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STUDIES ON THE

CAVE AND ENDOGEAN FAUNA of North America III

Edited by James R. Reddell
& James C. Cokendolpher

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Cover: *Plethodon* sp. from Seven Cave, Fort Hood, Bell County, Texas
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This volume is dedicated to

MARCELINO REYES

and

MIKE WARTON

for their dedication to cave biology and exploration

PREFACE

This is the third volume in a series devoted to the cavernicole and endogean fauna of North America, including Mexico. A majority of the species described herein are from Texas, but new species are also included from Mexico and other parts of the United States.

The only new Mexican species described in the present volume is a new troglobitic species in the arachnid order Amblypygi. This increases the number of unquestioned troglobites of this group in Mexico to six. The only other paper exclusively devoted to the Mexican fauna is a comprehensive review of the cave fauna of the Xilitla region, one of the more significant karst regions in Mexico.

A comprehensive report on the ant fauna of Belize and Mexico and California and Texas, U.S.A., is of special interest in documenting this neglected group of insects. Special attention is given to the invasion of the imported fire ant, *Solenopsis invicta*, in the caves of Texas.

One paper is devoted to the reproductive behavior of an abundant cave cricket, *Ceuthophilus carlsbadensis*, in the caves of New Mexico and western Texas. A second paper includes data on various aspects of the ecology of entotrophs and cave crickets in Hidden Cave, New Mexico.

The majority of papers in this volume are concerned with the taxonomy of cave invertebrates in Texas. Although the fauna of Texas has long been known for its diversity, many areas of the state remain completely unstudied and, as the present volume demonstrates, even well-studied areas continue to produce new species of interest.

Studies in the present volume include a report on the aquatic isopod family Asellidae, with descriptions of new stygobitic species from Texas and Washington.

Other papers concentrate on the rich terrestrial invertebrate fauna, with papers on pseudoscorpions, spiders, millipeds, ground beetles (Carabidae), and ant-like litter (mold) beetles (Pselaphinae). Eight new species of pseudoscorpion, five new species of spider, five new species of milliped, one new ground beetle, and five new ant-like litter beetles are described and additional records are provided for many more.

The listing by the U.S. Fish & Wildlife Service in 1988 of five Texas cave arthropods and subsequent listing of two additional species demonstrated that the fauna is highly threatened by development and fire ants. Nine additional species from Bexar County were listed in December 2000.

The need to define the ranges of the endangered and petitioned species has led not only to a significant increase in our knowledge of the distribution and ecology of these species but has led to the discovery of many additional species in some of the best-studied areas of the state. Many of these species appear to be far rarer (and thus presumably more endangered) than some of the listed or petitioned species.

The Austin and San Antonio Metropolitan Areas are among the most rapidly growing areas in the United States. The subsequent demand for land has already led to the destruction of numerous caves and others have been saved only by the necessity to protect the endangered invertebrates inhabiting them.

The majority of troglobites inhabiting the caves of Central Texas have very limited distributions, with many known only from one or a few very nearby caves. Protection of this valuable biological resource has become a top priority of conservationists, cavers, and governmental agencies.

One of the most active agencies concerned with endangered cave fauna has been the U.S. Army. Two major military bases (Camp Bullis in Bexar and Comal Counties and Fort Hood in Bell and Coryell Counties) are largely situated on karst. Continuing long-term studies have revealed a remarkably rich invertebrate cave fauna on both installations.

A significant part of the present volume is concerned with the fauna of Fort Hood. Prior to the species recorded in this volume only one aquatic and two terrestrial troglobites were known from Fort Hood. The richness of the fauna of this area is well illustrated by the description of one new troglobitic pseudoscorpion of the genus *Tartarocreagris*, three new troglobitic spiders of the genus *Cicurina*, one new probable troglobitic

spider of the genus *Neoleptoneta*, a new troglobitc ground beetle of the genus *Rhadine*, and three new troglobitic ant-like litter beetles of the genus *Batrisodes*. Additional troglobites from Fort Hood await description.

The present volume would not have been possible without the assistance of numerous dedicated cave explorers willing to collect while conducting other studies in the caves. We especially wish to thank Andy Grubbs, the late Joe Ivy, Jean Krejca, Peter Sprouse, and George Veni for their special efforts to obtain material in many parts of the state.

The dedicated crew of explorers working on Fort Hood deserve special thanks for their arduous efforts to discover, open, and study the numerous caves on Fort Hood. We very deeply appreciate the efforts of Doug Allen, Lee Jay Graves, Dan Love, David McKenzie, Rodney Price, Marcelino Reyes, Charley Savvas, and Mike Warton. We would know very little about the fauna of Fort Hood and many other parts of Texas without their assistance.

We express our appreciation to the authors included herein for their contributions. These dedicated scientists have made possible the conservation of many caves and species through their taxonomic efforts.

Dr. Robert W. Mitchell is thanked for providing the cover photograph.

Much of the funding for studies included in this volume was obtained from various contracts with the City of Georgetown, Sun City-Texas, the Texas Parks & Wildlife Department, U.S. Army, and the U.S. Fish & Wildlife Service. We thank all of these for their support.

Finally, we cannot state too strongly our appreciation to the following individuals for their assistance in working on Camp Bullis and Fort Hood. Dusty Bruns on Camp Bullis and B.R. Jones on Fort Hood have been remarkably generous of their time and effort to locate and obtain access to caves. Tim Buchanan, John Cornelius, and Dennis Herbert on Fort Hood have never hesitated to provide whatever assistance was needed. Paul Cavanaugh, with the Texas Nature Conservancy and Project Director for endangered species studies on Fort Hood, was instrumental in obtaining funding for the present volume from the U.S. Army.

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THREE NEW SPECIES OF SUBTERRANEAN ASELLIDS FROM WESTERN NORTH AMERICA, WITH A SYNOPSIS OF THE SPECIES OF THE REGION (CRUSTACEA: ISOPODA: ASELLIDAE)

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ABSTRACT

Three new species of subterranean asellids are described from western North America: *Lirceolus nidulus* (Border Cave, Culberson Co., Texas), *Lirceolus cocytus* (Texas and Coahuila, Mexico), and *Salmasellus howarthi* (Deadhorse Cave, Skamania Co., Washington). Two other undescribed species are reported, *Lirceolus* sp. (Dandridge Spring, Val Verde Co., Texas) and *Calasellus* sp. (Malheur Cave, Harney Co. Oregon), but the existing specimens are too damaged for descriptive purposes. New collection localities are given for several other western species: *Lirceolus hardeni*, *Salmasellus steganothrix*, *Calasellus californicus*, *Caecidotea sequoiae*, *C. reddelli*, and *C. bilineata*. A total of 18 subterranean asellid species are now known to occur in western North America.

INTRODUCTION

The purpose of this paper is to describe three new species as well as provide a summary of the taxa of subterranean asellid isopods known to occur in the western part of North America. The area covered herein starts in the tier of states encompassing Texas and includes 17 western states, southwestern Canada, and a part of Coahuila, Mexico (figure 1). Thirteen obligate subterranean species of asellids are presently described from this region, with four of the six known genera occurring in groundwaters of the U.S. represented: *Caecidotea*, *Lirceolus*, *Salmasellus* and *Calasellus*. All but *Caecidotea* are endemic to western North America. *Caecidotea* contains five western species that have clear zoogeographic affinities with the fauna of the eastern U.S.: *C. reddelli* and *C. bilineata* from Texas, *C. adenta* and *C. acuticarpa* from Oklahoma, and *C. tridentata* in Kansas. Several other species of *Caecidotea* occur in the sliver of the Ozark Plateau extending into southeastern Kansas and northeastern Oklahoma, but have been discussed elsewhere (Lewis, 1982; 1999; Lewis & Bowman, 1981). Thus, the subterranean asellids of the western U.S. are a mixture of the fauna predominant in eastern North America and a group of species unique to the west. Three epigean species have also been reported, *Asellus alaskensis*, *Caecidotea occidentalis* and *C. tomalensis*, as well as two species introduced from the eastern U.S., *Caecidotea communis* and *Caecidotea racovitzai* (Bowman, 1974; 1975a). The epigean species will not be considered further since their morphology suggests little discernible relationship to the subterranean species.

A review of the systematics literature of western subterranean asellids reveals a sparse collection of papers featuring a less than auspicious beginning. The first subterranean asellid discovered in the western U.S.,

Caecidotea smithii, was created as a *nomen nudum* by Eigenmann (1900). Ulrich (1902) subsequently described this species from the artesian well at San Marcos, Hays County, Texas. Hungerford (1922) described *Caecidotea tridentata* from specimens pumped from a cistern in Lawrence, Kansas. Miller (1933) described *Asellus californicus* from a well in Lake County, California. Mackin & Hubricht (1940) described seven new species of subterranean asellids from the central United States, including *Caecidotea acuticarpa* from caves, springs and wells in southeastern Oklahoma, and *C. adenta* from a cave in Kiowa County, Oklahoma. Steeves (1968) added three more species from caves in central Texas: *Asellus reddelli* from Bell, Coryell, Travis and Williamson counties; *A. pilus* from Valdina Farms Sinkhole, Medina County; and *A. bisetus* from Gorman Cave, San Saba County.

Much of our present understanding of western asellids is due to a series of papers by Bowman (1975b; 1981; Bowman & Longley, 1976; Lewis & Bowman, 1996). In the first, he described *Caecidotea sequoiae* (from Lilburn Cave, Tulare County, California), redescribed *Asellus californicus*, and erected the genus *Salmasellus* for a subterranean species discovered in the stomachs of salmon taken from a lake in Alberta, Canada (Bowman, 1975b). New material of *C. smithii* became available and proved to be so unusual that the genus *Lirceolus* was created to receive it (Bowman & Longley, 1976). A third paper erected the new genus *Calasellus* to receive *A. californicus* and another new species, *C. longus*, from a spring near Shaver Lake, in Fresno County, California (Bowman, 1981).

Lewis (1983) emended the description of *Lirceolus* and transferred *A. pilus* to *Lirceolus*. Bowman's final contribution on the western fauna was our collaboration on the subterranean asellids of Texas (Lewis & Bowman, 1996). In that paper we described *Lirceolus hardeni*, transferred *A. bisetus* to *Lirceolus*, described *Caecidotea bilineata*, and refigured *C. reddelli*.

Three new western species are described herein, and new records are provided for *Caecidotea sequoiae, C. bilineata, C. reddelli, Calasellus californicus, Salmasellus steganothrix* and *Lirceolus hardeni*. Records of two undescribed species are given, but not

Table 1.—A summary of the subterranean asellid taxa known to occur in western North America.

Taxon	References	Range
Caecidotea acuticarpa	Mackin & Hubricht, 1940 Lewis & Bowman, 1981	Arbuckle uplift, southeastern Oklahoma
Caecidotea adenta	Mackin & Hubricht, 1940	Kiowa Co., Oklahoma
Caecidotea bilineata	Lewis & Bowman, 1996	eastern Texas
Caecidotea reddelli	Steeves, 1968 Lewis & Bowman, 1996	eastern Texas
Caecidotea tridentata	Hungerford, 1922 Lewis & Bowman, 1981	eastern Kansas
Calasellus longus	Bowman, 1981	Fresno Co., California
Calasellus californicus	Miller, 1933 Bowman, 1975b; 1981	northwestern coastal California
Caecidotea sequoiae	Bowman, 1975b	Tulare County, California
Calasellus undescribed sp.		Harney Co., Oregon
Lirceolus smithii	Ulrich, 1902 Bowman & Longley, 1976 Lewis & Bowman, 1996	Hays Co., Texas
Lirceolus bisetus	Steeves, 1968 Lewis & Bowman, 1996	San Saba & Travis counties, Texas
Lirceolus cocytus		Jeff Davis Co., Texas to Coahuila, Mexico
Lirceolus hardeni	Lewis & Bowman, 1996	central Texas
Lirceolus nidulus		Culberson Co., Texas
Lirceolus pilus	Steeves, 1968 Lewis & Bowman, 1996	Medina and Bandera counties, Texas
Lirceolus undescribed sp.		Val Verde Co., Texas
Salmasellus steganothrix	Lewis & Bowman, 1996 Holsinger, Mort & Recklies, 1983	Alberta, Canada to northwestern Montana
Salmasellus howarthi		Skamania Co., Washington

described, due to the damaged condition of the single male specimens available. This brings the list of subterranean asellid species known from western North America to a total of 18 (table 1).

Family Asellidae G. O. Sars, 1897

Lirceolus Bowman & Longley, 1976

Lirceolus nidulus, new species
Figures 2-3

Undescribed species of asellid: Holsinger, 1992: 5.
Caecidotea species: Lewis and Bowman, 1996: 499.

Material examined.—TEXAS: *Culberson County*, Border Cave, deep phreatic lake, 15 August 1986, Scott J. Harden, C.F. Linblom, 1 male, 1 female. An 8.0 mm male is designated as the holotype (USNM 291382), an 8.8 mm ovigerous female is a paratype (USNM 291383), deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Description.—Eyeless, unpigmented, only known male 8.0mm, female 8.8mm. Body about 4X as long as wide, moderately setose, coxae visible in dorsal view. Antenna 1, flagellum of 7 segments, esthetes on distal 4 segments. Antenna 2 missing in both specimens. Mandibles with 4-cuspate incisors and lacinia mobilis, palp with plumose setae on distal segments. Maxilla 1, inner lobe with 5 plumose setae in male, 6 in female; outer lobe with 13 stout spines.

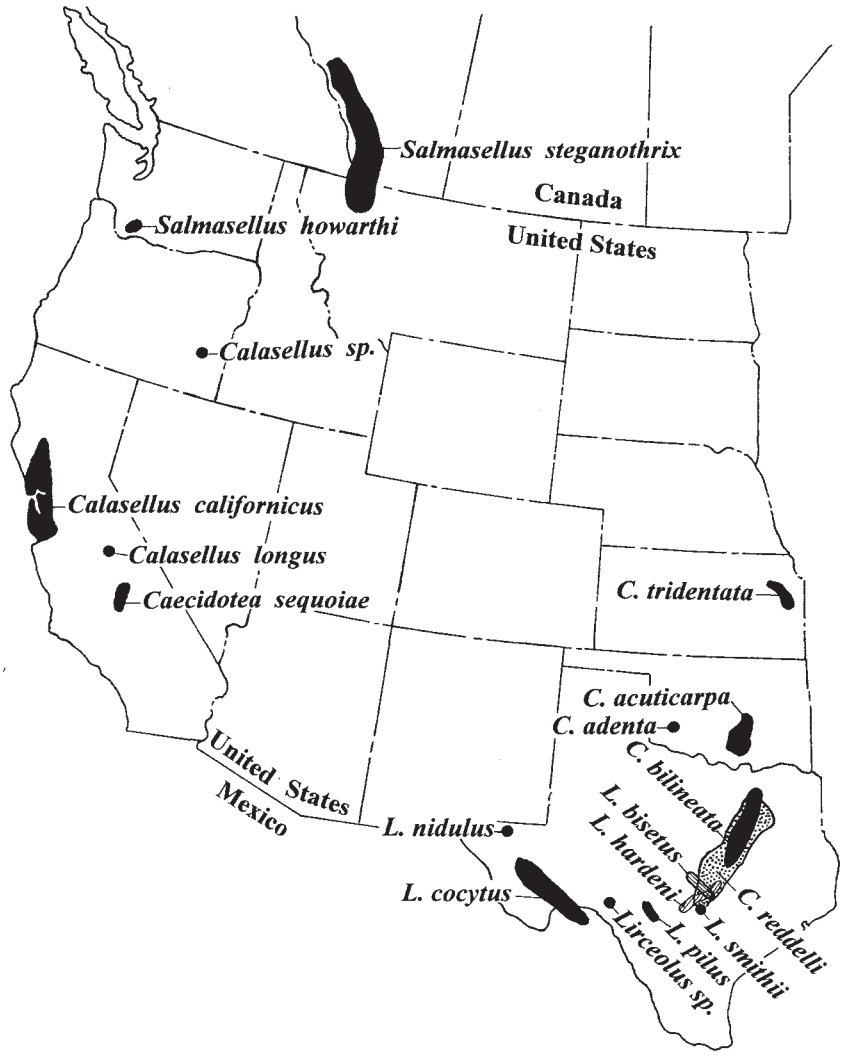

Fig. 1.—The approximate ranges of subterranean asellid isopods known from western North America.

Male pereopod 1, propus about 2.8X as long as wide in male, 3.0X in female; palmar margin lacking processes. Pereopod 4 sexual dimorphism of carpus barely discernible.

Pleotelson about 1.4X as long as wide, sides subparallel, caudomedial lobe weakly produced. Pleopod 1, protopod with 3 retinacula; exopod ovate, about 1.2X length of protopod, with about 20 setae along distal and distolateral margins. Pleopod 2 of male, protopod very elongate compared to endopod; exopod distal segment slender, subtriangular, with 4 plumose setae along distal margin. Endopod with moderately pronounced basal apophysis, short basal spur; tip with 4 elements: (1) cannula slender, conical,

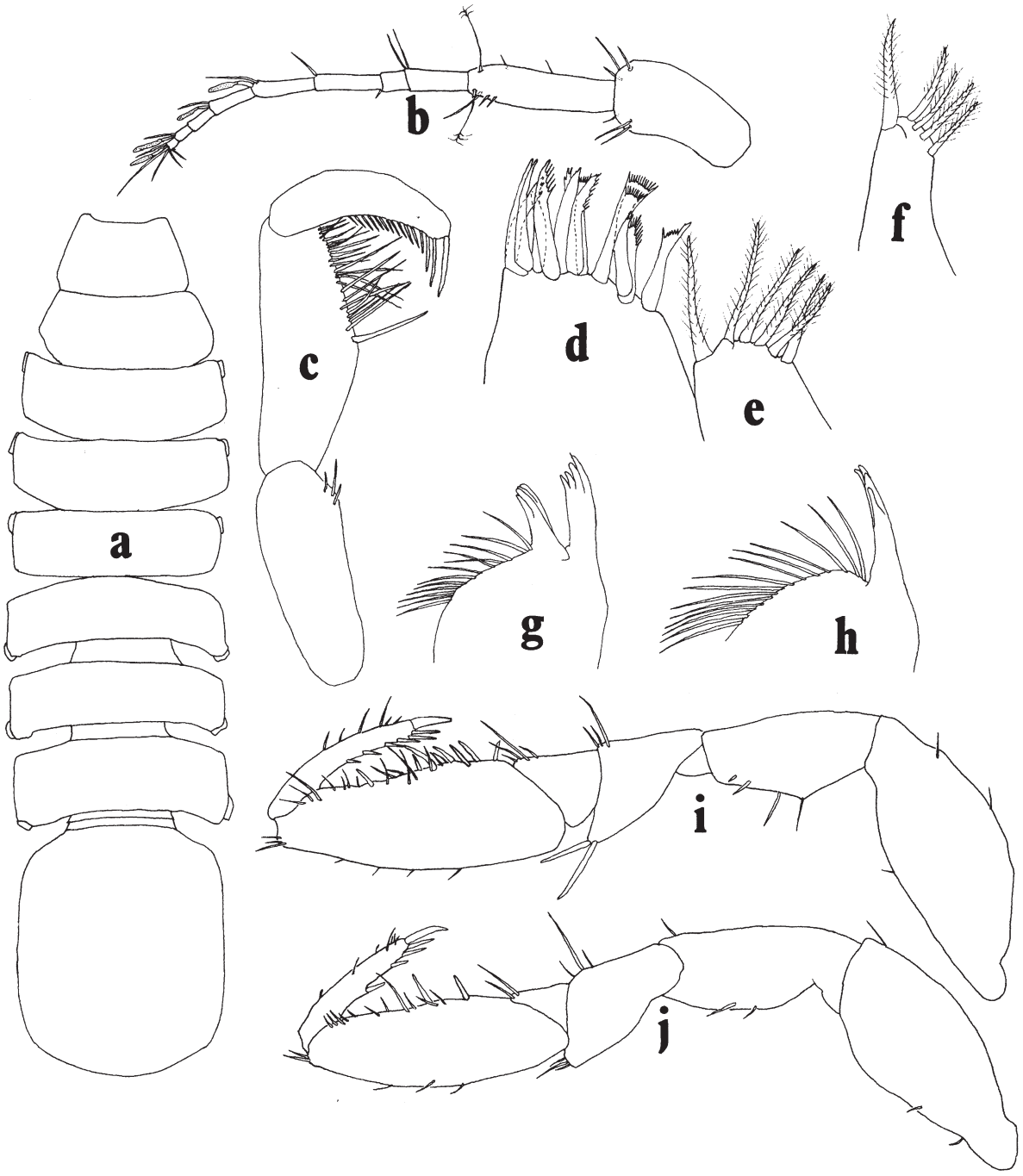

Fig. 2.—*Lirceolus nidulus*, new species, Border Cave, Culberson County, Texas, 8.0 mm holotype male (f, i), 8.8 mm paratype female (a-e, g-h, j): (a) habitus; (b) antenna 1; (c) mandibular palp; (d) maxilla 1, outer lobe; (e) maxilla 1, inner lobe; (f) maxilla 1, inner lobe; (g) left mandible; (h) right mandible; (i) pereopod 1; (j) pereopod 1.

blunt apically, extending roughly parallel to axis of endopod, slightly decurved laterad, nested between and partially obscured by mesial and lateral processes, terminating below apex of endopod; (2) mesial process broadly digitiform, obscuring much of the cannula; (3) lateral process shorter than mesial process, subtriangular; and (4) caudal rim of endopod connecting mesial and lateral processes. Pleopod 2 of female subtriangular, sparsely setose. Pleopod 3, exopod with slightly oblique suture. Pleopods 4 & 5 exopods with two sutures, oblique suture and second suture creating an oval area on lateral margin. Uropods about 0.75X length of pleotelson, exopod slightly shorter than endopod.

Etymology.—The name is derived from the Latin noun *nidulus* = small nest, referring to the nested appearance of the structures of the male second pleopod endopod tip. The subapical termination of the cannula is one of the structural features separating *Lirceolus nidulus* from *L. cocytus*. The suggested vernacular name for this species is the Border Cave isopod.

Habitat & range.—*Lirceolus nidulus* is known only from Border Cave, which is about 26 kilometers southwest of White City, New Mexico. This cave is formed in gypsum of the Permian Castile Formation. It is about 300 meters in length, with two deep phreatic lakes accessible from the passage. The isopods occur in the same habitat with two subterranean amphipods that are also endemic to Border Cave: *Artesia welbourni* and an undescribed species of *Stygobromus* of the *hubbsi* Group (Holsinger, 1992). It is with some misgivings that I describe *L. nidulus* based on a single damaged male specimen. However, the difficulties reported entailed in attempting to collect additional material have encouraged me to describe the species with the material available.

Relationships.—Many of the structures of *Lirceolus nidulus* closely resemble those of *L. cocytus*. *Lirceolus nidulus* is separated by (1) its larger size (twice that of the known specimens of *L. cocytus*); (2) the more elongate palmar margin of the propus of pereopod 1; (3) the very elongate male second pleopod protopod, (4) the male second pleopod endopod tip cannula that ends proximal to the apex of the endopod; and (5) the fourth pleopod exopod with an oblique suture and a second suture forming an ovate lateral area.

Lirceolus cocytus, new species
Figures 4-5

Material examined.—TEXAS: *Jeff Davis County*, Phantom Lake Spring Cave, 10-11 December 1995, B. Tucker, 10 males, 6 females; COAHUILA: Sótano de Amezcua, 35 miles west & 8 miles north of Ciudad Acuña, 25 June 1994, Dean A. Hendrickson, 2 males, 6 females; same locality, 15-17 June 1998, Jean Krecja, 3 males, 2 females. A 3.1mm male from Phantom Lake Spring Cave is designated the holotype (USNM 291384), the other specimens from that locality are designated as paratypes (USNM 291385), all deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Description.—Eyeless, unpigmented, longest male 3.2mm, longest female 4.0mm; body slender, linear, about 5.2X as long as wide. Antenna 1, flagellum to about 4 segments, esthete on distal segment. Antenna 2 flagellum to 35 segments. Mandibles with 4-cuspate incisors and lacinia mobilis, palp with plumose setae on distal segments. Maxilla 1, inner lobe with 5 plumose setae, outer lobe with 13 stout spines.

Pereopod 1, propus about 2.3X as long as wide in male, 2.7X in female; palmar margin lacking processes. Pereopod 4, carpus about 2.7X as long as wide in male, 2.2X in female.

Pleotelson about 2.7X as long as wide, sides subparallel, caudomedial lobe not produced. Pleopod 1, protopod with 3-4 retinacula; exopod ovate, with short setae on distal margin. Pleopod 2 of male, exopod distal segment slender, subtriangular, with 3 elongate setae along distal margin. Endopod with distinct basal apophysis and short basal spur, tip with 4 elements: (1) cannula slender, conical, apically truncate, extending roughly parallel to axis of endopod, slightly decurved to the lateral side, terminating beyond the apex of the endopod; (2) mesial process subtriangular; (3) lateral process slightly shorter, rounded, subtriangular; (4) caudal rim of endopod connecting mesial and lateral processes. Pleopod 2 of female subtriangular, single distal seta present. Pleopod 3, exopod with transverse suture, short setae sparsely distributed along distal margin. Pleopod 4 exopod with oblique suture extending to second transverse suture, setae absent. Pleopod 5 exopod with transverse suture. Uropods about 0.7X length of pleotelson.

Etymology.—The Latin noun *cocytus* is the name of one of the mythological rivers of the underworld crossed by phantoms to reach hell, and refers to the habitat at the type-locality of *L. cocytus*, the underground waters of Phantom Lake Spring Cave. The suggested vernacular name is the Phantom Cave isopod.

Habitat and range.—The type series of *Lirceolus cocytus* was collected by a scuba diver in the spring conduit from which Phantom Lake Spring emerges. This cave is the longest known in an isolated area of Cretaceous limestone, although most of the approximately 2000 meters of passage is underwater (Reddell, pers. comm.). Over 200 kilometers separate the type-locality and Sótano de Amezcua, the widest

range of any of the known species of *Lirceolus* (fig. 6) To demonstrate the morphological similarities exhibited by the specimens from these two populations I have presented illustrations of the male second pleopod structures side by side (figs 5b & d; c & e).

Cole (1976) described the spring amphipod *Gammarus hyalelloides* from Phantom Lake Spring and included information on other members of the spring fauna as well as notes and references on the water chemistry of the spring.

Relationships.—This species is clearly morphologically similar to *Lirceolus nidulus*, from which it can be separated by: (1) its smaller size; (2) the shorter palmar margin of the propus of pereopod 1;

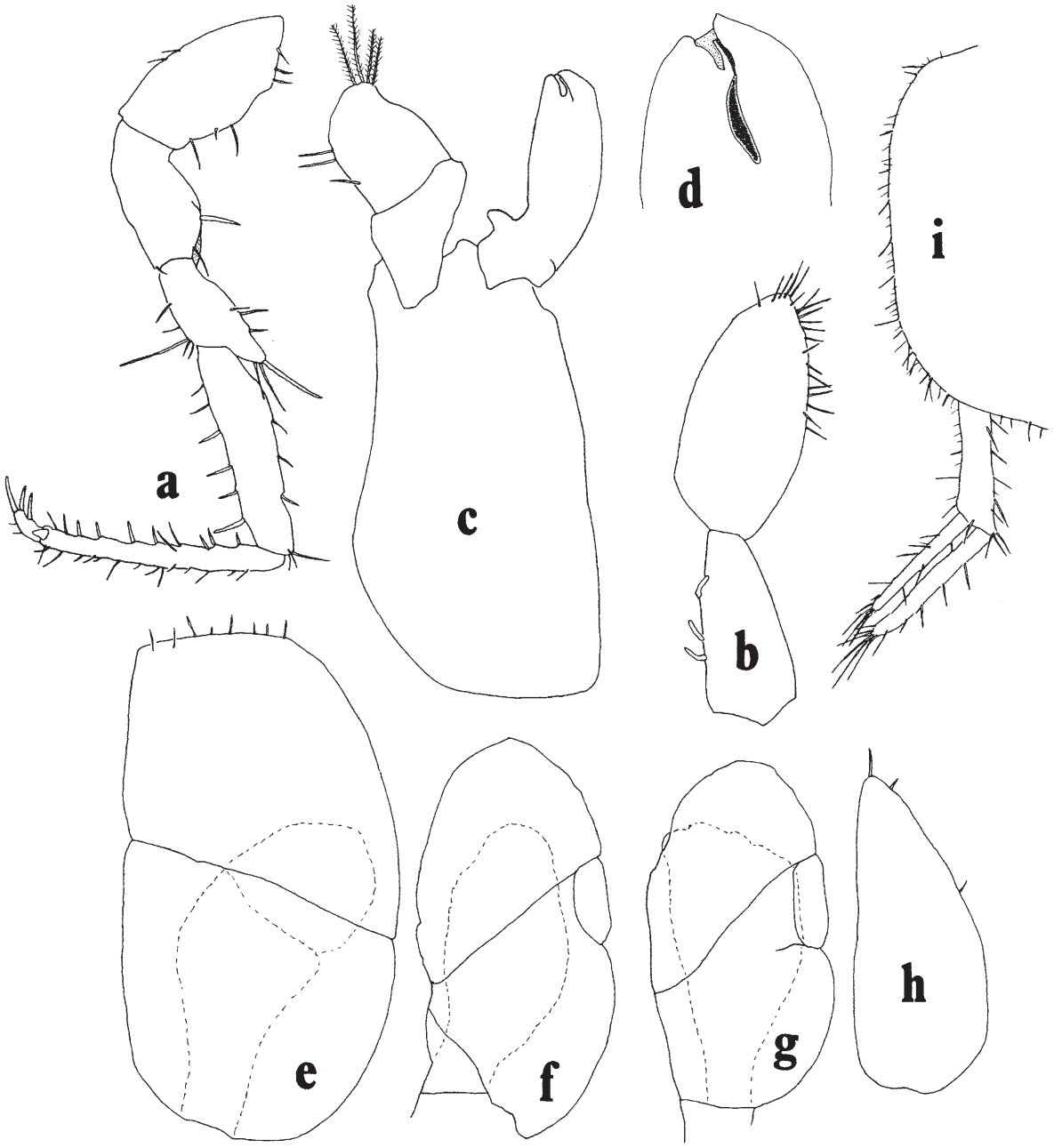

Fig. 3.—*Lirceolus nidulus*, new species, Border Cave, Culberson County, Texas, 8.0 mm holotype male (b-d), 8.8 mm paratype female (a, e-h): (a) pereopod 4; (b) pleopod 1; (c) pleopod 2; (d) pleopod 2 endopod tip; (e) pleopod 3; (f) pleopod 4; (g) pleopod 5; (h) pleopod 2; (i) pleotelson and uropod.

(3) the shorter male second pleopod protopod; (4) the cannula that ends beyond the apex of the endopod; and (5) the absence of two sutures on the exopods of pleopods 4 and 5, creating a small oval area on the lateral margin.

Lirceolus undescribed species

Material examined.—TEXAS: *Val Verde County*: Dandridge Spring on east bank of Devils River, about 3 miles above the mouth of the Dry Devils River, 22 February 1998, Dean A. Hendrickson, Jean Krejca, Peter Sprouse, Charlie Savvas, et. al., 1 male.

Range.—This species is known only from the tiny unique male from the above locality. It remains undescribed since the antennae, pereopods and uropods are absent from the specimen. Dissection of the remnant revealed a *Lirceolus* similar to *L. smithii*, but with maxilla 1 inner lobe with 5 apical setae and pleopod 2 endopod tip consisting of a simple conical cannula lacking other associated processes.

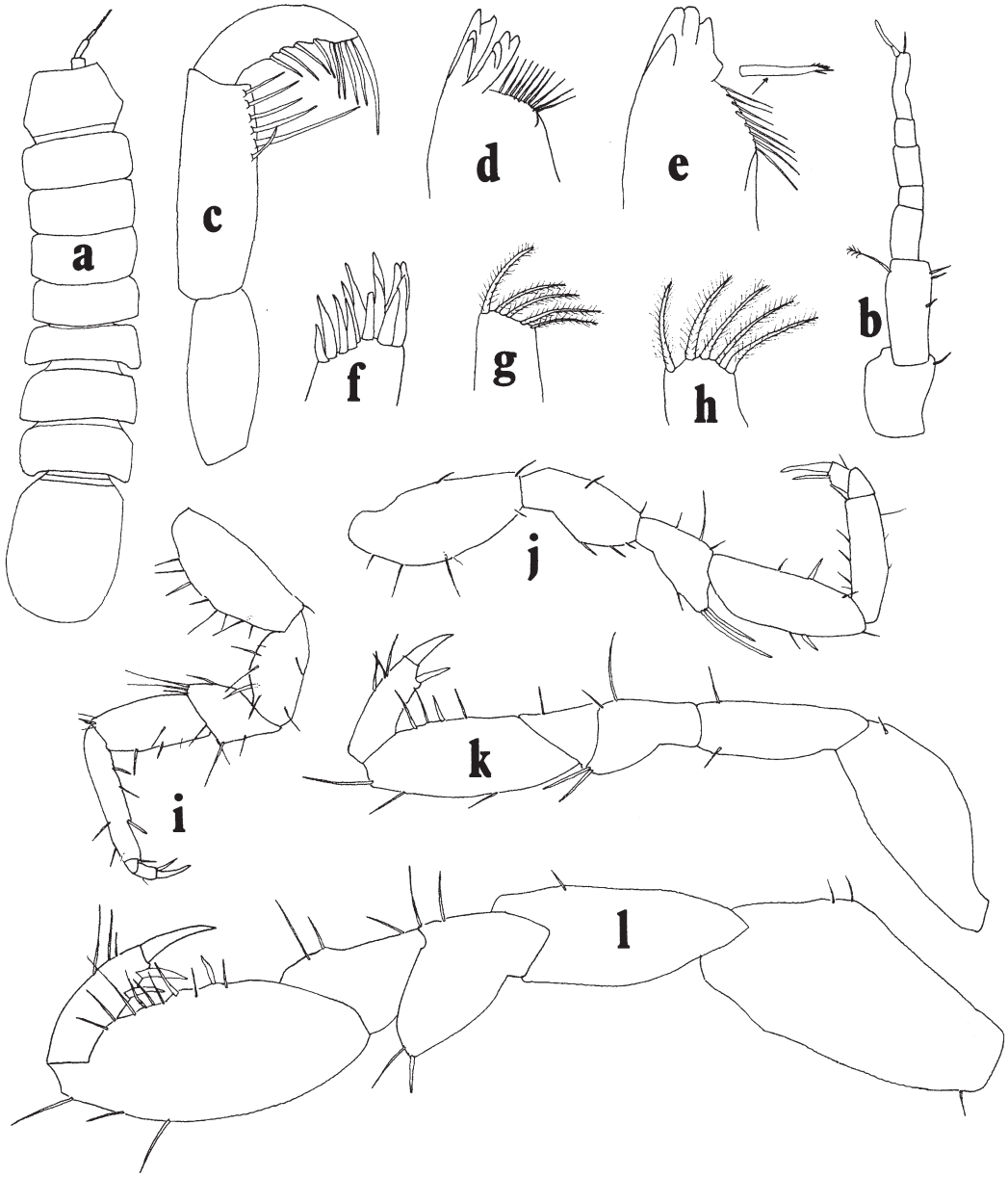

Fig. 4.—*Lirceolus cocytus*, new species, Phantom Lake Spring Cave, Jeff Davis County, Texas, 3.2 mm male (a, g), 3.0 mm male (b-f, j, l), 3.4 mm female (i, k); Sótano de Amezcua, Coahuila, 4.7 mm female (h): (a) habitus; (b) antenna 1; (c) mandibular palp; (d) left mandible; (e) right mandible; (f) maxilla 1, outer lobe; (g) maxilla 1, inner lobe; (h) maxilla 1, inner lobe; (i) pereopod 4; (j) pereopod 4; (k) pereopod 1; (l) pereopod 1.

Lirceolus hardeni Lewis & Bowman, 1996

Material examined.—TEXAS: *Williamson County*: PC Spring, Robinson Ranch, taken from mophead, 9 September 1999, P. Sprouse, 3 males, females; same locality, 10 September 1999, P. Sprouse, 1 female; same locality, 13 September 1999, P. Sprouse, 10 males, females; 22 September 1999, J. Reddell, M. Reyes, P. Sprouse, 21 males, females; same locality, 27 September 1999, P. Sprouse, 5 males, females.

Habitat and range.—A male from the 22 September 1999 collection from PC Spring was fully dissected and possessed the maxilla 1 inner lobe with 4 terminal setae characteristic of this tiny, difficult to identify species.

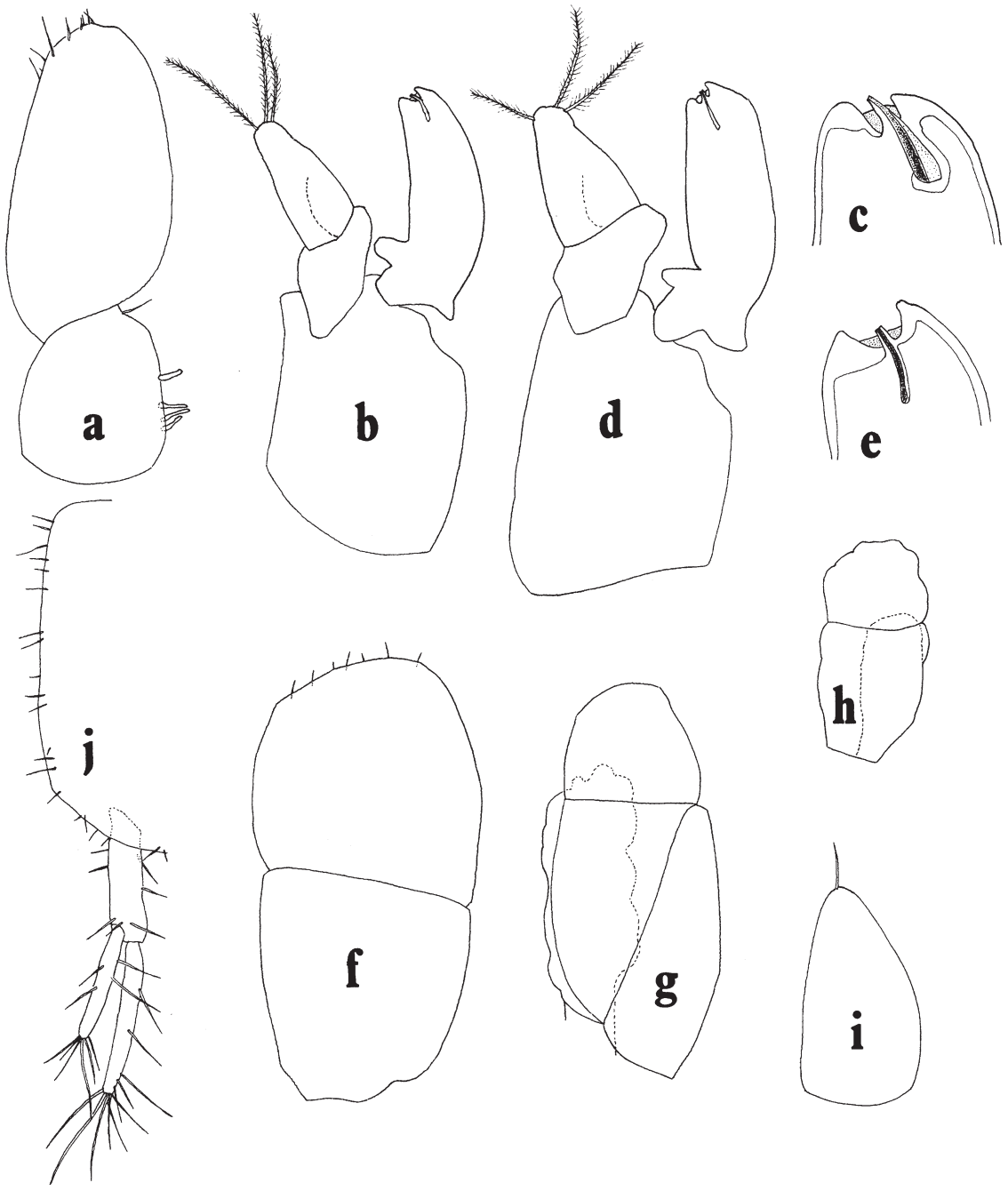

Fig. 5.—*Lirceolus cocytus*, new species, Phantom Lake Spring Cave, Jeff Davis County, Texas, 3.0 mm male (a-c, f-h), 3.3 mm female (i-j); Sótano de Amezcua, Coahuila, 3.0 mm male (d-e): (a) pleopod 1; (b) pleopod 2; (c) pleopod 2 endopod tip; (d) pleopod 2; (e) pleopod 2 endopod tip; (f) pleopod 3; (g) pleopod 4; (h) pleopod 5; (i) pleopod 2; (j) pleotelson and uropod.

The above series from PC Spring is the first locality for *L. hardeni* in Williamson County, otherwise reported from caves and springs in Blanco, Comal and Travis counties in Texas (Lewis & Bowman, 1996).

Salmasellus, Bowman, 1975b
***Salmasellus howarthi*, new species**
Figures 7-9

Asellus: Holsinger, 1974: 19.
Salmasellus steganothrix: Holsinger, Mort and Recklies, 1983: 545.

Material examined.—WASHINGTON: *Skamania County*, Deadhorse Cave, 14 August 1972, F.G. Howarth, 5 males (5.2, 6.0, 6.2, 6.5, 6.8mm), 1 female (5.5mm);Upper Falls Creek Cave System, 24 August 1972, F.G. Howarth, L. Nieuwenhuis, 1 female (3.0mm). The 6.8mm male is designated the holotype (BPBM-16249), the other specimens from the 14 August 1972 collection are paratypes, all deposited in the Bernice P. Bishop Museum, Honolulu, Hawaii.

Description.—Eyeless, unpigmented, largest male 6.8mm, longest female 5.5mm; body slender, linear, about 4.5X as long as wide; pereonites increasing slightly in width to pereonite 6, pereonite 7 slightly narrower, pleotelson narrower than pereonite 7. Coxae visible in dorsal view. Margins of head, pereonites and pleotelson moderately setose. Head about twice as wide as long, anterior margin with small rostrum, post-mandibular lobes moderately produced. Pleotelson about 1.4X as long as wide, sides convex, caudomedial lobe absent, caudal margin broadly rounded.

Antenna 1 flagellum of 6-7 segments, reaching to about distal end of 4th segment of antenna 2, last 3-4 segments each bearing esthete. Antenna 2 flagellum with about 34-35 segments. Mandibles, palp 3-segmented; incisors 4-cuspate, lacinia mobilis 3-cuspate, spine rows with about 11 spines per row. Maxilla 1, outer lobe with 13 stout spines, inner lobe with 5, 6 or 7 plumose setae. Maxilliped with 3-4 retinacula.

Pereopod 1 of male, propus about 2.7X as long as wide, margin straight, processes absent, about 3 stout spines present; dactyl relatively short in comparison to length of palmar margin of propus, flexor margin with about 2 spines. Pereopod 1 of female similar, slightly more elongate, spines fewer and less stout. Pereopods 2-7 long, slender, moderately spinose/setose, carpus of male about 3.5X as long as wide, 3.3X in female.

Pleopod 1 longer than pleopod 2 of male; protopod about 0.4X length of exopod, with 2 retinacula; exopod

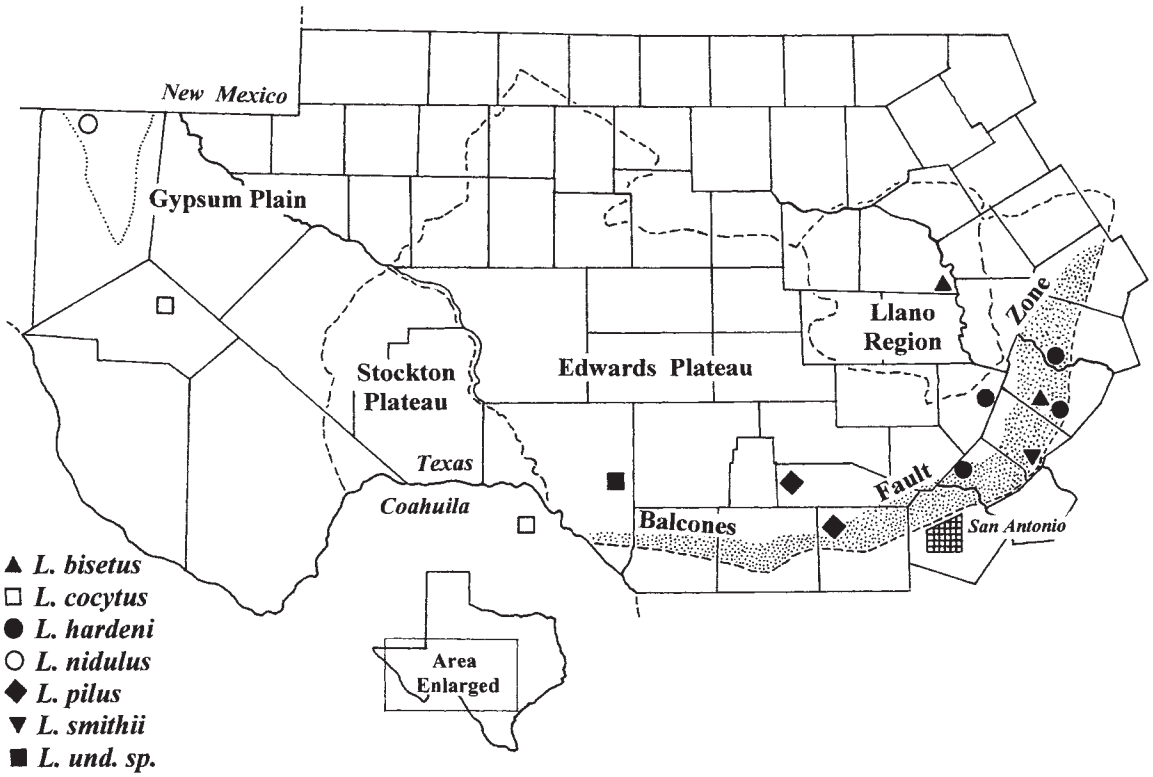

Fig. 6.—The distribution of *Lirceolus* species in Texas.

slightly over twice as long as wide, with about 25 setae along distal and distolateral margins. Pleopod 2 of female subtriangular. Pleopod 2 of male, exopod, distal segment with single plumose seta on apex; proximal segment with about 6 plumose setae along lateral margin. Endopod without basal spur or basal apophysis, L-shaped, with 2 long setae arising from base of the L, terminating prior to apex of endopod; subterminal spine directed laterad; rounded shoulder-like apex of cannula without setae; cannula extending beyond this shoulder as a grooved stylet containing the elongate setae, with elongate dentate extending along basal part of lateral margin. Pleopod 3 exopod with transverse suture, about 20 setae along distal and distolateral margin of distal segment; about 8 setae along lateral margin of proximal segment. Pleopods 4 and 5 with exopods lacking prominent sutures or marginal setae. Uropods slightly shorter than pleotelson.

Etymology.—It is with pleasure that I name this species after its collector, Dr. Francis G. Howarth, of the Bernice P. Bishop Museum, Honolulu. The suggested vernacular name is Howarth's cave isopod.

Habitat and range.—*Salmasellus howarthi* is known from Deadhorse Cave, located about 8 km

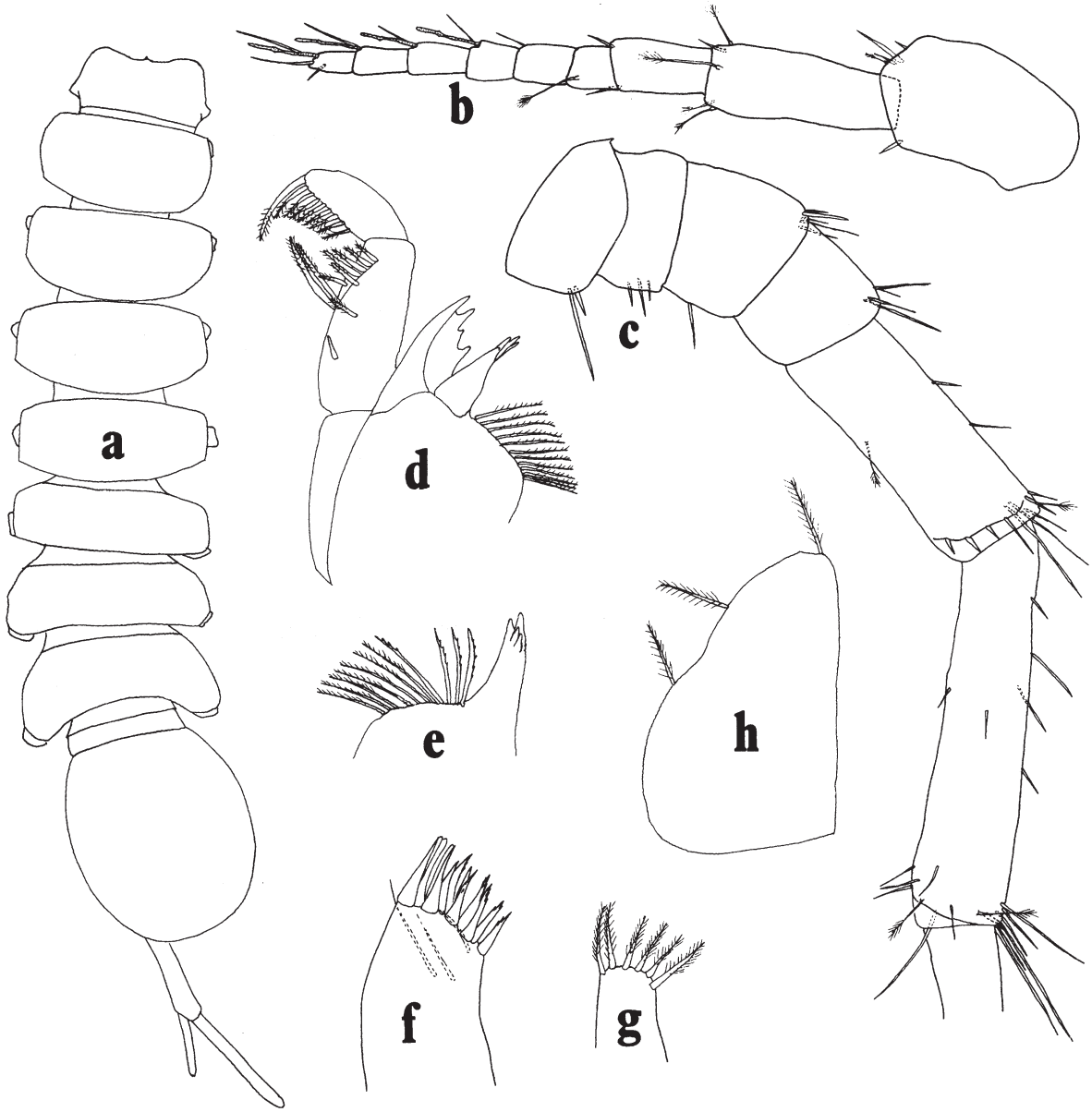

Fig. 7.—*Salmasellus howarthi,* new species, Deadhorse Cave, Skamania County, Washington, 6.5 mm male (a, d-g), 6.2 mm male (b-c), 6.3 mm female (h): (a) habitus; (b) antenna 1; (c) antenna 2; (d) left mandible and palp; (e) right mandible; (f) maxilla 1, outer lobe; (g) maxilla 1, inner lobe; (h) pleopod 2.

northwest of Trout Lake, Washington, and the Upper Falls Creek Cave System, approximately 20 km south-southwest of Deadhorse Cave. The Upper Falls Creek Cave System record should be considered provisional, since it is based on an immature female specimen (a mature male is required to confirm this identification). Both of these caves are lava tubes located within undated young pahoehoe lava flows on the slopes of Mount Adams, a volcano in the southern Cascade Range. Deadhorse Cave is particularly complex for a lava tube. The cave contains a stream with about 1300 meters of surveyed passage (Halliday, 1972). Howarth (pers. comm.) reported that the isopods were taken from a quiet stream pool with water temperature of 40° F. Holsinger (pers. comm.) reported visiting Deadhorse Cave on 16 July 1980, where he found the isopods to be common on rocks throughout most of the stream. In the Upper Falls Creek Cave System, Howarth (pers. comm.) collected the isopod from an isolated pool perched above the stream, with the water temperature 42° F.

The subterranean amphipod *Stygobromus elliotti* has also been reported from Deadhorse Cave and the Upper Falls Creek Cave System (Holsinger,1974).

Relationships.—*Salmasellus howarthi* closely resembles *S. steganothrix,* particularly in the elongate, unarmed propus of the first pereopod; the short pleopod 1 protopod; and the nearly identical male second pleopod, particularly the endopod. The two species may be separated by the following differences: (1) propus of male pereopod 1 is more elongate in *S. steganothrix* at about 3.2X as long as wide vs. 2.7X in *S. howarthi;* palmar margin of *S. steganothrix* has about 8 spines, whereas *S. howarthi* has only about 3; (2) mandibles with 3-cuspate lacinia mobilis in *S. howarthi*, 4 cuspate in *S. steganothrix*; incisor on left 4-cuspate in *S. howarthi*, 5-cuspate in *S. steganothrix*; (3) maxilla 1 inner lobe typically has 6-7 apical setae (one specimen had one side with 5) in *S. howarthi*, usually 5 in *S. steganothrix*; (4) pleopod 3 exopod with numerous setae on lateral margin of proximal segment in *S. howarthi,* setation sparse in *S. steganothrix*. From a zoogeographic standpoint, the two species are easily separated based on their ranges, with *S. steganothrix* occurring in the northern Rocky Mountains of Alberta and Montana, while *S. howarthi* occurs in the Cascade Mountains about 700 kilometers to the west.

Salmasellus steganothrix Bowman, 1975b

Material examined.—MONTANA: *Flathead County*, Glacier National Park, Algal Cave near west glacier, from pool, 25 August 1977, J.M. Chester, 1 male; same locality, 27 September 1999, 3 males, 7 females; site unspecified, Kalispell Valley, Flathead River System, J.V. Ward, 3 males, 3 females, 1 dessicated; ALBERTA: Banff National Park, Castleguard Cave, 16 April 1977, J.S. Mort, et. al., 6 males, 4 females (in 4 vials).

Habitat and Range.—This species was reported by Clifford & Bergstron (1976) from a cave spring near Cadomin, Alberta. Holsinger (1980) described *Stygobromus canadensis* from Castleguard Cave, Alberta, and reported *Salamasellus steganothrix* identified by T.E. Bowman from the same site (the material that I examined from this cave noted above is presumably the same specimens examined by Bowman). A detailed account of the occurrence of *S. steganothrix* in Castleguard Cave was presented by Holsinger, Mort & Recklies (1983). This species occurs in caves and springs in the Rocky Mountains from central Alberta south into northern Montana.

Calasellus Bowman, 1981

Calasellus californicus (Miller, 1933)

Material examined.—CALIFORNIA: *Marin County*, taken 40cm deep from gravel bed of Cronair Creek, 15 July 1997, Rosalie del Rosario, 3 males, 2 females; *Santa Cruz County*, Empire Cave, in flooded room, 4 December 1983, T. Briggs, 2 females.

Habitat and range.—This species is known only from subterranean habitats in California, where it has also been reported from Lake (Miller, 1933), Santa Clara and Napa counties (Bowman, 1975). The identification of the Empire Cave specimens as *C. californicus* is based on the strong similarity of pleopods 3, 4 and 5 with the illustrations of Miller (1933). Specifically, the Empire Cave specimens possess a pleopod 3 exopod with the same oblique suture, pleopod 4 has the elongate triangular exopod, and pleopod 5 has a rudimentary exopod (unlike *C. longus*, in which the exopod is absent), all identical to Miller's figures 3-5. A male from Empire Cave will be required to confirm this identification.

Calasellus longus Bowman, 1981

Habitat and range.—The location given for the only known population of this species contained an error. Bowman (1981) reported the type-locality at Shaver Lake as 35 miles northwest of Fresno. Inspection of a highway map for the preparation of Figure 1 revealed that Shaver Lake, and the town of the same name, is 35 miles northeast of Fresno.

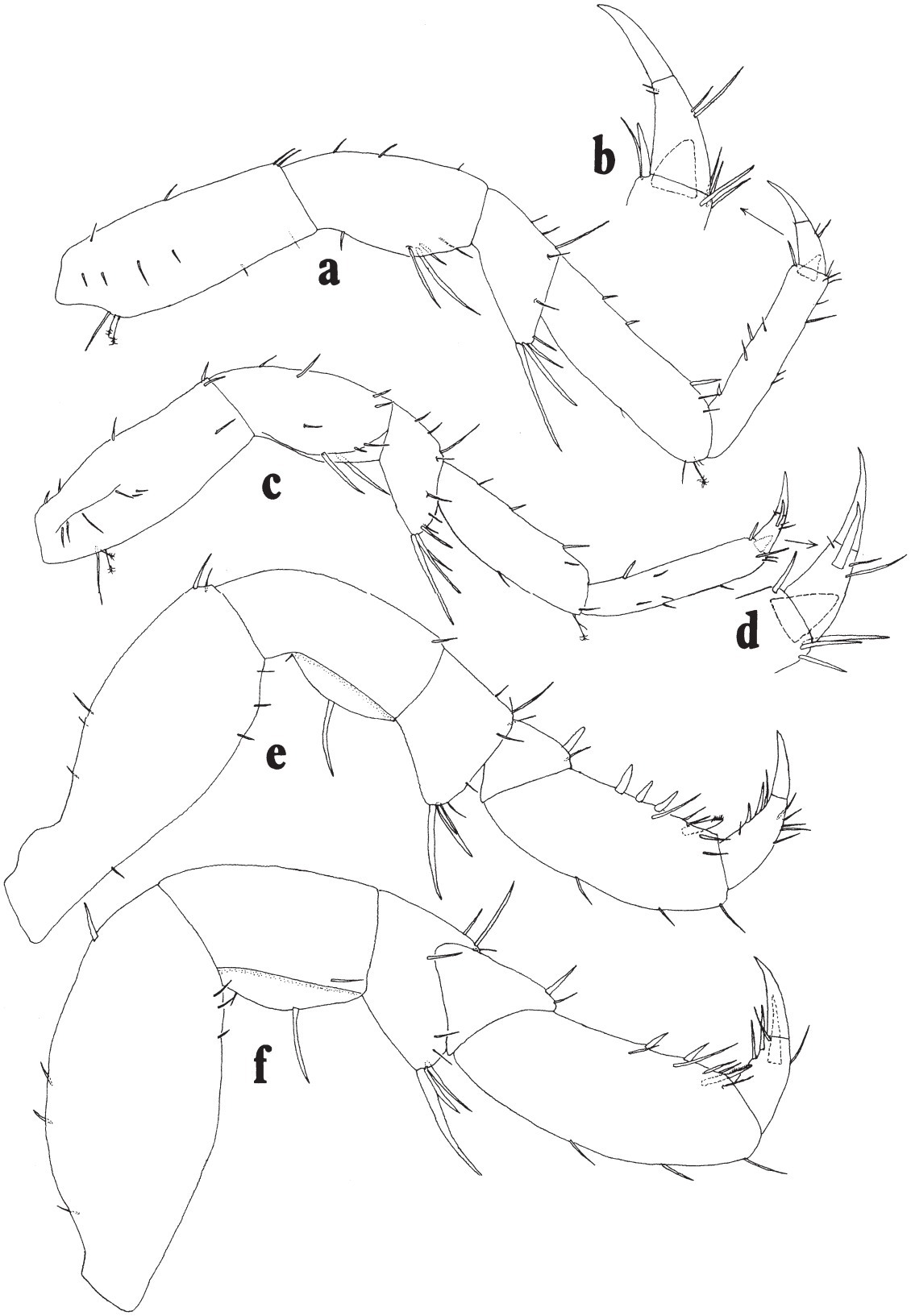

Fig. 8.—*Salmasellus howarth*i, new species, Deadhorse Cave, Skamania County, Washington, 6.5 mm male (a-b, e), 6.3 mm female (c-d, f): (a) pereopod 4; (b) pereopod 4, dactyl; (c) pereopod 4; (d) pereopod 4, dactyl; (e) pereopod 1; (f) pereopod 1.

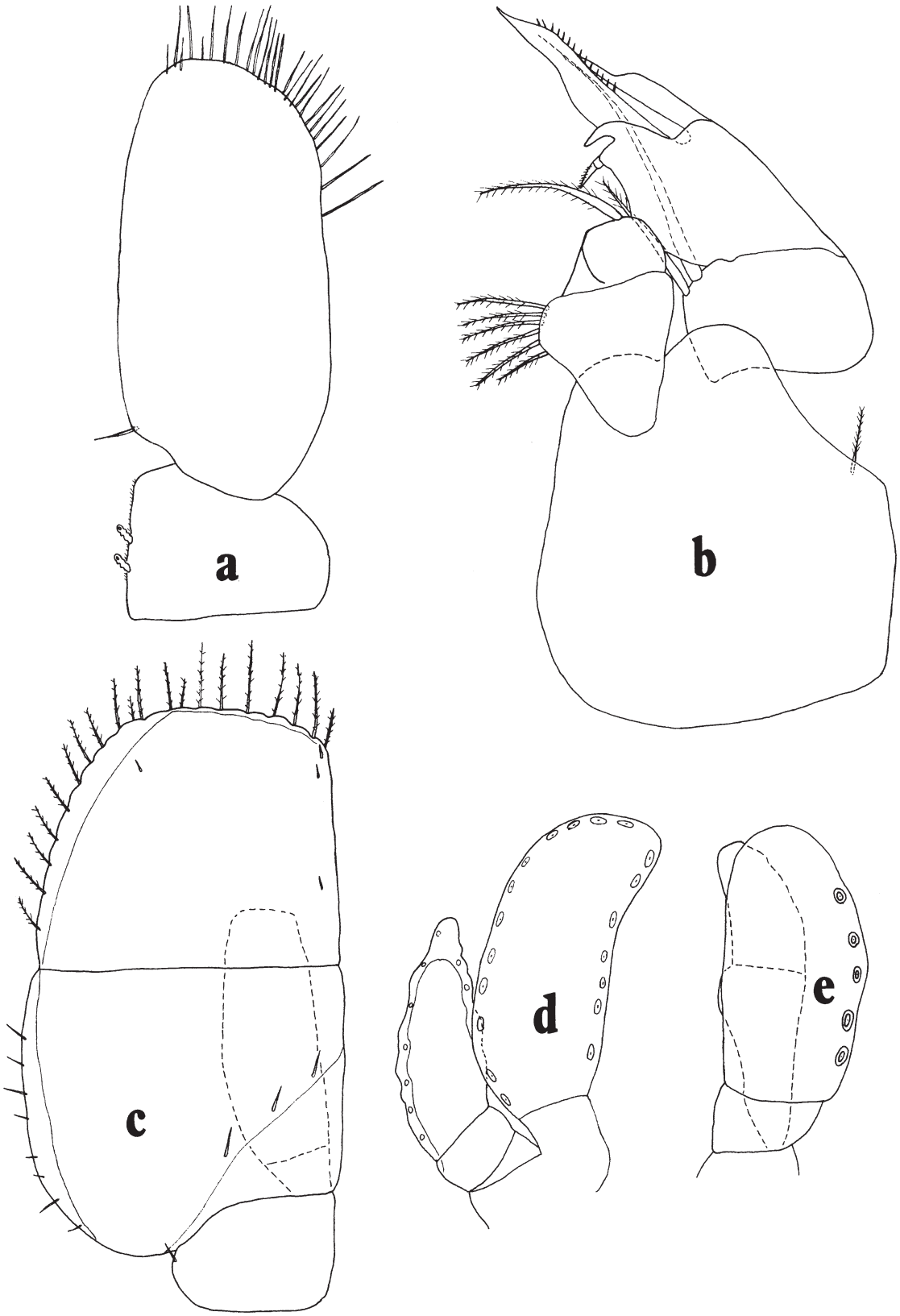

Fig. 9.—*Salmasellus howarthi*, new species, Deadhorse Cave, Skamania County, Washington, 6.5 mm male (a-e): (a) pleopod 1; (b) pleopod 2; (c) pleopod 3; (d) pleopod 4; (e) pleopod 5.

Calasellus undescribed species

Material examined.— OREGON: *Harney County*, Malheur Cave, 6 October 1978, E. Gruber, E. Benedict, 1 male, 5 females.

Habitat and range.— This undescribed species is known only from Malheur Cave. All of the specimens are in the 3-4mm range, damaged, with nearly all of the antennae, pereopods and uropods missing. Although the cave is not commercialized, it is well known and the entrance is marked on highway maps (A.A.A., 1999). Malheur Cave is a lava tube about 1000 meters in length, of which about half is filled with deep water requiring a raft to traverse (N.S.S., 1975). Holsinger (pers. comm.) reported visiting Malheur Cave on 13 July 1980 and 6 July 1982 without finding any isopods despite diligent searching, including baiting. The final 175 meters of the cave are totally filled with water and accessible only to divers, who reported seeing small isopods on two dives (Hill, 1999).

Holsinger (1976) redescribed the subterranean amphipod *Stygobromus hubbsi*, originally described by Shoemaker (1942) from Malheur Cave, and reported the presence of the troglobitic flatworm *Kenkia rhynchida* and "a tiny, white, eyeless isopod of the genus *Asellus*."

Caecidotea Packard, 1876

Caecidotea sequoiae Bowman, 1975b

Material examined.—CALIFORNIA: *Tulare County*, Kings Canyon National Park, Big Springs, Redwood Canyon, October 1997, Thomas M. Iliffe, 2 males, 3 females.

Habitat and range.—This species was previously known only from the type-locality at Liburn Cave (sic, Bowman, 1975b), Sequoia National Park. This is presumably a reference to Lilburn Cave. *Caecidotea sequoiae* is now known from two localities in Tulare County, California..

Discussion.—In the description this species was placed in the genus *Caecidotea*, but was clearly unlike other members of that genus in some ways (Bowman, 1975). In my conversations with Dr. Bowman at the Smithsonian Institution he related that he was not very comfortable with the placement of this species in *Caecidotea*, but had decided to take a conservative approach at the time of its description. *Caecidotea sequoiae* will probably be moved to *Calasellus* or another genus at some later date, but this would be premature prior to a better understanding of the asellid fauna of California.

Caecidotea bilineata Lewis & Bowman, 1996

Material examined.—TEXAS: *Collin County*, Parkhill Prairie, from crayfish burrow, 30 August 1995, B. Hall, 7 males, 5 females.

Habitat and range.—This is a non-cavernicolous groundwater species previously recorded from Bell and Dallas counties, Texas (Lewis & Bowman, 1996). *Caecidotea bilineata* appears to be morphologically similar to *C. adenta*. Both have a pereopod 1 propus that lacks processes, a male first plepod exopod with concave lateral margin and elongate setae along the apical edge, and uropods that are shorter than the pleotelson. The male second pleopod endopod tip of *C. adenta* appears to be very similar to that of *C. reddelli*, as noted by Steeves (1968).

Caecidotea reddelli (Steeves, 1968)

Material examined.—TEXAS: *Bell County*: Buchanan Cave, Fort Hood, 4 November 1998, J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes, 4 males, 8 females; Bumelia Well Cave, 28 October 1994, D. Allen, D. Love, 2 males; Nolan Creek Cave, Fort Hood, 19 May 1999, J. Reddell, M. Reyes, 1 male, 1 female; Tres Dedos Cave, Fort Hood, 24 March 1999, J. Reddell, M. Reyes, 1 male. *Coryell County*: Royalty Ridge Seep, Fort Hood, 31 March 1999, J. Reddell, M. Reyes, 5 males, 3 females; Taylor's Branch Spring, Fort Hood, 30 April 1998, L.J. Graves, J. Reddell, M. Reyes, 11 males, 8 females; Wagontop Spring Cave, 21 January 1992, J. Reddell, M. Reyes, C. Savvas, 12 males, 12 females. *Travis County*: Broken Arrow Cave, 29 April 1999, M. Sanders, G. Veni, 2 males, 6 females. *Williamson County*: Cis Springs, 8 July 1985, M. Maudlin, 3 males (2 vials); same locality & collector, 5 July 1985, 1 male; Water Tank Cave, 29 October 1998, J. Ivy, P. Sprouse, 1 male, 1 female.

Habitat and range.—This species is known from caves in the area of the north Balcones Fault Zone along with seeps and wells in the adjacent Gulf Coastal Plain. It is endemic to Texas, where it has been reported from Bell, Coryell, Dallas, Hays, Henderson, Travis and Williamson counties (Steeves, 1968; Mitchell & Reddell, 1971; Lewis & Bowman, 1996). *Caecidotea reddelli* appears to be morphologically (particularly in the structures of the male second pleopod) and zoogeographically (figure 1) related to *C. acuticarpa* and *C. adenta* in Oklahoma, and *C. tridentata* in Kansas.

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A NEW TROGLOBITIC *PARAPHRYNUS* FROM OAXACA, MEXICO (AMBLYPYGI, PHRYNIDAE)

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ABSTRACT

Paraphrynus grubbsi n. sp. is described from both an adult male and female from caves in the Huautla de Jiménez region of Oaxaca, Mexico. The new species is the sixth troglobitic member of the genus. A taxonomic key to troglobitic *Paraphrynus* is provided.

INTRODUCTION

Mullinex (1975) revised the genus *Paraphrynus* Moreno. She accepted 15 species from Central and North America and the northern West Indies. García Acosta (1977) and Reddell (1981) provided some new records from Mexico, but no new species were described. Quintero (1983) revised the species of the genus from Cuba but only recognized four Cuban species. Quintero synonymised *P. astes* Mullinex from Cuba with an older name that was not recognized by Mullinex. He deemed another species [*P. intermedius* (Franganillo, 1926)] that was accepted by Mullinex to be a dubious species. Since then, a new *Paraphrynus* species was described from Mexico by Mullinex (1979) and Quintero (1979) placed the Guatemalan *P. leptus* Mullinex as a synonym of *P. emaciatus* Mullinex.

Almost half of the approximately 100 species of amblypygids are known from caves (Weygoldt, 1994; Armas and Pérez, 1994; Harvey and West, 1998). Of these, the vast majority are troglophiles. Troglobites are known from the Phrynidae (*Phrynus noeli* Armas and Pérez, 1994 from Cuba and five *Paraphrynus* spp. from Mexico) and the Charinidae (*Charinus* sp. = *diblemma* Simon, 1936 [*nomen dubium* according to Weygoldt, 1994] from Zanzibar, Tanzania, and two species of *Charinus* (*Speleophrynus*) from caves in Venezuela). The present contribution describes the sixth troglobitic species of *Paraphrynus*.

METHODS

The specimens examined are deposited in the American Museum of Natural History, New York (AMNH) and the Texas Memorial Museum, Austin (TMMC).

Morphological terminology and methods for making measurements essentially follow Mullinex (1975), except for the nomenclature of some of the pedipalp and leg segments. We follow Harvey and West (1998) in the naming of appendages. We also use cephalothorax

rather than carapace; the latter being reserved for members of the Crustacea. The pedipalp segments and their alternate names used by Mullinex (in parenthesis) are: coxa (gnathocoxa), trochanter, femur, patella (tibia), tibia (basitarsus), and tarsus. In some species, the tarsus is further divided into a post-tarsus. The leg segments are: coxa, trochanter, femur, patella, tibia (tibia + basitarsus), metatarsus (tarsus 1), and tarsus (tarsus 2-4). The first pair of legs are modified into antenniform appendages, with the tibiae and tarsi being greatly subdivided. Tibiae II-IV are subdivided into a basitibia and a distitibia. Basitibiae IV are further subdivided into three segments and numbered 1-3 from the proximal end. Quintero (1981) called these segments proximal tibia, pre-basitibia, and basitibia, respectively. The distitibia (basitarsus of Mullinex, 1975) is easily recognized because it has long series of trichobothria on its distal end (Fig. 3). The metatarsus (tarsus 1 of Mullinex, 1975) is not divided. Tarsi II-IV are subdivided into three segments and numbered 1-3 here (proximal to distal, respectively). Our tarsal segments 1-3 are equal to Mullinex's tarsal segments 2-4.

The male holotype and allotype female were measured. The other three females were not measured because Amblypygi molt after reaching maturity (Weygoldt, pers. comm., 1998) and our N value was low. Because size varies with age we have tried to emphasis shapes and numbers of structures rather than size.

The genital sternites were removed from the abdomen and examined while they were immersed in lactophenol at room temperature.

We numbered all the spines on the pedipalp femur and patella of the male. Like Quintero (1981), we found that these numbers do not necessarily correspond with those on any other species. None the less, this system of numbering is useful for discussing variation in spination. Some of the major spines can be recognized in other species, but the homologies of others have not been demonstrated. See the illustrations (Figs. 1, 2) for spine numbers. Spines are numbered from dorsal (d) and ventral (v), femur (f) and patella (p), proximal to distal (1-x). Thus, df4 would be the fourth spine from the proximal end on the dorsal surface of the femur. We did not fully illustrate the pedipalp trochanter or tibia; preferring to simply record the spines as numbered by Mullinex (1975). Some details of these structures are present in Figs. 6, 7.

Trichobothrial designations (Fig. 3) of the distitibia follow Weygoldt (1970).

Key to Troglobitic Species of *Paraphrynus*

1. All eyes entirely missing, pedipalp with large spine between vf2 and vf3 (Yucatán).....*P. reddelli* Mullinex, 1979
   Eyes reduced, but at least lateral eyes present, pedipalp with proximal three spines (vf1-vf3) largest; anterior portion of cephalothorax bilobed in front (Fig. 4)..... 2

2. Median eyes absent, pedipalp tarsus subdivided into a post-tarsus; anterior portion of cephalothorax straight or evenly rounded in front (San Luis Potosí) *P. velmae* Mullinex, 1975
   Median eyes reduced but present, pedipalp tarsus entire 3

3 Pedipalp tarsus with a small ventral tooth (Quintana Roo, Yucatán)..... *P. chacmool* (Rowland, 1973)
   Pedipalp tarsus lacking such a tooth 4

4 Pedipalp vf1 spine straight distally, vp16 pointed 5
   Pedipalp vf1 spine curved dorsodistally, vp16 rounded (Fig 1) (Oaxaca)..... *P. grubbsi* new species

5. Legs relatively long, femur I more than four times as long as cephalothorax (Tamaulipas)..... *P. baeops* Mullinex, 1975
   Legs relatively short, femur I less than twice as long as cephalothorax [this character may be incorrect; Rowland stated that the only known specimen had femur I slightly less than 3.5 times longer than carapace, but he gives the measurements as: carapace 8.7, femur I 13.6] (Tabasco)..... *P. chiztun* (Rowland, 1973)

Paraphrynus Moreno

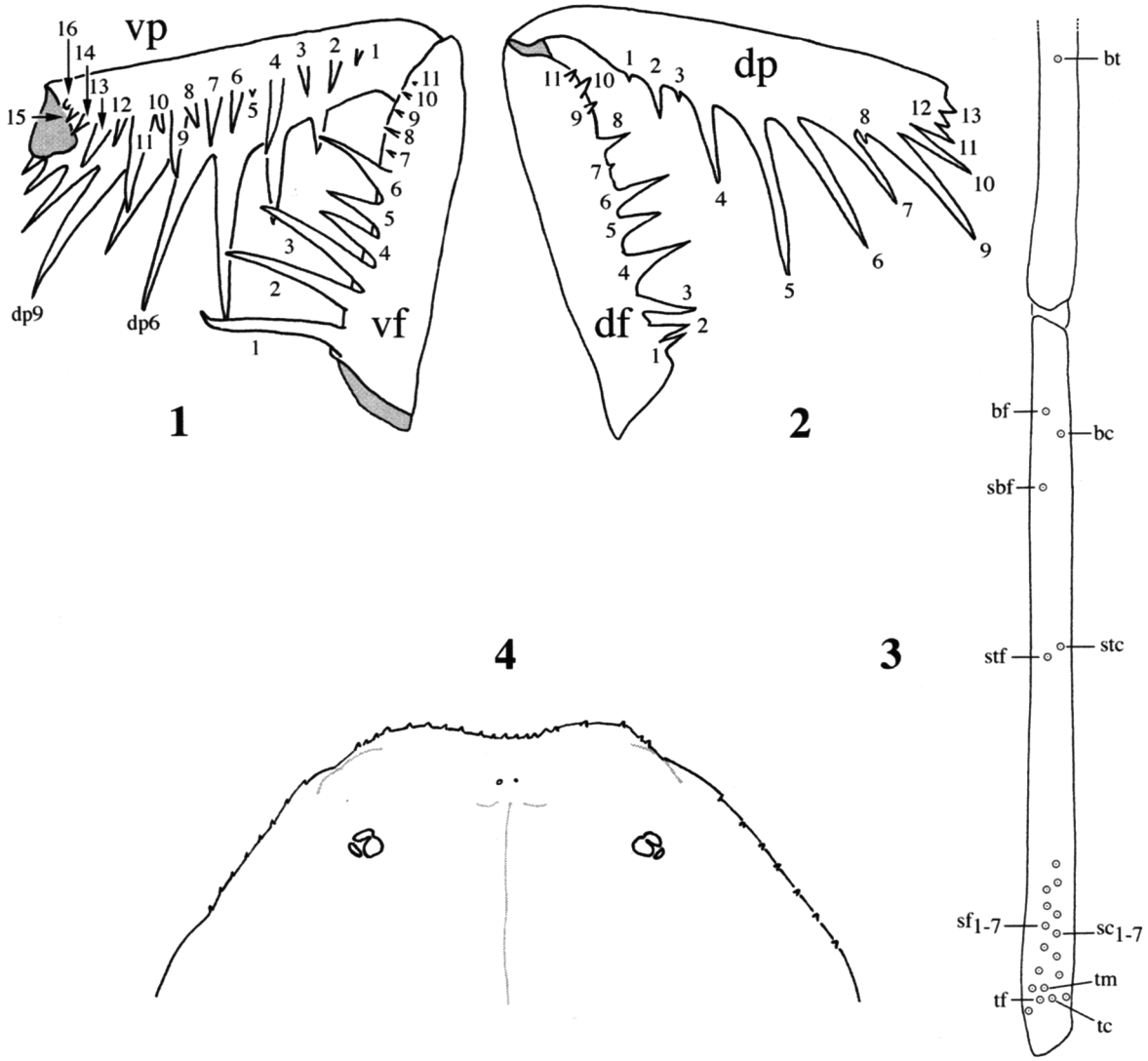
Hemiphrynus Pocock, 1902 (preoccupied).
Paraphrynus Moreno, 1940:167-168, Mullinex, 1975:1-80 (replacement name).

Diagnosis.—Dorsal margin of the pedipalp patella with two spines (Fig. 2- dp6, dp7) between the two longest spines (Figs. 2, 6- dp5, dp9). Without subcylindrical sclerotized apophysis on the ventral surface of the pedipalp trochanter [present in *Heterophrynus* Pocock (Quintero, 1981: fig. 11)]. Tibia of pedipalp armed with at least more than one long spine dorsally (Quintero, 1981: fig. 3). Anterior margin of cephalothorax with small pointed tubercles (Fig. 4).

Identification.—The eyed species of *Paraphrynus* can be identified by using the taxonomic keys by Mullinex (1975) for North American species and Quintero (1983) for West Indian species. The six species of troglobitic (with reduced or missing eyes) *Paraphrynus* (all from Mexico) can be identified by the taxonomic key.

***Paraphrynus grubbsi*,** new species
(Figs. 1-10)

Type Data.—México: Oaxaca: Huautla de Jiménez, Nita Lajao (-50 m, DL26), 11 April 1983, Mark Minton (male holotype, AMNH); Sótano de San Agustín, San Agustín, 5 km SE Huautla de Jiménez, April 1987, A.



Figs. 1 - 4.—*Paraphrynus grubbsi* new species. 1, ventral view of male pedipalp femur (vf) and patella (vp) showing position and numbering of spines. 2, dorsal view of male pedipalp femur (df) and patella (dp) showing position and numbering of spines. 3, left distal portion of the basitibia and distitibia IV of male showing positions and numbering of trichobothria. 4, dorsal view of the anterior portion of the male cephalothorax.

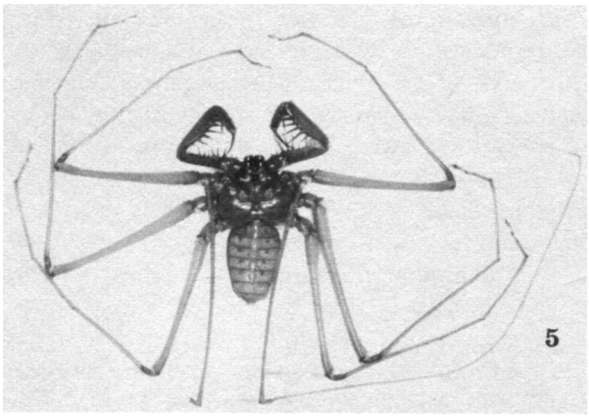


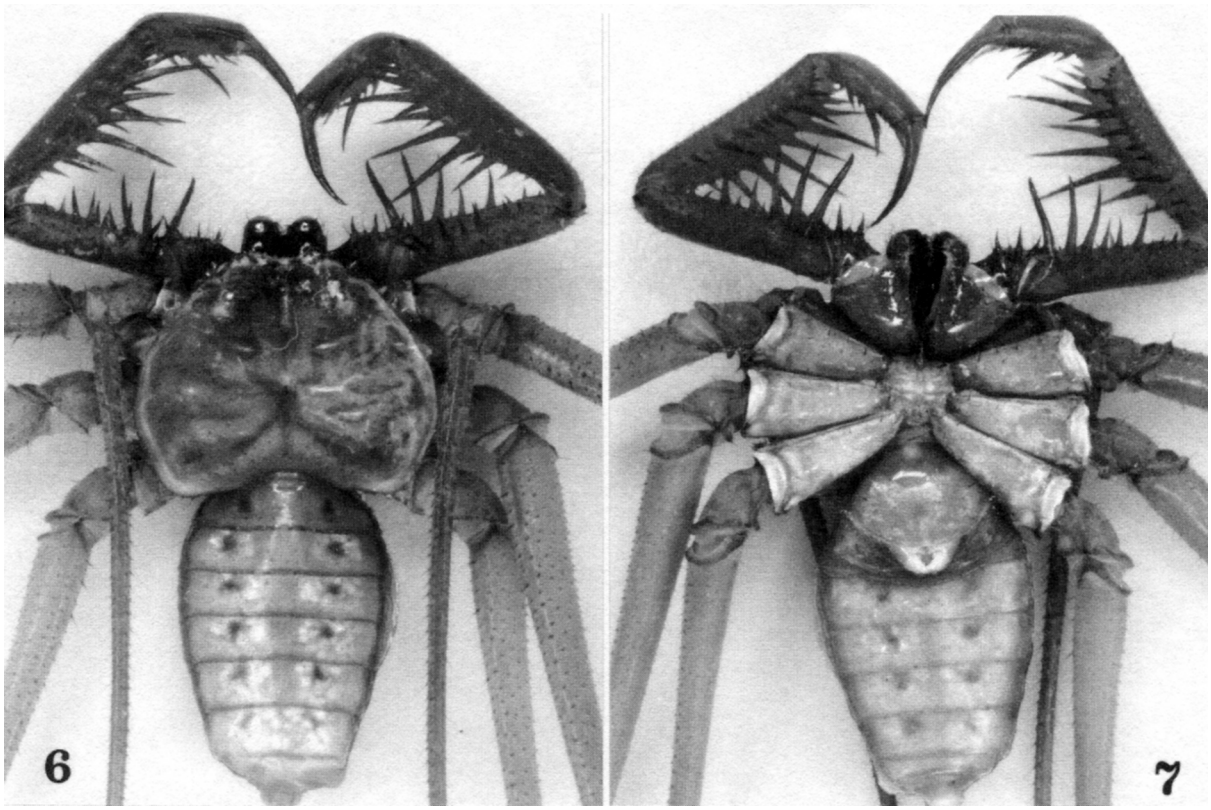
Fig. 5.—*Paraphrynus grubbsi* new species. 5, dorsal view of male.

G. Grubbs, J. Smith, E. Holiday (female paratype, TMMC Arth. Cat. # 8643); Cueva del Escorpíon, San Miguel Dolina, San Miguel, 5 km SE Huautla de Jiménez, January 1978, Roy Jameson, Patty Mothes (female paratype, TMMC Arth. Cat. # 8642); Cueva cerca de la Puente sobre el Río Huautla, 28 Dec. 1977, Roy Jameson (female paratype, TMMC Arth. Cat. # 8641; female allotype, AMNH).

Distribution.—Known only from higher elevation caves in the Huautla de Jiménez region of Oaxaca, Mexico.

Etymology.—The specific epithet is a patronym for Andy G. Grubbs of San Marcos, Texas, for helping to collect part of the specimens upon which this paper is based.

Diagnosis.—Medium-sized species (male body length 14.7 mm); color in alcohol orange-brown to light yellow-brown. Pedipalp tibia spine I longer than III. First three spines on ventral surface of pedipalp femur more or less diminishing evenly in length; spine vf1 curved dorsodistally on tip. Proximal end of dorso-inner lateral surface of pedipalp tarsus (next to cleaning organ) without small spine (spine shown by Mullinex, 1975: fig. 8h). Pedipalp tarsus and post-tarsus fused (shown separated in Mullinex, 1975: fig. 12g). Darkly pigmented median ocular tubercle absent, but two minute colorless eyes present (Fig. 4).



Figs. 6-7.—*Paraphrynus grubbsi* new species. 6, dorsal view of male body and pedipalps. 7, ventral view of male body and pedipalps, genitalia extended.

Description.—Male: Cephalothorax (Fig. 4) brownish anteriorly, intergrading to yellow-brown posteriorly; anterior edge moderately bilobed. Darkly pigmented median ocular tubercle absent, ocular area concolorous with rest of cephalothorax. Two minute median eyes, unpigmented. Lateral eyes reduced in size, unpigmented, small area under eyes with silvery tapetum. Measurements: length 5.5 mm, width 7.7 mm, sulcus from anterior edge 3.4 mm. Lateral eyes small and unpigmented: from each other about 2.5 mm, from lateral edge 0.4 mm, from anterior edge 0.9 mm; anterior edge of two most anterior lateral eyes joined.

Chelicerae basal segment with two teeth on outer edge of anteroventral surface, the distal one slightly smaller and somewhat blunt.

Pedipalps light orange-brown; dorsal, ventral, and lateral surfaces with small setiferous tubercles and fine granules. Ventrally, coxa with a narrow area of white ventrad to the longitudinal row of setae located on white mesal surface. Femur and patella spination as in Figs. 1, 2, 6, 7; all spines pointed except vp16 rounded with a terminal seta; all larger ventral spines with thin, inconspicuous setae on and along sides; length of some setae on vf1 and fv2 greater than width of spine; vf1 curved dorsodistally at tip. Tibia with dorsal spines I longer than III; dorsally with two spines between II and III, and two small spines distal to III; ventrally I and III well developed with I slightly longer; with two spines between II and III with the spine directly proximal to III slightly more than half the length of III. Tarsus without small spine on proximal end of dorso-inner lateral surface; tarsus not divided into a post-tarsus. Measurements: Femur: length 5.0 mm, width 1.0 mm. Patella: length 6.2 mm, width 1.4 mm, length of longest dorsal spine (dp5) 2.6 mm. Tibia: length 3.1 mm, width 0.9 mm. Metatarsus: length 3.0 mm.

Legs: Relatively long (Fig. 5), femur I four times as long as cephalothorax. Yellow-brown and lighter than pedipalps, except for femur of antenniform legs which is orange-brown and about the same color as the pedipalps. Second tarsomere of all tarsi with light transverse line on distal end. Measurements: Antenniform leg: femur 22.1 mm. Leg II: femur 14.5 mm, basitibia 13.9 mm, distitibia 7.2 mm, metatarsus 1.6 mm, first tarsal segment 0.5 mm, third tarsal segment 1.3 mm. Leg III: femur 15.9 mm, basitibia 16.6 mm, distitibia 8.3 mm, metatarsus 1.8 mm, first tarsal segment 0.7 mm, third tarsal segment 1.3 mm. Leg IV: femur 14.1 mm, basitibia 16.1 mm (first 9.6 mm, second segment 1.6 mm, third segment 4.9 mm), distitibia 7.9 mm, metatarsus 1.8 mm, first tarsal segment 0.7 mm, third tarsal segment 1.4 mm. Trichobothrial pattern of basitibia 3 and distitibia IV as in Fig. 3.

Abdominal dorsal surface uniform pale yellow-brown, about same color as legs, 9.2 mm long. Genital operculum: length 0.4 mm, width 0.8 mm. Genitalia as in Figs. 7-9.

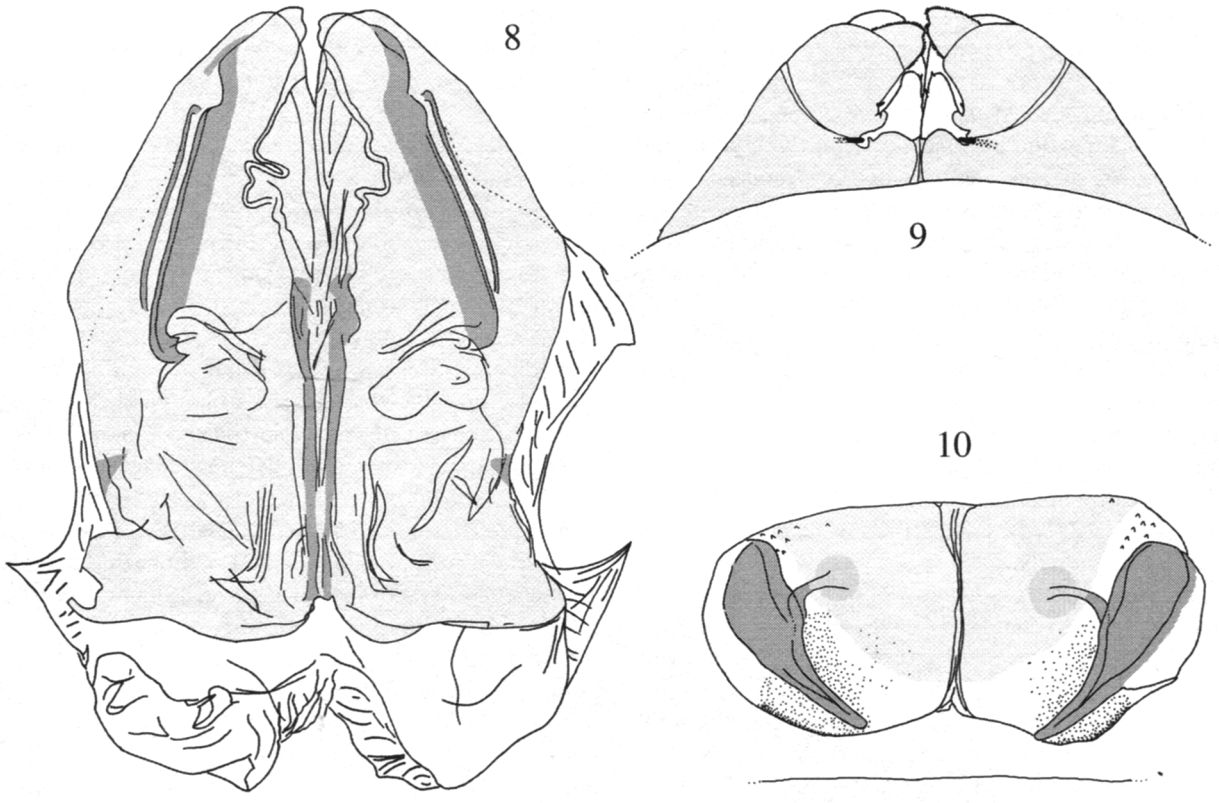
Female (Allotype): Similar to male except as follows: Cephalothorax. Measurements: Length 6.2 mm, width 8.7 mm, sulcus from anterior edge 4.0 mm. Lateral eyes: from each other about 3.1 mm, from lateral edge 0.6 mm, from anterior edge 1.0 mm; most lateral pair of lateral eyes touching, tapetum very small and only found under largest lateral eye pair.

Pedipalps: Measurements: Femur: length 6.3 mm, width 1.2 mm. Patella: length 7.3 mm, width 1.7 mm, length of longest dorsal spine (dp5) 3.3 mm. Tibia: length 3.8 mm, width 1.2 mm. Tarsus: length 3.9 mm.

Legs: Measurements: Antenniform leg: femur 24.1 mm. Leg II: femur 16.3 mm, basitibia 16.0 mm, distitibia 8.6 mm, metatarsus 1.8 mm, first tarsal segment 0.7 mm, third tarsal segment 1.5 mm. Leg III: femur 17.7 mm, basitibia 18.7 mm, distitibia 9.5 mm, metatarsus 2.1 mm, first tarsal segment 0.7 mm, third tarsal segment 1.5 mm. Leg IV: femur 15.7 mm, basitibia 18.5 mm (first segment 10.8 mm, second segment 2.0 mm, third segment 5.7 mm), distitibia 9.1 mm, metatarsus 2.1 mm, first tarsal segment 0.8 mm, third tarsal segment 1.5 mm.

Abdominal length 9.4 mm. Genital operculum length 0.5 mm, width 1.0 mm. Internal genitalia as in Fig. 10; posterior region beneath seminal receptacles (distal end of "beak") with many micropores.

Variation.—Significant variation was noted in the material examined. The median eyes of the holotype are of unequal sizes (left one twice as large as right), obviously an anomaly. The eye sizes, interdistances and size of tapetum vary between individuals. The tapetum is apparent under all the eyes in the male and ranges in size down to complete absence in a female. One female had all the lateral eyes separate, whereas each of the others has at least a tiny portion of two eyes (pairs vary) touching or joined. Because the eyes are not pigmented and the lenses are small this observed variation might be due in part to the difficulty in viewing these structures. There is also variation in the spination patterns of the pedipalps. Figs. 1, 2, 6, 7 show the number of spines as found on the single male. Variations found in the females were mostly bifurcations of spines and missing smaller spines. The variations found were: (female from Sótano de San Agustín) vf4+vf5 combined to form single bifurcate spine on one pedipalp; tiny spine added between dp5, dp6 and dp9, dp10 on one pedipalp; df9, df11, dp8 missing. (Cueva del Escorpíon) dp12 on both pedipalps with small tooth on spine; vf1 on one pedipalp replaced with tiny spine; single tiny spine in front of dp1 on one pedipalp; vp5 missing. (Cueva cerca



Figs. 8-10.—*Paraphrynus grubbsi* new species. 8, ventral view of male genitalia extending beyond edge of sternite. 9, dorsal view of male genitalia. 10. dorsal view of female (from Cueva del Escorpíon) genitalia.

de la Puente sobre el Río Huautla) df11 + df12 combined into bifurcate spine on one pedipalp, df10 + df11 combined into bifurcate spine on other pedipalp of smaller female; dp5 missing on both females. The position and number of distitibia trichobothria vary little except for the sf and sc series. The single male had (sf-sc) 8-8 whereas the females had 8-9 to 8-11 trichobothria. Several of the trichobothria forming the 8-11 were petite (on two different females); their bases being half the sizes of the normal bases. The interdistances between individual sf and individual sc trichobothria varied with no apparent pattern.

Comments.—There is a single subadult female *Paraphrynus* from near the type locality of *P. grubbsi* (Centipede Cave, Río Iglesia Dolina, Huautla de Jiménez, Oaxaca, 26 March 1981, A. Grubbs, S. Zeman, TMMC). This specimen is much smaller than *P. grubbsi* and the eyes are well developed and placed on pigmented tubercles. Reddell (pers. comm. 1999) informed us that he had identified another *Paraphrynus* from caves in Oaxaca. These specimens were similar to *P. chiztun* (Rowland) and were collected from low elevation caves in the Acatlán Region. *Paraphrynus grubbsi* and the unidentified juvenile are from the Huautla de Jiménez region; which is located in higher elevation mountains.

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NEW AND RARE NESTICID SPIDERS FROM TEXAS CAVES (ARANEAE: NESTICIDAE)

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ABSTRACT

Members of the family Nesticidae from caves in Texas are reviewed. *Eidmannella tuckeri*, new species, is described from Phantom Lake Cave, Jeff Davis County. Over 200 new distributional records of *Eidmannella* and 23 of *Gaucelmus* species are recorded. Notes are provided on the maternal care by *Eidmannella* and the general biology of nesticids in Texas caves is reviewed.

INTRODUCTION

Gertsch (1984) revised the taxonomy of the nesticid spiders of North America. He also reviewed the literature relative to our meager knowledge of the biology of this family in North America. Extensive cave explorations in Texas in the last decade have revealed the presence of one undescribed *Eidmannella* species and many new records for both *Eidmannella* Roewer and *Gaucelmus* Keyserling.

While five cavernicolous nesticid species from the southern Appalachians have been proposed for federal listing as threatened or endangered species (Drewry, 1994), none from Texas have thus far been listed as candidate species. Both *Eidmannella reclusa* Gertsch and *E. nasuta* Gertsch are troglobites with limited distributions in or near expanding metropolitan areas of central Texas. Their status should be examined. The new species, we describe herein is known from a single cave oasis in an arid region of western Texas. While urban expansion is not directly a threat to that cave habitat, the increasing needs for water in the nearby towns and for agriculture is a threat to this environment. The spring waters are home to species which are already listed as threatened or endangered. Hopefully, the habitat conservation plan (U.S. Fish and Wildlife Service, 1981) for one of the fish will benefit the new *Eidmannella* species by maintaining a wet cave environment.

Yaginuma (1979), in a study of the nesticids of Japan, noted that only one species was found per cave examined. We have verified the existence of two

different species of nesticids in four caves in Texas. In Robber Baron Cave and Government Canyon Bat Cave, Bexar County, both *E. rostrata* and *E. pallida* have been identified. This same species pair also occurs in East Fork Fissure, Georgetown, Williamson County, but *E. rostrata* is much more numerous. *Gaucelmus augustinus* and *E. pallida* occur in Sore-ped Cave, Williamson County. Unfortunately, data on the relative positions of these spiders in the caves were not recorded. Presumably, *E. pallida* which also lives on the surface occurs nearer the entrances to the caves, whereas the more cave-adapted species occur further inside the caves.

