TEXAS MEMORIAL MUSEUM
Speleological Monographs, 1

Studies on the CAVE AND ENDOGEAN FAUNA of North America

Edited by James R. Reddell

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Cover: *Euagrus cavernicola* Gertsch from Cueva de la Capilla, Tamaulipas, Mexico
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PREFACE

The present volume includes some of the results of a continuing program of study of the cave and endogean fauna of North America, including Central America and the West Indies. The cryptic fauna of the North American continent remains poorly known despite an increased interest in the smaller groups of arthropods.

This collection of papers includes several studies of particular interest. Perhaps the most notable contribution is the first review of the class Symphyla for the United States and Mexico. The description of one new genus and four new species demonstrates the past neglect of this important group of soil arthropods. Also included herein is a review of the cave Collembola of Mexico, a revision of the pholcid spider genus *Metagonia*, and papers describing new species of Brachyura, Scorpiones, Pseudoscorpionida, Schizomida, and Diplopoda.

Among the many taxa described in this volume are 47 new cavernicoles, of which 29 are troglobites (obligate cavernicoles). These new species come from Mexico, Belize, Guatemala, Jamaica, and Texas. The family Bochicidae (Pseudoscorpionida) is recorded from the United States for the first time, with the description of a new species from a cave in Texas. Although many of the cavernicole species described herein come from new or poorly known areas, the discovery of additional new species of troglobites from some of the most intensely studied caves in Mexico indicates that we still know very little about the subterranean fauna of this vast region even after more than 20 years of study.

I express my special appreciation to the authors of the papers included in this volume, for their excellent contributions and for their patience during the long delay between acceptance of their manuscripts and publication.

I also thank the many cave explorers who have taken the extra time to collect the majority of the material included in this volume. In particular I thank William Elliott, David McKenzie, Dale Pate, Terry Raines, Peter Sprouse, and Terri Treacy Sprouse for special efforts to obtain specimens needed to make possible the description of many of the taxa included herein.

The cover photograph was very kindly donated by Dr. Robert W. Mitchell, Texas Tech University, Lubbock, Texas. It is also appropriate here to express my gratitude to Alina Frackowiak, Jeff Jeffreys, and Georg Zappler for their assistance in the production of this volume.

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A NEW TROGLOBITIC CRAB (CRUSTACEA: DECAPODA: PSEUDOTHELPHUSIDAE) FROM BELIZE

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ABSTRACT

Typhlopseudothelphusa acanthochela is described from Blind Crab Cave, Cayo District, Belize. This is the fourth known member of this troglobitic genus, the range of which is here extended some 170 kilometers northeast of the previous eastern record, Cueva Chiacam, the type-locality of *T. juberthiei*, in central Guatemala.

INTRODUCTION

Described here is the fourth known member of the genus *Typhlopseudothelphusa*. The first species of the genus discovered was *T. mocinoi* Rioja (1953) from Cueva del Tío Ticho, approximately 3 km south of Comitán, Chiapas, México. It was reported to occur in two additional localities in Chiapas by Hobbs, Hobbs, and Daniel (1977:145): Cueva Murciélagos and Cueva de los Llanos, both located 14 km ESE of San Cristóbal de las Casas. Two additional species of the genus were described by C. Delamare Deboutteville in 1976: *T. mitchelli* was reported from grottes C3 and G3, Sierra de Pampur au Guatemala, Alta Verapaz, Guatemala, and *T. juberthiei* from Grotte de Chiacam, Sierra de Chama, Alta Verapaz, Guatemala, a short distance to the east of the caves in which *T. mitchelli* occurs. The locality in which the new species was found extends the range of the genus some 170 kilometers to the northeast and suggests the likelihood of the presence of one or more congeners in the intervening karst areas separating this crab from its closest allies in north-central Guatemala.

Typhlopseudothelphusa acanthochela, new species
Figs. 1, 2

Type-data.—Male holotype (carapace width 37.5 mm; carapace length 24.4 mm) from Blind Crab Cave, 12 km SW of Millionario, Cayo District, Belize, June 1984 (Tom Miller) (U.S.N.M. no. 216239).

Description.—Eyestalks reduced, lacking distinct faceted cornea and pigment, and finely tuberculate. Front sloping gently from minutely beaded interior border and lacking clearly defined margin above minute tubercles studding most of area (Figs. 1*a*, *i*, 2*c*). Inferior border weakly biconvex in dorsal view and conspicuously so in frontal aspect. Carapace weakly convex but somewhat depressed in median line; sutures delimiting regions poorly defined or absent. Paired postfrontal lobules well marked by median groove, but lateral limits not distinctly delimited. Cervical groove U-shaped, quite shallow, reaching margin of carapace in rather distinct emarginations situated lateral to unmistakable lateral orbital angles. Cephalic and lateral margins of carapace (Figs. 1*a*, 2*a*) almost uniformly, minutely beaded, even across front where "beads" along ventral border set off by constriction; caudal margin of carapace, however, smooth. Almost entire dorsal surface studded with very small tubercles not differing from "beads" of border of carapace. External scars of 2 pairs of apodemes marking otherwise gently sculptured surface.

Exopod of third maxilliped falling short of distolateral margin of ischium by slightly less than one-eighth of length of latter. Orifice of efferent branchial channel broadly open ventrally. Chelae subequal in size although left dactyl not reaching tip of fixed finger, probably partly regenerated. Except for opposable margins of fingers, surface almost smooth, broken here and there by very fine tubercles (see external borders of finger in Fig. 2*b*). Palm and fingers conspicuously gracile. Opposable margin of each finger bearing 9 to 11 major (long but comparatively slender), rather regularly spaced teeth; 0 (basally) to 11 smaller, although conspicuous teeth present between successive major teeth.

Gonopod moderately long: marginal lobe simple, produced only slightly in rudimentary caudal process: lobe delimited laterally by well defined lateral suture extending from base of distal segment of appendage almost to distal end of lobe. Cephalic lobe bearing sublinear cluster (mesial process) of 3 cephalomesially directed spines: most distally situated much larger than adjacent one, and most proximal quite inconspicuous. Distal end of gonopod capped by oblique, rather high ridge bearing row of 8 small tubercles caudomesially and 2 of similar size offset slightly caudomesially; ridge flanked cephalolaterally by lower one, and valley between them bearing sublinear arrangement of short apical setae (Fig. 2*d*–*f*). Distal aperture of sperm channel situated at terminal caudolateral junction of marginal lobe and two apical ridges just mentioned.

Relationships.—*Typhlopseudothelphusa acanthochela* resembles *T. mocinoi* and *T. juberthiei* in possessing a distal, tuberculate ridge on the gonopod. The distribution of the tubercles resembles that in the former more closely than that in *T. juberthiei*, in which the tubercles are clustered at the cephalomesial angle of the horizontally truncate ridge. In contrast, however, the presence of three teeth on the cephalic lobe of the gonopod and the heavy concentration of spines on the distal part of the second pleopod are similar to the corresponding elements in *T. mitchelli*, but the absence of apical spines and the subhorizontal, truncate end of the pleopod clearly distinguishes this crab from that species. The spines on the opposable margins of the chelae are also distinctly more strongly developed than in the other three. Thus, while sharing characters with the three previously

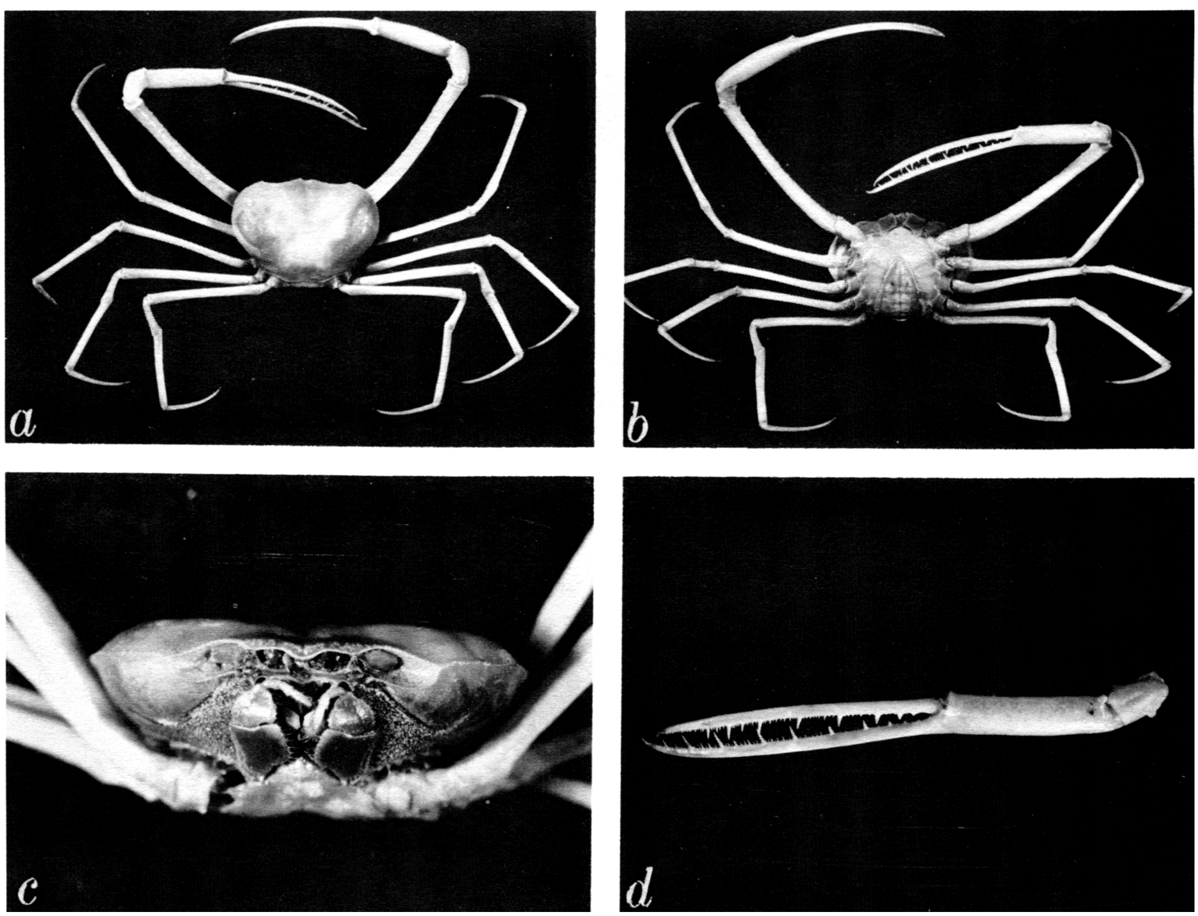

Fig. 1.—Holotype male of *Typhlopseudothelphusa acanthochela*, new species: *a*, Dorsal view (x0.51); *b*, Ventral view (x0.51); *c*, Frontal view of cephalothoracic region (x1.55); *d*, Abductor surface of left chela (x1.01).

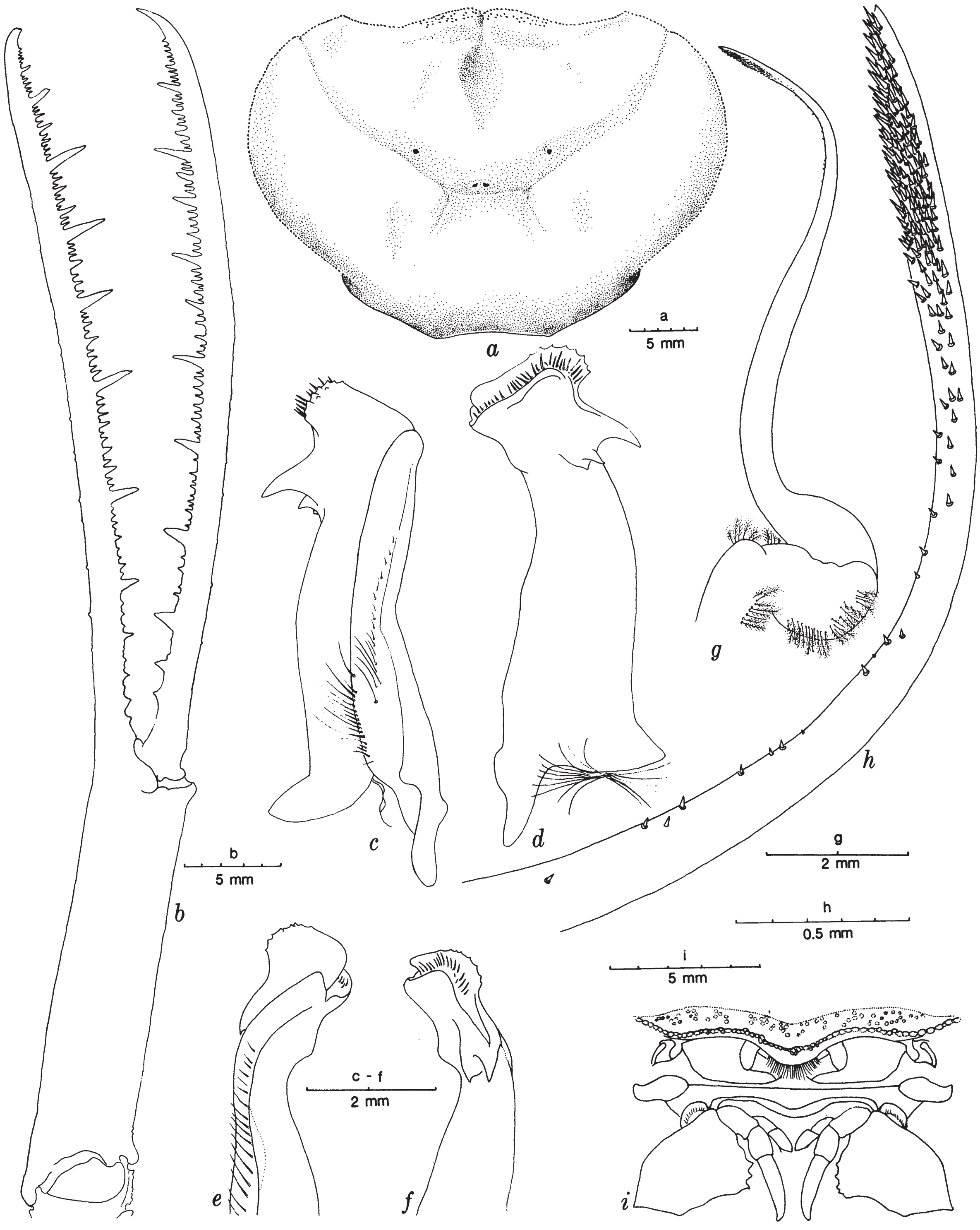

Fig. 2.—Holotypic male of *Typhlopseudothelphusa acanthochela*, new species: *a*, Dorsal view of carapace; *b*, Adductor surface of right chela; *c*, Caudal view of gonopod; *d*, Cephalic view of same; *e*, Mesial view of same; *f*, Lateral view of same; *g*, Caudal view of second pleopod (curvature of distal part intensified by clearing agent); *h*, Distal part of second pleopod; *i*, Frontal view of front and buccal region.

Key to the Species of the Genus *Typhlopseudothelphusa*
(Based on males; modified from Rodriguez, 1982)

1. Mesial process of gonopod ending in 3 spines; apical ridge with or without denticles. 2
   Mesial process of gonopod ending in 2 spines; apical ridge with denticles 3

2. Truncate extremity of gonopod perpendicular to axis of appendage; apical ridge without denticles. . . . . *mitchelli*
   Subtruncate extremity of gonopod oblique to axis of appendage; apical ridge with denticles . . . . *acanthochela*

3. Apical ridge with fewer than 5 teeth . . . . *juberthiei*
   Apical ridge with at least 5 teeth . . . . *mocinoi*

recognized members of the genus, *T. acanthochela* exhibits a unique combination of characteristics which is pointed out in the following key.

ACKNOWLEDGMENTS

My thanks are extended to Tom Miller of Eastern Washington University for permitting me to describe the crab, to James R. Reddell of the Texas Memorial Museum for advising me of its discovery and transmitting the single known specimen to the Smithsonian, and to Raymond B. Manning and Michael R. Carpenter of the Smithsonian Institution for criticisms of the manuscript and for the photographs, respectively.

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A NEW GENUS AND A NEW SPECIES OF TROGLOBITE SCORPION FROM MEXICO (CHACTOIDEA, SUPERSTITIONINAE, TYPHLOCHACTINI)

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ABSTRACT

Typhlochactas cavicola, new species from Cueva del Vandalismo, Purificacion System, Tamaulipas, is described and illustrated. *Sotanochactas*, new genus, is erected for *Typhlochactas elliotti* Mitchell, which differs significantly from the other four species in the genus.

RESUMEN

Typhlochactas cavicola, nueva especie de la Cueva del Vandalismo, Sístema Purificación, Tamaulipas, se describe e ilustra. *Sotanochactas*, nuevo género, es creado para *Typhlochactas elliotti* Mitchell, que difiere considerablemente de las otras cuatro especies en el género.

INTRODUCTION

> There are distinct differences between *Typhlochactas elliotti* and the two other troglobite scorpions which I have described, *T. rhodesi* and *T. reddelli*. Such are these differences that first examination would suggest, perhaps, a new genus for *T. elliotti*. But I have decided against this because there are similarities between all three species and because additional species of the series are needed to assist in clarifying the several systematic problems posed by these scorpions. Based upon criteria presently used in diagnosing scorpion genera, one could probably justify a new genus for *T. elliotti*, but this would probably necessitate separating *T. rhodesi* and *T. reddelli* into separate genera at the same time. This is what the future may well hold for these scorpions.
>
> Robert W. Mitchell, 1971:145.

Two additional species of *Typhlochactas* have been discovered since Mitchell's (1971) views were printed: *Typhlochactas sylvestris* Mitchell and Peck, from montane forest litter in Oaxaca, México (Mitchell and Peck, 1977), and *Typhlochactas cavicola*, a new species described below from Cueva del Vandalismo in Tamaulipas, México. These species, as well as the description of the troglobitic *Alacran tartarus* Francke, from Oaxaca (Francke, 1982), have indeed assisted in clarifying the systematic relationships within the tribe Typhlochactini Mitchell. *Typhlochactas rhodesi* Mitchell, *Typhlochactas reddelli* Mitchell, *T. sylvestris* and *T. cavicola* form a compact monophyletic group of species, and the differences between this group and *Typhlochactas elliotti* Mitchell are such that the recognition of a new genus is now justified.

