachnids, best expressed in the males, are largely centered in body shape and size, modifications of the second pair of legs and details of the copulatory apparatus on the third leg. The male of *Cryptocellus pearsei* is unique in possessing a prominent, pointed coupling spur on the tibia of the second pair of legs. The related species described here, *Cryptocellus cookei,* with vestiges of a similar spur in much the same position, exhibits morphological differences that mark it as a distinct species.

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Cryptocellus pearsei Chamberlin and Ivie
Figs. 1, 3-7, 12-13

Cryptocellus pearsei Chamberlin and Ivie, 1938, p. 104, figs. 8-9, 14-17. Sanderson, 1941, p. 283, plate labelled Podogona. Gertsch, 1971, p. 127. Brignoli, 1973 [1974], pp. 166-169. Márquez and conconi, 1973 [1974], pp. 73, 81 *(pearsi).*

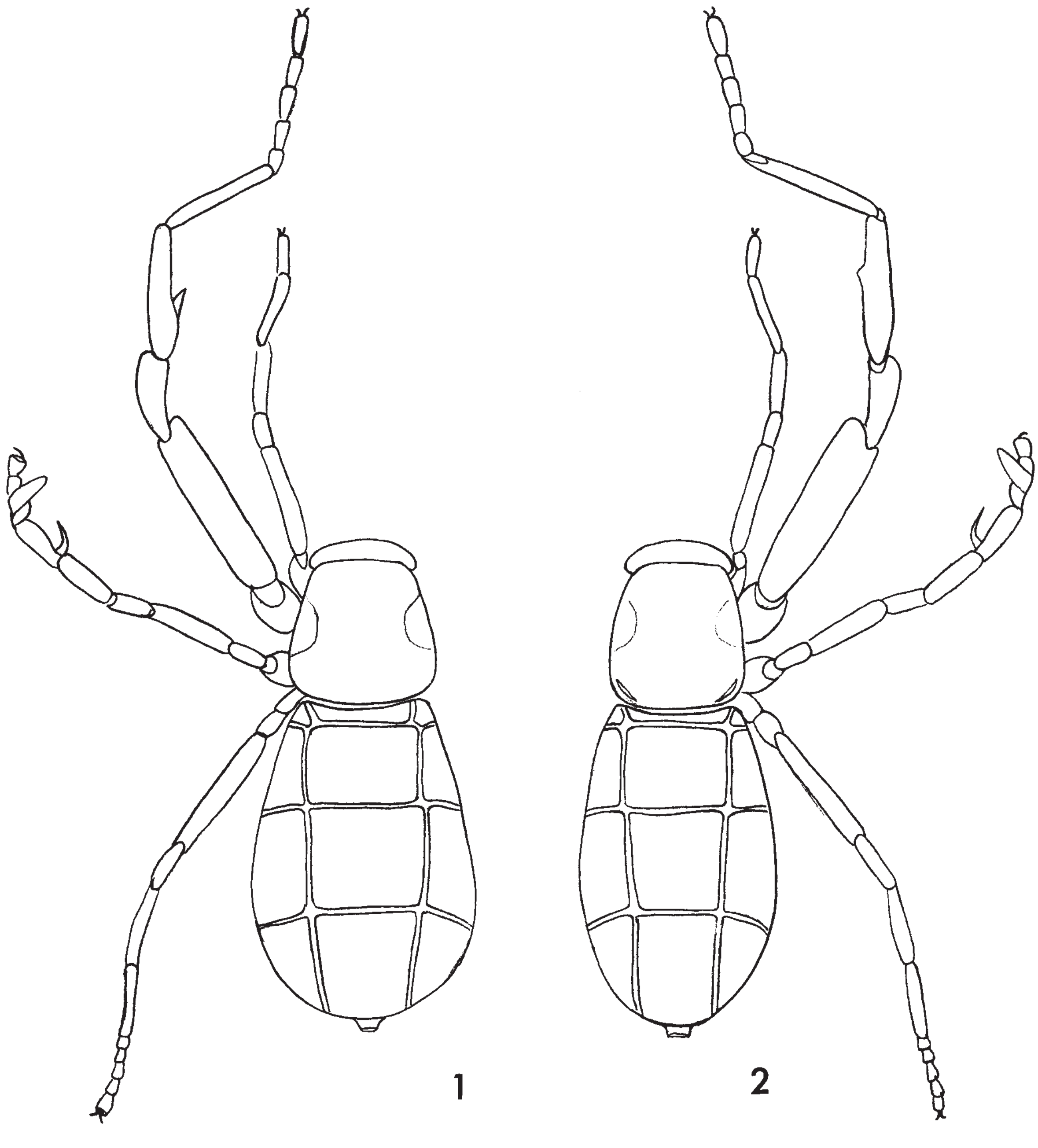
Diagnosis.—First described, typical representative of cavernicole species of México with following combination of characters: middle tergite of abdomen (Fig. 3) broader than long; carapace about as broad as long; second leg moderately enlarged with femur shorter than length of carapace and tibia bearing distinctive ventral coupling spur; copulatory apparatus on third leg of male of medium stoutness, its tarsal process curved, with trivial apical notch, and accessory piece drawn to thin spine. Female standard for group, with thinner legs and four oval seminal receptacles (Fig. 7).

Etymology.—Named for A. S. Pearse, who first collected this fine species.

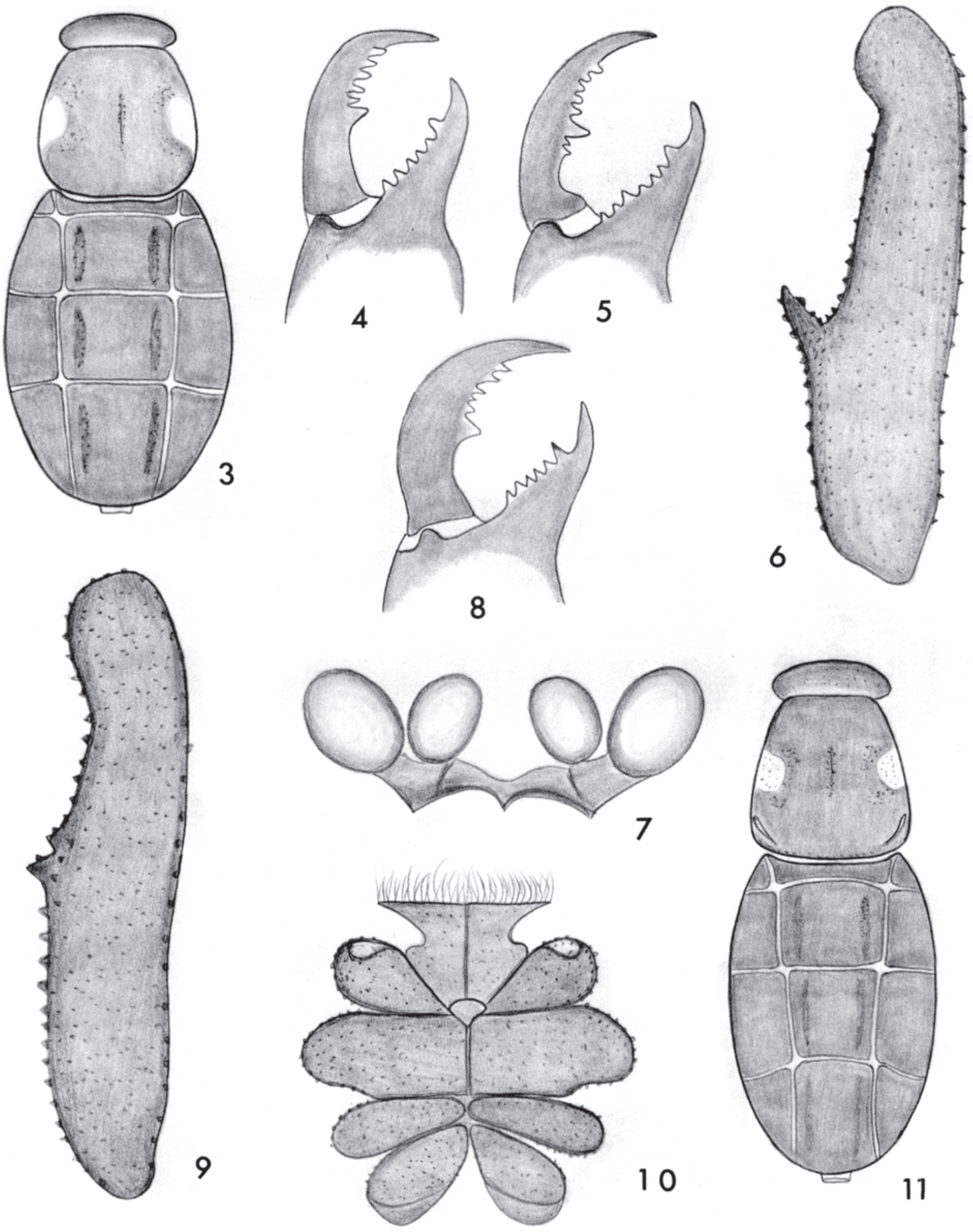
Coloration.—Adult specimens quite uniform bright reddish or mahogany brown with few contrasting markings. Carapace with whitish eye patch on each side of second coxae. Second legs often darker than other legs and pedipalps. Tergites of abdomen margined in dull yellow, separated from ventral valve by lateral yellowish groove; middle tergites with pair of dusky marks near side margins; venter of abdomen with dusky maculation running back from base two-thirds of length. Entire body and appendages covered evenly with short, whitish, inconspicuous hairs.

Male from Grutas de Balankanche.—Total length 5 mm; other males measure from 4.5 to 6 mm in length.

Dorsal outline of body and appendages as shown in Fig. 1. Carapace (Fig. 3) 1.5 mm long and wide, truncated in front and behind, gradually widened on sides to opposite third coxae where forming rounded lobe; dorsal surface covered quite uniformly with small dark tubercles but these concentrated in median furrow and shallow lateral depressions especially beside eye patches. Cucullus 0.7 mm long, 1.1 mm



Figs. 1-2.—1, *Cryptocellus pearsei* Chamberlin and Ivie, dorsal outline of male, right appendages omitted; 2, *Cryptocellus cookei*, new species, dorsal outline of male, left appendages omitted.



Figs. 3-7.–*Cryptocellus pearsei* Chamberlin and Ivie; 3, carapace and abdomen of male; 4, left chelicera of male; 5, left chelicera of female; 6, tibia of second right leg, prolateral view; 7, seminal receptacles of female.

Figs. 8-11.–*Cryptocellus cookei,* new species, male: 8, left chelicera; 9, tibia of second right leg, prolateral view; 10, sternal region; 11, carapace and abdomen.

wide, truncated in front and behind, broadly rounded on each side, covered evenly and thickly with small dark tubercles. Coxae forming venter of carapace covered evenly and thickly with small dusky tubercles; second coxae much larger as shown for *cookei* (Fig. 10). Chelicerae (Fig. 4) small, with thin, evenly curved fingers bearing somewhat variable dentition: movable finger with five or six, or few more, teeth of which basal one largest; fixed finger with five to seven teeth more uniform in size.

	I	II	III	IV	Palp
Femur	1.15	2.00	1.20	1.35	0.80
Patella	0.50	0.80	0.50	0.65	—
Tibia	0.80	1.30	0.70	0.80	—
Metatarsus	1.00	1.50	0.75	0.85	—
Tarsus	0.40	1.75	1.20	0.75	1.25
Total	3.85	7.35	4.35	4.40	3.05

Leg formula 2431. First femur three-fourths as long, first leg 2.5 times as long as carapace; second femur 1.3 times, second leg 4.9 times as long as carapace. Leg segments thickly covered with small tubercles. Second leg heavier than others; femur about five times as long as wide; tibia (Fig. 6) nearly four times as long as wide, considerably narrowed in apical half, armed at middle below with prominent sharp spur on prolateral side and smaller counterpart on retrolateral side forming unequal pair, and lower margin of segment armed with coarse tubercles. All tarsal claws thin, curved, of normal form

Copulatory apparatus of third leg (Figs. 12-13) relatively short and stout with following features: metatarsal process curved spur of typical length; movable tarsal process stout, curved to about right angle in apical half, with thick principal branch provided with trivial apical notch and accessory piece thin rod drawn to slender apical spine.

Abdomen (Fig. 3) 3.25 mm long, 2.25 mm wide, broadest at or just behind middle; principal tergites slightly to considerably broader than long; tergites quite evenly covered with small tubercles and with concentrations in dusky depressions on middle three; sternites smoother, coriaceous, with small tubercles mostly along sides and in depressions. Postabdomen short, with outer ring not emarginated.

Female from Grutas de Balankanche.—Total length 5.25 mm; other females measure from 4.5 to 6 mm in length. Carapace 1.5 mm long, 1.6 mm wide. Cucullus 0.65 mm long, 1.15 mm wide.

Coloration and general structure like those of male. Chelicerae occasionally with accessory denticles or teeth on fingers (Fig. 5).

	I	II	III	IV	Palp
Femur	1.15	2.00	1.20	1.35	0.80
Patella	0.65	0.85	0.65	0.65	—
Tibia	0.75	1.30	0.70	0.80	—
Metatarsus	1.00	1.60	0.75	0.85	—
Tarsus	0.40	1.70	0.70	0.70	1.25
Total	3.95	7.45	4.00	4.35	2.05

Leg formula 2431. First femur three-fourths as long, first leg about 2.5 times as long as carapace; second femur 1.3 times, second leg about five times as long as carapace. Legs tuberculate like those of male. Second leg heaviest but thinner than that of male, without modifications; femur six times as long as greatest width.

Type data.—Male holotype from Grutas de Balankanche (Balaam Canche Cave), Chichén Itzá, Yucatán, collected by A. S. Pearse, in the American Museum of Natural History (formerly University of Utah collection).

Distribution.—Known only from Yucatán caves.

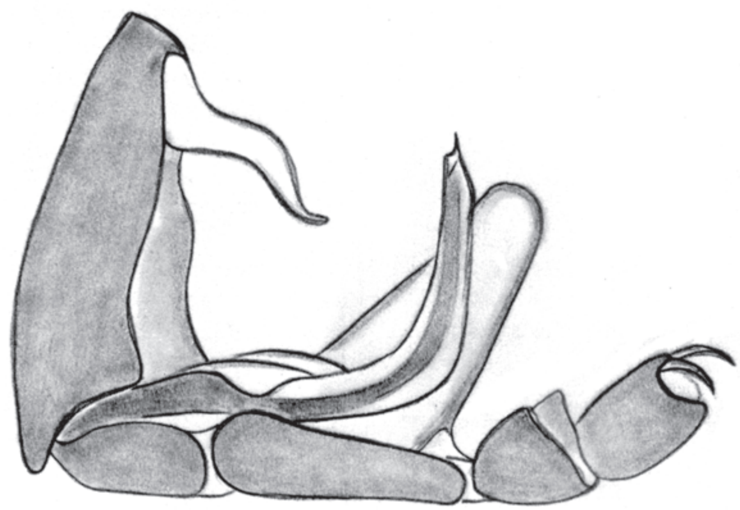
Records.—*Yucatán:* Cueva (Actún) Kaua, 1 km S Kaua, 7 May 1940, Ivan T. Sanderson, numerous males and females from "under stones in cave earth" in Chicago Field Museum, one pair in American Museum of Natural History; 9-10 October 1974, J. Reddell, D. McKenzie, S. Wiley, 9 males, 4 females, 2 nymphs; 20-21 October 1974, J. Reddell, D. McKenzie, S. Wiley, 3 males. Oxolodt Cave, Kaua, A. S. Pearse, female allotype from bat guano. Grutas de Balankanche, 4 km E Chichén Itzá, 10-12 December 1974, J. Reddell, D. McKenzie, S. Wiley, 11 males, 2 females, 2 nymphs; July 1948, C. Goodnight, 1 male. Cenote de San José, Mérida, 6 October 1974, J. Reddell, D. McKenzie, 1 nymph. Cenote Chen Mul, Ruinas de Mayapán, 24, 26 April 1973, J. Reddell, D. and M. McKenzie, M. Butterwick, 21 males, 37 females, 80 or more nymphs; 8 October 1974, J. Reddell, 2 males, 8 females, 11 nymphs. Grutas de Tzab-Nah, 2 km S Tecoh, 26 April 1973, J. Reddell, M. McKenzie, 8 males, 9 females, 10 nymphs. Cueva de Tecoh, Mérida, 6 October 1974, J. Reddell, D. McKenzie, 1 female, 6 nymphs; October 1974, J. Reddell, S. Wiley, 1 female, 3 nymphs. Cenote Chac si Kin (Sur), 1 mi E Ruinas de Mayapán, 24 April 1973, M. McKenzie, 1 nymph. Cueva (Actún) Sabaca, 6 km S Tekax, 4 December 1974, J. Reddell, D. McKenZie, S. Wiley, J. Andrews, R. Mitchell, 8 males, 3 females, 7 nymphs. Cenote G, Ruinas de Aké, 26 March 1973, J. Reddell, M. McKenzie, M. Butterwick, 2 males, 1 female. Cenote de Sambulá, Motul, 20 March 1973, J. Reddell, S. Murphy, 7 males, 22 females, 15 nymphs.

Cryptocellus cookei, new species
Figs. 2, 8-11, 14-15

Diagnosis.—Typical cavernicole species closely related to *pearsei*, readily separated by following features; posterior lobes of carapace with distinct groove just above margin; middle tergite of abdomen longer than broad; tibia of first leg with trivial coupling spur instead of sharp projection; tarsal process of copulatory apparatus of male without apical notch. Female unknown.

Etymology.—Named for Dr. J. A. L. Cooke of Oxford, England, friend and colleague who has contributed important data on the biology and systematics of the Ricinulei.

Male holotype.—Total length 5 mm. Coloration like that of *pearsei;* two mature males bright reddish brown. Structure and sculpturing of body and appendages like those of *pearsei* except as noted. Dorsal outline of body and appendages as shown in Fig. 2. Carapace (Fig. 11) 1.65 mm long, 1.45 mm wide, gradually widened on sides to opposite third coxae where forming rounded lobe marked above by shallow groove. Cucullus 0.75 mm long, 1.25 mm wide. Sternal region of cephalothorax (Fig. 10) covered



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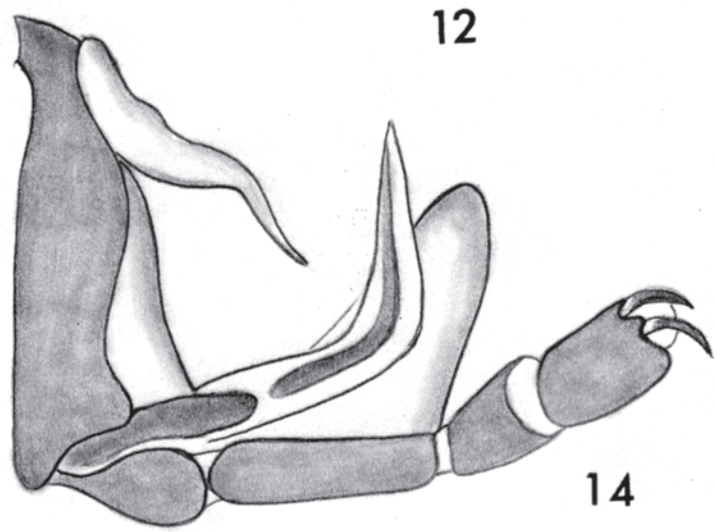

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Figs. 12-13.—*Cryptocellus pearsei* Chamberlin and Ivie, copulatory apparatus of male: 12, prolateral view; 13, distal part of tarsal process with accessory piece free of groove.

Figs. 14-15.—*Cryptocellus cookei,* new species, copulatory apparatus of male: 13, prolateral view; 14, distal part of tarsal process with accessory piece free of groove.

evenly with small tubercles. Left chelicera (Fig. 8): movable finger with single row of six sharp teeth of which basal tooth much larger; fixed finger with six sharp teeth of which apical one much larger.

	I	II	III	IV	Palp
Femur	1.20	2.15	1.30	1.50	0.80
Patella	0.65	0.90	0.60	0.65	—
Tibia	0.80	1.65	0.80	0.85	—
Metatarsus	1.15	1.65	0.75	0.85	—
Tarsus	0.50	1.80	1.15	0.85	1.35
Total	4.30	8.15	4.60	4.70	2.15

Leg formula 2431. First femur three-fourths as long, first leg 2.6 times as long as carapace; second femur 1.3 times, second leg five times as long as carapace. Leg segments thickly covered with small tubercles. Second leg much thicker than that of *pearsei;* femur four times as broad; tibia (Fig. 9) about four times as long as greatest width, moderately narrowed in apical half, provided below with short spur at middle and armed along ventral edge with coarse tubercles.

Copulatory apparatus of third leg (Figs. 14-15) similar to that of *pearsei;* metatarsal process longer and thinner; movable tarsal process stout, curved to nearly right angle, with principal branch drawn evenly to sharp point at apex and accessory piece thin rod gradually drawn to thin blade.

Abdomen 3.25 mm long, 2 mm wide, broadest at about middle, more slender than that of *pearsei* in two known males; principal dorsal tergites longer than broad; anal tubercle without indentation.

Type data.—Male holotype and male and nymph from Cueva Jobitzinaj, 3 km S Flores, El Petén, Guatemala, 22 January 1972, David McKenzie; male holotype in the American Museum of Natural History.

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LANIATORES (OPILIONES) OF THE YUCATAN PENINSULA AND BELIZE (BRITISH HONDURAS)

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In previous papers, we have described some elements of the opilionid fauna of the Yucatán Peninsula, particularly the Mexican portion (see Goodnight and Goodnight, 1947a and b, 1951, 1953). As this information is scattered, this present paper should be useful for presenting a clearer picture of the relationships of the fauna of this area.

The Yucatán Peninsula, a northeastern projection of Central America, lies between the Gulf of México and the Caribbean, between the latitudes of 22° and 16° north. Its area, some 55,500 square miles, includes the Mexican states of Campeche, Yucatán, and Quintana Roo, and much of northern Belize (British Honduras) and eastern Guatemala.

The peninsula is low, and is almost wholly composed of a bed of coraline and porous limestone rocks which form a low tableland gradually rising toward the south. The limestone rocks are covered with a layer of thin, dry soil, formed by the slow weathering of the coral rocks. To the north, the peninsula is low, sandy, and semi-barren; the eastern coast of México has many bluffs indented with bays. There are many off-shore islands. There is little or no surface water in many areas, but the ground is perforated with many natural wells, the cenotes, around which the ancient Mayas often settled.

Northern Yucatán is quite hot and dry, but the moisture increases from 18 inches of rain annually in the north to a maximum of 80 inches in the south. The scrub forests of northern Yucatán gradually give way to taller trees as one moves southward. Though the temperatures are quite high (75° to 98° F) sea breezes tend to moderate the climate. There is a pronounced dry season extending from December to May; the hottest months are May and June.

Belize (British Honduras) is bounded on the north by México, to the west and south by Guatemala, and to the east by the Caribbean. Three regions are usually recognized. In the north, Belize is a part of the Yucatán Peninsula, and like the Mexican portion is a limestone region of low relief. The Rivers New and Hondo are located here and flow into Chetumal Bay. As is true of most of the coastal regions of Belize, the coast is very low in this northern region and has many mangrove swamps and lagoons. Inland there are grass savannas with pines and palmettos.

The northern region gradually rises toward the south, changing into the central mountainous region. This central region is characterized by the tripartite Maya Mountains which are formed of granite and late paleozoic formation. Locally these mountains trend nearly north-south though the original structural trend was east-west. The Mountain Pine Ridge, a centrally located area, is covered with oaks and pines *(Pinus carribaea);* the highest point is Baldy Beacon, 3348 feet. The Cockscomb range, east of the main divide of the Maya Mountains has the highest peak in the country, Victoria Peak, with an elevation of 3680 feet. South of Belize City the coastal lowlands skirt the highlands and are crossed by short river valleys.

The third region, approximately that section south of the Maya Mountains, is a high hill land, much fractured, which descends from an elevation of about 2900 feet to sea level.

While there are some high areas in Belize, most of the country is low, averaging less than 200 feet above sea level. Near shore, the sea is very shallow, a submarine escarpment supports a barrier reef which runs the length of the coast some 15 miles offshore. Outward from the barrier reef are Glovers and Lighthouse Reefs as well as the Turneffe Islands. Within the reef are numerous small islands. All of these islands and reefs are very low, barely above sea level and subject to extensive damage from the occasional hurricanes which sweep across them.

The climate of Belize is subtropical; the rainfall varies from 52 inches annually in Corozal to approximately 180 inches annually on the southern border. The dry season, December to May, is well defined. The forests of the southern areas are classed as tropical wet forests in the Holdridge Life Zone classification.

Most of the country has seasonal broadleaf forests; swamp forests border the rivers, grass savannas are found on the coastal south and inland of Belize City. Mangroves fringe the coast, and oaks and pines are found on the Mountain Pine Ridge. The vegetation of the Caribbean islands is characterized by the presence of many coconut palms.

Politically, Belize is divided into districts. These are Corozal, the northernmost; Orange Walk, just south of Corozal; Cayo to the west; Belize, the central coastal area and the off-shore islands and reefs; Stann Creek, south of Belize City; and Toledo, the largest and most southern.

During the summers of 1971 and 1972, Marie Goodnight and our son, Charles, collected over much of Belize, traveling and collecting in representative sections of each of the three main geographical regions. Two weeks were spent on Glover's Reef some 22 miles offshore. The material studied from Yucatán, Campeche, and Chiapas, was collected by Robert Mitchell and his colleagues of Texas Tech University. A few collections were contributed by Drs. S. and J. Peck with whom we worked for a brief time in Belmopan in July of 1972.

Unless otherwise noted, all collections made in Belize were done by Marie and Charles Goodnight; the material from Yucatán is acknowledged under the species descriptions. Holotypes of new species are deposited in the collections of the American Museum of Natural History, New York. Paratypes are deposited both there and in the collections of The Museum, Texas Tech University in Lubbock.

The fauna of this study area shows its relationships to that of the main portion of México and Guatemala as well as to Central America and the islands such as Cúba. Many forms first described by Cambridge (1905) from Guatemala were found in Belize, but few known from Costa Rica were encountered.

In doing this study, we have followed the taxonomic scheme which we first used in 1953. In that study, we synonymized many genera, hopefully simplifying and clarifying the relationships of the opilionid fauna of Chiapas and contiguous areas. Because so many previous workers have tended to multiply the number of genera, the relationships of the fauna were obscured; we feel that the scheme we devised gives a much clearer picture of a complex situation.

We have attempted to illustrate salient features which we believe will be helpful in future identification of material from this area. We have not used the male genitalia for specific identification, but have illustrated it whenever possible. Hopefully future workers in this area will find this attempt to understand the opilionid fauna helpful.

We wish to express our appreciation to the many individuals who were helpful during our work in Belize. Particularly, we wish to thank the Educational Foundation of the American Association of University Women for the support and encouragement which they gave to Marie Goodnight.

Special appreciation must also be made to our son, Charles, whose enthusiasm and helpfulness during the field work were invaluable.

SUBORDER LANIATORES THORELL

PHALANGODIDAE SIMON

Phalangodinae Roewer

Cynortina Banks

Cynortina Banks, 1909, Proc. Acad. Nat. Sci. Philadelphia, 61:228. Roewer, 1923, Die Weberknechte der Erde, p. 120. Sorensen, 1932, K. Danske Vidensk. Selsk. Skr., 9:263. Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:14.

This is a much abbreviated synonymy of this genus. In 1953, Goodnight and Goodnight synonymized many genera into this single genus. The complete synonymy is in that publication.

Phalangodids with a common rounded eye tubercle which is usually removed from the anterior margin of the cephalothorax. Tubercle without large median spine above, but it may have a small spine. The abdominal scute with five dorsal areas, the first without a median line. Tarsi of third and fourth legs without scopulae and with simple untoothed double claws. Femur of first leg normal, not elongate or heavily spined. The tarsus of the first leg with three segments, distitarsus with two; distitarsus of second tarsus with three or four segments. The tarsi of the other legs have a varying number of segments. The metatarsi of the legs are not divided into astragali and calcanea. The maxillary lobe of the second coxa without a ventral projection. The secondary sexual characters of the male are variable, but usually consist only of heavier spines on the fourth leg.

Genotype: *Cynortina tarsalis* Banks.

Cynortina acanthotibialis Goodnight and Goodnight
Figs. 1a-1b

Cynortina acanthotibialis Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:15-16, figs. 2-8.

Male.—Total length of body, 2.8 mm. Cephalothorax, 0.7 mm. Width of body at widest portion, 2.1 mm.

	I	II	III	IV
Trochanter	0.2mm	0.4mm	0.4mm	0.5mm
Femur	0.9	1.6	1.3	2.6
Patella	0.5	0.8	0.6	1.1
Tibia	0.7	1.3	1.1	2.1
Metatarsus	1.0	1.7	1.5	2.1
Tarsus	0.7	1.3	0.8	0.8
Total	4.0mm	7.1mm	5.7mm	9.2mm

Cephalothorax smooth, often with a few small tubercles on the anterior margin and scattered over the surface. Eye tubercle removed from the anterior margin, rounded, usually with a small spine above. Dorsal scute rounded, areas defined by darker markings, smooth; second, third, and fourth areas often strongly curved posteriorly. Each dorsal area with many hair-tipped tubercles, which are arranged in transverse rows. Each free tergite with a transverse row of large spinose tubercles. These vary in size in the different specimens: in the males they are most often large and conspicuous, while in the females they are much smaller. Free sternites smooth; anal operculum with large spines as in illustration. Coxae granulate, fourth coxa with a distal posterior spine which only partially conceals the spiracle.

Trochanters tuberculate, remainder of legs clothed throughout with hairs. Femora, patellae, and tibiae, with tubercles. These are largest on the fourth leg, where they are more conspicuous, with the distal one being greatly enlarged. Tarsal segments: 3-6-5-5. Distitarsus of tarsus of first leg with two segments, second with three.

Palpus: trochanter, 0.2 mm long; femur, 0.5; patella, 0.4; tibia, 0.4; and tarsus, 0.4. Total length, 1.9 mm. Palpus quite small, armed as in figure.

Chelicera smooth, with only a few hairs on the distal segment.

The entire body and appendages are light reddish brown with much darker brown marking indicating the dorsal areas. Palpi, chelicerae, and trochanters of legs almost yellow; legs with much darker mottling, tarsi somewhat lighter.

Female.—Total length of body, 3 mm. Cephalothorax, 0.9 mm. Width of body at widest portion, 2.3 mm. The body shape and general coloration are similar to those of the male, but the female lacks the heavy spines of the anal operculum and free tergites. The fourth leg is much shorter than that of the males, with only a few spines which also are much less pronounced than those of the male.

Type locality.—Male holotype and male and female paratypes from Finca Guatimoc, Chiapas, August 4, 1950.

Records.—BELIZE: Columbia Forest, Toledo District, numerous males and females, July 6-17, 1971. Guacamallo Bridge, July 13, 1972, one female. Rio Frio Cave, July 1, 1971, one male, one female. Silkgrass, one female, August 3, 1972. Baldy Beacon, males and females, July 1, 1971.

GUATEMALA: Tikal, July 1, 1971.

Remarks.—The male from Tikal had the median spine of the anal operculum greatly enlarged; the other spines were relatively smaller. Its tarsal segments numbered 3-6-5-6.

Cynortina minutus, new species
Fig. 2

Male holotype.—Total length of body, 1.4 mm. Cephalothorax, 0.4 mm. Width of body at widest portion, 0.9 mm.

	I	II	III	IV
Trochanter	0.2mm	0.2mm	0.2mm	0.3mm
Femur	0.5	0.7	0.5	0.6
Patella	0.2	0.3	0.3	0.3
Tibia	0.3	0.5	0.4	0.5
Metatarsus	0.4	0.5	0.5	0.6
Tarsus	0.3	0.6	0.3	0.4
Total	1.9mm	2.8mm	2.2mm	2.7mm

Cephalothorax with a row of blunt tubercles extending from the eye, diagonally to the lateral area. The eye tubercle is at the apex of the triangle thus

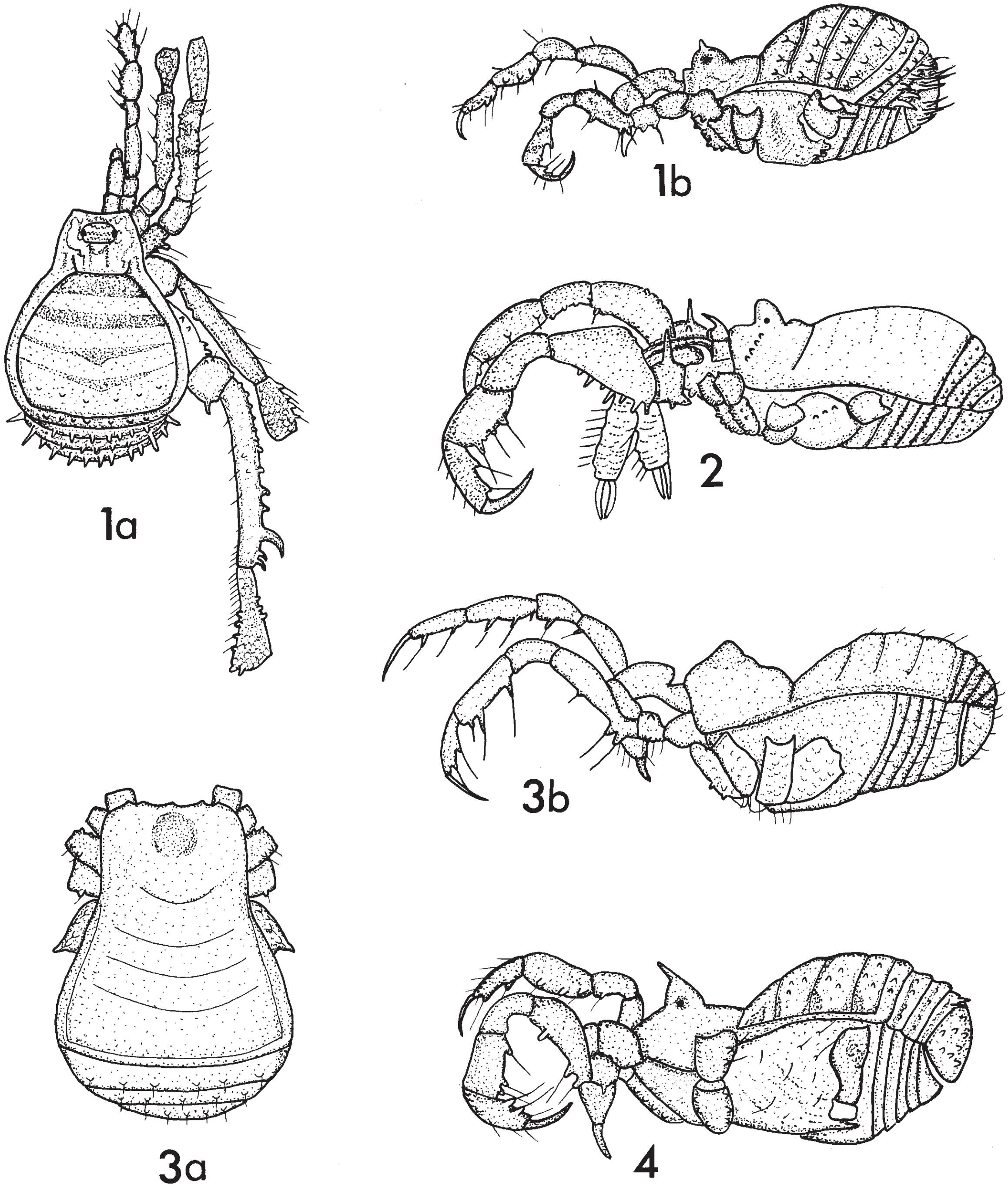


Fig. 1.–*Cynortina acanthotibialis* Goodnight and Goodnight: a, dorsal view of male; b, lateral view of male.
Fig. 2.–*Cynortina minutus,* new species: lateral view of male.
Fig. 3.–*Cynortina mistica,* new species: a, dorsal view of female; b, lateral view of female.
Fig. 4.–*Pachylicus acutus* (Goodnight and Goodnight): lateral view of male.

formed. The eye tubercle is only slightly removed from the anterior margin, and is cone-shaped. A small "hump" is present just posterior to the eye tubercle. The abdominal scute is smooth, with the dorsal areas being poorly defined. Each free tergite with a row of low tubercles. Ventral surface quite smooth, coxae of first and second legs with some low tubercles. The anterior surfaces of the third and fourth coxae with only a few tubercles. Palpal trochanter dorsally bears a single large spine and a smaller inner one. Free sternites smooth, anal operculum with scattered low tubercles.

All segments of the legs but the tibiae and tarsi somewhat roughened in appearance, with scattered hairs. Tarsal segments: 3-4-4-4. Distitarsus of first tarsus with two segments; of second, also with two.

Palpus: trochanter, 0.2 mm long; femur, 0.5; patella, 0.3; tibia, 0.4; and tarsus, 0.3. Total length, 1.7 mm. Palpus armed with spines and tubercles as illustrated. Surface generally smooth on both chelicera and palpus, except for the distal segment of the chelicera which has spines arranged as in the figure. The trochanters of both the chelicera and palpus are armed dorsally with spines; that of the chelicera is angled so as to be pointing forward.

Entire animal light yellow brown.

Type locality.--Holotype from Columbia Forest Station, Toledo District, Belize. Collected on July 6, 1971.

Record.–BELIZE: Rio Om, near Augustine, July 22, 1972.

Remarks.–Actual determination of the sex of this form was extremely difficult due to the small size and the few animals available to us. Because of the rather pronounced spination, it was assumed that both specimens were males. The unique spination of the palpi and chelicerae distinguish this animal from previously known forms. While the distitarsi of the second tarsi possess but two segments, it was felt better to place it in this genus.

Cynortina mistica, new species
Figs. 3a-3b

Female holotype.–Total length of body, 3.1 mm. Cephalothorax, 1 mm. Width of body at widest portion, 2.4 mm.

	I	II	III	IV
Trochanter	0.2mm	0.2mm	0.1mm	0.3mm
Femur	1.5	2.0	1.4	1.8
Patella	0.5	1.3	0.5	0.6
Tibia	0.8	1.4	1.0	1.9
Metatarsus	1.5	1.8	1.6	1.0
Tarsus	1.5	1.4	0.8	1.0
Total	2.7mm	8.1mm	5.4mm	6.6mm

Entire dorsum relatively smooth, without conspicuous tubercles or spines. Eye tubercle only slightly removed from the anterior margin of the cephalothorax, without spines or tubercles, without eyes, very low and somewhat rounded. Body more or less pear-shaped; first area without a median line. Venter smooth, coxae of legs with very low tuberculations which are somewhat more conspicuous on the first coxa. Free sternites and tergites with low tuberculations and some hairs which are arranged more or less in rows. Stigma small, but visible.

Ovipositor lobed at the tip, with numerous coarse hairs.

All segments of the legs bearing numerous hairs; fourth trochanter with a few tubercles. Hairs are most conspicuous on the femora of the fourth legs and most abundant on the tarsi. Tibiae without astragulus or calcaneus. Tarsal segments: 3-7-5-6. Distitarsus of first tarsus with two segments; second with four.

Palpus: trochanter 0.3 mm long, femur, 0.7; patella, 0.4; tibia, 0.7; tarsus, 0.6. Total length, 2.7 mm. Palpus armed as in figure. Dorsal surfaces of segments are slightly roughened.

Entire animal light yellow-brown; the color is darker than that of most cave-adapted forms. Appendages somewhat lighter than dorsum; tarsi nearly white.

Type locality.–Female holotype and female paratype from Footprint Cave, 4 km southwest of Caves Branch, Cayo District, Belize. Collected on August 6, 1976, by L. McNatt, T. Miller, and M. Shawcross.

Remarks.–*C. mistica* probably has its closest relationship to *C. acanthotibialis* which is abundant throughout the area; however, its lack of eyes and generally lighter appearance distinguish it clearly from that form. Its general appearance is more nearly like that of *Cynortina pecki* Rambla from Jamaica. This species does represent the first cave-adapted form of this genus in Central America.

Pachylicus Roewer

Metapachylus (non Cambridge, 1905) Banks, 1909, Proc. Acad. Nat. Sci. Philadelphia, 61:230.

Paramitraceras (part) Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 3, p. 155.

Pachylicus Roewer, 1923, Die Weberknechte der Erde, p. 118; Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:21.

Cerroa Roewer, 1928, Abhandl. Ver. Naturgesch. Bremen, 26:533.

Mexscotolemon Goodnight and Goodnight, 1942, American Mus. Novitates, 1163:1.

Brima Roewer, 1949, Senckenbergiana, 30:19.

Phalangodids with a common eye tubercle which is usually located on the anterior margin of the cephalothorax. Eye tubercle with a single prominent medians spine. Abdominal scute with five areas, the boundaries of which are parallel to one another. First area without a median line. Tarsi of third and fourth legs without scopulae and with untoothed claws. Femur of first leg normal, not elongate or spinose. Tarsus of first leg with three segments; distitarsus of first tarsus with two segments, second with three. Metatarsi not divided into astragali and calcanea. Maxillary lobe of second coxa without a ventral projection. Chelicera normal. Secondary sexual characteristics variable, often lacking.

Genotype: *Pachylicus rugosus* Banks.

Pachylicus acutus (Goodnight and Goodnight)
Fig. 4

Mexscotolemon acutus Goodnight and Goodnight, 1942, American Mus. Novitates, 1163:1, figs. 3-5.
Pachylicus acutus: Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:21-22, fig. 10.

Male.–Total length of body, 2.4 mm. Cephalothorax, 0.8 mm. Width of body at widest portion, 1.9 mm.

	I	II	III	IV
Trochanter	0.3mm	0.4mm	0.4mm	0.6mm
Femur	1.2	2.5	1.5	3.5
Patella	0.5	1.0	0.5	1.0
Tibia	0.9	2.1	1.3	3.0
Metatarsus	1.5	2.8	1.8	3.6
Tarsus	0.8	1.5	0.9	0.9
Total	5.2mm	10.3mm	6.4mm	12.6mm

Body pyriform in shape. Dorsum finely granulate, cephalothorax without tuberculations. Eye tubercle on the anterior margin of the cephalothorax, with a median spine. Abdominal segments without median armature, but with a few dorsal tubercles and a few very small tubercles at the distal lateral area. Fifth area and each free tergite with a transverse row of tubercles which are enlarged into small spines in the median portion of the third free tergite. Anal operculum with small tuberculations. Free sternites and coxae with granulations, third coxa with an anterior and posterior row of small teeth; first coxa with some low teeth on the ventral and anterior surfaces. Fourth coxa partially concealing the spiracle.

Legs clothed throughout with hairs, surface finely granulate, but without many tuberculations. Tarsal segments: 3-7-5-5. Distitarsus of first tarsus with two segments; second with three.

Palpus: trochanter, 0.3 mm long; femur, 0.5; patella, 0.3; tibia, 0.5; and tarsus, 0.3. Total length, 1.9 mm. Palpus armed as in figure. Chelicera smooth, movable claw with a few teeth on the inner surface.

Entire animal a uniform light yellow brown, dorsal areas vaguely outlined in a darker brown. Palpi, chelicerae, and distal portions of leg lighter.

Female.–Total length of body, 2.2 mm. Cephalothorax, 0.8 mm. Width of body at widest portion, 1.9 mm.

In general appearance, the female is similar to the male. The most noticeable difference between them is in the length of the legs, particularly that of the fourth. In the male, the femora measure: 1.2, 2.5, 1.5, and 3.5 mm respectively. In the female, the femora measure: 1.0, 1.5, 1.3, and 1.9 mm respectively.

Records.–BELIZE: Burrell Boom, July 18, 1972. Cacao Plantation, Hummingbird Highway, August 1, 1972. Corozal, July 13 and 15, 1972. Hummingbird Highway, near Middlesex, August 1, 1972.

GUATEMALA: Tikal, July 3, 1971.

MEXICO: *Yucatán:* Pyramid, Izamal, August 10, 1973, J. Reddell. Chichén Itzá, August 8, 1973, J. Reddell. Ruinas de Mayapán, August 24, 1973, J. Reddell. 7 km SW Oxkutzcab, July 31, 1973, J. Reddell, D. Denson, M. Kawakatsu, R. W., D. R., R. W. Jr., S. A., and S. R. Mitchell.

Tabasco: surface near Grutas del Coconá, Teapa, R. Mitchell and W. Russell.

Chiapas: Ruinas de Palenque, July 15, 1973, J. Reddell, R. W. Mitchell.

Campeche: 10 km N Hopelchen, July 27, 1973, J. Reddell and J. M. Rowland.

Note: Numerous males and females were present in all collections.

Remarks.–As was previously noted (Goodnight and Goodnight, 1953) this abundant and widespread species shows considerable variation in the size of the low spines of the third free tergite.

Paramitraceras Cambridge

Paramitraceras Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:575. Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 3, p. 155 (in part); 1923, Die Weberknechte der Erde, p. 117. Goodnight and Goodnight, 1953, American Mus. Novitates, 1619:23.
Panzosus Roewer, 1949, Senckenbergiana, 30(1-3): 12.
Solola Roewer, 1949, Senckenbergiana, 30(1-3):30.

Phalangodids with a common eye tubercle which is located on the anterior margin of the cephalothorax. Eye tubercle in the form of a forward-slanting, pointed cone. Abdominal scute with five areas, the first without a median line. On each side of the first area, there is a small lateral enlargement. Tarsi of third and fourth legs without scopulae and with untoothed claws. Femur of first leg not enlarged. Tarsus of first leg with three or four segments. Distitarsus of first tarsus with two segments; second also with two. Metatarsi of legs not divided into calcanea and astragali. Maxillary lobe of second coxa without a ventral projection. Chelicera enlarged, palpus usually heavy, with little ventral spination. Secondary sexual characters of the male usually seen in the heavier chelicerae.

Genotype: *Paramitraceras granulatus* Cambridge.

Paramitraceras hispidulus Cambridge
Figs. 5-6

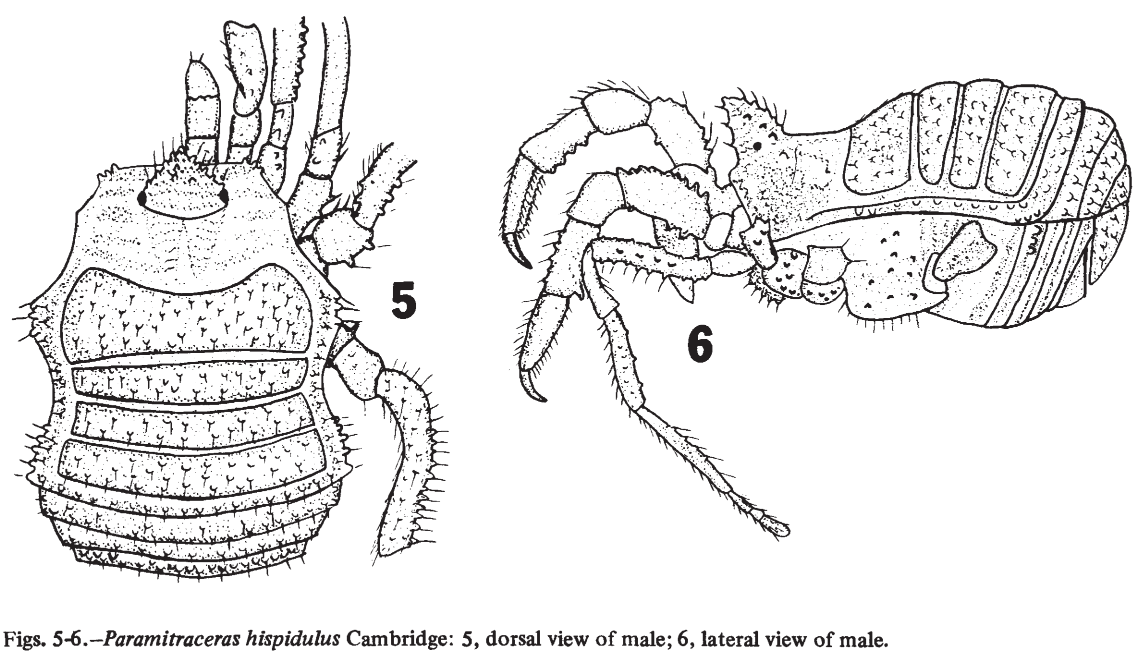
Paramitraceras hispidulus Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:576, pl. 54, figs. 4, 4a-d, 5, 5a-b. Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 3, p. 155; 1923, Die Weberknechte der Erde, p. 117, figs. 119, 120A-B.

Male.—Total length of body, 3.9 mm. Cephalothorax, 1.3 mm. Width of body at widest portion, 3 mm.

	I	II	III	IV
Trochanter	0.4mm	0.4mm	0.4mm	0.5mm
Femur	1.3	1.5	1.3	1.7
Patella	0.5	0.8	0.4	0.8
Tibia	0.8	1.2	1.1	1.3
Metatarsus	1.0	1.3	1.3	1.7
Tarsus	0.7	1.0	0.7	0.7
Total	4.7mm	6.2mm	5.2mm	6.7mm

Cephalothorax quite smooth, with a few small granulations on the anterior lateral margin. Eye tubercle on the anterior margin, in the form of a cone, covered with hair-tipped tubercles. Dorsum with five well defined areas, each with a transverse row of low hair-tipped tubercles. Small tubercles present on the disto-lateral borders of the dorsal scute. Each free tergite with numerous hair-tipped tubercles which are more or less arranged in rows. Anal operculum similarly covered with hair-tipped tubercles. Venter quite smooth, with hair-tipped tubercles at the lateral areas. Spiracle visible between the fourth coxae and the first free sternite. Coxae of legs and palpi with hair-tipped tubercles which are most conspicuous on the posterior border of the second coxa and the ventral surface of the first.

Trochanters of legs relatively smooth, the first with a few tubercles. Femora, patellae, and tibiae of legs with numerous large hair-tipped tubercles giving



Figs. 5-6.—*Paramitraceras hispidulus* Cambridge: 5, dorsal view of male; 6, lateral view of male.

a roughened appearance to the legs. Metatarsi with smaller tubercles and many hairs. Tarsi with hairs. Tarsal segments: 3-4-5-5. Distitarsi of both first and second tarsi each with two segments.

Palpus: trochanter, 0.4 mm long; femur, 0.8; patella, 0.5; tibia, 0.6; and tarsus, 0.7. Total length, 3 mm. Surface of palpus relatively smooth, with some ventral and dorsal spination as illustrated. All segments somewhat flattened laterally, tarsus almost triangular in shape, ventrally flattened, with bordering rows of low tubercles. Chelicera quite smooth, first segment with a few dorsal spines. Fixed portion of claw with teeth.

Overall color of animal is dark reddish brown. Areas of dorsum are separated by a lighter color. Cephalothorax with much darker marking. Trochanters and tarsi of legs lighter, remaining segments dark. Palpus and chelicera somewhat lighter.

Female.—Total length of body, 4.1 mm; cephalothorax, 1.3; width of body at widest portion, 2.9 mm.

Females are very similar in appearance to the males, but the spination of the legs is somewhat reduced. Actually it is usually very difficult to distinguish the sexes.

Type locality.—Petén, Guatemala.

Records.—BELIZE: Blue Hole, August 1, 1972. Caves Branch, near St. Herman's Cave, August 25, 1972. Cacao Plantation, Hummingbird Highway, August 1, 1972. Belmopan, July 20, 1972, S. and J. Peck. Hummingbird Gap, August 8, 1972, S. and J. Peck.

Remarks.—Cambridge (1905) described both *Paramitraceras hispidulus* and *Paramitraceras granulatus* from Guatemala. He differentiated the two species by their average difference in size (*P. granulatus* = 7 mm; *P. hispidulus,* 5 mm) and the general appearance.

Stygnomma Roewer emend. Goodnight and Goodnight

Stygnomma Roewer, 1912, Mem. Soc. Neuchatel, 5:155; 1923, Die Weberknechte der Erde, p. 144. Petrunkevitch, 1925, Trans. Connecticut Acad. Arts and Sci., 27:62-63. Goodnight and Goodnight, 1951, American Mus. Novitates, 1491:3; 1953, American Mus. Novitates, 1610:30-31.

For a complete synonymy of this genus, consult Goodnight and Goodnight, 1953.

Members of the family Phalangodidae without a common eye tubercle and with five dorsal areas on the abdominal scute, the first without a median line. Tarsi of third and fourth legs without scopulae and with simple untoothed double claws. Femur of first leg normal. Distitarsus of first tarsus with two segments; second with two or three. Metatarsi not divided into astragali and calcanea. Palpus and chelicera somewhat enlarged, varying in individual species. Maxillary lobe of second coxa without a ventral projection. Secondary sexual characters of the male apparent in the increased spination of the palpus and chelicera and in the enlargement of some portion of the metatarsus of the third leg.

Genotype: *Stygnomma fuhrmanni* Roewer from Plateau of Camelia, Colombia.

Since the 1951 revision of the genus by Goodnight and Goodnight, several additional species have been described. Members of this genus are found throughout Middle America, Cúba, and northern South America. Though they do vary considerably in appearance, all share the character of lacking an eye tubercle; the eyes are directly on the cephalothorax. In some forms, there is a spine between the eyes, and the eyes may be at varying distances from this spine. In fact, it can be quite difficult to be certain that the animals under consideration are members of this genus; usually, however, other traits are helpful, particularly the enlargement of a portion of the metatarsus of the third leg.

Stygnomma belizense, new species
Fig. 7

Male.—Total length of body, 2.5 mm. Cephalothorax, 0.8 mm. Width of body at widest portion, 1.9 mm.

	I	II	III	IV
Trochanter	0.3mm	0.4mm	0.4mm	0.5mm
Femur	1.9	1.9	1.4	1.7
Patella	0.7	0.7	0.5	0.6
Tibia	1.5	1.6	1.1	1.5
Metatarsus	1.8	1.8	1.7	2.2
Tarsus	1.7	1.7	1.1	1.4
Total	7.9mm	8.1mm	6.2mm	7.9mm

Cephalothorax without an eye tubercle, but with a small dorsal pointing spine between the eyes. The position of the spine is somewhat variable. Cephalothorax quite smooth, with only a slight appearance of granulations. Small spine-bearing tubercles at the anterior lateral margin. The five dorsal areas of the abdomen are clearly defined by small spine-bearing tubercles arranged transversely across each area. These are somewhat darker than the rest of the area. A similar row of small tubercles is along each lateral border and at the posterior margin of the fifth area. The free tergites also have transverse rows of small spine-bearing tubercles. Ventrally all surfaces are covered with small tubercles; in most cases they are spine-bearing. The coxa of the palpi are somewhat enlarged; third coxa of legs, each with a row of low teeth on both anterior and posterior surfaces. Free sternites, like the free tergites, have transverse rows of small spine-bearing tubercles; the anal operculum is covered with similar tubercles.

All leg segments quite rough in appearance due to the presence of many small spine-bearing tubercles, including the coxae, which from a dorsal view can be seen to be quite rough. In the male, the metatarsus of the third pair of legs is somewhat enlarged in the median section. Tarsal segments: 4-6-5-5. Distitarsus of first tarsus with two segments, second with three.

Palpus: trochanter 0.4 mm long; femur, 1.1; patella, 0.6; tibia, 0.9; and tarsus, 0.7. Total length, 3.7 mm. Palpus armed as in figure. The general appearance is somewhat roughened, and the enlarged coxa can be clearly seen from either dorsal or lateral view. The chelicera likewise are roughened in appearance, particularly on the second segment where the slightly enlarged roughened areas have short spines.

Color of entire animal is light yellowish brown, the only darker areas are the transverse rows of tubercles on the dorsal area. In the median section of the first and second areas of the abdomen is a lighter portion which looks somewhat like a saddle; it terminates at the distal portion of the third dorsal area.

Female.–Total length of body, 2.7 mm. Cephalothorax, 0.8 mm. Width of body at widest portion, 1.9 mm.

The female is very similar in appearance to the male, but lacks the enlargement of the middle section of the third metatarsus. The median section of the dorsum is not so light as that of the male.

Type locality.–Male holotype from Rio Frio, near Augustine, July 20, 1972.

Records.–BELIZE: Paratypes from Rio Frio, July 20, 1972. Blue Hole, near Belmopan, August 1, 1972. Belmopan, August 1, 1972. Belmopan, July 20, 1972, S. and J. Peck.

Remarks.–Though *S. belizense* shows its closest relationship to *S. spinifera,* it differs in the degree of spination of the dorsum and the shape of the spine between the eyes. There are also slight differences in the spination of the palpus.

Stygnomma granulosa (Goodnight and Goodnight)
Fig. 8

Pellobunus granulosa Goodnight and Goodnight, 1947, Fieldiana, 32(1):4, fig. 1.

Male.–Total length of body, 2.5 mm. Cephalothorax, 1 mm. Width of body at widest portion, 1.9 mm.

	I	II	III	IV
Trochanter	0.3mm	0.3mm	0.3mm	0.3mm
Femur	1.0	1.6	1.1	1.4
Patella	0.4	0.5	0.5	0.5
Tibia	0.6	1.2	0.9	1.3
Metatarsus	0.9	1.5	1.3	1.7
Tarsus	0.9	1.5	0.8	0.9
Total	4.1mm	6.6mm	4.9mm	6.1mm

Cephalothorax with some scattered low tuberculations, without eye tubercle, but with a blunt median spine located between the eyes. This spine is covered with tuberculations which reach nearly to the tip. The five dorsal areas are indicated only by transverse rows of slightly darker, low tubercles. These are slightly larger on the fifth area. Each free tergite with a transverse row of low tubercles, those of the third are slightly larger. Anal operculum also covered with rough tubercles. Ventrally, the coxae are covered with tuberculations. The palpal coxa ventrally have two enlarged tubercles; first coxa with ventral median row of enlarged tubercles; second also with a similar row, but with larger ones at the distal posterior margin; third coxa with slightly enlarged tubercles at the anterior distal borders; fourth with enlarged tubercles at the anterior lateral border, and a single enlarged tubercle near the median ventral line. The latter is visible from the lateral view. Each free sternite with a transverse row of low tubercles; spiracle barely visible between the fourth coxa and the first free sternite.

All leg segments but the metatarsi and tarsi with low tuberculations. Metatarsi with many hairs. Third metatarsus with a slight enlargement of the apical two-thirds. Tarsal segments: 4-6-5-6. Distitarsus of first tarsus with two segments; second with three.

Palpus: trochanter, 0.3 mm long; femur, 0.9; patella, 0.5; tibia, 0.8; and tarsus, 0.5. Total length 3 mm. Palpus armed as in figure. Chelicera covered with low tuberculations; claws with low teeth.

The general color is a uniform brownish yellow. The low tubercles of the dorsal areas are somewhat darker. There is some darker mottling on the metatarsi and tarsi of the legs.

Female.–Total length of body, 2.5 mm. Cephalothorax, 0.8 mm. Width of body at widest portion, 1.7 mm.

Female similar in general appearance to the male, but lacking the enlargement of the third metatarsus.

Type locality.–Silkgrass, Belize, November 17, 1939, I. T. Sanderson.

Record.—BELIZE: Corozal, July 15, 1972.

Remarks.—*S. granulosa* was originally described as *Pellobunus granulosa* from a single specimen. Additional material from Corozal, leads us to believe that this form actually should be in *Stygnomma.* While it is difficult to be absolutely certain, we believe the eyes are not on the eye tubercle; also, the enlargement of the distal portion of the third metatarsus would tend to support this decision to place this species in the genus *Stygnomma.*

Stygnomma pecki, new species
Fig. 11

Male.—Total length of body, 2.3 mm. Cephalothorax, 0.8 mm. Width of body at widest portion, 1.8 mm.

	I	II	III	IV
Trochanter	0.4mm	0.4mm	0.3mm	0.5mm
Femur	1.8	2.8	1.9	2.4
Patella	0.6	0.9	0.5	0.7
Tibia	1.3	2.1	1.4	1.9
Metatarsus	1.5	2.5	1.9	2.4
Tarsus	0.8	2.5	1.0	1.1
Total	6.4mm	11.2mm	7.0mm	9.0mm

A very small animal, the cephalothorax with only a few tuberculations at the posterior portion, no eyes present; cephalothorax rounded and somewhat elevated. Dorsal scute with five areas, indicated by shallow furrows; each area with a median row of small tuberculations, and a second smaller row somewhat anterior to the first more conspicuous row. Free tergites and fifth area with larger, transversely arranged spine-bearing tubercles. These are almost spinose on the free tergites. Anal operculum also with large spinose tubercles, all of which bear hairs. Ventrally the general surface of the coxae is roughly tuberculate, the free sternites with rows of low spine-bearing tubercles, ventral portion of anal operculum somewhat wider, covered with spinose tubercles. Genital operculum is located between the fourth coxae, spiracles just visible at the posterior junction of the fourth coxa and the first free sternite.

All segments of the legs covered with hairs. Trochanters covered with small tubercles; femora with some small tubercles, but mainly they are covered with quite conspicuous hairs.

Palpus: trochanter, 0.4 mm long; femur, 1.9; patella, 1.4; tibia, 1.8; tarsus, 2.5. Total length, 8 mm. Palpi greatly enlarged, especially the femur which is broadened both dorso-ventrally as well as laterally. There are two heavy spines which can be observed in the illustration; dorsal surface with many spine-like projections on the dorsal surface. All segments armed with spines as in the figure. The chelicerae likewise have unusual spination.

Entire animal light yellow in color; legs and palpi extremely light; tarsi nearly white.

Female.—Total length of body, 2.1 mm. Cephalothorax, 0.6 mm. Width of body at widest portion, 1.5 mm.

Female similar in appearance to male, but somewhat smaller. Palpi are less robust, not nearly so spinose in appearance. Coloration similar to that of the male.

Type locality.—Male holotype from St. Herman's Cave, Caves Branch, Belize, July, 1972, S. and J. Peck.

Record.—BELIZE: Male and female paratypes from Mountain Cow Cave, Caves Branch, July, 1972, S. and J. Peck.

Remarks.—This species, named in honor of Dr. and Mrs. Peck, is the first cave-adapted opilionid to be found in Belize. It is unusual in appearance; and it would be useful to have more material from other localities, better to indicate its relationships. It bears no obvious relationships to any forms we have previously observed.

Stygnomma spinifera tancahensis Goodnight and Goodnight
Figs. 12-16

Stygnomma spinifera tancahensis Goodnight and Goodnight, 1951, American Mus. Novitates, 1491: 13, figs. 13 and 14.

Male.—Total length of body, 2.5 mm. Cephalothorax, 0.9 mm. Width of body at widest portion, 1.8 mm.

	I	II	III	IV
Trochanter	0.3mm	0.4mm	0.3mm	0.3mm
Femur	1.0	1.7	1.1	1.8
Patella	0.5	0.7	0.5	0.5
Tibia	0.5	1.2	1.0	1.3
Metatarsus	1.0	1.5	1.3	1.3
Tarsus	0.7	1.8	1.0	1.0
Total	4.3mm	7.3mm	5.2mm	6.8mm

Cephalothorax with small granulations, those at the base of the median spine somewhat larger. Eyes large, widely separated. Five areas of the dorsum clearly indicated by transverse rows of tubercles. Each free tergite also with a transverse row of tubercles; anal operculum with numerous tubercles. Ventral surface with numerous granulations; a transverse row on the first and second coxa, tooth-like tuberculations on the anterior and posterior surfaces of the third coxa, fourth coxa with numerous scattered tuberculations. Each free sternite with a transverse row of granulations. Stigmen somewhat obscured by the fourth coxa.

All segments of the legs but the metatarsi and tarsi with granulations, which are somewhat larger on the femora. Metatarsi and tarsi with hairs. Distal portion of the third metatarsus somewhat clavate. Tarsal segments: 4-7-5-5. Though this is a relatively constant number, some few forms had 4-8-5-5. Distitarsus of first tarsus with two segments, second with three.

Palpus: trochanter, 0.4 mm long; femur, 1.1; patella, 0.7; tibia, 0.8; and tarsus, 0.9. Total length, 3.9 mm. Palpus armed as in figure. The basal spines of the femur are median in position. Chelicera with roughened surfaces; movable claw with but a single "tooth."

In color, this species is light orange yellow. Distal portions of the second femur, all of the patella, metatarsus, and tarsus darker brown; distal segments of other legs only slightly darker.

Female.–Total length of body, 2.5 mm. Cephalothorax, 0.7 mm. Width of body at widest portion, 1.8 mm.

Very similar in appearance to the male, lacking only the enlargement of a portion of the metatarsus of the third leg.

Type locality.–Male holotype and paratype from Tancah, near the Ruins of Tulum, Quintana Roo, México, August 12, 1949.

Records.–BELIZE: Males and females from Southeast Cay, Southwest Cay, and Long Cay, all on Glover's Reef, July 1971. Glover's Reef is some 25 miles off the coast of Belize.

MEXICO: *Quintana Roo:* Cueva de Abispa, Tancah, 1 July 1975, J. Reddell, A. Grubbs, S. Wiley.

Remarks.–Members of this species are widely distributed from Florida to Cúba and Quintana Roo, México; these records extend their distribution into Belize. As is to be expected, the material from Belize shows its closest affinities to that from the Yucatán Peninsula. Specimens from the different cays are illustrated here to show the variations that exist even within a single subspecies. We do not feel the differences are distinctive enough to regard them as a new subspecies.

Stygnomma toledensis, new species
Figs. 9-10

Male.–Total length of body, 2.5 mm. Cephalothorax, 1 mm. Width of body at widest portion, 2 mm.

	I	II	III	IV
Trochanter	0.3mm	0.3mm	0.3mm	0.5mm
Femur	1.1	1.7	1.4	1.5
Patella	0.5	0.5	0.5	0.6
Tibia	0.8	0.8	1.3	1.4
Metatarsus	1.0	1.0	1.3	1.8
Tarsus	0.9	0.9	1.7	1.2
Total	4.6mm	5.2mm	6.5mm	7.0mm

Cephalothorax quite smooth, with a few larger tubercles at the anterior-lateral margin. A median spine is present between the eyes and has many low tubercles on its surface. The five dorsal areas are not clearly defined, though a few tubercles can be discerned on each one. Free tergites are quite smooth, second with a transverse row of low tubercles on the posterior border, third with some low scattered tuberculations. Anal operculum likewise with scattered low tuberculations. Ventral surfaces of coxae with numerous tuberculations. First coxa with a few larger median tubercles; second with a few enlarged tubercles in the dorsal area; third coxa with anterior and posterior rows of teeth-like tubercles; fourth coxa with three or four enlarged tubercles at the posterior-lateral border. Spiracles barely visible. Free sternites each with a transverse row of very low tubercles.

All segments but the metatarsi and tarsi of the legs with numerous hair-tipped tubercles. Trochanters with tuberculations. Tarsal segments: 4-7-5-5. Distitarsus of first tarsus with two segments, second with three.

Palpus: trochanter, 0.4 mm long; femur, 1; patella, 0.5; tibia, 0.9; and tarsus, 0.8. Total length, 3.6 mm. Palpus armed as in figure; basal spine-bearing tubercles of the femur are ventral and median in position. First segment of chelicera quite long, both segments with somewhat enlarged tubercles which bear hairs.

Entire animal dark yellow brown, darker netting present on the eye tubercle; irregular darker markings on the cephalothorax. Dorsal areas vaguely indicated by darker markings; palpus and chelicera netted with darker markings. Free tergites darker, legs with darker, net-like markings.

Female.–Total length of body, 2.4 mm. Cephalothorax, 0.9 mm. Width of body at widest portion, 1.7 mm.

Female similar to male in appearance, but the chelicerae are somewhat smaller and the areas more clearly delineated by darker central mottlings. The third metatarsi of both male and female do not show the typical enlargement which usually is conspicuous in members of this genus.

Type locality.–Male holotype and female para-

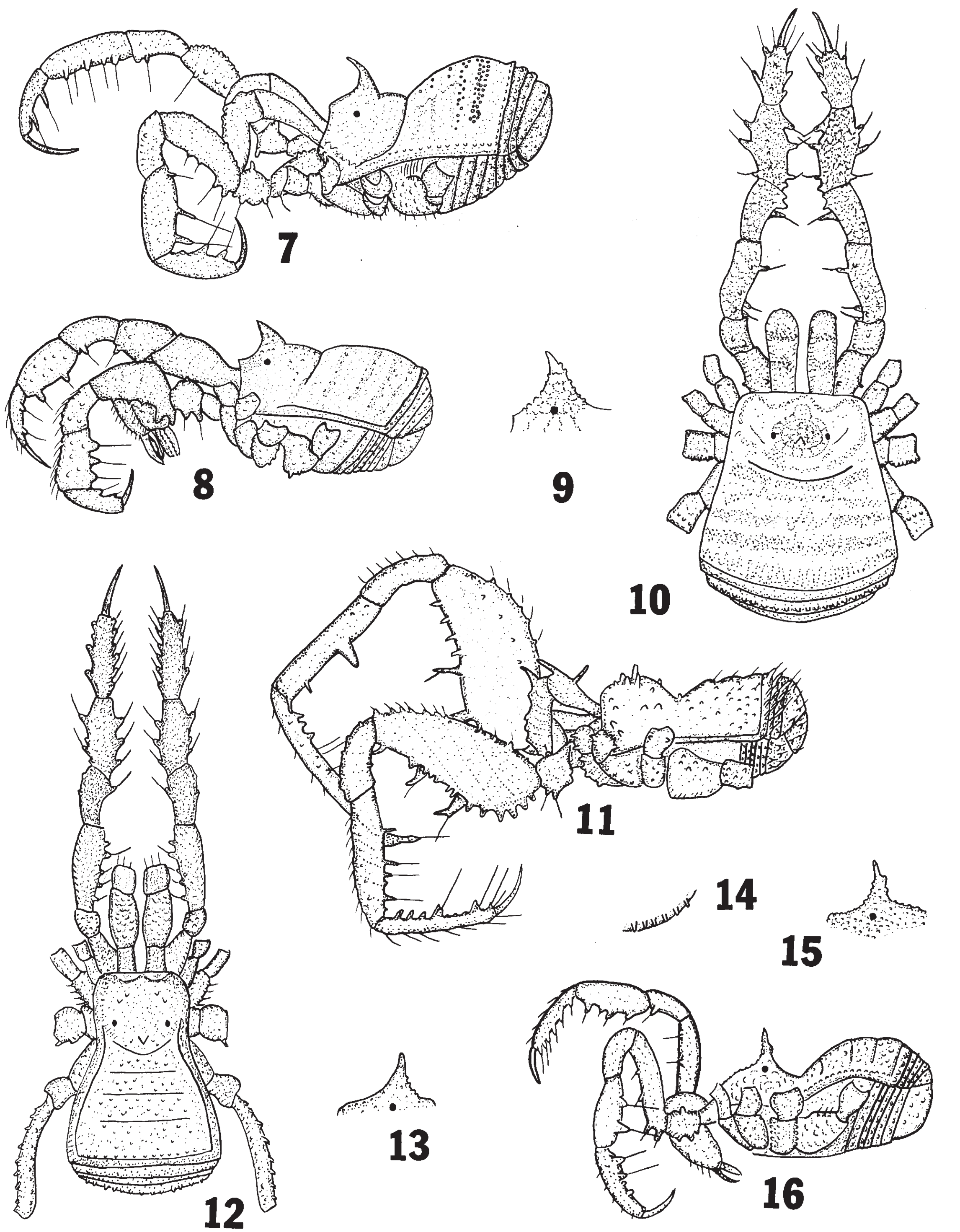


Fig. 7.–*Stygnomma belizense,* new species: lateral view of male.

Fig. 8.–*Stygnomma granulosa* (Goodnight and Goodnight): lateral view of male.

Figs. 9-10.–*Stygnomma toledensis,* new species: 9, lateral view of eye tubercle of male; 10, dorsal view of male.

Fig. 11.–*Stygnomma pecki,* new species: lateral view of male.

Figs. 12-16.–*Stygnomma spinifera tancahensis* Goodnight and Goodnight: 12, dorsal view of male from Long Cay, Glover's Reef; 13, lateral view of eye tubercle of male from Long Cay, Glover's Reef; 14, third free tergite of male from Southwest Cay, Glover's Reef; 15, lateral view of eye tubercle of male from Southwest Cay, Glover's Reef; 16, lateral view of male from Southeast Cay, Glover's Reef.

type from Columbia Forest Station, Toledo District, Belize, July 19, 1971.

Remarks.–This form is related to *S. spinifera*, but has somewhat different spinal arrangement on the palpi, is considerably darker, and has a different form to the eye tubercle.

COSMETIDAE SIMON

Cosmetinae Cambridge

The problem of defining genera among the members of the subfamily Cosmetinae is not a simple one. Roewer in his numerous publications used various combinations of characters as valid traits for genera; unfortunately, he considered every possible combination as a different genus. Because of the variation of tarsal segments and dorsal spination or tuberculation, the number of possible different combinations is astronomical. This lead to a multiplication of the number of genera, most of which were monotypic, to a point where it became virtually impossible to recognize relationships. Goodnight and Goodnight (1953) attempted to simplify this problem for members of the subfamily found in Chiapas, México. We recognized three genera *(Cynorta, Vonones, Paecilaema)* based primarily upon the number of segments in the tarsi of the first pair of legs, namely, 5, 6, or more than 6. Continued work has reinforced our opinion that this is a valid differentiation for the many cosmetids of much of México.

Our present study of the cosmetids of Belize has both reinforced and somewhat altered our viewpoint as expressed in 1953. We still feel that we were essentially correct in the criteria used for separation of the genera; but we also realize that generic concepts must constantly be examined. The study of these forms appears to indicate that throughout much of Central America and extending into southern México, another group of cosmetids with but six segments in the first tarsi should be recognized. Males of these forms have heavily spined fourth legs and often elaborate dorsal white patterns. The females tend to have somewhat heavier fourth legs which are usually less spinose than those of the males. In general, this character is a valid, easily recognized one; however, as is usually true, there are forms which are somewhat intermediate in form and whose exact taxonomic position may be difficult to determine. Nevertheless, in the interest of clarifying relationships, we feel that this is a valid difference.

Roewer in 1912 gave the name *Erginulus* to "robust animals with heavier third and fourth legs...first tarsus 6 segmented, 2-4 tarsi more than 6, variable." This genus and diagnosis appear valid to us to be applied to these forms which are abundant throughout Central America and southern México.

As we studied the cosmetids from Belize, it immediately became apparent that we were dealing with a complex group of closely related forms. The variations of color pattern and leg spination as well as that of the spines and/or tubercles of the dorsum were exceedingly complex. While Cambridge illustrated these, it is often difficult to interpret his drawings. His illustrations do not account for many possible variations. As nearly as possible, we have identified species first described by him in Guatemala which also range into Belize. We have probably made errors, but hope that others who have wrestled with these problems will be understanding of our efforts.

Cynorta C. L. Koch

Cosmetus Perty, 1833, Delectus animalium articulatorum, fasc. 3, pp. 203-208 (in part). Gervais, 1844, in Walckenaer, C. A., and F. L. P. Gervais, Histoire naturelle des insectes apteres, 3:115 (in part).

Cynorta C. L. Koch, 1839, Ubers Arachniden, 2:2; 1839, in Hahn, C. W. and C. L. Koch, Die arachniden, 7:100-102. Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 1:557. Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 31; 1923, Die Weberknechte der Erde, p. 310; 1926, Abhandl. Naturwiss. Ver. Bremen, 16:570. Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:37-38; 1973, Bull. Assoc. Mexican Cave Stud., 5:92.

For a more nearly complete synonymy of this large genus, see Goodnight and Goodnight (1953).

Cosmetids with simple untoothed double claws on the third and fourth tarsi, with but six segments in the first tarsus. Distitarsi of both first and second tarsi with three segments. Dorsum with five areas, variously armed with tubercles and spines. Third and fourth legs similar in size and appearance to first and second.

Genotype: *Cynorta conspersa* (Perty).

Cynorta columbiana, new species
Fig. 17

Male.–Total length of body, 3.4 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.5 mm.

	I	II	III	IV
Trochanter	0.3mm	0.4mm	0.4mm	0.4mm
Femur	1.6	2.9	2.3	3.3
Patella	0.7	0.9	0.8	1.1
Tibia	1.2	2.3	1.4	1.4
Metatarsus	1.6	2.9	2.2	2.6
Tarsus	1.3	2.9	1.5	1.6
Total	6.7mm	12.3mm	8.6mm	10.4mm

Small, slender animal. Dorsum smooth with paired spines on the median portion of the third area. Five dorsal areas indicated by lighter markings. Cephalothorax smooth, eye tubercle low, with eyes quite closely placed. A few very low tubercles are present on the lateral border of the dorsal scute, smaller tubercles are present on the posterior border of each of the free tergites. Venter, including the genital operculum and coxal surfaces smooth. Coxa I with a transverse row of low tubercles, coxa III with a posterior lateral, low tubercle. Free sternites smooth. Spiracles visible between the fourth coxae and first free sternites.

Legs slender, smooth except for some scattered hairs. Fourth femur with some low tubercles on the distal third of the medial surface; this portion of the fourth femur is slightly dilated. Basitarsus of first tarsus slightly enlarged. Tarsal segments: 6-12-7-7. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.4 mm long; femur, 0.8; patella, 0.5; tibia, 0.8; tarsus, 0.3. Total length, 2.8 mm. Trochanter of palpus without spines or tubercles, femur laterally compressed, somewhat triangular in shape, with low tubercles on the ventral surface, patella slender, tibia flattened, tarsal claw small. Chelicera normal in size, claws smooth.

Dorsum reddish brown, with darker markings on the cephalothorax and along the lateral border of the dorsal scute. Lighter areas delineate the suture between the cephalothorax and abdomen and between the areas. Trochanters and tarsi slightly lighter; remainder of legs similar in color to the dorsum.

Female.—Total length of body, 3.8 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.4 mm.

Female very similar in appearance to the male, but lacking the enlarged basitarsus of the first tarsus, and the fourth femur is somewhat shorter.

Type locality.—Male holotype and male and female paratypes from Columbia Forest Station, Toledo District, Belize, July 19, 1971.

Remarks.—*C. columbiana* differs from other members of this genus by its small size, lack of dorsal color pattern, and number of tarsal segments.

Cynorta dentipes Cambridge
Fig. 19

Cynorta dentipes Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 1:558, pl. 52, figs. 15-15b. Roewer, 1912, Arch. Naturg., 78, sect. A, no. 10, p. 34; 1923, Die Weberknechte der Erde, p. 313, figs. 340a and b.

Male.—Total length of body, 5.4 mm. Cephalothorax, 2.1 mm. Width of body at widest portion, 4.8 mm.

	I	II	III	IV
Trochanter	0.4mm	0.6mm	0.8mm	0.9mm
Femur	3.5	7.2	4.8	6.0
Patella	1.1	1.4	1.4	1.5
Tibia	2.2	6.0	2.9	4.2
Metatarsus	3.7	7.2	4.6	6.4
Tarsus	2.6	4.8	2.9	3.2
Total	13.5mm	27.2mm	17.4mm	22.2mm

Entire dorsum smooth, eye tubercle low, on the anterior third of the cephalothorax, without spines or tuberculations. Dorsal areas clearly indicated by white markings; low paired spines in the median portion of the third area. First free tergite smooth, second and third each with a transverse row of low tubercles at the posterior border. Ventral surfaces of coxae, genital operculum, and free sternites with very low hair-bearing tubercles. Spiracles clearly visible.

Leg segments quite smooth, with only a few low hair-bearing tubercles. First trochanter with a proximal-posterior low tubercle, third with small tubercles on both the proximal and distal areas of the posterior surface, fourth coxa with a small, blunt spine at the posterior distal surface. Fourth femur with a curved small spine at the distal, medial surface, a smaller lower spine at the distal retro-lateral surface. Tarsi clothed with hairs. Tarsal segments: 6-13-8-9. Distitarsi of both first and second tarsi with three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.5 mm long; femur, 1; patella, 0.7; tibia, 1.4; and tarsus, 0.7. Total length, 4.3 mm. Palpus quite smooth, clothed with scattered hairs. Femur laterally compressed, with a ventral row of low teeth (visible in illustration). Tibia flattened, tarsal claw small, smooth. Chelicera normal in size, with some scattered hairs, claws with roughened surfaces.

Entire animal dark reddish brown with darker (almost black) over the eye tubercle and at the lateral portions of the dorsal areas. White markings very conspicuous: a v-shaped arrangement behind the eye tubercle, joining with markings on the lateral border of the scute; first three areas outlined by white dot-like markings, 4th and 5th areas with posterior markings. First and second free tergites with some white. Legs lighter than the dorsum, almost yellow, with much darker mottling, giving a somewhat annulate appearance. Trochanters lighter than the dorsum, with some darker mottlings. Palpi and chelicerae quite dark, some mottlings on the tibia.

Female.—Total length of body, 5.4 mm. Cephalothorax, 1.8 mm. Width of body at widest portion, 4.5 mm.

Similar in appearance to the male, but without enlarged basitarsus and without the spines of the fourth femur.

Type locality.—Quirigua, Guatemala (Cambridge, 1905).

Records.—BELIZE: Columbia Forest, Toledo District, July 11-15, 1971.

GUATEMALA: Tikal, July 3, 1971.

Cynorta multilineata (Goodnight and Goodnight)
Fig. 18

Eucynortula multilineata Goodnight and Goodnight, 1947, Fieldiana, 32(1):35, fig. 17.

Male.—Total length of body, 5.2 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.5 mm.

	I	II	III	IV
Trochanter	0.4mm	0.6mm	0.6mm	0.6mm
Femur	3.2	7.4	4.5	6.1
Patella	0.9	1.4	1.3	1.3
Tibia	2.1	5.7	2.7	3.8
Metatarsus	3.4	6.1	4.5	6.0
Tarsus	2.5	4.5	2.5	3.0
Total	12.5mm	25.6mm	16.1mm	20.8mm

A slender long-legged animal, dorsal surfaces smooth. Cephalothorax without tuberculations, eye tubercle low with the eyes closely placed. Third dorsal area with low tubercles. Free tergites smooth. Venter with only some scattered hair-bearing low tubercles. First coxa with a mid-ventral row of low tubercles; third coxa with an anterior and posterior row of tooth-like tubercles. Free sternites with only a few low hair-bearing tubercles. Anal operculum with only a few hair-bearing tubercles. Spiracles visible.

Legs long and slender, all segments smooth, clothed only with scattered hairs. Tarsal segments: 6-13-9-9. Distitarsi of both first and second tarsi with three segments. Basitarsus of first tarsus somewhat enlarged.

Palpus: trochanter, 0.4 mm long; femur, 0.9; patella, 0.8; tibia, 1.4; and tarsus, 0.6. Total length, 4.1 mm. Palpal segments smooth, clothed only with scattered hairs. Femur laterally compressed, with teeth on the ventral border; tibia flattened; palpal claw quite long and smooth. Chelicera smooth, clothed only with scattered hairs.

Penis a slender shaft, with typically expanded distal portion consisting of three separate portions.