Gaucelmus Keyserling

Gaucelmus augustinus Keyserling

Comments.—This species is the largest nesticid in the state and uncommon compared to *Eidmannella* in Texas caves. Specimens are usually found hanging in webs in overhangs on cave walls.

New Records.—*Bell County*: Camp 6 Cave No. 1, Fort Hood, 20 April 1998 (L. J. Graves, J. Reddell, M. Reyes), 1 female. *Bexar County*: Lost Pot Hole, Government Canyon State Natural Area, 4 Feb. 1995 (A. G. Grubbs, G. Hoese, C. Vreeland), 1 male, 1 female, 3 immatures [1 male, 1 female JCC]; ?Wurzbach Bat Cave, 22 May 1993 (J. Reddell, M. Reyes), 1 immature from Berlese of leaf litter; Young Cave No. 1, 6 Aug. 1983 (G. Veni, J. Ivy), 1 female; 6 Sept. 1993 (J. Reddell, M. Reyes), 1 female, 1 immature. *Blanco County*: T Cave, 12 April 1982 (W. R. Elliott, B. Vinson), 7 females; 9 June 1984; (W. R. Elliott), 1 male, 3 females, 1 immature. *Comal County*: Coreth Bat Cave, New Braunfels, May 2000 (J. Krejca), 1 female, 1 immature; Ebert Cave, 21 May 1994, G. Veni, 5 females (JCC); Fischer Pit, 14 July 1989 (A. Grubbs, A. H., C. T.), 1 male, 1 female, 3 immatures. *Hays County*: Burnett Ranch Cave, 7 mi. W Wimberley, 1982 (A. G. Grubbs), 3 females, 1 immature; Wimberley Bat Cave, 8 Feb. 1987 (W. R. Elliott), 2 females; Wiseman Sink, 28 April 1995 (A. G. Grubbs), 1 male, 1 immature female; 30 April 1995 (A. G. Grubbs), 1 female; Wiseman Sink No. 2, 10 mi. W San Marcos, 22 April 1995 (A. G. Grubbs), 1 male, 1 female, 2 immatures. *Kendall County*: Cave Without A Name, 17 Sept. 1988 (G. Veni), 3 females; Knee Deep Cave, 10 Sept. 1994 (G. Veni, K. Thuesen), 2 females [1 female JCC]. *Travis County*: Lost Gold Cave, 3 March 1985 (J. Reddell, M. Reyes), 2 females, 2 immatures. *Williamson County*: Bonito Sink Cave, April 1994 (M. Warton), 1 male; Short Stack Cave, 19 May 1995 (J. Reddell), 2 females; Sore-ped Cave, 28 April 1990 (P. Sprouse), 1 female; 28 July 1990 (B. Larsen, J. Reddell, M. Reyes), 1 female; (B. Larsen), 1 female; Tres Amigos Cave, April 1994 (M. Warton), 1 female; Whiskey Jug Cave, April 1994 (M. Warton), 1 male, 2 females (JCC).

Eidmannella Roewer

Eidmannella sp.

Comments.—The following eyeless immatures cannot be positively identified. Material from Bexar, Comal, and Kendall counties is probably *E. rostrata* while that from Travis county is probably *E. reclusa*.

New Records.—*Bexar County*. Dirtwater Cave, 2 Aug. 1983 (G. Veni, J. Ivy), 1 immature; Dos Viboras Cave, 14 Dec. 1994 (W. R. Elliott, G. McDaniel), 2 immatures; Glinn's Gloat Hole, Camp Bullis, 18 Jan. 2000 (J. Reddell, M. Reyes), 1 immature; Jabba's Giant Sink, 22 Nov. 1996 (B. Johnson, J. Reddell, M. Reyes), 2 immatures; Two-Hit Cave, 30 March 1995 (J. Reddell, M. Reyes), 1 immature. *Comal County*. Camp Bullis Cave No. 1, Camp Bullis, 25 Jan. 2000 (J. Reddell, M. Reyes), 1 immature; Camp Bullis Cave No. 3, Camp Bullis, 25 Jan. 2000 (J. Reddell, M. Reyes), 1 immature; Tall Tales Cave, Camp Bullis, 17 Jan. 2000 (J. Reddell, M. Reyes), 1 immature. *Kendall County*, Two Step Cave, 30 Jan. 1988 (L. Palit, J. Ivy), 1 immature. *Travis County*: Gallifer Cave, 20 April 1991 (J. Reddell, M. Reyes), 1 immature; MWA Cave, 4 Jan. 1995 (M. Warton), 1 immature; Owl Eyes Cave, 29 Dec. 1994 (M. Warton), 1 immature.

Eidmannella bullata Gertsch

Comment.—This species is known only from the holotype female from Wiggley Cave, Culberson County, and the record listed below.

New Record.—Texas: *Culberson County*, Crystal Cave, 14 May 1988 (M. Reyes), 2 females, 4 immatures [1 female JCC].

Eidmannella delicata Gertsch

Comment.—This species is still known only from Ladder Cave, Val Verde County.

Eidmannella nasuta Gertsch

Comment.—This species is still known only from the female holotype from Davenport Cave, Medina County.

Eidmannella pallida (Emerton)

Comments.—This widespread species is usually found hanging from webs in small pockets in flowstone or cave walls. Unless the records of immatures are from caves from which adults are recorded, they should be regarded as only tentative. Thus far, the only known species of *Eidmannella* with well-developed eyes in the region is *E. pallida* and therefore immatures with eyes are listed here as that species. This is the only *Eidmannella* species which is known to occur on the surface in Texas.

New and Verified Records.—*Bell County*: Camp 6 Cave No. 1, Fort Hood, 20 April 1998 (L. J. Graves, J. Reddell, M. Reyes), 1 female, 4 immatures; 6 June 2000 (J. Reddell, M. Reyes), 1 male, 3 females; Figure 8 Cave, Fort Hood, 20 April 1998 (L. J. Graves, J. Reddell, M. Reyes), 1 female; Marcelino's Cave, Fort Hood, 2 May 2000 (M. Reyes), 1 female; Sledgehammer Cave, Fort Hood, 13 Jan. 1992 (D. Allen), 2 immatures; Sanford Pit Cave, Fort Hood, lower level, 13 June 2000 (J. Krejca, P. Sprouse), 1 female; Talking Crows Cave, Fort Hood, 20 April 1998 (L. J. Graves, J. Reddell, M. Reyes), 1 male; Valentine Cave, Fort Hood, 14 Feb. 1996 (M. Warton), 1 female; Viper Den Cave, 12 Jan. 1995 (D. Allen), 1 immature; (Mike Warton), 3 immatures. *Bexar County*: Cave No. 189, 4 mi. NE Helotes, 12 Jan. 1995 (A. G. Grubbs, N. Lake, G. Waid), 3 females, 1 immature (JCC); Cave No. 194, 4.5 mi. NE Helotes, 14 Oct. 1994 (A. G. Grubbs), 1 female, 2 immatures (JCC); Cave site #305, west of Helotes (Government Canyon Karst Fauna Region), Jan. 2000 (D. Bechtol, K. White), 3 females, 1 immature; Government Canyon Bat Cave, Government Canyon State Natural Area, 24 May 1993 (J. Reddell, M. Reyes), 1 male, 7 females; Kamikazi Cricket Cave, 10 June 1993 (J. Reddell, M. Reyes), 1 female; Robber Baron Cave, San Antonio, 10 March 1982 (A. G. Grubbs, B. Steele, R. Waters), 1 female, 3 immatures; 11 Dec. 1982 (R. M. Waters), 1 female; SARA Site 4 Cave, 17 Nov. 1993 (G. Veni), 1 penultimate male; 6 June 1994 (J. Ivy, G. Veni), 1 penultimate male; Stealth Cave, Camp Bullis, 25 Jan. 2000 (J. Reddell, M. Reyes), 1 immature; Stevens Ranch Cave No. 1, 1 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni), 1 male, 5 females, 1 immature; Voight's Bat Cave, 13 Sept. 1984 (S. Harden, G. Veni), 1 female, 1 penultimate male; Wren Cave, 8.3 mi. NE Helotes, 12 August 1994 (A. G. Grubbs), 1 female (JCC); Young Cave No. 1, 6 Sept. 1993 (J. Reddell, M. Reyes), 1 female. *Blanco County*: Forest View Cave, 20 Feb. 1983 (W. R. Elliott), 2 penultimate males; T Cave, 17 April 1982 (B. Vinson), 1 female, 2 immatures. *Burnet County*: Waldman Cave, 5 mi. W Spicewood, 30 March 1995 (A. G. Grubbs, G. Waid), 3 immatures. *Comal County*: Coreth Bat Cave, 28 Oct. 1995 (J. Reddell, M. Reyes), 2 immatures. *Coryell County*: Chigiouxs' Cave, Fort Hood, 22 Nov. 1994 (M. Warton), 1 male; Mixmaster Cave, Fort Hood, 9 Sept. 1997 (L. J. Graves, D. McKenzie, J. Reddell, M. Reyes), 2 immatures; Plateau Cave No. 1, Fort Hood, 23 March 1990 (J. Reddell, M. Reyes), 1 female; Tippit Cave, Fort Hood, 24 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 2 immatures or females (abdomens missing); 31 Jan. 1992 (J. Reddell, M. Reyes), 1 female; 22 April 1998 (L. J. Graves, J. Reddell, M. Reyes), 1 female. *Crockett County*: 0-9 Well, 31 July 1988 (G. Veni, A. Cobb, J. Ivy), 3 females, 1 immature. *Hays County*: Grapevine Cave, 7 mi. W Wimberly, 23 April 1995 (A. G. Grubbs, C. Vreeland), 1 female, 1 immature; McCarty Cave, 14 March 2000 (J. Kennedy, J. Jenkins, J. Fant), 1 female; Wiseman Sink, 30 April 1995 (A. G. Grubbs), 1 female, 2 immatures. *Kendall County*: Sattler's Deep Pit, 10 July 1994 (A. G. Grubbs), 3 females, 1 immature. *Llano County*: Enchanted Rock Cave, 14 April 1985 (W. Elliott, J. Reddell), 1 female. *Medina County*: Valdina Farms Sinkhole, 9 Dec. 1984 (J. L. Ivy), 1 female. *Menard County*: Powell's Cave, 23 Feb. 1991 (G. Veni), 2 females; 26 June 1993 (G. Veni), 2 females; 28 Oct. 1989 (G. Veni), 2 females; 24 Feb. 1995 (G. Veni), 1 immature from Downstream Section; 23 Oct. 1993 (J. Ivy, G. Veni), 1 male, 2 females, 3 immatures from Downstream Section (JCC). Silver Mine Cave, 21 Aug. 1982 (D. L. Pate), 1 immature. *Sutton County*: Caverns of Sonora, 25 Oct. 1993 (G. Veni), 1 female, 1 immature. *Travis County*: Brodie Sink, 6 Nov. 1990 (J. Reddell, M. Reyes, M. Warton), 6 immatures; Driskill Cave, Aug. 1990 (W. Russell, J. Wolff), 1 female; Flint Ridge Cave, 19 Jan. 1989 (M. Grimm, J. Reddell, M. Reyes), 1 female; Ireland's Cave, 23 Jan. 1989 (E. Grimm, M. Grimm, J. Reddell, M. Reyes), 1 female; Jester Pit, 8 Oct. 1996 (M. Sanders), 1 female, 1 immature; Kretschmarr Salamander Cave, 21 April 1984 (J. Reddell, M. Reyes), 1 immature (labeled by Gertsch as *E. rostrata*, but has large distinct eyes); Midnight Cave, 4 May 1985 (P. Sprouse), 1 female, 2 immatures; Moonmilk Cave (9K-2), Spicewood Springs Road, Austin, 11 Feb. 1995 (W. Elliott, P. Sprouse), 1 immature; Spider Cave, 14 April 1991 (W. Elliott), 1 female; Spyglass Cave, 8 Dec. 1997 (M. Sanders), 2 females; Whirlpool Cave, 29 July 1990 (A. Grubbs, J. Reddell), 1 immature; Wooden Derrick Cave, 14 April 1991 (W. Elliott), 1 female. *Val Verde County*: Emerald Sink, 31 March 1984 (R. M. Waters), 2 immatures; 3 Nov. 1984 (J. Reddell, M. Reyes), 3 males, 7 females, 25 immatures; H. T. Miers Cave, 24 Oct. 1987 (P. Sprouse), 3 females, 2 immatures; 5 Nov. 1988 (P. Sprouse), 2 females; Seminole Sink, Seminole Canyon State Historical Park, 21 May 1984 (R. Ralph, L.

Bement), 3 females. *Williamson County*: Agave Cave, 6 April 1994 (J. Reddell, M. Reyes), 1 female; Argo Cave, 25 March 1994 (J. Reddell, M. Reyes), 1 immature; The Bat Well, 4 March 1988 (J. Reddell, M. Reyes), 1 female, 2 immatures; Beck Creek Cave, 3 June 1996 (J. Reddell, M. Reyes), 1 male; Beck Pride Cave, 29 May 1996 (J. Reddell, M. Reyes), 1 immature; Beck Ranch Cave, 9 March 1989 (J. Reddell, M. Reyes), 2 females; Brents Bad Air Cave, April 1994 (M. Warton), 1 immature; Brown's Cave, 23 April 1987 (W. Elliott, J. Reddell, M. Reyes), 1 male; Cassidy Cave, 13 June 1996 (M. Warton), 1 male, 1 female; Cobb Caverns, 11 Feb. 1990 (M. Grimm), 1 male; Deliverance Cave No. 1, 18 Nov. 1993 (J. Reddell, M. Reyes), 2 females, 1 immature; 19 April 2000 (J. Reddell, M. Reyes), 1 female; Do Drop In Cave, 23 Nov. 1993 (J. Reddell, M. Reyes), 1 female; 28 July 1995 (W. Elliott), 1 female; 28 Nov. 1995 (W. Elliott), 1 female; Duckworth Bat Cave, 11 April 1994 (J. Reddell, M. Reyes), 1 female, 6 immatures; East Fork Fissure, Georgetown, 5 July 1991 (W. R. Elliott, D. Green), 1 female; Electro-Mag Cave, 24 July 1995 (J. Reddell, M. Reyes), 1 immature; 12 June 1996 (J. Reddell, M. Reyes), 1 immature; 26 March 2000 (J. Reddell, M. Reyes), 1 female; Florence Cave No. 18, 6 March 1994 (J. Reddell, M. Reyes), 1 immature; Hatchet Cave, 6 March 1994 (J. Reddell, M. Reyes), 1 immature; Holler Hole Cave, 12 June 1996 (J. Reddell, M. Reyes), 1 female; Kiva Cave No. 1, 6 Feb. 1994 (J. Reddell, M. Reyes), 2 females, 1 immature; 6 March 1994 (J. Reddell, M. Reyes), 1 female; 22 July 1995 (J. Reddell, M. Reyes), 2 females, 2 immatures; 30 Sept. 1995 (J. Reddell, M. Reyes), 1 female; Lorfing's Unseen Rattler Cave, 10 Nov. 1990 (W. Elliott, J. Reddell, M. Reyes), 1 female; Off Campus Cave, 8 April 1989 (W. Elliott, J. Reddell, M. Reyes), 6 males, 3 females, 1 immature, 42 eggs; Onion Branch Cave, 29 April 1998 (J. Reddell, M. Reyes), 2 females, 3 immatures; Polaris Cave, 19 April 1994 (J. Reddell, M. Reyes), 1 female, 1 immature; Reach-Around Cave, 25 March 2000 (J. Reddell, M. Reyes), 2 immatures; Rockfall Cave, 27 April 1993 (J. Reddell, M. Reyes), 1 female; Steam Cave, 19 May 1985 (J. Reddell, M. Reyes), 5 females, 6 immatures; Soreped Cave, 28 April 1990 (P. Sprouse), 1 immature; Sting Cave, 28 Sept. 1995 (P. Sprouse), 1 male; Texella Cave, 15 Sept. 1995 (A. G. Grubbs), 1 male, 2 females, 6 immatures; 8 April 1996 (M. Warton), 1 male, 3 females; Trail of Tears Cave, 18 Nov. 1993 (J. Reddell, M. Reyes), 1 immature; 16 April 1994 (J. Reddell, M. Reyes), 3 immatures; Turner Goat Cave, 8 April 2000 (J. Reddell, M. Reyes), 1 immature; War Party Cave, 10 April 1994 (J. Reddell, M. Reyes), 2 immatures.

Eidmannella reclusa Gertsch

Comments.—This species was previously known with certainty only from Tooth Cave, but tentatively identified from two other nearby caves. The five new caves in which this species has been found are all located in the same general area of Travis County.

New and Verified Records.—*Travis County*: McDonald (=Schultz) Cave, 18 May 1984 (D. Pate, J. Reddell, M. Reyes), 1 female, 3 immatures (labeled by Gertsch as *E. rostrata*); Plethodon Cave, 25 May 1991 (J. Reddell, M. Reyes), 1 male, 1 female, 2 immatures; Puzzle Pit, 16 Jan. 1995 (M. Warton), 4 immatures; 11 April 1995 (A. G. Grubbs, G. Waid), 1 female, 1 immature [1 female JCC]; Stovepipe Cave, 25 Oct. 1990 (J. Reddell, M. Reyes), 1 male, 2 females, 2 immatures; 25 Oct. 1990 (L. Sherrod), 2 immatures; Tooth Cave, 7 April 1984 (M. Reyes), 1 female; Twelve Foot Dome Pit, 18 March 1997 (M. Warton), 1 female; Ulls Water Cave, 31 March 2000 (M. Warton), 1 penultimate male; 27 April 2000 (M. Warton), 1 female, 1 immature.

Eidmannella rostrata Gertsch
Fig. 1

Comments.—Ives (1935, 1947), Kaston (1948), Nakamura and Kuramoto (1973), Gertsch (1984), and Reeves (1999) reported that female *Eidmannella pallida* (Emerton), *Nesticus akiyoshiensis* (Uyemura), *Nesticus barri* Gertsch, *Nesticus carteri* Emerton, *Nesticus cellulanus* (Clerck), and *Nesticus georgia* Gertsch drag their egg sacs, attached to the spinnerets. Nobuo Tsurusaki (pers. comm., 9 Aug. 1996) informed us that he had seen many female *Nesticus yezoensis* Yaginuma dragging egg sacs during his field studies in Masruyama, Sapporo, Japan. To this list we can add the troglobitic species *E. rostrata* from Texas; which one of us (JCC) observed dragging an egg sac in captivity. JCC (while in the company of Hedin, Reeves, and Reeves) also observed several females (at least 2 species of cavernicolous *Nesticus*) dragging egg sacs in the Great Smoky Mountains National Park, Tennessee. Although not stated to be dragging the egg sacs, Gertsch (1984) recorded that a collection of *Gaucelmus augustinus* Keyserling from Texas also included egg sacs. Presumably, these either were in close proximity to the females or were being drug by the females. We are unaware of any records of egg sac dragging by other genera of nesticids, but this does not mean that it does not occur. Some *Theridion* spp. (Theridiidae) also drag their egg sacs attached to their

spinnerets (Roberts, 1995), so this behavior may have occurred in the Theridiidae + Nesticidae ancestor.

A female *E. rostrata* collected in Up the Creek Cave, Bexar County, Texas on 14 Nov. 1995 was returned to Lubbock and placed alone in a terrarium. During her time in captivity (cut short by a need for fresh nesticids for a DNA study in the summer of 1996), she produced three fertile egg sacs (producing both male and female offspring). The first eggs were laid in early April, the second on or about 13 May, and the third about one month later in 1996. As this spider was only being maintained as a curiosity, detailed notes were not maintained. The emergence of the young was observed only from the second sac. In each case, the female would sit in the web or on a rock from which the web was connected with the sac being attached to her spinnerets. This attachment was quite strong. It was possible to grasp the sac by a pair of fine-tipped forceps and pull until lifting the spider off the substrate. Only after considerable agitation and pulling would the female drop the sac. Gertsch (1984) suggested that since nesticid spiders do not stray far from their webs that dragging the egg sac could serve as a protective function.

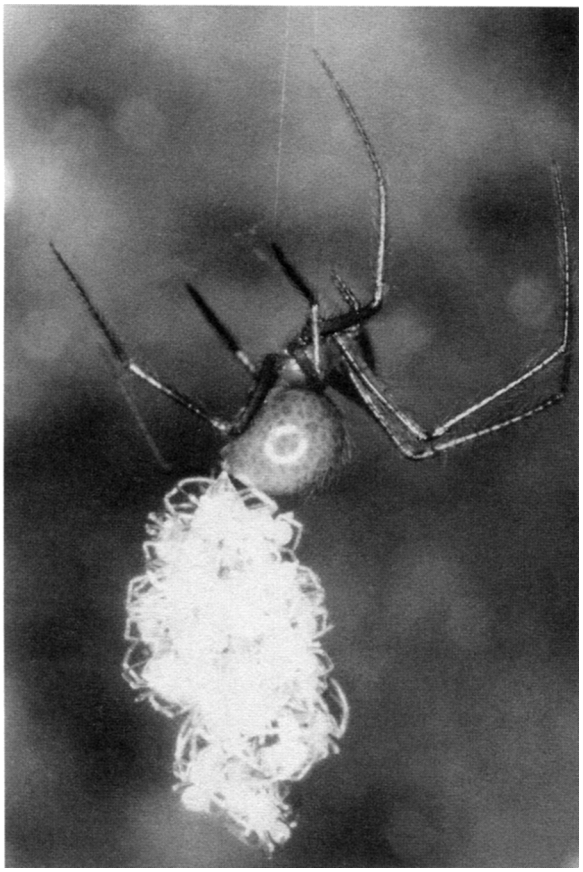


Fig. 1.—Mother *Eidmannella rostrata* from Up the Creek Cave, Bexar County, Texas and her two-day-old babies.

Petrunkevitch (1926) recorded his observations on the emergence of *E. pallida* (listed as *Bathyphantes ovigerus*) and made no mention of the spiderlings staying in the web of the mother, indicating that the spiderlings disperse shortly after leaving the egg sac. Likewise, Ives (1947) stated for the troglophilic *Nesticus carteri*: "The female spiders attach their cocoons or egg cases to the posterior part of their abdomen and drag them thus until the little spiderlings come out and 'shift for themselves.'" Only a single other observation of emergence has been published. In that case, Nakamura and Kuramoto (1973) photographed and described the event, but did not state how long the *N. yezoensis* spiderlings remained with their mother. In the case of the *E. rostrata*, which is a troglobite, the spiderlings remained on the outside of the egg sac for approximately three days after emergence (Fig. 1). After leaving the outside of the sac, the spiderlings moved onto the mother's web. The majority of the spiderlings remained on her web for another three days before they dispersed throughout the terrarium and built their own webs. Whether this is the first record of post-emergence maternal care or post-emergence tolerance is uncertain. The spiderlings were not observed to be fed by the female while in the web.

A female collected in Cross the Creek Cave, Bexar County, on 14 Nov. 1995 produced a fertile egg sac on 10 May 1996. Another female collected in Snakeskin Pit, Comal County, on 19 Nov. 1996 produced an egg sac on 7 Jan. 1997. Two virgin females from that egg sac survived in captivity until the first week of Dec. 1998. Sperm storage of up to half a year coupled with a relatively long life span (documented for about two years) could account for the ease in which this spider populates caves. This may also help explain how this species exhibits so much variation in morphological characters. Conceivably, a single female finding access to a new cave via cracks or other interstitial spaces in the soil could result in founding a colony with a genetic bottleneck.

Like *E. pallida*, this species apparently exhibits considerably variation. In Williamson and Burnet counties 8-eyed individuals occur. Those from Comal and Travis counties have the anterior median eyes missing in some specimens and the remaining eyes are reduced in size and none have pigment associated with the eyes. Specimens from Kinney County have the eyes about 1/2 the size of those from more northern counties and those from Uvalde County are essentially eyeless. These are just generally trends as essentially eyeless populations are also known from some caves in Comal County. Throughout the range, the coloration of the body is white to amber and does not appear to be correlated with the size of the eyes. Possibly the

coloration is more related to the age of the animal, with older animals being darker. The specimens which have been kept alive in captivity appear to darken with age, but no precise measurements have been made. Because of the incomplete loss of eyes, we assume this is a relatively recent troglobite and it may be for this reason that we are not actually able to distinguish a complex of closely related species. This is mostly the case because in order for an animal to evolve into a troglobite, it must remain isolated underground without a continual influx of genetic material from the surface populations. Once isolated there is no way for genetic exchange between spiders isolated in the different geographically/geologically isolated regions of the state. All isolated populations would convergently evolve troglomorphic characters which would make them difficult to separate by external morphology. Being isolated, there would not be a need to modify the genitalia, which are in themselves supposedly mechanisms to keep different species from interbreeding and wasting gametes. Hedin (1997) working with eastern USA nesticids from caves found that mtDNA sequence data could resolve morphologically similar lineages into populational phylogenetic units. Hopefully, this approach can be taken with Texas samples in the future.

This species is usually found hanging from webs in small pockets in flowstone or cave walls.

New and Verified Records.—*Bandera County*: Albino Bat Cave, 3 March 1984 (R. Waters, B. Cowell, J. Ivy), 2 females, 1 immature; Haby Salamander Cave, 9 Sept. 1984 (S. Harden), 1 female, 2 immatures; 31 Oct. 1984 (S. Harden, J. L. Ivy), 1 male. *Bexar County*: Backhole, 31 Jan. 1991 (L. McNatt), 1 penultimate male; 7 June 1994 (J. Ivy, G. Veni), 2 females; 20 Sept. 1994 (W. R. Elliott, J. Ivy), 1 immature; 9 Sept. 1998 (J. Cokendolpher, J. Krejca), 5 females, 1 immature; Banzai Mud Dauber Cave, 5 Dec. 1994 (P. Sprouse, C. Savvas), 1 female, 2 immatures; 5 Oct. 1995 (J. Reddell, M. Reyes), 1 female, 1 immature; Bone Pile Cave, Government Canyon State Natural Area, 29 Sept. 1996 (G. Veni), 2 females, 1 immature; 24 May 1998 (J. Reddell, M. Reyes), 5 females, 9 immatures; Breached Dam Cave, 29 March 1995 (J. Reddell, M. Reyes), 1 female, 3 immatures; 4 Oct. 1995 (J. Reddell, M. Reyes), 1 female, 5 immatures; Bullis Hole, 20 Nov. 1996 (W. Elliott), 1 female; Caracol Creek Coon Cave, 26 Aug. 1987 (A. Cobb, S. Harden), 2 females; 15 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni), 1 male, 1 female, 9 immatures [1 male, 1 female JCC]; Cave of the Half-Snake, April 1982 (G. Veni), 1 female; Cave No. 18, 4 mi. NE Helotes, 13 Jan. 1995 (A. G. Grubbs), 3 females, 1 immature (JCC); Cave site #2101 (Government Canyon Karst Fauna Region), 11 May 2000 (H. Bechtol, K. White), 4 males, 2 females, 7 immatures; Charley's Cute Little Hole, 30 March 1995 (J. Reddell, M. Reyes), 1 female; Cross the Creek Cave, 31 March 1995 (J. Reddell, M. Reyes), 1 male, 3 females, 2 immatures; 6 Oct. 1995 (J. Reddell, M. Reyes), 1 male, 4 females; 14 Nov. 1995 (J. C. Cokendolpher, J. R. Reddell, M. Reyes), 1 female (JCC); Eagles Nest Cave, 9 Nov. 1993 (J. Ivy, J. Treviño, G. Veni), 2 females, 7 immatures; 15 Nov. 1993 (J. Ivy, L. McNatt, G. Veni), 1 female, 3 immatures; 9 Sept. 1998 (J. Reddell, M. Reyes), 1 female; Flach's Cave, 2 Feb. 1999 (P. Sprouse, G. Veni), 1 female, 1 immature; Flying Buzzworm Cave, 9 Jan. 1995 (J. Reddell, M. Reyes), 2 females, 2 immatures; 4 Oct. 1995 (J. Reddell, M. Reyes), 2 males, 2 females, 2 immatures; 17 Nov. 1997 (P. Sprouse, G. Veni), 2 females, 2 immatures; Game Pasture Cave No. 1, 2 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni), 1 penultimate male, 4 females, 7 immatures; Georg's Hole, 20 Nov. 1996 (B. Johnson), 1 immature; Government Canyon Bat Cave, Government Canyon State Natural Area, 24 May 1998 (J. Reddell, M. Reyes), 1 female, 1 immature; Headquarters Cave, 16 June 1993 (S. Harden, J. Reddell, M. Reyes, G. Veni), 3 females, 1 immature; 29 Nov. 1993, M. Reyes, 1 female, 2 immatures (JCC); 3 females, 1 immature; 14 Nov. 1995 (J. C. Cokendolpher, J. Reddell, M. Reyes), 2 females, 1 immature; 12 March 1998 (W. Elliott), 1 female; 20 Oct. 1997 (W. Elliott), 1 female; 24 Jan. 1996 (W. R. Elliott), 1 immature; 5 April 1996 (W. R. Elliott), 1 male, 1 immature; 18 March 1998 (W. Elliott), 1 female; Helotes Blowhole, 25 Dec. 1982 (R. M. Waters), 2 females; Hold Me Back Cave, 3 March 1994 (W. Elliott, L. McNatt), 1 female; Isocow Cave, 15 Dec. 1993 (G. Veni), 1 female, 1 immature; 2 March 1994 (W. Elliott, G. Veni), 2 females, 3 immatures; Isopit, 4 Dec. 1983 (S. Harden, J. Ivy), 2 immatures; 1984 (R. M. Waters), 2 females, 2 immatures; 8 Jan. 1984 (S. Harden, R. Waters), 2 females; 17 Sept. 1984 (G. Veni, J. Ivy), 1 female, 1 immature; 15 June 1993 (J. Loftin, J. Reddell, M. Reyes), 2 females, 1 immature; Low Priority Cave, 9 Jan. 1995 (J. Reddell, M. Reyes), 1 female, 2 immatures; 29 March 1995 (J. Reddell, M. Reyes), 1 female;; 4 Oct. 1995 (J. Reddell, M. Reyes), 2 females, 1 immature; 8 Sept. 1998 (J. Cokendolpher, J. Reddell, M. Reyes), 1 female; MARS Shaft, 4 March 1994 (W. Elliott), 2 females, 1 immature; Mattke Cave, 10 June 1993 (D. McKenzie, J. Reddell, M. Reyes), 2 females; Poison Ivy Pit, 15 Aug. 1981 (R. Waters, K. Menking, E. Short), 1 female; 17 June 1993 (J. Reddell, M. Reyes), 2 females; Robber Baron Cave, San Antonio, 3 April ? (A. G. Grubbs), 4 immatures; 11 Dec. 1982 (R. M. Waters), 1 female; 6 April 1983 (R. M. Waters), 1 penultimate male; 1 May 1983 (R. M. Waters), 2 females, egg sac; 9, 11 Dec. 1983 (S. Harden, R. Waters), 2 females, 3 immatures; 8 March 1987 (J.

Reddell, M. Reyes), 3 females, 2 immatures; 22 May 1993 (J. Reddell, M. Reyes), 10 females; Stahl Cave, Lower Level, 8 Sept. 1998 (M. Reyes), 4 females, 1 immature; Surprise Sink, Government Canyon State Natural Area, 24 May 1998 (J. Reddell, M. Reyes), 1 female, 1 immature; Up the Creek Cave, 30 March 1995 (J. Reddell, M. Reyes), 1 female, 1 immature; 10 Sept. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), 2 females; Winston's Cave, 13-14 Dec. 1993 (J. Ivy, L. McNatt, G. Veni), 2 females, 2 immatures; 1 Feb. 1994 (L. McNatt), 1 immature; 1 Feb. 1994 (W. Elliott), 1 male, 2 females, 1 immature (JCC); 21 Sept. 1994 (W. R. Elliott, J. Ivy), 1 immature; Wurzbach Bat Cave, 4-5 Jan. 1984 (S. Harden), 1 female, 2 immatures; 25 June 1993 (D. Bowles, A. Grubbs, J. Reddell, M. Reyes, R. Stanford), 1 female. *Burnet County*: Big Bad Wolf Cave, 5 mi. NW Spicewood, 15 May 1993 (A. G. Grubbs, S. Brossard, T. Whitfield), 1 female, 2 immatures; MVN Cave, 5 mi. W Spicewood, 21 Feb. 1995 (A. G. Grubbs), 1 penultimate male; 17 July 1995, A. G. Grubbs, 1 female (JCC). *Comal County*: Badweather Pit, 30 Jan. 1988 (D. Pate), 1 male, 1 female; Bender's Cave, 13 Sept. 1987 (D. Arburn, A. Cobb), 3 females, 1 immature; Camp Bullis Bad Air Cave, 23 Oct. 1996 (G. Veni, P. Sprouse), 1 female, 1 immature; 22 Nov. 1996 (B. Johnson, J. Reddell, M. Reyes), 1 female; Camp Bullis Bat Cave, 21 Oct. 1996 (G. Veni, J. Ivy, A. Scott), 2 females; 19 Nov. 1996 (W. Elliott), 2 females; Camp Bullis Cave No. 1, 22 Oct. 1996 (G. Veni), 1 female, 2 immatures; 21 Nov. 1996 (B. Johnson, J. Reddell, M. Reyes), 6 females, 6 immatures; 8 April 1998 (J. Reddell, M. Reyes), 1 immature; 26 May 1998 (J. Reddell, M. Reyes), 2 females; 18 Jan. 2000 (J. Reddell, M. Reyes), 1 male, 2 immatures; Camp Bullis Cave No. 3, 29 Oct. 1996 (G. Veni), 3 females, 2 penultimate males; 21 Nov. 1996 (B. Johnson, J. Reddell, M. Reyes), 3 females, 7 immatures; Ebert Cave, 30 Jan. 1988 (J. Reddell, M. Reyes), 2 females, 3 immatures; Grosser's Sink, 14 May 1993 (A. G. Grubbs, P. Chippendale), 1 female; Just Now Cave, 14 Nov. 1996 (G. Veni, P. Sprouse), 2 females, 1 immature; 21 Nov. 1996 (B. Johnson), 1 female from lower level; Klar's Cave, 12 March 1988 (J. Spence, G. Veni), 2 females; Natural Bridge Caverns, 23 Sept. 1989, (O. Knox, J. Reddell, M. Reyes), 1 female; 1 March 1990 (O. Knox, J. Reddell, M. Reyes), 1 female; Preserve Cave, Honey Creek Preserve, 12 May 1984 (P. Sprouse), 1 male; Snakeskin Pit, 1 Nov. 1996 (G. Veni), 1 female; 19 Nov. 1996 (W. R. Elliott), 1 female; Wiley's Cave, 7 March 1988 (A. Cobb, G. Veni), 1 female, 1 immature. *Kendall County*: A Hole, 1 Oct. 1988 (G. Veni, K. Markette), 2 females, 1 immature; Cascade Caverns, 19 Oct. 1984 (R. Waters, J. Ivy), 1 female from lower level; Cueva de los Tres Bobos, 2 Aug. 1987 (A. Cobb, S. Harden, G. Veni), 1 male, 6 immatures; Forget-Me-Not Cave, 3 Oct. 1987 (G. Veni), 2 females, 2 immatures; Forlorn Hole, 30 Jan. 1988 (L. Palit), 1 female; Georgia W. Cave, 16 Nov. 1986 (R. M. Waters, K. Menking), 2 females, 1 immature; Glen Rose Cave, 4 March 1999 (M. Reyes, M. Warton), 1 male; Grand Column Cave, 1-5 March 1999 (M. Reyes), 1 female, 2 immatures; Hal's Cave, 22-26 Feb. 1999 (M. Reyes), 1 female, 3 immatures; 4 March 1999 (J. Killian, R. Price), 1 female, 2 immatures; Jan's Fissure, 6 March 1988 (J. Ivy, G. Veni), 2 females, 24 eggs; Knee Deep Cave, 9 Aug. 1984 (S. J. Harden), 1 immature; 5 May 1985 (J. Reddell, M. Reyes), 1 male, 1 female, 1 immature; Schwarz Cave, 12 Sept. 1987 (J. Ivy, G. Veni), 7 females, 3 immatures; Two Step Cave, Schmidt Ranch, 2 May 1981 (R. M. Waters), 2 females. *Kinney County*: Baker's Crossing Cave, 30 April 1995 (A. G. Grubbs), 4 females, 4 immatures. *Medina County*: Windmill Cave, 10 Nov. 1984 (S. J. Harden, J. L. Ivy), 1 female, 1 immature. *Travis County*: Feather Sink, 2 July 1990 (J. Reddell, M. Reyes), 1 female; Five Pocket Cave, 9 Nov. 1993 (Keeley, Horvath), 1 female; Jack's Joint, 23 Sept. 1990 (J. Reddell, M. Reyes), 2 females, 1 immature. *Uvalde County*: Barn-Sized Fissure Cave, 15 mi. N Sabinal, 17 March 1993 (A. G. Grubbs), 3 females, 1 immature. *Williamson County*: Double Dog Hole Cave, Sun City, 8 April 2000 (J. Reddell, M. Reyes), 1 female, 1 immature; East Fork Fissure, Georgetown, 12 July 1991 (W. R. Elliott, D. Allen), 16 females, 1 immature; 13 June 1995 (J. Reddell, M. Reyes), 11 females, 2 immatures; Temples of Thor Cave, 13 May 1991 (J. Reddell, M. Reyes), 3 immatures.

Eidmannella tuckeri, new species

Figs. 2-7

Type data.—The female holotype and immature paratype were collected in Phantom Lake Cave, Jeff Davis County, Texas, October 1996 (W. Tucker). The holotype is deposited at the American Museum of Natural History and the paratype at TMM.

Etymology.—This species is named in honor of the collector, William (Bill) Tucker of Grand Prairie, Texas.

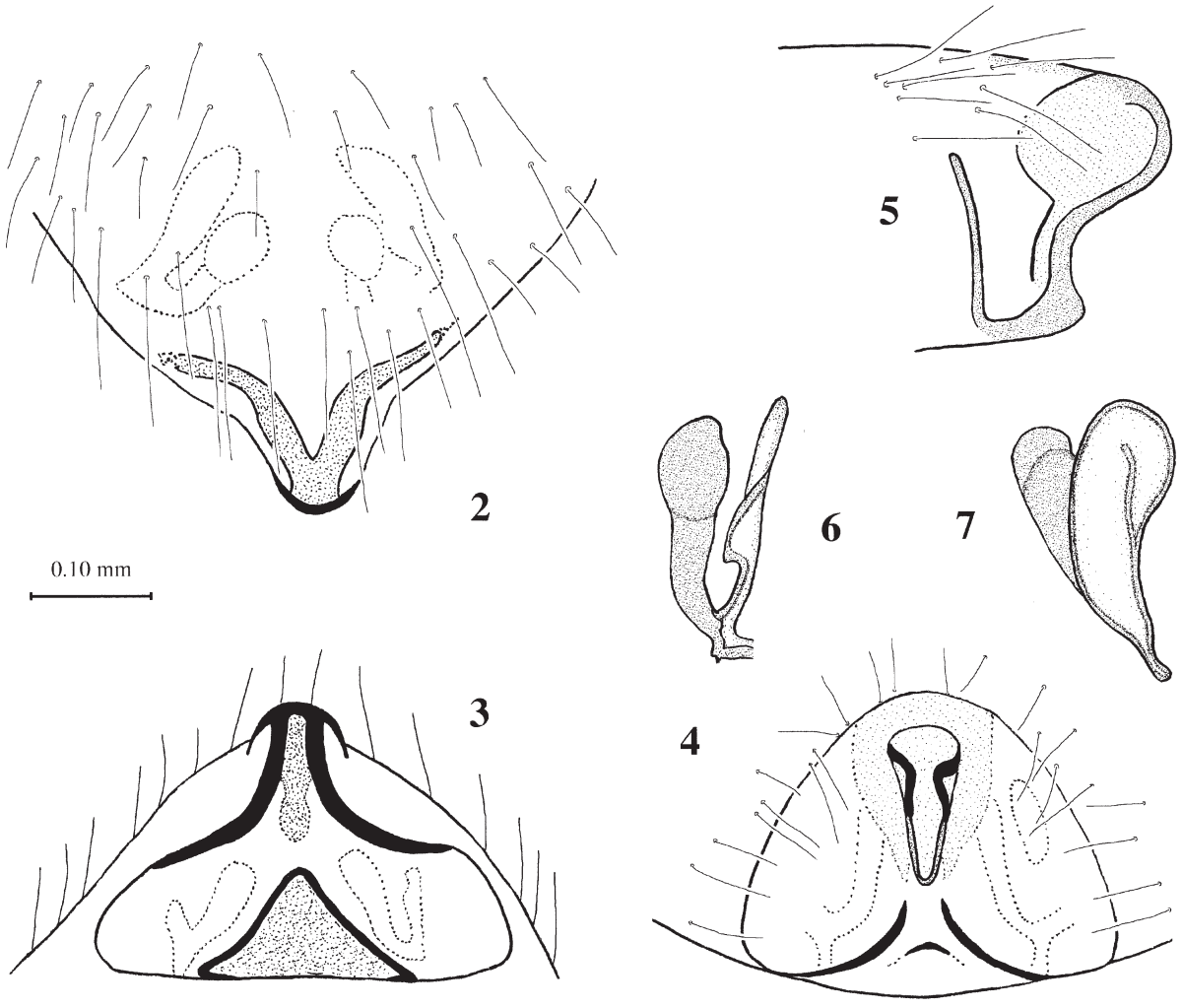
Diagnosis.—Depigmented troglobite with greatly reduced or missing eyes; legs medium length (first leg 5.8 times as long as cephalothorax); epigynum with anterior septum forming a rounded enlargement; median spermathecal bulb elongate and slightly shorter than lateral coils, stalk of median bulb thick.

Description.—Female: Total length 2.23 mm; cephalothorax 1.04 mm long, 0.92 mm wide; abdomen slightly overhanging cephalothorax, 1.20 mm long, 1.03 mm wide; body white; appendages pale yellow without

pattern; without any trace of eyes. Leg formula 1423; first leg 5.8 times, first femur 1.6 times as long as cephalothorax. Appendage lengths Table 1. Epigynum with anterior septum forming a rounded enlargement; in lateral view septum base forming a smooth straight line with anterior portion of epigynal plate; spermatheca with median bulb elongate, terminally enlarged, slightly shorter than lateral coils; lateral coils flattened and slightly twisted.

Immature (presumably male, slightly enlarged palps): Total length 1.52 mm; entire animal white. Differs from holotype by having very small anterior lateral eyes and almost undetectable anterior median eyes; positions of other missing eyes indicated by faint brown pigment.

Evolution.—Gertsch (1984) theorized that the various troglobitic species of *Eidmannella* in Texas all evolved from *E. pallida*. *Eidmannella pallida* is found throughout much of the state today, as well as most of North and Central America and the West Indies. Gertsch suggested that this species is very plastic and upon entering caves it would quickly adapt to the environment and develop troglobitic features (depigmentation, loss of eyes, long appendages). He maintained both the surface forms (*suggerens* phenotype) and cavernicolous forms (*pallida* phenotype) were the same species as both the male and female genitalia were essentially the same. Only when he could detect differences in the genitalia of the cave forms were they recognized as full species. If his proposal is correct, *E. tuckeri* might also have evolved from *E. pallida* which invaded the Phantom Spring Cave. This invasion would have been prior to the desertification of the region as no surface *E. pallida* are now known from the Trans-



Figs. 2-7.—Female holotype of *Eidmannella tuckeri,* n. sp.; 2-5 Epigynum: 2, anteroventral view; 3, posterior view; 4, subventral; 5, retrolateral view. 6, ventrolateral view of right spermatheca; 7, retrolateral view of right spermatheca.

Table 1.—Appendage lengths (in mm) of female holotype of *Eidmannella tuckeri*, new species.

	I	II	III	IV	Palp
Femur	1.66	1.42	1.13	1.68	0.44
Patella	0.49	0.42	0.34	0.42	0.14
Tibia	1.63	1.20	0.80	1.29	0.29
Metatarsus	1.52	1.17	0.88	0.46	—
Tarsus	0.77	0.68	0.58	0.68	0.53
Total	6.07	4.21	3.73	4.52	1.40

Pecos region of Texas (Gertsch, 1984: map 8). With this in mind, it is remarkable how similar *E. tuckeri* is to *E. reclusa*. Although these two species are on the two extremes of the geographical ranges (*E. tuckeri* in the west, *E. reclusa* in the east) of troglobitic *Eidmannella* in Texas, they share the unique form of the spermathecae (Gertsch, 1984: fig. 290) and the even surface between the anterior portion of the epigynum and the anterior septum. It also seems odd that new cavernicolous species of *Eidmannella* only developed in Texas caves, but not in any of the other cave populations in North and Central America or the West Indies. *Nesticus* spp. succeeded at speciation in the caves of North America. If *E. pallida* is as plastic of a species as suggested by Gertsch, more troglobitic *Eidmannella* spp. should have developed outside of Texas. When the males of *E. tuckeri* and *E. reclusa* are discovered, it will be interesting to see if they both share unique characteristics. We suggest that it is more reasonable to predict that the ancestor(s) to the cavernicolous *Eidmannella* from Texas invaded the caves before the arrival of *Eidmannella pallida*. Because of changing climates this ancestor(s) could have then perished on the surface. This is especially evident in the three records listed in the introduction where *E. pallida* and *E. rostrata* were collected in the same cave. In these cases the *E. pallida* collected were fully eyed and not some intermediate stage between the two species. In order for Gertsch's theory to have worked in these two widely separated caves, *E. pallida* would have had to invade the cave; then evolve into a second species with the elimination of the invading species; and then reinvade the cave with the original eyed species.

Habitat and biology.—Both spiders were obtained within Phantom Spring Cave. Access to the collection area is only possible by diving with scuba gear up the stream into the cave. Bill Tucker (pers. comm., 25 Nov. 1996) reported the following about the collections: "The spiders that I collected were on or near non-descript, irregular-shaped webs. More like random strands of silk instead of webs. The larger one appeared to attack the isopod underwater in the collection container, and was still alive at least one hour later, still underwater. Do you suppose that they regularly feed on underwater critters? They were both found in an air pocket that I have good access to, and can actually stand on the bottom and observe & collect easily there. This is about 160-180' into the cave, where no light penetrates. There are a few small strands of roots coming down the wall and laying across a horizontal surface that is just about 1' above the water line. Cave ceiling is at least 6' above waterline, and one can actually climb out of the water here and continue in dry passage for about 60'. There were several isopods around the roots, and I saw at least one more spider there, but could not say if it was similar to those collected. "Bic" lighter would not burn in this room, so expect oxygen content too low to breathe. In another air pocket, further into the cave, I saw other spiders. Two I remember as being a little darker were within 2" of the waterline, aimed head down on the vertical wall, facing the water."

ACKNOWLEDGMENTS

We appreciate the support of cave owners who permitted access to their caves, and in some cases contracted biological research which produced information included in this report. Major cave owners include the Texas Parks and Wildlife Department and the U.S. Army's Camp Bullis and Fort Hood commands. The United States Fish & Wildlife Service provided funding for many of the Bexar County collections made in 1993.

We are especially grateful to Dusty Bruns at Camp Bullis and to Tim Buchanan, John Cornelius, Dennis Herbert, and B. R. Jones at Fort Hood for their assistance in obtaining access and locating caves.

Dr. Nobuo Tsurusaki (Tottori University) kindly provided a copy and a partial translation of the paper by Nakamura and Kuramoto. Dr. George Veni commented on a draft of the manuscript; for which we are grateful. We also thank the many cavers who have so diligently collected creatures in the caves of Texas. Special thanks go to William R. Elliott, Andy G. Grubbs, Scott Harden, Joe Ivy, Peter Sprouse, Marcelino Reyes, George Veni, Mike Warton, and Randy Waters for their special efforts to obtain spiders from Texas caves. William Tucker is thanked for his collection of the new species under unusually trying conditions. Some of the new records are based on identifications by Willis J. Gertsch and Darrell Ubick. Mr. Ubick also kindly sent copies of the papers by Ives. They are all thanked for their contributions to this report. Marshal Hedin, William C. and Will K. Reeves are thanked for their

conversations about nesticids and assistance while caving in the Great Smoky Mountains National Park. Specimens listed as JCC are in the personal collection of James Cokendolpher; all other specimens except the types from the American Museum of Natural History are in the Texas Memorial Museum.

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CAVE SPIDERS (ARANEAE) OF FORT HOOD, TEXAS, WITH DESCRIPTIONS OF NEW SPECIES OF *CICURINA* (DICTYNIDAE) AND *NEOLEPTONETA* (LEPTONETIDAE)

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ABSTRACT

All records are included for all spiders known from 85 caves and sinks on Fort Hood, Bell and Coryell Counties, Texas. The fauna includes at least 45 species, including four troglobites: *Cicurina* (*Cicurella*) *coryelli* Gertsch, *C.* (*C.*) *caliga* new species, *C.* (*C.*) *hoodensis* new species, and *C.* (*C.*) *mixmaster* new species. The first authenticated occurrence of two troglobitic *Cicurina* spp. in the same cave is reported. *Neoleptoneta paraconcinna* new species is also described and is probably cave-restricted.

INTRODUCTION

The Fort Hood Military Reservation is a large military base located in central (Bell and Coryell Counties) Texas. It is the U. S. Army's largest tactical armor training base and contains about 217,000 acres of land, much of which is underlain by the Edwards Limestone of Cretaceous Age. This geological formation is highly soluble and contains caves in many parts of Texas. Physiographically, Fort Hood is located in the Lampasas Cut Plains, an area of limestone-capped mesas separated from each other by streams and lakes. On Fort Hood, two significant streams, Cowhouse Creek to the south and Owl Creek to the north, have dissected the area. In addition, other limestone-capped mesas have been isolated by erosion associated with downcutting of smaller streams. This has allowed isolation and speciation to occur in different areas of Fort Hood.

David McKenzie and James Reddell made the first collections of spiders on Fort Hood in 1963 and 1964. At that time, they visited Nolan Creek Cave, Shell Mountain Bat Cave, and Tippit Cave. A single immature

blind spider of the genus *Cicurina* was found in Tippit Cave. David McKenzie, James Reddell, and Marcelino Reyes made the first return trip to Fort Hood in 1990 and 1991, collecting in several caves. Adult blind *Cicurina* were obtained from Tippit Cave, and Gertsch (1992) described the species as *Cicurina* (*Cicurella*) *coryelli*. In 1992, an active program of study of the caves and cave fauna of Fort Hood was initiated with funding provided by the U.S. Army Construction and Engineering Research Laboratory. This program continues to the present and has resulted in the accumulation of an extensive collection of spiders from 85 caves and sinks in all parts of Fort Hood.

At least 45 species of spider are presently recorded from the caves of Fort Hood. These include accidentals (species fallen or washed into caves), threshold troglophiles (species usually hanging in webs or found in leaf litter in the twilight zone just inside of entrances), dark-zone troglophiles (species showing no special adaptations to the cave environment but capable of reproducing in the cave), and troglobites (species restricted to the cave environment and exhibiting such morphological adaptations as loss or reduction of eyes and pigment and elongation of appendages).

The species of greatest interest to the study of cave fauna are the troglobitic species. Four species of unquestioned troglobitic spiders are presently known from Fort Hood, all belonging in *Cicurina* (*Cicurella*). This is an extremely speciose group with 51 species having been described from caves in Texas; of which 46 are true eyeless troglobites (Gertsch, 1992). Additional undescribed species have been discovered since 1992 and the number is expected to increase considerably as new cavernous areas of the state are studied. A possible fourth troglobite encountered is a *Neoleptoneta* sp. with reduced eyes and pigment.

MATERIALS AND METHODS

Unless indicated otherwise, all specimens are deposited in the collection of the Texas Memorial Museum (TMM). Other collections are: AMNH (American Museum of Natural History), JCC (J. Cokendolpher Collection). With the exception of a few specimens studied earlier by Dr. W. J. Gertsch, Cokendolpher has identified all material.

ACKNOWLEDGMENTS

We are especially grateful to the following personnel at Fort Hood for their support throughout the process of studies on Fort Hood: Tim Buchanan, John Cornelius, Dennis Herbert, and B. R. Jones. B. R. Jones has been especially helpful in locating caves and assisting in access to artillery impact zones.

We are particularly grateful to Marcelino Reyes for his help in all aspects of fieldwork on Fort Hood; his collecting skills have been instrumental in obtaining much of the material upon which this report is based. While it may not be apparent to those that have not gone underground, it does take 3-4 people sometimes to access the deeper regions of a cave to catch a single tiny spider. Cave spider collecting is a team effort and we also thank the following cave explorers for their assistance in studying the caves and cave biology of Fort Hood: Doug Allen, Eddie Boyd, Lee Jay Graves, Jim Killian, Jean Krejca, Dan Love, David McKenzie, Rodney Price, Charley Savvas, Peter Sprouse, and Mike Warton.

Don Buckle (Saskatoon, Saskatchewan) kindly provided identifications or verifications of some of the linyphiids. His invaluable help is greatly appreciated.

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Norman I. Platnick (American Museum of Natural History, New York) and Darrell Ubick (California Academy of Sciences, San Francisco) are thanked for their reviews of the manuscript.

LIST OF SPECIES

Agelenidae

Agelenopsis sp.

Record.—*Bell County*: West Corral Sink, 3 May 2000 (J. Reddell, M. Reyes, M. Warton), 1 immature.

Comment.—This is an accidental. Because of the immature state it cannot be identified further.

Agelenopsis sp. prob. *aperta* (Gertsch)

Records.—*Bell County*: Hidden Chasm Cave, 18 May 1999 (J. Reddell), 1 immature; Skeeter Cave, 18 May 1999 (L.J. Graves, J. Reddell, M. Reyes), 1 immature.

Comment.—This is an accidental. Because of their immature state, these cannot be identified for certain.

Agelenopsis aperta (Gertsch)

Record.—*Bell County*: Rock Ring Sink, 13 May 1999 (J. Reddell), 1 male, 1 penultimate male.

Comment.—This is an accidental.

Anyphaenidae

Anyphaena sp.

Record.—*Bell County*: Septum Pit Cave, Oct. 1995 (M. Warton & Associates), 1 immature.

Comments.—This is an accidental found at the bottom of the cave entrance. Because of its immature state, it cannot be identified further.

Araneidae

Undetermined genus and species

Record.—*Bell County*: Fools Cave, 1 April 1999 (J. Reddell, M. Reyes), 1 immature; L.Z. Sid Sink, 3 May 2000 (J. Reddell, M. Reyes), 1 immature.

Comment.—These specimens are too immature for further identification.

Argiope aurantia Lucas

Argiope aurantia: Reddell, 1965:170.

Records.—*Bell County*: Medusa Cave, 18 Sept. 1997 (J. Reddell, M. Reyes), 1 female; Road Side Sink, 3 Nov. 1998 (J. Reddell); Seven Cave, 18 Sept. 1997 (J. Reddell).

Coryell County: Brokeback Cave, 16 Aug. 1964 (D. McKenzie, J. Reddell), 1 female (det. W.J. Gertsch) (AMNH) (Reddell, 1965); Mixmaster Cave, 9 Sept. 1997 (J. Reddell.

Comments.—The records for Road Side Sink, Seven Cave, and Mixmaster Cave are based on sight records of specimens resting in webs inside the entrance. This is a large colorful species that is easily recognized.

Hypsosinga singaeformis (Scheffer)

Record.—*Bell County*: Canyon Side Sink, 6 June 2000 (J. Reddell, M. Reyes), 1 male.

Comment.—This is an accidental.

Mangora sp.

Record.—*Coryell County*: Mixmaster Cave, 9 Sept. 1997 (L.J. Graves, D. McKenzie, J. Reddell, M. Reyes), 1 immature.

Comments.—This accidental is too immature for further identification. It was found at the bottom of the entrance drop.

Clubionidae

Undetermined genus and species

Record.—*Coryell County*: Plateau Cave No. 1, 23 March 1990 (J. Reddell, M. Reyes), 2 immatures (det. W.J. Gertsch) (AMNH).

Comments.—We have not seen this material. It may actually belong to the Corinnidae or Liocranidae.

Dictynidae

Cicurina (*Cicurella*) spp.

Cicurina spp.: Reddell, 1965:168.

Records.—*Bell County*: Buchanan Cave, 7 May 1998 (L.J. Graves, J. Reddell, M. Reyes), 3 immatures; 8 Nov. 1995 (D. Allen), 4 immatures; upper level, 13 June 2000 (J. Reddell, M. Reyes), 1 immature; Fellers Cave, 6 May 1998 (L.J. Graves, J. Reddell, M. Reyes), 3 immatures; Figure 8 Cave, 9 Feb. 1996 (M. Warton), 1 immature; Lucky Rock Cave, 22 Feb. 1996 (D. Allen, L.J. Graves, D. Love), 1 immature; 10 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 1 immature; 25 March 1999 (L.J. Graves, J. Reddell, M. Reyes), 1 immature; Owl Mountain Cave, 28 May 2000 (J. Reddell, M. Reyes), 2 immatures; 27 June 2000 (J. Reddell, M. Reyes), 1 immature; Peep in the Deep Cave, 8 May 1998 (J. Reddell, M. Reyes), 1 immature; 3 Nov. 1998 (J. Cokendolpher, J. Reddell), 2 immatures; Rugger's Rift Cave, 13 June 2000 (J. Reddell, M. Reyes), 1 damaged immature; Sanford Pit Cave, bottom of pit, 4 Nov. 1998 (J. Krejca), 1 immature; Seven Mile Mountain Cave, 11 April 1999 (R. Price, M. Warton), 1 immature; 28 June 2000 (J. Reddell, M. Reyes), 1 ?immature (abdomen missing); Streak Cave, 6 Oct. 1995 (M. Warton), 1 immature; 26 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 3 immatures; Treasure Cave, 21 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 immature; Triple J Cave, 23 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 2 immatures; 14 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 1 immature; Valentine Cave, 14 Feb. 1996 (M. Warton), 1 immature.

Coryell County: Big Red Cave, 30 April 1998 (J. Reddell, M. Reyes), 7 immatures; Egypt Cave, 13 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 1 immature; 23 Nov. 1994 (M. Warton), 1 immature; Mixmaster Cave, 9 Sept. 1998 (L.J. Graves, J. Reddell, M. Reyes), 3 immatures; 5 Nov. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), 4 immatures; Rocket River Cave System (Rocket River Cave), 16 Jan. 1992 (L.J. Graves,

Key to *Cicurina* from Caves on Fort Hood

1. With 8 well developed eyes.....*Cicurina* (*Cicurusta*) *varians*
   Without any trace of eyes.....*Cicurina* (*Cicurella*) spp. 2

2. Copulatory duct extending to anterior edge of spermathecal body (Figs. 1, 8, 10).....3
   Copulatory duct crossing over midline of spermathecae (Fig. 4).....*C. coryelli*

3. Index coil of copulatory duct at 90° to axis of spermatheca (Figs. 1, 4).....4
   Index coil of copulatory duct at 45° to axis of spermatheca (Fig. 8).....*C. mixmaster*

4. Index coil straight (Fig. 1).....*C. caliga*
   Index coil arched anteriorly (Fig. 10).....*C. hoodensis*

M. Warton, C. Savvas), 1 immature (det. W.J. Gertsch) (AMNH); 16 July 1993 (J. Reddell, M. Reyes), 1 immature; 27 Oct. 1994 (M. Warton), 3 immatures; Tippit Cave, 24 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 7 immatures; 31 Jan. 1992 (J. Reddell, M. Reyes), 2 immatures.

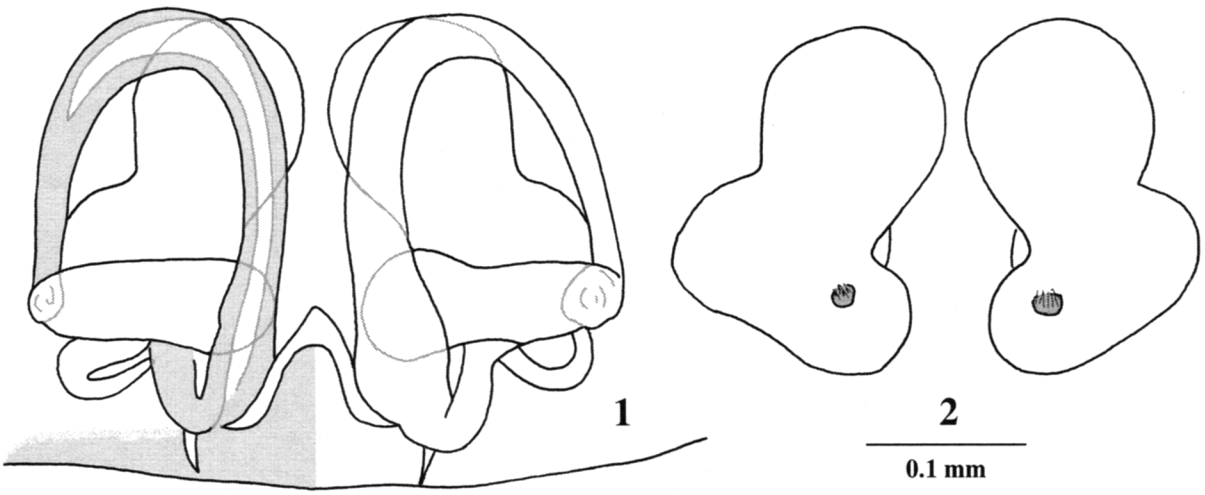
Comments.—These blind specimens cannot be further identified. Even immatures associated with adults cannot be identified because two eyeless spp. are recorded from the same caves (see below). All were taken in the dark zone of the caves. The immatures from Seven Mile Mountain Cave probably represent an undescribed species because this cave is geologically and geographically isolated from all other populations of eyeless *Cicurina* (Fig. 22).

Cicurina* (*Cicurella*) *caliga new species
Figs. 1-3A, 22

Diagnosis.—Eyeless troglobite from Triple J, Streak, and Buchanan Caves. Spermathecae with index coil of copulatory duct lying across posterior end of spermathecal base, not arched, straight; anterior-most arch of copulatory duct at anterior edge of spermathecal head.

The general morphology of the spermathecae resembles *C. hoodensis*, but the two can be easily separated by the index coil being straight in *C. caliga* and arched anteriorly in *C. hoodensis*.

Etymology.—Latin noun in apposition; referring to the boot shape of the spermathecae. Because the spider



Figs. 1-2.—Female holotype genitalia of *Cicurina caliga*, new species, from Triple J Cave: 1, ventral view with right copulatory duct shaded to show thick walls; 2, dorsal view of spermathecal lobes.

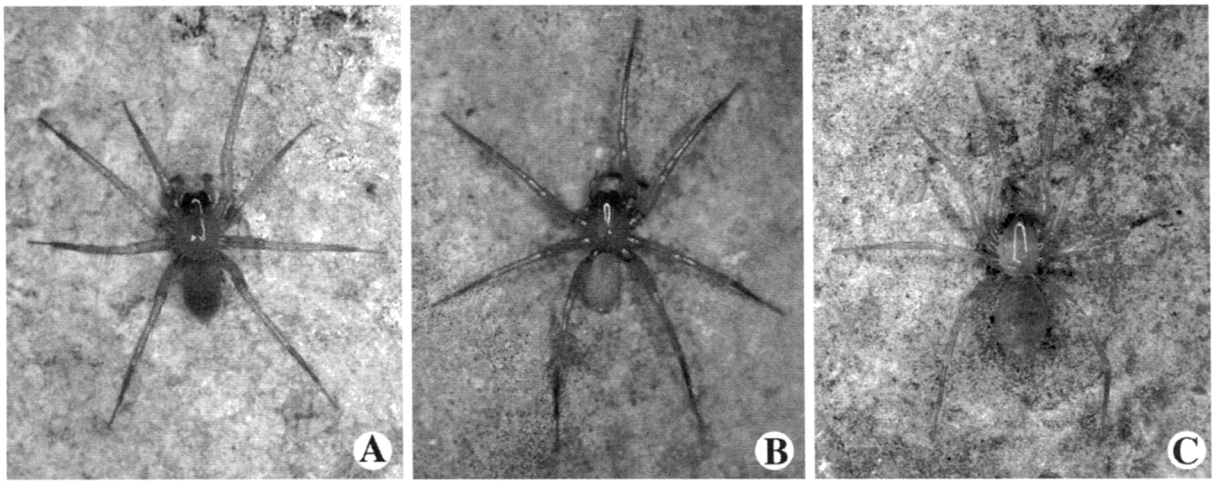


Fig. 3.—Female cicurinas: 3A, *Cicurina caliga* new species from Streak Cave; 3B, *Cicurina coryelli* Gertsch from Egypt Cave; 3C, *Cicurina hoodensis* new species from Buchanan Cave.

lives on an army base, we have specifically selected the noun for an army boot.

Type-data.—*Bell County*: Buchanan Cave, 5 May 1999 (J. Reddell, M. Reyes), 1 female paratype; Streak Cave, 13 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 1 female paratype; Triple J Cave, Nov. 1994 (M. Warton), female holotype (AMNH); 13 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 2 female paratypes; 14 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 1 female paratype (JCC).

Description (holotype followed by smallest and largest specimens in parentheses, see comments below).—Female creamy to straw-colored, troglobite, eyeless (Fig. 3A). Cephalothorax 2.1 (1.7, 3.0) mm long, 1.4 (1.15, 1.95) mm wide. Abdomen 2.25 (1.75, 3.0) mm long, 1.3 (1.05, 1.9) mm wide. Cheliceral retromargin with 6/7 (5/6, 7/7) teeth. Leg lengths: first femur 1.8 (1.45, 2.55) mm, fourth femur 1.9 (1.55, 2.9) mm; first patella-tibia 2.2 (1.8, 3.3) mm, fourth patella-tibia 2.3 (1.95, 3.5) mm. Ventral leg spines: first tibia 2-2-2 (2-2-0, 2-2-2), fourth tibia 1-2-2 (1-2-2, 2-2-2). Epigynum: spermathecae with index coil of copulatory duct lying across posterior end of spermathecal base, not arched, straight; anterior-most arch of copulatory duct at anterior edge of spermathecal head (Fig. 1); lateral end of index coil strongly bent dorsally with copulatory ducts looping dorsally lateral to spermathecae, then ventrally below spermathecae; spermathecae in dorsal view boot shaped, mesal and lateral sides of base approximately same width, with diaphanous ridge at mesal junction of two spermathecae (Fig. 2).

Distribution.—Known only from the eastern region of Fort Hood, Bell County, Texas (Fig. 22).

Comments.—Measuring the cephalothorax lengths (in mm) of all the specimens revealed the following variations: Buchanan Cave (3.0), Streak Cave (2.05), Triple J Cave (1.7, 1.7, 2.1, 2.52). The index coil of the copulatory duct is slightly arched (in ventral view) in the smallest specimen from Triple J Cave, but much less so than specimens of *Cicurina hoodensis* new species. The occurrences of this species with *C. hoodensis* in Buchanan and Triple J Caves are the first authenticated records of two troglobitic species of *Cicurina* being recorded from the same caves. Gertsch (1992) described *Cicurina reddelli* and *Cicurina elliotti* from Cotterell Cave in Travis County, Texas. Although we have not examined material from that cave, it seems unlikely that this is correct. Cotterell Cave is small and would not have provided sufficient habitat for two species to have evolved unless the ancestor of the second species arrived in the cave long after the first species was isolated and had started to evolve. This is not the case at Buchanan Cave. This is a large cave with a deep pit following a long entrance. Triple J Cave is also quite large. Using elongation of the legs versus cephalothorax length as a ratio (cephalothorax length/femur + patella + tibia I length) to rank the degree of troglomorphy resulted in the following data: *C. caliga* holotype 0.66, smallest paratype 0.52, largest paratype 0.55; *C. hoodensis* holotype 0.52, smallest paratype 0.54, largest paratype 0.54. Because a smaller number reveals relatively longer appendages, we can state that *C. hoodensis* is slightly more troglobitic and presumably has been isolated in the cave longer than *C. caliga*. While a single specimen of *C. caliga* was taken in the upper level of Buchanan Cave, this region as well as the lower sections of the cave are inhabited by *C. hoodensis*. There is only a single level to Triple J Cave and the positions of the two species within the cave

were not recorded (the species cannot be told apart outside of a laboratory, Fig. 3).

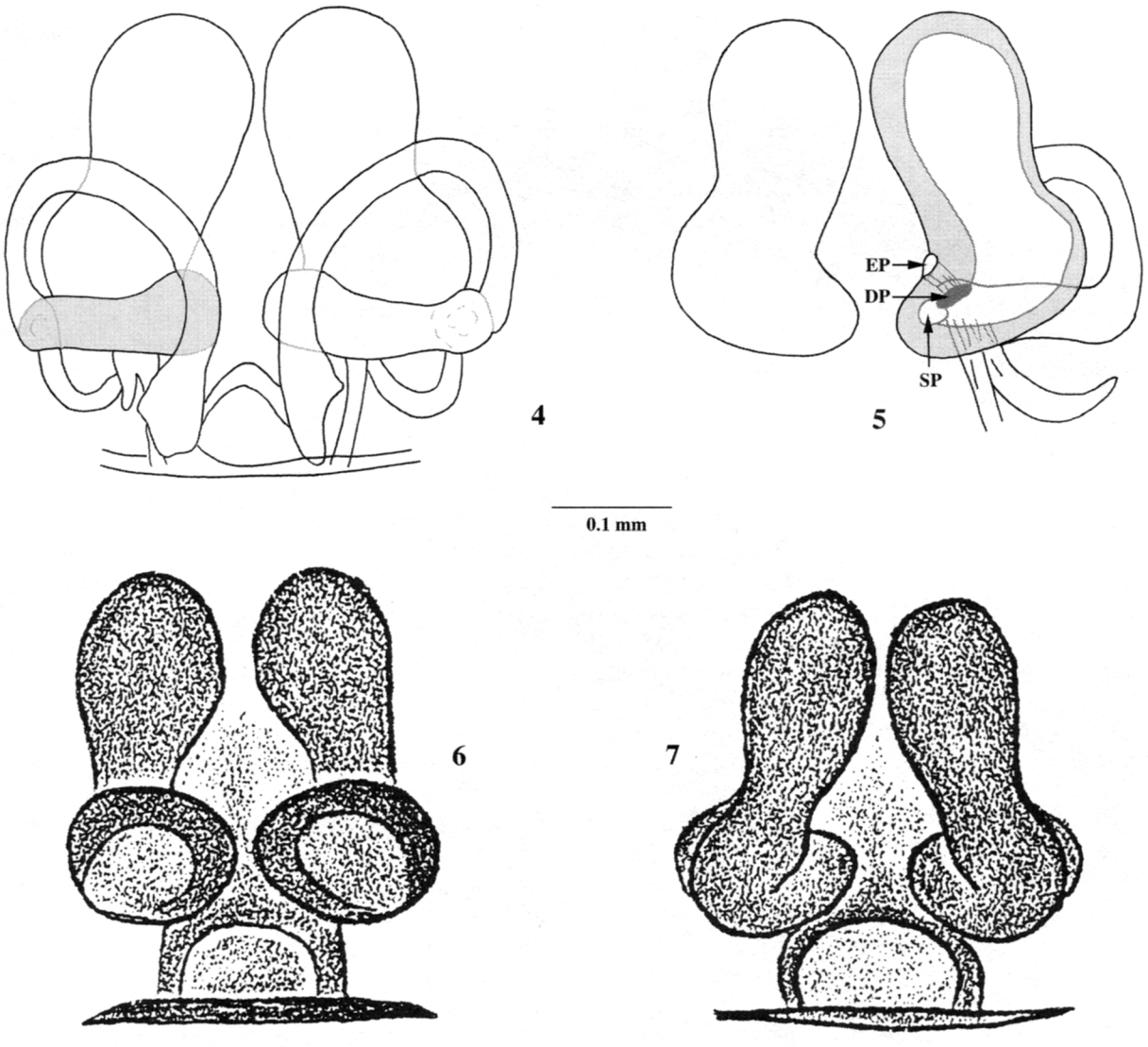
Cicurina (*Cicurella*) *coryelli* Gertsch
Figs. 3B, 4-7, 22

Cicurina (*Cicurella*) *coryelli* Gertsch, 1992:97, 102-103, figs. 71-72.

Diagnosis.—Eyeless troglobite from caves on Fort Hood. Spermathecae with index coil of copulatory duct lying across posterior end of spermathecal base, not arched, straight; anterior-most arch of copulatory duct at mid-point of spermathecum.

The general morphology and short copulatory duct of the spermathecae are like those of *C. mixmaster*. The two are easily separated by the position of the index coil of the copulatory duct: the coil in *C. coryelli* lies at the base of the spermathecal body; the coil of *C. mixmaster* crosses the spermathecae at the midline at 45° to axis of spermathecae.

Material examined.—*Coryell County*: Tippit Cave, 24 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 2 females; 31 Jan. 1992 (J. Reddell, M. Reyes), female holotype (AMNH); 8 April 1999 (M. Reyes), 1 female;



Figs. 4-7.—Female genitalia of *Cicurina coryelli* Gertsch: ventral (4) and dorsal (5) views of female from Tippit Cave: DP = dictynoid pore, EP = external pore, SP = spermathecal pore, shading on dorsal views showing thick walls of spermathecae, shading on ventral views showing index coil of copulatory duct. 6-7, Copies of illustrations of female genitalia of *C. coryelli* from Tippit Cave (Gertsch, 1992: figs. 71, 72); 6, ventral view; 7, dorsal view. Scale is only approximate for Figs. 6-7.

Egypt Cave, 7 April 1999 (J. Reddell, M. Reyes), 1 female; Big Red Cave, 30 April 1998 (J. Reddell, M. Reyes), 1 female; 6 May 1999 (J. Reddell, M. Reyes), 2 females (JCC).

Description (holotype followed by smallest and largest specimens in parentheses, see comments below).—Female creamy to straw-colored, troglobite, eyeless (Fig. 3B). Cephalothorax 1.85 (1.6, 2.85) mm long, 1.2 (1.2, 2.0) mm wide. Abdomen damaged, reported as 3.0 (2.0, 3.1) mm long, 1.6 (1.2, 1.7) mm wide. Cheliceral retromargin with 6/6 (7/7, 8/9) teeth. Leg lengths: first femur 1.5 (1.4, 2.7) mm, fourth femur 1.7 (1.5, 2.7) mm; first patella-tibia 1.9 (1.1, 3.25) mm, fourth patella-tibia 1.9 (1.85, 3.5) mm. Ventral leg spines: first tibia 2-2-2 (2-2-2, 2-2-2), fourth tibia 1-2-2 (1-2-2, 2[posterior setae petite]-2-2). Epigynum: Spermathecae with index coil of copulatory duct lying across posterior end of spermathecal base (Fig. 4), not arched, straight; anterior-most arch of copulatory duct at mid-point of spermathecum; lateral end of index coil strongly bent dorsally with copulatory ducts looping dorsally lateral to spermathecae, then ventrally below spermathecae; spermathecal bodies in dorsal view with base broadest, with what appears to be a pore opening on external surface of spermathecae at mesal junction of two bodies (Fig. 5 EP), pore of copulatory duct opening (SP) on ventral surface next to dictynoid pore (DP).

Distribution—Known only from three caves on Fort Hood, Coryell County, Texas.

Comments.—Gertsch (1992) reported the ventral spines of the first tibia as 2-2-2. This is incorrect; the first pair is missing a spine on both sides. There seems to be some variation found in the other specimens. The second pair of spines on some is shifted apart (distal and proximally) so that it appears 2-1-1-2, others are normal. We do not place much value on this character and only present it here because Gertsch used it in his revision. The variation which we observed is: 1-1-1-2 (Tippit Cave); 1-2-2 (Tippit Cave; Big Red Cave- 2 specimens); 2 (posterior setae petite)-1-1-2 (Tippit Cave); 2 (posterior setae petite)-2-2 (Egypt Cave; Big Red Cave). Gertsch's measurements are also slightly different from ours, so we present our measurements above. Measuring the cephalothorax lengths (in mm) of all the specimens revealed the following variations: Tippit Cave (1.7, 1.8, 1.85, 2.25), Big Red Cave (2.1, 2.55, 2.6), Egypt Cave (2.85). The female genitalia of the holotype is badly crushed, to the point that many structures cannot be recognized. This may be the reason Gertsch's illustrations (copied here as Figs. 6, 7) bear little resemblance to the genitalia of this species. Further evidence that Gertsch illustrated the genitalia from a crushed specimen is the fact that he shows no copulatory ducts, but does so on all his other species in the same publication. We are able to locate the copulatory duct on the right side and it is definitely that of what we have interpreted as this species. The anterior loop is very short and is not near the anterior end of the spermathecal head. The index coil is evident on the right side and it does appear to be arched in the middle (somewhat resembling what we illustrate for *C. hoodensis*), but not as arched as Gertsch illustrated. We assume this arch is because the index coil is broken in 5 places throughout its length. The index coil and part of the duct from the left side are detached and held in the genitalia vial. This index coil is not greatly curved and therefore probably was not arched when attached to the spermathecal base. The duct is short, as on the right side. The spermathecal bulbs are too badly smashed to determine their shapes. It is not clear why Gertsch selected a holotype with crushed genitalia. He recorded two other females and upon examining them, we found that the genitalia had not been dissected for microscopic examination.

Cicurina (Cicurella) mixmaster new species
Figs. 8, 9, 22

Diagnosis.—Eyeless troglobite from Mixmaster Cave. Spermathecae with index coil of copulatory duct lying across midline of spermathecae, not arched, straight; anterior-most arch of copulatory duct at anterior-most edge of spermathecum. The general morphology and short copulatory duct of the spermathecae are like those of *C. coryelli*. The two are easily separated by the position of the index coil of the copulatory duct: the coil in *C. coryelli* lies at the base of the spermathecal body; the coil of *C. mixmaster* crosses the spermathecae at the midline at 45° to axis of spermathecae. See also below under comments.

Etymology.—Noun in apposition; referring to the type locality.

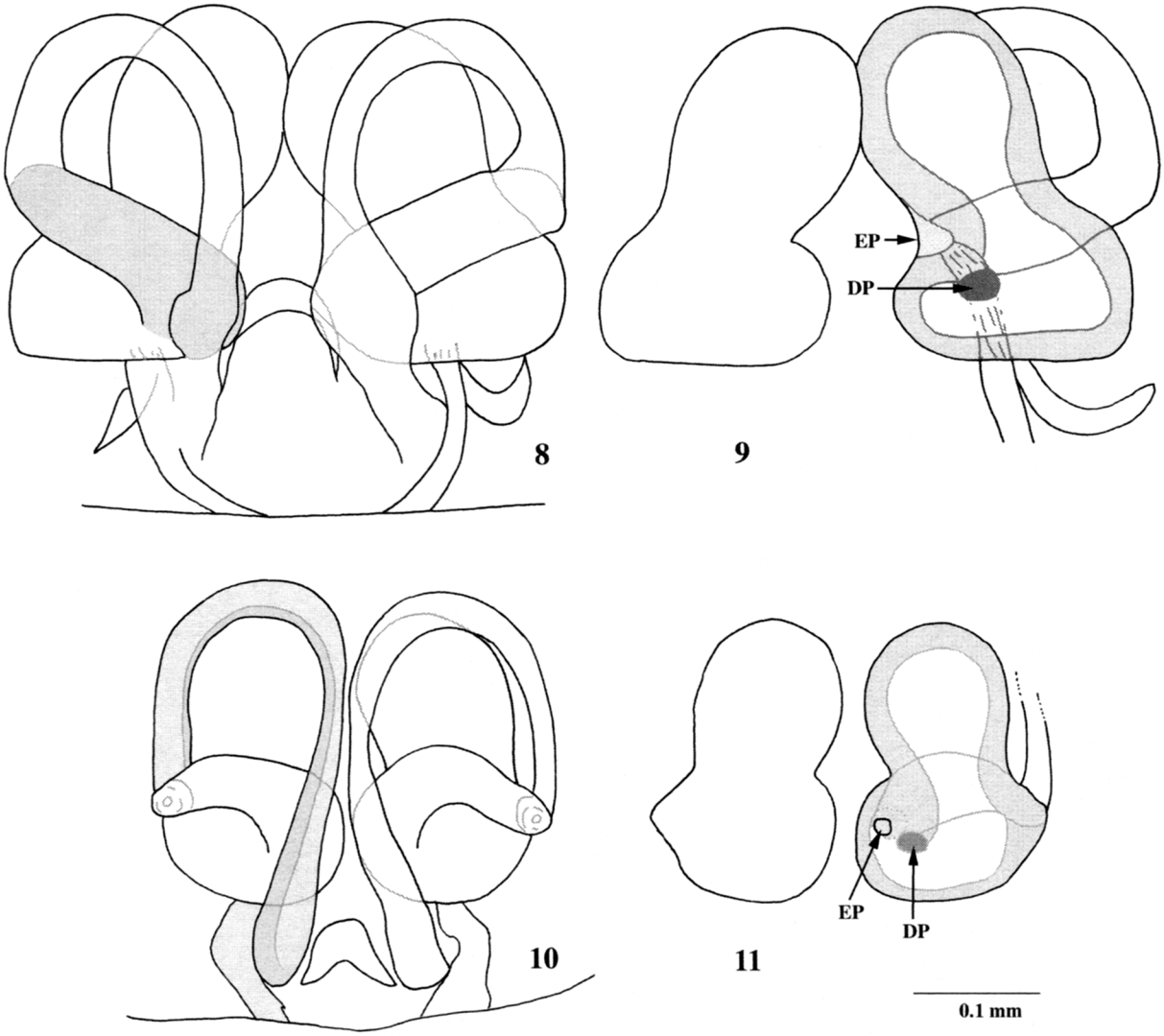
Type-data.—*Coryell County*: Mixmaster Cave, 5 Nov. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), female holotype (AMNH).

Description (holotype).—Female creamy to straw-colored, troglobite, eyeless. Cephalothorax 2.95 mm long, 1.95 mm wide. Abdomen 3.35 mm long, 2.4 mm wide. Cheliceral retromargin with 7/7 teeth. Leg lengths: first femur 2.6 mm, fourth femur 2.8 mm; first patella-tibia 3.35 mm, fourth patella-tibia 3.45 mm. Ventral leg spines: first tibia 2-2-2, fourth tibia 2-2-2. Epigynum: Spermathecae with index coil of copulatory duct lying across midline at about 45° angle to the epigastric furrow (Fig. 8, 9), not arched, straight; anterior-most arch of copulatory duct at anterior-most

edge of spermathecum; lateral end of index coil weakly bent dorsally with copulatory ducts looping dorsally lateral; spermathecal bodies in dorsal view with base broadest, with what appears to be pore opening on external surface of spermathecae at mesal junction of two bodies (Fig. 8 FP).

Distribution—Known only from Mixmaster Cave on Fort Hood, Coryell County, Texas.

Comments.— Because Mixmaster and Big Red Caves are within a mile of each other and there are no significant dispersal barriers between the two, we originally thought the single specimen from Mixmaster Cave was a member of *C. coryelli*. The Mixmaster Cave specimen differs from *C. coryelli* in four respects. First, the index coil is lifted laterally at approximately a 45° angle to the epigastric furrow (Fig. 8); making the anterior-most loop of the copulatory duct reach the anterior edge of the spermathecal head. One of the females of *C. coryelli* from Big Red Cave (JCC) also has the index coil lifted some but it appears the ducts are actually longer than those of the Mixmaster Cave specimen. Second, the spermathecae when viewed dorsally are touching anteriorly and widely separated at the base; the halves of the spermathecae are not in the typical "L" shape of *C. coryelli* but have the ends pulled together in more of a "<" shape (Fig. 9). Third, the pore opening upon the external face of the spermathecum of *C. coryelli* is placed inside of a small



Figs. 8-11.—8-9. female holotype genitalia of *Cicurina mixmaster* new species from Mixmaster Cave: 8, ventral view with shading to show index coil of copulatory duct; 9, dorsal view with left half shaded to show copulatory duct; 10-11, female holotype genitalia of *Cicurina hoodensis*, new species, from Buchanan Cave: 10, ventral view with left half shaded to show copulatory duct; 11, dorsal view of spermathecal lobes with right half shaded to show thick walls of spermathecum. DP = dictynoid pore, EP = external pore.

depression on the mesal side in *C. mixmaster* (Fig. 9). Fourth, *C. mixmaster* is slightly larger than *C. coryelli*.

We have two adult males from Mixmaster Cave (one collected 5 Nov. 1998, one matured in captivity on 4 Oct. 1999) that are probably this species, but we are not describing them here because of the uncertainty. The only other male of an eyeless *Cicurina* known from Ft. Hood is from Buchanan Cave (matured in captivity 28 Sept. 1999); where both *C. caliga* and *C. hoodensis* are known. Comparisons of these three specimens reveals some minor differences. Because so few males of other eyeless *Cicurina* spp. have been studied (6 out of 50 species studied by Gertsch, 1992) we are uncertain how significant these differences might be. Hopefully future collecting and rearings will result in additional males which can be compared and described.

Cicurina (*Cicurella*) *hoodensis* new species
Figs. 3C, 10, 11, 22

Diagnosis.—Eyeless troglobite from caves in the eastern section of Fort Hood. Spermathecae with index coil of copulatory duct lying across midline of spermathecal base, arched anteriorly; anterior-most arch of copulatory duct at or more anteriorly placed than tip of spermathecal head.

The general morphology of the spermathecae resembles *C caliga*, but the two can be easily separated by the index coil being straight in *C. caliga* and arched anteriorly in *C. hoodensis*.

Etymology.—This species is named for its occurrence on Fort Hood.

Type-data.—*Bell County*: Buchanan Cave, 7 May 1998 (L.J. Graves, J. Reddell, M. Reyes), female holotype (AMNH), 2 female paratypes (1 female JCC); 4 Nov. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), 3 female paratypes (2 matured in captivity on 28 Nov. 1998); 5 May 1999 (J. Reddell & M. Reyes), 1 female (matured in captivity on 6 Nov. 1999); upper level of cave, 13 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 1 female (JCC), 3 females; Camp 6 Cave No. 1, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female paratype; 2 Nov. 1998 (J. Cokendolpher, J. Reddell), 1 female paratype (matured in captivity on 22 Nov. 1998, JCC); Peep in the Deep Cave, 3 Nov. 1998 (J. Cokendolpher, J. Reddell), 1 female paratype (matured in captivity on 20 Jan. 1999); 5 May 1999 (J. Reddell, M. Reyes), 1 female (matured in captivity on 18 August 2000); Talking Crows Cave, 2 Nov. 1998 (M. Reyes), 1 female paratype; Treasure Cave, 2 Nov. 1998 (J. Cokendolpher, J. Reddell, M. Reyes), 1 female paratype (matured in captivity on 5 Dec. 1998); Triple J. Cave, 13 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 1 female.

Description (holotype followed by smallest and largest specimens in parentheses, see comments below).—Female creamy to straw-colored, troglobite, eyeless (Fig. 3C). Cephalothorax 1.6 (1.4, 2.2) mm long, 1.1 (1.0, 1.35) mm wide. Abdomen 1.95 (1.70, 2.85) mm long, 1.05 (0.9, 2.0) mm wide. Cheliceral retromargin with 7/7 (6/6, 7/7) teeth. Leg lengths: first femur 1.4 (1.2, 1.8) mm, fourth femur 1.5 (1.2, 1.9) mm; first patella-tibia 1.7 (1.4, 2.3) mm, fourth patella-tibia 1.8 (1.5, 2.4) mm. Ventral leg spines: first tibia 2-2-2 (2-2-2, 2-2-2), fourth tibia 2(posterior one petite)-2-2 (2-2-2, 2-2-2). Epigynum: Spermathecae with index coil of copulatory duct lying across midline of spermathecal base, arched anteriorly; anterior-most arch of copulatory duct at or more anteriorly placed than tip of spermathecal head (Fig. 10); lateral end of index coil strongly bent dorsally with copulatory ducts looping dorsally lateral to spermathecae, then ventrally below spermathecae; area near junction of spermathecal head and base on mesal side with large pore apparently opening on dorsal surface of base (Fig. 11 EP).

Distribution.—Known only from caves in the eastern section of Fort Hood, Bell County, Texas.

Comments.—Measuring the cephalothorax lengths (in mm) of all the specimens revealed the following variations: Buchanan Cave (1.4, 1.6, 1.7, 1.75, 1.9, 1.9, 1.9, 1.95, 2.0, 2.15, 2.2, 2.2), Camp 6 Cave No. 1 (1.6, 1.65), Peep in the Deep Cave (1.6, 2.05), Talking Crows Cave (2.05), Treasure Cave (1.55), Triple J Cave (1.95). The female illustrated in Fig. 3C appears to have spots on the abdomen. Numerous species of eyed *Cicurina* have spotted or otherwise pigmented abdomens, but this is not the case with *C. hoodensis*. The spots are from darker material inside the digestive system that are showing through the abdominal wall, not pigmentation of the integument. Rearing spiderlings in captivity revealed that this is not uncommon in troglobitic cicurinas. Also, it has been noted that older adult troglobitic cicurinas are darker than more recently matured females. Within minutes of molting specimens will be white which will gradually change to creamy yellow. This will continue to change over weeks to a darker straw color, almost brown. Older adults (legs missing, cheliceral teeth worn, etc.) of some troglobitic cicurinas will be very dark, almost as dark as some specimens of the eyed *C. varians*.

As noted above, this species occurs with *C. caliga* in Buchanan and Triple J Caves. See comments under that species for further discussion of this topic.

Eight females were reared to adulthood in captivity, all maturing during late summer to winter. The dates of maturation are given under type-data.

Cicurina (*Cicurusta*) sp. prob. *varians* Gertsch and Mulaik

Cicurina varians: Reddell, 1965:169.

Records.—*Bell County*: Buchanan Cave, 4 Nov. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), 1 penultimate female; Camp 6 Cave No. 2, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 immature; Cicurina Sink, 14 June 2000 (J. Reddell, M. Reyes), 1 immature; Coyote Den Cave, 21 April 1998 (J. Reddell, M. Reyes), 2 immatures; Deep in Dis Bear Cave, 18 May 1998 (J. Reddell, M. Reyes), 10 immatures; Herbert Cave, 10 Sept. 1997 (L.J. Graves, M. Reyes), 1 immature; Keilman Cave, 26 Sept. 1997 (J. Reddell), 1 immature; L.Z. Sid Sink, 3 May 2000 (J. Reddell, M. Reyes), 1 immature; Long Joint Sink, Nov. 1995 (M. Warton & Associates), 1 immature; Marcelino's Cave, 2 May 2000 (M. Reyes), 1 immature; Monkey Walk Cave No. 1, 23 April 1998 (J. Reddell, M. Reyes), 1 immature; Owl Mountain Cave, Oct. 1995 (D. Allen, L.J. Graves), 1 immature; Peep in the Deep Cave, 8 May 1998 (J. Reddell, M. Reyes), 1 immature; 3 Nov. 1998 (J. Cokendolpher, J. Reddell), 1 immature; 28 May 2000 (J. Reddell, M. Reyes), 1 immature; 27 June 2000 (J. Reddell, M. Reyes), 1 immature; Rugger's Rift Cave, 5 Nov. 1998 (J. Reddell, M. Reyes), 2 immatures; upper level, 13 June 2000 (J. Reddell, M. Reyes), 1 immature; Sanford Pit Cave, 23 Nov. 1994 (M. Warton), 1 immature; Seven Mile Mountain Cave, 11 April 1999 (R. Price, M. Warton), 5 immatures; 26 May 1999 (J. Reddell), 1 immature; 28 June 2000 (J. Reddell, M. Reyes), 3 immatures; Violet Cave, Oct. 1995 (M. Warton & Associates), 1 immature; 23 April 1998 (J. Reddell, M. Reyes), 1 immature; 5 June 2000 (J. Reddell, M. Reyes), 2 immatures.

Coryell County: Brokeback Cave, 16 Aug. 1964 (D. McKenzie, J. Reddell), 1 female (det. W.J. Gertsch) (AMNH) (Reddell, 1965); 5 Sept. 1991 (D. McKenzie, J. Reddell, M. Reyes), 3 immatures (det. W.J. Gertsch) (AMNH); Cornelius Cave, 21 Nov. 1995 (J. Reddell, M. Reyes), 1 immature; Fossil Spring Cave, 16 July 1993 (J. Reddell, M. Reyes), 1 immature; Keyhole Cave, 6 May 1999 (J. Reddell, M. Reyes), 1 immature; Nervous Rock Cave, 26 May 1999 (J. Reddell), 1 immature; Porter Cave, 8 April 1999 (J. Reddell, M. Reyes), 3 immatures.

Comment.—These immature specimens probably belong to *C. varians*, the only known eyed species of *Cicurina* on Fort Hood.

Cicurina (*Cicurusta*) *varians* Gertsch and Mulaik

Cicurina varians: Reddell, 1965:169.

Records.—*Bell County*: Camp 6 Cave No. 1, 5 May 1999 (J. Reddell, M. Reyes), 1 male; Figure 8 Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female, 2 immatures; Fools Cave, 1 April 1999 (J. Reddell, M. Reyes), 1 immature; 13 May 1999 (J. Reddell, M. Reyes); Gnarla Cave, 20 April 1998 (J. Reddell, M. Reyes), 1 male, 1 immature; 24 April 1998 (J. Reddell, M. Reyes), 1 male; Jagged Walls Cave, 14 March 1992 (J. Reddell, M. Reyes), 1 immature; 3 Nov. 1998 (J. Cokendolpher, M. Reyes), 2 females, 3 immatures; Moffatt Pit Cave, 1 May 1998 (J. Reddell, M. Reyes), 1 female; Nolan Creek Cave, 9 March 1963 (D. McKenzie, J. Reddell), 1 female, 1 immature (det. W.J. Gertsch) (AMNH) (Reddell, 1965); 27 Jan. 1990 (J. Reddell, M. Reyes), 1 female, 5 immatures; 17 July 1993 (J. Reddell, M. Reyes), 7 immatures; 19 May 1998 (J. Reddell, M. Reyes), 1 immature; Price Pit Cave, 23 March 1999 (E. Boyd, R. Price, J. Killian, M. Warton), 1 female; Root Sink, 13 May 1999 (J. Reddell), 1 female; Sledgehammer Cave, 27 Jan. 1990 (J. Reddell), 1 female; 13 Jan. 1995 (D. Allen), 1 female; Sparta Cave, 20 May 1998 (J. Reddell, M. Reyes), 1 female; Streak Cave, 6 Oct. 1995 (M. Warton), 1 female, 1 immature; 26 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 1 immature; 14 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 2 immatures; Talking Crows Cave, 8 Feb. 1996 (M. Warton), 1 immature; 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 2 females; 2 Nov. 1998 (M. Reyes), 1 immature; Tres Dedos Cave, 24 March 1999 (J. Reddell, M. Reyes), 2 females; Valentine Cave, 14 Feb. 1996 (M. Warton), 1 female; Viper Den Cave, 12 Jan. 1995 (D. Allen, M. Warton), 1 male, 3 females, 6 immatures.

Coryell County: Chigiouxs' Cave, 12 Nov. 1994 (M. Warton), 1 immature; 21 Nov. 1995 (J. Reddell, M. Reyes), 1 male, 2 immatures; Copperhead Cave No. 2, 20 Feb. 1999 (M. Reyes), 1 male; Egypt Cave, 13 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 2 females, 2 immatures (det. W.J. Gertsch) (AMNH); 21 Jan. 1992 (J. Reddell, M. Reyes), 2 immatures (det. W.J. Gertsch) (AMNH); 23 Nov. 1994 (M. Warton), 1 immature; Gann Cave, 1 male, 1 immature (det. W.J. Gertsch) (AMNH); Mixmaster Cave, 9 Sept. 1997 (L.J. Graves, D. McKenzie, J. Reddell, M. Reyes), 1 male, 3 females; 4 Nov. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), 1 female, 1 female (molted 5 Dec. 1998, 7 Feb., 29 April, 25 Aug. 1999, JCC), 10 immatures; Rocket River Cave System (Double Tree Cave), 23 March 1990 (J. Reddell, M. Reyes), 1 female, 5 immatures; 16 Jan. 1992 (J. Reddell, M. Reyes), 4 females, 4 immatures (det. W.J. Gertsch) (AMNH); Rocket River Cave System (Rocket River Cave), 16 Jan. 1992 (L.J. Graves, M. Warton, C. Savvas), 1 female (det. W.J. Gertsch) (AMNH); Runoff Cave, 27 Jan. 1990 (J. Reddell, M.

Reyes), 1 male, 1 immature; 28 Aug. 1991 (J. Reddell, M. Reyes), 1 male, 1 immature (det. W.J. Gertsch) (AMNH); Saltpeter Cave, 21 Nov. 1995 (J. Reddell, M. Reyes), 3 males, 2 females, 1 immature; Shell Mountain Bat Cave, 16 March 1963 (D. McKenzie, J. Reddell), 1 female (det. W.J. Gertsch) (AMNH) (Reddell, 1965); 31 March 1999 (L.J. Graves, J. Reddell, M. Reyes), 1 male, 2 females, 1 immature; Tippit Cave, 9 March 1963 (D. McKenzie, J. Reddell), 1 female (det. W.J. Gertsch) (AMNH) (Reddell, 1965); 24 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 3 females, 3 immatures; 31 Jan. 1992 (J. Reddell, M. Reyes), 2 immatures.

Comments.—This troglophilic spider occurs in caves throughout Texas. It is most frequently found under rocks in the dark zone of caves where it feeds on small arthropods. Records of immatures are only listed as this species when they were found in the same cave as adults. Two females were also collected under rocks on the surface near the entrance to Jagged Walls Cave, 3 Nov. 1998 (J. Cokendolpher, J. Reddell, M. Reyes).

Dictyna sp.

Record.—*Bell County*: Buchanan Cave, upper level, 13 June 2000 (J. Reddell, M. Reyes), 1 female.