Typhlochactas cavicola, new species
Figs. 1-10, 17-19

Type-data.—Holotype male from Cueva del Vandalismo, entrance about 2600 m elevation, 1 km SE Rancho Nuevo, Tamaulipas, México, 15 March 1982 (D. Honea). Permanently deposited at the American Museum of Natural History, New York.

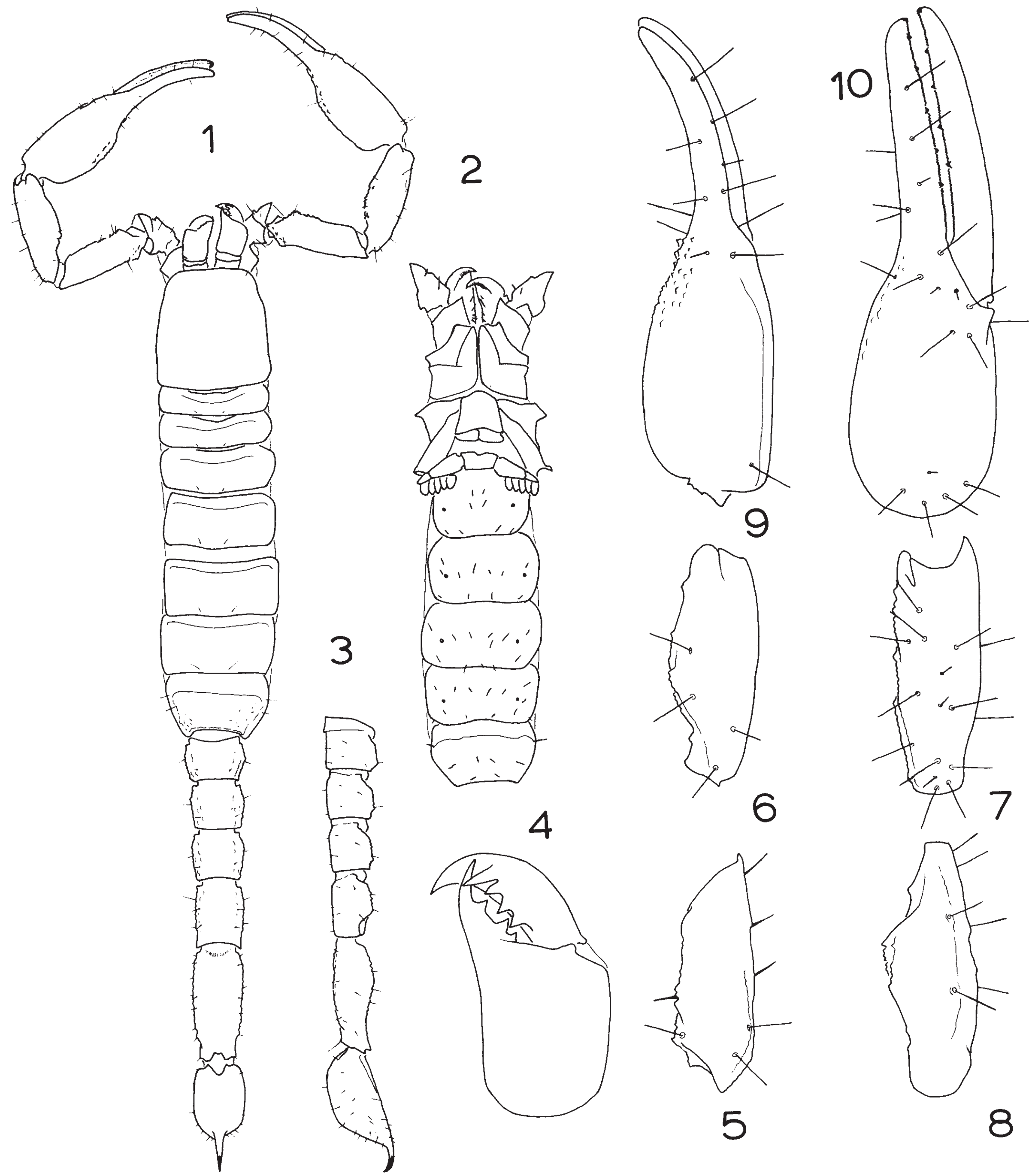
Diagnosis.—Eyeless and unpigmented. Metasomal segments I-III wider than long. Stigmata small, round. Cheliceral fixed finger with four distinct and separate teeth, basal pair not forming a bicusp. Cheliceral movable finger with four distinct teeth dorsally. Pedipalps with orthobothriotaxia C; tibia with two ventral trichobothria, internal trichobothria of chela located at fixed finger base. Fixed finger of pedipalp chela with six rows of denticles, with apical row very short; movable finger with five rows, with basal row very long. Legs lacking pedal and tibial spurs.

Description.—Known only from the holotype male (measurements in Table 1).

Prosoma: Carapace cream colored; subquadrate, slightly longer than wide, with anterior margin straight

(Fig. 1). Median eyes and ocular tubercle absent, lateral eyes absent. Median longitudinal and posterolateral furrows faintly indicated; disc smooth, all carinae absent. Venter cream colored; sternum pentagonal (Fig. 2), with shallow posteromedian depression.

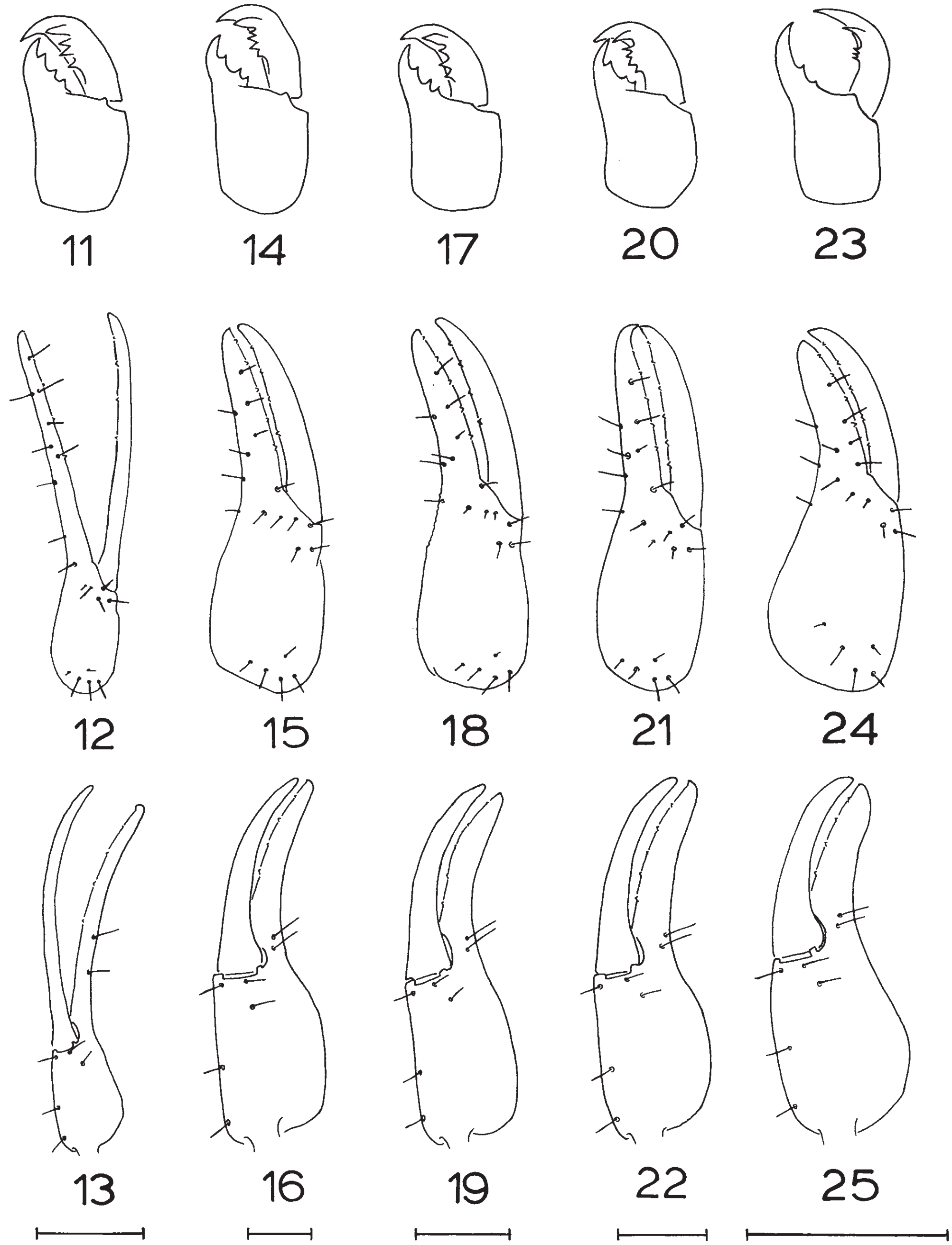
Mesosoma: Tergites cream colored; I-VI smooth throughout; VII with few small granules posterolaterally, with submedian and lateral carinae marked by slightly larger granules along posterior margin. Venter whitish. Genital opercula subovate, without median longitudinal membranous connection; no genital papillae could be detected. Pectines with only two marginal lamellae, one middle lamella, no fulcra, and five teeth on each side. Sternites with very



Figs. 1-10.–*Typhlochactas cavicola,* new species, holotype male: 1, dorsal aspect (without legs); 2, ventral aspect of pro- and mesosoma; 3, lateral aspect of metasoma; 4, dorsal aspect of chelicera; 5, dorsal aspect of pedipalp femur; 6, dorsal aspect of pedipalp tibia; 7, external aspect of pedipalp tibia; 8, ventral aspect of pedipalp tibia; 9, dorsal aspect of pedipalp chela; 10, external aspect of pedipalp chela.

rounded margins (Fig. 2); each with two transverse rows of 4-8 setae each, one medially and one along posterior margin; sternite VII smooth throughout; stigmata very small, round.

Metasoma (Figs. 1, 3): Cream colored. Segments I-IV with dorsal submedian and lateral supramedian keels weakly developed, irregularly granulose; other keels absent; dorsal intercarinal spaces with moderately dense small granulation, other intercarinal spaces smooth. Segment V with dorsolateral keels weak, irregularly granulose; lateral median keels absent; ventral lateral and ventral median carinae vestigial, their presence suggested by few low granules. Vesicle globose, aculeus relatively short (Fig. 3).



Figs. 11-25.—Dorsal aspect of chelicera (top), external aspect of pedipalp chela (middle), and ventrointernal aspect of pedipalp chela (bottom): 11-13, *Sotanochactas elliotti* (Mitchell); 14-16, *Typhlochactas rhodesi* Mitchell; 17-19, *Typhlochactas cavicola,* new species; 20-22, *Typhlochactas reddelli* Mitchell; 23-25, *Typhlochactas sylvestris* Mitchell and Peck. Scale lines refer to each column (and species), and represent 0.5 mm for chelicerae, and 1 mm for pedipalp chelae, respectively.

Table 1.—Measurements (mm) of the holotype male of *Typhlochactas cavicola*, new species, from Cueva del Vandalismo, Tamaulipas.

Total length	15.00
Carapace length	2.15
median width	1.90
Mesosoma length	5.15
Metasoma length	7.70
I length/width	0.70/1.05
II length/width	0.80/1.00
III length/width	0.85/0.95
IV length/width	1.15/0.85
V length/width	1.90/0.90
telson length/vesicle length	2.30/1.90
vesicle width/depth	1.00/0.90
aculeus length	0.40
Pedipalp length	7.40
Femur length/width	1.75/0.60
Tibia length/width	1.90/0.70
Chela length/width/depth	3.75/1.00/1.20
Movable finger length	2.20
Fixed finger length	1.70
Chelicera: Chela length/width	0.65/0.50
Movable finger length	0.65
Fixed finger length	0.30
Pectinal tooth count	5-5

Chelicera: Cream colored, teeth very light brown. Dentition as in Fig. 4, serrula well developed.

Pedipalp: Cream colored, fingers on chela very light brown. Femoral carinae weak, granulose; intercarinal spaces sparsely to moderately granulose; three femoral trichobothria (Fig. 5). Tibial carinae vestigial to obsolete; intercarinal spaces sparsely granulose to smooth; trichobothria as in Figs. 6-8. Chelal carinae vestigial to obsolete; dorsointernal area with moderately large granulation; trichobothria as in Figs. 9-10. Fixed finger with six rows of denticles, apical row very short (Fig. 10); movable finger with five rows of denticles.

Legs: Cream colored. Pedal and tibial spurs absent.

Comparisons.—*Typhlochactas cavicola* is most closely related to *T. rhodesi*, also from Tamaulipas and type-species of the genus, than it is to any other typhlochactine. These two species share the presence of five rows of denticles on the movable finger of the pedipalps, with the basal row relatively longer than the others (Fig. 15 and 18); the fixed finger with six rows, with the apical row shorter than the others (Figs. 16 and 19); and both species lack prolateral pedal spurs. They differ primarily in that *T. cavicola* has only four dorsal teeth on the movable finger of the chelicera (Fig. 17), whereas *T. rhodesi* has five (Fig. 14). *Typhlochactas reddelli*, from Veracruz, has prolateral pedal spurs, five dorsal teeth on the movable finger of the chelicera (Fig. 20), seven rows of denticles on the movable finger of the pedipalps (Fig. 21), and six rows on the fixed finger with the apical one subequal (Fig. 22). *Typhlochactas sylvestris*, from Oaxaca, has prolateral pedal spurs, three rather than four teeth on the fixed finger of the chelicera (Fig. 23), six rows of granules on the movable finger of the pedipalps with the basal row subequal (Fig. 24), and five rows on the fixed finger with the apical row subequal (Fig. 25).

Typhlochactas elliotti, from San Luis Potosí, differs considerably from the four species discussed above, and a new genus is hereby erected for it.

Sotanochactas, new genus

Type-species.—*Typhlochactas elliotti* Mitchell, 1971, by monotypy.

Etymology.—The name is derived from "sótano" which means pit in Spanish, in reference to the type-locality of *T. elliotti*—Sótano de Yerbaniz; and "chactas," a proper name in mythology. It is masculine in gender.

Diagnosis.—Eyeless. Stigmata small, round. Pectines without fulcra. Legs without pedal and tibial spurs. Cheliceral fixed finger with four distinct teeth, two basals not forming a bicusp; movable finger with four distinct dorsal teeth (Fig. 11), and well-developed serrula. Pedipalp tibia orthobothriotaxia C, with 19 trichobothria of which only two are ventral. Pedipalp chela with fingers twice as long as palm; fixed finger with five rows of granules, basal row very long; fixed finger with four external (e) trichobothria on distal half, two internal trichobothria clearly along finger (Figs. 12-13); movable finger also with five rows of granules, basal row very long (Fig. 13). Chela orthobothriotaxia C (n=26).

Comparisons.—*Alacran* Francke has prolateral pedal spurs, five dorsal teeth on the movable finger of the chelicera, seven rows of granules on the movable finger of the pedipalp, and six rows on the fixed finger, 26-27 tibial trichobothria (3 ventral), and 29 chelal trichobothria. *Typhlochactas* Mitchell has the fixed finger of the pedipalp chela about as long as the palm; the basalmost of the four external (e) trichobothria is located at the fixed finger base (Figs. 15, 18, 21, 24) as are the two internal trichobothria (Figs. 16, 19, 22, 25).

The phylogenetic relationships within the Typhlochactini remain as in an earlier cladogram (Francke, 1982, fig. 26), with the addition of *T. cavicola* along the branch leading to *T. rhodesi*.

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I am grateful to Dr. Norman I. Platnick, American Museum of Natural History, New York, and Mr.

Wilson R. Lourenço, Museum National d'Histoire Naturelle, Paris, for the loan of comparative specimens used in this study. My special thanks to Mr. James R. Reddell, Texas Memorial Museum, Austin, for the opportunity to study the holotype of *T. cavicola*, as well as many other troglobite scorpions; and to Mr. W. David Sissom and Mr. Wilson R. Lourenço for their comments on the manuscript. This study was supported in part by the Institute for Museum Research, Texas Tech University.

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DESCRIPTION OF THE MALE OF *VAEJOVIS GRACILIS* GERTSCH AND SOLEGLAD (SCORPIONES: VAEJOVIDAE), WITH A CLARIFICATION OF THE IDENTITY OF THE SPECIES

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ABSTRACT

Vaejovis gracilis Gertsch and Soleglad is redescribed on the basis of an adult male collected in the Sótano de las Golondrinas, Manzanilla, Veracruz, México. Specimens used in an earlier redescription (Soleglad, 1975) are not referable to *V. gracilis*. *V. gracilis* is considered to be a troglobite, but its features are indicative of the initial stages of regressive evolution in the cave environment.

INTRODUCTION

Gertsch and Soleglad (1972) described *Vaejovis gracilis* from a specimen collected in Grutas de Atoyac, near Atoyac, Veracruz, México. These authors noted that the holotype exhibits some potentially cave-adapted features: (1) its coloration is very pale yellow; (2) the cuticle is weakly sclerotized; (3) granulation is absent from cuticular surfaces; (4) the keels of the metasoma and pedipalps are poorly developed: (5) the appendages are attenuated: and (6) the eyes, although present, are noticeably small. However, several of these characters are also typical of early instars. This fact, coupled with the small size of the holotype (total length less than 20 mm), led Gertsch and Soleglad (1972) to only tentatively suggest that *V. gracilis* is a troglobite.

Three years later, Soleglad (1975) redescribed *V. gracilis* from five adult females collected in four caves in Oaxaca, Puebla, and Veracruz. With the exception of somewhat attenuated appendages, those specimens did not possess any troglobitic features. It seemed, then, that the characters exhibited by the holotype were indicative of immaturity, and that *V. gracilis* was troglophilic, but not troglobitic.