Entire animal reddish brown in color with some darker mottling around the anterior margin of the cephalothorax and on the lateral portions of the first and third areas. Legs yellowish, with darker markings, giving a striped appearance. The striped legs give this species a very distinctive appearance.

Female.—Total length of body, 5 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 4.5 mm.

Female very similar in general appearance to the male, but lacking the enlarged basitarsus of the first tarsus.

Type locality.—Silkgrass, Belize, December 5, 1939, Ivan T. Sanderson.

Records.—BELIZE: Columbia Forest, Toledo District, July 13, 1971. Near St. Herman's Cave, Caves Branch, July 7, 1972. Lower Pine Ridge, June 30, 1971.

Erginulus Roewer

Erginus (part) Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:559. Banks, 1906, Bull. American Mus. Nat. Hist., 11:189; (part) 1909, Proc. Acad. Nat. Hist. Philadelphia, 61:229.

Erginulus Roewer, 1912, Arch. Naturg., 78, sect. A, no. 10, p. 78; 1923, Die Weberknechte der Erde, p. 350.

Euerginus Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 84; 1923, Die Weberknechte der Erde, p. 359.

Cynorta (part) Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:37.

Cosmetids with simple untoothed double claws on the third and fourth tarsi, with but 6 segments in the first tarsus. Distitarsi of both first and second tarsi with three segments. Dorsum with five areas, variously armed with tubercles and/or spines, third and fourth legs conspicuously heavier than the first and second. Males having spinose fourth legs, heavier chelicerae, and usually an enlarged basitarsus on the first tarsus.

Genotype: *Erginulus serratifer* (Cambridge) from Coban, Guatemala.

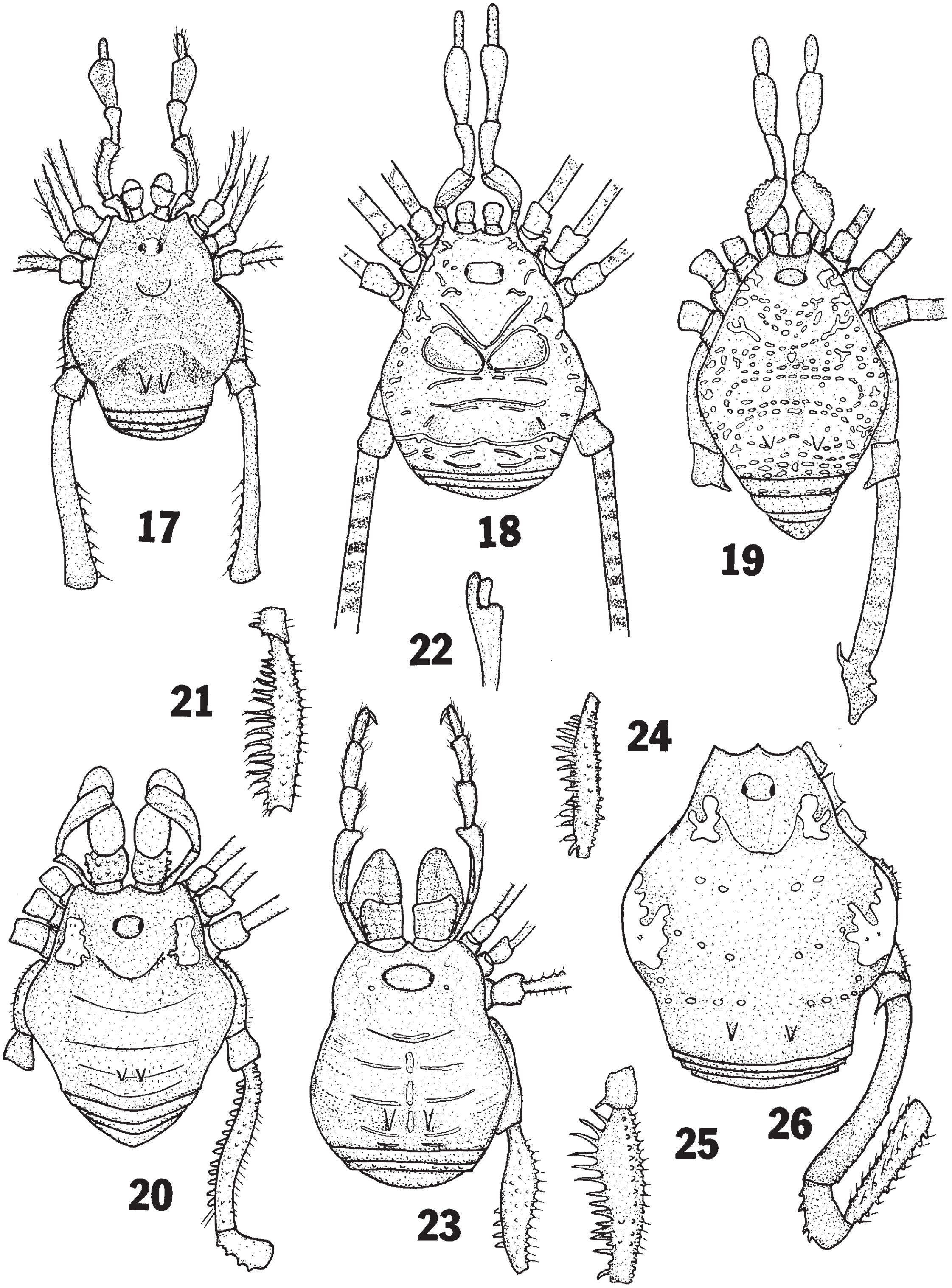


Fig. 17.–*Cynorta columbiana*, new species: dorsal view of male.

Fig. 18.–*Cynorta multilineata* (Goodnight and Goodnight): dorsal view of male.

Fig. 19.–*Cynorta dentipes* Cambridge: dorsal view of male.

Figs. 20-21.–*Erginulus bimaculata*, new species: 20, dorsal view of male; 21, ventral view of right fourth femur of male.

Figs. 22-25.–*Erginulus serratifer* (Cambridge): 22, lateral view of tip of male penis; 23, dorsal view of male; 24, ventral view of fourth femur of male; 25, ventral view of fourth femur of male.

Fig. 26.–*Erginulus roeweri* (Goodnight and Goodnight): dorsal view of male.

Erginulus bimaculata, new species
Figs. 20-21

Male.–Total length of body, 4.3 mm. Cephalothorax, 2.2 mm. Width of body at widest portion, 4.6 mm.

	I	II	III	IV
Trochanter	0.4mm	0.8mm	0.7mm	0.8mm
Femur	2.9	4.7	3.7	4.2
Patella	0.9	1.3	1.1	1.5
Tibia	1.9	4.0	2.5	3.4
Metatarsus	3.0	4.7	3.5	4.7
Tarsus	1.8	4.3	2.1	2.5
Total	10.9mm	19.8mm	13.6mm	17.1mm

A moderately sized animal, dorsal surface smooth: eye tubercle low, eyes closely placed. First area of dorsum with very low tubercles, third with low spines. Free tergites smooth, anal operculum with numerous low tubercles. Venter smooth, first coxa with a median row of low tubercles, third with anterior and posterior rows of low teeth, fourth coxa with some low tubercles on the dorsal surface. Spiracle visible.

All segments of the legs but the metatarsi and tarsi with low tubercles; each femur with a ventral row of low blunt spines; on the fourth femur, these are much enlarged. From the dorsal view of the fourth femur, a retrolateral row of low spines is visible; from the ventral view, the spines of the median border are visible as in the figure. Tarsal segments: 6-13-7-8. Basitarsi of both first and second tarsi with three segments; basitarsus of first tarsus slightly enlarged.

Palpus: Trochanter, 0.9 mm long; femur, 1.8; patella, 0.9; tibia, 1.5; and tarsus, 0.9. Total length, 6 mm. Palpus having a very slender trochanter; the femur is laterally flattened, with a ventral row of teeth, dorsally with roughened areas; tibia flattened, with spine-like hairs on lateral borders; tarsus slender, also with hairs, Chelicera somewhat enlarged, first segment with numerous low tubercles.

Penis a slender shaft, with typical tip consisting of three parts, 2.2 mm long.

Color a uniform reddish brown, with two conspicuous white spots, one at each side of the lateral posterior portion of the cephalothorax. Appendages only slightly lighter in color than the dorsum.

Female.–Total length of body, 5.7 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.6 mm.

Similar in appearance to the male, but lacking the heavy spines of the fourth femur, the enlarged chelicera and basitarsus of the first tarsus.

Type locality.–Male holotype from Grutas de Xtacumbilxunam, Bolonchenticul, Campeche, México, May 13, 1973, J. Reddell, D. McKenzie, M. H. McKenzie, M. Butterwick. Found under rocks and rotten wood on guano in main passage.

Records.–MEXICO: *Campeche:* Paratypes from Grutas de Xtacumbilxunam, Bolonchenticul, April 19, 1973, J. Reddell, D. McKenzie, M. H. McKenzie, S. Murphy, M. Butterwick.

Yucatán: Female from Cenote de la Paca, 7 km E Tikuch, April 11, 1973, S. Murphy.

Remarks.–A long series of animals was available for study, and there was a slight variation in the number of tarsal segments. Most forms had 6-13-7-8; but some were 6-13-7-7 or 6-12-7-8. This form is probably most closely related to *Erginulus serratofemoralis* (Goodnight and Goodnight); the chief difference is in the dorsal color pattern; possibly this species represents only a geographical variation.

Erginulus roeweri (Goodnight and Goodnight)
Fig. 26

Euerginus serratotibialis (Cambridge) Roewer, 1923, Die Weberknechte der Erde, p. 361, figs. 428, 429.
Acromares roeweri Goodnight and Goodnight, 1947, Fieldiana, 32(1):14-16, fig. 6.
Cynorta clavotibialis Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:46-48, figs. 34-38 (part).

Male.–Total length of body, 6.9 mm. Cephalothorax, 1.8 mm. Width of body at widest portion, 5.8 mm.

	I	II	III	IV
Trochanter	0.4mm	0.8mm	0.8mm	0.8mm
Femur	3.0	5.0	4.2	4.7
Patella	0.9	1.4	1.4	1.4
Tibia	2.1	4.0	2.6	3.7
Metatarsus	3.0	5.4	3.7	5.7
Tarsus	1.5	3.2	2.1	2.5
Total	10.9mm	19.8mm	14.8mm	18.8mm

Dorsum smooth, cephalothorax with the eye tubercle slightly removed from the anterior margin. Five dorsal areas indicated by extremely low tubercles, low paired spines on the fourth area. Free tergites with a few low tubercles on the posterior margin of each. Venter quite smooth, first coxa with three rows of low tubercles, the most anterior of which is slightly larger at the distal portion; second coxa with a few tubercles at the proximal anterior area; third coxa with low teeth on the distal portion of both the anterior and posterior margins; fourth coxa with a few tubercles (visible from dorsal view) at the anterior margin. Free sternites with low tubercles. Anal operculum with low tuberculations. Spiracle visible.

Trochanters of legs quite smooth, fourth with a small median spine. All segments of the legs but the metatarsi and tarsi somewhat roughened. Third and fourth femora curved, slightly enlarged. Fourth femur with a heavier row of tubercles on the prolateral margin. Two larger spines and numerous tubercles on the retrolateral surface of the patella. Tibia with a prolateral row of spines, a row of four or five spines at the proximal portion of the retrolateral margin, and a median row of spines, making three rows in all. Tarsal segments: 6-10-7-8. Distitarsi of both first and second tarsi with three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 1.1 mm long; femur, 1.8; patella, 1.3; tibia, 1.8; and tarsus, 0.9. Total length, 6.9 mm. Femur of palpus laterally compressed, with a ventral row of low teeth. Tibia flattened, with a row of small granulations on the dorsal portion. A few very small spinules on the dorsal margin of the patella and one spinule on the dorsal distal portion of the femur. Chelicera somewhat enlarged, proximal segment with a row of four or five spinules at the proximal portion and a prolateral spinule at the distal portion. Distal segment with a very slight elevation.

Dorsum reddish brown, giving the appearance of having four spots. Two of these spots are located on either side of the cephalothorax; the other two are on either side of the median portion of the abdomen. A few irregular white markings are just posterior to the abdominal spots. Transverse rows of very small white flecks are present across the fifth area and each free tergite; and a few light flecks are often present on the first three dorsal segments. Venter and coxae reddish brown, appendages somewhat lighter.

Female.–Total length of body, 7.5 mm. Cephalothorax, 2.6 mm. Width of body at widest portion, 6.1 mm.

Female very similar to male in appearance, but lacking the enlarged chelicera and basitarsus and the heavy spination of the fourth leg.

Records.–MEXICO: *Yucatán:* Actún Xpukil, 3 km S Calcehtok, August 3, 1973, J. Reddell; Hoctún, August 12, 1973, J. Reddell; Tixcocob, August 12, 1973, J. Reddell; 7 km SW Oxkutzcab, July 31, 1973, J. Reddell; surface at Actún Kaua, Kaua, August 12, 1972, J. Cooke, W. H. Russell.

Remarks.–In general appearance, this form is quite distinctive; but future collections from more localities may indicate that it is but a variation on *Erginulus serratotibialis* (Cambridge).

Erginulus serratifer (Cambridge)
Figs. 22-25

Erginus serratifer Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:561, pl. 52, fig. 18.
Erginulus serratifer: Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 84; 1923, Die Weberknechte der Erde, p. 358-359.

Male.–Total length of body, 4.7 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.3 mm.

	I	II	III	IV
Trochanter	0.6mm	0.6mm	0.6mm	0.9mm
Femur	2.5	4.3	3.2	4.3
Patella	0.9	1.3	1.1	1.4
Tibia	1.8	3.4	1.9	2.9
Metatarsus	3.0	4.6	3.4	4.5
Tarsus	1.9	4.3	2.5	2.7
Total	10.7mm	18.5mm	12.7mm	16.7mm

Dorsum smooth, eye tubercle in center of the cephalothorax, eyes widely separated. Five dorsal areas indicated by lighter markings, paired sharp spines on the third area. Free tergites smooth except for some very small sharp tubercles along the posterior borders. In some forms the first area had paired low tubercles. Venter, anal operculum, and free sternites quite smooth, with only a few scattered hairs. Spiracle clearly visible. First coxa with a row of low tubercles which are somewhat enlarged at the distal portion; fourth coxa with many hair-tipped low tubercles, visible from the dorsal view.

First and second legs with a few low tubercles, especially visible on the femur; many scattered hairs also present, but the surfaces are generally quite smooth. Third and fourth legs slightly heavier, all segments with hairs. Femur of the third leg with low, spinose tubercles arranged more or less in two rows. Fourth femur somewhat curved as in the illustration; fourth patella and tibia with some heavier tubercles on the dorsal surface. One male specimen had larger spines, also had small spines on the distal medial surface of the third and fourth patella. Tarsal segments: 6-12-8-8. Distitarsi of both first and second tarsi with three segments; basitarsus of first tarsus somewhat enlarged.

Palpus: trochanter, 0.9 mm long; femur, 1.6; patella, 0.9; tibia, 1.3; tarsus, 0.9. Total length, 5.6 mm. Palpus somewhat enlarged, all segments with hairs. Femur laterally compressed, with a few tubercles on the ventral surface, tibia flattened. Tarsal claw smooth. Chelicera enlarged, second segment very large, first with some laterally placed hair-bearing tubercles. Moveable claw with median, large tooth-like protuberances.

Dorsum a uniform reddish-brown overlain with darker netting which is most pronounced on the appendages. Venter with much darker mottling. Some small white markings usually present between cephalothorax and abdomen and lateral area of cephalothorax. Areas outlined with lighter markings.

Female.–Total length of body, 5 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 4 mm.

Female similar to male in appearance, but lacking the enlarged basitarsus of the first tarsus, the enlarged chelicera, and the heavy spines of the fourth femur. Some specimens did have enlarged spines at the distal portion of the fourth femur, but they were much smaller than those of the male.

Type locality.–Cobán, Cubilguitz, Guatemala (Cambridge's record).

Records.–BELIZE: Columbia Forest Station, Toledo District, July 6-17, 1971.

Erginulus serratofemoralis Goodnight and Goodnight
Figs. 30-31

Erginulus serratofemoralis Goodnight and Goodnight, 1947, Fieldiana, 32(1):29-30, fig. 14.

Male.–Total length of body, 4.7 mm. Cephalothorax, 2.2 mm. Width of body at widest portion, 4.6 mm.

	I	II	III	IV
Trochanter	0.4mm	0.6mm	0.9mm	0.9mm
Femur	2.5	4.5	3.5	4.5
Patella	0.8	1.1	1.3	1.5
Tibia	1.5	4.0	1.9	3.2
Metatarsus	2.5	4.5	3.5	4.5
Tarsus	1.8	3.8	2.1	2.6
Total	9.5mm	18.5mm	13.2mm	17.2mm

A robust animal with heavy legs. Dorsum smooth. Eye tubercle on the anterior third of the cephalothorax, eyes widely separated, with scattered low tubercles above. Dorsal areas smooth except for paired low spines on the third area. Free tergites armed only with low spinose tubercles on their posterior margins. Most portions of the venter smooth; first coxa with a row of rounded tubercles, fourth with scattered tubercles on the lateral and dorsal surfaces. Free sternites smooth except for a few low tubercles at the lateral margins. Anal operculum with scattered hairs and low tubercles. Spiracle visible.

Penis a slender shaft; distal end slightly dilated, with two outer flared processes; central process rounded.

Legs having most segments with tuberculations or spines of varying sizes, but particularly large on the third femur and the fourth tibia. On the fourth femur, these processes are enlarged into heavy spines; this femur is somewhat compressed laterally, is somewhat oval in cross-section, and the spines are actually ventral and dorsal in position. In the illustration, the leg has been turned, better to show these spines. Those projected toward the median line are actually dorsal in position. Tarsal segments: 6-12-8-9. Basitarsi of both first and second tarsi with three segments; basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.6 mm; femur, 1.5; patella, 0.9; tibia, 1.4; and tarsus, 0.8. Total length, 5.2 mm. Trochanter with a rounded tubercle at the ventral-distal portion; femur typically laterally compressed, with a row of teeth on the ventral border. Femur flattened, broad. Tarsal claw smooth. Chelicera enlarged, both portions of the claw with a median large tooth; a row of tubercles on the proximal portion of the lateral margin of the first segment.

Dorsum dark reddish brown, appendages somewhat lighter in color, with darker mottling over most surfaces. White pattern present, though variable. There are usually markings at the anterior-lateral portion of the junction of the cephalothorax and abdomen, a transverse white bowed line behind the spines of the third area, and a shorter line posterior to the fourth area. In some specimens, a few white markings were present at the lateral portion of the dorsal areas.

Female.–Total length of body, 5.2 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 3.6 mm.

Female similar in appearance to the male, but lacking the enlarged chelicera, the heavy spines of the fourth leg, and the enlarged basitarsi of the first tarsi. The white markings are generally more conspicuous on the females.

Type locality.–Male holotype and male and female paratypes from Silkgrass, Belize, November 17, 1939, I. T. Sanderson. In the collection of the Chicago Natural History Museum.

Records.–BELIZE: Guacamallo Bridge, July 13, 1972. Mountain Pine Ridge, near Augustine and the Rio Frio, June 29, 1971, July 20 and 23, 1972. Highway near Belmopan, July 30, 1972. Belmopan, July 20, 1972, S. and J. Peck.

Remarks.–*E. serratofemoralis* and *E. serratipes* (Cambridge) appear to have overlapping ranges; we have found them to be difficult to distinguish one from another; however, there are differences in the dorsal color patterns. The leg spination differs slightly also, but we have noted that this may vary within individuals in a single population. The general pattern of the spination is quite constant, but the details differ. Future studies may indicate that these should be considered a single species with geographic variations.

Erginulus serratipes (Cambridge)
Fig. 37

Erginus serratipes Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:565, pl. 53, figs. 5, 5a.
Erginulus serratipes: Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 82; 1923, Die Weberknechte der Erde, p. 352, figs. 401-402.

Male.–Total length of body, 5.4 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.3 mm.

	I	II	III	IV
Trochanter	0.4mm	0.6mm	0.6mm	0.6mm
Femur	2.2	3.8	3.2	4.0
Patella	0.8	1.1	1.1	1.3
Tibia	2.5	3.0	2.1	2.7
Metatarsus	2.7	4.2	3.4	4.5
Tarsus	1.9	3.2	1.9	2.2
Total	9.5mm	15.9mm	12.3mm	15.3mm

General body surface smooth, cephalothorax with some low scattered tuberculations. Eye tubercle low, in the anterior third of the cephalothorax, with low tuberculations above. Five dorsal areas clearly defined by white markings. Paired, very low tubercles on the first area, paired spines on the third. Free tergites smooth. All ventral surfaces with scattered, low, hair-bearing tuberculations. First coxa, ventrally, with a median row of low tubercles; third coxa with a few low teeth on both the anterior and posterior surfaces toward the apical region. Fourth coxa with hair-bearing larger tubercles. Free sternites and anal operculum covered also with hair-bearing tubercles. Stigmen visible.

Penis a slender shaft, distal area somewhat broadened, with two smaller projections at the apical end.

All segments of the legs but the metatarsi and tarsi with hair-bearing tubercles; metatarsi and tarsi covered with hairs. Trochanters somewhat roughened, third trochanter with distal low spine on posterior surface; fourth with a median blunt spine. Third femur with a ventral row of spinose tubercles which are larger toward the apical end; third tibia with heavier tuberculations. Fourth femur somewhat oval in cross section, with a ventral row of large spines and a dorsal row of shorter spines. An inner low row of heavy tubercles is visible at the base of the larger ventral row on the prolateral surface; this latter surface also may have low, heavy tubercles. Tarsal segments: 6-12-8-8. Distitarsi of both first and second tarsi with three segments; basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.8 mm long; femur, 1.1; patella, 0.8; tibia, 1.3; and tarsus, 0.4. Total length, 4.4 mm. Femur of palpus laterally compressed, dorsal surface with heavy granulations, ventrally with a row of teeth. Patella covered with hairs; tibia flattened, with spinose hairs on lateral borders, tarsus covered with hairs, claw slender. Chelicera enlarged, proximal portion of first segment with low tubercles on lateral surface; second segment smooth; both portions of claws with large triangular shaped tooth in basal region.

Dorsum and appendages reddish brown; some darker brown mottling at the junction of the cephalothorax and abdomen, at the anterior margin of the cephalothorax, and over the eye tubercle. White markings outline the dorsal areas, with a curved line behind the third and fourth areas; that of the third continues to the lateral border. Small white area lateral and just posterior to the eye tubercle.

Female.–Total length of body, 5.2 mm. Cephalothorax, 1.8 mm. Width of body at widest portion, 2.5 mm.

Similar to the male in general appearance, but lacking the enlarged chelicerae, spinose fourth leg, and enlarged basitarsus. The white color pattern tends to be more prominent in the females than in the males. In many the white lines appear as scallops outlining both the lateral and posterior borders of the dorsal areas; the fourth area is also distinctly outlined.

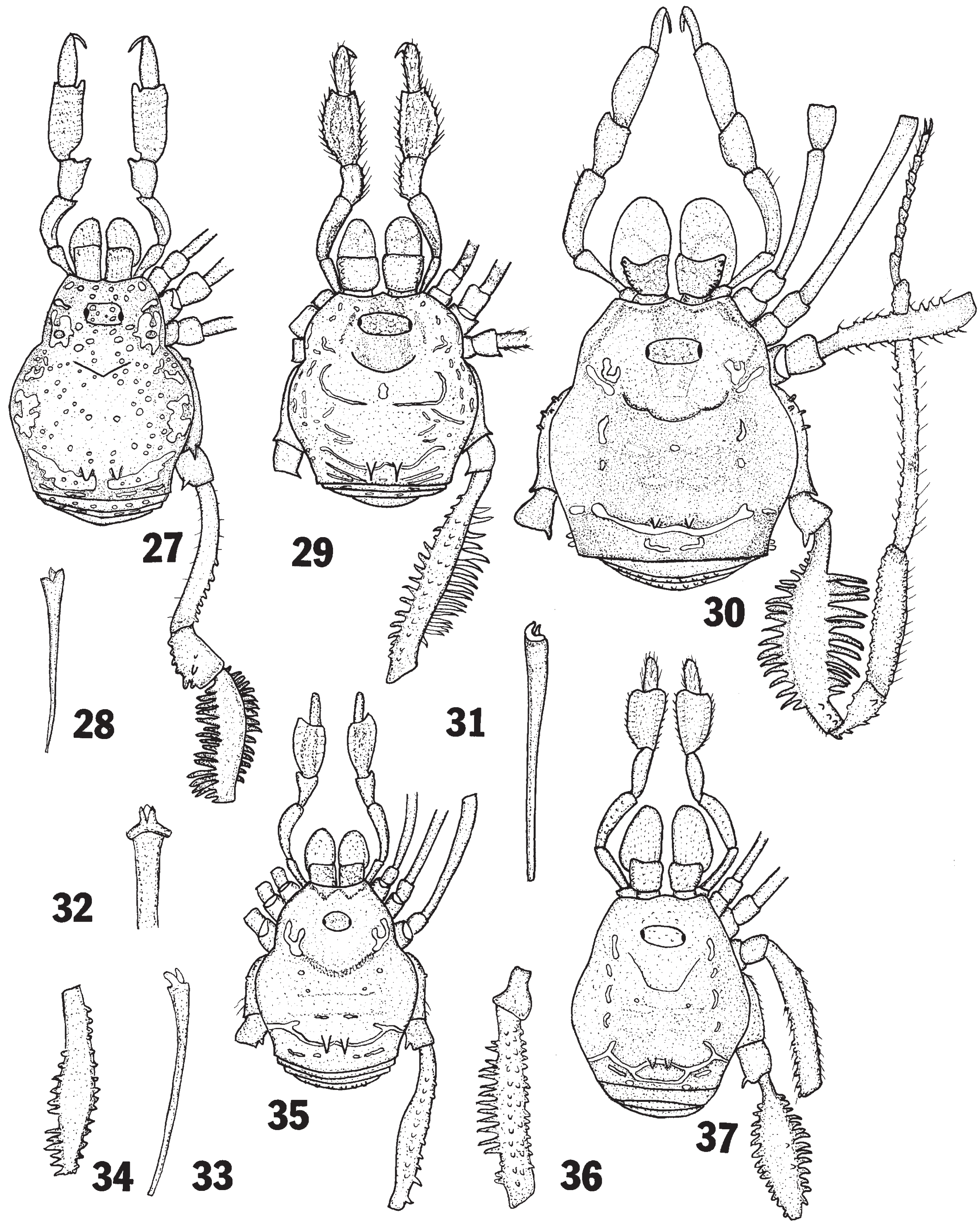
Type locality.–Tikal, Guatemala (Cambridge's record).

Records.–GUATEMALA: Tikal, July 3, 1971.

BELIZE: Rio Frio Cave, near Augustine, July 1, 1971. Columbia Forest Station, Toledo District, July 17, 1971.

Erginulus clavotibialis (Cambridge)
Figs. 27-28

Erginus clavotibialis Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:562, pl. 52, figs. 19, 19b.
Erginus serratotibialis Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:562, pl. 52, figs. 20, 20a.
Euerginus clavotibialis: Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 86; 1923, Die Weberknechte der Erde, p. 361, figs. 426, 427a-b.



Figs. 27-28.–*Erginulus clavotibialis* (Cambridge): 27, dorsal view of male; 28, male penis.

Fig. 29.–*Erginulus weyerensis,* new species: dorsal view of male.

Figs. 30-31.–*Erginulus serratofemoralis* Goodnight and Goodnight: 30, dorsal view of male; 31, lateral view of male penis.

Figs. 32-36.–*Erginulus singularis,* new species: 32, ventral view of tip of male penis; 33, lateral view of male penis; 34, ventral view of fourth femur of male; 35, dorsal view of male; 36, prolateral view of fourth femur of male.

Fig. 37.–*Erginulus serratipes* (Cambridge): dorsal view of male, femur of leg turned slightly to demonstrate ventral and dorsal spines.

Euerginus serratotibialis: Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 86; 1923, Die Weberknechte der Erde, p. 362, figs. 428, 429.

Acromares banksi Goodnight and Goodnight, 1942, American Mus. Novitates, 1184:7, figs. 36, 37; 1947, Fieldiana, 32(1):16.

Cynorta clavotibialis: Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:46-48, figs. 34-38.

Male.–Total length of body, 7.6 mm. Cephalothorax, 2.7 mm. Width of body at widest portion, 5.7 mm.

	I	II	III	IV
Trochanter	0.6mm	0.6mm	0.8mm	1.1mm
Femur	3.2	4.7	4.2	4.5
Patella	0.9	1.4	1.5	1.5
Tibia	1.9	4.0	1.6	3.4
Metatarsus	3.2	5.2	2.7	5.6
Tarsus	1.5	3.7	1.9	2.1
Total	11.3mm	19.6mm	13.7mm	18.2mm

Dorsum quite smooth; eye tubercle approximately in the center of the cephalothorax; dorsum armed only with low paired spines on the third area. Free tergites smooth. Venter, coxae, and genital operculum with some low granulations and scattered hairs. Spiracle clearly visible.

Legs clothed with scattered hairs, relatively slender. Coxa of fourth leg with some tubercles which can be seen from the dorsal view; fourth femur with a row of low tubercles at the distal third of the prolateral surface; patella with a retrolateral row of spines, numbering 5, with the largest ones in the center and tapering to smaller sizes at both proximal and distal portions; tibia with 16-17 spines on both retrolateral and prolateral surfaces; metatarsus with rows of low hair-bearing tubercles; tarsus clothed only with hairs. Tarsal segments: 6-10-7-8. Distitarsi of both first and second tarsi with three segments; basitarsus of first tarsus somewhat enlarged.

Palpus: trochanter, 1.1 mm long; femur, 1.8; patella, 1.3; tibia, 1.8; and tarsus, 0.9. Total length, 6.9 mm. Palpus clothed with hairs; femur laterally compressed with low rounded teeth on the ventral surface; patella with an inner-distal spine; flattened tibia with small projections on either side of the distal portion. Chelicera somewhat enlarged. Claws without teeth.

Penis a slender shaft, distal end somewhat inflated, 3 mm long.

Entire animal reddish brown, black mottling present on the cephalothorax and on the outer border of the dorsal scute. Yellow white markings present as illustrated. These markings are not pure white, rather they are somewhat dull yellow in appearance. The proximal segments of the legs are lighter than the dorsum. Darker mottling is present on the patellae, tibiae, and metatarsi and tarsi as well as on the chelicera and palpus. Venter somewhat lighter than the dorsum, free sternites darker.

Female.–Total length of body, 7.5 mm. Cephalothorax, 1.6 mm. Width of body at widest portion, 6.1 mm.

Female similar to male, but lacking the enlarged chelicera, spines of the fourth tibia, and enlarged basitarsus. Dorsal color pattern tends to be more distinctive than that of the male.

Type locality.–Vera Cruz (Cambridge's record).

Records.–MEXICO: *Chiapas:* 1 km N Palenque, July 25, 1973, J. Reddell, J. M. Rowland, D. Denson, M. Kawakatsu, R. W., D. R., R. W. Jr., S. A., and S. R. Mitchell.

BELIZE: Rio Frio near Augustine, July 20, 1972. Guacamallo Bridge, July 13, 1972. Columbia Forest, Toledo District, August 1, 1972. Caves Branch near St. Herman's Cave, July 20, 1972. Roaring Creek, August 1, 1972. Hummingbird Gap, August 19, 1972, S. and J. Peck. Belmopan, August, 1972, S. and J. Peck.

GUATEMALA: Tikal, July 1, 1971. El Petén, August 24, 1972, S. and J. Peck.

Erginulus singularis, new species
Figs. 32-36

Male holotype.–Total length of body, 4.5 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4 mm.

	I	II	III	IV
Trochanter	0.4mm	0.4mm	0.4mm	0.6mm
Femur	2.5	4.6	3.5	4.5
Patella	0.9	1.3	1.3	1.3
Tibia	1.5	4.0	2.5	3.2
Metatarsus	2.7	4.7	3.1	4.6
Tarsus	1.8	3.7	1.9	1.5
Total	9.8mm	18.7mm	12.7mm	16.7mm

Dorsum quite smooth, areas indicated by very shallow grooves. Third area with paired low spines, other areas without armature. Eye tubercle low, approximately in center of cephalothorax. Free tergites armed only with low tubercles on the posterior margins. Fourth coxa with a few low spinose tubercles which are visible from the dorsal view. Ventral surface of coxae with scattered hairs; first coxa with a median row of low tubercles; coxa three with a few tubercles at the distal-anterior portion; coxa four with a few low tubercles as indicated above. Spiracles clearly visible. Free sternites with some scattered hairs; anal operculum with low tubercles.

Trochanters of legs smooth, third and fourth trochanters each with a small posterior spine. All leg segments with scattered hairs. Third femur with an anterior row of low spine-bearing tubercles. Fourth femur dorsally with a row of low tubercles; ventrally with a median row of spines extending over the distal two-thirds of the segment; femur nearly oval in cross-section. Tarsal segments: 6-11-7-8. Distitarsi of both first and second tarsi with three segments; basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.6 mm long; femur, 1.1; patella, 0.8; tibia, 1.3; and tarsus, 0.9. Total length, 4.7 mm. Trochanter of palpus with single large tubercle; femur laterally compressed with a ventral row of teeth; patella with a spine on outer surface; tibia flattened, with spinose hairs on lateral borders; tarsus with numerous hairs. Chelicera only slightly enlarged, each claw with a single large tooth.

Penis a slender shaft, with typically expanded apical end.

Dorsum and appendages reddish brown with scattered white markings as in the figure. While the illustration is typical of most forms, there are some specimens which have more yellow markings. Some lighter mottling present over the eye tubercle, extending to the anterior margin. Appendages somewhat lighter, netted with darker markings.

Female.—Total length of body, 5.2 mm. Cephalothorax, 1.8 mm. Width of body at widest portion, 4.3 mm.

Female similar to male, but lacking the enlarged chelicera, the spines of the fourth leg, and the enlarged basitarsus.

Type locality.—Male holotype from Baldy Beacon, Belize, July 1, 1971.

Records.—BELIZE: Baldy Beacon, July 1, 1971. Caves Branch, near St. Herman's Cave, August 8, 1972, S. and J. Peck.

Remarks.—This species appears to be related to *Erginulus arcuatus* (Cambridge) from Cubilguitz, Guatemala; but differs in the spination of the fourth leg and the dorsal color pattern.

Erginulus weyerensis, new species
Fig. 29

Male holotype.—Total length of body, 5.4 mm. Cephalothorax, 2.2 mm. Width of body at widest portion, 4.3 mm.

	I	II	III	IV
Trochanter	0.6mm	0.6mm	0.8mm	1.1mm
Femur	3.0	5.5	4.3	4.5
Patella	0.9	1.1	1.3	1.5
Tibia	2.1	4.0	2.5	3.5
Metatarsus	3.4	5.8	4.2	6.1
Tarsus	2.1	4.3	2.2	3.0
Total	12.1mm	21.3mm	15.3mm	19.7mm

Dorsum quite smooth, eye tubercle low, eyes widely separated. Cephalothorax separated from the abdomen by a rounded groove, indicated by white markings. Dorsum armed only with paired spines on the posterior portion of the third area. Free tergites smooth. Venter smooth, with a few low tubercles arranged in a row on the median surface of the first coxa. Second and third coxae each with very low tubercles arranged in a row as well as along the distal margin. Free tergites each with a very low row of hair-tipped tubercles. Anal operculum smooth. Spiracles clearly visible at the junction of the fourth coxa and first free tergite.

First and second legs clothed with scattered hairs; femur of third leg with spinose tubercles arranged in rows, patella covered with tubercles, remaining segments smooth. Fourth femur with enlarged spines as in illustration; their bases are slightly separated from one another. Fourth patella with heavy tuberculations, smaller tubercles on the tibia; metatarsus and tarsus quite slender. Tarsal segments: 6-12-8-9. Distitarsi of both first and second tarsi with three segments; basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.9 mm long; femur, 1.5; patella, 1.1; tibia, 1.5; tarsus, 0.6. Total length, 5.6 mm. Scattered hairs present on all segments. Femur laterally compressed, with a row of teeth on the ventral surface, a row of hair-tipped tubercles on the medial surface of the patella; tibia flattened, with spinous hair-tipped low tubercles on each lateral margin; tarsus only with hairs, claw smooth. Chelicera enlarged, some small tubercles on the retrolateral surface of the distal portion of the first segment; moveable claw with a basal tooth; immoveable claw with a more distal one.

Entire animal dark brown-red, with slender white markings outlining the areas and the dorsal scute as illustrated. Venter a deep brown, appendages somewhat lighter, with scattered darker markings. Some white markings on the free tergites.

Female.—Total length of body, 5.4 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.3 mm.

Female similar to male, though the color pattern tends to be more distinctive than that of the male. The female lacks the enlarged basitarsi, the enlarged chelicerae, and the spines of the fourth leg.

Type locality.–Male holotype and male and female paratypes from Columbia Forest, Toledo District, Belize, July 6, 13, and 19, 1971.

Remarks.–*E. weyerensis* appears to be related to *Erginulus triangularis* (Cambridge) but the spination of the fourth leg is quite different as is the white pattern of the dorsum. This species is named in honor of Mrs. Dora Weyer of Belize City.

Paecilaema C. L. Koch

Cosmetus Perty, 1833, Delectus animalium articulatorum, fasc. 3, pp. 303, 304 (in part). C. L. Koch, 1839, in Hahn, C. W., and C. L. Koch, Die Arachniden, 7:109-111.

Flirtea (in part) plus *Paecilaema* C. L. Koch, 1839, Ubers Arachniden, 2:20, 21; 1839, in Hahn, C. W., and C. L. Koch, Die Arachniden, 7:97, 104. Roewer, 1923, Die Weberknechte der Erde, p. 364. Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:54-55.

For the complete synonymy of this genus, see Goodnight and Goodnight, 1953.

Cosmetids with simple untoothed claws on the third and fourth legs, with more than six segments in the tarsus of the first leg. Distitarsi of both first and second tarsi with three segments. Dorsum with five areas, variously armed with tubercles and spines. Secondary sexual characteristics of the male usually present as increased spination of the femur of the fourth leg.

Genotype: *Paecilaema U-flavum* (Perty)

Paecilaema toledensis, new species
Fig. 38

Female holotype.–Total length of body, 7.5 mm. Cephalothorax, 2.1 mm. Width of body at widest portion, 6.3mm.

	I	II	III	IV
Trochanter	0.8mm	0.9mm	1.1mm	1.3mm
Femur	6.0	12.4	8.7	12.1
Patella	0.9	1.9	1.9	2.1
Tibia	3.7	9.7	4.5	6.3
Metatarsus	6.3	13.8	8.7	12.7
Tarsus	2.7	6.0	4.0	4.7
Total	20.4mm	44.7mm	28.9mm	39.2mm

Large animal, with slender, long legs. Dorsum smooth, with paired tubercles on the first area and slender spines on the third. Remaining areas and free tergites smooth, without armature. Eye tubercle low, in median portion of cephalothorax. Ventral surfaces of coxae with low, hair-tipped tubercles; first coxa with a mid-ventral row of low tubercles. Free sternites smooth, with but a single transverse row of very low tubercles on each. Spiracles clearly visible.

Legs smooth, straight, armed with low tubercles which have very small hairs at their tips. Palpus: trochanter, 1.3 mm long; femur, 2.9; patella, 1.5; tibia, 2.6; and tarsus, 1.4. Total length, 9.7 mm. All segments of palpus with hairs. Trochanter apically with a few rounded hair-tipped tubercles; femur laterally compressed, with a row of low teeth on the ventral surface (illustration shows these); patella with small projecting hair-tipped tubercles on the inner-apical region; tibia flattened; tarsus slightly flattened with low tubercles bearing spine-like hairs on the lateral surfaces. Chelicera smooth with some investing hairs; cheliceral claws with low teeth, confined to the distal half.

Dorsum and appendages dark reddish brown, with an elaborate white pattern as in illustration.

Type locality.–Female holotype from Columbia Forest, Toledo District, Belize, July 15, 1971.

Remarks.–This species appears to be related to *Paecilaema basalis* (Cambridge); however, the dorsal color pattern is far more elaborate in this form.

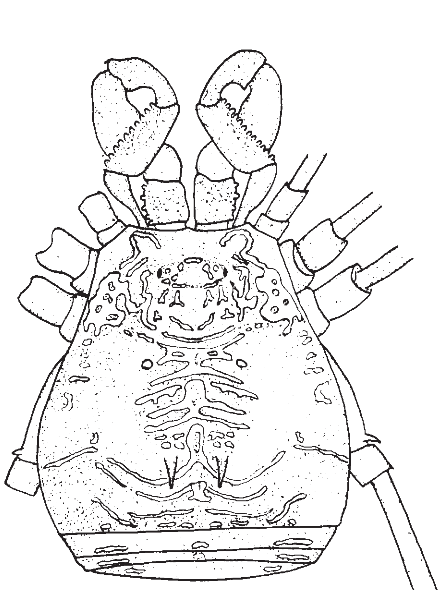
Paecilaema variegatus, new species
Fig. 39

Female holotype.–Total length of body, 6.3 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 5 mm.

	I	II	III	IV
Trochanter	0.4mm	0.6mm	0.8mm	0.8mm
Femur	2.7	5.7	4.3	5.2
Patella	0.9	1.3	1.3	1.3
Tibia	1.9	4.5	2.7	3.5
Metatarsus	3.0	6.0	4.3	6.0
Tarsus	1.5	4.0	2.5	2.7
Total	10.4mm	22.1mm	15.9mm	19.5mm

Slender animal with a conspicuous white pattern. Dorsum smooth. Eye tubercle located in the anterior third of the cephalothorax, low. Five dorsal areas well defined. Paired low tubercles on the first area; paired sharp spines on the third. Remaining areas and free tergites smooth. Venter smooth; third coxa with an anterior and posterior row of low teeth. Spiracles visible.

Legs slender, third and fourth trochanters each with a small posterior-apical spine. Fourth femur with



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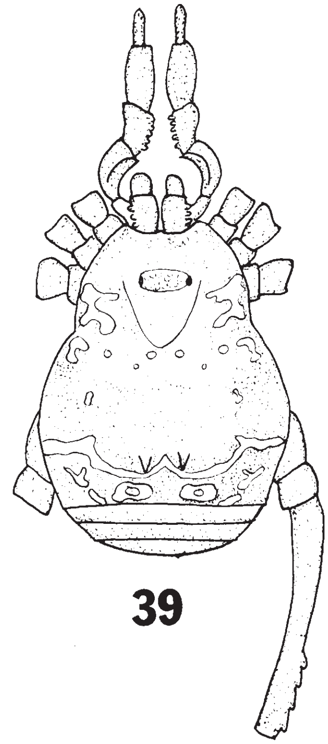

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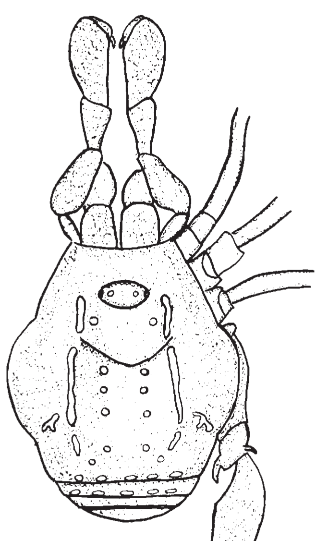

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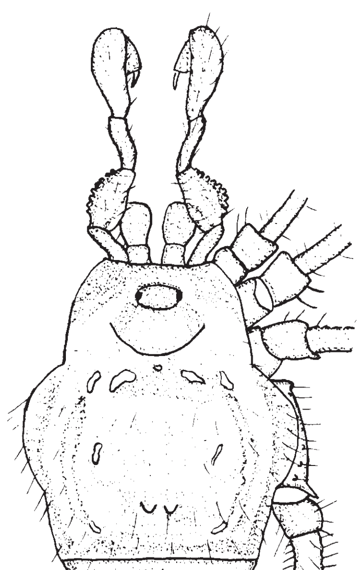

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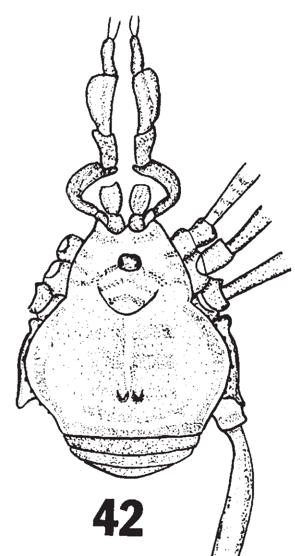

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Fig. 38.–*Paecilaema toledensis,* new species: dorsal view of male.
Fig. 39.–*Paecilaema variegatus,* new species: dorsal view of female.
Fig. 40.–*Vonones compressus* (Cambridge): dorsal view of male.
Fig. 41.–*Vonones pilosa,* new species: dorsal view of male.
Fig. 42.–*Vonones sandersoni,* (Goodnight and Goodnight): dorsal view of male.

a few low spines at the lateral distal portion. Third and fourth femora slightly curved. Tarsal segments: 7-13-9-10. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.6 mm long; femur, 1.3; patella, 0.9; tibia, 1.3; and tarsus, 0.8. Total length, 4.9 mm. Femur of palpus laterally compressed with blunt teeth along the ventral border. Patella with some low tubercles on the medial surface. Femur flattened, tarsus with numerous spine-like hairs. Chelicera with first segment bordered dorsally with some large tuberculations; claws with low teeth.

Dorsum a uniform reddish brown, white markings at anterior lateral portion of the cephalothorax, at junction of the cephalothorax and abdomen, and along the lateral margins. A white bowed line behind the spines of the third area and a second line behind the fourth area, some smaller markings on the fifth area. Venter dark brown; chelicera and palpus mottled with black. Femora of legs lighter than the dorsum, patellae and tibiae netted with black, metatarsi marked with black appearing somewhat annulate, tarsi darker.

Type locality.—Female holotype and female paratypes from Columbia Forest Station, Toledo District, Belize, July 9-15, 1971.

Remarks.—The distinctive color pattern of the dorsum distinguishes this form from other members of the genus.

Vonones Simon

Gonyleptes Say, 1821, J. Acad. Nat. Sci. Philadelphia, 2:68. Wood, 1870, Proc. Essex Inst., 6:37.

Vonones Simon, 1879, Ann. Soc. Ent. Belgique, 22: 212. Banks, 1909, Proc. Acad. Nat. Sci. Philadelphia, 61:228; 1909, Rept. Exp. Sta. Cuba, 2:170. Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 22; 1923, Die Weberknechte der Erde, p. 302. Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:59-60.

This is an abbreviated synonymy of this genus. For the entire synonymy, see Goodnight and Goodnight, 1953.

Cosmetids with simple untoothed double claws on the third and fourth legs, with five segments in the first tarsus. Distitarsi of both first and second tarsi with three segments. Dorsum with five areas, variously armed with tubercles and spines, without a median large spine on the third area.

Genotype: *Vonones octotuberculatus* Simon.

Vonones compressus (Cambridge)
Fig. 40

Paravonones compressus Cambridge, 1905, Biologia Centrali-Americana, Arachnida, 2:552, pl. 52, figs. 4, 4a.

Holovonones compressus: Roewer, 1912, Arch. Naturgesch., 78, sect. A, no. 10, p. 21; 1923, Die Weberknechte der Erde, p. 301.

Disvonones albilineatus Goodnight and Goodnight, 1944, Ciencia, 5(4-5):106-107, figs. 2, 4.

Disvonones albiornatus Goodnight and Goodnight, 1944, Ciencia, 5(4-5):107-108, fig. 3.

Disvonones bilineata Goodnight and Goodnight, 1944, Ciencia, 5(4-5):108-109, fig. 1.

Tecavonones clavipes Goodnight and Goodnight, 1944, Ciencia, 5(4-5):109, figs. 5, 6.

Vonones compressus: Goodnight and Goodnight, 1953, American Mus. Novitates, 1610:62, 63, figs. 54, 55.

Male.—Total length of body, 3.9 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 3.2 mm.

	I	II	III	IV
Trochanter	0.3mm	0.4mm	0.4mm	0.4mm
Femur	1.4	2.4	1.9	2.3
Patella	0.7	0.7	0.8	0.9
Tibia	1.0	2.0	1.2	1.5
Metatarsus	1.5	2.4	2.0	2.4
Tarsus	1.0	2.0	1.1	1.3
Total	5.9mm	9.9mm	7.4mm	8.8mm

Small animal, dorsum smooth, eye tubercle with a small tuberculation over each eye, otherwise smooth. Paired tubercles present on the first four dorsal areas. Fifth area and each free tergite and free sternite with a transverse row of tubercles. Anal operculum with scattered tubercles. Coxae smooth, first with a midventral row of teeth, fourth with anterolateral projection. Spiracle visible.

Legs clothed with scattered hairs, fourth trochanter with a dorsal and a ventral spine at the apical portion, ventral spine quite large. Fourth femur somewhat triangular in cross section, without spines on the ventral portion. Tarsal segments: 5-9-6-6. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.3 mm long; femur, 1.2; patella, 0.9; tibia, 1.1; and tarsus, 0.4. Total length, 3.9 mm. Femur laterally compressed, quite smooth; tibia typically flattened. Second segment of chelicera somewhat enlarged.

Penis a slender shaft, apical end with two lateral slightly expanded projections and a central blunted one.

Dorsum and venter a uniform reddish brown with white markings as illustrated. Legs only slightly lighter, with some darker mottling, particularly evident on the distal segments.

Female.—Total length of body, 3.9 mm. Cephalothorax, 1.7. Width of body at widest portion, 3.3 mm.

Female similar in appearance to male, but lacking the enlarged fourth femur and chelicerae.

Records.—BELIZE: Corozal, July 13 and 15, 1972, Road to Consejo, near Corozal, July 14, 1972. Burrell Boom, July 28, 1972. Lower Pine Ridge, June 30, 1971. Blancaneaux Lodge, Pine Ridge, June 29, 1971. Mountain Pine Ridge, July 23, 1972. Highway north of Punta Gordo, July 10, 1971. Columbia Forest Station, Toledo District, July 14, 1971.

MEXICO: *Yucatán:* 5-10 km N Valladolid, April 10, 1973, J. Reddell. Chichén Itzá, August 8, 1973, J. Reddell. Becanchén, August 1, 1973, J. Reddell. Ruinas de Mayapán, August 14, 1973, J. Reddell. 1 km S Muna, July 31, 1973, J. Reddell. Cenote Hunto Chac (Cueva del Pozo), April 12, 1973, J. Reddell and D. McKenzie. Tixcocob, August 12, 1973, J. Reddell.

Campeche: Surface at Grutas de Xtacumbilxunam, May 13, 1973, J. Reddell. 2 km S Bolonchenticul, July 29-30, 1973, D. Denson, M. Kawakatsu, R. W., D. R., R. W. Jr., S. A., and S. R. Mitchell.

Remarks.—This abundant form has also been recorded from Tabasco, Chiapas, and was originally described by Cambridge from Cahabon, Guatemala. Though the dorsal color pattern is recognizable in specimens from these many areas, there is considerable variation; for example, most of the animals from Yucatán lacked the lateral extension of the white markings in the region of the fourth coxae; animals from the Toledo District of Belize had the lateral markings more conspicuous. Variations can also be noted in the tarsal segments: 5-9-6-6; 5-10-6-6; 5-9-7-7; and 5-8-6-7 among the forms studied.

Vonones sandersoni (Goodnight and Goodnight)
Fig. 42

Bokwina sandersoni Goodnight and Goodnight, 1947, Fieldiana, 32(1):17-18, fig. 7.

Male.—Total length of body, 3.6 mm. Cephalothorax, 0.7 mm. Width of body at widest portion, 1.8 mm.

	I	II	III	IV
Trochanter	0.2mm	0.2mm	0.2mm	0.3mm
Femur	1.0	1.7	1.3	1.9
Patella	0.3	0.6	0.4	0.6
Tibia	0.7	1.2	0.9	1.2
Metatarsus	0.9	1.5	1.2	1.6
Tarsus	0.7	1.3	1.0	0.9
Total	3.8mm	6.5mm	5.0mm	6.5mm

Dorsum and appendages uniformly smooth, eye tubercle low. Low spines present on the posterior portion of the third area. Free tergites smooth, without spines or tubercles. Venter smooth, a few low teeth on the posterior portion of the third coxa and a larger tubercle at the posterior lateral portion. Fourth coxa with a tubercle at the anterior-lateral position. This is very close to the large tubercle of the third coxa and is visible from the dorsal view. Free sternites smooth, anal operculum also smooth. Spiracle slightly concealed by the fourth coxa.

Legs slender, fourth slightly curved. All segments with scattered hairs, very low tubercles present on all segments but the metatarsi and tarsi. Tarsal segments: 5-9-6-6. Distitarsi of both first and second tarsi with three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.2 mm long; femur, 0.8; patella, 0.4; tibia, 0.6; and tarsus, 0.2. Total length, 2.2 mm. Femur of palpus laterally compressed; tibia flattened. Femur with a ventral row of teeth. Chelicera normal, proximal segment slightly enlarged.

Dorsum reddish brown, darker mottlings on margins of dorsum. Lighter portions between dorsal areas and in central region. Legs basally lighter than the dorsum; apical portion of femora, all of patellae, tibiae and metatarsi quite dark; tarsi lighter. Free tergites with darker mottling. Palpi and chelicerae with darker mottlings, but lighter than the dorsum.

Female.—Total length of body, 3.7 mm. Cephalothorax, 0.7 mm. Width of body at widest portion, 1.9 mm.

Female similar to male in appearance, lacking only the enlarged basitarsus.

Type locality.—Male holotype from Bokowina, Belize, November 1, 1939, I. T. Sanderson. In the collection of the Chicago Natural History Museum.

Records.—BELIZE: Baldy Beacon, July 1, 1971. Lower Pine Ridge, June 30, 1971. Blancaneaux Lodge, Mountain Pine Ridge, June 29, 1971. Mountain Pine Ridge, June 29 and 30, 1971. Blue Hole, August 1, 1972, Rio Frio, near Augustine, July 20, 1972. Columbia Forest Station, Toledo District, July 13, 1971.

Vonones pilosa, new species
Fig. 41

Male Holotype.—Total length of body, 3.6 mm. Cephalothorax, 0.9 mm. Width of body at widest portion, 2.7 mm.

	I	II	III	IV
Trochanter	0.3mm	0.4mm	0.4mm	0.4mm
Femur	1.5	2.3	2.0	2.6
Patella	0.4	0.8	0.5	0.8
Tibia	1.0	1.7	1.0	1.7
Metatarsus	1.4	2.3	1.7	2.4
Tarsus	1.1	2.0	1.3	1.3
Total	5.7mm	9.5mm	6.9mm	9.2mm

Dorsum relatively smooth, only third area with low paired spines, other areas without tubercles or spines. All surfaces, including legs, palpi, and chelicera with hairs, giving the animal an unusual appearance. Areas delineated by lighter markings. Eye tubercle slightly removed from the anterior margin, smooth above. Dorsally the fourth coxa with a posterior-lateral spine. Venter smooth. Each third coxa with a posterior rounded protuberance; fourth coxa with an anterior protuberance which is very close to that of the third. Fourth coxa also with posterior blunt low spines on both sides. Dorsal one visible from above; ventral one partially covers the spiracle. Free tergites with very low tuberculations, clothed with hairs. Free sternites smooth, also clothed with long hairs.

All segments but the tarsi of the legs somewhat roughened, all clothed with hairs, sparsest on the trochanters. Tarsal segments: 5-10-6-6. Distitarsi of first and second tarsi with three segments; basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.3 mm long; femur, 0.7; patella, 0.5; tibia, 0.8; and tarsus, 0.3. Total length, 2.6 mm. Femur laterally compressed, ventral surface with tooth-like appearance (visible in drawing). Inner-distal surface of femur with a blunt protuberance; patella somewhat triangular in cross section, tibia and tarsus flattened. All segments clothed with hairs. Chelicera normal in size.

Entire dorsum dark reddish brown, with some lighter portions as indicated in figure. Some scattered white marking vaguely outlining areas in the lateral region.

Female.—Total length of body, 3.7 mm. Cephalothorax, 1 mm. Width of body at widest portion, 2.6 mm.

Female similar to male in appearance, lacking the enlarged basitarsus of the first tarsus.

Type locality.—Male holotype and male paratype from Blue Hole, Hummingbird Highway, Belize, August 1, 1972.

Records.—BELIZE: Rio Frio, July 20, 1972. Caves Branch, near St. Herman's Cave, July 20, 1972. Roaring Creek, August 1, 1972. Stamm Creek Valley, August 4, 1972. Belmopan, July 20-August 25, 1972, S. and J. Peck.

Remarks.—The unique "hairy" appearance of this form is quite unlike any other member of this genus.

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MILLIPEDES IN THE COLLECTION OF THE ASSOCIATION FOR MEXICAN CAVE STUDIES IV. NEW RECORDS AND DESCRIPTIONS CHIEFLY FROM THE NORTHERN YUCATAN PENINSULA, MEXICO (DIPLOPODA)

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This paper is a preliminary report on the millipedes of the northern part of the Yucatán Peninsula, along with a few new records and descriptions from the Mexican mainland. Most of the material was collected in 1973 and 1974 from caves and epigean sites by members of the Association for Mexican Cave Studies. Other epigean material was received from R. O. Albert, J. G. Edwards, John C. Moser, E. A. Liner, and Louis Ober. I am grateful to all of these collectors, especially to James R. Reddell, the principal collector of the AMCS in Yucatán, for the privilege of studying these millipedes. H. F. Loomis kindly sent specimens of *Poratioides disparatus.*

A. S. Pearse's 1936 collection of millipedes from the cenotes of Yucatán was the first and remained the only large collection from the Peninsula until the AMCS began working there. Pearse's material was worked up by R. V. Chamberlin (1938), who found in it only undescribed species representing seven families of four orders (Polydesmida, Spirobolida, Spirostreptida, Polyzoniida). As to their prediliction for caves, Chamberlin wrote, "Certainly most of the species will be found to occur outside as well as inside the caves."

Recent collections support Chamberlin's belief. In this land of many caves there are surprisingly few troglobites. *Orthoporus spelaeus* n. sp. and *O. zizicolens,* of the order Spirostreptida, are the only troglobites known with certainty. *Orthoporus solicolens* is a troglophile. Some of the polydesmoids of the families Stylodesmidae, Sphaeriodesmidae, and Rhachodesmidae are probably troglophiles.

The commonest order on the Peninsula, both inside and outside caves, is the Polydesmida, with five families represented. The previously unreported polydesmoids include five species known beyond the Peninsula, several undescribed species of hitherto reported families, and undescribed species of two families new to the Peninsula. Representatives of the order Polyxenida are known from three epigean sites and two caves in Yucatán and Campeche. The order Stemmiulida is now known from several epigean sites scattered across the Peninsula and from one cave in eastern Campeche. Colobognath millipedes are rare on the Peninsula. An introduced species of the order Polyzoniida is known from both epigean and cave collections and an endemic species of the order Siphonophorida is known by one epigean specimen. The order Spirobolida, represented by the family Rhinocricidae, is scarce in epigean collections and rare in cave collections. As yet there have been no collections of the Glomerida, Glomeridesmida, Chordeumida, Julida, and Platydesmida. Each of these orders is represented nearby in Tabasco and Chiapas.

In summary, the millipede fauna of the Peninsula, as compared with that of the Central American mainland, is poor as to taxa and number of specimens actually encountered, both inside and outside caves. Representatives of eleven families in seven orders are known. Colonization has been from both the west and the south and some has been by commerce.

Records.—Where sex is not stated, the collection contained at least one mature male. Some determinations, usually only of species familiar to me from multiple collections, were based on females and immatures. Such determinations are tentative, of course. They are included here in order to give a more nearly complete record of spatial and seasonal distribution. Records of spirostreptids based on immatures refer to only the last immature stadium.

Deposition.–Holotypes, paratypes of both sexes where there is sufficient material, and topotypes of *Synoptura tioticho* (Shear, 1974) have been deposited in the National Museum of Natural History, Smithsonian Institution. Both sexes of all species, where there is sufficient material, have been deposited in The Museum, Texas Tech University, Lubbock. The remaining specimens are in the author's collection.

ORDER POLYDESMIDA

FAMILY PARADOXOSOMATIDAE

Genus *Orthomorpha* Bollman

Orthomorpha Bollman, 1893, p. 159; type species, *Polydesmus coarctatus* Saussure.

Orthomorpha coarctata (Saussure)

Polydesmus coarctatus Saussure, 1860, p. 207.

This introduced tropicopolitan species is probably much more widespread in the Peninsula than present records suggest.

Records.–*Tabasco:* Near Grutas del Coconá, female, 25 Aug. 1972, R. Mitchell, W. Russell, J. Cooke.

Yucatán: Oxkintok, immatures, 3 Aug. 1973, J. Reddell. Uxmal, Chichén Itzá, both 20 Aug. 1969, N. Causey. Cueva Luchil, 3 km S Mérida, many males, females, Oct. 1974, S. Wiley, J. Reddell. Cenote de Acanceh, 8 Oct. 1974, J. Reddell.

Genus *Oxidus* Cook

Oxidus Cook, 1911, p. 628; type species, *Fontaria gracilis* Koch.

Oxidus gracilis (Koch)

Fontaria gracilis Koch, 1847, p. 142.

It is surprising that this introduced tropicopolitan species has not appeared in more collections from the Peninsula.

Records.–*Campeche:* N of Champotón, Aug. 1972, W. Russell.

Veracruz: Ojo Zarco, 3 km SSW Cd. Mendoza, 23 July 1973, J. Reddell.

FAMILY CHELODESMIDAE

Genus *Chondrodesmus* Silvestri

Chondrodesmus Silvestri, 1897, p. 13; type species, *C. armatus* Silvestri, 1897, Ecuador.

The northernmost distribution of this complex Neotropical genus is in the Yucatán Peninsula, where it is known by one species.

Chondrodesmus sabachanus Chamberlin
Figs. 1-2

Chondrodesmus sabachanus Chamberlin, 1938, pp. 174, 176, figs. 29-32; type locality, Cueva de Sabachá, Tekax, Yucatán, female holotype.

This flourishing epigean species occasionally gets into caves. I have collections from 31 sites, including six caves, in eastern Campeche and the northern half of Yucatán. The body width varies from 4 mm in the smallest males to 7 mm in the largest females. The roughened mesiodistal margin of the telopodite and the flange on the solenomerite characterize the gonopods (Figs. 1-2) of the Peninsula populations and distinguish them from *C. montanus* (Pocock) in Guatemala. The gonopods drawn here are from a male from 7 km SW of Oxkutzcab, Yucatán, which is near the type locality.

FAMILY RHACHODESMIDAE

Genus *Aceratophallus* Carl

Aceratophallus Carl, 1902, p. 608; type species, *A. unicolor* Carl, from San José, Costa Rica.

Curodesmus Chamberlin, 1922, p. 55; type species, *C. guatemalensis* Chamberlin, from San Rafael, Guatemala. NEW SUBJECTIVE SYNONYMY.

Phorositus Chamberlin, 1952, p. 562; type species, *P. grannulifer* Chamberlin, fromVolcán Tajumulco, Guatemala. Shear, 1974, p. 268.

Attems (1940) erroneously synonymized *Curodesmus* with *Neoleptodesmus.* The gonopods and body facies of *C. guatemalensis* closely resemble Peninsula populations of *Aceratophallus* that have not been described.

Aceratophallus is known from Costa Rica north to Yucatán and west only to Teapa, Tabasco. It is the only rhachodesmid genus that has been collected on the Yucatán Peninsula. On the Mexican mainland the family is highly diversified and several genera are known both inside and outside caves.

The maximum limits of my 38 Peninsula collection sites of *Aceratophallus* are Champotón, Campeche, and Tekax, Yucatán, a distance of about 230 miles. Chamberlin (1938) had specimens from two additional sites within this range. Although the emphasis has been on cave collecting, there is material from only 12 caves, and in none of them is there strong evidence that the populations are troglobitic. Some are probably troglophilic. The typical body color is orange, varying among populations from red-orange to pale yellow-orange. I have seen no completely depigmented populations. Each of the three species described by Chamberlin (1938) from cave collections has appeared in epigean collections. There are four other species, each one either rare or unknown in caves. Sympatry is common at most sites where the genus has been collected.

FAMILY SPHAERIODESMIDAE

Sphaeriodesmids are scarce in the Peninsula collections. I have seen specimens from five caves in Yucatán and one in Campeche and one epigean site in Yucatán. None of these can be definitely assigned to the only known Peninsula species, *Cylionus kauanus* Chamberlin, 1938, described from a female collected in Kaua Cave, Yucatán.

FAMILY STYLODESMIDAE

Representatives of five genera of stylodesmids are in collections from 32 caves and four epigean sites in the northern Yucatán Peninsula. Some populations have reduced body pigment. I see no other evidence of modification by cave life. *Prosopodesmus jacobsoni* is an introduced species which ranges far beyond the Peninsula. *Poratioides disparatus* is probably also introduced. The remaining stylodesmids, with the exception of *Synoptura italolegata*, are endemic to the Peninsula, but they belong to genera represented in other parts of Central America.

Genus *Calymmodesmus* Carl

Calymmodesmus Carl, 1914, p. 959; type species, *C. andinus* Carl, from Puerto de los Pobres, on the Cauca River, Columbia.

Yucodesmus Chamberlin, 1938, p. 178; type species, *Y. viabilis* Chamberlin, from Luchil Cave, Yucatán, México. Shear, 1974, p. 285.

Chamberlin (1938) described four species and Causey (1971) one species of *Calymmodesmus* from Yucatán caves. It is the most ubiquitous polydesmoid genus in the Peninsula caves. My collections from 25 caves and two epigean sites will be reported on in a later paper.

Three new species of *Ceratesmus* and *Myrmecodesmus* from the eastern parts of Chiapas and Veracruz are included here. These genera are well represented on the mainland but are still unknown on the Peninsula.

Genus *Ceratesmus* Chamberlin

Ceratesmus Chamberlin, 1942, p. 10; type species, *C. clarus* Chamberlin. Shear, 1974, p. 293.

This genus is characterized by the pair of large, conspicuous dorsal horns on the collum and all other body segments, but not on the anal segment. Either 19 or 20 body segments. Pore cones are on posterior angle of segments 5, 7, 10, 13, and 16. Marginal lobes

Key to the Genera of the Family Stylodesmidae in the Northern Yucatán Peninsula

1a.	Adults with 19 segments; outer pair of lobes on each side of front margin of collum is coalesced; body length is around 4 mm	*Poratioides*
1b.	Adults with 20 segments; outer pair of lobes on each side of front margin of collum is not coalesced; body length is well over 4 mm	2
2a.	Tubercles of metatergites are of uniform size and none form longitudinal series; pore cones are on segments 5, 7-19	*Prosopodesmus*
2b.	Tubercles of metatergites are of unequal size; major tubercles form either two or four longitudinal series; pore cones are either absent or are on segments 5, 7, 9, 10, 12, 13, 15, 16	3
3a.	Pore cones are absent; paranota are bilobed laterally	*Cryptyma*
3b.	Pore cones are present; nonporiferous paranota have either two or four lateral lobes	4
4a.	Collum has 12 (occasionally 10) marginal lobes; nonporiferous paranota are 4-lobed laterally	*Calymmodesmus*
4b.	Collum has 10 marginal lobes; nonporiferous paranota are 2-lobed laterally	*Synoptura*

Key to the Species of *Ceratesmus* in Chiapas and Veracruz

1a. Two outermost and two medial lobes of collum are slightly larger than intermediate lobes, and sinus between two medial lobes is distinctly deeper and wider than any others .... *C. fissus*, n. sp.
1b. Lobes of collum are approximately equal, and sinus between two medial lobes is no larger than any others 2

2a. Surfaces of metazonites between and laterad to horns is asetose, smooth, and iridescent golden color; remainder of dorsal surface of metazonites is covered with a dense network of black setae on a gray background .... *C. clarus*
2b. Dorsal surface of metazonites is completely covered with a dense network of black setae on a gray background .... *C. fuscus*, n. sp.

tend to be shallow and indistinct because of the adherent soil held by the network of spiculate fused setae, and no tubercles other than the horns are visible. Shear (1974) showed, by the use of ultrasonic cleaning of a Guatemalan female of undetermined species, that the margin of the collum is actually deeply incised into ten lobes, segment 2 into three, and all remaining segments into two, and that there are tubercles laterad to the horns. The gonopods, which have a large, hemispherical coxal region into which the short telopodite can be withdrawn, have not been studied because of the scarcity of suitable material.

Range.–Three species are now known from one epigean site and three caves in Veracruz and Chiapas, *C. clarus* and *C. fuscus* are sympatric in the Grutas de Atoyac, Veracruz. Shear (1974) reported a female from a cave in Guatemala which possibly represents a fourth species. No collections have been made on the Yucatán Peninsula.

Ceratesmus clarus Chamberlin

Ceratesmus clarus Chamberlin, 1942, p. 10, pl. 1, figs. 11-13; type locality, Grutas de Atoyac, Veracruz, México; female holotype, stated by Chamberlin to be in Escuela Nat., México; male topotype, USNM.

I have examined a mature male topotype of 20 segments, length 6 mm, width 1.2 mm. Marginal lobes of collum are equal and of moderate depth. Horns, paranota, and anterior margin of collum are thickly encrusted with fine soil particles held there by a network of black setae. Body surface between and immediately laterad to horns is asetose, smooth, iridescent, and golden in color. Overall color without magnification is pale gold. Horns are conical, their apex is simple from lateral view, and pair on collum is closer together than pairs on remaining segments. Telopodite is folded within large coxal region of gonopod and is invisible.

Record.–*Veracruz:* Grutas de Atoyac, 2 km E Atoyac, 1 male, 22 Aug. 1965, J. Reddell, J. Fish, W. Bell. *Ceratesmus fuscus* also occurs in this cave.

Ceratesmus fissus, new species
Fig. 3

Diagnosis.–Characterized by the collum, which has the frontal margin divided into the usual 10 lobes, of which the two outermost and two medial ones are almost equal and slightly larger than the three intermediate lobes, and the medial lobes are separated by a wider sinus.

Description of holotype.–Female, a fragment consisting of head and 17 segments. Length of fragment 5 mm, width 1 mm. Metatergites and vertex of head are covered with usual network of black setae and adhering gray soil particles, giving an overall dark putty color. Horns are no darker than other parts of dorsal surface. Exposed parts of prozonites, pore cones, antennae, head below antennae, legs, sterna, and anal valves are whitish. Lobes of collum (Fig. 3) are of two sizes and deeper than in *C. fuscus.* Lateral lobes of paranota are shallow; three are on segment 2 and two are on poreless segments; poriferous segments appear to be unlobed. Caudal margin of anal tergite is divided into six shallow, subequal lobes. Pore cones are on posterior angle of segments 5, 7, 10, 13, and 16. Horns are conical, but from a lateral view are slightly bilobed at apex; pair on collum is closer together than those on remaining segments.

Type locality.–Sumidero del Camino, 10 mi NE of Comitán, Chiapas, female holotype, 22 July 1967, J. Reddell and J. Fish.

Etymology.–*Fissus* refers to the deep sinus between the two medial lobes of the collum.

Ceratesmus fuscus, new species
Figs. 4-5

Diagnosis.–Characterized by the partially coalesced horns of the collum, the trilobed apex of the more posterior horns, and by the larger body.

Description of the holotype.–Male, 19 segments, length 9 mm, width 1.9 mm. All surfaces of metazonites and vertex of head are covered with a network of black setae on a light brown background; overall color is black, deepest on apex of horns and lateral margin of paranota. Antennae, head below antennae, legs, anal valves, and prozonites are whitish. Anterior margin of collum is divided indistinctly into 10 lobes of equal width but a little more shallow on middle than at sides (Fig. 4). Lateral lobes of paranota are shallow; three are on segment 2 and two on all of following segments. Pore cones are on posterior lobe of segments 5, 7, 10, 13, and 16. Margin of anal segment has two shallow lobes on each side and between them two wider, longer lobes which are angular at apex. A minute notch is on caudal margin of paranota adjacent to body. Horns of collum are conical and coalesced about half their length. From a lateral view, horns 1 through 5 are conical, 6 through 13 are bilobed, and 14 through 18 are trilobed at apex. Horns 1 through 6 are turned a little forward, those of middle body segments are directed more or less upright, and those of more distal segments are turned back, with the backward slope of 18 greatest. Horns of 18 reach as far back as margin of anal tergite does. Telopodite is folded within large coxal region of gonopod and is invisible.

Female paratype.–19 segments, length 8.8 mm, width 1.9 mm, probably immature. Color, horns, and lobation are as in the holotype.

Immature male paratype.–18 segments, length 7 mm, width 1.7 mm. Color, horns, and lobation are as in holotype.

Type locality.–Grutas de Atoyac, 2 km E of Atoyac, Veracruz; male holotype and an immature male, 22 Aug. 1965, in total darkness, J. Reddell, J. Fish, W. Bell. *C. clarus* also occupies this cave.

Other record.–*Veracruz:* Cueva de Sala de Agua Grande, 6 mi E Yanga, 9 Aug. 1967, female paratype, J. Reddell, J. Fish, T. Evans.

Etymology.–*Fuscus,* meaning swarthy, refers to the body color.

Genus *Cryptyma* Chamberlin

Cryptyma Chamberlin, 1943, p. 66; type species, *C. lobata* Chamberlin.

A Peninsula species that is certainly congeneric with the two species referred by Shear (1974) to *Cryptyma* will be described in a later paper. Specimens are from two widely separated Yucatán caves, Cenote Aká Chen, near Tixcancal, and Actún Ziz, near Oxkutzcab. Especially noteworthy are the presence of two rather than the usual four longitudinal rows of large tubercles, the shallow lateral lobes, and the heavy encrustation of the body with fine yellow silt.

Genus *Myrmecodesmus* Silvestri

Myrmecodesmus Silvestri, 1910, p. 359; type species, *M. formicarius* Silvestri, from Jalapa, Veracruz. Attems, 1940, p. 311.

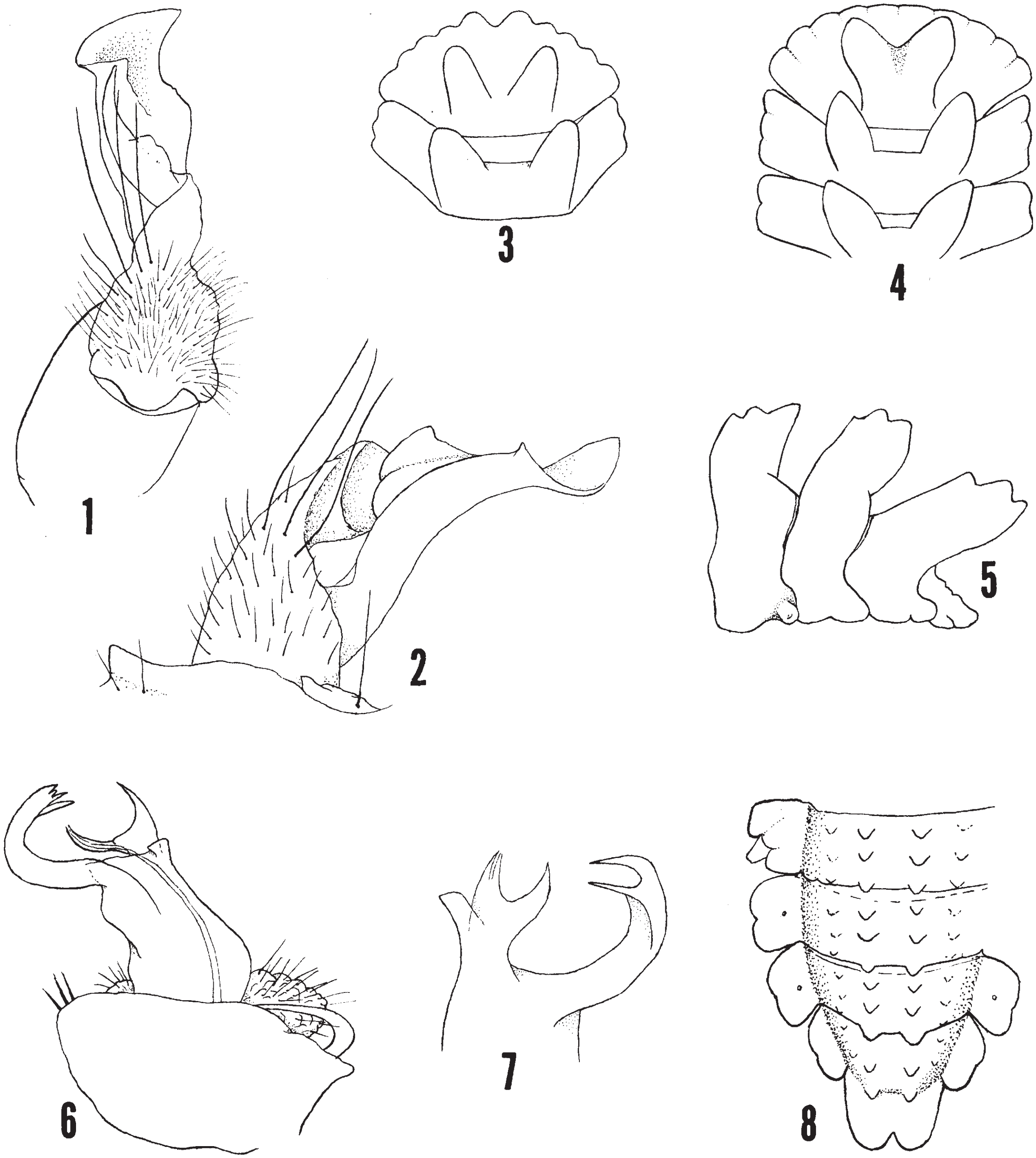
Ilyma Chamberlin, 1941, p. 24; type species, *I. orizaba* Chamberlin, from Orizaba, Veracruz. Hoffman, 1973, p. 511.

This genus extends from central México north through Texas and around the Gulf Coast into Alabama. It has never been collected on the Yucatán Peninsula. The species described here represents the easternmost extension of the genus in México. Shear (1974) greatly extended the concept of *Myrmecodesmus* when he added a species lacking pore cones, but having pores, two longitudinal series of medial horns, and a relatively short caudal prolongation of the tergite of segment 19. Both type species are characterized by the strongly arched body of 20 segments, pore cones on segments 5, 7, 9, 13, and 16, 10 marginal lobes on collum, two lateral lobes on segments 3 through 18, segment 19 prolonged well beyond segment 20, and major tubercles forming two or four longitudinal series. Telopodite of gonopods is bifid apically, and solenomerite is a subapical prong adjacent to a similar prong.

Myrmecodesmus margo, new species
Figs. 6-8

Diagnosis.–Resembles *M. orizaba* in yellowish color and in that caudal extension of segment 19 is flattened; differs in that marginal lobes of collum are equal.

Description of holotype.–Male, length 6.3 mm, width 1.0 mm. Antennae are typical for family. Front of head is brownish from vertex to sockets of antennae; head is whitish below. Collum and dorsum are strongly arched and light yellow-brown. Lobed margin of collum is horizontal and paranota are almost horizontal and yellowish. Dorsal setae are very short and in patches of about ten on metatergites. Almost no soil particles adhere to surface. Collum has 10 deep, equal lobes on anterior margin, paranota of seg-



Figs. 1-2.–*Chondrodesmus sabachanus* Chamberlin: 1, posterior view of right gonopod; 2, lateral view of left gonopod.

Fig. 3.–*Ceratesmus fissus* n. sp., female holotype, dorsal view of segments 1 and 2.

Figs. 4-5.–*Ceratesmus fuscus* n. sp., male holotype: 4, dorsal view of segments 1-3; 5, lateral view of segments 17-20.

Figs. 6-8.–*Myrmecodesmus margo* n. sp.: 6, topoparatype, anterior view of left gonopod; 7, same, submesial view of telopodite; 8, male holotype, dorsal view of segments 16-19; minor tubercles were omitted.

ment 2 have three equal lateral lobes, and paranota of segments 3 through 18 have two each. Segment 19 completely covers anal segment (Fig. 8). Margin of anal segment is divided into six lobes, of which two medial lobes are largest. Pore cones emerge below posterior lobes of segments 5, 7, 9, 13, and 16. Minute coneless pores are on middle of paranota 17 and 18. I have not seen glands associated with these pores. Closely placed, low, rounded tubercles cover arched parts of collum and metatergites. Major tubercles are not much larger than lesser ones except on more posterior segments. On collum there are eight major tubercles in two transverse series. On following metatergites, tubercles are in three transverse series, and major tubercles comprise four inconspicuous, longitudinal series. Between major tubercles there are lesser tubercles as follows, beginning in middle; two dorsals, two subdorsals, four laterals.

Gonopodal coxa is ovoid. Telopodite is directed down and its two terminal prongs are turned caudad. One terminal prong is tripartite. Solenomerite is the usual prong at middle of telopodite, and there are two unlike processes near it (Figs. 6-7).

Female paratype.–Length 6.5 mm, width 1.1 mm. Nonsexual characters are as in male.

Type locality and specimens.–Catemaco, Veracruz, México; 2 males, of which one is holotype, 4 females, several fragments, collected in nest of *Atta* sp., 4 May 1968 by P. Reyes and M. Cavera. 1 female and 3 immatures, collected in fungus garden of *Atta mexicana* at Dos Amates, Catemaco, 5 May 1968 by P. R. Castillo.

Etymology.–*Margo,* meaning boundary, refers to the provenance of this species on the eastern margin of the known range of the genus in México.

Genus *Poratioides* Loomis

Poratioides Loomis, 1970, p. 131; type species, *P. virginalis* Loomis; female holotype from St. John, Virgin Islands.

Species assigned to this genus have 19 segments, the outer pair of lobes on each side of the front margin of the collum coalesced, and pore cones on segments 5, 7, 9, 10, 12, 13, and 15. In addition to the type species, the genus is known by *P. disparatus* from Miami, Dade County, Florida (Loomis, 1973). The limits of the range of the genus include Duggan's Greenhouse, Lake Charles, Calcasieu Parish, Louisiana, and a coffee plantation at Quenzaltepeque, El Salvador. Dispersal by commerce is indicated.

Poratioides disparatus Loomis

Poratioides disparatus Loomis, 1973, pp. 322-323; type locality, 5355 SW 92 St., Miami, Dade Co., Florida; male holotype.

My Yucatán specimens correspond in size, lobation, and surface sculpture with female topoparatypes. It is interesting that the polyzoniid *Siphonoconus purpureus* (Pocock), widely distributed by commerce in tropical America, is sympatric with *P. disparatus* at both the type locality and Cueva Luchil.

Record.–*Yucatán:* Cueva Luchil, 3 km S Mérida, 4 females, Oct. 1974, J. Reddell and S. Wiley.

Genus *Prosopodesmus* Silvestri

Prosopodesmus Silvestri, 1910, p. 360; type species, *P. jacobsoni* Silvestri.

Homodesmus Chamberlin, 1918, p. 222; type species, *H. parvus* Chamberlin. Loomis, 1950, p. 166.