Comment.—Females of this large and complex genus are not easily identified unless associated with males. It is an accidental.

Gnaphosidae

Drassyllus aprilinus (Banks)

Record.—*Bell County*: Price Pit Cave, 6 May 1999 (J. Reddell, M. Reyes), 1 male (JCC).

Comment.—This accidental species was found at the bottom of the entrance drop in leaf litter.

Drassyllus gynosaphes Chamberlin

Record.—*Bell County*: Price Pit Cave, 6 May 1999 (J. Reddell, M. Reyes), 3 males (1 male JCC).

Comment.—This accidental species was found at the bottom of the entrance drop.

Drassyllus texamans Chamberlin

Record.—*Bell County*: Newby Cave, 19 May 1999 (J. Reddell, M. Reyes), 1 female.

Comment.—This is an accidental species found at the bottom of the entrance drop.

Gnaphosa sp.

Record.—*Bell County*: Seven Mile Mountain Cave, 11 April 1999 (R. Price, M. Warton), 1 penultimate male.

Comment.—This is an accidental and because of its immature state it cannot be identified to species.

Gnaphosa fontinalis Keyserling

Record.—*Bell County*: Cub Cave, 18 May 1999 (J. Reddell), 1 female.

Comment.—This is an accidental.

Micaria sp.

Records.—*Bell County*. Big Crevice, 14 June 2000 (J. Reddell, M. Reyes), 1 immature.

Comments.—Immatures of this genus cannot currently be identified.

Filistatidae

Filistatinella sp.

Record.—*Bell County*: Loop Joint Cave, 3 May 2000 (J. Reddell, M. Reyes), 1 immature.

Comment.— This specimen is too immature for further identification. Members of this genus are relatively common in buildings and are recorded from several Central Texas caves. There are at least four undescribed species (Texas to California).

Hahniidae

Undetermined genus and species

Records.—*Bell County*: Big Crevice, 6 June 2000 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 immature; Gnarla Cave, 24 April 1998 (J. Reddell, M. Reyes), Berlese of leaf litter from Gnarla Pit, 1 immature.

Coryell County: Copperhead Sink No. 2, 20 Feb. 1999 (M. Reyes), Berlese of leaf litter, 1 immature.

Comment.—These very young immature specimens cannot be further identified.

Hahnia sp.

Records.—*Bell County*: Lunch Counter Cave, 18 Sept. 1997 (J. Reddell), Berlese of leaf litter, 1 immature; Nolan Creek Cave, 17 July 1993 (J. Reddell, M. Reyes), Berlese of leaf litter, 9 immatures.

Comments.—Specimens from these caves cannot be further identified, but are probably the species listed below. Only one other *Hahnia* sp. has been recorded from a cave in Texas and it was from Bexar County.

Hahnia flaviceps Emerton

Records.—*Bell County*: Big Crevice, 13 May 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 female; Jagged Walls Cave, 3 Nov. 1998 (J. Cokendolpher, M. Reyes), 4 females; Price Pit Cave, 6 May 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 2 females.

Coryell County: Porter Cave, 8 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 female.

Comment.—This small species is known from leaf litter in the entrance areas of several additional caves in Texas.

Leptonetidae

Neoleptoneta spp.

Records.—*Bell County*, Peep in the Deep Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 female; 8 May 1998 (J. Reddell, M. Reyes), 1 female; 3 Nov. 1998 (J. Cokendolpher, J. Reddell), 1 female; Talking Crows Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 immature

Comments.—The area around the eyes of the immature is pigmented and is probably the species described below as new. The other specimens have no pigment in or around the eyes and have the eyes further reduced in size. They possibly represent an undescribed species. Until a male can be discovered we refrain from describing the species as new. With the reduction of eyes and pigmentation it is likely a troglobite. Gertsch (1974) recorded eye dimorphism in *Neoleptoneta valverde* Gertsch (1974: figs. 57, 58). In that case, the single male had smaller eyes and a reduction in pigmentation from the two known females. Unfortunately, the sexes were collected in separate caves 18 miles apart and could represent separate species or geographical variation. Further collections will be necessary to better understand eye polymorphy in these species. Although Gertsch (1974) found the spermathecae to be valuable diagnostic characters, we find that some of the characters used by Gertsch are influenced by the examination methodology. The weight of the cover-slip used for microscopic examinations can alter the position and axis of the spermathecae. The spermathecae of the species described below and the species represented here as a possible new species are similar, but so are all the members of the *coeca* series. The male genitalia appear to us to exhibit more and better characters to distinguish taxa in *Neoleptoneta*.

Neoleptoneta paraconcinna new species

Figs. 12-22

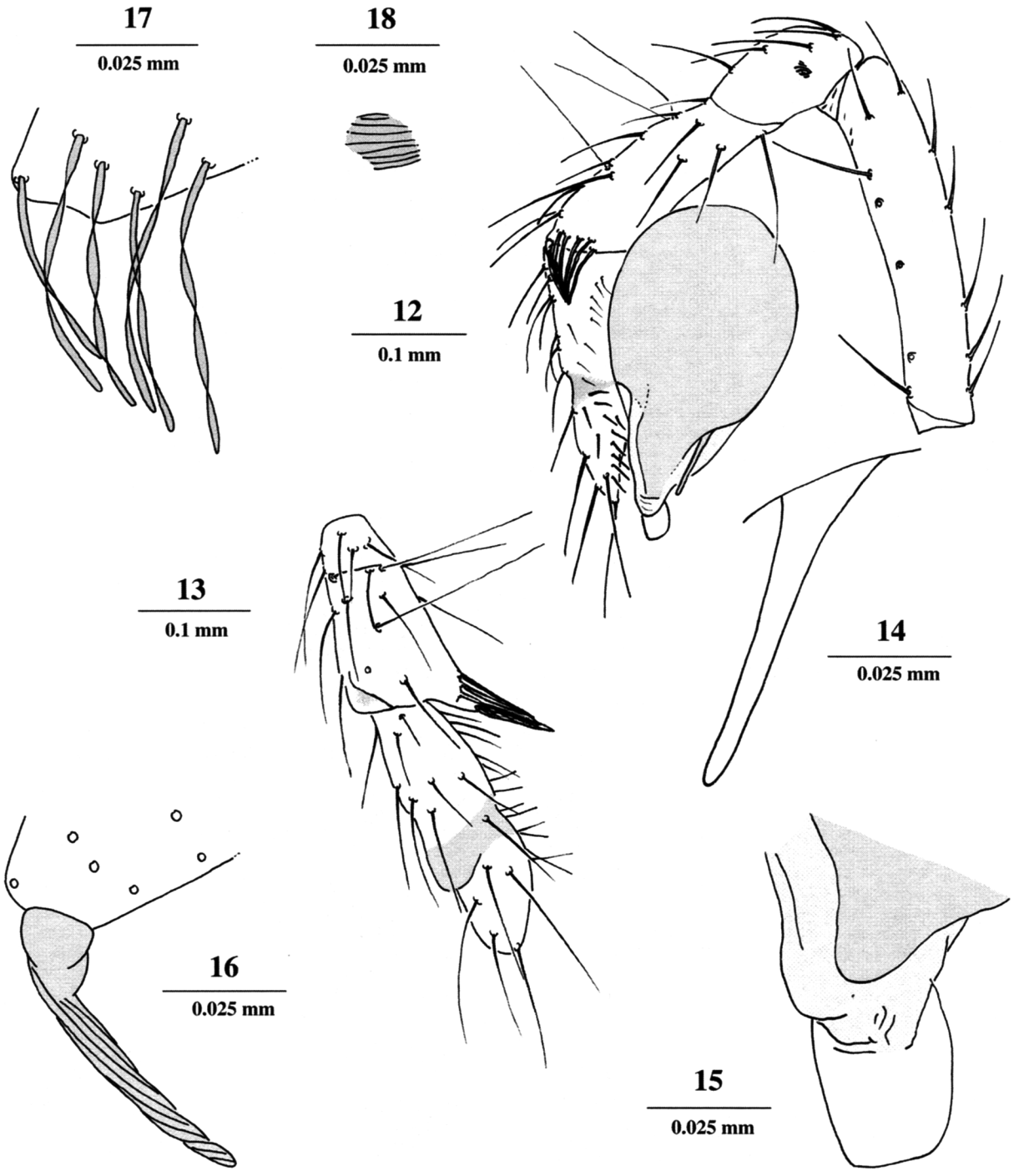
Diagnosis.—Pale cavernicole from Bell County caves; eyes present, relatively large, subcontiguous in front row; posterior eyes separated from anterior lateral eyes by 1-1.5 diameters of eyes; some surrounding cuticle with dark pigment; promargin of chelicerae with seven teeth; tibia of male pedipalp with retrolateral apophysis bearing a spur and six overlapping flattened setae; pedipalpal bulb with single retrolateral apophysis ventrally and bluntly rounded embolus; bulb of seminal receptacle medium sized with single loop in copulatory duct; first leg of male 4.9 times, of female 4.15 times as long as cephalothorax.

As indicated by the name, this species is most similar to *Neoleptoneta concinna* Gertsch. In Gertsch's key (1974) to the species of *Neoleptoneta* from Texas, the new species will key to *N. concinna* for both males and females. Males of *N. paraconcinna* share with *N. concinna* a series of setae on the retrolateral distal end of the palpal tibia. These setae are apparently not present on males of other species from the region. From males of *N. concinna*, the new species can be distinguished by differences in the palp: presence of 6 (4 in *N. concinna*) overlapping setae on the tibia; tibial spur about 1/3-1/4 (greater than 1/2 in *N. concinna*) length of tarsus; presence (absence in *N. concinna*) of numerous short setae on the distal half of the tarsus. Females of *N. paraconcinna* differ from *N. concinna* by having a loop in the copulatory duct.

Etymology.—*Para* from Greek, meaning near, and the species name *concinna*; referring to this species similarity to *N. concinna*.

Type-data.—TEXAS: *Bell County*: Camp 6 Cave No. 1, Fort Hood, 5 May 1999 (J. Reddell, M. Reyes), 1 male paratype; Peep in the Deep Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 female paratype; 8 May 1998 (J. Reddell, M. Reyes), male holotype (AMNH); Figure 8 Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female paratype.

Description.—Cephalothorax and appendages dusky yellow to creamy brown, abdomen creamy yellow. Promargin of chelicerae with 7-7 teeth, retromargin 2-



Figs. 12-18.—Male holotype of *Neoleptoneta paraconcinna*, new species, from Peep in the Deep Cave: 12, retrolateral view of pedipalp; 13, dorsal view of pedipalpal tibia and tarsus; 14, enlarged retrolateral view of apophysis on pedipalpal bulb; 15, enlarged retrolateral view of pedipalpal embolus; 16, enlarged retrolateral view of retrolateral spur; 17, enlarged retrolateral view of flattened spines which overlap the retrolateral spur; 18, enlarged retrolateral view of lyriform sensilla of pedipalpal patella.

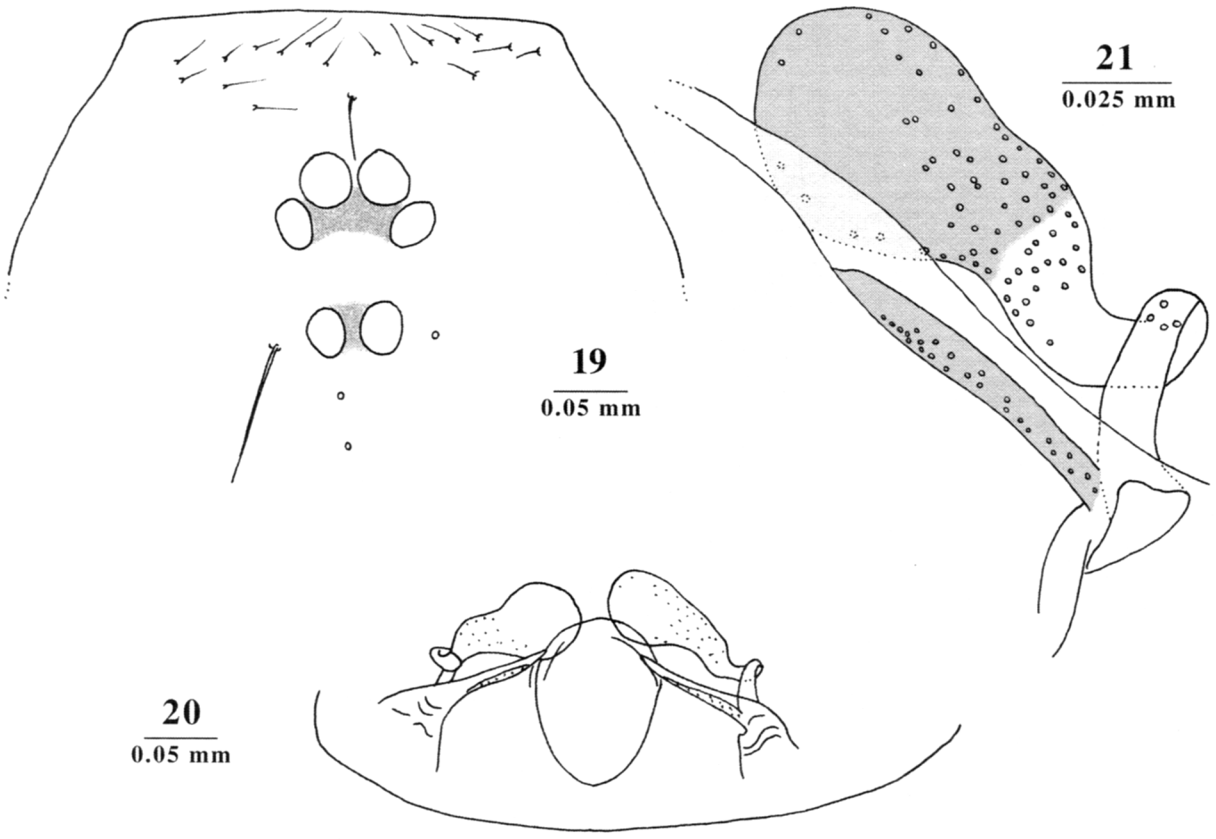
2 teeth. Eyes relatively large; anterior row strongly recurved, eyes subequal to posterior eyes slightly smaller, contiguous; anterior median eyes separated by less than half diameter of eye, posterior eyes contiguous, separated from anterior laterals by 1-1.5 diameter of eye; dark pigment between eyes (Fig. 19). Leg formula 1423.

Male (holotype followed by paratype in parentheses): Cephalothorax 0.64 (0.69) mm long, 0.45 (0.52) mm wide; abdomen 0.70 (0.94) mm long, 0.42 (0.76) mm wide. Femora I-IV lengths (in mm): 0.90 (0.99), 0.75 (0.82), 0.60 (0.68), 0.86 (0.92); patella + tibia I, II: 1.08 (1.16), 0.88 (missing). Legs relatively long, thin; femur I 6.9 (6.2) times longer than maximum wide; leg I (excluding coxa + trochanter) 3.16 (3.42) mm long, leg IV 3.04 (?, missing tarsi) mm long.

Pedipalp with lyriform sensilla on both lateral and retrolateral sides of patella (Figs. 12, 18); tibia with retrolateral spur, with twisted ridges running most of length of spur (Fig. 16); spur overlain by series of six, smooth, flattened, loosely twisted setae (Fig. 17); tibia dorsally with three trichobothria (Fig. 13); tarsus with relatively deep transverse groove in apical part, retrolateral side with group of 11 (9 on paratype) short stout setae distal to groove and 9 (10 on paratype) very thin, short setae starting at groove and extending basally (Fig. 12), setae of tarsus finely serrated; bulb with single smooth apophysis on retrolateral side near ventral border (Figs. 12, 14); embolus wide, bluntly rounded at tip (Figs. 12, 15).

Female (Peep in the Deep Cave, Figure 8 Cave): Cephalothorax 0.67, 0.60 mm long, 0.44, 0.42 mm wide; abdomen 0.98, 1.00 mm long, 0.74, 0.56 mm wide). Femora lengths (in mm): I= 0.85, 0.70; II= 0.70, 0.61 ; III= 0.62, 0.50; IV= 0.80, 0.73; patella + tibia I= missing, 0.86; II- missing, 0.70. Legs relatively long and thin; femur I 7.7, 6.4 times longer than maximum wide; leg I (excluding coxa + trochanter) broken, 2.49 mm long; leg IV 2.98, 2.60 mm long.

Genitalia: Seminal receptacles relatively large; bulb directed slightly anteriorly (about 20 degrees from epigastric furrow), covered with many minute pores; spermathecal duct with single coil; long thin sclerotized plate (or flattened duct?) attached at junction of the



Figs. 19-21.—Female paratype of *Neoleptoneta paraconcinna*, new species, from Peep in the Deep Cave: 19, anterodorsal view of eyes and clypeus; 20, ventral view of genitalia; 21, enlarged ventral view of left seminal receptacle.

copulatory and spermathecal ducts, posterior edge covered with minute pores (Figs. 20, 21).

Comments.—On 8 May the male holotype of this species and what we are referring to *N.* spp. (see above) were collected from under rocks lightly buried in clay at the bottom of Peep in the Deep Cave. On 21 April a female was collected just below the entrance and a female was collected in the same area as the 8 May specimens. Unfortunately, the 21 April samples consist of *N. paraconcinna* and what we are referring to *N.* spp. Presumably, the specimen with reduced eyes came from the lower level, but this is not certain as the holotype of *N. paraconcinna* also came from the lower level. Data available from other caves reveals *N. paraconcinna* to occur on the underside of a rock at the bottom of the entrance in twilight (Camp 6 Cave) and in the upper level within sight of the entrance (Figure 8 Cave).

Linyphiidae

Undetermined genus and species

Records.—*Bell County*: Big Crevice, 6 June 2000 (J. Reddell, M. Reyes), Berlese of leaf litter, 5 immatures; Buchanan Cave, 8 Nov. 1995 (D. Allen), 4 immatures; Camp 6 Cave No. 1, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 immature; 5 May 1999 (J. Reddell, M. Reyes), 1 penultimate male; Chimney Windows Cave, 19 May 1999 (J. Reddell, M. Reyes), 1 immature; Coyote Den Cave, 21 April 1998 (J. Reddell, M. Reyes), 2 immatures; Cub Cave, 18 May 1999 (J. Reddell), 2 immatures; Deep in Dis Bear Cave, 8 Feb. 1996 (L.J. Graves), 2 immatures; Jagged Walls Cave, 3 Nov. 1998 (J. Cokendolpher, M. Reyes), 4 immatures; Keilman Cave, Nov. 1994 (M. Warton), 1 immature; Lucky Rock Cave, 5 May 1999 (J. Reddell, M. Reyes),

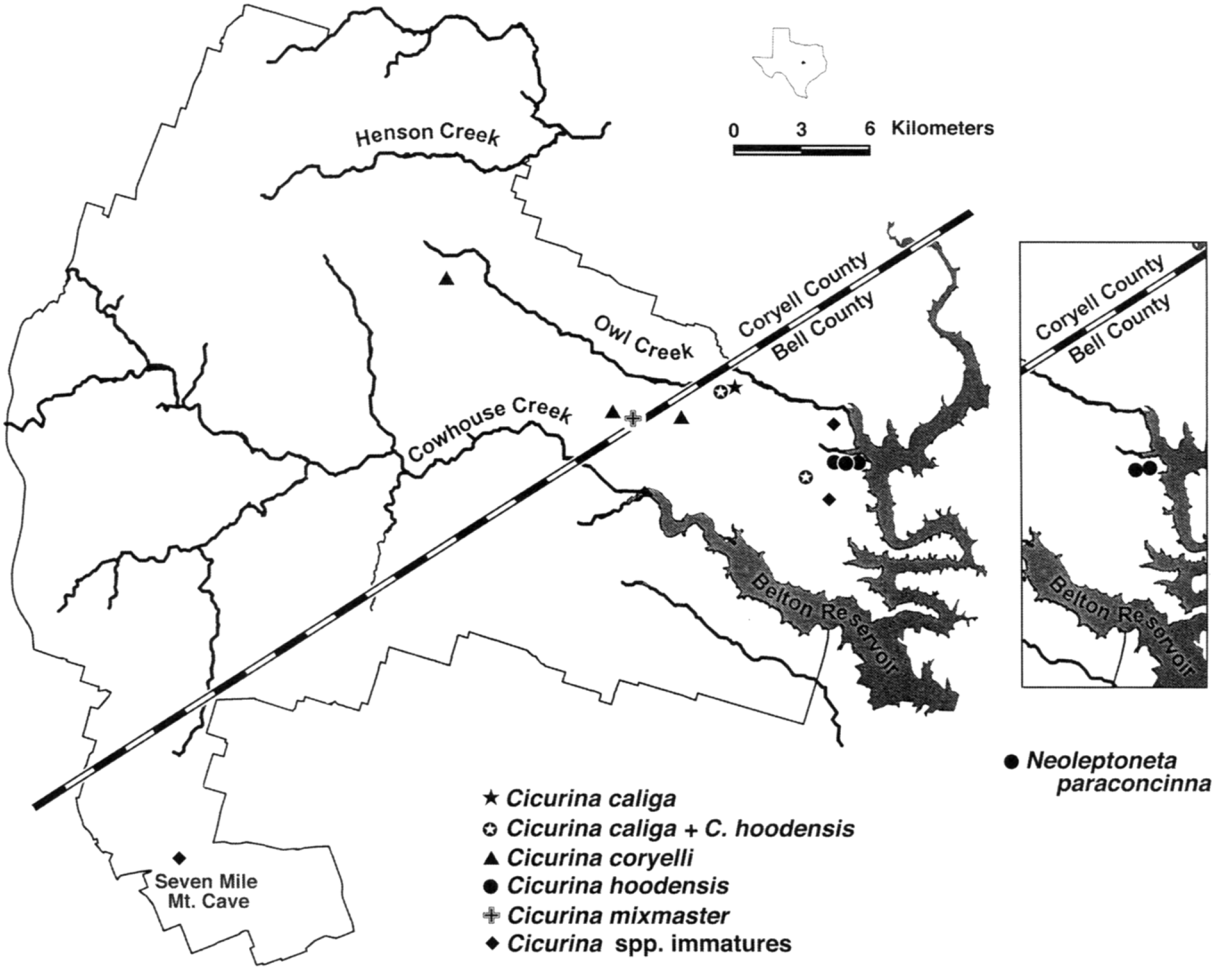


Fig. 22.—Map of Foot Hood showing distributions of troglobitic *Cicurina* and *Neoleptoneta* spiders.

1 immature; Nolan Creek Cave, 27 Jan. 1990 (J. Reddell, M. Reyes), 2 immatures; 17 July 1993 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 immature; Plasma Cave, 19 May 1999 (J. Reddell), Berlese of leaf litter, 5 immatures of sp. 1 and 1 immature of sp. 2; Price Pit Cave, 6 May 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 penultimate male, 4 immatures; Red Ant Cave, 28 Aug. 1991 (J. Reddell), 1 female (det. W.J. Gertsch) (AMNH); Septum Pit Cave, Oct. 1995 (M. Warton & Associates), 1 immature; Skeeter Cave, 18 May 1999 (L.J. Graves, J. Reddell, M. Reyes), 2 immatures; Talking Crows Cave, 6 June 2000 (J. Reddell, M. Reyes), 1 damaged immature; Valentine Cave, 14 Feb. 1996 (M. Warton), 2 immatures; 18 Sept. 1997 (J. Reddell, M. Reyes), 2 immatures; Viper Den Cave, Tumble Down Entrance, 13 Jan. 1995 (M. Warton), 1 immature.

Coryell County: Keyhole Cave, 20 Feb. 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 immature; Plateau Cave No. 2, 15 Jan. 1992 (J. Reddell, M. Reyes), 1 female (det. W.J. Gertsch) (AMNH); Porter Cave, 8 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 23 very young immatures; Rocket River Cave System (Rocket River Cave), 27 Oct. 1994 (M. Warton), 1 immature.

Comments.—Immatures from these caves cannot be further identified without adults. We have not seen the adults identified by W.J. Gertsch.

Erigonine genus and species

Records.—*Bell County*: Deep in Dis Bear Cave, 18 May 1999 (J. Reddell, M. Reyes), 1 female.

Coryell County: Copperhead Sink No. 2, 20 Feb. 1999 (M. Reyes), 1 female.

Comments.—These females have a distinctive epigynum vaguely reminiscent of *Sisicottus*. A male will have to be studied to be certain of the genus. It has large eyes and looks typical of a litter dweller and is therefore considered an accidental.

Eperigone new species

Records.—*Bell County*: Big Crevice, 13 May 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 5 females; Figure 8 Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male; Fools Cave, 1 April 1999 (J. Reddell, M. Reyes), Berlese of litter, 1 female; Keilman Cave, 26 Sept. 1997 (J. Reddell), Berlese of leaf litter, 1 female, 11 immatures; 23 April 1998 (J. Reddell, M. Reyes), Berlese of leaf litter, 6 females, 2 males; Peep in the Deep Cave, 8 May 1998 (J. Reddell, M. Reyes), Berlese of leaf litter), 1 female, 1 immature; Price Pit Cave, 6 May 1999 (J. Reddell, M. Reyes), Berlese of litter, 2 females, 2 immatures; Soldier's Cave, 25 March 1999 (J. Reddell, M. Reyes), Berlese of litter, 1 male, 2 immatures; Viper Den Cave, Tumble Down Entrance, 13 Jan. 1995 (M. Warton), 1 male.

Coryell County: Copperhead Sink No. 2, 20 Feb. 1999 (J. Reddell, M. Reyes), Berlese of litter, 1 female; Porter Cave, 8 April 1999, (J. Reddell, M. Reyes), Berlese of leaf litter, 2 females; Rocker River Cave System (B.R.'s Secret Cave), 9 Feb. 1992 (J. Reddell, M. Reyes), Berlese of litter, 1 female.

Comments.—This is an undescribed species known from many caves in Central Texas. It is related to "*Eularia*" *suspecta* Gertsch and Mulaik, which is known from a cave in Val Verde County.

Eperigone maculata (Banks)

Records.—*Bell County*: Keilman Cave, 26 Sept. 1997 (J. Reddell), Berlese of leaf litter, 1 female; 23 April 1998 (J. Reddell, M. Reyes), Berlese of leaf litter, 26 immatures; Plasma Cave, 19 May 1999 (J. Reddell), Berlese of leaf litter, 1 female, 1 immature; .

Coryell County: Chigiouxs' Cave, 21 Nov. 1995 (J. Reddell, M. Reyes), 1 male; Copperhead Sink No. 2, 20 Feb. 1999 (M. Reyes), 1 female; Plateau Cave No. 2, 15 Jan. 1992 (J. Reddell, M. Reyes), 1 female; Porter Cave, 8 April 1999 (J. Reddell, M. Reyes), 1 female; Berlese of leaf litter, 1 male; Runoff Cave, 8 May 1998 (J. Reddell, M. Reyes), 1 female.

Comments.—This troglophilic spider has been found in caves throughout Central Texas. It is usually found under rocks and in leaf litter.

Erigone autumnalis Emerton

Records.—*Bell County*: Fellers Cave, 6 May 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male.

Coryell County: Fossil Spring Cave, 16 July 1993 (J. Reddell, M. Reyes), 1 male.

Comment.—This species was taken from under rocks in darkness.

Lepthyphantes sp.

Record.—*Bell County*. L.Z. Sid Sink, 3 May 2000 (J. Reddell, M. Reyes), 1 immature.

Comment.—Without adults being known from this sink, this accidental cannot be identified further.

Lepthyphantes sabulosus (Keyserling)

Record.—*Bell County*: Treasure Cave, 2 Nov. 1998 (J. Cokendolpher, J. Reddell, M. Reyes), 1 male, 1 female (JCC).

Comment.—This species was taken from under rocks and is an accidental.

?*Meioneta* sp.

Records.—*Bell County*. Talking Crows Cave, 6 June 2000 (J. Reddell, M. Reyes), 1 damaged immature.

Coryell County: Ingram Cave, 16 Sept. 1997 (L.J. Graves, M. Reyes), 3 immatures.

Comment.—This material is too immature for positive generic identification.

Meioneta sp.

Records.—*Bell County*: Sanford Pit Cave, bottom of pit, 4 Nov. 1998 (J. Krejca), 1 immature.

Coryell County: Plateau Cave No. 2, 23 March 1990 (J. Reddell, M. Reyes), 2 immatures.

Comment.—This material is too immature for further identification.

Meioneta sp. prob. *llanoensis* (Gertsch and Davis)

Records.—*Bell County*: Cub Cave, 18 May 1999 (J. Reddell), 1 immature; Nolan Creek Cave, 19 May 1998 (J. Reddell, M. Reyes), 1 immature; Raining Rattler Cave, 2 May 2000 (M. Reyes), 2 immatures; Root Sink, 13 May 1999 (J. Reddell), 1 immature; Seven Mile Mountain Cave, 11 April 1999 (R. Price, M. Warton), 2 immatures; Streak Cave, 14 June 2000 (J. Krejca, J. Reddell, M. Reyes, P. Sprouse), 1 immature; Talking Crows Cave, 6 June 2000 (J. Reddell, M. Reyes), 2 immatures; Violet Cave, 23 April 1998 (J. Reddell, M. Reyes), 1 immature.

Coryell County: Plateau Cave No. 1, 15 Jan. 1992 (L.J. Graves), 1 male (det. W.J. Gertsch) (AMNH); Rocket River Cave System (Double Tree Cave), 1 female (det. W.J. Gertsch) (AMNH); Runoff Cave, 28 Aug. 1991 (J. Reddell, M. Reyes), 2 females (det. W.J. Gertsch) (AMNH).

Comments.—These specimens probably belong to the widespread species listed below. We have not seen the adults identified by W.J. Gertsch.

Meioneta llanoensis (Gertsch and Davis)

Records.—*Bell County*: Big Crevice, 13 May 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 female; Buchanan Cave, 7 May 1998 (L.J. Graves, J. Reddell, M. Reyes), 2 females, 1 immature; 4 Nov. 1998 (J. Cokendolpher, J. Krejca, J. Reddell, M. Reyes), 4 males, 4 females, 2 immatures; 5 May 1999 (J. Reddell, M. Reyes), 1 female; lower level, 13 June 2000 (J. Krejca, P. Sprouse), 1 female, 1 immature; upper level, 13 June 2000 (J. Reddell, M. Reyes), 2 males, 2 females, 1 immature; Bumelia Well Cave, 4 Nov. 1998 (J. Cokendolpher, J. Krejca), 1 male; C. B. Cave, 21 April 1998 (J. Reddell, M. Reyes), 2 females, 1 immature; Camp 6 Cave No. 1, 5 May 1999 (J. Reddell, M. Reyes), 2 males, 1 female, 1 immature; Deep in Dis Bear Cave, 18 May 1998 (J. Reddell, M. Reyes), 1 female, 3 immatures; Estes Cave, 28 June 2000 (M. Reyes, M. Warton), 2 males; Fellers Cave, 6 May 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male, 1 female; Figure 8 Cave, 9 Feb. 1996 (M. Warton); 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male, 2 females, 5 immatures; 3 Nov. 1998 (J. Cokendolpher, M. Reyes), 1 male, 4 females; Fools Cave, 1 April 1999 (J. Reddell, M. Reyes), 1 male, 1 female; Forgotten Sink, 1 April 1999 (J. Reddell, M. Reyes), 4 females, 1 immature; Gnarla Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 3 females, 1 immature; 24 April 1998 (J. Reddell, M. Reyes), 2 males; 3 females, 1 immature; Jagged Walls Cave, 14 March 1992 (J. Reddell, M. Reyes), 1 male; L.Z. Sid Sink, 3 May 2000 (J. Reddell, M. Reyes), 1 female; Long Joint Sink, Oct. 1995 (M. Warton & Associates), 2 females, 1 immature; Lucky Rock Cave, 22 Feb. 1996 (D. Allen, L.J. Graves, D. Love), 2 males, 1 immature; 10 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 2 males, 5 females, 7 immatures; Marcelino's Cave, 2 May 2000 (M. Reyes), 2 males, 1 female; Owl Mountain Cave, 24-25 Oct. 1995 (D. Allen, L.J. Graves), 1 female, 1 immature; 28 May 2000 (J. Reddell, M. Reyes), 1 male; 27 June 2000 (J. Reddell, M. Reyes), 1 female; Peep in the Deep Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 female, 1 immature; 8 May 1998 (J. Reddell, M. Reyes), 2 females; 3 Nov. 1998 (J. Cokendolpher, J. Reddell), 2 females, 1 immature; 5 May 1999 (J. Reddell, M. Reyes), 3 immatures; Road Side Sink, 1 July 1993 (M. Warton), 1 female; 3 Nov. 1998 (M. Reyes), 2 females; Rugger's Rift Cave, 5 Nov. 1998 (J. Reddell, M. Reyes), 2 males, 2 females; Sanford Pit Cave, 18 May 1998 (J. Reddell, M. Reyes), 1 female; 4 Nov. 1998 (J. Cokendolpher, J. Krejca), 2 males, 6 females, 4 immatures; Skeeter Cave, 18 May 1999 (L.J. Graves, J. Reddell, M. Reyes), 2 males; Soldiers Cave, 25 March 1999 (J. Reddell, M. Reyes), 1 female, 1 immature; Streak Cave, 6 Oct. 1995 (M. Warton), 1 male, 2 females; 26 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 1 male, 3 females, 5 immatures; Talking Crows Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 2 males, 3 females, 2 immatures; 2 Nov. 1998 (M. Reyes), 3 males, 1 female; 6 June 2000 (J. Reddell, M. Reyes), 1 male, 1 female, 3

immatures; Treasure Cave, 21 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female, 1 immature; 2 Nov. 1998 (J. Cokendolpher, J. Reddell, M. Reyes), 3 females; Triple J Cave, 23 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male, 6 immatures; Valentine Cave, 18 Sept. 1997 (J. Reddell, M. Reyes), 1 male, 3 females; Violet Cave, 5 June 2000 (J. Reddell, M. Reyes), 1 male, 2 immatures; Viper Den Cave, 27 Jan. 1990 (J. Reddell, M. Reyes), 1 female; West Corral Sink, 3 May 2000 (J. Reddell, M. Reyes, M. Warton), 1 female.

Coryell County: Big Red Cave, 6 May 1999 (J. Reddell, M. Reyes), 1 female; 14 June 2000 (J. Krejca, P. Sprouse), 1 female; Chigiouxs' Cave, 22 Nov. 1994 (M. Warton), 3 females; Copperhead Cave, 30 April 1998 (J. Reddell, M. Reyes), 1 female; Cornelius Cave, 21 Feb. 1995 (J. Reddell, M. Reyes), 1 female; Egypt Cave, 21 Jan. 1992 (J. Reddell, M. Reyes), 1 immature (det. W.J. Gertsch) (AMNH); 16 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 1 male; 7 April 1999 (J. Reddell, M. Reyes), 1 female; Ingram Cave, 7 April 1999 (J. Reddell, M. Reyes), 1 female, 1 immature; Keyhole Cave, 20 Feb. 1999 (J. Reddell, M. Reyes), 2 females; 6 May 1999 (J. Reddell, M. Reyes), 1 penultimate male, 1 female; Plateau Cave No. 2, 15 Jan. 1992 (J. Reddell, M. Reyes), 1 female, 1 immature; Porter Cave, 8 April 1999 (J. Reddell, M. Reyes), 1 male, 1 female; Tippit Cave, 24 Jan. 1992 (D. McKenzie, J. Reddell, M. Reyes), 1 male; 16 July 1993 (D. McKenzie, J. Reddell, M. Reyes), 1 male; 8 April 1999 (L.J. Graves), 1 female, 3 immatures; 22 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male, 1 female.

Comments.—This troglophilic species is extremely abundant in caves throughout Central Texas. It may be found under rocks and hanging from webs in small cavities on cave walls.

Neriene radiata (Walckenaer)

Record.—*Bell County*: Long Joint Sink, 1 May 1998 (J. Reddell, M. Reyes), 1 male, 1 female.

Comment.—This is an accidental species found in the entrance sink.

Liocranidae

Phrurotimpus sp.

Record.—*Bell County*: Fools Cave, 1 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter, 1 male.

Comments.—This is an accidental found in leaf litter at the bottom of the entrance sink. This genus is in need of taxonomic revision and many specimens cannot currently be identified with certainty.

Scotinella sp.

Records.—*Bell County*: Talking Crows Cave, 2 Nov. 1998 (M. Reyes), 1 female.

Coryell County: Mixmaster Cave, 9 Sept. 1997 (L.J. Graves, D. McKenzie, J. Reddell, M. Reyes), 1 immature.

Comments.—This is an accidental species taken from the entrance area of the caves. This genus is in need of taxonomic revision and many specimens cannot currently be identified with certainty.

Lycosidae

Undetermined genus and species

Record.—*Bell County*. Keilman Cave, 5 June 2000 (J. Reddell, M. Reyes), 3 immatures.

Comment.—These very early instar immatures cannot be reliably identified to genus.

Pirata sp.

Record.—*Coryell County*: Brokeback Cave, 5 Sept. 1991 (D. McKenzie, J. Reddell, M. Reyes), 1 male, 4 females (det. W.J. Gertsch) (AMNH).

Comments.—This is an accidental species. We have not seen this material.

Rabidosa rabida (Walckenaer)

Record.—*Bell County*. Keilman Cave, 5 June 2000 (J. Reddell, M. Reyes), 1 immature.

Comment.—Although immature, this distinctively marked species can be recognized. It is an accidental.

Schizocosa sp. prob. *saltatrix* (Hentz)

Record.—*Bell County*: Newby Cave, 19 May 1999 (J. Reddell, M. Reyes), 1 male.

Comment.—This is an accidental species. The identification of this specimen is uncertain because both pedipalps are missing. Further material needs to be collected from this cave.

Schizocosa saltatrix (Hentz)

Records.—*Bell County*: Coyote Den Cave, 8 May 1998 (J. Reddell, M. Reyes), 1 female; Keilman Cave, 8 May 1998 (J. Reddell, M. Reyes), 1 female; Lunch Counter Cave, 25 March 1999 (J. Reddell, M. Reyes), 1 male, 1 female; Seven Mile Mountain Cave, 11 April 1999 (R. Price, M. Warton), 1 male; Treasure Cave, 21 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female.

Comment.—This accidental species was taken in the entrance area of these caves.

Trochosa sp.

Record.—*Coryell County*: 1923 Cave, 15 Jan. 1992 (J. Reddell, M. Reyes), 1 immature (det. W.J. Gertsch) (AMNH).

Comments.—This is an accidental species. We have not seen this material.

Nesticidae

Eidmannella sp. prob. *pallida* (Emerton)

Records.—*Bell County*: Sledgehammer Cave, 13 Jan. 1995 (D. Allen), 2 immatures; Viper Den Cave, 12 Jan. 1995 (D. Allen, M. Warton), 4 immatures.

Comment.—These immature specimens probably belong to *E. pallida*.

Eidmannella pallida (Emerton)

Records.—*Bell County*: Camp 6 Cave No. 1, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female, 4 immatures; 6 June 2000 (J. Reddell, M. Reyes), 1 male, 3 females; Figure 8 Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female; 3 Nov. 1998 (M. Reyes), 1 female; Marcelino's Cave, 2 May 2000 (M. Reyes), 1 female; Rugger's Rift Cave, 5 Nov. 1998 (J. Reddell, M. Reyes), 1 female; Sanford Pit Cave, lower level, 13 June 2000 (J. Krejca, P. Sprouse), 1 female; Talking Crows Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 male; Valentine Cave, 14 Feb. 1996 (M. Warton), 1 female.

Coryell County: Chigiouxs' Cave, 22 Nov. 1994 (M. Warton), 1 male; Plateau Cave No. 1, 23 March 1990 (J. Reddell, M. Reyes), 1 female; Tippit Cave, 31 Jan. 1992 (J. Reddell, M. Reyes), 1 female; 22 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female.

Comments.—This is an abundant troglophile in caves throughout the United States and Mexico. It is usually found hanging from delicate webs in cavities of cave walls. Other species of the genus are troglobites in Texas.

Gaucelmus augustinus Keyserling

Record.—*Bell County*: Camp 6 Cave No. 1, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 female.

Comment.—This is a threshold troglophile found in many caves in Texas and Mexico.

Pholcidae

Modisimus texanus Banks

Records.—*Bell County*: Sledgehammer Cave, 13 Jan. 1995 (D. Allen), 2 females; Viper Den Cave, 12 Jan. 1995 (D. Allen, M. Warton), 2 females, 2 immatures.

Comments.—This is a troglophile found in many caves in Central Texas. It is found hanging from webs on cave walls.

Salticidae

Habrocestum acerbum Peckham and Peckham

Record.— *Bell County*: Road Side Sink, 1 July 1993 (M. Warton), 1 female.

Comment.—This accidental species was taken from the bottom of the entrance drop.

Scytodidae

Scytodes sp.

Record.—*Bell County*: Coyote Den Cave, 21 April 1998 (J. Reddell, M. Reyes), 3 immatures.

Comment.—This accidental species was taken from leaf litter just inside the entrance to the cave.

Sicariidae

Loxosceles sp.

Record.—*Coryell County*: Goathead Cave, 5 Sept. 1991 (D. McKenzie, J. Reddell, M. Reyes), 1 immature (det. W.J. Gertsch) (AMNH).

Comment.—This may be the same as the species reported below.

Loxosceles reclusa Gertsch and Mulaik

Record.—*Bell County*: Seven Cave, 18 Sept. 1997 (J. Reddell), 1 female.

Comments.—The brown recluse spider has been taken from caves in several counties in Texas. It is

presumably a troglophile. It was found in a web on the floor in the twilight zone of the cave.

Tetragnathidae

Leucauge venusta (Walckenaer)

Records.—*Bell County*: C. B. Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 female; Keilman Cave, 8 May 1998 (J. Reddell, M. Reyes), 1 female; Violet Cave, 23 April 1998 (J. Reddell, M. Reyes), 1 female.

Comment.—This accidental species was found in the entrance areas of these caves.

Tetragnatha sp.

Record.—*Bell County*: Long Joint Sink, 23 March 1999 (J. Reddell), 1 immature.

Comment.—This accidental species was taken from the entrance sink.

Theridiidae

Undetermined genus and species

Records.—*Bell County*. Owl Mountain Cave, 28 May 2000 (J. Reddell, M. Reyes), 1 immature.

Coryell County: Gann Cave, 14 Jan. 1992 (J. Reddell, M. Reyes), 1 female, 1 immature (det. W.J. Gertsch) (AMNH); Rocket River Cave System (Cave Springs Cave), 14 Jan. 1992 (J. Reddell, M. Reyes), 2 females (det. W.J. Gertsch) (AMNH).

Comments.–We have not seen the specimens determined by Gertsch; all may belong to *Achaearanea porteri*.

Achaearanea sp. prob. *porteri* (Banks)

Records.—*Bell County*: C. B. Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 immature; Night Vision Sink No. 2, 26 Sept. 1997 (J. Reddell), 1 immature; Red Ant Cave, 28 Aug. 1991 (J. Reddell), 4 females (det. W.J. Gertsch) (AMNH); Violet Cave, Oct. 1995 (M. Warton & Associates), 1 immature.

Coryell County: Egypt Cave, 23 Nov. 1994 (M. Warton), 1 immature; Goathead Cave, 5 Sept. 1991 (D. McKenzie, J. Reddell, M. Reyes), 1 female (det. W.J. Gertsch) (AMNH); Loop-Around Cave, 16 July 1993 (J. Reddell, M. Reyes), 4 immatures; Rocket River Cave System (Double Tree Cave), 16 Jan. 1992 (J. Reddell, M. Reyes), 2 females, 1 immature (det. W.J. Gertsch) (AMNH); Runoff Cave, 28 Aug. 1991 (J. Reddell, M. Reyes), 1 female, 1 immature (det. W.J. Gertsch) (AMNH).

Comments.—These specimens probably belong to *A. porteri*. We have not seen the material identified by W.J. Gertsch.

Achaearanea porteri (Banks)

Achaearanea porteri: Reddell, 1965:176.

Records.—*Bell County*: Cub Cave, 18 May 1999 (J. Reddell), 1 male, 1 immature; Gnarla Cave, 20 April 1998 (J. Reddell, M. Reyes), 1 female; Lunch Counter Cave, 18 Sept. 1997 (J. Reddell), 1 female; 25 March 1999 (J. Reddell, M. Reyes), 1 male, 2 females, 1 immature; Nolan Creek Cave, 9 March 1963 (D. McKenzie, J. Reddell), 3 females (det. W.J. Gertsch) (AMNH) (Reddell, 1965); 27 Jan. 1990 (J. Reddell, M. Reyes), 2 females, 5 immatures; 17 July 1993 (J. Reddell, M. Reyes), 3 females, 1 immature; Rugger's Rift Cave, 9 Nov. 1998 (J. Reddell, M. Reyes), 1 male, 2 immatures; Sanford Pit Cave, 18 May 1998 (J. Reddell, M. Reyes), 1 female; Streak Cave, 26 Nov. 1997 (L.J. Graves, J. Reddell, M. Reyes), 1 female.

Coryell County: Fossil Spring Cave, 16 July 1993 (J. Reddell, M. Reyes), 1 male, 1 female, 1 immature; Plateau Cave No. 2, 23 March 1990 (J. Reddell, M. Reyes), 1 female; Rocket River Cave System (Double Tree Cave), 23 March 1990 (J. Reddell, M. Reyes), 2 females; Saltpeter Cave, 21 Nov. 1995 (J. Reddell, M. Reyes), 2 males, 3 females, 4 immatures.

Comments.—This troglophile is found hanging from webs on cave walls, most commonly near entrances but may occur in the area of total darkness. It has been found in caves throughout Texas.

Argyrodes sp.

Record.—*Coryell County:* Cornelius Cave, 21 Nov. 1995 (J. Reddell, M. Reyes), 1 immature.

Comment.—This material is too immature for further identification. Species of this genus inhabit the webs of other species of Theridiidae, Araneidae, Tetragnathidae, and other web-builders.

Argyrodes furcatus (O. Pickard-Cambridge)

Records.—*Bell County*: Coyote Den Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 male, 1 immature; Talking Crows Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 immature.

Comment.—This species was taken from the webs of *Tidarren* sp. prob. *sisyphoides* in Talking Crows Cave and *Tidarren sisyphoides* in Coyote Den Cave.

Latrodectus sp. prob. *mactans* Fabricius

Record.—*Coryell County*: Mixmaster Cave, 9 Sept. 1997 (L.J. Graves, D. McKenzie, J. Reddell, M. Reyes), 1 female.

Comment.—This species was taken below the entrance gate.

Pholcomma? sp.

Record.—*Bell County*: West Corral Sink, 3 May 2000 (J. Reddell, M. Reyes, M. Warton), 2 females.

Comments.—In the absence of male specimens we are not certain of this identification. This is apparently the first record of the genus in Texas, otherwise known from Louisiana and states further east.

Tidarren sp. prob. *sisyphoides* (Walckenaer)

Records.—*Bell County*: Lunch Counter Cave, 3 Nov. 1998 (M. Reyes), 1 immature; Talking Crows Cave, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 1 immature.

Comment.—This material was taken from webs just inside the entrance to the cave.

Tidarren sisyphoides (Walckenaer)

Records.—*Bell County*: Camp 6 Cave No. 1, 2 Nov. 1998 (J. Cokendolpher, J. Reddell), 2 females, 2 immatures; 6 June 2000 (J. Reddell, M. Reyes), 1 female; Coyote Den Cave, 21 April 1998 (J. Reddell, M. Reyes), 1 female, 1 immature.

Comment.—This material was taken from webs near the cave entrances.

Thomisidae

Xysticus robinsoni Gertsch

Record.—*Bell County*. Keilman Cave, 5 June 2000 (J. Reddell, M. Reyes), 1 female.

Comment.—This species is an accidental.

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REVIEW OF THE GENUS *TARTAROCREAGRIS*, WITH DESCRIPTIONS OF NEW SPECIES (PSEUDOSCORPIONIDA: NEOBISIIDAE)

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ABSTRACT

The five species previously assigned to *Tartarocreagris* Curcic are reviewed and supplemental data are given. *T. reddelli* (Muchmore) is synonymized with *T. infernalis* (Muchmore). *Microcreagris ozarkensis* Hoff is reassigned to *Tartarocreagris*. Nine new species are described: *Tartarocreagris altimana, T. amblyopa, T. attenuata, T. cookei, T. domina, T. grubbsi, T. hoodensis, T. proserpina,* and *T. reyesi.* Representatives of the genus have been found in Texas, Oklahoma, and Arkansas; though most species are found only in caves, three species are known from epigean sites. The generic diagnosis is revised on the basis of the additional information accumulated. A key to the species of *Tartarocreagris* is provided.

INTRODUCTION

The pseudoscorpion genus *Tartarocreagris* was established by Curcic (1984), with *Microcreagris infernalis* Muchmore, 1969 as the type species; the type species was, at the time, known only from the holotype female, found in Inner Space Caverns, Williamson County, Texas. The genus was subsequently enlarged by the addition of four other species from Travis County, Texas, namely, *Microcreagris reddelli* Muchmore (1969), *M. texana* Muchmore (1969), *Tartarocreagris comanche* Muchmore, new species, and *T. intermedia* Muchmore, new species; and the generic diagnosis was revised, most importantly by the inclusion of some male sexual characters (Muchmore, 1992). More recently, active exploration of and collecting in and around Texas caves, especially by James Reddell, Marcelino Reyes, and Andy Grubbs, has resulted in the accumulation of many more specimens of pseudoscorpions referable to *Tartarocreagris*. These represent new records of established species and at least nine new species, which are documented below.

METHODS

Most of the specimens treated here were cleared and mounted on slides for microscopic examination, generally following the procedure outlined by Hoff (1959) but using clove oil instead of beechwood creosote for clearing. Mounted specimens are designated by (sl), those remaining in alcohol by (al). Some abbreviations are used in the descriptions: L = length; L/B = ratio, length/breadth; L/D = ratio, length/depth; D/B = ratio, depth/breadth; T = tactile seta. Lengths of palpal chela and hand are measured exclusive of the pedicel, and the ratios L/B and L/D are calculated using these measurements. Length of the pedicel is also given so that total lengths of chela and hand may be found easily.

All new types are deposited in the Florida State Collection of Arthropods, Gainesville, FL (FSCA);

various other specimens are from the American Museum of Natural History, New York, NY (AMNH), the Illinois Natural History Survey, Champaign, IL (INHS), and the Museum of Comparative Zoology, Harvard University, Cambridge, MA (MCZ).

Family NEOBISIIDAE Chamberlin

Genus *Tartarocreagris* Curcic

Tartarocreagris Curcic 1984:163-164; Harvey 1991:416; Muchmore 1992:131. Type species: *Microcreagris infernalis* Muchmore, 1969.

Diagnosis (revised).—Essentially as revised earlier by Muchmore (1992:131), but with some modifications. A genus of the family Neobisiidae Chamberlin (1930:9), and one of the American *Microcreagris*-related genera (see Curcic 1989). Carapace longer than broad; epistome small to absent; eyes present (4 or 2) or absent; chaetotaxy 20-30, with 4 at anterior and 4-6 at posterior margin. Palpal coxa with 3-4 (occasionally 5) long, apical setae. Middle tergites with 12-15 setae; middle sternites with 14-17 setae, including 2 discal setae on sternites 6-8 or 9. Male sternite 2 (anterior genital operculum) with about 25 scattered setae; sternite 3 (posterior genital operculum) slightly emarginate anteriorly, and with 6-12 small setae on face and 12-15 larger setae in posterior marginal row. Female sternite 2 with 3-8 setae on each side of midline, ranging in size from very small to minute in the various species; sternite 3 with marginal row of 12-15 setae of moderate size. Internal genitalia of male with conspicuous round ventral sac, 2 smaller, round or ovoid dorsal sacs, and 2 long, narrow, wrinkled lateral sacs. Internal genitalia of female not yet characterized. Chelicera large, about 0.6 as long as carapace; hand with 6-7 setae; flagellum of about 8 serrate setae; galea slender, bifurcate distad of middle, each ramus with 0-3 spinules, smaller in male than female. Palps varied in form, rather short and robust in epigean species, longer and attenuated in cavernicolous species; D/B of chelal hand of epigean species often >1 (up to 1.3), that of cavernicolous species <1; small granules usually present on medial sides of trochanter, femur and chelal hand; chelal fingers with numerous contiguous marginal teeth, the distalmost 10-20 cusped, the others rounded. Fixed finger of chela with trichobothria *et*, *it* and *est* in distal half, and *ist*, *isb* and *ib* in proximal half; *esb* and *eb* situated laterally on distal part of hand. Leg I with the ratio, femur L/ patella L, ranging from 1.3 in more robust, epigean species to 1.65 in attenuate troglobites. Leg IV with the suture between femur and patella nearly perpendicular to the long axis and a little proximad of the middle of the combined segment. Subterminal tarsal setae of legs usually with a spine near middle and/or a few spinules near tip. Arolia shorter than claws.

Distribution.—Representatives of this genus have been found in Texas, Oklahoma and Arkansas, both in epigean habitats and in caves.

Remarks.—It is noteworthy that the setae on sternite 2 (anterior genital operculum) of females are very small; in the most extreme example, *Tartarocreagris ozarkensis*, these setae are reduced to minute peglike structures (see below). This situation is similar to that described by Harvey for species in the family Hyidae, for which Harvey believed the reduced setae to be unique and diagnostic (1992:1396; 1993:2-4). It appears, then, that the reduced setae on sternite 2 in hyids and some species of *Tartarocreagris* are not so much indicative of close phylogenetic relationship as of similar environmental factors (as yet unknown).

In the possession of 2 rounded, dorsal genital sacs in males, *Tartarocreagris* resembles *Saetigerocreagris* Curcic (1984) and *Fissilicreagris* Curcic (1984) (see Chamberlin 1962:figs. 12F, G, I; Muchmore, 1994:fig. 4; Muchmore and Cokendolpher, 1995:fig. 7). What bearing this may have on the relationships among *Tartarocreagris* and the other two genera is not yet clear. Paired dorsal sacs are found only in these three genera among the *Microcreagris*-related genera in America (see Curcic 1989).

Tartarocreagris infernalis (Muchmore)
Fig. 1

Microcreagris infernalis Muchmore, 1969:15, 21, fig. 12; Mitchell and Reddell, 1971:44; Rowland and Reddell, 1976:15.

Microcreagris sp. Reddell 1970:403.

Tartarocreagris infernalis (Muchmore): Curcic, 1984:163, figs. 21, 40; Harvey, 1991:416; Muchmore, 1992:131, 151.

Microcreagris reddelli Muchmore, 1969:17, 21, fig. 11; Mitchell and Reddell, 1971:44; Rowland and Reddell, 1976:14. NEW SYNONYMY

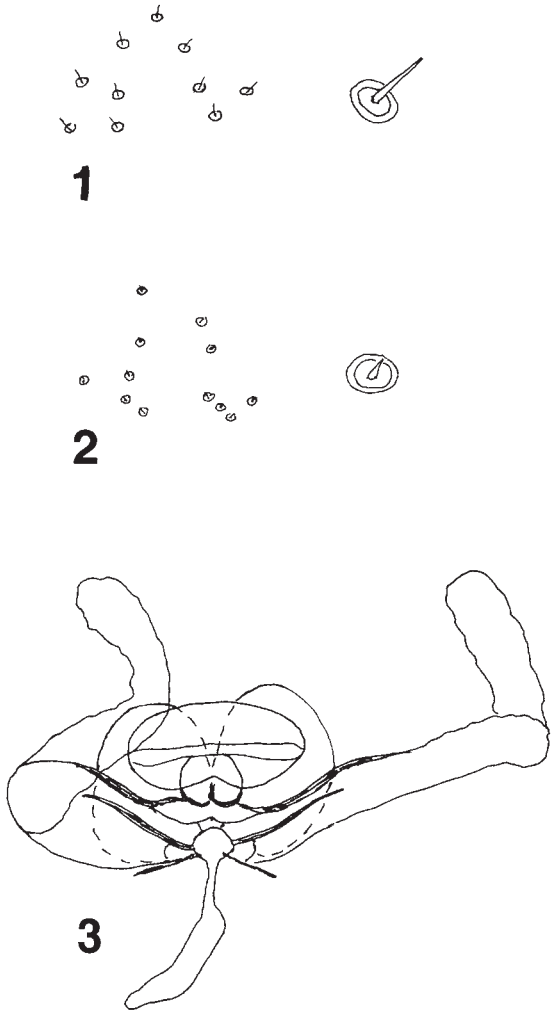
Australinocreagris reddelli (Muchmore): Curcic, 1989:360, figs. 7, 16; Harvey, 1991:330.

Tartarocreagris reddelli (Muchmore): Muchmore, 1992:132.

Type material examined.—Holotype female (DM176.01001), from Inner Space Caverns (= Core Hole Cave), 3 km S of Georgetown, Williamson County, Texas (sl, AMNH). Holotype female of *Microcreagris reddelli* (DM171.01001), from Schulze Cave (=

McDonald Cave) about 3 km E of Volente, Travis County, Texas (sl, AMNH).

New records.—TEXAS: *Travis County*: McDonald Cave, 15 December 1988 (J. Reddell, M. Reyes), 1 male. *Williamson County*: Beck Pride Cave, 29 May 1996 (J. Reddell, M. Reyes), 1 female; Beck Ranch Cave, 23 June 1968 (J. Reddell, R.W. Mitchell), 1 female; Broken Zipper Cave, 16 March 1993 (M. Warton), 1 female; Do Drop In Cave, 23 November 1993 (J. Reddell, M. Reyes), 1 male; Cat Hollow Cave No. 1, 30 June 1992 (M. Warton), 1 female, 1 tritonymph; Dragonfly Cave, 11 July 1994 (J. Reddell, M. Reyes), 4 males; East Fork Fissure, 5 July 1991 (W. R. Elliott, D. Green), 1 male; Electro-Mag Cave, 18 October 1995 (M. Reyes), 1 male; Electro-Mag Cave, 7 August 1996, under rock (J. Reddell, M. Reyes), 1 male, 1 female; Formation Forest Cave, 21 March 1993 (J. Reddell, M. Reyes), 1 male; Holler Hole Cave, 11 April 1994, 12 June 1996 (J. Reddell, M. Reyes), 1 male, 1 female; Joint Effort Cave, 25 June 1997 (J. Reddell, M. Reyes), 1 male; LakeLine Cave, 6 August 1991 (W. R. Elliott, D. Allen), 1 male; LakeLine Cave, 7 February 1990, underside of small rock in total darkness (J. Reddell, M. Reyes), 1 tritonymph; Mayor Elliott Cave, 30 April 1997 (W. R. Elliott), 1 female; Medicine Man Cave, 6 April 1994 (J. Reddell, M. Reyes), 1 female, 1 tritonymph; Off Campus Cave, 8 April 1989 (J. Reddell, M. Reyes), 1 female; On Campus Cave, 7 May 1992 (L. J. Graves, M. Warton), 1 female, 1 deutonymph; Papoose Cave, 18 April 1994 (J. Reddell, M. Reyes), 1 tritonymph; Polaris Cave, 19 April 1994 (J. Reddell, M. Reyes), 1 female; Texella Cave, 28 September 1991 (J. Reddell, M. Reyes), 1 male; Texella Cave, 15 September 1995 (A. G. Grubbs), 1 male; The Abyss, 6 March 1994 (J. Reddell, M. Reyes), 1 female; Venom Cave, 17 November 1993 (J. Reddell, M. Reyes), 1 male; War Party Cave, 20 April 1994 (J. Reddell, M. Reyes), 1 male; Waterfall Canyon Cave, 25 June 1992 (M. Reyes), 1 tritonymph, 1 deutonymph; (all on slides, in FSCA).



Figs. 1-3.—1, *Tartarocreagris infernalis* (Muchmore): setae on sternite 2 (anterior genital operculum) of female. 2-3, *Tartarocreagris ozarkensis* (Hoff): 2, setae on sternite 2 (anterior genital operculum) of female; 3, internal genitalia of male, ventral view.

Diagnosis.—A very large, eyeless, cave-dwelling species, with long, slender palps: palpal chela(without pedicel) 2.33-2.98 mm long, L/B 4.55-5.5; generally larger than other species of *Tartarocreagris*, with palpal femur up to 1.75 mm long.

Supplemental data (based on 29 adult specimens).—Male and female much alike in size and proportions. Epistome insignificant to small, rounded. Setae on carapace, 4-5 at anterior and 6-8 at posterior margin. Tergal chaetotaxy, usually 8 on 1st segment and 12-15 on middle segments. Males with anterior border of sternite 3 notched and bordered by 8-10 small setae. Females with 6-10 very small setae (Fig. 1) on sternite 2. Internal genitalia of males with 2 rounded dorsal sacs and long, narrow lateral sacs, as in *T. texana* (see Muchmore 1992:fig.4). Palp long and slender: femur 1.3-1.5x and chela 2.1-2.5x as long as carapace. L/B of trochanter 2.6 (2.35-2.85), femur 5.65 (5.2-6.0), patella 4.3 (3.85-4.6), and chela(without pedicel) 4.75 (4.55-5.5); L/D of hand(without pedicel) 1.95 (1.75-2.0); D/B of hand 0.92-0.97; movable finger 1.7 (1.75-2.15)x as long as hand. Leg I: femur 1.58 (1.5-1.7)x as long as patella. Leg IV: L/D of femur+patella 5.1 (4.7-5.9), tibia 8.9 (7.9-9.4).

Measurements (mm).—Figures given first for holotype, followed in parentheses by ranges for 28 other adult specimens, both male and female. Body L 3.80 (2.95-5.10). Carapace L 1.08 (0.975-1.24). Chelicera L 0.69 (0.605-0.78). Palp: trochanter 0.74 (0.65-0.79)

/ 0.29 (0.265-0.32); femur 1.58 (1.40-1.75) / 0.28 (0.25-0.31); patella 1.38 (1.20-1.50) / 0.32 (0.30-0.37); chela(without pedicel) 2.60 (2.33-2.98) / 0.55 (0.46-0.615); hand(without pedicel) 1.01 (0.83-1.04) / 0.52 (0.435-0.585); pedicel L 0.17 (0.16-0.22); movable finger L 1.70 (1.48-2.07). Leg I: femur 0.72 (0.64-0.835) / 0.16 (0.15-0.19); patella 0.455 (0.42-0.50) / 0.15 (0.13-0.16). Leg IV: femur+patella 1.21 (1.08-1.38) / 0.24 (0.205-0.265); tibia 1.15 (1.01-1.35) / 0.13 (0.12-0.15).

Tritonymph.— Like adults, but smaller and with less attenuate appendages. Palp: L/B of femur 4.75-5.2, patella 3.1-3.65, chela(without pedicel) 3.9-4.7; L/D of hand(without pedicel) 1.6-1.85; D/B of hand 0.92-0.98; movable finger 1.6-1.8x as long as hand.

Measurements (mm).—Ranges for 5 specimens. Body L 2.56-2.85. Carapace L 0.71-0.90. Palp: femur 0.84-1.08 / 0.17-0.22; patella 0.69-0.84 / 0.205-0.27; chela(without pedicel) 1.34-1.86 / 0.30-0.48; hand(without pedicel) 0.56-0.71 / 0.30-0.445; pedicel L 0.10-0.12; movable finger L 0.87-1.27.

Deutonymph.—Body L 1.92, 2.16. Carapace L 0.585, 0.605. Palp: femur 0.635, 0.70 / 0.14, 0.15; patella 0.53, 0.56 / 0.17, 0.17; chela(without pedicel) 1.10, 1.18 / 0.27, 0.265; hand(without pedicel) 0.41, 0.45 / 0.26, 0.245; pedicel L 0.07, 0.08; movable finger L 0.755, 0.76.

Measurements (mm).—2 specimens. Palp: L/B of femur 4.55, 4.65, patella 3.1, 3.33, chela(without pedicel) 4.05, 4.45; L/D of hand(without pedicel) 1.55, 1.85; D/B of hand 0.96, 0.92; movable finger 1.85, 1.7x as long as hand.

Remarks.—This species is apparently successful and widespread in caves in much of Williamson County and the very northern part of Travis County, Texas. However, because the variation in size and proportions of the specimens assigned here is quite large, there remains the possibility that one or more unrecognized species may be included. Nevertheless, the measurements of the holotype of *M. reddelli* fall within the ranges reported, and that species must here be considered a synonym of *Tartarocreagris infernalis*.

Tartarocreagris texana (Muchmore)

Microcreagris texana Muchmore, 1969:18, 21, figs. 13, 14; Mitchell and Reddell, 1971:44; Rowland and Reddell, 1976:15; Chambers and Jahrsdoerfer, 1988:36029; Tilton and Johnston, 1990:1.

Microcreagris sp. Reddell, 1970:403.

Australinocreagris texana (Muchmore): Curcic, 1989:360, figs. 8, 15; Harvey, 1991:330.

Tartarocreagris texana (Muchmore): Muchmore, 1992:131, figs. 3, 4; O'Donnell et al., 1994:8, fig. 4, etc.; Elliott and Veni, 1994:270.

Type material examined.—Holotype female (WM849.01001), from Tooth Cave, 0.5 km N of Hickmuntown, Travis County, Texas (sl, AMNH).

New records.—TEXAS: *Travis County*: Amber Cave, 8 April 1984 (J. Reddell, M. Reyes), 1 male (sl, FSCA); Kretschmarr Double Pit, 20 April 1991 (J. Reddell, M. Reyes), 1 male (sl, FSCA); MWA Cave, 4 January 1995 (M. Warton), 1 female, 1 deutonymph (sl, FSCA).

Diagnosis.—A very large, eyeless, cave-dwelling species, with long, slender palps: palpal femur 1.44-1.58 mm long; chela(without pedicel) 2.30-2.47 mm long, L/B 5.55-5.75; L/D of chelal hand 2.15 or greater; a little smaller than *T. infernalis*, but with more slender chela.

Supplemental data.—Our knowledge of this species was expanded by the description of a male (Muchmore 1992). Now, with additional information about another male and female, the range of variation of *T. texana* can be appreciated better. The epistome is variable, but always small and rounded. Apical setae on palpal coxa number 3-5. In the male, the anterior margin of sternite 3 is slightly notched; in the internal genitalia, the dorsal sac, in favorable position, appears as a deeply bilobed sac, rather than as 2 separate sacs. Setae on sternite 2 of female are very small. Setae on cheliceral hand may be 6 or 7. Number of teeth on fixed chelal finger vary, depending on size of specimen. The animals are very large and the appendages long and slender.

Measurements (mm).—Ranges for the 4 known specimens. Body L 3.95-4.30. Carapace L 1.03-1.08. Palp: femur 1.44-1.58 / 0.245-0.265; patella 1.29-1.39 / 0.29-0.30; chela(without pedicel) 2.30-2.47 / 0.44-0.44; hand(without pedicel) 0.89-0.97 / 0.39-0.42; pedicel L 0.19-0.20; movable finger L 1.46-1.56. Leg IV: femur 1.15-1.19 / 0.215-0.23.

Ratios.—Palp: femur 1.4-1.5x and chela 2.2-2.4x as long as carapace. L/B of trochanter 2.55-2.65, femur 5.75-6.1, patella 4.45-4.8, and chela(without pedicel) 5.55-5.75; L/D of hand(without pedicel) 2.15-2.35; D/B of hand 0.97-0.98; movable finger 1.6-1.75x as long as hand. Leg IV: L/D of femur+patella 5.15-5.55.

Remarks.—*Tartarocreagris texana* is apparently restricted to a few neighboring caves in northern Travis County, Texas; it is presently known from Tooth, Amber, Kretschmarr Double Pit, and MWA caves. It may be noted that this species, the so-called Tooth Cave Pseudoscorpion (as *Microcreagris texana),* has been listed as endangered under the Endangered Species Act (see Chambers and Jahrsdoerfer 1988; Tilton and Johnston 1990).

Tartarocreagris comanche Muchmore

Tartarocreagris comanche Muchmore, 1992:133, figs. 5-7.

Type material examined.—Holotype female (WM7367.01001), from New Comanche Trail Cave, Travis County, Texas (sl, FSCA).

New records.—TEXAS: *Burnet County*: surface site 8 km NW of Spicewood, 9 November 1994 (A.G. Grubbs), 1 male, 6 females; surface site 8.5 km NW of Spicewood, 13 November 1994 (A.G. Grubbs), 1 male, 5 females; surface site 3 km SE of Smithwick, 13 October 1994 (A.G. Grubbs), 1 male; surface site 8 km SE of Marble Falls, 13 October 1994 (A.G. Grubbs), 2 males, 1 female; Waldman Cave, 8 km NW of Spicewood, 27 March 1993, 21 February 1995, 30 March 1995 (A.G. Grubbs), 1 male, 2 females; underside of rocks loosely buried in silt, Simons Squirm-Around Cave, 20 November 1990 (J. Reddell and M. Reyes), 1 male, 1 female; underside of rock loosely buried in silt, Snake Pit Sink, 20 November 1990 (J. Reddell and M. Reyes), 1 male. *Hays County*: Kira's Karst Park, a surface site 8 km N of Wimberley, 23 April 1995 (A.G. Grubbs), 1 male. (All sl, FSCA).

Diagnosis.—A medium-sized, four-eyed species with rather robust palps: palpal femur 0.84-1.1 mm long, L/B 3.5-3.9; D/B of chelal hand 1.1-1.15; eyes sometimes reduced in size; from Burnet and Hays Counties, Texas.

Supplemental description.—The species has been known till now only from the holotype female; the following description incorporates information about the additional material studied. Representative of *Tartarocreagris* as outlined above, and with the following particular features. Palps light brown, carapace and chelicerae tan, other parts straw colored. Carapace as long as broad; surface generally smooth, but reticulated laterally and with a shallow, transversely striated band near posterior margin; epistome small, triangular; 4 corneate eyes; about 25 setae, 4 at anterior and 6 at posterior margin. Each palpal coxa of holotype and allotype with 3 apical setae, paratypes with 3 or 4 setae. Tergal chaetotaxy of holotype 8:12:14:14:16:16:13:14:12:12:T2T:2, others similar. Sternal chaetotaxy of holotype male 25:[4-4]:(4)10/16(4):(4)12(4):15:2/17:2/16:2/16:2/14:13:T2T3T1T:2, other males similar; that of allotype (female) 11:(5)14(4):(4)11(5):14:2/14:2/13:2/16:13:12:T1T2T1T:2, other females similar; setae on sternite 2 of female very small. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of 7 or 8 serrate setae; galea slender, usually twice bifid at tip, that of male smaller than that of female. Palp moderately slender; femur 1.0-1.1x and chela 1.55-1.65x as long as carapace. L/B of trochanter 1.95-2.15, femur 3.5-3.9, patella 2.4-2.7, and chela(without pedicel) 2.6-3.0; L/D of hand(without pedicel) 1.2-1.4; D/B of hand usually 1.1-1.15; movable finger 1.05-1.15x as long as hand. Granules on medial sides of trochanter, femur and chelal hand, other surfaces smooth. Trichobothriotaxy typical. Fixed finger with 40-45 and movable finger with 45-55 marginal teeth, only the distal 8-10 cusped, others rounded. Legs moderately slender; leg I with femur 1.35-1.45x as long as patella; leg IV with L/D of femur+patella 3.5-3.8 and tibia 5.3-5.7. Subterminal tarsal setae with 1 or 2 spinules.

Measurements (mm).—Male. Ranges for 7 specimens. Body L 2.77-3.44. Carapace L 0.77-0.98. Chelicera L 0.46-0.59. Palp: trochanter 0.43-0.57 / 0.21-0.27; femur 0.84-1.11 / 0.22-0.295; patella 0.73-0.96 / 0.28-0.36; chela(without pedicel) 1.21-1.61 / 0.43-0.63; hand(without pedicel) 0.60-0.815 / 0.48-0.65; pedicel L 0.13-0.17; movable finger L 0.72-0.92. Leg I: femur 0.355-0.465 / 0.12-0.16; patella 0.25-0.34 / 0.11-0.14. Leg IV: femur+patella 0.64-0.88 / 0.18-0.26; tibia 0.59-0.75 / 0.11-0.14; basitarsus 0.21-0.265 / 0.08-0.105; telotarsus 0.28-0.37 / 0.08-0.095.

Female.—Ranges for 16 specimens. Body L 2.96-3.94. Carapace L 0.815-0.975. Chelicera L 0.48-0.615. Palp: trochanter 0.435-0.57 / 0.22-0.28; femur 0.87-1.09 / 0.235-0.29; patella 0.74-0.94 / 0.30-0.38; chela(without pedicel) 1.26-1.56 / 0.44-0.58; hand(without pedicel) 0.64-0.85 / 0.50-0.64; pedicel L 0.12-0.17; movable finger L 0.73-0.87. Leg I: femur 0.36-0.465 / 0.125-0.155; patella 0.265-0.34 / 0.12-0.14. Leg IV: femur+patella 0.69-0.86 / 0.20-0.245; tibia 0.59-0.75 / 0.11-0.14; basitarsus 0.20-0.265 / 0.09-0.11; telotarsus 0.30-0.39 / 0.08-0.09.

Remarks.— The considerable variability in size is real, because it can be seen in single collections, e.g. the 6 specimens from a surface site NW of Spicewood, where length of palpal femur ranges from 0.835 to 1.05 mm and that of chela from 1.2 to 1.55 mm. Specimens collected from epigean situations have better developed eyes than those from caves, but otherwise all are quite similar.

Tartarocreagris intermedia Muchmore

Tartarocreagris intermedia Muchmore, 1992:152, figs. 28-29.

Type material examined.—Holotype male (WM7453.01002) and paratype male, from Airman's Cave, Travis County, Texas (sl., FSCA). No other representative known.

Diagnosis.—A large, weakly four-eyed, cave-dwelling species with moderately slender palps; palpal femur 1.26-1.29 mm long, L/B 4.25-4.35; from Travis County, Texas.

Supplemental data.—Both known specimens (males) have a slight notch in the middle of the anterior margin of sternite 3. For easier comparison with the values reported for other species, the ratios of palpal chela and hand (without pedicel) are 3.4-3.45 and 1.3-1.35, respectively.

Tartarocreagris ozarkensis (Hoff),
NEW COMBINATION
Figs. 2, 3

Microcreagris ozarkensis Hoff, 1945:34-37, figs. 1-4.
Australinocreagris ozarkensis (Hoff): Curcic, 1984:156, figs 7, 8, 28, 29; Harvey, 1991:330 (complete synonymy).

Type material examined.—Holotype male (5287-341.2) and paratype male (5327-341.3), from debris in deep crevice at Devil's Den State Park, Washington County, Arkansas, (sl, INHS); allotype female (5280-341.), from debris under tree, [Farmington], Washington County, Arkansas (sl, INHS).

Other material examined.—ARKANSAS: *Clark County*: De Gray Dam, 6.5 km N of Arkadelphia, 4 June 1973 (J.M. Rowland), 1 male (sl, MCZ); *Pulaski County*: Pinnacle Mountain State Park, leaf litter, 13 March 1989 (R. Anderson), 4 males, 4 females, 3 tritonymphs (sl, FSCA); *Washington County*: Boston Mountains, Cove Creek Valley, 25 km S of Prairie Grove, September-October 1955, May 1956, January 1957 (M. Hite), 3 males, 2 females (sl, MCZ); OKLAHOMA: *Latimer County*: Red Oak, woodland litter, October 1976 (K. Stephan), 1 male (sl, FSCA).

Diagnosis.—A small to medium-sized, four-eyed, epigean species, with relatively robust palps, but depth of chelal hand no greater than breadth: palpal femur 0.76-1.01 mm long, with L/B 3.4-4.0; D/B of chelal hand 0.95-1.0; from western Arkansas and eastern Oklahoma.

Supplemental description.—Adults. The original description by Hoff (1945) is quite comprehensive, but some details need to be added or clarified or emphasized, as follows. Representative of *Tartarocreagris* as outlined above, and with the following particular features. Male and female generally similar; size quite variable, but females average a little larger than males. Surface of carapace smooth, but with a wide, transverse band of striations in the posterior third; 4 small eyes, the posterior pair sometimes inconspicuous; total number of setae on carapace 24-26. Coxal area typical; palpal coxa usually with 3 setae, occasionally 2 or 4 (holotype has 2 setae on right side, 3 on left). Tergal chaetotaxy of holotype 7:11:14:15:14:13:12:12:12:11:T1T:2, others similar. Sternal chaetotaxy of holotype (male) 36:[4-4]:(6)7/18(6):(6)14(6):15:2/15:2/15:2/17:15:13:T1T3T1T:2; in other males, sternite 2 with 25-30 scattered small setae, and sternite 3 with 3-7 setae on the face, and 11-15 along the posterior margin (see Curcic, 1984:fig. 7); in all males, the anterior margin of sternite 3 has a small, shallow, median invagination or notch. Sternal chaetotaxy of female generally similar, but sternite 2 with 9-14 minute, peglike setae, barely extending from their areoles, on face (Fig. 2), and sternite 3 with 10-15 normal setae along posterior margin (see also Curcic, 1984:fig. 8). Internal genitalia of male typical of the genus, with 2 distinct dorsal sacs and long, narrow lateral sacs (Fig. 3). Chelicera 2/3 as long as carapace; hand with 7 setae (occasionally 6); flagellum of 8 denticulate setae; galea slender, variously divided near tip, less branched in male than in female. Palp moderately slender: femur 1.0-1.2x and chela 1.55-1.85x as long as carapace; L/B of trochanter 2.0-2.25, femur 3.4-4.0, tibia 2.35-2.85. and chela(without pedicel) 2.9-3.6; L/D of hand(without pedicel) 1.4-1.75; D/B of chelal hand 0.95-1.0; movable finger 1.1-1.3x as long as hand. Positions of trichobothria as illustrated by Hoff (1945: fig.4) and Curcic (1984: figs. 28, 29). Surfaces of palp a little more granulate than suggested by Hoff, with a few small granules on medial side of trochanter near base, and granules on femur extending to dorsal and ventral sides. Legs slender; leg IV with L/D of femur+patella 3.3-4.0 and tibia 5.25-6.3. Subterminal tarsal setae with 1-3 spinules on distal third.

Tritonymph.—Much like adults but pale in color, smaller, and less slender. No transverse band evident on carapace; eyes small, flat. Palpal coxa with 3 setae. Chelicera 0.6 as long as carapace; hand with 6 setae; galea slender, bifid. Palp with L/B of femur 3.45-3.6, patella 2.25-2.4, and chela(without pedicel) 3.1-3.25; L/D of hand(without pedicel) 1.55-1.65; movable finger 1.1-1.15x as long as hand.

Measurements (mm).—Adults. Ranges given for 8 males, followed in parentheses by ranges for 7 females. Body L 2.5-3.2 (2.45-3.1). Carapace L 0.72-0.87 (0.75-0.96). Chelicera L 0.46-0.54 (0.51-0.59). Palp: trochanter 0.415-0.50 (0.43-0.55) / 0.185-0.245 (0.19-0.26); femur 0.76-0.975 (0.79-1.01) / 0.21-0.27 (0.215-0.28); patella 0.65-0.87 0.37-0.53 (0.42-0.52); chela(without pedicel) 1.16-1.57 (1.21-1.57) / 0.36-0.53 (0.42-0.52); hand(without pedicel) 0.55-0.72 (0.56-0.83) / 0.35-0.52 (0.40-0.52); pedicel L 0.12-0.16 (0.105-0.15); movable finger L 0.68-0.94 (0.74-0.84).

Leg I: femur L 0.32-0.42 (0.41-0.46); patella L 0.215-0.31 (0.29-0.32). Leg IV: femur+patella 0.615-0.815 (0.65-0.83) / 0.185-0.21 (0.195-0.23); tibia 0.54-0.725 (0.55-0.73) / 0.095-0.12 (0.11-0.13).

Tritonymph.—Ranges for 3 specimens from Pulaski County, Arkansas. Body L 2.10-2.55. Carapace L 0.58-0.62. Chelicera L 0.35-0.385. Palp: femur 0.55-0.635/0.16-0.18; patella 0.46-0.51/0.19-0.22; chela(without pedicel) 0.84-0.985/0.27-0.32; hand(without pedicel) 0.445-0.47/0.265-0.30; D/B of hand 0.94-0.98; pedicel L 0.08-0.09; movable finger L 0.48-0.54. Leg IV: femur+patella 0.445-0.52/0.13-0.15; tibia 0.37-0.43/0.08-0.09.

In addition to the above, there is at hand a very large specimen from Cove Creek Valley, with the following measurements. Body L 4.58. Carapace L 1.18. Chelicera L 0.73. Palp: trochanter 0.75/0.35; femur 1.47/0.34; patella 1.24/0.43; chela(without pedicel) 2.04/0.80; hand(without pedicel) 1.03/0.78; pedicel L 0.19; movable finger L 1.19. Leg IV: femur+patella 1.12/0.26; tibia 1.04/0.15. Except in size, this individual is generally similar to the specimens described above; there are several small differences, but because it was found in the same location as undoubted *T. ozarkensis*, these do not, at present, seem sufficient to warrant its recognition as a separate species.

Remarks.— Curcic, without comment, assigned *Microcreagris ozarkensis* Hoff (1945) to the genus *Australinocreagris* Curcic (1984:156). However, the internal genitalia of the male of *M. grahami* Muchmore (1969), the type species of *Australinocreagris*, possesses only a single dorsal sac, while the male of *M. ozarkensis* has paired dorsal sacs like those of *M. infernalis* and other species of *Tartarocreagris*. Without doubt, *ozarkensis* belongs in the latter genus.

The unusual, minute setae on sternite 2 of the female are discussed above in the Remarks on the genus. Curcic (1984:fig. 8) shows the areoles of a female of this species (as *Australinocreagris ozarkensis*) apparently empty; my study of that same specimen reveals that there are indeed very small, peglike setae in the areoles. This species is now known from western Arkansas and eastern Oklahoma.

Tartarocreagris altimana, new species
Figs. 4-6

Type-data.—Holotype male (WM7935.01001) and allotype female (WM7935.01002) from Five Pocket Cave, Travis County, Texas, 22 October 1993, Brian Keeley and Phil Fraiser; paratype male (WM7934.01001) from same cave, 15 October 1993 (Lee. Sherrod and Mike Horvath) (sl, FCSA).

Diagnosis.—A medium-sized, eyeless, cave-dwelling species, with depth of chelal hand much greater than breadth: palpal femur 1.01-1.16, D/B of hand 1.2-1.3; from one cave in Travis County, Texas.

Description.—Representative of *Tartarocreagris* as outlined above, and with the following particular features. Male and female similar in most respects. Palps light brown, carapace and chelicerae tan, other parts lighter. Carapace a little longer than broad; surface smooth, no transverse furrow; epistome tiny, triangular; no eyes; about 25 setae, 4 at anterior and 6 at posterior margin. Palpal coxa with 4 apical setae. Tergal chaetotaxy of holotype male 9:12:12:12:12:13:13:14:11:9:T2T:2. Sternal chaetotaxy of holotype 20:[2-2]:(5)9/13(5):(4)9(4):15:2/14:2/15:2/13:2/11:13:T1T3T1T:2, paratype male similar; female similar but with 9 very small setae on sternite 2. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of 8 serrate setae; galea bifid at tip, each ramus sometimes also bifid.Palp (Fig. 4) moderately slender; femur 1.1-1.2x and chela 1.6-1.8x as long as carapace. L/B of trochanter 2.15-2.25, femur 3.8-4.05, patella 2.7-2.9, and chela(without pedicel) 3.3-3.6; L/D of hand(without pedicel) 1.25-1.4; D/B of hand 1.25-1.3 in male and 1.2 in female; movable finger 1.15-1.35x as long as hand. Small granules on trochanter, femur and chelal hand, other surfaces smooth. Trichobothriotaxy typical (Fig. 5). Fixed finger with 49-50 and movable finger with 55-60 marginal teeth, only the distal 10-15 cusped. Legs moderately slender; leg I with femur 1.39-1.40x as long as patella; leg IV (Fig. 6) with L/D of femur+patella 3.5-3.8 and tibia 5.3-5.9. Subterminal tarsal setae with 1-2 spinules.

Measurements (mm).—Figures given first for holotype male, followed in parentheses by those for paratype male and allotype female, respectively. Body L 3.67 (3.92, 3.86). Carapace L 0.86 (0.96, 1.00). Chelicera L 0.52 (0.60, 0.60). Palp: trochanter 0.50 (0.60, 0.56) / 0.23 (0.27, 0.25); femur 1.01 (1.16, 1.10) / 0.25 (0.29, 0.29); patella 0.865 (1.00, 0.94) / 0.30 (0.35, 0.35); chela(without pedicel) 1.63 (1.75, 1.64) / 0.435 (0.525, 0.495); hand(without pedicel) 0.70 (0.83, 0.82) / 0.57 (0.665, 0.585); pedicel L 0.155 (0.185, 0.17); movable finger L 0.96 (1.04, 0.95). Leg I: femur 0.495 (0.435, 0.46) / 0.16 (0.14, 0.155); patella 0.355 (0.31, 0.33) / 0.15 (0.125, 0.14). Leg IV: femur+patella 0.78 (0.91, 0.89) / 0.22 (0.265, 0.235); tibia 0.695 (0.785, 0.77) / 0.125 (0.15, 0.13); basitarsus 0.245 (0.265, 0.265) / 0.095 (0.12, 0.115); telotarsus 0.35 (0.43, 0.39) / 0.08 (0.08, 0.09).

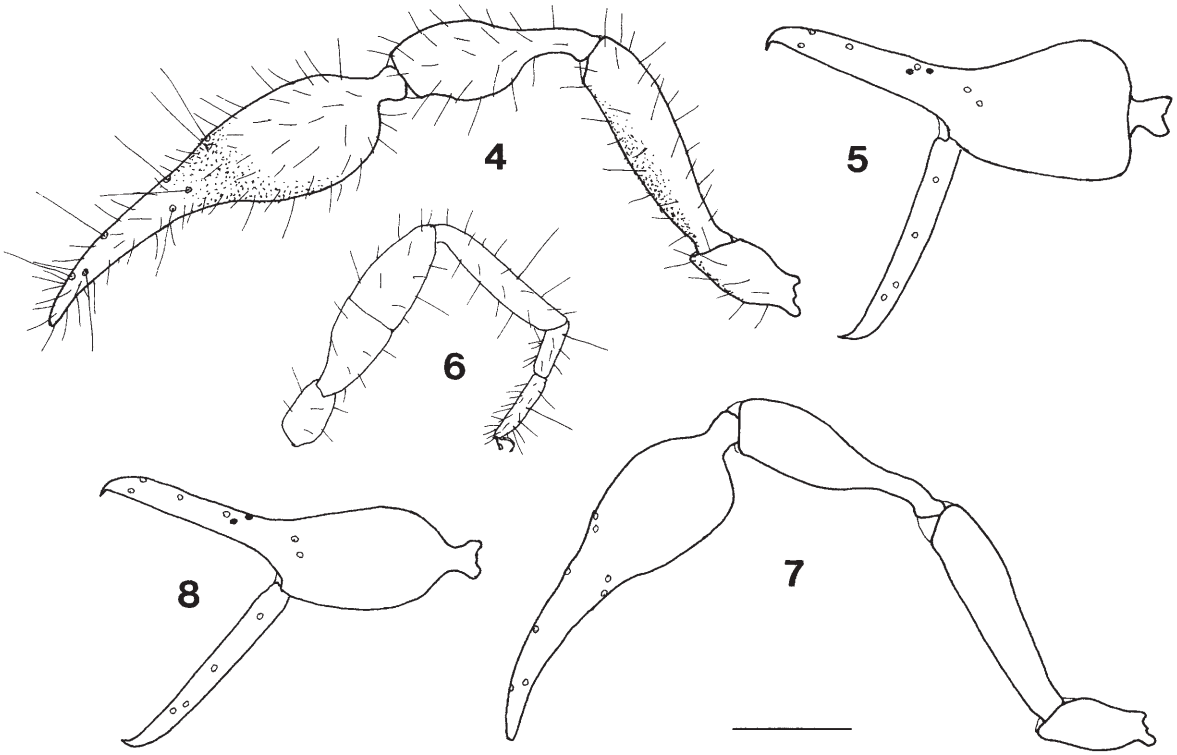
Etymology.—The species is called *altimana* in recognition of the distinctly greater depth (height) of the hand of the palpal chela in comparison to its breadth.

***Tartarocreagris amblyopa*, new species**
Figs. 7, 8

Type-data.—Holotype male (WM7892.02001) and allotype female (WM7892.02002) from underside of rock lightly buried in silt, Mattke Cave, Bexar County, Texas, 10 June 1993 (D. McKenzie, J. Reddell, M. Reyes) (sl, FSCA).

Diagnosis.—A medium-sized, two-eyed, cave-dwelling species, with moderately slender palps: palpal femur 1.0 mm long, L/B 4.6-4.65; D/B of chelal hand 0.95; from one cave in Bexar County, Texas.

Description.—Representative of *Tartarocreagris* as outlined above, and with the following particular features. Male and female very similar. Palps brown, carapace and chelicerae light brown, other parts lighter. Carapace longer than broad; surface smooth, no transverse furrow; epistome small, triangular or rounded; holotype with 2 small eyespots, allotype apparently with none; about 24 setae, holotype with 4 and allotype with 3 at anterior margin, both with 6 at posterior margin. Palpal coxa of holotype with 3 apical setae on right side and 4 on left, female with 3 setae on each side. Tergal chaetotaxy of holotype 8:11:12:13:12:13:13:12:14:10:T1T:2, allotype similar. Sternal chaetotaxy of holotype (male) 21:[3-3]:(6)9/10(6):(6)10(6):12:2/14:2/13:2/13:2/11:2/11:T1T3T1T:2; that of allotype (female) 6:(6)8(6):(5)8(6):14:2/12:2/14:2/15:2/12:2/12:T1T3T1T:2; in both specimens there are 2 larger setae well anteriad of the marginal row on sternites 6-8, and 2 corresponding setae barely anteriad of marginal row on sternites 9 and 10. Setae on sternite 2 of female very small. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of 7 or 8 setae; galea small, twice bifid near tip. Palp (Fig. 7) moderately slender, femur 1.25x and chela 1.75x as long as carapace. L/B of trochanter 2.4-2.5, femur 4.6-4.65, patella 3.3-3.6, and chela(without pedicel) 3.35-3.5; L/D of hand(without pedicel) 1.6-1.7; D/B of hand 0.95-0.96; movable finger 1.3-1.4x as long as hand. Trochanter, femur and chela (including bases of fingers) distinctly granulate, patella nearly smooth. Trichobothriotaxy typical (Fig. 8). Fixed finger with 50-55 and movable finger with 55-60 contiguous marginal teeth, only the distal 8-12 with cusps. Legs



Figs. 4-8.—4-6, *Tartarocreagris altimana*, new species: 4, right palp, dorsal view; 5, left chela, lateral view (darkened areoles are underneath); 6, leg IV, lateral view. 7-8, *Tartarocreagris amblyopa*, new species: 7, right palp, dorsal view; 8, left chela, lateral view (darkened areoles are underneath). Scale line = 0.5 mm.

moderately slender: leg I with femur 1.35x as long as patella; leg IV with L/D of femur+patella 4.2-4.25 and tibia 6.2-6.25. Subterminal tarsal setae denticulate at ends.

Measurements (mm).—Figures given first for holotype male, followed in parentheses by those for allotype female. Body L 2.92 (3.44). Carapace L 0.815 (0.815). Chelicera L 0.49 (0.48). Palp: trochanter 0.50 (0.495) / 0.21 (0.20); femur 1.01 (1.00) / 0.22 (0.215); patella 0.94 (0.88) / 0.26 (0.265); chela(without pedicel) 1.46 (1.41) / 0.435 (0.40); hand(without pedicel) 0.66 (0.66) / 0.415 (0.385); pedicel L 0.155 (0.15); movable finger L 0.925 (0.865). Leg I: femur 0.45 (0.43) / 0.13 (0.13); patella 0.325 (0.32) / 0.12 (0.115). Leg IV: femur+patella 0.79 (0.76) / 0.185 (0.18); tibia 0.68 (0.69) / 0.11 (0.11); basitarsus 0.25 (0.235) / 0.09 (0.09); telotarsus 0.37 (0.355) / 0.065 (0.065).

Etymology.—The species is called *amblyopa* (Gr., dim-sighted) because of the very much reduced eyes.

Tartarocreagris attenuata, new species
Figs. 9-11

Type-data.—Holotype male (WM7560.01001) from underside of rock loosely buried in silt, Stovepipe Cave, Travis County, Texas, 25 October 1990 (J. Reddell and M. Reyes) (sl, FSCA).

Diagnosis.—A very large, eyeless, cave-dwelling species, with very slender appendages; palpal femur 1.47 mm long; chela(without pedicel) 2.40 mm long, L/B 6.25; about the same size as *T. texana*, but with more slender chela; from one cave in Travis County, Texas.

Description of male (female unknown).—Representative of *Tartarocreagris* as outlined above, and with the following particular features. Palps and chelicerae tan, other parts lighter. Carapace longer than broad; surface smooth, no transverse furrow; no epistome; no eyes; with 24 setae, 4 at anterior and 6 at posterior margin. Coxal area typical; apex of palpal coxa with 4 long setae. Tergal chaetotaxy 9:11:12:13:13:15:15:13:13:11:T1T:2. Sternal chaetotaxy 29:[4-4]:(6)5/18(8):(7)10(7):15:2/15:2/16:2/14:2/14:13:T1T2T1T:2; anterior margin of sternite 3 with a slight median invagination. Internal genitalia typical, with 2 dorsal sacs and narrow lateral sacs. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of 9 denticulate setae; galea small, twice bifid. Palp long and very slender (Fig. 9); femur 1.35x and chela 2.2x as long as carapace; L/B of trochanter 2.55, femur 6.0, patella 4.9, and chela(without pedicel) 6.25; L/D of hand(without pedicel) 2.3; D/B of hand 0.98; movable finger 1.8x as long as hand. Medial sides of all segments lightly granulate. Trichobothria as shown in Fig. 10. Fixed finger with 92 rounded teeth; movable finger with 103 teeth, distal 8 cusped, others rounded. Legs long, slender: leg I with femur 1.58x as long as patella; leg IV (Fig. 11) with L/D of femur+patella 5.5 and tibia 8.9. Subterminal tarsal setae denticulate near end.

Measurements (mm).—Body L 3.84. Carapace L 1.10. Chelicera L 0.68. Palp: trochanter 0.635/0.25; femur 1.47/0.245; patella 1.35/0.275; chela(without pedicel) 2.40/0.385; hand(without pedicel) 0.88/0.38; pedicel L 0.18; movable finger L 1.59. Leg I: femur 0.68/0.16; patella 0.43/0.14. Leg IV: femur+patella 1.17/0.21; tibia 1.07/0.12; basitarsus 0.37/0.105; telotarsus 0.57/0.095.

Etymology.—The species is called *attenuata* in recognition of its long, slender appendages.

Tartarocreagris cookei, new species
Fig. 12

Type-data.—Holotype male (WM2101.01001) from along the Guadalupe River, about 5 km SE of Canyon Reservoir, Comal County, Texas, 14 February 1970 (J.A.L. Cooke) (sl, AMNH). Allotype female (WM7992.01001) from Magen's Sink, 6.5 km W of Wimberley, Hays County, Texas, 29 January 1995 (A.G. Grubbs); paratype female from Government Canyon State Natural Area, Bexar County, Texas, 2 October 1994 (A.G. Grubbs); 2 male, 2 female paratypes from epigean sites about 7 km NW of Helotes, Bexar County, Texas, 24-30 October 1994 (A.G. Grubbs); 2 paratype males from mixed hardwood litter in Lost Maples State Natural Area, Bandera County, Texas, 28 May 1988 (R. Anderson); (sl, FSCA).

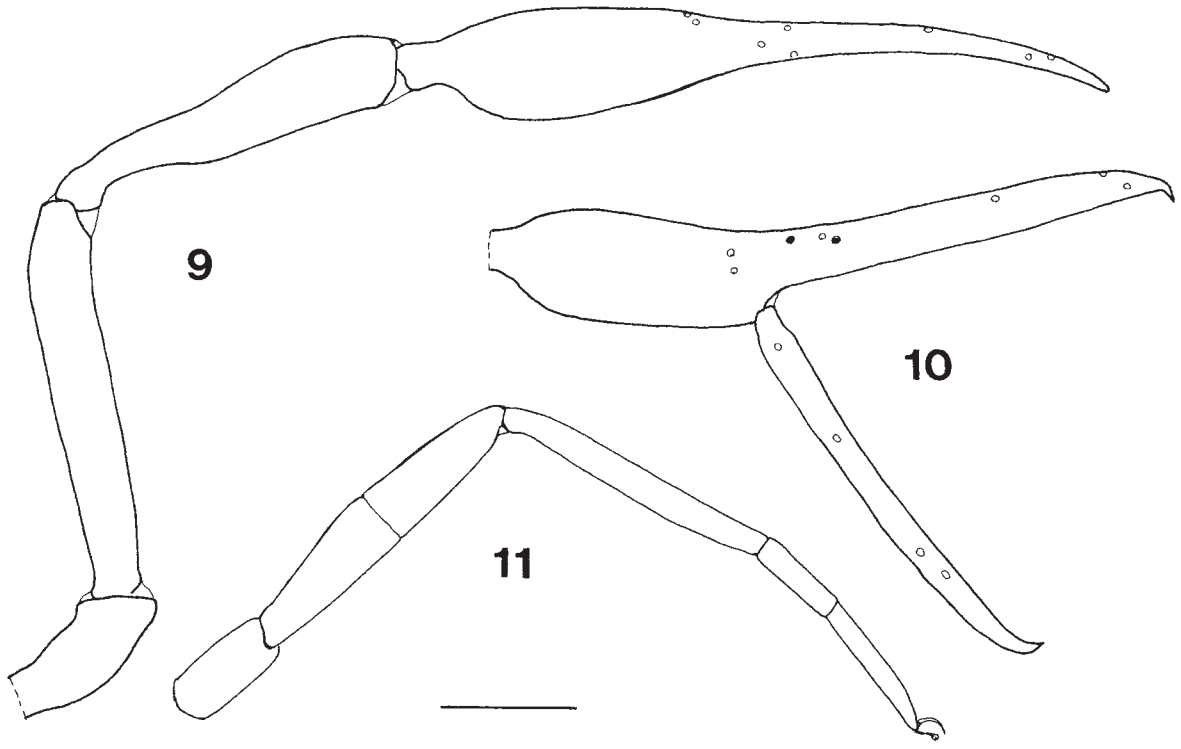
Diagnosis.—A small, four-eyed, epigean species with moderately robust palps; palpal femur less than 0.8 and chela less than 1.2 mm long; femur 3.35-3.75x and chela 2.8-3.45x as long as broad.