In January 1977, an adult male was collected by A. Grubbs from the Sótano de las Golondrinas, a cave near Potrero, Veracruz (and also near the type-locality of *V. gracilis*). This specimen differs greatly from the adults described by Soleglad, but is remarkably similar to the holotype (differing from it mainly in body size). The troglobitic facies exhibited by the holotype are also expressed in the adult male (Fig. 1), and there is little doubt that *V. gracilis* should be regarded as a troglobite.

Unfortunately, the five females examined by Soleglad (1975) cannot be located and are probably lost (Dr. W.J. Gertsch, Dr. N.I. Platnick, and Mr. M.E. Soleglad, pers. comms.). However, owing to the description and illustrations of Soleglad (1975), it is certain that they are not referable to *V. gracilis*, but represent one or more unnamed species. With the discovery of the male, and the knowledge that Soleglad's specimens are not *V. gracilis*, a second redescription of this species is necessary, and this is given below.

Vaejovis gracilis Gertsch and Soleglad
Figs. 1-10

Vejovis gracilis Gertsch and Soleglad, 1972:603-604, figs. 24, 25, 80-83, 147-149; Soleglad, 1975:107 (part).
Vaejovis gracilis: Díaz Nájera, 1975:6, 33.

Type-data.—Immature female holotype from Cueva de Atoyac, Atoyac, Veracruz, México, 6-9 Aug 1969 (S. and J. Peck). Deposited in the American Museum of Natural History, examined.

Distribution.—Known only from two caves in Veracruz, México: Cueva (=Grutas) de Atoyac and Sótano de las Golondrinas.

Diagnosis.—Medium-sized species (adult male 45 mm in length) of *Vaejovis.* Base color pale yellow brown. Carapace and tergites smooth to very finely granular. Pectinal tooth count 20-21. Metasoma: all segments distinctly longer than wide; segment V more than 4 times longer than wide. Keels of metasoma I-IV moderate, finely crenulate: of V weak to moderate, granular to finely crenulate. Pedipalps: all segments long and slender; femur longer than carapace; basal tubercle of tibia poorly developed. Chela: both fingers terminating in an enlarged clawlike tooth bearing an oblong whitish patch distally; fixed finger with six subrows of denticles; dorsointernal carina moderate, crenulate: other keels weak to moderate, granular. Trichobothrial pattern Type C, orthobothriotaxic (Vachon, 1974); *ib* and *it* of chela situated basally on fixed finger.

Description.—The following description is based on the two known specimens. Measurements of the adult male are given in Table 1.

Table 1.—Standard measurments (mm) of the adult male of *Vaejovis gracilis* Gertsch and Soleglad from Sótano de las Golondrinas.

Total length	45.2
Carapace, length	5.6
Carapace, anterior width	2.5
Carapace, width at median eyes	3.6
Mesosoma length	12.3
Metasoma length	21.4
I length/width	2.7/2.2
II length/width	3.3/1.9
III length/width	3.6/1.8
IV length/width	5.0/1.6
V length/width	6.9/1.6
Telson length	5.9
Vesicle length/width/depth	4.0/1.7/1.6
Aculeus length	1.9
Pedipalp length	22.9
Femur length/width	6.1/1.2
Tibia length/width	7.0/1.3
Chela length/width/depth	9.8/1.3/1.4
Movable finger length	6.4
Fixed finger length	5.6
Pectinal tooth count: left/right	20/20

Coloration: Base color of carapace. pedipalps, mesosoma, and metasoma pale yellow brown. Carapace and legs with very faint underlying dusky markings. Ocular tubercle and areas around lateral eyes blackish. Pedipalp fingers slightly darker than palm: dentate margins reddish brown. Keels of pedipalps, legs, and metasoma underlined with reddish brown. Chelicerae yellow at base, pale yellow brown distally; teeth reddish brown. Aculeus of telson dark brown.

Prosoma: Carapace: Anterior margin with moderately deep, rounded median notch. Median eyes small, width of ocular tubercle approximately 1/7 that of carapace width at median eyes: ocular tubercle situated in anterior 1/3 of carapace. First two lateral eyes subequal in size, third very small (holotype has a fourth eye located anteriorly on the right side; see Figs. 24-25 in Gertsch and Soleglad, 1972). Furrows: anterior median moderately deep, wide; posterior median deep, wide behind ocular tubercle, narrow near posterior margin of carapace; posterior lateral moderately deep, wide, curved; other furrows inconspicuous. Carapacial surface essentially smooth. Venter: sternum about as wide as long, somewhat rounded anteriorly.

Mesosoma: Tergites I-VI with fine granules along posterior margins: median keel obsolete on I-II, faint on III-VI. Tergite VII pentacarinate: median keel faint, present on anterior 2/5 of segment; two pairs lateral keels moderate, crenulate to serrate. Sternites: III-VI smooth with slit-like stigmata; VII with pair of moderate, serrate lateral keels. Genital operculum twice as wide as long, completely divided longitudinally; genital papillae present. Pectines: Basal piece twice as wide as long, with deep anteromedian notch; middle lamellae oval to round, setose, numbering 15-16; pectinal tooth count 20-21.

Metasoma: All segments distinctly longer than wide: III twice as long as wide, V more than four times longer than wide. Segments I-IV: Dorsolateral carinae moderate, crenulate: on I moderately convergent posteriorly, on II-IV subparallel. Lateral supramedian carinae moderate, crenulate. Dorsolateral and lateral supramedian carinae lacking enlarged distal granule on all segments. Lateral inframedian carinae on I complete, represented by a row of irregularly spaced pointed granules; on II present only on posterior 1/5 of segment, weak, smooth: on III-IV absent. Ventrolateral and ventral submedian carinae moderate, crenulate. Segment V: Dorsolateral carinae weak, crenulate anteriorly, granular posteriorly. Lateral median carinae present on anterior 3/4 of

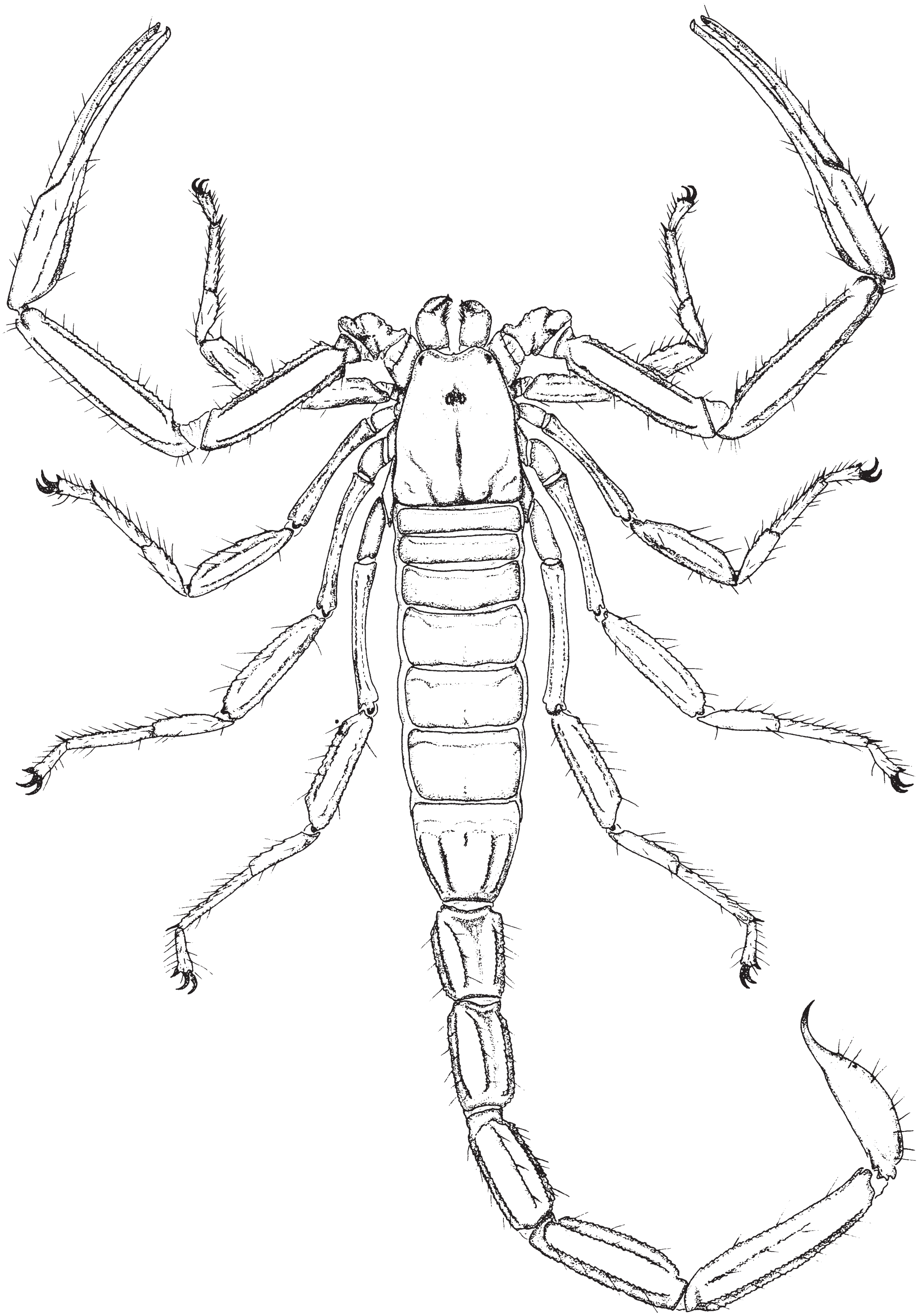

Fig. 1.—Dorsal view of adult male *Vaejovis gracilis* Gertsch and Soleglad from Sótano de las Golondrinas.

segment, weak, finely crenulate. Ventrolateral carinae weak, finely crenulate. Ventromedian carina moderate, crenulate. Intercarinal spaces of all segments smooth.

Telson: Vesicle somewhat elongate, 2.4 times as long as wide; flattened dorsally, with fine granulation below. Aculeus weakly curved.

Chelicerae: Dentition typical of genus. Serrulae well developed.

Pedipalps: Femur (Fig. 2): Dorsointernal and ventrointernal carinae moderate, granulose. Dorsoexternal carinae moderate, irregularly granular. Ventroexternal carina weak, granular. Internal face with row of about 25-30 small to medium granules: ventral face with weak granulation proximally; other surfaces smooth. Orthobothriotaxia C (Vachon, 1974).

Tibia (Figs. 3-5): Dorsointernal and ventrointernal carinae moderate, granulose. Dorsoexternal and ventroexternal carinae weaker, finely granular. External keel moderate, smooth to finely granular. Internal face with weak basal tubercle and row of about 15 irregularly spaced granules; other surfaces essentially smooth. Orthobothriotaxia C (Vachon, 1974): em_2 slightly basal to em_1.

Chela (Figs. 6-10): Manus slender, fingers long and tenuous; chela length/palm width ratio approximately 7.5; fixed finger as long as carapace. Dentition: Fixed finger (Fig. 9) with primary row divided into six subrows by five larger denticles; six inner accessory granules, of which all but distalmost closely paired with larger denticle in primary row. Movable finger (Fig. 10) with primary row divided into six subrows by five larger denticles; apical subrow with 4-5 granules; seven inner accessory granules, of which all but distalmost and basalmost closely paired with larger denticle of primary row. Each finger terminating distally in enlarged, clawlike denticle, bearing distally an oblong whitish patch. Dorsal marginal keel granular, weak basally, moderate distally, extending well into fixed finger. Dorsal secondary keel weak, granular. Digital keel moderate, granular, extending into fixed finger. External secondary keel weak, granular. Ventroexternal keel moderate, granular to finely crenulate. Ventromedian keel weak to moderate, granular, joining distally with ventroexternal keel and extending into fixed finger. Ventrointernal keel weak, granular. Dorsointernal keel moderate, crenulate, with a few larger, sharp granules. Orthobothriotaxia C (Vachon, 1974): *ib* and *it* situated basally on fixed finger (Fig. 9).

Variability.—The juvenile holotype differs from the adult by having weaker keels on the metasoma and pedipalps (those on the pedipalps are scarcely noticeable), by lacking granulation on cuticular surfaces, by possessing the fourth (aberrant) right lateral eye, by having more dusky markings, and by lacking genital papillae.

Comparisons.—*Vaejovis gracilis* was considered by Soleglad (1975) to be a member of the *mexicanus* group. The species of this group, however, do not possess enlarged, clawlike terminal denticles on the pedipalp chela fingers or well-developed white patches at the fingertips, as found in *V. gracilis.* These characters indicate that *V. gracilis* is more closely related to *Vaejovis nitidulus* C. L. Koch. It is also related to the form(s) described by Soleglad in 1975. *Vaejovis gracilis* cannot be confused with these species, however, because of its cave-adapted features.

Remarks.—*Vaejovis gracilis* is the only known troglobite among the Vaejovidae, although several species have been collected solely from caves. Of these, only *Uroctonus grahami* Gertsch and Soleglad from Samwell Cave in California exhibits structural modifications similar to those found in *V. gracilis.* This species, however, is currently thought to be endogean (Gertsch and Soleglad, 1972).

In degree of cave adaptedness, *V. gracilis* is quite comparable to *Diplocentrus cueva* Francke. Both species exhibit drastic elongation of the pedipalps and metasoma and slight to moderate regression in other features. Both also retain the full complement of eyes, with the median pair slightly reduced in size. Therefore, *V. gracilis,* like *D. cueva,* is still in the initial stages of regressive evolution, as defined by these characteristics (Francke, 1978).

Specimens examined.—MEXICO: *Veracruz*: Cueva (=Grutas) de Atoyac, Atoyac, 6-9 Aug. 1969 (S. and J. Peck), juvenile female holotype (AMNH); Sótano de las Golondrinas, Manzanilla, 11 km N Potrero, 8 Jan. 1977 (A. Grubbs), one male (OFF).

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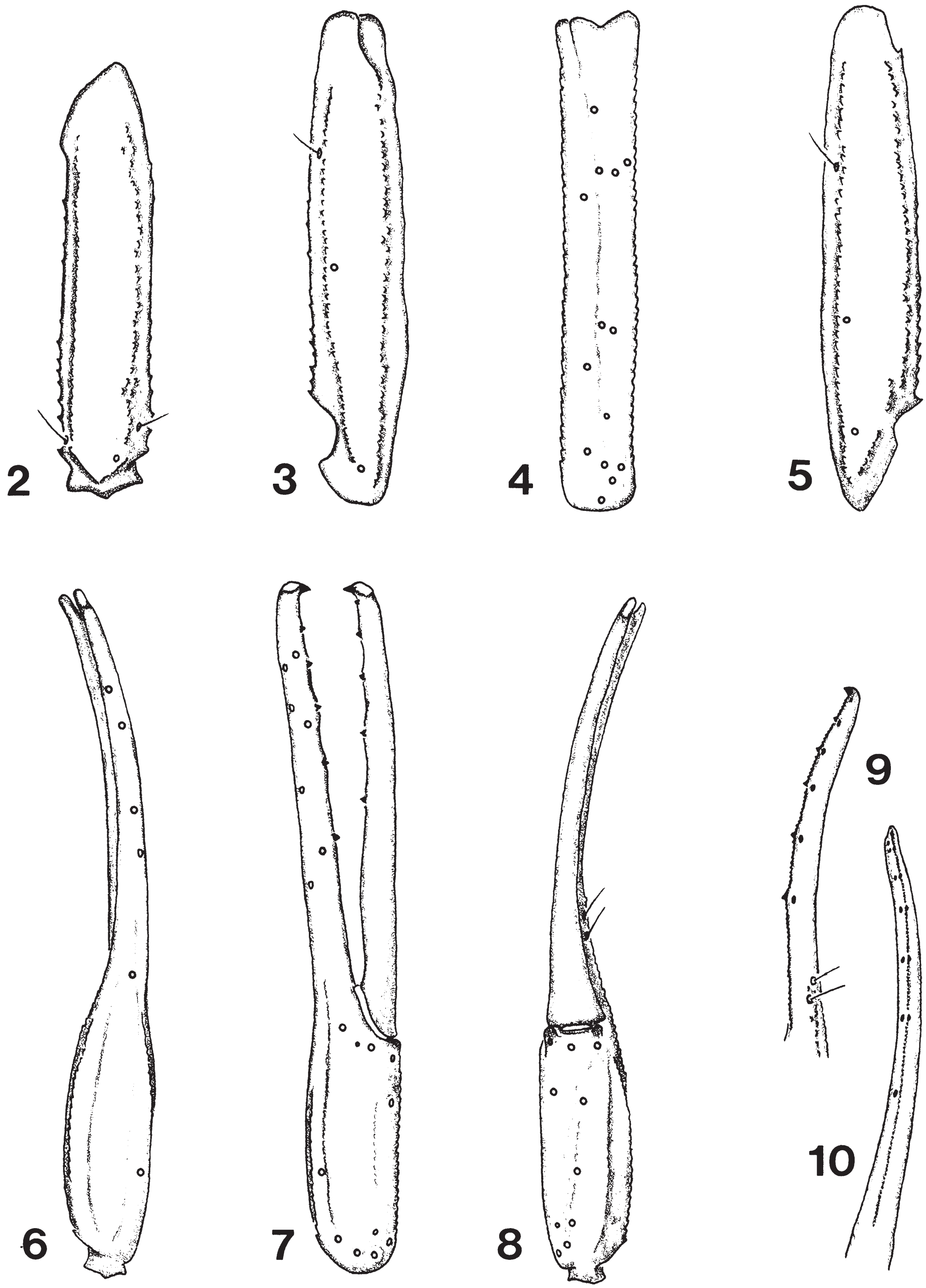

Figs. 2-11.—Morphology of *Vaejovis gracilis*, in particular showing trichobothrial patterns and carinal disposition: 2, pedipalp femur, dorsal view; 3, pedipalp tibia, dorsal view; 4, pedipalp tibia, external view; 5, pedipalp tibia, ventral view; 6, pedipalp chela, dorsal view; 7, pedipalp chela, external view; 8, pedipalp chela, ventral view; 9, pedipalp chela fixed finger, showing primary row denticles; 10, pedipalp chela movable finger, showing primary row denticles.

whereabouts of the specimens used in the first redescription of *V. gracilis*; I thank them for their assistance. Finally, I thank Dr. Francke and Dr. Gary A. Polis for their constructive criticism of the manuscript.