Prosopodesmus jacobsoni Silvestri

Prosopodesmus jacobsoni Silvestri, 1910, p. 362, figs. 6, 7; type locality, Batavia, Java, East Indies; male holotype.

Homodesmus parvus Chamberlin, 1918, p. 223; type locality, Manneville, Haiti, West Indies; male holotype, MCZ, no. 4480. Loomis, 1950, p. 166.

The Neotropical records of this widely dispersed species include the West Indies, several sites in Central America, including one cave, and southern Florida (Chamberlin, 1918; Loomis, 1968, 1970). There are no records from the Mexican mainland. The records from the Peninsula include seven caves and one epigean site.

Records.–*Yucatán:* Actún Xpukil, 3 km S Calcehtok, fragment, 15 April 1973, J. Reddell. Cenote de Hoctún, Hoctún, 16 March 1973, J. Reddell, D. McKenzie, M. H. McKenzie, S. Murphy, M. Butterwick. Cenote Sihunchén, Sihunchén, female, 23 March 1973, J. Reddell, M. H. McKenzie, S. Murphy, M. Butterwick. Grutas de Tzab-Nah, 2 km S Tecoh, 22 and 26 April 1973, J. Reddell, D. McKenzie, M. H. McKenzie. Oxkutzcab, immatures, 3 July 1973, J. Reddell. Cenote Kabahchén, Maní, 5 Oct. 1974, D. McKenzie, S. Wiley, J. Reddell.

Campeche: Grutas de Xtacumbilxunam, female, 19 April 1973, J. Reddell, D. McKenzie, M. H. McKenzie, S. Murphy, M. Butterwick; 29 July 1973, R. Mitchell, D. Denson, M. Kawakatsu. Actún Chen, Cumpich, 1 Nov. 1974, S. Wiley, J. Reddell.

Genus *Synoptura* Attems

Synoptura Attems, 1914, p. 174; 1940, p. 307; type species, *Lophodesmus laminatus* Pocock, male holotype.

Pocock (1909) included three species of stylodesmids from Tabasco and Guatemala in the genus *Lophodesmus* (Pocock, 1894). Subsequent authors, with the exception of Attems and Chamberlin, who assigned these species to *Synoptura,* have followed Pocock. Species from the East Indies and southeast Asia referred to *Lophodesmus* have a spinous solenomerite and the pore formula is 5, 7, 9, 10, 12, 13, 15-19.

In species of *Synoptura* which I have studied, the sperm canal does not pass through a spine, but a spine is adjacent to the canal opening in a depression of the large, thick, lightly chitinized solenomerite. This difference and the constancy of the pore formula, 5, 7, 9, 10, 12, 13, 15, and 16, warrant the use of Attems' genus for these Neotropical species.

There are 10 shallow marginal lobes on the collum, three on segment 2, two on the nonporiferous segments, and six on the anal tergite. The caudal margins of the paranota are incised. Pore pegs are on the caudal angle of the paranota. The major tubercles are in three transverse series, except as noted in the following paragraph, and in four longitudinal series. A medial sternal peg is anterior to the fifth legs of the male. The dorsum is high and the head is hidden by the collum.

Sexual dimorphism in the tuberculation exists in some species where, in the male, there are two rather than three major tubercles in the two innermost of the four longitudinal series on two or more of segments 11-15. Actually, no tubercles are missing; tubercles 2 and 3 are so close together they appear as one at lower magnifications. The tubercle arrangement is normal in the female. All of my collections of *S. italolegata* show this dimorphism. Pocock (1909, pl. 10, fig. 1) showed tubercle fusion in the male holotype of *S. laminata;* he lacked a female. Loomis (1970) reported tubercle fusion in *S. bituberculata* but did not state whether it occurs in only the male or in both sexes. He found tuberculation normal in *S. carabiana* but did not state which sex he studied. I have seen populations dimorphic for this character from southern Florida, Yucatán, Campeche, and Chiapas.

Species assigned here to *Synoptura* for the first time are: *Lophodesmus bituberculatus* Loomis, 1970, *L. tioticho* Shear, 1974, and *L. italolegatus* Shear, 1974. Possibly *Tresolobus caraibianus* Chamberlin, 1918 (type locality, Manneville, Haiti) will also go into *Synoptura.* I have never seen it. Loomis (1934, p. 59) identified a female collected at Nassau, Bahama Islands, as *Lophodesmus caraibianus* (Chamberlin) after comparing it with Haitian specimens and finding no significant differences.

Synoptura italolegata (Shear), NEW COMBINATION

Lophodesmus italolegatus Shear, 1974, pp. 286, 288, figs. 78-82; type locality, Cueva de la Golondrina, Bochil, Chiapas; male holotype, MCZ.

I have seen males from a cave west of the type locality with the telopodite of the gonopods well extended. The gonopods and body characters are as described by Shear, with the exception of the sexual dimorphism of the major tubercles, which he did not mention. In the male, the second and third major tubercles of the medial series of segments 12-15 are coalesced. In the female, the arrangement of the tubercles is normal.

The gonopods of the populations referred here to *S. italolegata* are small, complicated, and difficult to study. It is possible that I have failed to recognize sibling species.

Range.–Caves in western Guatemala, central Chiapas, and eastern Yucatán.

New records.–*Chiapas:* Hoyo de Don Nicho, 6 mi W Ocozocoautla, 4 males, 6 females, 16 Aug. 1967, J. Reddell, J. Fish, T. Evans.

Yucatán: Cenote de Sambulá, Motul, 21 adults, 28 March 1973, J. Reddell, S. Murphy. Cenote Amil, 6 km S Abalá, 1 male, 2 females, 28 March 1973, J. Reddell, Mariano Rodriguez. Cenote de Sihunchén, 3 females, 23 March 1973, J. Reddell, M. H. McKenzie, S. Murphy, M. Butterwick. Grutas de Tzab-Nah, 2 km S Tecoh, 1 male, 3 females, 22 April 1973, J. Reddell, D. McKenzie.

Synoptura laminata (Pocock)

Lophodesmus laminatus Pocock, 1909, p. 132, pl. 10, figs. 1-1g; type locality, Teapa, Tabasco, México; male holotype.

Synoptura laminata, Attems, 1914, p. 179.

This species has not been identified since the original description was made, nor have the gonopods of the holotype been restudied. The size (length 11 mm, width 2.8 mm) is large for the genus. Pocock's drawings of the gonopods lack details useful for identification. He pointed out and showed in a figure (pl. 10, fig. 1, *op. cit.*) the fusion of major tubercles on segments 12-14 of the male. He did not describe a female.

Synoptura tioticho (Shear), NEW COMBINATION

Lophodesmus tioticho Shear, 1974, p. 288-289, figs. 83-86; type locality, Cueva del Tío Ticho, Comitán, Chiapas, México; male holotype, MCZ.

I have seen male topotypes with the telopodite of the gonopods well extended. The gonopods are relatively simple as compared with the gonopods of *S. italolegata.* The solenomerite is anterior, simple, thick, lightly chitinized, with a large distal depression in which the sperm canal opens near a mesial spinous piece. The tibiotarsus is a slightly curved, well chitinized blade which arises mesially from the large, rounded femur. Both the tibiotarsus and the mesial spine are contiguous with the homologues in the midline. No major tubercles are reduced on the dorsal surface of either the male or the female.

Range.–Caves and epigean sites in central Chiapas southeast of range of *S. italolegata.*

Records.–*Chiapas:* Cueva del Tío Ticho, 1 mi S Comitán, 1 male, 2 females. Grutas de Zapaluta, 4 mi SE Zapaluta, 1 male. Sumidero del Camino, 10 mi NE Comitán, 1 female. All collected 20-22 Aug. 1967 by J. Reddell, J. Fish, T. Evans.

Synoptura sp.

Records.–GUATEMALA. *Huehuetenango:* Cueva de Santa Eulalia, immatures, Nov. 1967, D. McKenzie. *El Petén:* Cueva Jobitzinaj, 4 mi S Flores, 1 female, 22 Jan. 1972, D. McKenzie.

FAMILY TRICHOPOLYDESMIDAE

The collections of trichopolydesmids from Actún Xpukil, Ruinas de Mayapán, and Oxkutzcab, all in the state of Yucatán, and Grutas de Xtacumbilxunam, Campeche, total half a dozen tiny cylindrical specimens and represent one genus. They have the body facies of neither *Speodesmus* Loomis, 1939, nor *Tylogoneus* Causey, 1973, the genera best known on the Mexican mainland.

ORDER SPIROBOLIDA

Collections in the northern Yucatán Peninsula have yielded a few representatives of only one family of spiroboloid millipedes. Specimens from caves appear to be accidentals.

FAMILY RHINOCRICIDAE

Genus *Rhinocricus* Karsch

Rhinocricus Karsch, 1881, p. 68; type species, *Spirobolus (Rhinocricus) parcus* Karsch, by designation of Pocock.

Three species of *Rhinocricus* were described from the northern Yucatán Peninsula by Chamberlin (1938, 1947, 1953). Two are treated briefly in the following paragraph. The third, *R. chichen,* has not appeared in my collections. An undescribed species is represented by a female from Grutas de Xtacumbilxunam, 38 km S of Bolonchenticul, Campeche.

Rhinocricus motulensis Chamberlin

Rhinocricus motulensis Chamberlin, 1938, p. 172-173, figs. 19-24; type locality, Cenote de Sambulhá, Motul, Yucatán; male holotype.

I suspect that *R. mayanus* Chamberlin, 1947, is a junior synonym of *R. motulensis,* but having seen the holotype of neither species, I have withheld a decision. A collection of eight mature specimens from near Mérida exhibits variations in the shape of the anal scale which include those described by Chamberlin (1953) in differentiating between *motulensis* and *mayanus.*

New record.–*Yucatán:* Hacienda Teya, 7 km E Mérida, 6 males, 2 females, 4 July 1971, E. A. Liner.

Genus *Yucatobolus* Chamberlin, 1938

Yucatobolus Chamberlin, 1938, p. 173; type species, *Y. spukilensis* Chamberlin.

This monotypic genus is distinguished from *Rhinocricus* by the following somatic characters: a prominent rounded process set off by a deep furrow from the ventral margin of the second pleurite, and the presence of four rather than many antennal sensory cones. The male has not been described.

An immature female *Yucatobolus,* width 3 mm, collected at Balneario Bacalar, Laguna de Bacalar, Chetumal, Quintana Roo, by T. Alberto cannot be assigned to a species at this time.

Yucatobolus spukilensis Chamberlin

Yucatobolus spukilensis Chamberlin, 1938, p. 173-174, figs. 25-28; type locality, Spukil Cave, Calcehtok, Yucatán; female holotype.

New records.–*Yucatán:* 7 km SW Oxkutzcab, both sexes in last immature stadium, 31 July 1973, J. Reddell et al.; process on second segment is approximately as drawn by Chamberlin. Specimens in stadium 2 in this collection have four antennal sensory cones and lack process on second pleurites. Actún Sabacá, 6 km S Tekax, 1 immature, 4 Dec. 1974, J. Reddell, D. McKenzie, S. Wiley, J. Andrews, R. Mitchell. These sites are 60 and 70 km, respectively, SW of the type locality.

ORDER SPIROSTREPTIDA

FAMILY SPIROSTREPTIDAE

The identification of Central American spirostreptids is complicated by the many closely related species and the fact that some of them hybridize. I have seen no evidence of hybridization among the Yucatán populations.

Of the four species of spirostreptids that are endemic to the Yucatán Peninsula, two are troglobites, the only two reported in the order. *Orthoporus spelaeus* n. sp. is known from one cave in eastern Yucatán and *O. zizicolens* from five caves in western Yucatán. I suspect that *O. spelaeus* evolved from *O. solicolens* relatively recently. *O. zizicolens* shows the effects of a much longer period of troglobitization.

The other two spirostreptids have larger, overlapping ranges and sometimes are sympatric in epigean sites. They differ in their predilection for caves. *O. solicolens,* the largest and most abundant spirostreptid on the Peninsula, is often in cave entrances and in the zone of total darkness and even reproduces in caves. *O. yucatanensis* n. sp. is rarer in all collections. Single specimens of this species have been collected in two natural caves and in one quarried cave, where it is clearly an accidental.

The gonopods of these four spirostreptids are surprisingly similar, in view of the different habits and somatic characters. In each species the knee of the coxal sheath is thin and somewhat concave and its lateral spine is directed obliquely upward, either in a straight or a curved position. Frequently in preservative, the normal position of the delicate lateral spine is deformed. In situ, ventral view, the gonopods are similar; the knees of the coxal shields almost meet at about a 160° angle and the lateral spines normally are not visible. The key given here is reliable for identifying adults and the last immature stadium of each sex if careful attention is given to the somatic characters.

Orthoporus spelaeus, new species
Figs. 16-19

Diagnosis.–A troglobite closely related to *O. solicolens,* from which it is distinguished, in life, by the absence of pigment; other differences include the smaller body, shining body surface, and details of the gonopods, chiefly the mesial margin of the coxal sheath, which narrows along an oblique margin rather than in an acute spine.

Key to the Species of *Orthoporus* on the Northern Yucatán Peninsula

1a. Troglobitic; body is white in life and varies unevenly in alcohol from flesh color to light and dark gray to medium brown; ocelli are depigmented; antennae reach back to segment 4(5) or 8; body surface is smooth 2

1b. Either epigean or troglophilic; body is banded in shades of brown; antennae reach back to segment 2 or 3(4); metazonites are pitted 3

2a. Antennae are slender and reach back to segment 8; mostly flesh color or grayish in alcohol; collum is strongly sexually dimorphic, with anterior angle entirely covering mandibular cheek of mature male; body width is 4.0-5.0 mm . . . . *O. zizicolens* (Chamberlin)

2b. Antennae are thicker and reach back to segment 4(5); mostly light brown in alcohol; collum is less strongly dimorphic, in mature male anterior angle not entirely covering mandibular cheek; body width is 3.5-4.0 mm . . . . *O. spelaeus,* n. sp.

3a. Troglophilic, also is most abundant and largest spirostreptid at epigean sites; metazonites are finely pitted; striae of collum are shallow, varied in length, number, curvature, and uppermost is strongly curved and complete; collum is moderately dimorphic; mesial margins of anal valves are raised and moderately compressed; body width is usually 6.8-9.0 mm . . . . *O. solicolens* Chamberlin

3b. Rarely enters caves and seldom is as abundant at epigean sites as preceding species; metazonites are moderately pitted; striae of collum are coarse, deep, usually four are complete, and uppermost is almost straight; collum has almost no traces of sexual dimorphism; mesial margins of anal valves are raised and very slightly compressed; body width is usually 3.5-5.0 mm . . . . *O. yucatanensis,* n. sp.

Description of holotype.–Male, width 3.6 mm, length about 86 mm, 62 segments. In alcohol head and first few segments are light tan and remainder of body is medium brown. About 28 or 30 colorless ocelli are arranged in four horizontal rows; inner margin of eyepatch is angular and lateral margin is curved. Antennae, which reach to segment 4 or 5, are not as slender as in *O. zizicolens,* but are a little thicker than in *O. solicolens.* Ventral angle of cheek of mandible is rounded and margin is thickened. Metazonites are smoother than in *O. solicolens,* and on drying, surface shines. Collum (Fig. 16) has two long, curved, complete striae and below them three or four shorter and mostly incomplete striae. Striae are lightly incised, as in *O. solicolens.* Anterior angle of collum is right, posterior angle is obtuse, and ventral margin is straight. Anal valves (Fig. 17) are thin, compressed, resembling *O. solicolens;* anal tergite lacks a transverse sulcus. Lobes begin on fourth and fifth articles of fifth legs and disappear about 17 segments from hind end.

Gonopods (Fig. 18) have knee of coxal sheath thinner than in *O. solicolens,* and lateral spine is thin, rather than turgid, and is easily displaced. Mesial margin of coxal sheath differs from that of all other Peninsula species in that the usual spine is replaced by an oblique margin. Seminal spine extends beyond margin of corolla.

Female paratype.–Width 3.8 mm, length about 91 mm, 64 segments. Sexual dimorphism of collum (Fig. 19) is slight, about as in *O. solicolens.* Striae are approximately as in male, and anterior angle is broadly obtuse, posterior angle is slightly obtuse, and ventral margin is straight and shorter than in male.

Variations.–Range of seven adults: width, 3.5-4.0 mm, length 80 to 91 mm, segments 57-64. In alcohol, parts of body vary from whitish to medium brown. Immatures in alcohol are paler than matures.

Behavior.–James Reddell (in lett.) described *O. spelaeus* as follows: "The white *Orthoporus* from Cenote de Catzín are especially interesting... We could detect no eyes. All were about the same size but much smaller than *O. zizicolens* and, although they reacted slightly to light, did not demonstrate the wild contortions of *O. zizicolens.* At first I thought they were immature *O. solicolens* but later we found this species and all were typically pigmented and the eyes were obvious."

Type locality and specimens.–Cenote de Catzín, Catzín, E of Valladolid, Yucatán, 3 males, of which one is the holotype, 4 females, 11 immatures in four stadia, including last three and one specimen 15 mm long; collected 6 July 1975 by J. Reddell and A. Grubbs. *O. solicolens* is also in this cave.

Range.–Type locality in cave in eastern Yucatán.

Etymology.–The name *spelaeus* is an adjective that refers to the troglobitic adaptations of this millipede.

Orthoporus solicolens Chamberlin
Figs. 9-11

Orthoporus solicolens Chamberlin, 1938, p. 170, figs. 16, 17; type locality, Hoctún Cave, Hoctún, Yucatán; female holotype.

Orthoporus hoctunicolens Chamberlin, 1938, p. 170, 172, fig. 18; 1947, p. 47, fig. 72; type locality, Hoctún Cave, Hoctún, Yucatán; female holotype. NEW SUBJECTIVE SYNONYMY.

Orthoporus luchilicolens Chamberlin, 1938, p. 169-170, figs. 14, 15; type locality, Luchil Cave, Tixcancal, Yucatán; female holotype. NEW SUBJECTIVE SYNONYMY.

Orthoporus tizaminensis [sic!] Chamberlin, 1938, p. 168-170, figs. 11-13; type locality, Muruztún Cave, Tizimín, Yucatán; female holotype. NEW SUBJECTIVE SYNONYMY.

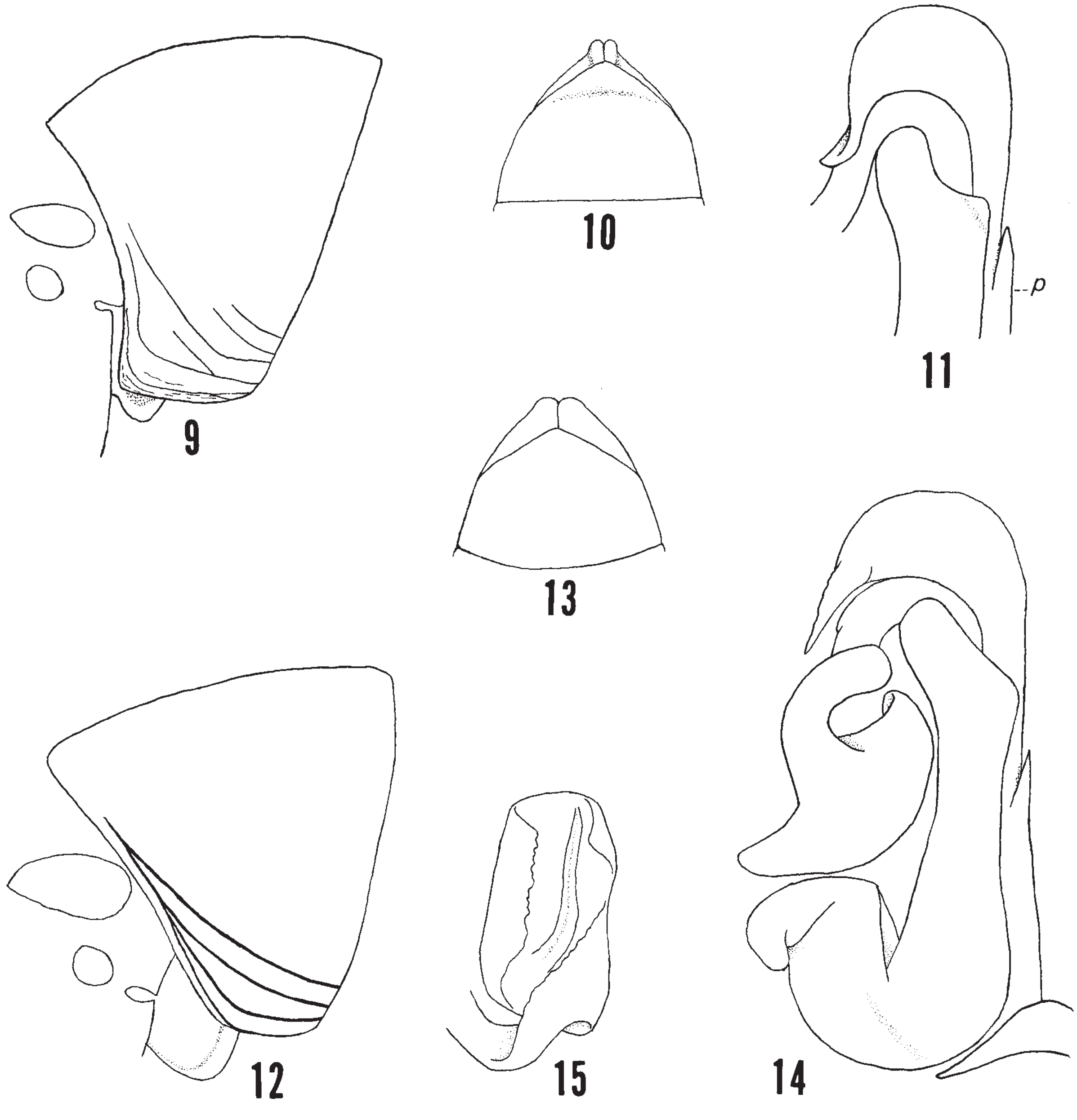
Diagnosis.–Closely related to the troglobite *O. spelaeus,* from which it is distinguished by the larger size, pigmented ocelli and body, and presence of a spine on the mesial margin of the coxal sheath of the gonopods.

Description.–Body width usually is 6.8-9.0 mm, but occasionally it is as little as 5.0 mm. 62-68 body segments. Brown body color and banding are variable in preserved specimens; most frequently medium brown and dark brown bands alternate. Antennae reach to segment 3(4). Ocelli are black; inner margin of eyepatch is angular and lateral margin is curved. Metazonites are finely pitted. Mesial margins of anal valves are raised and compressed, as in other spirostreptids of the Peninsula except *O. yucatanensis,* in which they are slightly compressed. Apex of anal tergite is angular, and a shallow transverse furrow is usually present (Fig. 10). Lateral striae of collum, as in *O. spelaeus,* are much shallower than in *O. yucatanensis,* curved, usually some are incomplete, and anterior end of uppermost seldom reaches above lower level of eye patch. Number of striae is highly variable, but usually there are three long, curved ones and several shorter ones. Sexual dimorphism of collum is as highly developed as in *O. spelaeus* but much less so than in *O. zizicolens.*

Male. Ventral angles of collum are right (anterior) and rounded-obtuse (posterior) (Fig. 9). Gonopods are characterized by turgid curved lateral spine, slightly thickened mesio-ventral angle of coxal sheath, and stout spine of mesial margin of coxal sheath (Fig. 11, p). Lateral spine varies in position and curvature; it is never as long as in *O. yucatanensis,* or thin as in *O. spelaeus.* Mesio-ventral angle of coxal sheath is either rounded or angular.

Female. Chamberlin (1938, figs. 11, 15, 17, 18) drew variations of the collum. It differs from the male's in that both angles are rounded-obtuse and the ventral margin is shorter. The number and arrangement of striae is variable.

Range.–Caves and epigean sites in eastern Campeche, Yucatán, and northern Quintana Roo. This is the big, conspicuous spirostreptid of the Peninsula. It is sympatric at several sites with the epigean *O. yucatanensis* and in caves, but at different locations,



Figs. 9-11.–*Orthoporus solicolens* Chamberlin, male from Cenote de Hoctún, Hoctún, Yucatán: 9, left view of collum; 10, dorsal view of hind end; 11, portion of left gonopod; p, spine on mesial margin of coxal sheath.

Figs. 12-15.–*Orthoporus yucatanensis* n. sp., male paratype from Hacienda Teya, Mérida, Yucatán: 12, left view of collum; 13, dorsal view of hind end; 14, anterior view of left gonopod; 15, same, tibio-tarsus.

with each of the troglobitic spirostreptids.

Type material.—The holotypes of *O. solicolens* and the species synonymized here with it are in the Chamberlin Collection. I have not examined them. I have studied adult topotypes of both sexes and late immatures collected in Hoctún Cave, the type locality of *O. solicolens* and *O. hoctunicolens.* No mature topotypes of *O. luchilicolens* and *O. tizaminensis* [sic!] were available to me, but collections made in the vicinity of each type locality were. I studied late immatures from Cueva de Orizaba, which is about 23 km east of Muruztum Cave, the type locality of *O. tizamensis.* James Reddell's search in Luchil Cave, 3 km south of Mérida, the type locality of *O. luchilicolens,* yielded no spirostreptids. I have studied specimens from the following sites, all within a few kilometers of Luchil Cave: Mérida airport, female; Cueva de San Isidro, immatures; Cenote de San José, immatures; Cueva de Tecoh, female.

Records.—I have studied collections from 48 sites, with a total of approximately 71 mature specimens and 310 immatures.

Campeche: Actún Chen, Cumpich, female, 1 Nov. 1974. Actún Halmensura, 5 km E Cumpich, 31 Oct. 1974. Cenote de Cantemo, 1 km N Cantemo, immatures, 18 Dec. 1974. Grutas de Monte Bravo, NW of Cantemo, immatures, 19 Dec. 1974. Grutas de San Antonio, 10 km ENE Bolonchenticul, 3, 23, 24, Nov. 1974. All of the preceding were collected by J. Reddell, D. McKenzie, S. Wiley. 5 km SSW Ich-Ek, female, 27 July 1973, J. Reddell, J. M. Rowland. Toh Laguna, female, 12 April 1968, P. Reyes. Grutas de Xtacumbilxunam, 13 May 1973, J. Reddell, D. McKenzie, M. H. McKenzie, M. Butterwick. Quarried cave N of Champotón, immatures, 22 Aug. 1972, W. Russell.

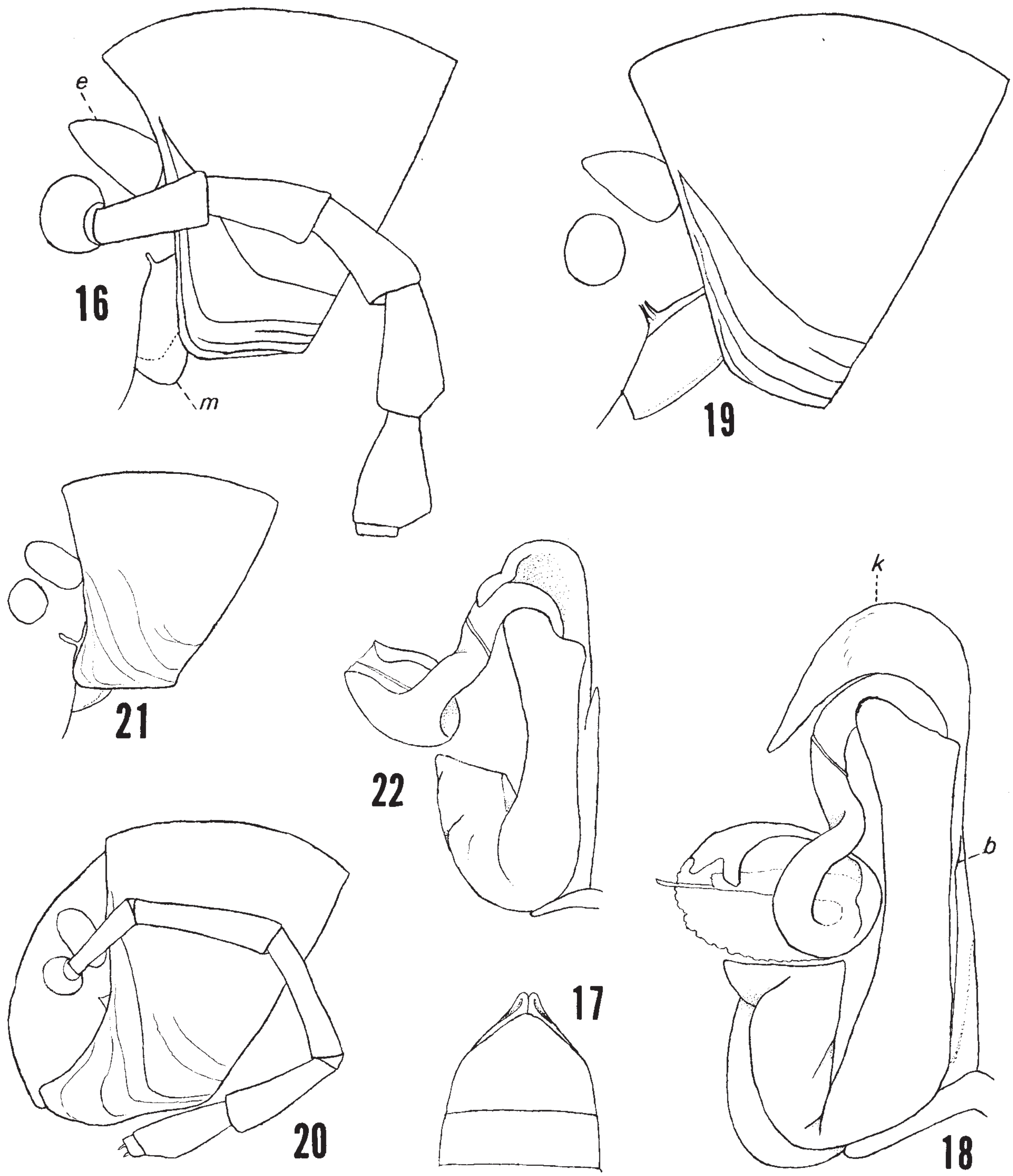
Yucatán: Actún Chen, 3 km W Kiuick, 13 Nov. 1974. Cenote Kabahchén, Maní, immatures, 5 Oct. 1974. Actún Kiuick, Kiuick, female, 13 Nov. 1974. Actún Okobichén, 8 km SW Santa Elena, immatures, 15 Nov. 1974. Cenote del Pochote, 10 km NE Muna, 4 Nov. 1974. All of the preceding were collected by J. Reddell, D. McKenzie, S. Wiley. Cenote Calchuntunil, 3 km E San Bernardo, immatures, 15 Oct. 1974, J. Reddell, R. Solis, S. Wiley. Cenote Chen Mul, Ruinas de Mayapán, immature, 8 Oct. 1975, J. Reddell. Cenote de Hoctún, Hoctún, 12 Nov. 1974, J. Reddell, S. Wiley. Cenote Poxil, 7 km SE Chemax, female, 15 Dec. 1975, J. Reddell. 3 km E San Bernardo, female, 15 Oct. 1974, J. Reddell, R. Solis. Cenote de San José, Mérida, immatures, 6 Oct. 1974, J. Reddell, D. McKenzie. Cueva de Tecoh, Mérida, immatures, Oct. 1974, J. Reddell, S. Wiley. Cenote de Telchaquillo, Telchaquillo, immatures, 8 Oct. 1974, J. Reddell. Cenote Aká Chen, 1 km NE Tixcancal, 2 April 1973, J. Reddell, D. McKenzie, M. H. McKenzie, S. Murphy, M. Butterwick. Grutas de Tzab-Nah, 2 km S Tecoh, female, 26 April 1973, J. Reddell, M. H. McKenzie. Cenote de Sambulá, Motul, immatures, 28 March 1973, J. Reddell, S. Murphy. Cueva de San Isidro, Mérida, immatures, 29 March 1973, J. Reddell. Actún Tucil, 2 km S Muna, immatures, 27 March 1973, J. Reddell. Cenote G, Ruinas de Aké, 26 March 1973, J. Reddell, M. H. McKenzie, M. Butterwick. Cenote Chen Mul, Ruinas de Mayapán, immatures, 24 April 1973, J. Reddell, D. McKenzie, M. H. McKenzie, M. Butterwick. Cenote de los Pinos, 7 km SSE Buenaventura, immatures, 1 April 1973, J. Reddell, S. Murphy. Cueva de Orizaba, Orizaba, immatures, 1 April 1973, J. Reddell, D. McKenzie, M. H. McKenzie, S. Murphy, M. Butterwick. Cenote Hunto Chac (Cenote del Pozo), immatures, 12 April 1973, J. Reddell, M. H. McKenzie. Cenote Calchum, 3 km E San Bernardo, immatures, 6 April 1973, J. Reddell, D. McKenzie. Cueva de Santa Elena, 5 km S Telchac Puerto, 22 March 1973, J. Reddell. 10 mi W Muna, 5 Jan. 1972. Izamal, pyramid, female, 10 Aug. 1973, J. Reddell. Surface at Cenote Zaci, Valladolid, 11 April 1973, M. H. McKenzie. Cenote de Catzín, near Valladolid, on dome near entrance, female, 5 July 1975, J. Reddell, A. Grubbs. Actún Kaua, female, immatures, 12 April 1973, J. Reddell, M. H. McKenzie. Chichén Itzá, 9 Aug. 1968; Uxmal, female, 20 Aug. 1969, R. O. Albert. Mérida, airport, female, 30 Dec. 1964, L. Ober. 3 km S Tecoh, 6 Aug. 1973, R. Mitchell.

Quintana Roo: Balneario Bacalar, Laguna de Bacalar, near Chetumal, female, 1971. 17.1 km S Puerto Juárez, 5 Aug. 1971. 27.5 km NE of X-can, 4 July 1971. All of the preceding collected by E. A. Liner. Cobá, 13 Nov. 1965, J. G. Edwards.

Orthoporus yucatanensis, new species
Figs. 12-15

Diagnosis.—Characterized by the combination of characters, including the narrow, elongated lateral spine of the gonopods, the heavy striae of the collum, the slender body, and pitted metazonites. Near *O. discriminans* Chamberlin, from which it is distinguished by the coarser pitting of the metazonites, and the thicker mesial margins of the anal valves.

Description of holotype.—Male, width 4 mm, length about 80 mm, 61 segments. In alcohol caudal half of metazonites is dark brown and remainder of body surface and legs are light brown. Ocelli are black, in transverse series of 11, 11, 10, 8, 7, 4. Mesial margin of eye patch is angular and ectal margin is



Figs. 16-19.–*Orthoporus spelaeus* n. sp.: 16, male holotype, left view of head and collum; e, eyepatch, m, mandibular cheek; 17, same, dorsal view of hind end; 18, same, anterior view of left gonopod; b, oblique mesial margin of coxal sheath; 19, female, topoparatype, left view of head and collum.

Figs. 20-22.–*Orthoporus zizicolens* (Chamberlin) from Actún Xpukil, Calcehtok, Yucatán: 20, male, left view of head and collum; 21, female, same; 22, anterior view of left gonopod.

curved. Antennae reach to hind margin of segment 2. Ventral angle of cheek of mandible is rounded and margin is thickened.

Surface of metazonites and anal valves is more coarsely pitted than in *O. solicolens* and *O. discriminans* but is finer than in some members of the closely related *O. otomitus* group of species. On drying, metazonites appear dusty. This is a good recognition character. Collum (Fig. 12) has four heavy, complete striae, the dorsal one almost straight and reaching to middle level of eyepatch. Ventral margin of collum is relatively short, and anterior angle is wider than posterior. Lateral striae reach almost to level of pores. Anal tergite is broadly angular and shorter than anal valves; mesial margins of anal valves are a little inflated and slightly compressed (Fig. 13). Lobes begin on third legs and continue through the penultimate legbearing segment. Gonopods (Figs. 14-15) are characterized by the narrow, weak, dorsally directed lateral spine.

Female paratype.—Width 4.8 mm, 68 segments. There is no conspicuous sexual dimorphism in the collum.

Variations.—Width ranges between 3.0 and 5.6 mm, body segments between 59 and 68. Anterior angle of ventral margin of collum is often a little more rounded in female than in male. Additional short striae, one or two, may be on collum; they are never above the long uppermost stria. An occasional specimen has a slight transverse depression on the anal tergite.

Type locality and specimens.—Hacienda Teya, 7.1 km E of Mérida, Yucatán, 4 males, of which one is the holotype, and 6 females collected 4 July 1971 by E. A. Liner at 9:00 a.m. in bright sunshine among yucca, brush, and rocks on a roadside.

Range.—Eastern Campeche, northern Yucatán, and northern Quintana Roo. Almost all records are epigean.

Other localities.—*Campeche:* Quarried cave N of Champotón, 1 male, 1 female, W. Russell, R. Mitchell. Sihochac, 1 male, 2 females, 8 Aug. 1968; 37 mi W Xpujil, 1 male; 12 Aug. 1968, R. O. Albert. 1 km N Cantemo, 1 female; Aquiles Serdán, 1 female, 28 Sept. 1974, J. Reddell. Grutas de San Antonio, 10 km ENE Bolonchenticul, 1 male, 1 immature, 23-24 Nov. 1974, J. Reddell, D. McKenzie, S. Wiley.

Yucatán: Chamberlin (1947) mentioned only the state. Oxkintok, many females and immatures; 3 km S Calcehtok, 1 male, 1 female, 3 Aug. 1973; 1 km S Muna, 1 female; 7 km SW Oxkutzcab, 1 female; Oxkutzcab, 1 female, 31 July 1973; Sucila, 1 female, 1 April 1973; Tixcocob, 3 males, 1 female, 12 Aug. 1973, all by J. Reddell. Ruins 4 mi E Kantunil on Hwy 180, many immatures, 24 Aug. 1972; 3 km S Tecoh, 1 female, 6 Aug. 1973, R. Mitchell. Valladolid, fragment, 10 Aug. 1968, R. O. Albert. Actún Sabacá, 6 km S Tekax, 1 immature, 4 Dec. 1974, J. Reddell, D. McKenzie, S. Wiley, J. Andrews, R. Mitchell.

Quintana Roo: 17.1 km S Puerto Juárez, 1 female, 5 July 1971; E. A. Liner. Balneario Bacalar, Laguna de Bacalar, near Chetumal, 1 female, 1971, T. Alberto.

Etymology.—The name *yucatanensis* is an adjective derived from the name of the Peninsula.

Orthoporus zizicolens (Chamberlin)
Figs. 20-22

Gymnostreptus zizicolens Chamberlin, 1938, p. 168, figs. 6-10; type locality, Ziz Cave, nr Oxkutzcab, Yucatán; male holotype.

Orthoporus zizicolens, Loomis, 1968, p. 105.

Orthoporus kiemi Loomis, 1962, p. 48-50, figs. 1-3; type locality, a cave on the Hda. San Bernardo, nr Maxcanú, Yucatán. See the note on new evidence as to the identity of this cave. Female holotype, USNM, no. 2778. NEW SUBJECTIVE SYNONYMY.

Diagnosis.—A troglobite distinguished from all other species of *Orthoporus* by the prominent forward protrusion of the anterior angle of the collum of the male and the longer legs and antennae.

Description.—Body width is 4-5 mm, maximum length is about 90 mm. Metazonites are shining and smooth. Color in life is almost white (Loomis, 1962); in alcohol body is usually evenly flesh colored, but sometimes it is dark gray over several segments or banded in gray and flesh color. Stink glands are black and threadlike. Ocelli are depigmented, arranged in 3 or 4 transverse series in widely spaced ovoid patches. Antennae are thin, elongated, reach back to segment 8. Legs are elongated. Beginning on segment 4 and continuing to near hind end of body, fourth and fifth articles of legs bear flat lobes. Mesial margins of anal valves are raised and compressed as in *O. solicolens*. Anal tergite has a slight transverse furrow. Sexual dimorphism of collum is great. Anterior angle of ventral margin of collum of male is produced forward in a conspicuous rounded protrusion that covers mandibular cheek (Fig. 20). Males of last immature stadium have collum somewhat approaching the condition in adult males, but not entirely covering mandibular cheek. Shape of anterior angle and number and precise pattern of striae of collum are a little variable. Mandibular cheek is flatter and its marginal welt is thinner than in associated species. Ventral margin of collum of female is squarish and does not cover mandibular cheek entirely (Fig. 21). Gonopods are characterized by deep concavity of coxal knee and oblique direction of its turgid spine. Chamberlin (1938) drew collum and gonopods of male and Loomis (1962) drew collum of female.

Behavior.—The behavior of *O. zizicolens* in light was reported by Loomis (1962) and reaffirmed by Reddell (in lett.) as follows: "This species does react very strongly to light, twisting and writhing until the light is turned away. I have never seen another *Orthoporus* react this way or show any particular reaction to light. *Cambala speobia,* of course, reacts strongly to light and will roll into a tight coil when light hits it." As to the functioning of the stink glands, Reddell observed (in lett.): "The most vigorous handling of living specimens does not produce the strong odors which the most casual handling of living epigean *Orthoporus* causes."

Range.—Five caves in western Yucatán between San Bernardo and Oxkutzcab. Length of range is about 85 km.

Type locality of ***O. kiemi.***—A cave not identified by name on the Hda. San Bernardo, near Maxcanú, was stated to be the type locality of *O. kiemi.* The only two caves on the present holding of the Hda. San Bernardo are small and unsuitable for this species (James Reddell, in lett.). Reddell has recently identified the probable name of the cave from which Loomis' specimen was collected as Actún Xpukil (=Caves of Calcehtok), 3 km south of Calcehtok and to the southeast of Maxcanú. He learned that Schell and Schell (1974) made a trip with the collector, Stanley Kiem, from the Hda. San Bernardo to the Caves of Calcehtok, where they explored with Kiem the chamber in which Reddell and his companions collected *O. kiemi* three times in 1973.

I have studied topotypes of both sexes from Actún Ziz and Actún Xpukil.

New records.—*Yucatán:* Grutas de Loltún, near Oxkutzcab, 1 male, 1 female, immatures, 1 Jan. 1972, D. McKenzie. Actún Xpukil, 3 km S Calcehtok, 3 males, 9 females, immatures, 19 Mar. 1973, 4-5 April 1973, 15, 30 April 1973, J. Reddell, D. McKenzie, M. H. McKenzie, S. Murphy, M. Butterwick. Actún Xkyc, 1 km S Calcehtok, immatures, 1 May 1973, J. Reddell, D. McKenzie, E. Alexander, M. Butterwick. Cueva de Sabre (=? Actún Sabacá), immature, O. Tafall (USNM). Actún Chukum, 2 km S Maxcanú, 3 males, 6 females, immatures, 3, 17 Oct. 1974, 29 Nov. 1974, J. Reddell, R. Solis, D. McKenzie, S. Wiley, R. Mitchell.

ORDER POLYZONIIDA

FAMILY POLYZONIIDAE

Genus *Siphonoconus* Attems

Siphonoconus Attems, 1930, p. 177; type species, *S. dendrobates* Attems, from Java. Causey, 1965, pp. 52-53.

Siphonoconus purpureus (Pocock)

Siphonotus purpureus Pocock, 1894, p. 479, pl. 37, fig. 5; type locality, Saint Vincent, British West Indies.

Siphonoconus purpureus, Causey, 1965, p. 53.

This species is widely distributed, probably by commerce, throughout the islands in the Caribbean, along the northern coast of South America, in the Panama Canal Zone, and on the Gulf Coast of the United States (Causey, 1965). Strangely, it has not appeared previously in Central American records (e.g., see Loomis, 1968).

New records.—*Tabasco:* Surface at Grutas del Coconá, under rocks, 3 km E Teapa, 28 Sept. 1974, J. Reddell.

Yucatán: Cueva Luchil, 3 km S Mérida, 15 Oct. 1974, J. Reddell, R. Solis, S. Wiley.

ORDER SIPHONOPHORIDA

FAMILY SIPHONOPHORIDAE

This family is known on the Peninsula by one specimen, the holotype of *Siphonophora sabachana* Chamberlin, 1938, from Cueva Sabachá, Tekax, Yucatán.

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THE SUBTERRANEAN AND EPIGEAN CATOPINAE OF MEXICO (COLEOPTERA: LEIODIDAE)

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INTRODUCTION

Prior to 1969 the fauna of beetles in the subfamily Catopinae in México, including Yucatán, was virtually unknown. Since then, much biological exploration in caves by several individuals and organizations has widely contributed to an understanding of cave-inhabiting catopine beetles. However, a full understanding of the evolution and distribution of cave faunas will come only with knowledge of the epigean (above ground) fauna from which the cave fauna was derived. Partly for this reason, extensive collections of Mexican catopine beetles were made by me in 1969 and 1971 and by Dr. Al Newton in 1970, 1971, and 1973.

The purpose of this paper is to bring together what is now known of the cave-dwelling Catopinae of México, including the Yucatán, and that material of forest-dwelling genera and species which it has been possible to collect and study.

MATERIALS AND METHODS

Baited pitfall traps were used in forests. These have proven to be the most successful way to gather large samples of Catopinae (Peck, 1973a; Newton and Peck, 1975). Human dung and carrion are the best baits. Squid and octopus are usually available in local markets and make good carrion bait. Catopinae living in pocket gopher burrows were captured by first carefully opening the burrow and by setting a gopher trap in each direction in the runway. The burrow is then carefully covered over so that no light enters the burrow. If it does, the gopher will plug the runway with soil. If and when the gopher is caught and removed, a small baited pitfall trap, or just bait, may be placed in the runway, and the burrow sealed again. The trap or bait is examined for beetles at a later time. More beetles can be obtained if the burrow is excavated and the rodent's fecal chamber can be found (Hubbard, 1901; Hubbell and Goff, 1940; Ross, 1944). In the future, more collecting in México should concentrate on these "micro-cavern" habitats, as well as *Neotoma* pack-rat nests and the burrows of land tortoises (Hubbard, 1896).

Location of collecting sites are given with regards to cities, towns, and numbered roads found on the tourist road map of México, prepared by the Secretaria de Obras Publicas, and in the Euzkadi Atlas "Caminos de México." Distances and elevations are given either in English or metric units, whichever was recorded in the field with the instruments and data available. Many of the forest collecting sites are described by Howden (1966), Ball and Whitehead (1967), and Ball (1973). Botanical papers useful as guides in finding field sites and in understanding the Mexican flora in its relation to beetle habitats are Beard (1944, 1955), Leopold (1950), Miranda and Sharp (1950), Sharp (1951), and Steyermark (1950). Interesting and useful biogeographic studies are Martin (1955, 1958), Martin and Harrell (1958), and Halffter (1974). Descriptions and locations of cave sites may usually be found in publications of the Association for Mexican Cave Studies.

Measurements of specimens were made with an ocular micrometer. All drawings were made using an ocular grid and squared paper. Spermathecae were drawn as temporary alcohol or glycerine-jelly mounts. In glycerine jelly care must be taken so that weakly sclerotized spermathecae are not collapsed or distorted. Genital segments and lateral views of aedeagi were drawn in temporary slide mounts. Dorsal views of aedeagi were prepared by propping the tip on a bit of glycerine jelly. Aedeagi of most *Ptomaphagus* were drawn without the parameres, which I have found to have little systematic value. Spermathecae of most *Ptomaphagus* were examined and then placed back in the female before she was dried and point mounted. These can be re-examined by relaxing the females in boiling water for a few minutes.

Type specimens of new species known from few specimens are at present being held in the author's collection (indicated SBP) but will be placed in a museum at a later date. Types of new species known from many specimens will be placed in the Canadian National Collection of Insects (CNC), Agriculture Canada, Ottawa. Some paratypes and representatives of other species will be placed in the Division of Invertebrate Zoology of the Museum of Texas Tech University and institutions listed in Peck (1973a:34). All other material is held in the author's collection.

Because of the broad scope of this paper and the large numbers of specimens and species involved, descriptions are reduced to what is judged to be a functional and useful minimum. This has eliminated a complete description of the antennae which have been so fully described before by others. The short verbal descriptions of important characters of what are otherwise rather monotonously uniform beetles are supplemented by illustrations which are of greater value, reliability, and utility.

Many Mexican *Ptomaphagus* species are not easily distinguished by the spermatheca alone, contrary to the situation with *Ptomaphagus* in the United States. Care must be exercised in dissecting spermathecae, in drawing their contours and contortions, and in evaluating them in relation to existing drawings.

A note of caution is in order about the difficulty in determining Mexican *Ptomaphagus* because of the incomplete knowledge of their characters, ranges, and variation. This is especially so in using the spermathecae. It can take on a wholly different appearance with a slight variation in the angle from which it is drawn or viewed.

Because of large numbers of new species of epigean *Ptomaphagus* described in this paper, we can assume that this fauna is still incompletely known. Because of this, the preparation of a key to the *Ptomaphagus* species of México is judged to be premature.

ACKNOWLEDGMENTS

Mr. James Reddell of Texas Tech University is thanked for making available for study the cave-inhabiting Catopinae collected by himself and associates in the Association for Mexican Cave Studies. Dr. Al Newton, Museum of Comparative Zoology, Harvard University, is thanked for his large collections of pitfall trapped Catopinae from Mexican forests. My 1969 Mexican field work was partially supported by NSF grant GB 7346 to the Evolutionary Biology Committee of Harvard University, and in 1971 by a Canadian National Research Council operating grant. Mr. P. M. Hammond of the British Museum (Natural History) is thanked for the loan for study of *Ptomaphagus forticornis* Matthews.

TRIBE NEMADINI

Genus *Dissochaetus* Reitter

Only a few species, listed below, are known from México. However, some 10,000 specimens have been collected by A. Newton and myself from forested habitats and await study.

Dissochaetus aztecus Szymczakowski

The species was described from the "Sierra de Durango" and is also known from caves in Nuevo León, Tamaulipas, and San Luis Potosí (Peck, 1973b; Szymczakowski, 1971).

New records.–*Nuevo León:* Cueva Tecolote, Conrado Castillo, 38 road mi SW El Barretal (Tamps.), 24.viii.1973, R. Jameson, D. McKenzie, F. Perez, 1 female.

Dissochaetus curtus Portevin

The species was doubtfully recorded from Guerrero (Szymczakowski, 1968) and is known from a cave in Chiapas (Peck, 1973b).

Dissochaetus fimbriatus (Matthews)

Jeannel (1936:147) gives México as the range of this species, described from Costa Rica, but gives no other data. This must be an error. *D. semipiceus* (Matthews, 1888) is described from Guatemala, and may be expected in México.

Dissochaetus mexicanus Jeannel

Jeannel (1936:152) gives only that this species is known from houses, apparently in the state of Méxi-

Key to genera of Catopinae in México, Central America, the Caribbean, and northern South America

1a. Hind margin of hind tibia with two inner long spines and an outer row or comb of short equal spines only (Fig. 1) 3
1b. Hind margin of hind tibia with two long inner spines, and perhaps with a comb of equal spines but more importantly also with about four longer outer spines (Fig. 2) 2

2a. Elytra with striae; at all elevations; in forests and caves; usually the most common catopid in baited pitfall traps . . . . *Dissochaetus*
2b. Elytra with granular surface, no striae; in México usually only in very high forested habitats about 2500 m and above; México northward . . . . *Catops*

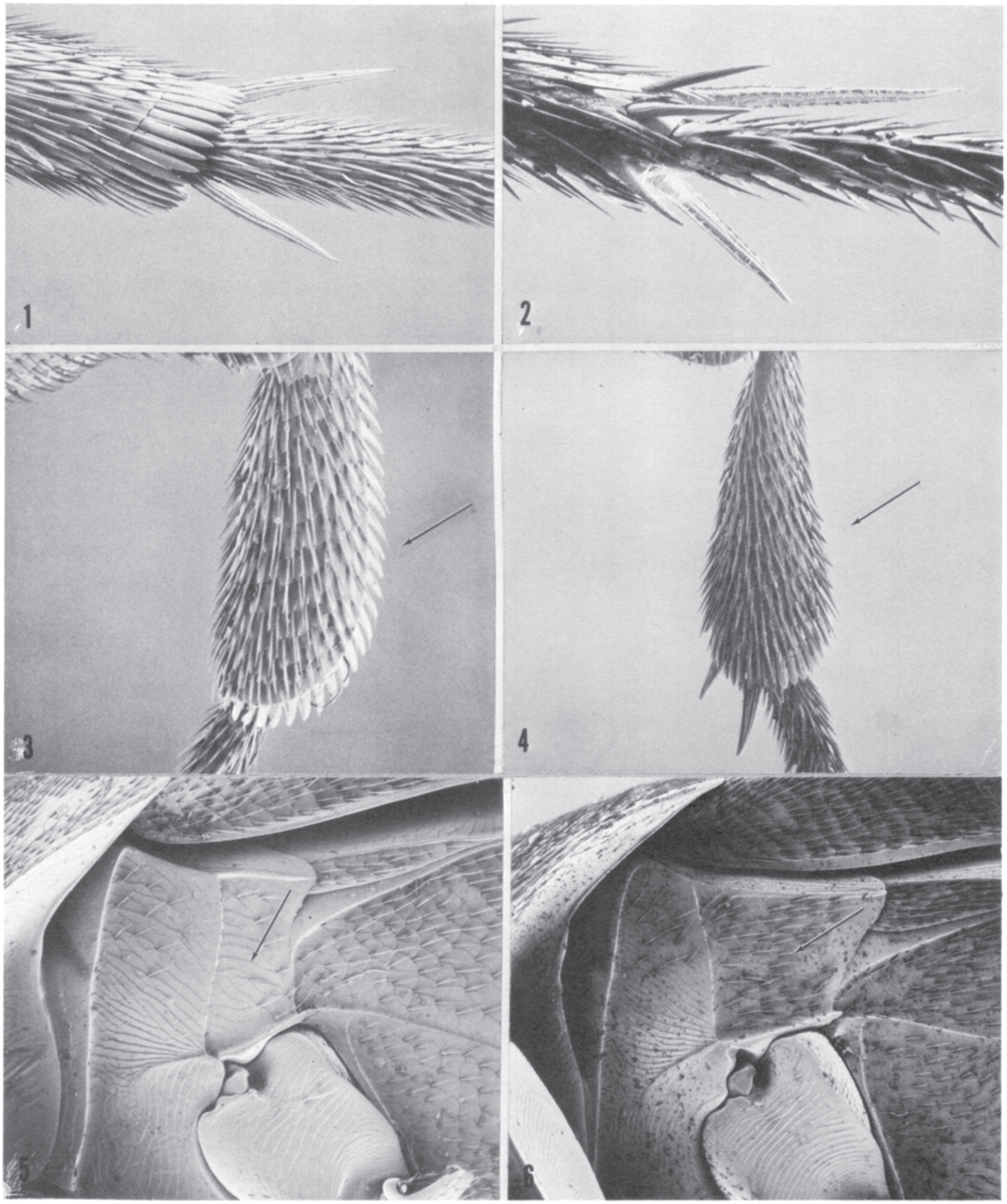
3a. Front tibia with comb of thick spines along outer margin (Fig. 3); mesepimeron longer than broad (Fig. 5) 4
3b. Front tibia without comb of thick equal spines on outer margin, although scattered spines may be present (Fig. 4); mesepimeron as broad as long (Fig. 6) 5

4a. Body shape compact oval; male protarsi dilated; mesosternal carina usually pronounced or highly developed; last article of maxillary palp elongate, much longer than preceding segment; male copulatory organ with short aedeagus and large flat basal blade; widespread but scarce in tropical lowland and montane forests . . . . *Eucatops*
4b. Body shape elongate oval; male protarsi not dilated; mesosternal carina weakly present; last article of maxillary palp smaller than preceding segment; male copulatory organ with tubular sclerotized aedeagus, basal blade reduced; in caves and forest litter and soil in México, Cúba, and Puerto Rico . . . . *Proptomaphaginus*

5a. Form oval; with long erect hairs as well as short hairs; obviously modified limuloid myrmecophile with *Pogonomyrmex* and *Novomessor* harvester ants in the southwestern United States; mesosternal carina low, effaced, or absent; may occur in México . . . . *Echinocoleus*
5b. Form elongate oval; with short recumbent hairs only; may live with ants but is not a highly modified myrmecophile; mesosternal carina present and usually well developed 6

6a. Size medium (2.5 mm) to smaller; antennae with a more loose club of gradually increasing segment size, usually last two segments conspicuously lighter in color; usually in forested habitats below 1000 m, occasionally in caves in South America; female spermatheca a more simple curved tube; aedeagus tip more elaborate, orifice terminal or cutting right angle . . . . *Adelopsis*
6b. Size rarely small, usually medium (2.5 mm) to larger; antennae with heavy set and more compact club in epigean species, usually with only last segment lighter in color; usually in forested habitats about 1000 m and above and in lowland and upland caves; spermatheca a more complicated curved tube; aedeagus tip simple, with genital orifice cutting left side . . . . Genus *Ptomaphagus* 7

7a. Antennal club beginning with segment VI or VII; antennae with last five segments with setae, but not dense and giving a silvery color on anterior surface; club segments not elongated latero-anteriorly and giving a saw-toothed appearance; in forests, animal burrows, and caves . . . . Subgenus *Adelops*
7b. Antennal club beginning with segment IV or V; antennae with last five segments with dense vestiture of small setae giving silvery appearance on anterior surface; club segments elongated latero-anteriorly to give saw-toothed appearance in some species (Figs. 149-158); in forested montane habitats only . . . . Subgenus *Tupania*



Figs. 1-6.—1, comb of equal spines on outer surface of hind tibia, *Ptomaphagus:* 2, large and often unequal spines on outer surface of hind tibia, *Dissochaetus;* 3, dorsal face of protibia showing comb of equal spines on outer margin, *Proptomaphaginus;* 4, dorsal face of protibia showing absence of comb of spines on outer margin, *Ptomaphagus;* 5, narrow mesothoracic epimeron, *Proptomaphaginus;* 6, broad mesothoracic epimeron, *Ptomaphagus.*

co, and Szymczakowski (1968) lists a specimen apparently from the valley of México.

Dissochaetus hetschkoi Reitter

This species is known from Brazil and Venezuela as well as a cave in Belize, forests in Nuevo León and Tamaulipas, and caves in San Luis Potosí and Veracruz (Peck, 1973b).

New records.–*Oaxaca:* Cueva del Lencho Virgen, 10 km SSW Acatlán, 2-3.i.1974, J. Reddell, R. Jameson, D. McKenzie, W. Elliott, 3 males, 4 females.

Yucatán: Cenote Sabacah, 1 km W Sucopo, 31.iii.1973, J. Reddell, on and near vampire guano, 6 males, 5 females. Cueva de Orizaba, Orizaba, 8 km S Buena Ventura, 1.iv.1973, J. Reddell, D. and M. McKenzie, M. Butterwick, S. Murphy, at edge of vampire guano pool, 8 males, 6 females. Cenote Aká Chen, 1 km NE Tixcancal, 1.iv.1973, J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick, at cave end on vampire guano, 3 males, 1 female. Cenote de San Luis, San Luis, 14 km S Buena Ventura, 2.iv.1973, J. Reddell, in twilight on sticks covered with owl droppings and owl pellets, 11 males, 13 females. Cenote Poxil, Poxil, 7 km S Chemax, 15.xii.1974, J. Reddell, at side of vampire bat guano pool, 1 female. Actún Kiuick, Kiuick, 13.xi.1974, J. Reddell, D. McKenzie, S. Wiley, at side of vampire bat guano pool, 1 female.

Campeche: Grutas de San Antonio, 10 km ENE Bolonchenticul, 3.xi.1974, J. Reddell, D. McKenzie, S. Wiley, 2 females.

TRIBE CATOPINI

Genus *Catops* Reitter

This large genus is widespread in the Holarctic region. It was not previously known from México.

Catops newtoni, new species
Figs. 8, 10-11

Holotype male and allotype female in CNC. Type locality: Oaxaca, 27.3 mi N Ixtlán de Júarez (on Mexican road 175 N of Oaxaca City), 9200 ft. Type data: 11-18.viii.1973, A. Newton, oak and pine forest, carrion trap 527. Paratypes: over 1000 with same data, and all the material listed below in section on material seen.

Diagnosis.–The species is readily distinguished by the shape of the aedeagus, and the sharp tooth on the male profemur.

Description.–Length 2.8 to 3.4 mm. Width 1.4 to 1.8 mm. Head and pronotum dark brown, elytra dark brown with bluish gray pruinose surface. Head coarsely punctured. Antennae robust, reaching slightly beyond base of pronotum. Pronotum densely haired and finely granulate with setal bases; sides curved in both sexes; widest at middle; wider than long; hind angles rounded. Elytra widest at basal third; densely covered with setae and granulate from setal bases; pruinose; apex more narrow in male; sutural angle rounded in male and female. Flight wings fully formed. Male profemur with tooth on inner margin (Fig. 11), protibia with irregular inner margin, protarsi moderately dilated. Male mesobasitarsomere dilated. Male trochanter not dentate. Aedeagus in lateral view (Fig. 8) drawn out to point with ventral button, in dorsal view (Fig. 10) tip broadly blunt. Female fifth abdominal segment not emarginate behind.

Discussion.–The species most closely fits the key and description of *C. simplex* Say in Hatch (1933), but differs in the shape of the profemur tooth and more elongate aedeagal tip. Its exact relationship to the more northerly North American *Catops* must await a careful review of this group.

Etymology.–The species is named after Dr. Al Newton of the Museum of Comparative Zoology, Harvard University, who has generously made available to me for study the many catopids collected in his Mexican field work.

Distribution.–The species is known to occur in very high elevation forests in Nuevo León (Cerro Potosí) and southward through the Sierra Madre Oriental to Oaxaca, and westward to Jalisco (Nevado de Colima).

Material seen.–*Hidalgo:* 7 mi NE Pachuca, 2 mi in on El Chico road, 9300 ft, 1-6.vii.1971, A. Newton; oak, pine, scattered *Abies* forest, dung trap 263, 1 female. 1 mi S El Chico, 8400 ft, 1-6.viii.1971, A. Newton; oak, *Abies* forest, dung trap 260, 2 males, 2 females. 2 mi S El Chico, 8800 ft, 1-6.viii.1971, A. Newton; *Abies*, some oak along stream, dung trap 261, 2 males. 5 mi S El Chico, 9600 ft, 1-6.viii.1971, A. Newton, *Abies* forest, dung trap 262, 2 males, 1 female.

Jalisco: 9 mi W Atenquique, 10,000 ft, 10-18.ix.1971, A. Newton, *Alnus* woodland, dung trap 402, 4 males, 2 females. 18 mi W Atenquique, 9300 ft, 10-18.ix.1971, A. Newton, fir forest, carrion trap 404, 47. East slope Nevado de Colima, 10,000 ft, 20-21.ix.1973, A. Newton, *Alnus* woodland, octopus carrion traps 547 (3), 197.

México: 5 mi E Santa Marta, 10,000 ft, km 8.5, 29.viii-4.ix.1971, A. Newton, fir forest, dung traps 372, 8 females, 10 males.

Morelos: 4 mi W Tres Cumbres, 8900 ft, km 6, 29.viii-4.ix.1971, A. Newton; oak, *Clethra?* madroño woodland, dung trap 375, 1 male. 7 mi W Tres Cumbres, 9600 ft, km 12, 29.viii-4.ix.1971, A. Newton; fir, pine, oak, madroño forest; dung trap 373, 1 male, 1 female.

Nuevo León: NW of Galeana, Cerro Potosí, 11,000 ft, 27.vi.1969, S. & J. Peck, 1 female on rotten mushroom. Same data but 11,500 ft, in mouse nest under log in open, 9 males, 8 females.

Oaxaca: 10.4 mi N Ixtlán de Júarez, 9100 ft, 10-18.viii.1973, A. Newton, oak pine forest, carrion trap 528, 56. 16 mi N Ixtlán, 9400 ft, 24-27.vii.1971, A. Newton, *Abies* and oak forest, dung trap 315, 55. 20 mi N Ixtlán, 9300 ft, 24-27.vii.1971, A. Newton, wet pine-oak forest, dung trap 314, 39. 25 mi N Ixtlán, 9100 ft, 23-29.vii.1971, A. Newton; wet oak, pine, *Alnus,* madroño woodland, dung trap 313, 13. Same data as preceding but 4 in carrion trap 313. 28 mi N Ixtlán, 9200 ft, 23-29.vii.1971, A. Newton, wet oak forest, dung trap 312, 69. Same as preceding but 9500 ft, heath with scattered pine, dung trap 311, 4.36 mi S Valle Nacional, 9000 ft, 23-29.vii.1971, A. Newton, wet oak-pine forest along stream, dung trap 310, 36. 35.9 mi S Valle Nacional, 8900 ft, 11-18.viii.1973, A. Newton, mesic oak-pine forest, carrion trap 512 b, 89. 1.4 mi W jct Méx. 175, Yuvila road (this road is at the crest on Méx. 175, 20.5 km N on 175 of jct of 175 and 190, near Oaxaca City), 9300 ft, 9-19.viii.1973, A. Newton, mesic oak forest, carrion trap 536, 150. Same data as preceding but dung trap 536, 60. 1.7 mi W jct Méx. 175, Yuvila road, 9400 ft, 9-19.viii.1973, A. Newton, mesic oak forest dung trap 537, 10. Same data as preceding but fish carrion trap 537, 349. 2 mi W jct Méx. 175, Yuvila road, 9500 ft, 8-19.viii.1973, A. Newton, pine-oak forest, dung trap 538, 175. 4 mi W jct Méx. 175, Yuvila road, 9300 ft, 8-19.viii.1973, A. Newton; oak, fir, pine forest, fish carrion trap 539, 119.

Catops oaxaca, new species
Figs. 7, 9, 12

Holotype male and allotype female in CNC. Type locality: México, Oaxaca, 1.7 mi W of Méx. 175 on Yuvila road (20.5 km N on 175 of the junction of 175 and 190, near Oaxaca City), 9500 ft. Type data: 9-19.viii.1973, A. Newton; mesic oak forest carrion trap 537. Paratypes: 4 with same data; two with preceding data but dung trap 537; same data but 1.4 mi W on Yuvila road, 9300 ft, 1 male in carrion trap 536 and one female in dung trap 536; same as preceding but 2 mi W on Yuvila road, 9500 ft, 5 in pine oak forest dung trap 538. 34.4 mi S Valle Nacional, 8500 ft, 11-18.viii.1973, A. Newton, oak-pine forest carrion trap 525, 1 male. 35 mi S Valle Nacional, 8000 ft, 23-29.vii.1971, A. Newton, wet oak and dense shrub forest dung trap 309, 1 male.

Diagnosis.–The species is distinguished by the male aedeagus, prominent broad tooth on the male protibial distal inner surface, low broad raised area on the male profemur inner face, and by the female pronotum with straight sides which converge posteriorly.

Description.–Length 3.0 to 3.5 mm. Width 1.5 to 1.9 mm. Head and pronotum dark brown; elytra light brown in front and dark brown behind with bluish-grey pruinose surface. Head coarsely punctured. Antennae robust, reaching slightly beyond base of pronotum. Pronotum densely hairy and finely granulate with setal bases, sides curved in male, straight and converging in posterior two thirds in female; widest at middle in male and at first one third in female; wider than long; hind angles rounded. Elytra widest in basal third; densely granulate from setal bases; pruinose; sutural angle feebly pointed in female, rounded in male. Flight wings fully formed. Male profemur with broad raised area on inner margin (Fig. 12), protibia with prominent broad tooth on inner margin near proximal end, protarsi moderately dilated. Male mesobasitarsomere dilated. Male trochanters not dentate. Aedeagus in lateral view (Fig. 7) drawn out to point with slightly upturned tip, in dorsal view (Fig. 9) tip somewhat drawn out, but rounded. Female fifth abdominal segment not emarginate behind.

Discussion.–The species does not key close to any *Catops* in Hatch (1933), and is markedly distinct from *C. newtoni* described above. Its exact relationship to the more northern North American *Catops* must await a review of this group.

Etymology.–The specific name is used as a noun in apposition and refers to the Mexican state of Oaxaca, in which the species seems to be confined.

Distribution.–The species is known only from very high (8000 to 9500 ft) elevation forests in the forests in the Sierra Madre de Oaxaca on the two mountain ranges crossed by the road between Oaxaca City and Valle Nacional, where it occurs with the more widespread and more abundant *C. newtoni.*

TRIBE EUCATOPINI

Genus *Eucatops* Portevin

The genus *Eucatops* has previously been reported only from South America. I have collections showing that it occurs through Central America to México, where it is widespread but uncommon in lowland moist to wet forests, and on a mountain in the Dominican Republic.

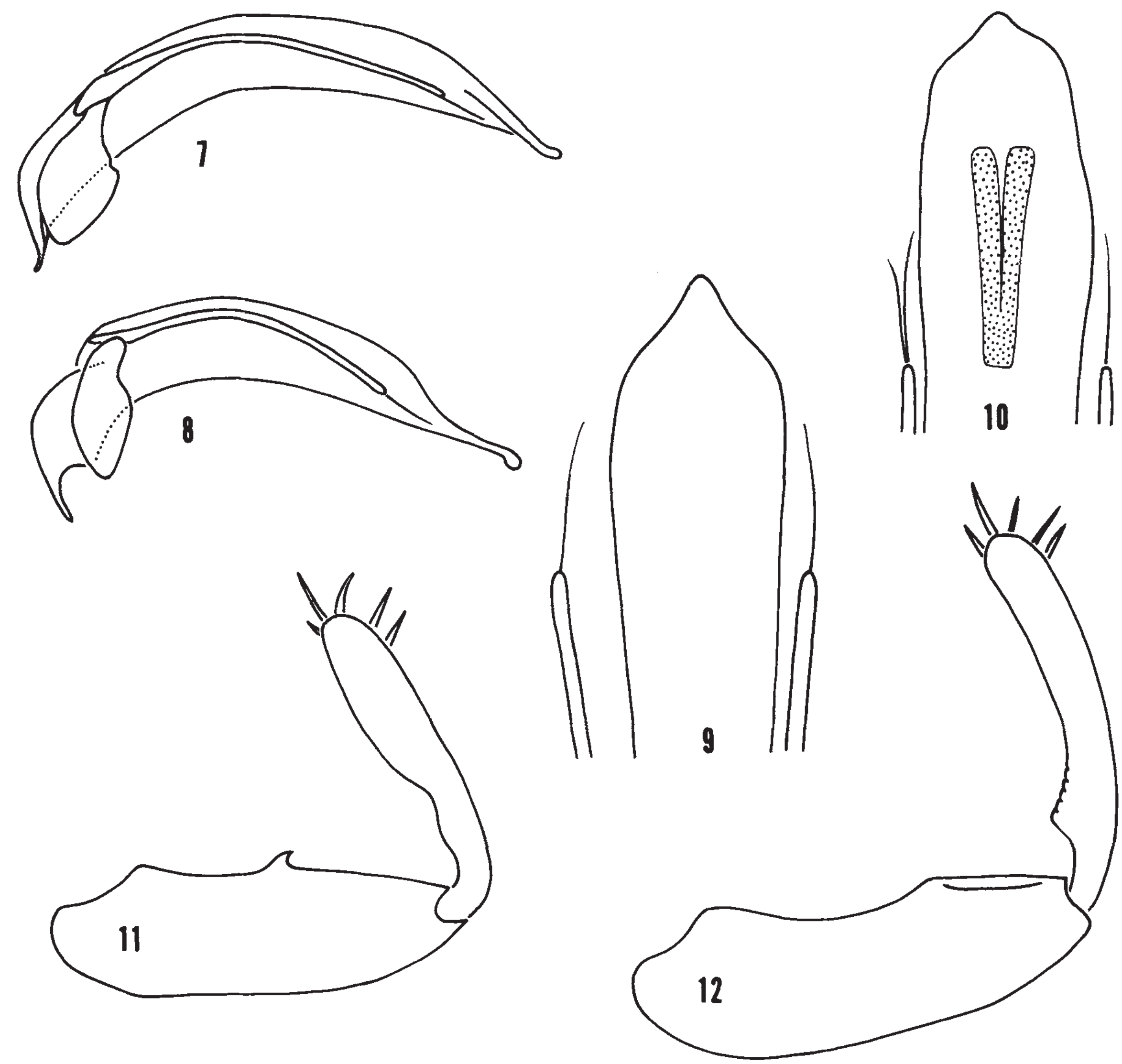
TRIBE PTOMAPHAGINI

Genus *Proptomaphaginus* Szymczakowski

The genus is known only from one edaphobitic species in México, *P. microps*, from Cueva Salitre, Xilitla, San Luis Potosí, and three species in caves and forests in Puerto Rico and Cúba (Peck, 1970, 1973a, 1973b; Szymczakowski, 1969; Decou, 1973).

Genus *Echinocoleus* Horn

This genus is known from nests of *Pogonomyrmex* and *Novomessor* harvester ants in New Mexico, Texas, and Arizona, and since these ants occur widely in México (Cole, 1968), the genus may also occur in México (Peck, 1973a, 1976). However, this habit alone will not distinguish the genus because *Ptomaphagus texanus* lives with *Pogonomyrmex* ants in



Figs. 7-12.--7, aedeagus of *Catops oaxaca;* 8, aedeagus of *C. newtoni;* 9, aedeagus tip, dorsal view, *C. oaxaca;* 10, aedeagus tip, dorsal view, *C. newtoni;* 11, male profemur and protibia of *C. newtoni;* 12, male profemur and protibia of *C. oaxaca.* Here and following, all illustrations are of type populations unless otherwise indicated.

Texas, and this and other *Ptomaphagus* species may be ant associates in México.

Genus *Adelopsis* Portevin

The genus *Adelopsis* is widespread in South America. There are no literature records of the genus in Central America, and only one from México *(A. simoni* (Portevin) (from Coatepec) which ranges south to Brazil (Szymczakowski, 1968)). My collections show that many species are present in Central America and México, where they occur, but not commonly, in lowland to mid-montane moist to wet forests.

Genus *Ptomaphagus* Illiger

Subgenus *Adelops* Tellkampf

The subgenus has been divided into three species groups (Peck, 1973a) based on the female spermatheca. It may be that as a result of the new species described below a revision of these groups will be needed.

consobrinus species group

Ptomaphagus (Adelops) fisus Horn
Figs. 18, 22-23, 66, 80

This species, widespread in the southwestern United States, is known only from the state of Chihuahua in México (Peck, 1973a). The species is usually associated with the nests and burrows of kangaroo rats and ground squirrels (Hubbard, 1901) and may occur in pack rat nests.

Ptomaphagus (Adelops) distinctus, new species
Figs. 20-21, 65, 78-79

Holotype female and allotype male in SBP. Type locality: Hidalgo, 4 mi SW Chapulhuacán, 3500 ft. Type data: 27.vi-1.vii.1973, A. Newton, forest carrion trap 493. Allotype: 6.6 mi S Chapulhuacán, 3900 ft, 17.vi-1.vii.1973, A. Newton, forest carrion trap 494.

Diagnosis.—The species is characterized by its large size, the simple spermatheca, and aedeagus with a constriction at the orifice.

Description.—Length 3.8 to 4.4 mm. Width 1.8 to 2.1 mm. Color brown. Form oval. Antennae normal, not quite reaching pronotum. Pronotum with sides straight, diverging to base, hind angles weakly pointed and somewhat drawn out. Elytra with oblique striae. Elytral tip and sutural angle rounded in male and female. Legs robust; male first three protarsomeres widely dilated; meso and metatarsi conspicuously thick in both sexes. Aedeagus normal in lateral view (Fig. 20), dorsal view with constriction at level of orifice (Fig. 21); parameres with two hairs at tip and one more proximal. Genital segment normal (Fig. 65) with plate elongated. Spermatheca unusually and distinctly simple; with only undulatory posterior piece, and expanded anterior shield with thin crest (Figs. 78-79).

Discussion.—The very simple and distinctive spermatheca seemingly places the species in the *hirtus* species group of Peck (1973a:62). However, this species has an expanded anterior end not otherwise well developed in the group. It could most readily be derived from the spermatheca of *P. ulkei* of the southeastern U. S. in the *consobrinus* group, an idea supported by the similar large size and robust tarsi of both species.

Etymology.—The specific name refers to the distinctive spermatheca.

Ptomaphagus (Adelops) meximontanus Peck
Figs. 24-25, 81-82

The species was previously known only from two males from the Pinal de Amoles vicinity. Females are now available. They have reduced eyes and no wings like the males. Female elytral tips are somewhat truncate and the sutural angles are pointed and only very slightly drawn out. The spermatheca (Figs. 81-82) shows a somewhat intermediate nature between the *consobrinus* and *cavernicola* species groups, but the species should probably be placed in the former group.

New records.—*Querétaro:* 5 mi SW Pinal de Amoles, 8500 ft, km 131, 21-27.vi.1971, A. Newton; pine, oak forest dung trap 243, 5. 2 mi NE Pinal de Amoles, 7400 ft, km 142, 21-27.vi.1971, A. Newton; *Crategus* (?), pine, oak forest along dry stream, dung trap 244, 110.

Ptomaphagus (Adelops) nevadicus Horn
Figs. 13, 26-27, 67, 83

This is the most widely spread species in North America. It is usually found in rodent burrows, such as those of pocket gophers, where it was previously known to occur in Durango.

New record.—*Durango:* 32 km E El Salto, 8000 ft, 17-19.vi.1971, S. Peck, 45 from burrows of pocket gophers in xeric scrub habitat.

Ptomaphagus (Adelops) reddelli Peck
Figs. 28-29, 84-85

The species was previously known only from two lowland caves near Valle Nacional, Oaxaca. Although it is not cave-specialized, it has not yet been found in an epigean habitat.

New record.–*Oaxaca:* Cueva del Lencho Virgen, 10 km SSW Acatlán, 2-3.i.1974, J. Reddell, R. Jameson, D. McKenzie, W. Elliott, 1 female. This site is some 100 km NW of the type locality, and is also in the lower elevations of the Gulf of México slope of the Sierra Madre.

cavernicola species group

The following Mexican species in this group are arranged alphabetically. A complete phylogenetic analysis is not now possible because of lack of time.

Ptomaphagus (Adelops) altus Peck
Figs. 15, 32-33, 87-89, 141

This species, characterized by its somewhat reduced eyes, spermatheca (Figs. 87-89), and more extensively pruinose female elytral tip, was previously known only from Chiapas, and possibly Michoacán (Peck, 1973a).

New records.–*Chiapas:* 6 mi W San Cristóbal de las Casas, 7700 ft, km 75.5, 21-24.viii.1971, A. Newton; oak, pine, madroño forest (type locality), dung trap 354, 1 female, 2 males. 12 mi W San Cristóbal, 7800 ft, km 66, 21-24.viii.1971, A. Newton; oak, *Alnus,* madroño, scattered pine forest, dung trap 355, 3 males, 2 females, 4 mi W San Cristóbal, 7900 ft, 30.viii-1.ix.1973, A. Newton, fungus trap 544, 1 male, 1 female.

México: 7 mi NE Temascaltepec, 7000 ft, km 56, 2.7.ix.1971, A. Newton; oak, pine, madroño, *Clethra?* forest, dung trap 401, 1 male. 5 mi SW Tenancingo, 7100 ft, km 56, 31.viii-6.ix.1971, A. Newton; oak, pine, *Alnus,* madroño forest, dung trap 391, 1 female. 4 mi SW Tenancingo, 7200 ft, km 54, 31.viii-6. ix.1971, A. Newton; oak, pine, madroño forest near stream, dung trap 394, 2 females, 5 males.

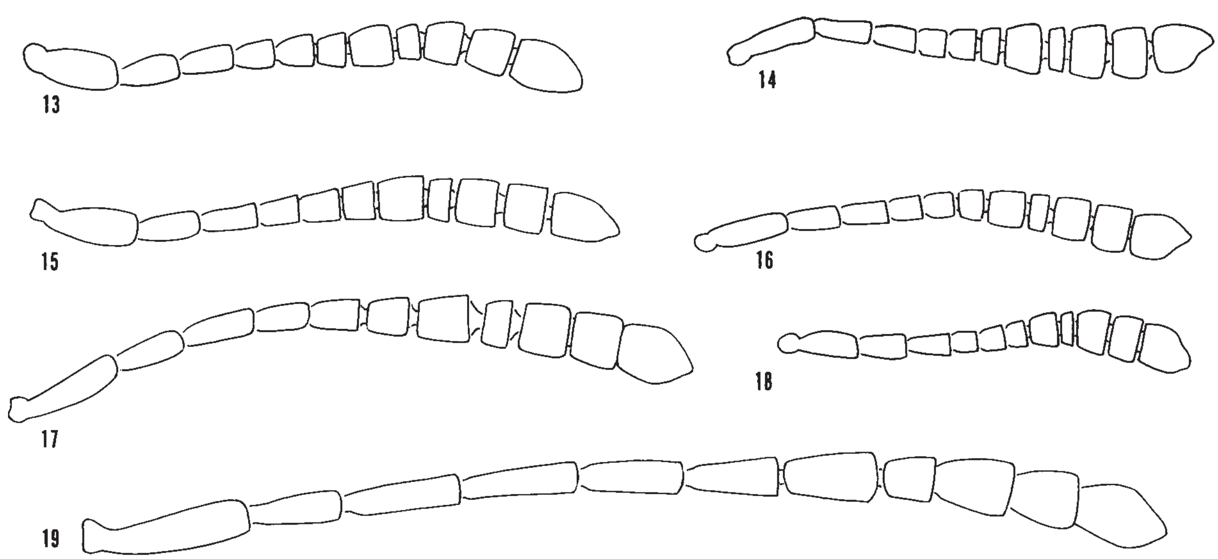
Morelos: 4 mi W Tres Cumbres, 9000 ft, 29.viii-4. ix.1971, A. Newton; oak, *Clethra?* woodland, dung trap 374, 1 male.