Description.—Representative of *Tartarocreagris* as outlined above, and with the following particular features. Male and female much alike but male with more slender appendages. Chelicerae and palps light brown, other parts lighter. Carapace little longer than broad; epistome low and slightly irregular; 4 small eyes; surface smooth, no transverse furrow; 24 setae, 4 at anterior and 6 at posterior margin. Palpal coxa usually with 3 apical setae, occasionally 2 or 4. Tergal chaetotaxy of holotype 7:11:12:13:14:13:12:13:14:12:T1T:2, others similar. Sternal chaetotaxy of holotype (male) 17:[2-2]:(5)4/10(5):(5)10(5):13:2/15:2/15:2/14:14:13:T1T2T1T:2; that of female similar, but with 7-9 very small setae on sternite 2. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand

with 6-7 setae; flagellum of 7-9 serrate setae; galea of male small and finely divided at tip, that of female larger and twice bifid. Palps moderately short and robust (Fig. 12); femur 1.0-1.05x and chela 1.55-1.65x as long as carapace; L/B of trochanter 2.0-2.25, femur 3.35-3.75, patella 2.4-2.7, and chela(without pedicel) 2.8-3.45; L/D of hand(without pedicel) 1.35-1.6; D/B of hand 1.0-1.1; movable finger 1.1-1.3x as long as hand. Surfaces smooth, except small granules on medial side of femur and on chela at base of fixed finger. Trichobothriotaxy typical. Fixed finger of chela with 35-45 and movable finger with 40-50 marginal teeth, only the distal 7-15 with cusps, the others rounded. Legs moderately slender; leg I with femur 1.35-1.45x as long as patella; leg IV with L/D of femur+patella 3.2-3.7 and tibia 4.9-5.5. Subterminal tarsal setae each with a prominent spine distad of middle and 1-2 spinules near tip.

Measurements (mm).—Male. Figures given first for holotype, followed in parentheses by ranges for the 4 paratypes. Body L 2.21 (2.25-2.90). Carapace L 0.585 (0.585-0.70). Chelicera L 0.36 (0.35-0.43). Palp: trochanter 0.33 (0.32-0.40) / 0.155 (0.15-0.19); femur 0.63 (0.59-0.78) / 0.17 (0.17-0.21); patella 0.57 (0.525-0.665) / 0.21 (0.21-0.245); chela(without pedicel) 0.96 (0.92-1.20) / 0.29 (0.295-0.35); hand(without pedicel) 0.43 (0.43-0.55) / 0.29 (0.32-0.35); pedicel L 0.095 (0.09-0.11); movable finger L 0.56 (0.56-0.725). Leg I: femur 0.27 (0.265-0.34) / 0.095 (0.09-0.125); patella 0.19 (0.19-0.23) / 0.09 (0.09-0.11). Leg IV: femur+patella 0.525 (0.48-0.615) / 0.155 (0.13-0.19); tibia 0.46 (0.40-0.525) / 0.08 (0.08-0.105); basitarsus 0.155 (0.14-0.185) / 0.065 (0.065-0.085); telotarsus 0.235 (0.215-0.28) / 0.05 (0.06-0.065).

Female.—Ranges for the 4 paratypes. Body L 2.68-3.27. Carapace L 0.65-0.755. Chelicera L 0.41-0.46. Palp: trochanter 0.355-0.40 / 0.17-0.20; femur 0.665-0.75 / 0.185-0.215; patella 0.53-0.66 / 0.23-0.265; chela(without pedicel) 1.00-1.19 / 0.33-0.39; hand(without pedicel) 0.48-0.58 / 0.33-0.42; pedicel L 0.10-0.105; movable finger L 0.585-0.69. Leg I: femur 0.30-0.325 / 0.11-125; patella 0.215-0.235 / 0.105-0.11. Leg IV: femur+patella 0.54-0.62 / 0.17-0.215; tibia 0.465-0.52 / 0.09-0.105; basitarsus 0.16-0.185 / 0.075-0.08; telotarsus 0.235-0.28 / 0.065-0.75.



Figs. 9-11.—*Tartarocreagris attenuata*, new species: 9, left palp, dorsal view; 10, right chela, lateral view (darkened areoles are underneath); 11, leg IV, lateral view. Scale line = 0.5 mm.

Etymology.—The species is named for John A.L. Cooke who collected the holotype, representing the first known epigean species of the genus.

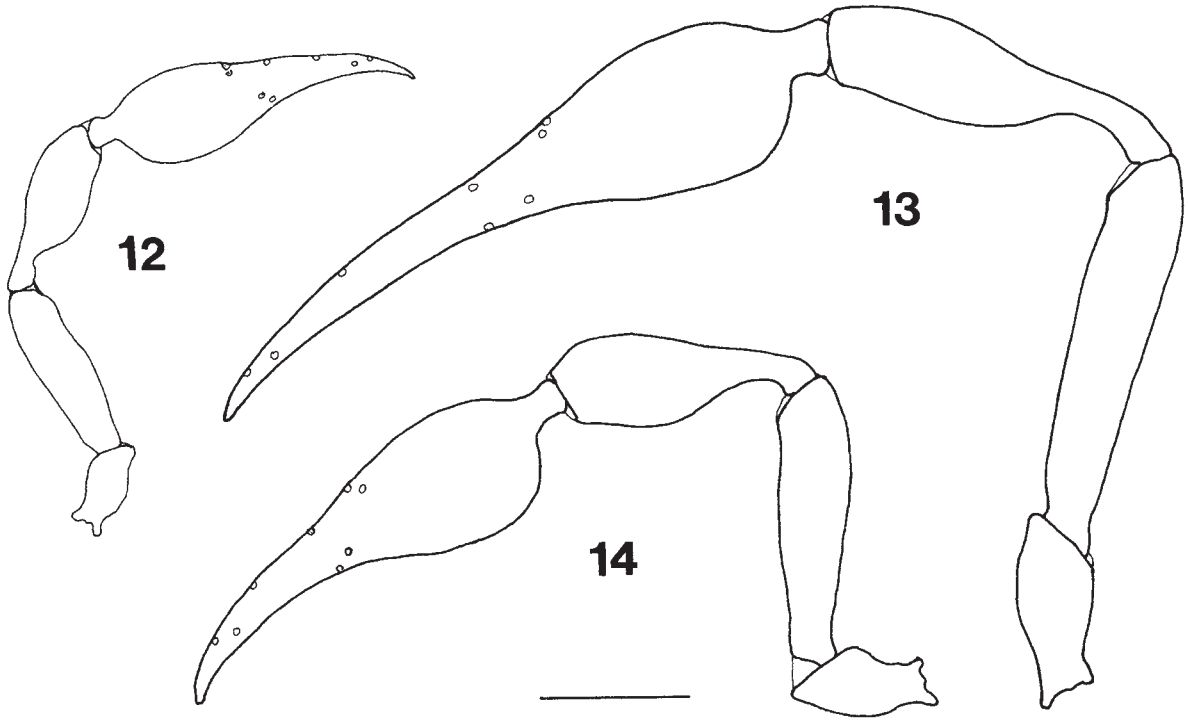
Tartarocreagris domina, new species
Fig. 13

Type-data.—Holotype male (WM7557.01001) and allotype female (WM7556.01001) from undersides of rocks loosely buried in silt, No Rent Cave, Travis County, Texas, 11 June and 6 June 1990 (J. Reddell and M. Reyes) (sl, FSCA).

Diagnosis.—A large, eyeless cave-dwelling species, with moderately slender palps: palpal femur 1.35-1.37 mm long; chela 2,15 mm long, with L/B 4.3-4.35; the chelal hand is broadest proximally; from one cave in Travis County, Texas.

Description.—Representative of *Tartarocreagris* as outlined above, and with the following particular features. Palps light brown, carapace and chelicerae tan, other parts lighter. Carapace distinctly longer than broad; surface smooth, no transverse furrows; no epistome, but anterior margin slightly convex; no eyes; about 24 setae, 4 at anterior and 6 at posterior margin. Apex of palpal coxa with 3 or 4 long setae. Tergal chaetotaxy of holotype 10:10:12:12:12:12:13:12:13:10:T2T:2, allotype similar but with only 8 setae on 1st tergite. Sternal chaetotaxy of holotype (male) 20:[3-3]:(6)8/12(6):(5)13(5):15:2/16:2/14:2/15:14:12:T1T3T1T:2; that of female 10:(6)13(6):(5)12(6):15:2/16:2/15:2/14:14:13:T1T2T1T:2, setae on sternite 2 minute. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand with 6 or 7 setae; flagellum of 8 serrate setae; galea twice bifid at tip. Palps long and slender (Fig. 13): femur 1.25-1.35x and chela 1.95-2.15x as long as carapace. L/B of trochanter 2.45, femur 5.1-5.25, patella 3.85-4.0, and chela(without pedicel) 4.3-4.35; L/D of hand(without pedicel) 1.65-1.75; D/B of hand 0.95-0.99; movable finger 1.77x as long as hand. Surfaces smooth with some granulation on medial sides of trochanter, femur, and chelal hand. Trichobothria typical. Fixed finger with 84-85 and movable finger with 95-98 teeth, the distal 10-15 cusped, others rounded. Legs quite long and slender: leg I with femur 1.55x as long as patella; leg IV with L/D of femur+patella 4.8-4.85 and tibia 8.1-8.2.

Measurements (mm).—Figures given first for holotype male, followed in parentheses by those for allotype female. Body L 2.82 (3.65). Carapace L 1.01 (1.10). Chelicera L 0.615 (0.62). Palp: trochanter 0.635 (0.64) / 0.26 (0.26); femur 1.37 (1.35) / 0.25 (0.265); patella 1.19 (1.20) / 0.31 (0.31); chela(without pedicel)



Figs. 12-14.—12, *Tartarocreagris cookei*, new species: left palp, dorsal view. 13, *Tartarocreagris domina*, new species: right palp, dorsal view. 14, *Tartarocreagris grubbsi*, new species: right palp, dorsal view. Scale line = 0.5 mm.

2.15 (2.15) / 0.50 (0.495); hand(without pedicel) 0.815 (0.83) / 0.495 (0.47); pedicel L 0.17 (0.19); movable finger L 1.44 (1.47). Leg I: femur 0.605 (0.60) / 0.15 (0.155); patella 0.385 (0.40) / 0.125 (0.14). Leg IV: femur+patella 1.04 (1.05) / 0.215 (0.22); tibia 0.975 (1.01) / 0.12 (0.125); basitarsus 0.33 (0.355) / 0.105 (0.105); telotarsus 0.525 (0.525) / 0.08 (0.09).

Etymology.—The species is named *domina*, which implies that it is the "owner" of No Rent Cave, therefore owes no rent.

Tartarocreagris grubbsi, new species
Fig. 14

Type-data.—Holotype male (WM7991.02001), allotype female (WM7991.02002), and paratype female from Wissman's Sink, about 10 km NW of San Marcos, Hays County, Texas, 22-30 April 1995 (A.G. Grubbs) (sl, FSCA).

Diagnosis.—A medium-sized, hypogean species with 2 indistinct eyes and with rather robust palps: palpal femur 0.94-1.05 mm long, and L/B 3.9-4.3; D/B of chelal hand 1.05-1.15; from a sink in Hays County, Texas.

Description.—With the characters of *Tartarocreagris* as outlined above, and the following particular features. Male a little smaller than female. Carapace and palps light brown, other parts tan. Surface of carapace mostly smooth; no transverse furrow, but a broad area of transverse striations near posterior margin; epistome small, triangular; eyes small, indistinct; about 24 setae, 4 at anterior and 6 at posterior margin. Each palpal coxa with 4 long apical setae. Tergal chaetotaxy of holotype 8:11:12:12:13:13:13:14:13:11:T2T:2, others similar. Sternal chaetotaxy of holotype (male) 20:[3-3]:(4)6/8(4):(5)10(5):14:2/13:2/12:2/12:2/12:12:T1T2T1T:2; that of allotype (female) similar, but with 9 very small setae on sternite 2. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of about 8 pinnate setae; galea slender, twice bifid. Palp (Fig. 14) moderately long and slender; femur 1.1-1.15x and chela 1.55-1.65x as long as carapace. L/B of trochanter 2.2-2.25, femur 3.9-4.15, patella 2.75-2.85, and chela(without pedicel) 2.9-3.1; L/D of hand(without pedicel) 1.3-1.4; D/B of hand 1.15 in male and 1.05-1.1 in females; movable finger 1.17-1.3x as long as hand. Surfaces smooth except granules on medial side of femur and base of fixed finger and hand of chela. Trichobothriotaxy typical. Fixed finger with 45-50 teeth, distal 12-15 cusped; movable finger with 55-60 teeth, distal 7-10 cusped. Legs moderately long and slender: leg I with femur 1.35-1.4x as long as patella. leg IV with L/D of femur+patella 3.6-3.7, tibia 5.6-6.2.

Measurements (mm).—Figures given first for holotype male, followed in parentheses by those for the allotype female and paratype female. Body L 2.91 (3.52, 3.05). Carapace L 0.84 (0.93, 0.89). Chelicera L 0.50 (0.55, 0.54). Palp: trochanter 0.51 (0.52, 0.49) / 0.23 (0.235, 0.22); femur 0.94 (1.01, 1.05) / 0.23 (0.26, 0.245); patella 0.85 (0.895, 0.89) / 0.30 (0.325, 0.31); chela(without pedicel) 1.39 (1.41, 1.37) / 0.445 (0.47, 0.47); hand(without pedicel) 0.66 (0.725, 0.70) / 0.51 (0.525, 0.50); pedicel L 0.16 (0.16, 0.16); movable finger L 0.865 (0.83, 0.85). Leg I: femur 0.42 (0.445, 0.435) / 0.145 (0.15, 0.15); patella 0.30 (0.325, 0.32) / 0.125 (0.13, 0.13). Leg IV: femur+patella 0.78 (0.78, 0.80) / 0.21 (0.215, 0.215); tibia 0.68 (0.66, 0.695) / 0.11 (0.12, 0.125).

Etymology.—The species is named for Andrew G. Grubbs, who collected the type specimens and many other interesting pseudoscorpions in Texas.

Tartarocreagris hoodensis, new species
Fig. 15

Type-data.—Holotype female (WM8049.01001) from underside of small rock, in total darkness, Chigiouxs' Cave, Fort Hood, Coryell County, Texas, 21 November 1995 (J. Reddell and M. Reyes); allotype male (WM8279.01001) from Buchanan Cave, Fort Hood, Bell County, Texas, 4 November 1998 (J.C. Cokendolpher, J. Krejca, J. Reddell, M. Reyes); paratype female from Ruggers Rift Cave, Fort Hood, Bell County, Texas, 5 November 1998 (J. Reddell and M. Reyes) (sl, FSCA).

Diagnosis.—A small to medium-sized, eyeless, cave-dwelling species, with palpal femur 0.77-0.90 mm long; chela 1.15-1.31 mm long, L/B 2.8-3.1; from Bell and Coryell Counties, Texas.

Description.—Representative of *Tartarocreagris* as outlined above, and with the following particular features. Palps light brown, carapace and chelicerae tan, other parts lighter. Carapace longer than broad; surface smooth, no transverse furrow; epistome very low, triangular; no eyes; with 24-25 setae, 4 at anterior and 6 at posterior margin. Coxal area typical, apex of palpal coxa with 3 setae. Tergal chaetotaxy of holotype 7:12:11:12:12:13:13:12:11:10:T2T:2, others similar. Sternal chaetotaxy of holotype (female) 12:(4)12(4):(4)10(4):12:2/12:2/11:2/12:2/11:12:T1T3T1T:2; setae on sternite 2 very small. Internal genitalia of male typical. Chelicera 0.6 as long as carapace; hand with 7 setae; galea slender, twice bifid at tip; about 9 small teeth on each finger. Palp (Fig. 15) moderately long and slender: femur 1.05x and chela 1.6x as long as carapace. L/B of trochanter 2.05-2.15,

femur 3.7-3.8, patella 2.45-2.55, and chela(without pedicel) 2.8-3.1; L/D of hand(without pedicel) 1.4; D/B of hand 1.0-1.05; movable finger 1.15-1.25x as long as hand. Surfaces smooth, except small granules on medial sides of femur and chelal hand. Trichobothria typical. Fixed finger with 48 teeth, distal 15 cusped, the others rounded; movable finger with 54 teeth, distal 9 cusped. Legs moderately slender: leg I with femur 1.35-1.45x as long as patella; leg IV with L/D of femur+patella 3.25-3.35, tibia 5.0-5.2. Subterminal tarsal setae with 1-2 small spinules.

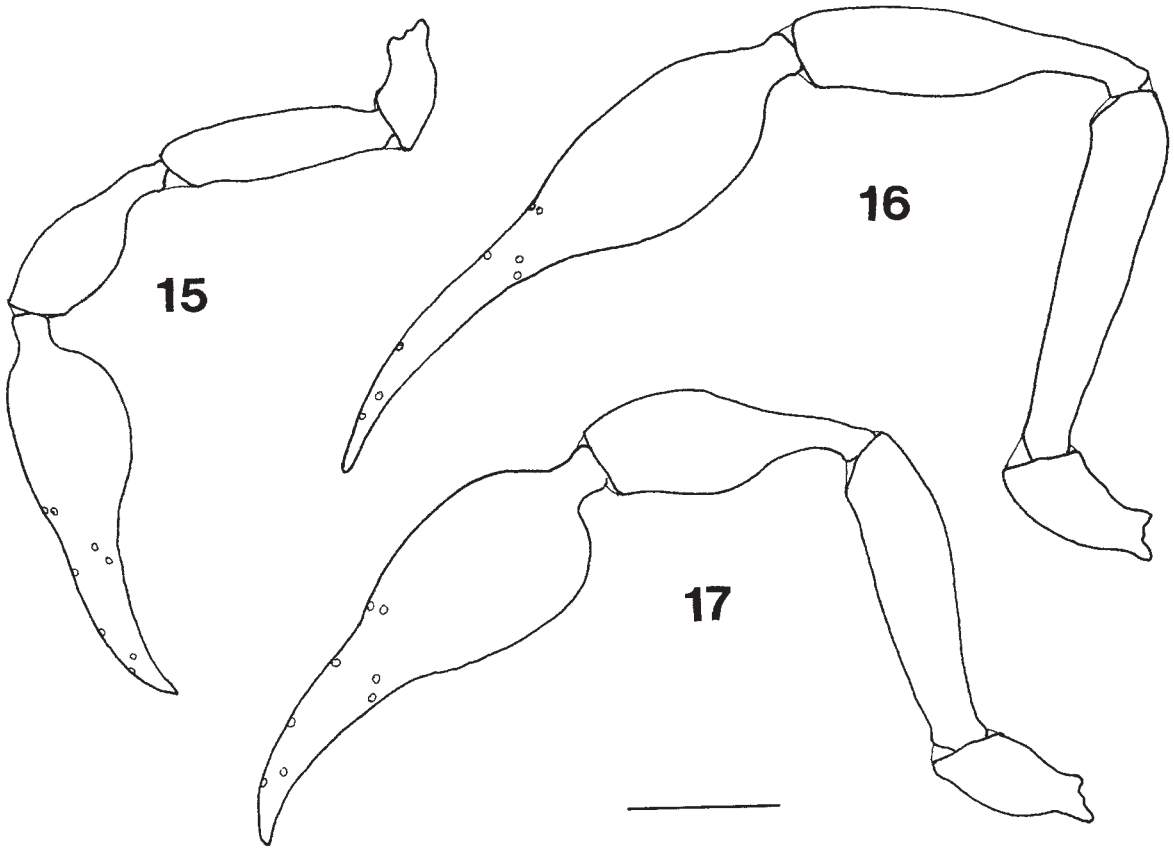
Measurements (mm).—Figures given first for holotype female, followed in parentheses by those for allotype male and paratype female, respectively. Body L 2.77 (2.60, 2.73). Carapace L 0.73 (0.77, 0.805). Chelicera L 0.45 (0.465, 0.51). Palp: trochanter 0.41 (0.445, 0.47) / 0.19 (0.21, 0.23); femur 0.77 (0.815, 0.90) / 0.21 (0.22, 0.235); patella 0.665 (0.74, 0.79) / 0.26 (0.29, 0.32); chela(without pedicel) 1.15 (1.26, 1.31) / 0.37 (0.41, 0.465); hand(without pedicel) 0.555 (0.59, 0.66) / 0.39 (0.42, 0.465); pedicel L 0.12 (0.13, 0.13); movable finger L 0.665 (0.755, 0.76). Leg I: femur 0.32 (0.34, 0.36) / ? (0.14, 0.15); patella 0.22 (0.26, 0.28) / ? (0.125, 0.13). Leg IV: femur+patella 0.605 (0.635, 0.665) / 0.185 (0.19, 0.24); tibia 0.52 (0.58, 0.59) / 0.10 (0.11, 0.125); basitarsus 0.19 (0.215, 0.21) / 0.075 (0.08, 0.095); telotarsus 0.27 (0.28, 0.30) / 0.065 (?, 0.075).

Etymology.—The species is named for Fort Hood, Texas, where it is found.

Tartarocreagris proserpina, new species
Fig. 16

Type-data.—Holotype female (WM8288.01001) from Maple Run Cave, Travis County, Texas, 7 April 1998 (M. Sanders) (sl, FSCA).

Diagnosis.—An eyeless, cave-dwelling species much like *T. domina* but slightly smaller and with relatively shorter movable finger of palpal chela: palpal femur length 1.26 versus 1.35mm, chela length 1.79 mm versus 2.15 mm, and movable finger 1.40 versus 1.77x as long as hand; the chelal hand is parallel-sided versus



Figs. 15-17.—15, *Tartarocreagris hoodensis*, new species: right palp, dorsal view. 16, *Tartarocreagris proserpina*, new species: right palp, dorsal view. 17, *Tartarocreagris reyesi*, new species: right palp, dorsal view. Scale line = 0.5 mm.

smoothly rounded; from one cave in Travis County, Texas.

Description of female (male unknown).— Representative of *Tartarocreagris* as outlined above, and with the following particular features. Palps brown, carapace lighter brown, other parts tan. Carapace a little longer than broad; surface smooth, no transverse furrows; epistome very small, triangular; no eyes; about 24 setae, 4 at anterior and 6 at posterior margin. Apex of palpal coxa with 4 long setae. Tergal chaetotaxy 7:10:10:12:12:11:12:13:12:9:T3T:2. Sternal chaetotaxy 7:(5)12(5):(4)9(5):13:2/13:2/13:2/13:2/12:12:T1T3T1T:2; setae on sternite 2 very small. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of 8 serrate setae; galea slender, twice bifid at tip. Palp (Fig. 16) long and slender; femur 1.35x and chela 1.95x as long as carapace. L/B of trochanter 2.2, femur 5.15, patella 4.0, and chela(without pedicel) 4.3; L/D of hand(without pedicel) 1.95; D/B of hand 0.99; movable finger 1.40x as long as hand. Small granules on femur, hand and base of fixed finger, other surfaces smooth. Trichobothria typical. Fixed finger with 75 and movable finger with 80 teeth, the distal 10-12 cusped, others rounded. Legs rather slender: leg I with femur 1.4x as long as patella; leg IV with L/D of femur+patella 4.45 and tibia 7.3. Subterminal tarsal setae with lateral and terminal spinules.

Measurements (mm).— Body L 3.60. Carapace L 0.925. Chelicera L 0.555. Palp: trochanter 0.555/0.25; femur 1.26/0.245; patella 1.16/0.29; chela(without pedicel) 1.79/0.415; hand(without pedicel) 0.80/0.41; pedicel L 0.16; movable finger L 1.12. Leg I: femur 0.50/0.14; patella 0.355/0.125. Leg IV: femur+patella 0.89/0.20; tibia 0.805/0.11; basitarsus 0.29/0.095; telotarsus 0.43/0.075.

Etymology.—The species is named for Proserpina, mythical queen of the Underworld.

Tartarocreagris reyesi, new species
Fig. 17

Type-data.—Holotype female (WM7902.01001) and paratype deutonymph from Young Cave No. 1, Bexar County, Texas, 6 September 1993 (J. Reddell and M. Reyes); paratype female from underside of small rock buried in silt, in upper level of MARS Pit, Camp Bullis, Bexar County, Texas, 9 October 1995, (J. Reddell and M. Reyes); paratype female from Up-the-Creek Cave, Camp Bullis, Bexar County, Texas, 10 September 1998 (J.C. Cokendolpher, J. Krejca, J. Reddell, M. Reyes) (sl, FSCA); paratype female on upper level ledge, MARS Pit, Camp Bullis, Bexar County, Texas, 10 September 1998 (J.C. Cokendolpher and J. Krejca) (al, FSCA).

Diagnosis.—A medium-sized, eyeless, cave-dwelling species with depth of chelal hand a little greater than breadth: palpal femur length 0.96-1.02 mm, and D/B of hand about 1.05; from Bexar County, Texas.

Description of female (male unknown).— Representative of *Tartarocreagris* as outlined above, and with the following particular features. Palps brown, carapace and chelicerae light brown, other parts lighter. Carapace 1.2x as long as broad; epistome low, rounded; surface smooth, no transverse furrow; no eyes; about 22 setae, 4 at anterior and 6 at posterior margin. Palpal coxa with 2-4 apical setae. Tergal chaetotaxy of holotype 9:11:12:14:12:14:12:14:11:10:T1T:2, others similar. Sternal chaetotaxy of holotype 8:(6)10(6):(6)8(5):13:2/13:2/14:2/13:2/15:12:T1T2T1T:2; setae on sternite 2 very small. Chelicera 0.6 as long as carapace; hand with 7 setae; flagellum of 7 or 8 serrate setae; galea slender, twice bifid near tip. Palp (Fig. 17) rather slender; femur 1.15x and chela 1.6x as long as carapace. L/B of trochanter 2.15-2.25, femur 4.0-4.2, patella 2.75-2.8, and chela(without pedicel) 2.95-3.1; L/D of hand(without pedicel) 1.4-1.45; D/B of hand 1.0-1.05; movable finger 1.2-1.25x as long as hand. Moderate sized granules on medial side of trochanter, femur and chelal hand, other surfaces smooth. Trichobothriotaxy typical. Fixed finger with 45-55 and movable finger with 55-60 marginal teeth, only the distal 10-15 with cusps. Legs rather slender; leg I with femur 1.4x as long as patella; leg IV with L/D of femur+patella 3.8-3.95 and tibia 5.8-6.2. Subterminal tarsal setae with 1 or 2 spinules.

Deutonymph.—Similar to adult in most respects, but much smaller. No eyes. Apex of palpal coxa with 3 setae. Hand of chelicera with 5 setae; galea long, slender, with 3 small rami. Fixed finger of palpal chela with 6 trichobothria, movable finger with 2.

Measurements (mm).—Figures given first for holotype, followed in parentheses by those for the 2 mounted paratypes. Body L 3.25 (3.22, 3.26). Carapace L 0.92 (0.815, 0.86). Chelicera L 0.555 (0.495, 0.53). Palp: trochanter 0.53 (0.47, 0.50) / 0.235 (0.22, 0.23); femur 1.02 (0.96, 0.955) / 0.25 (0.23, 0.245); patella 0.91 (0.82, 0.85) / 0.325 (0.295, 0.31); chela(without pedicel) 1.47 (1.33, 1.39) / 0.495 (0.43, 0.45); hand(without pedicel) 0.725 (0.635, 0.695) / 0.495 (0.45, 0.49); pedicel L 0.15; movable finger L 0.86 (0.79, 0.815). Leg I: femur 0.46 (0.41, 0.435) / 0.15 (0.13, 0.15); patella 0.325 (0.29, 0.31) / 0.13 (0.125, 0.13). Leg IV: femur+patella 0.815 (0.75, 0.74) /0.215 (0.19, 0.21); tibia 0.725 (0.63, 0.64) / 0.11 (0.11, 0.11); basitarsus 0.265 (0.23, 0.235) / 0.095 (0.09, 0.09); telotarsus 0.36 (0.355, 0.355) / 0.08 (0.08, 0.08).

KEY TO THE SPECIES OF *TARTAROCREAGRIS*

1. With 4 eyes..... 2
   With 2 indistinct eyes..... 4
   Eyeless..... 5

2. Larger, more slender species - palpal femur more than 1.25 mm long, with L/B greater than 4.2 (Airman's Cave, Travis County, Texas)..... *intermedia*
   Smaller, less slender species - palpal femur less than 1.15 mm long, with L/B smaller than 4.0..... 3

3. Depth of chelal hand at least 1.1 times as great as breadth (Travis, Hays, Burnet Counties, Texas)..... *comanche*
   Depth of chelal hand 1.0-1.05 times as great as breadth (Hays, Comal, Bexar, Bandera Counties, Texas)..... *cookei*
   Depth of chelal hand less than breadth (Ozark Mountains, Arkansas and Oklahoma)..... *ozarkensis*

4. Palpal chela with L/B less than 3.2 and depth of hand at least 1.05 times as great as breadth (Wissman's Sink, Hays County, Texas)..... *grubbsi*
   Palpal chela with L/B greater than 3.3 and depth of hand less than breadth (Mattke Cave, Bexar County, Texas)..... *amblyopa*

5. Depth of chelal hand greater than breadth..... 6
   Depth of chelal hand less than breadth..... 8

6. Depth of chelal hand 1.2-1.3 times as great as breadth (Five Pocket Cave, Travis County, Texas)..... *altimana*
   Depth of chelal hand less than 1.1 times as great as breadth..... 7

7. Larger species - palpal femur longer than 0.95 mm (two caves at Camp Bullis, Bexar County, Texas)..... *reyesi*
   Smaller species - palpal femur shorter than 0.9 mm (three caves at Fort Hood, Bell and Coryell Counties, Texas)..... *hoodensis*

8. Palpal chela with L/B greater than 6.0 (Stovepipe Cave, Travis County, Texas)..... *attenuata*
   Palpal chela with L/B less than 5.8..... 9

9. Chelal hand with L/D at least 2.15 (Tooth Cave and several adjacent caves, Travis County, Texas)..... *texana*
   Chelal hand with L/D no more than 2.0..... 10

10. Larger, more slender species - palpal chela 2.33-2.98 mm long, with L/B 4.55-5.5 (many caves in Williamson, few caves in Travis counties, Texas)..... *infernalis*
    Smaller, less slender species - palpal chela no more than 2.15 mm long, with L/B 4.3-4.35..... 11

11. Palpal chela 2.15 mm long, movable finger 1.77x as long as hand; hand broadest proximally (No Rent Cave, Travis County, Texas)..... *domina*
    Palpal chela 1.79 mm long, movable finger 1.40x as long as hand; hand parallel-sided (Maple Run Cave, Travis County, Texas)..... *proserpina*

Deutonymph.—Body L 1.74. Carapace L 0.48. Palp: femur 0.445/0.125; patella 0.34/0.14; chela(without pedicel) 0.695/0.20; hand (without pedicel) 0.295/0.185; pedicel L 0.05; movable finger L 0.445.

Etymology.—The species is named for Marcelino Reyes, who, along with J.R. Reddell, has collected many new and interesting pseudoscorpions in Texas caves.

Tartarocreagris, sp. indet.

There is at hand a single tritonymph from Bonham State Park, Fannin County, Texas, 31 May 1973 (J.M. Rowland) (sl, FSCA). This specimen agrees very well in most respects with the tritonymphs of *T. ozarkensis* mentioned above, but it is a little larger (palpal femur L 0.665 mm and chela L 1.07 mm). It apparently belongs to *ozarkensis* or a closely related species.

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A SYNOPSIS OF THE MILLIPED GENUS *ANIULUS* CHAMBERLIN (JULIDA: PARAJULIDAE: PARAJULINAE: ANIULINI)

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ABSTRACT

The parajulid milliped genus *Aniulus* comprises 22 species, one divided into two geographic races. Modern diagnoses are presented for these taxa along with a key and distribution maps. The following new syonymies are proposed: *Aniulus bollmani* Causey under *A. garius* (Chamberlin), and *A. oreines* Chamberlin under *A. paiutus* (Chamberlin). *Aniulus fili* Loomis is reduced to subspecific status under *A. craterus* Chamberlin.

INTRODUCTION

The Parajulidae is the dominant diplopod family in North America. It occurs across the continent and, north/south, from the Yukon and southcentral Alaska (61° N Latitude) to southwestern Guatemala (15° N Latitude) (Causey 1974). As noted by Hoffman (1992), the family was studied for 26 years by the late Dr. N. B. Causey, but she published only a few brief papers such that work must be begun *de novo*. Hoffman's study of *Pseudojulus* Bollman and *Georgiulus* Hoffman set the stage for future generic efforts, and the present contribution on *Aniulus* Chamberlin is the first of several planned investigations on parajulid genera. I emphasize that these are limited studies of type specimens and determined material in a few readily accessible collections; at this time I have not sorted through the wealth of preserved, unidentified samples in nearly every repository on the continent. The amount of unsorted material is truly enormous and working through it now is prohibitive if knowledge of the family is to be advanced. I agree with Hoffman (1992) that such treatments of individual genera carry liabilities in that early conclusions may be over-turned by future discoveries, and without question, additional species await discovery both in museum holdings and the field; however, the objective now must be progress of any sort. At the present stage of knowledge, there also is no recourse but to accept the current generic compositions. Based on the configurations of the sternum of segment 8 and the posterior gonopod telopodite, *Aniulus* seems somewhat heterogeneous and it lacks an apomorphy; however, informed generic concepts cannot be established until more genera are studied and knowledgeable rearrangements are feasible.

In the ensuing accounts, species are cited in chronological order, and in the interests of brevity I provide only diagnoses of the critical aspects of the gonopods in the terminology established by Hoffman (1992). Loomis (1976) presented a key to species of *Aniulus* in Texas, which I expand to cover the entire generic distribution. Acronyms of sources of preserved samples are as follows:

AMNH - American Museum of Natural History, New York, New York.

FSCA - Florida State Collection of Arthropods, Gainesville.

Key to Species of *Aniulus* (based on adult males)

1. Anterior gonopods with syncoxal lobes.....2
   Anterior gonopods without syncoxal lobes.....16

2. Posterior gonopod prefemoral process as long as or longer than telopodite.....3
   Posterior gonopod prefemoral process shorter than telopodite.....8

3. Posterior gonopod with acute spine caudal to telopodite (Fig. 29); Texas.....*craterus craterus* Chamberlin
   Posterior gonopod without such a spine.....4

4. Posterior gonopod prefemoral process becoming broader at mid-length or distad (Figs. 23, 26, 61, 71).....5
   Posterior gonopod prefemoral process tapering throughout length (Fig. 35); Texas.....*dorophor* Chamberlin

5. Posterior gonopod prefemoral process overlapping part of telopodite basally (Figs. 26, 61).....6
   Posterior gonopod prefemoral process crossing entire telopodite basally (Figs. 23, 71).....7

6. Distal extremity of anterior gonopod lateral syncoxal process entire (Figs. 59-60); Texas.....*acuminatus* Loomis
   Distal extremity of anterior gonopod lateral syncoxal process toothed (Figs. 24-25); Texas.....*brazonus* Chamberlin

7. Anterior gonopod lateral syncoxal process with strong depression on anterior surface (Fig. 69); Texas.....*camellus* n. sp.
   Anterior gonopod lateral syncoxal process without this feature (Fig. 21); Texas.....*austinensis* Chamberlin

8. Posterior gonopod with acute spine caudal to telopodite (Fig. 32); Texas.....*craterus fili* Loomis
   Posterior gonopod without such a spine.....9

9. Posterior gonopod prefemoral process vestigial, a short, bifurcate spur at base of telopodite (Fig. 53); Texas.....*vestigialis* Loomis
   Posterior gonopod prefemoral process not vestigial, a long structure extending for at least 2/3 the length of telopodite.....10

10. Posterior gonopod prefemoral process intertwined with telopodite, tip located on caudal side of latter (Fig. 38); Texas.....*fluviatilis* Chamberlin
    Posterior gonopod prefemoral process not intertwined with telopodite, tip overlying latter or located on anterior side (Figs. 5, 15, 41, 67).....11

11. Tip of telopodite overhanging entire prefemoral process (Figs. 5, 41, 44, 67-68, 77).....12
    Tip of telopodite overhanging tip of prefemoral process only (Fig. 15); Colorado, Utah, New Mexico, Arizona.....*paiutus* (Chamberlin)
    Tip of telopodite not overhanging prefemoral process, latter diverging (Fig. 19); Texas.....*adelphus* Chamberlin

12. Telopodite of posterior gonopod vaguely or strongly sigmoidal (Figs. 5, 41, 67-68).....13
    Telopodite of posterior gonopod not sigmoidal, upright or leaning anteriad (Figs. 44,77).....15

13. Tip of posterior gonopod telopodite directed dorsad (Figs. 5, 41).....14
    Tip of posterior gonopod telopodite directed mediad (Fig. 67); Mississippi.....*mississippiensis*, n. sp.

14. Anterior margin of anterior gonopod lateral syncoxal process curving strongly mediad, overlying most of caudal margin (Fig. 3); Québec and North Dakota to Kentucky and New Mexico.....*garius* (Chamberlin)
Anterior margin of anterior gonopod lateral syncoxal process directed anteriad, not overlying caudal margin (Fig. 39); Texas.....*prosoicus* Chamberlin

15. Anterior margin of anterior gonopod lateral syncoxal process extending anteriad (Fig. 42); Arizona.....*hopius* Chamberlin
Anterior margin of anterior gonopod lateral syncoxal process extending laterad (Fig. 75); Arizona.....*catalina,* n. sp.

16. Posterior gonopod prefemoral process as long as or longer than telopodite (Figs. 8, 11, 57-58).....17
Posterior gonopod prefemoral process shorter than telopodite (Figs. 47, 50, 64, 74).....19

17. Posterior gonopod prefemoral process curving broadly anteriad distad, clearly much longer than telopodite (Figs. 57-58); Ontario to Illinois.....*paludicolens* Causey
Posterior gonopod prefemoral process not curving anteriad, tip directed ventrad, roughly as long as telopodite (Figs. 8, 11).....18

18. Posterior gonopod telopodite with distinct tooth apically on outer margin (Fig. 11); Tennessee..... *annectans* (Chamberlin)
Posterior gonopod telopodite without such a tooth (Fig. 8); Tennessee.....*nigrans* (Chamberlin)

19. Posterior gonopod with spiniform process at base of telopodite on medial side (Fig. 74); Texas .....*spinifer*, n. sp.
Posterior gonopod without this character.....20

20. Posterior gonopod telopodite with two strong bends (Fig. 47); Tennessee.....*orthodoxus* Chamberlin
Posterior gonopod telopodite with one curve, near midlength or distad (Figs. 50, 64).....21

21. Posterior gonopod telopodite extending well beyond prefemoral process (Fig. 64); North Carolina.....*carolinensis*, n. sp.
Posterior gonopod telopodite slightly overhanging prefemoral process, overall configuration uncinate (Fig. 50); North Carolina.....*orientalis* Causey

MCZ - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

NCSM - North Carolina State Museum of Natural Sciences, Raleigh.

NMNH - National Museum of Natural History, Smithsonian Institution, Washington, DC.

TMM - Texas Memorial Museum, Austin.

VMNH - Virginia Museum of Natural History, Martinsville.

Genus *Aniulus* Chamberlin

Aniulus Chamberlin, 1940:3; Chamberlin and Hoffman, 1958:130; Causey, 1959:231; Jeekel, 1971:149; Loomis, 1976:289; Hoffman, 1980:108; 1999:146.

Type species.—*Aniulus adelphus* Chamberlin, 1940, by original designation.

Diagnosis.—A genus of moderate-size Aniulini with ca. 50-56 segments in adults. Sternum of segment 8 extending anteriad for varying distances over segment 7, projection of varying widths. Anterior gonopods with or without glabrous or hirsute syncoxal lobes, lateral syncoxal process highly variable, anterior and caudal margins curving in varying configurations. Posterior gonopods with or without basal spiniform projections caudal or medial to telopodite; prefemoral process usually present, vestigial in one species, a blade-like structure of varying widths extending distad; telopodite without accessory branches, a blade-like structure of varying breadths extending distad in varying

Fig. 1.—Distributions of species of *Aniulus* outside of Texas; some symbols represent more than one locality. Dots, *garius*; open triangles, *nigrans*; upright triangle, *annectans*; inverted triangle, *orthodoxus*; circles, *paiutus*; horizontal half-shaded dot, *hopius*; vertical half-shaded dot, *catalina*; open squares, *paludicolens*; solid squares, *carolinensis*; solid stars, *orientalis*; open stars, *mississippiensis*.

configurations, either upright and bent anteriad apically, or curving broadly anteriad, or sigmoidal. Cyphopods with synoperculum extending dorsad between valves, latter subovoid.

Species.—Twenty-two are known, one divided into two subspecies, but many more undoubtedly remain to be described, especially from Texas, the center of diversity. Stewart (1969) cited *A. medialis* from 5 mi. (8 km) S Red River, Bowie County, Texas, but this Causey manuscript name was never validated and is a *nomen nudum*.

Distribution.—Covering approximately 3/4 of the continental United States plus southern Ontario and Québec, Canada, although no species are known from the southeastern corner (the states of Alabama, Florida, Georgia, and South Carolina) (Figs. 1-2). The area extends from the Atlantic Ocean to southwestern Utah and, north/south, from southern Québec to southern Texas and Arizona, just inside the border with Mexico. Based on known occurrences, species should be expected in Sonora and Tamaulipas, Mexico, and possibly also Manitoba and Saskatchewan, Canada.

Remarks.—The heterogeneous nature of *Aniulus* is revealed by the generality of the generic diagnosis, in which all structures are variable. Females were examined but no diagnostic features at the species level were found; hence the cyphopods are only illustrated for the type species.

Aniulus garius (Chamberlin, 1912)
Figs. 3-5

Iulus venustus Wood (in part), 1864:10-11; 1865:196-198, figs. 26-29.

Paraiulus garius Chamberlin, 1912:167-168; Chamberlin and Hoffman, 1958:149.

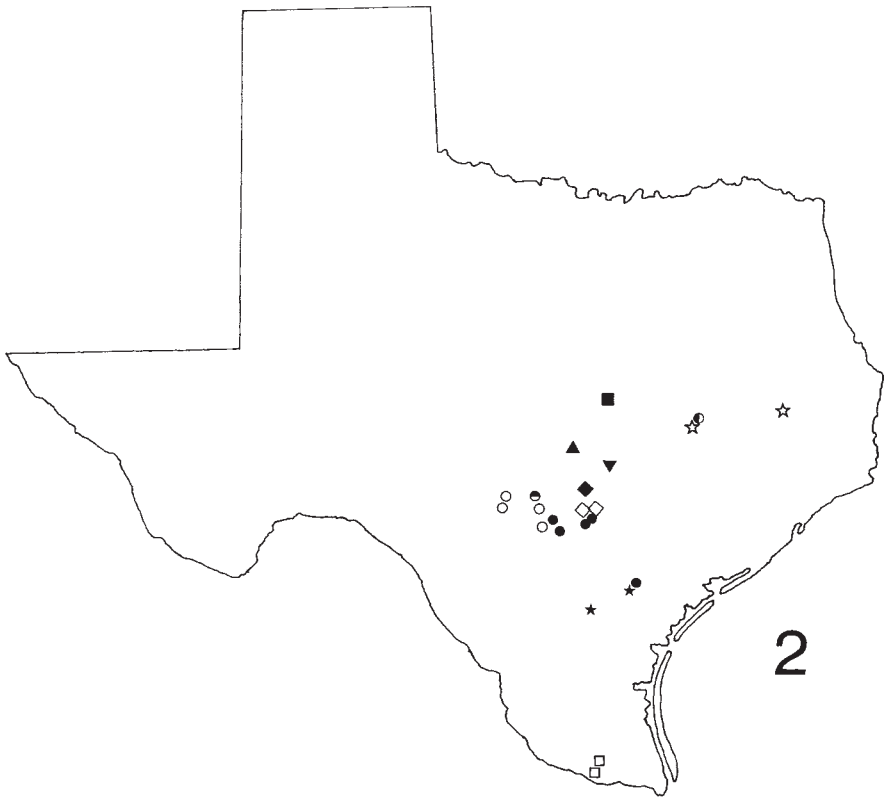


Fig. 2.—Distributions of species and subspecies of *Aniulus* in Texas. Dots, *adelphus*; solid inverted triangle, *austinensis*; vertical half shaded dot - *brazonus*; circles, *craterus craterus*; horizontal half shaded dot, *craterus fili*; solid stars, *dorophor*; open stars, *fluviatilis*; open squares, *prosoicus*; open diamonds, *vestigialis*; solid upright triangle, *acuminatus*; solid diamond, *camellus*; solid square, *spinifer*.

Parajulus impressus (not Say): Williams and Hefner, 1928:127-128, figs. 21a-c.

Aniulus impressus (not Say): Causey, 1950:46, figs. 7-8.

Aniulus bollmani Causey, 1952b:19-20; Chamberlin and Hoffman, 1958:130-131; Shelley, 1988:1646-1647, figs. 11-14; Snider, 1991:181; Hoffman, 1999:146. **New Synonymy**.

Aniulus garius: Hoffman, 1999:147.

Type specimen.—Not known to exist. One female topotype (VMNH) collected by R. L. Hoffman and son, 22 June 1978, at Tolland, Gilpin County, Colorado.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with moderate size, hirsute syncoxal lobes; anterior margin of lateral syncoxal process strong, well developed, extending mediad for greater distance than caudal margin, edges smooth. Posterior gonopod prefemoral process upright and broad, extending for 3/4 length of telopodite and overlapping latter for most of length; telopodite falcate, curving broadly anteriad then dorsad apically (Figs. 3-5).

Distribution. The most widely ranging species, *A. garius* occupies a broad area of the United States and Canada, extending from Québec and North Dakota to Kentucky and the northern Rocky Mountains of New Mexico (Fig. 1). Specimens were examined as follows:

CANADA: QUÉBEC: Dorval, 4M, F, 26 September 1985, L. LeSage, A. Smetana (NCSM).

ONTARIO: *Middlesex Co.*, London, 3M, F, 11 October 1952, W. W. Judd (NCSM).

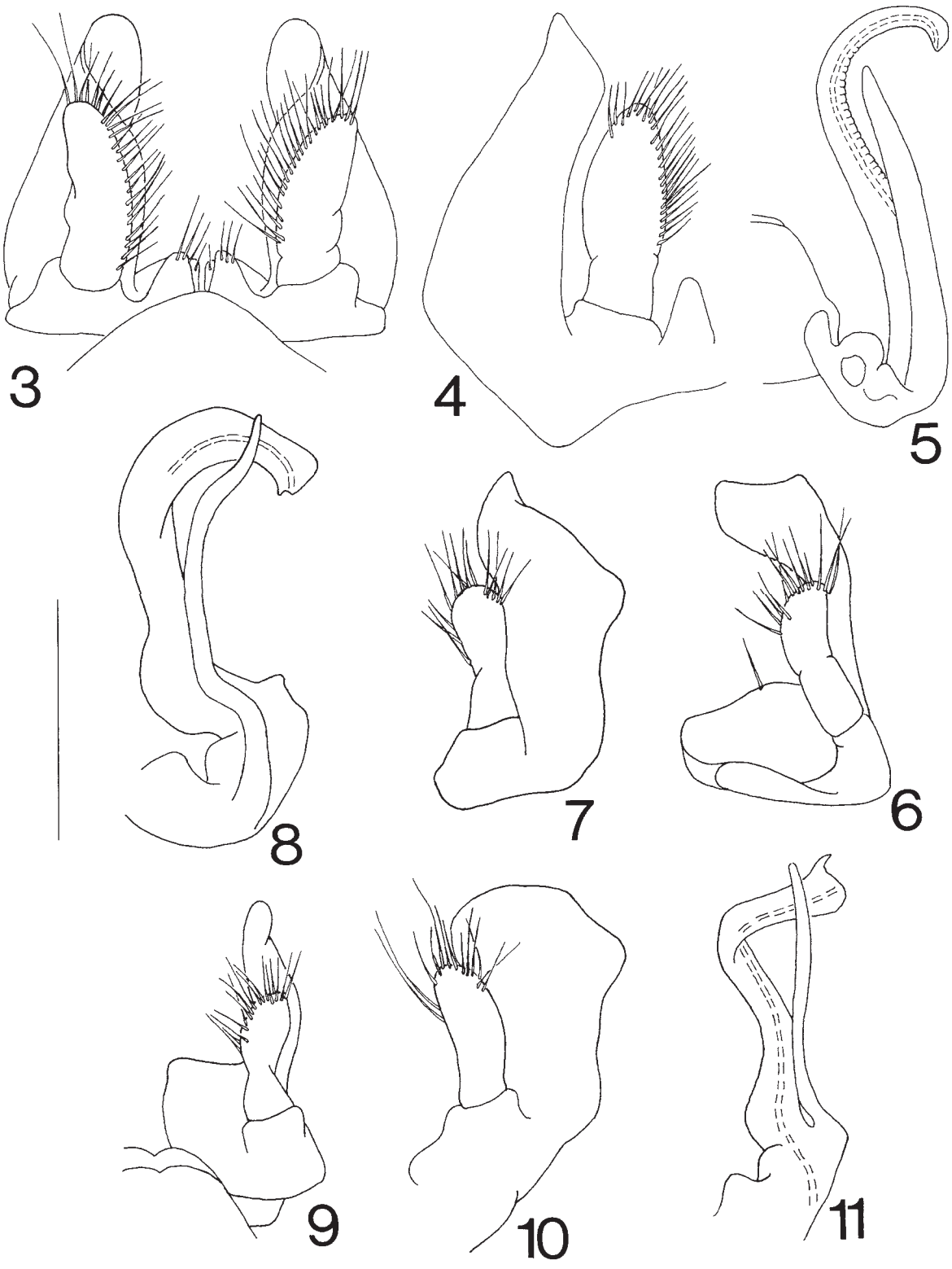
UNITED STATES: PENNSYLVANIA: *Allegheny Co.*, Pittsburgh, M, date and collector unknown (NCSM).

KENTUCKY: *Allen Co.*, Cedar Glade nr. Bays Ford E of Clay Pool, M, F, 5 October 1957, L. Hubricht (VMNH).

OHIO: *Harrison Co.*, Hopedale, old field, 2M, F, 16-29 April 1979, R. P. Urbanek (VMNH). *Preble Co.*, 1.2 mi. (1.9 km) ENE Somerville, Rush Run Game Pres., M, 15 April 1982, R. E. Ashton (NCSM).

MICHIGAN: *Kalkaska Co.*, NNE Kalkaska, upland oak woods, 2M, 4F, 30 August 1958, L. Hubricht (VMNH).

MISSOURI: *Adair Co.*, Charitan R. floodplain, M, F, 26 October 1991, Novinger (NCSM).



Figs. 3-5.—*A. garius*, specimen from Illinois. 3, anterior gonopods, anterior view. 4, right anterior gonopod, lateral view. 5, left posterior gonopod, medial view. Figs. 6-8, *A. nigrans*, holotype. 6, left anterior gonopod, anterior view. 7, the same, lateral view. 8, left posterior gonopod, medial view. Figs. 9-11, *A. annectans*, holotype. 9, left anterior gonopod, anterior view. 10, the same, lateral view. 11, left posterior gonopod, medial view. Scale line = 1.00 mm for all figs.

IOWA: *Dallas Co.,* nr. Raccoon R., under stones in damp creek bed, F, 19 August 1985, D. J. Perschau (VMNH).

NORTH DAKOTA: *Dunn Co.,* 2M, 24 August 1976, collector unknown (NCSM).

NEBRASKA: *Dawes Co.,* Chadron, 5M, 3F, 1 May - 24 November 1987, C. Drucker, H. R. Lawson (NCSM).

COLORADO: *Jefferson Co.,* Idledale, M, 16 August 1984, J. & W. Rapp (VMNH). *Larimer Co.*, 40 mi. (64 km) W Bellvue, 9,000', pine/spruce/aspen forest, M, 4F, 14 June 1970, T. & L. Erwin (VMNH).

NEW MEXICO: *Rio Arriba Co.,* ca. 13 mi. (20.8 km) N Tres Piedras, 2M, F, 13 August 1992, C. S. Crawford (NCSM).

The following additional literature records are available:

OHIO: Statewide (Williams and Hefner 1928).

ILLINOIS: *Cook County*, Chicago; *Stephenson County*, Winslow (Causey 1950).

MICHIGAN: Alcona, Alpena, Antrim, Charlevoix, Cheboygan, Crawford, Emmet, Genesee, Grand Traverse, Houghton, Huron, Kalkaska, Leelanau, Lenawee, Livingston, Luce, Muskegon, Oceana, Presque Isle, Sanilac, Saint Clair, Tuscola, Washtenaw, and Wexford counties (Snider 1991).

NORTH DAKOTA: *Grand Forks County*, Turtle River State Park (Causey 1950).

Remarks.—On the basis of the female topotype, Hoffman (1999) concluded that *A. garius* is a senior synonym of *A. bollmani*, but he deferred making the synonymy in the absence of a male. That from Jefferson County, only about 25 mi. (40 km) southeast of the type locality, is close enough in my view to proceed with the synonymy, which is plausible considering the wide distribution of this species east of the Rocky Mountains.

According to Williams and Hefner (1928), *A. garius* is known as the "corn milliped" in Ohio because of its frequency in corn fields.

Aniulus nigrans (Chamberlin, 1918)
Figs. 6-8

Parajulus nigrans Chamberlin, 1918:27-28.
Oriulus nigrans: Chamberlin and Hoffman, 1958:140.
Aniulus nigrans: Causey, 1959:231; Hoffman, 1999:147.

Type specimen.—Male holotype (MCZ) taken by an unknown collector on 19 August 1897 under stones in a juniper stand near the Nolensville Pike in Nashville, Davidson County, Tennessee.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods without syncoxal lobes; anterior margin of lateral syncoxal process strong but relatively short, extending dorsad only to level of distal extremity of telopodite, caudal margin extending caudad as short, rounded lobe, edges smooth. Posterior gonopod prefemoral process narrow, extending to level of distal extremity of telopodite and overlapping latter for 2/3 of length; telopodite straight for most of length, curving broadly anteriad distad (Figs. 6-8).

Distribution.—Known from the type locality and from New Piper Cave, Smith County, Tennessee (Causey 1959) (Fig. 1).

Aniulus annectans (Chamberlin, 1921)
Figs. 9-11

Parajulus annectans Chamberlin, 1921:233, figs. 1-3.
Oriulus annectans: Chamberlin and Hoffman, 1958:139.
Aniulus annectans: Hoffman, 1999:146.

Type specimen.—Male holotype (MCZ) collected by G. G. Ainslie on an unknown date at an unknown site in Knox County, Tennessee.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods without syncoxal lobes; anterior margin of lateral syncoxal process absent, caudal margin extending mediad near midlength to near midline. Posterior gonopod prefemoral process narrow, extending to level of distal extremity of telopodite and overlapping latter for 1/3 of length and also distad; telopodite with vague sigmoid curvature, curving subanteriad distad, with apical spur on outer margin (Figs. 9-11).

Distribution.—Known only from the type locality (Fig. 1).

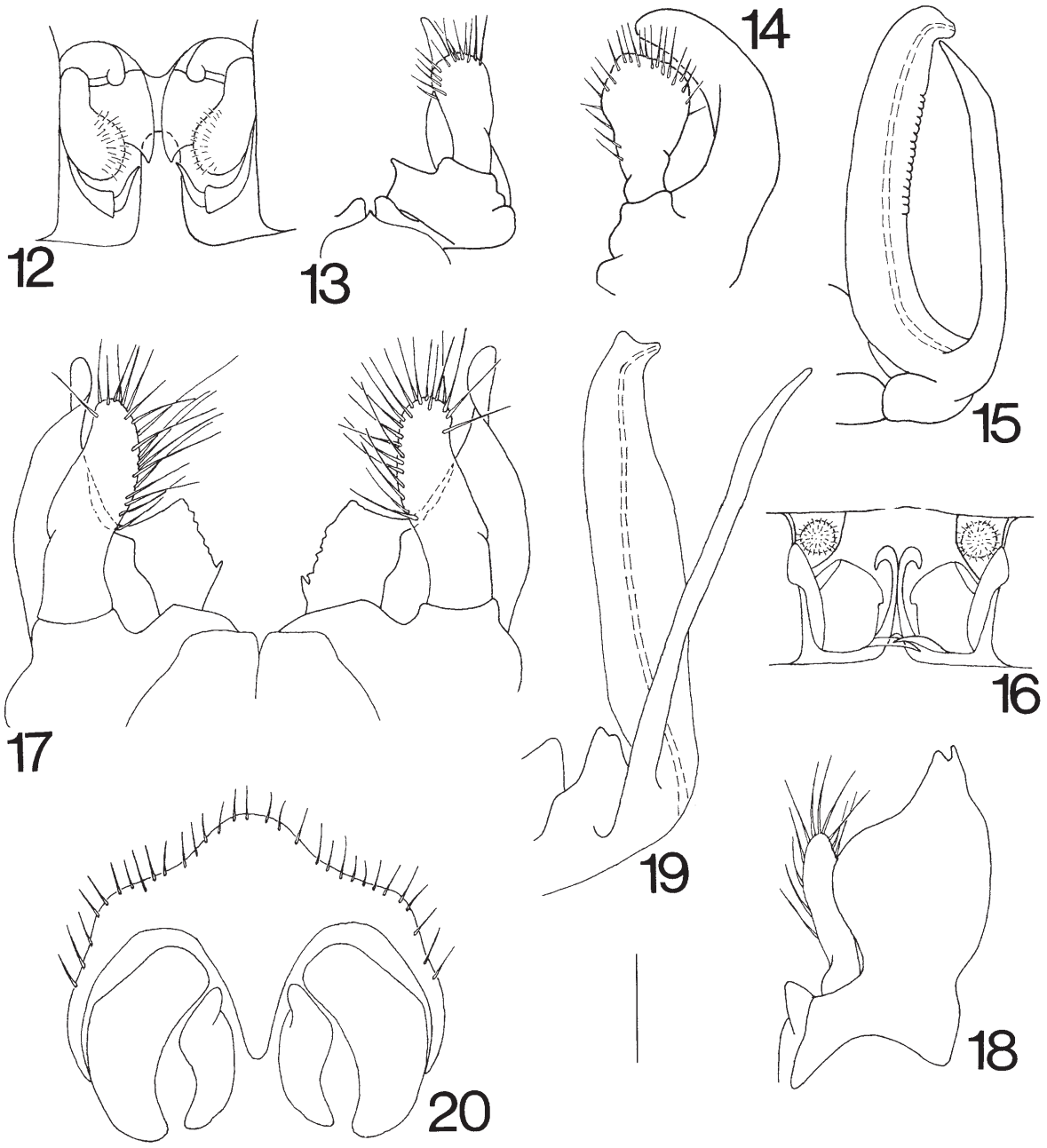
Remarks.—When more material is available, this species may be found to be a subspecies of *A. nigrans*.

Aniulus paiutus (Chamberlin, 1925)
Figs. 12-15

Parajulus paiutus Chamberlin, 1925:60.
Aniulus oreines Chamberlin, 1940:6, pl. 3, figs. 19-20; Chamberlin, 1943:146; Chamberlin and Hoffman, 1958:132; Hoffman, 1999:147-148. **New Synonymy**.
Aniulus paiutus: Causey, 1967:127; Hoffman, 1999:148.

Type specimen.—Male holotype (MCZ) collected by R. V. Chamberlin in May 1924 at Parowan, Iron County, Utah.

Diagnosis.—Sternum of segment 8 relatively long and narrow, protruding over half of segment 7. Anterior gonopods with moderate-size, glabrous syncoxal lobes; lateral syncoxal process semilunar in profile; anterior



Figs. 12-15.—*A. paiutus*, specimen from Garfield County, Colorado. 12, gonopods *in situ*, ventral view of segment 7 showing sternal projection of segment 8. 13, left anterior gonopod, anterior view. 14, the same, lateral view. 15, left posterior gonopod, medial view. Figs. 16-20, *A. adelphus*. 16, gonopods *in situ*, ventral view of segment 7 of holotype showing sternal projection of segment 8. 17, anterior gonopods, anterior view. 18, left anterior gonopod, lateral view. 19, left posterior gonopod, medial view. 20, cyphopods *in situ*, caudal view of female paratype. Scale line = 0.50 mm for all figs.

margin curving slightly mediad and protruding beyond telopodite in anterior view; caudal margin extending directly caudad. Posterior gonopod prefemoral process moderately broad, extending to near level of tip of telopodite, well segregated from latter for entire length; telopodite upright for most of length, bent abruptly anteriad apically (Figs. 12-15).

Distribution.—*Aniulus paiutus* occupies a broad area west of the Rocky Mountains, extending from western Colorado and southwestern Utah to southwestern New Mexico and southeastern Arizona (Fig. 1). Specimens were examined as follows:

ARIZONA: *Cochise Co.,* Chiricahua Mts., Barfoot Park, 8,200', F, 6 July 1962, J. A. Beatty (VMNH). *Coconino Co.,* outside North Rim Grand Canyon Nat. Pk., M, 3F, 26 August 1993, R. M. Shelley (NCSM).

NEW MEXICO: *Catron Co.,* along US hwy. 180 ca. 29.6 mi. (47.4 km) N Catron Co. line, M, 11 August 1991, W. D. Sissom (NCSM); and 20 mi. E. Mogollon, jct. NM hwy. 159/USFS 182, M, 2F, 2 juvs., 1 August 1992, C. S. Crawford (NCSM). *Cibola Co.,* Mt. Taylor, 2M, 4F, 12 August 1991, C. S. Crawford (NCSM); and San Mateo Spg., Mt. Taylor, M, 8F, 6-12 August 1977, S. B. Peck (VMNH). *Grant Co.,* ca. 5.6 mi. (9.0 km) N trailhead on USFS rd. 79, Emory Pass on NM hwy. 90, Black Range, Hillsboro Peak, 2M, 2F, juv., 25 July 1992, C. S. Crawford (NCSM). *Socorro Co.,* Mt. Withington, 2M, F, 28 July 1991, C. S. Crawford (NCSM); San Mateo Park, 2M, F, 27 July 1991, C. S. Crawford (NCSM); and top of Magdelene Mts., 10,000', 2M, F, 12 August 1990, C. S. Crawford.

The following additional literature records are available:

UTAH: *Iron Co.*, Cedar City, and *Washington Co.*, Zion National Park (Chamberlin 1925); *Salt Lake Co.*, Salt Lake City, Mill Creek Canyon (Chamberlin 1943).

COLORADO: *Garfield Co.*, Glenwood Springs (cited as Glenwood) (Chamberlin 1940).

Remarks.—With a longer sternal process on segment 8 than most species, *A. paiutus* may warrant generic distinction in the future. Hoffman (1999) suggested the synonymy of *A. oreines* with *A. paiutus*, which I now confirm.

Aniulus adelphus Chamberlin, 1940
Figs. 16-20

Aniulus adelphus Chamberlin, 1940:3-4, pl. 1, figs. 1-3; Chamberlin and Mulaik, 1941:61; Causey, 1952a:200; Chamberlin and Hoffman, 1958:130; Loomis, 1959:163; Reddell, 1965:162; Hoffman, 1999:146.

Type specimens.—Male holotype, female allotype, and 7 male, 25 female and one juvenile paratypes (NMNH), and one male and two female paratypes (VMNH) collected by S. & D. Mulaik in December 1939 at an unknown site in Kendall County, Texas. Four male and one female paratypes (NMNH) collected by P. H. Wright in February - March 1925 at San Antonio, Bexar County, Texas. Another set of paratypes — 8 males, 6 females, and one juvenile (NMNH) — collected by S. & D. Mulaik in December 1939, 11 mi. SW Boerne, Kendall County, are actually *A. craterus*.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with short, glabrous syncoxal lobes; anterior margin of lateral syncoxal process flared laterad, with inner flange angling dorsad and protruding beyond telopodites in anterior view, caudal margin extending strongly mediad near midlength, margins smooth except for irregularities in medial extension of caudal margin. Posterior gonopod prefemoral process moderately narrow, overlapping telopodite for 1/3 of length but angling away from and diverging from latter; telopodite upright for most of length, bent abruptly anteriad apically (Figs. 16-20).

Distribution.—A small area of central and southern Texas centering on Bexar County (Fig. 2). Specimens were examined as follows:

TEXAS: *Bexar Co.,* Camp Bullis, Isocow Cave, Zone 3, 2M, F, 2 March 1994, W. Elliott, G. Veni (NCSM) and Dangerfield Cave, M, 21 April 1999, J. Reddell, M. Reyes (TMM). *Guadalupe Co.,* nr. Schertz, J. O. Vaughn Ranch, 3M, 3F, 25 December 1958, H. F. & E. M. Loomis (VMNH).

The following additional literature records are available:

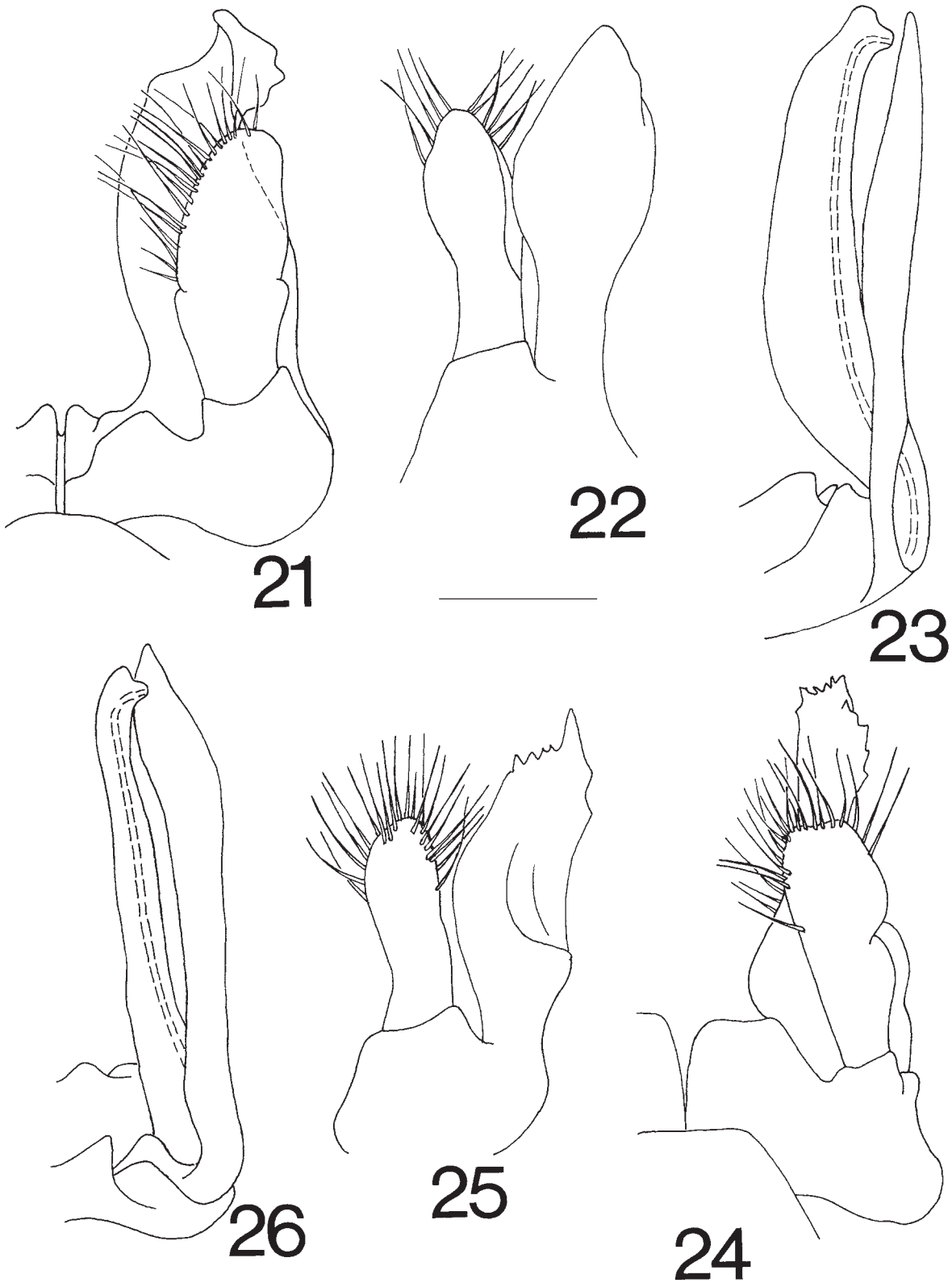
TEXAS: *Goliad Co.*, San Antonio River (Causey 1952a); *Guadalupe Co.*, Schertz and McQueeney (Loomis 1959); caves in Comal and Travis counties (Reddell 1965).

Aniulus austinensis Chamberlin, 1940
Figs. 21-23

Aniulus austinensis Chamberlin, 1940:4, pl. 1, figs. 4-5; Chamberlin and Hoffman, 1958:130; Reddell, 1965:162; Hoffman, 1999:146.

Type specimens.—Four male, 8 female, and 2 juvenile syntypes (NMNH), and one male syntype (VMNH) taken by an unknown collector on an unknown date in Austin, Travis County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with short, glabrous syncoxal lobes; anterior margin of lateral syncoxal process



Figs. 21-23.—*A. austinensis* holotype. 21, left anterior gonopod, anterior view. 22, the same, lateral view. 23, left posterior gonopod, medial view. 24-26, *A. brazonus*, holotype. 24, left anterior gonopod, anterior view. 25, the same, lateral view. 26, left posterior gonopod, medial view. Scale line = 0.50 mm for all figs.

extending directly anteriad, caudal margin extending moderately mediad for most of length, margins generally smooth. Posterior gonopod prefemoral process moderately broad, broadest at midlength, overlapping telopodite for 1/3 of length and moderately segregated thereafter; telopodite generally upright, bent abruptly anteriad apically (Figs. 21-23).

Distribution.—Known only from the type locality and an unnamed sink in Travis County (Fig. 2) (Reddell 1965).

Aniulus brazonus Chamberlin, 1940
Figs. 24-26

Aniulus brazonus Chamberlin, 1940:4, pl. 1, figs. 6-7; Chamberlin and Hoffman, 1958:131; Hoffman, 1999:146.

Type specimens.—One male and two female syntypes (NMNH) taken by an unknown collector in December of an unknown year in "river bottoms," Brazos County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with strong, glabrous syncoxal lobes; anterior margin of lateral syncoxal process extending directly anteriad, caudal margin extending moderately mediad, more so basally, margins smooth, toothed distad. Posterior gonopod prefemoral process very broad, broadest at 2/3-3/4 length, longer than telopodite, overlapping latter basally and apically, otherwise narrowly segregated; telopodite sublinear but leaning slightly caudad, bent abruptly anteriad apically (Figs. 24-26).

Distribution.—Known only from the type locality (Fig. 2).

Aniulus craterus Chamberlin

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with strong, glabrous syncoxal lobes; anterior margin of lateral syncoxal process curving slightly mediad, caudal margin angling moderately or slightly mediad for most of length then extending laterad, edges generally smooth. Posterior gonopod with strong spine on ventral surface at base of telopodite; prefemoral process moderately broad, broadest at 2/3 length or distad, shorter or longer than telopodite, arising on caudal side of latter and angling across stem; telopodite faintly sigmoid.

Remarks.—There are two forms with the spine caudal to the posterior gonopod telopodite. Their differences are of such small magnitude that I believe they are subspecifically related.

Aniulus craterus craterus Chamberlin, 1940, new status
Figs. 27-29

Aniulus craterus Chamberlin, 1940:5, pl. 2, figs. 9-10; Chamberlin and Mulaik, 1941:61; Chamberlin and Hoffman, 1958:131; Loomis, 1959:163; Hoffman, 1999:147.

Type specimens.—Male holotype, female allotype, and 2 male, 9 female, and 4 juvenile paratypes (NMNH), and one male and one female paratypes (VMNH) collected by S. & D. Mulaik in December 1939 at Raven Ranch, ca. 12 mi. (19.2 km) S Kerrville, Kerr County, Texas.

Diagnosis.—Anterior margin of anterior gonopod lateral syncoxal process obscured for most of length in anterior view by telopodite, caudal margin angling moderately mediad. Posterior gonopod prefemoral process longer than telopodite, widest at 2/3 length (Figs. 27-29).

Distribution.—A small area in central Texas ranging from Kerr to Bexar counties (Fig. 2). Specimens were examined as follows:

TEXAS: *Bexar Co.,* LAG Cave, Government Canyon State Natural Area, 3 mi, (4.8 km) W Helotes, M, 6 November 1994, S. Skoruppa (NCSM). *Kendall Co.,* 11 mi. (17.6 km) SW Boerne, 8 M, 6 F, juv., December 1939, S. & D. Mulaik (NMNH).

The following additional literature record is available:

TEXAS: *Bandera Co.*, along Texas highway 16 between Bandera and Kerrville (Loomis 1959).

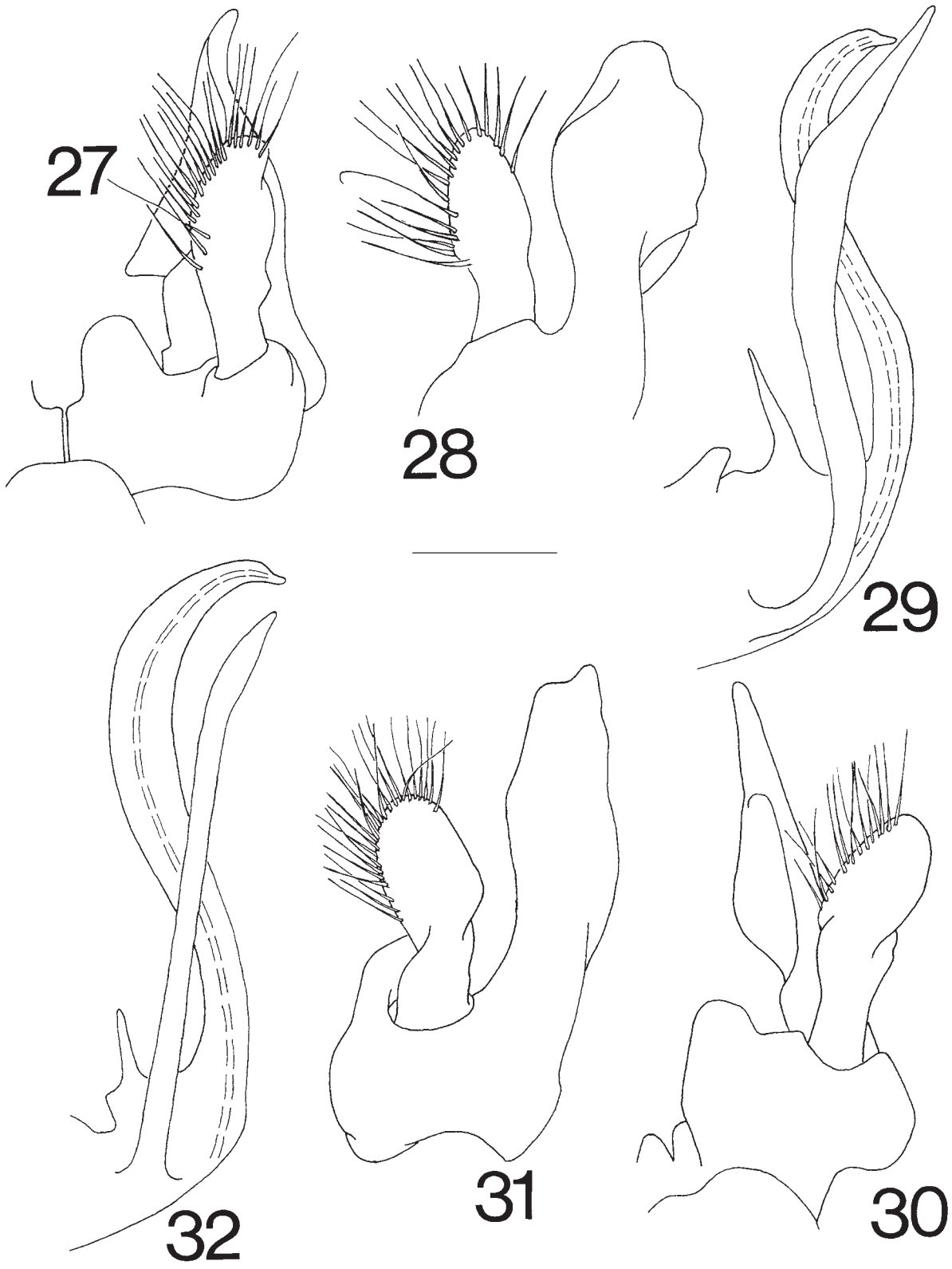
Aniulus craterus fili Loomis, new status
Figs. 30-32

Aniulus fili Loomis, 1975:219, figs. 5-8; Hoffman, 1999:147.

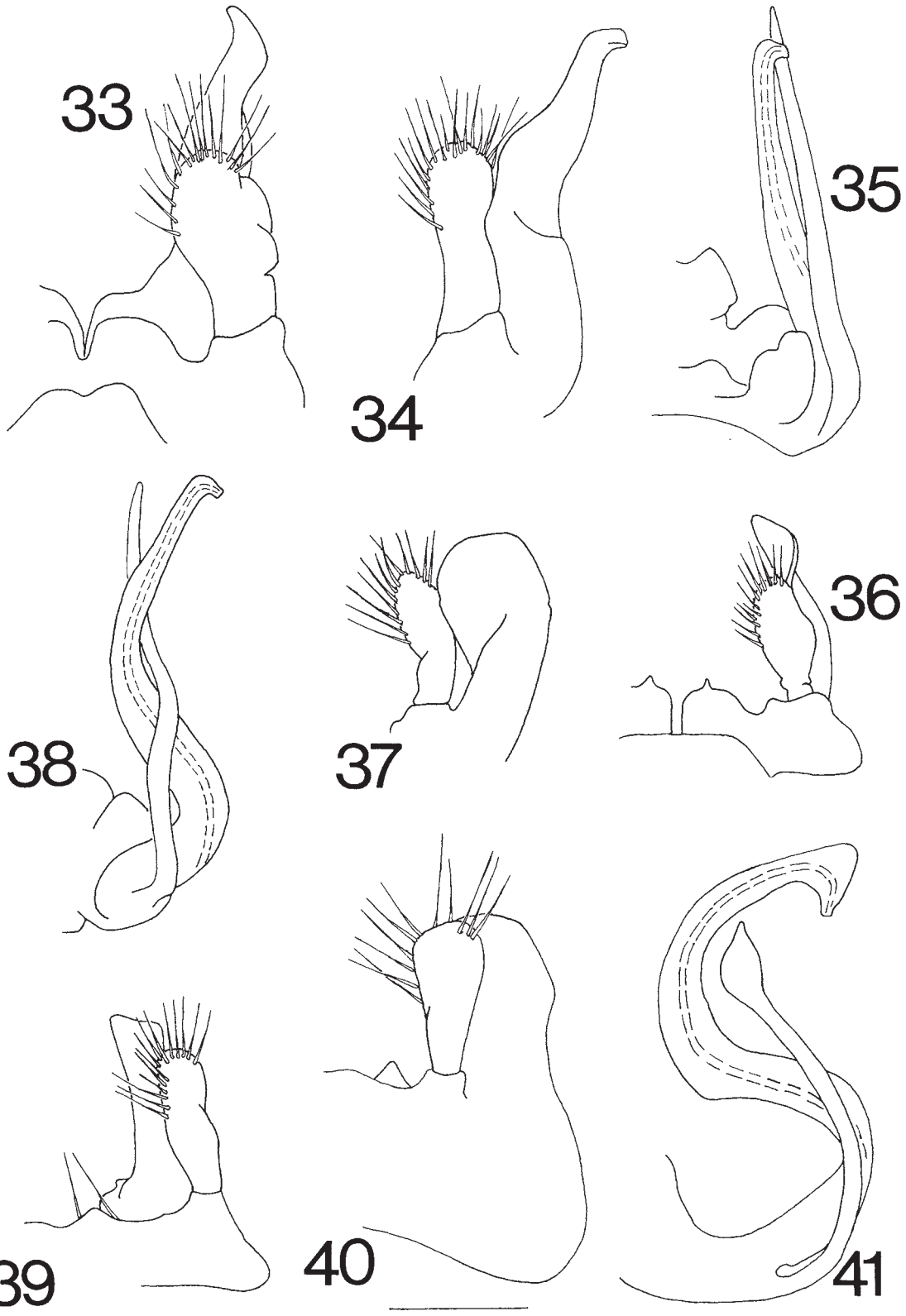
Type specimen.—Male holotype (FSCA) and one male paratype (VMNH) collected by J. C. Loomis in March 1970, 2 mi. S Comfort, Kendall County, Texas.

Diagnosis.—Anterior margin of anterior gonopod lateral syncoxal process visible for most of length in anterior view, caudal margin angling slightly mediad. Posterior gonopod prefemoral process shorter than telopodite, widest distad (Figs. 30-32).

Distribution.—Known only from the type locality (Fig. 2).



Figs. 27-29.—*A. c. craterus*, holotype. 27, left anterior gonopod, anterior view. 28, the same, lateral view. 29, left posterior gonopod, medial view. Figs. 30-32, *A. craterus fili*, holotype. 30, left anterior gonopod, anterior view. 31, the same lateral view. 32, left posterior gonopod, medial view. Scale line = 0.50 mm for all figs.



Figs. 33-35.—*A. dorophor*, holotype. 33, left anterior gonopod, anterior view. 34, the same, lateral view. 35, left posterior gonopod, medial view. 36-38, *A. fluviatilis*, holotype. 36, left anterior gonopod, anterior view. 37, the same, lateral view. 38, left posterior gonopod, medial view. 39-41, *A. prosoicus*, holotype. 39, left anterior gonopod, anterior view. 40, the same, lateral view. 41, left posterior gonopod, medial view. Scale line = 0.50 mm for all figs.

Aniulus dorophor Chamberlin, 1940
Figs. 33-35

Aniulus dorophor Chamberlin, 1940:5-6, pl. 2, figs. 11-13; Chamberlin and Mulaik, 1941:61; Causey, 1952a:200; Chamberlin and Hoffman, 1958:131; Hoffman, 1999:147.

Type specimens.—Male holotype, female allotype, and 20 male and 37 female paratypes (NMNH) collected by S. & D. Mulaik in December 1939 south of Three Rivers, Live Oak County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with moderate-size, glabrous syncoxal lobes; anterior margin of lateral syncoxal process extending directly anteriad, caudal margin angling moderately mediad for most of length, more so proximad, edges generally smooth. Posterior gonopod prefemoral process moderately broad, tapering throughout length, longer than telopodite, overlapping latter basally, otherwise narrowly segregated; telopodite sublinear but leaning slightly caudad, bent abruptly anteriad apically (Figs. 33-35).

Distribution.—Known from the type locality and along the San Antonio River, Goliad County (Causey 1952a) (Fig. 2).

Aniulus fluviatilis Chamberlin, 1940
Figs. 36-38

Aniulus fluviatilis Chamberlin, 1940:6, pl. 2, figs. 14-15; Causey, 1952a:200; Chamberlin and Hoffman, 1958:131; Hoffman, 1999:147.

Type specimen.—Male holotype (NMNH) taken by an unknown collector (probably S. & D. Mulaik) in December of an unknown year at Bottoms, Brazos County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with moderate-size, glabrous syncoxal lobes; anterior margin of lateral syncoxal process extending directly anteriad, caudal margin extending directly caudad, obscured for most of length by telopodite, edges smooth. Posterior gonopod prefemoral process moderately narrow, tapering throughout length, subequal in length to that of telopodite, intertwined with latter; telopodite curving gently anteriad, bent abruptly anteriad apically (Figs. 36-38).

Distribution.—Known only from the type locality and along the Trinity River, Polk County, Texas (Causey 1952a) (Fig. 2).

Aniulus prosoicus Chamberlin
Figs. 39-41

Aniulus prosoicus Chamberlin, 1940:7, pl. 2, fig. 16, pl. 3, figs. 17-18; Chamberlin and Mulaik, 1941:61; Causey, 1952a:200; Chamberlin and Hoffman, 1958:132; Hoffman, 1999:148.

Type specimens.—Male holotype, female allotype, and two male and one female paratypes (NMNH) collected by S. & D. Mulaik in 1938 at Edinburgh, Hidalgo County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with small, hirsute syncoxal lobes; anterior margin of lateral syncoxal process extending directly anteriad, caudal margin extending moderately mediad, visible for entire length, edges smooth. Posterior gonopod prefemoral process relatively narrow, expanding distad, much shorter than telopodite; latter strongly sigmoid, bent abruptly dorsad apically (Figs. 39-41).

Distribution.—Known only from the type locality and from McAllen, Hidalgo County, Texas (Fig. 2) (Causey 1952a).

Remarks.—As noted by Hoffman (1999), the configuration of the posterior gonopod suggests that this species may be referrable to *Ethojulus* Chamberlin.

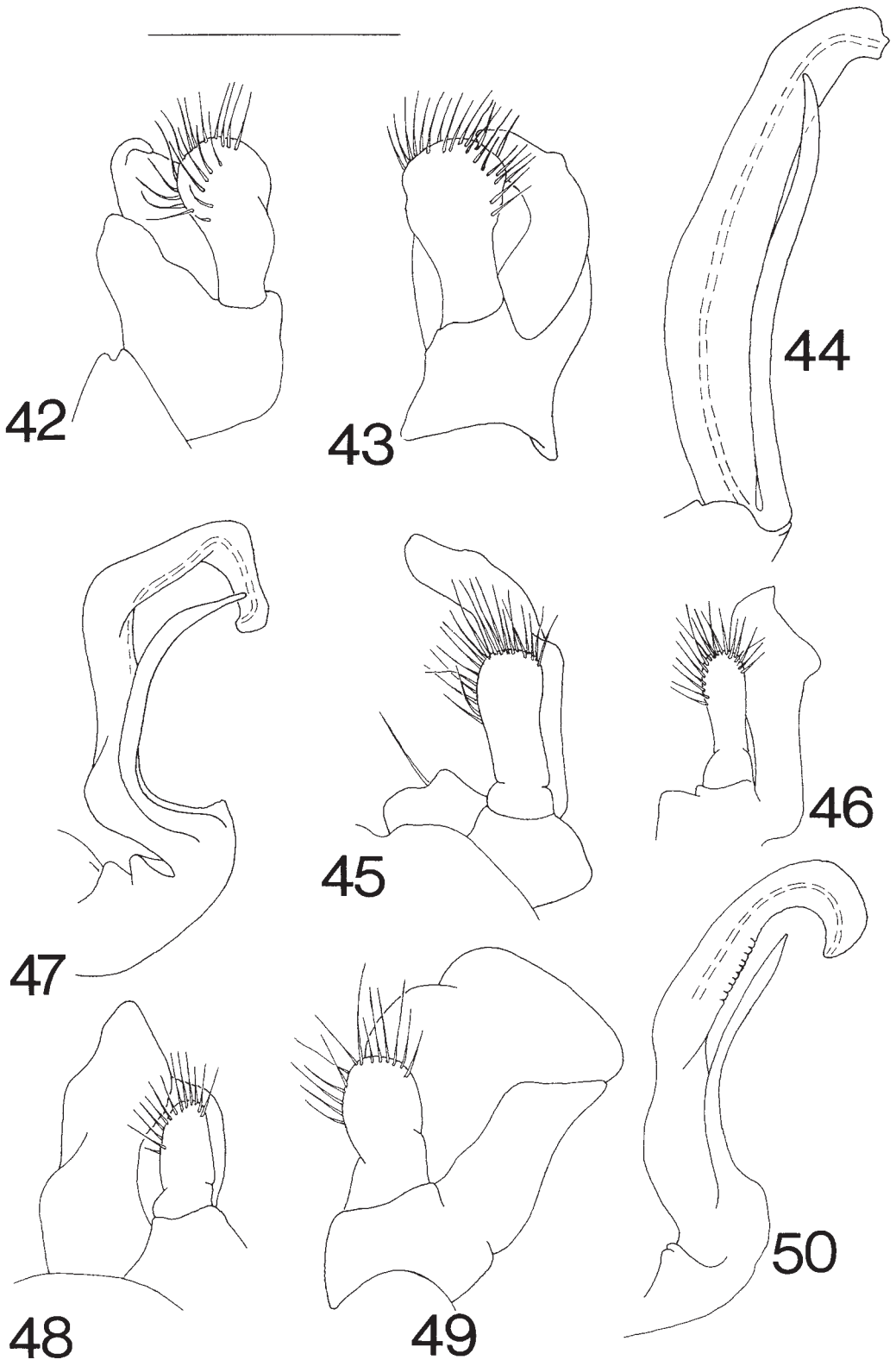
Aniulus hopius Chamberlin
Figs. 42-44

Aniulus hopius Chamberlin, 1941:19, pl. 4, figs. 30-31; Chamberlin and Hoffman, 1958:131-132; Hoffman, 1999:147.

Type specimens.—Male holotype, female allotype, and three male and 17 female paratypes (NMNH) collected by S. & D. Mulaik, 29 December 1940, at Greaterville, Pima County, Arizona.

Diagnosis.—Sternum of segment 8 moderately long and narrow, protruding a moderate distance over segment 7. Anterior gonopods with strong, glabrous syncoxal lobes; anterior margin of lateral syncoxal process extending directly anteriad, caudal margin extending moderately mediad, obscured for most of length by syncoxal lobe, edges smooth. Posterior gonopod prefemoral process moderately broad, tapering distad, shorter than telopodite, overlapping latter apically, otherwise narrowly segregated; telopodite curving slightly anteriad, more so apically (Figs. 42-44).

Distribution.—Known only from the type locality (Fig. 1).



Figs. 42-44.—*A. hopius*, holotype. 42, left anterior gonopod, anterior view. 43, the same, lateral view. 44, left posterior gonopod, medial view. 45-47, *A. orthodoxus*, holotype. 45, left anterior gonopod, anterior view. 46, the same, lateral view. 47, left posterior gonopod, medial view. 48-50, *A. orientalis*, holotype. 48, left anterior gonopod, anterior view. 49, the same, lateral view. 50, left posterior gonopod, medial view. Scale line = 1.00 mm for all figs.

Aniulus orthodoxus Chamberlin
Figs. 45-47

Aniulus orthodoxus Chamberlin, 1946:32, figs. 3-4; Chamberlin and Hoffman, 1958:132; Hoffman, 1999:148.

Type specimens.—Male holotype, female allotype, and one female paratype (NMNH) collected by J. & W. Rapp, 12 April 1945, at Reelfoot, Obion County, Tennessee.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods without syncoxal lobes; anterior margin of lateral syncoxal process directed mediad then angling laterad, obscuring caudal margin in anterior view, latter extending directly caudad distad, extending mediad proximad, edges smooth. Posterior gonopod prefemoral process moderately broad, broadest at midlength, narrowing distad, curving broadly anteriad, shorter than telopodite, overlapping latter for most of length and apically; telopodite sublinear proximad, bent strongly anteriad at midlength, bent dorsad at 3/4 length, tip directed caudad (Figs. 45-47).

Distribution.—Known only from the type locality (Fig. 1).

Remarks.—When more material is available, this species may be found to be a subspecies of *A. nigrans*, and there may be only one species in Tennessee.

Aniulus orientalis Causey
Figs. 48-50

Aniulus orientalis Causey, 1952b:20, figs. 1-4; Chamberlin and Hoffman, 1958:132; Shelley, 1978:48; Hoffman, 1999:148.

Type specimen.—Male holotype (AMNH) collected by N. B. Causey, 9 December 1939, probably at Durham, Durham County, North Carolina.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods without syncoxal lobes; anterior margin of lateral syncoxal process folded and extending strongly mediad, caudal margin extending laterad and visible outside telopodite, edges smooth. Posterior gonopod prefemoral process relatively narrow, widening slightly distad, shorter than telopodite, overlapping latter basally, narrowly segregated thereafter; telopodite upright and sublinear for most of length, uncinate distad, tip directed dorsad (Figs. 48-50).

Distribution.—From southern West Virginia to the "Triangle" area in central North Carolina (Fig. 1), Specimens were examined as follows:

NORTH CAROLINA: *Wake Co.,* 10.6 mi. (17.0 km) NW Raleigh, along SR 1002, 0.8 mi . (1.3 km) W Raleigh/Durham airport, M, 2F, 10 April 1980, A. L. Braswell (NCSM).

VIRGINIA: *Henry Co.,* Martinsville, Virginia Mus. Nat. Hist., M, F, October 1996, R. L. Hoffman (VMNH). *Mecklenburg Co.,* 7.5 mi. (12 km) SW Boyd, N bank Roanoke R., 3M, 2F, 28 March 1998, collector unknown (VMNH); and Elm Hill Small Game Management Area nr. Kerr Dam, M, 16 April 1988, R. L. Hoffman (VMNH). *Montgomery Co.,* 3 mi. (4.8 km) SW Blacksburg, M, 2F, 3 November 1956, R. L. Hoffman (VMNH). *Roanoke Co.,* nr. Vinton, Roanoke Sewage Treatment Plant, M, 15 October 1994, M. W. Donahue (VMNH).

WEST VIRGINIA: *Greenbrier Co.,* Clintonville, M, 14 May 1966, W. A. Shear (VMNH). *Mercer Co.,* 2 mi. (3.2 km) N Athens, under logs in pasture, 4M, 6F, 22 November 1971, W. A. Shear (VMNH).

Remarks.—The sample from Wake County, North Carolina, only about 10 mi. (16 km) east of Durham, increases the probability that Durham is indeed the type locality.

Aniulus vestigialis Loomis
Figs. 51-53

Aniulus vestigialis Loomis, 1959:163, figs. 15-18; Hoffman, 1999:148.

Type specimens.—Male holotype and three female and two juvenile paratypes (NMNH) collected by E. M. & H. F. Loomis, 29 December 1958, in Landa Park, New Braunfels, Comal County, Texas.

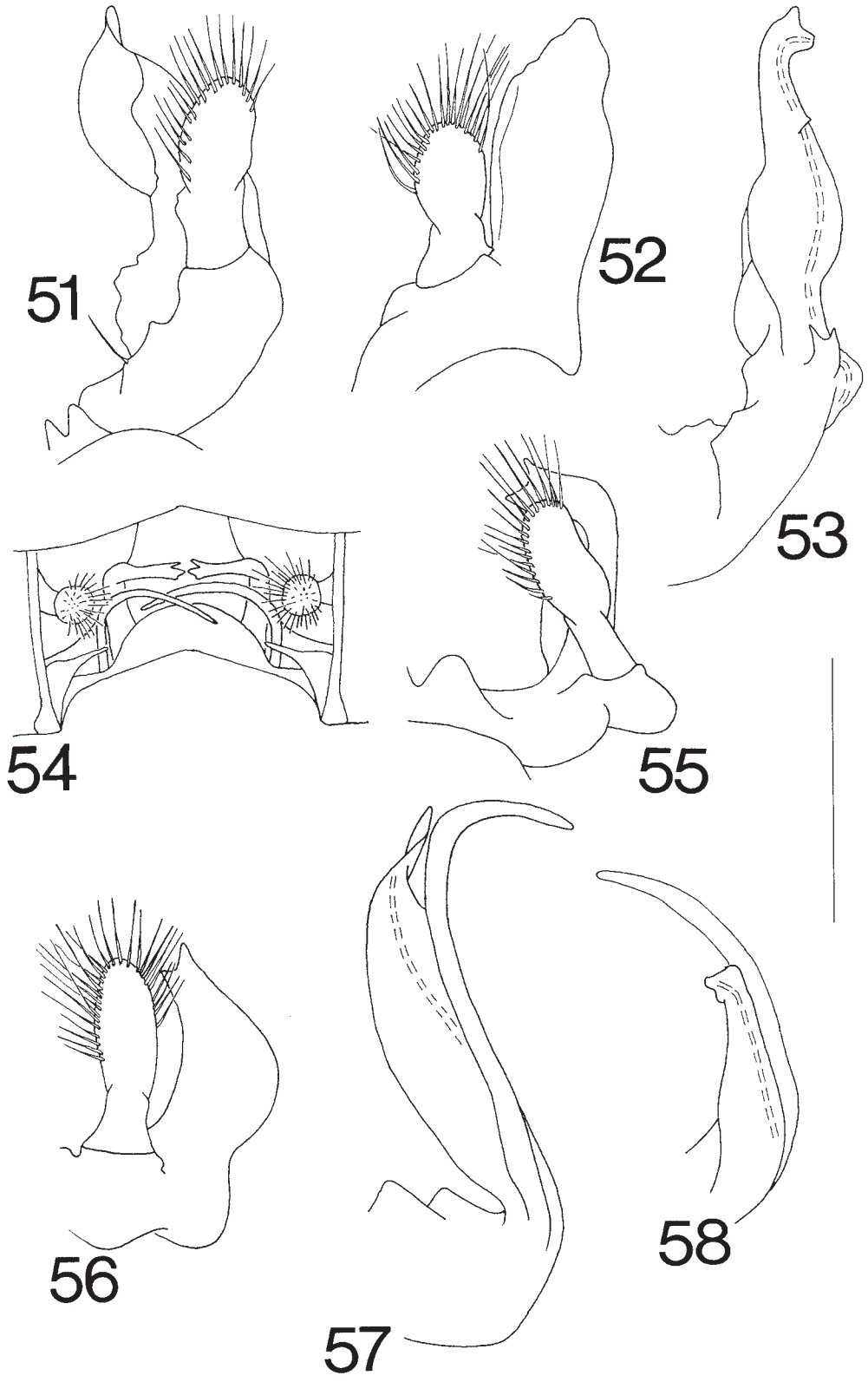
Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with small, hirsute syncoxal lobes; anterior margin of lateral syncoxal process angling strongly mediad, caudal margin curving broadly mediad then angling laterad and obscured by anterior margin, edges smooth or irregular. Posterior gonopod prefemoral process vestigial, bifurcate; telopodite long and upright, expanding at midlength then narrowing, bent abruptly anteriad apically (Figs. 51-53).