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ADDITIONAL PSEUDOSCORPIONS, MOSTLY FROM CAVES, IN MEXICO AND TEXAS (ARACHNIDA: PSEUDOSCORPIONIDA)

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ABSTRACT

Ten new species are described: *Aphrastochthonius palmitensis* from Nuevo León; *Pseudochthonius troglobius* from Yucatán; *Tyrannochthonius vampirorum* and *T. intermedius* from Tamaulipas; *Tyrannochthonius tlilapanensis* and *T. volcancillo* from Veracruz; *Tyrannochthonius troglodytes* from Llano Co., Texas; *Mexobisium reddelli* from San Luis Potosí; *Leucohya texana* from Uvalde Co., Texas; and *Typhloroncus xilitlensis* from San Luis Potosí. A discussion of the unique chelal trichobothriotaxy of all known species of *Typhloroncus* is included.

INTRODUCTION

Continued collection of biological specimens in the caves of Mexico and adjacent areas has resulted in the accumulation of a number of new pseudoscorpions. As reported earlier (Muchmore, 1982), most of these belong to the family Chernetidae and have not yet been studied sufficiently for publication. However, some new representatives of the families Chthoniidae, Bochicidae, and Ideoroncidae are described and discussed below.

All types are in the Florida State Collection of Arthropods, Gainesville, Florida.

FAMILY CHTHONIIDAE HANSEN

Genus *Aphrastochthonius* (Chamberlin)

Aphrastochthonius Chamberlin, 1962:307; Muchmore, 1972b:433.

Aphrastochthonius is now known to include 13 species, of which all but 2 are troglobites. Seven of these species, including one epigean form, are from Mexico and Guatemala, while 3, all troglobites, are from New Mexico and California. Representatives of the genus are characterized by the possession of coxal spines on the coxae of legs I and II, a bisetose intercoxal tubercle, and a conspicuously heavy condyle on the base of the movable finger of the palpal chela.

Aphrastochthonius palmitensis, new species
Fig. 1

Type-data.—Holotype male (WM6103.01001) from Grutas del Palmito, 7 km SSW Bustamante, Nuevo León, México, 3 October 1981 (S. Robertson and J. Johnston).

Diagnosis.—Very similar to *A. parvus* Muchmore (1972b) from Cueva de la Florida, Tamaulipas, but with only 4 setae on tergite 4 and more slender palp (chela l/w = 6.0).

Description of male (female unknown).—With the characters of the genus (Muchmore, 1972b:433). Carapace about as broad as long; anterior margin slightly depressed at center and with about 8 small denticles; no eyes; chaetotaxy m4m-4-4-2-2, the major setae long, heavy, and acuminate. Coxal area typical: chaetotaxy m+1-2-1(2m):3m-3-1-CS:3-2-CS:2-5:2-5; 5 flat parallel-rayed coxal spines on each coxa I and 8 similar spines on each coxa II; intercoxal tubercle with 2 small setae. Abdomen typical. Tergal chaetotaxy 4:4:4:4:6:6:6:6:6:6:T2T:0; setae nearly as heavy as those on carapace but shorter. Sternal chaetotaxy 7:[4-4]:(3)6-6/16(3):(3)8(3):10:10:10:10:8:7:0:2.

Chelicera 4/5 as long as carapace; hand with 6 setae, *sb* long and stout, *es* very small; movable finger with 10-11 and fixed finger with 8-9 teeth, in each case the distal one largest; spinneret not evident; flagellum apparently of 6 pinnate setae.

Palp typical for the genus (Fig. 1). Trochanter 1.55, femur 6.1, tibia 2.5, and chela 6.0 times as long as broad; hand 2.75 times as long as deep; movable finger 1.22 times as long as hand. Femur about 1.5 and chela 2.0 times as long as carapace. Distal setae on femur and tibia long and stout. Placement of trichobothria on chela typical (*st* is missing from the movable finger of the left chela). Movable finger with 6 spaced, acute teeth and 5 rounded denticles proximally; fixed finger with 16 spaced, acute teeth and one accessory denticle distally. Sensillum on movable finger proximad of last denticle.

Legs typical. Leg IV with entire femur 2.4 and tibia 5.25 times as long as deep.

Measurements (mm).—Body length 1.15. Carapace length 0.33. Chelicera 0.26 long. Palpal trochanter 0.125 by 0.08; femur 0.49 by 0.08; tibia 0.20 by 0.085; chela 0.66 by 0.11; hand 0.30 by 0.11; movable finger 0.37 long. Leg IV: entire femur 0.385 by 0.16; tibia 0.29 by 0.055.

Etymology.—The name *palmitensis* refers to Grutas del Palmito, the type-locality.

Remarks.—Though *A. palmitensis* is very similar

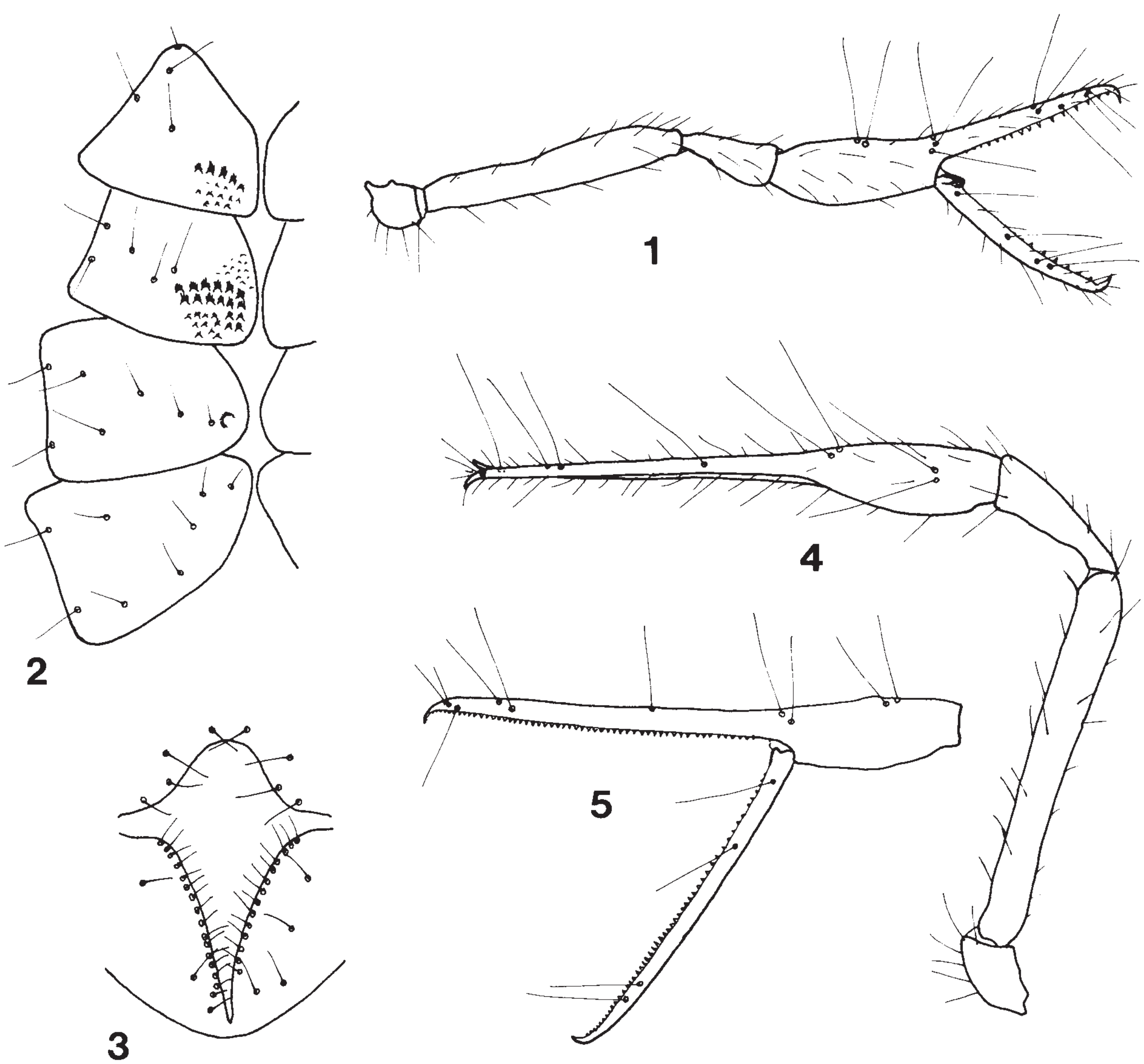


Fig. 1.—*Aphrastochthonius palmitensis*, new species, holotype male: dorsal and lateral view of right palp.

Figs. 2-5.—*Pseudochthonius troglobius*, new species, holotype male: 2, coxal area showing chaetotaxy and coxal spines; 3, genital opercula; 4, dorsal view of right palp; 5, lateral view of left chela.

in most respects to *A. parvus*, it is certainly distinct. As mentioned above, there are several small morphological differences, but most importantly the two forms are separated by 450 km of mountainous terrain. It is inconceivable that the same troglobitic species could occur in caves so far apart. The nearest known *Aphrastochthonius* species, *A. patei* Muchmore (1982), is from Sumidero de Oyamel, Tamaulipas, about 300 km distant. From this species *A. palmitensis* differs in many aspects of size, proportions, and chaetotaxy. In its more northern location, *A. palmitensis* approaches the domain of *A. pachysetus* Muchmore (1976) but it shares none of the morphological peculiarities of that species.

Another remarkable troglobitic pseudoscorpion, *Leucohya heteropoda* Chamberlin (1946), also occurs in Grutas del Palmito.

Genus *Pseudochthonius* Balzan

Pseudochthonius Balzan, 1891; Chamberlin, 1929: 173; Muchmore, 1977:64.

Pseudochthonius is known from Africa and America. Of the 18 American forms described previously, only 2 have been found in caves. Two species, both epigean, have been known from Mexico. Representatives of the genus are characterized by the possession of coxal spines on the coxae of legs I and II, and sometimes III, the lack of an intercoxal tubercle, and the usually strongly curved fingers of the palpal chela.

Pseudochthonius troglobius, new species
Figs. 2-5

Type-data.—Holotype male (WM6400.01001) from Cueva del Cenote Xtolok, Chichén Itzá, Yucatán, México, 26 July 1983 (J. Reddell).

Diagnosis.—Very large for the genus (palpal femur 1.27 mm long) and highly modified for cavernicolous existence (no eyes and appendages highly attenuated, e.g. femur l/w = 8.2).

Description of male (female unknown).—With the characters of the genus (Hoff, 1963:6; Muchmore, 1977:64) but highly modified in several respects. Carapace and palps light tan, other parts straw colored. Carapace 1.3 times as long as wide; anterior margin with a prominent, denticulate epistome; no eyes; surface finely reticulate; chaetotaxy 6-4-4-2-4, all setae long and heavy, there being no small preocular setae. Coxal area modified: palpal coxa long and narrow; coxa I without a prominent apical projection or microseta; coxal chaetotaxy 2-3-1:0-4-1-CS:2-3-CS:2-5-CS:2-6; each coxa I with a transverse row of 5 broad, flat, scalelike, parallel-rayed spines, behind which are 4 irregular rows of smaller, dentate spinules (Fig. 2); each coxa II with 2 rows of broad, parallel-rayed spines, followed by 3 irregular rows of smaller spinules; each coxa III with a single broad, flat spine or scale with a denticulate edge; no intercoxal tubercle present.

Abdomen typical. Tergal chaetotaxy 4:4:4:4:6:6:6:6:6:4:T2T:0, most setae long and heavy; sternal chaetotaxy 9:[3-3]:(2)15-14/11(2):(2)7(2):8:8:8:8:7:4:0:2. Setae of genital opercula shown in Fig. 3; as in other species of *Pseudochthonius*, all setae of anterior operculum lie along indented posterior margin (see also Chamberlin, 1929:Fig. O; Wagenaar Hummelinck, 1948:Fig. 14g); all setae on posterior operculum nearly straight; none of the border setae S-shaped or falcate as in some other Mexican and Central American forms.

Chelicera long and narrow, nearly as long as carapace and 2.65 times as long as broad; hand of left chelicera with 4 setae, that of right with 6; flagellum of 8 pinnate setae; fingers with about 10 irregular teeth, the distal ones largest; galea a toothlike protuberance on the outer margin of movable finger, as in females of other *Pseudochthonius* species.

Palp very long and slender (Fig. 4); femur 1.9 and chela 2.55 times as long as carapace. Trochanter 2.0, femur 8.2, tibia 2.95, and chela 7.8 times as long as broad; hand 2.5 times as long as deep; movable finger 2.14 times as long as hand. Chelal fingers nearly straight and movable finger reaching nearly to tip of fixed finger. Placement of trichobothria about typical for the genus (Fig. 5), though distances between some pairs magnified by attenuation of the fingers. Chelal fingers homodentate, the teeth equally well developed on the two fingers; fixed finger with 65 tall, cusped, spaced teeth arranged in a distinct double row, movable finger with 50 similar teeth in a staggered row. A sensillum on external surface of movable finger just distad of trichobothrium *sb*.

Legs very slender; leg IV with entire femur 3.9 and tibia 6.5 times as long as deep. Tactile setae on metatarsus and telotarsus.

Measurements (mm).—Body length 2.07. Carapace length 0.67. Chelicera 0.665 by 0.25. Palpal coxa 0.62 by 0.235; trochanter 0.33 by 0.165; femur 1.27 by 0.155; tibia 0.50 by 0.17; chela 1.73 by 0.22; hand 0.555 by 0.22; movable finger 1.185 long. Leg I: basifemur 0.65 by 0.08; telofemur 0.32 by 0.065; tibia 0.35 by 0.05; tarsus 0.62 by 0.045. Leg IV: entire femur 0.92 by 0.235; tibia 0.62 by 0.095; metatarsus 0.30 by 0.075; telotarsus 0.60 by 0.05.

Etymology.—The species is named *troglobius* because of its striking modifications for life in a cave.

Remarks.—Two other species of *Pseudochthonius* have been found in caves but *T. troglobius* is much more modified than either for cave life. *P. arubensis* Wagenaar Hummelinck (1948) from Aruba, Netherlands Antilles, is of about the same size and proportions as epigean forms from the Caribbean region but is pallid and has no eyes. *P. strinatii* Beier (1969) from Brasil is also pallid and eyeless but, in addition, is larger and has more attenuated appendages than epigean forms. *P. troglobius* is not as light in color as the others (perhaps because of its size) but is eyeless, is the largest species known in the genus, and the appendages are greatly elongated, even including the chelicera which is usually not much changed in troglobitic forms. In addition, *P. troglobius* shows several other modifications which may or may not be associated directly with cave living: there are no preocular setae on the carapace, unusual for the genus; there are 4 setae at the posterior margin of the carapace, rather than 2 as usual for the genus; the galea is a well developed protuberance on the cheliceral finger similar to that found in females, but not males, in other *Pseudochthonius* species; there is no prominent apical projection or apical microseta on coxa I as is usual for the genus; the coxal spines are quite numerous and varied on coxae I and II and include one spine or scale on coxa III. The latter feature apparently allies *P. troglobius* with the epigean *P. moralesi*, *P. yucatanus* and *P. falcatus* from Chiapas, Yucatán, and Belize, all of which have 1 or 2 small spines on coxa III (Muchmore, 1977).

Genus *Tyrannochthonius* Chamberlin

Tyrannochthonius is apparently widely distributed around the world in tropical and subtropical areas. In the Western Hemisphere is is well represented in the southeastern United States and the West Indies (see Chamberlin and Malcolm, 1960; Hoff, 1959; Muchmore, 1984; Malcolm and Muchmore, 1985) and in South America (Mahnert, 1979). Two cavernicolous and one epigean species have been described from Mexico (Muchmore, 1969; 1973c; 1977) and several epigean forms are under study (Malcolm, personal communication). Five new cave-adapted species from Mexico and Texas are described below.

The genus includes chthoniid pseudoscorpions with coxal spines only on the coxae of the 2nd legs and with a single stout, spinelike seta on the medial side of the palpal chela. Many American species possess a small seta on the carapace in front of each anterior eye, but the known Mexican and Texas forms lack such preocular setae.

Tyrannochthonius troglobius Muchmore

Tyrannochthonius troglobius Muchmore, 1969:31.

A topotype was collected in Cueva de la Mina, Tamaulipas, México, 9 March 1969, by J. Reddell. Like the holotype, it is a female. It corresponds very closely in all respects to the holotype. It can be mentioned that the movable finger of the palpal chela possesses a small sensillum on the dental margin just distad of tooth 12.

Also at hand is a specimen collected in the entrance room of Cueva del Ojo de Agua de Manantiales, 13.5 km NE Ocampo, Tamaulipas, México, 30 December 1978, by W. R. Elliott. This cave is about 18 km SSE of Cueva de la Mina. The specimen, also a female, corresponds to the types in most respects but has 4 setae on tergites 1-5 rather than 1-6 as in the types. It probably belongs to this species.

Tyrannochthonius vampirorum, new species
Figs. 6, 7

Type-data.—Holotype female (WM1764.02002) and paratype female from edge of vampire bat guano pool in Cueva de los Vampiros, 9.5 km NNE Chamal, Tamaulipas, México, 27 May 1968 (J. Reddell); 1 paratype female on moist flowstone in Cueva del Ojo de Agua de Manantiales, 8.5 km NNW Chamal, Tamaulipas, 27 May 1968 (J. Reddell); and 1 paratype female from Cueva de Guadalupe, 12 km S Gómez Farías, Tamaulipas, 8 March 1981 (D. C. Rudolph, J. A. Matos, R. Collins).