Ptomaphagus (Adelops) cavernicola cavernicola Schwarz
Figs. 17, 30-31, 68, 86

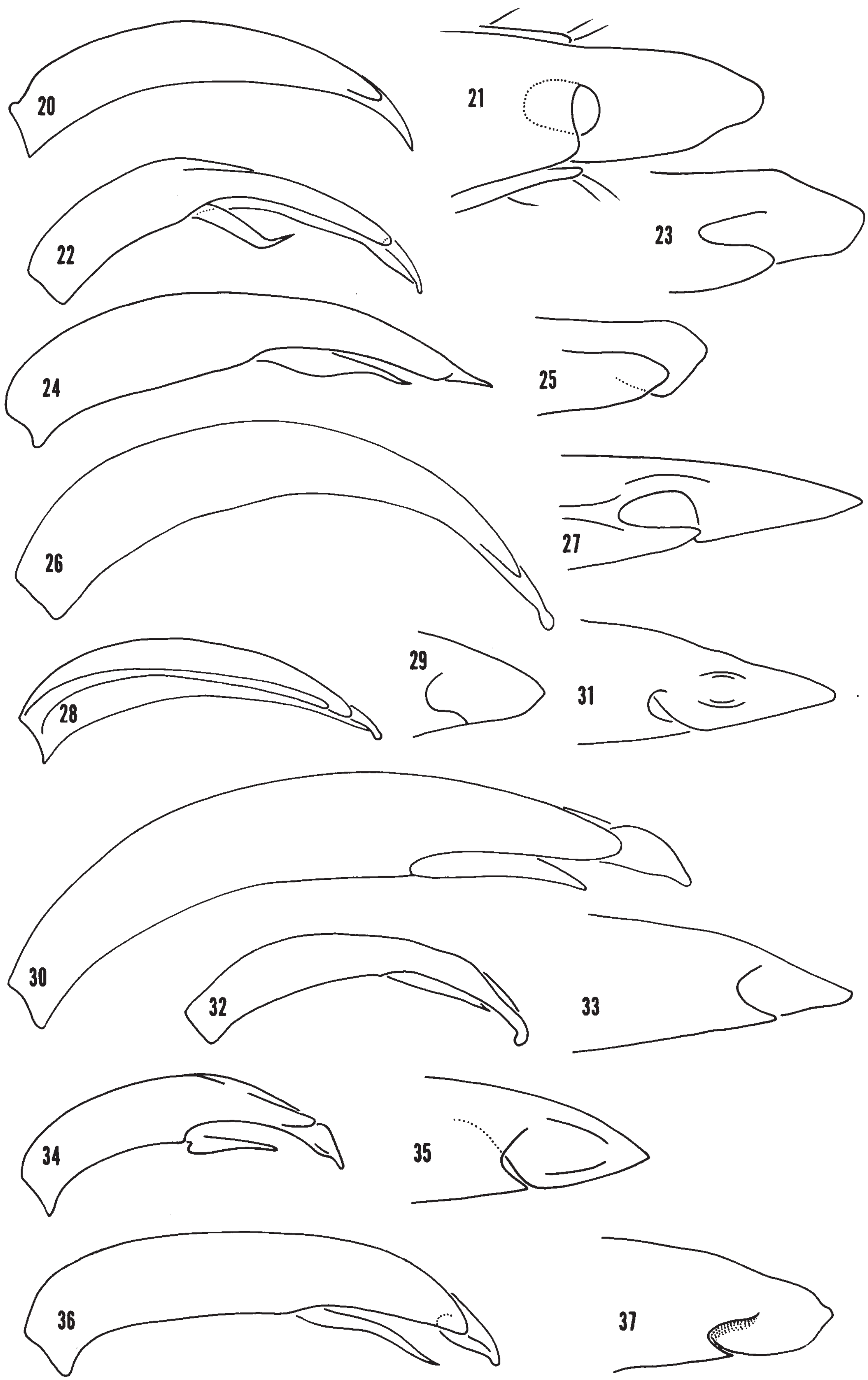
This subspecies, widespread in caves in the United States, is known in México only in La Gruta Palmito, Bustamante, Nuevo León (Peck, 1973a, 1973b).

Ptomaphagus (Adelops) cavernicola aditus Peck

This subspecies is known only from Cueva de la Boca, Santiago, Nuevo León (Peck, 1973a, 1973b).



Figs. 13-19.–*Ptomaphagus* antennae: 13, *P. nevadicus,* California; 14, *P. leo,* Chipinque Mesa; 15, *P. altus,* San Cristóbal de las Casas; 16, *P. elabra,* Cueva de El Pachón; 17, *P. cavernicola,* Missouri; 18, *P. fisus,* California; 19, *P. troglomexicanus,* Cueva de la Capilla. All to same scale.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Ptomaphagus (Adelops) colima, new species
Fig. 91

Holotype female and allotype male in SBP. Type locality: Jalisco, 14 mi W Atenquique, 7900 ft. Type data: 10-18.ix.1971, A. Newton; hardwood forest with *Alnus, Oreopanax* and *Alchornea,* dung trap 405. Allotype from 17 mi W Atenquique, 7500 ft, 10-18.ix.1971, A. Newton; oak pine woodland dung trap 408.

Diagnosis.–The species is recognized by the somewhat reduced eyes, reduced wings, spermatheca, and pruinose female elytral tip; and is probably restricted to high elevation forests on the Nevado de Colima in Colima and Jalisco.

Description.–Length 3.0 to 3.5 mm. Width 1.5 to 1.6 mm. Color brown. Shape oval. Antennae short, not reaching pronotal base. Eyes coarsely faceted; somewhat reduced, their horizontal diameter somewhat greater than space from eye to antennal socket. Pronotum with sides parallel and widest in hind third, slightly more narrow than elytra. Elytral tips and sutural angle rounded in male and female; tips and along suture pruinose in female. Wings reduced to three quarters the length of the elytra. Spermatheca (Fig. 91) elongate. Aedeagus with thin tip, downturned in lateral view, tapering to terminal tooth in dorsal view.

Etymology.–The name is used as a noun in apposition and refers to the Nevado de Colima to which the species is probably restricted.

Ptomaphagus (Adelops) conejera, new species
Figs. 34-35, 69, 92-93

Holotype female and allotype male in CNC. Type locality: Oaxaca, 3 mi N Suchixtepec, 9500 ft. Type data: 4-6.vi.1971, S. Peck, in pocket gopher burrows. Paratypes: 1 female and 3 males with same data, 3 females from 3.5 mi S Suchixtepec, 8000 ft, 3.vi.1971, S. Peck, Berlese 208, 39 liters, 15 kg sifted oak-alder-*Carpinus* litter in shaded ravine.

Diagnosis.–The species is readily distinguished only by its reduced eyes, lack of flight wings, and habitat of living in forest litter and pocket gopher burrows in the Sierra Madre del Sur of Oaxaca.

Description.–Length 2.5 to 3.0 mm. Width 1.1 to 1.4 mm. Color reddish brown. Form elongate oval. Eyes reduced, their horizontal diameter slightly more than the width of the space between the anterior eye margin and edge of antennal socket; coarsely faceted and pigmented. Antennae normal, reaching base of pronotum when laid back. Pronotum sides widest and parallel in basal third; narrower than elytra. Elytra not fused; elytral tip pruinose in female and tip and sutural angle rounded in female and male. Flight wings reduced to small scale. Mesosternal carina medium, notch distinct. Aedeagus somewhat robust (Fig. 34), tip normally pointed (Fig. 35). Genital segment with stout spiculum and normal genital plates (Fig. 69). Spermatheca (Figs. 92-93) with thin curved central piece and broad anterior swelling.

Discussion.–The species is very close to *P. altus* and can be easily separated from it only by the presence of wings and somehat larger eyes in *altus.*

Etymology.–The name is used as a noun in apposition. It is Spanish for a burrow, and refers to this habitat of the species.

Ptomaphagus (Adelops) elabra Peck
Figs. 16, 36-37, 70, 90

This species is known only from lowland caves in and near the Sierra de El Abra, Tamaulipas and San Luis Potosí. It does not have any cave modifications, but has not yet been found in epigean habitats (Peck, 1973a, 1973b).

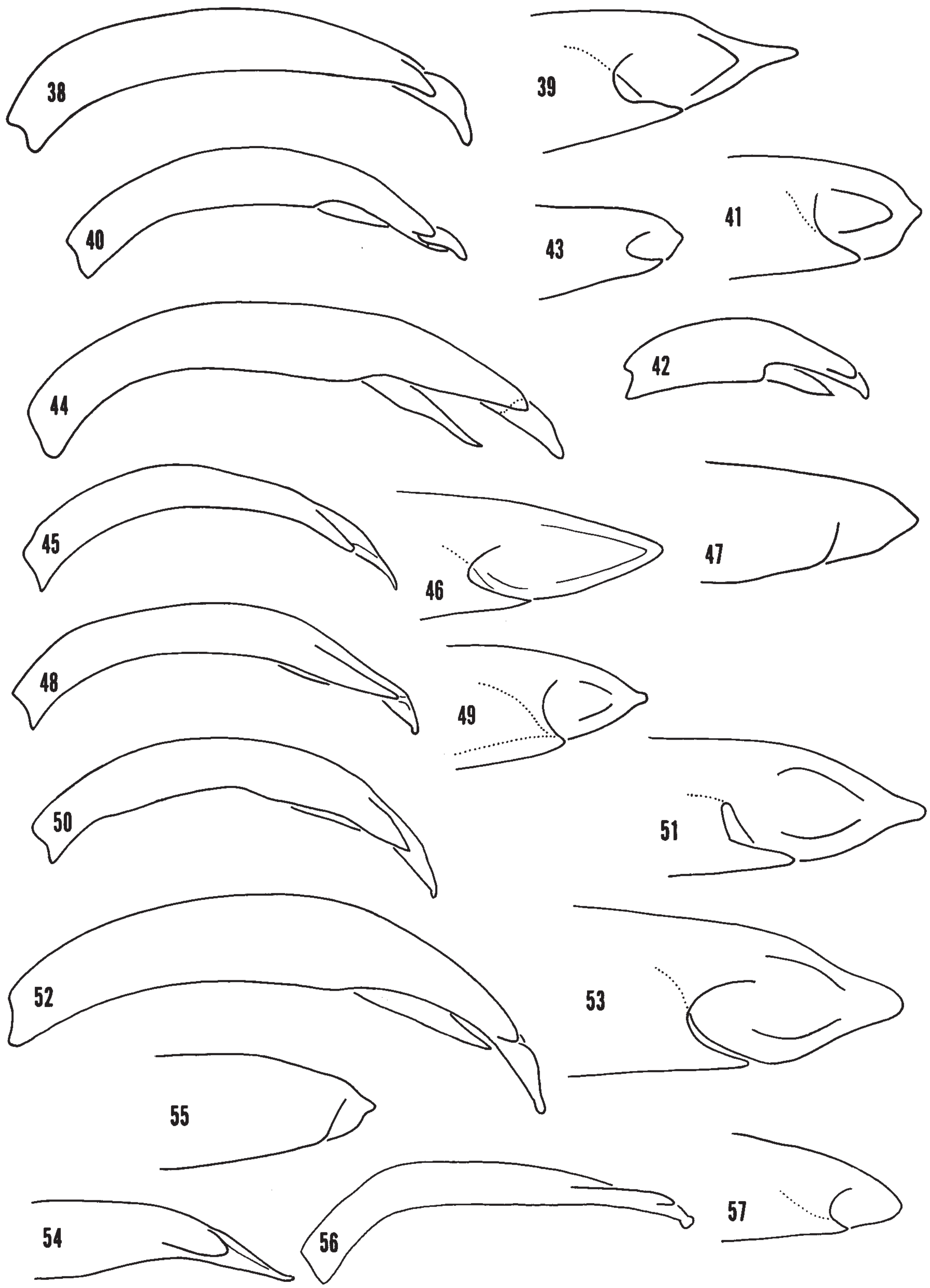
Ptomaphagus (Adelops) gypsum Peck
Figs. 38-39, 71, 94-95

This species was previously known only from one female from a gypsum cave near the village of Pablillo, 32 km S Galeana, Nuevo León.

The following collections from the same general area show that the species occurs in epigean environments. I now consider the cave specimen to be very likely a part of the epigean population because the cave is one which floods extensively and into which epigean insects may easily be washed in heavy rains. Consequently, it cannot be a troglobite.

Additional description.–The spermatheca (Figs. 94-95) is similar to that of *P. cavernicola,* as is the genital segment (Fig. 71) and aedeagus (Figs. 38-39) except that the tip of the latter is more drawn out. The eyes are reduced but pigmented, contrary to the original description. Dry material shows a tendency for the pigment to pull away from the eye facets. The elytra are fused and the wings are more reduced than in the type, being from about one fourth to one

← Figs. 20-37.–*Ptomaphagus* aedeagi: 20-21, *P. distinctus;* 22-23, *P. fisus,* Arizona; 24-25, *P. meximontanus;* 26-27, *P. nevadicus,* California; 28-29, *P. reddelli;* 30-31, *P. cavernicola,* Missouri; 32-33, *P. altus,* San Cristóbal de las Casas; 34-35, *P. conejera;* 36-37, *P. elabra,* Cueva de El Pachón.



Figs. 38-57.–*Ptomaphagus* aedeagi: 38-39, *P. gypsum;* 40-41, *P. jamesi;* 42-43, *P. laselva;* 44, *P. leo;* 45-46, *P. liquidambar;* 47, tentative variation in *P. liquidambar,* Teocelo; 48-49, *P. mckenziei;* 50-51, *P. newtoni;* 52-53, *P. oaxaca;* 54-55, tentatively associated males of *P. pruina;* 56-57, *P. spelaeus.*

half the length of the elytra. The epigean specimens are judged to be conspecific with the cave specimen, but with the noted differences. If it is later shown that there is a population in the cave, Resumidero de Pablillo, and its range of variability does not overlap with the epigean specimens, then the epigean populations will need new specific or subspecific recognition.

New records.–*Nuevo León:* 18 mi S jct Méx. 60 and 68, 8000 ft, km 29, 27-30.v.1971, A. Newton; oak and piñon pine woodland along dry stream, dung trap 229, 3 females, 4 males. NE slope Cerro Potosí, 8100 ft, 27-29.v.1971, A. Newton; chaparral and scattered *Pseudotsuga* along dry stream, dung trap 231, 1 male, 1 female. NE slope Cerro Potosí, 9200 ft, 27-29.v.1971, A. Newton; pine forest dung trap 232, 6 females.

Ptomaphagus (Adelops) jalisco, new species
Figs. 97-98

Holotype female in CNC. Type locality: Jalisco, 9.5 mi SW Autlán, 4300 ft, km 169. Type data: 12-20.ix.1971, A. Newton, tropical subdeciduous forest, squid carrion trap 423. Paratypes: 2 females and one broken male with same data. One male and one female, 10 mi SW Autlán, 4200 ft, km 170, 2-19.ix.1971, A. Newton, scrub oak forest, dung trap 422.

Diagnosis.–The species is characterized from others in western México by its elongate spermatheca, and lack of a pruinose patch on the female elytral tip.

Description.–Length 3.3 to 3.6 mm. Width 1.5 to 1.6 mm. Color brown. Form oval. Eyes normally large. Antennae short, not reaching pronotal base. Pronotum diverging to base. Fully winged. Elytral tip and sutural angle rounded in female and male, female elytral tip without pruinose patch. Spermatheca (Figs. 97-98) elongate, without pronounced curve in central part. Tentatively associated male with curved aedeagus without downward curved knob on tip; in dorsal view tapering to point.

Etymology.–The name is used as a noun in apposition and refers to the state of Jalisco, in which the species occurs.

Ptomaphagus (Adelops) jamesi Peck
Figs. 40-41, 96

The species is known only from a forest near San Cristóbal de las Casas, Chiapas (Peck, 1973a).

Ptomaphagus (Adelops) laselva, new species
Figs. 42-43, 72, 100-102

Holotype female and allotype male in CNC. Type locality: Oaxaca, 5 mi S Valle Nacional, 1600 ft. Type data: 20-30.viii.1971, A. Newton, tropical subevergreen forest, dung trap 298. Paratypes: six with same data: 7 from 6 mi S Valle Nacional, 2000 ft, 20-31.viii.1971, A. Newton, tropical subevergreen forest, carrion trap 299. 3 from 5.7 mi S Valle Nacional, 2000 ft, 13-16.viii.1973, A. Newton, tropical subevergreen forest, carrion trap 521. Veracruz, Córdoba, 4-6.viii.1969, S. & J. Peck, tropical evergreen forest, dung traps 543-544, 1 (listed by Peck (1973: 137) as first specimen in "species 4").

Diagnosis.–The species is characterized by its small size, by the shape of the spermatheca, and its habitat of low elevation forests in the southern part of the Sierra Madre Oriental.

Description.–Length 1.8 to 2.2 mm. Width 1.0 to 1.1 mm. Color medium to dark reddish brown. Form somewhat elongate oval. Eyes large. Antennae normal, reaching just to pronotum base when laid back. Pronotum with sides diverging, widest at base. Elytra widest in basal one third; elytral tips and sutural angles rounded in male and female; elytral tips not pruinose in females. Flight wings fully formed. Mesosternal carina and notch normal. Aedeagus small (Fig. 42), tip blunt with small blunt terminal tooth (Fig. 43) in dorsal view. Genital segment normal (Fig. 72). Spermatheca with unusual twist on posterior end (Figs. 100-102).

Etymology.–The name is used as a noun in apposition and is the Spanish-Mexican name for lowland evergreen tropical forests in which the species lives.

Ptomaphagus (Adelops) leo Peck
Figs. 14, 44, 73, 99

The species, characterized partly by the spermatheca (Fig. 99), is found in less-moist upland forests, often on limestone, in northeastern Mexican states (Peck, 1973a, 1973b).

New records.–*Nuevo León:* Chipinque Mesa, 4000 ft, near Monterrey, 25-26.v.1971, A. Newton; oak, pine, redbud forest, dung trap 223, 11. 16 mi W Linares, 2200 ft, 16-31.v.1971, A. Newton, *Platanus,* oak, *Populus* forest along stream in thorn forest, dung trap 225a, 1 male. Same data as preceding but 27-31.v.1971, dung trap 225c, 2 females, 1 male.

Querétaro: 2 mi E Jalpan, 2900 ft, km 184, 21-27.vi.1971, A. Newton, *Ficus* etc. along stream, dung trap 247, 1 female, 4 males. 18 mi E Landa de Matamoros, 5300 ft, 28-30.vi.1973, A. Newton, carrion trap 492, 1 female, 2 males.

San Luis Potosí: 11 mi E El Naranjo, 3200 ft, km 52, 1-18.vi.1971, A. Newton, oak-*Liquidambar* forest, dung trap 236, 5 fragmented males. 14 mi W Xilitla, 4800 ft, km 240, 20-28.vi.1971, A. Newton, *Liquidambar* forest dung trap 250, 3 males, 2 females (one female has an atypical spermatheca with the coil at the posterior end more produced and thrown over itself as in *P. liquidambar* and may be this species.)

Tamaulipas: 4 mi W Antiguo Morelos, 1200 ft, km 6, 1-3.vi.1971, A. Newton, tropical deciduous forest, dung trap 238, 1 male.

Ptomaphagus (Adelops) liquidambar, new species
Figs. 45-47, 74, 103-110, 142

Holotype female and allotype male in CNC. Type locality: Hidalgo, 6.6 mi SW Chapulhuacán, 3900 ft. Type data: 27.vi.-1.vii.1973, A. Newton, cloud forest, fish carrion trap 494. Paratypes: 18 with same data, and 7 from 4 mi SW Chapulhuacán, 3500 ft, 27.vi.-1.vii.1973, fish carrion trap 493.

Diagnosis.—The species is characterized by its medium size, the spermatheca, the tip of the female elytra which is pointed but not sharp at the sutural angle and is not pruinose along the suture at the tip, and the aedeagus which is pointed and drawn out, and habitat of cloud forest in the Sierra Madre Oriental.

Description of type and paratype specimens and variation.—Length 2.5 mm to 3.0 mm. Width 1.3 mm to 1.5 mm. Color medium to dark brown. Antennae normal, just reaching base of pronotum. Eyes variable; large to somewhat reduced in both sexes. Pronotum diverging to base. Female elytral tip (Fig. 142) weakly truncate, pointed at sutural angle to somewhat effaced point; elytral tips at angle apposed or nearly so varying to tips with distinct space separating them; not pruinose at tip along suture; more southerly populations with female elytral tips distinctly drawn out into acute angle. Male elytral tip rounded, sutural angle rounded. Spermatheca variable, typically as in Figs. 103-104, with posterior curves (arrow in Fig. 103) more or less developed and central area (arrow, Fig. 103) more or less gradually curved, may vary to shape shown in Figs. 105-110 (which would normally be variation characterizing a different species), and to like that in *P. altus* (Figs. 87-89). I am presently unable to correlate this spermathecal variation with other characters such as the more apposed or more open female elytral tips. Aedeagus thin, drawn to point in lateral view (Fig. 45), tip in dorsal view (Fig. 46) sharp, sometimes appearing as a tooth at tip (Fig. 47). Genital plates with short spiculum (Fig. 74).

Discussion.—This species and ones close to it such as *P. volcanica* and *P. pruina,* all inhabiting cloud forest and nearby forests in the Sierra Madre Oriental and southward, are fairly similar and difficult to characterize and separate. They occur in similar habitats over a similar geographical area in the Sierra Madre Oriental and southward to at least Guatemala. Variation within the topotypic population is not understood and the lack of a series of specimens from many of the sites listed for these species, plus the unknown limits of variation of the populations casts uncertainty on the reliability of the determinations as listed for these three species.

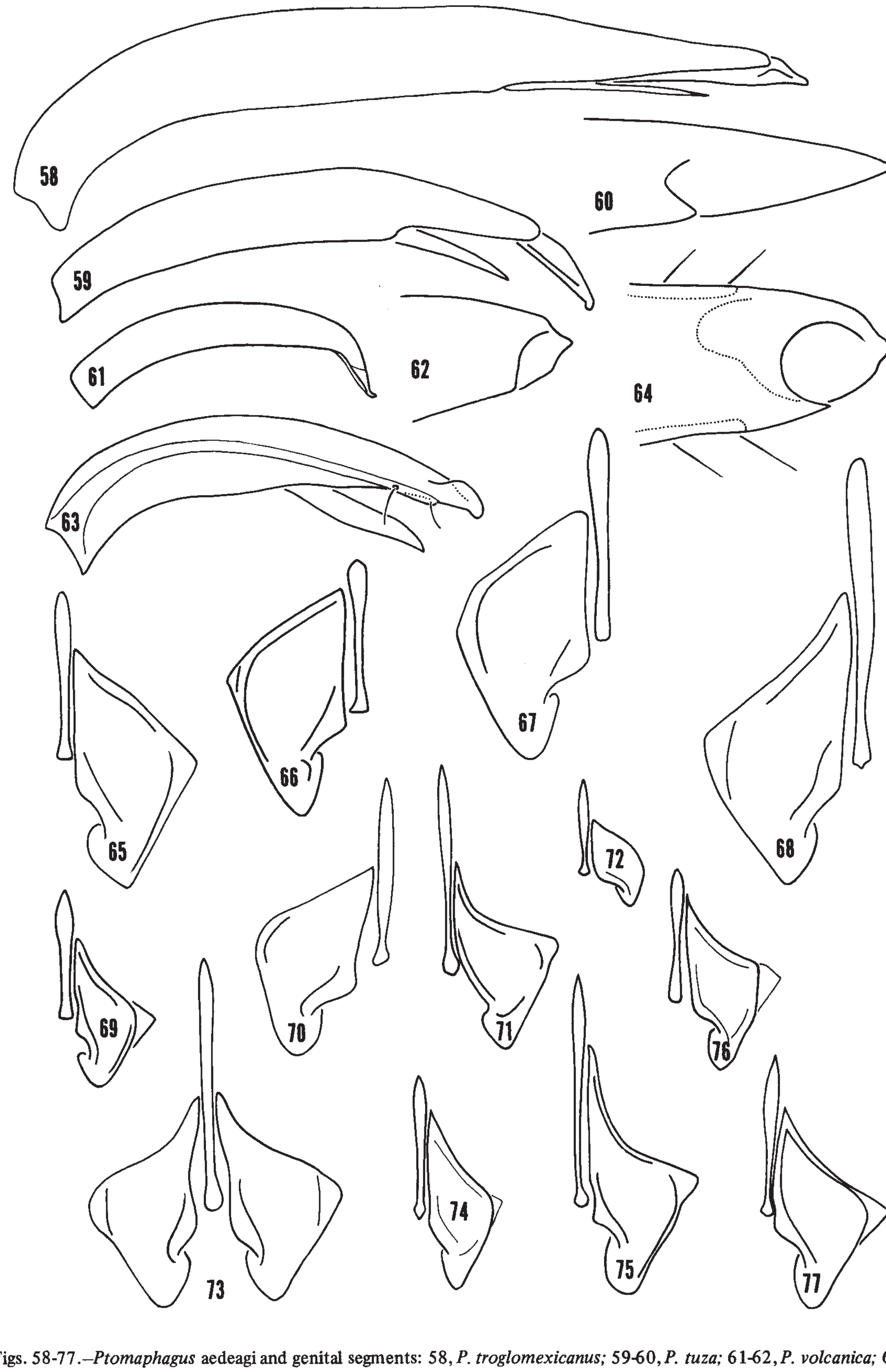
Distribution.—The species, as presently understood, is found in middle elevation cloud forest and subevergreen forests along the Sierra Madre Oriental from Querétaro through Hidalgo, Puebla, and Veracruz into Oaxaca, Chiapas, and into Guatemala.

Material seen.—*Chiapas:* 1 mi SW Rizo de Oro, 1700 ft, km 24, 20-26.viii.1971, A. Newton, tropical subdeciduous forest along stream, dung trap 366, 4. Comitán, Lagunas de Montebello, 14-17.viii.1969, S. & J. Peck, 4500 ft, tropical montane forest, 4 (listed as "species 3" in Peck, 1973a:137).

Hidalgo: 2 mi NE Chapulhuacán, 2600 ft, km 165.6, tropical subevergreen forest, 22-29.vi.1971, A. Newton, dung trap 254, 2. 4 mi SW Chapulhuacán, 3500 ft, km 155, 22-29.vi.1971, A. Newton, *Liquidambar, Nyssa* forest, dung trap 255, 8. 6+ mi SW Chapulhuacán, 3900 ft, km 151, 23-29.vi.1971, A. Newton, *Liquidambar* forest, dung trap 256, 5. 10 mi NE Rancho Viejo, 5100 ft, km 131.5, 23-29.vi.1971, A. Newton, very wet *Alnus, Cercis, Liquidambar* forest dung trap 257, 1. 12 mi SW Jacala, 6200 ft, km 79, 23-30.vi.1971, A. Newton; *Juglans,* oak, *Cercis,* pine, juniper along dry stream, dung trap 259, 6. 10 mi SW Jacala, 1-3.viii.1960, H. Howden, 1 in malt trap (listed as "species 4" in Peck, 1973a:137).

Oaxaca: Huautla, 1700 m, 9.vi.1969, K. Kowalski, in Polish Institute Systematic Zoology, 1 female. 12 mi S Valle Nacional, 3200 ft, 22-31.vii.1971, A. Newton, tropical subevergreen forest, dung trap 302, 2. Same data as preceding but carrion trap 302, 1.

Puebla: 5 mi W Huachinango, 6100 ft, 3-7.vii. 1971, A. Newton; oak, *Alnus, Podocarpus* forest along stream, dung trap 268, 1. 4 mi E Teziutlán, 5000 ft, km 59, 10-14.vii.1971, A. Newton, rich cloud forest, dung trap 281, 4. Nuevo Necaxa, 25-28. vii.1969, S. & J. Peck, 1200 m, sycamore forest, 1 in malt trap (listed as "species 5" in Peck, 1973a:137).



Figs. 58-77.–*Ptomaphagus* aedeagi and genital segments: 58, *P. troglomexicanus;* 59-60, *P. tuza;* 61-62, *P. volcanica;* 63-64, *P. (Tupania) yuvila;* 65, *P. distinctus;* 66, *P. fisus,* Arizona; 67, *P. nevadicus,* California; 68, *P. cavernicola,* Missouri; 69, *P. conejera;* 70, *P. elabra;* 71, *P. gypsum;* 72, *P. laselva;* 73, *P. leo;* 74, *P. liquidambar;* 75, *P. tuza;* 76, *P. volcanica;* 77, *P. (Tupania) yuvila.*

Querétaro: 11 mi SW Jalpan, 4000 ft, 18-19.vii. 1970, A. Newton, thorn forest with *Platanus* along stream, dung trap 130, 1.

Veracruz: 12 mi S Tlapacoyan, 3900 ft, 9-14.vii. 1971, A. Newton, cloud forest, dung trap 277, 3. 14 mi S Tlapacoyan, 4000 ft, 9-14.vii.1971, A. Newton, forest, dung trap 276, 4. 8 mi S Tlapacoyan, 2700 ft, 9-14.vii.1971, A. Newton, second growth forest with *Cecropia* and *Cyathea*, dung trap 279, 1. 4.4 mi N Huatusco, 4200 ft, 29.vii.-2.viii.1973, A. Newton, cloud forest, dung trap 514, 1. 1.2 mi S Huatusco, 1344 m, 5-8.viii.1969, S. & J. Peck, cloud forest, 5 in trap (listed as "species 4" in Peck, 1973a:137). 4 mi N Huatusco, 4100 ft, 11-16.vii.1971, A. Newton, cloud forest of *Liquidambar*, oak, *Cyathea*, etc., along stream, dung trap 288, 1 female, 1 male. 2 mi S Huatusco, 4100 ft, 11-17.vii.1971, A. Newton, cloud forest, dung trap 289, 1. Canyon SW Río Metlac (near Córdoba), 3200 ft, 28.vii.-1.viii.1973, tropical subevergreen forest, A. Newton, carrion trap 513, 1 male. 1.5 mi N Teacelo, 3700 ft, 11-16.vii.1971, A. Newton; *Platanus, Liquidambar*, tropical subevergreen forest along stream, dung trap 285, 1 female, 4 males. Cañón Río Metlac, near Fortín, 5-8.viii.1969, S. & J. Peck, tropical evergreen forest, 2 in trap (listed as "species 4" in Peck, 1973a:137).

Guatemala. *Alta Verapaz:* Patal, 5 km S Tactic, 24.27.viii.1969, S. & J. Peck, 4500 ft, cloud forest, 2 (listed as "species 3" in Peck, 1973a:137).

Etymology.–The name is used as a noun in apposition and is the genus of the Sweet Gum tree, a good indicator species for Mexican cloud forest habitats.

Ptomaphagus (Adelops) mckenziei, new species
Figs. 48-49, 112

Holotype female and allotype male in CNC. Type locality: Tamaulipas, Cueva de California, 4 mi NE Rancho Nuevo, 46 road mi SW El Barretal. Type data: 23.viii.1973, D. McKenzie, R. Jameson. Paratypes: seven with above data and one from Cueva Brinco, Conrado Castillo, 38 road mi SW El Barretal, 24-27.viii.1973, R. Jameson, D. McKenzie, F. Perez.

Diagnosis.–The species is readily distinguished by its reduced and depigmented eyes, the features of the spermatheca and genitalia, and the combination of its geographical and ecological characteristics.

Description.–Length 2.9 to 4.0 mm. Width 1.3 to 1.7 mm. Color light to dark reddish brown. Form elongate oval. Eyes reduced, the space between the antennal socket and inner eye margin 1.4 times the horizontal width of the eye; facet remnants present, pigment absent. Antennae elongated, reaching into first quarter of elytra when laid back, segment III longer than II and IV. Pronotum with sides parallel and widest in hind third, striae distinct. Elytra widest one third from base, striae oblique and distinct. Elytral tip truncate and sutural angle pointed in female and both rounded in male. Flight wings reduced to three quarters of length of elytra, venation absent. Mesosternal carina and notch medium. Aedeagus curved and tapering to point (Fig. 48), in dorsal view tip with blunt point (Fig. 49). Genital segment with long spiculum; genital plates with elongated edges enclosing spiculum. Spermatheca (Fig. 112) with long thin curved central part.

Discussion.–The species should be considered a troglobite. The shape of the spermatheca places the species in the *cavernicola* species group and very close to *P. cavernicola* itself, from which it may be directly descended.

Etymology.–The species is named for Mr. David McKenzie in recognition of his many collections of cave-inhabiting catopid beetles from México.

Ptomaphagus (Adelops) newtoni Peck
Figs. 50-51, 111, 143

This species was previously known only from 5750 to 6800 ft on the road south from Valle Nacional, Oaxaca. It is now known from 3200 to 8000 ft on this road and on the next mountain road to the south from 6200 to 9500 ft. The species is partially characterized by its spermatheca (Fig. 111), large size, rounded non-pruinose female sutural angles, and normal antennae (Peck, 1973a).

New records.–*Oaxaca:* 9 mi NE Oaxaca (km 10 on Méx. 175), 6200 ft, 9-20.viii.1973, A. Newton, in *Alnus-Salix* forest along stream, dung trap 540, 14. 14.2 mi S Ixtlán de Juárez on Méx. 175, 7600 ft, 10-18.viii.1973, A. Newton, oak woodland, dung trap 530, 1 male. Same data as preceding but fish carrion trap 530, 7 males. 15.5 mi S Ixtlán de Juárez, 7600 ft, 10-18.viii.1973, A. Newton, oak woodland dung trap 531, 6. 17.6 mi S Ixtlán de Juárez, 7900 ft, 10-19.viii.1973, A. Newton, oak woodland, dung trap 532, 2 males. Yuvila road, 1.4 mi W jct with Méx. 175 (20.5 km N on 175 of jct of 175 and 190, near Oaxaca City), 9300 ft, 9-19.vii.1973, A. Newton, mesic oak forest, carrion trap 536, 1 female. Yuvila road, 1.7 mi W jct Méx. 175, 9400 ft, 9-19. viii.1973, A. Newton, mesic oak forest, dung trap 537, 3 males. Same data as preceding but carrion trap 537, 2 males. Yuvila road, 2 mi W jct Méx. 175, 9500 ft, 8-19.viii.1973, A. Newton, oak pine forest, dung trap 538, 1 male. Yuvila road, 3.3 mi E jct Méx. 175, 9-19.viii.1973, A. Newton, oak pine forest, fish carrion trap, 535, 6. Yuvila road, 5 mi E jct Méx.

175, 7600 ft, 9-19.viii.1973, A. Newton, oak pine forest, dung trap 533, 1 male.

12 mi S Valle Nacional, 3200 ft, 22-31.vii.1971, A. Newton, tropical subevergreen forest, carrion trap 301, 7. 13 mi S Valle Nacional, 3600 ft, July 1970, tropical subevergreen forest, carrion trap 143, 2. 18 mi S Valle Nacional, 4800 ft, 23-31.vii.1971, A. Newton, tropical evergreen cloud forest, dung trap 304, 5. 19 mi S Valle Nacional, 5100 ft, 22-31.vii.1971, A. Newton, tropical evergreen forest, dung trap 305, 2 males. 21 mi S Valle Nacional, 5400 ft, 22-31.vii. 1971, A. Newton, dung trap 306, 10. 22.4 mi S Valle Nacional, 5600 ft, 23-30.vii.1971, A. Newton, forest carrion trap, 7. 24 mi S Valle Nacional, 6300 ft, 23-30.vii.1971, A. Newton, tropical evergreen cloud forest, dung trap 307, 4. 25 mi S Valle Nacional, July 1970, A. Newton, tropical evergreen cloud forest, dung trap 146, 10. Same data as preceding but carrion trap, 3. 29.7 mi S Valle Nacional, 6800 ft, 2-17.viii.1973, A. Newton, cloud forest dung trap 524, 8 females, 3 males. Same data as preceding but carrion trap 524, 22. 30 mi S Valle Nacional, 6800 ft, July 1971, A. Newton, tropical evergreen and oak cloud forest, dung trap 308, 1. 32 mi S Valle Nacional, 7000 ft, 21-24.v.1971, S. Peck, forest dung traps 727-732, 19 males, 10 females. Same data as preceding but carrion traps 733-738, 2 females, one male. Same data as preceding but Berlese sample 205, 24 liters sifted leaf litter from dense and wet mossy oak forest, soil 58°F, 2 females. 34.4 mi S Valle Nacional, 8000 ft, 11-18.viii.1973, A. Newton, pine-oak forest, carrion trap 525, 1 female.

Ptomaphagus (Adelops) oaxaca Peck
Figs. 52-53, 115, 147

The species was previously known from 5750 to 8000 ft elevation on the Valle Nacional road in Oaxaca (Peck, 1973a:130). The following records extend the range down to 3200 ft on this road, and up to 9500 ft in the next mountain to the south on the Yuvila road.

New records.—*Oaxaca:* 13 mi S Valle Nacional, 3600 ft, July 1970, A. Newton, tropical subevergreen forest, carrion trap 143, 2. Same data as preceding but dung trap 143, 1 female. 15 mi S Valle Nacional, 4300 ft, 12-31.vii.1971, A. Newton, tropical evergreen cloud forest, dung trap 303, 1 female. 19 mi S Valle Nacional, 5100 ft, 11-31.vii.1971, tropical evergreen cloud forest, dung trap 305, 1 male. 21 mi S Valle Nacional, 5400 ft, 22-31.vii.1971, A. Newton, cloud forest, dung trap 306, 12. 22.4 mi S Valle Nacional, 5600 ft, 23-30.vii.1971, A. Newton, forest carrion trap, 2. 24 mi S Valle Nacional, 6300 ft, 13-30.vii.1971, A. Newton, tropical evergreen cloud forest, dung trap 307, 11. 25 mi S Valle Nacional, 6350 ft, July 1970, tropical evergreen cloud forest, dung trap 146, 10. Same data as preceding but carrion trap 146, 5. 29.7 mi S Valle Nacional, 6800 ft, 2-17. viii.1973, A. Newton, cloud forest dung trap 524, 2 females, 5 males. Same data as preceding but fish carrion trap 524, 9. 34.4 mi S Valle Nacional, 8000 ft, 11-18.viii.1973, A. Newton, oak-pine forest, carrion trap 525, 3 females, 1 male. 20.5 mi N Oaxaca, on Yuvila road, 2 mi W of its jct with Méx. 175, 9500 ft, 8-19.viii.1973, A. Newton, oak-pine forest, dung trap 538, 1 male.

Ptomaphagus (Adelops) pruina, new species
Figs. 54-55, 113-114, 144

Holotype female in CNC. Type locality: Hidalgo, 1 mi S Santa Monica, 6100 ft. Type data: 7-12.vii. 1973, A. Newton, *Liquidambar* forest, dung trap 505. Paratypes: 1 female with same data.

Diagnosis.—The species is characterized by its spermatheca and sharp and pruinose female elytral tips, and habitat of cloud forest.

Description of holotype.—Length 3.2 mm. Width 1.6 mm. Color dark brown. Antennae not reaching base of pronotum. Eyes somewhat reduced, a small space present between their anterior margin and antennal socket. Pronotum diverging to base, narrower than elytra. Elytra widest in anterior third; elytral tips (Fig. 144) weakly obliquely truncate; sutural angles almost a sharp angle, slightly less than a right angle; pruinose patch along suture; tips not apposed at suture. Spermatheca (Figs. 113-114) approaching that of *P. altus* (Figs. 87-89). Tentatively associated males with bluntly tipped aedeagus with protruding tooth (Fig. 55), in side view tip downcurved (Fig. 54) sometimes with slightly upturned apex; elytral tips rounded.

Discussion.—This species occurs in cloud forest with *P. liquidambar* and perhaps *P. volcanica.* They are a difficult set of species to distinguish and may be a complex of species. The small series makes association of males and females difficult as well as an understanding of variation. The spermatheca approaches that of *P. altus* in nearby but higher elevation more open habitats, but this species has a pruinose female elytral tip which is distinctly rounded at the suture and has smaller eyes.

Material seen and distribution.—*Hidalgo:* 25 mi N Tlanchinol, 5200 ft, 6-11.vii.1973, A. Newton, cloud forest, dung trap 497, 2 females, 1 fragmented male. 2.8 mi N Tlanchinol, 5200 ft, A. Newton, 6-11.vii. 1973, A. Newton, cloud forest, dung trap 501, 1 male. 12 mi SW Jacala, 6200 ft, 23-30.vi.1971, A. Newton; *Juglans*, oaks, *Cercis*, pine, juniper along dry stream, dung trap 259, 2 females. 4 mi E Acaxochitlán, 6900 ft (3 mi in on road to Naupan), 2-7.vii. 1971, A. Newton, oak-pine forest, dung trap 267, 1 female.

San Luis Potosí: 15 mi W El Naranjo, 3600 ft, km 58.5, 1-18.vi.1971, A. Newton, oak woodland, dung trap 237, 1 female, 2 fragmented males.

Veracruz: 6 mi NE Catemaco, 1700 ft, 2-5.viii. 1971, A. Newton, rain forest, dung trap 321, 1 female.

Guatemala. *Alta Verapaz:* Patal, 5 km S Tactic, 4500 ft, 24-27.viii.1969, S. & J. Peck, cloud forest traps 580-583 (listed as "species 2" in Peck, 1973a: 137).

Etymology.–The name, used as a noun in apposition, refers to the pruinose patch along the suture at the elytral tip.

Ptomaphagus (Adelops) quercus, new species
Figs. 116-117

Holotype female and allotype male in SBP. Type locality: Oaxaca, 20 km N Oaxaca City (at crest of highway 175, 2 mi W of 175 on Yuvila road), 9500 ft. Type data: 7.vi.1971, S. Peck, Berlese 210, 9 liters of sifted oak litter. Paratypes: one male with same data.

Diagnosis.–The small eyes, reduced wings, pronotum wider than elytra, spermatheca, and locality in the Sierra Madre de Oaxaca serve to distinguish this species from others.

Description.–Length, 2.3 to 2.9 mm. Width 1.2 to 1.4 mm. Color brown. Form oval. Antennae elongated, reaching base of pronotum. Eyes coarsely faceted; reduced, their horizontal diameter equal to space between their anterior margin and antennal socket. Pronotum wider than elytra, widest at middle, sides converging behind, hind angles pointed. Elytra fused, tips weakly truncate and sutural angle weakly pointed in both sexes. Wings reduced to small remnant. Aedeagus normally curved and tip normal in side view, tip tapering in dorsal view. Genital plates elongate, spiculum long. Spermatheca (Figs. 116-117) thin.

Discussion.–Of other small-eyed litter species, this is close to *P. meximontanus* in pronotum shape but more like *P. conejera* in spermathecal shape.

Etymology.–The name is used as a noun in apposition and refers to the oak litter in which the species was captured.

Ptomaphagus (Adelops) spelaeus (Bilimek)
Figs. 56-57, 121-123, 145

The species was previously known only from three caves in Guerrero (Peck, 1971, 1973a, 1973b). The following epigean records greatly extend the known range of this species characterized by its spermatheca (Figs. 121-123), large eyes, and pruinose female elytral tips at the sutural angle.

New records.–*Guerrero:* 7.5 mi W Mazatlán, 7000 ft (microondas road), 30.viii-5.ix.1971, A. Newton; oak, madroño, pine woodland, malt trap 385, 1. Same as preceding but dung trap 385, 16. Same as preceding but 7100 ft, oak, madroño, *Alnus* woodland, dung trap 386, 10.

Jalisco: 6 mi W Atenquique, 5500 ft, 10-18.ix. 1971, A. Newton; pine, oak woodland, squid carrion trap 412, 3. Same as preceding but malt trap 412, 1. 10 mi W Atenquique, 6700 ft, 10-18.ix.1971, A. Newton, oak woodland, dung trap 409, 1 male. 9.5 mi SW Autlán, 4300 ft, km 169, 12-20.ix.1971, A. Newton; tropical sub-deciduous forest near oak forest, dung trap 423, 1. Same data as preceding but carrion trap 423, 4. 12 mi SW Cocula, 5800 ft, 14-20.ix.1971, A. Newton, scrub oak forest, carrion trap 428, 2. Same as preceding but dung trap 428, 2.

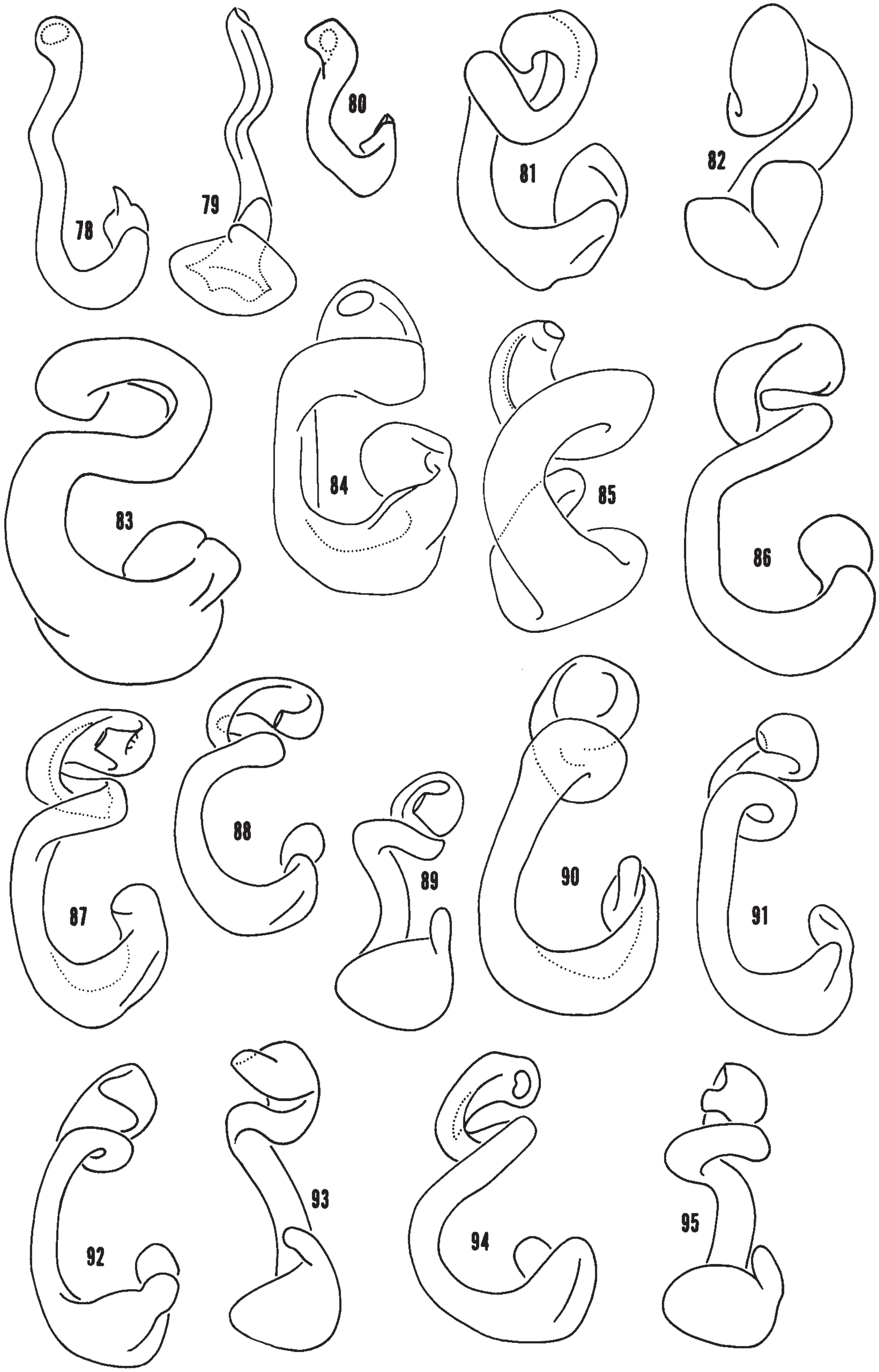
Oaxaca: 20 mi S Juchatengo, 6000 ft, 28-30.v. 1971, S. Peck, forest carrion traps 750-753, 3. 3.5 mi S Suchixtepec, 8000 ft, 2-4.vi.1971, S. Peck, forest dung traps 761-764, 1. 12 mi S Sola de Vega, 6500 ft, 27-31.v.1971, S. Peck, oak woodland traps 742, 4.

Variation.–The illustrated spermatheca from Juchatengo, Oaxaca (Fig. 122), is more thick than previously illustrated (Fig. 121). The spermathecae from Sola de Vega and Mazatlán (Guerrero) are more typically slender and drawn out. These two populations have aedeagi with the terminal bump pronounced in lateral view.

Life cycle data are presented by Sbordoni and Cobolli-Sbordoni (1973).

Ptomaphagus (Adelops) szymczakowskii, new species
Figs. 118-120

Holotype female and allotype male in SBP. Type locality: Veracruz, 28.6 mi W Ciudad Mendoza, on Mexican highway 150D, 8500 ft. Type data: 27.vii-3. viii.1973, A. Newton; pine, oak, madroño, *Alnus* forest, squid carrion trap 517. Paratypes: one male with above data. Two females with above data except 13.8 mi W Ciudad Mendoza, 7300 ft; pine, oak, *Alnus* forest, carrion trap 516. Two females and four males; Oaxaca, Huautla, 1700 m, 9.vi.1969, forest litter,



Figs. 78-95.–*Ptomaphagus (Adelops)* spermathecae: 78-79, *P. distinctus;* 80, *P. fisus,* México, see Peck, 1973a, for variation; 81-82, *P. meximontanus;* 83, *P. nevadicus,* California; 84-85, *P. reddelli;* 86, *P. cavernicola,* Arkansas; 87, *P. altus,* San Cristóbal de las Casas; 88-89, *P. altus,* Tenancingo; 90, *P. elabra;* 91, *P. colima;* 92-93, *P. conejera;* 94-95, *P. gypsum.*

K. Kowalski, in Polish Institute Systematic Zoology (these 6 specimens were listed as "species 6" in Peck, 1973a: 137).

Diagnosis.—The large size and pointed female elytral apices make this species closest to *P. oaxaca.* The spermatheca, pruinose female elytral tips, and subequal antennal segments II and III separate this species from *P. oaxaca.*

Description.—Length 3.4 to 3.8 mm. Width 1.5 to 1.7 mm. Color medium to dark brown. Antennae normal, slightly exceeding pronotum; segments II and III equal or nearly so. Eyes somewhat reduced; horizontal diameter across eye more than twice the width of the eye-antennal socket space. Pronotum gradually widening in posterior half to base; narrower than elytra. Elytral tips and sutural angles rounded in males, tips truncate and angles sharp and drawn out in females, pruinose at suture at tip in female. Spermatheca thin and curved (Figs. 118-120), with variation between the two known populations. Aedeagus drawn out to thin point in dorsal and lateral view.

Etymology.—The species is named for Dr. Waclaw Szymczakowski of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, Cracow, in recognition of his research on Neotropical Catopinae.

Ptomaphagus (Adelops) tabascensis Sbordoni
Figs. 124-125

This species was previously known only from Coconá Cave, near Teapa, Tabasco (Sbordoni, 1973). The following records show that it also lives in forests in Campeche, and caves in Campeche, Quintana Roo, and Yucatán. This is undoubtedly the species of *Ptomaphagus* recorded from Spukil Cave and Sabacha Cave, Yucatán, by Pearse (1938).

New records.—*Campeche:* 87 mi E Escárcega, km 143.5, 800 ft, 8-14.viii.1971, A. Newton, tropical subevergreen forest, dung trap 337, 1 female, 3 males. Grutas de Xtacumbilxunam, 13.vi.1973, D. McKenzie, M. McKenzie, M. Butterwick, 7. Grutas de Xtacumbilxunam, 29-30.vii.1973, D. Denson, M. Kawakatsu, R. W., J. W. Jr., S. A., and S. R. Mitchell, 4. Grutas de San Antonio, 10 km ENE Bolonchenticul, 3.xi. 1974, J. Reddell, D. McKenzie, S. Wiley, 4 males, 2 females. Same locality and collectors as preceding, 23-24.xi.1974, 3 males, 1 female.

Quintana Roo: Cenote Aká Chen, Cobá, 30.vi. 1975, J. Reddell, S. Wiley, A. Grubbs, 2 males from vampire guano (females are needed to verify this record).

Tabasco: Grutas del Coconá, 3 km E Teapa, 28.ix. 1974, J. Reddell, 15; 15.vi.1975, J. Reddell, A. Grubbs, S. Wiley, 1 female.

Yucatán: Actún Xpukil, 18-19.iii.1973, J. Reddell, S. Murphy, D. & M. McKenzie, M. Butterwick, 12. Grutas de (or Actún) Loltún, 7 km SSW Oxkutzcab, 1.i.1972, D. McKenzie, 3 males, 1 female (this last collection was previously tentatively recorded as *P. barbarae* Peck (Peck, 1973b), which it is not); 25-26. vi.1975, J. Reddell, A. Grubbs, D. McKenzie, S. Wiley, 15 from bat guano. Actún Chen, Santa Rita, 3 km W Kuiuck, 13.x.1974, J. Reddell, D. McKenzie, S. Wiley, on vampire bat guano at pool edges, 20. Actún Sabacá, 6 km S Tekax, 4.xii.1974, J. Reddell, D. McKenzie, S. Wiley, J. Andrews, R. Mitchell, on vampire bat guano and at guano pool edges, 9.

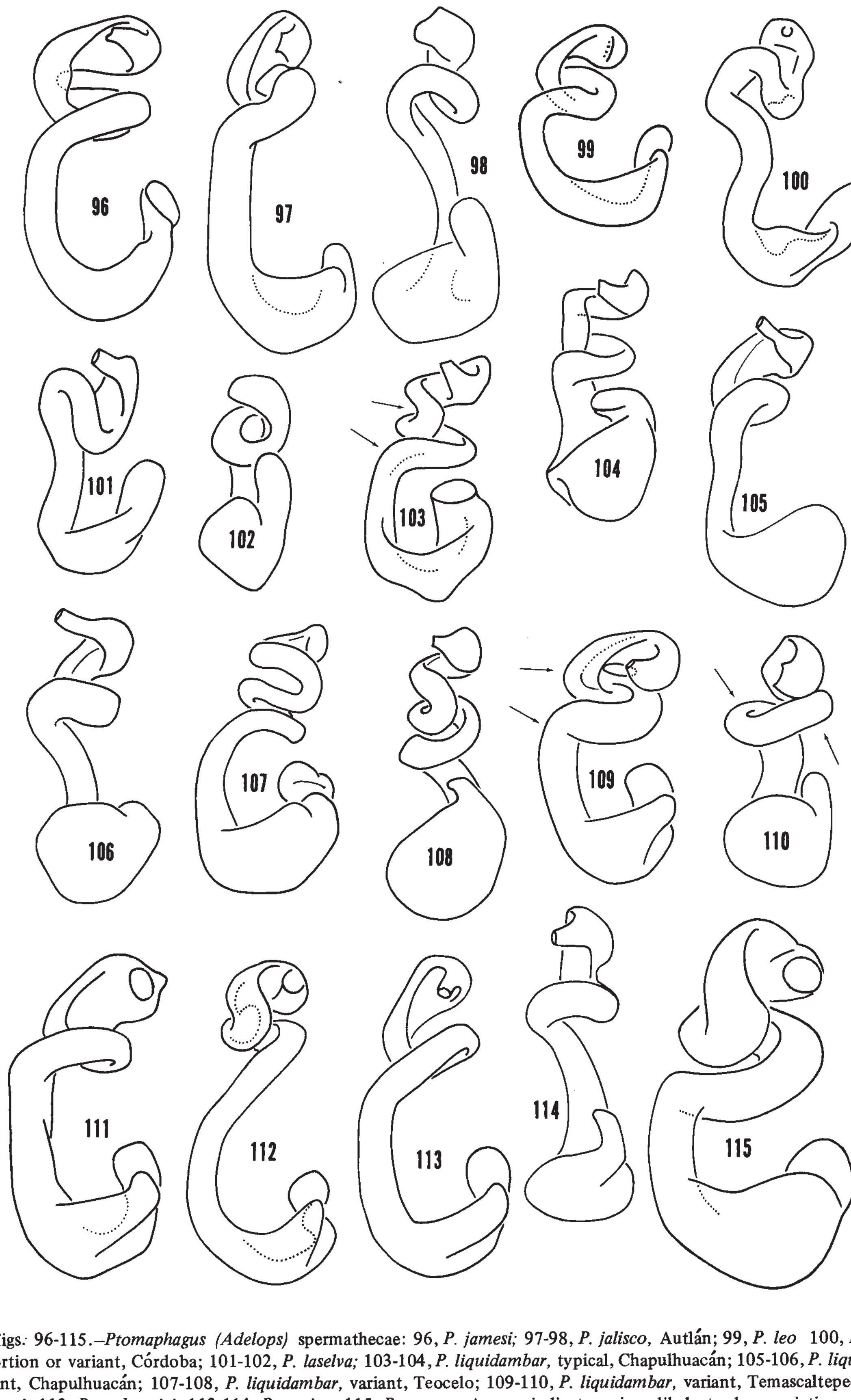
Discussion.—The Yucatán populations have several notable but slight differences in the spermathecae (Figs. 124-125), perhaps of subspecific significance, when compared to the type locality population. They have a less expanded crest with less of a groove on the posterior end, lack the low bulge on the inner surface of the central part, and are with the orifice opening less to the side. These differences suggest genetic separation of the populations though the epigean collection shows that it is not because of an inability to inhabit the more moist epigean forests of Campeche.

Ptomaphagus (Adelops) tierrabaja, new species
Figs. 126-127

Holotype female and allotype male in CNC. Type locality: Chiapas, 7 mi S Palenque, 1100 ft. Type data: 7-15.viii.1971, A. Newton, rainforest dung trap 332. Paratypes: same as preceding but dung trap 331, 1 female. 4 mi S Palenque, 700 ft, 7-15.viii.1971, A. Newton, rainforest dung trap 327, 1 male. Same as preceding but 6 mi S Palenque, dung trap 328, 2 females. Same as preceding but 4 mi S Palenque, 600 ft, dung trap 326, 1 female. 15 mi NW Ocozocoautla, 2800 ft, 19-25.viii.1971, A. Newton, rainforest dung trap 360, 1 male, 1 female.

Diagnosis.—The small size, unusually broad spermatheca, and the lowland rainforest habitat (from Chiapas to Belize) distinguish this species.

Description.—Length 2.0 to 2.3 mm. Width 1.0 to 1.1 mm. Shape oval. Color light to medium brown. Eyes normally large. Antennae short, not reaching pronotal base. Pronotum with sides diverging to base but almost parallel in hind third; slightly narrower than elytra. Elytral tips and sutural angles rounded in both sexes, tip not pruinose. Flight wings fully formed. Aedeagus pointed in lateral view, blunt in dorsal view at tip. Spermatheca (Figs. 126-127) with broadly expanded anterior portion, wide central por-



Figs. 96-115.–*Ptomaphagus (Adelops)* spermathecae: 96, *P. jamesi;* 97-98, *P. jalisco,* Autlán; 99, *P. leo* 100, *P. laselva,* distortion or variant, Córdoba; 101-102, *P. laselva;* 103-104, *P. liquidambar,* typical, Chapulhuacán; 105-106, *P. liquidambar,* variant, Chapulhuacán; 107-108, *P. liquidambar,* variant, Teocelo; 109-110, *P. liquidambar,* variant, Temascaltepec; 111, *P. newtoni;* 112, *P. mckenziei;* 113-114, *P. pruina;* 115, *P. oaxaca.* Arrows indicate regions likely to show variation within and between populations.

tion, and broad curl at posterior end.

Etymology.–The name is used as a noun in apposition and is Spanish for lowland, referring to the lowland rainforests which the species inhabits.

Additional material.–*Belize (formerly British Honduras):* Beaver Dam, 39 mi W Belize City, 6-12.viii. 1972, S. & J. Peck, swamp forest dung traps, 1 female, 1 male. Belmopan, 8-14.viii.1972, S. & J. Peck, streamside lowland seasonal forest, dung traps, 1 male.

Note on variation.–The spermatheca of the one Belize female has a much more pronounced bulge at the region indicated by the arrow in Fig. 126.

Ptomaphagus (Adelops) troglomexicanus Peck
Figs. 19, 58, 130

Life cycle data on the species, known only from upper elevation caves in the Sierra de Guatemala, Tamaulipas, are presented by Sbordoni and Cobolli-Sbordoni (1973). These authors note that the type locality cave does not have a bat colony (1973:340) but I took all my specimens in 1969 here from an 8 m wide area heavily sprinkled with guano in the large terminal room of the cave. This species is not very close phylogenetically to *P. spelaeus,* contrary to Sbordoni and Cobolli-Sbordoni (1973:340), and again contrary to these authors it is unlikely that the ancestors of these two beetles entered caves at the same time. *P. troglomexicanus* is in an older group of species which shows some morphological preadaptation to caves as well as being associated with montane cloud forests in cave areas (Peck, 1973a) while *P. spelaeus* shows little or no specialization and is widespread in what must be considered temperate climates, in more dry mountain forests as well as caves of southwestern México (data given elsewhere in this paper). Lastly, life cycle data for these two species are difficult to compare and interpret as presented by Sbordoni and Cobolli-Sbordoni because *P. troglomexicanus* was raised at 14°C and *P. spelaeus* at 22°C. It is not reasonable, based on the effects of temperatures on insect metabolism, and the Q_{10} law of metabolic rates, that the duration of life cycle stages were not appreciably affected. A Q_{10} calculation shows that *P. troglomexicanus* raised at the temperature experienced by *P. spelaeus* (22°C) might have a pre-imaginal development time of about 42 days. This is a more important figure for comparing with the *P. spelaeus* development time of 28 days than the 73 day pre-imaginal development time of *P. troglomexicanus* at 14°C.

New record.–*Tamaulipas:* Cueva de las Perlas, 13.5 km NNW Gómez Farías, 16.v.1971, J. Reddell, W. Elliott, R. Mitchell, S. Wiley, 2 females.

Ptomaphagus (Adelops) tuza, new species
Figs. 59-60, 75, 128-129

Holotype female and allotype male in CNC. Type locality: Oaxaca, 3 mi N Suchixtepec, 9600 ft. Type data: 4-6.vi.1971, S. Peck, in pocket gopher burrows in forest remnant. Paratypes: 4 males and 2 females with same data, and 2 males and 3 females from Oaxaca, 20 mi S Juchatengo, 6000 ft, 28-30.v.1971, S. Peck, pocket gopher burrows in scrub forest; one female with same Juchatengo data but from forest carrion traps 750-753.

Diagnosis.–The species is distinguished by the combination of the features of the spermatheca, the very narrow and drawn-out aedeagus tip, large eyes, long antennae, fully developed wings, and habitat of forests and pocket gopher burrows in the Sierra Madre del Sur of Oaxaca.

Description.–Length 3.1 to 4.0 mm. Width 1.4 to 1.9 mm. Color dark brown. Form elongate oval. Eyes large, their horizontal diameter twice the space between anterior eye margin and antennal socket. Antennae elongated, reaching beyond pronotum when laid back; segment III longer than II and IV. Pronotum with sides diverging, widest at base. Elytra widest one third from base; striae oblique; tip rounded in male and female; sutural angle sharp in female and rounded in male. Flight wings fully formed. Mesosternal carina low, notch pronounced. Aedeagus curved (Fig. 59), very narrow and drawn out at tip in dorsal view (Fig. 60). Genital segment with long thin spiculum, genital plates drawn out along spiculum (Fig. 75). Spermatheca (Figs. 128-129) with thin curved central part, anterior part with pronounced notch on upper side.

Etymology.–The specific name is used as a noun in apposition and is the common name in México for pocket gophers.

Ptomaphagus (Adelops) volcanica, new species
Figs. 61-62, 76, 131-132, 146

Holotype female in CNC. Type locality: Veracruz, 20.6 mi W Ciudad Mendoza on Méx. road 150D, 8500 ft. Type data: 27.vii.-3.viii.1973, A. Newton; pine, oak, madroño, *Alnus* forest, two squid carrion traps 517. Paratypes: 6 with same data; 8 with same data but from 13.8 mi W Ciudad Mendoza on Méx. 150D; pine, oak, *Alnus* forest at 7500 ft.

Diagnosis.–The spermatheca, blunt aedeagus, and pointed non-pruinose female elytral tips characterize the species.

Figs. 116-132.–*Ptomaphagus (Adelops)* spermathecae: 116-117, *P. quercus,* 118-119, *P. szymczakowski,* Ciudad Mendoza; 120, *P. szymczakowski,* Huautla; 121, *P. spelaeus,* Gruta de Acuitlapán; 122-123, *P. spelaeus,* Juchatengo; 124-125, *P. tabascensis,* Grutas del Coconá, after Sbordoni, 1973; 126-127, *P. tierrabaja;* 128-129, *P. tuza,* Suchixtepec; 130, *P. troglomexicanus;* 131-132, *P. volcanica.*

Description of type population.—Length 2.7 mm to 2.9 mm. Width 1.3 mm to 1.4 mm. Color brown. Eyes somewhat reduced, conspicuous space between their anterior margin and antennal socket. Antennae slightly exceeding pronotum when laid back. Pronotum slightly diverging in posterior third, widest at base. Male elytral tips rounded; female tips weakly obliquely truncate, sutural angle pointed (Fig. 146). Spermatheca as in Figs. 131-132, with region indicated by arrow more thrown over in some. Aedeagus with blunt tip in dorsal view (Fig. 61), tip down curved in lateral view (Fig. 62). Genital segment normal (Fig. 76).

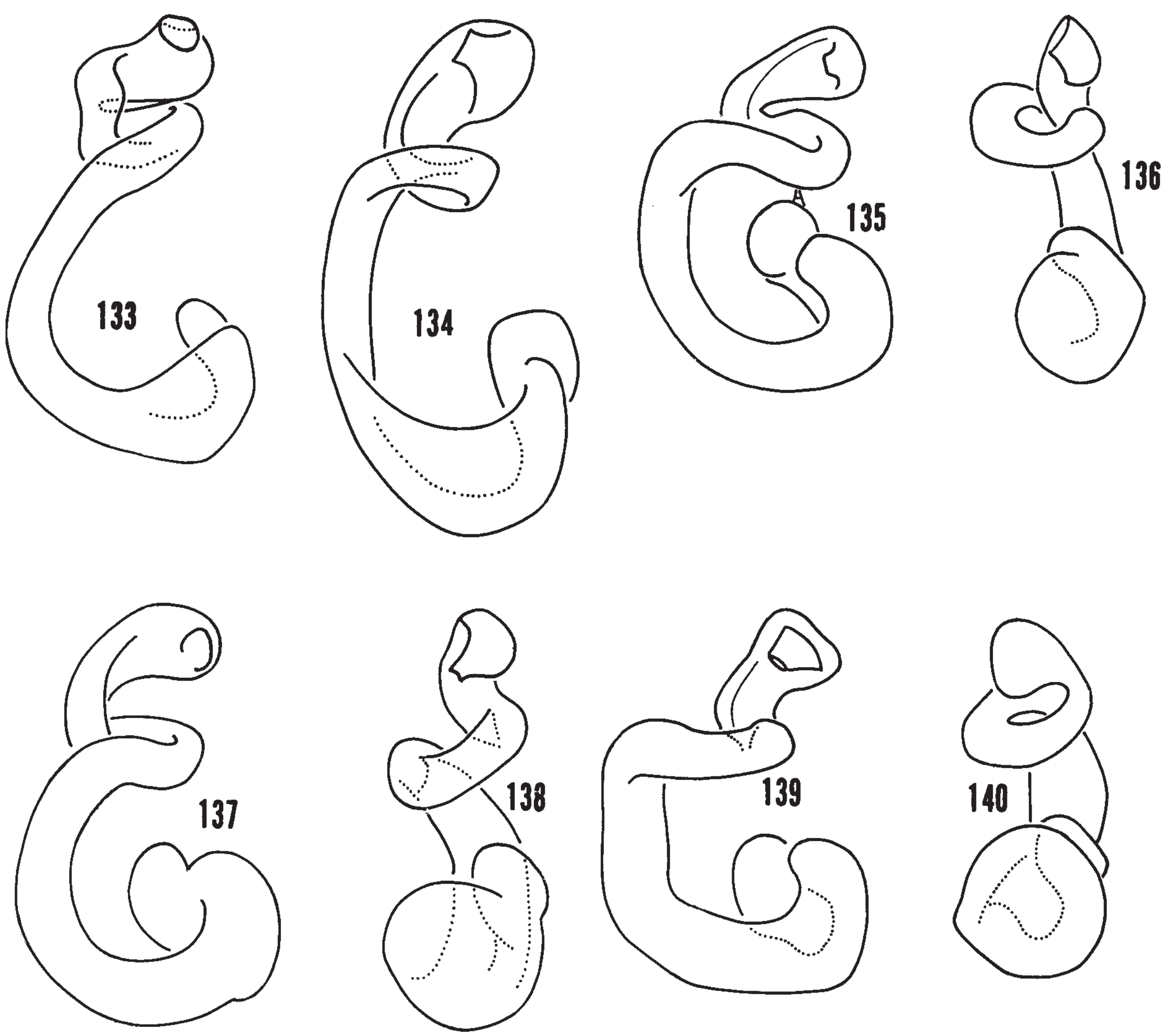
Discussion.—This species occurs in habitats close to, and perhaps identical with, those of *P. pruina* and *P. liquidambar.* It is difficult to separate these three species, which may be a complex, because of incompletely understood variation.

Etymology.—The name is used as a noun in apposition and refers to the Sierra Volcanica Transversal, in whose forests the species lives.

Subgenus *Tupania* Szymczakowski

Subgenus *Tupania* Szymczakowski, 1961:146. Type species *Ptomaphagus forticornis* Matthews, 1888.

The only described species in the subgenus besides the type is *Ptomaphagus (Tupania) flabellatus* Szymczakowski from southern Brazil (Figs. 149-150).



Figs. 133-140.—*Ptomaphagus (Tupania)* spermathecae: 133, *P. argenticornis;* 134, *P. forticornis,* holotype female; 135-136, *P. delsur;* 137-138, *P. oriental;* 139-140, *P. yuvila.*

Ptomaphagus (Tupania) forticornis Matthews
Figs. 234, 151-152

Ptomaphagus forticornis Matthews, 1888:100. Type locality: México, Córdoba; no other data (type in British Museum, Natural History, seen).

The species, previously known only from the type specimen, a female, may be distinguished from the following new species only by the shape of the spermatheca (here illustrated for the first time, Fig. 134), rounded female elytral tips and sutural angles, and antennae without anteriorly pectinate elongations (Figs. 151-152), and antennae with last five segments with distinct silvery appearance from dense vestiture of fine setae.

The following specimens are tentatively assigned to this species, primarily on the basis of the last mentioned character, which was not noted on the type but should be looked for in the future.

New records.–*Hidalgo:* 1 mi S Santa Monica, 6000 ft, 7-12.vii.1973, A. Newton, *Liquidambar* forest, dung trap 504, 1 female. 6.5 mi S Tianguistengo, 6800 ft, 7-12.vii.1973, oak-pine forest, dung trap 502, 1 female.

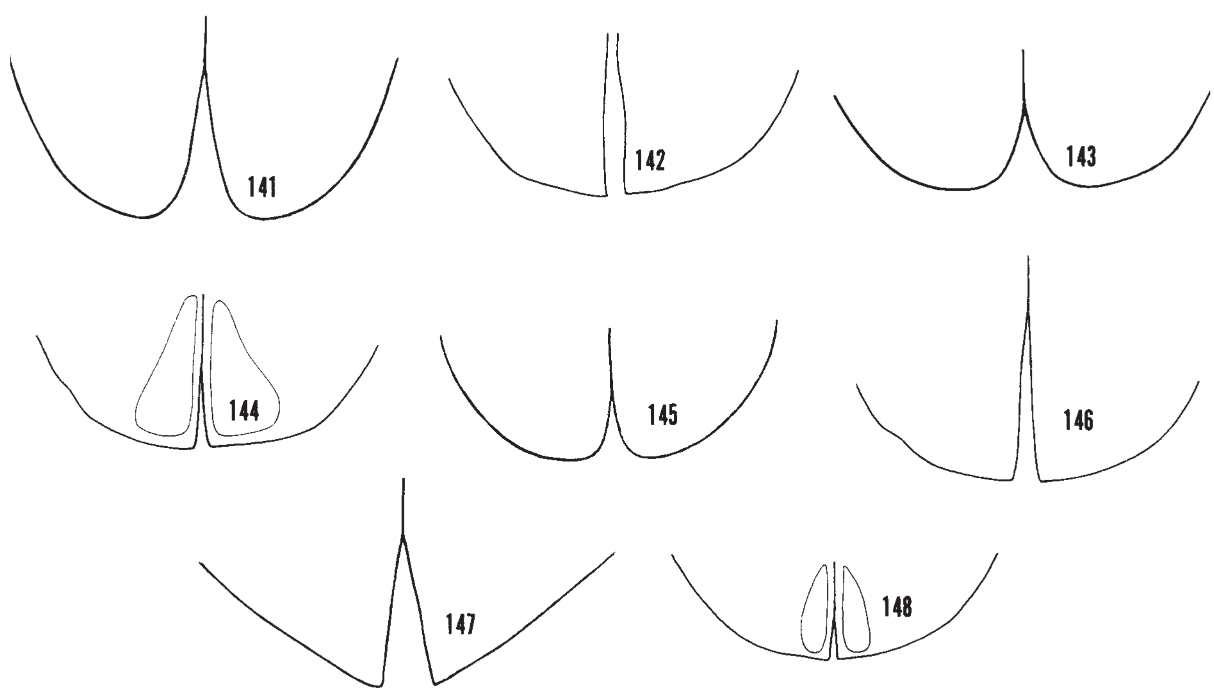
Puebla: 5 mi W Huachinango, 6000 ft, 3-7.vii. 1971, A. Newton; oak, *Alnus, Podocarpus, Sauronia,* pine forest near stream, dung trap 269, 1 male. Same data as preceding but 6100 ft, dung trap 268, 1 female.

Ptomaphagus (Tupania) argenticornis, new species
Figs. 133, 148, 153

Holotype female in SBP. Type locality: Oaxaca, 23 mi S Valle Nacional, W slope, 5750 ft. Type data: 9-12.viii.1970, A. Newton, cloud forest, human dung trap no. 3. This specimen was referred to as "species 1" in Peck (1973a:137).

Diagnosis.–The species is distinguished by the silvery appearance of the last five antennal club segments, which are not otherwise modified (Fig. 153), the almost obliquely truncate elytral tips; the almost rectangular sutural angle and nearly apposed elytra at the angle; pruinose patch at the elytral tip; and spermatheca.

Description.–Based on the female holotype, the only known specimen. Length 2.9 mm. Width 1.3 mm. Form elongate oval. Color: pronotum and anterior two-thirds of elytra light brown, head and elytral posterior third dark brown (perhaps a subteneral condition). Eyes normally large. Antennae not quite reaching base of pronotum; with club beginning in segment V in anterior view (Fig. 153); segment II longer than III; club with last five segments with dis-



Figs. 141-148:–*Ptomaphagus* female elytral tips: 141, *P. altus;* 142, *P. liquidambar,* Chapulhuacán; 143, *P. newtoni*; 144, *P. pruina;* 145, *P. spelaeus;* 146, *P. volcanica;* 147, *P. oaxaca;* 148, *P. argenticornis.* Pruinose regions indicated in Figs. 144 and 148.

tinct silvery appearance on anterior surface produced by dense and fine setae; club segments normal, not anteriorly elongated. Pronotum widest at base; sides almost parallel in basal third; wider than elytra. Elytra (Fig. 148) with almost obliquely truncate elytral tips; sutural angle almost rectangular and angle itself just perceptibly rounded; elytra at suture not quite apposed at tip; pruinose area along suture. Spermatheca (Fig. 133) with expanded anterior, thin curved central, and contorted posterior parts.

Discussion.–This species is closest to the subgenus *Adelops* in its lack of antennal club segment projections, and in its spermatheca.

Etymology.–The name is used as a noun in apposition and is a combination of the Latin words for silver and antenna, referring to the silvery appearing antennal club.

Ptomaphagus (Tupania) yuvila, new species
Figs. 63-64, 77, 139-140, 154-155

Holotype female and allotype male in CNC. Type locality: Oaxaca, 4.0 mi W of Méx. 175 on Yuvila road (this road is 20.5 km N (on 175) of the jct of 175 and 190, near Oaxaca City), 9300 ft. Type data: 8-19.viii.1973, A. Newton, pine-oak forest, fish carrion trap 539. Paratypes: 39 with same data. One from 20 km N Oaxaca, Yuvila road, 9500 ft, 1-7.vi. 1971, S. Peck, forest carrion traps 756-758; one with same data but forest dung traps 759-761. One from 24 mi S Valle Nacional, 6300 ft, 23-30.vii.1971, A. Newton, tropical evergreen cloud forest, dung trap 307. Seven from 10.4 mi N Ixtlán de Juárez, 9100 ft, 10-18.viii.1973, A. Newton, oak-pine forest, carrion trap 528.

Diagnosis.–The species can be distinguished from other *Tupania* only by the shape of the spermatheca.

Description.–Length 2.9 to 3.4 mm. Width 1.4 to 1.7 mm. Color brown. Form somewhat compressed oval. Antennae (Figs. 154-155) reaching to base of pronotum; club beginning with segment IV; segments V to X conspicuously drawn out in anterior distal edge, giving a saw-toothed appearance to the club; anterior surface of segments VII to XI appearing silvery from dense fine pubescence. Pronotum widest at base, hind angles pointed; striae distinct. Elytral striae oblique; elytral tips somewhat truncate and sutural angle rounded in female, both rounded in male. First three protarsi broadly, conspicuously dilated. Male genital segment normal (Fig. 77), aedeagus (Fig. 63) curved with blunt tip; in dorsal view (Fig. 64) blunt; parameres with two large widely spaced setae. Spermatheca (Figs. 139-140) with anterior end large, and sharp bend in middle portion.

Etymology.–The specific name is used as a noun in apposition and refers to the mountain village of Yuvila near which the large series was collected.

Ptomaphagus (Tupania) delsur, new species
Figs. 135-136, 156

Holotype female and allotype male in SBP. Type locality: Oaxaca, 3 mi N Suchixtepec (on the road south from Oaxaca City to Puerto Angel), 9500 ft. Type data: 4-6.vi.1971, S. Peck, forest carrion trap 766-777. Paratypes: one female with same data.

Diagnosis and description.–The species differs from the others in the subgenus only in the shape of the spermatheca (Figs. 135-136), and in a pointed but not drawn-out sutural angle, and more truncate elytral tip in females. Antenna in Fig. 156.

Etymology.–The name is used as a noun in apposition and refers to the Sierra Madre del Sur of Oaxaca, to which the species is probably restricted.

Ptomaphagus (Tupania) oriental, new species
Figs. 137-138, 157-158

Holotype female and allotype male in SBP. Holotype locality: Puebla, 4 mi E Teziutlan, 5000 ft, km 59. Type data: 10-14.vii.1971, A. Newton, cloud forest dung trap 281. Allotype and paratype males: Puebla, 5 mi W Huachinango, 6000 ft, 3-7.vii.1971, A. Newton; oak, *Alnus*, pine, *Podocarpus* forest along stream, dung trap 269. Paratypes: Querétaro, 2 mi NE Pinal de Amoles, 7400 ft, km 142, 21-27.v.1971, A. Newton, *Crategus?*, pine, oak forest along dry stream, dung trap 244, 1 male. Hidalgo, 3.5 mi N Tlanchinol, 5100 ft, 6-11.vii.1973, A. Newton, cloud forest dung trap 501, 1 male. 6.6 mi SW Chapulhuacán, 3900 ft, 27.vii-1.viii.1973, A. Newton, forest carrion trap 494, 1 male missing head and pronotum.

Diagnosis and description.–The species differs from other *Tupania* only in the shape of the spermatheca (Figs. 137-138). The female elytral tip is weakly truncate and the sutural angle weakly pointed. The antennae are more pectinate and the aedeagus more slender and straight than in *P. (T.) yuvila* (Figs. 157-158).

Etymology.–The name is used as a noun in apposition and refers to the Sierra Madre Oriental, in whose forests the species seems to be widespread, but uncommon.

Additional material.–This material is tentatively assigned to this species; females needed for confirmation. *Chiapas:* 11 mi NW Ocozocoautla, 3400 ft, 19-25.viii.1971, A. Newton, oak and tropical evergreen forest, dung trap 363, 1 male.

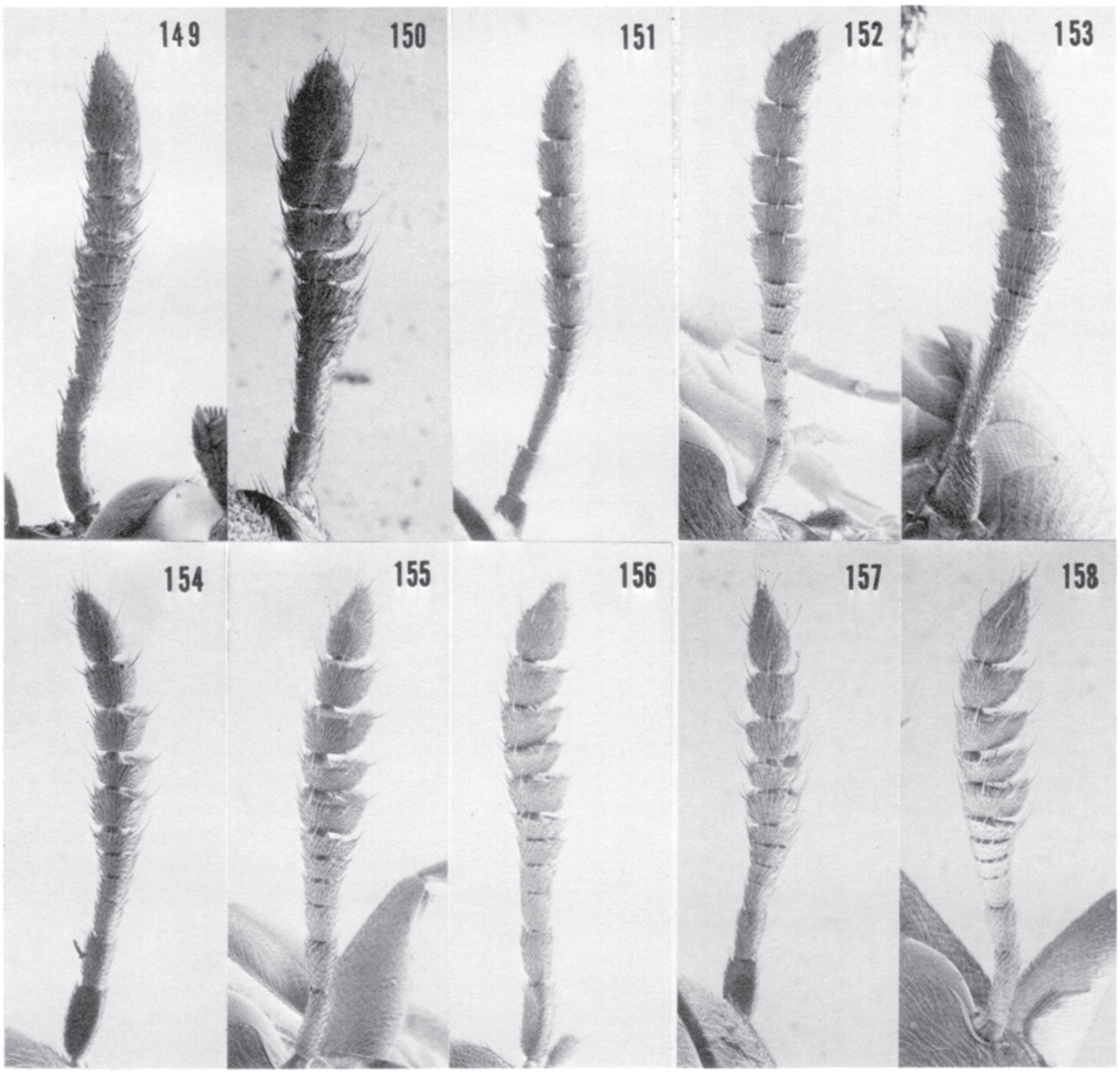
SUMMARY

The fauna of Catopinae in México is now known to include the genera *Dissochaetus, Catops, Eucatops, Proptomaphaginus, Adelopsis,* and *Ptomaphagus.* The genus *Echinocoleus* probably occurs in México.