Distribution.—Known from the type locality and the following additional site (Fig. 2):

TEXAS: *Guadalupe Co.,* McQueeny, M, 2F, 29 December 1958, H. F. & E. M. Loomis (VMNH).

Aniulus paludicolens Causey
Figs. 54-58

Aniulus paludicolens Causey, 1967:127-129, figs. 1-6; Shelley, 1988:1647; Hoffman, 1999:148.



Figs. 51-53.—*A. vestigialis*, holotype. 51, left anterior gonopod, anterior view. 52, the same, lateral view. 53, left posterior gonopod, medial view. 54-58, *A. paludicolens*, holotype. 54, gonopods *in situ*, ventral view of segment 7 showing sternal projection of segment 8. 55, left anterior gonopod, anterior view. 56, the same, lateral view. 57, left posterior gonopod, medial view. 58, distal extremity of the same, lateral view. Scale line = 1.00 mm for all figs.

Type specimens.—Male holotype and female allotype (NMNH), and two male, 7 female and ca. 7 juvenile paratypes (FSCA) collected by W. Suter, 4 May 1961, in Dollar Tamarack Swamp, Edwin S. George Reserve, near Pinckney, Livingston County, Michigan.

Diagnosis.—Sternum of segment 8 relatively long and broad, protruding about halfway over segment 7, with ventral flange. Anterior gonopods with moderate-size, glabrous syncoxal lobes, anterior margin of lateral syncoxal process extending strongly mediad distad then curving laterad, apically bifurcate, caudal margin curving gently mediad. Posterior gonopod prefemoral process long and narrow, of subequal width throughout, longer than telopodite and overlapping latter for 2/3 of length, curving broadly anteriad distad; telopodite very broad, curving laterad distad, tip directed dorsad (Figs. 54-58).

Distribution.—Extending from southern Ontario, Canada, to northeastern Illinois (Fig. 2). In addition to the type locality, Causey (1967) recorded *A. paludicolens* from the following localities: Soyer Bog, Volo, Lake County, Illinois; Cowle's Bog, Dune Acres, Porter County, Indiana; and Byron Bog, London, Middlesex County, Ontario, Canada.

Remarks.—Causey's statement (1967) that *A. paludicolens* was closest to *A. paiutus*, misspelled as "*paitus*," was merely a guess, as the holotype of *A. paiutus* was undissected when I received it. The considerable differences in the gonopods suggest instead a distant relationship, and the unique posterior gonopod prefemoral process and sternum of segment 8 may require generic recognition in the future.

Aniulus acuminatus Loomis
Figs. 59-61

Aniulus acuminatus Loomis, 1976:290, figs. 4-6; Hoffman, 1999:146.

Type specimens.—Male holotype, female allotype, and one male paratype (FSCA) collected by J. C. Loomis, 15 February 1975, 5 mi. ESE Marble Falls, Burnet County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with short syncoxal lobes; anterior margin of lateral syncoxal process extending slightly mediad then dorsad, caudal margin extending directly caudad then mediad proximad. Posterior gonopod prefemoral process relatively broad, expanding at 2/3 length, upright and longer than telopodite, narrowly segregated from latter; telopodite upright, bent abruptly anteriad apically (Figs. 59-61).

Distribution.—Known only from the type locality (Fig. 2).

Remarks.—When more material is available, *A. acuminatus* may be found to be a subspecies of *A. brazonus*.

Aniulus carolinensis, new species
Figs. 62-64

Type specimens.—Male holotype and 2 male and 23 female paratypes (NCSM) collected by D. L. Stephan, 21-28 January 1990 at 1611 Oberlin Rd., Raleigh, Wake County, North Carolina. Seven male and 5 female paratypes (NCSM) collected by A. L. Braswell, 20 March 1977-7 April 1979 along Wakefield St., Raleigh.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods without syncoxal lobes; anterior margin of lateral syncoxal process extending directly anteriad, caudal margin curving gently mediad distad, then laterad, then mediad again proximad. Posterior gonopod prefemoral process moderately narrow, tapering distad, shorter than telopodite, upright and linear for most of length and overlapping telopodite, curving slightly distad at 3/4 length and segregated from latter; telopodite upright for half of length, then curving broadly anteriad and extending well beyond level of distal extremity of prefemoral process, tip directed laterad (Figs. 62-64).

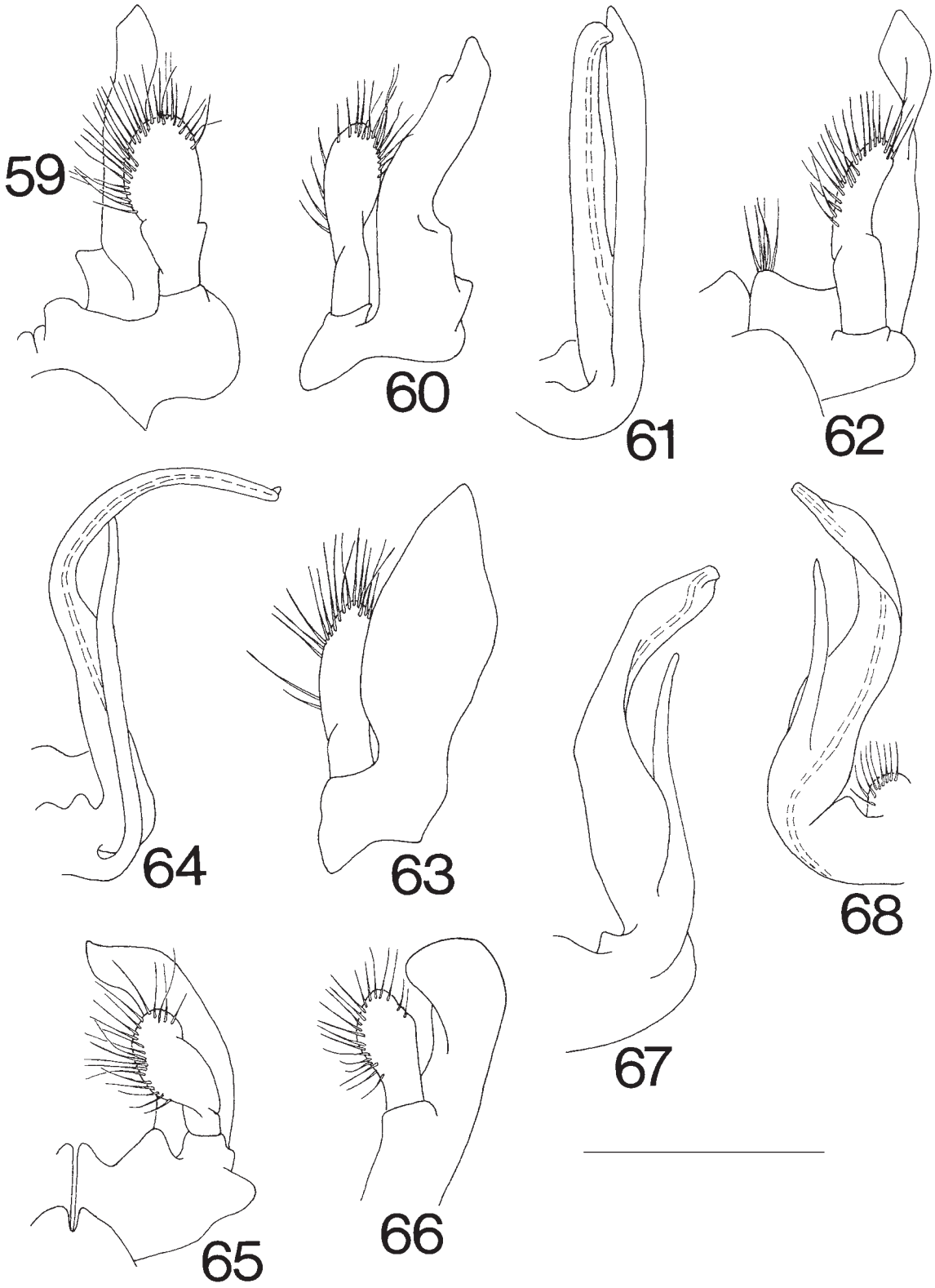
Distribution.—Ranging from Raleigh to the Outer Banks of North Carolina, a distance of approximately 180 mi. (288 km) (Fig. 1). In addition to the types, specimens were examined from the following locality:

NORTH CAROLINA: *Dare Co.,* Buxton, 3M, 8F, 18-19 November 1980, D. L. Stephan (NCSM).

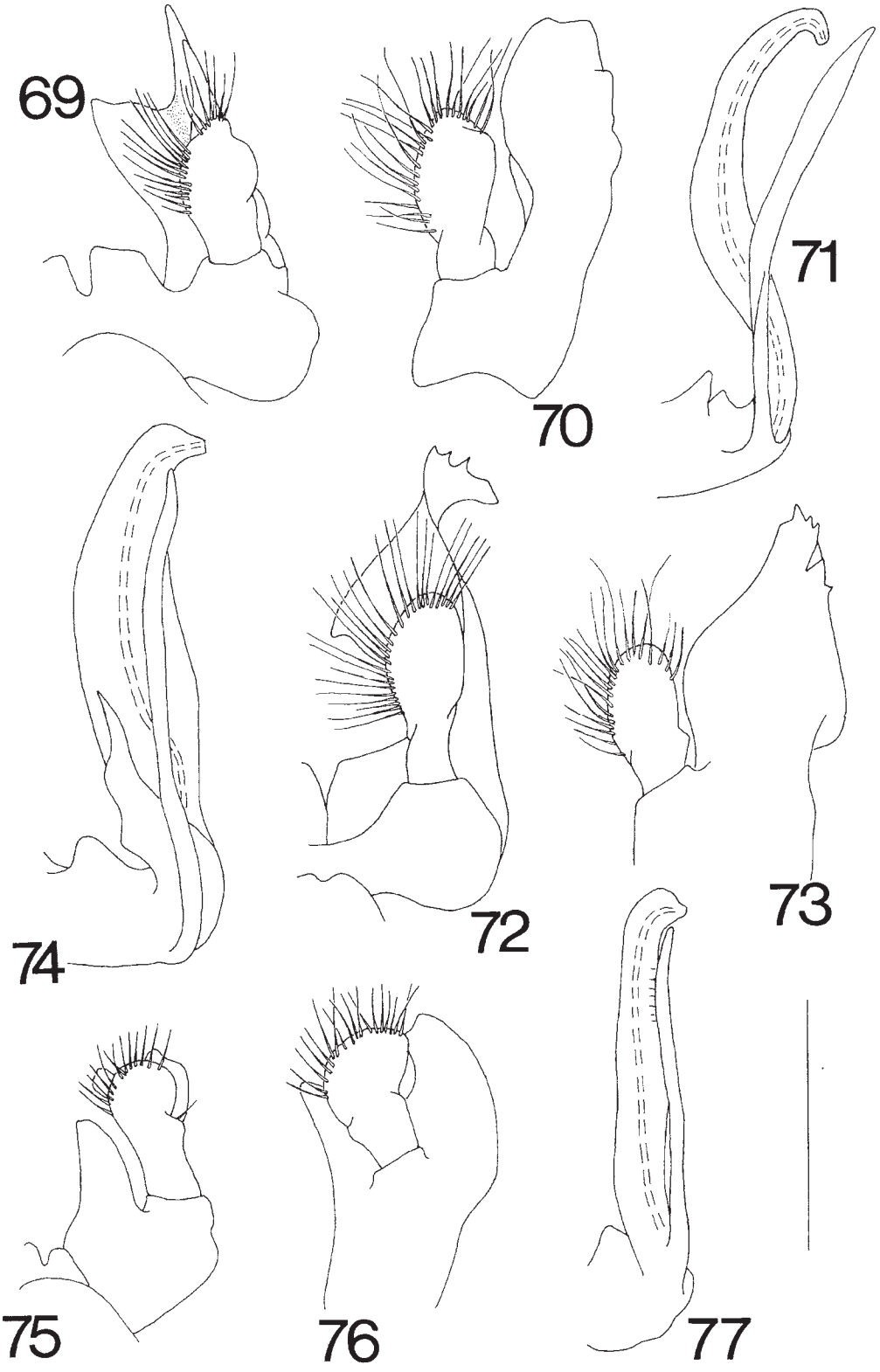
Aniulus mississippiensis, new species
Figs. 65-68

Type specimens.—Male holotype and 10 male and 3 female paratypes (VMNH) collected by P. K. Lago, 27 February 1987, in pine woods, 2.5 mi. SSW Prentiss, Jefferson Davis County, Mississippi. Ten male and 5 female paratypes taken in a pitfall trap by same collector, 11 March 1990, at Dixie Springs, Pike County, Mississippi.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with moderate-size syncoxal lobes; anterior margin of lateral syncoxal process curving strongly mediad, approaching opposite member in midline, then angling laterad and obscured by telopodite in anterior view, caudal margin extending directly caudad distad then angling slightly mediad. Posterior



Figs. 59-61.—*A. acuminatus*, holotype. 59, left anterior gonopod, anterior view. 60, the same, lateral view. 61, left posterior gonopod, medial view. Figs. 62-64, *A. carolinensis*, holotype. 62, left anterior gonopod, anterior view. 63, the same, lateral view. 64, left posterior gonopod, medial view. 65-68, *A. mississippiensis*, holotype. 65, left anterior gonopod, anterior view. 66, the same, lateral view. 67, left posterior gonopod, medial view. 68, the same, lateral view. Scale line = 1.00 mm for all figs.



Figs. 69-71.—*A. camellus*, holotype. 69, left anterior gonopod, anterior view. 70, the same, lateral view. 71, left posterior gonopod, medial view. 72-74, *A. spinifer*, holotype. 72, left anterior gonopod, anterior view. 73, the same, lateral view. 74, left posterior gonopod, medial view. 75-77, *A. catalina*, holotype. 75, left anterior gonopod, anterior view. 76, the same, lateral view. 77, left posterior gonopod, medial view. Scale line = 1.00 mm for all figs.

gonopod prefemoral process moderately narrow and subupright, extending for about 2/3 the length of telopodite and overlapping latter basally; telopodite curving broadly over distal extremity of prefemoral process, twisted at midlength, tip directed mediad (Figs. 65-68).

Distribution.—Known only from the type and paratype localities (Fig. 1).

Aniulus camellus, new species
Figs. 69-71

Type specimens.—Male holotype and two male paratypes (VMNH) collected by R. Highton, 1 April 1961, at Fern Bank Springs near Wimberly, Hays County, Texas.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with strong, glabrous syncoxal lobes; anterior margin of lateral syncoxal process extending subdirectly anteriad, caudal margin extending ventrad then dorsomediad, then ventrad again to form shallow cup. Posterior gonopod prefemoral process moderately broad, tapering distad, subequal in length to telopodite, overlapping latter for 1/3 of length then diverging; telopodite curving in vague sigmoid fashion, tip directed dorsad (Figs. 69-71).

Distribution.—Known only from the type locality (Fig. 2).

Remarks.—The specific name denotes the cup-shaped configuration of the anterior gonopod lateral syncoxal process.

Aniulus spinifer, new species
Figs. 72-74

Type specimens.—Male holotype and two female and one juvenile paratypes (NCSM) collected by J. C. Cokendolpher and J. R. Reddell, 3 November 1998, outside the entrance to Jagged Walls Cave, Fort Hood, Bell County, Texas. One male and three female paratypes (NCSM) collected by J. R. Reddell and M. Reyes, 23 April 1998, in Keilman Cave, Fort Hood; one male and one female paratypes (NCSM) collected by L. J. Graves, J. R. Reddell, and M. Reyes, 21 April 1998, in Treasure Cave, Fort Hood; one male, one female, and one juvenile paratypes (NCSM) collected by J. R. Reddell and M. Reyes, 18 May 1998, in Sanford Pit Cave, Fort Hood; and one male paratype (TMM) collected by J. R. Reddell and M. Reyes, 21 April 1998, in Coyote Den Cave, Fort Hood.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods without syncoxal lobes; anterior margin of lateral syncoxal process extending anteriad then curving mediad proximad, caudal margin curving broadly mediad then angling laterad. Posterior gonopod with strong spiniform process at base of telopodite on medial side; prefemoral process moderately narrow, widening slightly around midlength, shorter than telopodite and overlapping latter for entire length; telopodite subupright, bending abruptly anteriad distad (Figs. 72-74).

Distribution.—Known only from the type and paratype localities (Fig. 2).

Remarks.—The specific name denotes the spine at the base of the posterior gonopod telopodite.

Aniulus catalina, new species
Figs. 75-77

Type specimens.—Male holotype and two male and eight female paratypes (VMNH) collected by J. A. Beatty, 17 September 1962, at 7,500' in Marshall Gulch, Santa Catalina Mountains, Pima County, Arizona. Four male and six female paratypes (VMNH) taken by same collector on 9 August of unknown year at the Ski Lodge, 8,300', in the Santa Catalina Mountains; and one male, two female, and one juvenile paratypes (VMNH) taken by same collector on 19 September 1960, under a rock at 7,900' in Bear Wallow in the Santa Catalina Mountains.

Diagnosis.—Sternum of segment 8 relatively short and narrow, protruding only short distance over segment 7. Anterior gonopods with strong, glabrous syncoxal lobes; anterior margin of lateral syncoxal process extending laterad, caudal margin curving mediad then angling laterad at midlength. Posterior gonopod prefemoral process relatively narrow, upright, shorter than telopodite and overlapping latter for most of length; telopodite upright, bent abruptly anteriad distad (Figs. 75-77).

Distribution.—Known only from the type and paratype localities (Fig. 1). This species is probably endemic to forested habitats at high elevations in the Santa Catalina Mountains, which are isolated from forests in other inselberg mountains in southern Arizona by the hot, dry desert floor.

Remarks.—The gonopods of this species are closest to those of *A. hopius*, but the wide geographic separation, ca. 88 mi. (141 km), argues for full species status.

ACKNOWLEDGEMENTS

I thank the following curators and collection managers for loaning the indicated type specimens from

the collections under their care: L. Leibensperger (MCZ), holotypes of *Parajulus nigrans, P. annectans,* and *P. paiutus*; J. A. Coddington (NMNH), holotype, allotype, and paratypes of *A. adelphus, A. craterus, A. dorophor, A. prosoicus,* and *A. hopius,* holotype of *A. fluviatilis*, syntypes of *A. austinensis* and *A. brazonus*, holotype and allotype of *A. oreines, A. orthodoxus*, and *A. paludicolens*, and holotype and paratypes of *A. vestigialis*; G. B. Edwards (FSCA), holotype of *A. fili*, holotype, allotype, and paratypes of *A. acuminatus*, and paratypes of *A. paludicolens*; N. I. Platnick (AMNH), holotype of *A. orientalis*, and holotype and paratypes of *A. bollmani*; and R. L. Hoffman (VMNH), paratypes of *A. adelphus, A. austinensis, A. craterus,* and *A. fili*. I am grateful to Dr. Hoffman for loan of general material from the VMNH, which contained the holotype and paratypes of *A. mississippiensis, A. camellus,* and *A. catalina*; likewise I thank J. R. Reddell (TMM) for loan of general material containing the types of *A. spinifer*, most of which was retained at the NCSM with his permission. Figures 12, 16, and 54 were prepared by R. G. Kuhler, NCSM Scientific Illustrator.

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Note Added in Proof

Upon examining further material of the Aniulini, I now realize that *Aniulus carolinensis* is a synonym of *Oriulus venustus* (Wood), and I take this opportunity to formally combine the names.

Cokendolpher, James C., Richard K. Lawrence, and Victor J. Polyak. 2001. Seasonal and site-specific bait preferences of crickets and diplurans in Hidden Cave, New Mexico. Texas Memorial Museum, Speleological Monographs, 5:95-104.

SEASONAL AND SITE-SPECIFIC BAIT PREFERENCES OF CRICKETS AND DIPLURANS IN HIDDEN CAVE, NEW MEXICO

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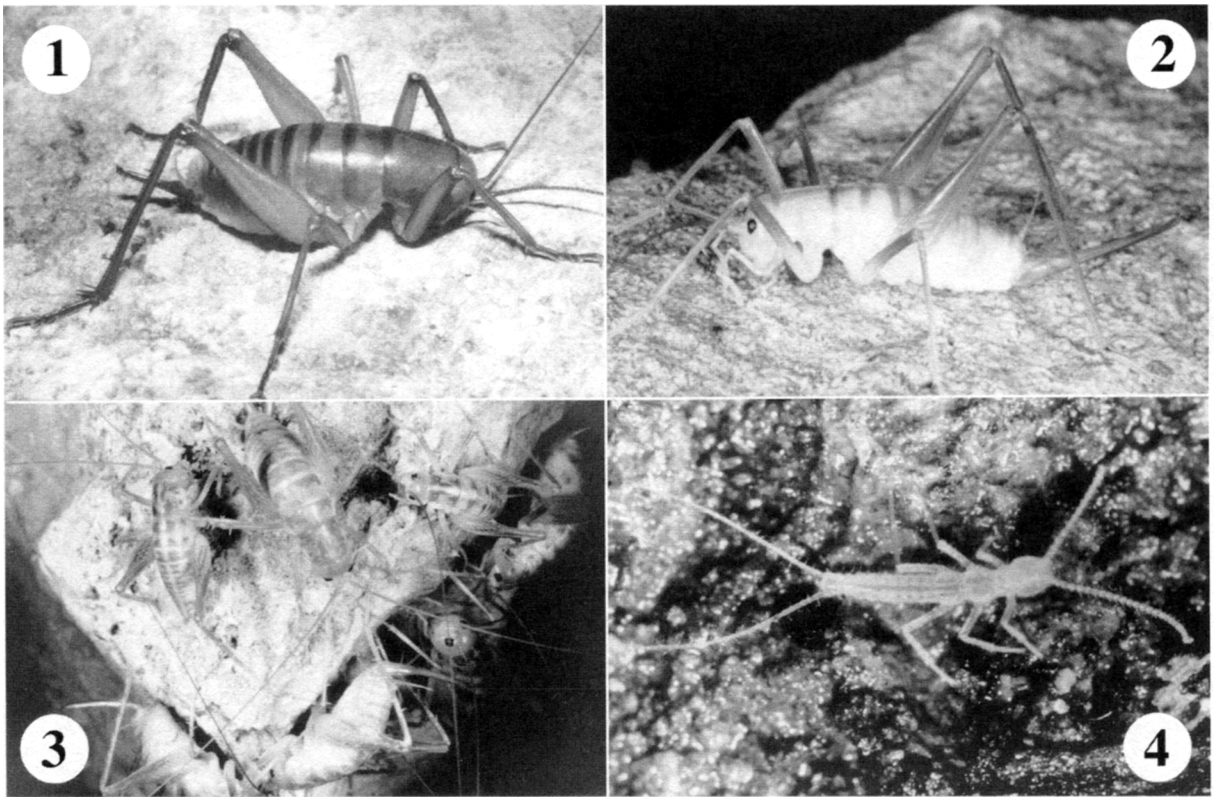
ABSTRACT

Effects of season and trap site characteristics on bait preferences of two cave-dwelling crickets (Gryllacrididae), *Ceuthophilus longipes* and *C. carlsbadensis*, and an undescribed genus and species of dipluran (Campodeidae) were investigated. Three pitfall traps, each baited with either rancid beef liver, grape jelly, or tuna fish, were placed in 10 independent sites in Hidden Cave for a 24-hour period in February (winter) and August (summer) of 1992. Abundance and bait preference differed seasonally within the cave for the three species. *C. longipes* and diplurans strongly preferred rancid liver over tuna and grape jelly baits during summer. *C. carlsbadensis* preferred tuna over liver and jelly during summer, but preferred liver during winter. Additionally, *C. longipes* preferred tuna in twilight sites during summer, while baits in dark sites during summer were not preferred. Diplurans preferred rancid liver equally in twilight and dark sites in summer. *C. carlsbadensis* sample sizes were insufficient for testing twilight effects upon bait selection. Rancid liver was the most favored bait, probably owing to its similarity with larger naturally occurring cave carrion. Subdominant (i.e., prey) hexapods, such as *C. longipes* and the diplurans, may augment their foraging preferences, habitat selection, distribution patterns, or any combination of the three, to reduce interactions with the larger, more predatory *C. carlsbadensis* in Hidden Cave.

INTRODUCTION

Like most of the large limestone caves in southeastern New Mexico, Hidden Cave is populated by three camel cricket species (Figs. 1-3), a dipluran (entotroph, Fig. 4), and numerous smaller invertebrates



Figs. 1-4.—Larger arthropods known from Hidden Cave. 1, *Ceuthophilus carlsbadensis*; 2, *Ceuthophilus longipes*; 3, *Ceuthophilus conicaudus* (not photographed in Hidden Cave); 4, New genus and species of dipluran.

(Barr & Reddell, 1967; unpubl. data). Crickets (Orthoptera, Rhaphidophoridae, *Ceuthophilus*) are the largest and most active invertebrates in the cave. Although three species (*C. carlsbadensis* Caudell, *C. longipes* Caudell, *C. conicaudus* Hubbell; Figs. 1-3) have been recorded from caves and adjacent surface sites in the region, only the latter is regularly observed on the surface (Barr & Reddell, 1967; Campbell, 1976; Elliott, 1978). *Ceuthophilus conicaudus* is considered to be a trogloxene (species that use caves as refuges, but return to the surface regularly to feed). Barr & Reddell (1967) and Campbell (1976) reported that this cricket leaves caves in considerable numbers during summer nights. It is most often found clumped in domes near the entrances to caves, but can be found throughout the caves. Although Barr & Reddell (1967) reported finding this cricket in Hidden Cave, we did not collect it during our investigations. The crickets we encountered near the entrance in the twilight zone, typical habitat for *C. conicaudus*, were *C. longipes*. *C. longipes* sometimes clumps in small groups in the entrance zone, whereas *C. carlsbadensis* does not.

The dipluran from southeastern New Mexico is an undescribed new genus and species (Entotrophi: Campodeidae) which has been recorded as "*Plusiocampa* sp." (Barr & Reddell, 1967; Elliott, 1978; Welbourn, 1978; and citations therein). According to Ferguson (1990:960), members of the new genus ("Campodeid Genus A") are troglobitic (species restricted to living in caves) and are found in western Texas (Guadalupe Mountains) and southeastern New Mexico. This species is found throughout Hidden Cave, including the twilight zones, and is most often observed on flat, silty mud floors. It is a moderate-sized (about one cm long, excluding cerci) hexapod, but very delicate. It is eyeless, depigmented, has long slender appendages, and is restricted to the cave environment (Fig. 4). While the crickets will eat almost anything (including each other), the dipluran is apparently restricted to scavenging (Northup & Kuper, 1987; Northup & Crawford, 1992; unpubl. data).

We collected within and above Hidden Cave to determine: (1) which bait(s) would be most attractive to a variety of invertebrates and thus be most useful in surveys, and (2) any detectable bait shifts due to (in order of emphasis)- season, luminosity, or region within the cave. The present contribution concerns data obtained from the three most numerous invertebrates collected in Hidden Cave. *C. carlsbadensis*, *C. longipes*, and the undescribed dipluran were examined to better

understand their foraging ecology and biological interactions. Few other species were captured in pitfall traps in the cave. Of those, only the ground beetle (*Rhadine longicollis* Benedict, Carabidae) was collected during both seasons. Unfortunately, the four samples collected revealed little about this beetle's preferences: two beetles from tuna, two beetles from rancid liver baited traps.

MATERIALS AND METHODS

Study site.—Hidden Cave is located in the Guadalupe Mountains of Eddy County, New Mexico. The entrance to this limestone cave is at an elevation of about 2,000 m. The cave is constantly moist (dripping water and pools are present), while the

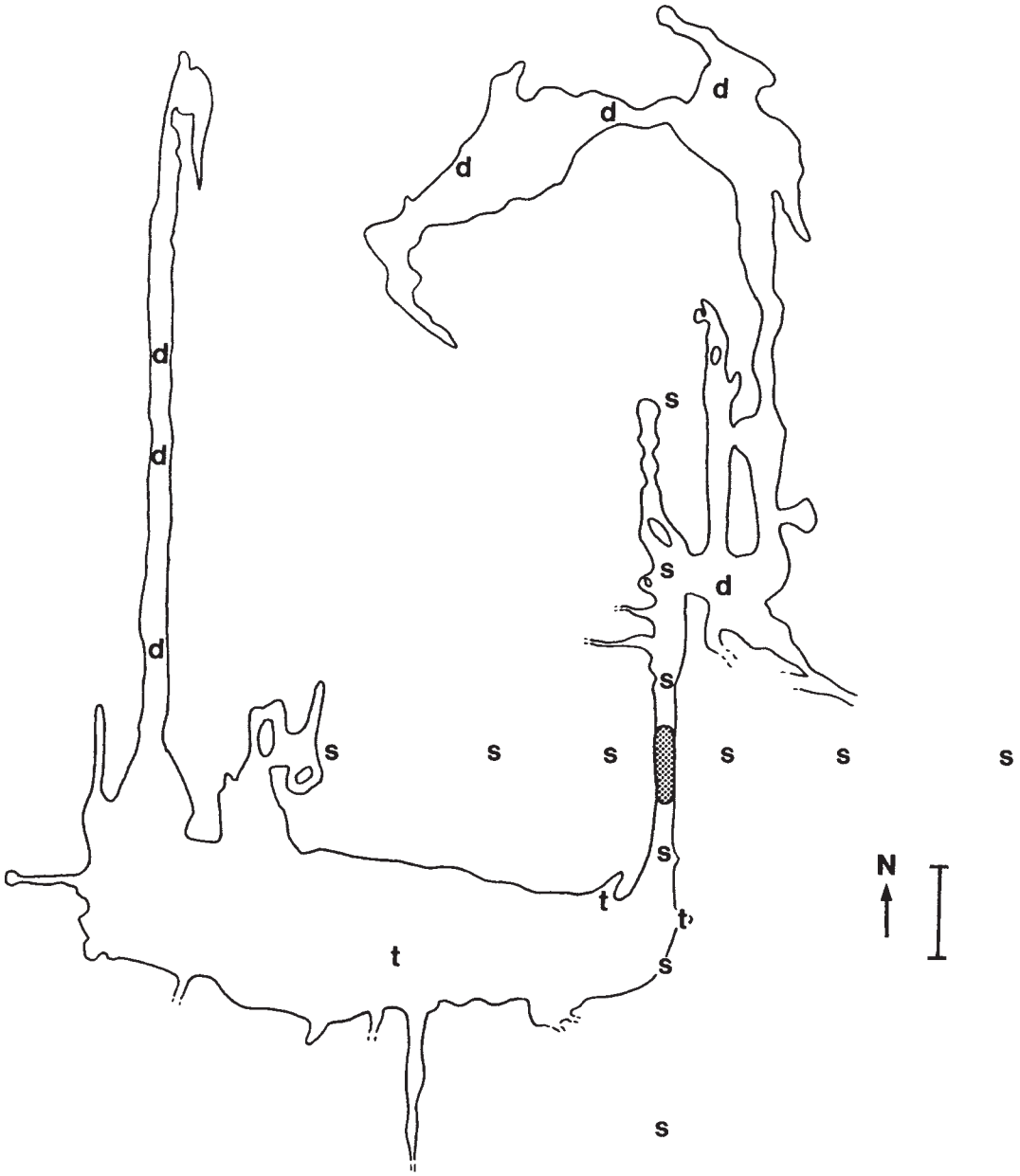


FIG. 5.—Schematic drawing of Hidden Cave showing the locations of pitfall traps. The 20 m deep pit entrance is indicated by stippling. Single surface traps = s. Trap sites within the cave are indicated for each series of three traps: d = dark zone traps. t = twilight zone traps. Traced from an unpublished map by Evatt, Skinner, and Davis; scale bar = 15 m.

surface is more arid. The area immediately surrounding the entrance is a mesic-xeric conifer/oak woodland. Hidden Cave is entered by a rappel of about 20 m down a fissure-type pit. The walking passage is about 600 m long, and contains active formations and pools. Some smaller passages are located to the sides of the central passage (Fig. 5). The floor is relatively flat. In addition to larger pieces of wood, smaller bits of wood, leaves, and other organic matter which have been carried in by externally originating water flow, are incorporated into the silty mud floor. Many areas showed evidence of small intermittent stream-type water flow which probably is active only during periods of heavy rainfall or rapid snow melt. Precipitation runoff is responsible for deposition of organic surface debris inside the cave. Peak rainfall (recorded at Pine Springs, Guadalupe Mountains; U.S. Dept. of Commerce, 1992) occurred during January (7.49 cm), May (10.11 cm), July (6.27 cm), and August (9.55 cm). The other months had 2.5 cm or less of rainfall. Air temperature and relative humidity are essentially constant inside the cavern away from the entrance, ranging from 11 °C and 86% R. H. in winter to 12 °C and 95% R. H. in the summer of 1992.

Data collection.—Pitfall traps were placed in Hidden Cave for a 24-hour period (starting about mid-day) during February (winter) and August (summer) of 1992. Traps consisted of 16-oz. Solo® plastic cups having a smaller, bottomless, plastic cup placed within and toward the lip of the larger cup so that organisms entering the cup would have difficulty escaping through the inverted funnel. Three traps were buried to their rims about 1.5 m apart at 10 different sites in the cave, totaling 30 traps per season (Fig. 5). Each trap was baited with either canned-tuna (> 50% protein), grape jelly (> 50% carbohydrate), or rancid beef liver (one-week storage in a sealed bag at room temperature). The type of bait placed in each trap was random by season, but each of the three baits was used at each site (i.e., the same type of bait was not always placed in the middle trap, Tables 1, 2) and the sequence of baits was followed in both seasons. Baits were placed on the bottom of the cup. In addition to placement of the pitfall traps in the cave, twelve traps [four sets (north, south, east, west) of three traps] were planted on the surface immediately adjacent to the cave entrance. The same three baits were used in the surface pitfall traps.

Although some hexapods undoubtedly wandered into the traps (as evidenced by many other studies in which empty pitfalls were used), others were possibly repelled by the presence of the plastic cup. These are problems inherent in this type of research and, although not

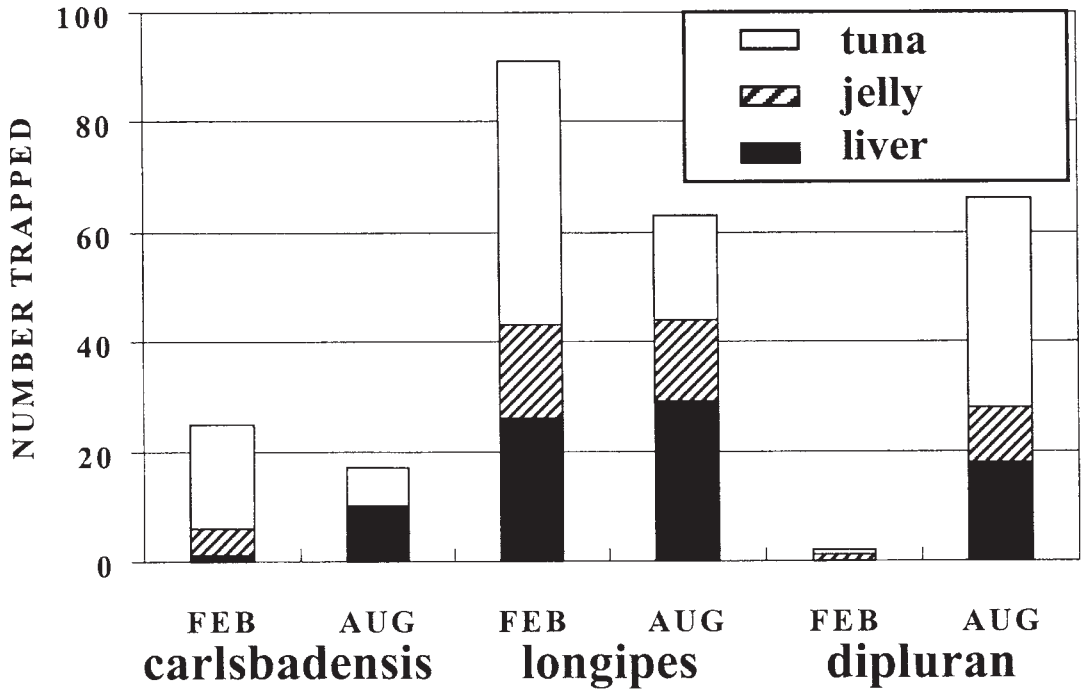


FIG. 6.—Numbers of camel crickets and diplurans collected in Hidden Cave during winter (February) and summer (August). Pitfall traps were baited with rancid beef liver, tuna fish, or grape jelly.

controllable, the random placement of baits at each site should have precluded any one type of trap receiving more wanderers or avoiders. All traps had an equal chance of being a repellent or attractant of wandering hexapods. While the pitfall trap method of sampling arthropod populations has been criticized (Southwood, 1978), numerous entomologists and arachnologists have considered them valid and comparable to other methods (Muma, 1975; Marsh, 1984; Morrill, Lester & Wrona, 1990; and citations therein).

Cave luminosity and region were noted for all trap sites. Luminosity was defined as "twilight" for sites from which any light could be seen, and "dark" otherwise. Areas in the back of the twilight zone were quite dark, but upon looking in the direction of the entrance, some light could be seen. No traps were located in the entrance zone where they would receive direct sunlight. Cave region was defined as "northern" or "southern," based upon entrance and main room placement (Fig. 5). The northeastern section of the cave is locally referred to as the "upper" level and the southwestern section as the "lower" level. This notion of upper and lower is based upon the entrance location and not the elevation of the main floors. We will refer to the "upper" and "lower" regions as "northern" and "southern," respectively. The entrance to the northern region is located at the top of the breakdown pile which was created when the roof collapsed. This entrance, from which the northeastern section of the cave slopes downward, is approximately 12 m below the surface. The main floors and back ends of both cave sections are probably at the same elevation, about 20 m below the surface.

The hexapods that could be identified, were counted and if still alive they (mostly larger crickets) were released in the cave. The sampling periods and number of traps were limited because of the possible detrimental effects to the delicate ecosystem (Crawford & Senger, 1988). Voucher specimens are deposited at the Texas Memorial Museum, The University of Texas at Austin, and the Arthropod Museum, New Mexico State University, Las Cruces.

Although Northup & Crawford (1992) stated that "subjuvenile" and "juvenile" camel crickets could not be identified reliably, we found all but the very smallest crickets in Hidden Cave could be identified based on differences in both their coloration and the length of the third leg femora. The lightly-colored *C. longipes* have much thinner and longer legs than do *C.*

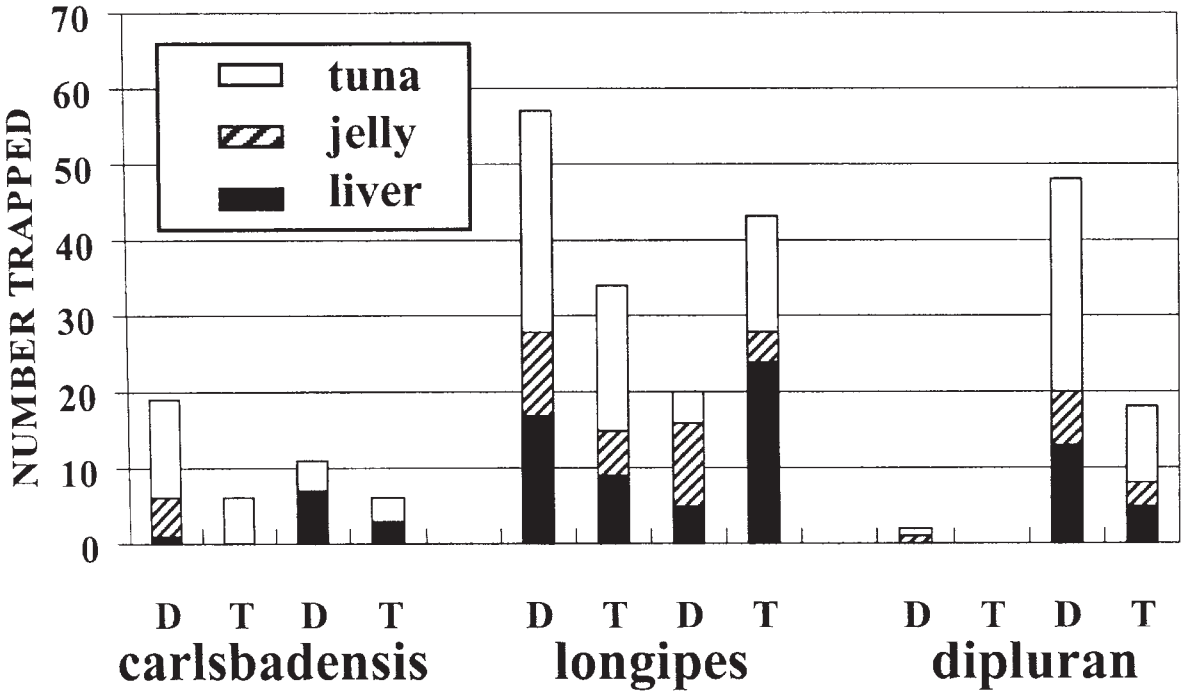


FIG. 7.—Numbers of camel crickets and diplurans collected in Hidden Cave in dark (D) and twilight (T) zones during winter (February- first set of bars) and summer (August- second set of bars). Pitfall traps were baited with rancid beef liver, tuna fish, or grape jelly.

carlsbadensis (Figs. 1, 2). The latter cricket species starts to show brown pigmentation in the second instar (unpubl. data). It is possible that some of the juveniles we identified could have been *C. conicaudus*. Barr & Reddell (1967) reported *C. conicaudus* from Hidden Cave, and the two females we obtained from the surface probably were this species. During a one-year faunal survey (collections during each season), we did not collect adult *C. conicaudus* within the cave. Furthermore, we collected *C. longipes* adults throughout the cave, including the entrance zone, which is generally occupied by *C. conicaudus* in other caves.

Analysis.—A bait was "preferred" when it was selected more often than availability would have suggested. The term "preference," in the relative sense (Aebischer, Robertson & Kenward, 1993), was used because baits were presented to organisms in equal amounts (about one teaspoon) in all traps. "Neutral preference" occurred when a bait was selected in proportion to availability. "Least preferred" baits were selected less often than availability would have predicted, and "avoidance" occurred when no bait selection was made. Associations between bait selection and site (environmental) variables were evaluated using Chi-square tests of independence (Conover, 1980). Analyses of association among hexapod species were tested using a sign test (Conover, 1980). Independence analyses were conducted hierarchically for effects of season, cave luminosity, and cave region. If preference was associated with a particular variable (e.g., luminosity), subsequent tests were performed within each level of that variable (e.g., twilight and dark). Otherwise, preference was reported at the next higher level of the testing sequence (e.g., season). Chi-square goodness-of-fit tests were used to test equal bait selection within a given level of analysis. Bonferroni Z-tests were used to determine preference type when goodness-of-fit tests were significant. Seasonal effects on abundance and life stages were tested using Chi-square tests of independence. We define the failure of the null hypothesis and therefore differences as significant at the $P < 0.10$ probability level. Bonferroni tests were evaluated at the adjusted probability level ($\alpha/2k$), where α = the 0.10 probability level chosen, and k = the number of simultaneous comparisons being made (Neu, Byers & Peek, 1974).

RESULTS AND DISCUSSION

Surface pitfall traps.—Surface collections revealed no invertebrates that were also in the cave pitfall traps except for a few flies (Drosophilidae and Phoridae) and possibly a camel cricket. A single subadult female cricket was collected on the surface that appeared to be *C. longipes*. Because it was immature, it could not be determined for certain if it was that species or one of the other species known only from the surface. We also collected two females of a third *Ceuthophilus* species (probably *C. conicaudus*) in the surface traps. Two other camel crickets are recorded from the surface near Hidden Cave by Hubbell (1936), but were not found during this study. We collected one additional camel cricket (*C. nodulosus* Brunner) from the surface above Hidden Cave, but it was located under rocks and not captured in pitfall traps.

Cave pitfall traps.—Pitfall trap data are listed by season in Tables 1 and 2. Chi-square tests indicated no significant shifts in numbers of either life-stage within each cricket species, or of the two species between winter and summer seasons ($P > 0.10$). Although Chi-square tests were not appropriate for testing abundance shifts for the dipluran, an obvious shift in abundance was observed between winter ($n = 2$) and summer (66).

Preference by season.—Bait preferences of *C. carlsbadensis* shifted between winter and summer ($P < 0.001$), and selection differed during both winter ($P < 0.001$) and summer ($P < 0.01$). *C. carlsbadensis* preferred liver, selected jelly neutrally, and preferred tuna least during winter (Fig. 6). However, tuna was highly preferred, liver was neutrally preferred, and jelly was completely avoided during summer. Rancid liver and tuna odors probably are more similar to natural cave carrion odors than that of jelly, explaining the nature of their winter and summer preferences. Neutral jelly selection in winter when there was none during summer may have been the result of higher carbohydrate demand by *C. carlsbadensis* (an occasional surface dweller) during winter.

Preference shifts also occurred for *C. longipes* ($P = 0.02$). Selection among baits differed during both winter ($P < 0.001$) and summer ($P = 0.09$). *C. longipes* showed a marked preference for rancid liver during winter. While the number of *C. longipes* selecting tuna and jelly remained roughly constant between seasons, over twice as many of these crickets selected liver during winter than during summer. Thus, its preference was high for liver, neutral for tuna, and least for jelly during winter (Fig. 6). *C. longipes* selected all three baits in proportion to availability during summer, and even though a goodness-of-fit test indicted differences, the Bonferroni-test power was not sufficient to detect a selection difference. Liver selection by more crickets during winter was the major factor explaining preference shifts between seasons. Perhaps larger naturally occurring carrion was more scarce during winter than in summer. During summer, several dead *Peromyscus* mice were observed near the base of the

Table 1.—Pitfall collections of crickets (*Ceuthophilus carlsbadensis* and *C. longipes*) and diplurans (Genus and species new) in Hidden Cave during 24 hours of winter (February 1992). Areas of the cave are listed in order of distance from cave entrance (nearest to farthest south and farthest north).

Site #/area	Luminosity	Bait	*C. carlsbadensis*			*C. longipes*			Diplurans
			Total	Adult	Juvenile	Total	Adult	Juvenile	
1 south	twilight	liver	3	3	0	13	1	12	0
1 south	twilight	jelly	0	0	0	5	1	4	0
1 south	twilight	tuna	0	0	0	4	0	4	0
2 south	twilight	tuna	0	0	0	3	0	3	0
2 south	twilight	liver	2	2	0	3	1	2	0
2 south	twilight	jelly	0	0	0	1	0	1	0
3 south	twilight	liver	1	0	1	3	1	2	0
3 south	twilight	jelly	0	0	0	0	0	0	0
3 south	twilight	tuna	0	0	0	2	0	2	0
4 south	dark	liver	0	0	0	7	1	6	0
4 south	dark	tuna	0	0	0	0	0	0	0
4 south	dark	jelly	0	0	0	3	0	3	0
5 south	dark	liver	0	0	0	3	1	2	0
5 south	dark	jelly	0	0	0	3	0	3	1
5 south	dark	tuna	0	0	0	2	2	0	0
6 south	dark	jelly	0	0	0	2	1	1	0
6 south	dark	tuna	0	0	0	0	0	0	0
6 south	dark	liver	0	0	0	0	0	0	0
7 north	dark	jelly	1	1	0	1	0	1	0
7 north	dark	tuna	0	0	0	4	0	4	0
7 north	dark	liver	0	0	0	7	0	7	0
8 north	dark	jelly	0	0	0	2	0	2	0
8 north	dark	tuna	0	0	0	4	0	4	0
8 north	dark	liver	4	0	4	1	0	1	0
9 north	dark	tuna	1	0	1	1	0	1	0
9 north	dark	jelly	2	0	2	0	0	0	0
9 north	dark	liver	3	0	3	5	0	5	0
10 north	dark	tuna	0	0	0	6	0	6	0
10 north	dark	liver	6	1	5	6	0	6	1
10 north	dark	jelly	2	0	2	0	0	0	0
Total			25	7	18	91	9	82	2

entrance pit, presumably having died when falling into the deep entrance. The few bats in the cave were observed only during winter. If carrion were scarce in winter, then trap baits would have been in higher demand during winter, thus compounding the effect of rancid liver odor as a strong attractant. Smaller carrion was not observed in the cave during our visits, except for dead flies which were stuck to wet walls and the ceiling of the cave. The flies had been killed by pathogenic fungi and possibly were not sought as food by the cave inhabitants. As with *C. carlsbadensis*, jelly was selected less by *C. longipes* than other baits during at least one season.

Independence tests of dipluran selection were limited by sample size. However, season was considered a major factor affecting dipluran prevalence because only two were captured during winter, compared to 66 during summer. Little is known about the biology of diplurans in southeastern New Mexico. This species was found in the cave during the winter; numerous adult sized animals were under rocks and larger organic debris. Possible explanations for the shift in capture rates may be because this species becomes torpid or restricts its food sources to items which were not offered in our traps during winter. Because only two individuals were collected during winter, it is possible that they simply

Table 2.—Pitfall collections of crickets (*Ceuthophilus carlsbadensis* and *C. longipes*) and diplurans (Genus and species new) in Hidden Cave during 24 hours of summer (August 1992). Areas of the cave are listed in order of distance from cave entrance (nearest to farthest south and farthest north).

Site #/area	Luminosity	Bait	*C. carlsbadensis*			*C. longipes*			Diplurans
			Total	Adult	Juvenile	Total	Adult	Juvenile	
1 south	twilight	liver	3	3	0	12	1	11	0
1 south	twilight	jelly	0	0	0	3	0	3	0
1 south	twilight	tuna	0	0	0	0	0	0	0
2 south	twilight	tuna	0	0	0	24	2	22	2
2 south	twilight	liver	3	1	2	0	0	0	1
2 south	twilight	jelly	0	0	0	0	0	0	0
3 south	twilight	liver	0	0	0	3	2	1	9
3 south	twilight	jelly	0	0	0	1	0	1	3
3 south	twilight	tuna	3	1	2	0	0	0	3
4 south	dark	liver	3	1	2	0	0	0	4
4 south	dark	tuna	0	0	0	1	0	1	3
4 south	dark	jelly	0	0	0	0	0	0	0
5 south	dark	liver	0	0	0	0	0	0	1
5 south	dark	jelly	0	0	0	0	0	0	0
5 south	dark	tuna	1	0	1	0	0	0	2
6 south	dark	jelly	0	0	0	4	1	3	0
6 south	dark	tuna	0	0	0	0	0	0	0
6 south	dark	liver	0	0	0	0	0	0	0
7 north	dark	jelly	0	0	0	4	2	2	6
7 north	dark	tuna	2	0	2	1	1	0	7
7 north	dark	liver	1	0	1	0	0	0	15
8 north	dark	jelly	0	0	0	2	0	2	0
8 north	dark	tuna	0	0	0	1	1	0	0
8 north	dark	liver	0	0	0	0	0	0	4
9 north	dark	tuna	2	2	0	1	0	1	1
9 north	dark	jelly	0	0	0	1	0	1	0
9 north	dark	liver	0	0	0	1	0	1	1
10 north	dark	tuna	2	0	2	1	1	0	0
10 north	dark	liver	0	0	0	3	0	3	3
10 north	dark	jelly	0	0	0	0	0	0	1
Total			20	8	12	63	11	52	66

fell into the traps and were not attracted to or repelled by the baits. Dipluran preferences for the baits differed during summer ($P < 0.001$). Like *C. longipes*, diplurans preferred rancid liver, selected tuna in proportion to availability, and preferred jelly least.

Preference and cave luminosity.—Only captures of *C. longipes* and diplurans were sufficient for further independence tests. *C. longipes* bait preference was not dependent on luminosity during winter ($P = 0.90$); when liver was preferred, tuna neutrally selected, and jelly least selected. Bait selection was dependent upon cave luminosity during summer ($P < 0.001$). No bait preference was observed in dark sites during summer, while in twilight sites, tuna was preferred, rancid liver was neutrally preferred, and jelly was least preferred ($P < 0.001$). This result clarified ambivalent results of preference tests for summer in which differential selectivity was detected by goodness-of-fit, but not by subsequent Bonferroni tests. Apparently, the lack of preference in dark sites was sufficient to mask selection differences in twilight sites in the higher level test.

C. longipes preference for tuna and neutral selection for liver during summer paralleled the bait selection of the more predatory *C. carlsbadensis*. However, *C. longipes* either selected baits at sites where *C. carlsbadensis* was not captured, or where they greatly out-numbered the larger cricket, or they were absent (not captured) at sites where *C. carlsbadensis* was

observed ($P < 0.001$). *C. carlsbadensis*, by their aggressive and predatory nature, are dominant over *C. longipes*. As such, *C. longipes* can and do serve as prey in situations where both species coexist (Northup & Kuper, 1987; pers. obs.).

In winter, *C. longipes* showed the same bait selection pattern of either not selecting baits or sites where *C. carlsbadensis* were observed, outnumbering the larger cricket where both species occurred, or using sites where no *C. carlsbadensis* were captured ($P < 0.10$). In twilight sites, *C. longipes* were always either observed in greater numbers or completely absent (not captured) where *C. carlsbadensis* was attracted to baits. In dark sites, *C. longipes* marginally tended to be either captured in greater numbers or completely absent (not captured) in locations where *C. carlsbadensis* selected baits ($P < 0.14$). In situations where both crickets were captured in the same traps, most (one case involved only one adult) *C. carlsbadensis* present were in juvenile life stages (five of eight cases in summer and two of four cases in winter). Bait and site selection patterns by *C. longipes* suggest that they may have shifted their bait selection or habitat use to decrease encounters with the more predatory *C. carlsbadensis*. That the response was stronger in twilight locations, in which *C. longipes* may have been more detectable by predators, than in dark locations may indicate a risk trade-off associated with bait selection.

Diplurans were generally absent from baited traps in the cave during winter (Fig. 6). However, more diplurans were observed in the cave (but not captured in the traps) during winter than capture rates would indicate (pers. obs.). Only test results for summer are presented. They preferred liver, neutrally preferred tuna, and preferred jelly least in both dark and twilight locations during summer ($P < 0.001$). Diplurans showed no preference shift associated with cave luminosity ($P = 0.32$). Like *C. longipes*, bait selection or habitat use may have been in response to presence or absence of predatory crickets. In the case of diplurans, both camel crickets in this study could have functioned as predators. In the two cases of capture in winter (both in dark sites, Fig. 7), diplurans were either associated with juvenile crickets, or avoided sites or baits selected by crickets. Numerous diplurans observed in the cave during winter tends to support the latter explanation. No diplurans were captured in twilight locations in winter. In summer, at 17 of 18 dark sites where diplurans or *C. carlsbadensis* (or both) were present, diplurans outnumbered the crickets, occurred with juvenile *C. carlsbadensis*, or entirely avoided sites selected by *C. carlsbadensis* ($P < 0.0001$). The same pattern occurred during summer six of six times in twilight sites. Diplurans outnumbered *C. carlsbadensis* in seven of eight co-existence situations (five of six in dark sites ($P < 0.02$) and two of two in twilight sites) ($P < 0.004$).

Preference and cave region.—Cave regions are discussed according to the hierarchical nature of our data analysis and, therefore, were not completely independent of luminosity. Independence tests of *C. longipes* bait preference indicated association with light intensity only during summer. Further tests were unnecessary for both *C. carlsbadensis* and diplurans in both seasons, based upon previous independence tests. There were no traps in the northern cave region from which twilight could be seen, therefore the only combinations possible for comparison were southern region*twilight, southern region*dark, and northern region*dark. Captures of *C. longipes* were insufficient to test for independence between preference and region within each season* luminosity combination. However, captures were sufficient to test for bait preference in each of the three region*luminosity combinations described above, with subsequent, non-statistical comparisons made among the three combinations.

Equal numbers of *C. longipes* occupied nine traps in twilight and 21 traps in dark zones in the cave. However, capture rates in twilight sites (4.8 crickets/trap) were double those in dark sites (2.0 crickets/trap). In addition, all 43 *C. longipes* captured at twilight sites were in the southern cave region, as no twilight sites in the northern region were sampled. Most (38 of 43) *C. longipes* captured at dark sites were in the northern cave region. This cricket, as well as other cave hexapods, probably were present in northern, twilight sites, but such sites were not included in our sampling scheme. *C. longipes* showed apparent selection differences in all three light*region combinations. In twilight southern sites, tuna was preferred, liver was neutrally preferred, and jelly was least preferred ($P < 0.001$), while at dark southern sites, jelly was preferred, tuna neutrally preferred, and liver least preferred ($P < 0.10$). No bait preferences were exhibited in dark northern sites ($P > 0.10$). Sample size for dark southern site preference tests was extremely small (5). Nevertheless, *C. longipes* selection of jelly in southern, dark sites where *C. carlsbadensis* selected both tuna and liver, but not jelly, also supported the idea that *C. longipes* in Hidden Cave may have avoided baits selected by, or selected baits avoided by *C. carlsbadensis*.

In summary, season can play a major role not only in abundance of cave hexapods, but also in their preference among bait items. All three cave hexapods exhibited a high preference for rancid liver, possibly because its strong odor resembled that of larger natural carrion. Rancid liver and tuna odors probably were more similar to natural cave carrion odors than that of jelly. Levy (1981) reported that the cave cricket (*Hadenoecus*

subterraneus Scudder) from the eastern U.S. preferences were most strongly correlated with odor intensity and caloric content, especially the latter. Crickets in that pitfall trap study selected baits high in calories and therefore maximized energy gain per unit time. According to Northup & Crawford (1992), both crickets probably oviposit year-round. If this is the case in Hidden Cave, seasonal shifts in bait preference could not be explained by differing dietary needs in response to reproduction. Why tuna was least preferred by *C. carlsbadensis* in winter and most preferred in summer is not clear. Neutral tuna preference in winter, outnumbering of, avoidance of, or selection of sites avoided by *C. carlsbadensis* by both *C. longipes* and diplurans (including avoidance and outnumbering of *C. longipes* by diplurans) all supported the notion of anti-predator responses by these subdominant hexapods. Seasonal forage abundance (for all three hexapods) and predator avoidance strategies (of *C. longipes* and diplurans) appeared to be important factors for determining foraging preferences, habitat selection, or distribution patterns, or any combination thereof, of the cave hexapods in this study.

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REPRODUCTIVE BEHAVIOR OF *CEUTHOPHILUS CARLSBADENSIS*, A CAVE INHABITING CAMEL CRICKET

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Studies on the breeding habits of members of camel crickets of the genus *Ceuthophilus* Scudder are limited to those reported by Turner (1915) and Eades (1964). As part of studies on the cave faunas of two regions in southeastern New Mexico (Cokendolpher & Polyak, 1996; in prep.), populations of *Ceuthophilus carlsbadensis* Caudell were maintained for closer observation. These crickets were found to be hardy and easily transported and maintained in culture if ample room was supplied. Single generations were reared from samples collected in several gypsum caves and from a population in a limestone cave in Eddy County, New Mexico.

Specimens (up to six adult pairs) were maintained in 10 gallon glass terraria. The substrate consisted of 3-5 cm of sandy-clay soil, to which limestone and gypsum rocks (varying sizes up to about 20 cm in length and 15 cm tall) were stacked approximately half to three-quarters to the top of the terrarium. The soil was kept moist and the lowest levels of the soil were wet. Humidity was maintained near 100% R.H. by sealing the top with plastic food wrap.

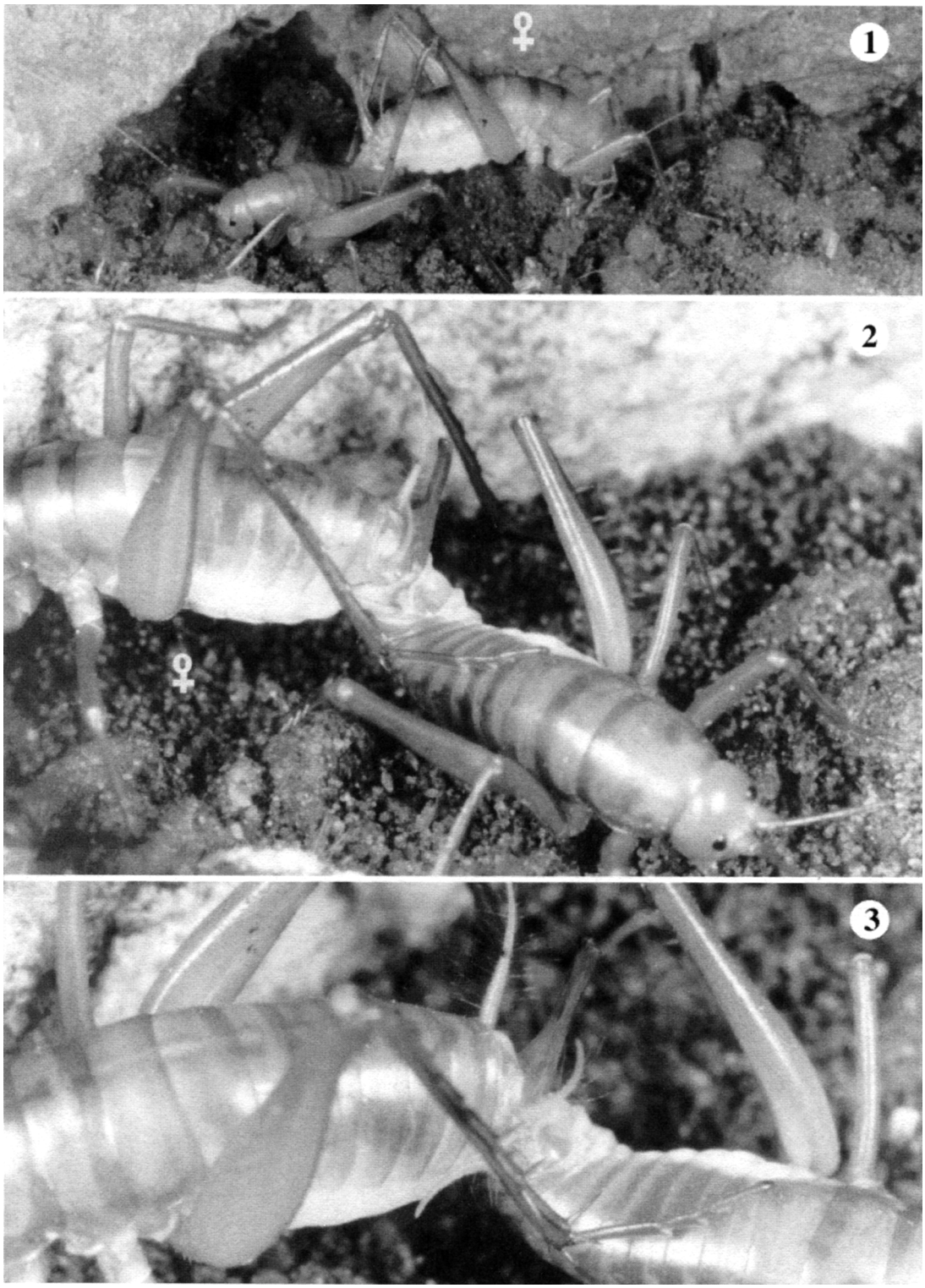
The terraria were placed in a room with varied temperatures (up to 20° F change in a single day) depending on time of day and season (seasonal range about 50-90° F) and received dim indirect light.

Lamb & Willey (1987) reported on the captive maintenance of cave crickets of the genera *Euhadenoecus* Hubbell and *Hadenoecus* Scudder. Apparently species of these genera are harder to maintain in captivity than the present species. Because temperature does not seem to be that important in maintaining camel crickets, the use of a Styrofoam chest seems unnecessary. The use of glass terraria also affords a much better observation chamber through which close-up photographs can be taken (Figs. 1-3). Sulfa drugs (as recommended by Lamb & Willey) were not needed as no gregarine parasites were observed in any of the three species of *Ceuthophilus* I collected in caves of Eddy County, New Mexico.

Food was always present to reduce fighting and cannibalism. Dried oatmeal flakes were the main item, with additions of dead or injured insects and arachnids. Occasionally fruit or bread was also added. Fungi were always present on uneaten food and may also have served as a resource.

Crickets placed in terraria started mating during the early fall and generally died by late winter or spring. My observations in caves of Eddy County revealed that some adult crickets are present during all seasons of the year, but were most numerous during the same periods observed in captive populations. Likewise, Northup & Crawford's (1992) census of crickets in Carlsbad Caverns, Eddy County, revealed year-round adult populations with the peak numbers of adult *C. carlsbadensis* during December and January.

Mating starts within days of reaching sexual maturity and continues until the animals are too badly damaged from battles and old age. Oviposition was observed within a few days of mating. This behavior continued at frequent intervals until the females died. Oviposition was always in the soil and not in rock cracks or crevices. The eggs were placed in the soil and were not left exposed to predators. Northup & Kuper (1987) reported



Figs. 1-3.—Copulation during March in two captive pairs of *Ceuthophilus carlsbadensis*. The female is on the right side in Fig. 1, left in Figs. 2, 3.

that *C. carlsbadensis* mated only during late November and apparently oviposited naturally in fine grained sand in Carlsbad Caverns. Northup & Crawford (1992) examined eggs within the female's body and determined that they were essentially present year-round, suggesting that the reproductive period showed no seasonality. Regardless of when the eggs were laid in the terraria, no juveniles were observed until 10 days after the last adults died. It is uncertain if the eggs diapaused or if newly emerging nymphs were cannibalized before I detected them. I suspect the latter because this species readily captured and ate other smaller camel crickets (*Ceuthophilus longipes* Caudell and *C. conicadus* Hubbell) as well as other epigean insects. Northup & Kuper (1987) also observed *C. carlsbadensis* eating other camel crickets in the wild.

I did not observe preliminaries to mating. All observations were incidental to maintaining the animals in culture for other purposes. Fortunately, couples in copula would remain motionless for extended periods of time so that I was able to prepare the camera and make several photographs (Figs. 1-3). Northup & Kuper (1987) reported that copulations would last approximately five minutes. As can be seen from the photographs the male and female face away from each other. The female holds the ovipositor up, almost 90° to the axis of the body, and the cerci are held up and slightly out from the tip of the abdomen. The setae on the cerci of both sexes are held erect (Fig. 3). Females were observed several times to place the hind leg tarsi of one leg over the abdomen or base of the hind femur of the male. The posterior end of the male's abdomen is rotated at about 180° with the cerci being held against the female's abdomen (Fig. 3). The rotation of the male's abdomen was photographed (in different individuals) in both a right (Fig. 1) and left handed twist (Figs. 2, 3). In none of the photographs is it clear what the male does with the epiphallus. It appears that they may be partially retracted into the male (Figs. 2, 3).

The observed mating behavior of *C. carlsbadensis* matches that reported for *C. latens* Scudder (Turner, 1915) in position of the bodies, cerci, ovipositor, and abdominal twisting. Eades (1964) also noted the lack of superposition of bodies and the twisting of the male abdomen during mating of *C. guttulosus* Walker. Although not noted, the illustration (Fig. 3) provided by Turner clearly shows the female with the tarsi of one leg holding down a hind femur of the male.

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A NEW SPECIES OF TROGLOBITIC *RHADINE* (COLEOPTERA: CARABIDAE) FROM TEXAS

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ABSTRACT

A new robust species of the *subterranea* group of the ground beetle genus *Rhadine* LeConte is described. *Rhadine reyesi*, new species, is known from eight caves on Fort Hood, Bell and Coryell Counties, Texas. The new species is thought to be most closely related to *Rhadine persephone* Barr from Travis and Williamson Counties, Texas. The genitalia of both species are illustrated and the possible value of the ovipositor as a taxonomic character is discussed. The first phoretic mite recorded from a troglobitic *Rhadine* has been identified as *Echinomegistus wheeleri* (Wasmann) (Mesostigmata: Paramegistidae).

INTRODUCTION

The *subterranea* group of the genus *Rhadine* as revised by Barr (1974) included 11 species, all troglobitic, from caves in Texas. Barr (1982) added two additional troglobitic species, both from caves in northern Mexico. With the addition of the species described herein, the total species in the *subterranea* group numbers 14. Extensive collecting from Texas caves has resulted in the discovery of numerous new populations of troglobitic *Rhadine*. Several of these new populations appear to be undescribed species. Further study will be required to decide on most of them. However, among the new populations is a distinctive new species endemic to caves on the Fort Hood Military Reservation in Bell and Coryell Counties. Because this material is part of an active series of studies it is desirable to describe this new species at this time.

Although a few studies were conducted in Fort Hood caves in 1963 and 1964 by David McKenzie and James Reddell, troglobitic *Rhadine* were not known there until 1992 when Marcelino Reyes discovered the first specimen in Tippit Cave. An intensive program of studies on Fort Hood caves from that time until the present has resulted in the collection of specimens of *Rhadine* from nine caves on Fort Hood. Study of this

material reveals no significant differences between the populations and all are assigned to the species described below.

Barr (1974) discussed the evolution and zoogeography of Texas troglobitic *Rhadine*. He concluded that the most significant barriers to dispersal were major streams and that isolation of populations occurred due to erosional mechanisms, creating isolated outcrops of limestone. The Edwards Limestone is the only cavernous geologic unit on Fort Hood. This formation crops out only on the tops of several elongate mesas and small hilltops. All of the caves known to contain *Rhadine* occur in northern Fort Hood on a single elongate outcrop. A minor gap occurs in the cavernous limestone between the eastern (Tippit Cave) and western areas (remaining caves) containing populations of *Rhadine*. This gap in the limestone appears to be too recent to have allowed speciation to occur between different populations of *Rhadine*.

Geographically, the closest known species of troglobitic *Rhadine* is *R. noctivaga* Barr in northern Williamson County. This species is separated from Fort Hood by about 30 miles of non-cavernous deposits. Furthermore, *R. noctivaga* is one of a series of slender species that are presumably older troglobites, whereas *R. reyesi* is a robust species and apparently has become isolated more recently in caves. Other species of terrestrial troglobite on Fort Hood, including spiders (*Cicurina*), millipede (*Speodesmus*), and pselaphid beetle (*Batrisodes*), are also apparently recent troglobites. The closest known species of robust troglobitic *Rhadine* is *R. persephone* from northern Travis and southern Williamson County. The new species and *R. persephone* differ from other *subterranea* group members by having a relatively wide, glabrous pronotum.

Rhadine reyesi, new species
(Figs. 1-9)

Type-data.—Texas: *Coryell County*: Fort Hood: Tippit Cave, 8 April 1999 (M. Reyes), holotype male (AMNH), 1 paratype male (TMM), 1 paratype female (AMNH); 8 April 1999 (L.J. Graves), 1 paratype male (TMM); 31 Jan. 1992 (J. Reddell, M. Reyes), 1 paratype male (TMM); 9 Feb. 1992 (J. Reddell, M. Reyes), 2 paratype males (TMM); 3 Nov. 1992 (J. Reddell, M. Reyes), 3 paratype males, 3 paratype females (TMM); 6 Nov. 1992 (J. Reddell, M. Reyes), 1 paratype female (TMM); 16 July 1993 (D. McKenzie, J. Reddell, M. Reyes), 1 paratype male, 1 paratype female (UTAM).

Other material examined (all TMM).—*Bell County*: Fort Hood: Big Red Cave, 5 May 1999 (R. Price), 1 male; 6 May 1999 (J. Reddell, M. Reyes), 3 females. Bumelia Well Cave, 28 Oct. 1994 (D. Allen, D. Love), 1 female. Fellers Cave (L.J. Graves, J. Reddell, M. Reyes), 1 teneral male (TMM). Figure 8 Cave, 3 Nov. 1998 (M. Reyes), 2 females. Lucky Rock Cave, 22 Feb. 1996 (D. Allen, L.J. Graves), 1 teneral male, 1 teneral female; 10 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 1 male. Sanford Pit Cave, 23 Oct. 1994 (M. Warton), 1 female. Streak Cave, 6 Oct. 1995 (M. Warton), 2 males; 26 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes), 2 females. Triple J Cave, Oct. 1994 (M. Warton), 2 males; 23 April 1998 (L.J. Graves, J. Reddell, M. Reyes), 2 females.

Etymology.—This species is named for Marcelino Reyes, who collected the first and many additional specimens of this species, in recognition of his many contributions to the cave biology of Fort Hood and other areas of Texas.

Diagnosis.—Form robust, integument subglabrous; pronotum about 0.6 as wide as long, without marginal setae; eye rudiment large (about 0.12 x 0.20 mm); distinguished from *R. persephone* by narrower pronotum (about 0.6) and wider neck (0.68 to 0.78 greatest width of head) and longer wrinkled area lateral to frontal grooves; from *R. koepkei* (Barr), *R. infernalis* (Barr & Lawrence), and *R. privata* Barr by absence of pronotal setae.

Description.—Length 8.28-9.94 mm (Table 1). Form moderately robust, convex (Figs. 1-3). Integument rufotestaceous, virtually glabrous, shining. Head 0.54-0.64 longer than wide, cervical constriction weak; neck 0.67-0.78 narrower than greatest head width; labrum conspicuously emarginate; frontal grooves broad, shallow, extending to distal third of eye; frontal and antennal ridges short, weak, associated wrinkles reaching posterior supraorbital puncture; eye rudiment large, about 0.12 by 0.20 mm, ovate, individual ommatidia rudiments distinct. Pronotum about 0.6 longer than wide, narrowest at base, widest medially; anterior margin slightly narrower than median, about 0.7 as wide as widest part of pronotum; disc glabrous, shining, subconvex; lateral margin shallowly sinuate in basal quarter; anterior angles not produced; posterior angles rounded; marginal setae absent. Elytra about twice longer than wide, about 2.6 times length of pronotum; disc glabrous, shining, slightly carinate along suture, subconvex except narrow, shallow concavity adjacent to lateral margins; apical sinus as long as scutellum, apexes rounded; longitudinal striae weak, but distinct; one pair anteromedain setae present on second interval about one tenth posterior from anterior margin; one pair discal setae on third interval about 2/3 back from anterior margin; row of 17 to 19 umbilicate punctures, setae generally longer in third, ninth, and thirteenth positions. Palps sparsely pubescent, never

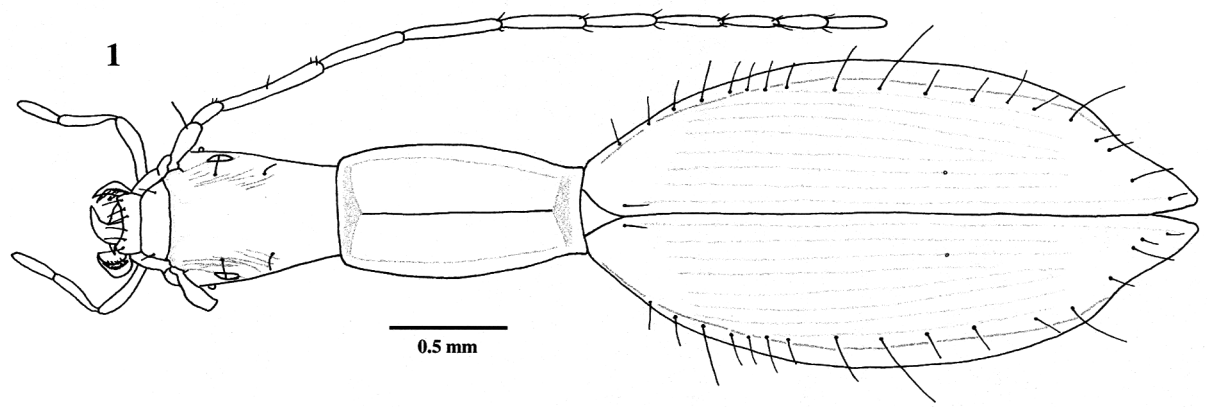
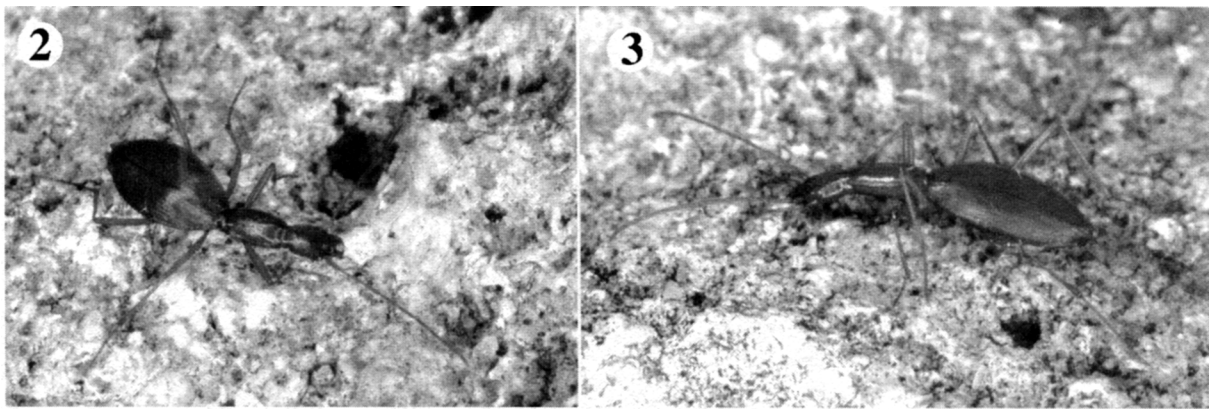


Fig. 1, Dorsal aspect of a male *Rhadine reyesi*, n. sp., from Tippit Cave.



Figs. 2-3. Female *Rhadine reyesi*, n. sp. from Figure 8 Cave: 2, dorsal aspect. 3, dorsolateral aspect.

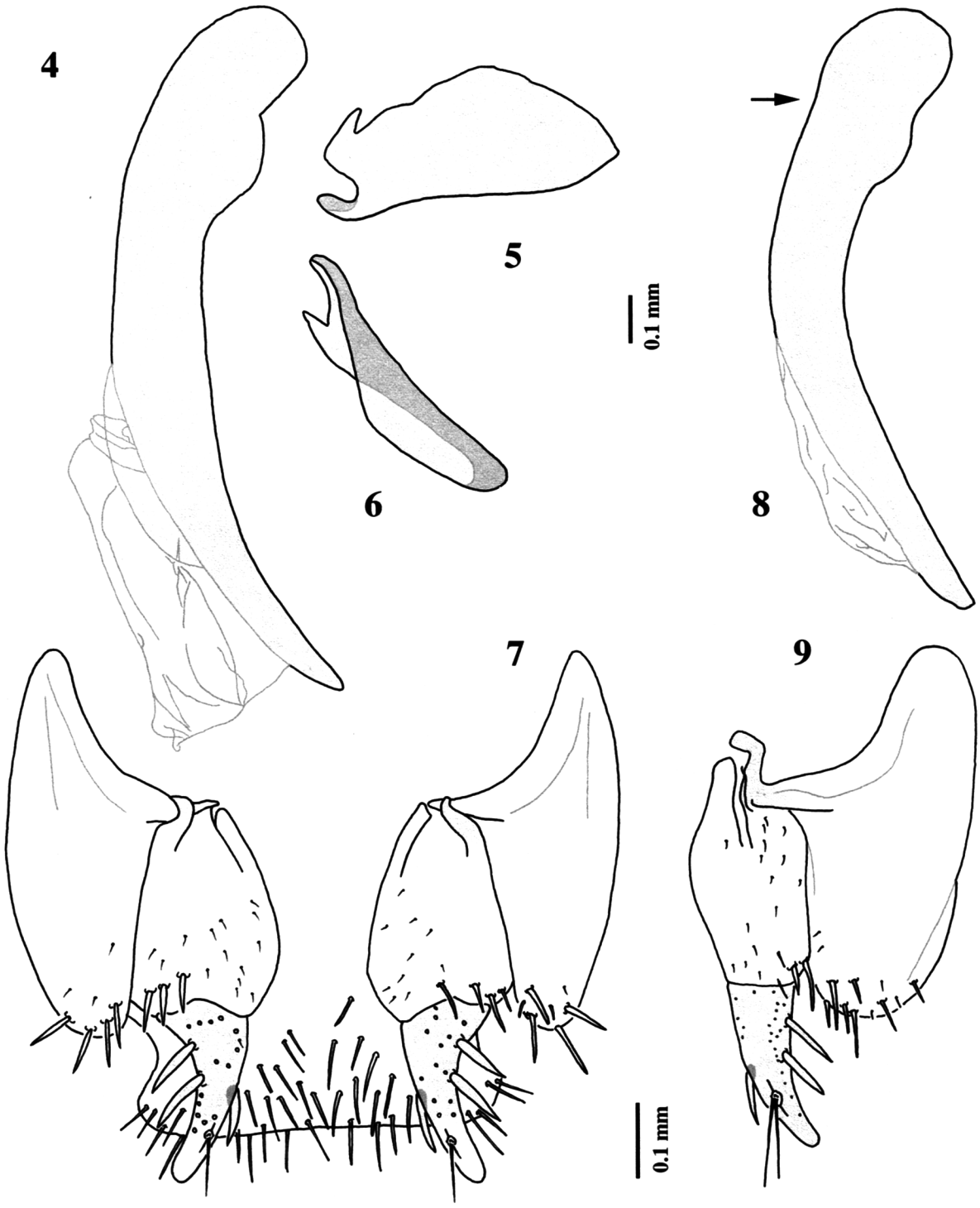
swollen; apexes pale, glabrous only at distal tip, not produced. Antenna about 0.7 total body length; segment III longest, about twice the length of I; segments I-III sparsely pubescent, others densely pubescent. See Table 1 for body proportion ratios.

Aedeagus long, flattened, blade-like, about 1.7 mm long (Fig. 4); parameres as illustrated (Figs. 5-6).

Each side (stylus) of ovipositor (Fig. 7) composed of three structures. Proceeding from apex to base, conspicuous sclerotized distal stylomere (1) (= gonocoxa, or apical valve) inserted at membranous (2) basal stylomere, which is subtended by longer (3) lateral segment. Lateral segment width subequal to basal stylomere width, bearing four large setae apically. Basal stylomere membranous, setose, widest subapically; bearing three conspicuous large (sometimes also single smaller) setae at distolateral angles. Distal stylomere sclerotized, punctate, dorsoventrally flattened, blade-like, acuminate with broad angulate base, rounded diaphanous tip; bearing three large flattened setae, two ventrolaterally, one dorsomesally; bearing one (rarely two) long subapical setae arising from short ventral sulcus; punctures evenly distributed, relatively large (0.7-1.6 times greatest diameter of long subapical seta).

Variation.—The genitalia of only a few species of *Rhadine* have thus far been illustrated. The aedeagi of 10 species were illustrated by Barr (1974, 1982). The aedeagi of most are similar to each other and to the new species illustrated herein. Barr (1974) showed a constriction on the right side (basal most region) of the aedeagus of *R. persephone*. We examined a male from a nearby locality to that illustrated by Barr and did not see this depression (position of constriction indicated by arrow in Fig. 8) so it probably is not of value as a taxonomic character. As noted by Barr, the lengths of the aedeagi vary but this seems to be positively correlated to the total body length. *Rhadine reyesi* has the longest aedeagus of the *subterranea* group, thus far reported, and has the longest overall body length.

Only a single ovipositor (stylus) of a member of the genus has thus far been illustrated, but Barr (1982) noted the following: "reduced setation of basal stylomere and



Figs. 4-9. Internal genitalia of *Rhadine*: 4-7 *R. reyesi*, n. sp. , from Tippit Cave; 8 *R. persephone* from Kretschmarr Double Pit, Travis County, Texas, 9 *R. persephone* from MWA Cave, Travis County, Texas. 4, ventral view of aedeagal median lobe with internal sac only partially everted; 5, ventral view of ventral paramere; 6, ventral view of dorsal paramere; 7, ventral view of ovipositor and associated dorsal plate; 8, ventral view of aedeagal median lobe with internal sac only partially everted (see text for discussion of arrow); 9, ventral view of left ovipositor stylus.

Table 1.--Measurements and ratios of specimens of *Rhadine reyesi* new species. Abbreviations are: Head length (HL), head width (HW), neck width (NW), pronotum width (PW), pronotum length (PL), elytra width (EW), elytra length (EL).

Cave	# specimens	Sex	Total length	HW/HL	NW/HW	PW/PL	EW/EL	HL/PL
Big Red	2	males	9.16-9.32	0.59-0.61	0.73-0.76	0.59-0.61	0.51-0.52	0.92-0.94
Big Red	2	females	8.82-9.44	0.59-0.61	0.70-0.73	0.58-0.59	0.52-0.54	0.91-0.92
Bumelia Well	1	female	9.24	0.61	0.73	0.59	0.51	0.90
Fellers	1	male	8.56	0.61	0.75	0.57	0.48	0.90
Figure 8	2	females	9.18-9.44	0.62-0.64	0.71-0.72	0.57-0.60	0.48-0.52	0.85-0.90
Lucky Rock	2	males	9.22-9.82	0.60-0.61	0.72-0.78	0.52-0.56	0.49-0.50	0.81-0.83
Lucky Rock	1	female	9.94	0.65	0.77	0.60	0.50	0.86
Sanford Pit	1	female	9.26	0.67	0.74	0.61	0.47	0.85
Streak	3	males	8.28-8.50	0.56-0.59	0.69-0.71	0.57-0.59	0.50	0.89-0.93
Streak	2	females	8.38-9.54	0.61	0.73-0.75	0.57-0.60	0.49-0.50	0.88
Tippit	11	males	8.62-9.36	0.55-0.62	0.67-0.78	0.57-0.61	0.48-0.51	0.88-1.01
Tippit	6	females	8.28-9.40	0.54-0.64	0.68-0.78	0.57-0.60	0.49-0.51	0.87-1.02
Triple J	2	males	8.88-9.80	0.61-0.64	0.74-0.75	0.58-0.58	0.47-0.50	0.86-0.91
Triple J	3	females	9.22-9.48	0.60-0.62	0.69-0.74	0.56-0.60	0.49-0.52	0.89-0.93

unusually long subapical seta (doubled in some species) are typical for genus; one inner and two outer spines present in *dissecta*, *perlevis*, and *subterranea* groups." The ovipositor illustrated (Fig. 7) of *R. reyesi* has a single terminal subapical seta. Of the four females examined from Tippit Cave, one had no seta and one had two on one side and a single on the other. The two other specimens had typical setation. We also examined several females of *R. persephone* and found a specimen from Kretschmarr Double Pit (20 April 1991, J. Reddell, M. Reyes, Travis County) that also lacked these setae. Female *R. persephone* from the following caves all had paired setae on both sides: M.W.A. Cave (4 Jan. 1995, M. Warton, Travis County, see Fig. 9), Gallifer Cave (20 April 1991, J. Reddell, M. Reyes, Travis County), Nelson Ranch Cave (9 May 1992, M. Warton, Williamson County), Lamm Cave (2 Dec. 1992, M. Warton, Travis County), Japygid Cave (3 Jan. 1995, M. Warton, Travis County). The setae are located in a pit which lies along a short fissure. The specimens lacking the setae appeared to lack the pit, but this is not certain because a slight twisting of the stylus could hide the pit in the fissure. All of the specimens examined differ from the drawing of *R. tenebrosa* Barr (Barr, 1982: fig. 45) in that our specimens had a pair of large setae on the ventral surface and a single large seta on the dorsolateral side of the terminal segment of the stylus. The female from M.W.A. Cave was aberrant in that it had three ventral flattened setae on one stylus and two on the other. Obviously, such variations in setal counts will cause problems when examining only one specimen but our overall counts indicate a single subapical seta is typical for *R. reyesi* and a pair of setae for *R. persephone*. When comparing the ovipositors of *R. reyesi* and *R. persephone* we did find several characters which appear to be significant. The basal most piece of the basal stylomere extends beyond the junction of the lateral segment in *R. persephone*. The distal portion of the basal stylomere is widest in *R. reyesi* and thinnest in *R. persephone*. Although the anterior end of the lateral segment of the ovipositor appears pointed in *R. reyesi* and rounded in *R. persephone* in our drawings, the other specimens vary in this character. It was also noted that when the stylomere was lying slightly angled on the microscope slide it would appear to be more pointed than it would in a more flattened view. The base of the distal stylomere is wide and sinuate in shape in *R. reyesi* and thinner and straight in *R. persephone*. This was consistent except for the female from Streak Cave which had the base only slightly sinuate but still wide. Although difficult to see, the pores on the ventral surface of the distal stylomere are minute and numerous on the edges of *R. persephone*. These pores are larger, less numerous, and more evenly distributed in *R. reyesi*. Precise measurements of these pores is difficult because examination must be made under oil immersion. Observation of a female of *R. reyesi* from Sanford Pit Cave revealed that there were 11/12 pores on the distal styli ventrally. These pores were 0.7 diameters of the subapical seta (measured at base) at the base of the basal stylomere and increased in diameter distally. Those at the middle were 1.4 diameters and those most distal were 1.6 diameters. The subapical setae were the same diameter on a *R. persephone* from Lamm Cave as in *R. reyesi* and could therefore be compared directly. On the Lamm Cave specimen there were 18/20 pores that were all approximately 0.7-0.8 diameters of the subapical setae. It appears that the ovipositor can be of

taxonomic significance at the species level in *Rhadine* and should be investigated in future studies on this genus.

Distribution.—Known only from caves on Fort Hood Military Reservation in northern Bell and southern Coryell Counties, Texas.

Comments.—*Rhadine reyesi* has been found only on red clay in total darkness. Tippit Cave once contained a colony of bats, but none have been observed in the cave since 1992. Large adult phoretic mites, *Echinomegistus wheeleri* (Wasmann) (Mesostigmata: Paramegistidae) have been taken from these beetles in Tippit Cave. As many as six have been taken from a single beetle and they are usually attached to the elytra or thorax, but one was covering an eye. This is the first record of a phoretic mite on troglobitic *Rhadine*. The species was described from the nest of the ant *Lasius apidicola* (Walsh) in Connecticut. The only other species in the genus is *E. narvaezi* Hyatt, described from a passalid beetle in Venezuela. Other troglobites associated with *Rhadine reyesi* include pselaphid beetles (*Batrisodes*), millipedes (*Speodesmus* and *Cambala*), and spiders (*Cicurina*).

A single male from Lucky Rock Cave was observed in captivity. It eagerly accepted and ate damaged but still alive and moving fruitflies. Presumably, in the caves these beetles are opportunistic and feed upon whatever they might find. Although this species has rudimentary eyes, it's foraging behavior was not noticeably altered by turning on and off a strong microscope light. Air movement did cause a change so observations were made in a sealed chamber. The beetle would walk in what appeared to be an aimless fashion in the container while constantly tapping the substrate with the pale distal tips of its palps.

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Types are deposited in the following institutions: AMNH (American Museum of Natural History, New York); TMM (Texas Memorial Museum, The University of Texas at Austin); UTAM (Texas A&M University, College Station). The remaining specimens are placed in the Texas Memorial Museum.

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A REVIEW OF THE ANT-LIKE LITTER BEETLES FOUND IN TEXAS CAVES (COLEOPTERA: STAPHYLINIDAE: PSELAPHINAE)

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ABSTRACT

Further work with the ant-like litter beetles from caves along the eastern margins of the Edwards Plateau in Texas has produced nineteen species. Four are undescribed troglobites in the genus *Batrisodes*: *B.* (*Babnormodes*) *feminiclypeus*, *B.* (*Babnormodes*) *gravesi*, B. (*Babnormodes*) *wartoni*, and *B.* (*Excavodes*) *cryptotexanus*. Another new species, *Bibloplectus comanche*, is found in leaf litter at cave entrances. Two species are newly recorded from cave entrances, and new records are added for eleven of the twelve species previously known from Texas caves. A single *Batrisodes* female from western Texas represents a new species, but is not described.

INTRODUCTION

The small caves at the eastern perimeter of the Edwards Plateau have recently been sampled intensively for their unique arthropod faunas. The group of interest here, the ant-like litter beetles (Staphylinidae, subfamily Pselaphinae), was initially known from two species described in the early 1960's (Park, 1960; Barr and Steeves, 1963), but a much richer fauna of twelve species was documented recently (Chandler 1992). Five of these species are members of the tribe Batrisini, and are obligate cave associates (*Batrisodes grubbsi* Chandler, *B. reyesi* Chandler, *B. texanus* Chandler, *B. venyivi* Chandler, and *Texamaurops reddelli* Barr and Steeves), judging from their reduced or absent eyes, long sensory setae on the head venter, and elongate legs and antennae. One species, *Batrisodes uncicornis* (Casey), is a troglophile, while the rest are found at cave entrances in leaf litter. Two species, *Batrisodes clypeonotus* (Brendel) and *Tmesiphorus costalis* LeConte, are known to be associated with ants (Chandler 1997), or are of uncertain ecological status. Three species of Pselaphinae are placed on the federal list of endangered species, *Texamaurops reddelli, Batrisodes texanus*, and *Batrisodes venyivi*. The first two are known only from isolated groups of caves between Austin and

Georgetown, while the third is limited to a few caves northwest of San Antonio.

Further sampling conducted during 1992 to 1999 has revealed seven additional species, and new records have accumulated for eleven of the twelve species covered in the earlier paper. Four of the new species represent undescribed species of *Batrisodes* that are troglobites, judging from their lack of eyes and occurrence in caves away from the entrances. An undescribed species of *Bibloplectus* was found in leaf litter at cave entrances. Two other litter-associated species, *Rhexius stephani* Chandler and *Sebaga ocampi* Park, were known from other states and have now been taken in leaf litter at cave entrances in Texas. A single female from the Caverns of Sonora in western Texas represents another undescribed species of *Batrisodes*, but is not described here because males are critical for identification and for placement of species in subgenera. The information presented here documents the appearance of more troglobitic species along the eastern margin of the Edwards Plateau, and summarizes new data on cave associations that have accumulated since 1991.

Pselaphids found in caves range from accidental, normally epigean species, to highly evolved troglobites. *Bibloplectus comanche*, *Trimioarcus musamator*, *Rhexius stephani*, *Sebaga ocampi*, and *Tmesiphorus costalis* are found in leaf litter in cave entrances or in litter washed deeper into the caves. This habitat is essentially epigean and the relationship of the beetles to caves is incidental. The ecological status of *Cylindrarctus bicornis* is uncertain, but it is probably also an accidental.

Hamotus electrae was considered by Chandler (1991) as probably accidental in caves. The species has, however, been found deep in caves and is likely a facultative troglophile. The status of *Batrisodes clypeonotus* is uncertain. It is a myrmecophile with reduced eyes and its occurrence in caves may be incidental. However, the presence of this species several hundred meters from the entrance of Powell's Cave, Menard County, indicates that it may be a facultative troglophile. *Batrisodes globosus* has been found both in the bottom of shallow sinkhole caves and on the underside of rocks in darkness, and it is likely a troglophile. It has been found in close association with the troglobitic *B. reyesi* in Snake Pit Sink.

The only unquestioned troglophilic species in the caves of Texas is *B. uncicornis*. The species has been found in caves from Williamson County south to Bexar County and west to Burnet and Llano Counties. It is extremely abundant in many caves, with specimens found in all parts of caves from the twilight zone to total darkness. Although usually found on the underside of rocks lightly buried in silt, it has also been found crawling over cave walls and moist flowstone. This species has only been found in two caves containing troglobitic species. It was found in Karankawa Cave, Williamson County, with *B. cryptotexanus*; and in Water Tank Cave, Williamson County, with *B. reyesi*.

Batrisodes grubbsi is known only from Grapevine Cave, Hays County. *Batrisodes venyivi* has been found only in three caves northwest of San Antonio. The distribution of *B. reyesi* is of interest in that it has been found in three different karst regions (Wyatt Cave on the Edwards Plateau, Post Oak Ridge and adjacent hilltops in Burnet and Travis Counties, and Water Tank Cave in the Georgetown region). The patchy distribution suggests that this species is a recent troglobite and probably has not been isolated in the different karst regions long enough for speciation to occur. A similar example is provided by the millipede *Cambala speobia* (Chamberlin) which ranges widely throughout the Edwards Plateau and Central Texas.

The three highly derived troglobitic species in Texas have very restricted distributions. *Texamaurops reddelli* is known only from a few caves on the Jollyville Plateau northwest of Austin. It is separated from the geographically closest troglobite, *B. texanus*, by a gap of 25 miles in distribution. *Batrisodes uncicornis* is extremely abundant in the caves occurring between the distributions of the two species. *Batrisodes texanus* is known only from a few caves in southwestern Georgetown. The record of this species from Red Crevice northwest of Georgetown is based on a single female and may actually be *B. cryptotexanus*. *Batrisodes cryptotexanus* is definitely known only from caves north of the North San Gabriel River, which has cut through the cavernous limestone and thus serves as a barrier separating this species from *B. texanus* (if the Red Crevice specimen is misplaced).

Three troglobitic species of *Batrisodes* (*Babnormodes*) found on Fort Hood in Bell and Coryell Counties are of considerable interest. These may have evolved directly from *B. uncicornis* or an immediate common ancestor of the four species. *Batrisodes uncicornis* has not been found in this area. *Batrisodes wartoni* has been found in three caves in northwestern Fort Hood and is separated from the other two Fort Hood species by an area where the cavernous Edwards Limestone has been removed. *Batrisodes gravesi* is found in a large contiguous block of Edwards Limestone in eastern Fort Hood. It has been found deep in the caves in association with red clay. The third species, *B. feminiclypeus*, is known only from Skeeter Cave. There are no obvious barriers between the distribution of this species and *B. gravesi*. *Batrisodes feminiclypeus* is somewhat less cave-adapted than *B. gravesi* and has

been found under rocks buried in black topsoil at the bottom of the entrance drop. Possibly *B. gravesi* became cave-restricted earlier and *B. feminiclypeus* is a more recent derivative of the common ancestor and occupies an ecological cave zone not suitable for *B. gravesi*.