Diagnosis.—A large species (chela length > 1.15 mm) with attenuated appendages (chela l/w = 6.0 or greater), reduced posterior eyes, and 4 setae on tergites 1-5. From Tamaulipas.

Description of female (male unknown).—All parts light brown or tan. Carapace a little longer than wide: epistome very small or lacking; 4 eyes present, the anterior ones corneate, the posterior reduced to flat clear spots; chaetotaxy 4-4-4-2-2. Coxa I medially with a prominent, rounded apical projection; coxal chaetotaxy 2-2-1:3-0:2-2-CS:2-3:2-3; each coxa II with an oblique row of 8-11 incised spines.

Abdomen typical. Tergal chaetotaxy of holotype 4:4:4:4:4:5:6:6:6:4:T2T:0; paratypes similar, one with 3 setae on tergite 5, another with 7 setae on tergite 9. Sternal chaetotaxy of holotype 10:(3)7(3):(3)6(3):9:9:8:9:8:7:0:2; others with slight variations.

Palp slender, as shown in Fig. 6; femur 1.4-1.45 and chela 2.05-2.1 times as long as carapace. Femur

5.45-5.85, tibia 1.9-2.1, and chela 6.0-6.35 times as long as broad; hand 2.25-2.35 times as long as deep; movable finger 1.6-1.75 times as long as hand. Chelal trichobothriotaxy typical for the genus, as shown in Fig. 7; spinelike seta on hand rather stout. Fixed finger with 21-23 spaced macrodenticles and 17-18 interspersed microdenticles; movable finger with 11-14 macrodenticles and 10-12 interspersed microdenticles distally and 10-11 very low rounded teeth proximally. Sensillum on movable finger near dental margin between teeth 9 and 10.

Legs slender; leg IV with entire femur 2.75-2.9 and tibia 5.15-5.3 times as long as deep. Long tactile setae on tibia and both tarsi of leg IV.

Measurements (mm).—Figures given first for holotype, followed in parentheses by the ranges of the 3 paratypes. Body length 2.00 (1.81-2.08). Carapace length 0.63 (0.57-0.605). Chelicera 0.555 (0.50-0.525) long. Palpal femur 0.89 (0.79-0.85) by 0.16 (0.145-0.16); tibia 0.35 (0.32-0.35) by 0.185 (0.16-0.17); chela 1.29 (1.175-1.27) by 0.215 (0.19-0.20); hand 0.50 (0.435-0.47) by 0.215 (0.185-0.20); movable finger 0.79 (0.74-0.79) long. Leg IV: entire femur 0.79 (0.725-0.77) by 0.28 (0.25-0.28); tibia 0.555 (0.50-0.54) by 0.105 (0.095-0.105).

Etymology.—The name *vampirorum* refers to the vampire bats in Cueva de los Vampiros, where the holotype was found.

Remarks.—Though this species is a close neighbor of *T. troglobius*, it is distinguishable from the latter by its smaller size and less attenuated appendages, the possession of 4 eyes (rather than 2), and the occurrence of 4 setae on tergites 1-5 (rather than 1-6). Cueva de los Vampiros is also the type-locality of *Ideoblothrus vampirorum* Muchmore (1982:214).

Tyrannochthonius intermedius, new species
Fig. 8

Type-data.—Holotype male (WM975.01001) and paratype male from Sótano de San Rafael de los Castros, 13 km WNW Ciudad Mante, Tamaulipas, México, 10 April 1966 (J. Fish and D. McKenzie).

Diagnosis.—A medium sized species (chela length ca. 0.9 mm), with somewhat attenuated appendages (chela l/w = 5.75-5.95), 4 corneate eyes, and 4 setae on tergites 1-5. From Tamaulipas.

Description of male (female unknown).—All parts light brown or tan. Carapace about as wide as long; epistome very small, triangular; 4 large, corneate eyes present; chaetotaxy 4-4-4-2-2. Coxa I medially with a prominent apical projection; coxal chaetotaxy 2-2-1:3-1:2-2-CS:2-3:2-3; each coxa II with an oblique row of 8-9 terminally incised spines.

Abdomen typical. Tergal chaetotaxy 4:4:4:4:4:6:6:6:7:4:T2T:0. Sternal chaetotaxy of holotype 11:[4-4]:(3)8-9/9(3):(3)6(3):9:9:8:8:9:9:0:2; paratype similar.

Chelicera 0.85 as long as carapace; hand with 5 setae; flagellum of 6-7 pinnate setae; dentition of fingers typical; galeal elevation barely evident.

Palp as shown in Fig. 8: femur 1.35 and chela 1.95 times as long as carapace. Femur 4.9-5.0, tibia 1.9-1.95, and chela 5.75-5.95 times as long as broad; hand 2.2-2.3 times as long as deep; movable finger 1.63 times as long as hand. Chelal trichobothriotaxy typical; spinelike seta on medial side of hand rather heavy. Fixed finger with 24 spaced macrodenticles and about 15 interspersed microdenticles; movable finger wtih 11 macrodenticles and 10 interspersed microdenticles distally and about 10 very low rounded teeth proximally. Sensillum near dental margin of movable finger between teeth 9 and 10.

Legs very slender; leg IV with entire femur 2.55-2.6 and tibia 4.75-4.8 times as long as deep. Long tactile setae on tibia and both tarsal segments of leg IV.

Measurements (mm).—Figures given first for the holotype, followed in parentheses by those of the paratype. Body length 1.30 (1.29). Carapace length 0.45 (0.45). Chelicera 0.38 (0.38) long. Palpal femur 0.61 (0.60) by 0.125 (0.12); tibia 0.25 (0.245) by 0.13 (0.125); chela 0.89 (0.89) by 0.155 (0.15); hand 0.34 (0.335) by 0.155 (0.145); movable finger 0.55 (0.545) long. Leg IV: entire femur 0.56 (0.545) by 0.22 (0.21); tibia 0.39 (0.385) by 0.08 (0.08).

Etymology.—The species is named *intermedius* because it is intermediate in many respects between the large troglobitic species in Tamaulipas and the smaller, local epigean form.

Remarks.—*T. intermedius* is considerably smaller than the 2 other known cavernicolous forms from Tamaulipas, *T. troglobius* and *T. vampirorum*, and has less attenuated appendages and 4 corneate eyes. It is in turn larger than the local epigean form (compare Fig. 12), and has more attenuated appendages and 4 setae (rather than 6) on tergite 5.

Tyrannochthonius volcancillo, new species
Fig. 9

Type-data.—Holotype male (WM3495.01002) and 2 paratype males from Cueva del Volcancillo, 5 km SE Las Vigas, Veracruz, México, 8 January 1974 (J. Reddell and R. Jameson).

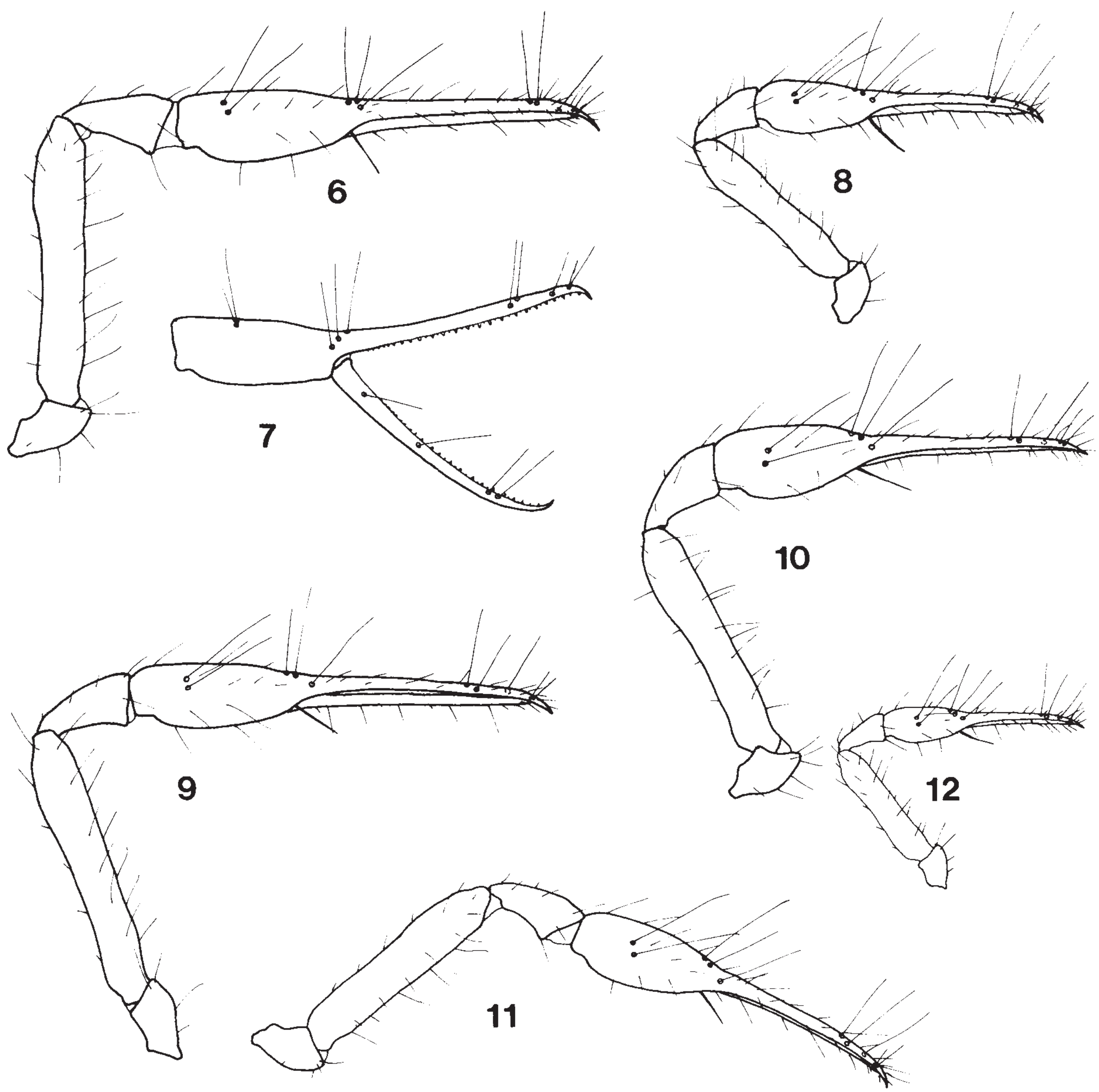
Diagnosis.—A large species (chela length > 1.25 mm), with attenuated appendages (chela l/w > 6.3), only 2 eyes, and 4 setae on tergites 1-5. From Veracruz.

Description of males (female unknown).—All parts light tan. Carapace a little longer than wide; epistome barely discernible; only 2 small eyes present; chaetotaxy 4-4-4-2-2. Coxa I with promiment rounded apical projection; coxal chaetotaxy 2-2-1:3-0:2-2-CS:2-3:2-3; each coxa II with an oblique row of 10 incised spines.

Abdomen typical. Tergal chaetotaxy of holotype 4:4:4:4:4:6:6:7:7:4:T2T:0; one paratype similar but with 5 setae on tergite 6 and 6 setae on tergite 8; other paratype damaged. Sternal chaetotaxy of holotype 10:[4-4]:(3)8-9/9(3):(3)6(3):8:8:8:7:9:7:0:2; paratype similar.

Chelicera 0.85 as long as carapace; hand with 5 setae; flagellum of about 8 pinnate setae; dentition of fingers typical; galeal elevation barely discernible.

Palp as shown in Fig. 9; femur about 1.5 and chela 2.25 times as long as carapace. Femur 5.75-5.95, tibia 2.0-2.05, and chela 6.35-6.55 times as long as broad; hand 2.2-2.35 times as long as deep; movable finger 1.75-1.8 times as long as hand. Chelal trichobothriotaxy typical; spinelike seta on medial side of



Figs. 6-12.—*Tyrannochthonius* spp.: 6-7, *T. vampirorum*, new species, holotype female: 6, dorsal view of left palp; 7, lateral view of right chela; 8, *T. intermedius*, new species, holotype male: dorsal view of left palp; 9, *T. volcancillo*, holotype male: dorsal view of left palp; 10, *T. tlilipanensis*, new species, holotype female: Dorsal view of left palp; 11, *T. troglodytes*, new species, holotype male: dorsal view of left palp; 12, *T.* unnamed epigean species from Tamaulipas: dorsal view of left palp. All figures here drawn to same scale.

hand long and heavy. Fixed finger with 24-27 spaced macrodenticles and 14-18 interspersed microdenticles; movable finger with 13-15 macrodenticles and 11-13 tiny, interspersed microdenticles distally and 11-14 low, rounded teeth proximally. Sensillum on movable finger near dental margin in vicinity of tooth 12.

Legs slender; leg IV with entire femur 3.2-3.3 and tibia 5.9-6.0 times as long as deep. Long tactile setae on tibia and both tarsi of leg IV.

Measurements (mm).—Figures given first for holotype, followed in parentheses by those for the paratypes. Body length 1.83(2.01). Carapace length 0.57(0.58). Chelicera 0.48(0.49-0.495) long. Palpal femur 0.88(0.89-0.895) by 0.15(0.15-0.155); tibia 0.35(0.35) by 0.175(0.17); chela 1.31(1.27-1.28) by 0.20(0.20); hand 0.46(0.445-0.45) by 0.205 (0.19-0.20); movable finger 0.80(0.785-0.80) long. Leg IV: entire femur 0.77(0.75-0.76) by 0.24 (0.23-0.235); tibia 0.56 (0.56-0.57) by 0.095 (0.095).

Etymology.—The specific name refers to the volcano Volcancillo on the flank of which the type-locality is situated.

Remarks.—Unlike the other caves from which pseudoscorpions are reported here, Cueva del Volcancillo is a lava tube cave.

Tyrannochthonius tlilapanensis, new species
Fig. 10

Type-data.—Holotype female (WM3414.01002) and paratype female and tritonymph from Cueva Macinga, 2 km E Tlilapan, Veracruz, México, 5 March 1973 (J. Reddell et al.).

Diagnosis.—A large species (chela length > 1.0 mm), with attenuated appendages (chela l/w > 5.5), reduced posterior eyes, and 4 setae on tergites 1-4 or 5. From Veracruz.

Description of females (male unknown).—All parts light brown or tan. Carapace a little longer than wide; epistome very small; holotype with 2 corneate eyes and 2 faint spots, but paratype with 2 corneate eyes only; chaetotaxy of holotype 5-4-4-2-2, of paratype 4-4-4-2-2. Coxa I with prominent, rather pointed apical projection; coxal chaetotaxy 2-2-1:3-0:2-2-CS:2-3:2-3; each coxa II with an oblique row of 8 incised spines.

Abdomen typical. Tergal chaetotaxy of holotype 4:4:4:4:6:6:6:6:7:4:T2T:0; paratype with only 4 setae on tergite 5 and 5 setae on tergite 6. Sternal chaetotaxy of holotype 10:(3)6(3):(3)6(3):10:9:9:9:9:7:0:2; paratype similar.

Chelicera 0.85 as long as carapace; hand with 5 setae; flagellum of 7 pinnate setae; dentition of fingers typical; galeal elevation small.

Palp as shown in Fig. 10; femur 1.4 and chela 2.1 times as long as carapace. Femur 5.2-5.25, tibia 1.95-2.0, and chela 5.55-5.7 times as long as broad; hand 2.05-2.15 times as long as deep; movable finger 1.67 times as long as hand. Chelal trichobothriotaxy typical; spinelike seta on hand long and stout. Fixed finger with 21 spaced macrodenticles and 13 interspersed microdenticles; movable finger with 9-11 macrodenticles and 7-9 interspersed microdenticles distally and 11-13 low teeth proximally. Sensillum on movable finger near tooth 10.

Legs slender: leg IV with entire femur 2.85-3.0 and tibia 4.9-4.95 times as long as deep. Long tactile setae on tibia and both tarsi of leg IV.

Measurements (mm).—Figures given first for holotype, followed in parentheses by those for paratype. Body length 1.60(1.86). Carapace length 0.55 (0.525). Chelicera 0.47(0.46) long. Palpal femur 0.78(0.735) by 0.15(0.14); tibia 0.33(0.30) by 0.165(0.155); chela 1.17(1.09) by 0.21(0.19); hand 0.435(0.41) by 0.21(0.19); movable finger 0.735 (0.68) long. Leg IV: entire femur 0.66(0.625) by 0.23(0.21); tibia 0.465(0.445) by 0.095(0.09).

Etymology.—The specific name refers to the municipio of Tlilapan, in which the type-locality lies.

Remarks.—This species is easily distinguishable from the other cavernicolous *Tyrannochthonius* in Veracruz, *T. volcancillo*, in being less adapted to cave life. It is smaller, has less attenuated appendages, has small posterior eyes (at least occasionally), and sometimes has 6, rather than 4, setae on tergite 5.

Tyrannochthonius troglodytes, new species
Fig. 11

Type-data.—Holotype male (WM2716.01001) and allotype female (WM2716.01002) from under rocks in twilight zone in Rock Slab Cave on Enchanted Rock, 19 mi. SSE Llano, Llano County, Texas, 25 April 1979 (J. Reddell).

Diagnosis.—A large species (chela length > 1.0 mm), with slightly attenuated appendages (chela l/w = 4.75-5.4), posterior eyes reduced, and 4 setae on tergites 1-4. From Texas.

Description.—Male and female very similar. All parts light brown. Carapace a little longer than wide; epistome small, rounded; with 4 distinct eyes, the anterior pair corneate; chaetotaxy 4-4-4-2-2. Coxa I with prominent rounded apical projection; coxal chaetotaxy 2-2-1:3-0:2-2-CS:2-3:2-3; coxa II with oblique row of 7-9 incised spines.

Abdomen typical. Tergal chaetotaxy 4:4:4:4:6:6:6:6:7:4:T2T:0. Sternal chaetotaxy of male 14:[4-4] :(3)10-10/12(3):(3)6(3):8:7:7:8:9:8:0:2; female with 9:(3)6(3):(3)6(3):- anteriorly.

Chelicera 0.8 as long as carapace; hand with 5 setae; flagellum of 7 or 8 pinnate setae; dentition of fingers typical; galeal elevation small in both sexes.