The Mexican faunas of *Dissochaetus, Eucatops,* and *Adelopsis* are not known in detail. Many collections have been assembled of these genera but are not yet studied.

Detailed study of all available material shows that *Proptomaphaginus* contains one Mexican species, *Catops* has two, and *Ptomaphagus* in the subgenus *Adelops* contains five species in the *consobrinus* species group and 23 species in the *cavernicola* species group and no species in the *hirtus* group, while the subgenus *Tupania* contains 5 species.

In distribution, all known species are endemic to México except for the following: *D. curtus* which ranges to Bolivia; *D. hetschkoi* and *D. simoni* which



Figs. 149-158.–*Ptomaphagus (Tupania)* left (unless otherwise indicated) antennae: 149-150, *T. flabellatus,* dorsal and anterior surface, Bocaina, Brasil, paratype; 151-152, *T. forticornis,* dorsal and anterior surfaces, Huachinango, México; 153, *T. argenticornis,* anterior surface, right antenna, 23 mi S Valle Nacional, México, holotype; 154-155, *T. yuvila,* dorsal and anterior surface, 10 mi N Ixtlán, México, paratype; 156, *T. delsur,* anterior surface, Suchixtepec, México, allotype; 157-158, *T. oriental,* dorsal and anterior surface, 11 mi NW Ocozocoautla, México.

range to Brazil; *Pt. fisus* which is also in the southwestern U. S.; *Pt. nevadicus* which is found over much of western North America; *Pt. cavernicola cavernicola* which is widespread in U. S. caves; *Pt. liquidambar* and *Pt. pruina* which may extend into Guatemala; and *Pt. tierrabaja* which is also known from Belize.

In habits, all genera and species known from México are scavengers and primarily inhabitants of forest litter. *Catops, Eucatops,* and *Adelopsis* are known only from these habitats in México, the first from high (temperate) and the latter two from lower (tropical) elevations. *Dissochaetus* is mostly a forest-dwelling genus but has been found in caves, including those in Yucatán. The single known Mexican *Proptomaphaginus* is probably a relict soil-inhabiting species, and was only fortuitously found in a cave.

In *Ptomaphagus,* the subgenus *Tupania* is known only from forests, but the subgenus *Adelops* is exceedingly variable in its habitats. Although most *Adelops* species are large-eyed and fully winged and are known primarily from forested habitats, there are exceptions which are listed below.

1. Mammal, bird, and reptile nest and burrow associates. In these "micro-cavern" habitats, the beetles' eyes and/or wings are usually reduced. The *consobrinus* group: *P. fisus, P. nevadicus.* The *cavernicola* group: *P. conejera* (also in forest litter), *P. tuza* (also in forest litter). *Echinocoleus* and some *Ptomaphagus* may be found in ant nests.

2. Montane forest litter inhabitants, with reduced eyes and/or reduced wings. These features in a sense "pre-adapt" the species for caves but they seem to be limited to upper elevation mountain forests. The *consobrinus* group: *P. meximontanus.* The *cavernicola* group: *P. colima, P. gypsum, P. quercus.*

3. Facultative troglophiles. These are cave-associated species which do not show morphological cave adaptations, and which are also known from non-cave (forested) habitats. The *cavernicola* group: *P. spelaeus, P. tabascensis.*

4. Obligate troglophiles. These are cave-associated species which do not show morphological cave adaptations but are known only from cave habitats. The *consobrinus* group: *P. reddelli.* The *cavernicola* group: *P. c. cavernicola, P. cavernicola aditus, P. elabra.*

5. Troglobites. These species are restricted to caves and have morphological cave specializations such as elongated appendages, reduced pigmentation, and reduced eyes and wings. The *cavernicola* group: *P. mckenziei, P. troglomexicanus.*

Undoubtedly, for years to come, as additional field collecting is conducted in México in forest and more-specialized habitats, more species will be added to an already rich and evolutionarily varied, interesting, and adaptable *Ptomaphagus* fauna. A challenge will be to organize this fauna and reconstruct its complex evolutionary and ecological history.

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A PRELIMINARY SURVEY OF THE CAVES OF THE YUCATAN PENINSULA

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INTRODUCTION

The Peninsula of Yucatán projects northward from Central America, extending from about 17° to 21°40′ N latitude. It is bordered on the north by the Gulf of México, on the west by the Gulf of México and the Río Usumacinta, on the east by the Caribbean Sea, and on the south by the Maya Mountains of Belize and the Guatemalan highlands. Included are the Mexican states of Campeche, Yucatán, and Quintana Roo and part of Tabasco; the Petén of Guatemala; and northern Belize.

Northern Yucatán is generally low, with little relief; it slopes gradually up to the south to elevations of about 30 m above sea level. To the west the Sierra de Ticul rises abruptly from the coastal plain (see Fig. 1) with elevations ranging from about 70 m in the northern part of the range to about 100 m near Ticul. Elevations in the Sierra de Bolonchén vary from less than 100 m in the northern part of the range to a maximum of nearly 300 m in eastern Campeche along the highway from Chetumal to Escárcega (Isphording, 1975).

No long-term meteorological records are available for Yucatán, but Contreras Arías (1959) summarized the data for periods up to 31 years for various stations in the Peninsula. Mean annual temperatures range from 25.2° C at Valladolid to 28.2° C at Oxkutzcab and Telchaquillo. The lowest temperature cited by Contreras Arías is 2.7° C at Zohlaguna, Campeche, while the highest is 47.0° C at Oxkutzcab. Temperatures usually range between 7° and 41° C. The lowest temperature occurs between December and February, with the highest between May and August.

There are distinct dry and wet seasons in the Peninsula, with rains usually beginning in May and gradually ending by December or January. In the coastal plain of northern Yucatán the mean annual rainfall ranges from a low of 58.6 cm at Telchac Puerto on the coast to 92.8 cm at Mérida. Rainfall increases gradually to the south, with Valladolid receiving 109.5 cm/yr, Maxcanú and Motul near the northern end of the Sierra de Ticul more than 106 cm/yr, and Oxkutzcab to the south about 124 cm/yr. Chetumal on the coast of Quintana Roo receives more than 125 cm/yr; the maximum average annual recorded rainfall is at Escárcega, Campeche, which has a mean annual rainfall of 138.2 cm. The lowest recorded rainfalls range from 48.2 cm/yr at Acanceh to 103.2 cm/yr at Escárcega. High rainfalls range from 98.2 cm/yr at Acanceh to 184.4 cm/yr at Escárcega.

GEOLOGY

Butterlin and Bonet (1963) have published a useful stratigraphic map of the Peninsula. The coast of northern Yucatán is composed of Pleistocene and Holocene deposits, but deposits of Miocene and Eocene age are exposed throughout most of the Peninsula. Deposits of possible Paleocene age occur in southeastern Campeche and adjacent Guatemala.

The following is a brief discussion of the stratigraphic units as recognized by Butterlin and Bonet (1963). Formations not occurring in the Mexican portion of the Peninsula are omitted.

Undifferentiated Paleocene (?) or Eocene rocks.—This is a group of rocks which appear to be of the same age or older than the Formación Chichén Itzá but which lack determinable fossils. These rocks occur in three areas: north and south of the highway from Chetumal to Xpujil, a zone which extends from southeast of Campeche to the Guatemalan frontier, and the Sierra de Ticul. They are compact white to yellow limestones, which are generally dolomitized, silicified, or recrystalized. In the Sierra de Ticul a variety of this limestone is red and, in fact, has been called by some authors the "red limestones of the Sierra." These limestones contain all of the caves known in the Sierra de Ticul; the red limestone frequently is seen at the top of high domes or in other places in the cave, and it appears to restrict upward cavern development. No extensive caves are known in the outcrops of these limestones outside of the Sierra de Ticul.

Formación Icaiche (Eocene or Paleocene).—This formation crops out along the highway from Chetumal to Escárcega in the vicinity of Xpujil and extends north to Chumul and south into Guatemala, although its exact limits are not known. It consists of white limestone interbedded with marl and gypsum. Cueva del Yeso west of Chicanná is developed in this formation. It is also possible that Volcán de los Murciélagos is formed in the Formación Icaiche. The cave is developed in very thin-bedded limestone, but it lies outside of the boundary of the Icaiche as shown by Butterlin and Bonet.

Formación Chichén Itzá (Eocene).—This formation has been subdivided into three members with different rock types. The Miembro Xbacal crops out from Km 25 to Km 75 on the highway from Champotón to Escárcega. It consists of yellow, white, and gray limestone ranging from thin to massive bedded. Several caves, including Grutas de Monte Bravo, are presumably formed in the Xbacal. The Miembro Piste occupies the central portion of the Yucatán Peninsula except for the Sierra de Ticul. The Sierra de Bolonchén is apparently entirely formed of this limestone member. It consists of somewhat massive white or yellow limestones. Some of the larger and deeper caves in the Peninsula are developed in it. The Miembro Chumbec, found only in a thin strip near Libre Unión, Yucatán, is massive, crystalline white limestone. No caves are known with certainty from the Chumbec, but it should be excellent for the development of large caves.

Formación Bacalar (upper Miocene).—This formation occurs in a narrow band between Laguna Bacalar and Bahía de Chetumal and extends south along the border of Belize almost to Orange Walk and east to the Bahía de Chetumal. It consists of marly white limestone with gypsum and caliche. No caves are known from it.

Formación Estero Franco (upper Miocene or Pliocene).—Exposed only in a narrow band extending NE-SW from the Belize-Quintana Roo border to the highway from Chetumal to Escárcega, this formation consists of yellow crystalline thin-bedded dolomite and limestone containing calcite nodules. The upper beds are more massive and are white or rose. No caves are known from this formation.

Formación Carrillo Puerto (upper Miocene or Pliocene).—This formation is exposed along the coastal plain west of Dzitbalché and Maxcanú, then extends as a band north of Maxcanú and south of Mérida across to the Caribbean Sea, and south in a band from Kaua on the east and the Caribbean Sea on the west south to near Chetumal. It is composed of hard, massive white limestones. Many caves, including Actún Kaua, are developed in the Carillo Puerto.

Undifferentiated Pleistocene-Holocene rocks.—These deposits occur in a band extending along the entire northern coast of Yucatán. Although this band is usually rather narrow, it extends as far south as Mérida. Another band of Quaternary rocks extends along the coast southwest of Champotón. These deposits are generally massive white to cream conchiferous limestones. Several caves, such as Cueva de Santa Elena, are known in these rocks.

The northwestern part of the state of Yucatán consists of flat-lying strata, but east of Holcá the strata show signs of arching and folding, and dips of 10 to 15 degrees occur at Valladolid (Isphording, 1975). This tilt to the northwest is a result of the regional uplift during the late Tertiary.

The Central Hill District in western Yucatán and adjacent Campeche is made up of two hill systems, the Sierra de Ticul and the Sierra de Bolonchén. The scarp that forms the front of the Sierra de Ticul has been considered to represent either a normal fault, a shoreline feature, or the dip slope of an anticline. Isphording (1975) indicates that it had its origin as a fault and that it also formed a Miocene shoreline feature. He contends that it may be a "down-to-the-northeast growth fault that has been active since late Cretaceous time." The Sierra de Ticul is comprised of two roughly parallel ridges which probably formed as a result of *en echelon* faulting.

The hills that form the Sierra de Bolonchén are not structurally or stratigraphically related to the Sierra de Ticul and appear to have been formed as a result of the deformation that took place in the Chapayal Basin in Chiapas and northern Guatemala during the Oligocene (Isphording, 1975). The limestones forming the Sierra de Bolonchén are in places, flat-lying, but more commonly dip more than 40 degrees. Many large, flat-bottomed valleys in the Sierra de Bolonchén are believed to be the result of faulting.

A series of basins extending from about Chetumal south into northern Belize are thought to be subparallel block fault basins. This has been designated the Rio Hondo Fault System (Isphording, 1975). The age of the fault system is uncertain, but faulting probably continued into the Pleistocene. The saline Lago de Chichankanab was apparently part of a marine embayment during the Pliocene. With the elevation of the Peninsula in the late Pliocene and early Pleistocene, the marine waters became trapped, and in the absence of connections to subterranean fresh-water the lake became progressively more saline (Robles Ramos, 1959).

PHYSIOGRAPHY

Physiographically, the Yucatán Peninsula forms a distinct province, divisible into several regions. West (1964) and other authors have subdivided the Peninsula into two regions, the Coastal Plain and the Hill District. This is an oversimplification, and recent authors have subdivided it into 3 or more regions. Based on karst features, Finch (1973) divided the state of Yucatán into three principal regions: the narrow Coastal Region extending along the northern coastline of the state; the Hill Region including the Sierra de Ticul and adjacent hills; and the Central Regions occupying almost all of the state. He subdivided the Central Regions into a northeastern region occupying a small part of the extreme northeastern corner of the state, an eastern region extending south from near the coast at Dzilam Bravo to the hill region near Ticul, and a western region comprising the remainder of the state. Isphording and Wilson (1973) subdivide the Peninsula into the karst plain, the northwest hill district, and the central hill district. This is still an oversimplification, however, as shown by the comprehensive treatment of Yucatán physiography by Isphording (1975). The following discussion of the physiography of the Peninsula is based on this last study.

Isphording (1975) has divided the Peninsula into five physiographic regions: (1) Coastal Beach and Supra-tidal Zone, (2) Northwestern Coastal Plain, (3) Northeastern Coastal Plain, (4) Central Hill District, and (5) Eastern Block Fault District. The Central Hill District is subdivided into the Sierra de Ticul and the Sierra de Bolonchén.

(1) The Coastal Beach and Supra-tidal Zone extends along the northwestern and northern coasts of Yucatán from Punta Arena to El Cuyo. It is characterized by narrow beaches and shallow, seasonally flooded lagoons. Freshwater springs emerge in the shallow waters immediately offshore.

(2) The Northwestern Coastal Plain is underlain by flat-lying limestone and dolomite with relief seldom in excess of 2 meters. There is usually only a few centimeters of soil present. Surface water is restricted to a few shallow cenotes and aguadas.

(3) The Northeastern Coastal Plain is distinguished from the Northwestern Coastal Plain by greater relief and the extensive development of karst topography. The lifting of this area in the Tertiary and the higher rainfall have allowed solution to occur more rapidly, with the result that caves and cenotes are more numerous and relief is locally in excess of 15 m. Soil has been deposited in depths of up to 2 meters in some of the large depressions. As in the northwestern region, all drainage is subterranean.

(4) The Central Hill District is divisible into two distinct regions with different physiography, stratigraphy, and origin. The Sierra de Ticul consists of two parallel ridges running from Maxcanú on the north to near Lago de Chichankanab. The ridges are separated by a shallow valley, and relief is considerably greater than in the Coastal Plain. Surface water is completely absent and all drainage is subterranean. The Sierra de Bolonchén is made up of numerous distinct rounded hills, ranging in elevation from 100 to 300 m. Also present in the Sierra de Bolonchén are many large, flat-bottomed valleys, up to 5 kilometers wide. Now dry, they probably held water in the past. Although soil is thin on the hills, the valleys may have up to 10 meters of soil.

(5) The Eastern Block Fault District extends along the southeastern side of the Peninsula from near Chetumal south into Belize. Physiographically, it is characterized by closed basins underlain by deep soils and by saline lakes. The largest of the basins is Laguna Bacalar, which is more than 30 km long. Lago de Chichankanab is a saline lake 11 km long and up to 600 m wide; it is bounded by an escarpment reaching heights of 20 m along the eastern margin.

VEGETATION

The flora of the Yucatán Peninsula is derived from the south of México and from northwestern Central America. No more than 17 percent of the recorded species appear to be endemic to the Peninsula, and this number may reflect limited knowledge of the flora of Central America. Finch (1973) has outlined the nature of the flora of the state of Yucatán, particularly with respect to its relationships to karst. The following discussion follows the more comprehensive treatment by Miranda (1959).

The coastal areas are characterized by dense shrub thickets, palms, and grasses on the sandy beaches. In some areas mangrove swamps have developed. Inland from the beaches is a transition zone (Monte Bajo) with small trees up to 8 m in height, primarily thorn legumes *(Acacia)* and cacti.

Farther inland the vegetation changes to a low deciduous thorn forest consisting of thorny deciduous shrubs and trees with *Acacia, Bursera,* and *Mimosa* the abundant genera. Although most trees are less than 8 m in height, a few reach up to 15 m. Tree height increases to the east as rainfall increases.

Near Libre Unión and Tecoh the thorn forest gives way to a transition forest containing both low deciduous and semi-deciduous trees. The transition forest also covers the Sierra de Ticul and the northern Sierra de Bolonchén.

East of Valladolid and extending to a few kilometers east of the Yucatán-Quintana Roo border, the vegetation may be characterized as a semi-deciduous forest with trees reaching up to 35 m in height. The dominant species are *Vitex gaumeri,* ramón *(Brosimum alicastrum),* wild fig *(Ficus),* and *Bursera simaruba.*

The northern two-thirds of Quintana Roo is covered by high to medium semi-evergreen forest. It is characterized by the zapote tree *(Achras).*

High semi-evergreen forest covers the southern third of Quintana Roo and all of Campeche from Hopelchen in the north, south into Guatemala and west to Laguna Terminos. Trees have a mean height of 25 to 35 meters. The characteristic species are the zapote *(Achras zapota), Bucida,* and *Chrysophila argentea.*

Fig. 1.–The eastern face of the Sierra de Ticul near its northern end, as seen from Calcehtok, Yucatán (photo by David McKenzie).

The vegetation of much of Yucatán has been drastically altered since the first habitation by the Maya as a result of their slash-and-burn type of agriculture. Probably very little virgin forest is left. In recent years vast areas of northern Yucatán have been cleared for henequen *(Agave)* plantations. An attempt to develop the cattle industry in northwestern Yucatán has resulted in the clearing of much of the forest. Recent settlement in Quintana Roo is also expected to modify substantially the vegetation of this area.

Finch (1973) has discussed in detail the associations of plants to karst features in the state of Yucatán. The following briefly summarizes the flora associated with caves and larger cenotes. In the absence of surface water, caves and cenotes provide a moist environment for many different species of plant, including large trees. In the Coastal Plain, where trees seldom exceed 10 m in height, large *Ficus* growing from cenotes may attain heights in excess of 20 m. Other plants which grow from the floor of caves and cenotes include ramón *(Brosimum alicastrum), Ehretia mexicana,* plantain *(Musa paradisiaca),* and *Pileus mexicanus.* Ferns, liverworts, and other plants may grow from the walls. In open-air cenotes the water may contain a large variety of algae and floating and submerged plants. The walls of the cenotes are also covered by a variety of plants. The large entrance sinks in the Sierra de Ticul shelter numerous plant species. These range from small shrubs and grasses to large trees. The entrance to Actún Loltún sheltered the following plants: *Castilla elastica, Cecropia* sp., *Chlorophora tinctoria, Ficus cotinifolia, Persea americana* (the aguacate or avocado), *Musa paradisiaca* (plantain), *Plumeria* sp., and *Sabal mayarum.* The avocados and plantains were doubtless planted in the cave. Other food plants have also been grown in the moist, silt-floored sinkhole entrances of caves throughout the Peninsula.

CAVES AND KARST

Caves and other karst features have been observed in every part of the Peninsula which has been examined, with the exception of the Eastern Block Fault District. Finch (1973) treated the karst of the state of Yucatán in some detail, but no systematic study has been made in Campeche or Quintana Roo. Some information on karst in these areas is available in Isphording and Wilson (1973) and Isphording (1975). The amount of karst development varies greatly throughout the Peninsula, with its most extreme expression being in the Northeastern Coastal Plain.

In the absence of any study of Yucatán by karst morphologists, little can be said about the factors which control karst and cavern development in the Peninsula, but a few factors appear to be important in explaining the different types of karst and the different nature of caves in the Peninsula.

Isphording (1975) has emphasized the case-hardened caprock overlying the *sascab,* a soft permeable layer of caliche which allows rapid infiltration of meteoric water. He thinks the *sascab* is the reason for the absence of surface water and nearly complete subterranean drainage in the Peninsula.

Earlier workers in Yucatán considered the Peninsula to be drained by large subterranean rivers running from the Sierras to the sea, but others consider the groundwater to be a vast lake slowly moving toward the sea. The latter is probably a more accurate representation of the situation in the Coastal Plain. Water levels in the Peninsula vary greatly and do not appear to correlate closely with sea level. Furthermore, as the underwater exploration of Cenote Xlaká indicates, large cave passages exist well below sea level. The entrance to Cenote Xlaká is probably less than 20 m above sea level, but a large horizontal passage exists at a depth of 48 m below the surface.

Minor karst features.—Solutional features such as small circular pit-like depressions and fretted furrows and crests occur on exposed limestone surfaces throughout the Peninsula. Furrows may either occur with random orientations or may appear to form a pattern, which is presumably related to lithology or structure. They seldom exceed a few centimeters in depth. Small solutional pits, known locally as *sartenejas,* up to 1 meter in depth and 2 meters in diameter occur at the junction of two or more furrows in many places.

Poljes.—Isphording (1975) has called the large, flat-bottomed valleys found in the Sierra de Bolonchén "poljes," and ascribes their origin to faulting. No study of these features has been made, and it is not known if they are solutional in origin.

Hoyas.—Hundreds of large funnel-shaped dolinas occur in eastern Yucatán. These depressions, known locally as *hoyas,* may be up to 100 m in diameter and 30 m in depth and usually have a flat, silt floor. Some hold water for short periods during the wet season, but they are generally dry.

Aguadas.—Wide, shallow ponds which may dry completely during the dry season are locally known as *aguadas.* Cole (1910) and Pearse (1936b) ascribe their origin to filling of cenotes by debris, and some *aguadas* may be formed in this manner. Others, however, are certainly shallow solutional depressions, and some are presumably man-made.

Ojos de agua.—Fresh-water springs rising through solution channels into the brackish water of the lagoons formed on the landward side of beaches in northern Yucatán are known as *ojos de agua.* Other springs also rise in the shallow water off the coast in the Gulf of México.

Sumideros.—In the Sierra de Bolonchén many caves have entrances at the end of arroyos. Although not commonly used in Yucatán, the term *sumidero* has been applied to this type of cave entrance. The most spectacular caves with sumidero-type entrances are Grutas de Xtacumbilxunam and Grutas de San Antonio near Bolonchenticul.

Cenotes.—The most conspicuous karst feature in the Yucatán Peninsula is the *cenote.* In fact, the classic picture of Yucatán is that of a flat plain pitted with spectacular cenotes. This concept of the cenote, based on the famed Cenote Sagrado, is misleading. Cenote (a Spanish corruption of the Mayan *tzonot)* is a term used by the Maya for any subterranean chamber which contains permanent water. Cole (1910), Pearse (1936b), and Finch (1973) have all accepted a subdivision of cenotes into five basic types: (A) a bell-shaped cavity with a small surface opening; (B) a vertical shaft with a large surface opening and with water more than 25 ft below the surface; (C) a vertical shaft with a large surface opening and with water less than 25 ft below the surface; (D) a large cavity with sloping walls leading down to water; and (E) a lateral passage which leads to a chamber containing water. Although intermediate forms exist, this is generally a useful classification to use in discussing cenotes and their development, with the exception of types B and C, which obviously have the same origin and merely reflect the depth of the local water table. Also, type E is a rather unsatisfactory type as defined by Finch (1973), in that it may have a small vertical opening or a large sinkhole entrance. In this discussion any cave, regardless of its type of entrance, which is basically horizontal is considered as a type E cenote.

Cole (1910) proposed a sequence of events for the origin of the different types of cenotes in which a large cavity forms beneath the water table, a small opening develops (the bell-shaped cenote), collapse occurs until it is a vertical-walled cenote, erosion continues to form the sloping-walled cenote, and finally debris chokes the opening to the water and an aguada is formed. This may be an accurate explanation for the origin of some cenotes, but many of the aguadas and sloping walled cenotes may represent dolina-type solutional depressions.

Caves.—The caves of the Sierra de Ticul and the Sierra de Bolonchén are almost invariably referred to as *actuns,* the Mayan word for cave. This term is also occasionally used for caves in the Coastal Plain which lack water. Occasionally, as in the case of Actún Kaua, it is used for an extensive horizontal cave whether it contains water or not. The entrances may be small, obscure holes, but frequently they are enormous sinkholes ranging up to 35 m in diameter and 30 m in depth.

KARST REGIONS

Northwestern Coastal Plain.—Few surface karst features are evident in the Northwestern Coastal Plain. The limestone surface shows considerable solutional pitting, but the spectacular cenotes of eastern Yucatán are absent. A few cenotes with large surface openings have been seen in this area, but the water level is seldom more than a few meters below the surface and the surrounding plain is level. Cenote Xlaká at the ruins of Dzibilchaltún north of Mérida is an example of this type of cenote. Most cave entrances are small vertical sinks lying even with the plain, and are apparently solutional in origin (see Fig. 2). Caves are locally abundant, but in general they are small. They range from single solution chambers to linear passages up to 150 m long. The water level is generally less than 10 m below the surface, and the caves frequently terminate in siphons with the water rising from deep fissures. The absence of conspicuous karst features and the small size of the caves is probably a result of three factors: low rainfall, recent uplift of the area, and low elevations.

Northeastern Coastal Plain.—This part of Yucatán has been characterized as a pitted karst plain. In the northern part of the plain the cenote is the dominant karst form, although hoyas, aguadas, and minor karst forms such as sartenejas and furrows are abundant. All four basic types of cenotes occur in this region, but large vertical shafts appear to be more common in a band along the highway from Libre Unión to Valladolid. Finch (1973) has implied that cave-like cenotes are rare in some areas, but they have been found in all parts of the Northeastern Coastal Plain which have been investigated. Because of the small size of their openings, the more difficult access to water, and the abundance of large well-like cenotes in some areas the caves are less commonly used by the local people and therefore seem to be rarer.

In the extreme northeastern part of Yucatán the topography is generally a rolling plain with vast numbers of hoyas and few vertical cenotes. If, as has been supposed, this part of the Peninsula arose earlier, this represents an older karst terrain.

In the vicinity of Cobá in Quintana Roo the only caves found were small shallow sinkholes containing water only a few meters below the surface. Only hydrological studies will give evidence as to why the water table in this area is higher than in other parts of the Peninsula of about the same elevation. Along the coast of Quintana Roo (see Fig. 3) from Puerto Juárez to Tulum, small shallow caves and vertical sinks are abundant. Immediately north of Tancah at the Rancho San Martín is an extensive karst area marked by the collapse of long horizontal cave passages. Literally hundreds of sinkholes occur in this area, many of which lead into uncollapsed segments of what must have been a very extensive system of maze passages. About 20 km inland at Ancah there have been reported to be "enormous caves," but they have not been investigated. The presence of the largely dissected cave system near the coast indicates that extensive cave systems may occur where overburden is thicker.

Although most caves in the Northwestern Coastal Plain are small solution chambers or short horizontal passages, others are large and extensive. Grutas de Balankanche near Chichén Itzá contains more than 1 km of passage, much of it large galleries. Actún Kaua, with more than 6 km of surveyed passage, is a complex maze of passages ranging up to 5 m in diameter. Most vertical cenotes are simple shafts without any passages from the bottom, but Cenote de Catzín has a maze of walking passages extending from its large vertical entrance sink. The extensive development, both of large cenotes and long caves, is presumably related to the greater relief, higher rainfall, dipping limestones, and the earlier uplift of this part of the Peninsula.

Sierra de Ticul.—Karst development in the Sierra de Ticul is limited to caves and to minor karst features. No caves in the first ridge of the range have been observed which receive appreciable surface runoff, although all drainage is subterranean. Cave entrances are remarkably abundant throughout the length of the first ridge of the Sierra de Ticul, and hundreds, if not thousands, of caves occur in it. Entrances range

Fig. 2.—The entrance to Cenote de Hoctún, Yucatán; shown are Mary Butterwick and James Reddell (photo by David McKenzie).

from small vertical shafts to sinks with sloping passages leading from the bottom to spectacular sinkholes up to 30 m in diameter. Caves along the edge of the escarpment tend to be steep sloping fissures with few, if any, large rooms. They possibly follow the dip of the limestone. A few kilometers back from the escarpment in the northern part of the range, the sinkholes usually drop into large irregular to oval phreatic chambers. There may be a single large entrance room with no passages, or a succession of two or more oval chambers in excess of 50 m in diameter and up to 20 m in height connected by way of small passages. Actún Chukum near Maxcanú in the extreme northern part of the range consists of two large chambers of this type. Farther south near Calcehtok, Actún Xpukil, the largest cave investigated in the northern part of the Sierra de Ticul, consists of several large oval chambers; some are connected by small crawlways, but others are reached by long, horizontal passages. Actún X-Kukicán near Oxkutzcab apparently has a similar plan. The red limestone seems to have controlled upward development forming a less permeable layer below which solution occurred. No permanent water, other than small drip pools, has been seen in any of the caves in this part of the range, but in a few of the deeper caves, such as Actún Xpukil, Pearse collected troglobitic crustaceans, indicating that during unusually wet seasons the water table rises to flood the lower parts of the caves. Actún Loltún, near Oxkutzcab, consists of a series of large oval chambers, several with vertical sinkhole entrances, with a long trunk passage leading to a long sloping entrance. Farther south, near Tekax, caves tend to be more linear. Actún Sabacá is an example of a long, linear cave with little vertical relief. Other caves in this same area also appear to have a similar plan, but have not been visited by members of the AMCS.

Caves in the second ridge of the Sierra de Ticul seem to be far less common and to have a distinctly different pattern. The entrances of all of the caves investigated are small vertical or near-vertical sinkholes which lead down into largely horizontal passages to water. Actún Chac contains a vertical entrance, with the cave descending in a series of drops to a gently sloping passage intersected by narrow joint-controlled fissure passages; Actún Xcoch and Actún Okobichén also follow this same basic pattern. Actún Nohcacab has been filled with debris, but the entrance

Fig. 3.–Xel-há, Quintana Roo, showing the limestone karst along the Caribbean coast (photo by David McKenzie).

is basically of the same type. Farther south, near Kiuick, both of the caves investigated contain fill before reaching either a horizontal passage or water, but the general plan is much the same. A few caves in this part of the range do receive some surface runoff, which may partially explain the large amounts of silt and subsequent filling of the caves. No large oval chambers have been found in this area, similar to those so common in the first ridge of the Sierra de Ticul.

Sierra de Bolonchén.—Isphording (1975) has compared the karst of the Sierra de Bolonchén to "cone karst" based on the occurrence of rounded knobs and hills. Whether or not this is a valid comparison must await study by karst morphologists. Numerous flat-bottomed valleys may be either the result of faulting or solution; these "poljes" are the most distinctive characteristic of the Sierra de Bolonchén. Compared to the first ridge of the Sierra de Ticul, caves are relatively rare in the Bolonchén but many do occur. Greater relief and beds dipping up to 40° in the Sierra de Bolonchén allow for greater vertical development of caves. Grutas de Xtacumbilxunam attains a depth of at least 105 m, making it one of the deepest caves in the Peninsula. Reports of a large lake and active "river" beyond the limits of recent explorations indicate that it may be even deeper. Many entrances in the vicinity of Bolonchenticul in the northern part of the range are sumideros, receiving considerable surface run-off and resembling the arroyo entrances of the Sierra de El Abra in San Luis Potosí. (see Fig. 12).

Both Grutas de Xtacumbilxunam and Grutas de San Antonio have enormous sumidero entrances. The caves tend to be more complex with considerable development of dome-pits, some more than 30 meters deep. Caves in this area contain the only known active streams in the Peninsula. Grutas de San José contains a small, active stream even in the dry season and there is apparently a large stream in Grutas de Xtacumbilxunam. Some of the caves, notably Grutas de Xtacumbilxunam and Cenote Espiritú, contain bad air, presumably due to poor circulation and the decomposition of large quantities of organic matter.

Several caves have been investigated near Cumpich in the extreme northeastern part of the Sierra de Bolonchén. As near Bolonchenticul, vertical development is considerable in some caves, such as Actún Chen which apparently descends in a series of drops to the water table. There are also large vertical shafts up to 20 m in depth and 15 m in diameter; Actún Ek-Biz contains the longest drop in the Peninsula, in excess of 60 m. Many caves are primarily horizontal. Grutas de Xkalumkín consists of large horizontal passages interconnected by small crawlways and was apparently an important water source for the Mayan inhabitants of Xkalumkín; and currently blocked descending passages may once have led down to the water table.

Only three caves have been investigated in the hills north of Escárcega. Cueva de Chuiná is a small fissure cave formed along exfoliation cracks on the edge of a cliff. Cenote de Cantemo, which receives run-off from a small area through its sumidero-type entrance, consists entirely of a small descending passage terminating in a single chamber. Grutas de Monte Bravo, on the other hand, is an extensive horizontal cave with large joint-controlled fissure-like passages and several sinkhole entrances; it is formed almost entirely beneath one of the "poljes."

The only cave visited in the hills southeast of Escárcega is Volcán de los Murciélagos. The entrance, a spectacular collapse sinkhole 25 by 33 m in size and dropping up to 60 m vertically, leads into a large trunk passage more than a kilometer long with deep permanent pools. Locals report that nearby wells exceed 200 m in depth without reaching water, indicating that subterranean drainage is along large solution channels.

Two small caves have been seen in the wide plain-like area east of the hills proper in extreme southeastern Campeche. Actún Xpujil is a small solutional cavity of no consequence, and Cueva de Yeso is a shallow sinkhole entirely in gypsum.

HISTORY

Mayan Uses of Caves

The history of cave exploration in the Yucatán Peninsula begins with the first settlers. The virtual absence of surface water on the Peninsula necessitated the use of cenotes and caves as a primary water source. Thompson (1975) estimates that the Mayan inhabitants of Yucatán began their explorations of caves 2,700 to 3,000 years ago. Pottery collected in Cenote Kabahchén at Maní has been dated at about 800 B. C. (Brainerd, 1958). It is doubtful if any cave in the entire Peninsula has not been fully explored by the Maya. Their explorations carried them down long vertical drops, through tortuous crawlways, and into the most remote parts of large, complex cave systems. Pottery shards, charcoal, masonry work, torches, art work, and skeletons all testify to the thoroughness and long history of Mayan explorations. Many of the caves have seen continual use from the beginnings of Mayan history in Yucatán to the present. The following is only a brief summary of the use to which caves have been put, of archeological study in the caves, and of contemporary explorations.

Because caves and cenotes in Yucatán were the only source of water and, therefore, essential to survival, they played a vital role in Mayan life. Thompson (1975) has discussed at some length the role of caves in Maya culture. They were used as sources of drinking water, sources of "virgin" water for religious rites, for religious rites themselves, burials, sacrifices, art galleries, depositories of ceremonially discarded utensils, places of refuge, mines for red earth, gypsum, and attapulgite, and as hunting sites. Caves today are also used for swimming and bathing.

Caves and cenotes throughout the Yucatán Peninsula have always been used as sources of water for drinking, cooking, and bathing purposes. The evidence for this is the vast amount of broken pottery in every cave which contains water. In recent years the drilling of deep wells and the expansion of the public water system into even small villages has reduced the dependency on caves for water but has not eliminated this important source of water. Even in the larger cities caves and cenotes are still utilized as wells. Where the public water system has not reached, especially in rural areas, the village cenote remains an important, or sole, source of water for domestic use. In some places, such as Bolonchenticul, Santa Elena, and Cumpich, the drilling of deep wells has led to the abandonment of the deep, difficult caves as water sources. In many cases this has resulted in the silting-in of the lower levels of the caves, and water is no longer accessible.

Thompson (1975) has discussed at length the important role which caves played as sources of "virgin" water for use in religious rites. Virgin water is that which had never been touched by man and which had never fallen to the ground. To obtain this water, the Maya placed pottery jars and stone water basins beneath drips in many caves. In the Sierra de Ticul these containers are present in almost every cave, in places in the most remote areas of the caves (see Fig. 4). The vast number of stone water basins in the entrance areas of the caves of the Sierra de Ticul, however, may have been used to collect water for hunters and field workers. Many of these containers were placed directly beneath stalactites or on top of stalagmites and are now completely covered with calcite. Excellent examples are in Actún Xkyc, Actún Xpukil, and Actún Sabacá.

The most spectacular example of a cave used for religious rites is Grutas de Balankanche. This remarkable cave contained an enormous number of ceremonial pottery vessels, stone censers, corn grinders, and other votive materials (Andrews, 1970). The artifacts recovered from the cave indicate that it was utilized from the Formative state of Maya culture until the Modified Florescent period, at which time its use essentially ceased. The outer cave doubtless continued to serve as a source of water. At least one other cave in the vicinity of Chichén Itzá, but not yet excavated, also served as a source for religious rites. Upon the discovery of Grutas de Balankanche a local *h-men* (a practitioner of the native folk religion and magic, which still survives in Yucatán) contacted the archeologists and asked to be allowed to perform a ceremony in the cave to appease the spirits. The tradition of the cave's religious importance and of the rites persisted for the thousand years since the sealing of the inner chambers. Another important cave which has been archeologically investigated is Actún X-Kukicán in the Sierra de Ticul. This cave is located in the important ruins of X-Kukicán and was considered to be sacred to the serpent god. A sealed inner passage led into an area containing pottery and other artifacts (Valentine, 1965; Cottier, 1967). Doubtless, many other caves of religious importance to the early Maya remain to be discovered in Yucatán. When these caves were abandoned their entrances or the inner, sacred chambers were sealed.

Although many caves in the Maya region were utilized as ossuaries, crematoria, and burial grounds, there is apparently little documentation for this practice in Yucatán. Skeletons are frequently found in caves, but they are usually not accompanied by any indications of a ceremonial burial. An exception is the High Priest's Grave in a cave in Chichén Itzá. His burial was accompanied by a large number of artifacts, including jade and onyx, placed with the burial before the cave was sealed.

Cenotes served occasionally as the scenes of sacrifices. The most famous site, of course, is the Cenote Sagrado at Chichén Itzá, but other cenotes were apparently used for the same purpose. Roys (1957) reports that in about 1561 two boys were purchased at Tahdziu and sacrificed in a cenote at Tekom, representing a revival of the cenote cult practiced at Chichén Itzá. Undoubtedly, numerous sacrifices were made in other cenotes.

The rich Mayan art was almost exclusively restricted to buildings and usually primitive. An exception is the relief at the Nohcacab Entrance to Actún Loltún. This fine piece of art apparently is a representation of the corn god. Hieroglyphs, handprints, and crude drawings occur in several other places in the cave as well (Thompson, 1897). A remarkable sculpture, known as the Loltun Head, was discovered in an inner sealed chamber of Actún Loltún in the 1960's. Other examples of Mayan cave art include a serpent on the wall of a cave near Mérida, a sculpture and crude hieroglyphs in Cueva de Tancah, Quintana Roo, and numerous petroglyphs in caves in the Sierra de Ticul. Very primitive clay drawings in Actún Kaua are of unknown date but may be contemporary. Dr. Matthias Strecker is now conducting an extensive survey of Yucatán cave art, and many additional sites will probably be found.

Thompson (1975) has recorded several examples of the ceremonial breakage of vessels in caves. The only cave which is cited in Yucatán is Actún Chac, which was found to contain a vast number of shards of the finest ornate polychrome pottery in Yucatán. Since the cave was sacred to the rain gods, the Chacs, he contends that the pottery was ceremonially broken in the cave. Andrews (1965), on the other hand, speculates that the broken pottery was no more than a reflection of the difficulty of reaching water in the cave.

The use of caves as places of refuge is poorly documented. Mercer (1896) records their use for such purposes during the War of the Castes. It is also possible that caves, such as Actún Xpukil, were used for refuge during the Toltec invasion, but no evidence supports this supposition. Careful investigation of the clay fill in the larger caves might provide an important clue about the use of the inner chambers of Actún Xpukil.

Caves were important sources of clay and calcite for pottery-making. Many of the caves of the Sierra de Ticul have been almost stripped of speleothems by potters who use the calcite as temper. Arnold (1971) has discussed this usage among present-day potters in the town of Ticul, and the practice probably dates to the early days of Mayan occupation of Yucatán. Hatt (1953) documents the use of caves as sources of clay. Up to one meter of clay has been removed from the passages in Actún Kaua, and the total volume removed from this cave alone is con-

Fig. 4.–Pottery in the inner chamber of Actún Xpukil, Yucatán; shown is Martha Helen McKenzie (photo by David McKenzie).

siderable, considering that the cave contains several kilometers of passage and almost all have been at least partially excavated. It must have served as an important source of clay for the potters of Chichén Itzá.

Cenote Nohchén at Sacalum was one of the few known sources of the mineral attapulgite used in making the pigment Maya Blue, which was very important in Mayan ceremonial functions. Arnold and Bohor (1975) describe the attapulgite mine in this cave and discuss its significance.

A minor use of caves in recent years and probably earlier is for hunting. The larger, heavily-vegetated entrance areas of caves, particularly in the Sierra de Ticul, serve as refuges for many animals, and, during the dry season when these are the only moist places, they abound in birds and small animal life. Stone walls in the sheltered area of the sinkholes serve as hunters' blinds for shooting birds and small game.

Many caves today are frequently used by the local inhabitants as swimming holes. Grutas de Tzab-Nah contains a cleared walkway and ladders to reach the water level, allowing the boys and young men of Tecoh to swim in its clear waters. In Cenote de Sihunchén lights have been strung back to the lake to facilitate entry for swimming and bathing. Several caves have been in use as public baths since before Pearse visited Yucatán in the 1930's, among them Cenote de Sambulá at Motul and Cueva de San Isidro in Mérida.

Archeological Cave Explorations

The history of modern cave exploration in Yucatán begins with John Lloyd Stephens and Frederick Catherwood. Their first expedition to Yucatán was made in 1839 but was cut short by illness. Stephens (1841) briefly recounts visiting Cenote de Mukuyché before continuing on to begin their historic investigation of the ruins of Uxmal. They returned in 1841 to Yucatán and introduced to the world the wonders of the ruined cities of Yucatán. Always an intrepid explorer, Stephens seldom passed up an opportunity to explore the caves of the Peninsula. His vivid accounts of the exploration of Grutas de Xtacumbilxunam and Actún Chac have become classic speleological adventure stories. Unlike many earlier cave explorers, Stephens' accounts of the caves are amazingly accurate. During the course of the 1841 expedition, Stephens visited and explored at least 15 caves and cenotes, and describes in some detail ten of them (Stephens, 1843). The caves visited were Cenote de Telchaquillo, an unidentified cave near Telchaquillo, Cenote Chen Mul, Cenote de Mukuyché, Actún Xcoch, Actún Chac, a cave at Labná, Actún Loltún, Actún Kiuick, a cave at Xul, Grutas de Xtacumbilxunam, Cenote Kabahchén, Cenote Sagrado, Cenote Xtoloc, and a cenote in the ruins of Aké. Although Stephens made no excavations in the caves, he emphasized their importance and, at the same time, dispelled local tales of elaborate sculptures and structures which were supposed to fill them.

Following publication of Stephens' books on his travels in Yucatán, many European archeologists conducted expeditions to excavate the ruins. Most of them visited at least one or two caves. Among the distinguished visitors to Yucatán who have recorded information on caves were Desireé Charnay, Teobert Maler, and Abbé Brasseur de Bourbourg. Few of them made any extensive excavations in the caves. Brasseur de Bourbourg (1867a, 1867b) briefly describes Cenote Chen Mul at Mayapán and Cenote de Sambulá in Mérida.

The first systematic study of the caves of Yucatán was made by Henry C. Mercer in 1895. During the course of his explorations in Yucatán he visited 29 caves, excavating 10. His pioneering study proved that the caves of Yucatán had not been inhabited by primitive man, and his book, *The Hill-Caves of Yucatan,* has become a classic of speleology. Most of the caves visited by Mercer are in the Sierra de Ticul, but a few are located on the coastal plain near the Sierra. He carefully describes all the caves he visited and includes profiles of Actún Xkahbak, Actún Sayab, Actún Xmak, Actún Chanz Coyok, Actún Oxkintok, Actún Lara, Actún Chac, Actún Loltún, Actún Ziz, Actún Sabacá, and Cenote Kabahchén.

Another classic study of Yucatán was made by Edward H. Thompson in 1888-1889 at Actún Loltún (Thompson, 1897). He excavated the cave thoroughly, recorded and illustrated the rock art, and drew detailed maps of the entrance complex.

Although several attempts to explore the Cenote Sagrado had been unsuccessful, Thompson dredged the cenote between 1904 and 1907 and recovered a rich assortment of artifacts. The early history of attempts to explore the cenote is recounted by Folan (1970).

S. K. Lothrop, during an archeological investigation of the east coast of the Yucatán Peninsula, visited and described Cenote de Tulum and Cueva de Tancah (Lothrop, 1924). In the latter he discovered hieroglyphs, a stone idol, and an altar.

In 1929 Robert T. and Marcelle R. Hatt visited the Yucatán Peninsula to excavate caves for paleontological remains. An account of their findings, along with descriptions of the caves and several maps, is included in Hatt (1953). During their excavations they recovered a number of human bones, some of which showed evidence of possible cannibalism. Except for Actún Tuz-ic all the caves are in the Sierra de Ticul.

George W. Brainerd in 1940 excavated Cenote de Yaxcuná, Cenote Chen Mul, and Cenote Kabahchén and studied the ceramics recovered from them (Brainerd, 1958). His report also refers to two cenotes at Holactún (=Xkalumkín) and describes the ceramics recovered from Cenote Sagrado.

In 1947 R. T. Hatt, B. Villa R., and H. O. Wagner continued paleontological studies in the caves of the Sierra de Ticul (Hatt, 1953). They discovered a considerable amount of ceramic and other artifacts; the ceramics are described by Brainerd (1953).

Lawrence Roys and Edwin M. Shook made a preliminary excavation at the ruins of Aké in 1951. Their report also includes the location and description of eight cenotes in the ruins (Roys and Shook, 1966).

The Carnegie Institution of Washington initiated an extensive survey of the ruins of Mayapán during the 1950's. H. E. D. Pollock prepared a complete map of the ruins, on which are located 29 cenotes (Jones, 1952). Several of the cenotes were excavated, and reports have been published on the ceremonial Cenote X-Coton (Smith, 1953; 1954), Cenote Chen Mul (Smith, 1954), Cenote de Telchaquillo (Smith, 1954), and Grutas de Tzab-Nah (Stromsvik, 1956). An unusual wooden statuette was discovered in the last cave.

Edwin M. Shook examined Cueva de Tecoh and Cenote de San José (=Cenote de Tecoh) and briefly reported on the archeological materials recovered from the caves (Shook, 1955).

The National Geographic Society, during its study of the ruins of Dzibilchaltún, recovered numerous artifacts from Cenote Xlaká by diving (Marden, 1959).

The discovery in 1959 by José Humberto Gómez of the hidden inner chambers of Grutas de Balankanche led to a full-scale excavation of the cave under the sponsorship of the National Geographic Society and the Mexican government. The finds of this study, a map of the cave, and a full account of the ceremony which was conducted in the cave are included in Andrews (1970).

Two recent studies of Cenote Sagrado have been made, the first under the sponsorship of the National Geographic Society and the second under the auspices of the Instituto Nacional de Antropología e Historia and the Club de Exploraciones y Deportes Acuáticos de México. The first expedition is described by Davalos Hurtado (1961), Littlehales (1961), and Folan (1970). Ediger (1971) has published a popular account of the second expedition.

In November 1962 Jaime Fernández, an amateur cave explorer in Mérida, discovered a beautiful polychrome jar in Actún Chac. His discovery was of such interest that an excavation was undertaken by members of the National Geographic Society–Tulane University Program of Research at Dzibilchaltún, Yucatán. A full account of their findings is published in Andrews 1965).

The entomologist J. Manson Valentine made an examination of Actún Loltún and located Actún X-Kukikán. He has published an account of his findings, with speculations on their significance (Valentine, 1965). Actún X-Kukikán was fully excavated by archeologists from the University of Alabama in 1967 and 1968 (Cottier, 1967; Kurjack, Nielsen, and Driskell, 1968). In addition about 15 other caves were investigated and some partially excavated.

The discovery that Cenote Nohchén at Sacalum was a source of the pigment Maya Blue led to its investigation in 1967 and 1968 by Dean E. Arnold and Bruce F. Bohor. A description and map of the cave, as well as a discussion of its significance, is included in Arnold and Bohor (1975).

The Instituto Nacional de Antropología e Historia is presently conducting a full-scale study of Actún Loltún, preparatory to its being opened to the public. Matthias Strecker (personal communication) is also engaged in a long-term study of the rock art of Yucatán caves. He has examined more than ten caves which contain rock art.

Other Studies and Explorations

Except for the archeological studies mentioned above and the biological studies outlined below in the discussion of Yucatán cave biology, little scientific work has been done in the caves of Yucatán. The caves have been explored by literally thousands of people, but there are remarkably few accounts. Casares (1905) has discussed the physiography of Yucatán and the importance of cenotes and caves; he includes descriptions of a few of the more famous caves and cenotes. Cole (1910) presents the first attempt to explain the origin of cenotes and discusses the general hydrography of Yucatán. Almost everyone (e. g., Pearse, 1936b; and Shrock, 1945) who has written on the karst of Yucatán has followed Cole in his explanation.

An expedition in March 1947 under the auspices of the Dirección General de Geología de la Secretaría de Recursos Hidráulicos examined several caves and cenotes. Robles Ramos (1950) provides information on the karst morphology of Yucatán and describes the caves which were visited.

In 1959 and 1960 two American speleologists, Jack Grant and Dailey, prepared generalized maps of Actún Loltún and apparently of other caves in Yucatán, but their studies have apparently not been published.

A doctoral dissertation on the karst landscape of Yucatán by William A. Finch, Jr., includes much information on the vegetation associated with caves and cenotes, a subdivision of the state of Yucatán into physiographic regions based on karst landforms, and descriptions and generalized maps of a few caves (Finch, 1973).

Eugene M. Wilson and W. C. Isphording of the University of South Alabama have recently made an extensive study of the geology and karst morphology of the Yucatán Peninsula. Much of their work remains unpublished, although Isphording (1975) has published an account of the physical geology of Yucatán which includes a subdivision of the Peninsula into physiographic districts.

The expeditions sponsored by The Museum, Texas Tech University, and the National Geographic Society and which have resulted in the information included in this report are outlined in the discussion of biological history. Although the emphasis of much of this study was on biology, detailed maps of many of the larger caves in Yucatán are being prepared.

BIOLOGY

History

The first biological notice of caves and cenotes in the Yucatán Peninsula was by Cope (1865), who described a species of frog collected by Arthur Schott in Cenote Pamanche (=Taamanché), Yucatán. In the late 1880's F. C. Baker visited several caves in northern Yucatán and reported a few species of bird and snail obtained in them. In early 1904 L. J. Cole visited Chichén Itzá, Yucatán, and described new species of fish from Cenote Sagrado and Cenote Xtolok and reported various other species of vertebrates from these localities. October to December 1929 R. T. and M. R. Hatt, during the course of paleontological studies in caves in the Sierra de Ticul, collected several species of bats (Hatt, 1938).

The first serious studies of the subterranean fauna of Yucatán was made by the Carnegie Institution of Washington. June to August of 1932 E. P. Creaser, A. S. Pearse, and F. G. Hall visited numerous cenotes and several caves in the coastal plain of northern Yucatán. Their extensive collections and the information obtained are summarized in Pearse (1936b) and Hall (1936). That expedition was followed in June to August 1936 by A. S. Pearse, who visited many caves throughout northern Yucatán (Pearse, 1938a). The two expeditions revealed the unique nature of the Yucatán cave fauna and laid the basis for future work in the Peninsula.

In September 1943 B. F. Osorio Tafall visited several caves in northern Yucatán and obtained distinctive new species of troglobite (Anonymous, 1947). His expedition was followed by one in March 1947 by Osorio Tafall and M. Cárdenas Figueroa to several caves in Yucatán (Cárdenas Figueroa, 1950). In June 1948 C. J. Goodnight visited caves and cenotes near Chichén Itzá. In January 1953 A. Villalobos visited a few caves in northern Yucatán. Stanley Kiem collected millipeds in Actún Xpukil, Yucatán, in March 1959 (Loomis, 1960). J. F. G. Clarke collected snails in a sinkhole on Isla de Cozumel, Quintana Roo, in April 1960 (Rehder, 1966).

Studies of the vertebrate fauna of the Yucatán Peninsula, with special emphasis on bats, were made during November to December 1947 by R. T. Hatt, B. Villa R., and H. Wagner (Hatt and Villa, 1950; Hatt, 1953); by J. Knox Jones, W. E. Duellman, and others from the University of Kansas during the summer of 1962 (Duellman, 1965; Jones et al., 1973); by P. L. Clifton in April 1963 (Duellman, 1965); and by a team from the Bell Museum of Natural History in the spring of 1973 (Birney et al., 1974).

Small collections of invertebrates were made in November 1962 by E. W. Andrews IV in Gruta de Chac and Grutas de Balankanche (Hobbs and Hobbs, 1976); by W. Gonzalez-Angulo and R. E. Ryckman in the summer of 1965 in a cave near Ticul, Yucatán, and in a cave on Isla de Cozumel (Gonzalez-Angulo and Ryckman, 1967); by R. E. Main in December 1966 in caves at Tancah, Quintana Roo (Mullinex, 1975); by J. D. Haddock and N. Ueshima in Cueva Valladolid, Yucatán, in March 1967 (Ueshima, 1968); by T. Raines in March 1969 in Cenote de Hoctún, Yucatán; by E. H. Sallee in April 1971 in Cenote X-ebiz, Yucatán (Hobbs and Hobbs, 1976); by H. Wilkens and others in the early 1970's in caves in northern Yucatán (Wilkens, 1973); and by D. McKenzie in December 1971 to January 1972 in several caves in Campeche and Yucatán.

The first systematic study of the cave fauna of the entire Yucatán Peninsula was begun in 1973 and continues to the present. Four expeditions, sponsored in part by The Museum, Texas Tech University, and by

The National Geographic Society have been conducted to date. From February until May 1973, James Reddell, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and Mary Butterwick visited numerous caves in northern Yucatán. In July 1973 additional caves in northern Yucatán were visited by Robert W., Rexell, Robert W. Jr., Scott, and Sharon Mitchell, Deborah Denson, Masaharu Kawakatsu, J. Mark Rowland, and James Reddell. The third expedition lasted from September until December 1974 and included David McKenzie, James Reddell, and Suzanne Wiley. Caves in many parts of Yucatán and Campeche were visited. During the summer of 1975 Andrew Grubbs, David McKenzie, James Reddell, and Suzanne Wiley extended the area of study into other parts of Campeche and into Quintana Roo. A total of 17 caves in Campeche, 14 in Quintana Roo, and 80 in Yucatán were studied biologically during the course of these four expeditions.

Systematic Survey

Approximately 565 animal species have been reported from the caves and cenotes of the Yucatán Peninsula. Of these, 115 are known only from open-air cenotes and will be briefly discussed. There are 46 aquatic species, of which 11 are troglobites. The terrestrial fauna includes 23 troglobites. The number of species known, including troglobites, will certainly increase when large collections of terrestrial isopods, centipedes, mites, diplurans, collembolans, roaches, beetles, and flies are studied.

Phylum Platyhelminthes

Freshwater triclad turbellarians of the genus *Dugesia* have been found in Cenote Kabahchén, Yucatán. This is the only record of the genus in Yucatán. Two species of terrestrial planarian have been reported from caves in the Sierra de Ticul (Hyman, 1938); *Geoplana multipunctata* Fuhrmann in Actún Loltún and *Diporodemus yucatani* in Actún Sabacá.

Phylum Annelida

Four species of earthworm have been identified from caves in Yucatán (Pickford, 1938). *Balanteodrilus pearsei* Pickford was described from Actún Góngora and Cueva de San Isidro, and has recently been collected in Actún Loltún (Gates, 1977). *Eodrilus oxkutzcabensis* Pickford was described from three caves in Yucatán. Both of these species appear to be endemic to the Yucatán Peninsula. Two introduced species, *Dichogaster affinis* (Michaelsen) and *D. bolaui* (Michaelsen), were also found in several caves in Yucatán.

Phylum Arthropoda

Class Crustacea

Order Copepoda.—Fourteen species of copepod were reported from caves and cenotes in Yucatán by Wilson (1936) and Pearse and Wilson (1938); five of these are known only from open-air cenotes. The canthocamptids *Nitocra pusilla* Sars and *Nitocrella subterranea* (Chappuis) were reported only from caves. *Eucyclops serrulatus* (Fischer), *E. (Tropocyclops) prasinus* (Fischer), *Macrocyclops albidus* (Jurine), and *Mesocyclops leuckarti* (Claus), were common both in caves and cenotes throughout Yucatán; Yeatman (1977) has identified *Mesocyclops ellipticus* Kiefer from Grutas de Xtacumbilxunam, Campeche. The diaptomid *Attheyella pilosa* Chappuis was identified from Cenote Luchil, Yucatán, but this species probably does not occur in Yucatán and the correct identity of the Yucatán species must await further collection.

Order Podocopa.—Ten ostracods have been identified from caves and cenotes in Yucatán (Furtos, 1936, 1938), but of these, only three are known from caves. *Cypridopsis inaudita* Furtos and *C. mexicana* Furtos were described from Cueva de Santa Elena, and *C. yucatanensis* Furtos was reported from Grutas de Balankanche and four open-air cenotes.

Order Isopoda.—The troglobitic cirolanid *Creaseriella anops* (Creaser) is known from 20 caves in the coastal plain of Yucatán and Quintana Roo. A single incomplete specimen of asellid, *Caecidotea* sp., was reported from Grutas de Balankanche (Creaser, 1938). The terrestrial isopod fauna of the Yucatán Peninsula remains poorly studied, but six species have been reported from caves in Yucatán. The troglobitic squamiferid *Trichorhina pearsei* (Creaser) is known from seven caves (Creaser, 1938). Two trichoniscids have been found in caves in Yucatán: *Cylindroniscus maya* Rioja from Grutas de Balankanche and Cenote de Sambulá (Motul) (Rioja, 1958), and *Trichoniscus hoctuni* Mulaik (1960) from Cenote de Hoctún. Schultz (1977) described the troglobitic philosciid *Troglophiloscia levis* from Actún Xpukil. The remaining two species reported from caves in Yucatán appear to be troglophiles. Mulaik (1960) described *Hoctunus vespertilio* from Cenote de Hoctún, and Creaser (1938) reported an unidentified species of *Porcellionides* from six caves.

Order Amphipoda.—Four species of amphipod have been found in caves in Yucatán. *Hyallela azteca* (Saussure) was identified from three open-air cenotes by Creaser (1936) and has recently been collected in Grutas de San José, Campeche. The Caribbean species *Quadrivisio lutzi* (Shoemaker) has recently been found in two caves in Quintana Roo, the first record for this species in mainland North America. Holsinger (1977) has described two troglobitic amphipods from caves in the Yucatán Peninsula. *Mayaweckelia cenoticola* is a widespread species known from nine caves in Campeche, Quintana Roo, and Yucatán, whereas *M. yucatanensis* appears to be restricted to Grutas de Xtacumbilxunam, Campeche.

Order Mysidacea.—Creaser (1936) described the troglobitic mysid *Antromysis cenotensis* from two caves in Yucatán, and later (Creaser, 1938) added 10 additional records. It has since been found in many caves in Yucatán and Quintana Roo (Bowman, 1977).

Order Decapoda.—Creaser (1936) described two unusual shrimps from the caves of Yucatán. *Creaseria morleyi*, originally reported from four caves, was later found in six additional localities (Creaser, 1938), and now is known to be the most widely distributed crustacean in the Peninsula. A total of 30 records from Campeche, Quintana Roo, and Yucatán are now known for this species (Hobbs and Hobbs, 1976). The atyid *Typhlatya pearsei* was described from two caves in the coastal plain of Yucatán (Creaser, 1936) and is now known from 19 caves in Campeche, Quintana Roo, and Yucatán. Hobbs and Hobbs (1976) described two additional species of *Typhlatya* from the Yucatán Peninsula: *T. mitchelli*, known from 16 caves in the coastal plain of Yucatán and Quintana Roo; and *T. campecheae*, known only from Cenote de Cantemo and Grutas de Xtacumbilxunam, Campeche.

Class Arachnida

Order Scorpionida.—Five species of scorpion are known from caves in the Yucatán Peninsula. The family Diplocentridae is represented by four species, two of which are troglobites (Francke, 1977). *Diplocentrus anophthalmus* Francke is known only from Actún Chukum in the Sierra de Ticul, while *D. mitchelli* Francke was described from Actún Halmensura, Campeche. The first species is essentially eyeless, while the latter has reduced eyes and pigmentation (see Figs. 5-6). *Diplocentrus reddelli* Francke from Actún Xpukil is a troglophile, while an undescribed genus and species is known only from Actún Loltún. Chamberlin and Ivie (1938a) described *Centrurus yucatanus* from Actún Loltún. This species, however, has been restudied and found to be identical to *Centruroides ochraceus* (Pocock) (Wagner, 1977), which is now known from the entrance areas of four caves in Yucatán.

Order Pseudoscorpionida.—Six troglophile and five troglobite pseudoscorpions are known from caves in the Yucatán Peninsula. Chamberlin (1938) described *Pachychitra maya* from Cueva Primera del Camino de San Roque, *Lustrochernes minor* from three caves in the Sierra de Ticul, and *Parazaona cavicola* from two caves in the coastal plain. All of these species appear to be troglophiles. A remarkable new family, genus, and two species were added to the Yucatán fauna by Chamberlin (1947) with the description of the troglobites, *Vachonium boneti* and *V. maya*, from Actún Sabacá and Grutas de Balankanche respectively. A third species of this genus was added by Muchmore (1973) with the description of *V. kauae* from Actún Kaua; a fourth species, *Vachonium cryptum*, was later described from Actún Xkyc (Muchmore, 1977). Additional specimens belonging to this genus have recently been found in Actún Loltún and Actún Xpukil but remain unidentified. A troglophile belonging to the family Cheiridiidae has recently been collected in Actún Xpukil, and a possible troglobitic chernetid of uncertain genus has been found in Cenote de Santo Domingo, Quintana Roo. The chernetid *Neoallochernes* sp. is extremely abundant on bat guano in Volcán de los Murciélagos, Campeche.

Order Schizomida.—Chamberlin and Ivie (1938a) described *Schizomus cavernicolens* from caves in Yucatán. This species has since proven to be identical to *S. portoricensis* (Chamberlin), which is present in essentially every cave in the Yucatán Peninsula (Rowland and Reddell, 1977).

Order Amblypygida.—The amblypygid *Tarantula fuscimana* (Koch) was identified from several caves in Yucatán by Chamberlin and Ivie (1938a). This species is now considered to be a *nomen dubium* (Mullinex, (1975). The common eyed amblypygid in Yucatán has been identified by Mullinex (1975) as *Paraphrynus raptator* (Pocock), and is abundant throughout the Peninsula. A blind amblypygid, *Paraphrynus chacmool* (Rowland), is known from 14 caves in Yucatán.

Order Araneae.—The suborder Mygalomorphae is represented by four species. Chamberlin and Ivie (1938b) reported *Zygopelma meridana* Chamberlin and Ivie, *Euagrus* sp., and *Eurypelma* sp., from caves in Yucatán. Numerous specimens of the family Theraphosidae have recently been collected in caves in Campeche and Yucatán. The ecological status of these is not known, but the presence of some in the more remote parts of the caves indicates that at least one species may be a troglophile. A ctenizid of undetermined genus has been collected from the entrance

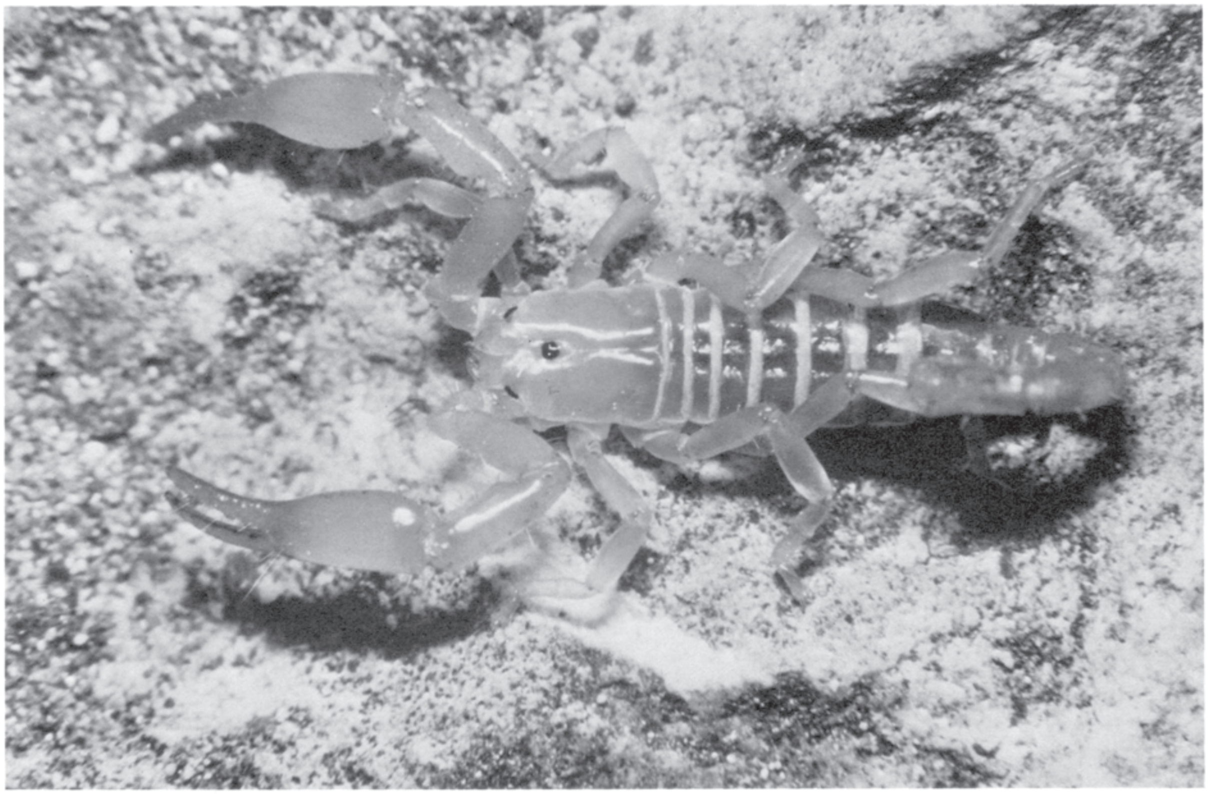


Fig. 5.–The troglobitic scorpion *Diplocentrus mitchelli* from Actún Halmensura, Campeche (photo by Robert W. Mitchell).

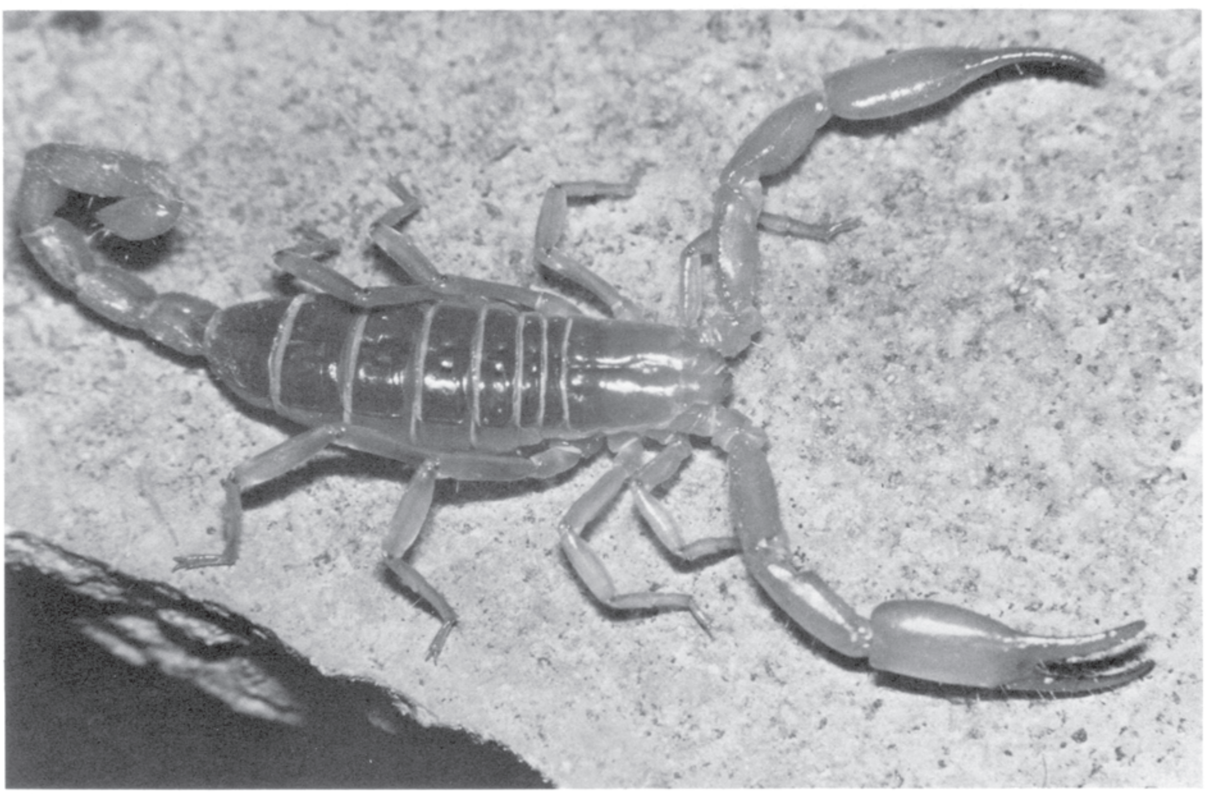


Fig. 6.–The troglobitic scorpion *Diplocentrus anophthalmus* from Actún Chukum, Yucatán (photo by Robert W. Mitchell).

area of Cenote de Tos Virlol, Quintana Roo.

The suborder Araneomorphae is well-represented in caves in the Peninsula, with about 50 species collected. The following summary will mention only those species closely associated with caves. The only agelenid known from Yucatán is the troglobitic *Cicurina maya* described from Actún Tucil (Gertsch, 1977b). *Goeldia tizamina* (Chamberlin and Ivie) (family Amaurobiidae) is a troglophile and has been found in several caves in Campeche and Yucatán. Although five clubionids have been identified from caves in the Peninsula, only *Tixcocoba maya* Gertsch (known from seven caves in the Sierra de Ticul and the coastal plain) appears to be a troglophile. The nesticid *Eidmannella suggerens* (Chamberlin) is among the more commonly collected species in the Peninsula, having been found in 13 caves in Campeche and Yucatán. Gertsch (1977b) described the probable troglobite, *Theotima martha,* from Cueva Sodzil, Yucatán; this species is also tentatively identified from Cueva de Abispa, Quintana Roo. Two other, still undescribed, ochyroceratids have been found in caves in Yucatán: *Ochyrocera* n. sp., known only from Grutas de Balankanche; and *Theotima* n. sp., collected only in Actún Loltún. Chamberlin and Ivie (1938b) described *Wanops coecus* from Grutas de Balankanche. This eyeless species, currently known as *Oonops coecus,* is now known from caves in Campeche, Quintana Roo, and Yucatán. Gertsch (1977b) has described two additional species of *Oonops,* both presumably troglophiles, from Yucatán caves: *Oonops mitchelli* from Actún Xpukil; and *O. reddelli* from Cenote de Sihunchén and Actún Tucil.

The family Pholcidae is well-represented in the caves of the Yucatán Peninsula, as it is in all of México. Three species are considered to be troglobites: *Metagonia chiquita* Gertsch from Cenote Chen Mul; *M. torete* Gertsch from caves in Campeche, Quintana Roo, and Yucatán; and *Pholcophora pearsei* (Chamberlin and Ivie) from two caves in Quintana Roo and three caves in Yucatán. *Metagonia maya* Chamberlin and Ivie, *M. yucatana* Chamberlin and Ivie, *Modisimus iviei* Gertsch, *Pholcophora speophila* (Chamberlin and Ivie), and *Physocyclus globosus* (Taczanowski) are all widespread troglophiles or threshold trogloxenes in the caves of the Peninsula. Three scytodids appear to be closely associated with the cave habitat. *Loxosceles yucatana* Chamberlin and Ivie is present in the dry dusty areas of almost every cave with a suitable habitat; both *Scytodes fusca* Walckenaer and *S. meridana* Chamberlin and Ivie are frequently found in caves and may be troglophiles. The symphytognathid *Maymena mayana* (Chamberlin and Ivie) is also present as a troglophile in many caves and is reported from caves in Campeche, Quintana Roo, and Yucatán. Two species of the tetrablemmid genus *Tetrablemma* have been found in Yucatán caves: *Tetrablemma cambridgei* (Bryant) known from Actún Xpukil; and an undescribed eyeless species known from two caves in northeastern Campeche. Two genera of the family Theridiidae are frequently collected in caves in the Peninsula. *Thymoites spukilum* (Chamberlin and Ivie) is an apparent troglophile in caves in Campeche and Yucatán, while several species of *Theridion* are frequently found.

Order Ricinuleida.—Chamberlin and Ivie (1938a) described *Cryptocellus pearsei* from Grutas de Balankanche and Cueva Oxolodt, Yucatán. It was later collected from Actún Kaua by Sanderson (1941) and from Actún Sabacá by Osorio Tafall (Cárdenas Figueroa, 1950). This species has been redescribed and seven additional localities reported by Gertsch (1977a). It is present in several caves in extremely large numbers.

Order Opilionida.—Six species of opilionid have been collected in caves in the Yucatán Peninsula. Goodnight and Goodnight (1977) described *Erginulus bimaculata,* an apparent troglophile, from Grutas de Xtacumbilxunam, Campeche, and Cenote de la Paca, Yucatán. *Erginulus clavotiabilis* (Cambridge) from Cenote Bolchén, Campeche; *E. roeweri* (Goodnight and Goodnight) from Actún Xpukil, Yucatán; *Vonones compressus* (Cambridge) from Cenote Hunto Chac (Cueva del Pozo) and Actún Sabacá; and *Stygnomma spinifera tancahensis* Goodnight and Goodnight from Cueva de Abispa are all probably trogloxenes or accidentals. The harvestman *Geaya yucatana* Goodnight and Goodnight is a common threshold trogloxene in caves throughout the Peninsula.

Order Acarina.—Ten argasid and two ixodid ticks have been collected from caves in the Peninsula. *Antricola mexicanus* Hoffmann is abundant on bat guano wherever large bat colonies are present. The tick, *Nothoaspis reddelli,* described from bat guano in Grutas de Xtacumbilxunam (Keirans and Clifford, 1976), is also known from Actún Xpukil. Seven species of the genus *Ornithodoros* have been collected from Yucatán caves. Two ixodids, *Amblyomma cajennense* (Fabricius) and *Amblyomma dissimile* (Koch), have been reported from caves in Yucatán (Wharton, 1938). They presumably dropped off of wild animals using the cave entrances for shelter.

Marshall (1936) identified eight species of aquatic mite from caves and cenotes in Yucatán. None of these, however, are probably closely associated with the cave habitat. Twelve species of mite (most strictly parasitic, but four of which are free-living) were identified from caves in Yucatán by Wharton (1938). *Uropoda pearsei* Wharton, *Oribatella monospicus* Wharton, and *Galumna jacoti* Wharton were collected in Cenote de Sambulá (Motul), while *Scheloribates luchili* Wharton was described from Cenote Luchil. Of these, *Uropoda pearsei,* is certainly a troglophile. Numerous collections of uropodids in Yucatán caves may be referable to this species. Adult trombiculids are abundant on bat guano in caves throughout the Peninsula, but the taxonomy of this family is based on larval characteristics and the specific identity of this material is not known. Wharton (1938) based his description of *Trombicula camilla* on adults from four caves in Yucatán.

Class Diplopoda

Order Polydesmida.—Chamberlin (1938) described nine polydesmid millipeds from caves in Yucatán. Most of these species have not been restudied and some will probably prove to be invalid. The chelodesmid *Chondrodesmus sabachanus* was described from Actún Sabacá, and has recently been collected in eight caves in the coastal plain and Sierra de Ticul (Causey, 1977). The introduced paradoxosomatid *Orthomorpha coarctata* (Saussure) has recently been collected in Cenote de Chun Kapoc and Cenote Luchil, both of which are in cities and are heavily polluted by trash. The rhachodesmid genus *Aceratophallus* is an almost ever-present member of the Yucatán cave fauna. Chamberlin (1938) described *A. calcehtokanus* from three caves in the Sierra de Ticul, *A. hoctunanus* from Cenote de Hoctún, and *A. oxkutzcabus* from three caves in the Sierra de Ticul. The status of these species and of numerous specimens recently collected from caves in Campeche, Quintana Roo, and Yucatán must await a revisionary study of the genus. *Cylionus kauanus* (family Sphaeriodesmidae) was described from Actún Kaua by Chamberlin (1938). Collections of sphaeriodesmids from one cave in Campeche and seven in Yucatán apparently belong both to *Cylionus* and another genus, but the material remains unstudied. The family Pyrgodesmidae is an important element of the Yucatán cave fauna. Chamberlin (1938) described four species in the genus *Yucodesmus* and Causey (1971) added a fifth species. Causey (1977) has since removed these species to the genus *Calymmodesmus. Calymmodesmus alienus* (Chamberlin) is known from Actún Kaua, *C. hoctunanus* (Causey) from Cenote de Hoctún, *C. isidricus* (Chamberlin) from Cueva de San Isidro, *C. muruztunicus* (Chamberlin) from Cueva Muruztún, and *C. viabilis* (Chamberlin) from five caves in Yucatán. Numerous collections assignable to this genus remain unstudied. The introduced pyrgodesmid *Prosopodesmus jacobsoni* Silvestri is known from two caves in Campeche and four in Yucatán; all of these caves are frequented by man. Causey (1977) has identified millipeds from four Yucatán caves as *Synoptura italolegata* (Shear). Several collections of the family Trichopolydesmidae from Campeche and Yucatán remain unstudied, but may represent troglobites.

Order Polyzonida.—Chamberlin (1938) described the siphonophorid *Siphonophora sabachana* from Actún Sabacá. Additional collections of this genus from Yucatán may be referable to this species.

Order Spirobolida.—Two species of the family Rhinocricidae were described by Chamberlin (1938) from caves in Yucatán. *Rhinocricus motulensis* is known only from Cenote de Sambulá (Motul), while *Yucatobolus spukilensis* is known only from Actún Xpukil. Both species are probably accidentals or entrance trogloxenes.

Order Spirostreptida.—Four species of the genus *Orthoporus* were described by Chamberlin (1938) from caves in Yucatán, but in a recent study Causey (1977) has synonymized three of these under the name *O. solicolens* Chamberlin, a common troglophile in caves throughout the Peninsula. A second species, *C. yucatanensis* Causey, is occasionally found in caves, but probably should be considered an accidental. Two troglobitic species of *Orthoporus* are known from Yucatán. *O. zizicolens* (Chamberlin) is known from six caves in the Sierra de Ticul, while *O. spelaeus* Causey is known only from Cenote de Catzín. These are the only troglobites in the genus.

Order Stemmiulida.—The "jumping" millipeds of the family Stemmiulidae are known from caves only by a large, apparently troglophilic, population in Grutas de Xtacumbilxunam, Campeche. This undescribed species apparently belongs to the genus *Prostemmiulus.*

Class Insecta

Order Diplura.—The family Japygidae is represented in Yucatán caves by at least five species. Silvestri (1948) identified *Parajapyx mexicanus* Silvestri from Cueva de Carroza, Yucatán. Collections from nine caves in Campeche, Quintana Roo, and Yucatán remain unstudied, but represent at least four additional species.

Order Collembola.—Although collembolans have been collected from virtually every cave in the Yucatán Peninsula, the only material which has been studied was that collected by A. S. Pearse in 1936 and reported by Mills (1938). Seven species were identified, of which three are troglobites. *Cyphoderus innominatus* Mills is known from four caves, *Metasinella falcifera* (Mills) from Actún Sazich, and *Troglopodetes maya* (Mills) from Grutas de Balankanche and Actún Xkyc. Other species reported from Yucatán caves are *Isotomurus* sp. from Cenote Yunchén, *Lepidocyrtus pearsei* Mills from four caves, *Proisotoma centralis* Denis from Cenote Yunchén, and *Xenylla yucatana* Mills from Cenote de Sambulá (Motul).

Order Blattodea.—Large collections of roaches from the Peninsula remain unstudied. Pearse (1938b) reported *Holocompsa zapoteca* Saussure from six caves. The gigantic blaberid *Blaberus craniifer* Burmeister was identified from the entrance area of three caves, and *Blaberus atropos* (Stoll) was reported from Cueva de Xmahit.

Order Saltatoria.—Two species of crickets have been described from caves in Yucatán (Hubbell, 1938). *Amphiacusta yucatana* was reported from 24 caves in Yucatán, while the blind *Tohila atelomma* was described from six caves. *Amphiacusta* is abundant around entrances, but may be found throughout the caves, while *Tohila* is most frequently found beneath rocks and always in total darkness. Many collections of crickets from throughout the Peninsula await study.

Order Hemiptera.—Hungerford (1936) reported 18 aquatic and semi-aquatic hemipterans from cenotes in Yucatán, and Pearse (1938b) identified five terrestrial species from caves in Yucatán. Most of the species of true bugs reported from caves are accidentals or trogloxenes, but a few are closely associated with the cave habitat. The parasitic cimicids *Cimex hemipterus* Fabricius was found on bats in two caves (Pearse, 1938b) and *Primicimex cavernis* Barber was found in a cave at Valladolid on bat guano (Ueshima, 1968). Cydnids are frequently found on bat guano in caves, and *Pangaeus docilis* (Walker), *P. piceatus* Stal, and *Tominotus unisetosus* Froeschner have each been collected in two or more caves. The family Reduviidae is frequently found in the dry, dusty entrance areas of caves. *Opisthacidius mexicanus* (Pelaez), *Ploiaria* sp., and *Triatoma* spp., common throughout the Peninsula, are significant as possible vectors of Chagas' Disease.

Order Neuroptera.—The antlion, *Eremeleon longior* Banks, was described from caves in Yucatán (Banks, 1938), and has since been collected from several additional caves. The presence of both adults and immatures in the caves indicates that it may be a troglophile.