All measurements are in millimeters. Illustrations and descriptions are based on whole and disarticulated specimens in temporary mounts on slides, and checked against whole specimens mounted on points. Holotypes are deposited in the Field Museum of Natural History, Chicago (FMNH). Specimens cited in the records that were collected in the 1960's are deposited in the Field Museum, while specimens taken in the 1990's are split between the collection of the author (DSC) and the Texas Memorial Museum, The University of Texas at Austin (TMMC).

The following new records and species are organized in a sequence reflecting the current arrangement of higher categories in the Pselaphinae (Newton and Chandler, 1989). This former family was placed as a subfamily within the Staphylinidae by Newton and Thayer (1995).

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The manuscript was much improved by the reviews of Dr. Chris Carlton, Louisiana State University, and Alfred F. Newton, Field Museum of Natural History. Dr. Carlton also kindly allowed use of significant new records of *Trimioarcus musamator*.

SYSTEMATICS

Bibloplectus comanche Chandler and Reddell, n. sp. (Figs. 3-5)

Description.—Length 1.00-1.02 mm. Body orange to orange-brown, elytral apices darker; male mesotibiae swollen in apical half, with small blunt preapical tubercle dorsal to curved spine; metatibiae swollen in apical half, with only small curved spine at apex; aedeagus elongate, with broad, flattened, truncate, left apical lobe that is obliquely oriented so that it appears large in both dorsal and lateral views; in a dorsolateral view it appears much thinner.

Specimens examined.—2. Holotype male: TEXAS, *Coryell County*: Plateau Cave No. 2, XI-4-1992, J. Reddell & M. Reyes, berlese litter (FMNH). The following female is associated with this species, but is not designated as a paratype: *Bell County*: 1 female, Nolan Creek Cave, VII-17-1993, J. Reddell & M. Reyes, berlese litter. Additional single females that may be this species bear the data: *Travis County*: Three-Holer Cave, III-7-1991, J. Reddell & M Reyes; *Williamson County*: Beck Horse Cave, IV-26-1991, J. Reddell & M. Reyes.

Etymology.—The specific name is taken from a group of Native Americans found in central Texas.

Comments.—Members of *Bibloplectus* were revised by Chandler (1990), with five new species described from Oklahoma. Adults are found in leaf litter. This species is perhaps closest to *Bibloplectus cherokee* Chandler from Oklahoma. They share the swollen mesotibiae, small subapical tubercle on the mesal margin of the mesotibiae, simple metatibiae, and general form of the aedeagus. They differ by the smaller, blunter, subapical mesotibial tubercle, and the broadly truncate, left apical lobe of the aedeagus of *B. comanche*. The mesotibial tubercle is more acute and distinct, and the left apical lobe of the aedeagus is swollen from a narrow neck and then attenuate to an acute point in *B. cherokee*. This species has only been found in leaf litter from the entrance area or that has washed into caves.

Trimioarcus musamator Chandler, 1992

Specimens examined.—38. *Bell County*: Big Crevice, Fort Hood, V-13-1999, J. Reddell & M. Reyes, berlese leaf litter (5); Fools Cave, Fort Hood, IV-1-1999, J. Reddell & M. Reyes (2); Gnarla Cave, Fort Hood, IV-24-1998, J. Reddell & M. Reyes, berlese litter from Gnarla Pit (7); Jagged Walls Cave, Fort Hood, XII-4-1992, J. Reddell & M. Reyes, berlese litter; Keilman Cave, Fort Hood, IV-23-1998, J. Reddell & M. Reyes, berlese leaf litter (6); Price Pit Cave, Fort Hood, V-6-1999, J. Reddell & M. Reyes, berlese leaf litter (13); Soldier's Cave, Fort Hood, III-25-1999, J. Reddell & M. Reyes, berlese leaf litter. *Coryell County*: Copperhead Cave No. 2, Fort Hood, II-20-1999, M. Reyes, berlese leaf litter; Keyhole Cave, Fort Hood, II-20-1999, J. Reddell & M. Reyes, berlese leaf litter; Tippit Cave, I-24-1992, D. McKenzie, J. Reddell & M. Reyes, berlese litter.

Additional records.—NEW MEXICO: *Santa Fe County*: 1 male from 10 mi. NE of Golden, 6950 ft.,

KEY TO SPECIES

1. Abdominal segments II-IV with acute lateral margins.....2
   Abdominal segments II-IV with lateral margins rounded, abdomen round in cross section (Fig. 1, Chandler 1992) (Batrisitae, Batrisini).....8

2. (1) Last segment of maxillary palpi laterally angulate, previous two segments with spine on outer face (Fig. 21, Chandler 1992) (Pselaphitae, Tmesiphorini).....*Tmesiphorus costalis*
   Last segment of maxillary palpi elongate, lacking lateral angulation or spines on previous segments (Figs. 20, 22; Chandler, 1992).....3

3. (2) Last segment of maxillary palpi elongate, penultimate segment angulate on mesal margin (Fig. 20, Chandler 1992) (Goniaceritae, Tychini).....*Cylindrarctus bicornis*
   Last segment of maxillary palpi enlarged, penultimate segment much smaller (Figs. 22, 24; Chandler 1992).....4

4. (3) Last segment of maxillary palpi enlarged, nearly half as long as head, with longitudinal membranous sulcus on mesal margin (Fig. 22, Chandler 1992); tarsi with two equal claws (Pselaphitae, Tyrini).....*Hamotus electrae*
   Last segment of maxillary palpi smaller, no more than one-third head length, smoothly sclerotized on mesal margin; tarsi with only one claw visible (Euplectitae).....5

5. (4) Pronotum apically pedunculate; first antennomere elongate, one-third antennal length, antennae geniculate (Fig. 1) (Trogastrini).....*Rhexius stephani*
   Pronotum broadly rounded at apex (Figs. 2, 3); first antennomere short, no more than twice length of second antennomere.....6

6. (5) Pronotum abruptly constricted near base (Fig. 2); head venter with prominent Y-shaped carina (Jubini).....*Sebaga ocampi*
   Pronotum slightly and smoothly constricted near base, or margins nearly straight near base; head venter with faint median longitudinal carina (Euplectini).....7

7. (6) Pronotum with lateral margins smoothly but distinctly constricted adjacent to lateral foveae; antennal club formed by large last antennomere (Fig. 24, Chandler 1992).....*Trimioarcus musamator*
   Pronotum with lateral margins nearly straight through most of length, smoothly rounded to base; antennal club smaller, formed by last 2-3 antennomeres (Fig. 3).....*Bibloplectus comanche*

8. (1) Apex of metatibiae lacking elongate pencil of appressed setae (Fig. 18, Chandler 1992); ocular area bluntly protruding, lacking distinct eyes (Fig. 17, Chandler 1992); Travis County .....*Texamaurops reddelli*
   Apex of metatibiae with elongate pencil of appressed setae (Fig. 18, Chandler 1992); ocular area with distinct eyes or with eyes lacking, ocular area not bluntly protruding (*Batrisodes*).....9

9 (8) Pronotal disc with distinct median sulcus to near apex; eyes distinct, with 10 to 50 facets grouped together, may be small and angularly produced in *B. clypeonotus*.....10
   Pronotal disc convex or with faint median impression; eyes apparently absent, possibly up to 10 disassociated pale granules in ocular area, ocular area broadly to narrowly rounded (Figs. 6, 12).....12

10. (9) Vertex of head and anterior portion of pronotum coarsely punctate; males with anterior margin of vertex angulate (Fig. 1, Chandler 1992).....*Batrisodes uncicornis*
Basal half of vertex and anterior portion of pronotum smoother, not coarsely punctate; males with anterior margin of vertex truncate to broadly rounded (Figs. 3, 15; Chandler 1992); females with vertex at most coarsely punctate on antennal tubercles, area between vertexal foveae smooth or sparsely granulate.....11

11. (10) Males with anterior margin of vertex broadly rounded, penultimate antennomere with small fovea at base (Fig. 15, Chandler 1992); females with large eyes of more than 40 facets.....*Batrisodes globosus*
Males with anterior margin of vertex broadly truncate, penultimate antennomere lacking basal fovea (Fig. 3, Chandler 1992); females with small eyes of approximately 15 facets, ocular area angularly protruding.....*Batrisodes clypeonotus*

12. (9) Antennal tubercles prominent, coarsely punctate (Fig. 12); apical tergite of abdomen prominent, narrowly rounded at apex.....13
Antennal tubercles lacking or indistinct; apical tergite broadly rounded or bluntly pointed.....14

13. (12) Apical tergite of abdomen with projection about as long as wide; males with lateral ridges of sternite VI acutely projecting; Williamson County.....*Batrisodes cryptotexanus*
Apical tergite with projection about half as long as wide; males with form of lateral ridges of sternite VI unknown at this time; Williamson County.....*Batrisodes texanus*

14. (12) Antennomere VIII at least twice as long as wide; males with vertex depressed at apex, apex forming an acute point between antennal bases (Fig. 8); Bell and Coryell Counties.....*Batrisodes gravesi*
Antennomere VIII less than twice as long as wide; males with apex of vertex formed differently.....15

15. (14) Head lacking lateral and vertexal carinae (Fig. 13, Chandler 1992); vertex smooth; Bexar County.....*Batrisodes venyivi*
Head with lateral carinae present, may be faint; vertex in apical half distinctly punctate or rugulose.....16

16. (15) Vertex depressed between prominent median and lateral carinae; males with anterior margin of vertex prominent, weakly biemarginate (Fig. 7, Chandler 1992); Burnet, Travis, and Williamson Counties.....*Batrisodes reyesi*
Vertex nearly flat between weakly defined or low median and lateral carinae; males with anterior margin of vertex formed differently.....17

17. (16) Males with anterior margin of vertex prominent, apex shallowly curved in dorsal view (Fig. 5, Chandler 1992); second mesotarsomeres straight; Hays County.....*Batrisodes grubbsi*
Males with anterior margin of vertex depressed, modified or smoothly merging with clypeus (Figs. 6, 10); second mesostarsomeres sinuate, notched at base.....18

18. (17) Punctures on anterior half of vertex distinct; males with anterior margin of vertex depressed, apex shallowly bifurcate (Fig. 10); Coryell County.....*Batrisodes wartoni*
Punctures on anterior half of vertex indistinct; males with anterior margin of vertex smoothly merging with clypeus (Fig. 6); Bell County.....*Batrisodes feminiclypeus*

VII-11-1952, Hoff and Parrack, pinyon litter and soil. TEXAS: *Brewster County*: 37 males, 39 females from Big Bend National Park, Pine Canyon, Cattail Falls, and Oak Canyon, IX-6-8-1988, R. Anderson. (Records supplied by Chris Carlton).

Comments.—Adults have usually been found only in leaf litter near or in cave entrances. The type-series was taken from a rodent nest less than 10 m from the cave entrance. The holotype and most males of this species typically have a vertexal tubercle that is quite prominent, with the apex longitudinally flattened and sloped, and the lateral margins above the eyes raised and somewhat protruding. In the series from Price Pit and Big Crevice in Bell County, a single male was found in each series where the vertexal tubercle is best characterized as a small pimple, and the lateral margins above the eyes were not developed. One of these males was cleared and disarticulated. The characters of the middle legs were identical with those of the typical males, and the male genitalia are very close in appearance. We are reluctant to describe these different males as a new species without more information, though the vertices of the males appear to be quite different. The Price Pit material has both male forms together, and outside of the different structure of the vertex, they cannot be separated.

This may be the first North American example of the phenomenon of male sexual polymorphism, which is well known in some groups of European pselaphids, where males with strongly developed sexual features, and others with weakly developed features occur in the same population (Jeannel, 1950; Löbl *et al.*, 1998). While polymorphic males are best known in the genus *Bryaxis* Kugelann, this phenomenon has been observed in *Trogaster* Sharp, *Brachygluta* Thomson, and *Tychus* Leach (Jeannel, 1950), but never before in the Euplectini, where *Trimioarcus* is placed.

Rhexius stephani Chandler, 1990

Specimens examined.—9. *Coryell County*: Porter Cave, Fort Hood, IV-8-1999, J. Reddell & M. Reyes, berlese leaf litter (8). *Travis County*: Tardus Hole, V-25-1992, J. Reddell, berlese litter.

Comments.—This species was originally described from Oklahoma (Chandler 1990), and these specimens represent the first records from Texas. Adults are found in leaf litter in cave entrances.

Sebaga ocampi Park, 1945

Specimens examined.—2. *Bexar County*: 1 male, 3.5 mi. NE Helotes, Surface Site, X-25-1994, A. G. Grubbs; 1 female, Up the Creek Cave, Camp Bullis, III-30-1995, J. Reddell & M. Reyes.

Comments.—These are the first records from Texas. This species was originally described from Mexico, and was previously known only from Oklahoma in the United States (Chandler, 1990). Adults are found in leaf litter that may be at or inside cave entrances.

Batrisodes* (*Babnormodes*) *feminiclypeus
Chandler and Reddell, n. sp.
(Figs. 6-7)

Description.—Length 2.20-2.48 mm. Male head smoothly convex between antennal bases from vertex to clypeus, lacking modifications; vertex with lateral carinae indistinct; median carina short, extending to small shallow impression, carina not quite reaching to point even with vertexal foveae; antennal tubercles indistinct; vertex and clypeus smoothly punctate, only area between vertexal foveae to base smooth; slightly converging shallow sulci extending anteriorly from vertexal foveae to vertexal apex; clypeus smoothly rounded; antennomeres II-VII about twice as long as wide, VIII slightly longer than wide, IX and X half again as long as wide; antennomere I simple; lacking eyes.

Pronotum with disc smooth; median and lateral longitudinal sulci faint; antebasal tubercles distinct. Elytra each with three faint basal foveae; lacking subhumeral fovea; with sulcus on lateral margin extending from area of subhumeral fovea to elytral apex; elytra sparsely but distinctly punctate. Second mesostarsomeres sinuate, notched near base; protibiae obliquely flattened in apical third; mesotibiae with setose angulation on mesal margin near apex.

Abdomen with median carina on second visible sternite extending through length; sternite II flattened medially, II-VI broadly and slightly impressed medially.

Females with head and antennae similar to male; sternites all convex at middle; lacking tibial and tarsal modifications.

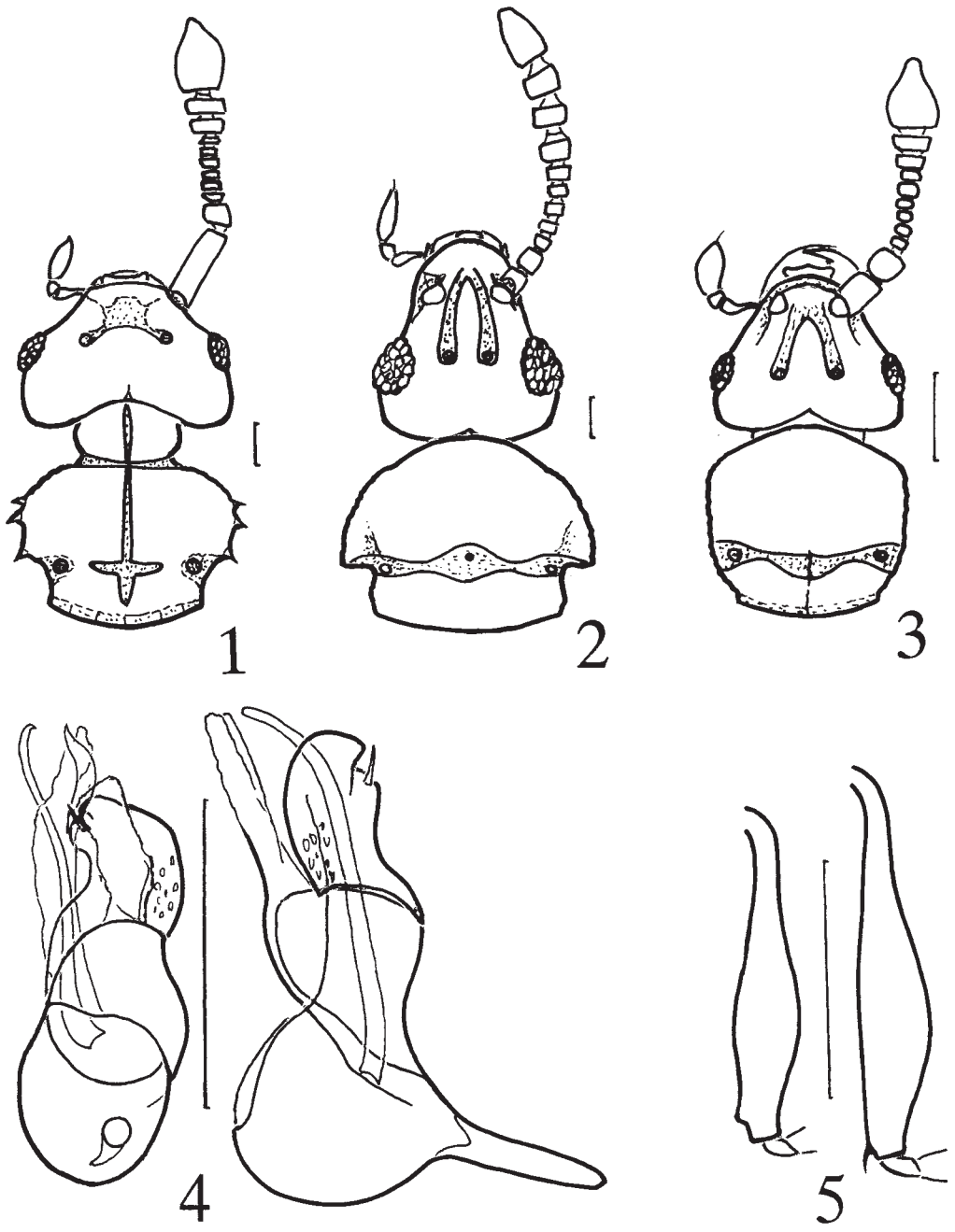
Male holotype: antennae 1.28; metafemora 0.84; metatibiae 0.80; metatarsi 0.40.

Specimens examined.—5. Holotype male: TEXAS: *Bell County*: Skeeter Cave, Fort Hood, V-18-1999, L. J. Graves, J. Reddell, & M. Reyes (FMNH). PARATYPES: 1 male, 3 females, eutopotypical (DSC, TMMC).

Etymology.—The specific name refers to the similarity of the male clypeus to that of the female.

Comments.—Monophyly of this and the other two species of the subgenus *Babnormodes* described here (*B. gravesi* and *B. wartoni*) is supported by shared modifications of the male protibiae, mesotibiae, and

abdominal sternites, and similarity in body form and punctation. All antennomeres of *Batrisodes feminiclypeus* are slightly shorter than in the other two species, and the species lacks any indication of male modifications of the clypeus and the anterior margin of the vertex. This group of species shares the apically flattened protibiae and subapical, setose angulation of the mesotibiae with *B. uncicornis*, where this combination of features is the most marked in all of the members of the subgenus *Babnormodes*. These troglobitic species probably represent sequential or independent origins from a troglophilic common

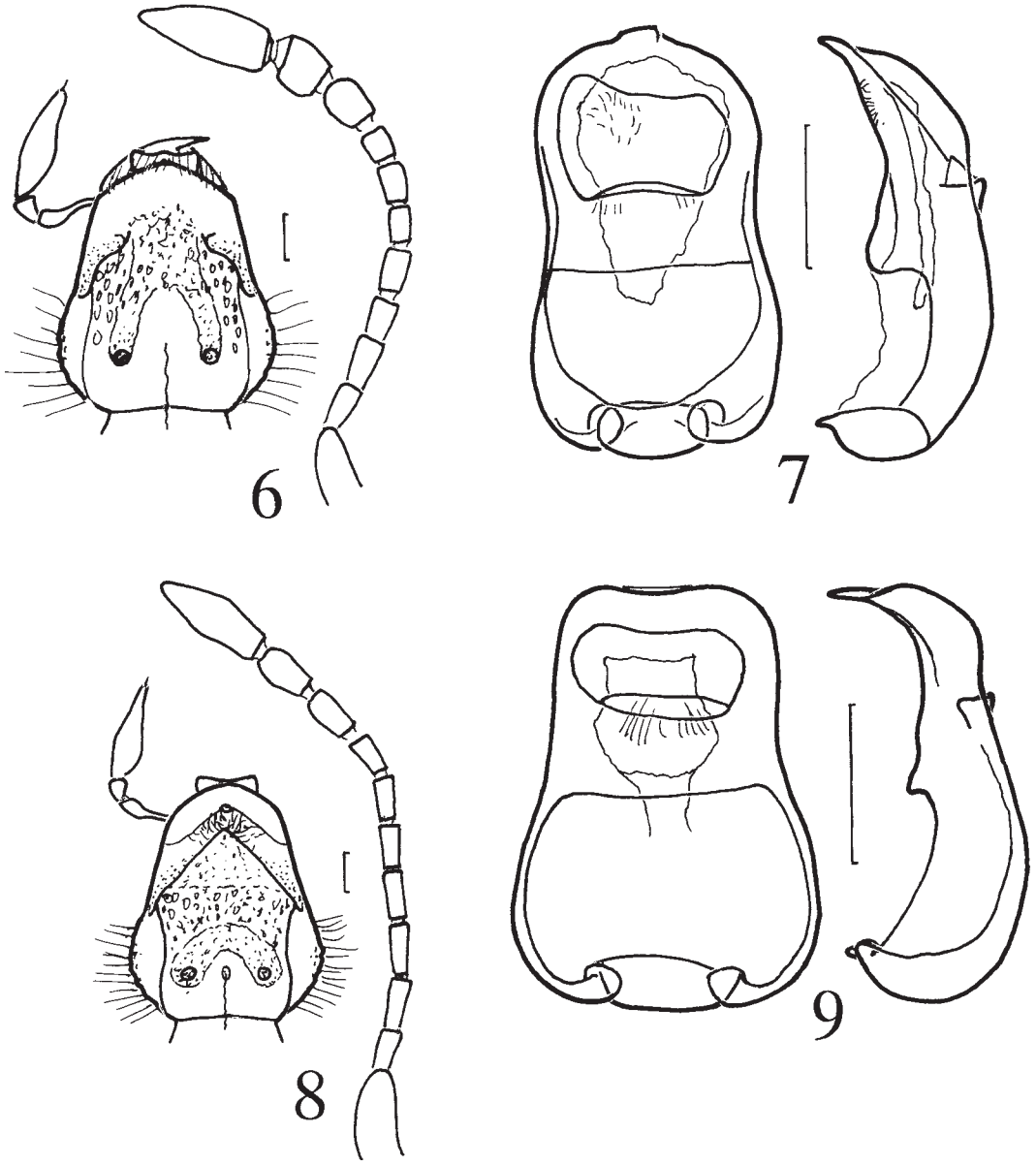


Figs. 1-5.--1. *Rhexius stephani*, head and pronotum, dorsal view 2. *Sebaga ocampi*, head and pronotum, dorsal view. 3. *Bibloplectus comanche*, head and pronotum, dorsal view. 4. *Bibloplectus comanche*, dorsal and left lateral view aedeagus. 5. *Bibloplectus comanche*, posterior view right meso- and metatibiae.

ancestor with *B. uncicornis*. All specimens were found on the underside of small rocks lightly buried in silt at the bottom of the entrance drop.

Batrisodes (Babnormodes) gravesi
Chandler and Reddell, n. sp.
(Figs. 8-9)

Description.—Length 2.32-2.64 mm. Male head with deep transverse impression anterior to antennal bases, impression with dense setae; vertex sparsely punctate, shining; lacking antennal tubercles; with low lateral carina extending from head base to above antennal insertions; median carina short, extending to point even with nude vertexal foveae, often with small foveal impression at anterior margin of carina; front abruptly declivous between antennal insertions, margins evenly converging to sharp angulation, angulation



Figs. 6-9.-- 6. *Batrisodes feminiclypeus*, dorsal view head, mesal view right antenna. 7. *Batrisodes feminiclypeus*, dorsal and right lateral view aedeagus. 8. *Batrisodes gravesi*, dorsal view head, mesal view right antenna. 9. *Batrisodes gravesi*, dorsal and right lateral view aedeagus. Figs. 6, 8 with apical three antennomeres in ventral view. Line = 0.1 mm.

slightly projecting over transverse impression; front sparsely but more deeply punctate than vertex; clypeus with blunt median point at base, with fringe of long setae along apex; antennomeres all elongate, antennomeres VIII and X twice as long as wide, X only slightly wider than IX and lacking ventral fovea, antennomere I simple; lacking eyes.

Pronotum with disc convex and smooth; lateral longitudinal sulci faint; median antebasal fovea shallow; antebasal tubercles distinct. Elytra each with three small basal foveae; lacking distinct subhumeral fovea, with sulcus extending from position of subhumeral fovea to elytral apex; elytra sparsely but distinctly punctate. Second mesotarsomeres sinuate, notched near base. Protibiae obliquely flattened in apical third; mesotibiae with setose angulation on mesal margin before apex; metatibiae vaguely and broadly constricted in apical fourth.

Abdomen with second visible sternite bearing a median carina through length; sternites II-V medianly flattened, VI broadly impressed.

Females with head lacking transverse sulcus anterior to antennal insertions, clypeus and vertex smoothly merging; antennae slightly more robust; sternites II-V convex at middle, VI broadly flattened; tibiae cylindrical.

Male holotype: antennae 1.44; metafemora 0.84; metatibiae 0.84; metatarsi 0.44.

Specimens examined.—15. Holotype male: TEXAS: *Bell County*: Streak Cave, Fort Hood, IX-26-1997, L. J. Graves, J. Reddell & M. Reyes (FMNH). PARATYPES: *Bell County*: 4 females, eutopotypical; 1 female, same data except, X-6-1995, M. Warton; 1 female, Buchanan Cave, Fort Hood, V-7-1998, L. J. Graves, J. Reddell & M. Reyes; 1 male, Bumelia Well Cave, Fort Hood, X-28-1994, D. Allen & D. Love; 1 male, same data except XI-4-1998, J. Cokendolpher, J. Krejca, J. Reddell & M. Reyes; 1 male, Figure 8 Cave, Fort Hood, II-9-1996, M. Warton; 1 female, Lucky Rock Cave, Fort Hood, IX-10-1997, L. J. Graves, J. Reddell & M. Reyes; 1 male, Price Pit, Fort Hood, V-6-1999, J. Reddell & M. Reyes; 1 female, Triple J Cave, Fort Hood, X-4-1995, M. Warton; 3 males, Triple J Cave, Fort Hood, IV-23-1998, L. J. Graves, J. Reddell & M. Reyes. *Coryell County*: 1 female, Keyhole Cave, Fort Hood, V-6-1999, J. Reddell & M. Reyes; 1 female, Mixmaster Cave, Fort Hood, XI-5-1998, J. Cokendolpher, J. Krejca, J. Reddell & M. Reyes (DSC, TMMC).

Etymology.— The specific name is in honor of one of the collectors of the specimens, Lee Jay Graves, in recognition of his contributions to our understanding of the cave fauna of Fort Hood and other parts of Texas.

Comments.—This species is closely related to *B. wartoni*, with which it shares the form of the modified protibiae, mesotibiae, abdominal sternites, and long, slender antennae. The two species are best distinguished by the form of the male anterior vertexal margin, which projects to a point in *B. gravesi*, and forms a narrowly bifurcate apex in *B. wartoni*, and the eighth antennomeres are twice as long as wide or longer. This species has been found on the underside of rocks lightly buried in silt and clay in total darkness.

Batrisodes (*Babnormodes*) *uncicornis* (Casey), 1897

Specimens examined.—217. *Bexar County*: Alligator Lizard Cave, 8.3 mi. NW Helotes, IX-14-1994, A. G. Grubbs (7); B-52 Cave, XII-6-1994, III-31-1995, W. R. Elliott & J. Ivy, J. Reddell & M. Reyes, zones 2 and 3 (5); B-52 Cave, IX-10-1998, J. Cokendolpher, J. Krejca, J. Reddell & M. Reyes (2); Charlie's Cute Little Hole, XII-5-1994, G. McDaniel & B. Johnson; Cross the Creek Cave, III-31-1995, X-6-1995, IX-10-1998, J. Reddell & M. Reyes (16); 40 mm Cave, XI-29-1993, X-5-1995, J. Ivy, J. Reddell & M. Reyes, J. Reddell & M. Reyes, dark zone beneath rocks lightly buried in silt (5); Hairy Tooth Cave, I-21-1994, W. Elliott, J. Ivy & G. Veni; 5 mi. ENE Helotes, Site 39, VI-13-1994, A. G. Grubbs (7); 5.5 mi. E Helotes, Surface Site 101604, IV-6-1995, A. G. Grubbs (2); Lone Gunman Pit, III-24-1998, J. Reddell & M. Reyes; MARS Pit, X-9-1995, IX-10-1998, J. Reddell & M. Reyes, upper level (2); Meusebach Flats Cave, XI-14-1997, J. Ivy, B. Johnson & P. Sprouse; Platypus Pit, III-30-1995, X-24-1995, V-20-1996, J. Reddell & M. Reyes, J. Ivy, beneath rocks lightly buried in silt, zone 1 (3); 1.8 mi. W Smithwick, X-13-1994, A. G. Grubbs (2); Strange Little Cave, XI-29-1993, X-5-1995, J. Reddell & M. Reyes, dark zone beneath rocks lightly buried in silt (7); Two-Hit Cave, III-30-1995, J. Reddell & M. Reyes; Winston's Cave, XII-13/14-1993, J. Ivy, L. McNatt & G. Veni. *Blanco County*: Flat Creek Ranch, 12 mi. E Johnson City, V-28-1995, VI-22-1995, A. G. Grubbs (9); Wells Sink, 4.9 mi. ENE Johnson City, V-21-1995, A. G. Grubbs & E. Boyd (3). *Burnet County*: County Road 404, 5.4 mi. NW Spicewood, Site #2, IX-18-1994, I-19-1995, A. G. Grubbs (7); M.V.N. Cave, 5 mi. W Spicewood, III-20-1993, VIII-22-1993, A. Grubbs, T. Whitfield & G. Waid (6); 1.6 mi. S Marble Falls, Site #3, IX-20-1994, A. G. Grubbs; Moon Rocks surface, 5 mi. NW Spicewood, II-21-1995, A. G. Grubbs; Railroad Cave, 1 mi. W Marble Falls, VIII-22-1993, A. G. Grubbs, G. Hoese & T. Whitfield (3); Roadcut Hwy. 281, 3.8 mi. S Marble Falls, X-4-1994, A. G. Grubbs; 1 mi. W Smithwick, X-13-1994, A. G. Grubbs (2); Snelling's Cave, IX-1965, B. Russell & D. McKenzie; Waldman Cave, 5 mi. NW Spicewood, VI-9-1993, A. G. Grubbs & G. Waid (4). *Comal County*: Camp Bullis Bad Air Cave, X-23-1996,

XI-22-1996, G. Veni & P. Sprouse, B. Johnson, J. Reddell & M. Reyes, Zones 2 and 3 (6); Camp Bullis Cave No. 3, XI-21-1996, B. Johnson, J. Reddell & M. Reyes, Zones 1 and 2 (3); Ebert Cave, X-24-1992, P. Chippendale, A. Grubbs & J. Hunter (2); Snake Skin Pit, XI-19-1996, W. Elliott; Washington Cave, XI-21-1996, J. Reddell & M. Reyes (2). *Hays County*: Wissman's Sink #1, 10 mi. W San Marcos, A. G. Grubbs, N. Lake & H. Dues. *Kendall County*: Cascade Caverns, VI-15-1964, J. Reddell; Pfeiffer Crawlway Cave, IX-9-1963, J. Reddell & D. McKenzie; Pfeiffer Crawlway Cave, IV-1-1965, J. Reddell & K. Christianson; Sattler's Deep Pit, VII-10-1994, A. G. Grubbs; Schneider Ranch Cave, IX-8-1963, J. Reddell & D. McKenzie. *Travis County*: Airman's Cave, 2.5 mi. S downtown Austin, VIII-14-1994, A. G. Grubbs & A. Beshur (2); Get Down Cave, X-5-1998, J. Reddell; Ireland's Cave, III-14-1964, B. Russell; Pedernales River & Hwy. 71, 23 mi. W Austin, VI-22-1995, A. G. Grubbs; Weldon Cave, IV-30-1996, M. Warton. *Williamson County*: Argo Cave, Sun City-Georgetown, III-25-1994, J. Reddell & M. Reyes, beneath rocks lightly buried in silt; Bat Well Cave, III-24-1963, J. Reddell; Beck Bat Cave, V-16-1996, J. Reddell & M. Reyes; Beck Bridge Cave, 2.5 mi. W Round Rock, IV-14-1995, A. G. Grubbs (5); Beck Pride Cave, V-21-1996, V-29-1996, J. Reddell & M. Reyes (4); Beck Ranch Cave, X-2-1963, J. Reddell; Beck Sewer Cave, I-23-1965, J. Reddell & R. Mitchell; Beck Tin Can Cave, 3 mi. W Round Rock, III-12-1963, J. Reddell; Black Bat Cave, 2.5 mi. W. Round Rock, IV-14-1995, A. G. Grubbs (4); Bluewater Cave No. 2, IV-21-1992, M. Warton (2); Cat Hollow Cave No. 2, VI-30-1992, M. Warton (2); Core Barrel Cave, VI-4-1991, J. Reddell & M. Reyes (2); Cricket Cave, 8 mi. WSW Jarrell, VIII-23-1963, J. Reddell & B. Russell; East Fork Fissure, Georgetown, VI-13-1995, J. Reddell & M. Reyes, beneath rocks lightly buried in silt (5); Either Side Cave, Sun City-Georgetown, IV-13-1994, VIII-14-1994, J. Reddell & M. Reyes, beneath rocks lightly buried in silty clay near end of cave (2); El Tigre Cave, VI-30-1992, M. Warton; El Tigre Cave, 2.5 mi. W Round Rock, IV-14-1995, A. G. Grubbs; Ensor Cave, IV-1994, M. Warton; Fern Cave, III-1994, M. Warton (2); Florence Cave No. 18, Sun City-Georgetown, III-6-1994, J. Reddell & M. Reyes, dark zone beneath rock lightly buried in silt; Formation Forest Cave, III-31-1993, J. Reddell & M. Reyes, beneath rock lightly buried in silt; Fortune 500 Cave, IV-28-1998, J. Reddell & M. Reyes (4); Hook Cave, Sun City-Georgetown, III-5-1994, J. Reddell & M. Reyes, beneath rock lightly buried in silt; Jackhammer Cave, VI-24-1993, D. Allen; Joint Effort Cave, VI-25-1997, J. Reddell & M. Reyes (2); Karankawa Cave, Sun City-Georgetown, IV-20-1994, J. Reddell & M. Reyes, dark zone beneath rocks buried in silty clay; Kiva Cave No. 1, Sun City-Georgetown, II-8-1996, J. Reddell & M. Reyes; LakeLine Cave, VIII-20-1994, W. R. Elliott (2); LakeLine Cave, II-7-1995, P. Sprouse (2); LakeLine Cave, X-30-1997, W. Elliott; Lobo's Lair, IX-1-1991, J. Reddell & M. Reyes; Mangrove Cave, IV-28-1998, J. Reddell & M. Reyes; Leaning Tree Cave, IV-18-1996, M. Warton (2); Mustard Cave, VI-12-1993, J. Reddell & M. Reyes, dark zone beneath rock lightly buried in silt; O'Connor Cave, 2.5 mi. W Round Rock, IV-15-1995, A. G. Grubbs; Ominous Entrance Cave, III-31-1993, J. Reddell & M. Reyes, beneath rock lightly buried in silt (2); Pemmican Cave, Sun City-Georgetown, IV-19-1994, J. Reddell & M. Reyes, dark zone beneath rock lightly buried in silty clay; Pugilist Cave, Sun City-Georgetown, IX-19-1994, J. Reddell & M. Reyes, beneath rock lightly buried in clay and silt; Snake Dancer Cave, Sun City-Georgetown, IV-19-1994, J. Reddell & M. Reyes, beneath rock lightly buried in black silt; Stonewall Ranch Cave, III-3-1993, M. Warton; Terrell's Cave, XI-20-1991, J. Reddell & M. Reyes (6); Thin Roof Cave, IV-28-1998, J. Reddell, M. Reyes & J. Wolff (3); Undercut Cave, Sun City-Georgetown, XI-18-1993, J. Reddell & M. Reyes (2); Venom Cave, Sun City-Georgetown, XI-17-1993, J. Reddell & M. Reyes, dark zone beneath rock lightly buried in silt; Vericose Cave, IV-1994, M. Warton (2); Walsh Ranch Cave, VIII-23-1963, J. Reddell & B. Russell; Water Tank Cave, X-28-1998, J. Reddell & M. Reyes; Water Tower Cave, V-15-1993, J. Reddell & M. Reyes, beneath rock lightly buried in silt; Water Tower Cave, III-15-1994, L. Sherrod (2); Waterfall Canyon Cave, V-22-1992, J. Reddell & M. Reyes; Whiskey Jug Cave, IV-1994, M. Warton; Williams Cave No. 1, VIII-23-1963, B. Russell & J. Reddell.

Comments.—This species is a troglophile found in caves along the Balcones Fault Zone. It is only rarely taken in caves containing troglobitic species and may outcomplete troglobites in most caves.

Batrisodes* (*Babnormodes*) *wartoni
Chandler and Reddell n. sp.
(Figs. 10-11)

Description.—Length 2.08-2.24 mm. Male head with deep transverse impression anterior to antennal bases, impression with dense short setae laterally; vertex with low lateral carinae distinct from head base to above antennal insertions; median carina short, ending at point even with nude vertexal foveae, with foveal impression at anterior margin of carina; antennal tubercles indistinct; vertex sparsely punctate medially and basally, densely and coarsely punctate above antennal insertions and onto front; front abruptly declivous between antennal insertions, front broadly convex, broadly and

shallowly bifurcate at apex above transverse impression; clypeus with blunt median tubercle at base, tubercle with line of laterally directed setae to each side; antennomeres all elongate, VIII with width about three-fourths length, X with width about two-thirds length, X lacking ventral fovea, antennomere I simple; lacking eyes.

Pronotum with disc convex and smooth; lateral longitudinal sulci distinct; median antebasal fovea shallow; antebasal tubercles distinct. Elytra each with three small basal foveae; lacking subhumeral fovea, with sulcus on lateral margin from area of subhumeral fovea to elytral apex; elytra sparsely but distinctly punctate. Second mesostarsomeres sinuate, notched near base. Protibiae obliquely flattened in apical third; mesotibiae with setose angulation on mesal margin near apex; metatibiae vaguely and broadly constricted in apical fourth.

Abdomen with second visible sternite bearing a short carina posterior to basal sulcus; sternites III-VI flattened medially.

Females with head lacking transverse sulcus anterior to antennal insertions; clypeus and vertex smoothly merging; antennomeres slightly more robust, IX and X nearly as wide as long; sternites all convex at middle; lacking tibial and tarsal modifications.

Male holotype: antennae 1.24; metafemora 0.76; metatibiae 0.76; metatarsi 0.40.

Specimens examined.—10. Holotype male: TEXAS: *Coryell County*: Rocket River Cave, Fort Hood, X-27-1994, M. Warton (FMNH). PARATYPES: *Coryell County*: 1 female, Chigiouxs' Cave, Fort Hood, XI-21-1995, J. Reddell & M. Reyes, under chunks of clay at cave end; 2 females, Tippit Cave, II-9-1992, J. Reddell & M. Reyes; 1 male, Tippit Cave, I-31-1992, J. Reddell & M. Reyes; 1 female, Tippit Cave, XI-3-1992, J. Reddell & M. Reyes, beneath rock lightly buried in clay; 1 female, Tippit Cave, XI-6-1992, J. Reddell & M. Reyes, beneath rock lightly buried in clay; 3 females, Tippit Cave, VII-1-1993, D. McKenzie, J. Reddell & M. Reyes, beneath rock lightly buried in clay (DSC, TMMC).

Etymology.—The specific name was chosen in honor of the collector of the holotype, Mike Warton, in recognition of his contributions to the cave fauna of Fort Hood and other parts of Texas.

Comments.—*Batrisodes wartoni* is closely related to *B. gravesi* with which it shares all the features mentioned in the Comments section of that species. The two species may be distinguished by the form of the male anterior vertexal margin, which is broadly bifurcate in *B. wartoni* and pointed in *B. gravesi*. The ranges of the two species are allopatric in different areas of Fort Hood. The first specimens of this species were taken from under balls of clay near peanut butter and banana bait at the end of Tippit Cave. All other specimens have been found under rocks or clay balls on red clay. In Tippit Cave it occurs in close association with the troglobitic ground beetle *Rhadine reyesi* Reddell and Cokendolpher.

Batrisodes (Excavodes) clypeonotus (Brendel), 1893

Specimens examined.—2. *Blanco County*: Flat Creek Ranch, 12 mi. E Johnson City, V-28-1995, VI-22-1995, A. G. Grubbs. *Travis County*: Jest John Cave, V-29-1993, W. Russell & J. Sigmond.

Comments.—This species is known to be associated with the ant, *Camponotus americanus* Mayr (Chandler 1992). Its ecological status is uncertain, but it may be a troglophile.

Batrisodes (Excavodes) cryptotexanus
Chandler and Reddell, n. sp.
(Figs. 12-13)

Description.—Length 2.80-3.04 mm. Male head with transverse impression anterior to antennal bases barely indicated, with small median tubercle at upper margin; vertex smoothly and faintly rugulose; lateral carinae distinct from base to prominent antennal tubercles, tubercles smoothly roughened; median carina distinct from cervix to point nearly even with basal margin of antennal tubercles; vertexal foveae large and nude; surface deeply convex between median and lateral carinae, and between antennal tubercles; clypeus with low tubercle at base close to frontal tubercle, best seen in lateral view; all antennomeres elongate, X twice as wide as IX and medianly swollen, with large nude fovea occupying one-fourth to one-third of ventral surface; antennomere I simple; eyes lacking, area of eyes smoothly convex; genal setae often long.

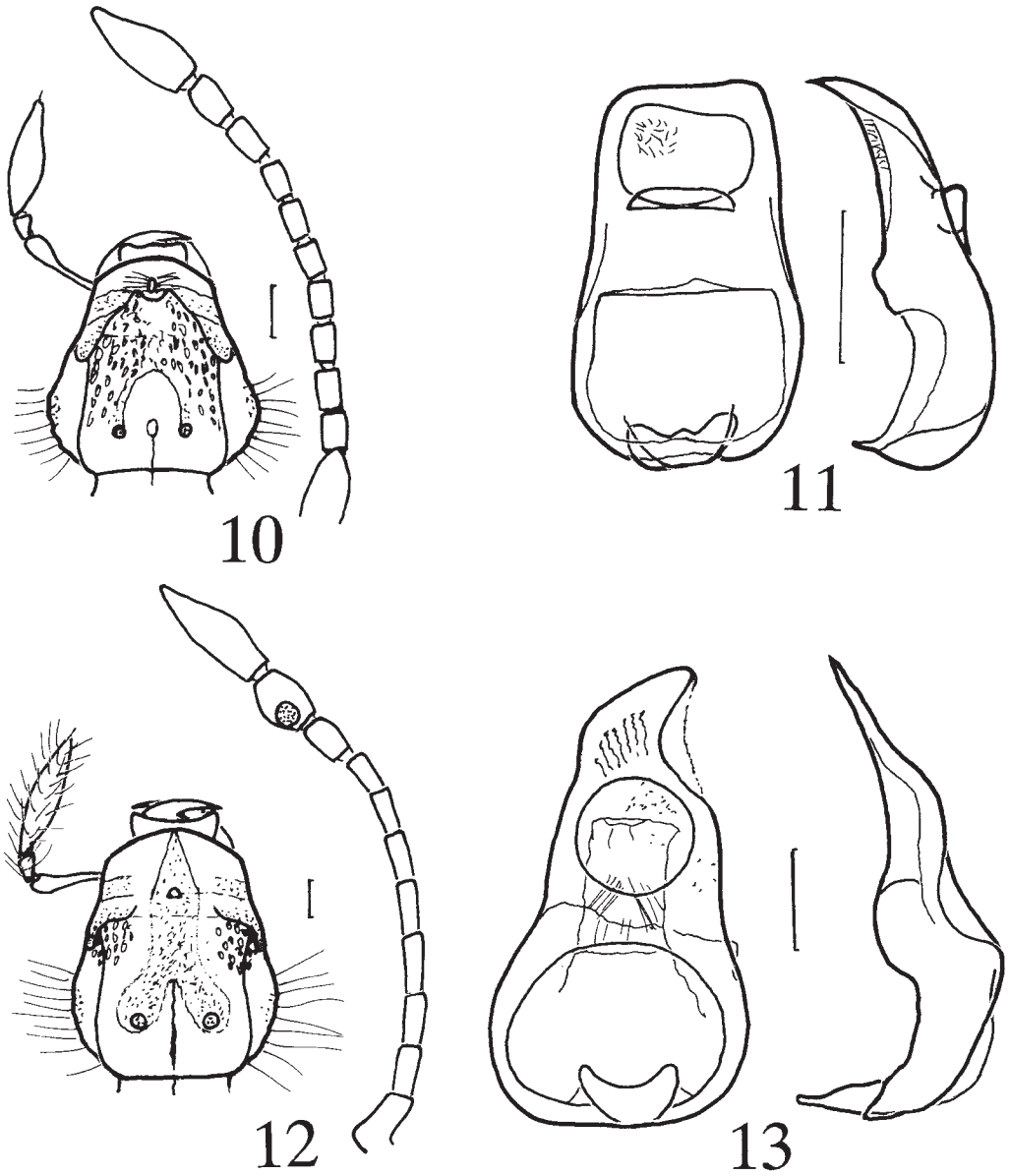
Pronotum with median longitudinal sulcus shallow on disc; lateral longitudinal sulci distinct, lateral margins of pronotum prominent at middle; median and lateral antebasal foveae distinct. Metasternum with median carina in basal third; deep median fovea present at posterior margin of carina. Elytra with three basal foveae; humeral angles with small tooth; with small subhumeral fovea, sulcus extending from fovea to elytral apex. Mesotrochanters with ventral carina; mesotibiae slightly swollen and densely setate in apical fifth; second mesotarsomeres straight. Abdomen with sternite VI deeply and broadly impressed at middle, raised laterally as setose flanges; tergite V protruding posteriorly as long thumb, in dorsal view about as long as wide.

Females with clypeus smoothly curving up to vertex; antennomere X close to cylindrical, lacking ventral

fovea, not much wider than IX; sternite VI broadly rounded; sternite VIII not quite as prominent.

Male holotype: antennae 1.72; metafemora 1.32; metatibiae 1.32; metatarsi 0.72.

Specimens examined.—15. Holotype male: TEXAS, *Williamson County*: Dragon Fly Cave, Sun City-Georgetown, VII-11-1994, J. Reddell & M. Reyes, beneath rocks lightly buried in black silt (FMNH). PARATYPES: *Williamson County*: 1 female, eutopotypical; 1 female, Coffin Cave, 10 NW Georgetown, XI-3-1963, J. Reddell, PARATYPE *Batrisodes texanus* Chandler; 1 female, Deliverance Cave No. 2, Sun City-Georgetown, XI-17-1993, M. Reyes, dark zone beneath rock lightly buried in silt; 1 male, Electro-Mag Cave, Sun City-Georgetown, X-13-1994, J. Reddell, beneath rock lightly buried in silt; 1 male, Karankawa Cave, Sun City-Georgetown, IV-20-1994, J. Reddell & M. Reyes, dark zone beneath rocks



Figs. 10-13.--10. *Batrisodes wartoni*, dorsal view head, mesal view right antenna. 11. *Batrisodes wartoni*, dorsal and right lateral view aedeagus. 12. *Batrisodes cryptotexanus*, dorsal view head, mesal view right antenna. 13. *Batrisodes cryptotexanus*, dorsal and right lateral view aedeagus. Figs. 10, 12 with apical three antennomeres in ventral view. Line = 0.1 mm.

buried in silty clay; 1 female, Medicine Man Cave, Sun City-Georgetown, IV-6-1994, J. Reddell & M. Reyes, dark zone beneath rock lightly buried in silty clay; 1 female, Priscilla's Well Cave, Sun City-Georgetown, VII-25-1995, J. Reddell & M. Reyes, beneath rock lightly buried in silt; 1 male, Priscilla's Well Cave, Sun City-Georgetown, II-11-1996, J. Reddell & M. Reyes; 1 female, Reach Around Cave, Sun City-Georgetown, III-5-1994, J. Reddell & M. Reyes, at cave end in total darkness; 1 male, Shaman Cave, Sun City-Georgetown, IX-29-1994, J. Reddell & M. Reyes, beneath flat rock on clay and silt; 2 females, Shaman Cave, Sun City-Georgetown, XI-27-1995, P. Sprouse, beneath rocks lightly buried in silt; 1 female, Unearthed Cave, Sun City-Georgetown, XI-17-1993, J. Reddell & M. Reyes, dark zone beneath rocks lightly buried in silt; 1 male, Viper Cave, Sun City-Georgetown, XII-13-1996, J. Reddell & M. Reyes.

Etymology.—A single female of the species was initially confused with *B. texanus*, which suggested this name.

Comments.—This species and *B. texanus* appear to be sister species and share the prominently developed tergite V of the abdomen, prominent antennal tubercles, and form of the head. They may be distinguished by the projection of tergite V being about as long as wide, and the setate lateral ridges of sternite VI are acutely projecting in *B. cryptotexanus*, while the projection of tergite V is about half as long as wide in *B. texanus*. The setate lateral ridges of sternite VI are acutely prominent in *B. cryptotexanus*, but since this portion of the abdomen was apparently lost when the genitalia were initially dissected from the male holotype of *B. texanus*, and only a single male is known for this species, the two species cannot be compared using this feature at this time. This species has been taken only from the underside of rocks lightly buried in silt or clay in total darkness.

Batrisodes (*Excavodes*) *grubbsi* Chandler, 1992

Specimens examined.—1. *Hays County*: 1 male, Grapevine Cave, 7 mi. W Wimberley, IV-23-1995, A. G. Grubbs.

Comments.—This species is known only from this cave.

Batrisodes (*Excavodes*) *reyesi* Chandler, 1992

Specimens examined.—5. *Edwards County*: Wyatt Cave, IX-21-1963, J. Reddell & D. McKenzie. *Travis County*: GCWA Cave, V-18-1996, P. Sprouse; Ceiling Slot Cave, III-31-1991, J. Reddell & M. Reyes (2). *Williamson County*: Water Tank Cave, X-28-1998, J. Reddell & M. Reyes.

Comments.—This species was taken from the underside of small rocks lightly buried in silt and clay in Ceiling Slot and Water Tank Caves.

Batrisodes (*Excavodes*) *texanus* Chandler, 1992

Specimens examined.—2. *Williamson County*: On Campus Cave, Georgetown, V-7-1992, L. J. Graves & M. Warton; Red Crevice Cave, V-13-1991, J. Reddell & M. Reyes.

Comments.—This species was taken from the underside of rocks lightly buried in red clay in these caves.

Batrisodes (*Excavodes*) *venyivi* Chandler, 1992

Specimens examined.—2. *Bexar County*: Christmas Cave, IX-6-1993, J. Reddell & M. Reyes, beneath rock lightly buried in clay; Cave 189, 4.5 mi. NE Helotes, XI-20-1994, A. G. Grubbs.

Comments.—This species is known only from caves in the Helotes area of Bexar County west and northwest of San Antonio.

Batrisodes sp.

Specimen examined.—1. *Sutton County*: Caverns of Sonora, VIII-21-1993, G. Veni.

Comments.—A single female from western Texas is certain to be an undescribed species, but is not described here. The eyes are reduced to a few obscure granules, while the appendages are of typical length for an epigean species. A male is required to place members of *Batrisodes* in the correct subgenus, and necessary to provide the features that can be used for identification and separation from other species. The single known specimen of this species was found crawling across the concrete commercial trail deep in the cave.

Texamaurops reddelli Barr and Steeves, 1963

Specimens examined.—4. *Travis County*: Japygid Cave, 10.8 mi. NW Austin, I-3-1995, IV-11-1995, A. G. Grubbs & G. Waid; M.W.A.Cave, I-4-1995, M. Warton (2).

Comments.—This species has been found only on the Jollyville Plateau in northwestern Travis County.

Cylindrarctus bicornis Chandler, 1988

Specimens examined.—2. *Bell County*: Buchanan Cave, Fort Hood, XI-4-1998, J. Cokendolpher, J. Krejca, J. Reddell & M. Reyes; Lucky Rock Cave, Fort Hood, II-22-1996, D. Allen & L. J. Graves.

Comments.—The holotype of this rare species was not taken in a cave, but the few specimens taken subsequently have been taken from darkness in caves.

Tmesiphorus costalis LeConte, 1849

Specimens examined.—6. *Travis County*: Tooth Cave, X-8-1965, J. Calvert & J. Reddell; Twisted Elm Cave, 10.8 mi. NW Austin, IV-11-1995, A. G. Grubbs & G. Waid. *Williamson County*: Abused Cave, IV-21-1993, M. Warton; Core Barrel Cave, VI-4-1991, J. Reddell & M. Reyes; Lobo's Lair, IX-13-1991, J. Reddell & M. Reyes, berlese litter (2).

Comments.—This species is commonly taken in leaf litter. Specimens from caves have been found on the underside of rocks and in leaf litter in entrance areas. Adults have been found with ants (Chandler 1997).

Hamotus (*Hamotoides*) *electrae* Park, 1942

Specimens examined.—4. *Hays County*: Morton's Cave, 6 mi. N San Marcos, IX-9-1963, W. Russell & D. McKenzie. *Kinney County*: Bader Cave [=Rattlesnake Cave], V-3-1964, J. Reddell & D. McKenzie. *Medina County*: Valdina Farms Sinkhole, 20 mi. NW Hondo, I-12-1964, J. Reddell & D. McKenzie. *Uvalde County*: Story Cave, X-18-1964, J. Reddell & D. McKenzie.

Comments.—Adults are found in leaf litter on the surface. Specimens from caves have been found on the underside of rocks lightly buried in silt or bat guano in darkness.

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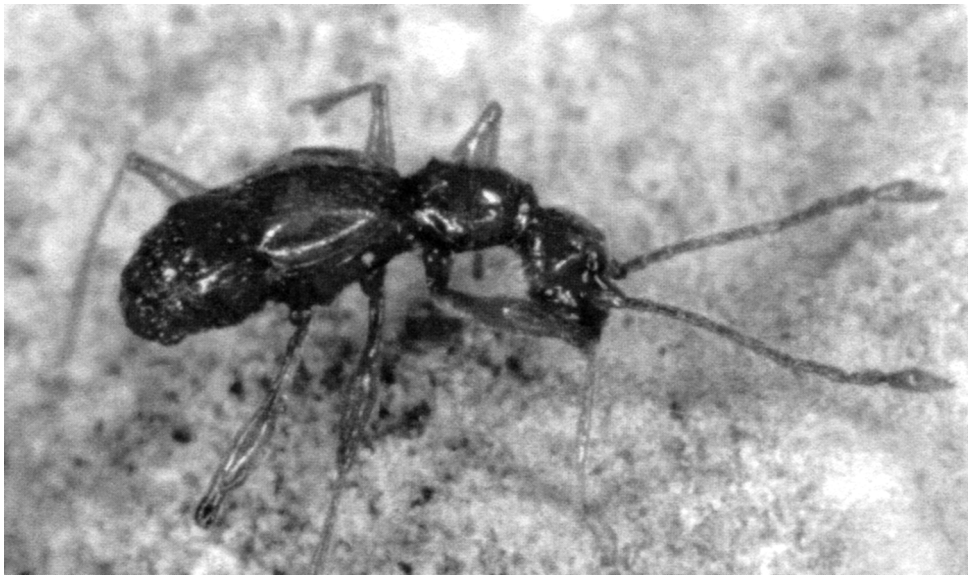

Batrisodes gravesi from Buchanan Cave, Fort Hood, Texas, Image by J.C. Cokendolpher

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ANTS (HYMENOPTERA: FORMICIDAE) FROM THE CAVES OF BELIZE, MEXICO, AND CALIFORNIA AND TEXAS (U.S.A.)

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ABSTRACT

A complete list is provided of all available records of ants from caves in Belize, Mexico, and California and Texas, U.S.A. The ecological status of species for which there is sufficient data is discussed, with special emphasis on the red imported fire ant, *Solenopsis invicta*, in Texas caves. The only species considered to be troglophiles are three Mexican species: *Brachymyrmex cavernicola*, *Oligomyrmex urichi*, and *Paratrechina pearsei*.

INTRODUCTION

Few ants are closely associated with caves despite the subterranean habits of many species. The few species once considered troglobitic (restricted to life in caves) are now generally considered as troglophiles (reproduce in caves, but also occur on the surface) or trogloxenes (enter caves sometime during life but cannot reproduce there). Wilson (1962) in a review of species considered troglobitic argues convincingly that no ants are likely to be cave-restricted. The only species in the present areas of study ever considered to be troglobites were reported from caves in Yucatán, Mexico. Of these species, *Oligomyrmex urichi* (Wheeler) was described from a cave in Trinidad but has also been found in surface localities (Wilson, 1962). *Paratrechina pearsei* Wheeler belongs to a poorly studied group and may have been recorded from the surface under another name. *Brachymyrmex cavernicola* Wheeler is a microphthalmic species that forms small nests in total darkness in caves. Wilson (1962) points out that this species belongs to a poorly studied group and may also have been recorded from the surface under another name. Its discovery in a cave in Oaxaca indicates that it is a widespread species in southern Mexico.

The only paper specifically devoted to ants from caves in this region is the study by Wheeler (1938) on ants from the caves of Yucatán, Mexico. This work listed 16 species from numerous caves. The remaining published records of ants from the caves of this region are scattered in reports on the fauna of different areas.

Most collections of ants were incidental to general biospeleological surveys in all of the areas included here. The California material was obtained as part of a study to determine the impact on potentially endangered harvestmen by construction of the New Melones Dam on the Stanislaus River. Much of the Texas ant material was obtained as part of studies on the distribution of

endangered or potentially endangered cave invertebrates in Central Texas.

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ECOLOGY

Decu, et al. (1999) provided a general discussion of cavernicole ants and divide the species into three main categories: "trogloxènes," "trogloxènes réguliers," and "trogloxènes phylétiques." The first category is used for species that only occasionally wander into caves or that inhabit entrance areas. This to a certain extent applies to the term "accidental" used by most North American workers. The second category is used to describe species that habitually enter caves, but that do not nest in caves. This essentially corresponds to the term "trogloxene" used by North American workers. The third category is used for species that nest in caves; this closely fits the concept of troglophiles as used by most American workers, that is species that can reproduce in caves but may also be found on the surface.

Many of the ants found in the caves of the areas under consideration are species that have washed or fallen into cave entrances or that inhabit leaf litter below entrances. A significant number of species recorded from caves in Mexico inhabit large entrance sinkholes that show few differences from sheltered surface habitats. All of these species can probably be considered accidentals ("trogloxènes of Decu, et al.). Insufficient habitat data exist for many of the species recorded from caves, but given the few available records for these species, they are likely not associated with the true cave habitat.

Belize: At least eight species of ants have been identified from two caves in Cayo District. With the exception of *Solenopsis geminata*, all were taken from the immediate entrance area under essentially surface conditions. *Solenopsis geminata* was found deeper in the cave and is apparently a true trogloxene.

Mexico: Yucatán Peninsula: The cavernicole ant fauna of the Yucatán Peninsula (Campeche, Quintana Roo, and Yucatán) is the most studied of any karst region in Mexico, but still is inadequately known. At least 47 species have been identified from this area, but most are accidentals. Most of the ants that have been collected were taken from within large surface sinks or in the twilight zone near cave entrances. Three species are considered herein to be troglophiles (trogloxènes phylétiques). *Brachymyrmex cavernicola* and *Paratrechina pearsei* have been found nesting in total darkness in caves in Yucatán. The third species, *Oligomyrmex urichi*, although not recorded from nests in México has been documented as nesting deep within the Guacharo Cave, Trinidad. Several genera probably contain trogloxenes (trogloxènes reguliers), but there are insufficient habitat data to properly document their ecological status.

Acromyrmex octospinosus has been taken from deep within caves in Yucatán, but there is insufficient information to indicate whether it nests in the caves or simply retreats into the caves for shelter. *Acromyrmex* are leaf-cutter ants which grow fungi on vegetable matter in their nest. Because the collectors did not note

columns of ants carrying cut leaves into the caves, they are presumably only visitors to the cave environment. *Labidus coecus* and *Labidus praedator* have been taken in the dark areas of caves and these may be considered trogloxenes. Five species of the genus *Pachycondyla* have been found in caves of the Yucatán Peninsula, with *P. harpax* being the most abundant. Unfortunately, most records do not give habitat data, but many were found in cave entrances and these species may actually be accidentals. Wheeler in 1900 (cited by Creighton, 1950) stated that *P. harpax* construct small, irregular nests in soil under stones and logs. The workers avoid direct sunlight and forage in the morning and stay in the shade as much as possible. They eat other insects and myriapods. This would therefore suggest that the *Pachycondyla* were simply staying in the shade. Because these are very large ants, it is unlikely that they could find enough to feed upon except for crickets near cave entrances. *Solenopsis* (*Solenopsis*) *geminata* is the most abundant trogloxene ant in the caves of the Yucatán Peninsula. These have been found to be extremely abundant deep in caves, where they are doubtless a significant predator on other cavernicoles.

Mexico: Other areas: Despite the vast area under consideration only 36 species have been positively identified from all parts of Mexico outside of the Yucatán Peninsula. Many collections remain unstudied, but despite this the ant fauna has been seriously neglected. The 36 known species must represent a small percentage of species that will eventually be found in the caves of Mexico.

As with Yucatán, most of the recorded species are accidentals. The only species likely to be a troglophile is *Brachymyrmex cavernicola*, recorded here for the first time from a cave outside the Yucatán Peninsula. It was found deep in a cave in Oaxaca. Three species also known as trogloxenes in Yucatán are also known from other parts of Mexico. *Labidus coecus* has been obtained in caves from Oaxaca and Tamaulipas. *Labidus praedator* has been identified from a cave in San Luis Potosí. The fire ant, *Solenopsis geminata*, is known from caves in Morelos, Oaxaca, Puebla, San Luis Potosí, Tabasco, and Veracruz. An enormous infestation occurred in Sótano de Guadalupe, San Luis Potosí, where numerous columns were present entering and leaving the 20 m entrance drop and moving deep into the cave. Prey being removed from the cave included troglobitic thysanurans and millipedes.

USA: California: The ant fauna of California caves is essentially unknown, with no records having been previously published. Six species from 15 caves and one mine tunnel are included below. With the exception of *Prenolepis imparis* all are known from a single cave and are presumably accidentals. The occurrence of *P. imparis* in 11 caves and a mine indicates that this may be a trogloxene. Unfortunately, with the exception of a record of the species in all parts of Porcupine Cave, there are no data that provide sufficient information to allow further comments on the ecological status of this species. Normally, *P. imparis* feeds on liquids, especially the honey-dew of homopterans, nectar and exudates of plants, as well as juices of dead and dying earthworms (Wheeler, 1930). This ant is well known for its dislike of dry warm habitats and possibly its occurrence in caves is a means by which it can escape the undesired conditions sometimes found in surface habitats. Some of the caves from which this species have been collected contain roots descending through cave roofs; aphids have been collected from these roots and may further explain the presence of this species deep in some of the caves.

USA: Texas: At least 36 ant species have been found in Texas caves. Most are clearly accidental, but a few are trogloxenes. *Labidus coecus* has been found in numerous caves and has been taken from nests in at least three caves. These appear, however, to be temporary bivouacs, since subsequent trips a few months later found the sites empty. *Labidus coecus* is a generalist and feeds upon whatever source of food can be found with high protein content. Because most of their movements are in subterranean voids it is not entirely surprising to find them moving through caves (Fig. 1). Three species of fire ants, *Solenopsis geminata*, *S. invicta*, and *S. xyloni*, have all been found in Texas caves. *Solenopsis geminata* and *S. xyloni* have each been found in only three caves. A population of *S. geminata* in Featherman's Cave, Travis County, was observed to prey on cave invertebrates. This species, however, has been largely replaced in Central Texas by *S. invicta*.

The most important cave-associated ant in Texas is the red imported fire ant, *Solenopsis invicta*. This species was first introduced into the United States near Mobile, Alabama, in about 1930. It has since expanded its range to include large parts of the southern United States. The Texas distribution of this and other fire ants is plotted in Francke, et al. (1983). This species has had a devastating effect on cave fauna in all areas within its range. Studies by Nichols and Sites (1989) and Porter and Savignano (1990) have documented the impact of *S. invicta* on epigean arthropod communities.

Although there is little information available on early infestations of Texas caves, a few caves were found to have been invaded in the late 1980s. The U.S. Fish & Wildlife Service placed five Texas cave invertebrates on the federal endangered species list (Chambers and Jahrsdorfer, 1988). These species are the Tooth Cave pseudoscorpion *Tartarocreagris texana* (Muchmore), the Tooth Cave spider *Neoleptoneta myopica* (Gertsch),

the Bee Creek Cave harvestman *Texella reddelli* Goodnight and Goodnight, the Tooth Cave ground beetle *Rhadine persephone* Barr, and the Kretschmarr Cave mold beetle *Texamaurops reddelli* Barr and Steeves. Two additional species, the Bone Cave harvestman *Texella reyesi* Ubick and Briggs and the Coffin Cave mold beetle *Batrisodes (Excavodes) texana* Chandler, were added to the list (Chambers, 1993). All of these species are restricted to small areas of Travis and Williamson Counties. The concern for protecting these species in this rapidly urbanizing area led to numerous intensive studies on cavernicole fauna. With the greater attention to the cave fauna of this region came the realization that *S. invicta* was a serious threat to the survival of the endangered and other species in the caves of Central Texas. A study in 1991 by William R. Elliott and James R. Reddell found 24 of 64 known endangered species caves to have serious infestations of fire ants (Elliott, 1992, 1993). The infestation of caves in this and other areas of Central Texas has steadily increased since that time, and most caves have at least some degree of infestation throughout the area.

Fig. 8.--Rut made by *Labidus coecus* in Ant-Path Passage, Powell's Cave, Menard County, Texas; by David Meredith, 1960s.

A study by Cokendolpher and Francke (1985) revealed that the temperature and humidity in Texas caves is nearly optimal for *S. invicta*. The greatest infestation of Texas caves by fire ants is during periods of drought. Most of the caves containing endangered species are less than 50 m long and 10 m deep. Under hot, dry conditions in the summer, fire ants can be found in all parts of the caves that are humanly accessible. Only one nest has been found away from cave entrances and it did not appear to be viable. Other nests have been found in larger soil-floored sinkhole entrances or crawlways leading into caves.

During the most severe infestations the entire floor and much of the walls of the cave are carpeted with ants. Under these conditions essentially the only fauna that can be found are cave crickets (*Ceuthophilus* spp.) and harvestmen (*Leiobunum townsendii* Weed) that roost on the ceiling, and a few larger, fast-moving spiders. Less severe infestations usually consist of columns moving from the entrance deep into the dark zone. These columns usually lead directly to prey. The greatest impact on cave fauna has been to slower, sedentary species. Predation has been observed on earthworms, the troglobitic millipedes *Cambala speobia* (Chamberlin) and *Speodesmus* spp., the common troglophile scorpion *Pseudouroctonus reddelli* (Gertsch and Soleglad), the pseudoscorpion *Tyrannochthonius texanus* Muchmore, cave crickets of the genus *Ceuthophilus*, dipteran larvae, and the white-throated slimy salamander *Plethodon albagula* Grobman. In Williams Cave No. 1, Williamson County, hundreds of exoskeletons of the troglobitic millipede *Cambala speobia* were found. A trail extended more than 20 m into the cave to end at a still-living but doomed millipede. Ants were observed crawling into the millipede, removing tissue and bringing it out to join a column exiting the cave.

Even though no direct observations have been made on predation by fire ants on the endangered species, the rarity of these small animals within the caves makes such observations unlikely. Probably the greatest ultimate impact on the ecology of caves by fire ant predation is the reduction of cave cricket populations. The cave cricket genus *Ceuthophilus* is a major source of nutrients for caves in this area. Of three species found in local caves, one species, *Ceuthophilus (Geotettix) cunicularis* Hubbell, is a troglophilic floor-dwelling species. This species has disappeared from some caves following fire ant invasion. In other caves, a few individuals have been found on cave walls where they have retreated, presumably in an attempt to escape the ants. The adults of other species roost on the ceiling and are less susceptible to direct predation by fire ants. Their eggs, however, are laid in cave soil and the

nymphs largely live on the floor. Very heavy predation on nymphs has been observed throughout the area.

A primary concern for recovery of the endangered invertebrates is to find a practical, ecologically sound method for control of *S. invicta* (Elliott, 1993b; O'Donnell, et al., 1994). Dr. William R. Elliott has conducted several studies on cave ecology, cave cricket foraging, and control of fire ants around several caves in Central Texas (1993, 1994). His studies indicate that most cave crickets forage within 30 m of cave entrances. Two control methods consisted of baiting with the low-impact pesticides Amdro® (hydramethylnon) and Logic® (fenoxycarb). These baits are formulated on corn grit with soybean oil. Amdro is a toxicant, whereas Logic impairs insect reproduction. The third method was the direct application of hot water to the mounds. The baiting methods were both found to be effective, but concerns exist over their impact on cave cricket populations since the crickets find the baits attractive. Hot water was the most effective method for immediate destruction of colonies and had the most lasting effects, but is extremely labor intensive. Recent attempts at control have included applications of hot water within 30 m of cave entrances and the placement of baits in areas beyond that. Despite the success of these treatments, reinfestation occurs following mating flights.

The results of studies on the impact of *S. invicta* indicate that without a continuous program of control, cave fauna will continue to be severely impacted. Despite the short-term success of treatment using boiling water and baits, the cost in time and money makes it costly to treat large numbers of caves over long periods of time. Survival of the cave fauna, however, requires that these methods be used until a permanent biological control method is devised.

FAUNA LIST

The following list of records includes all ants known to occur in the caves of Belize, Mexico, and California and Texas (U.S.A.). The only literature cited are those papers that specifically record the species in caves in the areas under consideration. Collection data are provided for all specimens obtained during studies by James Reddell and other speleologists conducting studies in Belize, Mexico, California and Texas. The initials of the taxonomists studying this material are included in parentheses following the record. These are: WLB – W.L. Brown, Jr., Cornell University; ACC – A.C. Cole, The University of Tennessee, Knoxville; JCC – James C. Cokendolpher, Lubbock, Texas; DRS - D.R. Smith, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; RRS – Roy R. Snelling, Los Angeles County Museum of Natural History. Many of the identifications by DRS were later verified by RRS. Specimens identified by W.L. Brown, Jr., A.C. Cole, and R.R. Snelling are deposited in the Los Angeles County Museum of Natural History. Specimens identified by James C. Cokendolpher are in the collection of the Texas Memorial Museum, The University of Texas at Austin.

Subfamily Ponerinae

Anochetus sp.

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, 1975).

Comment.—This is an accidental taken from the main entrance sink.

Gnamptogenys strigata (Norton)

Record.—MEXICO: *Veracruz*: Cueva de la Sala de Agua Grande, 5 km N Cuitlahuac, 4 Jan. 1977 (A. Grubbs, D. McKenzie, J. Reddell, D. McKenzie) (RRS, 1981).

Comment.—This species was found in the main entrance room.

Hypoponera spp.

Records.—MEXICO: *Campeche*: Actún Huachap, 14 km NNW Bolonchenticul, 24 June 1975 (A. Grubbs, D. McKenzie, W. Russell, S. Wiley) (DRS, 1978); Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 13 May 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981). *San Luis Potosí*: Ventana Jabalí, 20 km NE Ciudad Valles (W. Bell, D. McKenzie, T. Raines) (ACC).

USA: TEXAS: *Travis County*: Three-Holer Cave, 1 May 1992 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1992). *Williamson County*: Lobo's Lair, 13 Sept. 1991 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1992); Pussy Cat Cave, 6 June 1991 (D. Allen, W. Elliott) (JCC, 1992).

Comments.—The status of this material is unknown. Members of this genus nest in small colonies generally in soil or rotten wood. They rarely forage on the surface and as far as known (Creighton, 1950) all species feed on insects or other small arthropods.

Hypoponera sp. 1

Records.—MEXICO: *Campeche*: Grutas de San

Antonio, 10 km NNE Bolonchenticul, 3 Nov. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *Oaxaca*: Cueva de Juan Sánchez, 10 km NW Acatlán, 26 Dec. 1976 (A. Grubbs, J. Reddell, C. Soileau) (RRS, 1981). *Yucatán*: Cenote de Sambulha, Motul, 28 March 1973 (S. Murphy, J. Reddell) (DRS, RRS, 1981).

Comment.—The status of this material is unknown.

Hypoponera sp. 2

Records.—MEXICO: *Campeche*: Grutas de San Antonio, 10 km NNE Bolonchenticul, 23-24 Nov. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *Tamaulipas*: Sótano de Santa Elena, 14 km SE Antiguo Morelos, 6 Jan. 1971 (W. Elliott, J. Shepperd) (DRS, RRS, 1981). *Veracruz*: Cueva de la Sala de Agua Grande, 5 km N Cuitlahuac, 4 Jan. 1977 (A. Grubbs, D. McKenzie, J. Reddell, C. Soileau) (RRS, 1981).

Comment.—The status of this material is unknown.

Hypoponera sp. 3

Record.—MEXICO: *Yucatán*: Cenote Sucopo, Sucopo, 31 March 1973 (S. Murphy, J. Reddell) (DRS, RRS, 1981).

Comment.—The status of this material is unknown.

Hypoponera sp. 4

Records.—MEXICO: *San Luis Potosí*: Sótano de la Tinaja, 10.5 km NE Ciudad Valles, 4 July 1970 (D. Broussard, J. Cooke, R. Mitchell) (DRS, RRS, 1981); 16 March 1972 (J.M. Rowland) (DRS, RRS, 1981).

Comment.—The status of this material is unknown.

Hypoponera sp. 5

Record.—MEXICO: *San Luis Potosí*: Sótano de Santa Elena, 14 km SE Antiguo Morelos, 6 Jan. 1970 (W. Elliott, W. Russell) (DRS, RRS, 1981).

Comment.—The status of this material is unknown.

Hypoponera sp. 6

Record.—MEXICO: *San Luis Potosí*: Cueva de Taninul no. 1, 13 km SE Ciudad Valles, 29 March 1970 (W. Elliott, S. Wiley) (DRS, RRS, 1981).

Comment.—The status of this material is unknown.

Hypoponera inexorata (Wheeler)

Record.—USA: TEXAS: *Williamson County*: Deliverance Cave No. 1, 18 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994).

Comment.—This species was taken just inside the entrance.

Hypoponera opaciceps (Mayr)

Ponera opaciceps: Wheeler, 1938:251; Pearse, 1945:189; Reddell, 1971b:76.

Records.—MEXICO: *Yucatán*: Cenote de Sambulá, Motul (Wheeler, 1938); Cueva de San Isidro, Mérida (Wheeler, 1938). USA: TEXAS: *Bexar County*: Stealth Cave, 29 Oct. 1997 (P. Sprouse, G. Veni) (JCC, 1998).

Comment.—This species was found from under stones and debris near cave entrances in Mexico. The specimens from Texas probably washed into the cave.

Hypoponera opacior (Forel)

Ponera trigona opacior: Reddell, 1966b:37.
Hypoponera opacior: Davis, 1979:85, 131, 134, 136; Reddell, 1988c:44.

Records.—USA: TEXAS: *Bexar County*: Eagles Nest Cave, 20 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1999); Strange Little Cave, 29 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994); Voight's Bat Cave, 13 Sept. 1984 (S. Harden, G. Veni) (RRS, 1985). *Coryell County*: Porter Cave, Fort Hood, 8 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1999). *Uvalde County*: Indian Creek Cave, 3 Dec. 1963 (J. Reddell), on 60 ft. level (ACC, 1964).

Comments.—This species is probably an accidental; collections for which habitat data are available were taken from near the entrance.

Hypoponera punctatissima (Roger)

Ponera ergatandria: Wheeler, 1938:251; Pearse, 1945:189; Reddell, 1971b:76.
Hypoponera punctatissima: Reddell, 1977b:235; Reddell, 1981:237.

Records.—MEXICO: *Campeche*: Grutas de Monte Bravo, 10 km NW Cantemo, 19 Dec. 1974 (L. Elliott, D. McKenzie, J. Reddell) (RRS, 1977); Grutas de San Antonio, 10 km NNE Bolonchenticul, 23-24 Nov. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *San Luis Potosí*: Ventana Jabalí, 20 km NE Ciudad Valles, 12 July 1969 (J. Peck, S. Peck) (RRS, 1977). *Yucatán*: Cenote Sihunchén, Sihunchén, 23 March 1973 (M. Butterwick, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comments.—Specimens from Grutas de Monte Bravo and Grutas de San Antonio were taken from the

entrance sinks; specimens from Cenote Sihunchén were taken from leaf litter in darkness.

Leptogenys sp.

Record.—MEXICO: *Campeche*: Grutas de Xkalumkín, 5 km W Cumpich, 20 June 1975 (A. Grubbs, D. McKenzie, J. Reddell, S. Wiley) (DRS, 1978).

Comment.—This material was taken from near the entrance.

Leptogenys sp. 1

Records.—MEXICO: *Oaxaca*: Cueva del Lencho Virgen, 9 km SSW Acatlán, 3 Jan. 1973 (D. McKenzie, J. Reddell) (DRS, RRS, 1981); Grutas de Monteflor, Monteflor, 6 km N Valle Nacional, 28 Dec. 1973 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comment.—This material was taken from near the entrance.

Leptogenys sp. 2

Records.—MEXICO: *Quintana Roo*: Cenote de Juan Coh, Felipe Carrillo Puerto, 4 July 1975 (A. Grubbs, D. McKenzie, J. Reddell) (RRS, 1977). *Yucatán*: Cueva de Orizaba, Orizaba, 8 km S Buenaventura, 1 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981).

Comment.—Specimens from these caves were taken from the entrance area.

Leptogenys sp. 3

Record.—MEXICO: *Yucatán*: Cenote Amil, 6 km S Abalá, 28 March 1973 (J. Reddell, M. Rodríguez) (RRS, 1977).

Comment.—This material was taken from below the entrance drop.

Leptogenys elongata (Buckley)

Leptogenys elongata: Reddell, 1966b:37; Mitchell and Reddell, 1971:83; Reddell, 1988c:44; Reddell, 1992a:137.

Records.—USA: TEXAS: *Bell County*: Big Ash Tree Sink, Fort Hood, 14 March 1992 (J. Reddell, M. Reyes) (JCC, 1992); Big Crevice, Fort Hood, 6 June 2000 (J. Reddell, M. Reyes) (JCC, 2000); Chimney Windows Cave, Fort Hood, 19 May 1999 (J. Reddell, M. Reyes) (JCC, 1999); Seven Mile Mountain Cave, Fort Hood, 11 April 1999 (R. Price, M. Warton) (JCC, 1999). *Bexar County*: Backhole, 9 Sept. 1998 (J. Cokendolpher, J. Krejca) (JCC, 1999); John Wilson Ranch Cave no. 3, 23 Dec. 1962 (O. Knox) (ACC, 1963); Kamikazi Cricket Cave, 3 Oct. 1984 (G. Veni) (RRS, 1985); Skull Cave, 25 Sept. 1984 (G. Veni, R. Waters) (RRS, 1985). *Coryell County*: Brokeback Cave, 16 Aug. 1964 (D. McKenzie, J. Reddell) (ACC, 1965); Cornelius Cave, Fort Hood, 21 Nov. 1995 (J. Reddell, M. Reyes) (JCC, 1996). *Stonewall County*: Aspermont Bat Cave, May 1963 (J. Reddell, W. Russell) (ACC, 1964). *Travis County*: Tooth Cave, 2 March 1963 (J. Reddell) (ACC, 1963). *Williamson County*: Forest Trail Pit, 10 Nov. 1991 (M. Warton) (JCC, 1992).

Comments.—This species is presumably an accidental; it is usually found near cave entrances. It is known to build its nest in soil or rotten logs and feeds largely on isopods of the genera *Armadillium* and *Oniscus* which are only found in the entrances of caves.

Odontomachus sp.

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comment.—This accidental was taken in the main entrance sink.

Odontomachus clarus Roger

Record.—USA: TEXAS: *Bexar County*: Platypus Pit, 30 May 1996 (J. Ivy), Zone 1 (JCC, 1996).

Comment.—This accidental was taken in the entrance area.

Odontomachus ruginodis M.R. Smith

Odontomachus haematoda: Wheeler, 1938:251; Reddell, 1971b:76.

Records.—MEXICO: *Tabasco*: Cueva del Azufre, 3.5 km S Tapijulapa, 15 June 1975 (A. Grubbs, D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *Yucatán*: ?Cueva Segunda del Camino a San Roque, on road from Oxkutzcab to San Roque (Wheeler, 1938).

Comment.—This species was taken near the entrance to Cueva Segunda del Camino a San Roque (Wheeler, 1938).

Pachycondyla spp.

Euponera sp.: McKenzie, 1965:35; Reddell, 1971b:75; Reddell and Mitchell, 1971a:158.

Records.—MEXICO: *Campeche*: Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 25 Nov. 1974 (D. McKenzie, J. Reddell, S. Wiley) (DRS, RRS, 1978). *Chiapas*: Cueva del Salto de Agua, 15 km SE Palenque, Dec. 1973 (D. Coons, A. Cochrane) (DRS, RRS, 1981); *San Luis Potosí*: Ventana Jabalí, 20 km NE Ciudad Valles, 26 March 1964 (W. Bell, D. McKenzie, T. Raines) (ACC).

Comments.—Specimens from Grutas de Xtacumbilxunam were taken from the large entrance sink. This is presumably an accidental.

Pachycondyla sp. 1

Records.—MEXICO: *Yucatán*: Actún Kaua, 1 km S Kaua, 9 Nov. 1974 (J. Reddell) (RRS, 1977); Actún Sabacá, 6 km SW Tekax, 4 Dec. 1974 (J. Andrews, D. McKenzie, R. Mitchell, J. Reddell, S. Wiley) (RRS, 1977).

Comment.—This species was taken from near the cave entrance.

Pachycondyla apicalis (Latreille)

Neoponera latreille: Wheeler, 1938:251; Pearse, 1945:188; Reddell, 1971b:76.

Pachycondyla apicalis: Reddell, 1977b:235; Reddell, 1981:237.

Records.—MEXICO: *Campeche*: Grutas de Xtacumbilxunam, 2 km SW Bolonchenticul, 13 May 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981). *Quintana Roo*: Cenote de Juan Coh, Felipe Carrillo Puerto, 4 July 1975 (A. Grubbs, D. McKenzie, J. Reddell) (RRS, 1977); Cenote de Tos Virlol, 13 km S Señor, 4 July 1975 (A. Grubbs, J. Reddell) (RRS, 1977). *Yucatán*: Cenote Aká Chen, 1 km E Tixcancal, 2 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); Grutas de Balankanche, 4 km E Chichén Itzá, 10-12 Dec. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); Cueva Segunda del Camino a San Roque, on road from Oxkutzcab to San Roque (Wheeler, 1938); Cueva del Cinco de Mayo, 1 km SW Tekax (Wheeler, 1938); Actún Puz, near Oxkutzcab (Wheeler, 1938); Actún Tucil, 2 km S Muna, 27 March 1973 (J. Reddell) (DRS, RRS, 1981); Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comments.—The material reported by Wheeler (1938) was taken near cave entrances. The remaining material for which locality data is available was also taken near cave entrances.

Pachycondyla carinulata (Roger)

Pachycondyla carinulata: Reddell and Veni, 1996:137.

Record.—BELIZE: *Cayo*: Cebada Cave, Zone B, 9 May 1986 (G. Veni) (RRS, 1986).

Comment.—This species was taken in twilight less than 20 m from the cave entrance.

Pachycondyla ferruginea (F. Smith)

Records.—MEXICO: *San Luis Potosí*: Sótano de Guadalupe, 10 km W Aquismón, 18 March 1980 (D. Pate) (WLB, 1981); Ventana Jabalí, 20.5 km NE Ciudad Valles, 12 July 1969 (J. Peck, S. Peck) (RRS, 1981); Cueva de Oxtalja, Tamapatz, 30 Aug. 1980 (S. Balsdon, P. Sprouse, T. Treacy) (WLB, 1981). *Yucatán*: Actún Sabacá, 6 km S Tekax, 4 Dec. 1974 (J. Andrews, D. McKenzie, R.W. Mitchell, J. Reddell, S. Wiley) (RSS, 1981).

Comment.—This species was taken from near the cave entrance of Actún Sabacá.

Pachycondyla harpax (Fabricius)

Pachycondyla harpax montezumia: Wheeler, 1938:251; Pearse, 1945:188; McKenzie, 1965:38; Reddell, 1967f:54; Reddell, 1970c:53; Reddell, 1971b:76 [part—Yucatán record only]; Reddell and Mitchell, 1971a:158; Reddell and Mitchell, 1971b:196; Reddell, 1981:237; Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Pachycondyla harpax: Reddell, 1977b:235.

Records.—MEXICO: *Campeche*: Actún Halmensura, 5 km E Cumpich, 31 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *Oaxaca*: Grutas de Monteflor, Monteflor, 6 km N Valle Nacional, 28 Dec. 1973 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); Sótano Sin Hondo, 5 km SSW Acatlán, 28 Dec. 1976 (R. Hemperly) (RRS, 1981). *San Luis Potosí*: Sótano del Arroyo, 12 km NNE Ciudad Valles, 25 Nov. 1963 (J. Reddell), found on 10 m level (ACC, 1964); Cueva Chica, 16 km SE Ciudad Valles, 26 March 1964 (W. Bell, D. McKenzie, T. Raines) (ACC, 1964); Sótano de Yerbaniz, 21.5 km N Ciudad Valles, 7 Jan. 1970 (S. Wiley) (DRS, RRS, 1981).

Tamaulipas: Sótano del Molino, 1 km NW Gómez Farías, 168.5 m elev., June 1964 (T. Raines) (ACC, 1964); Sótano de la Joya de Salas, Joya de Salas, 15 km NW Gómez Farías, 1560 m elev., 3 June 1965 (J. Fish, O. Knox, Jr., D. McKenzie) (ACC, 1965). *Yucatán*: Actun Góngora, near Oxkutzcab (Wheeler, 1938); Cueva de Orizaba, Orizaba, 6 km S Buenaventura, 1 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Actún Sabacá, 6 km SW Tekax, 4 Dec. 1974 (J. Andrews, D. McKenzie, R. Mitchell, J. Reddell, S. Wiley) (RRS, 1977); Grutas de Tzab-Nah, 2 km S Tecoh, 1 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); Actún Ziz, Oxkutzcab, 3 Dec. 1974 (A. Gamboa, D. McKenzie, R. Mitchell, J. Reddell, S. Wiley) (RRS, 1977).

USA: TEXAS: *Medina County*: Weynand Cave, 12 Aug. 1965 (J. Fish, J. Reddell), in entrance room (ACC, 1966).

Comments.—Wheeler (1938) reported this species from under stones near the mouth of Actún Góngora. It was generally found near the entrance of the other caves.

Pachycondyla stigma (Fabricius)

Euponera stigma: Reddell and Mitchell, 1971b:196.

Records.—MEXICO: *San Luis Potosí*: Cueva de San Pedro, 4 km N Tlamaya, 28 Dec. 1984 (P. Sprouse) (RRS, 1985); Cueva Tepametl, 3 km NE Tlamaya, 26 Dec. 1984 (T. Raines) (RRS); Sótano de Tlamaya, Tlamaya, 2.5 km NNW Xilitla, 26 Nov. 1964 (W. Bell, T. Raines) (ACC, 1965); 21 Nov. 1983 (P. Sprouse) (RRS, 1985). *Tamaulipas*: Sótano de Gómez Farías, 3 km ESE Gómez Farías, 300 m elev., 6 Dec. 1964 (T. Raines) (ACC, 1965).

Comment.—This species is probably an accidental.

Pachycondyla unidentata Mayr

Record.—MEXICO: *San Luis Potosí*: Sótano de Tampamache, 8 km NW Aquismón, 31 Aug. 1986 (P. Sprouse) (RRS, 1986).

Comment.—The status of this material is unknown.

Pachycondyla villosa (Fabricius)

Neoponera villosa inversa: Wheeler, 1938:251; Pearse, 1945:188; Reddell, 1971b:76.
Neoponera villosa: Reddell and Mitchell, 1971b:196.
Pachycondyla villosa: Reddell, 1977b:235; Reddell, 1981:237.

Records.—MEXICO: *Campeche*: Grutas de San Antonio, 10 km NNE Bolonchenticul, 3 Nov. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *Quintana Roo*: Cenote de Juan Coh, Felipe Carrillo Puerto, 4 July 1975 (A. Grubbs, D. McKenzie, J. Reddell) (RRS, 1977). *Tamaulipas*: Sótano del Molino, 1 km NW Gómez Farías, 268.5 m elev., June 1964 (T. Raines) (ACC, 1964). *Yucatán*: Cueva del Cinco de Mayo, 1 km SW Tekax (Wheeler, 1938); Actún Silil, 3 km S Calcehtok, 23 June 1975 (W. Russell, W. Wiley) (RRS, 1977); Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comments.—Wheeler (1938) reported this species from near the mouth of Cueva del Cinco de Mayo. It was found in cave entrance areas of the other caves. Sótano del Molino floods and the species possibly washed into that cave.

Proceratium sp. prob. *compitale* Ward

Record.—USA: TEXAS: *Val Verde County*: Seminole Sink, Nov. 1984 (L. Bement).

Comments.—This species was taken from the entrance room. RRS, 1985, identified this sample as *Proceratium pergandei* (Emery), but because that identification was before Ward (1988) described *P. compitale*, we assume Snelling's identification is incorrect. Ward noted that the nearest *P. pergandei* record was from Bandera County. All the records Ward presented from Val Verde and Terrell Counties were of *P. compitale*.

Proceratium compitale Ward

Proceratium compitale Ward, 1988:102, 104, 112, 113-115, 117, figs. 6, 10, 13; Cokendolpher and Francke, 1990:14, 15, 45.

Records.—MEXICO: *Coahuila*: Cueva de los Lagos, 15 mi. NW Ciudad Acuña, 27 Jan. 1966 (J. Reddell) (Ward, 1988).

USA: TEXAS: *Sutton County*: Caverns of Sonora, 25 Oct. 1993 (G. Veni). *Val Verde County*: Emerald Sink, 30 Nov. 1984 (J. Reddell, M. Reyes) (Ward, 1988). *Terrell County*: Blackstone Cave, 5 Feb. 1967 (D. Erickson, D. McKenzie) (Ward, 1988). *Uvalde County*: Barn-Sized Fissure Cave, 17 March 1993 (A. Grubbs) (JCC, 1993).

Comments.—Although this species is known only from caves it will certainly be found in other cryptic habitats on the surface. The type-locality is Emerald Sink.

Subfamily Ecitoninae

Members of this subfamily are the army ants. According to Watkins (1985), most of the USA army ants are mostly hypogaeic in their nesting, raiding, and migrating behavior. The few exceptions are species whose raids and migrations are partially epigaeic, especially when the soil moisture is high. Although many species prefer to predate upon brood of ants of other species, others are generalists and will feed upon practically anything with a high protein content, including living and dead arthropods, carrion and pieces of various nuts.

Eciton burchellii (Westwood)

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comment.—This species was found in the main entrance sink.

Labidus coecus (Latreille)

Eciton (*Labidus*) *coecus*: McKenzie and Reddell, 1964:42; Reddell, 1966b:36; Reddell, 1967f:27; Reddell, 1970c:53.

Labidus coecus: Davis, 1979:85, 131, 134, 136, 137; Reddell, 1981:237; Reddell, 1988c:44.

Labidus (*Eciton*) *coecus*: Davis, 1979:84-85.

Eciton coecum: Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Records.—MEXICO: *Oaxaca*: Cueva de las Bellotas, 5 km NW Santiago Apoala, 2240 m elev., 3 Jan. 1973 (J. Reddell) (DRS, RRS, 1981); Cueva del Guano, 8 km N Valle Nacional, 28 Dec. 1972 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981). *Tamaulipas*: Cueva del Cañón del Burro, 8 km N San Antonio, 700 m elev., 2 Sept. 1984 (D. Pate) (RRS, 1985). *Yucatán*: Actún Loltún, 7 km SSW Oxkutzcab, 25-26 July 1975 (A. Grubbs, D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977).

USA: TEXAS: *Bell County*: Camp 6 Cave No. 1, Fort Hood, 22 Feb. 1996 (D. Allen, L.J. Graves, D. Love) (JCC, 1996); Soldiers Cave, Fort Hood, 25 March 1999 (J. Reddell, M. Reyes) (JCC, 1999). *Bexar County*: Dirtwater Cave, 2 Aug. 1983 (J. Ivy, G. Veni) (RRS, 1984); Poor Boy Baculum Cave, 15 Dec. 1994 (W. Elliott, B. Johnson), Zone 1, 2, 3 (JCC, 1995); Root Canal Cave, 30 Nov. 1994 (G. McDaniel) (JCC, 1995); Stevens Ranch Trash Hole Cave, 12 June 1993 (J. Loftin) (JCC, 1993); Strange Little Cave, 29 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994). *Burnet County*: Longhorn Caverns (Crownover Cave section), 24 Sept. 1999 (A. Cobb) (JCC, 1999). *Coryell County*: Briar Cave, Fort Hood, 15 Jan. 1992 (L.J. Graves, J. Reddell) (JCC, 1992); Egypt Cave, Fort Hood, 21 Jan. 1992 (J. Reddell, M. Reyes) (JCC, 1992); Frank's Cave, 1 Feb. 1963 (D. McKenzie) (ACC, 1963); Rocket River Cave System (B. R's Secret Cave), 9 Feb. 1992 (L.J. Graves, J. Reddell, M. Reyes) (JCC, 1992); Saltpeter Cave, Fort Hood, 8 Sept. 1997 (J. Reddell, M. Reyes) (JCC, 1997). *Hays County*: Ezell's Cave (Davis, 1979). *Kendall County*: Pfeiffer's Water Cave, 7 Nov. 1992 (P. Chippendale, A. Grubbs, J. Hunter) (JCC, 1993). *Kerr County*: Seven Room Cave, Jan. 1966 (J. Fish, J. Reddell), entrance room (ACC, 1966). *Medina County*: Lutz Cave, Feb. 1966 (D. McKenzie, W. Russell), present in thousands from entrance to end of cave (ACC, 1966). *Menard County*: Powell's Cave, 23 Feb. 1991 (G. Veni) (JCC, 1991). *Sutton County*: Caverns of Sonora, entrance to Sam Odom Pit, 27 July 1994 (G. Veni, B. Sawyer) (JCC, 1994); Caverns of Sonora, dome intersected by utility borehole at entrance to Hall of the White Giants, 3 Aug. 1996 (G. Veni) (JCC, 1996). *Travis County*: Contortionist Cave, Dec. 1994 (M. Warton) (JCC, 1995); Ireland's Cave, 1 March 1986 (D. Pate) (RRS, 1986); Weldon Cave, 6 Feb. 1965 (D. McKenzie, J. Reddell) (ACC). *Val Verde County*: Emerald Sink, 3 Nov. 1984 (J. Reddell, M. Reyes) (RRS, 1985); *Williamson County*: Beck Crevice Cave, 3 June 1996 (J. Reddell, M. Reyes), from nest in total darkness (JCC, 1996); Beck Sewer Cave, 23 Jan. 1965 (R. Mitchell, J. Reddell) (ACC, 1966); 27 Sept. 1965 (J. Calvert Reddell, J. Reddell), in two colonies in silt in main first room 75 ft. from entrance in darkness (ACC, 1966); Cricket Cave, 30 March 1965 (J. Reddell) (ACC, 1966); Fern Bluff Cave, 5 July 1986 (W. Elliott) (RRS, 1986); LakeLine Mall Well Trap No. 3, 19 Oct. 1990 (L. Sherrod), lower bottle (JCC, 1991); LakeLine Mall Well Trap No. 4, 15 Oct. 1990 (L. Sherrod), 25 Oct. 1990 (L. Sherrod) (JCC, 1991); LakeLine Mall Well Trap No. 5, 19 Oct. 1990 (L. Sherrod) (JCC, 1991); 29 Oct. 1990 (L. Sherrod); LakeLine Mall Well Trap No. 6, 19 Oct. 1990 (L. Sherrod), lower trap (JCC, 1991); 25 Oct. 1990 (L. Sherrod), lower trap baited with blue cheese; 29 Oct. 1990 (L. Sherrod), lower trap (JCC, 1991); Testudo Tube, Jan. 1991 (L. Sherrod), (JCC, 1992); 21 Dec. 1992 (J. Reddell) (JCC, 1993).

Comments.—This trogloxene is frequently abundant in caves. Bivouacs have been found in Beck Crevice Cave, Beck Sewer Cave, and Testudo Tube in darkness. See discussion on ecology above for further discussion of the species. Decu, Casale, Scaramozzino, López, and Tinaut (1998) erroneously reported that Beck Sewer Cave and Lutz Cave are in Mexico.

Labidus praedator (F. Smith)

Labidus praedator: Reddell, 1981:237.

Records.—MEXICO: *San Luis Potosí*: Sótano de Yerbaniz, 21.5 km NNE Ciudad Valles, 241.5 m elev., 17 Feb. 1970 (collector unknown) (DRS, RRS, 1981). *Yucatán*: Grutas de Balankanche, 4 km E Chichén Itzá, 10-12 Dec. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); Cenote de Hoctún, 1 km W Hoctún, 16 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981).

Comment.—Specimens from Cenote de Hoctún were taken from bat guano.

Neivamyrmex fallax Borgmeier

Neivamyrmex fallax: Reddell, 1966b:37.

Record.—USA: TEXAS: *Travis County*: Cotterell Cave, 25 Feb. 1963 (W. Russell) (ACC, 1963).