Palp rather long and slender (Fig. 11); femur 1.25 and chela 1.95 times as long as carapace. Femur

4.8-4.85, tibia 1.85-1.95, and chela 4.75-5.4 times as long as broad; hand 1.6-1.85 times as long as deep; movable finger 1.77-1.84 times as long as hand. Chelal trichobothriotaxy typical; spinelike seta on hand short but stout. Fixed finger with 22-26 spaced tall macrodenticles and 12 or fewer tiny interspersed microdenticles; movable finger with 10-11 spaced macrodenticles and about 5 tiny interspersed microdenticles distally and 9-10 low teeth proximally. Sensillum on movable finger near tooth 10.

Legs moderately slender: leg IV with entire femur 2.65-2.9 and tibia 4.6-4.75 times as long as deep. Long tactile setae on tibia and both tarsi of leg IV.

Measurements (mm).—Figures given first for the holotype, followed in parentheses by those for the allotype. Body length 1.95 (2.06). Carapace length 0.55 (0.555). Chelicera 0.45 (0.465) long. Palpal femur 0.70 (0.695) by 0.145 (0.145); tibia 0.31 (0.30) by 0.16 (0.16); chela 1.08 (1.07) by 0.20 (0.225; hand 0.38 (0.37) by 0.205 (0.23); movable finger 0.67 (0.68) long. Leg IV: entire femur 0.65 (0.62) by 0.245 (0.215); tibia 0.45 (0.435) by 0.095 (0.095).

Etymology.—The name *troglodytes* signifies that the form lives in a cave.

Remarks.—*T. troglodytes* is much larger than the epigean forms from Texas that I know, and it has reduced posterior eyes and only 4 setae on tergites 1-4 (rather than 1-3).

Though the genus *Tyrannochthonius* is widespread in the southern United States, as far north as Kentucky and Arkansas, only a single species has been described previously, namely *T. floridensis* from western Florida and Alabama (Malcolm and Muchmore, 1985). Other forms are currently under study by D. R. Malcolm. *T. troglodytes* is, therefore, the first recorded species of the genus from southwestern U.S.; also it is the only known cave-adapted *Tyrannochthonius* from this area, though troglophilic or trogloxenic forms are present in several caves in Texas.

FAMILY BOCHICIDAE CHAMBERLIN

Genus *Mexobisium* Muchmore

Mexobisium Muchmore, 1972a:272; 1973b:63.

Mexobisium has been known from 9 species, of which 4 are found in caves. Six of these, including all the troglobites, are from Mexico, Guatemala, and Belize. Representatives of the genus are characterized by the location of trichobothrium *ib* on the dorsum of the chelal hand, the presence of venom apparatus in both chelal fingers, 1 or 2 setae in the cheliceral flagellum, and the presence of distinct spines on the tarsi of legs I to III.

Though not stated in published generic diagnoses, all previously described species of *Mexobisium* have chelal teeth which are fairly homogeneous along each finger. With the inclusion of *M. reddelli*, new species, the diagnosis must be amended to include forms with the proximal teeth of the movable chelal finger elongated into a distinct crest, as in species of *Leucohya* Chamberlin (1946) and *Apohya* Muchmore (1973a). This feature certainly adds support to the idea that *Mexobisium* is closely related to these other two genera (see Muchmore, 1973b:65).

Mexobisium reddelli, new species
Figs. 13-15

Type-data.—Male holotype (WM5924.01001) and female allotype (WM5924.01002) from under rocks in very moist, dense tropical forest at Agua Fría, 10 km S Tamán, San Luis Potosí, México, 27 March 1981 (J. Reddell and T. Archey).

Diagnosis.—A medium sized epigean form (palpal femur about 0.65 mm long and with l/w = 2.85) with only one seta in cheliceral flagellum and with basal teeth on movable chelal finger raised into a distinct crest.

Description.—Male and female similar, but female slightly larger. Carapace, chelicerae, and palps light reddish-brown, other parts lighter. Carapace a little longer than broad; anterior margin with a small, triangular epistome; each anterolateral corner with a prominent projection; surface smooth but with a distinct, transversely striated, membranous band near posterior margin; no eyes; 40-44 vestitural setae, 8 at anterior and 6 at posterior margin. Coxal chaetotaxy 2-5-5:3-2:3-2:3-3:3-5; palpal coxa with 2 large apical setae set close together.

Abdominal tergites and sternites smooth: pleural membranes heavily granulate, each granule with a prominent apical spinule. Tergal chaetotaxy of holotype male 10:12:11:11:12:11:10:11:12:10:T2T:2; allotype similar. Sternal chaetotaxy of holotype 12:[2-1]:(4)6/8(3):(4)13(4):17:18:17:16:15:11:T1T1T1T:2; allotype with 4:(3)8(4):(4)14(4):17:17:16:16:16:12:T1T1T1T:2; both with 2 setae near middles of sternites 5-9 moved forward onto disc, especially noticeable on sternites 6 and 7.

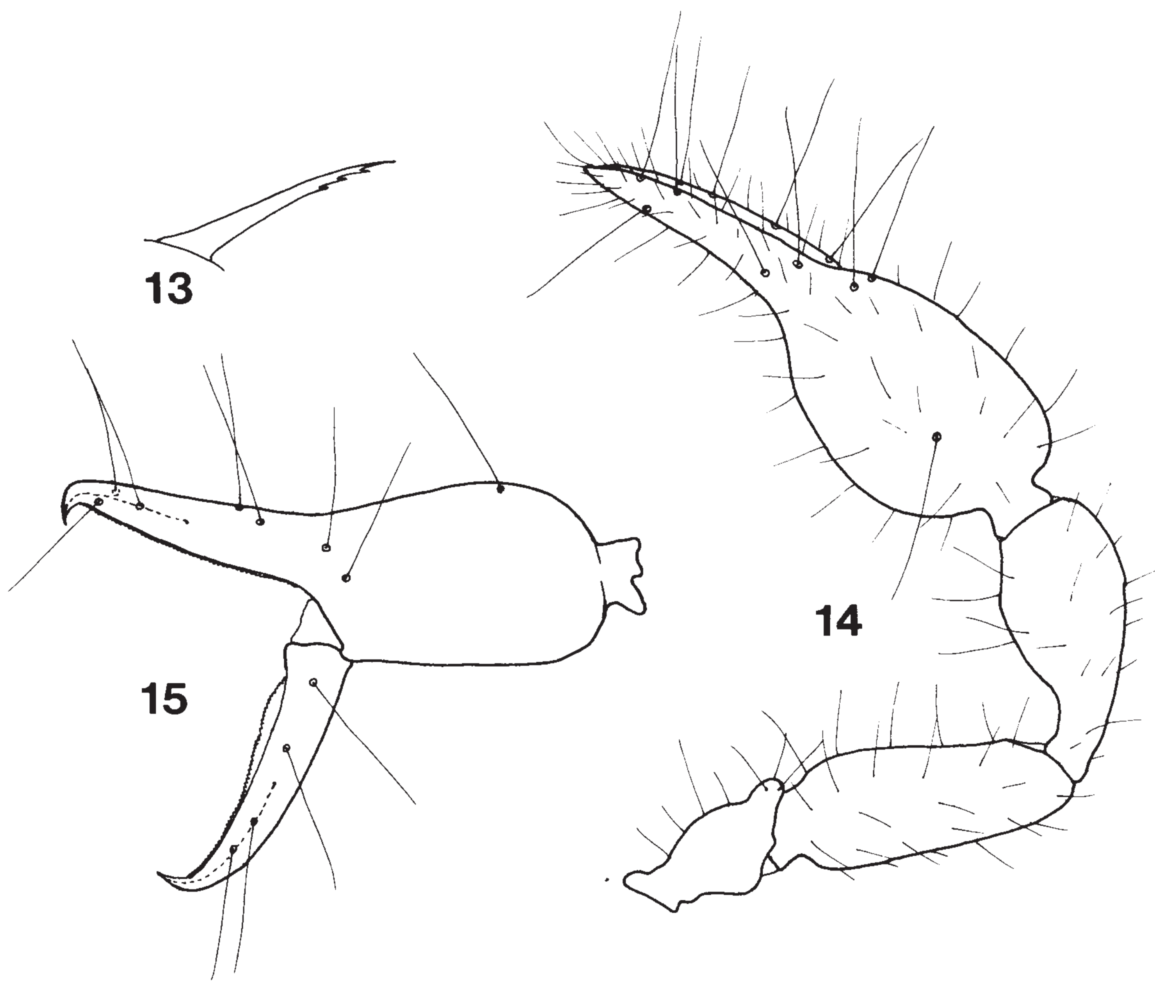
Chelicera about 1/2 as long as carapace; hand of holotype male with 7 setae, that of allotype with 6; flagellum of a single seta, finely denticulate in the distal half (Fig. 13); movable finger with 7-8 and fixed finger with 8-10 rounded, irregular teeth; galea long, slender, curved, a little longer in female.

Palp rather short and robust for the genus (Fig. 14); femur about 0.9 and chela 1.55 times as long as carapace; femur 2.85, tibia 2.2-2.25, and chela 2.85 times as long as broad; hand 1.5-1.6 times as long as deep; movable finger about 1.05 times as long as hand. Surfaces smooth except few granules on bases of chelal fingers. Trichobothria as shown in Fig. 15. Fixed finger with 67-68 contiguous teeth, cusped except at proximal end of row; movable finger with 59-61 generally similar teeth, except that the proximal 15 are elongated into a conspicuous crest (Fig. 15). Venom apparatus well developed in both fingers, ducts long.

Legs relatively stout; leg IV with entire femur 2.9 and tibia 5.0 times as long as deep. Tarsal spines long, sharp on telotarsi I-III, reduced to small rounded projections on telotarsi IV; subterminal tarsal setae with one lateral spinule; arolia shorter than claws; leg IV with long tactile seta on tibia and metatarsus.

Measurements (mm).—Figures given first for holotype, followed in parentheses by those for allotype. Body length 2.58 (3.15). Carapace length 0.73 (0.75). Chelicera 0.34 (0.38) long. Palpal trochanter 0.38 (0.40) by 0.18 (0.19); femur 0.64 (0.69) by 0.225 (0.245); tibia 0.585 (0.63) by 0.265 (0.28); chela (without pedicel) 1.09 (1.205) by 0.385 (0.42); hand (without pedicel) 0.54 (0.62) by 0.36 (0.385); pedicel 0.08 long; movable finger 0.59 (0.635) long. Leg IV: entire femur 0.58 (0.605) by 0.20 (0.21); tibia 0.525 (0.55) by 0.105 (0.11); metatarsus 0.125 (0.14) by 0.075 (0.08); telotarsus 0.265 (0.295) by 0.065 (0.07).

Etymology.—The species is named in honor of James Reddell, who discovered this as well as many other new pseudoscorpions.



Figs. 13-15.—*Mexobisium reddelli*, new species, holotype male: 13, flagellum on chelicera; 14, dorsal view of right palp; 15, lateral view of left chela.

Remarks.—Though the new species generally shows the characters of the genus *Mexobisium* (Muchmore, 1973b:63), it is unusual in two respects:

1) There is only a single seta, rather than two, in the flagellum on the chelicera. This feature is shared only with *M. paradoxum* Muchmore, a highly modified troglobite from the Orizaba region of Veracruz.

2) The proximal 15 or so teeth on the movable chelal finger are elongated into a crest. Though not stated explicitly in published generic diagnoses, other species of *Mexobisium* do not show such a modification of the chelal teeth. A similar dental crest is, however, to be seen in the three known species of *Leucohya* and in the single known species of *Apohya*.

Mexobisium ruinarum Muchmore

Mexobisium ruinarum Muchmore, 1977:71.

Some additional specimens have been collected at or near the type-locality, Ruinas de Palenque, Chiapas, México: 2 tritonymphs by C. Alteri on 16 March 1975 and 4 adults by J. Reddell at Cascada Motiepa on 18 July 1983. Like the holotype and paratype, the adult topotypes are all females; the male is still unknown.

The females are very similar to the types in all respects, including the lack of setae on the ventral anal plate. One specimen is, however, smaller than the others. Ranges in important measurements (in mm) are: Body length 2.55-2.9. Carapace length 0.73-0.82. Palpal femur 0.725-0.82 by 0.19-0.235; tibia 0.64-0.755 by 0.23-0.27; chela (without pedicel) 1.22-1.405 by 0.35-0.43; hand (without pedicel) 0.48-0.57 by 0.325-0.415; pedicel 0.075-0.095 long; movable finger 0.76-0.89 long. Leg IV: entire femur 0.615-0.725 by 0.17-0.19; tibia 0.59-0.70 by 0.095-0.105.

Genus *Leucohya* Chamberlin

Leucohya Chamberlin, 1946:7; Muchmore, 1973a:51.

Leucohya has been known from only 2 species, both troglobites, from Nuevo León. The genus is characterized by the location of trichobothrium *ib* on the dorsum of the chelal hand, the presence of venom apparatus in both chelal fingers, 4 setae in the cheliceral flagellum, and the lack of spines on the tarsi of the legs.

Leucohya texana, new species
Figs. 16-18

Type-data.—Holotype female (WM6399.01001) from Frio Queen Cave, Uvalde County, Texas, summer 1983 (R. M. Waters).

Diagnosis.—Generally similar to *L. heteropoda* Chamberlin and *L. magnifica* Muchmore, but smaller and with less slender appendages than those species (palpal femur < 1.5 mm in length and with l/w $<$ 4.5).

Description of female (male unknown).—Generally with the characters of the genus (Chamberlin, 1946; Muchmore, 1973a). Carapace and palps light brown, other parts tan. Carapace about 1.5 times as long as wide; epistome inconspicuous, low, rounded; no eyes; surface reticulate; about 30 vestitural setae, with 6 at anterior and 4 at posterior margin. Palpal coxa with 2 large, subequal setae on apex.

Abdomen elongate. Tergites and sternites reticulate; pleural membranes granulate. Tergal chaetotaxy 7:10:10:11:11:12:12:12:11:8:T1T1T1T:2; sternal chaetotaxy 8:(4)10(4):(4)14(4):17:2/16:17:15:14:15:T1T:2. Genitalia appear as shown in Fig. 16.

Chelicera about 1/2 as long as carapace; hand with 6 setae; flagellum of 4 apparently simple, subequal setae; galea long, slender, gently curved; serrula exterior with about 30 blades.

Palp long and slender; femur 1.1, tibia 0.9, and chela 1.95 times as long as carapace. Proportions of segments as shown in Fig. 17; trochanter 2.35, femur 4.45, tibia 2.8, and chela (without pedicel) 4.05 times as long as broad; hand (without pedicel) 1.5 times as long as deep; movable finger 1.88 times as long as hand. Fine granulation on medial sides of trochanter, femur and tibia and on bases of chelal fingers. Trichobothria on chela as shown in Fig. 18. Fixed finger with 118 contiguous marginal teeth; movable finger with 120 teeth, the proximal 18 raised in a conspicuous crest. Venom ducts long, the nodi ramosi between trichobothria *est* and *ist* on fixed finger and between *st* and *sb* on movable finger.

Legs slender, leg IV with entire femur 4.45 and tibia 8.15 times as long as deep. All tarsi divided; subterminal tarsal setae denticulate; no distinct tactile setae; arolia as long as claws. Surfaces, especially of femora, scaly.

Measurements (mm).—Body length 3.7. Carapace length 1.125. Chelicera 0.57 by 0.26. Palpal trochanter 0.605 by 0.26; femur 1.25 by 0.28; tibia 1.00 by 0.355; chela (without pedicel) 2.20 by 0.54; hand (without pedicel) 0.78 by 0.52; pedicel 0.12 long; movable finger 1.465 long. Leg I: basifemur 0.65 by 0.14; telofemur 0.32 by 0.125; tibia 0.605 by 0.095; metatarsus 0.26 by 0.08; telotarsus 0.465 by 0.07. Leg IV: entire femur 0.96 by 0.215; tibia 0.895 by 0.11; metatarsus 0.27 by 0.095; telotarsus 0.55 by 0.08.

Etymology.–The new species is named for the State of Texas where it is found.