Order Coleoptera.—The beetle fauna of Yucatán caves is still poorly known and many collections remain unstudied. None appear to be cave-adapted, but several species are doubtless troglophiles. Darlington (1936) reported nine species of aquatic beetle from cenotes in Yucatán, and Pearse (1938b) recorded 26 species from caves. In addition, many additional records have been obtained during recent collections in the Peninsula. Eight genera of carabids have been identified from caves in Yucatán. The ecological status of these is unknown, but species of *Masoreus* and *Tachys* are almost certainly troglophiles. Six genera of histerids are known from Yucatán, all collected from bat guano and probably guanophiles. The genus *Saprinus* is particularly well-represented and is known from four caves. Two leiodid beetles, both troglophiles usually found on bat guano, have been identified from caves in Yucatán, Quintana Roo, and Campeche: *Dissochaetus hetschkoi* Reitter, known from seven caves; and *Ptomaphagus (Adelops) tabascensis* Sbordoni, known from six caves. The small beetles of the families Pselaphidae and Scydmaenidae have been collected in several caves but remain unstudied. They will probably prove to be troglophiles, but specimens from Grutas de Xtacumbilxunam appear to have reduced eyes and may be troglobitic. Ten genera of staphylinid have been found in Yucatán caves and some will prove to be troglophiles. The family Tenebrionidae is represented in caves in Yucatán by four genera. Of these, *Rhinandrus* sp. cf. *elongatus* Horn, reported from six caves by Pearse (1938b), is possibly a troglophile.

Order Lepidoptera.—The phalaenid moth *Latebraria amphipyroides* Guen. is abundant about cave entrances in Yucatán, as in many parts of México. Guano moths belonging to the family Tineidae are frequently collected from the dark zone of caves and may be troglophilic.

Order Diptera.—Pearse (1936a; 1938b) reported chironomid flies from cenotes and caves in Yucatán. The presence of pupae and larvae in several caves indicates that these may be troglophiles. Mosquitoes frequently utilize the entrance area of caves for shelter, and seven species were reported from Yucatán caves by Pearse (1938b). *Drosophila* spp. have been taken in caves, at times in great swarms, and may be troglophiles. Phorids belonging to the genera *Conicera* and *Megaselia* are apparently troglophiles, and *M. scalaris* Lw. has been identified from four caves in Yucatán (Pearse, 1938b). Phyllomyzid flies belonging to the genera *Desmometopa* and *Milichia* were reported from many caves by Pearse (1938b). Many additional collections of this family remain unstudied.

Sciarid and sphaerocerid flies are also frequently found in Yucatán caves and some species may be troglophiles. The bat parasites of the family Streblidae are occasionally abundant in caves. Nine species have been reported, representing the genera *Euctenodes, Megistopoda, Nycterophilia,* and *Trichobius.* The thereviid *Psilocephala* sp. was reported by Pearse (1938b) from 10 caves and is possibly a troglophile.

Order Hymenoptera.—Bees, wasps, and ants all frequent the entrance area of caves, occasionally to the dismay of the unwary explorer. The honey bee, *Apis mellifera* L., commonly builds its nests on the vertical walls of cave entrances in Yucatán. Two other bees, *Trigona atrolutea* Moure and *Trigona testacea cupira* Sm., have also been collected from caves in Yucatán. These build their small nests on the underside of ledges near the entrance. Sphecid wasps of the genera *Chorion, Crabro, Notogonidea,* and *Podium* have been collected in the entrance area of several caves. Ants are abundant in Yucatán caves and occur both within the entrance area and in the dark zone. Wheeler (1938) reported 17 species of ants from Yucatán caves, of which two were undescribed and closely associated with the cave habitat. An additional 25 species have been recently collected from caves in the Peninsula. *Acromyrmex octospinosus* (Reich) is a leaf-cutter and Wheeler (1938) speculated that the specimens found in caves had wandered into the caves and become lost. Recent collections, however, have revealed that this species brings leaves into the caves and builds its nests in the twilight zone. Perhaps the most interesting ant associated with Yucatán caves is *Paratrechina pearsei* (Wheeler). This small, pale yellow species with small eyes is known from many caves. In each instance it has been taken only in the dark zone and usually on moist flowstone or rock, frequently near drip pools. Its ecological status is uncertain, but it is probably the ant most likely to be considered a troglobite. Another pale yellow species with small eyes is *Brachymyrmex cavernicola* Wheeler, known only from Grutas de Balankanche and not recollected during the course of the AMCS expeditions. Among other species closely associated with caves in Yucatán are *Hypoponera punctatissima* (Roger), *Solenopsis geminata* (Fab.), *Pachycondyla apicalis* (Latr.), *P. harpax* (Fab.), and *P. villosa* (Fab.).

Phylum Mollusca

Class Gastropoda

Order Neritoidea.—Two species of the family Helicinidae have been collected in caves: *Lucidella lirata* (Pfeiffer), taken in Grutas de San Antonio, Campeche; and *Oligyra arenicola* (Morelet), reported from five caves in Yucatán (Bequaert and Clench, 1936, 1938).

Order Mesogastropoda.—The family Cyclophoridae is represented in Yucatán caves only by the species *Neocyclotus dysoni berendti* (Pfeiffer), reported from cenotes and caves by Bequaert and Clench (1936, 1938). Additional specimens have been taken in Actún Xpukil. The hydrobiid snail *Pyrgophorus coronatus* (Pfeiffer) was taken in two caves and two cenotes (Bequaert and Clench, 1936, 1938). A possible undescribed species of *Pyrgophorus* was taken in Grutas de San Antonio, Campeche. The pomatiid *Choanopoma largillierti* (Pfeiffer) is an important element of the snail fauna of Yucatán caves, with Bequaert and Clench (1936, 1938) reporting it from 15 caves and cenotes. Recently it has been collected in Actún Xpukil.

Order Basommatophora.—Two species of physid snail have been collected from caves in Yucatán. Bequaert and Clench (1938) reported *Aplexa spiculata abbreviata* (Fischer and Crosse) from Grutas de Balankanche, while *Stenophysa* sp. has been found to be abundant in pools in Volcán de los Murciélagos and Grutas de San Antonio, Campeche.

Order Geophila.—Five species of achatinid snail have been found in caves in the Peninsula. *Lamellaxis gracilis* (Hutton) is known from Cenote de Sambulá (Mérida); *L. micra* (d'Orbigny) was reported by Bequaert and Clench (1938) from eight caves in Yucatán; *Opeas yucatanense* Pilsbry was reported by Bequaert and Clench (1938) from Grutas de Balankanche and Cueva Chac Mol; *Pseudosubulina* sp. was recently found living in Cenote de Juan Coh, Quintana Roo; and *Subulina octona* (Brugière) was found alive in Actún Nohcacab. In addition, numerous unidentified *Lamellaxis* have been found in several caves in Campeche and Yucatán. Although six species of the family Orthalicidae have been found in Yucatán caves, only *Bulimulus unicolor* Sowerby, known from four caves, seems to be a troglophile. The Spiraxidae has contributed five species to the faunal list of the Peninsula, with *Euglandina cylindracea* (Phillips), *Orizosoma tabiense* (Pilsbry), *Streptostyla meridana meridana* (Morelet), and *S. ventricosula* (Morelet) reported from caves by Bequaert and Clench (1938). In addition to new records for all of these species (except *O. tabiense*), *Spiraxis* sp. has been recently found in caves. The urocoptid snails *Brachypodella dubia* Pilsbry and *Microceramus concisus* (Morelet) and the zonitid snail *Hawaiia minuscula* (Binney) were reported from Yucatán caves by Bequaert and Clench (1936). New records have been recently added for *B. dubia* and *H. minuscula.*

Phylum Chordata

Class Teleostomi

Order Cypriniformes.–Four subspecies of the catfish *Rhamdia guatemalensis* have been described from caves and cenotes in Yucatán (Hubbs, 1936, 1938). *R. guatemalensis decolor* Hubbs is known from three open-air cenotes and four caves; *R. guatemalensis depressa* Barbour and Cole is known from 17 caves and cenotes; *R. guatemalensis sacrificii* Barbour and Cole is known only from Cenote Sagrado and Cenote Xtolok; and *R. guatemalensis stygaea* Hubbs is known only from Cenote Luchil and Cueva de San Isidro. The latter subspecies has small eyes and is somewhat depigmented, indicating it may be an incipient troglobite.

Order Cyprinodontiformes.–Hubbs (1936) reported three poeciliid fish, *Gambusia yucatana* Regan, *Poecilia sphenops altissima* (Hubbs), and *P. velifera* (Regan), from cenotes in Yucatán.

Order Perciformes.–The family Brotulidae is represented in the caves of Yucatán by the species *Typhliasina pearsei*, described from Grutas de Balankanche by Hubbs (1938). A record of the species in Cenote del Pochote was published by Solorzano (1953), and it has since been collected in Cenote de Calchuhuim, Cenote de Hoctún, and Grutas de Tzab-Nah. Two species of cichlids have been reported from cenotes in Yucatán (Hubbs, 1936, 1938): *Cichlasoma meeki* (Brind) from Cenote Chapultepec and *C. urophthalmus.* The latter species is represented by four subspecies: *C. urophthalmus conchitae* Hubbs from Cenote Conchita, *C. urophthalmus ericymba* Hubbs from Cenote de Sambulá (Mérida), *C. urophthalmus mayorum* Hubbs from Cenote Sagrado and Cenote Xtolok, and *C. urophthalmus zebra* Hubbs from Cenote Xlaká.

Order Symbranchiformes.–One of the more distinctive elements of the Yucatán cave fauna is the blind eel *Ophisternon infernale* (Hubbs), described from Cenote de Hoctún by Hubbs (1938) (see Figs. 7-8). It has recently been collected in Grutas de Balankanche, Cenote del Pochote, and Grutas de Tzab-Nah. Blind eels probably belonging to this species have also been seen in Actún Ha and Cenote de Santo Domingo, Quintana Roo.

Class Amphibia

Order Urodela.–The only salamander known from the Yucatán Peninsula is the plethodontid *Bolitoglossa yucatana* (Peters). This species has been recorded from Cenote Seco by Duellman (1965) and has been recently collected in Actún Sabacá.

Order Anura.–Although eight species of frogs have been reported from caves and cenotes in Yucatán, only *Bufo valliceps* Wiegmann, *Eleutherodactylus yucatanensis* Lynch, and *Leptodactylus labialis* (Cope) can be expected to appear with any degree of frequency in the entrance zone of caves.

Class Reptilia

Order Squamata.–Two snakes have been reported from caves in Yucatán. *Tropidodipsas sartorii sartorii* Cope was reported by Duellman (1965) from a cave near Pueblo Nuevo X-Can, Quintana Roo, and by Gaige (1938) from Actún Loltún. The rattlesnake *Crotalus durissus tzabcan* Klauber has recently been observed in the entrance areas of Actún Xkalumkín, Campeche, and Cenote de la Culebra, Yucatán. Two geckos, *Coleonyx elegans elegans* Gray and *Thecadactylus rapicaudus* (Houttuyn), are frequently found in the entrance area of caves in Yucatán. Two iguanid lizards, *Basiliscus vittatus* Wiegmann and *Ctenosaura similis* (Gray), have been observed in the entrance area of caves in the coastal plain of Yucatán.

Class Aves

Order Falconiformes.–Buzzards, *Coragyps atratus* (Bechstein), have been observed nesting in two caves in the ruins of Aké, Yucatán.

Order Strigiformes.–The owl *Tyto alba pratincola* (Bonaparte) has been observed roosting in four caves in Yucatán. The abundance of owl pellets in other caves attests to its utilization of many more caves than these few records indicate.

Order Coraciiformes.–The mot-mot *Eumomota superciliosa superciliosa* (Swainson) is present in numerous caves in Campeche and Yucatán, and probably can be found in almost any cave with a large open sinkhole entrance.

Order Passeriformes.–Two swallows, *Petrochelidon fulva citata* Van Tyne and *Stelgidopteryx ruficollis ridgwayi* Nelson, are abundant in many caves with large entrances in the Peninsula. Colonies of these species probably number into the hundreds in many of the larger caves.

Class Mammalia

Order Chiroptera.–Although 24 species of bat have been identified from caves in Yucatán, only 15 appear to be of significance to a study of the cave fauna. Jones, Smith, and Genoways (1973) review the bat

Fig. 7.–The blind eel *Ophisternon infernale* from Cenote de Hoctún, Yucatán (photo by David McKenzie).

Fig. 8.–Close-up of the head of the blind eel *Ophisternon infernale* from Cenote de Hoctún, Yucatán (photo by David McKenzie).

fauna of Yucatán. Birney *et al.* (1975) add new records, most notably from Cueva de Oxkintok (=Actún Xpukil). The species of greatest significance are as follows: *Peropteryx macrotis macrotis* (Wagner), *Mormoops megalophylla megalophylla* Peters, *Pteronotus davyi fulvus* (Thomas), *Pteronotus parnelli mesoamericanus* Peters, *Natalus stramineus saturatus* Dalquest and Hall, *Artibeus jamaicensis yucatanicus* J. A. Allen, *Chrotopterus auritus auritus* (Peters), *Desmodus rotundus murinus* Wagner, *Diphylla ecaudata centralis* Thomas, *Glossophaga soricina leachii* (Gray), and *Myotis keaysi pilosatibialis* La Val. The freetail bat *Tadarida laticaudata yucatanica* (Miller) has also been taken in one cave. An enormous colony of bats in Volcán de los Murciélagos, Campeche, has not been studied, but the odor of the guano and the size of the colony indicates that it may be Mexican freetails. If so, this is of interest in that this bat has not been previously recorded from the Peninsula.

Order Rodentia.—The rodent *Ototylomys phyllotis phyllotis* Merriam has been collected in Grutas de Balankanche and Cueva Chac Mol and will probably be found in other caves. The paca *Agouti paca nelsoni* Goldman, also recorded from Grutas de Balankanche, is reported by local people to frequent caves. The porcupine *Coendou mexicanus yucataniae* Thomas has been found in two caves in the coastal plain of Yucatán.

Distribution

Cave faunal distributions in the Yucatán Peninsula are still poorly understood. Although the fauna of northern Yucatán is well-known, comparatively few collections have been made in southern Yucatán, Quintana Roo, and Campeche. The few caves investigated in Quintana Roo, however, indicate that the fauna differs little from that of northern Yucatán. The only cave studied in southern Campeche is Volcán de los Murciélagos, a large bat cave unsuitable for terrestrial troglobites. Thus, it is not possible to outline the southern limit of the distribution of Yucatán troglobites. Furthermore, no cave collections have been made in northern Belize, the Petén of Guatemala, or extreme western Campeche. Only intesnive collecting in these areas will determine the southern and western limits of the troglobitic fauna of the Yucatán Peninsula. Several caves have been investigated in northeastern Campeche, but few reach the permanent water level, and it is not possible to say with certainty that the aquatic distributions are known. Despite this paucity of information, certain distributional patterns are emerging, and the following is a preliminary discussion of these patterns.

Troglophiles

Terrestrial species.—As is to be expected, the distribution of the terrestrial troglophiles and trogloxenes is much greater than that of the troglobites. In general, the troglophile fauna of the Peninsula is seldom found outside of southern México. Although a few species are known only from the Yucatán Peninsula, most are also known from caves in other parts of México. Several troglophiles are even known to occur also in islands of the Caribbean and in the United States. Several of the species which are considered to be troglophiles and are known only from caves may, in fact, be restricted to caves. Most notable of these is the ricinuleid *Cryptocellus pearsei,* which is known only from caves in the state of Yucatán. The apparent absence of several species of spider, milliped, isopod, collembolan, and ant on the surface in Yucatán is probably an indication of the greater amount of collecting in caves as compared to the endogean habitat. Most of northern Yucatán is now unsuitable for endogean species, and essentially no study has been made of the endogean fauna of the remaining forests of southern Yucatán and Quintana Roo.

Aquatic species.—With the exception of a few planktonic species, the aquatic troglophile fauna of Yucatán is comprised of widely distributed species. When the aquatic fauna of southern México is better known, these species will also prove to have wider distributions than now known.

Troglobites

The controlling factor in the distribution of troglobites in the Yucatán Peninsula appears to be physiography. Our knowledge of the geology of the Peninsula is still very limited, but the work of Butterlin and Bonet (1963) has done much to clarify the situation. An attempt to correlate troglobite faunal distributions with geologic formations indicates that these are not significant in limiting species. A similar analysis of distributions with respect to physiographic provinces reveals that many species are restricted to distinct physiographic regions, but some species have ranges which encompass two or more regions. It is not possible to speculate on whether this is a reflection of different times of invasion, a greater degree of mobility of the species, or a slower evolutionary rate.

Six basic distributional patterns are evident from the limited information available: (1) Species which are known from one or a few nearby caves; (2) species which range throughout the coastal plain, but do not occur in the Central Hill District; (3) species which occur both in the coastal plain and the Sierra de Ticul; (4) species which are known only from the Sierra de Ticul; (5) species which are known only from the Sierra de Bolonchén; and (6) species which occur throughout the Peninsula. Table 1 lists, by physiographic district, the troglobites of the Yucatán Peninsula.

(1) Species which are known only from one or a few nearby caves include the pseudoscorpions of the genus *Vachonium,* the spiders *Theotima martha, Metagonia chiquita,* and *Cicurina maya;* the scorpions of the genus *Diplocentrus;* the isopods *Troglophiloscia levis* and *Caecidotea* sp.; the milliped *Orthoporus spelaeus;* the amphipod *Mayaweckelia yucatanensis;* and the collembolan *Metasinella falcifera.* At least some of these species will unquestionably prove to have wider ranges than the limited records indicate. In a few instances, however, it is evident that the distributions are extremely limited. Most notable are the species of *Vachonium.* Few troglobitic pseudoscorpions are known from more than one cave, and, in the coastal plain of Yucatán, *V. kauae* and *V. maya* are known from caves only about 10 km apart. The two described species of *Vachonium* from the Sierra de Ticul are widely separated, but two additional collections of this genus may represent undescribed forms. The amphipod *Mayaweckelia yucatanensis* may also be limited to Grutas de Xtacumbilxunam. Collections from several nearby caves have not produced troglobitic amphipods, and the fauna of Grutas de Xtacumbilxunam is unique in other respects, suggesting that it may be geologically or hydrologically isolated. *Orthoporus spelaeus* is a large milliped known only from Cenote de Catzín in eastern Yucatán. Few caves which would appear to be suitable for this species have been visited near Catzín, but considering the size of this animal and the geologic and physiographic continuity throughout northern Yucatán, it would be expected to range into the area around Tizimín and Chichén Itzá. Its absence from caves with habitats similar to that of Cenote de Catzín indicates that it may also be restricted to this cave or to caves near Catzín. The remaining species are all small and rare, and the limited distributions may be artifacts of collecting.

(2) The only species which are restricted either to the Northwestern or Northeastern Coastal Plain are those known only from one cave, as discussed above. Four aquatic and two terrestrial species do occur over a wide area in the Coastal Plain. The spider *Pholcophora pearsei* is known from three caves in northern Yucatán and two in Quintana Roo. Its wide range in the Coastal Plain indicates that it should have appeared in the caves of the Central Hill District, but numerous collections in this area have failed to produce this species, even though recording other small troglobitic spiders. The cricket *Tohila atelomma* has been identified only from the Coastal Plain, but blind crickets from the Sierra de Ticul remain unstudied. The mysid *Antromysis cenotensis,* the shrimp *Typhlatya mitchelli,* and the two blind fish *(Typhliasina pearsei* and *Ophisternon infernale)* are all known only from caves in the Coastal Plain. All have wide distributions in this district, and would have been expected to appear in the caves of the Central Hill District. *Antromysis cenotensis* is incredibly abundant wherever it is found, and yet it has not been found in suitable habitats anywhere outside the Coastal Plain. *Typhlatya mitchelli* is also widely distributed across the Coastal Plain and locally present in large numbers. It is sympatric in many caves with *T. pearsei* which ranges throughout all parts of the Peninsula which have been studied. The brotulid *Typhliasina pearsei* is known only from caves in the northern part of Yucatán, but few suitable caves for it are in the Central Hill District. A sight record of "blind fish" in part of Grutas de Xtacumbilxunam indicates that the species may occur there. *Ophisternon infernale* is less cave-adapted than *Typhliasina* and is usually found in caves with substrates of silt and small rocks. It is probably restricted to the Coastal Plain.

(3) Four terrestrial and one aquatic troglobite are known from caves both in the Coastal Plain and the Sierra de Ticul. The cirolanid *Creaseriella anops* is widespread both in the Coastal Plain and the Sierra de Ticul, but it has not been found in any of the caves in the Sierra de Bolonchén which are known to reach permanent water. It is frequently collected with *Typhlatya pearsei* and *Creaseria morleyi,* both of which occur in the Sierra de Bolonchén, and there is no apparent reason why *C. anops* should not be found there too. Only intensive collecting, possibly using baiting techniques, will determine if this species is absent from the Sierra de Bolonchén. The four terrestrial troglobites which are known only from the Coastal Plain and the Sierra de Ticul belong to largely unstudied groups. These species (the isopod *Trichorhina pearsei,* the amblypygid *Paraphrynus chacmool,* and the collembolans *Cyphoderus innominatus* and *Troglopodetes maya)* are all widespread, and their discovery in the Sierra de Bolonchén would not be surprising.

(4) Eight species of terrestrial troglobite are known

Table 1.–The troglobitic fauna of the Yucatán Peninsula by physiographic districts.

Species	Northwestern Coastal Plain	Northeastern Coastal Plain	Sierra de Ticul	Sierra de Bolonchén
Isopods				
Creaseriella anops	X	X	X	
Caecidotea sp.	X			
Troglophiloscia levis			X	
Trichorhina pearsei	X	X	X	
Cylindroniscus maya	X	X		
Amphipods				
Mayaweckelia cenoticola	X			X
Mayaweckelia yucatanensis				X
Mysids				
Antromysis cenotensis	X	X		
Shrimps				
Typhlatya campecheae				X
Typhlatya mitchelli	X	X		
Typhlatya pearsei	X	X	X	X
Creaseria morleyi	X	X	X	X
Scorpions				
Diplocentrus anophthalmus			X	
Diplocentrus mitchelli				X
Pseudoscorpions				
Vachonium sp.			X	
Vachonium boneti			X	
Vachonium cryptum			X	
Vachonium kauae	X			
Vachonium maya	X			
Amblypygids				
Paraphrynus chacmool	X	X	X	
Spiders				
Cicurina maya			X	
Theotima martha	X			
Oonops coecus	X	X		X
Metagonia chiquita		X		
Metagonia torete	X	X		X
Pholcophora pearsei	X			
Tetrablemma n. sp.				X
Millipeds				
Orthoporus spelaeus	X			
Orthoporus zizicolens			X	
Collembolans				
Cyphoderus innominatus		X	X	
Metasinella flacifera			X	
Troglopodetes maya	X		X	
Crickets				
Tohila atelomma	X	X		
Fishes				
Typhliasina pearsei	X	X		
Ophisternon infernale	X	X		

only from the Sierra de Ticul. The isopod *Troglophiloscia levis*, the scorpion *Diplocentrus anophthalmus*, the pseudoscorpions of the genus *Vachonium*, and the spider *Cicurina maya* all have limited distributions, as discussed above. All are almost certainly restricted to the Sierra de Ticul. The collembolan *Metasinella falcifera* is known only from one cave in the Sierra de Ticul, but considering the wide distributions of cavernicole collembolans in general, it would be expected to be found throughout the Sierra de Ticul and possibly in other regions as well. The milliped *Orthoporus zizicolens* is a large species known from several caves throughout the Sierra de Ticul. It is abundant wherever it occurs, and caves which appear to be ideal for it have been investigated both in the Coastal Plain and the Sierra de Bolonchén.

(5) Two aquatic and two terrestrial species are known only from the Sierra de Bolonchén. The amphipod *Mayaweckelia yucatanensis* is known only from Grutas de Xtacumbilxunam. The fauna of this cave differs from that of caves less than 15 km away, and it is assumed that this species is restricted to Grutas de Xtacumbilxunam or other nearby caves which reach permanent water. The shrimp *Typhlatya campecheae* is known only from Grutas de Xtacumbilxunam and Cenote de Cantemo. Its absence from the Coastal Plain and the Sierra de Ticul is conspicuous and this species almost certainly will not be found outside the Sierra de Bolonchén. The scorpion *Diplocentrus mitchelli* is known only from Actún Halmensura in northeastern Campeche. Cave scorpions in general have very limited distributions, and this species is probably restricted to the Sierra de Bolonchén. The tetrablemmid spider *Tetrablemma* n. sp. is known only from two caves in the Sierra de Bolonchén. The related epigean species *Tetrablemma cambridgei* occurs in caves in the Sierra de Ticul and in endogean habitats in the Coastal Plain. The troglobitic *Tetrablemma* is presumably limited to the Sierra de Bolonchén.

(6) Two aquatic troglobites occur in all four physiographic districts. These two shrimps (*Typhlatya pearsei* and *Creaseria morleyi*) are highly adapted troglobites and are abundant throughout the Coastal Plain and the Central Hill District, although both are absent from Grutas de Xtacumbilxunam. Two spiders, *Oonops coecus* and *Metagonia torete*, have been found in the caves of the Coastal Plain and the Sierra de Bolonchén. These are small, rare spiders, and their presence in the Sierra de Ticul is likely.

CAVE DESCRIPTIONS

The following includes descriptions of all caves and cenotes in the Mexican portion of the Yucatán Peninsula which have been biologically investigated, either by previous workers or during the course of the Association for Mexican Cave Studies expeditions. More detailed descriptions and maps eventually will be published in a volume exclusively devoted to the caves of the Peninsula. The numbers following cave names refer to the location maps for Campeche (Fig. 9), Quintana Roo (Fig. 10), and Yucatán (Fig. 11). Caves not visited by the AMCS are not located on the maps.

CAMPECHE

MUNICIPIO DE CALKINI

CENOTE DE BOLCHEN (1)

Cenote de Bolchén is located in a densely wooded area about 3 km south of the village of San Antonio Sacabchén. A small collection of invertebrates was made on 30 October 1974 by James Reddell, Suzanne Wiley, and David McKenzie.

The entrance to the cave is a circular opening about 1 m in diameter dropping vertically for 3 m onto a small mound of rubble. A slope leads down to a pool of water completely covering the floor of the cave passage. The 3 m wide passage extends about 30 m before turning to the right. The floor is of liquified guano in excess of 1 m in depth and is covered by 1 to 2 m of water. No attempt was made to explore the cave fully. The cave is probably formed in the Carrillo Puerto Formation.

Numerous bats of unknown species inhabit the cave. Copepods, ostracods, insect larvae, and palaemonid shrimps (*Creaseria morleyi*) comprise the invertebrate fauna of the pool. The terrestrial fauna was limited to a few trogloxenes below the cave entrance. Roaches, ants, harvestmen, spiders, and millipeds were collected.

MUNICIPIO DE CHAMPOTON

QUARRIED CAVE (CHAMPOTON) (10)

This probably artificial cave is located about 20 km north of Champotón and about 20 m east of the

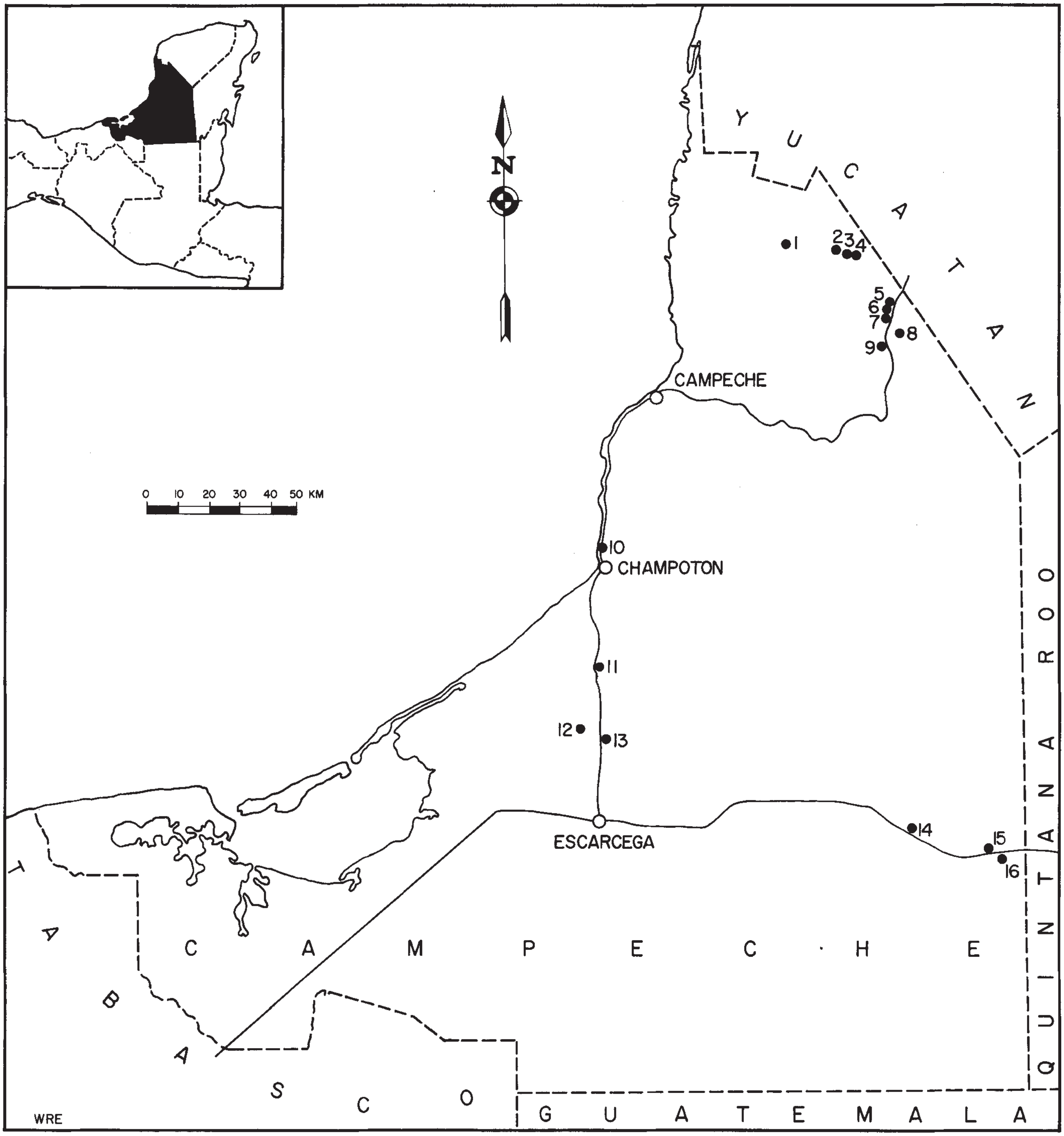


Fig. 9.–Map of Campeche showing locations of caves visited by members of the Association for Mexican Cave Studies. 1, Cenote de Bolchén; 2, Grutas de Xkalumkín; 3, Actún Chen; 4, Actún Halmensura; 5, Grutas de San Ignacio and Grutas de San José; 6, Actún Huachap; 7, Cenote Espiritú; 8, Grutas de San Antonio; 9, Grutas de Xtacumbilxunam; 10, Quarried cave (Champotón); 11, Cueva de Chuiná; 12, Grutas de Monte Bravo; 13, Cenote de Cantemo; 14, Volcán de los Murciélagos; 15, Cueva del Yeso; 16, Cueva Sascabá.

highway to Campeche. A small collection of invertebrates was made in the cave on 22 August 1972 by Jerry W. Cooke, Robert W. Mitchell, and William H. Russell.

The cave is a *sascabera* (caliche mine) and, although parts of it may have been natural, it appears to be primarily artificial. Two small entrances on the side of a low hill lead into a 1.5 m high passage which ends after about 7 m.

The fauna of the cave includes amblypygids, theraphosid and pholcid spiders, and several species of milliped.

CENOTE DE CANTEMO (13)

Cenote de Cantemo is located on a small ranch 1 km north of the village of Cantemo on the highway from Escárcega to Champotón. Small collections of invertebrates were made on 18 December 1974 by Linda Elliott, David McKenzie, and James Reddell; and on 31 July 1975 by Andy Grubbs, David McKenzie, James Reddell, and Suzanne Wiley.

The natural entrance to the cave is at the end of a shallow arroyo. Several small drops lead into a sloping passage 2 m wide and 4 m high, which opens after a few meters into a room about 4 m wide, 10 m long, and containing a 3 m in diameter, 1.5 m deep pool. An artificial entrance is located above the pool and a gasoline-driven pump used to remove water for the ranch sits atop the entrance. No passages extend from this room. The cave is probably formed in the Xbacal Member of the Chichén Itzá Formation.

The pool, despite pollution by oil, contained a large population of atyid shrimps *(Typhlatya campecheae)* and snails. Terrestrial fauna collected included schizomids, amblypygids, spiders, isopods, symphylans, millipeds, collembolans, diplurans, gryllid crickets, hemipterans, and carabid beetles.

CUEVA DE CHUINA (11)

Cueva de Chuiná is located on a cliff about 8 m above the famed shrine of the Virgin of Chuiná. This cave is visited frequently by local people and by the hundreds of people who make a pilgrimage to the shrine. It was reported by Pacheco Blanco (1928) as being very extensive, but a careful recent exploration revealed it to be of little extent. A small collection was made in the cave on 31 July 1975 by James Reddell.

An elongate vertical opening about 0.8 by 1 m drops into one end of a fissure formed along an exfoliation crack parallel to the cliff-face. The fissure is about 7 m long at the longest point and up to 1.5 m wide. It is possible to chimney this 10 m drop to a sloping floor littered with crosses, crutches, bandages, and other debris. At the base of the slope is a foul pool about 0.8 m wide, 1 m long, and less than 0.5 m deep. The fissure terminated at this pool, and no other passages were found.

The only fauna collected in the cave were small trichopolydesmid millipeds on a stick lying partially in the pool. Many large cockroaches were seen but were not collected.

GRUTAS DE MONTE BRAVO (12)

Grutas de Monte Bravo is located west of the highway from Escárcega to Champotón and about 10 km NW of Cantemo. The cave is well-known locally and was apparently a source of water for the early Maya as it is for the present inhabitants of the region. The cave floor is strewn with potshards, and human skeletal fragments were observed in several parts of the cave. A collection of invertebrates was made on 19 December 1974 by Linda Elliott, David McKenzie, and James Reddell.

The cave has at least four entrances, all located along the edges or beneath a large vegetation-covered "polje." The most accessible entrance is a small sink located about 4 m from a large unclimbable sinkhole entrance. A crawlway over rubble leads down into an elongate room 10 m wide and 30 m long; several passages extend from this room. One immediately to the right is a high, dry fissure-like passage extending about 50 m to an entrance chamber about 15 m in diameter. Several short side passages from this fissure passage dead-end shortly. At the opposite end of the first entrance room a complex series of largely parallel passages and crawlways provide a route into an elongate chamber 80 m long, 10 m wide, and up to 10 m high. Before this chamber is reached, a hole in the floor leads down to a deep pool of clear water. The main pool in the cave lies in the center of the large elongate room. This pool is about 2 m wide, 4 m long, and more than 3 m deep. Beyond the pool a slope descends into a small moist dead-end area inhabited by vampire bats. To the right from this chamber a passage leads to a fourth unclimbable entrance. To the left of the chamber two interconnecting passages lead into an elongate passage 75 m long, 5 to 10 m wide, and up to 6 m high, inhabited by a large colony of bats. Except for the two large inner chambers the cave is very dry owing to circulation between entrances. The cave is probably formed in the Xbacal Member of the Chichén Itzá Formation.

Several species of bat, including vampires and possibly Mexican freetails inhabit the cave, but were not collected. The main pool contained a large population of atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimps. Terrestrial invertebrates, most of which were obtained in the inner rooms, included amblypygids, spiders, ticks, isopods, millipeds, collembolans, roaches, gryllid crickets, hemipterans, fleas, and ants.

VOLCAN DE LOS MURCIELAGOS (14)

Volcán de los Murciélagos is located to the north of the highway from Chetumal to Escárcega at kilometer 107 approximately 11 km east of Conhuas. A collection of invertebrates was made in the cave on 30 July 1975 by Andy Grubbs, David McKenzie, and James Reddell.

The entrance to the cave, a vertical sinkhole about 25 by 33 m, is located on the sloping side of a hill and drops about 60 m on the high side and 25 m on the low side. A difficult handline descent on the low side leads to a steep rubble slope. The walls of the entrance are composed of poorly consolidated limestone and other rocks. The rubble slope leads down under the high side of the sink, where it becomes covered in a deep layer of guano. A steeply-sloping passage 25 to 35 m wide descends abruptly for 70 m vertically to an area of massive breakdown. A climb through this breakdown opens onto another guano slope which drops 25 to 35 m into a passage 13 to 20 m wide and 7 to 14 m high. The floor slopes further to a deep pool of permanent water inhabited by snails and amphipods. Beyond this pool the cave continues with approximately the same dimensions for at least 1,000 m before appearing to end in a massive breakdown slope, but careful exploration of this breakdown might lead to an extension of the cave. The cave is formed in thin-bedded brittle limestone, and the floor is covered with highly unstable breakdown coated with a deep layer of slick, wet guano. Several pools occur beyond the first, but all can be bypassed by climbing along steep breakdown slopes lining the walls. Although no temperatures were taken in the cave, it was very warm and the atmosphere was stifling.

A colony of bats probably numbering in the hundreds of thousands, if not more, inhabited the cave. The bat flight lasted at least three hours, and thousands of bats remained in the cave. No bats were collected but from the odor of the cave and the size of the bat colony, it is speculated that the bats were Mexican freetails. The first pool contained a large population of snails *(Stenophysa* sp.) and troglobitic amphipods *(Mayaweckelia cenoticola).* The entrance area fauna included a large unidentified theraphosid tarantula, reduviid bugs, and ants. The guano throughout the cave was covered with pseudoscorpions *(Neoallochernes* sp.) and ticks *(Antricola mexicanus).*

CUEVA SASCABA (16)

Cueva Sascabá is a small, probably artificial cave located in the ruins of Chicanná. A small collection of invertebrates was made on 30 July 1975 by James Reddell.

The entrance to the cave is a vertical opening 1 m in diameter and dropping 2.8 m to a small room about 7 m in diameter. It is formed entirely in chalky limestone. It almost certainly was used as a source of material during the construction of the temples at Chicanná.

With the exception of wasps near the cave entrance, the only fauna observed in the cave were harvestmen *(Geaya yucatana).*

CUEVA DEL YESO (15)

Cueva del Yeso is located less than a meter north of the highway from Chetumal to Escárcega and 3.8 km west of the turnoff to the ruins of Chicanná. A small collection was made in the cave on 30 July 1975 by James Reddell.

The entrance to the cave is a vertical hole 1 m in diameter and 4 m deep, which leads into a 1 m wide, 2 m high passage. To the left the passage ends almost immediately, but to the right it extends 5 m, turns left, and becomes a few centimeters high. Digging led into a passage less than 1 m wide, 1.2 m high, and 3 m long before ending in a narrow crevice. The cave is formed in gypsum deposits of the Icaiche Formation.

Wasps inhabited the entrance area. The only fauna collected were millipeds.

MUNICIPIO DE HECELCHAKAN

ACTUN CHEN (3)

Actún Chen is located near the main plaza of Cumpich. The cave was described by Pacheco Blanco (1928) as the only source of water for the town. In about 1930 a water well was dug, and the cave no longer serves as a water source. A small collection of invertebrates was made on 1 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley. An unsuccessful attempt to excavate the cave and reach the lower levels was made by Andy Grubbs and William Russell on 19 June 1975, at which time an additional small collection of frogs and invertebrates was made.

This famous cave once apparently descended a series of drops to a lake, but it now consists only of a single chamber with a few dead-end crawlways. The entrance receives considerable run-off via a small arroyo and, with the cessation of its use as a water source, the cave was apparently allowed to become plugged with debris. A 5 m diameter entrance gradually narrows to form an elongate opening about 4 m by 3 m. An 8 m unclimbable drop leads to a rubble slope at one side of a chamber about 10 m in diameter. The slope descends about 4 m to a floor of rotten wood, dirt, and small rocks. Crawlways above the slope lead into small rooms but do not extend more than 10 m in any direction. A hole in flowstone from a small room above the slope emits a strong air current. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

The cave contains a rich assortment of endogean forms, including schizomids, spiders, isopods, millipeds, collembolans, diplurans, hemipterans, and small beetles. Amblypygids and nesticid spiders were collected from the walls, and a frog, *Leptodactylus labialis*, was collected from the entrance room.

ACTUN HALMENSURA (4)

Actún Halmensura is located 5 km east of Cumpich. A small collection of invertebrates was made on 31 October 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

The cave entrance, in a milpa at the lowest point of a shallow dolina, is a vertical opening about 0.8 m in diameter, dropping 2 m to a mound of breakdown. One way from the mound leads back under the entrance and into an irregular breakdown-floored room. The other way leads into a room 10 m wide, 15 m long, and up to 4 m high. It is floored with large slabs of guano-covered breakdown. Several large roots enter the room, and flowstone lines the walls along part of the room. To the left a slope goes up into a low crawlway-stoopway passage about 10 m long. Much of the floor of the cave is covered with a thin layer of bat guano. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

In addition to unidentified bats, the cave is inhabited by scorpions with reduced eyes *(Diplocentrus mitchelli)*, schizomids, amblypygids, pholcid spiders, blind tetrablemmid spiders *(Tetrablemma* n. sp.), trichoniscid and porcellionid isopods, collembolans, gryllid crickets, ants, and snails.

GRUTAS DE XKALUMKIN (2)

Grutas de Xkalumkín is located in the extensive ruins of Xkalumkín about 5 km west of Cumpich. The cave was doubtless an important source of water for the inhabitants of Xkalumkín, although no water was found. Pottery shards were abundant throughout the cave, and a carved stone phallus was found a short distance from the smaller of the two entrances. A collection of invertebrates was made in the cave on 20-21 June 1975 by Andy Grubbs, David McKenzie, James Reddell, and Suzanne Wiley. The cave was mapped and additional collections were made by the same people on 15-16 July 1975.

The smaller entrance is located in a shallow sink about 7 m in diameter and 3 m deep. At one side a slope descends into a horizontal passage 1 to 3 m wide and up to 3 m high. A rock-floored passage extends about 15 m to an unclimbable drop of 5 m. This leads into a rocky area sloping down an additional 10 m to a cobble-plugged horizontal crawlway. It is possible to bypass this drop on the left and continue about 35 m to a drop into a large trunk passage. This drop is 7 m and may be climbed with considerable difficulty. After about 25 m a major junction is reached. Straight ahead it extends as a large walking tunnel with bats and numerous pottery shards for about 70 m to a junction. The right-hand passage, after about 150 m, becomes a complex of low passages which was not fully explored, while the left passage gradually lowers to a crawlway with increasingly bad air and was not explored after about 100 m. The passage to the right at the major junction is 3 to 7 m high and 2 to 3 m wide, passes by a short dead-end passage to the right, and branches after about 100 m. Straight ahead it ends after about 20 m. The right-hand passage is a cobble-floored crawlway up to 5 m wide and 1 m high, which enters a wide low room and splits. To the right the passage splits again after about 20 m, with the right passage ending after an additional 20 m. To the left the low crawlway continues about 35 m where it intersects the crawlway from the low room. This crawlway then continues to a breakdown area. A climb up leads into a large passage. To the right one small hole leads into a bat room 10 m in diameter and 1 to 2 m high. The main passage goes in two directions. To the right it leads up over breakdown into a bat-inhabited area and ends after about 40 m. To the left it extends as a 3 to 5 m wide, 2 to 4 m high passage for 65 m to an 11 m deep, 7 to 8 m entrance, which requires equipment. No other passages lead from this entrance.

The cave is inhabited by several unidentified species of bat, and a rattlesnake, *Crotalus durissus tzabcan* Klauber, was seen in the entrance area. The invertebrate fauna included schizomids, spiders (including the blind *Oonops coecus)*, ticks, isopods, millipeds, collembolans, hemipterans, ants, and beetles.

MUNICIPIO DE HOPELCHEN

CENOTE ESPIRITU (7)

Cenote Espiritú is located approximately 10 km

NNW of Bolonchenticul. The cave has probably been used as a source of water for hundreds of years and continues to be used by local farmers and hunters. Small ruins are located nearby, and these were supplied, at least in part, by water from this cave. A small collection of invertebrates was made on 3 November 1974 by James Reddell, David McKenzie, and Suzanne Wiley.

The entrance to the cave, in a cleared flat area, is a sinkhole about 6 m in diameter and 8 m deep. A somewhat irregular guano-floored passage, partly cleared of rubble, extends for about 100 m to several pools of tepid water. These pools appear to be drip water rather than part of the ground water. The cave air is extremely bad and will not support a carbide lamp flame. Exploration ceased at the pools, although the cave continued as a crawlway. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

A large population of unidentified bats inhabits the cave. Numerous isopods and pyrgodesmid millipeds live on the guano. Amblypygids, spiders, and crickets were collected from the cave walls and in the breakdown along the walls.

ACTUN HUACHAP (6)

Actún Huachap is located about 14 km NNW of Bolonchenticul and about 3 km from the Rancho Miramar. Ruins are located near the entrance to the cave, which may have served as a water source. A collection of invertebrates was made on 24 June 1975 by Andy Grubbs, David McKenzie, William Russell, and Suzanne Wiley.

A large entrance sink about 40 by 15 m gives access to the main trunk passage which is 25 m wide and 20 m high. Near the entrance the passage is floored with rounded cobble-sized rocks. The main passage continues for several hundred meters and descends a small, 5 m drop into a large bat room. A passage extending from the bat room splits into upper and lower levels which separate and join several times as they continue several hundred meters to terminate in a breakdown room. Graffiti and broken glassware, possibly dating from the Colonial Period, were noted. A 15 by 30 m side passage leading to the left before the bat room was not fully explored.

Fauna of the cave has not been thoroughly collected and doubtless will prove to be of more interest than the few species recorded from it show. Blind spiders *(Oonops coecus)*, millipeds, isopods, hemipterans, and snails have been collected.

GRUTAS DE SAN ANTONIO (8)

Grutas de San Antonio is located on the Rancho San Antonio about 10 km NNE of Bolonchenticul. The cave was an important source of water for the early Maya and early Spanish inhabitants of this area. John Lloyd Stephens on his visit to Bolonchenticul in 1841 mentions hearing of the cave but did not visit it. A hand-dug well intersecting the lake at the end of the cave was reportedly excavated about 1875. The cave was mapped and collections of invertebrates were made on 3 November 1974 and 23-24 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

The entrance to the cave is an impressive sumidero into which a shallow arroyo enters. The arroyo is somewhat indistinct until about 100 m before the cave entrance proper; at this point it begins to incise and descends in a series of drops up to about 10 m in depth. The arroyo intersects at right angles an elongate entrance sink 60 m long and 30 m wide, with a headwall more than 30 m high. To the right a slope leads up into an elongate room from which a dead-end passage extends. To the left a slope descends into a passage which opens into a 30 m wide, 40 m long room extending back beneath the arroyo. At the opposite end of this room from the entrance a dug well intersects the cave but does not pass below the level of the cave floor. To the right from this room a descent over breakdown leads into a 1 to 3 m high, 10 m long room, which is rich in organic debris. Water entering the cave, however, rushes down a slope to the left, through the entrance room, and drops into a 10 m in diameter pit approximately 50 m deep. Immediately before the pit a slope leads up to the left into a large gallery passage 10 to 15 m wide, 10 to 15 m high, and 130 m long. On the right side of this passage a pit drops about 5 m into a meandering passage. Two passages to the left extend for short distances to the main pit. The main passage continues down a 5 m drop, cuts back underneath, and also intersects the main pit. The floor of the pit is covered by large breakdown blocks and smaller rubble, and ends in a climb-down over flowstone to one side of a lake. A passage floored with water more than 2 m deep ends in a siphon after about 15 m. Immediately before the climb-down to the lake a hand dug well 1.8 by 4 m intersects the cave passage and continues into the rubble of the cave floor to the water level. From the surface to the water level the well is about 120 m deep. The air temperature ranged from 22.2°C in the gallery passage to 23.3°C in the lake room; water temperature in the lake was 27.8°C. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

The cave receives considerable floodwater and in areas away from air circulation is rich in terrestrial invertebrates. Schizomids, amblypygids, spiders, opilionids, isopods, millipeds, collembolans, hemipterans, psocids, crickets, ants, carabid and leiodid beetles, snails, and earthworms were among the fauna collected. The lake is inhabited by large populations of snails, ostracods, copepods, atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimp, and aquatic hemipterans. Bats are abundant in the lake room, and the well is used as a roosting site for unidentified birds.

GRUTAS DE SAN IGNACIO (5)

Grutas de San Ignacio is located about 15 km north of Bolonchenticul near the village of Chen Cedro. The cave was an important source of water for the Maya, and a large highly-decorated pot was found in it. The cave was partially explored and a small collection of invertebrates was made on 25 June 1975 by Andy Grubbs, David McKenzie, and Robert W. Mitchell, Jr.

A 12 m deep pit drops into a 5 by 7 m entrance room floored with surface dirt, rocks, and wooden debris. A second drop of 7 m leads into a smaller room. A stoopway-walkway with a trail worn into the rock extends past several small drip pools and down a 3 m drop to a small room. The cave continues as a steeply sloping, almost vertical, passage descended by climbing eroded flowstone cascades. After descending 20 to 30 m the passage becomes horizontal. More than a hundred meters of small, muddy passage connecting small rooms was explored but no end was reached.

The cave will probably prove to have an exceptionally rich fauna when it has been thoroughly explored and studied. The small collection made in the cave included isopods, spiders (including blind tetrablemmids of the genus *Tetrablemma)*, and millipeds.

GRUTAS DE SAN JOSE (5)

Grutas de San José is located about 15 km northeast of Bolonchenticul near the village of Chen Cedro. A small collection of invertebrates was made in the cave on 13 July 1975 by Andy Grubbs, David McKenzie, James Reddell, and Suzanne Wiley.

The entrance is a circular opening about 1 m in diameter at the bottom of a 1.8 m deep vertical sink about 5 m long and 2 m wide. A shallow arroyo drains into the sink. An unclimbable drop of 8 m leads to a floor of debris, from which a slope descends under an overhang to a climbable 4 m drop. At the bottom of this drop a 1 m in diameter crawlway leads 3 m to a large skylit dome-pit 20 m deep and perhaps 15 m high and 15 m in diameter. From the bottom of this unclimbable drop a walking passage extends about 100 m to a 10 m drop which also requires equipment. At the bottom a passage extends 50 m, at which point it intersects a stream passage. Upstream, the passage is about 1.5 m wide and less than 1 m high. It was explored about 10 m but continued with the same dimensions. Downstream, the passage extends a short distance to a small breakdown-floored room where the passage forks. To the right a climb up over breakdown leads to a passage 1 to 2 m high and 1.5 m wide with breakdown and water on the floor. The left passage contains water and mud. After about 35 m the two join and extend an additional 35 m to a second breakdown room. The stream passage disappears under the breakdown, but it is possible to climb up into the room through a low crawlway. The room is about 10 m long, 7 m wide, and has a sloping ceiling usually less than 1.6 m high. To the right a breakdown-floored crawlway 0.8 m high and 0.9 m wide continues at least 10 m but was not explored.

The fauna of the cave includes amphipods *(Hyalella azteca)* and leeches in the stream and spiders, isopods, millipeds, and crickets in the dry areas.

GRUTAS DE XTACUMBILXUNAM (9)

Grutas de Xtacumbilxunam has also been erroneously referred to as Cueva de Bolonchén. Spelling variations on the name include Ixtacumbilxunan and Xtacumbilxunan. The cave is located 2 km southwest of Bolonchenticul. It has served as a primary source of water for the Maya for more than 1000 years. Small ruins are located near the entrance. Although the town of Bolonchenticul contains nine wells in the plaza, these periodically become dry and in years before the digging of deep wells in the town the people would retire to Grutas de Xtacumbilxunam where they would repair the great ladders used to reach the water in the cave. This is described vividly in the account of the 1841 exploration of the cave by John Lloyd Stephens. The cave has recently been modified somewhat to facilitate entry by tourists, and steps and concrete paths have been constructed back to the great pit room. The wooden ladders which lead to the lower levels are in serious disrepair. Collections of invertebrates were made in the cave by David McKenzie on 31 December 1971; by Mary Butterwick, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell on 19 April 1973; by Mary Butterwick, David McKenzie, Martha Helen McKenzie, and James Reddell on 13 May 1973; by Deborah Denson, Masaharu Kawakatsu, and Robert W., Robert W. Jr., Sharon A., and Rexell Mitchell on 29-30 July 1973; by David McKenzie, James Reddell, and Suzanne Wiley on 25 November 1974; by Andy Grubbs, David McKenzie, James Reddell, Suzanne Wiley, and William Russell on 17 June 1975; and by Andy Grubbs, David McKenzie, and James Reddell on 14 July 1975. The cave was mapped during the 1973, 1974, and 1975 trips.

The main entrance to Grutas de Xtacumbilxunam is an impressive sumidero descending gradually for about 20 m to enter a 15 m high, 20 m wide opening (see Fig. 12). This 50 m long passage descends steadily to the edge of the main pit in the cave. A complex of small passages and rooms may be reached by partially circling the pit to the right. A second entrance forms an impressive skylight over the 25 m deep pit. Across the pit the main cave passage slopes up to intersect a 20 m deep, 45 m long, 40 m wide entrance sink from which large trees grow. On the opposite side of this sink a short drop leads into a series of smaller passages and rooms. One of these small passages in turn leads into a complex area of pits and rooms which are still not fully explored. The deepest point of the cave is reached at -105 m in this area.

The main pit in the cave, figured impressively by Catherwood in Stephens' account of the 1841 exploration of the cave, contains wooden ladders which are now too dangerous to use. From the bottom of the pit a sloping drop leads down to a second vertical drop of about 15 m into a rubble-floored room. Two passages extend from this room. One to the right slopes up to intersect a high dome reaching to the passage between the skylight and large entrance sink and a drop of 15 m into a long, meandering series of bat-inhabited passages and rooms. About 100 m from the bottom of this drop the cave forks, with the left fork leading 60 m to a pool of deep liquid guano, at which point exploration has stopped. The right fork passes through a series of small bat rooms for about 100 m to a pool of water inhabited by shrimp. The air in this passage becomes progressively bad until it will not support the flame of a carbide lamp. Exploration stopped at the edge of the pool. The air temperature in this part of the cave ranges from 28.8°C to 33.3°C.

From the main junction room a large gallery passage extends about 75 m before ending. To the left

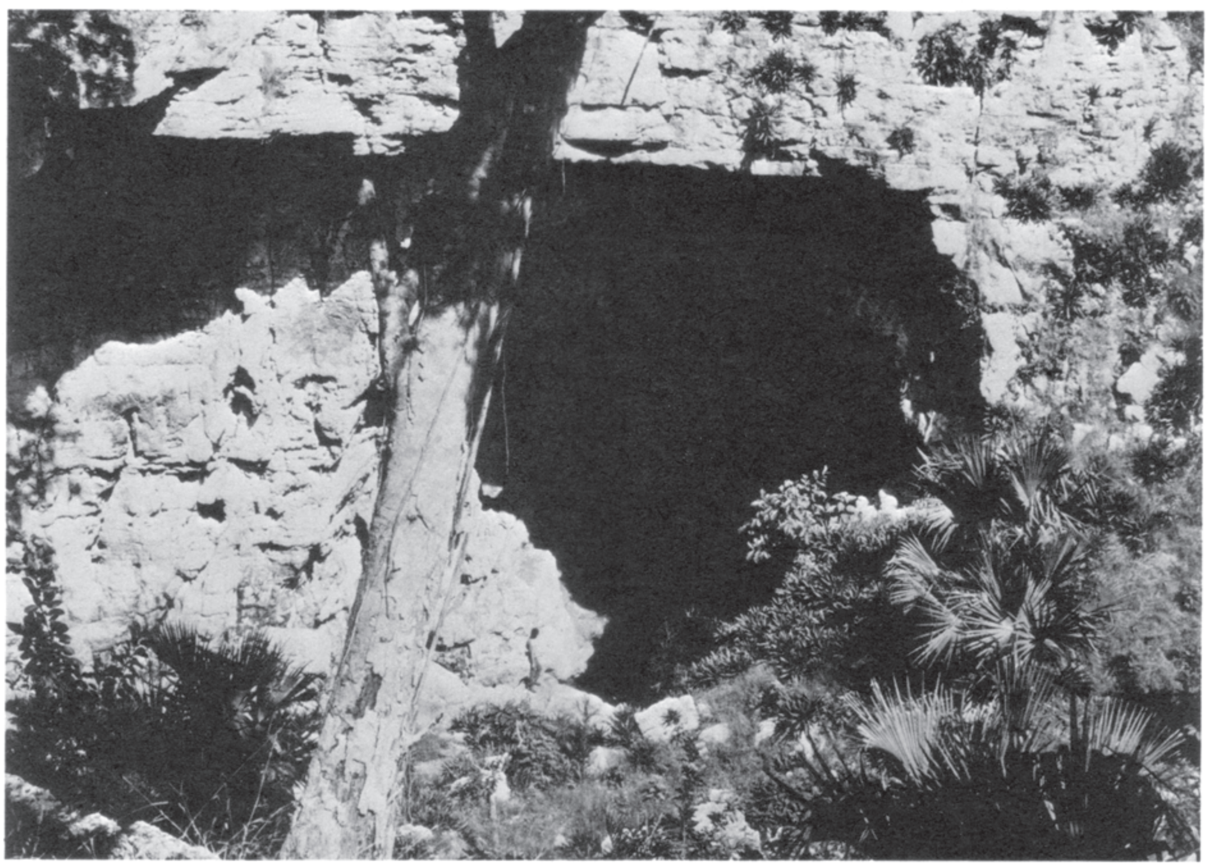


Fig. 10.—Suzanne Wiley in the sumidero entrance to Grutas de Xtacumbilxunam, Campeche (photo by David McKenzie).

about midway along this passage a crawlway leads into a large tunnel which extends 80 m to a junction. To the left a wide passage goes 50 m to a high room 25 m wide and 60 m long. A possible passage 5 m above the floor could not be reached but may continue. From the junction the main passage consists of several rooms connected by crawls, with several side passages of varying size. It eventually becomes a low crawl over small rocks and reaches a shallow pool about 250 m from the junction. Two additional pools lie a few meters beyond the first pool. In all recent trips to the cave the last of these pools has siphoned, but the caretaker of the cave reports that in the past it has been possible to pass beyond the pool into a large lake room from which a river exits. This lake is reported to contain blind fish. The air temperature near the pools was 25.5°C. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

As might be expected for so large and varied a cave, the fauna is extremely rich. The pools are inhabited by ostracods, a rare species of copepod *(Mesocyclops ellipticus)*, troglobitic atyid shrimp *(Typhlatya campecheae)*, and troglobitic amphipods *(Mayaweckelia yucatanensis)*. Terrestrial troglobites apparently include only trichoniscid isopods, but the troglophile fauna is quite varied. Schizomids, amblypygids, five species of spider, opilionids, mites, ticks, isopods, millipeds, japygid diplurans, collembolans, hemipterans, carabid beetles, leiodid beetles, scydmaenid beetles, ants, dipterans, snails, and other species were collected. Of unusual interest is an enormous population of ticks, including at least one species of *Antricola*, one species of *Ornithodoros*, and a remarkable new genus and species of argasid recently described by Keirans and Clifford (1975) as *Nothoaspis reddelli*. The cave also harbors the only known cavernicole milliped of the order Stemmiulida, present in many parts of the cave in vast numbers. Several species of bat, including *Mormoops megalophylla megalophylla*, inhabit the cave, most notably in the lower bat rooms and near the inner pools. Mot-mots, *Eumomota superciliosa superciliosa*, are abundant in the entrance sink.

QUINTANA ROO

MUNICIPIO DE CHETUMAL

ACTUN XPUJIL (1)

This cave is located in the ruins of Xpujil. A small collection of invertebrates was made in the cave on 4 July 1975 by Robert W. Mitchell and Suzanne Wiley.

The entrance to the cave is an opening less than 2 m high in the side of an embankment. This leads directly into one small dry room, from which a crawlway extends for several meters.

The limited fauna of this cave includes amblypygids, spiders, ticks, crickets, and reduviid bugs.

MUNICIPIO DE COZUMEL

SINK (ISLA DE COZUMEL)

This sink is reported by Rehder (1966) as being located "2 mi. NE of San Miguel, beyond airfield, 1/4 mi. E of road" on Isla de Cozumel. Three species of snail were collected "5 ft below road level" on 8 April 1960 by J. F. G. Clarke.

CENOTE (PLAYA DEL CARMEN)

This cenote is located 14 km northeast of Playa del Carmen. It is reported by Birney *et al.* (1974) as a "cenote, which lead into a small cave with a pool of standing water." Three species of bat were obtained from the cave in the spring of 1973.

CAVE (PUEBLO NUEVO X-CAN)

This cave is located 1.5 km south and 1 km east of Pueblo Nuevo X-Can. It is reported by Jones, Smith, and Genoways (1973) as having a deep chimney-like dome into which tree roots penetrated. They report five species of bat from the cave. Duellman (1965) reports a frog and a snake from the cave.

CAVE (RANCHO SANTA RITA)

This cave is located on the Rancho Santa Rita, Isla de Cozumel. It is reported by Gonzalez-Angulo and Ryckman (1967) as being a "cave which was frequented by wild animals, as opossums and pigs." Reduviid bugs, *Triatoma hegneri* Mazzotti, were collected in the cave on 30 July 1965.

CAVE (TANCAH)

This cave is reported by Mullinex (1975) as "Tancah, unnamed cave near Cenote." Amblypygids, *Paraphrynus raptator*, were collected in the cave on 20 December 1966 by R. E. Main.

CUEVA DE ABISPA (9)

Cueva de Abispa is located less than 50 m east of Cueva de Tancah, which is about 2 km from the village of Tancah. A small collection of invertebrates was made in the cave on 1 July 1975 by Andy Grubbs, James Reddell, and Suzanne Wiley. It was mapped on the same date by Andy Grubbs, David McKenzie, and James Reddell.

The entrance is about 35 m wide and 2 m high. A

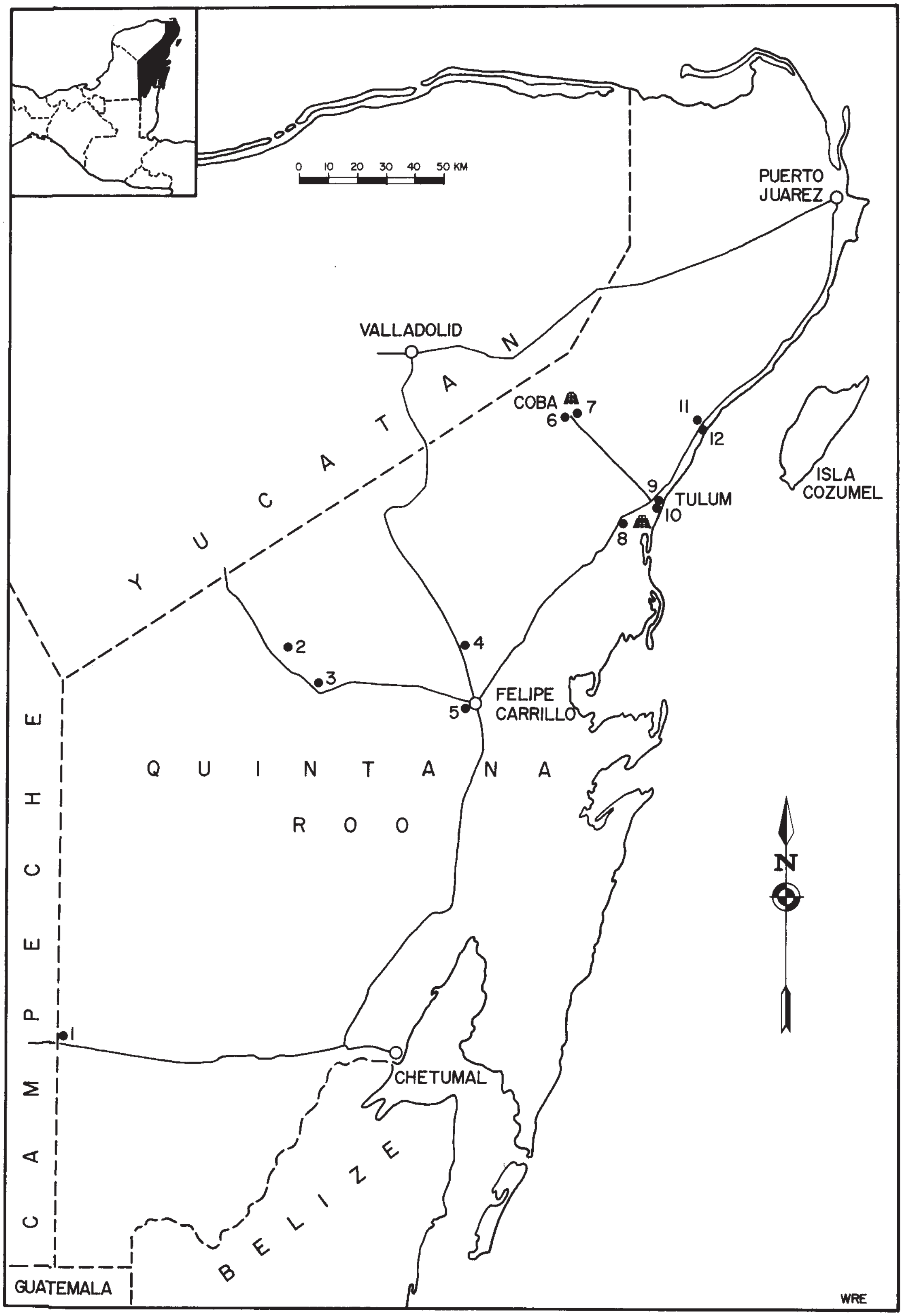


Fig. 11.–Map of Quintana Roo showing locations of caves visited by members of the Association for Mexican Cave Studies. 1, Actún Xpujil; 2, Cenote de Santo Domingo; 3, Cenote de Las Ruinas; 4, Cenote de Tos Virlol; 5, Cenote de Juan Coh; 6, Actún Ha; 7, Cenote Aká Chen; 8, Cueva de Kopoil; 9, Cueva de Abispa and Cueva de Tancah; 10, Cenote de Tulum; 11, Cueva del Fermín; 12, Cenote de San Martín and Pozo de San Martín.

slope leads down a few meters to water up to 2 m deep. To the left a 7 m wide, 2 to 3 m high passage extends for about 13 m. To the right a passage extends about 13 m beyond the entrance as a crawlway. At this point a hole opens to the surface, while a tight crawlway continues unexplored.

The only fauna observed in the water were catfish and tetras. The terrestrial fauna included several species of spider, opilionids, and ants.

CENOTE AKA CHEN (7)

Cenote Aká Chen is located about 1.6 km from the main lake in the ruins of Cobá. A small collection of invertebrates was made on 30 June 1975 by Andy Grubbs, James Reddell, and Suzanne Wiley.

The entrance to the cave is at one end of a sinkhole about 3 m deep, 7 m wide, and 10 m long. A slope leads down to two passages. Straight ahead a crawlway opens into a 1.8 m high, 5 m in diameter room after about 3 m. A low muddy hole from here extends about 2 m into a circular dome room 5 m in diameter and up to 2 m high. This area is very moist, and a colony of vampire bats lived in domes in the ceiling. The other passage from the entrance leads down a slope to a water crawlway at least 20 m long and about 2 m wide.

Several species of spider, opilionids, leiodid beetles, ants, and snails were collected in the cave.

CUEVA DEL FERMIN (11)

Cueva del Fermín is located on the north side of the highway from Puerto Juárez to Felipe Carrillo Puerto on the Rancho San Martín and about 3 km east of Pamul. A small collection of invertebrates was made in the cave on 3 July 1975 by Andy Grubbs, David McKenzie, and James Reddell.

A long trench-like sink about 7 m deep terminates in a cave passage. The sink is obviously a collapsed segment of cave passage. A crawlway leads into a dry passage 1 to 2 m high and up to 5 m wide which forks immediately. The left branch extends about 45 m before ending abruptly. The right-hand passage goes about 35 m, at which point it becomes floored with water from a few centimeters to 1 m in depth. After 7 m the passage branches, with the left branch leading through deep water to a second entrance after 10 m. The right fork continues to an end in an area of dry land and a breakdown fill. This passage is up to 2.1 m high and 5 m wide. The cave has about 135 m of passage.

The terrestrial fauna was sparse, and only spiders, amblypygids, crickets, and reduviid bugs were collected. The lake was inhabited by atyid *(Typhlatya mitchelli* and *T. pearsei)* and palaemonid *(Creaseria morleyi)* shrimp and eyed catfish.

ACTUN HA (6)

Actún Ha is located about 100 m from the ticket office at the ruins of Cobá. A small collection of invertebrates was made in the cave on 30 June 1975 by Andy Grubbs, David McKenzie, James Reddell, and Suzanne Wiley.

Openings at several places along the side of a 2 m deep sinkhole lead into low muddy "rooms" up to 2 m high, 5 m long, and 10 m wide. One of these openings, however, leads down over breakdown to a small pool of water.

The drier parts of the cave produced only a few spiders and crickets. A large black scorpion on the ceiling evaded capture. The pool was inhabited by mysids *(Antromysis cenotensis)* and atyid shrimp *(Typhlatya mitchelli).* A blind eel in the pool was seen but could not be captured.

CUEVA ROUEL

Cueva Rouel is known only as being located at or near Tancah (Mullinex, 1975). Amblypygids *(Paraphrynus raptator,* were collected in the cave on 21 December 1966 by R. E. Main.

CENOTE DE SAN MARTIN (12)

Cenote de San Martín is located about 100 m east of Rancho San Martín and a short distance south of the highway. A small collection of invertebrates was made on 3 July 1975 by Andy Grubbs and James Reddell.

A slope-in entrance leads back, past a junction, and down to water in a "bottomless" lake about 25 m from the entrance. About 10 m from the back a passage to the right leads up through formations for about 18 m before ending.

The terrestrial fauna of the cave was limited to a few spiders and reduviid bugs. The aquatic fauna included cirolanid isopods *(Creaseriella anops),* mysids *(Antromysis cenotensis),* and amphipods *(Mayaweckelia cenoticola).*

POZO DE SAN MARTIN (12)

Pozo de San Martín is a natural well located by the corrals at Rancho San Martín, 2.5 km east of Pamul. A small collection of invertebrates was made in the well on 2 July 1975 by James Reddell.

The entrance to the well is about 1 m in diameter and about 5 m deep. It is floored with water up to 1 m deep, but along one side a steep slope leads down into a deep, water-filled hole.

A few millipeds were collected from the walls of the cave, but no other terrestrial fauna was seen. The aquatic fauna included atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimp.

CUEVA DE TANCAH (9)

Cueva de Tancah is located about 2 km from the village of Tancah. The cave is a noted archeological site and was investigated by Lothrop (1924). A small collection of invertebrates was made on 1 July 1975 by Andy Grubbs, James Reddell, and Suzanne Wiley. The cave was mapped on the same date by Andy Grubbs, David McKenzie, and James Reddell.

The entrance is along the right side of a shallow sink and is an opening about 10 m long and 1 to 2 m high. A slope leads down for about 3 m to water. The pool is less than 4 m wide and covers the back wall of the cave. To the right it extends 3 m back into a small root-blocked alcove. To the left it extends 10 m into semi-darkness where a stela with crude carvings had been erected. A crawlway continues another 7 m. Water depth ranges from a few centimeters to about 1 m. The water is slightly brackish.

The fauna of the cave is limited, as would be expected from the small size of the cave. The aquatic fauna included troglobitic amphipods *(Mayaweckelia cenoticola)*, eyed amphipods *(Quadrivisio lutzi)*, fish, and shrimp. Terrestrial species collected included spiders, schizomids, isopods, crickets, fulgoroids, and collembolans. Wasps nested in the entrance area.

CENOTE DE TULUM (10)

Cenote de Tulum is located in the ruins of Tulum and less than 100 m from the sea. A collection of amphipods was made in the cenote on 3 July 1975 by James Reddell.

A gentle slope leads down between rock walls to end at an opening about 2 m high and 1.5 m wide. The water level is only about 0.5 m below the level of the entrance, and the cenote extends back for only about 5 m before the ceiling descends to the water level. The slightly brackish water is less than 0.5 m deep and is heavily polluted with trash and human feces.

The only fauna collected in the cenote were amphipods, *Quadrivisio lutzi*.

MUNICIPIO DE FELIPE CARRILLO PUERTO

CENOTE (FELIPE CARRILLO PUERTO)

This cenote is located 2 km north of Felipe Carrillo Puerto. It is reported by Jones, Smith, and Genoways (1973) as "a large water-filled cenote about 60 feet long, 40 feet wide, and with a ceiling up to 10 feet high. Two small holes at one end of the stalagtite-covered ceiling were the only means of access into the cavern." Five species of bat were collected in the cave.

CENOTE DE JUAN COH (5)

Cenote de Juan Coh is located near the western edge of Felipe Carrillo Puerto and has no local name as far as could be found, so it was named after the owner. A pipe leads down into the cave, which serves as a source of water. A collection of invertebrates was made in the cave on 4 July 1975 by Andy Grubbs, David McKenzie, and James Reddell.

A rectangular entrance about 2 by 5 m drops vertically for about 3.1 m onto a breakdown slope near one end of a room 20 m in circumference. At the far end of the room an apparently dug well drops directly to a murky pool of water. A dug channel leads from this pool to a second pool near the natural entrance. The second pool ranges from a few centimeters to 1 m in depth and swarmed with shrimp and mysids.

The cave was inhabited by a small bat colony and was very rich in endogean forms. Among the terrestrial species collected were pseudoscorpions, schizomids, spiders, opilionids, ticks, hemipterans, roaches, ants, several species of beetle, and snails. The aquatic fauna included mysids *(Antromysis cenotensis)* and atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimp.

CUEVA DE KOPOIL (8)

Cueva de Kopoil is located about 0.5 km north of Kopoil and 100 m north of Kilometer 83 on the highway from Puerto Juárez to Felipe Carrillo Puerto. A small collection of invertebrates was made on 3 July 1975 by Andy Grubbs and James Reddell.

The entrance is a sink about 3 m in diameter and 3 to 4 m deep, dropping onto a slope of breakdown. At the bottom a slope leads down in two directions. One way leads to a shelter-like overhang 7 m long. The other is a stoopway and crawlway about 35 m long and up to 5 m wide ending in a shallow pool of water about 6 m below the surface. Small holes dug in the floor also had water in them so the floor of the cave is apparently at the water level.

The water contained no apparent life, but endogean species collected included schizomids, roaches, and ants.

CENOTE DE LAS RUINAS (3)

Cenote de Las Ruinas is located at an abandoned place known as Las Ruinas, which is about 6 km ENE of Polyuc. A small collection of invertebrates was made on 29 July 1975 by Andy Grubbs, David McKenzie, and James Reddell.

The entrance to the cave is about 2 m in diameter and extends down a steep slope into an irregular room inhabited by bats. This room is actually a sloping guano-floored passage with wide areas of breakdown along both sides. To the left it is not possible to go more than a few meters, but to the right about 3 m above the bottom of the slope a passage extends along the breakdown slope for 13 m to a hole dug down to the water level. Beyond this it continues 10 m before ending. The passage is about 1 m high and up to 5 m wide. The entrance slope is about 35 m long from the entrance, and a pool of water occurs about 46 m from the entrance. The pool is rock-floored, about 1.6 m in diameter and 0.8 m deep.

Troglobitic amphipods *(Mayaweckelia cenoticola)*, mysids *(Antromysis cenotensis)*, and palaemonid shrimp *(Creaseria morleyi)* inhabited the pool. Terrestrial fauna included isopods, millipeds, schizomids, ticks, several species of spider (including the blind *Pholcophora pearsei)*, roaches, beetles, and ants.

CENOTE DE SANTO DOMINGO (2)

Cenote de Santo Domingo is located about 5 km ENE of the town of Kilometer 50. A small collection of invertebrates was made in the cave on 28 July 1975.

The entrance, located in a large grove of trees, is at the bottom of a large shallow sink. It is a 50 m wide arc-shaped shelter-like opening which leads immediately into a chamber floored with breakdown. The ceiling height ranges from less than 1 to more than 2 m. At the back of the shelter area a slope leads down to a small silt-floored pool about 2 m in diameter and less than 0.5 m in depth. This pool is located about 35 m from the entrance. The ceiling along the slope is low, and it is possible to get into near darkness at the pool.

The aquatic fauna collected included troglobitic amphipods *(Mayaweckelia cenoticola)*, mysids *(Antromysis cenotensis)*, atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimp. A blind eel was seen in the pool but could not be captured. The guide reported that women coming for water in the morning frequently see two or three eels in the pool. The terrestrial fauna included pseudoscorpions, schizomids, spiders (including the blind *Oonops coecus* and *Pholcophora pearsei)*, trombiculid mites, crickets, histerid beetles, and ants.

CENOTE DE TOS VIRLOL (4)

Cenote de Tos Virlol (questionable spelling) is located 0.5 km east of Kilometer 129 on the highway from Señor to Felipe Carrillo Puerto and about 13 km south of Señor. A small collection of invertebrates was made in the cave on 4 July 1975 by Andy Grubbs and James Reddell.

The principal entrance is a circular opening about 3.2 m in diameter and dropping vertically for about 12 m to a large lake. About 7 m from the entrance a 2 m in diameter entrance with a tree growing from it drops 1.9 m to a tight squeeze about 1.2 m wide. This leads down over small rocks and silt to a slightly larger crawlway ending in a 2 m vertical hand-line drop to a ledge overlooking the pool. A steep hand-line slope and drop leads to the lake which is a deep pool about 25 m in diameter.

The lake was inhabited by a large population of cirolanids *(Creaseriella anops)* and atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimp. The silt at the base of the tree in the small entrance contained spiders, diplurans, roaches, beetles, ants, and other endogean forms.

YUCATAN

MUNICIPIO DE ABALA

CENOTE AMIL (13)

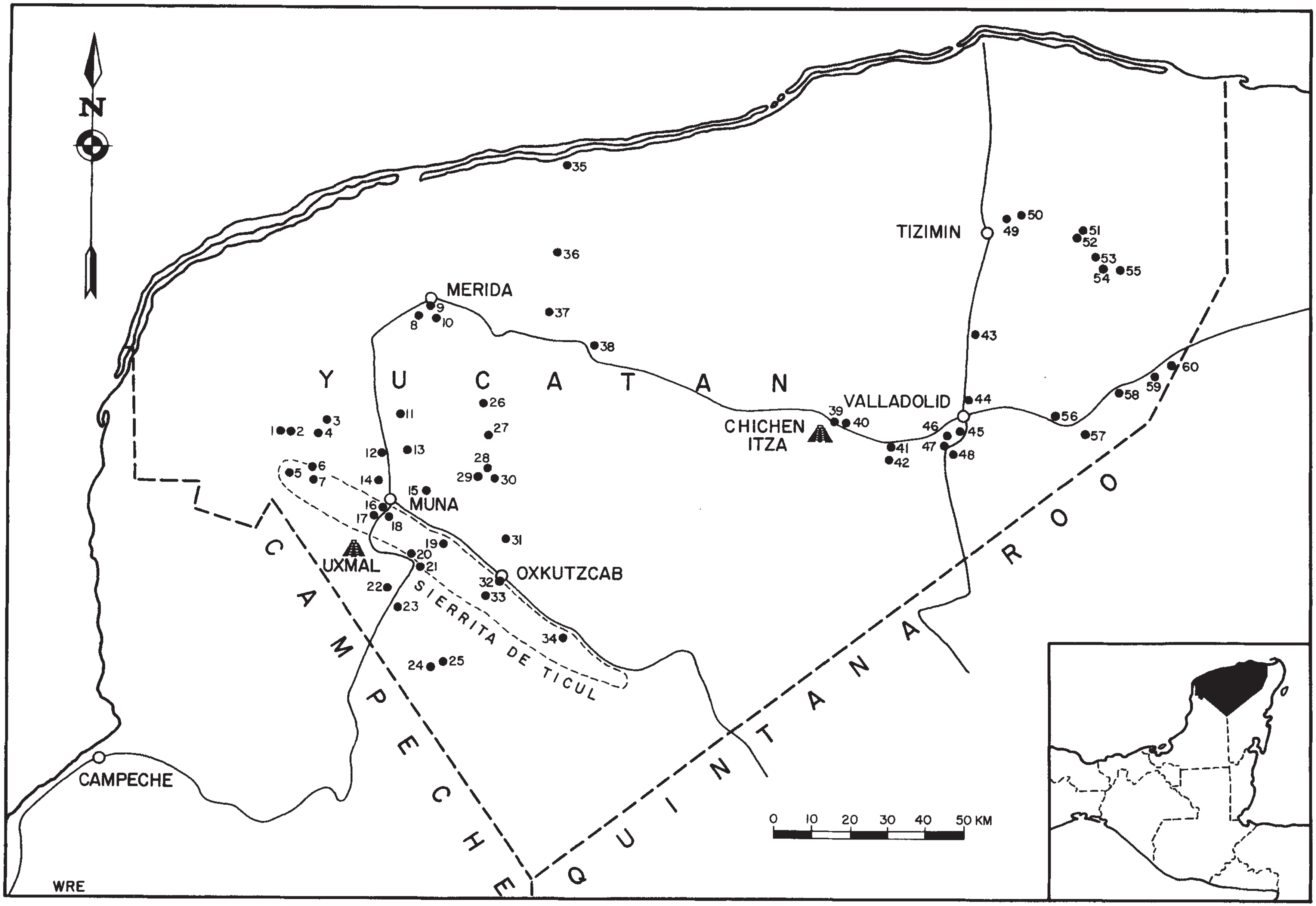
Cenote Amil is located about 6 km south of Abalá. A collection of invertebrates was made and the cave mapped on 28 March 1973 by Mary Butterwick, Martha Helen McKenzie, Stuart Murphy, James Reddell, and Mariano Rodriguez. A collection was also made on 5 August 1973 by Robert W. Mitchell and Francis E. Abernethy.

The cave is located in a wooded area and is an oval sinkhole about 30 m long by 20 m wide. The floor along one side is of silt and is about 11 m below the surface. The other three sides are largely undercut and drop to water ranging from a few centimeters to several meters in depth. Along one side is an overhanging area about 10 m long, but no passages extend from it. The air temperature at the edge of the water was 28.3°C, and the water temperature was 25.6°C.

Rocks and logs on the floor of the sinkhole served as shelter for pyrgodesmid millipeds, isopods, spiders (including a theraphosid tarantula), ants, and other endogean forms. The lake was inhabited by *Rhamdia guatemalensis*, cichlids, and other fish. Mot-mots were abundant about the entrance.

CENOTE CHIUOH

Cenote Chiuoh (also spelled Chiuok) is located on the Hacienda Mukuyché. A collection of fish was made in it on 29 July 1932 by A. S. Pearse, E. P.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Creaser, and F. G. Hall.

Hubbs (1936) describes it as "a cavern (crescentic 18 by 30 meters), with a side opening. The water was clear over a bottom of gravel and stone and was without vegetation." Hall (1936) reports that the water depth was in excess of 6.7 m. In a report on the physical and chemical characteristics of the cave water he reports a temperature of 27.0°C and a pH of 6.85.