Comment.—This is presumably an accidental.

Nomamyrmex esenbeckii wilsoni (Santschi)

Records.—MEXICO: *Quintana Roo*: Cueva de Kopoil, 0.5 km N Kopoil, 3 July 1975 (A. Grubbs, J. Reddell) (RRS, 1977). *Yucatán*: Cenote Aká Chen, 1 km E Tixcancal, 2 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS. 1977).

Comment.—These specimens were taken from below cave entrances.

Nomamyrmex hartigii (Westwood)

Record.—MEXICO: *Oaxaca*: Cueva de Juan Sánchez, 10 km NW Acatlán, 26 Dec. 1976 (A. Grubbs, J. Reddell, C. Soileau) (RRS, 1981).

Comment.—This is probably an accidental washed into the cave.

Subfamily Pseudomyrmecinae

Pseudomyrmex sp.

Record.—MEXICO: *Quintana Roo*: Cenote de Las Ruinas, 6 km ENE Polyuc, 29 July 1975 (A. Grubbs, D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977).

Comment.—This accidental species was found near the entrance.

Subfamily Myrmicinae

Acromyrmex octospinosus (Reich)

Acromyrmex ectospinosus ekchuah Wheeler, 1937:74; Wheeler, 1938:252; Pearse, 1945:189; Reddell, 1971b:75.

Acromyrmex octospinosus echinatior: Wheeler, 1938:252.

Acromyrmex octospinosus: Wheeler, 1938:251; Reddell, 1977b:235; Reddell, 1981:237; Zeppelini Filho and Castaño Meneses, 1995:11.

Records.—MEXICO: *Yucatán*: Cenote Aká Chen, 1 km E Tixcancal, 2 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); Cenote Calchum, 1 km E Hacienda San Bernardo, 16 April 1973 (D. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Actún Chukum, 2 km S Maxcanú, 29 Nov. 1974 (D. McKenzie, R. Mitchell, J. Reddell, S. Wiley) (RRS, 1977); Cenote G, Ruinas de Aké, 26 March 1973 (M. Butterwick, M. McKenzie, J. Reddell) (DRS, RRS, 1981); Actún Góngora, near Oxkutzcab (Wheeler, 1937); Cueva Luchil, 8 km SSE Mérida (Wheeler, 1937); Actún Puz, Oxkutzcab (Wheeler, 1937); Cenote de Sambulá, Mérida (Wheeler, 1937); Cenote de Sihunchén, Sihunchén, 23 March 1973 (M. Butterwick, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Actún Toh (Zeppelini Filho and Castaño Meneses, 1995); Grutas de Tzab-Nah, 2 km S Tecoh, 22 April 1973 (D. McKenzie, J. Reddell) (RRS, 1977); Actún Xkyc, 2 km S Calcehtok (Wheeler, 1937); 1 May 1973 (E. Alexander, M. Butterwick, D. McKenzie, J. Reddell) (DRS, RRS, 1981); Actún Ziz, Oxkutzcab (Wheeler, 1937).

Comments.—This leaf-cutter ant was reported by Wheeler (1938) to occur up to 62 m from the entrance of caves in Yucatán. Specimens were found well within the dark zone of several caves during the 1973 and 1974 studies. *Acromyrmex* grow fungi on vegetable matter in their nest. Because the collectors did not note columns of ants carrying cut leaves into the caves, the ants are presumably only visitors to the cave environment.

Aphaenogaster spp.

Aphaenogaster sp.: Palacios-Vargas and Morales-Malacara, 1983:168; Hoffmann, Palacios-Vargas, and Morales-Malacara, 1986:135, 218.

Records.—MEXICO: *Morelos*: Cueva 8 de Julio (Palacios-Vargas and Morales-Malacara, 1983:168). San *Luis Potosí*: Cueva de Potrerillos, 2 km WSW

Ahuacatlán, 1250 m elev., 27 Nov. 1972 (T. Raines, J. Reddell) (DRS, RRS, 1981).

USA: TEXAS: *Coryell County*: Loop-Around Cave, Fort Hood, 16 July 1993 (J. Reddell, M. Reyes) (JCC, 1993).

Comment.—These specimens, presumably not the same species, were taken from the entrance area of Cueva de Potrerillos and Loop-Around Cave.

Aphaenogaster sp. nr. *texana* Emery

Record.—MEXICO: *Tamaulipas*: Sistema Purificación (Cueva del Brinco), 4 Sept. 1978 (W. Elliott) (RRS, 1981).

Comment.—This species was taken from the entrance sink.

Aphaenogaster texana Emery

Aphaenogaster texana: Reddell, 1966b:36; Fieseler and Kunath, 1975:20.

Records.—USA: TEXAS: *Bell County*: Bumelia Well Cave, Fort Hood, 5 Nov. 1998 (J. Cokendolpher, J. Krejca) (JCC, 1999). Creek Bed Sink, Fort Hood, 14 June 2000 (J. Reddell, M. Reyes) (JCC, 2000). *Brewster County*: O.T.L. Cave, 25 June 1963 (J. Reddell, W. Russell), near entrance (ACC, 1964).

Comment.—This species was found near cave entrances.

Apterostigma sp.

Record.—MEXICO: *Veracruz*: Cueva del Ojo de Agua Grande, 5 km N Potrero, 550 m elev., 4 Jan. 1974 (W. Elliott, R. Jameson, D. McKenzie, J. Reddell) (DRS, RRS, 1981).

Comment.—This species was taken from the entrance room.

Atta sp.

Atta sp.: Zeppelini Filho and Castaño Meneses, 1995:11.

Record.—MEXICO: *Yucatán*: Actún Toh (Zeppelini Filho and Castaño Meneses, 1995)

Comment.—The status of this leaf-cutter ant is unknown, but like other leaf-cutters is probably an accidental.

Atta cephalotes (Linnaeus)

Atta cephalotes var. *opaca*: Wheeler, 1938:252.

Atta cephalotes opaca: Pearse, 1945:189; Reddell, 1971b:75.

Record.—MEXICO: *Yucatán*: Cueva Muruztún (Wheeler, 1938)

Comments.—Wheeler (1938) reported that "these leaf-cutting ants were taken in the middle of the cave. They belonged to a mound above, but had come through the roof and deposited a great mound of rubbish."

Atta mexicana (F. Smith)

Records.—MEXICO: *San Luis Potosí*: Cueva de las Lagunitas, 3 km S San Nicolás de los Montes, 13 km N Agua Buena, 2 Jan. 1976 (T. Byrd, M. Cassey, A. Grubbs) (RRS, 1977); Sótano del Pozo, 1 km W Ahuacatlán, 26 Nov. 1964 (W. Bell, T. Raines) (ACC, 1965). *Yucatán*: Actún Kaua, 1 km S Kaua, 9-10 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); Cenote Poxil, Poxil, 7 km SE Chemax, 15 Dec. 1974 (J. Reddell) (RRS, 1977).

Comment.—These ants were all taken below the cave entrances.

Atta texana (Buckley)

Records.—USA: TEXAS: *Bandera County*: Fog Fissure, 30 Oct. 1963 (D. McKenzie) (ACC, 1964). *Bexar County*: Jabba's Giant Sink, Camp Bullis, 18 Nov. 1996 (G. Veni) (JCC, 1997).

Comment.—This species was found below cave entrances and is considered an accidental.

Crematogaster spp.

Crematogaster sp.: Reddell, 1966b:36; Reddell, 1967a:19; Reddell, 1970c:53.

Records.—BELIZE: *Cayo*: Balam's Cave (Uchen Balam), 22-26 March 1979 (L. McNatt) (RRS, 1981).

USA: TEXAS: *Bell County*: Septum Pit Cave, Fort Hood, 1 May 1998 (M. Reyes) (JCC, 1998). *Edwards County*: Deep Cave, 4 Sept. 1965 (D. Dickey) (ACC, 1966). *Sutton County*: Felton Cave, 4 July 1964 (J. Reddell) (ACC, 1964). *Travis County*: Enfield Sinkhole, 18 June 1991 (W. Elliott, C. Ladd) (JCC). *Williamson County*: Priscilla's Cave, 6 June 1996 (W. Elliott), on cave gate (JCC, 1996).

Comments.—Most of these specimens were found near entrances; specimens from Felton Cave were taken from cave swallow droppings on top of a stalagmite in the entrance room. Most *Crematogaster* spp. march in long, narrow files, and gather whatever prey or dead insects that they can find. They also depend on the

secretions of aphids and coccids which they tend (Buren, 1958). Several species tend homopterans on plant roots and this might account for the discovery of specimens in cave entrances where roots are often exposed.

Crematogaster (*Acrocoelia*) sp.

Crematogaster (*A.*) sp.: Reddell, 1966b:36.

Record.—USA: TEXAS: *Hardeman County*: Campsey Cave, May 1963 (J. Reddell, W. Russell) (ACC, 1964).

Comments.—This species was taken from silt about 60 m from the entrance. The cave floods and the specimens were probably washed into the cave.

Crematogaster (*Crematogaster*) sp. prob. *laeviuscula* Mayr

Record.—USA: TEXAS: *Edwards County*: Devil's Sinkhole, 27 July 1974 (W. Elliott, M. McKenzie) (RRS, 1977).

Comment.—This species was found below the cave entrance.

Crematogaster (*Crematogaster*) *laeviuscula* Mayr

Record.—USA: TEXAS: *Travis County*: Wildflower Cave, 3 May 1990 (J. Reddell, M. Reyes) (RRS, 1984).

Comment.—This species was found among trash in the entrance room.

Crematogaster sumichrasti Mayr

Crematogaster sumichrasti: Reddell and Veni, 1996:137.

Record.—BELIZE: *Cayo*: Cebada Cave, Zone A, 8 May 1986 (G. Veni) (RRS, 1986).

Comment.—This species was found just inside the entrance.

Cyphomyrmex rimosus (Spinola)

Record.—USA: TEXAS: *Bexar County*: Up the Creek Cave, 14 Nov. 1995 (J. Cokendolpher, J. Reddell, M. Reyes) (JCC, 1996).

Comments.—This species was found in twilight. These ants, like other gardening ants (including the leaf-cutters), feed on fungus which they cultivate in their nest. Creighton (1950) stated that this ant grows its fungus on collected caterpillar droppings, rather than leaf cuttings.

Eurhopalothrix pilulifera Brown and Kempf

Record.—MEXICO: *Yucatán*: Cenote Chen Mul, Ruinas de Mayapán, 24, 26 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, J. Reddell) (RRS, 1977).

Comment.—This species was found near the entrance.

Leptothorax sp.

Record.—USA: TEXAS: *Coryell County*: Runoff Cave, Fort Hood, 14 May 1992 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1992).

Comment.—This is an accidental known only from leaf litter in the cave entrance. Mackay (2000) described *Leptothorax cokendolpheri* from a colony (including the female) collected in a cave in the Guadalupe Mountains of southern New Mexico. The species is also known from a worker collected on the surface in Big Bend National Park of Texas. The type series was collected under a rock in the large pit entrance to Hidden Cave and shows no special features indicating that it is anything more than a trogloxene.

Monomorium sp.

Record.—MEXICO: *Nuevo León*: Cueva de la Cerca de Piedra, 4.2 km S San José de las Boquillas, 3080 m elev., 21 Jan. 1984 (D. Pate, P. Sprouse) (RRS, 1985).

Comment.—The status of this material is unknown.

Monomorium sp. prob. *cyaneum* Wheeler

Record.—USA: TEXAS: *Bexar County*: Bullis Hole, 21 Sept. 1972 (J. Reddell, W. Russell) (DRS)

Comments.—This material probably washed into the cave. It is an accidental. These ants were identified as *Monomorium viridum peninsulatum* Gregg by DRS. Since that time, DuBois (1986) revised the New World *Monomorium* and only recorded *viride* from Florida. It seems likely that DRS misidentified the sample using the same taxonomic keys as used by Moody and Francke (1982) when they misidentified Texas samples as *M. viridum peninsulatum*. Moody and Francke's material has since been identified as *Monomorium cyaneum* (Cokendolpher, 1990).

Monomorium minimum (Buckley)

Records.—USA: TEXAS: *San Saba County*: Gorman Cave, 12 June 1978 (E. Kastning, J. Reddell), in bat guano between entrance and Separation Lake (RRS, 1981). *Travis County*: Whirlpool Cave, 29 July

1990 (A. Grubbs, J. Reddell) (JCC, 1990). *Williamson County*: Stonewall Ranch Cave, 3 March 1993 (M. Warton) (JCC, 1993).

Comments.—This species was taken from bat guano about 75 m from the entrance in Gorman Cave. In this and Whirlpool Cave it probably had washed into the caves. It is probably an accidental.

Myrmecina americana Emery

Records.—USA: TEXAS: *Bell County*: Big Crevice, Fort Hood, 6 June 2000 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 2000); Keilman Cave, Fort Hood, 26 Sept. 1997 (J. Reddell), Berlese of leaf litter (JCC, 1997). *Bexar County*: Charley's Hammer Hole, 9 Oct. 1995 (J. Reddell, M. Reyes) (JCC, 1995). *Coryell County*: Copperhead Cave No. 2, Fort Hood, 20 Feb. 1999 (M. Reyes), Berlese of leaf litter (JCC, 1999); Porter Cave, Fort Hood, 8 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1999). *Travis County*: Trapjaw Sink, 7 April 1984 (J. Reddell), Berlese of leaf litter (RRS, 1985); Wade Sink, 7 Feb. 1991 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1991).

Comment.—This accidental species has only been found in leaf litter in cave entrances.

Octostruma sp.

Octostruma sp.: Zeppelini Filho and Castaño Meneses, 1995:11.

Record.—MEXICO: *Yucatán*: Actún Siete Aguas (Zeppelini Filho and Castaño Meneses, 1995)

Comment.—The status of this material is unknown.

Oligomyrmex longii (Wheeler)

Oligomyrmex longii: Reddell, 1992a:137.

Record.—USA: TEXAS: *Coryell County*: Viper Den Cave, 27 Jan. 1990 (J. Reddell, M. Reyes) (JCC, 1990).

Comment.—This accidental was found in the entrance area.

Oligomyrmex urichi (Wheeler)

Spelaeomyrmex urichi: Wheeler, 1938:251, 252; Pearse, 1945:189.

Oligomyrmex urichi: Peck, 1971a:433-434.

Erebomyrma urichi: Reddell, 1971b:75; Reddell, 1981:238; Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Record.—MEXICO: *Yucatán*: Cenote de Sambulá, Motul (Wheeler, 1938).

Comments.—This species was found on bat guano (Wheeler, 1938). The species is also known from caves in Trinidad and from surface localities in other parts of tropical America and the West Indies.

Pheidole spp.

Pheidole sp.: Reddell, 1966b:37; Reddell, 1967a:19; Reddell, 1970c:54; Elliott and Reddell, 1973:199.

Records.—MEXICO: *San Luis Potosí*: Ventana Jabalí, 20 km NE Ciudad Valles, 12 July 1969 (J. Peck, S. Peck) (DRS, RRS); Sótano de San Francisco no. 2, San Francisco, 17 May 1972 (M. McEachern) (RRS). *Tamaulipas*: Sistema Purificación (Cueva del Brinco entrance sink), 4 Sept. 1978 (W. Elliott) (RRS, 1981).*Yucatán:* Cenote Kabahchén, Maní, 5 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (DRS, 1978).

USA: TEXAS: *Bell County*: Streak Cave, Fort Hood, 26 Sept. 1997 (L. J. Graves, J. Reddell, M. Reyes) (JCC, 1997). *Bexar County*: Platypus Pit, 20 May 1996 (J. Ivy), Zone 1 (JCC, 1996). *Burnet County*: Longhorn Caverns, off commercial trail, 23 Sept. 1999 (A. Cobb) (JCC, 1999). *Edwards County*: Punkin Cave, 4 Sept. 1965 (J. Reddell), on rotten log at bottom of entrance drop (ACC, 1966). *Travis County*: Dobie Shelter, 19 Aug. 1984 (W. Elliott, C. Sexton) (RRS, 1985); Jester Estates Well Trap No. 9, 15 March 1991 (L. Sherrod) (JCC, 1991). *Val Verde County*: Diablo Cave, 10 Aug. 1963 (D. McKenzie, J. Reddell) (ACC, 1964).

Comment.—It is not possible to further identify this material without major workers and further study.

Pheidole sp. (*bicarinata*) group

Pheidole sp.: McKenzie, 1965:37; Reddell, 1971b:76.
Pheidole sp. (*bicarinata* group): Reddell and Mitchell, 1971a:158.

Record.—MEXICO: *San Luis Potosí*: Cueva Grande, 11 km SE Ciudad Valles, 9 June 1964 (D. McKenzie, J. Reddell) (ACC, 1964).

Comment.—This is probably an accidental.

Pheidole sp. 1

Records.—MEXICO: *Quintana Roo*: Cenote de Juan Coh, Felipe Carrillo Puerto, 4 July 1975 (A. Grubbs, D. McKenzie, J. Reddell) (RRS, 1977).

Comment.—This probable accidental was taken from below the entrance drop.

Pheidole sp. 2

Record.—MEXICO: *San Luis Potosí*: Ventana Jabalí, 20 km NE Ciudad Valles, 12 July 1969 (J. Peck, S. Peck) (RRS, 1977).

Comment.—The status of this material is unknown.

Pheidole sp. 3

Record.—MEXICO: *Yucatán*: Cenote Amil, 6 km S Abalá, 28 March 1973 (J. Reddell, M. Rodríguez) (RRS, 1977).

Comment.—This species was taken from near the cave entrance.

Pheidole sp. 4 (*flavens* group)

Pheidole sp. (*flavens* group): Wheeler, 1938:252; Reddell, 1971b:76.
Pheidole sp.: Pearse, 1945:189.

Records.—MEXICO: *Yucatán*: Cenote Chen Mul, Ruinas de Mayapán, 24, 26 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, J. Reddell) (RRS, 1977); Cenote de Sambulá, Mérida (Wheeler, 1938); Actún Xpukil, 3 km S Calcehtok, 19 March 1973 (J. Reddell), Berlese of entrance litter (RRS, 1977); 3 Aug. 1973 (J. Reddell), from entrance sink (RRS, 1977).

Comment.—This species has been taken from the entrance area of all these caves.

Pheidole absurda Forel

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comment.—This species was taken from the entrance sink and is probably an accidental.

Pheidole dentata Mayr

Pheidole dentata: Reddell, 1988c:44.

Record.—MEXICO: *Tamaulipas*: Sótano del Molino, 1 km NW Gómez Farías, 268.5 m elev., June 1964 (T. Raines) (ACC, 1964).

USA: TEXAS: *Bexar County*: Cave of the Bearded Tree, April 1982 (G. Veni) (RRS, 1984).

Comment.—This is presumably an accidental.

Pheidole punctatissima Mayr

Pheidole punctatissima: Wheeler, 1938:252; Pearse, 1945:189; Reddell, 1971b:76; Reddell and Veni, 1996:137.
Pheidole punctatissima red var.: Wheeler, 1938:252.

Records.—BELIZE: *Cayo*: Cebada Cave, Zone A, 8 May 1986 (G. Veni) (RRS, 1986).

MEXICO: *Yucatán*: Cenote de Sambulá (Motul) (Wheeler, 1938); Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comments.—This accidental species was found just inside the cave entrance of Cebada Cave, on swallow guano in Cenote de Sambulá (Wheeler, 1938), and on swallow droppings in the entrance area of Actún Xpukil.

Pheidole tolteca Forel

Pheidole tolteca: Palacios-Vargas and Morales-Malacara, 1983:168; Hoffmann, Palacios-Vargas, and Morales-Malacara, 1986:135, 143, 218, 225.
Pheidole tolteka: Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Records.—MEXICO: *Morelos*: Cueva del Diablo (Palacios-Vargas and Morales-Malacara, 1983); Cueva del Idolo (Palacios-Vargas and Morales-Malacara, 1983); Cueva 8 de Julio (Palacios-Vargas and Morales-Malacara, 1983). *Puebla*: Unnamed cave-sinkhole, 10 mi. E of road to Derramedero, 200 m N of highway to Izucar de Matamoros, 31 Dec. 1981 (D. McKenzie) (RRS, 1984).

Comment.—The status of this material is unknown.

Pogonomyrmex barbatus (F. Smith)

Pogonomyrmex barbatus: Reddell and Smith, 1965:33; Reddell, 1966b:37; Reddell, 1970c:54; Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Records.—USA: TEXAS: *Edwards County*: Dunbar Cave, 30 Aug. 1964 (D. McKenzie, T. Raines) (ACC, 1965). *Williamson County*: Shaman Cave, 29 Sept. 1994 (J. Reddell, M. Reyes), 3 Oct. 1994 (J. Reddell, M. Reyes) (JCC, 1994).

Comments.—This accidental was found below the entrance to Shaman Cave. Decu, Casale, Scaramozzino, López, and Tinaut (1998) mentioned that this species is known from caves in San Luis Potosí, Tamaulipas, and Yucatán. This is almost certainly in error.

Pogonomyrmex comanche Wheeler

Record.—USA: TEXAS: *Travis County*: Fossil

Cave, 22 July 1974 (W. Elliott, P. Knoll, B. Welbourn) (RRS, 1977).

Comment.—This certainly is an accidental.

Solenopsis sp.

Solenopsis sp.: Zeppelini Filho and Castaño Meneses, 1995:11.

Records.—MEXICO: *San Luis Potosí*: Sótano de las Piedras, 7.5 km NE Ciudad Valles, 28 March 1970 (W. Elliott) (DRS, RRS, 1981). *Yucatán*: Cueva del Rancho Sambulá (Zeppelini Filho and Castaño Meneses, 1995); Actún Siete Aguas (Zeppelini Filho and Castaño Meneses, 1995); Actún Toh (Zeppelini Filho and Castaño Meneses, 1995).

Comment.—This is probably a trogloxene.

Solenopsis sp. 1

Record.—MEXICO: *Yucatán*: Cenote de Sihunchén, Sihunchén, 23 March 1973 (J. Reddell), Berlese of leaf litter in darkness (RRS, 1977).

Comment.—This species is probably a trogloxene.

Solenopsis sp. 2

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 19 March 1973 (J. Reddell), Berlese of entrance litter (RRS, 1977).

Comment.—This species is probably a trogloxene.

Solenopsis (*Diplorhoptrum*) *texana* Emery

Record.—USA: TEXAS: *Bell County*: Big Crevice, Fort Hood, 6 June 2000 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 2000).

Comment.— Thief ants generally are subterranean (not in caves, but below the surface of the ground) and are rarely found foraging on the surface.

Solenopsis (*Solenopsis*) *geminata* (Fabricius)

Solenopsis geminata: Wheeler, 1938:252; Pearse, 1945:189; Reddell, 1971b:76; Reddell, 1977b:235; Reddell, 1981:237; Hoffmann, Palacios-Vargas, and Morales-Malacara, 1986:113, 218; Reddell and Veni, 1996:137; Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Solenopsis germinata: Palacios-Vargas and Morales-Malacara, 1983:168 [erroneous spelling].

Records.—BELIZE: *Cayo*: Cebada Cave, Zone C, 9 May 1986 (G. Veni) (RRS, 1986).

MEXICO: *Campeche*: Volcán de los Murciélagos, 11 km E Conhuas, 31 July 1975 (A. Grubbs, D. McKenzie, J. Reddell) (RRS, 1977). *Morelos*: Cueva del Diablo (Palacios-Vargas and Morales-Malacara, 1988); *Oaxaca*: Cueva de Juan Sánchez, 10 km NW Acatlán, 26 Dec. 1976 (A. Grubbs, J. Reddell, C. Soileau) (RRS, 1981); Cueva del Lencho Virgen, 9 km SSW Acatlán, 2-3 Jan. 1974 (W. Elliott, R. Jameson, D. McKenzie, J. Reddell) (RRS, 1977); Grutas de Monteflor, Monteflor, 6 km N Valle Nacional, 28 Dec. 1973 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); Cueva del Nacimiento del Río San Antonio, 10 km SSW Acatlán, 26 Dec. 1972 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Grutas de San Sebasián, 3 km N San Sebasián de las Grutas, 1820 m elev., 31 Dec. 1972 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981). *Quintana Roo*: Cueva de Abispa, Tancah, 1 July 1975 (A. Grubbs, J. Reddell, S. Wiley) (RRS). *Puebla*: Cueva Vampiros de la Mona, 3 km W Xicotepec, 24 Feb. 1973 (J. Reddell) (DRS, RRS, 1981). *San Luis Potosí*: Cueva de los Cuates, 16 km SE Ciudad Valles, 29 May 1974 (J. Prentice) (RRS, 1977); Sótano de Guadalupe, 10 km W Aquismón, 24 Nov. 1972 (T. Raines) (DRS, RRS, 1981); Cueva de Taninul no. 1, 13 km SE Ciudad Valles, 29 March 1970 (W. Elliott, S. Wiley) (DRS, RRS, 1981). *Tabasco*: Resumidero del Coconá, 3 km NE Teapa, 14 June 1975 (A. Grubbs, J. Reddell) (RRS, 1977). *Veracruz*: Cueva de Cantil Blanco, 1 km N Buena Vista, 23 Dec. 1976 (A. Grubbs, D. McKenzie, J. Reddell, C. Soileau), in bat guano (RRS, 1981); Cueva del Ojo de Agua Grande, 5 km N Potero, 4 Jan. 1974 (W. Elliott, R. Jameson, D. McKenzie, J. Reddell) (DRS, RRS, 1981); Cueva de Ungurria, 20 km WSW Tezonapa on island in the Río Tonto, 25 Dec. 1972 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981). *Yucatán*: Cenote Calchum, 3 km E San Bernardo, 16 April 1973 (D. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Actún Góngora, near Oxkutzcab (Wheeler, 1938); Actún Jih, 3 km W Ticul, 18 June 1975 (A. Grubbs, D. McKenzie, J. Reddell) (DRS, 1978); Cenote Kabachén, Maní, 1 Aug. 1973 (J. Reddell) (DRS, RRS, 1981); Actún Puz, near Oxkutzcab (Wheeler, 1938); Cueva de San Isidro, Mérida (Wheeler, 1938); Cenote de Sihunchén, Sihunchén, 23 March 1973 (M. Butterwick, M. McKenzie, S. Murphy, J. Reddell) (RRS); Grutas de Tzab-Nah, 2 km S Tecoh, 22 April 1973 (D. McKenzie, J. Reddell) (RRS, 1977); 16 April 1973 (M. McKenzie, J. Reddell) (DRS, RRS, 1981); Actún Xkyc, 2 km S Calcehtok, 1 May 1973 (E. Alexander, M. Butterwick, D. McKenzie, J. Reddell) (DRS, RRS, 1981).

USA: TEXAS: *Bexar County*: Kamikazi Cricket

Cave, 3 Oct. 1984 (G. Veni) (RRS, 1985). *Travis County*: Featherman's Cave, 15 Oct. 1998 (M. Sanders) (JCC, 1999), 25 June 1999 (M. Sanders) (JCC, 1999). *Williamson County*: Squaw Cave, 29 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994).

Comments.—This is a trogloxene in the caves of Mexico. In Central Texas the species has been virtually extirpated in areas of heavy infestations by *S. invicta* (Porter and Savignano, 1990).

Solenopsis (*Solenopsis*) *invicta* Buren

Solenopsis (*Solenopsis*) *invicta*: Reddell, 1988c:44.
Solenopsis invicta: Elliott, 1992:13; Elliott, 1993a:331-332; Elliott, 1993b:1-33; Stanford and Shull, 1993:63328; O'Donnell, Elliott, and Stanford, 1994.

Records.—USA: TEXAS: *Bell County*: Camp 6 Cave No. 1, Fort Hood, 2 Nov. 1998 (J. Cokendolpher, J. Reddell) (JCC, 1999); Camp 6 Cave No. 2, Fort Hood, 20 April 1998 (J. Reddell) (JCC, 1998); Canyon Side Sink, Fort Hood, 6 June 2000 (J. Reddell, M. Reyes) (JCC, 2000); Coyote Den Cave, Fort Hood, 8 May 1998 (J. Reddell, M. Reyes) (JCC, 1998); Figure 8 Cave, Fort Hood, 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes) (JCC, 1998); Flapjack Cave, Fort Hood, 24 April 1998 (J. Reddell) (JCC, 1998); Hanging Stump Cave, Fort Hood, Berlese of litter, 9 March 1993 (J. Reddell) (JCC, 1993); Herbert Cave, Fort Hood, 10 Sept. 1997 (L.J. Graves, M. Reyes) (JCC, 1997); 2 Nov. 1998 (J. Cokendolpher) (JCC, 1999); Jagged Walls Cave, Fort Hood, Berlese of litter, 4 Dec. 1992 (J. Reddell, M. Reyes) (JCC, 1993); Lunch Counter Cave, Fort Hood, 18 Sept. 1997 (J. Reddell) (JCC, 1997); Berlese of leaf litter, 18 Sept. 1997 (J. Reddell) (JCC, 1997); Medusa Cave, Fort Hood, 18 Sept. 1997 (J. Reddell, M. Reyes) (JCC, 1997); Monkey Walk Cave No. 2, Fort Hood, 23 April 1998 (L.J. Graves) (JCC, 1998); Mystery Rock Sink, Fort Hood, 20 May 1998 (J. Reddell) (JCC, 1998); Newby Cave, Fort Hood, 19 March 1999 (J. Reddell, M. Reyes) (JCC, 1999); Owl Mountain Cave, Fort Hood, 27 June 2000 (J. Reddell, M. Reyes) (JCC, 2000); Peep in the Deep Cave, Fort Hood, Berlese of leaf litter, 8 May 1998 (J. Reddell, M. Reyes) (JCC, 1998); Rock Ring Sink, Fort Hood, 6 May 1998 (J. Reddell) (JCC, 1998); Root Sink, Fort Hood, 21 April 1998 (M. Reyes) (JCC, 1998); Talking Crows Cave, Fort Hood, 8 Feb. 1996 (M. Warton) (JCC, 1996); 20 April 1998 (L.J. Graves, J. Reddell, M. Reyes) (JCC, 1998); Valentine Cave, Fort Hood, 14 Feb. 1996 (M. Warton) (JCC, 1996); 18 Sept. 1997 (J. Reddell, M. Reyes) (JCC, 1997); Violet Cave, Fort Hood, Nov. 1995 (M. Warton) (JCC, 1996). *Bexar County*: B.J. Pit, 22 June 1993 (J. Loftin) (JCC, 1993); Backhole, 9 Sept. 1998 (J. Cokendolpher, J. Krejca) (JCC, 1998); Bone Pile Cave, Government Canyon State Natural Area, 29 Sept. 1996 (G. Veni) (JCC, 1996); Bullis Hole, Zone 2, 20 Nov. 1996 (W. Elliott) (JCC, 1997); Buzzard Egg Cave, 29 March 1995 (J. Reddell, M. Reyes) (JCC, 1995); Caracol Creek Coon Cave, 15 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni) (JCC, 1993); Cross the Creek Cave, 6 Oct. 1995 (J. Reddell, M. Reyes) (JCC, 1995); Dangerfield Cave, 21 April 1999 (J. Reddell, M. Reyes) (JCC, 1999); Eagles Nest Cave, 15 Nov. 1993 (J. Ivy, L. McNatt, G. Veni) (JCC, 1994); Elmore Cave, 14 July 1993 (J. Reddell, M. Reyes) (JCC, 1993); Flying Buzzworm Cave, 4 Oct. 1995 (J. Reddell, M. Reyes) (JCC, 1995); Goat Cave, Government Canyon State Natural Area, 24 May 1998 (J. Reddell, M. Reyes) (JCC, 1998), Berlese of leaf litter (JCC, 1998); Government Canyon Bat Cave, Government Canyon State Natural Area, 24 May 1998 (J. Reddell, M. Reyes) (JCC, 1998); Haz Mat Pit, 8 Sept. 1998 (J. Reddell) (JCC, 1998); Headquarters Cave, Zone 1, 20 Oct. 1997 (W. Elliott) (JCC, 1997); Isocow Cave, entrance crawl, 20 Sept. 1994 (G. Veni) (JCC, 1994); John Wagner Ranch Cave No. 3, 15 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni) (JCC, 1993); Kamikazi Cricket Cave, 10 June 1993 (J. Reddell, M. Reyes) (JCC, 1993); Linda's First Cave Find, 13 June 1993 (J. & L. Loftin, S. Woods) (JCC, 1993); Logan's Cave, 10 May 1992 (G. Veni); 8 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni) (JCC, 1993); Lone Gunman Pit, 23 Oct. 1997 (P. Sprouse, G. Veni) (JCC, 1997); Madla's Drop Cave, 8 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni) (JCC, 1993); MARS Cave, 29 March 1995 (J. Reddell, M. Reyes) (JCC, 1995); MARS Pit, 29 March 1995 (J. Reddell, M. Reyes) (JCC, 1995); 21 May 1996 (W. Elliott), Zone 1 (JCC, 1996); Mastodon Pit, 17 June 1993 (S. Harden, G. Veni) (JCC, 1993); Mattke Cave, 10 June 1993 (D. McKenzie, J. Reddell, M. Reyes) (JCC, 1993); Meusebach Flats Cave, 14 Nov. 1997 (J. Ivy, B. Johnson, P. Sprouse) (JCC, 1998); 21 Nov. 1997 (G. Veni) (JCC, 1998); 25 March 1998 (J. Reddell, M. Reyes) (JCC, 1998); 8 Sept. 1998 (J. Reddell, M. Reyes) (JCC, 1998); 21 April 1999 (J. Reddell, M. Reyes) (JCC, 1999); NBC Cave, 15 Dec. 1993 (L. McNatt, G. Veni) (JCC, 1994); Poison Ivy Pit, 15 Aug. 1981 (K. Menking, E. Short, G. Veni, R. Waters) (RRS, 1984); Ponytail Pit, 7 Nov. 1997 (G. Veni) (JCC, 1998); Poor Boy Ranch Cave, 13 Aug. 1983 (G. Veni) (RRS, 1984); Pot-Bellied Stove Cave, 2 June 1993 (J. Loftin) (JCC, 1993); Rattlesnake Cave, 19 July 1989 (A. Cobb) (JCC, 1989); Record Fire 1 Pit, 20 Sept. 1994 (G. Veni), bottom of entrance (JCC, 1994); Robbers Cave, 22 June 1993 (J. Loftin, J. Reddell, M. Reyes) (JCC, 1993); Root Toupee Cave, 20 April 1999 (J. Reddell), entrance crawlway (JCC, 1999); SARA Site 4 Cave, 17 Oct. 1993 (G. Veni)

(JCC, 1993); 6 June 1994 (J. Ivy, G. Veni) (JCC, 1994); Scorpion Cave, 1 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni) (JCC, 1993); Sink Hole, 17 June 1993 (S. Harden, G. Veni) (JCC, 1993); Stahl Cave, upper level leaf litter, 8 Sept. 1998 (J. Cokendolpher, J. Reddell) (JCC, 1998); Stevens Ranch Cave No. 1, 1 June 1993 (J. Loftin, J. Reddell, M. Reyes, G. Veni) (JCC, 1993); Stevens Ranch Trash Hole Cave, 12 June 1993 (J. Loftin) (JCC, 1993); Strange Little Cave, 5 Oct. 1995 (J. Reddell, M. Reyes) (JCC, 1995); Surprise Sink, Government Canyon State Natural Area, 21 April 1996 (G. Veni, K. Veni, J. Kennedy) (JCC, 1996); 24 May 1998 (J. Reddell, M. Reyes) (JCC, 1998); Three Fingers Cave, 22 June 1993 (J. Loftin, J. Reddell, M. Reyes) (JCC, 1993); Two Raccoon Cave, 1 June 1993 (J. Loftin, J. Reddell, M. Reyes) (JCC, 1993); Vera Cruz Shaft, 9 Sept. 1998 (J. Krejca, M. Reyes) (JCC, 1998); Winston's Cave, 13-14 Dec. 1993 (J. Ivy, L. McNatt, G. Veni) (JCC, 1994); Zone 1, 21 Sept. 1994 (W. Elliott, J. Ivy) (JCC, 1995); Zone 2, 21 Sept. 1994 (W. Elliott, J. Ivy) (JCC, 1995); World News Cave, 14 July 1993 (J. Reddell, M. Reyes) (JCC, 1993); Wurzbach Bat Cave, 22 May 1993 (J. Loftin, J. Reddell, M. Reyes) (JCC, 1993); 22 May 1993 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1993); Young Cave No. 1, 6 Sept. 1993 (J. Reddell, M. Reyes) (JCC, 1993). *Comal County*: Camp Bullis Cave No. 1, 21 Nov. 1996 (B. Johnson, J. Reddell, M. Reyes), Zone 3 (JCC, 1997); Ebert Cave, 21 May 1994 (G. Veni) (JCC, 1994); Fischer Pit, 14 July 1989 (A. Grubbs, A. H., C. T.) (JCC, 1989). *Coryell County*: Cicurina Sink, 14 June 2000 (J. Reddell, M. Reyes) (JCC, 2000); Egypt Cave, Fort Hood, 16 Sept. 1997 (L.J. Graves, J. Reddell, M. Reyes) (JCC, 1997); Ingram Cave, Fort Hood, 16 Sept. 1997 (L.J. Graves, M. Reyes) (JCC, 1997); 7 April 1999 (J. Reddell, M. Reyes) (JCC, 1999); Mixmaster Cave, Fort Hood, 9 Sept. 1997 (L.J. Graves, D. McKenzie, J. Reddell, M. Reyes) (JCC, 1997); Porter Cave, 8 April 1999 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1999); Price Pit, Fort Hood, 6 May 1999 (J. Reddell, M. Reyes) (JCC, 1999); Shults Cave, Fort Hood, 16 Sept. 1997 (J. Reddell) (JCC, 1997). *Hays County*: Antioch Cave, March 1994 (W. Russell) (JCC, 1994); Autumn Woods Well, 22 Aug. 1993 (W. Russell), potato peal bait trap (JCC, 1993). *Kendall County*: Covered Hole, 17 July 1991 (D. Allen, L.J. Graves) (JCC, 1991); Pfeiffer's Water Cave, 21 May 1994 (G. Veni) (JCC, 1994). *Travis County*: Balcones Sink, 12 July 1990 (J. Reddell, M. Reyes) (JCC, 1990); Bulldozer Cavern, 4 Oct. 1997 (W. Elliott, P. Sprouse) (JCC, 1997); Cave Z, 2 July 1990 (M. Reyes) (JCC, 1990); Central Sink, 18 Aug. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Disbelievers Cave, 28 June 1995 (J. Reddell, M. Reyes) (JCC, 1995); District Park Cave, 20 Sept. 1990 (J. Reddell, M. Reyes) (JCC, 1990); 19 Jan. 1991, Berlese of litter (J. Reddell, M. Reyes) (JCC, 1991); Driskill Cave, 29 July 1990 (J. Reddell, M. Reyes, W. Russell) (JCC, 1990), 1 Sept. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Enfield Sinkhole, 18 June 1991 (W. Elliott, C. Ladd) (JCC, 1991); Five Pocket Cave, 22 Oct. 1993 (B. Keeley, Fraiser) (JCC, 1993); Flint Ridge Cave, 28 June 1999 (M. Sanders) (JCC, 1999); Fossil Garden Cave, 22 June 1990 (J. Reddell, M. Reyes) (JCC, 1990); Gallifer Cave, 12 Sept. 1990 (J. Reddell); 8 Aug. 1991 (J. Cokendolpher) (JCC, 1990), 17 May 1993 (J. Reddell) (JCC, 1993); Geode Cave, 21 July 1994 (W. Elliott, P. Sprouse) (JCC, 1994); 11 Aug. 1994 (P. Sprouse) (JCC); 13 Sept. 1994 (W. Elliott) (JCC, 1994); Hawk Tract Well Trap No. 1, 2 Nov. 1990 (J. Reddell) (JCC, 1990); Hawk Tract Well Trap No. 3, 2 Nov. 1990 (J. Reddell) (JCC, 1990); Hawk Tract Well Trap No. 5, 2 Nov. 1990 (J. Reddell) (JCC, 1990); Hawk Tract Well Trap No. 7, 2 Nov. 1990 (J. Reddell) (JCC, 1990); Hole in the Road, 20 Sept. 1998 (J. Reddell, M. Reyes) (JCC, 1998); Homestead Cave, 11 April 1995 (A.G. Grubbs, G. Waid) (JCC, 1995); Japygid Cave, 3 Jan. 1995 (M. Warton) (JCC, 1995); 19 Sept. 1995 (J. Reddell, M. Reyes) (JCC, 1995); Jest John Cave, 22 June 1993 (W. Elliott); 29 May 1993 (W. Russell, J. Sigmond) (JCC, 1993); Jollyville Jewel Cave, 14 March 1991 (J. Reddell, M. Reyes) (JCC, 1991); Kretschmarr Salamander Cave, 15 Feb. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Lamm Cave, 2 Dec. 1992 (M. Warton) (JCC, 1993); M.W.A. Cave, 19 July 1995 (J. Reddell, M. Reyes) (JCC, 1995); Midden Sink, 18 Aug. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Moss Pit, 5 March 1991 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1991); Outhouse Hole Sink, 18 Aug. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Rock Top Cave, 14 April 1991 (W. Elliott) (JCC, 1991); Singletary Cave, 26 June 1990 (D. Green, J. Reddell, M. Reyes) (JCC, 1990); 27 June 1990 (J. Reddell) (JCC, 1990); 6 July 1990 (J. Reddell) (JCC, 1990); Spyglass Cave, 18 Aug. 1992 (M. Warton) (JCC, 1992); Stoneworks Sink, 18 Aug. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Three-Holer Cave, 18 Aug. 1990 (J. Reddell, M. Reyes) (JCC, 1990); 27 March 1991 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1991); 1 May 1992 (J. Reddell, M. Reyes), Berlese of litter (JCC, 1992); Tight Pit Cave, 19 June 1997 (M. Reyes) (JCC, 1997); Tooth Cave, 12 Sept. 1990 (J. Reddell) (JCC, 1990); Two Trunks Cave, 19 June 1997 (J. Reddell, M. Reyes) (JCC, 1997); Weldon Cave, 30 April 1996 (M. Warton) (JCC, 1996); Weldon Windmill Cave, 6 June 1990 (J. Reddell, M. Reyes) (JCC, 1990); Whirlpool Cave, 29 July 1990 (A. Grubbs, J. Reddell) (JCC, 1990); Yaupon Ridge Cave, 23 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994). *Williamson County*: Agave Cave, 6 April 1993 (J. Reddell, M. Reyes) (JCC, 1993); 14 Aug. 1994 (J. Reddell, M. Reyes) (JCC, 1994);

Avery Avenue Cave, March 1994 (M. Warton) (JCC, 1994); Bat Well, 11 Aug. 1992 (J. Hunter, W. Russell) (JCC, 1992); Beck Bat Cave, Oct. 1989 (J. Reddell) (JCC, 1989); Beck Bridge Cave, 19 June 1992 (M. Warton) (JCC, 1992); Beck Cowcatcher Cave, 3 June 1996 (J. Reddell, M. Reyes) (JCC, 1996); Beck Creek Cave, 3 June 1996 (J. Reddell, M. Reyes) (JCC, 1996); Beck Pride Cave, 1 Oct. 1991 (W. Elliott, J. Reddell, M. Reyes) (JCC, 1991); Beck Rattlesnake Cave, 5 April 1993 (D. Allen, L.J. Graves, D. Love), big half (JCC, 1993); Beck Salamander Cave, 21 May 1996 (J. Reddell, M. Reyes) (JCC, 1996); Beck Tex-2 Cave, 21 May 1996 (J. Reddell, M. Reyes) (JCC, 1996); Beck's Beside Road Cave, April 1994 (M. Warton) (JCC, 1994); Big Oak Cave, 12 June 1997 (M. Reyes) (JCC, 1997); Blue Wasp Cave, 4 June 1991 (J. Reddell, M. Reyes) (JCC, 1991); Bone Cave, 27 Aug. 1990 (D. Allen, W. Elliott) (JCC, 1990); Borgarigmie Cave, 21 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Broken Plate Cave, 20 April 1993 (M. Warton) (JCC, 1993); Buttercup Blow Hole Cave, 27 Feb. 1995 (D. Allen, D. Love) (JCC, 1995); Cannibal Lector Cave, 14 April 1994 (J. Reddell, M. Reyes) (JCC, 1994); Cat Cave; 11 April 1994 (J. Reddell, M. Reyes) (JCC, 1994); Cat Hollow Bat Cave, 13 July 1992 (M. Warton) (JCC, 1992); Chagas Cave, 24 Aug. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Circle Sink Cave, 2 Oct. 1991 (J. Reddell, M. Reyes) (JCC, 1991); Coon Crawl Cave, 30 April 1996 (M. Warton) (JCC, 1996); Crescent Cave, April 1994 (M. Warton) (JCC, 1994); Deliverance Cave No. 1, 17 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994); Dion Cave, 18 April 1994 (J. Reddell, M. Reyes) (JCC, 1994); 20 July 1994 (J. Reddell, M. Reyes) (JCC, 1994); Do Drop In Cave, 28 Sept. 1995 (W. Elliott) (JCC, 1995); Dragon Fly Cave, 11 July 1994 (J. Reddell, M. Reyes) (JCC, 1994); East Fork Fissure, 12 July 1991 (D. Allen, W. Elliott) (JCC, 1991), 13 June 1995 (J. Reddell, M. Reyes) (JCC, 1995); Eclipse Cave, April 1994 (M. Warton) (JCC, 1994); Electro-Mag Cave, 24 July 1995 (J. Reddell, M. Reyes) (JCC, 1995); Fence-Line Cave, 7 Sept. 1992 (J. Reddell, M. Reyes) (JCC, 1992); Fern Cave, March 1994 (M. Warton) (JCC, 1994); Fire Ant Cave, 2 Oct. 1991 (J. Reddell) (JCC, 1991); Flat Rock Cave, 25 May 1992 (R. Aalbu, J. Reddell, M. Reyes) (JCC, 1992); Flathead Cave, 29 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Flint Wash Cave, 4 June 1991 (J. Reddell, M. Reyes) (JCC, 1991); Floral Cave, April 1994 (M. Warton) (JCC, 1994); Formation Forest Cave, 31 March 1993 (J. Reddell, M. Reyes) (JCC, 1993); Fortune 500 Cave, 28 April 1998 (J. Reddell, M. Reyes) (JCC, 1998); Gasch Cave, 14 Aug. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Godwin's Goat Grave Cave, 31 Oct. 1990 (J. Reddell, M. Reyes) (JCC, 1990); Good Omen Spring, 30 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Hawk Tract Well Trap No. 2, 2 Nov. 1990 (J. Reddell) (JCC, 1990); Holler Hole Cave, 29 March 1994 (J. Reddell, M. Reyes) (JCC, 1994); Jackhammer Cave, 24 June 1993 (D. Allen) (JCC, 1993); Joker Cave, April 1994 (M. Warton) (JCC, 1994); Knife Cave, 21 July 1994 (J. Reddell, M. Reyes) (JCC, 1994); Ku Klux Klan Cave, 2 Sept. 1990 (D. Allen, W. Elliott) (JCC, 1990); LakeLine Cave, 16 Feb. 1990 (J. Reddell, M. Reyes) (JCC, 1990); 16 Feb. 1990 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1990); 24 Sept. 1991 (W. Elliott), on cheese bait (JCC, 1991); 15 Oct. 1992 (W. Elliott), entrance plate (JCC, 1992); 24 April 2000 (J. Krejca, P. Sprouse) (JCC, 2000); LakeLine Mall Well Trap No. 2, 10 Oct. 1990 (L. Sherrod) (JCC, 1990); 12 Oct. 1990 (L. Sherrod) (JCC, 1990); 15 Oct. 1990 (L. Sherrod) (JCC, 1990); 19 Oct. 1990 (L. Sherrod) (JCC, 1990); 29 Oct. 1990 (L. Sherrod) (JCC, 1990); LakeLine Mall Well Trap No. 3, 10 Oct. 1990 (L. Sherrod), lower and upper bottles (JCC, 1990); 12 Oct. 1990 (L. Sherrod), lower and upper bottles (JCC, 1990); 15 Oct. 1990 (L. Sherrod), lower bottle (JCC, 1990); LakeLine Mall Well Trap No. 6, 10 Oct. 1990 (L. Sherrod), lower bottle and upper bottles (JCC, 1990); 12 Oct. 1990 (L. Sherrod), upper bottle (JCC, 1990); Leaning Tree Cave, 18 April 1996 (M. Warton) (JCC, 1996); Lineament Cave, 12 June 1993 (J. Reddell, M. Reyes) (JCC, 1993); Lorfing's Unseen Rattler Cave, 10 Nov. 1990 (W. Elliott, J. Reddell, M. Reyes) (JCC, 1991); Man-With-A-Spear Cave, 2 Sept. 1990 (D. Allen, W. Elliott) (JCC, 1990); Medicine Man Cave, 25 July 1995 (J. Reddell, M. Reyes) (JCC, 1995); Mushroom Cave, 27 April 1992 (M. Warton) (JCC, 1992); Mustard Cave, 31 May 1993 (J. Reddell, M. Reyes) (JCC, 1993); 12 June 1993 (J. Reddell, M. Reyes) (JCC, 1993); Nostromos Cave, 16 April 1994 (J. Reddell, M. Reyes) (JCC, 1994); 20 July 1994 (J. Reddell, M. Reyes) (JCC); O'Connor Cave, 31 March 1993 (D. Allen, L.J. Graves) (JCC, 1993), 12 April 1993 (M. Warton) (JCC, 1993); Ominous Entrance Cave, 30 March 1993 (J. Reddell, M. Reyes) (JCC, 1993); On Campus Cave, 18 May 1992 (J. Reddell, M. Reyes) (JCC, 1992); Overlooked Cave, 7 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Paleospring Cave, 28 July 1994 (B. Larsen, P. Sprouse) (JCC, 1994); 2 Aug. 1994 (B. Larsen, P. Sprouse) (JCC, 1994); Pow Wow Cave, 29 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Priscilla's Cave, 6 June 1996 (W. Elliott), on gate (JCC, 1996); Pussy Cat Cave, 6 June 1991 (D. Allen, W. Elliott) (JCC, 1991); Quinceñera Cave, 16 Aug. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Raccoon Cave, 16 March 1990 (J. Reddell, M. Reyes) (JCC, 1990); 18 March 1990 (J. Reddell, M. Reyes); Berlese of leaf litter (JCC, 1990); 27 March 1990 (J. Reddell, M. Reyes) (JCC, 1990); Red Crevice Cave, 24 April 1991 (W. Elliott, J. Reddell, M. Reyes) (JCC,

1991); Scoot Over Cave, May 1994 (M. Warton) (JCC, 1994); Shaman Cave, 29 Sept. 1994 (J. Reddell, M. Reyes) (JCC, 1994); 13 June 1996 (P. Sprouse) (JCC, 1996); Shawnee Pit Cave, 3 Oct. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Short Stack Cave, April 1994 (M. Warton) (JCC, 1994); Sierra Vista Cave, 28 July 1991 (J. Reddell) (JCC, 1991); Spiny Tortilla Cave, 25 Aug. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Sting Cave, 14 June 1996 (W. Elliott) (JCC, 1996); Temples of Thor Cave, 13 May 1991 (J. Reddell, M. Reyes), Berlese of raccoon scat (JCC, 1991); 17 May 1991 (W. Elliott, L.J. Graves) (JCC, 1991); 2 July 1991 (W. Elliott) (JCC. 1991); 1 Sept. 1993 (W. Elliott) (JCC, 1993); 3 Aug. 1995 (P. Sprouse), Zone 6 (JCC, 1995); Testimony Cave, 14 Aug. 1994 (J. Reddell, M. Reyes) (JCC, 1994); Testudo Tube, 2 Aug. 1995 (W. Elliott), zone 0 (JCC, 1995); Texella Cave, 24 Sept. 1991 (J. Reddell, M. Reyes); 2 Oct. 1991 (W. Elliott) (JCC, 1991); The Chimney, 24 April 1991 (M. Reyes) (JCC); Thin Roof Cave, 28 April 1998 (J. Reddell, M. Reyes, J. Wolff) (JCC, 1998); Turner Goat Cave, 17 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994); 16 April 1994 (J. Reddell, M. Reyes) (JCC, 1994); 21 July 1994 (J. Reddell, M. Reyes) (JCC, 1994); Undercut Cave, 18 Nov. 1993 (J. Reddell, M. Reyes) (JCC, 1994); 18 April 1994 (J. Reddell, M. Reyes) (JCC); 21 July 1994 (J. Reddell, M. Reyes) (JCC, 1994); Undertaker Cave, 24 June 1993 (L.J. Graves, C. Savvas) (JCC, 1993); Ute Cave, 24 July 1995 (J. Reddell, M. Reyes) (JCC, 1995); Valley Cave, March 1994 (M. Warton) (JCC, 1994); Varicose Cave, April 1994 (M. Warton) (JCC, 1994); Villa de Indios Cave, 6 April 1994 (J. Reddell, M. Reyes) (JCC, 1994); Village Idiot Cave, 31 Oct. 1994 (M. Warton) (JCC, 1994); 17 Nov. 1994 (J. Reddell, M. Reyes) (JCC, 1995); Walsh Pasture Cave, 14 May 1992 (J. Reddell) (JCC, 1992); Wigglewise Cave, March 1994 (M. Warton) (JCC, 1994); Wild Card Cave, April 1994 (M. Warton) (JCC, 1994); Williams Cave No. 1, 1 Aug. 1991 (W. Elliott, J. Reddell, M. Warton) (JCC, 1991); Zee End Cave, 25 Oct. 1994 (J. Reddell) (JCC, 1994).

Comments.—See the discussion under ecology in the introduction for further information on this trogloxene. What is presumed to be this species has been reported as sight records for numerous other caves, but the only records given here are for collections.

Solenopsis (*Solenopsis*) *xyloni* McCook

Solenopsis (*Solenopsis*) *xyloni*: Reddell, 1988c:44.

Records.—USA: TEXAS: *Bexar County*: Braken Bat Cave, 18 Oct. 1983 (E. Short, G. Veni) (RRS, 1985). *Val Verde County*: Seminole Sink, 21 May 1984 (L. Bement, R. Ralph) (RRS, 1985). *Williamson County*: Hanging Branch Cave, 5 July 1986 (W. Elliott, M. Tuttle) (RRS, 1986). CALIFORNIA: *Tuolumne County*: McLean's Cave, 4.6 km NNW Columbia, 12 Dec. 1977 (W.R. Elliott, A.G. Grubbs) (RRS as *S. maniosa* Wheeler, 1981).

Comments.—This species was taken from the entrance talus cone in Seminole Sink. Like *S. geminata*, the distribution of this native fireant is shrinking with the invasion of the exotic *S. invicta*.

Stenamma prob. n.sp.

Records.—MEXICO: *Quintana Roo*: Cenote de Santo Domingo, 5 km NE Kilometer 50, 29 July 1975 (A. Grubbs, D. McKenzie, J. Reddell) (RRS, 1977).

Comment.—This species was taken from the entrance room.

Strumigenys languinosa Wheeler

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comment.—This species was taken from the main entrance sink.

Tetramorium bicarinatum (Nylander)

Record.—MEXICO: *Yucatán*: Actún Nohcacab, Santa Elena, 15 Nov. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977, as *Tetramorium guineense* (Fabricius).

Comment.—This species was taken from the entrance area.

Tetramorium lanuginosum Mayr

Records.—MEXICO: *Yucatán*: Cenote de Hoctún, 1 km W Hoctún, 16 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981). Cenote Kabachchén, Maní, 5 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (DRS, 1978); Cenote de los Pinos, 7 km S Buenaventura, 23 July 1983 (J. Reddell) (RRS, 1984, as *Triglyphothrix lanuginosa* and *T. striatidens*).

Comments.—This is probably an accidental. The specimens from Cenote de Hoctún were taken from bat guano in the main cave passage.

Trachymyrmex sp.

Record.—MEXICO: *Yucatán*: Grutas de Tzab-Nah, 2 km S Tecoh, 22 April 1973 (D. McKenzie, J. Reddell) (DRS).

Comments.—This is an accidental. *Trachymyrmex* ants are fungus growers, a behavior not suited for life in a cave. These ants collect vegetable matter which they use to culture their fungal gardens.

Wasmannia auropunctata (Roger)

Wasmannia auropunctata: Reddell and Veni, 1996:137.

Records.—BELIZE: *Cayo*: Cebada Cave, Zone A, 8 May 1986 (G. Veni) (RRS, 1986).

MEXICO: *San Luis Potosí*: Sótano de Tampamache, 8 km NW Aquismón, 31 Aug. 1986 (P. Sprouse) (RRS, 1986). *Veracruz*: Cueva del Río Atoyac, 3 km E Atoyac, 6 Jan. 1977 (D. McKenzie, J. Reddell), in swallow guano (RRS, 1981). *Yucatán*: Cenote Amil, 6 km S Abalá, 28 March 1973 (J. Reddell, M. Rodríguez), Berlese of litter (RRS, 1977, 1981).

Comments.—This species was taken from just inside the entrance of Cebada Cave; from cave swallow guano in Cueva del Río Atoyac, and from leaf litter below the entrance of Cenote Amil.

Subfamily Dolichoderinae

Azteca sp.

Azteca sp.: Reddell and Veni, 1996:137.

Record.—BELIZE: *Cayo*: Cebada Cave, Zone A, 8 May 1986 (G. Veni) (RRS, 1986).

Comment.—This species was found just within the entrance zone of the cave.

Dolichoderus bispinosus (Olivier)

Dolichoderus (*Monacis*) *bispinosus*: Wheeler, 1938:252; Reddell, 1971b:75.

Dolichoderus bispinosus: Pearse, 1945:189; MacKay, 1993:43.

Records.—MEXICO: *Quintana Roo*: Cueva de Abispa, 2 km N Tancah, 1 July 1975 (A. Grubbs, J. Reddell, S. Wiley) (RRS, 1977). *Yucatán*: Actún Xconsacab (Wheeler, 1938).

Comments.—Wheeler (1938) reported this species from "inner part 46 m. from mouth" of Actún Xconsacab. It was found in the entrance room of Cueva de Abispa. MacKay (1993) reported that this species is common and widely distributed in the southern half of Mexico and the northern half of South America. This species occurs in many different habitats and tends dew producing insects as well as being an effective predator. The species appears to be able to adapt to varying habitats and it is therefore not surprising to find it in a cave. Because the nests are populous, it is unlikely the ants were nesting in the cave because they would have to leave the cave to find enough food to thrive.

Forelius mccooki (McCook)

Forelius maccooki: Wheeler, 1938:252; Pearse, 1945:189; Reddell, 1971b:76.

Record.—MEXICO: *Yucatán*: Cenote de San Isidro, Mérida (Wheeler, 1938).

Comment.—A single worker was found below the cave entrance.

Liometopum apiculatum Mayr

Liometopum apiculatum: Reddell, 1982a:275.

Records.—MEXICO: *Chihuahua*: Cueva del Salitre, 16 km W Villa Matamoros, 22 July 1965 (J. Fish, J. Reddell) (ACC, 1966).

USA: TEXAS: *Brewster County*: O.T.L. Cave, 25 June 1963 (J. Reddell, W. Russell) (ACC, 1964).

Comments.—This accidental species was found in the entrance area on cave swallow guano in Cueva del Salitre and in the entrance sink of O.T.L. Cave.

Liometopum luctuosum Wheeler

Record.—USA: CALIFORNIA: *Amador County*: Fern Frond Cave, 4 mi. NW Volcano, 15 April 1979 (D.C. Rudolph, S. Winterath, E. van Ingen, D. Cowan) (RRS, 1981).

Comment.—It is not known where in the cave this accidental was found.

Liometopum occidentale Emery

Record.—USA: CALIFORNIA: *Tuolumne County*: Confluence Cave, NW 1/4, Sec. 34, T3N, R14E, 2.5 mi. NW Columbia, 8 April 1979 (D.C. Rudolph, D. Cowan) (RRS, 1981).

Comment.—It is not known where in the cave this accidental was found.

Tapinoma sp.

Tapinoma sp.: Elliott and Reddell, 1973:199.

Record.—MEXICO: *San Luis Potosí*: Sumidero de Fantasmas, 5 Aug. 1966 (J. Reddell) (DRS).

Comment.—This species was taken from the bottom of the entrance sink.

Tapinoma sessile (Say)

Record.—USA: CALIFORNIA: *Tuolumne County*: McNamee's Cave, 2.5 mi. E Columbia, June 1977 (D. Cowan, B. Martin) (RRS, 1981).

Comments.—It is not known where in the cave this accidental was found.

Subfamily Formicinae

Acropyga sp.

Record.—MEXICO: *Quintana Roo*: Cueva de Tancah, Tancah, 1 July 1975 (J. Reddell, A. Grubbs, S. Wiley) (DRS, 1984).

Comment.—This accidental species was taken from the entrance area.

Brachymyrmex cavernicola Wheeler

Brachymyrmex cavernicola Wheeler, 1938:251, 252-254; Pearse, 1945:189; Wilson, 1962:68, 70; Reddell, 1971b:75; Reddell, 1977b:235; Reddell, 1981:238; Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Records.—MEXICO: *Oaxaca*: Cueva de las Maravillas, 6 km SSW Acatlán, 29 Dec. 1976 (A. Grubbs, D. McKenzie, J. Reddell, C. Soileau) (RRS, 1981). *Yucatán*: Grutas de Balankanché, Chichén Itzá (Wheeler, 1938); Cueva de Cenote Xtolok, Chichén Itzá, 26 July 1983 (J. Reddell) (RRS, 1984).

Comments.—Wheeler (1938) reported this species from "under a stone near the mouth." It was found in numerous small nests under rocks in total darkness in Cueva de Cenote Xtolok.

Camponotus spp.

Camponotus sp.: Reddell, 1971a:228; Reddell, 1982a:275.

Probablemente *Camponotus*: Navarro-Mendoza, 1988:117.

Camponotus: Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Records.—MEXICO: *Chihuahua*: Socavón de las Moscas, 8 km NW Santo Tomas, 16 June 1980 (J. Reddell) (RRS, 1981); Socavón del Pino, 8 km NW Santo Tomas, 14 June 1980 (J. Reddell) (RRS, 1981). *Quintana Roo*: ?Cenote Tan Kah (Navarro-Mendoza, 1988). *San Luis Potosí*: Cueva de Ojita de Agua, 3 km SSE San Nicolás de los Montes, 13 km N Agua Blanca, 2 Jan. 1976 (T. Byrd, M. Cassey, A. Grubbs, J. Rodemaker) (RRS, 1977). *Veracruz*: Sótano del Profesor, Tequila, 2 June 1964 (W. Bell, T. Raines) (ACC, 1964).

USA: TEXAS: *Bell County*: Herbert Cave, Fort Hood, 10 Sept. 1997 (L.J. Graves, M. Reyes) (JCC, 1997). *Coryell County*: Chigiouxs' Cave, Fort Hood, 10 Sept. 1997 (J. Reddell, M. Reyes) (JCC, 1997). *Kendall County*: Glen Rose Cave, 4 March 1999 (M. Reyes, M. Warton) (JCC, 1999).

Comments.—This genus was usually taken from near cave entrances. Specimens tentatively identified as *Camponotus* were taken from the stomach contents of the fish *Poecilia velifera* Regan in Cenote Tan Kah (Navarro-Mendoza, 1988).

Camponotus atriceps (F. Smith)

Camponotus abdominalis: Reddell and Veni, 1996:137.

Record.—BELIZE: *Cayo*: Cebada Cave, Zone A, 8 May 1986 (G. Veni) (RRS as *C. abdominalis* (Fabricius), 1986).

Comment.—This species was taken just inside the cave entrance.

Camponotus decipiens Emery

Record.—USA: TEXAS: *Burnet County*: Simons Road Side Sink No. 1, 20 Nov. 1990 (J. Reddell) (JCC, 1991).

Comment.—This species was abundant just below the cave entrance.

Camponotus festinatus (Buckley)

Camponotus fumidus festinatus: Reddell, 1966b:36.

Record.—USA: TEXAS: *Sutton County*: Felton Cave, 4 July 1964 (J. Reddell) (ACC, 1964).

Comment.—This species was taken from cave swallow droppings on top of a stalagmite in the entrance room.

Camponotus nearcticus Emery

Record.—USA: TEXAS: *Bexar County*: Backhole, 7 June 1994 (J. Ivy, G. Veni) (JCC, 1994).

Comment.—This species was taken from the bottom of the entrance drop.

Camponotus picipes (Olivier)

Record.—MEXICO: *Tamaulipas*: Cueva del Camino, 1 km W Rancho Nuevo, 34 km WNW Ciudad Victoria, 2500 m elev., 23 Aug. 1973 (D. McKenzie) (DRS, RRS, 1981).

Comments.—It is not known where in the cave this species was found.

Camponotus planatus Rogers

Record.—MEXICO: *Yucatán*: Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977).

Comment.—This species was found in the main entrance sink.

Camponotus rectangularis Emery

Record.—MEXICO: *Yucatán*: Actún Loltún, 7 km SSW Oxkutzcab, 25-26 July 1975 (A. Grubbs, D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977).

Comment.—This species was taken from near the cave entrance. It normally nests in twigs, and thus was apparently only a forager.

Camponotus sansabeanus (Buckley)

Camponotus sansabeanus: Reddell, 1966b:36; Davis, 1979:84, 131, 134.

Records.—USA: TEXAS: *Hays County*: Ezell's Cave (Davis, 1979). *Williamson County*: Elm Water Cave, 24 Aug. 1963 (J. Reddell, W. Russell) (ACC, 1964).

Comment.—This species was abundant in the downstream water passage and possibly washed into the cave.

Camponotus semitestaceus Snelling

Record.—USA: TEXAS: *Williamson County*: Yearwood Gold Mine Cave, 19 Oct. 1994 (J. Reddell, M. Reyes) (JCC, 1994).

Comment.—This species was taken from among trash and small rocks on the crawlway leading from the bottom of the entrance to the main part of the cave.

Camponotus texanus Wheeler

Records.—USA: TEXAS: *Bell County*: Nolan Creek Cave, Fort Hood, 19 May 1998 (J. Reddell, M. Reyes) (JCC, 1998). *Bexar County*: Encino Park Cave (=Here Today, Gone Tomorrow Cave), 1 July 1994 (J. Loftin) (JCC, 1994); Headquarters Cave, 21 Oct. 1997 (W. Elliott) (JCC, 1997).

Comment.—This species was found in the entrance area of these caves. As nests are found in dead tree limbs, these records are undoubtedly for foragers only.

Formica sp. (*fusca* group)

Formica sp. (*fusca*) group: Reddell, 1966b:36.

Record.—USA: TEXAS: *Hardeman County*: Campsey Cave, May 1963 (J. Reddell, W. Russell) (ACC, 1964).

Comments.—This species was found on silt about 60 m from the entrance. It had probably washed into the cave.

Formica sp. (*rufibarbis* group)

Formica sp. (*rufibarbis* group): Reddell, 1971a:228.

Record.—MEXICO: *Veracruz*: Sótano del Profesor, Tequila, 2 June 1964 (W. Bell, T. Raines) (ACC, 1964).

Comments.—This is presumably an accidental. It was found in the vicinity of the decaying remains of a human body at the bottom of the entrance drop.

Formica moki Wheeler

Record.—USA: CALIFORNIA: *Calaveras County*: Barren Cave, NW 1/4, Sec. 34, T3N, R14E, 3 mi. N Columbia, 30 March 1979 (D.C. Rudolph, B. Martin, S. Winterath, W. Elliott, J. Reddell) (RRS, 1981).

Comment.—It is not known in what part of the cave this accidental was found.

Paratrechina spp.

Paratrechina sp.: Reddell and Veni, 1996:137.

Records.—BELIZE: *Cayo*: Cebada Cave, Zone A, 8 May 1986 (G. Veni) (RRS, 1986).

MEXICO: *Oaxaca*: Grutas de Monteflor, Monteflor, 6 km N Valle Nacional, 28 Dec. 1973 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977). *Yucatán*: Actún Sabacá, 6 km SW Tekax, 4 Dec. 1974 (J. Andrews, D. McKenzie, R. Mitchell, J. Reddell, S. Wiley) (RRS, 1977); Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); 3 Aug. 1973 (J. Reddell) (RRS, 1977).

USA: TEXAS: *Kinney County*: Baker's Crossing Cave, 30 April 1995 (A. Grubbs) (JCC, 1995). *Travis*

County: Dobie Shelter, 19 Aug. 1984 (W. Elliott, C. Sexton) (JT, 1985). *Williamson County*: Beck Horse Cave, 29 May 1996 (J. Reddell, M. Reyes), Berlese of leaf litter (JCC, 1995); Priscilla's Cave, 6 June 1996 (W. Elliott), on cave gate (JCC, 1996).

Comment.—This material was taken from cave entrance areas.

Paratrechina sp. (*caeciliae* group)

Records.—MEXICO: *Yucatán*: Actún Dxibi, 25 km NE Valladolid, 1 June 1986 (G. Veni) (RRS, 1986).

Comment.—The status of this material is unknown.

Paratrechina sp. 1

Records.—MEXICO: *Hidalgo*: Cueva de El Ocote, 1.5 km N Palomas, 22 July 1973 (J. Reddell, J.M. Rowland) (DRS, RRS, 1981). *Puebla*: Waterfall Cave, near Xocoyolo, 30 Dec. 1979 (J. Hooper, M. Minton, L. Wilk) (RRS, 1981). *San Luis Potosí*: Cueva de Potrerillos, Rancho de Potrerillos, 2 km WSW Ahuacatlán, 27 Nov. 1972 (T. Raines, J. Reddell) (DRS, RRS, 1981).

Comment.—The status of this material is unknown.

Paratrechina sp. 2 [possibly *caeciliae* (Forel)]

Records.—MEXICO: *Puebla*: Grutas de Jonotla, 1.5 km SSW Cuetzalan, 26 Dec. 1973 (W. Elliott, R. Jameson, D. McKenzie, J. Reddell) (DRS, RRS, 1981); Sima Chica de Xochitlán, Xochitlán, 28 Dec. 1973 (W. Elliott) (DRS, RRS, 1981). *San Luis Potosí*: Cueva de los Viet Cong, Xilitla Plateau, 1 April 1980 (T. Treacy) (RRS, 1981).

Comment.—This species was found in the entrance sink of Cueva de los Viet Cong.

Paratrechina pearsei (Wheeler)

Nylanderia pearsei Wheeler, 1938:251, 254-255; Pearse, 1945:190; Decu, Casale, Scaramozzino, López, and Tinaut, 1998:1021.

Paratrechina (Nylanderia) pearsei: Wilson, 1962:68; Reddell, 1971b:76.

Paratrechina pearsei: Reddell, 1977b:235; Reddell, 1981:238.

Records.—MEXICO: *Campeche*: Grutas de Xkalumkín, 5 km W Cumpich, 20 June 1975 (A. Grubbs, D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977). *Quintana Roo*: Cenote Aká Chen, Ruinas de Cobá, 30 June 1975 (A. Grubbs, J. Reddell, S. Wiley) (RRS, 1977); Cueva del Fermín, 3 km E Pamul, 19-20 July 1983 (J. Reddell) (RRS, 1984). *Yucatán*: Cenote Aká Chen, 1 km E Tixcancal, 2 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (RRS, 1977); Grutas de Balankanche, 4 km E Chichén Itzá, 10-12 Dec. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); Cueva de Cenote Xtolok, Chichén Itzá, 26 July 1983 (J. Reddell), abundant in nests under rocks in total darkness (RRS, 1984); Cueva Chac Mol, Tohil (Wheeler, 1938); Actún Coch Leb, 3 km S Calcehtok, 16 April 1973 (J. Reddell) (DRS, RRS, 1981); Actún Kaua, 1 km S Kaua, 9-10 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); 20-21 Oct. 1974 (D. McKenzie, J. Reddell, S. Wiley) (RRS, 1977); 9 Nov. 1974 (J. Reddell) (RRS, 1977); Cueva Muruztún, 5 km S Tizimín (Wheeler, 1938); Cueva de Orizaba, Orizaba, 8 km S Buenaventura, 1 April 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Cenote de los Pinos, 7 km S Buenaventura, 1 April 1973 (S. Murphy, J. Reddell) (DRS, RRS, 1981); Actún Silil, 3 km S Calcehtok, 23 June 1975 (W. Russell, S. Wiley) (RRS, 1977); Cenote Salud (=Soldado), S of Tekom, 12 April 1973 (S. Murphy) (DRS, RRS, 1981); Grutas de Tzab-Nah, 2 km S Tecoh, 22 April 1973 (D. McKenzie, J. Reddell) (RRS, 1977); Actún Xpukil, 3 km S Calcehtok, 18-19 March 1973 (M. Butterwick, D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); 4-5 April 1973 (D. McKenzie, M. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); Cenote Xtacabihá, 9 km NNE Tikuch, 11 April 1973 (D. McKenzie, S. Murphy, J. Reddell) (DRS, RRS, 1981); 25 July 1983 (J. Reddell) (RRS, 1981, 1984); Actún Ziz, Oxkutzcab, 3 Dec. 1974 (A. Gamboa, D. McKenzie, R. Mitchell, J. Reddell, S. Wiley) (RRS, 1977).

Comments.—The type-locality of this species is Cueva Muruztún. Wheeler (1938) reported this species from a "big midden pile of a leaf-cutter [*Atta cephalotes*] mound" in Cueva Muruztún; from the "Temple Pool, 260 m. from mouth" in Grutas de Balankanche. It was also found in abundance in nests in total darkness in Cueva del Cenote Xtolok. This species should be considered a troglophile.

Paratrechina terricola (Buckley)

Paratrechina melanderi: Reddell, 1982a:275.

Records.— MEXICO: *Coahuila*: Cueva de Empalme, 1.5 km E Entronque la Cuchilla, 24 Feb. 1966 (W. Bell, J. Reddell) [ACC as *P. melanderi* (Wheeler), 1966)].

USA: TEXAS: *Bexar County*: Droll Cave, 2 June

1993 (J. Reddell, M. Reyes, G. Veni) (JCC, 1993). *Sutton County*: Caverns of Sonora, 27 July 1994 (B. Sawyer, G. Veni), entrance to Sam Odom Pit (JCC, 1994).

Comments.—This species was found in total darkness in Caverns of Sonora. The status of the species is uncertain, but it may be a trogloxene in that cave. The record from Mexico is an accidental found in the entrance area.

Prenolepis imparis (Say)

Records.—USA: CALIFORNIA: *Amador County*: Connie's Cave, 0.5 mi. N Volcano, 15 April 1979 (D.C. Rudolph, S. Winterath, E. van Ingen, D. Cowan) (RRS, 1981); Fern Frond Cave, 4 mi. NW Volcano, 15 April 1979 (D.C. Rudolph, S. Winterath, E. van Ingen, D. Cowan) (RRS, 1981); Fiddler Cave, 6 mi. NW Volcano, 15 April 1979 (D.C. Rudolph, S. Winterath, E. van Ingen, D. Cowan) (RRS, 1981); Violin Cave, 6 mi. NW Volcano, 15 April 1979 (D.C. Rudolph, S. Winterath, E. van Ingen, D. Cowan) (RRS, 1981). *Calaveras County*: Cave of Skulls, NE 1/4, Sec. 33, T3N, R14E, 3 mi. NW Columbia, 25 March 1979 (D.C. Rudolph) (RRS, 1981); Coral Cave, SE 1/4, Sec. 27, T3N, R14E, 3 mi. N Columbia, 22 March 1979 (D.C. Rudolph, B. Martin, S. Winterath, W. Elliott, J. Reddell) (RRS, 1981); Grapevine Gulch Cave, SW 1/4, Sec. 22, T3N, R14E, 4 mi. N Columbia, 15 March 1979 (D.C. Rudolph, S. Winterath, B. Martin); Porcupine Cave, SW 1/4, Sec. 22, T3N, R14E, 4 mi. N Columbia (D.C. Rudolph, B. Martin, S. Winterath) (RRS, 1981); Scat Cave, NE 1/4, Sec. 6, T2N, R14E, 4 mi. NW Columbia, 25 March 1979 (D.C. Rudolph, B. Martin, S. Winterath) (RRS, 1981). *Mariposa County*: Damp Cave, SE 1/4, Sec. 29, T2S, R18E, 7 April 1979 (D.C. Rudolph, B. Martin, S. Winterath) (RRS, 1981). *Tuolumne County*: Crystal Tuolumne Cave, 8 mi. SE Tuolumne, 16 June 1979 (D. Cowan, J. Espinal) (RRS, 1981); Transplant Mine, 3.7 mi. N Columbia, 10 Jan. 1978 (W.R. Elliott, A.G. Grubbs, S.A. Winterath) (RRS, 1981).

Comments.—This species was taken from near the entrance of Grapevine Gulch Cave and in the tailings at the entrance of the Transplant Mine. It was found in all parts of Porcupine Cave. Normally, *P. imparis* feeds on liquids, especially the honey-dew of homopterans, nectar and exudates of plants as well as juices of dead and dying earthworms (Wheeler, 1930). This ant is well known for its dislike of dry warm habitats and possibly its occurrence in caves is a means by which it can escape the undesired conditions normally found on surface habitats. Although this ant shows a preference for honey-dew, it has not been recorded tending dew producing homopterans.

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CAVE FAUNA OF THE XILITLA REGION, QUERETARO AND SAN LUIS POTOSI, MEXICO

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ABSTRACT

All published and unpublished species records and bibliographic citations are provided for caves in the Xilitla region, Querétaro and San Luis Potosí, México. A minimum of 320 species are recorded, of which about 40 are troglobites. Aquatic troglobites include species of Tricladida Dugesiidae, Haplotaxida Acanthodrilidae, Branchiobdellia, Podocopa Entocytheridae. Isopoda Cirolanidae, Mysidacea Lepidomysidae, Decapoda Cambaridae, and Decapoda Palaemonidae. Terrestrial troglobites include Isopoda Squamiferidae and Trichoniscidae; Schizomida Protoschizomidae; Amblypygi Phrynidae; Araneae Dipluridae, Theraphosidae. Caponiidae. Liocranidae, and Pholcidae; Pseudoscorpiones Chthoniidae and Ideoroncidae; Opiliones Nemastomatidae and Stygnopsidae; Chilopoda Lithobiida; Diplopoda Glomeridae, Trichopetalidae, Rhachodesmidae, Fuhrmannodesmidae, and Cambalidae; Collembola Hypogastruridae; Orthoptera Phalangopsidae; and Coleoptera Carabidae. The distsribution of the fauna is briefly discussed.

INTRODUCTION

The Xilitla region is one of the premier karst regions of Mexico and one of the better known. This holds true not only for the caves but also for the fauna inhabiting the caves. Despite the fact that the present report includes an estimated 320 species from the caves of the Xilitla region, this must be considered a preliminary report. Once large numbers of mites, centipedes, and other groups are studied it would be surprising if the final total of species for the region does not exceed 500.

Reddell (1981) subdivided the area herein covered into several regions: Aquismón, Xilitla, Xilitla Plateau, and Laguna Colorado. As was discussed in that report this was considered an arbitrary subdivision of a large contiguous karst region. Each of these subdivisions exhibits some geologic, physiographic, and faunal differences, but with the additional study of the last few years there appears to be a gradation between the regions and the previous regions are best considered as a single unit, albeit one exhibiting differences from one part to another.

The geology, physiography, and other physical parameters are briefly described by Reddell (1981), but are considered in slightly more detail below.

HISTORY

The first study of a cave in the Xilitla region was made in December 1945 when F. Bonet, C. Bolívar y Pieltain, J. Alvarez, and other members of the Escuela Nacional de Ciencias Biológicas de México visited

Cueva de El Jobo. In November and December 1950 F. Bonet and others began the serious study of the caves and cave fauna of the region. This was followed by extensive collections in January 1952 by F. Bonet, R. Ortiz, J.V. Flores, M. Camacho, and A. González in numerous horizontal caves (Bonet, 1953).

The modern era of cave fauna studies in this region began with the organization of the Speleological Survey of Mexico (now the Association for Mexican Cave Studies). In November 1962 T.R. Evans, Terry Raines, James Reddell, and William Russell conducted the first expedition of this group. Among the caves visited was Sótano de Huitzmolotitla. The discovery in this cave of a new genus of isopod and other fauna indicated the richness of the area and inspired future studies.

In November 1963 Glen Merrill, Terry Raines, and Bill Russell collected in Sótano de Huitzmolotitla, Cueva de la Porra, and Cueva de la Selva. Sótano de Huitzmolotitla was revisited by Tom Phillips and Terry Raines in January 1964, at which time they collected a new genus and species of millipede in the terminal room of the cave. Other trips in 1964 resulted in collections in March in Cueva del Nacimiento del Rió Huichihuayán by Bill Bell, David McKenzie, and Terry Raines; in June by Terry Raines in Sótano de las Hoyas and Sótano del Pozo, and by David McKenzie and James Reddell in Cueva del Ahuate no. 2; and by Bill Bell and Terry Raines in Sótano del Pozo, Cueva de la Selva, and Sótano de Tlamaya. John Fish and Terry Raines made additional collections in July 1965.

In April 1966 Terry Raines collected in Cueva del Salitre and Cueva de la Selva. July 1966 saw still additional collections by Terry Raines in Sótano de Tlamaya. In August 1966 James Reddell collected in Cueva de la Iglesia and Sótano de Camposantos. John Fish made the first collection in Sótano de las Golondrinas in June 1967. A reconnaissance trip in July 1967 to various parts of the Sierra Madre Oriental by John Fish, James Reddell, and Philip Russell resulted in collections in Cueva del Niño and Cueva de las Tablas, Querétaro, and in Cueva de Potrerillos and Sótano de Potrerillos, San Luis Potosí. The first serious study of the cave fauna of the Aquismón region was made in September 1967 by John Fish at which time collections were made in Cueva de Agua Bendita no. 1, Sótano de las Golondrinas, Nacimiento de La Laja, Cueva de la Luz, and Cueva del Nacimiento de San Miguel. In November 1967 T.R. Evans and John Fish collected in Cueva de Potrerillos.

Collections in 1968 were made by Terry Raines in Cueva del Ahuate no. 2 in January; by Dwight Deal, Duane Faith, and John Fish in April in Cueva de San Nicolas; and in December by Ron Bridgemon in Cueva de la Cisterna and Sótano de la Navidad.

Collections were made in April 1969 by William Russell in Cueva del Agua (Aquismón), Sótano del Fin, and Cueva de las Hormigas; by Miles Abernathy, Tom Albert, William Elliott, and John Fish in Sótano de la Linja; and by T.R. Evans in Sumidero del Llano Conejo. An expedition by Stewart and James Peck in July and August 1969 to various parts of Mexico included collecting trips with William Elliott to Cueva del Nacimiento del Río Huichihuayán, Cueva de la Porra, and Cueva del Salitre. In the fall of 1969 Roberto Argano, Vittorio Parisi, and Roberto Argano of the Accademia Nazionale dei Lincei of Italy as part of an expedition to various parts of Mexico visited Cueva del Madroño and Cueva del Niño.

Collecting in the Xilitla region was not resumed until January 1972 when Peter Strickland collected in Sótano de la Lagunita Seca. The only other collecting trip to this region in 1972 was a visit in November by Terry Raines, James Reddell, and Jack White at which time collections were made in Sótano de las Golondrinas, Agua de Guadalupe, Sótano de Guadalupe, Nacimiento de La Laja, Cueva de El Jobo, Cueva de la Laja, Cueva de Potrerillos, and Sótano del Rancho de la Barranca.

Sótano del Potrero was studied in February 1973 by Robert W. Mitchell, Tony Mollhagen, and Suzanne Wiley. Collections were made in December 1973 and January 1974 by Peter Strickland in Cueva del Agua de Quital, Hoya de Quital, and Cueva de San Rafael. In May 1974 Chuck Elliott collected the blind tarantula *Spelopelma stygia* in Sótano del Pozo. Carmen Soileau made collections in Cueva del Agua del Rancho Ojo de Agua and El Socavón during a trip to the area in December 1974.

The only collections made in 1976 were by Carmen Soileau in January in Hoya de las Guaguas and by Roy Jameson in June in Sumidero del Llano Conejo and Cueva de los Grillos. Study of the Xilitla Plateau by Roy Jameson was continued in May 1977 when he collected in Sumidero del Llano Conejo and Sumidero del Llano Chiquito. Andy Grubbs and Bill Stone collected in Hoya de las Guaguas in September 1978. A collection was made in Cueva de los Fosiles in December 1979 by Peter Sprouse.

A major expedition to the Xilitla region in March and April 1980 by David Honea, Peter Keys, Dale Pate, Randy Rumer, Peter Sprouse, and Terri Treacy resulted in the discovery of many new species in the following caves: Cueva del Agua de La Silleta, Cueva de los Antiguos, Cueva de los Caracoles no. 1, Sótano de Cepillo, Sótano de las Golondrinas, Sótano de Guadalupe, Cueva del Jilguero, Cueva de los Ladrones, Cueva de los Muertos, Cueva de La Silleta, Sótano de La Silleta, Sótano del Tigre, and Cueva de los Viet Cong. In August 1980 Steve Robertson collected in Joya de

las Guaguas and Sheila Balsdon, Peter Sprouse, and Terri Treacy in Cueva de Oxtalja.

Collections were made by Peter Sprouse and Terri Treacy in Sótano de las Golondrinas, Sótano de El Lobo, Cueva de Potrerillos, Cueva de Potrerillos no. 2, and Sótano de El Ranchito in August and September 1981. In January 1982 Olga Kukal collected in Cueva de Garza and Sótano de Huitzmolotitla. Andy Grubbs, Mark Minton, and Rich Rohrer in August and Steve Robertson in September 1982 collected in Hoya de las Guaguas.

Interesting collections were made in December 1982 and January 1983 by Gerald Atkinson, Mark Minton, and Steve Zeman in Cueva de Cerro Pilón, Cueva de Cerro Quebrado, and Sótano de Trinidad. In March 1983 Gerald Atkinson, Duane Whitis, and B. Wilson collected in Cueva de Oxtalja and Grieta de la Reina, while in April 1983 Scott Harden collected in Cueva de Plan de Juárez.

An expedition by Peter Keys, Susan Lasko, Terry Raines, Peter Sprouse, and Terri Treacy in November 1983 resulted in collections from Cueva de El Rincón, Cueva de la Rosal, Cueva de Salitre, and Sótano de Tlamaya.

In November 1984 Peter Sprouse and Tom Strong collected in Sótano de Tlamaya. Collections were made in December 1984 by Paul Fambro, Gary Mele, Terry Raines, Peter Sprouse, Luc Trepanier, and Terri Treacy in Cueva de El Cañón, Sótano de Huitzmolotitla, Cueva de San Pedro, Cueva Tepametl, Cueva de Tlamaya, and Sótano de Tlamaya.

In 1986 Susan Lasko and Peter Sprouse collected in Hoya de las Guaguas, Cueva de la Selva, and Sótano de Tampemache. The only collections for 1987 were made in November by Andy Grubbs in Sótano de las Golondrinas and Hoya de las Guaguas. In May and June 1988 John Fogarty, Susan Lasko, and Peter Sprouse collected in Sótano del Aserradero, Sótano del Jaguey del Monte, Sótano de la Mesa Grande, and Sótano de las Golondrinas. No new collections have been made in the area for over a decade.

DISTRIBUTION

The cave fauna of the Xilitla region primarily contains species belonging to genera still existing on the surface in the Sierra Madre Oriental. A few species, however, are temperate relicts not known from the surface in Mexico. Several species belonging to tropical groups are found on the surface in Mexico, but usually at lower elevations.

The aquatic fauna includes species derived from both freshwater and marine ancestors. The freshwater species are as yet unidentified paludicole flatworms probably belonging to the genus *Dugesia*, and the crayfish *Procambarus* (*Ortmannicus*) *xilitlae*. The genus *Dugesia* contains troglobitic species in several parts of Mexico. Apparent troglobites have been found in caves west of Aquismón, near Xilitla, and on the Xilitla Plateau. The crayfish is known only from Hoya de las Guaguas west of Aquismón. It is related to several Mexican surface species. Species derived from marine ancestors include the two isopods *Speocirolana bolivari* and *S. pelaezi*, their commensal ostracod *Hobbsiella cirolanae*, the mysid *Spelaeomysis* poss. n.sp., and the shrimp *Troglomexicanus perezfarfanteae*. The two isopods, ostracod, and shrimp are also found in caves of the Sierra de El Abra. The mysid may be endemic to Hoya de las Guaguas, but a second species of the genus inhabits caves in the Sierra de El Abra. The remarkable earthworm *Eodrilus mexicanus* is known only from pools and has apparently become secondarily adapted to freshwater from a terrestrial ancestor.

With one exception, the terrestrial troglobitic fauna is endemic to the Xilitla Region. These include two species belonging to families represented in Mexico only by troglobitic species. The millipede *Mexiterpes fishi* belongs to the family Trichopetalidae that is predominantly found in the eastern United States. The millipede *Mexicambala russelli* belongs to the family Cambalidae that ranges widely throughout the United States, but is most abundant in forests in the eastern United States. These species apparently are temperate relicts once widespread on the surface in Mexico, but now surviving only in caves. *Mexiterpes fishi* is endemic to the Xilitla region, but *Mexicambala russelli* has also been found (though with slight morphological differences) in caves of the Purificación region to the north.

Of special interest is the isopod *Mexiconiscus laevis*, known only from caves in the Xilitla region. This species is amphibious with immature specimens living on land, but adults almost exclusively in water.

The millipede *Glomeroides caecus*, the isopod *Trichorhina boneti*, and the tarantula *Spelopelma stygia* belong to tropical genera not known from the surface except in southern Mexico and Central America. The pseudoscorpion *Typhloroncus xilitlensis* belongs to a genus known only from caves in Mexico, but also found on the surface in the Virgin Islands.

The schizomid *Agastoschizomus huitzmolotitlensis* and the ground beetle *Mexaphaenops* n.sp. belong to genera occurring only in caves in the northern Sierra Madre Oriental. The millipede genus *Unculabes* is known only from caves in the Sierra Madre Oriental. Three species, *U. arganoi*, *U. crispus*, and *U. porrensis*, appear to be troglobites in caves of the Xilitla region. A fourth species from the Xilitla region, *U. columbinus*, is known only from caves but is distinctly pigmented.

It is possible it will also be found on the surface, but it appears to be a recent troglobite.

The millipedes *Sumidero sprousei* and *Tylogoneus rainesi* belong to genera restricted to caves but ranging widely throughout Mexico. Several species belong to genera with both troglobitic and troglophilic species inhabiting caves in the same area and in some cases in the same caves. The gryllid cricket *Paracophus cladonotus* is an eyeless species sharing caves with the eyed *P. placonotus*. The blind amblypygid *Paraphrynus velmae* inhabits caves with the eyed *Paraphrynus pococki* and an undetermined species of *Paraphrynus*. The blind tarantulas *Euagrus anops* and *Euagrus troglodyta* have not yet been found in the same caves with an eyed species, but undetermined eyed *Euagrus* have been found in other caves in the region. The same situation is true for the eyeless spiders *Metagonia luisa*, *M. oxtalja*, and *M. tlamaya* and the eyeless harvestmen *Hoplobunus* n.sp. 1, *Hoplobunus planus*, and *Hoplobunus queretarius*. Four eyed species of *Metagonia* have been described from other caves in the same area and some may also occur sympatrically with the blind species. As yet undetermined or undescribed eyed *Hoplobunus* have been found in other caves in the vicinity of caves inhabited by the blind species.

Two species of spider, an undescribed species of the family Caponiidae and an undescribed species of the genus *Phonotimpus*, are of special interest in being the only blind species known for the family Caponiidae and the genus *Phonotimpus*. Until they are studied their relationships remain uncertain.

There appears to be no clearcut distinction between the fauna throughout the region. Each subarea treated by Reddell (1981) contains species endemic to that area, but in some cases a species will be found throughout the area. A thrust fault between the Aquismón and Xilitla regions may help to explain some differences between the fauna, but the presence of species on both sides of the fault indicate that this is not necessarily a firm barrier to dispersal. It is also possible, of course, that species occurring on both sides of the fault may simply have not diverged sufficiently to produce morphologically distinct species.

Probably a more significant factor influencing speciation in the area is elevation. Species restricted to higher elevations of the Xilitla Plateau or lower elevations in the Laguna Colorado area may reflect different times of invasion of caves and isolation from surface ancestors by extinction of the surface fauna with climatic changes.

Until additional collections are made over a broader part of the region and taxonomic studies are completed on many poorly understood groups, any generalizations on distribution are probably fruitless at this time.

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Weisman (Lepidoptera); W.W. Wirth (Diptera Asilidae); N.E. Woodley (Diptera Stratiomyidae).

CHECKLIST OF FAUNA

In the following list troglobites are marked by an asterisk. Records with a question mark are based on material insufficient to permit a positive identification. The bibliographic citations usually refer only to the presence of the taxon in the Xilitla region.

PHYLUM PLATYHELMINTHES
CLASS TURBELLARIA
Order Tricladida (flatworms)
Suborder Paludicola (freshwater flatworms)
Undetermined material

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Sótano de Guadalupe; Sótano de Huitzmolotitla; Cueva de los Ladrones; Cueva de los Viet Cong.

Comments.—This material was listed by Reddell (1980) only as "blind planarians." All of this material probably will prove to belong in the genus *Dugesia*.

Bibliography.—Reddell (1973b; 1980).

Family Dugesiidae
Dugesia sp. nr. *dorotocephala* (Woodworth)

Records.—*San Luis Potosí*: Sumidero del Llano Conejo; Cueva de San Rafael.

Comments.—Reddell (1980) listed this material only as "blind planarians." Raines (1989) reported "white flatworms" from Sumidero del Llano Conejo.

Bibliography.—Jameson (1977); Raines (1989); Reddell (1980).

Suborder Terricola (terrestrial flatworms)
Undetermined material

Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de Tlamaya.

Family Bipaliidae
Bipalium sp. cf. *kewense* Moseley

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Bibliography.—Reddell (1981).

Family Rhynchodemidae
?*Rhynchodemus* sp.

Record.—*San Luis Potosí*: Sótano del Pozo.

Bibliography.—Reddell (1981).

PHYLUM MOLLUSCA
CLASS GASTROPODA (snails)
Undetermined material

Records.—*Querétaro*: Sótano del Aserradero; Cueva del Madroño; Cueva del Niño. *San Luis Potosí*: Cueva del Arco; Cueva del Banana Grande; Cueva de la Hoya; Sótano de La Linja; Cueva de Potrerillos; Cueva del Salitre; Cueva de San Nicolas; Cueva de San Pedro; Sótano de Tampemache; Cueva Tepametl; Cueva de Tlamaya; Sótano de Tlamaya; Cueva Ventosa.

Comments.—Bonet (1953) reported "Pulmonata sp." from Cueva de la Hoya. The Cueva del Arco, Cueva del Banana Grande, Cueva de San Nicolas, and Cueva Ventosa records are sight records.

Bibliography.—Bonet (1953); Currie (1994); Lazcano Sahagún (1986); Raines (1989); Sbordoni and Argano (1972).

Order Diotocardia
Family Ceresidae
Ceres nelsoni Dall

Records.—*San Luis Potosí*: Cueva de los Caracoles no. 1; Sótano del Cepillo; Sótano de las Golondrinas; Sótano de Guadalupe; Cueva del Oxtalja; Sótano de la Porra; Sótano del Rancho de la Barranca.

Comments.—The Sótano de la Porra record may be based on dead specimens. This is a large snail frequently found in the entrance area of caves. Raines (1989) reported this as "terrestrial gastropod" from Sótano de la Porra.

Bibliography.—Bridgemon (1974); Raines (1989); Thompson (1980).

Family Helicinidae
Helicina sp.

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Helicina chrysocheila Binney

Records.—*San Luis Potosí*: Nacimiento de La Laja; Sótano de Tlamaya.

Bibliography.—Reddell (1981).

Helicina turbinata Pfeiffer

Record.—*San Luis Potosí*: Sótano de la Porra.

Comment.—This record may be based on empty shells. Raines (1989) reported this as "terrestrial gastropod" from Sótano de la Porra.

Bibliography.—Bridgemon (1974); Raines (1989).

Schazicheila sp.

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Order Mesogastropoda

Family Cyclophoridae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva de los Ladrones; Cueva de los Muertos.

Aperostoma mexicanum (Menke)

Record.—*San Luis Potosí*: Sótano de la Porra.

Comments.—This species was listed by Bridgemon (1974) as *Cyrtotoma mexicanum*. The record may have been based on empty shells. Raines (1989) reported this as "terrestrial gastropod" from Sótano de la Porra.

Bibliography.—Bridgemon (1974); Raines (1989).

Family Thiaridae

Pachychilus sp.

Record.—*San Luis Potosí*: Cueva del Oxtalja.

Pachychilus sp. poss. *atratus* Pilsbry and Hinkley

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Order Basommatophora

Family Physidae

Physa sp.

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Order Sigmurethra

Family Achatinidae

Lamellaxis sp.

Records.—*San Luis Potosí*: Cueva de las Ladrones; Cueva de los Muertos.

Family Helicodiscidae

Helicodiscus sp.

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Cueva de Oxtalja.

Comment.—This genus is a frequent troglophile in caves.

Family Spiraxidae

Euglandina sp.

Records.—*San Luis Potosí*: Cueva de los Caracoles no. 1; Sótano de la Porra.

Comments.—Specimens from Sótano de la Porra were probably empty shells. Raines (1989) reported this as "terrestrial gastropod" from Sótano de la Porra.

Bibliography.—Bridgemon (1974); Raines (1989).

Selasiella sp.

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Streptostyla sp.

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Sótano de la Porra; Sótano del Rancho de la Barranca.

Comment—The record for Sótano de la Porra may be based on empty shells. Raines (1989) reported this as "terrestrial gastropod" from Sótano de la Porra.

Bibliography.—Bridgemon (1974); Raines (1989).

Streptostyla bartschi (Dall)

Records.—*San Luis Potosí*: Cueva de los Caracoles no. 1; Sótano del Pozo.