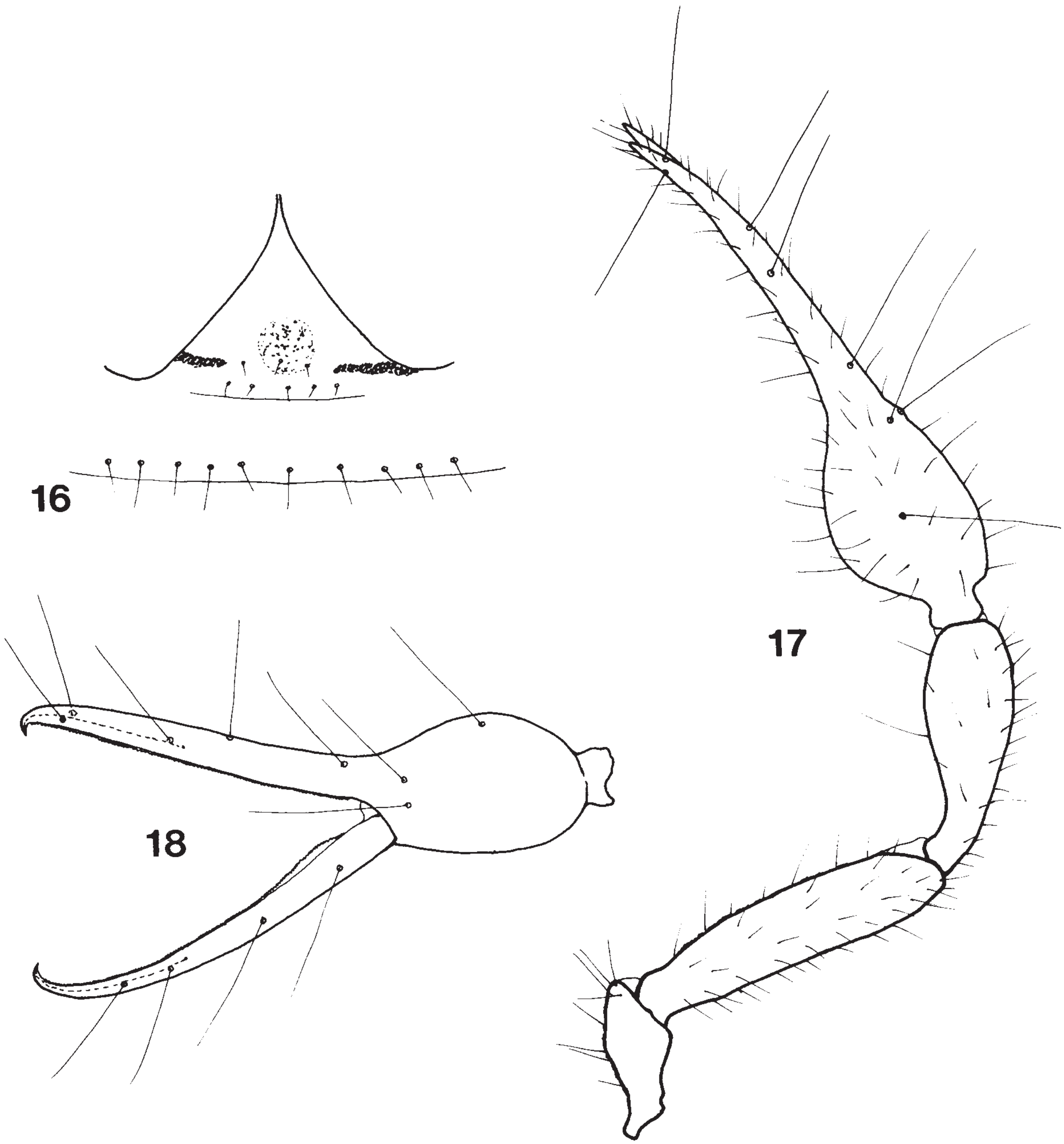
Remarks.–The genus *Leucohya* has been known heretofore only from the region around Bustamante in northern Nuevo León. Discovery of this new species extends the range of *Leucohya* some 300 km to the north and across the Rio Grande. This is the first record of a representative of the family Bochicidae from the United States, all others being from Mexico, Central America, and the Caribbean region.

FAMILY IDEORONCIDAE CHAMBERLIN

Genus *Typhloroncus* Muchmore

Typhloroncus Muchmore, 1979:317; 1982:71.

Following the lead of Mahnert (1981), the chelal trichobothriotaxy of all available specimens of the genus have been examined carefully. It is not easy to count the trichobothria because there are so many other setae of various shapes and sizes on the chela;



Figs. 16-18.–*Leucohya texana*, new species, holotype female: 16, genital opercula and internal genitalia; 17, dorsal view of right palp; 18, lateral view of left chela.

it is especially difficult when trichobothria have been lost, as the empty areoles are not certainly distinguishable from those of large vestitural setae. Nevertheless, I am reasonably confident of the counts made, which show that all species of the genus, as presently represented, have 22 trichobothria on the hand and fixed finger and 10 on the movable finger (Fig. 19). Further, the trichobothria are grouped more or less as described by Mahnert for *Negroroncus*, *Nannoroncus*, and *Afroroncus* (see below under *T. coralensis*). Unfortunately, nothing is yet known about intraspecific variation in the gènus, as only single individuals are known for each of the 5 described species.

Typhloroncus coralensis Muchmore
Fig. 19

Typhloroncus coralensis Muchmore, 1979:318; 1982: 71.

The trichobothriotaxy of the palpal chela of the holotype female was reexamined carefully. As shown in Fig. 19, there are 22 genuine trichobothria on the hand and fixed finger and 10 on the movable finger. Following the terminology of Mahnert (1981:557), there are 6 trichobothria in the *est* area, 7 in the *ist* area and 4 in the *ib* area, while *et*, *it*, *isb*, *esb* and *eb* are single; and there are 6 in the *t* area and 2 in the *b* area, while *st* and *sb* are single.

Typhloroncus troglobius Muchmore

Typhloroncus troglobius Muchmore, 1982:71.

Careful reexamination of the palpal chela of the holotype female reveals that there are 22 trichobothria on the hand and fixed finger and 10 on the movable finger, as in *T. coralensis*. Positions of the trichobothria are much as in *T. coralensis* though there are some differences in the relative distances among them, probably due to the greater lengths of the fingers.

The original description of *T. troglobius* states erroneously that there are 5 setae on the hand of the chelicera. There are, in fact, 6 setae on the hand of each chelicera of the holotype.

Typhloroncus diabolus Muchmore

Typhloroncus diabolus Muchmore, 1982:73.

Careful reexamination of the palpal chela of the holotype female reveals that there are 22 trichobothria on the hand and fixed finger and 10 on the movable finger. They are distributed generally as in *T. coralensis* but with some variation in position due probably to the increased length of the fingers. Viewed in relation to the situation in other species of *Typhloroncus*, the setae on the dorsum of the hand are not as different in placement as was indicated in the original description; the most distal of the 5 mentioned trichobothria is probably just a more dorsally and proximally situated member of the *ist* group, leaving a typical 4 in the *ib* area.

Typhloroncus attenuatus Muchmore

Typhloroncus attenuatus Muchmore, 1982:73.

Careful reexamination of the palpal chela of the holotype female reveals that there are 22 trichobothria on the hand and fixed finger and 10 on the movable finger. They are distributed generally as in *T. coralensis*, with some variation in position probably due to increased length of the fingers.

The original description of *T. attenuatus* (1982: 75) states inaccurately that there are 5 setae on the hand of the chelicera. Actually, there are 5 setae on the hand of the left chelicera but 6 setae on the hand of the right chelicera of the holotype.

Typhloroncus xilitlensis, new species
Figs. 20, 21

Type-data.—Holotype female (WM6104.01001) from Sótano de Huitzmolotitla, 2 km NNW Xilitla, San Luis Potosí, México, 4 January 1982 (O. Kukal).

Diagnosis.—A large species generally with the characters of the genus (Muchmore, 1979:317). About the size of *T. diabolus* from Veracruz (palpal femur 2.37 mm vs. 2.34 mm in length) but with much more slender appendages (l/w of palpal femur 7.65 vs. 5.7). It is larger and slightly more slender than *T. troglobius* from Puebla and is smaller and less slender than *T. attenuatus* from Tamaulipas.

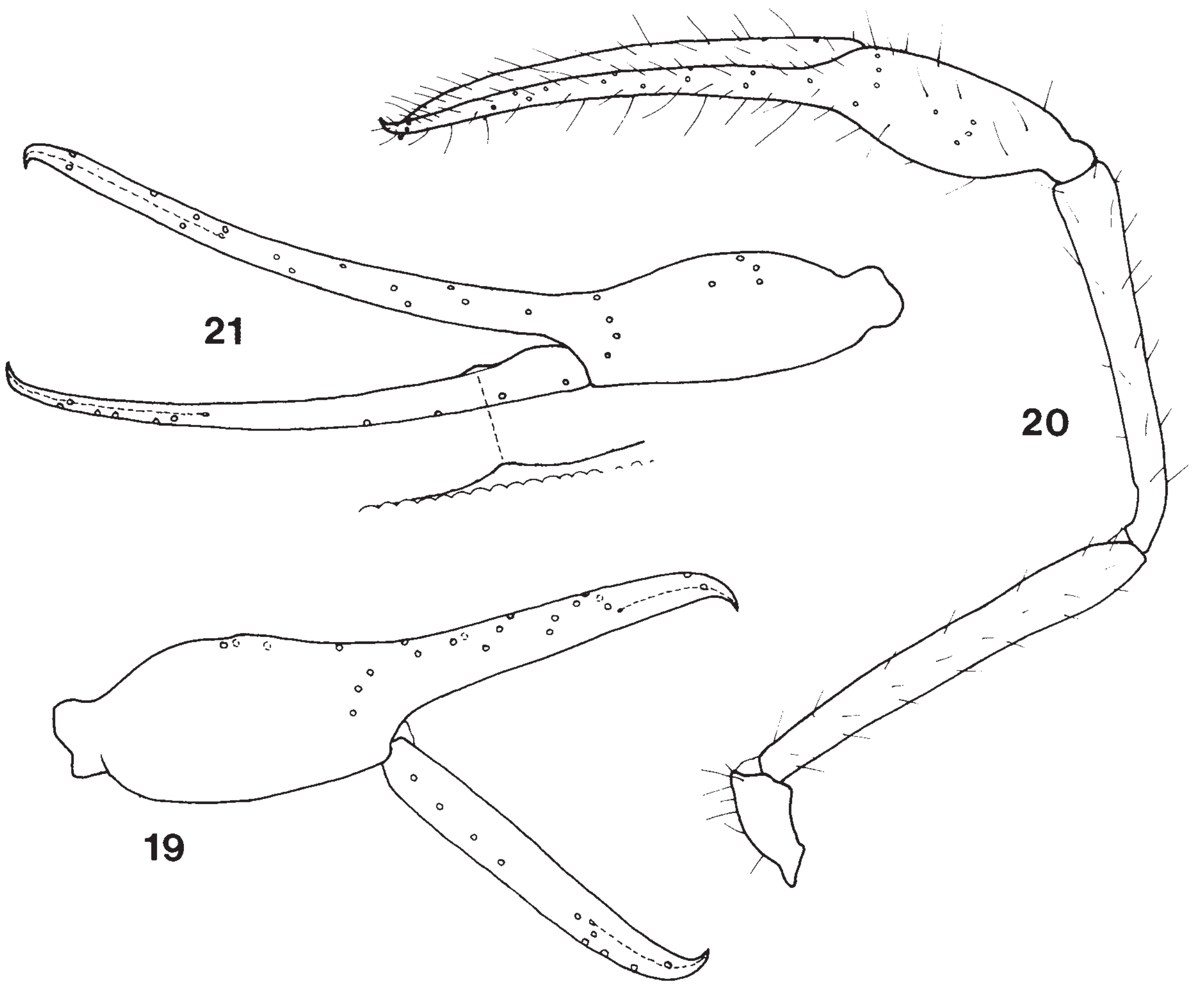
Description of female (male unknown).—Carapace and palps light reddish brown, other parts lighter. Carapace longer than broad; anterior margin with a broad, low, rounded epistome; no eyes present; surface distinctly reticulate, a very shallow transverse furrow near posterior margin; with 16-18 small setae, 4 at anterior and 2 at posterior margin. Coxae lightly scaly; apex of palpal coxa with 2 long setae; gently curved at tips. Abdominal tergites scaly anteriorly, becoming smooth posteriorly; sternites smooth; pleural membranes longitudinally finely striate. Tergal chaetotaxy 2:2:2:4:4:4:6:5:5:4:T1T1T1T:2; sternal chaetotaxy 15:(1)10(1):(1)8(1):9:9:10:10: 11:9:TT:2.

Chelicera a little more than 1/2 as long as carapace; hand with 6 setae, *es* long and straight; flagellum of 4 setae, all dentate; each finger with 10-12 teeth; galea long, slender, gently curved; serrula exterior with 28 blades.

Palp long and slender (Fig. 20); femur 1.78, tibia 1.65, and chela 2.83 times as long as carapace. Femur 7.65, tibia 6.45, and chela (without pedicel) 6.85 times as long as broad; hand (without pedicel) 2.3 times as long as deep; movable finger 2.09 times as long as hand. Most surfaces, including chelal fingers, granulate. Trichobothria of chela as shown in Fig. 21; 22 on hand and fixed finger, 10 on movable finger. They are distributed much as in *T. coralensis*, though there are some variations in positions probably due to the greatly increased length of the fingers. Fixed finger with irregular marginal row of 133 contiguous teeth, most with cusps; movable finger with 123 teeth, cusped in distal half of finger but lower and rounded in proximal half. Both fingers with well developed venom apparatus and long ducts, the nodi ramosi about 0.3 finger length from distal end. Movable finger with a prominent elevation along the dental margin medial to the row of teeth (Fig. 21); no evidence of gland openings on the elevation.

Legs very slender: leg IV with entire femur 7.8 and tibia 10.05 times as long as deep. Tarsi with prominent setae along outer margin, but no obvious tactile setae; subterminal tarsal setae small, simple; arolia not divided, shorter than claws, which are long and slender.

Measurements (mm).—Body length 4.18. Carapace length 1.33. Chelicera 0.75 long. Palpal trochanter 0.71 by 0.32; femur 2.37 by 0.31; tibia 2.19 by 0.34; chela (without pedicel) 3.77 by 0.55; hand (without pedicel) 1.22 by 0.525; pedicel 0.19 long; movable



21

20

19

Figs. 19-21.—*Typhloroncus* spp.: 19, *T. coralensis* Muchmore, holotype female: lateral view of right chela showing locations of trichobothrial areoles; 20-21, *T. xilitlensis*, new species, holotype female: 20, dorsal view of right palp; 21, lateral view of left chela, showing locations of trichobothrial areoles and unique elevation on dental margin of movable finger.

finger 2.55 long. Leg IV: entire femur 1.72 by 0.22; tibia 1.26 by 0.125; metatarsus 0.48 by 0.11; telotarsus 1.00 by 0.08.

Etymology.—The species is named *xilitlensis* for the Municipio de Xilitla in which it is found.

Remarks.—This species is generally typical of the genus, but differs from all the other species in the possession of a prominent medial elevation near the dental margin of the movable chelal finger. This elevation appears not to be the site of gland openings, and it is probably not involved in courtship activities as the specimen is a female. It seems likely that it supplements the chelal teeth in grasping some special item of food.

The trichobothria of the palpal chela are distributed roughly in the same way as those of *T. coralensis*. However, there are some variations in the positions of individual trichobothria and in the relative distances between some pairs, due, at least in part, to the greatly increased length of the chela in the cavernicolous *T. xilitlensis*.

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I am greatly indebted to all those persons who collected the pseudoscorpions considered herein. Special thanks go to J. R. Reddell for assembling the material and sending it to me.

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NEW SPECIES AND RECORDS OF *SCHIZOMUS* (ARACHNIDA: SCHIZOMIDA) FROM MEXICO

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ABSTRACT

Two new species of *Schizomus* are described from Mexico: *S. hoffmannae* from Tapijulapa, Tabasco, and *S. palaciosi* from Gruta de Acuitlapán, Guerrero. Included herein are all new records of *Schizomus* spp. from Mexico since revision of New World Schizomida by Rowland and Reddell (1979-1981). Also included are all unpublished records of *S. portoricensis* (Chamberlin) in the New World.

INTRODUCTION

Several new species of *Schizomus* have accumulated since Rowland and Reddell (1979a, 1979b, 1980, 1981) revised the New World Schizomida. Two species are of sufficient interest to warrant description in advance of a comprehensive review of the Mexican fauna. One, *S. hoffmannae*, new species from Tabasco, is closely related to an aberrant species, *S. infernalis* Rowland from Chiapas. The second species, *S. palaciosi*, new species from Guerrero, is closely related to an undescribed Chiapas species and is apparently a troglobite.

We also include in this paper all new records of *Schizomus* from Mexico, including older material recently discovered in the collection of the American Museum of Natural History. Finally, all new records of *S. portoricensis* (Chamberlin) from the New World are included.

The following acronyms are used to indicate the collections in which specimens are deposited:

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

FMNH—Field Museum of Natural History, Chicago, Illinois.

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

PWHC—P. Wagenaar Hummelinck collection.

SBPC—Stewart B. Peck collection, Carleton University, Ottawa, Canada.

TMM—Texas Memorial Museum, The University of Texas at Austin, Austin, Texas.

UCR—University of California at Riverside, Riverside, California.

UNAM—Universidad Nacional Autónoma de México, México, D.F., México.

UV—University of Vermont, Burlington, Vermont.

WBMC—William B. Muchmore collection, Rochester, New York.

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We wish in particular to express our gratitude to Dra. Anita Hoffmann and M. de C. José Palacios-Vargas of the Laboratorio de Acarología, Universidad Nacional Autónoma de México, for allowing us to study the two interesting new species described herein. We also thank the following curators for loans of specimens: Dr. Saul I. Frommer, University of California at Riverside; Dra. Anita Hoffmann, Universidad Nacional Autónoma de México; Dr. John Kethley, Field Museum of Natural History; Dr. Herbert W. Levi, Museum of Comparative Zoology, Harvard University; Dr. Norman I. Platnick, American Museum of Natural History. Dr. William B. Muchmore, Dr. Stewart B. Peck, and Dr. P. Wagenaar Hummelinck also loaned specimens from their personal collections. We also thank the many cave explorers whose names are included in the collection data for providing us with specimens from Mexican cave and surface habitats. Special thanks go to Mr. Andrew G. Grubbs, Mr. David McKenzie, and Dr. D. Craig Rudolph for their special efforts to obtain specimens.

Schizomus Cook

brasiliensis group

Schizomus lacandonus Rowland

Schizomus lacandonus Rowland, 1975:16-18; Rowland and Reddell, 1979b:89, 103, 104-107, 108, 110, 114, 116, figs. 34, 37, 48, 55, 65.

New record.—MEXICO: *Chiapas*: Ruinas de Palenque, 28 September 1974 (J. Reddell), 1 female (TMM); 18 July 1983 (J. Reddell), 1 male (TMM).

mexicanus group

Schizomus reddelli Rowland

Schizomus reddelli Rowland, 1971:123, 124, 126. For complete synonymy see Rowland and Reddell, 1980:10.

New records.—MEXICO: *Tamaulipas*: Cueva de Guadalupe, 8 March 1981 (D.C. Rudolph, J.A. Matos, R. Collins), 1 male, 3 females (TMM); Cueva del Ojo de Agua (Sección Norte), Ojo de Agua, 2.5 km E of Gómez Farías, 28 March 1981 (J. Reddell, D. McKenzie, T. Archey, F. Endres), 2 females, 6 immatures (TMM); Cueva del Ojo de Agua de Manantiales, 13.5 km NE of Ocampo, 3 September 1979 (D.C. Rudolph), 1 immature (TMM).

Schizomus mexicanus Rowland

Schizomus mexicanus Rowland, 1971:117-119, figs. 1-3, 16. For complete synonymy see Rowland and Reddell, 1980:12.