The cave was inhabited by catfish *(Rhamdia guatemalensis depressa)* and mollies *(Gambusia yucatana)*.

CENOTE DE LA CULEBRA (12)

Cenote de la Culebra is located about 20 m to the west of México highway 180 from Mérida to Muna and midway between Kilometer 175 and 176. It possibly is located in the Municipio de Muna. A collection of aquatic invertebrates was made in the cave on 27 March 1973 by James Reddell.

The entrance to the cave is an opening 2.8 m in diameter shaded by a large tree. A 5 m drop leads into one side of a single, blind room 5 m wide and 8 m long. Two small pools of water occur on opposite sides of the room.

The cave contains an abundant aquatic fauna which includes cirolanid isopods *(Creaseriella anops)*, mysids, *(Antromysis cenotensis)*, atyid shrimp *(Typhlatya mitchelli)*, palaemonid shrimp *(Creaseria morleyi)*, and catfish *(Rhamdia guatemalensis)*. A large rattlesnake, *Crotalus durissus tzabcan*, was seen in an alcove.

CENOTE MUKUYCHE

Cenote Mukuyché is located at Yuncú on the Hacienda Mukuyché. It may be the same cenote which was visited by John Lloyd Stephens in 1841. A collection of invertebrates and fish was made in the cenote on 29 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

This cenote is described by Hubbs (1936) as "a cavern about 23 meters in diameter with an opening at the side. It contained clear water without vegetation, and was floored with stone and fine gravel." The water depth is reported to be in excess of 7.0 meters. Hall (1936) in a report on the physical and chemical characteristics of the water reports a water temperature of 26.8°C and a pH of 6.9.

The invertebrate fauna obtained in the cenote included copepods, ticks, and chironomid flies. It was inhabited by catfish *(Rhamdia guatemalensis depressa)* and mollies *(Gambusia yucatana)*.

CENOTE DE SIHUNCHEN (11)

Cenote de Sihunchén is located near the plaza in the village of Sihunchén. A collection of invertebrates was made in the cave on 5 January 1972 by David McKenzie. The cave was mapped and additional collections made on 23 March 1973 by Mary Butterwick, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

The entrance to the cave is at one end of a shallow collapse sink 10 m in diameter. A 1 m wide, 3 m long opening drops 3 m along a talus slope into a junction room. To the left a 10 m wide, 1.5-3 m high passage with a flat silt floor extends about 30 m before narrowing to 3 m and ascending a steep slope of flowstone covered breakdown. At the top a flat-floored crawlway goes over silt into a room 10 m wide and 5 m long. A hole too small to admit a human body leads up through the breakdown at the bottom of an 8 m in diameter, 3 m deep sink largely filled with henequen pulp. From the main entrance a crawlway 1 m high, 1 m wide, and 5 m long extends into a dry area which slopes down into a lake passage. The water

← Fig. 12.–Map of Yucatán showing locations of caves visited by members of the Association for Mexican Cave Studies. 1, Cenote Calchum; 2, Cenote Calchuhuim; 3, Cenote de las Abejas; 4, Cenote de Sambulá; 5, Cueva de Aguacate, Actún Chukum, and Actún Chunup; 6, Actún Chom and Actún Xkyc; 7, Actún Chacaljas, Actún Coch Leb, Actún Silil, and Actún Xpukil; 8, Cenote de San José and Cueva de Tecoh; 9, Cenote de San Isidro; 10, Cueva Luchil; 11, Cenote de Sihunchén; 12, Cenote de la Culebra; 13, Cenote Amil; 14, Cenote de Kankirixché and Cenote del Pochote; 15, Cenote Nohchén; 16, Actún Xpek; 17, Actún Ziizhá; 18, Actún Tucil; 19, Actún Jih; 20, Actún Xkoch; 21, Actún Nohcacab; 22, Actún Okobichén; 23, Actún Chac; 24, Actún Chen; 25, Actún Kiuick; 26, Cenote Chun Kapoc; 27, Cenote de Telchaquillo; 28, Grutas de Tzab-Nah; 29, Cenote Chen Mul; 30, Cenote de Chac Sikiin (Norte) and Cenote de Chac Sikiin (Sur); 31, Cenote Kabahchén; 32, Actún Ziz; 33, Actún Loltún; 34, Actún Sabacá; 35, Cueva de Santa Elena and Pozo de Santa Elena; 36, Cenote de Sambulá; 37, Cenote D, Cenote G, and Cueva de Zopilote Negro; 38, Cenote de Hoctún; 39, Cenote Xtolok and Cueva del Cenote Xtolok; 40, Grutas de Balankanche; 41, Actún Kaua; 42, Cueva Escondida; 43, Cenote Sucila; 44, Mine (Valladolid); 45, Cenote Hunto Chac (Cueva de Mamey) and Cenote Hunto Chac (Cueva del Pozo); 46, Cenote Xkeken; 47, Cenote Tekom; 48, Cenote Salud; 49, Cenote Sodzil and Cueva Sodzil; 50, Cenote Sabacah and Cenote Sucopo; 51, Cenote de San Luis; 52, Cenote de los Pinos; 53, Cenote de Orizaba and Cueva de Orizaba; 54, Cenote Tixcancal; 55, Cenote Aká Chen and Cueva de las Derrumbes; 56, Cenote de la Paca and Cenote Xtacabihá; 57, Cenote Poxil; 58, Cenote de Catzín; 59, Cenote de San Diego; 60, Cenote de Cocoyol.

depth ranges from about 0.5 m to more than 2 m and the ceiling height above the water is 1 to 3 m. After 65 m the ceiling drops abruptly, and the cave apparently siphons after a few meters. Lights have been strung from the entrance into the right-hand passage back to the lake which is used for swimming by the villagers.

The cave is inhabited by a small colony of bats and the lake by catfish, but none were collected. McKenzie reported sighting a blind fish which appeared to be a brotulid. Mysids *(Antromysis cenotensis)* were collected from the lake. The terrestrial fauna collected included schizomids, blind amblypygids *(Paraphrynus chacmool)*, spiders, mites, millipeds, hemipterans, homopterans, gryllid crickets, ants, collembolans, and beetles belonging to several families.

CENOTE YUNCU

Cenote Yuncú is located at Estación Yuncú on the railroad line between Mérida and Ticul. It may be situated in the Municipio de Sacalum. The cenote was biologically investigated on 29 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

The cenote is described by Hubbs (1936) as follows: "This crescentic limestone cavern, about 30 meters long by 12 meters wide, contained clear, plantless water over a bottom of stone and fine sand." Pearse (1936b) reports that it is a cave-like cenote. Hall (1936) gives a water temperature of 26.6°C, a pH of 7.3, and a water depth in excess of 10 meters.

The fauna of the cenote includes copepods, ostracods, cladocerans, ticks, aquatic mites, chironomid flies, fish *(Rhamdia guatemalensis depressa)*, frogs *(Bufo valliceps)*, and owls *(Tyto alba pratincola)*.

MUNICIPIO DE ACANCEH

CENOTE CHUN KAPOC (26)

Cenote Chun Kapoc (also known as Cenote Acanceh) is located a few blocks north of the plaza in Acanceh. A small collection of invertebrates was made on 8 October 1974 by James Reddell.

The entrance to the cave is an opening about 1.5 m in diameter which drops vertically for about 6 m to a floor of rubble. The large roots of an alamo tree facilitate entry into the cave. At the bottom a slope leads down into an elongate room about 7 m wide and 30 m long, floored with water after 10 m. Near the opposite end of the room a dug well intersects the cave above the lake. The water depth ranges up to more than 2 m. The cave is heavily polluted with trash, and the floor of the lake is a thick layer of guano and organic debris. The cave is probably formed in the Carrillo Puerto Formation.

The terrestrial fauna was poor due to the air circulation but did include pyrgodesmid and other millipeds, isopods, schizomids, roaches, hemipterans, and gryllid crickets. The aquatic fauna included atyid shrimp *(Typhlatya mitchelli)*, mysids *(Antromysis cenotensis)*, and palaemonid shrimp. The last could not be collected. A large population of bats also inhabits the cave.

MUNICIPIO DE CHEMAX

CENOTE DE CATZIN (58)

Cenote de Catzín is located in the town of Catzín and serves as the town well. A collection of invertebrates was made in the cave on 6 July 1975 by James Reddell and Andy Grubbs.

The entrance is an impressive vertical sinkhole about 35 m in diameter and 17 m deep. Rope is needed for easy entrance, although local Mayan boys descend on large roots to the floor of the sink. The bottom of the entrance is an island covered by small trees, brush, and vines. It is possible to wade in 1.6 m deep water to the principal cave passage which connects in turn to a second passage opening onto the sink. These two openings lead into a complex area of silt and guano-floored passages containing about 150 m of passage. These passages range in size from about 1 to 3 m in height, and all end either abruptly or by becoming too small to negotiate. Three other passages open into the entrance sink. Two are located near the openings into the main cave passages and are connected to each other by a small series of passages. The fifth is reached by swimming across about 20 m of water and consists of a crawlway about 20 m long. Much of the water in the entrance sink is covered by a thick mat of water lilies. The floor is of deep mulch. In areas under the overhang and beneath stalactites are large cone-shaped deposits of white crystalline sand.

The water of the entrance sink was inhabited by catfish, and the cave passages harbored a small colony of bats. The invertebrate fauna included spiders, millipeds (including the troglobitic *Orthoporus spelaeus)*, gryllid crickets, and beetles.

CENOTE DE COCOYOL (60)

Cenote de Cocoyol is located in the village of Cocoyol and serves as the town well. A small collection of spiders was made in the cave on 5 July 1975 by Andy Grubbs and James Reddell.

The entrance is a sinkhole about 27 m in diameter dropping vertically on three sides. On one side it is deeply overhung, and the town well is situated here. Opposite the overhang a slope over massive breakdown blocks leads beneath the overhang to a depth of about 17 m below the surface. A square hole 1 m in diameter has been dug in the floor of the breakdown on the slope to water level. The bottom of the sink is situated about 10 m under the overhang and is a flat mud floor which obviously contains water at times. One small sterile pool occurred at the lowest point. The total dimensions of the cave within the entrance were about 40 m wide and 20 m long.

The only fauna collected in this cave were theridiid and pholcid spiders obtained from webs along the cave walls and on a large tree growing from the entrance slope.

CENOTE POXIL (57)

Cenote Poxil is located about 7 km southeast of Chemax. A small collection of invertebrates was made on 15 December 1974 by James Reddell.

The entrance to the cave is a large vertical sinkhole about 20 m in diameter and 15 m in depth. Large trees grow from and around the entrance and their roots make entry possible with a handline. The bottom of the sinkhole is covered with small rubble. A shallow pool along one side serves as a water source for a small settlement above the entrance. Beyond this pool an alcove 5 m wide and 10 m long extends to an abrupt end.

The cave contains few species of interest. The water was inhabited only by insect larvae and aquatic hemipterans. Leiodid beetles, amblypygids, crickets, millipeds, ticks, and spiders were collected from the alcove, which also harbored a vampire colony.

CENOTE DE SAN DIEGO (59)

Cenote de San Diego is located across the highway south of the small settlement of San Diego, which is about 2 km west of Cocoyol. A small collection of invertebrates was made on 5 July 1975 by Andy Grubbs and James Reddell.

A rock-floored slope leads down into an entrance about 7 m in diameter. About 7 m below the surface a railing overhangs a pool which serves as the well for San Diego. By climbing along the left side of the cave wall, it is possible for one to descend to within 7 m of the cave floor. A log 3 m below this permitted very difficult access, and a ladder or rope is recommended for the descent. This drop descends onto a rubble and dirt floor in the center of a chamber about 14 m in diameter with water along most of its periphery. Immediately below the railing a pool has been cleared to facilitate the obtaining of water. The cave contains much flowstone and other speleothems.

Atyid shrimp and mysids *(Antromysis cenotensis)* inhabited the water, but only the mysids could be collected. The terrestrial fauna was limited and only schizomids, spiders, roaches, diplurans, hemipterans, and beetles were collected.

MUNICIPIO DE CHOCHOLA

CAVE (CHOCHOLA)

This cave is reported by Ingles (1959) as being "una cueva de las cercanías de Chochola." He obtained specimens of the bat *Artibeus jamaicensis* in it.

MUNICIPIO DE HOCTUN

CUEVA DE CARROZA

Cueva de Carroza is reported by Cárdenas Figueroa (1950) as being located at Hoctún, but he gives no description or other information on the cave. A collection of invertebrates was made in the cave on 16 March 1947 by Mauro Cárdenas Figueroa and B. F. Osorio Tafall. The only species reported from the cave are japygid diplurans and reduviid bugs.

CENOTE DE HOCTUN (38)

Cenote de Hoctún (also referred to as Cueva de Hoctún) is located about 1 km west of Hoctún on the north side of the highway to Valladolid. The cave was visited by A. S. Pearse on 7-8 July 1936, at which time an extensive collection was made. It was again visited on 16 March 1947 by M. Cárdenas Figueroa and B. F. Osorio Tafall who obtained, among other material, two undescribed species of terrestrial isopod. The cave was visited and an invertebrate collection made by Terry Raines in March 1969. A collection of bats was made in the cave in the spring of 1973 (Birney *et al.*, 1975). Recent collections have included ones by James Reddell, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and Mary Butterwick on 16 March 1973; by Robert W. Mitchell on 29 April 1973; by James Reddell on 12 August 1973; and by James Reddell and Suzanne Wiley on 10 November 1974. Pearse (1938a) published a generalized outline of the plan of the cave. A slightly more detailed map was published by Robles Ramos (1950). The cave was completely resurveyed on 16 March 1973.

The entrance to the cave is a 1 m in diameter hole in the middle of a henequen field (Fig. 2). It drops vertically about 1 m onto a rubble slope which descends into a generally level passage 3 to 10 m in width and 1.2 to 3 m in height. The cave slopes steadily down at a gentle angle to water approximately 150 m from the entrance. The water in the cave consists of a guano-floored lake 10 m wide and about 20 m long. Although generally shallow, the floor drops abruptly along the walls, and the water depth there is in excess of 2 m. A path leads from the entrance to the lake, which is used by nearby inhabitants for bathing. Pearse (1938a) reported the air temperature at the lake to be 27.9°C and the water temperature to be 27.2°C. The relative humidity was 99.6 percent. The cave is formed in the Carrillo Puerto Formation.

The invertebrate fauna is rich in numbers of species, but most are guanophiles. The only terrestrial troglobite known from the cave is the amblypygid *Paraphrynus chacmool.* Other terrestrial fauna identified from the cave includes schizomids, eyed amblypygids, spiders, ticks, mites, millipeds, gryllid crickets, carabid and histerid beetles, tineid moths, flies, ants, isopods, and snails. Seven species of bat have been identified (Pearse and Kellogg, 1938; Birney *et al.*, 1975). The aquatic fauna includes two species of copepod, cirolanid isopods *(Creaseriella anops),* mysids *(Antromysis cenotensis),* atyid shrimp *(Typhlatya pearsei),* palaemonid shrimp *(Creaseria morleyi),* eels *(Ophisternon infernale),* and brotulid fish *(Typhliasina pearsei).* The cave is particularly notable for a large population of *Creaseria morleyi.*

CENOTE X-EBIZ

Cenote X-ebiz is reported only as located near Hoctún. A collection of palaemonid shrimp *(Creaseria morleyi)* was made in the cave on 26 April 1971 by E. H. Sallee (Hobbs and Hobbs, 1975).

MUNICIPIO DE HUNUCMA

CENOTE DE HUNUCMA

Cenote de Hunucmá is reported by Villa (1966) as being located 2 km north of Hunucmá. He reports the bat *Artibeus jamaicensis yucatanicus* from the cave. Jones, Smith, and Genoways (1973) report the vespertilionid bat *Myotis keaysi pilosatibialis* from the cave. No other information is available.

MUNICIPIO DE KANASIN

CUEVA LUCHIL (10)

Cueva Luchil (also known as Cenote Luchil) is located 8 km SSE of Mérida, immediately south of the Ciudad Militar, and about 1 km northeast of the Hacienda Tixcacal. Biological collections were made in the cave by A. S. Pearse, E. P. Creaser, and F. G. Hall on 25 July 1932; by A. S. Pearse on 6 July 1936; by James Reddell on 21 March 1973; and by James Reddell and Suzanne Wiley in October 1974. No local name could be found for the cave during the 1973 and 1974 visits and the name Cueva Luchil was not known to people near the cave.

The entrance is an undercut vertical pit about 3.2 m in diameter, dropping about 4 m into the center of a near-circular room 17 by 20 m. Although a log had been placed in the entrance, a handline was useful. Water lines the edges of the cenote and is usually shallow, but deep crevices along the walls extend to unknown depths. A gasoline-driven pump had been placed in the cave in 1973 to pump water for road construction, but the pump had been removed by October 1974. The cave is badly polluted by oil and debris. Piles of human feces are abundant on the rocks below the entrance. The water temperature was reported by Hall (1936) as 26.2°C. He also summarizes the physical and chemical characteristics of the water. Pearse (1938a) reports a water temperature of 27.0°C, an air temperature of 27.3°C, and relative humidity of 99.2%.

The collections of Pearse *et al.* indicated that the cave was comparatively abundant in life and they reported copepods, mysids *(Antromysis cenotensis),* schizomids, amblypygids, spiders, mites, millipeds, eyeless crickets *(Tohila atelomma),* tineid moths, flies, ants, snails, frogs, and fish *(Rhamdia guatemalensis depressa* and *R. guatemalensis stygaea).* In 1973 and 1974, however, no fish were seen and only a few pyrgodesmid millipeds, spiders, an eyed amblypygid, and mysids were collected.

MUNICIPIO DE KAUA

CUEVA CHAC MOL

Cueva Chac Mol is reported to be located at Tohil near Chichén Itzá. A collection was made in the cave on 27 June 1936 by A. S. Pearse.

The cave is reported to be entered by a narrow well-like entrance and to have a floor of broken contour. It is 35 m long, 20 m deep, and has a 2 to 8 m high roof. Water in pools is present in the cave. Pearse (1938a) reports a water temperature of 24.7°C, an air temperature of 24.0°C, and a relative humidity of 99%.

The aquatic fauna of the cave includes cirolanid isopods *(Creaseriella anops),* mysids *(Antromysis cenotensis),* and palaemonid shrimp *(Creaseria morleyi).* Terrestrial species reported from the cave include schizomids, amblypygids, spiders, ticks, gryllid crickets (including the blind *Tohila atelomma),* beetles, flies, ants, and snails.

CENOTE DZADZ

Cenote Dzadz (also referred to as Aguada Dzadz) is located 10 km southwest of Chichén Itzá. A collection was made on 29 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

No description of this locality is available. This is probably not a true cenote, but a few authors do refer to it as such and for that reason it is included here.

The fauna of Cenote (or Aguada) Dzadz includes sponges, snails, copepods, ostracods, dragonflies, damselflies, aquatic hemipterans, and aquatic beetles.

CUEVA ESCONDIDA (42)

Cueva Escondida is located approximately 200 m west of the road from Kaua to Dzeal and about 3.5 km south of Kaua. A collection of invertebrates was made in the cave on 21 July 1975 by James Reddell, David McKenzie, Andy Grubbs, and Suzanne Wiley.

The entrance is a 1 m in diameter vertical pit located in dense brush. It is possible to climb down 7 m onto a small rubble slope in a room about 5 m in diameter. A crawlway extends for 18 m to two pits, one of which is blind. The other is a 5 m drop with a climbing pole in it. This leads to a low crawlway about 13 m long, which ends at a 5 to 7 m deep unclimbable pit. A traverse to the left goes into a 13 m long crawlway opening onto a 5 m in diameter room. A climb down leads eventually to a passage 3 to 5 m wide and 1 to 2 m high, floored with red silt. This main passage extends for about 180 m before filling to within several centimeters of the ceiling. One major side passage to the right ends after about 30 m. In two or three places loops form short parallel passages to the main passage.

The cave was generally very dry and contained little organic matter. Among the species obtained were two troglobitic spiders, *Oonops coecus* and *Pholcophora pearsei.* Other fauna included only gryllid crickets, millipeds, isopods, and a few miscellaneous insects.

CENOTE IXIL

Cenote Ixil (also spelled Ikil) is located 4.8 km southeast of Chichén Itzá. A collection of fish was made in the cave by Leon J. Cole in the early part of 1904. A collection of invertebrates was made in the cave on 10, 14-15, and 30 June 1932 by A. S. Pearse, E. P. Creaser, and F..G. Hall.

This cenote is described by Hubbs (1936) as follows: "This pit in the wooded plain was found to be about 30 meters in diameter between the vertical cliffs, and 18 meters deep from the surface of land to the clear water, which was 27.5 meters deep. The water temperature was 23°.9 to 24°.5 C." Hall (1936) reports that the water depth was 32.6 m. In a summary of the physical and chemical characteristics of the water he reports water temperatures of 25.5°C at the top and 23.7°C at the bottom. He gives the pH at the top as 7.2 and at the bottom as 7.0.

The aquatic fauna of the cenote includes ostracods, amphipods, several species of copepod, and catfish *(Rhamdia guatemalensis depressa).* Other fauna reported include porcellionid isopods, dragonflies, aquatic hemipterans, snails, and cave swallows *(Petrochelidon fulva citata).*

ACTUN KAUA (41)

Actún Kaua is located in a lightly wooded area less than 1 km south of the town of Kaua. It apparently has served as a major source of clay for the Maya since the early habitation of Chichén Itzá. The first biological study of the cave was made by A. S. Pearse on 16-17 June 1936. A large collection of ricinuleids was made on 7 May 1940 by Ivan T. Sanderson as recounted in his book *Living Treasure* (1941). Recent collections have included those by David McKenzie on 8 January 1972; Robert Mitchell and Jerry Cooke on 23 August 1972; Martha Helen McKenzie and James Reddell on 9 and 12 April 1973; David McKenzie, James Reddell, and Suzanne Wiley on 9-10 and 20-21 October 1974, 20 November 1974, and 11 December 1974; and Andy Grubbs, David McKenzie, James Reddell, and Suzanne Wiley on 19-20 July 1975.

The cave entrance is a rectangular sinkhole 4 m long by 2 m wide. A slope leads down the east side to a point about 3 m below the surface. On the west side of the sinkhole, beneath an overhang, a drop of 7 m containing a wooden ladder opens into a small rubble-floored chamber. A slope to the left extends a short distance before ending in rubble fill. To the right a steep slope leads into the main part of the cave. Actún Kaua is an exceptionally complex maze cave trending largely north-south. To the south a single passage past the rubble of the entrance sink opens into a complex maze area which terminates in a series of water-filled passages after a distance of about 200 m. To the north the cave trends towards two large open-air cenotes located in the town of Kaua. Also toward the north the maze becomes progressively more dense until, near the limit of exploration, it is a vast region of open area broken by hundreds of columns, each only a few meters in diameter. Although much of the North Maze is crawlway, several main passages up to 5 m high and wide extend through the maze. Despite extensive surveying in the North Maze there remains an estimated 3000 m of unmapped passage enclosed by a single survey line. At the northern limit of exploration the cave slopes gradually down to the water level, and numerous passages continue as water-floored tunnels. A newly-discovered area on the western edge of the North Maze is reached only by two low crawlways. This extensive region of dry passages remains largely unexplored. Several hand-dug wells 20 to 33 m in depth intersect the North Maze.

To date, a total of more than 7,000 m of passage has been surveyed in Actún Kaua, the third longest surveyed cave in México. The extent of the cave to the west is not known. To the north the cave may terminate at the two cenotes. The western cenote has no passages extending from it, but the eastern one is a vertical shaft about 30 m deep, which has not been descended. It is a large water-floored chamber with a deep overhang to the south, and local reports indicate that it may connect with Actún Kaua. Numerous passages in the cave trend between the two cenotes, and the cave may continue beyond them.

The passages in the cave are generally level and floored with clay or rock. The larger passages were apparently originally filled with up to 1 m of clay and some smaller passages, once completely clay-filled, have been excavated by the Maya to rock floors. Areas inhabited by bats have small guano deposits on the floor. Pearse (1938a) reported an air temperature near the cave mouth of 26.6°C and a temperature near an inner pool of 25.7°C. The water temperature at the inner pool was 24.5°C. The relative humidity ranged from 94.3% near the mouth to 96.0% at the inner pool. The cave is probably formed in the Carrillo Puerto Formation.

Actún Kaua is extremely rich biologically and contains four aquatic and at least five terrestrial troglobites. The aquatic fauna includes cirolanid isopods *(Creaseriella anops)*, mysids *(Antromysis cenotensis)*, and atyid shrimp *(Typhlatya mitchelli* and *T. pearsei)*. In addition the lakes are inhabited by catfish *(Rhamdia guatemalensis)*. The terrestrial troglobite fauna includes unidentified trichoniscid isopods, amblypygids *(Paraphrynus chacmool)*, pseudoscorpions *(Vachonium kauae)*, and spiders *(Oonops coecus* and *Pholcophora pearsei)*. The cave is also notable for its large population of the ricinuleid *Cryptocellus pearsei*. Oth-

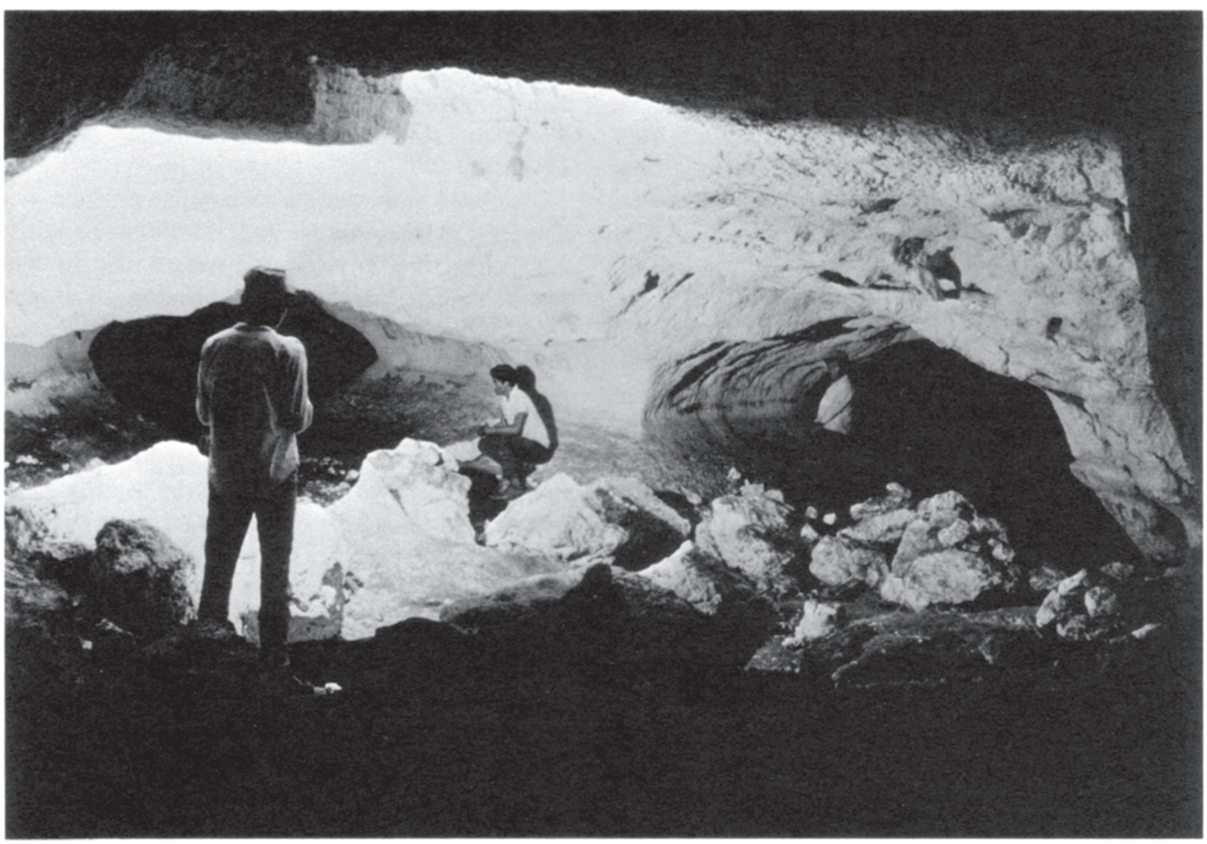

Fig. 13.–Typical passages in Actún Kaua, Yucatán (photo by David McKenzie).

er terrestrial species collected include scorpions, troglophile pseudoscorpions, schizomids, eyed amblypygids, several families of spiders, ticks, trombiculid and other mites, polydesmid millipeds belonging to several families, roaches, crickets, hemipterans, several families of beetles, tineid moths, several families of flies, wasps, ants, snails, and bats. Pearse and Kellogg (1938) identified *Artibeus jamaicensis yucatanicus* from the cave.

CENOTE DE KAUA

Cenote de Kaua is one of two large cenotes in Kaua. The one from which collections have been made is immediately south of the Valladolid-Mérida highway and west of the road from Kaua to Dzeal. A collection of snails was made in the cenote in March 1929 by G. C. Shattuck.

This cenote is an impressive open-air sinkhole more than 100 m in diameter and about 30 m below the surrounding land surface. It is possible to walk down a trail along the south side, but the other walls are more or less vertical. Several short dead-end passages extend into the cenote walls. The water surface is more than 50 m in diameter and the water appears to be very deep.

The only species recorded from Cenote de Kaua is the large snail *Pomacea yucatanensis* (Crosse and Fischer). This snail was used by the Maya as a food source and is probably still eaten today by the local inhabitants.

CUEVA OXOLODT

Cueva Oxolodt is reported as being located at Kaua. Attempts in 1974 and 1975 to locate a cave by this name failed. A collection was made in the cave on 18 June 1936 by A. S. Pearse.

The cave is reported to have a narrow well-like entrance which leads into a passage with irregular floors. It is 15 m long, 20 m deep, and has a 5 to 8 m high ceiling.

The aquatic fauna includes mysids *(Antromysis cenotensis)* and catfish *(Rhamdia guatemalensis decolor)*. Terrestrial species collected from the cave include two troglobites, the spider *Pholcophora pearsei* and the cricket *Tohila atelomma*. Other terrestrial species include amblypygids, symphytognathid spiders, ricinuleids *(Cryptocellus pearsei)*, trombiculid mites, millipeds, eyed crickets, moths, flies, and bats *(Diphylla ecaudata centralis)*.

CENOTE TIKIMUL

Cenote Tikimul (also spelled Ticimul) is located at the village of Tikimul about 7 km south of Chichén Itzá. It was visited in 1929 by G. C. Shattuck, who published a photograph of the entrance (Shattuck, 1933). A collection of fish was made in the cenote on 23 June 1932 by F. Castillo.

As described by Hubbs (1936), "this cenote, 23 meters in diameter and with vertical walls, contained clear water without apparent vegetation." Shattuck (1933) describes it as "a beautiful cenote 50 feet across with slightly overhanging lips from which it is easy to lower buckets into the dark, cool depths."

The only species which has been reported from the cenote is the catfish *Rhamdia guatemalensis depressa*.

CENOTE CHICA DE XANABA

Cenote Chica de Xanabá (also known as Xanabá Cenote Chico) is located 6.5 km southwest of Chichén Itzá. A collection of invertebrates and fish was made in it on 25 and 28 June 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

The cenote is described by Hubbs (1936): "The smaller Xanaba Cenote, measuring about 30 meters between its vertical limestone cliffs, contained much clear water, having a Secchi disk reading of 28 meters. The temperature was also moderate (24°.4 to 24°.7), vegetation lacking, bottom of mud and sand, depth 8 to 33.2 meters." Hall (1936) gives additional data on the physical and chemical characteristics of the water.

The only species reported from this cenote are argulids, copepods, gerrid hemipterans, and catfish *(Rhamdia guatemalensis depressa)*.

CENOTE GRANDE DE XANABA

Cenote Grande de Xanabá (also known as Xanabá Cenote Grande) is located 8 km southwest of Chichén Itzá. A collection of fish and invertebrates was made in the cenote on 27 June 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

This cenote is described by Hubbs (1936) as follows: "This, the larger of the two Xanaba cenotes, was about 60 meters in diameter between the limestone cliffs. The water was green and not very clear (Secchi disk reading 3 meters), of moderate temperature (22° to 27° C.) and 20.7 meters deep. Some water lilies grew here and the bottom was covered with leaves." Hall (1936) describes other physical and chemical characteristics of the water.

The aquatic fauna of this cenote includes five species of copepod, ostracods, cladocerans, amphipods, mites, dragonflies, damselflies, aquatic hemipterans, aquatic beetles, snails, and catfish *(Rhamdia guatemalensis depressa)*.

MUNICIPIO DE KINCHIL

CAVE (KINCHIL)

This is reported by Birney *et al.* (1975) as being located 6 km south and 5 km west of Kinchil. No description is available. Two species of bat *(Pteronotus davyi fulvus* and *Natalus stramineus saturatus)* were reported from the cave.

MUNICIPIO DE KOPOMA

CENOTE DE LAS ABEJAS (3)

Cenote de las Abejas is located on the north side of the Mérida-Maxcanú highway and about 2 km north of Kopomá. A small collection of aquatic invertebrates was made in the cave on 16 April 1973 by David McKenzie and Stuart Murphy.

The entrance to the cave is about 7 m in diameter and is shaded by a large tree. A drop of 3 m leads into a 15 m long room containing a stagnant pool 3 m in diameter. Three alcoves along the edge of the room contain shallow pools extending beneath ledges. The name of the cave derives from bee hives located by the entrance, but it may have a local name we could not find.

The cave contains a rich aquatic fauna which includes mysids *(Antromysis cenotensis),* cirolanid isopods *(Creaseriella anops),* atyid shrimp *(Typhlatya pearsei),* and palaemonid shrimp *(Creaseria morleyi).*

CENOTE DE SAMBULA (4)

Cenote de Sambulá is located on the southern edge of the town of Kopomá. A small collection of invertebrates was made by James Reddell, Reynaldo Solis, and Suzanne Wiley on 15 October 1974.

The entrance to the cave is a 5 m in diameter, 4 m deep climbable sinkhole in a wooded area. A rubble slope leads down into a single elongate chamber about 7 m wide and 40 m long. About 30 m from the natural entrance a shaft opens above an artificially modified pool which is used as a well. Beyond the well shaft the floor of the cave is covered by water from 0.5 to more than 2 m in depth.

The aquatic fauna collected included only mysids *(Antromysis cenotensis),* but atyid shrimp and catfish were seen. The terrestrial fauna was sparse owing to strong air circulation between the two entrances, but schizomids, amblypygids, and a few trogloxenes were collected.

MUNICIPIO DE MANI

CENOTE KABAHCHEN (31)

Cenote Kabahchén (also known as Actún Caba Chen) is located in the town of Maní. This cave is one of the more famous in Yucatán because of its occurrence in one of the early centers of power in this area. It was utilized as a source of water by the Maya since the habitation of this region. John Lloyd Stephens visited the cave in 1841. The cave was excavated by Mercer (1896) who found extensive pottery deposits. Brainerd (1958) studied the pottery deposits from the cave and reports that they date back to 800 B.C. A profile of the cave is included in Mercer's report. Collections of invertebrates were made in the cave by James Reddell, Robert W. Mitchell, and Masaharu Kawakatsu on 1 August 1973. On 5 October 1974 the cave was mapped and a collection made by David McKenzie, James Reddell, and Suzanne Wiley.

A rock wall surrounds the 6 m in diameter sinkhole entrance. Steps lead down about 6 m, then a slope descends to a small pool over which a well has been dug. About 15 m from the entrance a passage to the right extends 20 m into a room. From this room a passage to the left goes 16 m to a junction. Straight ahead the passage ends in breakdown after about 40 m. To the left from the junction a passage intersects the entrance passage after 15 m. Beyond the pool, which is 35 m from the natural entrance, two passages lead into a room after about 13 m. The main passage from this room extends 10 m to a junction. Straight ahead the passage ends abruptly after 20 m; to the right a muddy crawlway extends 20 m to intersect a second pool. A well has also been excavated above this pool. Only a short dead-end passage goes beyond this pool. The floors of the cave are generally rock and, with the exception of the room to the right of the entrance passage, contain little organic matter other than small deposits of bat guano. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

The pools of the cave are inhabited by eyed planarians *(Dugesia* sp.), atyid shrimp *(Typhlatya mitchelli* and *T. pearsei),* and palaemonid shrimp *(Creaseria morleyi).* The terrestrial fauna collected included schizomids, amblypygids, scytodid spiders, isopods, millipeds, roaches, ants, hemipterans, ants, flies, and other endogean forms.

MUNICIPIO DE MAXCANU

CUEVA DE AGUACATE (5)

Cueva de Aguacate is located approximately 2 km south of Maxcanú in the Sierra de Ticul. A collection of invertebrates was made in the cave on 17 October 1974 by David McKenzie, James Reddell, Reynaldo Solis, and Suzanne Wiley.

The entrance to the cave is an opening 1 m in diameter in one side of a large shallow sinkhole with a crawlway into a dry, breakdown-floored room about 20 m wide and 15 m long. On the side of the room opposite the entrance a steep slope over breakdown and loose rubble descends for about 20 m into an area of fissure-like passages and breakdown rooms which was not carefully explored. The upper areas of the cave away from the entrance contained considerable deposits of silt and organic debris, and these were rich in endogean forms. The cave is formed in limestone of Paleocene or Eocene age.

The fauna collected included schizomids, spiders, millipeds, carabid beetles, diplurans, hemipterans, dipterans, crickets, and roaches. A theraphosid spider in combat with a tarantula hawk was captured in the entrance room.

CENOTE CALCHUM (1)

Cenote Calchum is located about 1 km east of the Hacienda San Bernardo. A small invertebrate collection was made and the cave mapped on 16 April 1973 by David McKenzie, Stuart Murphy, and James Reddell.

The entrance to this small cave is in a shallow sinkhole in the middle of a large henequen field. An opening about 1.8 m wide and 2 m high descends a small slope into an irregular junction room. Straight ahead a passage extends for about 30 m as a crawlway before ending in a small room. To the left from the junction room a passage leads into a dome room about 10 m long and 8 m wide. A passage to the right extends for about 10 m to a low crawlway floored with water, which in turn siphons after a few meters.

The cave contained few species of interest, but the fauna collected did include mysids *(Antromysis cenotensis)*, atyid shrimp *(Typhlatya pearsei)*, and blind amblypygids *(Paraphrynus chacmool)*. Other fauna collected included a few isopods, millipeds, gryllid crickets, and ants. A palaemonid shrimp was seen in the water crawl but could not be captured.

CENOTE CALCHUHUIM (2)

Cenote Calchuhuim is located about 2 km east of the Hacienda San Bernardo. The spelling of the name is very uncertain and one informant indicated that the name might be Calchuntunil. A small collection of fish and invertebrates was made on 15 October 1974 by James Reddell, Reynaldo Solis, and Suzanne Wiley.

The entrance to the cave is a sloping sinkhole in a henequen field. This leads down into an oval-shaped room about 5 m wide, 8 m long, and 2 m high floored with water up to 1.5 m in depth. A crawlway to the left near the entrance goes into a second chamber about 6 m long, 4 m wide, and up to 3 m high. The floor of this room is also largely covered with water.

The fauna of this small cave is primarily notable in possessing a population of the eyeless brotulid *Typhliasina pearsei,* three specimens of which were obtained. Other aquatic fauna included cirolanid isopods *(Creaseriella anops)*, mysids *(Antromysis cenotensis)*, atyid shrimp *(Typhlatya mitchelli)* and palaemonid shrimp *(Creaseria morleyi)*. The terrestrial fauna was very sparse, and only millipeds and a few accidental or trogloxenic species were collected.

ACTUN CHUKUM (5)

Actún Chukum is located in the Sierra de Ticul about 2 km south of Maxcanú. The cave was mapped and a collection of invertebrates made on 17 October 1974 by David McKenzie, James Reddell, Reynaldo Solis, and Suzanne Wiley. An additional collection was made on 29 November 1974 by David McKenzie, Robert W. Mitchell, James Reddell, and Suzanne Wiley.

The entrance to the cave is a 1.5 m in diameter vertical opening in a lightly wooded area. A slope from the bottom of the 2 m deep entrance leads steeply down into one side of a large room. At the bottom of the slope a vertical drop of about 10 m leads to the floor of the room. A ledge to the left permits one to bypass the drop and descend to the floor by a series of short drops, some of which have been modified by crude steps. A passage to the left from the ledge goes to a small pit from the bottom of which a crawl extends into a second room. This breakdown-floored room is about 20 m in diameter and up to 10 m high. With the exception of a few crawls through breakdown no passages lead from this room. The principal room of the cave is a well-decorated chamber about 40 m in diameter and up to 15 m high. The floor is broken by massive breakdown and formations and is strewn with pottery shards. Opposite the entrance a small hole in breakdown leads down a slope into a small chamber containing a pool of drip water. Several other small passages in breakdown extend short distances, and it is possible to climb up the breakdown and flowstone along the right wall and re-enter the entrance passage along the slope.

Actún Chukum is rich biologically and includes several unusual troglobites. The troglobitic fauna includes the only eyeless species of scorpion of the family Diplocentridae *(Diplocentrus anophthalmus)*, a blind amblypygid *(Paraphrynus chacmool)*, a blind pseudoscorpion *(Vachonium* sp.), and the blind spirostreptid milliped *Orthoporus zizicolens.* Other fauna collected includes eyed amblypygids, spiders, several species of milliped, crickets, ants, and other troglophiles and trogloxenes.

ACTUN CHUNUP (5)

Actún Chunup is located in the Sierra de Ticul about 2 km southwest of Maxcanú. A collection of invertebrates was made on 17 October 1974 by David McKenzie and Suzanne Wiley.

The entrance to the cave is an elongate vertical sinkhole about 7 m long, 4 m wide, and 27 m deep. Tree roots descend to the floor of the cave, but rope is necessary for the climb. The entrance drops into a room 16 m long and 10 m wide. To one side a climb-down among boulders leads to a room 20 m long, 12 m wide, and 3 m high. A sloping breakdown floor descends to a flat silt-floored area 7 m wide and 10 m long. The total depth of the cave is about 35 m.

Actún Chunup is comparatively rich in endogean forms, but few have yet been studied. Species collected include schizomids, spiders, isopods, millipeds, hemipterans, crickets, ants, beetles, and other troglophiles.

MUNICIPIO DE MERIDA

CENOTE (DZITYA)

This cenote is located 2.5 km northwest of Dzitya. A collection of bats was made in it in the spring of 1973 (Birney *et al.*, 1975).

The cenote is described by Birney *et al.* (1975) as follows: "Water level in the cenote was about 3 meters below ground level of the area, but less than 1 meter below the top of the lowest part of the limestone wall. Dimensions of the water-covered surface were about 10 by 20 meters. A subterranean passageway that led from the primary opening to a vertical secondary entrance about 15 meters away was used by bats as a flyway and perhaps as a roost." Nine species of bat were collected at the cenote, but some were certainly using it only as a source of water.

ARTIFICIAL CAVE (MERIDA)

This small dug cave is located in a vacant lot near the corner of Calle 24 and Calle 19 in Mérida. A small collection of invertebrates was made by James Reddell on 20 March 1973.

The entrance to the dry, dusty artificial cave is an opening about 1 m in diameter, dropping about 1.5 m to a floor of rubble. A 1.5 m high passage extends about 15 m before ending. Below the main entrance a small crawlway extends a few meters to a second, smaller entrance.

Invertebrates obtained in the cave included pholcid spiders, amblypygids, and crickets on the wall and nesticid spiders, isopods, and roaches from the floor.

CENOTE (MERIDA)

This cenote is reported by Villa (1966) to be located in Mérida at No. 97, Calle 24. No information is available on it. An attempt in 1974 to locate it failed. A house has been built at the reported location and it is assumed the cenote was filled. Vampire bats, *Desmodus rotundus murinus,* were collected in the cenote.

CUEVA AMIL

Cueva Amil was reported to be located on the Hacienda Tixcacal, 14 km southeast, and 2 km east of Mérida. Inquiries in 1974 indicated that the cave is no longer on the grounds of the hacienda but probably on property controlled by the Ciudad Militar south of Mérida and north of the Hacienda Tixcacal. A collection of invertebrates was made in the cave on 25 July 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

The cave was described by Hubbs (1936): "This covered cavern contained clear water without vegetation, floored with gravel, rock and mud; temperature 26°.8 C. The small pools in this cave....contained no fish." Hall (1936) reports a pH of 6.9 and gives other data on the cave water.

The only species reported from Cueva Amil are cirolanid isopods *(Creaseriella anops)* and palaemonid shrimp *(Creaseria morleyi).*

CENOTE CHAPULTEPEC

Cenote Chapultepec is located in Mérida. A collection was made in the cave on 20 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

This cenote is reported by Hubbs (1936) as "an artificial cenote 15 meters in circumference, dug straight down into the limestone. The water was murky; vegetation, absent; bottom, sandy; temperature, 27°.2 C.; depth, 1.8 meters." Hall (1936) also reports a pH of 7.6, as well as other data on the water.

The cenote was inhabited by dragonflies, gerrid hemipterans, chironomid flies, three species of presumably introduced fish, and bats *(Glossophaga soricina leachii).*

CENOTE CONCHITA

Cenote Conchita is located in Mérida. A collection was made in the cenote on 19 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

This cenote is described by Hubbs (1936): "Almost completely covered, and with vertical walls, this small cenote (9 meters in diameter) contained clear water 1.8 meters deep, without water plants, and registering 25°.8 C. The bottom was of sand. It is reputed that the water level in this cenote varies with the tides." Hall (1936) gives additional data on the water. Robles Ramos (1950) reports an air temperature of 26.5°C, a water temperature of 24.5°C, and a pH of 7.0. He also provides other data on the physical and chemical characteristics of the water.

The only fauna reported from the cenote, other than damselflies, is aquatic: copepods, ostracods, and cichlids *(Cichlasoma urophthalmus conchitae* Hubbs).

CENOTE DEL COUNTRY CLUB

Cenote del Country Club is located on the grounds of the Country Club in Mérida. A collection of invertebrates was made on 19 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

No description of this cenote is available, but it is reported to be cave-like with 1.5 m deep water. Hall (1936) reports a water temperature of 24.8°C and a pH of 7.4, as well as other data on the nature of the water.

Copepods, aquatic mites, damselflies, chironomid flies, and snails are the only groups reported from the cenote.

CENOTE DE LA ESCUELA CARLOS MORALES

Cenote de la Escuela Carlos Morales is located in Mérida. A collection of invertebrates was made on 23 July 1932 by E. P. Creaser, F. G. Hall, and A. S. Pearse.

This is reported to be an artificial cave-like cenote, but no other description is available. Hall (1936) reported a water depth of 1.0 m, water temperature of 25.7°C, and a pH of 7.5. He also gives other data on the nature of the water.

Copepods, ostracods, aquatic mites, gerrid hemipterans, and chironomid flies are the only groups reported from this cenote.

CENOTE GEISER

Cenote Geiser (also spelled Geyser) is located in Mérida. A collection was made in it on 19 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

Hubbs (1936) describes this cenote: "This cliff-lined and completely covered cenote at Mérida measured 15 by 23 meters. Its water was found to be clear, without vegetation, of 26°.8 C., and as deep as 1.8 meters." Hall (1936) also reports on other characteristics of the water. Robles Ramos (1950) reports an air temperature of 27.0°C, a water temperature of 25.0°C, and a pH of 6.5. He also gives other data on the nature of the water.

CENOTE HALAL

Cenote Halal is reported to be located on the Hacienda Xcanatún, about 14 km north and 2 km east of Mérida. A collection was made in it on 22 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

Hubbs (1936) reports: "Halal Cenote was a small crescentic-shaped structure, 7.5 by 15 meters in size, with a cliff on one side. The clear water contained some algae and higher plants, was as deep as 1.8 meters in places and had a bottom of limestone slabs." Hall (1936) reports a water temperature of 26.7°C, a pH of 6.8, and gives other data on the nature of the water.

Copepods, mosquitoes, catfish *(Rhamdia guatemalensis depressa),* mollies *(Gambusia yucatana),* and frogs were the only animals reported from this cenote.

CENOTE MANZANILLA

Cenote Manzanilla is located in Mérida. A collection was made in it on 23 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

Hubbs (1936) reports: "This, an artificial cavern in the limestone, about 7.5 by 9 meters in size and with opening on one side, contained water which was 1.2 meters deep, clear, with algae and floored with mud and gravel." Hall (1936) reports a water temperature of 24.5°C and a pH of 7.4, among other data on the water.

Copepods, aquatic mites, damselflies, gerrid hemipterans, and three species of introduced fish were obtained in the cenote.

CENOTE NIAGARA

Cenote Niagara (sometimes spelled Niagra) is located in Mérida. A collection was made in it on 21 July 1932 by E. P. Creaser, F. G. Hall, and A. S. Pearse.

Hubbs (1936) described it as follows: "This cavern, about 7.5 meters in diameter and probably artificial, contained clear water about one meter deep with an abundance of algae and with a gravel bottom." Hall (1936) in a report on the nature of the water reports a water temperature of 24.4°C and a pH of 7.4.

The fauna of this cave includes copepods, ostracods, aquatic mites, gerrid hemipterans, chironomid flies, and fish *(Poecilia velifera).*

CENOTE OLIVUT

Cenote Olivut (also known as Cenote San Cosmé) is located in Mérida. A collection was made in it on

23 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

No description is available of this cenote, except that it is cave-like and has water in excess of 1.3 meters in depth. Hall (1936) gives data on the cave water, including a temperature of 26.8°C and a pH of 6.85.

The only species reported from this cenote is the aquatic mite, *Limnesia paucispina* Wolcott.

CENOTE DE SAMBULA

Cenote de Sambulá (also referred to as Cueva San Bulhá, Cueva Sambulá, and Cenote San Bulhá) is located in the Sambulá subdivision of Mérida a block or two northwest of Calle 81. It was visited by the archeologist Abbé Brasseur de Bourbourg (1867a). A collection was made in the cave on 21 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall. A second collection was made by A. S. Pearse on 13 July 1936.

The cave is reported to have a wide entrance and to be 17 m long, 6 m deep, and with a 4 m high ceiling. It contains water in pools. Hall (1936) reports water depth in excess of 1.0 meters, water temperature of 27.0°C, and a pH of 6.85. Pearse (1938a) reports a water temperature of 27.2°C, air temperature of 26.6°C, and a relative humidity of 95.5%.

The aquatic fauna of the cave includes copepods, catfish *(Rhamdia guatemalensis decolor)*, and cichlids *(Cichlasoma urophthalmus ericymba)*. Terrestrial fauna reported from the cave includes schizomids, amblypygids, spiders, millipeds, beetles, ants, wasps, antlions, and snails.

CENOTE DE SAN ISIDRO (9)

Cenote de San Isidro (also known as Cueva de San Isidro and Cenote de El Retiro) is located near the southern end of Calle 66 in Mérida. It has been considerably modified as a public bath and is periodically open for bathing and swimming under the name of the Baños Catacumbas. The cave was first studied biologically by A. S. Pearse, E. P. Creaser, and F. G. Hall on 20 and 27 July 1932. It was revisited by A. S. Pearse on 3 July 1936. A generalized plan of the cave was published by Pearse (1938a). The cave was mapped and a collection of invertebrates made by David McKenzie, Stuart Murphy, and James Reddell. Additional collections were made on 29 March 1973 by James Reddell.

The entrance is a sinkhole about 4 m long and 3 m wide. A rock wall has been constructed around the entrance, and steps lead down into the cave near one end of the wall. Behind the steps the cave goes only about 10 m before ending. A single passage 6 to 10 m wide and up to 5 m high extends for about 60 m before ending abruptly. A low crawlway near the end fills with silt after a few meters. Much of the floor is covered with pools less than 0.5 m up to more than 2 m in depth and large breakdown blocks occur throughout the cave. Because of heavy use as a public bath the cave is polluted with trash and human feces throughout most of its length. Pearse (1938a) reported the air and water temperature to be 27.0°C, while the relative humidity was 99.6%.

The aquatic fauna consists of four species of copepod, cirolanid isopods *(Creaseriella anops)*, mysids *(Antromysis cenotensis)*, atyid *(Typhlatya pearsei)* and palaemonid *(Creaseria morleyi)* shrimp, and catfish *(Rhamdia guatemalensis stygaea)*. The terrestrial fauna includes schizomids, amblypygids, spiders, ticks, trombiculid and other mites, millipeds, homopterans, hemipterans, blind crickets *(Tohila atelomma)*, eyed crickets, ants, and snails.

CENOTE DE SAN JOSE (8)

Cenote de San José is located on the grounds of the Mérida airport near the intersection of Calle 54 and Calle 113 in southern Mérida. A small biological collection was made on 6 October 1974 by James Reddell and David McKenzie.

The entrance is a sinkhole about 2 m wide and 4 m long. A breakdown slope leads after 20 m to a water-floored passage about 30 m long, 1 to 2 m high, and 2 to 3 m wide. The water depth increases steadily from a few centimeters to more than 2 meters. Large breakdown blocks near the end of the cave are partially covered with bat guano. The cave is heavily polluted with trash and human feces.

Although palaemonid shrimp and catfish were seen in the cave, only mysids *(Antromysis cenotensis)* could be collected. The terrestrial fauna included millipeds, schizomids, amblypygids, ricinuleids *(Cryptocellus pearsei)*, and several trogloxenes.

CENOTE SODZIL

Cenote Sodzil is located on a plantation 8 km north and 1.6 km east of Mérida. A collection of fish was made on 21 July 1932 by A. S. Pearse, E. P. Creaser, and F. G. Hall.

This cenote is described by Hubbs (1936): "Another cavern with limestone walls, this cenote was about 9 by 12 meters in major dimensions. The water, as deep as 1.8 meters in crevices, was clear and without vegetation. The bottom was of gravel and limestone slabs." Hall (1936) reports a water temperature of 26.6°C and a pH of 6.85 in a report on the chemical and physical characteristics of the water.

The only species reported from this cave is the catfish *Rhamdia guatemalensis depressa.*

CENOTE TAAMANCHE

Cenote Taamanché (also reported as Cenote Pamanché) is located at Taamanché on the highway from Mérida to Progreso. A frog was collected in the cenote by Arthur Schott prior to 1865.

The only information available on this locality is that provided by Cope (1865) who reports that the frog was taken from "a hole in the rocky wall of the Cenote Pamanche."

The only species reported from this cenote is the hylid frog *Triprion petasatus* (Cope).

CUEVA DE TECOH (8)

Cueva de Tecoh is located on the Hacienda Tecoh near the intersection of Calle 54 and Calle 113 in southern Mérida. A small collection of invertebrates was made on 6 October 1974 by David McKenzie and James Reddell.

The principal entrance to the cave is at one end of a shallow elongated sinkhole. A gentle slope leads down into an irregular chamber up to 15 m wide, 40 m long, and 6 m high with a second entrance at the opposite end of the room. The cave has been used as a dump for trash and dead animals. A low passage to the right 15 m from the main entrance opens into a level-floored room approximately 40 m wide, 50 m long, and up to 2 m high. In the lower areas a few centimeters of water cover the floor. This room has almost certainly been, at least, in part excavated.

The cave was inhabited by schizomids, blind amblypygids *(Paraphrynus chacmool),* oonopid spiders, ricinuleids *(Cryptocellus pearsei),* millipeds, crickets, and a few trogloxenes.

CENOTE XLAKA

Cenote Xlaká (also spelled Xlacah) is located in the ruins of Dzibilchaltún north of Mérida. This cenote was located at the base of a temple which collapsed and fell into the cenote. It also apparently was utilized as a sacrificial cenote. It was excavated by the National Geographic Society in 1958 (Andrews, 1959). A detailed account of the exploration and finds in the cenote and a sketch map of it are included in Marden (1959). A collection was made in the cenote by E. P. Creaser, F. G. Hall, and A. S. Pearse on 22 July 1932.

The cenote has a surface area of about 15 by 30 meters and is bordered by low cliffs. The underwater explorations of the National Geographic Society revealed a long rubble slope descending to 46 meters, at which point a large cave passage gently descended to 48 meters and became level. Hall (1936) reports that the water temperature at the surface was 28.5°C; it decreased to 26.8°C at a depth of 7.0 m. He reports pH values of 7.2 at the top and 6.8 at 7.0 m.

Numerous species of damselflies and dragonflies were collected over the cenote. Other fauna reported includes copepods, ostracods, aquatic beetles, and four species of fish.

MUNICIPIO DE MOTUL

CENOTE DE SAMBULA (36)

Cenote de Sambulá (also known as Cueva de San Bulhá) is located approximately seven blocks south of the plaza in Motul near the intersection of Calle 26 and Calle 41(?). The cave was first studied biologically by A. S. Pearse, F. G. Hall, and E. P. Creaser on 26 July 1932. It was revisited by A. S. Pearse on 9 July 1936. M. Cárdenas Figueroa and B. F. Osorio Tafall made collections in it on 18 March 1947. The cave was also visited in January 1953 by A. Villalobos and on 22 March 1973 by Stuart Murphy and James Reddell. Robles Ramos (1950) describes the cave and briefly discusses its geology. A generalized plan was published by Pearse (1938a).

This cave has been converted into a public bath. The entrance is a natural sinkhole about 5 m in diameter and 6 m deep. A set of concrete steps supported by pillars descends into a spacious rock- and concrete-floored chamber about 10 m wide. Underneath the steps the passage goes 20 m before ending in several small dead-end crawlways. In the opposite direction the passage extends about 15 m before the floor becomes covered with water gradually deepening from 0.8 to 2 m. After 18 m a dug well with a water pump over it opens above the pool. After 12 m more the pool ends, and two crawlways 0.8 m above the water level lead off. The two crawls connect after about 1.5 m and then extend as a single passage 1.2 m wide and up to 1 m high for about 10 m before filling almost completely with silt. The floor of the crawl is of small rocks and organically rich silt mixed with bat guano. Hall (1936) has described the physical and chemical nature of the water in the cave. Pearse (1938a) reports a relative humidity of 95.5% and air and water temperatures of 26.7°C. Robles Ramos (1950) reports an air temperature of 31.0°C, and a water temperature of 27.0°C, and a pH of 6.5; he also gives other data on the water. The cave is formed in the Carrillo Puerto Formation.

The entrance area was predictably sterile, and only flies on piles of human feces, an amblypygid, small crickets, and spiders were found. The water contained a large population of fish *(Rhamdia guatemalensis decolor),* Other aquatic fauna included copepods, mysids *(Antromysis cenotensis),* cirolanid isopods *(Creaseriella anops),* and palaemonid shrimp *(Creaseria* *morleyi).* Four terrestrial troglobites have been reported from the cave: isopods *(Trichorhina pearsei* and *Cylindroniscus maya)* and collembolans *(Cyphoderus innominatus* and *Lepidocyrtus pearsei).* Other terrestrial fauna collected includes eyed isopods, pseudoscorpions, schizomids, amblypygids, spiders, ricinuleids *(Cryptocellus pearsei),* mites, ticks, millipeds, diplurans, epigean collembolans, dragonflies, eyed crickets, beetles, tineid moths, flies, ants, and snails. Pearse and Kellogg (1938) identified the bat *Desmodus rotundus murinus* from the cave.

CENOTE UKI

Cenote Uki (also referred to as Uki Cave) is located 3 km northwest of Motul. A collection was made on 26 July 1932 by A. S. Pearse, F. G. Hall, and E. P. Creaser.

Hubbs (1936) describes this cenote: "This small water hole, about 4.5 to 6 meters in major dimensions and 1 meter deep, had a cliff on one side. Its clear water contained an abundance of algae and stood at 27°.1 C...." Hall (1936) also reports a pH of 6.9 when he presents the data on the nature of the water.

The collection made in this cenote included copepods, ostracods, damselflies, aquatic hemipterans, snails, and catfish *(Rhamdia guatemalensis decolor).*

MUNICIPIO DE MUNA

CENOTE DE KANKIRIXCHE (14)

Cenote de Kankirixché is located on the Rancho San Isidro Kankirixché about 10 km northwest of Muna. A collection of aquatic invertebrates was made in the cave on 18 June 1975 by Robert W. Mitchell, William Russell, and Suzanne Wiley.

The entrance is a small hole in rocks, about 1.1 by 1.6 m, which drops vertically for 8 m. A slope leads down to water in a semi-circular room 20 m in diameter. Water covers the floor along all the walls except that on which the entrance slope is located. Water is probably more than 2 m deep along the walls.

The aquatic fauna collected included cirolanid isopods *(Creaseriella anops),* mysids *(Antromysis cenotensis),* and palaemonid shrimp *(Creaseria morleyi).* A brotulid fish was seen but could not be captured. The cave was also inhabited by vampire bats.

CENOTE DEL POCHOTE (14)

Cenote del Pochote (also known as Cueva de Caxcuy) is located about 10 km northwest of Muna on the Rancho San Isidro Kankirixché. It was first studied biologically by B. F. Osorio Tafall and M. Cárdenas Figueroa on 14 March 1974. Their collection was particularly notable for the collection of 10 specimens of *Typhliasina pearsei,* allowing a study of variation in this species (Solorzano, 1958). A collection of fish and invertebrates was made in the cave on 4 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley. Additional material, including the blind eel *Ophisternon infernale,* was obtained on 16 June 1975 by Robert W. Mitchell and Suzanne Wiley.

The entrance to the cave is a sinkhole about 2 m in diameter located in a wooded area. A climb down of about 4 m leads onto a mound of breakdown and flowstone. Slopes on three sides lead down into an elongate room about 6 m wide and 15 m long. Water covers three sides of the room and ranges in depth from less than 1 to more than 2 m.

The aquatic fauna included cirolanid isopods *(Creaseriella anops),* atyid shrimp *(Typhlatya mitchelli),* palaemonid shrimp *(Creaseria morleyi),* mysids *(Antromysis cenotensis),* eels *(Ophisternon infernale),* and brotulid fish *(Typhliasina pearsei).* The terrestrial fauna included millipeds, isopods, collembolans, reduviid bugs, and a number of other species.

ACTUN TUCIL (18)

Actún Tucil is located east of the highway from Muna to Bolonchenticul and about 2 km south of Muna. It was mapped and a collection of invertebrates made on 26-27 March 1973 by James Reddell, Martha Helen McKenzie, and Stuart Murphy. Additional invertebrates were collected on 3 August 1973 by Robert W. Mitchell and others.

Entrance to the cave may be gained by descending one of several large trees growing from the larger and shallower of the two entrances leading into a single chamber 60 m long and 40 m wide. The shallow entrance to the cave is about 20 m in diameter and 7 m deep on the low side. From the floor of this entrance a slope over breakdown leads down into an area lit by a skylight entrance about 10 m long, 5 m wide, and 20 m high. Large breakdown blocks in the skylight area are largely covered with swallow guano. From the shallow entrance a series of holes along one wall lead down through breakdown into a crawlway about 10 m long. This, in turn, opens about 3 m up on the wall of a large irregular inner chamber about 25 m in diameter. Holes in breakdown in this inner chamber lead into a small complex of low passages and rooms. Bat guano covers the floor of most of the chamber. Numerous pottery shards litter the floor of the entire cave, including the inner rooms.

The fauna of Actún Tucil is varied, with the entrance chamber harboring a wide variety of species living among the vegetation and in the swallow guano. Among species taken from the entrance chamber are scorpions, spiders, millipeds, hemipterans, homopterans, neuropterans, ants, beetles, roaches, pseudoscorpions, and other trogloxenes. The inner chamber is inhabited by one troglobite, an agelenid spider *(Cicurina maya),* and numerous troglophiles, including pholcid and oonopid spiders, amblypygids, and millipeds. The bat guano is inhabited by mites, tineid moths, and numerous other species. Three species of bird have been identified from the entrance area: owls *(Tyto alba pratincola),* swallows *(Petrochelidon fulva citata),* and mot-mots *(Eumomota superciliosa superciliosa).*

ACTUN XPEK (16)

Actún Xpek is located in the Sierra de Ticul about 1 km south of Muna in a wooded area along a gently sloping hillside near the face of the Sierra. A small collection was made on 1 August 1973 by Robert W. Mitchell and James Reddell.

The entrance is a sinkhole about 1.5 m in diameter from which a slope leads down into the single chamber of the cave. A rock stairway descending this slope indicates that the cave was considered of some importance to the early Maya. The floor of the room, which is about 15 m long, 5 m wide, and up to 3 m high, is comparatively flat and littered with pottery shards. With the exception of a few small alcoves, no passages lead from the entrance room.

The cave is dry and generally devoid of life. A few pholcids and crickets were taken from the walls, and a large population of the scytodid spider *Loxosceles yucatana* inhabited rocky areas on the floor. Several specimens of the neuropteran *Eremeleon longior* were obtained from the inner walls of the cave.

ACTUN ZIIZHA (17)

Actún Ziizhá is located in the Sierra de Ticul about 2 km south of Muna in a wooded area. A small collection of invertebrates was made on 3 August 1973 by Frances Abernethy, Manuel Ay Canul, Eleuterio Gonzalez, and Robert W. Mitchell.

The entrance is in the edge of a sink about 18 m in diameter and 10 m deep. A walk-in slope along one side leads down to several openings which extend back only about 25 m. There are a few speleothems, but the cave was dry when visited.

The only fauna obtained in the cave were two species of spider, amblypygids, millipeds, and a few trogloxenes.

MUNICIPIO DE OPICHEN

WELL (CALCEHTOK)

This well is located at Calcehtok. A collection of mysids *(Antromysis cenotensis)* was made in it in 1936 by A. S. Pearse.

ACTUN CHACALJAS (7)

Actún Chacaljas (also known as Actún Ankah) is located about 0.5 km north of Actún Xpukil and 3 km south of Calcehtok in the Sierra de Ticul. The cave was visited by A. S. Pearse on 6 August 1936, but apparently no biological collections were made. A small excavation was made in the cave by R. T. Hatt *et al.* and a number of fossils recovered (Hatt, 1953). A small collection of invertebrates was made on 3 August 1973 by James Reddell.

The cave is a large dry, mostly open-air sinkhole about 50 m wide and 75 m long with a floor generally of vegetation-covered breakdown. The total depth below the surface is about 16 m. On the west side it is possible to enter a passage, formed by a combination of the overhanging wall of the sink and by breakdown, which extends less than 20 m before ending. The temperature in this part of the cave was reported by Pearse (1938a) to be 25.5°C and the relative humidity to be 95.1%.

The cave passage was inhabited by crickets, amblypygids, and wasps. A small series of typical epigean species was obtained from the floor of the sinkhole. This included schizomids, snails, millipeds, and a terrestrial planarian. Owls *(Tyto alba pratincola)* were observed roosting in the walls of the sinkhole.

ACTUN CHOM (6)

Actún Chom is located in the Sierra de Ticul at the edge of the escarpment overlooking, and about 1 km south of, Calcehtok. A small collection of invertebrates was made in the cave on 1 May 1973 by James Reddell.

The entrance to this cave is a sinkhole about 5 m in diameter and 5 m deep. From the bottom of the entrance a low passage extends a few meters to the edge of a steep slope to the right leading down for a total of about 10 m. Several low passages from the bottom of this slope end after a few meters. The cave is dry and has very little organic debris.

The fauna of the cave is poor, and only a few trogloxenes in the vicinity of the entrance were found. These included roaches, ants, crickets, and spiders.

ACTUN COCH LEB (7)

Actún Coch Leb is located about 3 km south of Calcehtok in the Sierra de Ticul. The cave was mapped and a small collection made on 16 April 1973 by Stuart Murphy and James Reddell.

The entrance to the cave is a vertical sinkhole about 7 m in diameter and 20 m deep with deeply undercut walls. A large mamey tree grows by the entrance, and its roots descend to the cave floor. The cave consists essentially of one large chamber about 25 m in diameter which is floored with large breakdown blocks. Small crawls lead into small chambers, but no distinct passages were found leading from the entrance area.

The cave was generally dry, and the only fauna collected were several species of spider, hemipterans, ants, crickets, and other trogloxenes.

ACTUN OXKINTOK

Actún Oxkintok is located within 450 m of one of the ruined temples in the ruins of Oxkintok, about 2 km southwest of Calcehtok. The cave may have served as a water source by the Mayan inhabitants of Oxkintok. The cave was excavated by Mercer (1896) and by Hatt (1953). A generalized map of the cave is in Hatt (1953) and a profile in Mercer (1896). A collection of bats was made in the cave by S. C. Harriot. Birney *et al.* (1975) reports a large collection of bats from "Cueva de Oxkintok," but from the location and description of the cave it is apparent that they are referring to Actún Xpukil.

The cave is entered by a large collapsed sinkhole down which it is possible to walk into the single large level-floored room, a chamber about 35 m long and 22 m wide. The ceiling is never more than 9 m high, and stalactites are well developed in a few areas.

The only species reported from the cave is a bat, *Artibeus jamaicensis,* and a streblid fly removed from it and described by Peterson and Hurka (1974) as *Trichobius intermedius.*

ACTUN SAZICH

Actún Sazich is located near Calcehtok. A collection of invertebrates was made in it on 6 August 1936 by A. S. Pearse.

The cave is reported to have a wide entrance and to be 70 m long, 15 m deep, and to have a 20 m high ceiling. Pearse (1938a) reports a water temperature of 22.8°C at the middle pools and air temperatures of 23.3°C at the middle pools and 23.5°C at the inner pool. The relative humidity ranged from 97.5% to 99.5%.

Two terrestrial troglobites are known from the cave: the isopod *Trichorhina pearsei* and the collembolan *Metasinella falcifera.* Other species reported include earthworms, schizomids, trombidiid mites, millipeds, crickets, carabid beetles, moths, flies, hymenopterans, and snails.

ACTUN SILIL (7)

Actún Silil is located less than 100 m from Actún Xpukil about 3 km south of Calcehtok. The cave was mapped and a collection of invertebrates made on 23 June 1975 by David McKenzie, William Russell, and Suzanne Wiley.

The entrance to the cave is a sinkhole in a heavily wooded area. An opening about 2 m high and 8 m wide leads down a slope into a chamber about 10 m below the surface and about 75 m wide and 25 m long. Along one side a low crawlway over breakdown continues for about 25 m before becoming too small. The cave is dry.

The fauna of the cave was limited, and only spiders, ticks, crickets, ants, and a few other trogloxenes were collected.

ACTUN TUZ-IC

Actún Tuz-ic (also spelled Tuc-ic) is located along the left side of the *tranvia* track from San Bernardo to Opichén and about 5 km ENE of Calcehtok. A collection of bats was made in the cave on 24 November 1947 by R. T. Hatt, B. Villa R., and H. Wagner.

Hatt (1953) describes the cave as having "a head-high tunnel, descending abruptly about 15 m. to standing water, which is exposed over an area of about 1.5 sq. m."

The bat *Mimon cozumelae* Goldman is the only species reported from the cave. Hatt (1953) reports seeing two white fish in it. These were probably brotulids.

ACTUN XKYC (6)

Actún Xkyc (also referred to as Actún Ix-kix) is located on the eastern slope of the Sierra de Ticul about 2 km south of Calcehtok. Hatt (1953) reports that it was discovered in 1935 and, at that time, contained many unbroken pots. Hatt conducted an archeological and paleontological excavation of the cave. It was biologically studied by A. S. Pearse on 6 August 1936. An additional collection was made on 1 May 1973 by Edward Alexander, Mary Butterwick, David McKenzie, and James Reddell.

The entrance is an opening about 1.5 m wide and 0.5 m high located in a shallow depression. A low crawlway leads from this opening into a low irregular "room." To the left a crawl leads into an irregular passage about 6 m wide and 15 m long, with a slight descent over flowstone. To the right of the "room" the crawlway opens into a room about 12 m in diameter and up to 2 m high. Along one wall of the room a steep slope descends in stairstep fashion about 30 m. Although fairly narrow at the top, it widens until the slope is about 30 m long. There are no passages from the bottom of the slope. Extensive pottery deposits occur throughout the cave, and at one point along the slope an intact pot, now completely covered with flowstone, was found beneath a drip. Pearse (1938a) reported an air temperature of 26.5°C and a relative humidity of 99.5% in the inner chamber. The cave is formed in limestone of Paleocene or Eocene age.

Actún Xkyc contains three identified troglobites: a pseudoscorpion *(Vachonium cryptum)*, a spirostreptid milliped *(Orthoporus zizicolens)*, and a collembolan *(Troglopodetes maya)*. Other fauna includes chernetid pseudoscorpions, schizomids, amblypygids, spiders, trombiculid mites, polydesmid millipeds, crickets, hemipterans, beetles, flies, ants, and snails. A gekko *(Coleonyx elegans elegans)* was reported from the entrance area and Pearse and Kellogg (1938) identified the bat *Glossophaga soricina leachii* from the cave.

ACTUN XPUKIL (7)

Actún Xpukil (also reported as Actún Spukil, Grutas de Calcehtok, and Cueva de Oxkintok) is located in the Sierra de Ticul about 3 km south of Calcehtok. Paleontological and archeological investigations were made in the cave by Mercer (1896) and by Hatt (1953). They found abundant evidence for its use by the Maya from at least 900 A.D. Hatt (1953) includes a generalized plan and profile of the areas which were investigated. The cave was completely surveyed during 1973, at which time additional archeological remains were discovered in inner chambers unknown to Mercer and Hatt. Baker (1895) reports a visit to a cave near Santa Cruz which is certainly Actún Xpukil and reports swallows in it. The cave was first studied biologically by A. S. Pearse on 5 August 1936. Stanley Kiem visited it on 20 March 1959, at which time he collected specimens of the troglobitic milliped *Orthoporus zizicolens*. Birney *et al.* (1975) report seven species of bat from "Cueva de Oxkintok." From their location and brief description of the cave it is apparent that this is Actún Xpukil. Additional biological collections have been made by David McKenzie on 5 January 1972; by Mary Butterwick, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell on 18-19 March 1973; by David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell on 4-5 April 1973; by James Reddell on 15 April 1973; by Robert W. Mitchell and James Reddell on 30 April 1973; by James Reddell on 3 August 1973; and by Andy Grubbs, Robert Mitchell Jr., William Russell, and Suzanne Wiley on 23 June 1975.

The principal entrance to Actún Xpukil is a sinkhole 30 by 15 m and 7 m deep. A ladder has been placed in the entrance which is undercut on all sides. Heavy vegetation, including palms and banana trees, covers the floor of the entrance chamber. To the south a slope leads down to a dry dead-end area 40 m long, 20 m wide, and 12 m high. To the northeast a 35 to 45 m wide passage slopes steeply down over breakdown into a chamber 75 m long and lit by a 29 m high, 15 m in diameter skylight (Fig. 14). Three major passages lead from this room. A 12 to 20 m wide sloping passage leads down to the left for 50 m to a crawlway which, after 5 m, opens into a complex of silt-floored, speleothem-adorned rooms and passages. More than 400 m of passage have been surveyed in this area. The floor of most of this area is silt, and numerous trenches dug by Mercer and Hatt can still be seen. The second passage from the skylight room is entered by two narrow crevices dropping about 10 m in several short drops. At the bottom a level area about 25 m long is followed by an impressive breakdown and flowstone slope 25 m wide, up to 10 m high, and 75 m long. It approaches the surface and ends abruptly.

The major portion of the cave is reached by continuing beyond the skylight to the southeast and descending a slope at the end of which is a narrow hole almost blocked by a wall of stone. This hole opens abruptly into an enormous chamber with a highly irregular floor of breakdown and speleothems. The room is 100 m long and 50 m wide with ceiling heights up to 10 m. At the east end it slopes down into an extension of the same chamber. This lower part of the room is a silt-floored dome room known as La Media Naranja and is 45 m long, 35 m wide, and 16 m high. Along the east side of this room a small hole was excavated, which led after about 5 m to the base of a steep breakdown slope about 25 m wide, which rises to a large walk-in sinkhole entrance. To the northeast from La Media Naranja a very irregular passage 3 to 7 m high extends about 30 m before opening into a large irregular breakdown-floored chamber about 40 m in diameter and up to 15 m high. A steep, in places vertical, mountain of breakdown rises in the center of the room. On the northeast side near the top of the breakdown a ledge about 2 m high leads to the top of an 8 m drop. A narrow traverse over Mayan steps leads along the left wall of this 15 by 20 m chamber. Beyond the traverse access is easily gained into a 45 m long, 15 m wide, 3 m high tunnel which opens into La Sala de los Mayas, a breakdown-floored room 20 by 25 m in size. A passage from this room extends to the edge of a steep slope leading about 7 m down to a very tight keyhole dropping down a steep slope into a speleothem-decorated passage 25 m long. This, in turn, opens into a large junction room floored with breakdown and about 25 m in diameter. To the left a 5 to 10 m wide passage with numerous speleothems and intact pottery extends 65 m before ending abruptly (see Fig. 4). To the right a slope leads into a flat silt-floored passage 5 m wide, 3 m high, and 25 m long. This reaches a Mayan stone wall with an opening leading directly into a large chamber 30 by 20 m and up to 10 m high. A slope leads up breakdown into this room, which also contains much intact pottery. A steep slope from this room goes down and then back up to an old filled entrance which corresponds to a 10 m deep filled sinkhole on the surface. A third passage from the junction room is a crawlway which leads into La Sala de la Culebra. A fourth passage, located below this crawlway, is a walking tunnel formed at the base of the breakdown from La Sala de la Culebra. After 50 m several holes on the left lead up to a vertical, unclimbable breakdown mountain. To the right a passage extends into a complex of rooms and passages, all of which dead-end. La Sala de la Culebra is a chamber 50 m long, 35 m wide, and up to 10 m high. It is inhabited by a large bat population, and the floor is a treacherous jumble of wet guano-covered breakdown blocks. Several small passages leading from this room end after less than 30 m. Most of the cave is hot and humid. Pearse (1938a) reported that at the "inner pool" water temperature was 25.2°C, air temperature, 26.1°C, and relative humidity 97.8%; while at a "high middle" pool water temperature was 23.9°C, air temperature 25.3°C, and relative humidity 98.5%. The cave is formed in limestone of Paleocene or Eocene age.

As is to be expected in a system as large and environmentally diverse as Actún Xpukil, the fauna is extremely rich. Three distinct ecological zones occur in the cave: the large, heavily-vegetated entrance areas, the chambers inhabited by bats, and the inner chambers. The entrance areas contain large numbers of many species of endogean and plant-feeding forms, among which are isopods, scorpions, schizomids, many spiders, mites, millipeds, japygid diplurans, roaches, hemipterans, homopterans, beetles, bees, ants, collembolans, and orthopterans. The bat-inhabited areas have been found to harbor spiders, ticks (including *Nothoaspis reddelli, Antricola mexicana,* and *Ornithodoros* sp.), mites, millipeds, cydnid hemipterans, histerid and leiodid beetles, tineid moths, and streblid

Fig. 14.–View of the skylight entrance of Actún Xpukil, Yucatán; shown are Mary Butterwick and Martha Helen McKenzie (photo by David McKenzie).

flies. The inner chambers contain troglobitic isopods *(Troglophiloscia levis* and *Trichorhina pearsei),* blind amblypygids *(Paraphrynus chacmool),* eyed amblypygids, blind and eyed crickets, spiders, opilionids, millipeds (including *Orthoporus zizicolens),* collembolans, and ants. Creaser (1938) identified cirolanid isopods *(Creaseriella anops)* and palaemonid shrimp *(Creaseria morleyi)* from the cave, but in 1973 and 1975 the only water found was in drip pools. It is assumed that in an unusually wet year ground water levels rise and bring with them aquatic organisms. The entrance area is inhabited by owls *(Tyto alba pratincola),* mot-mots *(Eumomota superciliosa superciliosa),* and swallows *(Stelgidopteryx ruficollis ridgwayi).* Nine species of bat have been identified from the cave.

MUNICIPIO DE OXKUTZCAB

WELL (OXKUTZCAB)

This well is located at an iron mill in Oxkutzcab. A collection of mysids *(Antromysis cenotensis)* was made in the well by A. S. Pearse in 1936 (Creaser, 1938).

ACTUN CHEN (24)

Actún Chen is located on the Rancho de Santa Rita, 3 km west of Kiuick. The cave contains enormous deposits of pottery shards, indicating a long history of use by the Maya. An artificial well has been excavated in historic times to the water level, and the well is the principal source of water for the ranch. A collection of invertebrates was made on 13 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

The natural entrance to the cave is at one side of a large tree-filled sink into which some water runs. A slope down over small breakdown leads through a 5 m wide, 2 m high entrance into a passage largely cleared of rubble, possibly by Mayans. After 15 m a hand-dug well passes from the surface through the cave and continues through the floor to water 80 m below the surface. Beyond the well the cave passage extends 10 m and forks. To the right a low crawl leads to a drop of about 20 m. The main passage ends in a circular pit 3 m in diameter which drops unclimbably 18 m to a mud-floored room. To the right from this room a slope leads down past the drop in the passage to the right and into an elongate sloping chamber floored with more than 5 m of pottery-filled silt deposits. The chamber is 50 m long, 8 m wide, and up to 10 m high. At its end a pit, resulting from eluviation of silt through large breakdown, leads into an area of low crawlways and small rooms beneath very unstable rocks. A strong air current emerges from this hole. It is probable that, following excavation of the well, the cave passage was no longer used and has since filled with rubble and debris.

The cave is comparatively rich in terrestrial animal life, and several species of milliped, isopod, cricket, beetle (including leiodids and carabids), hemipteran, earthworm, and spider were collected.

ACTUN COYOK

Actún Coyok (also known as Actún X-Koyoc) is located about 6.5 km southwest of Oxkutzcab. The cave was excavated by Mercer (1896) and Hatt (1953). Hatt (1953) includes a generalized plan of the cave. Bats were collected in the cave by M. R. and R. T. Hatt in late 1929.

The entrance is 18.5 m wide and 3 m high and is level. It opens into an irregular chamber about 20 m in diameter and containing numerous speleothems. The cave floor is generally level and mostly dry reddish silt.

Hatt (1938) reports the bats *Artibeus jamaicensis yucatanicus* and *Glossophaga soricina leachii* from the cave.

ACTUN EBIZT

Actún Ebizt is located near Oxkutzcab. A collection was made on 18 July 1936 by A. S. Pearse. The cave was also visited by M. Cárdenas Figueroa and B. F. Osorio Tafall on 25 March 1947. A generalized plan of the cave is in Pearse (1938a).

A wide entrance leads into this 97 m long, 32 m deep cave with a ceiling height of 1 to 10 m. It is reported to contain pools and numerous speleothems. Pearse (1938a) reports that, at an inner pool, the water temperature was 23.9°C, the air temperature 24.0°C, and the relative humidity 95.0%.

The cave has a somewhat limited fauna, which includes amblypygids, scytodid spiders, roaches, gryllid crickets, antlions, tenebrionid beetles, moths, flies, snails, and bats.

ACTUN GONGORA

Actún Góngora (also referred to as Actún Góngurrah and Cueva de Gorgosa) has been reported as being located both 1.5 km south of Oxkutzcab and 3 km east of Oxkutzcab. It is not known which location is correct. The cave was excavated by Hatt (1953). A biological collection was made in it on 16 July 1936 by A. S. Pearse.