Streptostyla jilitlana Dall

Records.—*Querétaro*: Sótano del Potrero. *San Luis Potosí*: Sótano del Rancho de la Barranca.

Family Urocoptidae

Eucolodium speciosum (Dunker)

Record.—*San Luis Potosí*: Sótano de la Porra.

Comment.—This material may have been dead. Raines (1989) reported this as "terrestrial gastropod" from Sótano de la Porra.

Bibliography.—Bridgemon (1974); Raines (1989)

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PHYLUM ANNELIDA

CLASS CLITELLATA

Order Haplotaxida (earthworms)

Undetermined material

Records.—*Querétaro*: Sótano del Aserradero. *San Luis Potosí*: Cueva de Agua de Cabrera; Sótano de Cepillo; Hoya de las Guaguas; Cueva de Jilguero; Cueva de los Ladrones; Cueva de Plan de Juárez; Hoya de Quital; Cueva de La Silleta; Sótano de La Silleta; Cueva de Tlamaya; Cueva Ventosa; Cueva de los Viet Cong.

Comments.—The record for Sótano de La Silleta is based on a sight record of "white, aquatic earthworms" by Sprouse (1980). The record for Cueva de Agua de Cabrera is based on a report of "pink worms" by Atkinson (1983). Sprouse (1974a; 1974b) reported "troglobitic earthworms" in Hoya de Quital. "Transparent aquatic earthworms" were observed in Cueva Ventosa (Raines, 1989). The specimens from Sótano de La Silleta, Cueva de Agua, Cueva de Plan de Juárez, Hoya de Quital, and Cueva Ventosa may well belong to *Eodrilus mexicanus*.

Bibliography.—Atkinson (1983); Palacios-Vargas (1996); Raines (1989); Russell and Raines (1967); Sprouse (1974a; 1974b; 1980a).

Family Acanthodrilidae

Diplocardia sp.

Records.—*San Luis Potosí*: Sótano de la Linja; Cueva de la Selva.

Comment.—Raines (1989) reported "earthworms" from Cueva de la Selva.

Bibliography.—Gates (1977); Raines (1989).

**Eodrilus mexicanus* Gates

Records.—*San Luis Potosí*: ?Cueva de la Porra; ?Cueva del Salitre; Sótano de Tlamaya.

Comment.—Reddell (1967) listed this species as an undescribed species of *Eodrilus*.

Bibliography.—Gates (1968; 1971; 1972); Peck and Peck (1973); Raines (1965; 1967); Reddell (1967; 1971; 1973a; 1981).

Family Glossoscolecidae

Pontoscolex ?corethrurus (Mueller)

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Bibliography.—Reddell (1981).

Family Lumbricidae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de los Cuchos.

Comment.—This species was listed by Bonet (1953) as "Lumbricidae sp. A."

Bibliography.—Bonet (1953).

Octolasion tyrtaeum (Savigny)

Record.—*San Luis Potosí*: Sótano de la Linja.

Bibliography.—Gates (1971; 1973).

Family Megascolecidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de la Selva.

Comment.—Raines (1989) reported "earthworms" from this cave.

Bibliography.—Raines (1989).

Pheretima diffringens (Baird)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Bibliography.—Gates (1971; 1972).

Order Branchiobdellida

*Undetermined material, species 1

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Grieta de la Reina.

Comment.—These specimens were taken from *Speocirolana* poss. n.sp. in Sótano de las Golondrinas and from Cirolanidae genus and species in Grieta de la Reina.

Undetermined material, species 2

Record.—*San Luis Potosí*: Cueva de Oxtalja.

Comment.—This material was taken from the crayfish *Procambarus (Ortmannicus) toltecae* Hobbs.

PHYLUM ARTHROPODA

CLASS CRUSTACEA

Order Podocopa (ostracods)

Family Entocytheridae

*Undetermined genus and species

Records.—*San Luis Potosí*: Grieta de la Reina; Cueva de la Selva.

Comments.—This material was taken from undetermined cirolanid isopods.

Ankylocythere toltecae Hobbs

Records.—*San Luis Potosí*: Sótano de Huitzmolotitla; Cueva de Oxtalja; Cueva de San Nicolas.

Comment.—This species was taken from the crayfish *Procambarus (Ortmannicus) toltecae*.

Bibliography.—Hart and Hart (1974); Hobbs (1971).

Entocythere claytonhoffi Rioja

Records.—*San Luis Potosí*: Sótano de Huitzmolotitla; Cueva de Oxtalja; Cueva de San Nicolas.

Comment.—This species was taken from the crayfish *Procambarus (Ortmannicus) toltecae*.

Bibliography.—Hart and Hart (1974); Hobbs (1971).

**Hobbsiella cirolanae* (Rioja)

Record.—*San Luis Potosí*: Sótano de las Golondrinas

Comment.—This species was taken from the isopod *Speocirolana* poss. n.sp.

Order Isopoda

Undetermined material

Record.—*San Luis Potosí*: Cueva de Muhuatl.

Comment.—Isopods were observed in a stream in this cave but were not collected.

Bibliography.—Raines (1989).

Suborder Flabellifera (aquatic isopods)

Family Cirolanidae

*Undetermined genus and species

Records.—*San Luis Potosí*: Grieta de la Reina; Cueva de la Selva.

Comment.—Russell and Raines (1967) reported "white isopods" in water in Cueva de la Selva. Raines (1989) reported "white troglobitic isopods" from Cueva

de la Selva and "cirolanid isopods" from Grieta de la Reina.

Bibliography.—Raines (1989); Russell and Raines (1967).

**Speocirolana* poss. n.sp.

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Bibliography.—Raines (1989).

**Speocirolana bolivari* (Rioja)

Record.—*San Luis Potosí*: Nacimiento de La Laja.

Comment.—This species also occurs in caves in Tamaulipas.

Bibliography.—Reddell (1981).

**Speocirolana pelaezi* (Bolívar y Pieltain)

Records.—*San Luis Potosí*: Cueva de Agua Bendita no. 3; Cueva del Agua de Quital; Nacimiento de La Laja; Cueva de la Luz; Hoya de Quital.

Comments.—This species also occurs in caves in the Sierra de El Abra of San Luis Potosí and Tamaulipas. Sprouse (1974a; 1974b) mistakenly refers to the isopods in Hoya de Quital as "troglobitic shrimp." Raines (1989) reports the material from Cueva de Agua Bendita no. 3 as "white isopods."

Bibliography.—Raines (1989); Reddell (1981); Sprouse (1974a; 1974b).

Suborder Oniscoidea (terrestrial isopods)

Undetermined material

Records.—*Querétaro*: Sótano del Aserradero; Cueva del Madroño; Sótano de la Mesa Grande; Cueva del Niño. *San Luis Potosí*: Cueva de los Caracoles no. 1; Cueva de la Cisterna; Sótano de las Golondrinas; Sótano de Guadalupe; Cueva de la Iglesia; Cueva de los Ladrones; Sumidero del Llano Conejo; Cueva de los Muertos; Cueva de La Rosal; Cueva del Salitre; Cueva de Tlamaya; Sótano de Tlamaya.

Bibliography.—Raines (1965); Sbordoni and Argano (1972).

Family Armadillidae

Venezillo sp.

Record.—*San Luis Potosí*: Cueva del Salitre.

Family Oniscidae

Undetermined genus and species A

Record.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species B

Record.—*San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species C

Record.—*San Luis Potosí*: Cueva de la Laja.

Bibliography.—Bonet (1953); Reddell (1971).

Family Philosciidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Bibliography.—Bonet (1953).

Family Squamiferidae

**Trichorhina boneti* Rioja

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Comment.—This is apparently the species listed by Bonet (1953) as "la forma afín al género *Troglophiloscia*" and "Oniscidae sp. D."

Bibliography.—Bonet (1953); Lemos de Castro (1964); Mulaik (1960); Nicholas (1962); Palacios-Vargas (1996); Reddell (1967; 1971; 1981); Rioja (1956).

Family Trichoniscidae

*Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Sótano de Cepillo; Cueva de Cerro Pilón; Sótano de las Golondrinas; Sótano de Guadalupe; Sumidero del Llano Conejo; Cueva de los Muertos; Cueva de Oxtalja; Cueva de Plan de Juárez; Cueva de Potrerillos no. 2; Grieta de la Reina; Cueva de San Pedro; Sótano de La Silleta; Sótano de Tlamaya; Sótano de Trinidad.

Comment.—Raines (1989) reported "isopods" from Cueva de Cerro Pilón.

Bibliography.—Raines (1989).

**Mexiconiscus laevis* (Rioja)

Records.—*San Luis Potosí*: Cueva de la Hoya; Sótano de Huitzmolotitla; Cueva de la Luz; Sótano de la Navidad; Cueva de la Porra; Cueva de Potrerillos; Cueva de la Selva.

Comments.—This species was originally described in the genus *Cordioniscus*. Schultz (1964) described a new species, *Mexiconiscus tlamayaensis*, for specimens from Sótano de Huitzmolotitla. Bowman (1965) erected the new genus *Xilitloniscus* for specimens of *C. laevis* from Cueva de la Porra and Cueva de la Selva. Schultz (1968) recognized the synonymy of *M. tlamayaensis* and *X. laevis* and created the combination *Mexiconiscus laevis* based on the priority of the genus *Mexiconiscus* over *Xilitloniscus*. Vandel (1970) described the apparent amphibious nature of the species, reporting that most young specimens are found on land, while adults usually

occur in water. This is presumably the species listed by Bonet (1953) as *Protrichoniscus* sp. Raines (1989) reported this species as "troglobitic amphibious isopods" from Sótano de la Navidad.

Bibliography.—Bonet (1953); Bowman (1965); Mulaik (1960); Nicholas (1962); Palacios-Vargas (1996); Raines (1989); Reddell (1967; 1971; 1981); Rioja (1956); Schultz (1964; 1965; 1968; 1994); Vandel (1970).

Order Amphipoda (amphipods)
Family Hyalellidae
Hyalella azteca (Saussure)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comments.—This is a widespread species throughout North America. It has been frequently found in caves and is presumably a troglophile.

Order Mysidacea (mysids)
Family Lepidomysidae
**Spelaeomysis* prob. n.sp.

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Comment.—This apparent new species is known only from the sump pool at the bottom of the cave.

Order Decapoda
Suborder Reptantia (crayfish, shrimp, and crabs)
Family Cambaridae
Procambarus (Ortmannicus) toltecae Hobbs

Records.—*San Luis Potosí*: Agua de Guadalupe; Sótano de Huitzmolotitla; Cueva de Oxtalja; Cueva de San Nicolas.

Comment.—Currie (1994) reports "crawdads" from Cueva de San Nicolas.

Bibliography.—Currie (1994); Hart and Hart (1974); Hobbs, Jr. (1971); Hobbs III (1994); Reddell (1981).

**Procambarus (Ortmannicus) xilitlae*
Hobbs and Grubbs

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Comments.—Grubbs (1982) erroneously listed this species as *Procambrarus xilitlae*. Stone (1977) first reported this species as "blind crayfish." It was listed by Reddell (1980) as *Procambarus* (*?Scapulicambarus*).

Bibliography.—Grubbs (1982); Hobbs III (1994); Hobbs and Grubbs (1982; 1986); Raines (1989); Reddell (1980); Sprouse (1980); Stone (1977).

Family Palaemonidae
**Troglomexicanus perezfarfanteae* (Villalobos)

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Comment.—Grubbs (1982) erroneously listed this genus as *Troblocubenism*. This species was described as *Troglocubanus perezfarfanteae* from Sótano de la Tinaja. It has since been reported from Cueva del Nacimiento del Río Mante, Tamaulipas (Hobbs and Hobbs, 1989). The recent descriptions of new species from San Luis Potosí and Tamaulipas (Villalobos, Alvarez, and Iliffe, 1999) indicate that the records of this species from Hoya de las Guaguas and Cueva del Nacimiento del Río Mante need re-evaluation.

Bibliography.—Grubbs (1982); Hobbs III (1994); Hobbs and Hobbs (1989).

CLASS ARACHNIDA
Order Scorpiones (scorpions)
Undetermined material

Records.—*San Luis Potosí*: Sótano del Escorpión; Hoya de las Guaguas.

Comment.—Hosley (1968) saw a large scorpion at the bottom of Sótano del Escorpión.

Bibliography.—Hosley (1968).

Family Buthidae
Centruroides gracilis (Latreille)

Record.—*San Luis Potosí*: Cueva del Salitre.

Comment.—This large darkly-colored scorpion is occasionally taken near cave entrances in Mexico.

Bibliography.—Reddell (1981).

Order Uropygi (whipscorpions)
Family Thelyphonidae
Mastigoproctus giganteus Lucas

Records.—*San Luis Potosí*: Cueva de la Barranca; Sótano de las Golondrinas; Sótano de Guadalupe; Cueva de La Rosal; Cueva de Tlamaya.

Comments.—This species is occasionally taken on walls near the entrance to caves in Mexico. Raines (1989) reported this as a "whipless whip scorpion, or vinegaroon."

Bibliography.—Bonet (1953); Raines (1989); Reddell (1971).

Order Schizomida (shorttailed whipscorpions)
Family Protoschizomidae
**?Agastoschizomus* sp.

Records.—*San Luis Potosí*: Cueva de San Pedro; Sótano de Tlamaya.

Comment.—This material is too immature for positive identification.

Bibliography.—Cokendolpher and Reddell (1992).

**Agastoschizomus huitzmolotitlensis* Rowland

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Comments.—Reddell (1967; 1971) lists this as *Schizomus* sp. This highly cave-adapted species is known only from this cave, although it is possible that the undetermined material from Cueva de San Pedro and Sótano de Tlamaya may be identical.

Bibliography.—Palacios-Vargas (1996); Reddell (1967; 1971; 1981); Reddell and Cokendolpher (1986); Cokendolpher and Reddell (1992); Rowland (1975a; 1975b); Rowland and Reddell (1977; 1979).

Order Amblypygi (tailless whipscorpions)
Family Phrynidae
Paraphrynus sp.

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Sótano de Cepillo; Cueva de Potrerillos; Cueva de Potrerillos no. 2; Cueva de San Nicolas.

Comments.—Only immatures are known from these caves. The report of a "pseudo scorpion" by Currie (1994) probably refers to this species.

Bibliography.—Currie (1994).

Paraphrynus pococki Mullinex

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Huichihuayán.

Comment.—This species is abundant in the Sierra de El Abra.

Bibliography.—Mullinex (1975).

**Paraphrynus velmae* Mullinex

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Sótano de Huitzmolotitla; Cueva de Oxtalja; Cueva de San Rafael; Sótano de Tampamache; Sótano de Tlamaya.

Comment.—This blind species is known only from these caves.

Bibliography.—Mullinex (1975); Palacios-Vargas (1996); Reddell (1981).

Order Araneae (spiders)
Undetermined material

Records.—*San Luis Potosí*: Cueva de la Café en Huatulucán; Sótano Café Plantation; Sótano de Cepillo; Cueva de los Cuchos; Cueva de la Hoya; Sumidero del Llano Chiquito; P.I.G. 4 (San Juan de los Durán); Cueva Ventosa.

Comments.—Bonet (1953) reported "Araneida, fam. indet. sp. A" from Cueva de los Potrerillos and "Araneida, fam. indet. sp. B" from Cueva de los Cuchos, Cueva de la Hoya, Cueva de El Jobo, and Cueva de los Potrerillos. "White spiders" were reported from Cueva Ventosa but were not collected. Skorupka (1987?) reported the presence of "spiders with leg-spans of at least 6."

Bibliography.—Bonet (1953); Raines (1989); Reddell (1971); Sbordoni and Argano (1972); Skorupka (1987?).

Infraorder Mygalomorphae (tarantulas)
Family Cyrtaucheniidae
Eucteniza n.sp.

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Comment.—This species of trap-door spider is known only from this cave.

Family Dipluridae
Undetermined genus and species

Record.—*San Luis Potosí*: Cueva del Salitre.

Bibliography.—Bonet (1953); Reddell (1971).

Euagrus sp.

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Comment.—This material was immature.

**Euagrus anops* Gertsch

Record.—*San Luis Potosí*: Cueva de la Porra.

Comment.—This species is known only from this cave.

Bibliography.—Coyle (1988); Gertsch (1973; 1982); Palacios-Vargas (1996); Reddell (1981).

**Euagrus troglodyta* Gertsch

Records.—*San Luis Potosí*: Sumidero del Llano Conejo; Sótano de La Silleta.

Comments.—Reddell (1980) reported this only as an "eyeless diplurid spider." It is known only from these two caves.

Bibliography.—Coyle (1988); Gertsch (1982); Palacios-Vargas (1996); Reddell (1980).

Family Theraphosidae
Undetermined genus and species

Records.—*San Luis Potosí*: Cueva con Ollas; Cueva de los Viet Cong.

Comment.—A "tarantula" was seen in Cueva con Ollas but not collected.

Bibliography.—Raines (1989).

Aphonopelma sp.

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Cueva de La Rosal.

Spelopelma sp. nr. *elliotti* (Gertsch)

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

**Spelopelma stygia* (Gertsch)

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Cueva de Potrerillos; Cueva de Potrerillos no. 2; Sótano del Pozo.

Comments.—This species has been erroneously listed in the genera *Aphonopelma* and *Schizopelma*. This species is known only from these caves.

Bibliography.—Gertsch (1971; 1973; 1982); Palacios-Vargas (1996); Reddell (1973a; 1980; 1981; 1984).

Infraorder Araneomorphae (true spiders)

Family Agelenidae

Tegenaria sp.

Record.—*Querétaro*: El Socavón.

Comment.—This material was immature.

Tegenaria decora Gertsch

Records.—*Querétaro*: Sótano de Potrero. *San Luis Potosí*: Cueva de Potrerillos.

Comment.—This troglophile is known only from these caves.

Bibliography.—Gertsch (1971); Reddell (1981).

Tegenaria selva Roth

Records.—*San Luis Potosí*: Sumidero del Llano Conejo; Cueva de los Muertos; Cueva de la Selva; Sótano de La Silleta.

Comment.—This troglophile is known from numerous caves in San Luis Potosí and Tamaulipas.

Bibliography.—Gertsch (1971); Reddell (1971; 1973a; 1981); Roth (1968).

Family Anyphaenidae

Aysha sp.

Record.—*San Luis Potosí*: Sótano de Trinidad.

Family Araneidae

Undetermined genus and species

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Comment.—This material was too immature to permit further identification.

Acacesia folifera Marx

Record.—*Querétaro*: Cueva de la Lagunita Seca.

Family Caponiidae

*Undetermined genus and species

Record.—*San Luis Potosí*: Sótano de la Silleta.

Comment.—This is the only blind species in this family.

Family Ctenidae

Cupiennius sp.

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Ctenus sp.

Records.—*Querétaro*: Cueva de la Lagunita Seca. *San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de los Caracoles no. 1; Sótano de las Golondrinas; Sótano de Guadalupe; Cueva del Nacimiento del Río Huichihuayán; Cueva de la Porra; Cueva del Salitre; Cueva de San Pedro; Cueva Tepametl; Cueva de Tlamaya; Sótano de Tlamaya.

Bibliography.—Reddell (1967; 1971)

Ctenus n.sp.

Record.—*San Luis Potosí*: Cueva de La Rosal

Ctenus mitchelli Gertsch

Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de El Jobo; Cueva de la Laja; Sótano del Rancho de la Barranca; Cueva de La Rosal; Cueva de la Selva; Cueva Tepametl.

Comments.—This species was listed by Reddell (1967) only as *Ctenus*. This large spider is frequently found on cave walls near the entrance. Many of the records for *Ctenus* sp. above will probably prove to belong to this species when adult specimens are obtained.

Bibliography.—Gertsch (1971); Reddell (1967).

Family Dictynidae

Undetermined genus and species

Record.—*Querétaro*: Sótano del Jaguey del Monte.

Comment.—This material was immature.

Family Hahniidae

Calymmaria sp.

Record.—*Querétaro*: Sótano de la Mesa Grande.

Family Leptonetidae

Undetermined genus and species

Record.—*Querétaro*: Sótano del Aserradero.

Comment.—This material was too immature for further identification.

Neoleptoneta sp.

Record.—*Querétaro*: Cueva del Madroño.

Bibliography.—Lazcano Sahagún (1986)

Neoleptoneta capilla (Gertsch)

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Cueva de Cerro Pilón.

Comments.—This species is also found in caves in the Sierra de Guatemala, Tamaulipas. It was reported as "spiders" by Raines (1989).

Bibliography.—Raines (1989).

Family Linyphiidae
Erigoninae genus and species
Record.—*Querétaro*: Cueva del Niño.

Erigone monterreyensis Gertsch
Record.—*San Luis Potosí*: Sótano del Rancho de la Barranca.

Meioneta sp.
Record.—*Querétaro*: Sótano de Jaguey del Monte.

Family Liocranidae
Phonotimpus sp.
Records.—*Querétaro*: Sótano del Aserradero; Sótano de La Mesa Grande.

**Phonotimpus* n.sp.
Record.—*San Luis Potosí*: Cueva de San Pedro.
Comment.—This is the only blind species in this genus.

Family Lycosidae
Undetermined genus and species
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Comment.—This is certainly an accidental.

Lycosa sp.
Record.—*Querétaro*: Sótano de Potrero.
Comment.—This is an accidental.

Pardosa sp.
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Comment.—This is an accidental.

Family Miturgidae
Strotarchus planeticus Edwards
Record.—*San Luis Potosí*: Cueva de El Cañón.

Family Mysmenidae
Maymena sp.
Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Sótano de Huitzmolotitla.
Comment.—This genus is frequently found as troglophiles in Mexican caves.
Bibliography.—Reddell (1967; 1971).

Maymena n.sp.
Records.—*San Luis Potosí*: Sótano de Guadalupe.

Maymena chica Gertsch
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Bibliography.—Reddell (1967; 1971).

Family Nesticidae
Eidmannella sp.
Record.—*Querétaro*: Sótano de Jaguey del Monte.

Eidmannella pallida (Emerton)
Records.—*San Luis Potosí*: Cueva de los Grillos; Cueva de El Jobo; Cueva de Potrerillos; Cueva de Tlamaya; Sótano de Tlamaya.
Comment.—This species is an abundant troglophile in caves throughout North and Central America.

Gaucelmus sp.
Record.—*San Luis Potosí*: Sótano de la Linja.

Gaucelmus calidus Gertsch
Records.—*San Luis Potosí*: Sótano de Huitzmolotitla; Cueva de la Laja; Sótano de Tlamaya.
Comment.—This troglophile is widespread in Mexico.
Bibliography.—Gertsch (1984).

Nesticus sp.
Records.—*San Luis Potosí*: Cueva de Cerro Pilón; Cueva de Garza; Cueva de La Silleta.
Comments.—This material is immature. Raines (1989) reported it as "spiders."
Bibliography.—Raines (1989).

Nesticus campus Gertsch
Record.—*San Luis Potosí*: Sumidero del Llano Conejo.
Comment.—This troglophile is known only from this cave.
Bibliography.—Gertsch (1984).

Nesticus rainesi Gertsch
Record.—*San Luis Potosí*: Cueva del Agua de La Silleta.
Comment.—This species also occurs in caves in Nuevo León and Tamaulipas.

Nesticus sedatus Gertsch
Records.—*San Luis Potosí*: Cueva de los Antiguos; Sótano de Guadalupe; Sumidero del Llano Conejo; Cueva de los Muertos; Sótano de La Silleta.
Comment.—This troglophile is known only from these caves.
Bibliography.—Gertsch (1984).

Family Pholcidae
Undetermined genus and species
Record.—*San Luis Potosí*: Cueva de Potrerillos.
Bibliography.—Bonet (1953); Reddell (1971).

Coryssocnemis iviei Gertsch

Records.—*San Luis Potosí*: Cueva de Potrerillos; Cueva de Potrerillos no. 2.

Bibliography.—Gertsch (1971; 1973).

Metagonia sp.

Record.—*Querétaro*: Sótano de Potrero.

Metagonia n. sp.

Record.—*San Luis Potosí*: Sótano de las Goldondrinas.

Metagonia amica Gertsch

Record.—*San Luis Potosí*: Cueva de El Jobo.

Comment.—This troglophile is known only from this cave.

Bibliography.—Gertsch (1971; 1986); Reddell (1973a).

Metagonia guaga Gertsch

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Comment.—This troglophile is known only from this cave.

Bibliography.—Gertsch (1986); Palacios-Vargas (1996).

**Metagonia luisa* Gertsch

Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.

Comment.—This troglobite is known only from this cave.

Bibliography.—Gertsch (1986); Palacios-Vargas (1996).

Metagonia maximiliani Brignoli

Record.—*Querétaro*: Cueva del Madroño.

Comment.—This troglophile is known only from this cave.

Bibliography.—Brignoli (1972); Gertsch (1986); Lazcano Sahagún (1986).

Metagonia modesta Gertsch

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Comment.—This troglophile is known only from this cave.

Bibliography.—Gertsch (1986); Palacios-Vargas (1996).

**Metagonia oxtalja* Gertsch

Record.—*San Luis Potosí*: Cueva de Oxtalja.

Comment.—This species is known only from this cave.

Bibliography.—Gertsch (1986); Palacios-Vargas (1996).

**Metagonia tlamaya* Gertsch

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comments.—Reddell (1967; 1971) listed this as *Metagonia* sp. This species is known only from this cave.

Bibliography.—Gertsch (1971; 1986); Palacios-Vargas (1996); Reddell (1967; 1971; 1973a; 1981).

Modisimus sp.

Record.—*Querétaro*: Sótano de La Mesa Grande.

Modisimus n.sp.

Records.—*San Luis Potosí*: Hoya de las Guaguas; Sótano de Tampemache.

Comment.—This is a troglophile.

Physocyclus sp.

Record.—*Querétaro*: El Socavón.

Family Plectreuridae

Plectreurys paisana Gertsch

Record.—*San Luis Potosí*: Cueva de El Jobo.

Family Salticidae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Sótano de las Golondrinas; Sótano de Tampemache.

Comment.—This material is accidental.

Corythalia sp.

Record.—*San Luis Potosí*: Sótano de la Linja.

Comment.—This is an accidental.

Family Tetragnathidae

Chrysometa sp.

Record.—*San Luis Potosí*: Cueva de la Laja.

Comment.—This may be *C. alboguttata* (O. Pickard-Cambridge) which has been found in a cave in Tamaulipas (Levi, 1986).

Leucauge sp.

Record.—*Querétaro*: Sótano del Aserradero.

Leucauge venusta (Walckenaer)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Tetragnatha sp.

Record.—*San Luis Potosí*: Sótano de La Linja.

Comment.—This is an accidental.

Family Theridiidae

Undetermined genus and species

Records.—*Querétaro*: Sótano del Jaguey del Monte; Sótano de La Mesa Grande.

Achaearanea sp.
Record.—*Querétaro*: Cueva de las Tablas.

Theridion trepidum O.P.-Cambridge
Record.—*San Luis Potosí*: Sótano del Pozo.

Family Zoropsidae
Zorocrates sp.
Record.—*San Luis Potosí*: Cueva de la Selva.

Zorocrates n.sp.
Record.—*San Luis Potosí*: Cueva de los Viet Cong.

Order Pseudoscorpiones (pseudoscorpions)
Undetermined material
Records.—*Querétaro*: Cueva del Madroño; Cueva del Niño. *San Luis Potosí*: Cueva del Ahuate no. 2; Cueva del Aire-Cueva del Brujo; Cueva de los Cuchos; Sótano de Guadalupe; Cueva de la Hoya; Cueva de El Jobo; Cueva de La Rosal.
Comment.—Bonet (1953) reported "Chernethidea sp. A" from Cueva del Madroño, Cueva del Ahuate no. 2, Cueva del Aire-Cueva del Brujo, Cueva de los Cuchos, and Cueva de la Hoya; and "Chernethidea sp. B" from Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971); Sbordoni and Argano (1972).

Family Chernetidae
Undetermined genus and species
Records.—*Querétaro*: Cueva del Madroño; Cueva del Niño. *San Luis Potosí*: Cueva del Salitre.
Bibliography.—Lazcano Sahagún (1986).

Family Chthoniidae
Tyrannochthonius sp.
Record.—*San Luis Potosí*: Cueva del Salitre.

**Tyrannochthonius pallidus* Muchmore
Record.—*San Luis Potosí*: Cueva de El Jobo.
Comment.—This species is known only from this cave.
Bibliography.—Muchmore (1973); Palacios-Vargas (1996); Reddell (1971).

Family Ideoroncidae
**Typhloroncus xilitlensis* Muchmore
Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.
Comment.—This species is known only from this cave.
Bibliography.—Muchmore (1986); Palacios-Vargas (1996); Reddell (1984).

Order Acarina (mites)
Undetermined material
Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de El Cañón; Sótano de las Golondrinas; Sótano de Guadalupe; Hoya de las Guaguas; Cueva de la Luz; Cueva de Oxtalja; Cueva de Potrecillos; Sótano de El Ranchito; Grieta de la Reina; Cueva del Salitre; Cueva de la Selva; Sótano de La Silleta; Cueva de Tlamaya; Cueva de los Viet Cong.
Bibliography.—Sbordoni and Argano (1972).

Suborder Mesostigmata
Family Laelapidae
Laelapinae genus and species A
Records.—*San Luis Potosí*: Cueva de los Cuchos; Cueva de la Hoya.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Laelapinae genus and species B
Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva del Aire-Cueva del Brujo; Cueva de El Jobo; Cueva del Salitre.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Laelapinae genus and species C
Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva del Aire-Cueva del Brujo; Cueva de los Cuchos; Cueva de El Jobo; Cueva del Salitre.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Laelapinae genus and species D
Record.—*San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Laelapinae genus and species E
Record.—*San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Macrochelidae
Macrocheles sp.
Record.—*San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Macrocheles coprophila Womersley
Record.—*San Luis Potosí*: Cueva de la Hoya.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Paramegistidae
Undetermined genus and species
Records.—*San Luis Potosí*: Cueva de los Cuchos; Cueva del Salitre.
Bibliography.—Bonet (1953); Reddell (1971).

Family Parasitidae
Undetermined genus and species
Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.
Comment.—This was reported by Bonet (1953) as "Paecilochirtidae."
Bibliography.—Bonet (1953); Reddell (1971).

Family Polyaspidae
Dipolyaspis sp.
Records.—*San Luis Potosí*: Cueva de la Hoya; Cueva de El Jobo; Cueva del Salitre.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Prodinychidae
Undetermined genus and species A
Record.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo.
Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species B
Record.—*San Luis Potosí*: Cueva de la Hoya.
Bibliography.—Bonet (1953); Reddell (1971).

Family Rhadacaridae
Undetermined genus and species
Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971).

Family Spinturnicidae
Undetermined genus and species
Record.—*San Luis Potosí*: Cueva de la Barranca.
Bibliography.—Bonet (1953); Reddell (1971).

Family Trematurellidae
Trematurella sp. A
Records.—*San Luis Potosí*: Cueva de El Jobo; Cueva del Salitre.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Trematurella sp. B
Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva de la Hoya; Cueva de El Jobo.
Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971; 1981).

Suborder Prostigmata
Family Cunaxidae
Undetermined genus and species
Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.
Bibliography.—Bonet (1953); Reddell (1971).

Family Trombiculidae
Hannemania hylae (Ewing)
Record.—*San Luis Potosí*: Cueva de Potrerillos.
Comment.—This species is a parasite of frogs.
Bibliography.—Bonet (1953); Hoffmann (1952; 1969); Reddell (1971).

Trombicula sp.
Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.
Bibliography.—Bonet (1953); Reddell (1971).

Family Trombidiidae
Microtrombidiinae genus and species A
Records.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo; Cueva de los Cuchos.
Bibliography.—Bonet (1953); Reddell (1971).

Microtrombidiinae genus and species B
Record.—*San Luis Potosí*: Cueva de la Laja.
Bibliography.—Bonet (1953); Reddell (1971).

Suborder Astigmata
Family Acaridae
Rhizoglyphinae genus and species
Records.—*San Luis Potosí*: Cueva de los Cuchos; Cueva de El Jobo; Cueva del Salitre.
Bibliography.—Bonet (1953); Reddell (1971).

Acarus sp.
Record.—*San Luis Potosí*: Cueva de la Hoya.
Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Glycyphagidae
Undetermined genus and species
Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de los Cuchos.
Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971; 1981).

Suborder Cryptostigmata
Family Achipteriidae
Undetermined genus and species
Record.—*San Luis Potosí*: Cueva del Salitre.
Comment.—This species was reported by Bonet (1953) as "Notaspididae."
Bibliography.—Bonet (1953); Reddell (1971).

Family Belbidae

Undetermined genus and species A

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva del Aire-Cueva del Brujo; Cueva de la Hoya; Cueva de El Jobo; Cueva del Salitre.

Bibliography.—Bonet (1953); Reddell (1971; 1981).

Undetermined genus and species B

Records.—*San Luis Potosí*: Cueva de los Cuchos; Cueva del Salitre.

Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Carabodidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Bibliography.—Bonet (1953); Reddell (1971).

Family Eremaeidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Bibliography.—Bonet (1953); Reddell (1971).

Family Hermanniidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva del Salitre.

Bibliography.—Bonet (1953); Reddell (1971).

Family Hypochthoniidae

Undetermined genus and species

Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva del Salitre.

Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971).

Family Oribatellidae

Undetermined genus and species A

Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva del Ahuate no. 2; Cueva del Salitre.

Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971; 1981).

Undetermined genus and species B

Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Oribatulidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Phthiracaridae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo; Cueva del Salitre.

Bibliography.—Bonet (1953); Reddell (1971).

Order Opiliones (opilionids)

Undetermined material

Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Cueva de las Hormigas; Cueva de la Luz; Cueva del Nacimiento del Río Huichihuayán; Cueva de la Porra; Cueva del Salitre.

Bibliography.—Sbordoni and Argano (1972).

Suborder Laniatores

Family Cosmetidae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva de los Caracoles no. 1; Sótano de Huitzmolotitla; Cueva de San Pedro; Cueva Tepametl; Sótano de Tlamaya.

Cosmetinae genus and species

Record.—*San Luis Potosí*: Cueva de la Hoya.

Bibliography.—Bonet (1953); Reddell (1971).

Cynorta sp.

Record.—*San Luis Potosí*: Cueva de los Muertos.

Cynorta guadalupensis Goodnight and Goodnight

Record.—*San Luis Potosí*: Agua de Guadalupe.

Comment.—This species is known only from Agua de Guadalupe.

Bibliography.—Goodnight and Goodnight (1973).

Paecilaema sp.

Records.—*San Luis Potosí*: Cueva de El Cañón; Sótano de Guadalupe; Cueva del Salitre; Cueva Tepametl; Sótano de Tlamaya.

Family Stygnopsidae

Undetermined genus and species

Records.—*Querétaro*: Sótano del Aserradero. *San Luis Potosí*: Cueva del Blitzkrieg; Cueva de Oxtalja; Sótano de El Ranchito; Sótano de Tampemache.

"Phalangodinae" genus and species A

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de Potrerillos.

Bibliography.—Bonet (1953); Reddell (1971).

"Phalangodinae" genus and species B

Record.—*San Luis Potosí*: Cueva de Potrerillos.

Bibliography.—Bonet (1953); Reddell (1971).

**Hoplobunus* n.sp.

Record.—*San Luis Potosí*: Sumidero del Llano Conejo.

**Hoplobunus* n.sp. 1

Record.—*San Luis Potosí*: Sótano de La Silleta.

Hoplobunus n.sp. 2

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

**Hoplobunus* sp. nr. *planus* Goodnight and Goodnight

Record.—*San Luis Potosí*: Cueva de Cerro Pilón.

Hoplobunus boneti (Goodnight and Goodnight)

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; ?Cueva del Cerro Pilón; Sótano de las Golondrinas.

**Hoplobunus planus* Goodnight and Goodnight

Records.—*San Luis Potosí*: Hoya de las Guaguas; Cueva de San Nicolas; Cueva de Tlamaya; Sótano de Tlamaya.

Comment.—This species is known only from these localities.

Bibliography.—Goodnight and Goodnight (1973); Palacios-Vargas (1996); Reddell (1981).

**Hoplobunus queretarius* Silhavy

Records.—*Querétaro*: Cueva del Madroño; El Socavón.

Comment.—This species is known only from these caves.

Bibliography.—Lazcano Sahagún (1986); Palacios-Vargas (1996); Reddell (1981); Silhavy (1974).

Karos sp. nr. *dybasi* (Goodnight and Goodnight)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Karos n.sp.

Record.—*San Luis Potosí*: Cueva de San Rafael.

Karos depressus Goodnight and Goodnight

Record.—*San Luis Potosí*: Sumidero del Llano Conejo.

Bibliography.—Goodnight and Goodnight (1971); Reddell (1973a; 1981).

Karos dybasi (Goodnight and Goodnight)

Record.—*San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Goodnight and Goodnight (1973); Reddell (1981).

Karos gratiosus Goodnight and Goodnight

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Bibliography.—Goodnight and Goodnight (1971); Reddell (1973a; 1981).

Karos projectus Goodnight and Goodnight

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Bibliography.—Goodnight and Goodnight (1971); Reddell (1973a; 1981).

**Stygnopsis* n.sp. nr. *robustus* (Goodnight and Goodnight)

Record.—*San Luis Potosí*: Sótano de Guadalupe.

Suborder Palpatores (harvestmen)

Family Nemastomatidae

*Undetermined genus and species

Record.—*San Luis Potosí*: ?Hoya de las Guaguas.

Family Sclerosomatidae

Undetermined genus and species

Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva de Daddy Long Legs; P.I.G. 4 (San Juan de los Durán); Cueva de Potrerillos.

Comment.—Skorupka (1987?) reported that "the entire walls and roof at the entrance were coated in a seething mass of giant Daddy Long Legs."

Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971); Skorupka (1987?).

Gagrellinae or Leiobuninae genus and species

Record.—*San Luis Potosí*: Cueva de los Viet Cong.

Krusa n.sp.

Record.—*San Luis Potosí*: Cueva de los Viet Cong.

Leiobunum viridorsum Goodnight and Goodnight

Record.—*Querétaro*: Cueva de los Fosiles.

CLASS PAUROPODA (pauropods)

Order Pauropoda

Family Pauropodidae

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de El Jobo.

Comments.—Bonet (1953) listed this material as "Pauropidae." This is the only cave record for this class in Mexico.

Bibliography.—Bonet (1953); Reddell (1971; 1981).

CLASS CHILOPODA (centipeds)

Undetermined material

Records.—*Querétaro*: Cueva del Madroño; Cueva del Niño.

Bibliography.—Lazcano Sahagún (1986); Sbordoni and Argano (1972).

Order Scutigerida
Family Scutigeridae
Undetermined genus and species

Records.—*Querétaro*: Cueva de las Tablas. *San Luis Potosí*: Sótano del Cepillo; Cueva de la Porra; Cueva de Potrerillos no. 2; Cueva de San Pedro; Sótano de Tlamaya.

Order Lithobiida
Undetermined material

Records.—*Querétaro*: El Socavón. *San Luis Potosí*: Sótano de las Golondrinas; Cueva de Jilguero; Cueva de los Ladrones; Sótano del Rancho de la Barranca; Cueva del Salitre; Cueva de San Pedro; Sótano de la Silleta; Sótano del Tigre; Sótano de Tlamaya; Cueva de los Viet Cong.

Comment.—Specimens from Sótano de Tlamaya are unquestionably representative of a new species of troglobite.

Family Lithobiidae
Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de El Jobo.

Bibliography.—Bonet (1953).

Order Geophilida
Undetermined material

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Cueva de los Ladrones; Cueva de la Luz.

CLASS DIPLOPODA (millipeds)
Undetermined material

Records.—*Querétaro*: Sótano de El Lobo. *San Luis Potosí*: Cueva de los Caracoles no. 1; Sótano de las Golondrinas; Hoya de las Guaguas; Sótano de Huitzmolotitla; Cueva del Muerto; Cueva de Oxtalja; Cueva de Potrerillos; Sótano de El Ranchito; Grieta de la Reina; Cueva de Rincón; Cueva de San Pedro; Sótano de La Silleta; Sótano de Tampemache; Sótano del Tigre; Sótano de Tlamaya; Sótano de Trinidad; Cueva Ventosa; Cueva de los Viet Cong.

Comments.—The record for Cueva del Muerto is based on a sight record (Evans, 1965). The Cueva Ventosa record is also based on a report of "millipedes" in that cave.

Bibliography.—Evans (1965); Raines (1989); Sbordoni and Argano (1972).

Order Glomerida (pill millipeds)
Family Glomeridae
**Glomeroides* sp.

Record.—*San Luis Potosí*: Hoya de Quital.

Comment.—This material was immature.

**Glomeroides caecus* Causey

Records.—*San Luis Potosí*: Sótano de Huitzmolotitla; Cueva de los Ladrones; Sótano de Tlamaya.

Comment.—This species is known only from these caves.

Bibliography.—Causey (1964b); Loomis (1968); Palacios-Vargas (1996); Raines (1965); Reddell (1967; 1971; 1973a; 1981); Shear (1982; 1986).

Order Chordeumatida
Suborder Chordeumatidea
Family Cleidogonidae
Cleidogona sp.

Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Cueva de los Ladrones; Sótano del Pozo; Sótano del Rancho de la Barranca.

Comment.—This material was either immature or female.

Cleidogona treacyae Shear

Record.—*San Luis Potosí*: Cueva de los Viet Cong.

Comment.—This species is known only from this cave.

Bibliography.—Palacios-Vargas (1996); Shear (1982).

Family Trichopetalidae
**Mexiterpes* sp.

Records.—*San Luis Potosí*: Sumidero del Llano Conejo; Cueva de los Viet Cong.

Comment.—This material is either immature or female.

**Mexiterpes fishi* (Causey)

Records.—*San Luis Potosí*: Sumidero del Llano Conejo; Cueva de la Luz; Sótano de Trinidad.

Comments.—This species was originally described by Causey (1969) as *Poterpes fishi*. It is known only from these caves.

Bibliography.—Causey (1969); Palacios-Vargas (1996); Reddell (1971; 1973a; 1981); Shear (1982; 1986).

Order Polydesmida
Undetermined material

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Comment.—Specimens from Cueva del Ahuate no.

2 and Cueva de los Cuchos were listed by Bonet (1953) as Polydesmoidea, fam. indet. sp. A and B; specimens from Cueva de la Hoya were listed as Polydesmoidea, fam. indet. sp. C.

Bibliography.—Bonet (1953).

Suborder Chelodesmidea

Family Platyrhachidae

Amplinus sp.

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Sótano de la Linja; Cueva de la Luz; Cueva del Salitre.

Family Rhachodesmidae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Cueva de El Cañón; Cueva de Cerro Pilón; Cueva de Cerro Quebrado; Cueva de la Luz; ?Sótano de los Milpies Azules; Cueva de Plan de Juárez; Cueva Tepametl; Sótano de Trinidad.

Comment.—"Blue millipeds" seen but not collected in Sótano de los Milpies Azules almost certainly belong to an epigean species of the family Rhachodesmidae. Raines (1989) reported "millipeds" from Cueva de Cerro Pilón and "blue millipedes" from Sótano de los Milpies.

Bibliography.—Raines (1989).

Strongylodesmus sp.

Records.—*Querétaro*: Sótano de Camposantos. *San Luis Potosí*: Cueva de la Hoya; Cueva de la Laja.

Bibliography.—Bonet (1953); Reddell (1971).

Strongylodesmus n.sp.

Record.—*San Luis Potosí*: Cueva del Nacimiento de San Miguel.

Strongylodesmus conspicuus Causey

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Sótano de Tlamaya.

Comment.—This large blue species is frequently found on the surface and occasionally in caves in the Sierra Madre Oriental of San Luis Potosí and Tamaulipas.

Bibliography.—Causey (1973); Raines (1965).

**Unculabes* sp.

Records.—*Querétaro*: Cueva del Niño; Cueva de las Tablas. *San Luis Potosí*: Sótano del Rancho de la Barranca; Cueva de la Selva.

Comment.—This material was either immature or female and cannot be identified further.

**Unculabes* n.sp.

Record.—*San Luis Potosí*: Cueva del Nacimiento de San Miguel.

Comment.—This may belong in one of the troglobitic species listed below.

**Unculabes arganoi* Shear

Record.—*Querétaro*: Cueva del Madroño.

Comment.—This species is known only from this cave.

Bibliography.—Lazcano Sahagún (1986); Palacios-Vargas (1996); Reddell (1981); Shear (1974).

Unculabes columbinus Causey

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Cueva de las Ladrones; Cueva de La Silleta.

Comment.—This species is known only from these caves.

Bibliography.—Causey (1973); Palacios-Vargas (1996); Reddell (1981); Shear (1986).

**Unculabes crispus* Causey

Records.—*San Luis Potosí*: Cueva de Cerro Pilón; Cueva de Cerro Quebrado; Sótano de Guadalupe; Sótano de Huitzmolotitla; Sumidero del Llano Chiquito; Sumidero del Llano Conejo; Cueva de Potrerillos; Sótano de El Ranchito; Grieta de la Reina; Sótano de La Silleta; Sótano de Tlamaya.

Comments.—Specimens from Cueva de Potrerillos and Sumidero del Llano Conejo were originally described by Causey (1971b) as a second species, *Unculabes versatilis*. This species is now considered a synonym of *U. crispus*. Reddell (1967) listed this species only as an undescribed genus and species of polydesmoid. Reddell (1971) listed this species only as an undescribed genus and species of Rhachodesmidae. This extremely delicate species is frequently present in caves in enormous numbers. Raines (1989) reported "millipeds" from Cueva de Cerro Pilón.

Bibliography.—Causey (1971b; 1973); Palacios-Vargas (1996); Raines (1965; 1989); Reddell (1967; 1971; 1973a; 1973b; 1981); Shear (1986).

**Unculabes porrensis* Shear

Record.—*San Luis Potosí*: Cueva de la Porra.

Comment.—This species is known only from this cave.

Bibliography.—Reddell (1981); Palacios-Vargas (1996); Shear (1974).

Family Xystodesmidae

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva de El Cañón;

Hoya de las Guaguas; Cueva de Oxtalja; Sótano de La Silleta.

Rhysodesmus sp.

Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Sótano de la Linja; Sótano del Pozo; Cueva de la Selva.

Comment.—The ecological status of this material is unknown, but some records may represent troglobites. The taxonomy of the genus is in too poor condition to permit species identification.

Stenodesmus sp.

Record.—*San Luis Potosí*: Sótano de Potrerillos.

Suborder Paradoxosomatidea

Family Paradoxosomatidae

Orthomorpha sp.

Record.—*San Luis Potosí*: Cueva de la Laja.

Comment.—This is probably *Oxidus gracilis* (Koch), a species previously placed in the genus *Orthomorpha*.

Bibliography.—Bonet (1953); Reddell (1971).

Oxidus gracilis (Koch) (hothouse milliped)

Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Cueva del Ahuate no. 2; Sótano de Huitzmolotitla; Cueva de la Iglesia; Cueva de El Jobo; Cueva de Potrerillos; Sótano de Potrerillos; Sótano del Pozo; Sótano de Tlamaya.

Comments.—This is an introduced species now occurring throughout the southern United States and Mexico. It is frequently found in caves in the vicinity of towns.

Suborder Polydesmidea

Family Cryptodesmidae

Peridontodesmus sp.

Records.—*San Luis Potosí*: Cueva de El Jobo; Sótano de la Linja.

Comment.—This material may belong to the species listed below

Peridontodesmus punctatus (Loomis)

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Bibliography.—Shear (1986).

Family Fuhrmannodesmidae

**Sumidero sprousei* Shear

Record.—*San Luis Potosí*: Sótano de La Silleta.

Comment.—This is the only known locality for this species.

Bibliography.—Palacios-Vargas (1996); Shear (1982).

**Tylogoneus rainesi* Causey

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Comment.—This species is known only from this cave.

Bibliography.—Causey (1973); Palacios-Vargas (1996).

Family Pyrgodesmidae

Undetermined genus and species

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Cueva del Salitre; Cueva de San Pedro; Cueva de La Silleta; Sótano de Tampemache; Cueva de Tlamaya.

Myrmecodesmus sp.

Records.—*San Luis Potosí*: Cueva de Potrerillos; Cueva de la Selva.

Comment.—This material was immature or female.

Myrmecodesmus amarus (Causey)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comments.—This species was originally described by Causey (1971b) as *Stenotodesmus amarus*. It is known only from this cave.

Bibliography.—Causey (1971b); Raines (1965); Reddell (1973a; 1981); Shear (1977).

Myrmecodesmus potosinus (Shear)

Record.—*San Luis Potosí*: Cueva de la Porra.

Comment.—This species was originally described in the genus *Bolivaresmus*.

Bibliography.—Reddell (1981); Shear (1974; 1977).

Order Spirostreptida

Suborder Cambalidea

Family Cambalidae

*Undetermined genus and species

Records.—*San Luis Potosí*: Sótano de Tampemache; Cueva de Tlamaya.

Comment.—This material almost certainly belongs in *Mexicambla*.

**Mexicambala russelli* Causey

Records.—*San Luis Potosí*: Cueva del Agua (Aquismón); Cueva del Agua de Quital; Cueva del Ahuate no. 2; Cueva de los Caracoles No. 1; ?Cueva de la Hoya; ?Sótano de Huitzmolotitla; Cueva de la Laja; Cueva del Nacimiento de San Miguel; Cueva de Oxtalja; Cueva de la Porra; Cueva de Potrerillos; Cueva del Salitre; Sótano de Tlamaya.

Comments.—This species was listed by Bonet (1953) only as Cambalidae sp. The record for Cueva de la Hoya needs verification with recently collected specimens. The record for Sótano de Huitzmolotitla is based on immature specimens. This species has also been tentatively identified from caves in the Purificación region of Tamaulipas (Shear, 1986).

Bibliography.—Bonet (1953); Causey (1964a; 1971a; 1973); Loomis (1968); Palacios-Vargas (1996); Raines (1965); Reddell (1967; 1971; 1973a; 1981); Shear (1969; 1974; 1986).

Suborder Spirostreptidea

Family Spirostreptidae

Orthoporus sp.

Record.—*Querétaro*: Cueva del Niño.

Comment.—This is an accidental.

SUPERCLASS HEXAPODA

CLASS ENTOGNATHA

Order Collembola (springtails)

Undetermined material

Records.—*Querétaro*: Cueva del Niño; Cueva de las Tablas. *San Luis Potosí*: Cueva de Cerro Pilón; Sótano de las Golondrinas; Cueva de Plan de Juárez.

Bibliography.—Sbordoni and Argano (1972).

Suborder Arthropleona

Family Entomobryidae (slender springtails)

Lepidocyrtus sp.

Records.—*Querétaro*: Cueva del Madroño. *San Luis Potosí*: Cueva de los Cuchos; Cueva de El Jobo; Cueva del Salitre.

Bibliography.—Bonet (1953); Christiansen and Reddell (1986); Reddell (1971; 1981).

Orchesella sp.

Record.—*Querétaro*: Sótano de El Lobo.

Pseudosinella cava Christiansen and Reddell

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Huichihuayán.

Comment.—This troglophile is also known from caves in Hidalgo and Querétaro.

Bibliography.—Christiansen and Reddell (1986); Palacios-Vargas (1996).

Pseudosinella finca Christiansen

Records.—*San Luis Potosí*: Cueva de La Rosal; Cueva de San Pedro; Sótano de Tampemache.

Comment.—This species ranges from Guatemala to San Luis Potosí.

Pseudosinella reddelli Christiansen

Records.—*San Luis Potosí*: Cueva de Tlamaya; Sótano de Tlamaya.

Comment.—This species is widespread in caves from Querétaro and San Luis Potosí north to Nuevo León.

Pseudosinella vera Christiansen

Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; ?Cueva de la Barranca; Sótano de Guadalupe; Hoya de las Guaguas; ?Cueva de la Hoya; ?Cueva de El Jobo; Cueva de la Laja; Cueva del Oxtalja; Cueva de Potrerillos; Cueva de la Selva; Sótano de La Silleta; Cueva Tepametl; Cueva de Tlamaya; Sótano de Tlamaya; Cueva de los Viet Cong.

Comments.—Localities marked with a question mark were listed by Bonet (1953) as *Pseudosinella* sp. The records need verification by newly collected specimens. This species is known from caves and occasional surface collections from Veracruz to Tamaulipas. Raines (1989) reported "troglobitic springtails" from Cueva de la Laja.

Bibliography.—Bonet (1953); Christiansen (1982); Christiansen and Reddell (1986); Palacios-Vargas (1996); Raines (1989); Reddell (1971; 1981).

Tomocerus (Pogognathellus) flavescens Tullberg

Record.—*San Luis Potosí*: Cueva de Tlamaya.

Family Hypogastruridae (elongate-bodied springtails)

**Acherontides potosinus* (Bonet)

Records.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo; Cueva de los Cuchos; Cueva de la Hoya; Cueva de El Jobo; Cueva del Salitre.

Comment.—This troglomorphic species has been taken from caves in the Acatlán region of Oaxaca, the Cuetzalan region of Puebla, and the Xilitla region.

Bibliography.—Bonet (1946; 1953); Christiansen and Reddell (1986); Delamare Deboutteville (1948); Nicholas (1962); Palacios-Vargas (1996); Reddell (1967; 1971; 1981); Stach (1959).

Acherontiellina sabina (Bonet)

Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de la Laja.

Comment.—This troglophile is known from cave and surface localities from Veracruz to New Mexico, U.S.A.

Bibliography.—Christiansen and Reddell (1986); Palacios-Vargas (1996).

Brachystomella parvula (Schaeffer)

Record.—*San Luis Potosí*: Cueva de la Hoya.

Bibliography.—Bonet (1953); Christiansen and

Reddell (1986); Palacios-Vargas and Najt (1981); Reddell (1971; 1981).

Family Isotomidae (smooth springtails)
Folsomia sp.
Record.—*San Luis Potosí*: Cueva de la Hoya.
Bibliography.—Bonet (1953); Christiansen and Reddell (1986); Reddell (1971; 1981).

Folsomina onychiurina (Denis)
Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de El Jobo.
Comment.—This troglophile is widely distributed in Mexican caves.
Bibliography.—Bonet (1953); Christiansen and Reddell (1986); Reddell (1971; 1981).

Isotoma sp.
Record.—*San Luis Potosí*: Cueva de Tlamaya.

Proisotoma (*Appendisotoma*) *dubia*
Christiansen and Bellinger
Record.—*San Luis Potosí*: Hoya de las Guaguas.
Bibliography.—Christiansen and Reddell (1986); Palacios-Vargas (1982).

Family Onychiuridae (blind springtails)
Onychiurus sp.
Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de la Hoya.
Bibliography.—Bonet (1953); Christiansen and Reddell (1986); Reddell (1971; 1981).

Tullbergia (*Mesaphorura*) *krausbaueri* Borner
Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de los Cuchos; Hoya de las Guaguas; Cueva del Salitre.
Comment.—This is a frequently encountered troglophile in Mexican caves.
Bibliography.—Bonet (1953); Christiansen and Reddell (1986); Palacios-Vargas (1982); Reddell (1971; 1981).

Suborder Symphypleona
Family Sminthuridae (globular springtails)
**Sminthurus* sp.
Records.—*San Luis Potosí*: Cueva de los Cuchos; Cueva de la Hoya; Cueva de El Jobo.
Comments.—This species was listed by Reddell (1971) as *Smynthurus* n.sp. The identity of this material must await further study. Bonet (1953) considered it to be a troglobite, but no other member of the genus shows troglomorphic adaptations.
Bibliography.—Bonet (1953); Christiansen and Reddell (1986); Reddell (1971; 1981).

Order Entotrophi (entotrophs)
Undetermined material
Record.—*Querétaro*: Cueva del Niño.
Bibliography.—Sbordoni and Argano (1972).

Family Campodeidae (slender entotrophs)
Undetermined genus and species
Records.—*Querétaro*: Sótano de El Lobo. *San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de Cerro Pilón; Sótano de las Golondrinas; ?Cueva de los Ladrones; Sumidero del Llano Conejo; Cueva de la Selva; Sótano de Tlamaya; Cueva de los Viet Cong.
Comment.—This material probably includes both troglobites and troglophiles.
Bibliography.—Bonet (1953); Reddell (1971).

Family Iapygidae (earwiglike entotrophs)
Undetermined genus and species
Records.—*San Luis Potosí*: Sótano de Cepillo; Cueva de La Rosal; Cueva de Tlamaya.
Comment.—The ecological status of this material is unknown.

Family ?Projapygidae
Undetermined genus and species
Record.—*San Luis Potosí*: Cueva de La Rosal.
Comment.—This family is otherwise unknown from Mexican caves.
Bibliography.—Reddell (1984).

CLASS INSECTA
Undetermined material (larvae)
Records.—*Querétaro*: Sótano de la Mesa Grande. *San Luis Potosí*: Cueva del Agua de La Silleta; Cueva del Ahuate no. 2; Cueva del Blitzkrieg; Cueva de El Cañón; Sótano de Cepillo; Cueva de Cerro Pilón; Sótano de las Golondrinas; Sótano de Guadalupe; Hoya de las Guaguas; Sótano de La Linja; Cueva de los Muertos; Cueva de Oxtalja; Cueva de Plan de Juárez; Grieta de la Reina; Cueva del Salitre; Cueva de la Selva; Cueva de La Silleta; Sótano de la Silleta; Sótano de Tlamaya; Cueva de los Viet Cong.

Order Microcoryphia
Family Machilidae (jumping bristletails)
Undetermined genus and species
Records.—*Querétaro*: Sótano del Aserradero. *San Luis Potosí*: Cueva de El Cañón.
Comment.—This material is probably accidental.

Order Thysanura (silverfish)
Undetermined material
Records.—*San Luis Potosí*: Cueva de Potrerillos; Sótano de La Silleta; Sótano de Tlamaya.

Order Odonata (dragonflies and damselflies)
Suborder Zygoptera (damselflies)
Family Megapodagrionidae
Undetermined genus and species
Record.—*San Luis Potosí*: ?Sótano de Tlamaya.
Comment.—Only immature specimens were found.

?*Paraphlebia* sp.
Record.—*San Luis Potosí*: Cueva del Agua de La Silleta.
Comment.—This and the preceding material is presumably accidental.

Suborder Anisoptera (dragonflies)
Undetermined material
Records.—*San Luis Potosí*: Cueva de la Café en Huatulucán.

Order Plecoptera (stoneflies)
Family Perlidae (common stoneflies)
Anacroneuria sp.
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Comment.—This is probably an accidental.

Order Phasmatodea (walkingsticks)
Undetermined material
Record.—*San Luis Potosí*: Cueva de los Viet Cong.
Comment.—This is an accidental.

Order Orthoptera (grasshoppers, crickets, and katydids)
Undetermined material
Records.—*San Luis Potosí*: Sótano del Fin; Cueva de los Grillos de Campeche; Hoya de las Guaguas.
Comment.—The Cueva de los Grillos de Campeche record is based on "cave crickets" seen but not collected in the cave.
Bibliography.—Raines (1989).

Family Gryllacrididae
Undetermined genus and species
Record.—*San Luis Potosí*: Sótano de las Golondrinas.
Comment.—This is an accidental.

Family Gryllidae (crickets)
Nemobius sp.
Record.—*Querétaro*: Cueva del Niño.
Comment.—This is an accidental.

Family Phalangopsidae (crickets)
Undetermined genus and species
Records.—*San Luis Potosí*: Cueva de El Cañón; Cueva de Garza; Hoya de las Guaguas; Cueva del Jilguero; Cueva de Plan de Juárez; Cueva de Potrerillos no. 2; Grieta de la Reina; Cueva de La Rosal; Cueva del Salitre; Cueva de San Pedro; Sótano de Tampemache; Cueva Tepametl; Cueva de Tlamaya.
Comment.—Most of these records probably represent members of the genus *Paracophus*.

"Amphiacusta" sp.
Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Huichihuayán.
Comment.—The genus *Amphiacusta* is now restricted to species in the Greater Antilles. The generic status of this material is unknown.

Paracophus sp.
Records.—*Querétaro*: ?Sótano de la Mesa Grande. *San Luis Potosí*: Cueva del Blitzkrieg; Cueva de la Laja.
Comment.—Bonet (1953) listed specimens from this cave as Phalangopsinae sp. B.
Bibliography.—Bonet (1953); Reddell (1971).

**Paracophus cladonotus* Hubbell
Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Sótano de Guadalupe; Cueva de la Luz; Cueva de los Muertos; Cueva de Oxtalja; Cueva de Potrerillos; Sótano del Pozo; Cueva de San Nicolas; Sótano de La Silleta; Sótano de Tlamaya.
Comments.—This species was listed by Reddell (1967; 1971) as *Paracophus* sp. This blind species is known only from these caves.
Bibliography.—Hubbell (1972); Palacios-Vargas (1996); Raines (1965); Reddell (1967; 1971; 1973a; 1981).

Paracophus placonotus Hubbell
Records.—*Querétaro*: Sótano de Camposantos; Cueva del Madroño; Cueva de las Tablas. *San Luis Potosí*: Cueva del Ahuate no. 2; ?Sótano de Cepillo; Cueva de los Cuchos; Sótano de las Golondrinas; Sótano de Guadalupe; Hoya de las Guaguas; Cueva de la Hoya; Sótano de Huitzmolotitla; Cueva de la Iglesia; ?Cueva del Jilguero; Cueva de El Jobo; Cueva de la Luz; Cueva del Nacimiento del Río Huichihuayán; Cueva de la Porra; Cueva de Potrerillos; Sótano del Pozo; Cueva de San Nicolas; Sótano de Tlamaya.
Comments.—Bonet (1953) listed this troglophile as "Phalangopsinae sp. A," "Phalangopsinae sp. B," "Phalangopsinae sp. C," and "Phalangopsinae sp. D." This species was erroneously referred to by Reddell

(1967) as *Paracophus apterus* Chopard. It is also reported by Reddell (1967; 1971) as *Paracophus* sp.

Bibliography.—Bonet (1953); Hubbell (1972); Lazcano Sahagún (1986); Raines (1965); Reddell (1967; 1971; 1973a; 1981).

Family Rhaphidophoridae (camel crickets)
Undetermined genus and species

Records.—*Querétaro*: Sótano del Jaguey del Monte. *San Luis Potosí*: Small cave near Sótano de Trinidad.

Exochodrilus sp.

Record.—*San Luis Potosí*: Sótano de La Silleta.

Comment.—This is a trogloxene.

Leptargyrtes boneti Hubbell

Records.—*Querétaro*: Sótano de Camposantos; Cueva de los Fosiles; Cueva del Madroño.

Comment.—This species was listed by Reddell (1967) only as "Rhaphidophorine crickets." Raines (1989) reported this species from Cueva de los Fosiles as "crickets." This is a trogloxene known only from these caves.

Bibliography.—Hubbell (1972); Lazcano Sahagún (1986); Raines (1989); Reddell (1967; 1971; 1973a; 1981).

Family Stenopelmatidae (jerusalem crickets)
Anabropsis sp.

Records.—*San Luis Potosí*: Sótano del Pozo; Sótano de Tlamaya.

Comment.—This is an accidental.

Family Tettigoniidae (long-horned crickets)
Undetermined genus and species

Record.—*San Luis Potosí*: Sótano de Tampemache.

Comment.—This is an accidental.

Order Dermaptera (earwigs)
Undetermined material

Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de Oxtalja.

Comment.—This material is accidental.

Order Dictyoptera (mantids and cockroaches)
Suborder Blattaria (cockroaches)
Family Blattellidae (German cockroaches)
Undetermined genus and species

Record.—*San Luis Potosí*: Cueva Oxtalja.

Comment.—This material is too immature for further identification.

Aglaopteryx n.sp.

Record.—*San Luis Potosí*: Cueva del Jilguero.

Comment.—This is probably a troglophile.

Bibliography.—Reddell (1984).

Euthlastoblatta sp.

Record.—*San Luis Potosí*: ?Sótano de Tlamaya.

Comment.—Small nymphs from Sótano de Tlamaya are tentatively referred to the genus *Euthlastoblatta*.

Pseudomops ?septentrionalis Hebard

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comment.—Only nymphs were collected.

Order Psocoptera (booklice and barklice)
Undetermined material

Record.—*San Luis Potosí*: Cueva del Salitre.

Bibliography.—Bonet (1953); Reddell (1971).

Family Epipsocidae (damp barklice)
Bertkauia sp. or *Epipsocus* sp.

Record.—*Querétaro*: Sótano de El Lobo.

Comment.—Only nymphs were collected.

Order Hemiptera (bugs)
Undetermined material

Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Hoya de las Guaguas; Sótano de La Linja; Cueva de San Pedro.

Bibliography.—Sbordoni and Argano (1972).

Suborder Cimicomorpha
Family Reduviidae (assassin bugs)
Reduviinae genus and species

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Bibliography.—Bonet (1953); Reddell (1971).

?*Zelurus* sp.

Record.—*San Luis Potosí*: Sótano de Guadalupe.

Comment.—Only early instar nymphs were collected.

Suborder Enicocephalomorpha
Family Enicocephalidae (unique-headed bugs)
Systelloderes sp.

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Suborder Gerromorpha
Family Veliidae (smaller water strider bugs)
Rhagovelia sp.

Record.—*San Luis Potosí*: Sótano de Cepillo.

Suborder Pentatomomorpha

Family Cydnidae (burrower bugs)

Amnestus subferrugineus (Westwood)

Record.—*San Luis Potosí*: Cueva del Salitre.

Comment.—This is a troglophile frequently found in Mexican caves.

Pangaeus (Pangaeus) docilis (Walker)

Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de Oxtalja.

Comment.—This is an abundant troglophile in Mexican caves.

Pangaeus (Pangaeus) ?piceatus Stal

Record.—*San Luis Potosí*: Cueva del Salitre.

Comment.—Only a female was collected.

Family Lygaeidae (seed bugs)

Undetermined genus and species

Records.—*San Luis Potosí*: Sótano de Guadalupe; Sótano del Rancho de la Barranca.

Comment.—This material is accidental.

Order Homoptera (cicadas, leafhoppers, and allies)

Undetermined material

Record.—*San Luis Potosí*: Cueva de San Pedro.

Suborder Auchenorrhyncha

Family Cicadellidae (leafhoppers)

Gyponana germari (Stal)

Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Comment.—This is an accidental.

Bibliography.—Reddell (1981).

Suborder Sternorrhyncha

Family Ortheziidae (ensign scale insects)

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Bibliography.—Bonet (1953); Reddell (1971).

Order Thysanoptera (thrips)

Undetermined material

Record.—*San Luis Potosí*: Cueva de los Muertos.

Comment.—This is an accidental.

Order Coleoptera (beetles)

Undetermined material

Records.—*Querétaro*: Sótano de la Mesa Grande; Cueva del Niño. *San Luis Potosí*: Cueva del Ahuate no. 2; Sótano de Cepillo; Sótano de las Golondrinas; Sótano de Huitzmolotitla; Cueva de El Jobo; Cueva de los Ladrones; Sótano de La Linja; Cueva de Oxtalja; Cueva de Potrerillos; Cueva del Salitre; Cueva de La Silleta; Sótano de La Silleta; Sótano de Tampemache; Sótano de Tlamaya; Cueva de los Viet Cong.

Comment.—Bonet (1953) reported "Coleoptera, fam. indet. sp. A" from Cueva de El Jobo and Cueva del Salitre and "Coleoptera, fam. indet. sp. B" from Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971); Sbordoni and Argano (1972).

Suborder Adephaga

Family Carabidae (ground beetles)

Undetermined genus and species

Records.—*San Luis Potosí*: Cueva del Blitzkrieg; Hoya de las Guaguas; Sótano de Huitzmolotitla; Cueva de Oxtalja; Cueva del Salitre; Sótano de La Silleta; Sótano de Tampemache; Sótano de Tlamaya.

Undetermined genus and species A

Record.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species B

Record.—*San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species C

Record.—*San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species D

Record.—*San Luis Potosí*: Cueva de la Laja.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species E

Record.—*San Luis Potosí*: Cueva de la Hoya.

Bibliography.—Bonet (1953); Reddell (1971).

Agonum sp.

Record.—*Querétaro*: Small cave at Laguna Colorado.

Bibliography.—Peck (1977b).

Ardistomis sp.

Records.—*San Luis Potosí*: Sótano de Guadalupe; Sótano de Tlamaya.

Bibliography.—Reddell (1967; 1971).

Ardistomis sp. nr. *rotundipennis* Putzeys

Records.—*San Luis Potosí*: Sótano de Huitzmolotitla; Cueva de la Porra.

Bibliography.—Reddell (1967; 1971).

Eripus sp. cf. *scydmaenoides* Dejean

Record.—*San Luis Potosí*: Cueva de El Jobo.

**Mexaphaenops* n.sp.

Record.—*Querétaro*: Cueva de las Tablas.

Comment.—Material from this cave was fragmentary.

Mexisphodrus sp.

Record.—*Querétaro*: Sótano de El Lobo.

Comment.—This is probably *M. gertschi camposantos*.

Mexisphodrus gertschi ahuacatlan Barr

Records.—*Querétaro*: Sótano de Potrero. *San Luis Potosí*: Sumidero del Llano Conejo; Cueva de los Potrerillos.

Comment.—This subspecies is known only from these caves.

Bibliography.—Barr (1982).

Mexisphodrus gertschi camposantos Barr

Records.—*Querétaro*: Sótano de Camposantos; ?Cueva del Madroño; Cueva del Niño; Cueva de las Tablas.

Comments.—Specimens from Cueva del Madroño reported by Sbordoni and Argano (1972) as *Mexisphodrus* probably belong to this subspecies. Raines (1989) reported material from Sótano de Camposantos and Cueva de las Tablas as "sphodrini beetles." Reddell (1967; 1971) refers to this subspecies as *Mexisphodrus* sp. This subspecies is known only from these caves.

Bibliography.—Barr (1968; 1982); Fish and Reddell (1967); Raines (1989); Reddell (1967; 1971); Sbordoni and Argano (1972).

Mexisphodrus gertschi sprousei Barr

Record.—*San Luis Potosí*: Cueva del Agua de La Silleta.

Comment.—This is the only locality for this subspecies.

Bibliography.—Barr (1982).

Pachyteles ?urrutiai Bolívar y Pieltain

Record.—*San Luis Potosí*: Cueva de El Jobo.

Comment.—*Pachyteles urrutiai* is a troglophile in the caves of the Sierra de El Abra, San Luis Potosí and Tamaulipas.

Paratachys sp. 1

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Huichihuayán.

Comment.—This is probably a troglophile.

Paratachys sp. 2

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Huichihuayán.

Comment.—This is probably a troglophile.

Platynus sp.

Records.—*Querétaro*: Sinkhole at Laguna Colorado. *San Luis Potosí*: Sótano de Huitzmolotitla; Sótano del Pozo.

Comment.—This genus was listed by Reddell (1967; 1971) as *Colpodes* sp.

Bibliography.—Reddell (1967; 1971).

Platynus stricticollis (Bates)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Bibliography.—Reddell (1981).

Platynus tlamayaensis (Barr)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comments.—This troglophile was described in the genus *Mexisphodrus*.

Bibliography.—Barr (1966; 1968); Hendrichs and Bolívar y Pieltain (1973); Raines (1967); Reddell (1967; 1971; 1973a; 1981).

Tachys sp.

Records.—*San Luis Potosí*: Sótano de Guadalupe; Sótano de Huitzmolotitla; Sótano de la Linja; Sótano de Tlamaya.

Comment.—This material is troglophilic.

Bibliography.—Reddell (1967; 1971).

Suborder Polyphaga

Family Alleculidae (comb-clawed bark beetles)

Hymenorus sp.

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2; Cueva de la Porra.

Lobopoda subcuneata Casey

Record.—*San Luis Potosí*: Sótano del Pozo.

Comment.—This may be a troglophile. It is also known from caves in Texas, U.S.A.

Bibliography.—Deal and Fieseler (1975); Reddell (1966; 1971; 1981).

Family Anthicidae (antlike flower beetles)

Anthicus sp.

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comment.—This is an accidental.

Family Artematopidae
Undetermined genus and species
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Comment.—Only larvae were collected.

Family Dascillidae (soft-bodied plant beetles)
Tetraglossa palpalis Champion
Record.—*San Luis Potosí*: Sótano de Huitzmolotitla.
Comment.—This is an accidental.

Family Elateridae (click beetles)
Melanotus sp.
Record.—*San Luis Potosí*: Sótano de Guadalupe.
Comment.—Only larvae were collected.

Family Histeridae (clown beetles)
Undetermined genus and species
Records.—*San Luis Potosí*: ?Cueva del Agua de La Silleta; Cueva de los Cuchos.
Bibliography.—Bonet (1953); Reddell (1971).

?*Epierus* sp.
Record.—*San Luis Potosí*: Cueva de Potrerillos.

Family Lampyridae (firefly beetles)
Undetermined genus and species 1
Record.—*San Luis Potosí*: Cueva del Salitre.
Comment.—Only larvae were collected.

Undetermined genus and species 2
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Comment.—Only larvae were collected.

Family Leiodidae (round fungus beetles)
Undetermined genus and species
Records.—*Querétaro*: Cueva de las Tablas. *San Luis Potosí*: Sótano de Tlamaya.

Dissochaetus sp.
Records.—*San Luis Potosí*: Sótano de las Golondrinas; Cueva de Potrerillos.
Bibliography.—Peck (1973).

Dissochaetus aztecus Szymczakowski
Record.—*San Luis Potosí*: Cueva de la Porra.

Proptomaphaginus microps Peck
Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de los Muertos; Cueva del Salitre.
Comment.—This is probably an endogean form.
Bibliography.—Peck (1973; 1977a; 1977b; 1983); Reddell (1981).

?*Ptomaphagus* sp.
Record.—*San Luis Potosí*: Cueva de Cerro Pilón.
Comment.—Only larvae were found.

Ptomaphagus (*Adelops*) *leo* Peck
Records.—*Querétaro*: Sinkhole at Laguna Colorado; ?Cueva del Madroño.
Bibliography.—Lazcano Sahagún (1986); Peck (1973; 1977b); Sbordoni and Argano (1972).

Family Ptilodactylidae (toed-winged beetles)
Undetermined genus and species
Records.—*San Luis Potosí*: Cueva del Agua de La Silleta; Cueva de El Cañón; Cueva del Salitre.
Comment.—Only larvae were collected.

?Anchytarsini genus and species
Record.—*Querétaro*: El Socavón.
Comment.—Only larvae were found.

Ptilodactyla sp.
Records.—*San Luis Potosí*: ?Cueva del Agua de La Silleta; Sótano de la Linja; ?Sótano de La Silleta; ?Cueva de los Viet Cong.
Comment.—Only larvae were found in caves marked with a question mark.

Family Scarabaeidae (lamellicorn beetles)
Aphodius sp.
Record.—*San Luis Potosí*: Cueva del Salitre.

Copris laeviceps Harold
Record.—*San Luis Potosí*: Cueva de la Porra.

Onthophagus poss. n.sp.
Records.—*San Luis Potosí*: Cueva del Ahaute no. 2; Cueva de los Cuchos.
Comment.—Bonet (1953) reported this species only as "Onthaphagini."
Bibliography.—Bonet (1953); Howden, Cartwright, and Halffter (1956); Reddell (1971).

Onthophagus incensus Say
Record.—*San Luis Potosí*: Sótano de Tlamaya.
Bibliography.—Reddell (1981).

Family Scolytidae (bark beetles)
Coccotrypes sp.
Record.—*San Luis Potosí*: Cueva de La Laja.

Family Scydmaenidae (antlike stone beetles)
Undetermined genus and species
Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Cueva del Oxtalja.

Bibliography.—Sbordoni and Argano (1972).

Undetermined genus and species A
Record.—*San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971)

Undetermined genus and species B
Record.—*San Luis Potosí*: Cueva de los Cuchos.
Bibliography.—Bonet (1953); Reddell (1971).

Family Staphylinidae (rove beetles)
Undetermined genus and species
Records.—*Querétaro*: Sótano del Aserradero; Cueva del Niño. *San Luis Potosí*: Cueva del Ahuate no. 2; Sótano de las Golondrinas; Sótano de Tlamaya.
Comment.—The Sótano de Tlamaya record is based on larvae.
Bibliography.—Sbordoni and Argano (1972).

Undetermined genus and species A
Record.—*San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species B
Record.—*San Luis Potosí*: Cueva de El Jobo.
Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species C
Record.—*San Luis Potosí*: Cueva de la Hoya.
Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species E
Record.—*San Luis Potosí*: Cueva de los Cuchos.
Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species F
Record.—*San Luis Potosí*: Cueva de los Cuchos.
Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species G
Record.—*San Luis Potosí*: Cueva de los Cuchos.
Bibliography.—Bonet (1953); Reddell (1971).

Aleocharinae genus and species
Records.—*San Luis Potosí*: Cueva de la Laja; Cueva de Oxtalja; Cueva de la Porra; Sótano de Tampemache; Sótano de Tlamaya.

Pselaphinae genus and species (ant-like litter beetles)
Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Cueva del Aire-Cueva del Brujo; Cueva de San Pedro.
Bibliography.—Bonet (1953); Reddell (1971); Sbordoni and Argano (1972).

Belonuchus sp.
Records.—*San Luis Potosí*: Sótano de Guadalupe; Hoya de las Guaguas; Cueva de la Laja; Cueva de la Porra; Cueva del Salitre.

Coproporus arizonae Blackwelder
Record.—*San Luis Potosí*: Sótano de Tlamaya.

Eustilicus n.sp. nr. *condei* Jarrige
Records.—*San Luis Potosí*: Cueva de la Laja; Sótano de Tlamaya.
Comments.—This species was previously listed as *Stilicolina condei*. Further study has shown it to be an undescribed species of the genus *Eustilicus*.
Bibliography.—Herman (1970); Reddell (1967; 1971; 1981).

Holotrochus sp.
Record.—*San Luis Potosí*: Sumidero del Llano Conejo.

Homaeotarsus sp.
Record.—*San Luis Potosí*: Sótano del Rancho de la Barranca.

Lithocharodes sp.
Record.—*San Luis Potosí*: Sótano de Tlamaya.

Lobrathium sp.
Record.—*San Luis Potosí*: Cueva de Oxtalja.

Osorius sp.
Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Paederomimus sp.
Record.—*San Luis Potosí*: Sótano de las Golondrinas.

Philonthus sp.
Record.—*San Luis Potosí*: Sótano de Tlamaya.

Family Tenebrionidae (darkling beetles)
Undetermined genus and species
Records.—*Querétaro*: Cueva del Madroño; Sótano de la Mesa Grande. *San Luis Potosí*: Cueva de los Cuchos; Cueva de los Ladrones.
Bibliography.—Bonet (1953); Lazcano Sahagún (1986); Reddell (1971).

Anaedus sp.
Record.—*San Luis Potosí*: Sótano de Tlamaya.

Uloma mexicana Champion

Record.—*San Luis Potosí*: Cueva de la Luz.

Order Hymenoptera (wasps, ants, and bees)

Undetermined material

Records.—*San Luis Potosí*: Cueva de El Cañon; Cueva de las Colmenas; Sótano de La Linja; Sótano del Rancho de la Barranca; Sótano de Tlamaya.

Comments.—Raines (1989) and Reddell (1974) reported the presence of "wasps" in Sótano del Rancho de la Barranca. A large red species inhabited a nest below the overhang into the vertical pit entrance to the cave. An explorer climbing out of the cave on rope was stung numerous times before he could reach the surface. Sprouse (1985) reported the presence of "honeybees" high on the cave wall near the entrance to Cueva de El Cañon. Honeybees have also been seen but not collected in Cueva de las Colmenas.

Bibliography.—Raines (1989); Reddell (1973b; 1974); Sprouse (1985).

Suborder Apocrita

Family Formicidae (ants)

Undetermined genus and species

Records.—*Querétaro*: Cueva del Niño. *San Luis Potosí*: Sótano de las Golondrinas; Cueva de las Hormigas; Sótano de La Linja.

Comment.—The Cueva de las Hormigas record is based on a report of "ants" in this cave.

Bibliography.—Raines (1989); Russell (1973); Sbordoni and Argano (1972).

Undetermined genus and species A

Record.—*San Luis Potosí*: Cueva del Ahuate no. 2.

Bibliography.—Bonet (1953); Reddell (1971).

Undetermined genus and species B

Record.—*San Luis Potosí*: Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971).

Aphaenogaster sp.

Record.—*San Luis Potosí*: Cueva de Potrerillos.

Bibliography.—Reddell and Cokendolpher (2001).

Atta mexicana (F. Smith)

Record.—*San Luis Potosí*: Sótano del Pozo.

Bibliography.—Reddell and Cokendolpher (2001).

Pachycondyla ferruginea (F. Smith)

Records.—*San Luis Potosí*: Sótano de Guadalupe; Cueva de Oxtalja.

Bibliography.—Reddell and Cokendolpher (2001).

Pachycondyla stigma (Fabricius)

Records.—*San Luis Potosí*: Cueva de San Pedro; Cueva Tepametl; Sótano de Tlamaya.

Bibliography.—Reddell and Cokendolpher (2001).

Pachycondyla unidentata (Mayr)

Record.—*San Luis Potosí*: Sótano de Tampamache.

Bibliography.—Reddell and Cokendolpher (2001).

Paratrechina sp. 1

Record.—*San Luis Potosí*: Cueva de Potrerillos.

Bibliography.—Reddell and Cokendolpher (2001).

Paratrechina sp. 2

Record.—*San Luis Potosí*: Cueva de los Viet Cong.

Bibliography.—Reddell and Cokendolpher (2001).

Solenopsis (*Solenopsis*) *geminata* (Fabricius)

Record.—*San Luis Potosí*: Sótano de Guadalupe.

Comments.—This species was listed by Reddell (1974) as "army ants." An enormous colony was present at the entrance to Sótano de Guadalupe; large numbers were entering the cave and carrying off many species of invertebrate, including some troglobites, from deep within the cave.

Bibliography.—Reddell (1973b; 1974; 1981); Reddell and Cokendolpher (2001).

Wasmannia auropunctata (Roger)

Record.—*San Luis Potosí*: Sótano de Tampamache.

Bibliography.—Reddell and Cokendolpher (2001).

Order Trichoptera (caddisflies)

Family Calamoceratidae

(comblipped casemaker caddislies)

Phylloicus sp.

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Comment.—Hosley (1966) described the behavior of this species in a shallow pool at the top of the 209 ft. drop in the cave.

Bibliography.—Hosley (1966); Reddell (1981).

Order Lepidoptera

(moths, butterflies, and skippers)

Undetermined material (moths)

Records.—*Querétaro*: Sótano de la Mesa Grande. *San Luis Potosí*: Hoya de las Guaguas; Sótano de Huitzmolotitla; Sótano de Tlamaya.

Suborder Ditrysia

Family Noctuidae (noctuid moths)

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de la Hoya.

Comment.—Bonet (1953) reported this as "Phalenidae sp. B."

Bibliography.—Bonet (1953); Reddell (1971).

Latebraria amphipyroides Guen.

Records.—*San Luis Potosí*: Cueva del Ahuate no. 1; Cueva de los Cuchos; Cueva de la Laja; Cueva de Potrerillos.

Bibliography.—Bonet (1953); Reddell (1971; 1981).

Family Saturniidae (giant silkworm moths)

Automeris sp.

Record.—*Querétaro*: Cueva del Agua del Rancho Ojo de Agua.

Comment.—Only larvae were collected.

Family Tineidae (clothes moths)

Undetermined genus and species A

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Bibliography.—Bonet (1953).

Undetermined genus and species B

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Comment.—Bonet (1953) reported this as "Acrolophidae sp."

Bibliography.—Bonet (1953).

Amydria sp.

Record.—*San Luis Potosí*: Sótano de Guadalupe.

Comment.—Only larvae were collected.

Order Diptera (flies)

Undetermined material

Records.—*Querétaro*: Sótano del Aserradero; Sótano de El Lobo. *San Luis Potosí*: Cave near Tenaxo; Sótano de las Golondrinas; Sótano de Guadalupe; Hoya de las Guaguas; Cueva de El Jobo; Cueva de Oxtalja; Cueva de Potrerillos; Sótano de La Silleta; Sótano de Tlamaya; Cueva de los Viet Cong.

Comment.—Bonet (1953) reported "Diptera, fam. indet. sp. A" and "Diptera, fam. indet. sp. B" from Cueva de El Jobo.

Bibliography.—Bonet (1953); Reddell (1971).

Suborder Nematocera

Undetermined material

Record.—*San Luis Potosí*: Cueva del Salitre.

Comment.—Bonet (1953) reported this as "Nematocera sp."

Bibliography.—Bonet (1953); Reddell (1971).

Family Chironomidae (midges)

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Bibliography.—Bonet (1953).

Family Psychodidae (moth and sand flies)

Undetermined genus and species

Record.—*Querétaro*: Cueva del Madroño.

Bibliography.—Bonet (1953).

?*Pericoma* sp.

Record.—*San Luis Potosí*: Sótano de Guadalupe.

Comment.—Only larvae were collected.

Family Scatopsidae (minute black scavenger flies)

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Bibliography.—Bonet (1953).

Family Tipulidae (crane flies)

Undetermined genus and species

Record.—*San Luis Potosí*: Sótano de La Silleta.

Comment.—Only larvae were collected.

Suborder Brachycera

Family Asilidae (robber flies)

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de la Selva.

Comment.—Only a pupa was collected.

Family Muscidae (house flies)

Undetermined genus and species

Record.—*San Luis Potosí*: Cueva de los Cuchos.

Bibliography.—Bonet (1953).

Family Sphaeroceridae (small dung flies)

Leptocera sp.

Record.—*Querétaro*: Sótano de El Lobo.

Opacifrons sp.

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Family Stratiomyidae (soldier flies)

?*Sargus* sp.

Record.—*San Luis Potosí*: Cueva del Agua de La Silleta.

Comment.—Only larvae were collected.

Family Streblidae (bat flies)

Euctenodes mirabilis Waterhouse

Records.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo; Cueva del Nacimiento del Río Huichihuayán; Cueva de Potrerillos.

Bibliography.—Bonet (1953); Hoffmann (1953); Reddell (1971).

Trichobius sp. nr. *dugesii* Townsend

Record.—*San Luis Potosí*: Cueva de El Jobo.

Comment.—This species was reported by Bonet (1953) as *Trichobius blandus* Curran.

Bibliography.—Bonet (1953); Reddell (1971).

Trichobius mixtus Curran

Record.—*San Luis Potosí*: Cueva de Potrerillos.

Bibliography.—Bonet (1953); Reddell (1971).

Trichobius parasiticus Gervais

Records.—*San Luis Potosí*: Cueva del Aire-Cueva del Brujo; Cueva de la Barranca; Cueva del Nacimiento del Río Huichihuayán.

Bibliography.—Bonet (1953); Hoffmann (1953); Reddell (1971).

PHYLUM CHORDATA

CLASS TELEOSTEI (fish)

Order Cyprinodontiformes

Family Poeciliidae (livebearers)

Heterandria jonesi (Gunther)

Record.—*San Luis Potosí*: Cueva de Oxtalja.

CLASS AMPHIBIA

Order Urodela (salamanders)

Undetermined material

Records.—*Querétaro*: Cueva de las Tablas. *San Luis Potosí*: Sótano de las Hoyas; Cueva de la Luz; Sótano de los Milpies Azules; Sótano de las Salamanquesas.

Comment.—The Sótano de los Milpies Azules and Sótano de las Salamanquesas records are based on reports of "salamanders" in these caves.

Bibliography.—Fish and Reddell (1967); Raines (1989).

Suborder Ambystomatidea

Family Plethodontidae (lungless salamanders)

Undetermined genus and species

Record.—*Querétaro*: Cueva del Madroño.

Bibliography.—Sbordoni and Argano (1972).

Chiropterotriton sp.

Records.—*Querétaro*: Small cave at Laguna Colorado. *San Luis Potosí*: Cueva de los Viet Cong.

Bibliography.—Peck (1977b).

Chiropterotriton arborea (Taylor)

Records.—*San Luis Potosí*: Cueva de la Hoya; ?Sótano de Tlamaya.

Bibliography.—Rabb (1965); Reddell (1971).

Chiropterotriton magnipes Rabb

Records.—*Querétaro*: Cueva del Madroño; Sótano de Potrero. *San Luis Potosí*: Sótano Sin Nombre (Tlamaya); Sótano Doble de la Joya; Cueva de la Iglesia; Cueva de Potrerillos.

Comments.—Bonet (1953) reported specimens from Cueva del Madroño and Cueva de Potrerillos only as "Plethodontidae." Raines (1989) reported "salamanders" from Sótano Doble de la Joya and Cueva de la Iglesia.

Bibliography.—Bonet (1953); Evans and Fish (1965); Fish and Reddell (1967); Hanken (1979); Lazcano Sahagún (1986); Rabb (1965); Raines (1989); Reddell (1971; 1981); Smith and Taylor (1966).

Chiropterotriton multidentata (Taylor)

Records.—*San Luis Potosí*: Sótano de las Golondrinas; Sótano de La Silleta.

Comment.—This species was reported by Raines (1989) as "salamanders" from Sótano de las Golondrinas.

Bibliography.—Raines (1989); Reddell (1981).

Order Anura (frogs)

Undetermined material

Records.—*San Luis Potosí*: Cueva de la Hoya; Sótano de Huitzmolotitla; Cueva de Potrerillos.

Comment.—Bonet (1953) reported "Salientia sp. A" from Cueva de la Hoya; and "Salientia sp. B" from Cueva de Potrerillos.

Bibliography.—Bonet (1953); Reddell (1971).

Suborder Neobatrachia

Family Leptodactylidae

Eleutherodactylus decoratus decoratus Taylor

Records.—*Querétaro*: Cueva de las Tablas. *San Luis Potosí*: Sótano de la Linja.

Eleutherodactylus hidalgoensis Taylor

Record.—*San Luis Potosí*: Cave near Xilitla.

Bibliography.—Taylor (1949).

Hylactophryne augusti augusti (Dugès)

Record.—*San Luis Potosí*: Cueva de El Jobo.

Comment.—This species was listed in the genus *Eleutherodactylus* by Zweifel (1956).

Bibliography.—Reddell (1971); Zweifel (1956).

Syrrhophus cystignathoides (Cope)

Records.—*San Luis Potosí*: Cueva de la Luz; Sótano del Rancho de la Barranca.

Syrrhophus guttilatus (Cope)

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Syrrhophus longipes (Baird)

Records.—*Querétaro*: Cueva de las Tablas. *San Luis Potosí*: Cueva sin nombre (Xilitla).

Bibliography.—Lynch (1970); Reddell (1971).

CLASS REPTILIA

Order Squamata (snakes and lizards)

Suborder Serpentes (snakes)

Undetermined material

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Bibliography.—Tew, Parker, and Schelling (1965).

Family Colubridae

Rhadinaea gaigeae Bailey (slender snake)

Record.—*San Luis Potosí*: Cueva del Salitre.

Bibliography.—Myers (1974).

Storeria dekayi (Holbrook) (brown snake)

Record.—*San Luis Potosí*: Sótano de Tlamaya.

Bibliography.—Reddell (1981).

Family Crotalidae

Bothrops atrox asper (Garman)

Record.—*San Luis Potosí*: Cueva de Cuatro Narices.

Comment.—This cave is named for the presence of the fer-de-lance or cuatro narices snake seen in the entrance area.

Bibliography.—Raines (1989).

CLASS AVES (birds)

Order Psittaciformes (parrots)

Family Psittacidae

Ara militaris Linnaeus (military macaw)

Record.—*San Luis Potosí*: Hoya de las Guaguas.

Comment.—This species once inhabited Hoya de las Guaguas but no individuals have been seen recently.

Bibliography.—Whitacre (1979).

Aratinga holochlora (Sclater) (green parakeet)

Records.—*Querétaro*: El Socavón. *San Luis Potosí*: Hoya de Aguacita; Cueva del Cepillo; Sótano de Chuchumbé; Sótano de las Golondrinas; Hoya de las Guaguas; Sótano de Huitzmolotitla; Sótano de las Quilas; Hoya de Quile; Hoya de Quital.

Bibliography.—Currie (1994); Harden (1972); Jackson and Wood (1975; 1982); Lazcano Sahagún (1986); Raines (1968; 1989); Reddell (1981); Sevenair (1977); Sprouse (1974a; 1974b); Whitacre (1979); Williams (1978).

Order Apodiformes

Family Apodidae

Streptoprocne zonaris mexicanus Ridgway (white-throated swift)

Records.—*San Luis Potosí*: Large pit 2 km W Tamapatz; Hoya de Aguacita; Sótano de las Golondrinas; Hoya de las Guaguas; Sótano de Huitzmolotitla; Hoya de Quile; Hoya de Quital.

Bibliography.—Broussard (1980); Harden (1972); Jackson and Wood (1975; 1982); Lazcano Sahagún (1987); Raines (1968; 1989); Sevenair (1977); Sprouse (1974a; 1974b); "Sweeney" (1987?); Whitacre (1979); Williams (1978).

CLASS MAMMALIA

Order Chiroptera (bats)

Undetermined material

Records.—*Querétaro*: Cueva del Madroño; Cueva de San Isidro No. 1; Sotanito de Tancoyol. *San Luis Potosí*: Cave near Tenaxo; Cueva del Desagüe; Sótano de las Golondrinas; Cueva de Maíz Tostada; Cueva del Muerto; Sótano de La Navidad; Cueva de la Nopalera; Cueva de las Ollas; Hoya de Quital; Cueva de La Rosal.

Bibliography.—Allen (1987?); Bonet (1953); Currie (1994); Evans (1965); Jameson (1977); Raines (1989); Reddell (1971); Sbordoni and Argano (1972); Sprouse (1974a; 1974b; 1985).

Family Mormoopidae

Mormoops megalophylla megalophylla Peters

Record.—San Luis Potosí: Cueva del Nacimiento del Río Coy.

Bibliography.—Constantine (1958).

Pteronotus davyi fulvus (Thomas)

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Coy.

Bibliography.—Constantine (1958).

Pteronotus parnellii mexicanus (Miller)

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Coy.

Bibliography.—Constantine (1958).

Pteronotus personatus psilotis (Dobson)

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Coy.

Bibliography.—Constantine (1958).

Family Natalidae

Natalus stramineus saturatus Dalquest and Hall

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Coy.

Bibliography.—Constantine (1958).

Family Phyllostomatidae

Artibeus jamaicensis yucatanicus Allen

Record.—*San Luis Potosí*: Cueva del Nacimiento del Río Coy.

Bibliography.—Constantine (1958).

Artibeus lituratus intermedius J.A. Allen

Records.—*San Luis Potosí*: Cueva de El Jobo; Cueva del Nacimiento del Río Coy.

Comment.—Villa R. (1967) listed this species as *Artibeus lituratus palmarum* J.A. Allen and Chapman.

Bibliography.—Constantine (1958); Mollhagen (1971); Reddell (1971); Villa R. (1967).

Carollia brevicauda (Schinz)

Records.—*San Luis Potosí*: Cave 4 km W on road to Xilitla; large cave 9 km NNE Xilitla; Cueva de El Jobo.

Comment.—This species has been reported as *Carollia perspicillata azteca* Saussure.

Bibliography.—Dalquest (1950; 1953); Mollhagen (1971); Pine (1972); Reddell (1971).

Desmodus rotundus murinus Wagner (vampire bat)

Records.—*Querétaro*: ?Cueva de la Agua Zarca; ?Sótano del Aserradero; ?Sótano de Molcjete. *San Luis Potosí*: ?Cave on Santa María; ?Cueva del Ahuate no. 2; Cueva del Aire-Cueva del Brujo; ?Cueva del Banana Grande; Cueva de la Barranca; ?Cueva de la Diversión; Cueva del Nacimiento del Río Coy; Cueva del Nacimiento del Río Huichihuayán; ?Cueva de la Porra; Cueva de Potrerillos; ?Cueva de las Vacas.

Comments.—The record for Cueva del Ahuate no. 2 is based on a record by Hosley (1968) of "vampires". Russell and Raines (1965) reported "vampire bats" in Cueva de la Porra. The remaining records marked by a question mark are of sight records of "vampire bats" in those caves. Raines (1989) recorded "bats" from Cueva de la Barranca and Cueva del Aire-Cueva del Brujo and "vampire bats" from Cueva de la Agua Zarca, Cueva del Banana Gande, Cueva de la Diversión, Cueva de la Porra, Sótano de Molcajete, Cueva de Potrerillos, and Cueva de las Vacas.

Bibliography.—Bonet (1953); Constantine (1958); Hoffmann (1953); Hosley (1968); Lug (1987?); Mollhagen (1971); Raines (1989); Reddell (1971); Russell and Raines (1965).

Diphylla ecaudata centralis Thomas
(hairy-legged vampire bat)

Records.—*San Luis Potosí*: Large cave 9 km NNE Xilitla; Cueva de El Jobo; Cueva de Potrerillos.

Bibliography.—Dalquest (1950; 1953); Malaga Alba and Villa R. (1957); Mollhagen (1971); Reddell (1971); Villa R. (1953; 1967).

Glossophaga soricina leachii (Gray)

Record.—*San Luis Potosí*: Large cave 9 km NNE Xilitla; Cueva del Nacimiento del Río Coy.

Bibliography.—Cockrum (1955); Constantine (1958); Dalquest (1953); Mollhagen (1971); Reddell (1971).

Family Vespertilionidae

Plecotus mexicanus (G.M. Allen)

Record.—*Querétaro*: Sink 3.8 km W El Madroño.

Bibliography.—Baumgardner, Wilkins, and Schmidly (1977).

Order Rodentia

Undetermined material

Record.—*San Luis Potosí*: Sótano de las Golondrinas; Cueva de Vermino.

Comment.—Three "mouse-sized rodents" were seen on the floor of the entrance room. Allen (1987?) reported "a pair of black rats" in Cueva de Vermino.

Bibliography.—Allen (1987?); Broussard (1980).

Order Artiodactyla
Suborder Suiformes

Family Tayassuidae

Tayassu tajacu angulatus (Cope) (collared peccary)

Record.—*San Luis Potosí*: Cave on Cerro San Juan.

Comment.—Russell (1973) reported killing a "javelina" in a small narrow cave.

Bibliography.—Russell (1973).

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