The entrance is an inconspicuous opening under a rock ledge which requires crawling to enter. A low, narrow passage extends for about 60 m, where a pile of rock and soil closes a former entrance. It is possible to crawl around this plug to reach a section of steep rocky slopes and precipices, where there are higher, stalactite-covered ceilings from which water drips. Numerous potshards were found at the bottom of the cave (23 m). Pearse (1938a) reported a water temperature of 27.2°C, an air temperature of 27.3°C, and a relative humidity of 99.6%.

Creaser (1938) reported two aquatic troglobites, the cirolanid isopod *Creaseriella anops* and the palaemonid shrimp *Creaseria morleyi* from the cave. Hatt (1953) reported finding no water in the cave in November, so apparently water rises into the cave with the summer rains. Other fauna recorded from the cave includes earthworms, troglobitic isopods (*Trichorhina pearsei*), chernetid pseudoscorpions, schizomids, amblypygids, spiders, millipeds, collembolans (including the blind *Cyphoderus innominatus* and *Lepidocyrtus pearsei*), gryllid crickets, homopterans, alleculid beetles, moths, flies, ants, and snails. A gecko, *Coleonyx elegans elegans*, was found near the entrance.

ACTUN KIUICK (25)

Actún Kiuick is located in the ruins of Kiuick. It was visited by John Lloyd Stephens in 1841, but he only entered the entrance and looked down the second drop into the big room. A small collection of invertebrates was made on 13 November 1974 by James Reddell, David McKenzie, and Suzanne Wiley.

The entrance to the cave is at one end of a shallow trough-like depression and drops vertically for about 3 m, opening out into the side of a large room completely floored with breakdown. A 15 m drop leads to the floor of the room, but a ledge 5 m down allows one to leave the rope and climb down the remainder of the way to the floor. A slope down over loose rubble leads across the room to the wall opposite the entrance. A very steep slope descends to an end in rubble. No passages extend from the single room, which measures 15 m wide, 30 m long, and up to 20 m high. Pottery shards were found throughout the room, and it is possible that an opening once led to water, but has since been filled.

The cave was generally sterile, but schizomids, amblypygids, spiders, millipeds, collembolans, crickets, and leiodid beetles were collected.

ACTUN LOLTUN (33)

Actún Loltún is located about 7 km SSW of Oxkutzcab in the Sierra de Ticul. This is the most famous cave in Yucatán and among the more famous in México. The cave was utilized by the Maya at least from 900 A.D. as a water source and perhaps as a habitation. Numerous pictographs, petroglyphs, and some carvings have been found in the cave, some far back in darkness. The cave was visited in 1841 by John Lloyd Stephens. Other well-known archeologists of the late 19th century also visited the cave, but it was not seriously excavated until 1888 when Edward H. Thompson directed a study of the cave. He continued his exploration in 1890. The account of his findings and a map of part of the cave were published in 1897. Mercer (1896) also made a detailed study of the cave and includes a profile of part of the cave. Hatt (1953) made a hasty examination of the cave. Baker (1895) visited the cave and collected snails from it. The first extensive study of the cave fauna was made by A. S. Pearse on 26-27 July 1936. On 1 January 1972 David McKenzie made a small collection in the cave. A map of the cave was begun and an extensive collection of invertebrates was made on 24-27 July 1975 by Andy Grubbs, David McKenzie, James Reddell, and Suzanne Wiley. A generalized map of the cave was prepared by Dailey and Grant from November 1959 to January 1960, but it has apparently not been published. Finch (1973) studied the floral associations of the cave and includes a generalized plan of the entrance areas.

Actún Loltún has seven entrances. The most accessible is perhaps the Nukup Entrance. A long gentle slope leads down to the actual cave entrance. Along the left wall are several shallow shelters and on the wall a large carved Mayan drawing of a god. The main cave entrance is about 8 m wide and 2 m high. A second, smaller opening on the right also leads into the same entrance room. A trail leads down a breakdown slope and into the main passage. To the right an irregular level chamber 7 m high, 15 by 30 m is an ideal camping site. The main cave passage is an impressive gallery averaging about 30 m wide and 5 to 22 m high. In an alcove to the right about 45 m from the entrance is a small pool of apparently permanent water. Beyond this are several columns and travertine dams. An attractive waterfall pours from a high dome during rainstorms and doubtless comes directly from one of several shallow surface sinks or small caves above Actún Loltún. The main cave passage, with an occasional short side passage, extends about 400 m from the entrance, at which point a rock pillar divides it into two small openings. Throughout much of the main passage a seasonal stream has incised one or more distinct channels in the silt of the cave floor. Much of the water runs into a 60 m long dead-end passage on the left about 100 m before the cave narrows. Beyond the low narrow passages the cave becomes heavily decorated. To the right an irregular passage extends about 60 m to a pool. The main passage continues as a 15 to 30 m wide, 3 to 6 m high level gallery for 250 m where it changes character drastically. The floor becomes covered with enormous breakdown blocks and descends several meters. This area was named the Grand Canyon Room by Grant and Dailey. To the left a wide 7 to 8 m high passage extends into a very irregular 3 to 6 m high room with vast numbers of columns and other speleothems. To the left from this room a passage extends into Ledo Road. Straight ahead from the room a Mayan trail leads down to what was once a blocked crawlway, which was excavated to allow entrance into an extremely complex area of rooms and small passages. The trail, visible only in places, leads through this complex of much smaller passages and irregular formation rooms for about 150 m to a major junction. Straight ahead a 3 to 5 m high passage up to 10 m wide extends 150 m to an abrupt end. A 1 m high passage leads along the Mayan trail into an irregular room 1 to 3 m high and 30 by 40 m, from which six passages lead. Three of these end after less than 50 m, but the other three are flat, parallel, silt-floored passages leading into the same area. The Mayan trail follows the middle passage. After about 20 m the passage divides into two parallel ones connected in three places before they join again after about 75 m. The trail follows the 4 m high, 7 m wide left passage. The two passages join in an irregular room 30 m in diameter and 3 to 4 m high with several shallow drip pools and a shallow 6 m in diameter pit in the floor. Beyond this room the main passage and the trail extend to the right for 50 m where it opens into a 20 by 45 m, 6 to 7 m high chamber. In this general area Dailey and Grant found a unique sculptured head now on display at the archeological museum in Mérida.

The Grand Canyon Room is a greatly enlarged section of the main cave passage and is up to 50 m wide, 20 to 30 m high, and 130 m long. The floor is covered almost throughout by massive breakdown blocks. On the right side at its end there is an extension of the room into what has been named the Ante-Chamber. Holes along the walls of this 30 m in diameter room drop into a lower level complex of small passages. To the left at the end of the Grand Canyon Room the passage narrows to about 15 m, then extends about 40 m before opening into a large skylit room. This room, Chamber No. 3, is about 110 m long and 60 m wide. Two small openings above a large rubble slope open to the surface. Two passages extend south from this room. One along the eastern edge leads into Chamber No. 2, an 80 m in diameter room. Immediately inside this room a small passage to the east leads into Ledo Road. This 10 m wide, 100 m long passage connects back into the complex area described above. South from this room a large gallery passage up to 15 m wide extends about 200 m before opening into Chamber No. 7, which is about 60 m long and 30 m wide. The other passage from Chamber No. 2 is a wide passage opening almost immediately into Chamber No. 1, which is 30 m wide and 80 m long. A skylight entrance is on the western side of the room. The principal entrance to this part of the cave is along the eastern side of the room; the 20 m in diameter opening has a ladder in it and is that used by most of the early visitors to the cave. A small hole on the western side of the room leads into a wide passage lit by a large entrance, known as the Huechil Entrance. Beyond it the passage opens into Chamber No. 6, a 30 by 50 m room. From Chamber No. 3 a narrowing of the cave leads into Chamber No. 4, actually a passage about 80 m long and up to 30 m wide. A skylight entrance illuminates the southern half of the "room." Beyond, a narrow passage extends about 40 m to open into Chamber No. 5, an irregular room approximately 30 m in diameter, with several smaller rooms and passages extending from it.

As can be seen from the above description, Actún Loltún is divisible into three distinct sections: the large gallery passage extending from the Nukup Entrance to end in the Grand Canyon Room; the complex of small passages and formation rooms extending from the Grand Canyon Room; and a very complex area of large dome-like chambers, many of which have skylight entrances. In the last section are to be found most of the sculpture and drawings on the walls. Many stone water dishes also are found near the edges of entrances where they catch drip water.

Pearse (1938a) reports that the water temperature was 22.7°C near the mouth, 22.3°C 0.5 km inside, and 22.0°C 1.5 km inside. The air temperature at these locations respectively was 22.1°C, 22.0°C, and 21.9°C. Relative humidity ranged from 98.5% near the mouth and 1.5 km inside to 97.5% 0.5 km inside.

The fauna of Actún Loltún is still not fully studied. There have been few collections in the complex entrance areas and only one in the potentially rich inner formation complex. The only troglobites recorded from the cave are pseudoscorpions *(Vachonium* sp.) and millipeds *(Orthoporus zizicolens)*. Other species which have been collected in the cave include copepods and ostracods from drip pools. The terrestrial fauna includes terrestrial planarians, earthworms, schizomids, scorpions, amblypygids, many species of spider, ticks, millipeds, japygid diplurans, gryllid crickets, hemipterans, leiodid beetles, flies, ants, sphecid wasps, snails, a snake, and six species of bat.

ACTUN PUZ

Actún Puz is located near Oxkutzcab. A collection was made in the cave on 20-21 July 1936 by A. S. Pearse. A rough sketchmap is in Pearse (1938a).

A wide entrance leads into an oval chamber with two passages. One to the left extends a short distance and branches; the two branches rejoin and the passage ends shortly. The passage to the right is a narrow, blind, elongate tunnel. The cave is more than 80 m long, 16 m deep, and has a 1 to 5 m high ceiling. Water is present in pools, and the cave has some speleothems. Pearse (1938a) reports a water temperature of 24.4°C, an air temperature of 25.0°C, and a relative humidity of 94.2% in the "Upper Cave." Air temperature in the "Cave" is reported as 25.9°C and the realtive humidity as 99.6%.

The only troglobite reported from the cave is the terrestrial isopod *Trichorhina pearsei.* Other fauna collected included earthworms, amblypygids, spiders, ticks, millipeds, roaches, crickets, reduviid bugs, antlions, moths, flies, chalcidid hymenopterans, ants, pompilid wasps, snails, geckos, and bats.

CUEVA PRIMERA DEL CAMINO A SAN ROQUE

Cueva Primera del Camino a San Roque is the first cave on the San Roque Road from Oxkutzcab. A collection was made on 22 July 1936 by A. S. Pearse.

The cave is reported to have several passages and to be more than 45 m long, more than 25 m deep, and to have a ceiling 1 to 4 m high. Water is present in pools. Pearse (1938a) reports a water temperature in the inner chamber of 24.5°C, an air temperature of 25.0°C, and a relative humidity of 99.6%.

The fauna of the cave includes earthworms, blind isopods *(Trichorhina pearsei),* syarinid pseudoscorpions, spiders, roaches, crickets, reduviid bugs, tenebrionid beetles, and a gecko.

CUEVA SEGUNDA DEL CAMINO A SAN ROQUE

Cueva Segunda del Camino a San Roque (also referred to as Cueva Oxkutzcab) is the second cave on the road from Oxkutzcab to San Roque. A collection was made in the cave on 23 July 1936 by A. S. Pearse. A generalized sketch map is in Pearse (1938a).

The cave is apparently a single large chamber with smaller alcoves. It is reported to be 35 m long, more than 16 m deep, and to have a 2 to 6 m high ceiling with a level or gradually sloping floor. Pearse (1938a) reports that at the cave mouth the water temperature was 23.7°C, the air temperature 24.1°C, and the relative humidity 98.5%. In an inner chamber the air temperature was 24.5°C and the relative humidity 97.5%.

The fauna of the cave includes ticks, mites parasitic on bats, troglobitic collembolans *(Cyphoderus innominatus* and *Lepidocyrtus pearsei),* reduviid bugs, antlions, beetles, flies, ants, snails, and bats.

ACTUN ZIZ (32)

Actún Ziz (also spelled Sitz) is located near the chapel of l'Ermita near the crest of a ridge on the southwestern edge of Oxkutzcab. It was visited by Mercer, and a profile of the cave is published by him (1896). The cave was also visited by Hatt (1953), but neither worker found it suitable for excavation. The presence of potshards scattered throughout the cave indicates that it probably served as a source of water for the Maya. The cave was first studied biologically on 25 July 1936 by A. S. Pearse. Additional biological collections were made on 3 December 1974 by James Reddell, Arsenio Gamboa, David McKenzie, Suzanne Wiley, and Robert W. Mitchell.

The entrance to the cave is an elliptical opening about 5 m long by 2 m wide dropping almost vertically for about 4 m into one side of an irregular room. This chamber is about 25 m wide, with large breakdown rising almost to the ceiling along the right wall and with small rocks and flowstone sloping steeply down opposite the entrance. This slope descends about 20 m to terminate in two small flowstone-lined pools. At the lower end of the slope, flowstone-cemented breakdown and fissures lead up to 15 m to the right, but no distinct passages extend from the main entrance chamber. The cave is extremely humid, and Pearse (1938a) records an air temperature of 26.2°C, a water temperature of 25.7°C, and a relative humidity of 100% at the inner pools.

The cave is very productive biologically. Troglobites include trichoniscid isopods, amblypygids *(Paraphrynus chacmool),* millipeds *(Orthoporus zizicolens),* and gryllid crickets. Other species known from the cave include porcellionid isopods, schizomids, pholcid and scytodid spiders, pyrgodesmid and rhachodesmid millipeds, eyed gryllid crickets, beetles, moths, flies, ants, and snails. A small colony of unidentified bats inhabited the dark portions of the cave.

MUNICIPIO DE SACALUM

CENOTE NOHCHEN (15)

Cenote Nohchén is located in the plaza of Sacalum and serves as a well. The cave is of considerable archeological interest in that it served as a source of the important pigment, Maya Blue. The cave was visited in 1962 by William J. Folan, in 1965 by Dean E. Arnold, and in 1967 and 1968 by Arnold and B. F. Bohor. They took mineralogical samples which confirmed that the white earth *(sak lu'um)* in the cave was pure attapulgite, the source of Maya Blue. A discussion of the archeology and a map of the cave are included in Arnold and Bohor (1975). A biological collection was made in the cave on 18 June 1975 by Andy Grubbs, David McKenzie, and James Reddell.

The natural entrance to the cave is a sinkhole with a stone wall around it. A stairway leads down into a large circular room 17 m below the surface. This room is about 25 m in diameter, up to 13 m high, and has a floor of small rubble which is probably covered almost entirely by water at times. In June, however, the only water present was in a rectangular dug hole immediately below an artificial well entrance. A low crawlway opposite the stairs goes 7 m into a dug chamber 33 m long, about 10 m wide, and 1 to 2 m high, which is the attapulgite mine discussed in Arnold and Bohor (1975). A few shallow pools were present in this inner room.

The aquatic fauna in the inner room included insect larvae (mostly mosquitoes), mysids *(Antromysis cenotensis)*, amphipods *(Mayaweckelia cenoticola)*, and atyid shrimp *(Typhlatya* sp.). Terrestrial fauna was sparse but included isopods, spiders, amblypygids, schizomids, and crickets.

MUNICIPIO DE SANTA ELENA

ACTUN CHAC (23)

Actún Chac is located on the right side of the road to the ruins of Sayil and less than 1 km east of the highway from Muna to Hopelchén. The area is no longer under cultivation, and the old Rancho Chac has been abandoned, making the cave difficult to find in the heavy brush. Exploration of this cave was vividly described by John Lloyd Stephens and by Henry Mercer following their trips to the cave in 1841 and 1895, respectively. In November 1962 Jaime Fernandez of Mérida recovered a polychrome jar, the unusual nature of which indicated that the cave was of considerable archeological interest. Extensive surface collections and a small excavation by Andrews and others (Andrews, 1965) revealed the cave to possess a very rich accumulation of broken pottery. Shrimp were collected in the cave on 24 November 1962 by E. W. Andrews. The cave was mapped and a collection of invertebrates made on 16 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

The entrance is an inconspicuous sinkhole about 2 m in diameter and 5 m deep. To one side of the sinkhole a low crawl extends to a 10 m drop which leads down a short slope to a 6 m drop. This in turn is followed by a 2.8 m drop from the bottom of which a slope leads down over a bridge to a 13 m drop. With the exception of the 10 m drop near the entrance, the ladders were still intact and usable with caution in 1974. From the bottom of the 13 m drop a short slope leads down into the main passage of the cave. This is a long, meandering passage with crawls and small rooms alternating. It extends about 35 m, at which point a slope leads up to the right into a large room about 15 m wide and 20 m long. From here the cave continues for a total distance of about 500 m to terminate abruptly in a deep clear pool. The passage throughout is extremely dry, with powdery dust and pottery shards covering the floor. The ceiling is blackened with soot, and the cave is generally unpleasant to explore, although much less so than is indicated by the descriptions of Stephens and Mercer. Several fissure-like side passages were noted and partially explored, and there is the definite possibility of the cave being much longer than the mapped length. A cold current of air blowing from the entrance was not noted in the back of the cave, and an attempt to follow this would perhaps lead to a significant extension. The cave temperature ranges from 24.0°C near the entrance to 28.3°C at the end, and the water temperature in the terminal pool was 28.3°C. The cave is probably formed in the Pisté Member of the Chichén Itzá Formation.

The terrestrial fauna of the cave is very poor due to excessive dryness, and only a few common trogloxenes and troglophiles were collected. These included crickets, amblypygids, scytodid spiders, roaches, and tenebrionid beetles. The pool was inhabited by cirolanid isopods *(Creaseriella anops)*, mysids *(Antromysis cenotensis)*, atyid shrimp *(Typhlatya pearsei)*, and palaemonid shrimp *(Creaseria morleyi)*. A fer-de-lance *(Bothrops atrox asper)* was resting on a rung of the ladder at the 6 m drop but crawled away upon being disturbed.

ACTUN NOHCACAB (21)

Actún Nohcacab is located in the plaza of Santa Elena. The cave was probably used by the Mayan inhabitants of Nohcacab (now Santa Elena) as a water source, but the excavation of the wells described by Stephens (1843) and the levelling of the plaza led to its filling with rubble. The cave is now reopening naturally and is also being excavated by local people, and it is possible that the water level will eventually be accessible. It was biologically investigated on 15 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

The cave is now entered by an artificial rock-lined tunnel apparently constructed in 1841 when the plaza was levelled. A small hole along one side of the dirt-floored plaza admits one into the tunnel which is about 1 m in diameter and extends about 15 m before turning sharply to the right and opening out onto a drop of about 2 m which is easily climbable.

A climb down a slope leads to the top of an unclimbable drop of about 6 m. At the bottom of this drop one enters a room about 15 m wide and 10 m long and up to 5 m high. The walls and ceiling are almost entirely of rubble, closely packed with pottery shards. The floor is a slope down over large breakdown blocks. This climb down over rubble and breakdown extends for a vertical distance of about 20 m where it ends in a small hole in the floor from which a strong air current emerges. A low crawl goes a few meters before ending. The cave is reported to have once taken considerable floodwater.

Because of the strong air current the cave is very poor biologically. Only a few earthworms, spiders, millipeds, isopods, and crickets were found in the cave.

ACTUN OKOBICHEN (22)

Actún Okobichén is located about 8 km southwest of Santa Elena. It has obviously been a major source of water for the Maya for centuries and is still occasionally used for this purpose. Crude wooden ladders remain in the cave, but are rotten now. A carved stone pillar overlooks a drop into the lower level route to water. A small biological collection was made in the cave on 15 November 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

The entrance to the cave is a small sinkhole in a wooded area near a milpa. A slope down over rubble leads from the 5 m in diameter, 3 m deep sink into a narrow cave passage. This passage is about 1 m wide by 2 m high at the highest point and slopes steadily down to an easily climbable vertical drop of about 2.5 m. A rotten ladder is in place, but the drop is easily negotiable without equipment. The passage continues about 5 m and opens into a room. A trail runs along the right side of the room and about 5 to 10 m above the floor. A railing of logs has been placed along the side of this ledge. Here, also, the carved stone pillar was found. On the opposite side of the room a climb up and through breakdown opens into an irregular area of crawls and small rooms. A ladder leads down to the floor of the room, but the drop may be easily negotiated without using it. At the lowest point of the room a 1 m wide, 1.5 m high passage extends beneath the room and for about 30 m before it slopes gently into a pool of water completely covered with small sticks and other organic debris. The passage continues through the water before ending in a small chamber about 5 m farther. The chamber is floored with water up to 2 m in depth.

The terrestrial fauna was generally poor, and only a few crickets, spiders, millipeds, amblypygids, and trogloxenes were collected. The pool contained mysids, atyid and palaemonid shrimps, and cirolanid isopods. Because of the dense accumulation of debris, however, only atyid shrimps *(Typhlatya pearsei)* and cirolanid isopods *(Creaseriella anops)* could be collected.

ACTUN XKOCH (20)

Actún Xkoch (also spelled Xcoch) is located near one of the pyramids in the ruins of Xkoch north of Santa Elena. The area is heavily overgrown, and the entrance partly filled with dirt and rubble and is known to very few local people. The cave was visited in 1841 by John Lloyd Stephens, and the following description is largely based on his account. A brief reconnaissance of the cave and small biological collection was made on 26 October 1974 by David McKenzie and Suzanne Wiley.

The entrance to the cave is now an opening barely large enough to crawl through, although Stephens reported it as being 3 ft high and 4 or 5 ft wide. A strong current of air blows from the entrance, as is the case in many of the caves in this region. A slope leads down into a horizontal passage in the floor of which is worn a track several centimeters deep. After about 50 m the passage opens into a chamber about 15 m wide and 4 m high. Passages branch off the main one but were not explored. Some distance farther along the passage is a large room. An ascent up a high breakdown mound leads to a descent into a narrow crawlway. This in turn goes to a vertical drop about 1 m in diameter with steps cut in the rock down to a ledge with a deep drop on the left. Logs laid along the edge of this ledge serve as a bridge. The passage turns to the right, lowers to 1 m in diameter, and slopes steeply down. About 20 m farther it doubles on itself and opens into a large room ending in a drop with a ladder. At the bottom a crawlway leads to a large chamber with a deep pool of water at one end. The pool was not reached on the 1974 reconnaissance, but from Stephens' account it is the end of the cave.

The hasty reconnaissance of the cave resulted only in the collection of nesticid and scytodid spiders and a few trogloxenes. The cave is dry and will probably produce few species of interest.

MUNICIPIO DE TECOH

CENOTE DE CHAC SIKIIN (NORTE) (30)

Cenote de Chac Sikiin (Norte) is located in the southeastern part of the ruins of Mayapán and is marked on the map of Mayapán (Jones, 1952). It is now reached by driving south from Telchaquillo on the highway to Tekit. A small collection of invertebrates and a map of the cave was made on 24 April 1973 by James Reddell.

Cenote de Chac Sikiin (Norte) is entered by a vertical opening about 15 m in diameter dropping unclimbably for about 12 m into a fissure-like passage about 50 m long and with dimensions of 2 to 4 m wide and 5 to 10 m high. Water covers much of the floor, and the cave is used as a source of water for a small ranch located nearby. To the south the cave passage slopes up to an end after 25 m; to the north after 15 m it becomes a narrow crawlway fissure which becomes too small in about 10 m.

The fauna of the cave was poor due to a strong circulation of air. No aquatic troglobites were observed, and the only terrestrial species collected were eyed spiders, isopods, and crickets.

CENOTE DE CHAC SIKIIN (SUR) (30)

Cenote de Chac Sikiin (Sur) is located about 75 m to the south of Cenote de Chac Sikiin (Norte). It is frequently visited by local youths for swimming. A small collection of invertebrates was made on 24 April 1973 by Martha Helen McKenzie and James Reddell.

The cave is entered by a vertical sinkhole about 1 m in diameter and dropping 2.5 m to the top of a steep slope which descends 10 m to a deep lake of clear water. Roots entering the cave facilitate the descent of the slope. The cave floor is covered with water in excess of 5 m in depth except at one point where a limestone rock divides the pool and at the end where a crawlway above the water level extends for less than 5 m. The passage dimensions are about 6 m high and 3 m wide.

The fauna of the cave is very poor, and only isopods, ants, and a ricinuleid *(Cryptocellus pearsei)* were collected. The ricinuleid was in the terminal crawlway.

CENOTE CHEN MUL (29)

Cenote Chen Mul is located at the base of the great pyramid in the Ruins of Mayapán (Fig. 15). The cave has been the object of interest by archeologists since the early explorations of Yucatán. It was visited by, among others, Stephens in 1841 and by Brasseur de Bourbourg (1867b). The Carnegie Institution of Washington conducted serious excavations in the cave in 1953 (Smith, 1954). It was mapped and collections of invertebrates made on 24 and 26 April 1973 by Mary Butterwick, David McKenzie, Martha Helen McKenzie, and James Reddell; and on 8 October 1974 by David McKenzie, James Reddell, and Suzanne Wiley. Additional collections were made on 2 May 1973 by Robert W. Mitchell and James Reddell.

The entrance to the cave is an 8 m in diameter sink dropping vertically for 3 m. Three passages extend from the bottom of the entrance sink. One passage ends abruptly after 10 m; a second is only 40 m long; the third leads into the main part of the cave. This 7 to 10 m wide passage extends 40 m before becoming a crawlway. Fifteen meters before the crawlway a climb up through breakdown on the left leads to two small pools. Ten meters before the crawlway a wide, low passage to the right leads into a low irregular chamber with water in various places. Straight ahead in the main passage a low crawl opens after 10 m into a large bat room 30 m long and wide, with water on the floor on the left. An irregular passage extends beyond the bat room about 60 m before ending in a pool. The complex cave is hot and humid.

Cenote Chen Mul is among the more biologically productive caves in northern Yucatán. The pools are inhabited by mysids *(Antromysis cenotensis)* and atyid shrimp *(Typhlatya mitchelli)*. The terrestrial fauna includes at least three troglobites: the amblypygid *Paraphrynus chacmool* and two spiders *(Oonops coecus* and *Metagonia chiquita)*. The most notable aspect of the fauna, however, is the presence of an enormous population of ricinuleids *(Cryptocellus pearsei)* in the bat room. Other fauna includes epigean spiders, pseudoscorpions, mites, isopods, millipeds, crickets, roaches, ants, and flies. The mormoopid bat *Pteronotus parnelli mesoamericanus* inhabits the cave.

CENOTE DE TELCHAQUILLO (27)

Cenote de Telchaquillo is located in the plaza of Telchaquillo. It was visited by Stephens in 1841. In 1953 the Carnegie Institution of Washington excavated the cave (Smith, 1954). The cave was mapped and a small collection made on 8 October 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

A concrete stairway leads through an opening about 4 m wide and 3 m high into a room 15 m wide and then for about 15 m down a gentle slope to a concrete platform beneath a 3 by 9 m skylight entrance about 13 m high. The platform overlooks a large pool of shallow water. At the back of the chamber is a second small pool with a well opening above it. It is possible to crawl about 10 m through breakdown along the right side of the room and reach a third small pool.

The fauna of the cave is limited because of the strong air circulation between entrances. Millipeds, isopods, gryllid crickets, and a few other invertebrates were found in the breakdown crawlway, which was heavily polluted with human feces. The small inner pool contained atyid shrimps and mysids, but none

Fig. 15.–The entrance to Cenote Chen Mul, Mayapán, Yucatán, as seen from the top of the main pyramid; shown is James Reddell (photo by David McKenzie).

were collected.

GRUTAS DE TZAB-NAH (28)

Grutas de Tzab-Nah (also spelled Dzab-Nah) is located about 100 m to the east of the highway from Tecoh to Telchaquillo and about 2 km south of Tecoh. The cave was excavated by the Carnegie Institution of Washington in 1955 (Stromsvik, 1956). Biological collections were made in the cave on 22 April 1973 by David McKenzie and James Reddell; on 26 April 1973 by Martha Helen McKenzie and James Reddell; on 1 October 1974 by David McKenzie, James Reddell, and Suzanne Wiley; and on 8 October 1974 by James Reddell.

The entrance to the cave is a gently sloping sink in a lightly wooded area. A 1.8 m high, 3 m wide opening leads into a wide irregular area 1 to 2 m high. To the right this extends as a rather nebulous room up to 50 m wide and 80 m long, broken into more or less distinct passages by rock pillars and breakdown. Along the left wall a distinct passage leads down a slope into a lower chamber 25 m wide, 33 m long, and 7 m high, with a shallow lake covering the floor. On the left of this chamber a 7 m in diameter sinkhole entrance, from which a large tree grows, lights the room. Beyond the lake a slope leads up into a passage 3 m wide and 2 to 3 m high which loops around and encounters the nebulous area reached from the walk-in entrance; it also opens as a balcony overlooking the lake room. Beyond the junction of this passage with the area near the entrance a 0.5 to 3 m high chamber up to 30 m wide and 50 m long is encountered. From the edge of this chamber a low narrow crawl extends 10 m before opening into a 1 to 5 m high, 15 by 30 m room. This entire area of the cave is dry, with small breakdown and silt floors.

Continuing to the left from the walk-in entrance a 10 m wide, 2 m high passage extends about 30 m before opening onto the lip of a 7 m drop into an elongate chamber about 100 m long and 10 to 15 m wide. A steel ladder allows descent to a lake which, at times, completely covers the floor of this lower chamber. The water depth varies from a meter to more than 2 meters. At times a beautiful white sandbar rises above the water. The pool siphons at both ends. A bridge crosses the right side of the lake and leads to a passage extending 25 m to a T-intersection. To the left the passage ends after 33 m, but to the right it leads into the main passage of the cave. The main passage averages 7 m wide and, for more than 100 m, is distinguished by an upper area on the right which slopes in several places down to the left to deep, occasionally interconnected pools. After about 200 m a walled-in well entrance is seen on the left, but it has been blocked by rocks and is not accessible. Shortly before the well the passage becomes a crawlway. After about 30 m of crawlway it opens into a passage 65 m long and 12 m wide, lit by a 3 m long, 1.8 m well opening near the right wall. Just past this entrance a slope leads down to a deep lake about 30 m long, with a dug well entering it at the opposite end. To the left at this well a passage extends for about 150 m before ending in a deep siphoned lake.

Grutas de Tzab-Nah is among the more biologically productive caves in the Yucatán Peninsula. The shallow lake below the skylight entrance is inhabited by large populations of mysids *(Antromysis cenotensis)*, amphipods *(Mayaweckelia cenoticola)*, atyid shrimp *(Typhlatya mitchelli* and *T. pearsei)*, and palaemonid shrimp *(Creaseria morleyi)*. This, as well as other lakes in the cave, is also inhabited by blind eels *(Ophisternon infernale)*. Brotulids *(Typhliasina pearsei)* have been found in the inner lakes past the bridge. The terrestrial fauna is also rich in number of species. Three terrestrial troglobites identified from the cave are an amblypygid *(Paraphrynus chacmool)* and two spiders *(Oonops coecus* and *Metagonia torete)*. The cave also contains a large population of ricinuleids *(Cryptocellus pearsei)*. Other fauna collected includes terrestrial isopods, schizomids, eyed spiders belonging to several families, eyed amblypygids, pyrgodesmid and spirostreptid millipeds, beetles, flies, ants, roaches, crickets, and other insects.

MUNICIPIO DE TEKAX

CUEVA DEL CINCO DE MAYO

Cueva del Cinco de Mayo (also known as Cueva del Cinquo de Mayas) is located 1 km southwest of Tekax. The cave was first biologically investigated by A. S. Pearse on 29 July 1936. It was also visited on 21 March 1947 by M. Cárdenas Figueroa and B. F. Osorio Tafall. W. A. Finch, Jr., made a study of the floral associations of the cave (Finch, 1973).

The entrance to the cave is a rectangular opening 65 m wide and 5 m high in the face of a ridge slope. A breakdown slope leads down into a large chamber about 25 m long and up to 10 m high. A breakdown mound separates this room from a second which is about 33 m long and 12 m high. At the end of the second room a steeply sloping passage continues, but nothing is known of its extent. Pearse (1938a) reports an air temperature of 24.0°C, a water temperature of 23.5°C, and a relative humidity of 98% in the inner part of the cave. Robles Ramos (1950) gives an air temperature of 32.6°C, a water temperature of 24.8°C, a pH of 6.5, and other data on the nature of the water.

The fauna of the cave includes no troglobites. Groups which are represented in the collection of Pearse include scytodid spiders, trombidiid mites, roaches, crickets, cimicid and reduviid hemipterans, histerid and staphylinid beetles, moths, flies, bees, wasps, ants, and bats.

CUEVA CHAKXIX

Cueva Chakxix is located near Tekax. A collection was made in the cave on 1 August 1936 by A. S. Pearse.

The cave is reported to be 10 m deep, in excess of 40 m long, and with ceiling heights ranging from 1 to 4 m. The floor is level or gradually sloping, and speleothems are present. Pearse (1938a) reports that at an inner pool the water temperature was 23.9°C, the air temperature 24.2°C, and the relative humidity 94.6%.

The fauna of the cave is limited to pholcid spiders, trombiculid mites, crickets, antlions, moths, flies, a gecko, and bats.

ACTUN SABACA (34)

Actún Sabacá (also referred to as Cueva Sabré and with the variant spellings of Sabaká and Sabachá) is located in the Sierra de Ticul about 6 km southwest of Tekax. The cave was excavated by Mercer (1896), who found stone water dishes and other evidences of Mayan use for probably more than a thousand years. A collection was made in the cave on 30 July 1936 by A. S. Pearse. The cave was also visited on 26 September 1943 by B. F. Osorio Tafall. An additional collection was made on 4 December 1974 by Joanne Andrews, David McKenzie, Robert W. Mitchell, James Reddell, and Suzanne Wiley.

The cave is entered by a 30 m long, 8 m wide sink with trees growing from it. One side is a slope, but the others are vertical 7 m drops. A passage from this entrance extends about 50 m, passing beneath three skylight entrances, to a 7 m drop into a large entrance chamber. A steel ladder is in place at the drop. This chamber is floored with breakdown, and large trees grow from it. A slope out of this room leads down into the main cave passage. This wide 8 m high flat-floored passage extends about 230 m to a chamber lit by a 10 m in diameter skylight about 33 m high. A large number of stone water basins, some filled with calcite, occur throughout this passage (Fig. 5). A slope up from this room leads past a constriction into a 13 m wide, 7 to 14 m wide passage extending about 150 m to a junction. The floor is very wet and lightly covered with bat guano. To the left at the junction a passage goes about 70 m to end in breakdown sloping up to the ceiling. The right-hand passage begins as a 5 m wide passage but opens shortly into a 13 m wide passage. This extends about 80 m before narrowing to 10 m and then after a short distance opening into an elongate chamber about 80 m long, 25 m wide, and 10 m high. Breakdown, speleothems, and small pits complicate this terminal room. The only water in the cave is at the bottom of a small pit about 3 m deep near the junction. Pearse (1938a) reports that the water temperature of the pool was 22.2°C, the air temperature 22.8°C, and the relative humidity 98.0%. In 1974 the air temperature in the large skylight room was 20.0°C and 25.5°C in the junction room.

The fauna of the cave includes terrestrial planarians, troglobitic pseudoscorpions *(Vachonium boneti)*, schizomids, blind amblypygids *(Paraphrynus chacmool)*, eyed amblypygids, several species of spider, ricinuleids *(Cryptocellus pearsei)*, phalangids, ticks, eight species of milliped (including the troglobitic *Orthoporus zizicolens)*, mantids, crickets, cydnid hemipterans, beetles, flies, ants, a salamander *(Bolitoglossa yucatana)*, and bats *(Artibeus jamaicensis yucatanicus)*.

ACTUN XMAHIT

Actún Xmahit is located near Tekax. It was biologically studied by A. S. Pearse on 31 July 1936.

The cave, reported to have a narrow, well-like entrance, is 320 m long, 16 m deep, with a 12 m high ceiling, and has water present in pools. Pearse (1938a) reports a water temperature of 24.5°C, an air temperature of 26.2°C, and a relative humidity of 99.0%.

This cave will probably prove to be biologically productive when it is investigated more carefully, but only troglophiles and trogloxenes are known from it The fauna reported includes amblypygids, diplurid and pholcid spiders, millipeds, roaches, crickets, streblid flies, and bats.

MUNICIPIO DE TEKOM

CENOTE SALUD (48)

Cenote Salud is located on the Rancho Salud to the west of the highway from Valladolid to Felipe Carrillo Puerto and a few kilometers south of Tekom. A collection was made on 12 April 1973 by Stuart Murphy.

The entrance to the cave is in a corral and is an opening about 8 m in diameter from which a small tree grows. A 16 m drop leads into a passage going in two directions. One way extends about 50 m as a dead-end narrow, winding crawlway. The other way opens onto a slope overlooking a 7 m drop into a water-floored room 13 m long and 10 m wide. An artificial well entrance has been opened in the ceiling of this room. The drop from the surface through the well to the water surface is about 24 m.

No attempt was made to reach the water, but it will probably prove to be inhabited by aquatic troglobites. The only fauna collected were ants and amblypygids.

CENOTE TEKOM (47)

Cenote Tekom is located in the plaza at Tekom. A small collection was made on 11 April 1973 by James Reddell.

The entrance to the cave is a natural opening about 1.5 m in diameter and is now used as a well. After a few meters the entrance drop opens into the center of a chamber about 35 m in diameter. The floor of the cave is covered with water 1 m deep below the entrance to more than 2 m along the walls. The drop from the surface to the water is 21.6 m. With the exception of an alcove a few meters long there is no dry area in the cave.

The only fauna collected were amblypygids and spiders. A few catfish were seen in the lake, but no crustaceans could be found.

MUNICIPIO DE TELCHAC PUERTO

CENOTE DE MIRAMAR

Cenote de Miramar is more accurately described as a spring and is located 1 km southwest of Telchac Puerto. A collection was made in it on 31 July 1932 by E. P. Creaser, F. G. Hall, and A. S. Pearse. It is almost always referred to as a spring, and its fauna is not associated with that of the cenotes and caves of the Peninsula. It is mentioned here only because some authors have incorrectly reported it as a cenote.

CUEVA DE SANTA ELENA (35)

Cueva de Santa Elena (also referred to as Cueva or Cenote de los Camarones) is located 4.8 km south of Telchac Puerto about 40 m east and on the right side of the road to the Hacienda de Santa Elena. The cave was first visited on 31 July 1932 by A. S. Pearse, F. G. Hall, and E. P. Creaser. Other collections include ones by M. Cárdenas Figueroa and B. F. Osorio Tafall on 28 March 1947; and by James Reddell on 22 March 1973. A profile of the cave is included in Robles Ramos (1950).

The entrance is a vertical sink about 1 m in diameter. A drop of 1.6 m leads to a breakdown mound sloping off in two directions. On one side it descends about 1.6 m into a chamber 3 m long, 2 m wide, and 1 m high from which two crawls extend about 1 m each before ending. In the other direction a slope down for 2 m leads into a chamber 2 m high and 3 m in diameter with a small pool 0.4 m deep and 0.8 m in diameter in the center. Hall (1936) reports a water temperature of 26.8°C and summarizes other aspects of the water chemistry. Robles Ramos (1950) reports an air temperature of 31.0°C, a water temperature of 27.0°C, and a pH of 7.0. He also gives additional data on the nature of the water.

The aquatic fauna includes copepods, ostracods, cladocerans, cirolanid isopods *(Creaseriella anops),* atyid shrimp *(Typhlatya pearsei),* aquatic mites, and veliid hemipterans. The terrestrial fauna includes spiders, millipeds, collembolans, flies, crickets, snails, and a hylid frog.

POZO DE SANTA ELENA (35)

Pozo de Santa Elena is located near the Hacienda de Santa Elena about 1 km on the dirt road to the hacienda and 4.8 km south of Telchac Puerto. A small collection was made on 22 March 1973 by Stuart Murphy and James Reddell.

This dug well is about 1 m in diameter and easily climbed. At a depth of 4 m a natural cave passage is encountered. The ceiling height above very deep water is about 0.8 m. A narrow, fissure-like passage went off from the well entrance, but was not explored.

The aquatic fauna of the well included cirolanid isopods *(Creaseriella anops),* mysids *(Antromysis cenotensis),* palaemonid shrimp *(Creaseria morleyi),* and an uncollected white catfish. Spiders and gryllid crickets were also obtained.

MUNICIPIO DE TEMOZON

CENOTE SUCILA (43)

Cenote Sucila (also incorrectedly spelled Sucuil) is located 8 km east of Hunkú. A collection was made in the cave on 10 April 1973 by James Reddell.

The most accessible entrance is an opening about 1 m in diameter about which a stone wall has been built. A 15 m vertical drop leads into the middle of a water-floored room about 20 m long and 10 m wide. Tree roots hanging from the ceiling reach the water level in many places. A second entrance is a steeply sloping sinkhole with vegetation in it at one end of the room. This sink is about 5 m in diameter and vertical for the last 8 to 10 m. The water in the cave is very deep, and no passages lead from the room.

The only fauna observed in the cave were bees, which nested immediately below the well entrance. They were identified as *Trigona testacea cupira.*

MUNICIPIO DE TICUL

CAVE (TICUL)

Gonzalez-Angulo and Ryckman (1967) report that one specimen of the reduviid, *Triatoma dimidiata maculipennis* (Stal), was collected 9 July 1965 "in a pile of stones on the floor of a cave which served as a refuge for lizards, wild pigs and opossums." They locate it only as at Ticul. This is probably one of the caves reported below.

CAVE (YOCAT)

Hatt (1938) reports the bat *Artibeus jamaicensis yucatanicus* and the streblid fly *Trichobius dugesii* Townsend from a cave near Yocat, almost certainly one of the caves described below.

ACTUN HAS

Actún Has is located about 6.5 km south of Yocat. The cave was excavated by Hatt (1953). His collections included several snails, some of which certainly lived in the cave.

The cave consists of two chambers, each about 30 m in diameter and about 8 m high. A connecting fissure, too small for humans, is utilized by coatis *(Nasua* sp.) and other animals. A collapse sinkhole leads into one of the rooms, which has a broad level dusty floor. The other room, also dry and dusty, is entered through a 12 m diameter sinkhole entrance. Vines facilitate entry into the cave. Numerous trees grow from the cave floor.

Shells of four species of snail were collected in the cave. All of these are also known by live specimens collected in other Yucatán caves and will doubtless also be found in this cave.

ACTUN JIH (19)

Actún Jih (also spelled Hi) is located 3 km from the plaza of Ticul. The cave was excavated by Mercer (1896) and by Hatt (1953). A collection of bats and streblid flies was made in the cave on 12 November 1926 by R. T. and M. R. Hatt. A collection of invertebrates was made on 18 June 1975 by Andy Grubbs, David McKenzie, and James Reddell.

The cave is entered by a slope down into a shallow sink with a 5 m wide, 3 m high opening. A breakdown slope leads about 3 m farther down into a large irregular entrance room. To the left several passages go short distances before ending. One passage straight ahead leads into a blind room about 25 m long, 10 m wide, and up to 7 m high. Hard to the right the entrance room extends about 13 m where a rubble slope leads up to below a vertical entrance sink about 3 m in diameter and 3 m deep. The room circles this sink on all sides. Near this entrance several short passages extend to abrupt ends, but one passage leads into a large irregular breakdown-floored room 25 m long, 7 to 10 m wide, and 3 to 7 m high. The cave is hot, dry, and has been heavily mined for calcite crystals used by the Ticul potters since early Mayan days. Soot covers large areas, and the cave is generally of little interest.

The fauna includes scytodid spiders, amblypygids, crickets, roaches, ants, a thysanuran, streblid flies, and vampire bats *(Diphylla ecaudata centralis).*

ACTUN LARA

Actún Lara is located in the Sierra de Ticul about halfway between Yocat and Ticul. The cave was excavated by Mercer (1896) and Hatt (1953). A collection of bats and streblid flies was made by R. T. and M. R. Hatt in 1929. A profile of the cave is in Mercer (1896), and a generalized map in Hatt (1953).

The cave is entered by a large opening about 10 m wide. This leads down sharply to the left into a chamber about 60 m long and up to 18 m wide. The floor is covered with coarse rubble and stalagmitic masses except at the bottom, where there are a few small areas of soft dirt. To the right of the main entrance is a low room from which a few small passages extend.

The only fauna reported from the cave are streblid flies, snail shells (all belonging to common species still living in caves), and bats. An owl was reported to have its perch near the entrance.

MANHOLE CAVE

Manhole Cave is located in the Sierra de Ticul about 3.2 km south of Yocat. A collection of bats was made in the cave in November 1929 by R. T. and M. R. Hatt.

The only information on the cave is the following by Roigneau (1930): "We had to enter it through a small round hole, less than a yard in diameter, by supporting the weight of the body with the hands flat on the rim, groping around with the feet to find the steep pile of rocks on which it was possible to sit down, and then jerkily slide to the bottom. It was a beautiful cave, with many chambers, but all unfit for excavation. We named it the Manhole Cave..."

The only fauna collected were bats and streblid flies.

MUNICIPIO DE TINUM

GRUTAS DE BALANKANCHE (40)

Grutas de Balankanche (also spelled Cueva de Balaam Canche, and incorrectly referred to as Cueva Bolonchén) is located about 4 km east of Chichén

Itzá, and may be in the Municipio de Kaua. The first biological study of the cave was made by A. S. Pearse, E. P. Creaser, and F. G. Hall on 24, 27, and 30 June 1932. It was revisited on 10-12 June 1936 by A. S. Pearse. Besides these initial investigations, collections have been made by B. F. Osorio Tafall on 28 September 1943; by M. Cárdenas Figueroa and B. F. Osorio Tafall on 22 March 1947; by C. J. and M. L. Goodnight in July 1948; and in September 1959 by E. W. Andrews IV. The bat fauna of the cave was studied by zoologists from the Museum of Natural History at The University of Kansas in the summer of 1962. An extensive collection of fish and invertebrates was made on 10-12 December 1974 by David McKenzie, James Reddell, and Suzanne Wiley.

Grutas de Balankanche is one of the more important archeological sites in Yucatán, and is certainly the most significant cave site. It had been recognized as a water source for the archeological site of Balankanche for many years, but its true significance was not realized until 15 September 1959 when José Humberto Gómez broke through a sealed passage and discovered several undisturbed ceremonial chambers. The cave was then extensively investigated by several archeologists under the direction of E. Wyllys Andrews IV (Andrews, 1970). It has now been converted into an archeological zone, and guided tours are conducted through much of the dry part of the cave. A map of part of the cave prepared by George E. Stuart was published by Andrews (1970). A complete map was made by David McKenzie, James Reddell, and Suzanne Wiley in December 1974.

The entrance to the cave is a sinkhole descending abruptly into a large flat-floored tunnel ranging in size from about 5 to 15 m wide and up to 5 m high. After about 75 m, two passages to the left extend about 100 m, at which point water is reached. This rather complex area is generally low and muddy, with several interconnecting passages. From the intersection the main passage extends an additional 100 m to a large room containing much breakdown. Passages to the left connect into the previously mentioned complex area. Beyond the room the main passage continues about 50 m to an intersection. A passage to the left extends as a winding tunnel for about 100 m before terminating abruptly in a pool. About 50 m beyond this side passage, the main passage reaches the previously sealed tunnel. This passage has been largely excavated and leads up into a large breakdown-floored room with tree roots growing from the ceiling. Beyond this room a slope descends to a level tunnel which, after about 100 m, rises again into a room about 30 m in diameter and floored with breakdown and flowstone. Massive speleothems in the center of the room are surrounded by numerous ceremonial censers. Two passages at the base of the breakdown slopes on opposite sides of the room both lead to additional areas of pottery. That to the right extends for about 200 m as a dry, partly breakdown-floored passage up to 8 m high and 10 m wide, ending abruptly where the floor rises to the ceiling. Just before the end additional ceremonial pottery was found, some of which remains. To the left from the main ceremonial room a slope down leads a short distance to a large breakdown-floored chamber. Along one wall in front of a row of columns, are additional ceremonial vessels. The commercial trail goes along the left wall of the room, passes one area of ceremonial vessels, and reaches another group positioned at the entrance to a long stream passage. This passage extends for about 150 m as a completely water-floored tunnel up to 5 m high and wide, with a water depth of 0.5 to 1.8 m. It gradually lowers until there is less than 5 cm of air space. Many roots from the ceiling almost block the passage in places. At the end of the water passage the floor rises into a small room less than 8 m in diameter and containing ceremonial vessels. The existence of this pottery here indicates that the water level in the cave was considerably lower in the past than it is now. A second passage from the second ceremonial chamber is reached by a slope down over breakdown and is a water passage with short ascents into two separate breakdown-floored areas. It finally rises out of the water completely and terminates abruptly. The cave is apparently formed in the Pisté Member of the Chichén Itzá Formation. Hall (1936) reports a water temperature of 23.8°C and a pH of 7.4. He also gives other data on the physical and chemical characteristics of the water. Pearse (1938a) reports air temperatures of 23.7°C near the entrance and 27.4°C farther back in the cave; water temperatures were 23.5°C near the entrance and 25.4°C at an inner pool.

Grutas de Balankanche contains one of the better studied and richer faunas of any cave in Yucatán. About 80 species are known from the cave, of which 13 are troglobites. The aquatic fauna includes both species of eyeless fish known from the Peninsula *(Ophisternon infernale* and *Typhliasina pearsei),* as well as four troglobitic crustaceans: *Caecidotea* sp. (known by one imperfect specimen and the only record for the family in Yucatán), *Antromysis cenotensis, Typhlatya pearsei,* and *Creaseria morleyi.* The terrestrial troglobite fauna includes a squamiferid isopod *(Trichorhina pearsei),* a trichoniscid isopod *(Cylindroniscus maya),* a pseudoscorpion *(Vachonium maya),* an amblypygid *(Paraphrynus chacmool),* an oonopid spider *(Oonops coecus),* a collembolan *(Trog-*

lopodetes maya), and a gryllid cricket *(Tohila atelomma)*. In addition the cave is noted for a large population of the ricinuleid *Cryptocellus pearsei*. Several species of bat have been identified from the cave, although nowhere is there a large concentration of bats.

CENOTE CHOTCH

Cenote Chotch is located 3 km northeast of Pisté. A collection was made on 21 June 1932 by E. P. Creaser, F. G. Hall, and A. S. Pearse.

This cenote is described by Hubbs (1936) as follows: "The pool of this cenote, about 45 meters wide, was found to be bordered by overhanging cliffs, and to be 30.3 meters deep. The water was clear..." Hall (1936) reports that the water temperature ranged from 24.8°C at the bottom to 24.9°C at the top and that the pH was 7.0. He also gives other data on the chemistry of the water.

The fauna of Cenote Chotch includes copepods, aquatic mites, dragonflies, damselflies, aquatic hemipterans, mosquitoes, snails, and fish *(Rhamdia guatemalensis depressa)*.

CENOTE CIRUAK

Cenote Ciruak is located 3 km north of Pisté. A collection was made on 22-23 June 1932 by E. P. Creaser, F. G. Hall, and A. S. Pearse.

The cenote is described by Hubbs (1936) as a vertical-walled cenote 15 by 23 meters with clear water. Hall (1936) reports that the water depth was 15.3 m, the water temperature ranged from 24.4°C at the bottom to 24.2°C at the top, and the pH ranged from 6.9 at the bottom to 7.2 at the top. Hall also gives additional data on the chemistry of the water.

Copepods, dragonflies, aquatic hemipterans, mosquitoes, and fish *(Rhamdia guatemalensis depressa)* were the only groups collected in the cenote.

CENOTE HOTUN

Cenote Hotún is located 1.5 km southwest of Pisté. A collection was made on 18-19 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

It is described by Hubbs (1936) as follows: "This cave-like cenote, having cliffs with stalactites and a single opening 1.8 x 3 meters in the roof, was about 30 meters in diameter at the surface of the water, which was 18 meters below the surface of the land. The water was clear (disk reading 21.3 meters), apparently without vegetation, of moderate and uniform temperature (25°.7 C. at surface, 26°.0 C. at bottom) and deep (29.8 meters). There were stones on the bottom." Hall (1936) in a report on the physical and chemical characteristics of the water also reports that the pH ranged from 7.0 at the bottom to 7.2 at the surface.

The only fauna reported from this cave were copepods, dragonflies, and catfish *(Rhamdia guatemalensis depressa)*.

CENOTE HUNTUN

Cenote Huntún is located 4.8 km west of Pisté. A collection was made on 18 and 20 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

It is described by Hubbs (1936) as: "This 30-meter wide cenote was bordered by cliffs 15 meters high. The bottom consisted of rock and branches of trees. The depth was 23.8 meters; temperature 23°.8 C. at surface and bottom; water, clear, vegetation, none." Hall (1936) gives other data on the nature of the water, including a pH of 7.0.

The fauna of this cenote includes copepods, ostracods, dragonflies, damselflies, aquatic hemipterans, and fish *(Rhamdia guatemalensis depressa)*.

CENOTE DE PISTE

Cenote de Pisté is located on the plaza of Pisté. A collection was made on 18 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

No published description of this cenote is available, but it is probably the same as a cenote located on the north side of the highway from Mérida to Chichén Itzá and across from the plaza in Pisté. A rock wall has been built around the 6 by 10 m entrance to this cenote. A drop of about 20 m leads into a large water-floored chamber which has not been entered. Hall (1936) reports that the water is 21.0 m deep, the water temperature 25.7°C, and the pH 7.4. He also gives other information on the nature of the water.

The fauna of the cenote includes copepods, aquatic mites, dragonflies, fish *(Rhamdia guatemalensis depressa)*, and three species of bat. Swallows *(Petrochelidon fulva citata* and *Stelgidopteryx ruficollis ridgwayi)* nest in the entrance area.

CENOTE SAGRADO

Cenote Sagrado (also known as the Sacrificial Cenote) is located in the ruins of Chichén Itzá. It is the most famous cenote in Yucatán owing to its use for human sacrifices during the Toltec occupation of Chichén Itzá. It is commonly cited as a typical example of a cenote. Roys (1967) briefly reviews the early history of the cenote. Early attempts at excavation are reviewed by Folan (1970). The first successful excavation was made by Edward H. Thompson between 1904 and 1907 when he dredged up a rich accumulation of artifacts. Two recent expeditions have recovered additional material from the well. The first of these is recounted by Davalos Hurtado (1961), Littlehales (1961), and Folan (1970), and the second by Ediger (1971). During the latter expedition chlorination was used to help clear the water, with the result that life was killed in the cenote. The only collection which has been made in the cenote was of fish, reptiles, and amphibians by Thomas Barbour and Leon Cole in 1904. A detailed history, description, and map are in Tozzer (1957).

The entrance to the Cenote Sagrado is 56 m by more than 67 m. The walls are practically vertical. The water level varies between 20 and 25 m below the rim; at the greatest point the water depth is 12 m. There is an estimated 10 to 20 m of detritus on the bottom.

No systematic faunal study has been made of the cenote. The only species reported from it are fish *(Rhamdia guatemalensis sacrificii* and *Cichlasoma urophthalmus mayorum),* frogs, turtles, and vultures *(Coragyps atratus).*

CENOTE SCAN YUI

Cenote Scan Yui (also spelled Xcan Yui) is located 3 km east of Chichén Itzá and 0.5 km east of Cenote de Thompson. A collection was made on 15-17 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

This cenote is described by Hubbs (1936) as follows: "This cliff-bordered cenote, only 12 by 15 meters in size, contained water which was without vegetation, very clear (Secchi disk reading 27.7 meters), of moderate temperature (25°.2 C.) and very deep (54 meters)." Hall (1936) in a report on the nature of the water gives a pH value of 6.9.

The fauna of the cenote includes argulids, copepods, cladocerans, aquatic mites, dragonflies, aquatic hemipterans, aquatic beetles, snails, fish *(Rhamdia guatemalensis decolor* and *R. guatemalensis depressa),* and a turtle.

CENOTE SECO

Cenote Seco is located near Chichén Itzá. It was visited in 1929 by R. T. and M. R. Hatt and on 10 July 1948 by C. J. and M. L. Goodnight.

No description of the cenote is available.

The only fauna recorded from this cenote are terrestrial species also found on the surface. These include schizomids, scytodid and theridiid spiders, streblid flies, salamanders *(Bolitoglossa yucatana),* geckos, an owl, bats, and rodents.

CENOTE DE THOMPSON

Cenote de Thompson is located 2.4 km east of Chichén Itzá. A collection was made on 13 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

The only description of this cenote is that of Pearse (1936b) who describes it as consisting of a round basin with a pool connected with deep crevices along the margins. Hall (1936) reports a water depth of 0.5 m, a water temperature of 23.0°C, and a pH value ranging from 6.8 at the bottom to 7.3 at the surface of the water.

Copepods, crickets, aquatic hemipterans, snails, a frog, and an iguana have been reported from Cenote de Thompson.

CENOTE XAL

Cenote Xal is located near Chichén Itzá. The only reference to this cenote is that of Bequaert and Clench (1936) who report the snail *Choanopoma largillierti* (Pfeiffer) from it.

CENOTE XTOLOK (39)

Cenote Xtolok (also known as the Great Cenote) is located in the ruins of Chichén Itzá on the south side of the highway from Chichén Itzá to Valladolid. This cenote was important as a major source of water for the former inhabitants of Chichén Itzá. Collections were made in the cenote on 5-11, 23, and 28 June 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

This large open-air cenote is bordered by steep slopes and sheer cliffs. A trail leads down to the water surface which is about 30 meters in diameter. The water is green with algae, but no large plants grow in it. Hall (1936) reports a water depth of 15.4 m, water temperatures ranging from 21.9°C at the bottom to 27.3°C on the surface, and pH values of 7.4 at the bottom and 8.6 at the surface. A cave passage leads from the southern edge of the cenote and is described separately below.

The fauna of Cenote Xtolok includes copepods, cladocerans, an argiopid spider, aquatic mites, dragonflies, damselflies, aquatic hemipterans, aquatic beetles, snails, fish *(Rhamdia guatemalensis sacrificii* and *Cichlasoma urophthalmus mayorum),* frogs, snails, lizards, birds, and rodents.

CUEVA DEL CENOTE XTOLOK (39)

Cueva del Cenote Xtolok is located in a cliff on the southern side of Cenote Xtolok. The trail leading to the water surface passes by the mouth of the cave which is 5 m above the water and 15 m below the land surface. A collection was made on 24 June 1936 by A. S. Pearse. It was also visited in July 1973 by James Reddell.

The cave has almost certainly been artificially enlarged and may even be entirely artificial. It consists of a single linear passage 2 to 4 m high and 90 m long. It is generally dry and dusty, and the ceiling is sooty from torches.

The fauna of the cave is typical of dry caves in northern Yucatán. It includes schizomids, amblypygids, spiders, ticks, millipeds, roaches, crickets (including the blind *Tohila atelomma)*, psocids, antlions, melyrid beetles, mosquitoes and other flies, and bats *(Desmodus rotundus murinus)*.

MUNICIPIO DE TIXKOKOB

CENOTE D (37)

Cenote D is located in the ruins of Aké. It is accurately marked on the location map in Roys and Shook (1966). No local name could be found for the cave, so the designation of Roys and Shook is used. It was first visited by Lawrence Roys and Edwin M. Shook in the early 1950's. Stuart Murphy and James Reddell visited it on 26 March 1973 and made observations of vertebrates present in the cave but made no collection.

The entrance is a sink about 3 m in diameter dropping vertically for about 3 m on three sides. A slope on the fourth side leads down through thorny brush into an entrance chamber about 5 m in diameter. To the right a crawl extends 1.6 m into a room 3 m in diameter and 1 to 2 m high. Straight ahead a slope leads gently down through a 1 m high area and into an irregular chamber 5 m wide and 1.8 m long. Although Roys and Shook (1966) report that the cave goes to water, none was found in 1973.

A vulture *(Coragyps atratus)* with two eggs was seen in the cave. Also present were iguanas *(Ctenosaura similis)* and a basilisk *(Basiliscus vittatus)*.

CENOTE G (37)

Cenote G is located in the ruins of Aké and is marked on the map in Roys and Shook (1966). No local name could be found for the cave. A collection of invertebrates was made on 26 March 1973 by Mary Butterwick, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

The main entrance to the cave is a vertical pit about 1.8 m wide and 2 m long, located in a cleared area. A drop of about 1.8 m leads to a level floor covered with henequen pulp. A second smaller entrance lies a short distance away to the southwest and enters the same small entrance chamber. It is possible to squeeze down over the dried pulp and enter a breakdown-floored room about 13 m in diameter. At one end an extension leads about 7 m farther. On each side of the talus slope from the entrance it is possible to climb down over breakdown. On the left side this leads to a passage extending to the left along the side of the breakdown forming the floor of the main room. After about 12 m this becomes very small and probably ends. To the right this passage intersects the passage to the right of the entrance talus and continues down a slope to a 1 m diameter pool. The pool continues under the breakdown and possibly below the level of the cave wall. The total depth of the cave is 10 to 13 m.

The pool was inhabited by mysids *(Antromysis cenotensis)*. The terrestrial fauna included nesticid spiders, ricinuleids *(Cryptocellus pearsei)*, millipeds, isopods, ants, and several trogloxenes.

CUEVA DE ZOPILOTE NEGRO (37)

Cueva de Zopilote Negro is located in the ruins of Aké about 100 m southwest of Cenote G. It was visited on 26 March 1973 by Stuart Murphy and James Reddell.

The main entrance is an elongate sink about 32 m long, 7 m wide, and 1 to 3 m deep. At the southeast end a slope leads down into an overhanging area about 13 m long. The floor of the sink is of massive breakdown covered with a tangle of thorny vines and shrubs. On the opposite end from the overhang a hole leads down into a passage 5 m wide, 1 to 2 m high, and 10 m long. A slope leads up into a second sink, 2.8 m deep and 5 m in diameter. A slope down to the right then leads into a large shelter-like area 20 m long, 7 m wide, and 1.8 to 2.8 m high.

No collection was made in the cave, although amblypygids were seen in the shelter-like area. A buzzard *(Coragyps atratus)* occupied the cave, and iguanas *(Ctenosaura similis)* utilized it for shelter.

MUNICIPIO DE TIXPEHUAL

CENOTE (TIXPEHUAL)

This cenote is located 8 km northeast of Tixpehual on the road to Tixkokob. The only reference to it is a record of the bat *Mimon cozumelae* Goldman published by Villa (1966).

MUNICIPIO DE TIZIMIN

CAVE (TIZIMIN)

This cave is reported by Jones, Smith, and Genoways (1973) and Jones, Genoways, and Lawlor (1974) to be located 6 km north of Tizimín. The only information is that it is a "rocky cave." Bats *(Chrotopterus auritus auritus* and *Desmodus rotundus murinus)* and a porcupine *(Coendou mexicanus yucataniae)* were collected in the cave.

CENOTE AKA CHEN (55)

Cenote Aká Chen is located 1 km east of Tixcancal. It was mapped and a collection of invertebrates made on 2 April 1973 by Mary Butterwick, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

The entrance to the cave is an inconspicuous opening in a heavily wooded area. The 1.8 by 3 m opening drops 8 m to one edge of a room 100 m by 70 m. From the entrance, which requires equipment to enter, a breakdown slope extends 25 m down to the edge of a lake about 50 m in diameter and ranging from less than 1 m to more than 10 m in depth. To the right a breakdown slope with many attractive speleothems circles the lake, and it is possible to walk to a dry alcove opposite the entrance. A dry area to the left of the lake extends through holes in speleothems into a small room. The shore of much of the lake is lined with crystals. The water level is about 17 m below the entrance. The cave is probably formed in the Carrillo Puerto Formation.

Fallen logs and debris below the entrance provided a rich habitat for endogean forms, including millipeds, isopods, hemipterans, collembolans, ants, and staphylinid beetles. Pools of vampire guano in the dry alcove supported a large population of fly larvae and histerid and leiodid beetles. Other terrestrial fauna collected included flies, halictid hymenopterans, amblypygids (including the blind *Paraphrynus chacmool),* spiders, and crickets. The lake contained atyid shrimp *(Typhlatya mitchelli),* mysids *(Antromysis cenotensis),* and catfish *(Rhamdia guatemalensis).*

CUEVA DE LAS DERRUMBES (55)

Cueva de las Derrumbes is located about 1 km south of Tixcancal. A small collection was made on 1 April 1973 by James Reddell.

The entrance is a small sink 2 m in diameter in a wooded area. A slope down one side leads for about 1 m to a breakdown-floored crawl with breakdown along the left wall. A tight squeeze straight ahead leads down into a passage 1 to 2 m in diameter and 25 m long. One wall is breakdown, and the passage apparently circles a large breakdown-filled sink. To the right immediately inside the entrance a crawl leads into a room floored with large slab breakdown and containing a few speleothems. A slope along the left wall leads downward, but no passages were found.

The only fauna collected in this dry cave were a few spiders and harvestmen.

CENOTE DE KIKIL

Cenote de Kikil is located about 8 km north of Tizimín on the northern edge of the village of Kikil. It is almost certainly the cenote reported by Duellman (1965).

This cenote is approached by a gentle slope terminating in a short climbable drop to water. The other three sides are vertical and the northern wall is deeply overhung. The floor of the cenote is completely covered with water except for a few short alcoves on the north side. These alcoves can be reached only by swimming across about 50 m of very deep water. The water level is about 10 m below the surface, and the width of the cenote is about 20 m.

The only fauna reported from the cenote is a turtle, but bats were observed in the deeper alcoves.

CUEVA MURUZTUN

Cueva Muruztún is located on the Rancho Muruztún about 5 km south of Tizimín. A collection was made in the cave on 12 August 1936 by A. S. Pearse.

As reported, a narrow entrance leads into a reticulate cave 105 m long, 12 m deep, and with ceiling heights of 1 to 3 m. Pearse (1938a) reports a water temperature of 24.8°C, an air temperature of 25.3°C, and a relative humidity of 97.8%.

The only troglobites reported from Cueva Muruztún are collembolans *(Cyphoderus innominatus* and *Lepidocyrtus pearsei).* Other fauna reported from the cave includes earthworms, amblypygids, spiders, millipeds, crickets, scarab beetles, mosquitoes and other flies, ants, snails, and bats.

CENOTE DE ORIZABA (53)

Cenote de Orizaba is located in the small village of Orizaba about 8 km south of Buenaventura. The entrance is immediately west of the plaza, and a well across from the plaza intersects the cave. A collection was made on 1 April 1973 by Mary Butterwick, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

A sinkhole entrance leads into a wide, low passage floored with massive slab breakdown. This passage ranges up to 10 m wide and mostly less than 1 m high. A slope along the right wall leads down to crawlways through the breakdown blocks. About 100 m from the entrance a slope leads down the right side of the breakdown to a shallow pool of water over which a well has been dug. Beyond the well the passage gradually becomes lower and probably ends, but no attempt was made to explore it fully.

The upper level breakdown area is very dry, and the only fauna collected were schizomids and a few spiders. Japygid diplurans were taken in the entrance sink. The pool was inhabited by mysids *(Antromysis cenotensis)* and atyid shrimp *(Typhlatya mitchelli).*

CUEVA DE ORIZABA (53)

Cueva de Orizaba is located a short distance beyond and on the north side of the plaza in Orizaba. A collection was made on 1 April 1973 by Mary Butterwick, David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

The entrance is a tight squeeze over organic debris and rubble at the bottom of a broad, shallow sinkhole in a wooded area. This squeeze leads into a small chamber about 2 m high, 5 m wide, and 10 m long. On the far side from the entrance is a shallow pool with numerous roots entering it. To the right from the entrance a crawlway leads into several small poorly-defined rooms and passages.

The pool was inhabited by mysids *(Antromysis cenotensis)* and amphipods *(Mayaweckelia cenoticola).* The entrance area contained schizomids, amblypygids, millipeds, reduviid bugs, leiodid and staphylinid beetles, flies, ants, crickets, and other endogean and trogloxenic forms.

CENOTE DE LOS PINOS (52)

Cenote de los Pinos is located about 7 km south of Buenaventura on the right side and about 20 m from the road. A collection was made on 1 April 1973 by Stuart Murphy and James Reddell.

The entrance is a vertical sink about 3 m in diameter and 5 m deep from which a large tree grows. At the bottom of the leaf- and rubble-covered sink a climbable drop of 4 m leads to a deep lake. This lake room is 10 m long, 5 m wide, and 6 m high. To the right a dry crawlway extends 13 m to end in a small dome room 3 m wide, 5 m long, and 2 m high. A large vampire colony inhabits this room. To the left of the lake room a low water passage leads through a forest of stalactites hanging into the water. Through the stalactites is a dome room which contains a large bat colony. Breakdown on the floor rises up to 2 m above water level. This terminal room is 10 m in diameter and 5 m high.

The invertebrate life of the cave included millipeds, isopods, small beetles, moths, ants, and snails. The water was inhabited by dark catfish, mysids, and atyid shrimp, but no aquatic collection was made.

CENOTE SABACAH (50)

Cenote Sabacah is located on the western edge of Sucopo. A collection was made on 31 March 1973 by David McKenzie and James Reddell.

The entrance is a slope-in sink 23 m long, 13 m wide, and 10 m deep with an elongate pool of water at the lowest point. The cave is frequently used by local people for bathing and swimming. On the north side of the sink the pool is overhung for about 5 m. A wide dry alcove extends back for about 7 m more. At the back of the alcove two passages lead off. One to the right extends as a 1 to 1.2 m high passage about 7 m before ending. On the left a crawlway 1.5 to 3 m wide goes about 20 m where up and to the right is an area of breakdown-floored crawlways less than 1 m high. These all end in a few meters. The floor of the cave is generally covered with dust or small breakdown.

The fauna of the cave is typical of dry caves in northern Yucatán. In addition to vampire and other bats, it was inhabited by scytodid and uloborid spiders, reduviid bugs, leiodid and staphylinid beetles, and flies.

CENOTE DE SAN LUIS (51)

Cenote de San Luis (also known as Cenote Tuxctuc) is located in the plaza of the small town of San Luis Tuxctuc about 7 km south of Tixcancal. A collection was made on 2 April 1973 by James Reddell.

The entrance is a roughly circular collapse sink surrounded by a stone wall. A second, probably artificial, opening now used as the village well, is located about 3 m away. The principal entrance is about 13 m in diameter and drops about 18 m to a small rubble heap covered with vines and small shrubs. This lies almost entirely beneath the entrance and is surrounded on all sides by water. The room is about 50 m in diameter and up to 10 m high. The only "passage" out of the room is a dome which extends up at a steep angle for about 7 m. Although part of the lake is more than 2 m deep, it is possible to wade through 0.8 m deep water and muck to reach the dome. The surface of the lake is covered with algae.

The surface of the water was too covered with algae to see if it was inhabited by crustaceans. An owl *(Tyto alba pratincola)* roosted in the dome and the area beneath was rich in leiodid, staphylinid, and other beetles. Spiders were collected from the walls of the dome.

CENOTE SODZIL (49)

Cenote Sodzil is located at a small place called Sodzil about 5 km west of Sucopo. A collection was made on 31 March 1973 by David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

The entrance is a vertical sinkhole about 3 m wide, 10 m long, and 10 m deep, dropping into a single 50 m long chamber up to 18 m wide. Ladders on the north side lead down to the floor of the cenote, which is almost entirely covered with water ranging from less than 1 to more than 2 m in depth. A few breakdown blocks protrude above the water level. A ledge along the right wall about 1 m above the water runs almost the entire length of the cenote. Several small drip pools along this ledge-passage were inhabited by mysids and atyid shrimp. Holes in the overhung south wall were not thoroughly checked and are rumored to connect to Cueva Sodzil.

The main pool was inhabited by fish, and small drip pools, presumably filled when the water level in the cenote is higher, were inhabited by mysids *(Antromysis cenotensis)* and atyid shrimp *(Typhlatya mitchelli).* The only other fauna collected were theridiid spiders hanging from webs.

CUEVA SODZIL (49)

Cueva Sodzil is located about 50 m from Cenote Sodzil. A collection was made on 31 March 1973 by David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell.

The entrance is an elongate collapse sinkhole about 20 m long, 10 m wide, and up to 5 m deep. It is floored entirely with large blocks of breakdown. A hole along one side leads down into a series of low, wide crawlways which slope down to a shallow lake. The cave was not thoroughly explored but trends toward Cenote Sodzil.

The water was inhabited by palaemonid shrimp *(Creaseria morleyi).* The terrestrial fauna included schizomids, spiders (including the troglobites *Theotima martha* and *Metagonia torete),* ticks, crickets, and various trogloxenes.

CENOTE SUCOPO (50)

Cenote Sucopo is located on the western edge of Sucopo. A collection was made on 31 March 1973 by Stuart Murphy and James Reddell.

The main entrance is a circular opening 10 m in diameter and 7 m deep. Four smaller openings, three of which are used as wells, also drop into the cave. The cave consists of a single chamber about 200 m in circumference and floored entirely with very deep water. One small, dry alcove about 3 m wide and 7 m long extends from the room. The air temperature in the alcove was 22.8°C, and the water temperature was 22.2°C.

The only aquatic fauna observed were catfish. Schizomids, amblypygids, flies, and ants were collected from the alcove. An owl *(Tyto alba pratincola)* roosted in the cave.

CENOTE TIXCANCAL (54)

Cenote Tixcancal is located about one block south of the plaza in Tixcancal. A collection was made on 2 April 1973 by Stuart Murphy.

Five small holes, used as wells, drop about 21 m into the approximate center of a large water-floored chamber about 27 m in diameter. Along one side a slope leads up for a few meters onto a ledge of breakdown about two meters above the water level.

The only fauna collected were scytodid and theridiid spiders from the breakdown ledge.

CUEVA XCONSACAB

Cueva Xconsacab is located near Tizimín. A collection was made on 11 August 1936 by A. S. Pearse.

A well-like entrance leads into a reticulate cave 20 m long, 10 m deep, and with ceiling heights of 1 to 3 m. Water is present in pools. Pearse (1938a) reports a water temperature of 24.5°C, an air temperature of 24.4°C, and a relative humidity of 90.2% near the entrance. At an inner pool the air temperature was 23.3°C and the relative humidity 93.0%.

The aquatic fauna includes copepods, cirolanid isopods *(Creaseriella anops),* mysids *(Antromysis cenotensis),* and palaemonid shrimp *(Creaseria morleyi).* Terrestrial fauna includes amblypygids, gryllids, histerid beetles, moths, mosquitoes, streblid and other flies, ants, and bats.

MUNICIPIO DE VALLADOLID

MINE (VALLADOLID) (44)

This *sascabá* is located 5 km north of Valladolid on the east side of the highway to Tizimín. A collection was made on 11 April 1973 by James Reddell.

The entrance to the mine is located near the highway and may be driven into. It consists of an extensive series of passages and rooms constantly being modified by the mining activity. Several new entrances have formed in recent years. In areas away from the entrances, however, it proved to have a fauna typical of dry caves in northern Yucatán.

The fauna included amblypygids, pholcid spiders, isopods, gryllid crickets, ants, and reduviid bugs.

CENOTE HUNTO CHAC (CUEVA DE MAMEY) (45)

Cenote Hunto Chac is a name applied to two separate caves on Rancho Hunto Chac on the west side of the highway from Valladolid to Felipe Carrillo Puerto and about 4 km south of Valladolid. Cueva de Mamey is located by the corrals. A collection was made on 12 April 1973 by David McKenzie and Stuart Murphy.

The entrance is an oval sinkhole 10 m wide, 20 m long, and 15 m deep. It is overshadowed by a large mamey tree. At the bottom of the sinkhole is an elongate chamber 50 m long, 10 to 18 m wide, and up to 10 m high. No passages lead from the room, which is dry except for two small pools.

The fauna of the cave was limited to a few trogloxenes and troglophiles, including scytodid spiders, pseudoscorpions, and beetles.

CENOTE HUNTO CHAC (CUEVA DEL POZO) (45)

Cenote Hunto Chac (Cueva del Pozo) is located on the Rancho Hunto Chac about 4 km south of Valladolid and about 100 m from Cueva de Mamey. A collection was made on 12 April 1973 by Martha Helen McKenzie and James Reddell.

The most accessible entrance is a small vertical opening in which a ladder has been placed. A drop of about 5 m leads into a large, irregular chamber from less than 1 to 3 m high. About 10 m to the south of the ladder entrance a second opening, 4 m in diameter, drops into the room. The room, which is divided into numerous smaller areas by speleothems and breakdown, is about 25 by 35 m. To the north the room ends at a drop of about 13 m into a lower chamber, floored with deep water. A windmill has been built over this lake, and water is pumped from it. The lake room is about 25 by 33 m. Along the east edge of the lake a steep slope leads up to the bottom of a 2 by 3 m sinkhole entrance. The depth of the cave from the base of the windmill to the water surface is 21 m.

Because of the circulation between entrances the cave was relatively dry and contained only a limited fauna. Schizomids, amblypygids, spiders, opilionids, millipeds, roaches, crickets, snails, and other trogloxenes and troglophiles were collected.

CENOTE DE LA PACA (56)

Cenote de la Paca is located 7 km east of Tikuch. A collection was made on 11 April 1973 by Stuart Murphy.

This cenote is a vertical sinkhole about 15 m wide, 20 m long, and 17 m deep. Small trees and brush cover the floor, except in a few areas where the walls overhang the floor. A small pool less than 1 m deep was located on one side of the cenote.

The pool was inhabited by atyid *(Typhlatya mitchelli)* and palaemonid shrimp *(Creaseria morleyi)*. Logs and rocks at the bottom of the entrance harbored schizomids, spiders, opilionids, millipeds, and other endogean forms.

CENOTE DE SANTA ANA

Cenote de Santa Ana is located in Valladolid. This is probably identical to the cenote now commercially operated as Cenote Zaci. A collection was made on 12 June and 2 July 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

This cenote is described by Hubbs (1936) as follows: "In this half-covered cenote, 45 meters in diameter and surrounded by cliff and woodland, the water over the gravel bottom was crystal clear, of moderate temperature (25°.6 C. on July 2) and very deep (4.0 to 21.2 meters). The vegetation consisted of algae on the rocks and *Lemna* at the surface." Hall (1936) in a discussion of the nature of the water gives a pH of 6.8.

The fauna includes copepods, amphipods *(Hyalella azteca)*, aquatic mites, dragonflies, damselflies, aquatic hemipterans and beetles, snails, fish *(Rhamdia guatemalensis depressa)*, and bats *(Desmodus rotundus murinus)*.

CENOTE SISAL

Cenote Sisal is located in Valladolid. Collections were made on 12 June and 1 July 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

The cenote is described by Hubbs (1936) as follows: "Here the bottom as well as the vertical cliffs are of solid limestone, as is also the roof, except for two small openings. The water, which was without any obvious vegetation, was found to be 19 meters deep and of moderate temperature (24°.0 to 24°.4 C.)..." Hall (1936) reports that the pH ranged from 7.2 at the bottom to 7.7 at the surface of the water.

The only fauna reported from this cenote were copepods and catfish *(Rhamdia guatemalensis depressa)*.

CUEVA VALLADOLID

Cueva Valladolid is located in Valladolid. It is possible that this is identical to Cenote de Santa Ana. A collection of cimicid bugs was made on 21 March 1967 by J. D. Haddock and N. Ueshima.

The only information on the cave is from Ueshima (1968). He reports, "The bats were roosting in a fissure of an overhanging cliff outside the main entrance of the cave.... We were unable to reach the roosting site itself, since the cliff extended over a deep pool and the face of the cliff was sheer..."

The only fauna reported from the cave were cimicids, *Primicimex cavernis* Barber. Ueshima (1968) speculated that the bats in the cave were *Tadarida brasiliensis mexicana*, because of the unique odor.

CENOTE XIX

Cenote Xix is located at or near Valladolid. A collection was made on 1 July 1932 by E. P. Creaser, A. S. Pearse, and F. G. Hall.

The only information on this cenote is that it is an old open cenote, with water about one meter deep and green with algae (Pearse, 1936b).

The only fauna reported from Cenote Xix are copepods, ostracods, and cladocerans.

CENOTE XKEKEN (46)

Cenote Xkeken is located 3 km north of Dzit-Nup. A collection was made on 10 December 1974 by David McKenzie and James Reddell.

This cenote, now open to the public for a small fee, is located on the side of a large elongate sinkhole. The entrance is in the wall of the sink, and a path and steps lead down into the single room of the cave. It is about 25 m in diameter and is lit by a skylight entrance about 15 m high and 5 m in diameter. A slope leads down from the walk-in entrance to a deep, clear lake over which beautiful stalactites hang. The lake apparently siphons against two walls. On the left a steep flowstone and breakdown slope leads up to several small, dead-end alcoves.

The only fauna obtained in the cave were atyid shrimp *(Typhlatya mitchelli)*.

CENOTE XTACABIHA (56)

Cenote Xtacabihá (also known as Cenote Xalau) is located 9 km NNE of Tikuch and about 1 km south of the small town of Xalau. The cave was mapped and a collection made on 11 April 1973 by David McKenzie, Martha Helen McKenzie, Stuart Murphy, and James Reddell. An additional collection was made on 6 July 1975 by Andy Grubbs and James Reddell.

The entrance to the cave is along the slopes of a large vegetation-filled sink about 25 m in diameter and up to 7 m deep, with vertical walls along one side. The 2 m wide walk-in entrance leads down a steep slope for a distance of 13 m where a wide irregular passage extends to the right. This passage narrows and ends after about 7 m. The steeply sloping main passage continues 15 m into the main room, which is about 20 m in diameter and 10 m high. Water at least 2 m deep covers much of the floor of the room. To the left a 1.2 m high, 7 m diameter extension contains two small shallow pools. On one side of the main room a narrow fissure-like passage about 2 m above the pool level goes about 13 m before becoming too small. It is inhabited by bats, and the floor and small ledges are covered with moldy guano.

The main lake was inhabited by catfish, while the small pools contained amphipods *(Mayaweckelia cenoticola)*, mysids *(Antromysis cenotensis)*, and atyid shrimps *(Typhlatya mitchelli* and *T. pearsei)*. The terrestrial fauna included an eyed scorpion, blind amblypygids *(Paraphrynus chacmool)*, spiders (including the blind *Metagonia torete)*, millipeds, crickets, ants, and a few other troglophiles and trogloxenes.

MUNICIPIO DE YAXCABA

CENOTE YUNCHEN

Cenote Yunchén (also known as Cueva Yunchén) is located in Libre Unión about two blocks south of the plaza. A collection was made on 11 July 1936 by A. S. Pearse.

This cenote, used as a well, is about 2 m in diameter and 13 m deep. It drops vertically into the center of a room 16 m in diameter and with a 12 m high ceiling. Water is present in a pool below the entrance. Pearse (1938a) reports a water temperature of 25.3°C and an air temperature of 26.2°C.

The aquatic fauna included copepods, mysids *(Antromysis cenotensis)*, palaemonid shrimp *(Creaseria morleyi)*, and aquatic beetles. The terrestrial fauna included ticks, collembolans, and mosquitoes and other flies.

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