New records.—MEXICO: *San Luis Potosí*: Cueva Chica, El Pujal, 15 km SE of Ciudad Valles, 22 July 1969 (S. & J. Peck), 1 immature (TMM); Cueva de Los Sabinos, 20 January 1944 (collector unknown), 1 male, 2 females, 3 immatures (AMNH); Sótano de la Tinaja, 11 km NE of Ciudad Valles, 24 December 1963 (D. McKenzie), 1 male (TMM); 16 March 1972 (collector unknown), 2 females, 1 immature (TMM); 16 March 1972 (J.A.L. Cooke), 3 males, 2 females, 5 immatures (AMNH); 16 April 1972 (D. Kiser, M. Brownfield), 1 immature (TMM); 20 February 1973 (S. Wiley), 4 immatures (TMM); 11 January 1980 (B. & V. Roth), 1 male, 1 female, 1 immature (AMNH). *Tamaulipas*: Gómez Farías, lowland forest, July 1965 (B. Brown), 1 female (MCZ); 3 km S of Gómez Farías, 15 March 1972 (R. Mitchell), 4 females (TMM); 10 km SE of Gómez Farías, 4 km W of Highway 85, 21 May 1982 (H.L. McCutchen), 5 females, 1 immature (TMM); 24 May 1982 (H.L. McCutchen), 1 male (TMM); road cut near Gómez Farías, 15 March 1972 (R.W. Mitchell et al.), 3 males (TMM); 15 February 1970 (collector unknown), 1 male (TMM); Nacimiento del Río Frío, 15 February 1970 (collector unknown), 1 female (TMM); Arroyo del Nacimiento del Río Frío, 16 February 1970 (collector unknown), 5 males, 5 immatures (TMM).

Schizomus portoricensis (Chamberlin)

Stenochrus portoricensis Chamberlin, 1922:11-12.
Schizomus antilus Hilton, 1933:91-92.
Schizomus cavernicolens Chamberlin and Ivie, 1938: 102, 103, figs. 4-7.
Schizomus probably *latipes* Hansen: Cloudsley-Thompson, 1949:261 (misidentification).
Schizomus floridanus Muma, 1967:18-20, figs. 13-15.
Schizomus longimanus Rowland, 1971:119-120, figs. 4-6, 17.
Schizomus portoricensis: Rowland, 1973b:197.
For complete synonymy see Rowland and Reddell, 1980:14.

New records.—UNITED STATES: *Florida*: Dade County: Florida City, 26 August 1965 (W. Suter), CNHM(HD) no. 65-316 (Suter no. 65-126), 10 females, 50 immatures (FMNH); Miami, in association with *Prorhinotermes simplex*, 13 December 1936 (R.F. Dodd), 1 female (AMNH); Palma Vista Hammock, Everglades National Park, floor duff, 26 November 1961 (J. Wagner), 1 female, 30 immatures (FMNH); buttress of large smooth-barked tree (with tree snails), 27 August 1965 (W. Suter), CNHM(HD) no. 65-334 (Suter no. 65-127a), 5 immatures (FMNH); palmetto-gumbo limbo upland, forest floor, 18 June 1965 (W. Suter), FM(HD) no. 65-76 (W. Suter no. 65-28), 7 females, 6 immatures (FMNH); 27 August 1965 (W. Suter), CNHM(HD) no. 65-335 (Suter no. 165-127), 33 females (some gravid), 17 immatures (FMNH). Monroe County: Everglades National Park, Snake Bight Trail, berlese of litter under mangrove along road, 29 March 1967 (W. Suter), FM(HD) no. 67-44, 2 females, 11 immatures (FMNH); Snake Bight Trail, 0.5 mi. N of Flamingo, Everglades National Park, areas in sawgrass-mangrove area, 27 August 1965 (W. Suter), FM(HD) no. 65-377, 10 females, 22 immatures (FMNH); 5 mi. S of North Key Largo, floor at 100, 28 August 1965 (W. Suter), CNHM(HD) no. 65-365 (Suter no. 65-129), 1 female (FMNH); Marathon, Key Vaca, berlese no. 223, palm and hardwood litter (78 litres), 7 August 1971 (S. Peck), FM(HD) no. 71-359, 1 immature (FMNH); No Name Key, 31 December 1976 (R.T. Bell), 1 female (UV); Virginia Key, near Laboratory (Casuarina), 7 September 1963 (P. Wagenaar Hummelinck), 2 females (PWHC); Zim's Tavernier, 5 February 1967, 1 immature (AMNH).

MEXICO: *Campeche*: Ruins of Becán, Xpujil, Christmas trip 1973-74 (R.B. Waide), sample 13, 1 female (TMM), sample 14, 1 immature (TMM), sample 16, 1 female (TMM), sample 18, 1 female (TMM); 11 July 1974 (Waide & Mundel), litter 1, 1 female (TMM); 10 September 1974 (R.B. Waide), suction sample 4 right, 2 females (TMM), suction sample 5B-left, 1 female (TMM); 11 September 1974 (R.B. Waide), suction sample 5, Wilfredo, 1 female (TMM); 27 September 1974 (R.B. Waide), suction sample 1-L, Felipe, 1 female (TMM), suction sample 2 left, 1 female (TMM); 18 October 1974 (R.B. Waide), suction sample 2-L, Juan, 1 immature (TMM). *Chiapas*: Comitán, no. 6, 29 December 1960 (R. Meza), 1 female (UNAM); 2.5 mi. SW of El Bosque, 4,000 ft., on grassy ground, 25 August 1973 (A. Newton), 1 female (MCZ); Ruinas de Palenque, 4 September 1974 (E.M. Fisher), 1 female, 7 immatures (UCR). *Quintana Roo*: Cobá, 20°30'N-87°44'W, 1 February 1984 (B. & V. Roth), 1 female, 1 immature (UNAM); Cueva del Fermín, 3 km E of Pamul, 19-20 July 1983 (J. Reddell), 1 female (TMM). *Tabasco*: Grutas del Coconá, 3 km E of Teapa, 28 September 1974 (J. Reddell), 1 female (TMM). *Yucatán*: 3 km S of Calcehtok, 3 August 1973 (J. Reddell), 1 female (TMM); Chichén Itzá, 16-18 February 1939 (collector unknown), 1 female (AMNH); 28 June 1975, CA1/WCS, 1 female (MCZ); Cenote de la Culebra, 12 km N of Muna, 31 July 1983 (J. Reddell), 1 male (TMM); Actún Kaua, Kaua, March 1982 (T. Raines, S. Raines, J. Rodemaker), 1 immature (TMM); Actún Loltún, 24 March 1947 (Osorio), 2 females, 1 immature (AMNH); Oxkutzcab, 31 July 1973 (J. Reddell), 1 male, 1 female (TMM); 3 km N of Pisté, 26 July 1983 (J. Reddell), 1 male, 5 females, 1 immature (TMM); Cueva de Sabacá (=Actún Sabacá), Tecax (=Tekax de Alvaro Obregón), 26 September 1941 (collector unknown), 1 male (AMNH); Cueva del Cenote Xtolok, Chichén Itzá, 26 July 1983 (J. Reddell), 1 female (TMM); Cenote de Yaxcabá, Yaxcabá, 20 July 1983 (J. Reddell), 1 female (TMM).

HONDURAS: Copán, 15 August 1976 (Charles, Ann, and Marie Goodnight), 7 females, 5 immatures (TMM).

VIRGIN ISLANDS: *St. John*: Catherineberg, between large rocks under mango trees, 14 March 1984 (W.B. Muchmore), 5 females, 20 immatures (WBMC); Maho Bay, under large sea grape tree at side of road, 8 March 1984 (W.B. Muchmore), 2 females, 3 immatures (WBMC); under trees along road, 12 March 1984 (W.B. Muchmore), 1 immature (WBMC).

ECUADOR: *Archipélago de Colón*: Isla Santa Cruz: Bellavista, 200 m, Horneman Farm, screening of litter beneath exotic giant bamboo, litter very wet, 3 April 1975 (W.G. Reeder), 1 female (TMM); 1 km E of Bellavista, 210 m, transition forest, cave ravine litter, 3 June 1985 (S. & J. Peck), 1 female (SBPC); 2 km N of Bellavista, 360 m, avocado grove, leaf and fruit litter, 14 May 1985 (S. & J. Peck), 13 females, 70 immatures (SBPC); Cueva Bellavista No. 1, Bellavista, 210 m, dung bait pit traps, 15-25 May 1985 (S. & J. Peck), 7 females, 3 immatures (SBPC); Cueva Bellavista No. 2, 1 km E of Bellavista, 210 m, meat and banana baits, 13-14 July 1985 (S. & J. Peck), 31 females, 1 immature (SBPC); dung bait pit traps, 15-25 May 1985 (S. & J. Peck), 30 females, 21 immatures (SBPC); Cueva Finca Kastdalen, 2 km NE of Bellavista, 300 m, 25 June 1985 (S. & J. Peck), 1 female (SBPC); Gallardo Caves nr. Bellavista, 29 April 1981 (309) (Y. Lubin), 2 females (MCZ); Cueva Sra. Colombia (=Cueva Jorge Sevilla), Bellavista, 280 m, 25 June 1985 (S. & J. Peck), 3 females (SBPC).

Schizomus cookei Rowland

Schizomus cookei Rowland, 1971:122-123, figs. 10, 12, 19. For complete synonymy see Rowland and Reddell, 1980:21.

New records.—MEXICO: *San Luis Potosí*: Sótano de la Tinaja, 18 February 1970 (J.A.L. Cooke), 3 females (AMNH); Sótano de Yerbaniz, 7 January 1970 (R.W. Mitchell et al.), 1 male, 4 females, 2 immatures, 5 larvae (TMM); on mud and wet debris, 17 February 1970 (J. Shepperd), 2 females (TMM).

Schizomus infernalis Rowland

Schizomus infernalis Rowland, 1975b:18-20; Rowland and Reddell, 1981:41-43, 44, figs. 43, 46-47, 50.

New records.—MEXICO: *Chiapas*: Ruinas de Palenque, 4 September 1974 (E.M. Fisher), 1 male (UCR); soil no. 4, 7 July 1949 (C.J. Goodnight), 1 female (AMNH); ca. 12 mi. from Palenque, on Nututun Road, berlese of dirt and rotten wood, 20 January 1976 (C. Alteri), 1 female, 1 immature (AMNH).

Schizomus hoffmannae, new species
Figs. 6-10

Type-data.—Male holotype from Tapijulapa, Tabasco, México, 13 February 1982 (R. Murillo), "habitat: hojarasca selva" (UNAM).

Etymology.—This species is named for Dra. Anita Hoffmann of the Laboratorio de Acarología, Universidad Nacional Autónoma de México, in recognition of her contributions to Mexican arachnology.

Description.—Holotype male (length from distal edge of propeltidium to base of flagellum, 3.5 mm). Body orangish-brown; legs somewhat lighter.

Cephalothorax: Propeltidium 1.2 mm long, 0.7 mm wide; with two apical setae and two pair dorsal setae. Apical margin of propeltidium drawn to sharp point. Eyespots distinct, elongate oval. Mesopeltidia separated by slightly more than the width of one plate. Metapeltidium undivided. Anterior sternum with 11 bifid setae and two long anteriorly directed setae arising from front of sternum; posterior sternum with six setae.

Abdomen: Sternite V about 3.6 times as wide as long. Tergite I with one pair dorsal setae; tergite II with three pair small setae anteriorly and five dorsal setae (two on left side, three on right side) near posterior margin; tergites III-VII with one pair dorsal setae each; tergite VIII with one pair dorsal and one pair lateral setae; tergite IX with one pair dorsolateral and one pair lateral setae. Segments X-XI telescoped: segment X with one dorsal, two dorsolateral, and six ventral setae; segment XI with two lateral and five ventral setae; segment XII with two dorsal, four lateral, and five ventral setae. Segment XII without posterior dorsal process. Flagellum (Figs. 9-10) 0.4 mm long, 0.22 mm wide; spade shaped, depressed posteriorly; without significant dorsal relief; with five dorsal and eight ventral setae.

Pedipalps (Figs. 6-7): Robust. Trochanter broadly connected to femur; produced distally to triangular point; row of setae on ventral margin; two spinose setae on ventral margin near distal end; one spine and two setae on mesal surface. Femur (Fig. 7) wide with distal margin straight; ventral surface flattened, expanded distally, ending in spine-bearing spur; mesodistal margin with blunt spur bearing a spine; row of setae and spinose setae on dorsal margin; one seta on lateral surface; two spines on ventrolateral margin at distal end; two spines on mesal surface. Patella strongly curved and flattened ventrally; with scattered setae. Tibia with scattered setae; spur on ventromesal surface apposible to basitarsus-tarsus. Claw about 1/2, spurs about 1/5 as long as dorsal length of basitarsus-tarsus.

Chelicerae (Fig. 8): Fixed finger with four teeth between large outer teeth. Chelicera with the following setation (terminology after Lawrence, 1969): Three type 1 setae; four type 2 setae; four type 3 setae; two type 4 setae (plus five long plumose dorsal setae); seven type 5 setae; and one type 6 seta. Serrula with 18 teeth.

Legs: Lengths of segments in Table I. Leg I, including coxa, 5.04 mm long; basitarsal-tarsal segment proportions: 14:3:3:3:4:4:7. Femur IV about 2.3 times as long as deep.

Female: Unknown.

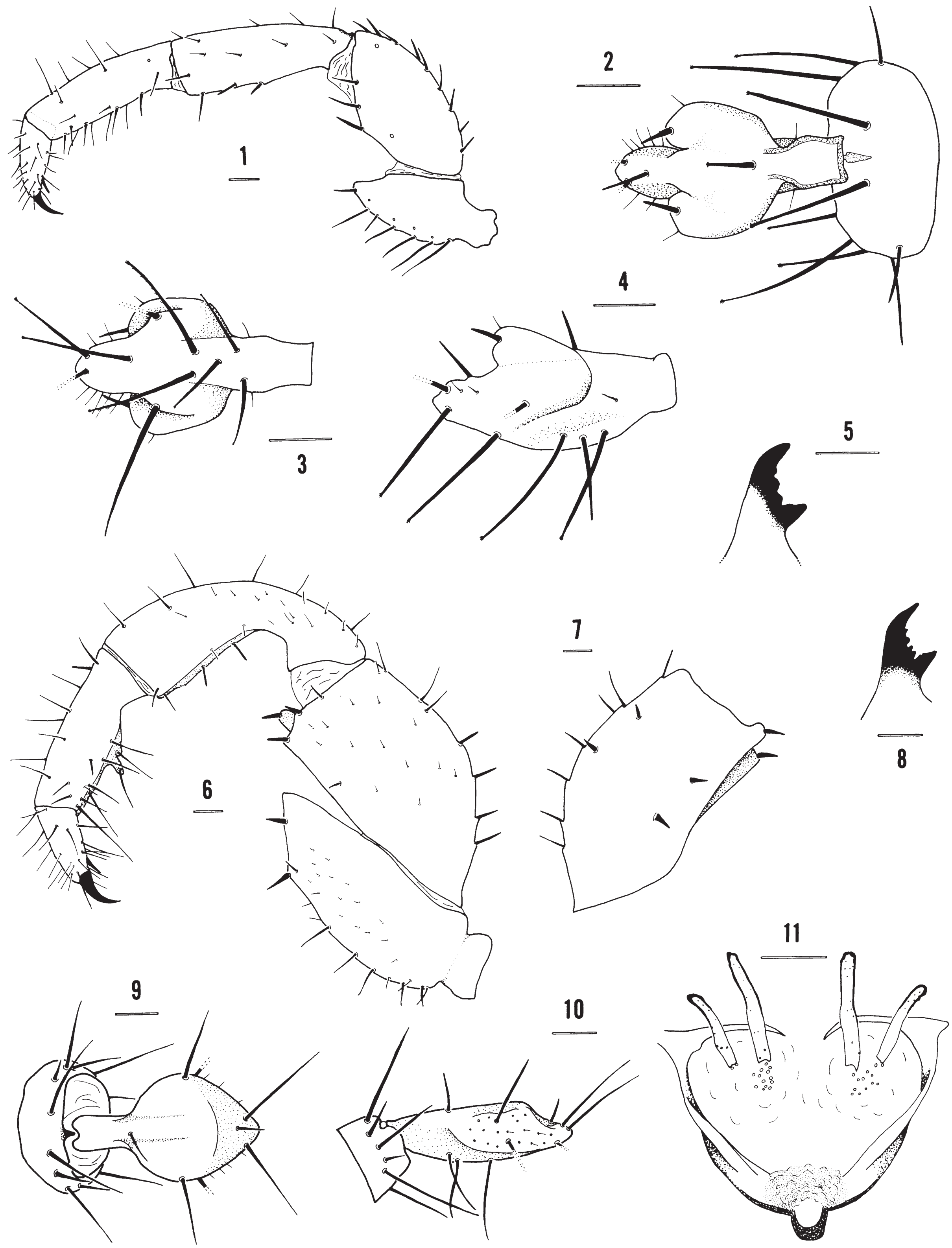
Discussion.—This species is most closely related to *Schizomus infernalis* Rowland from 0.8 km N of Ruinas de Palenque, Chiapas. These two species share the unusual morphology of the male pedipalp and the general shape of the flagellum. *Schizomus hoffmannae* differs from *S. infernalis* in having the flagellum more strongly depressed posteriorly and in details of the structure of the pedipalp, including a comparatively shorter patella and a less well-developed tibial spur. *Schizomus hoffmannae* also differs in possessing five instead of four dorsal setae on tergite II, but as these are grouped 2/3 per side the normal setal number may be 4, 5, or 6.

The relationships of *S. hoffmannae* and *S. infernalis* to other *Schizomus* species are somewhat obscure. *Schizomus infernalis* was not assigned to a species group by Rowland and Reddell (1981), although they suggested it might belong to the *mexicanus* group. The male flagellum is strongly suggestive of several species in the *mexicanus* group, but the remarkable nature of the pedipalps indicates that these two species should be considered a separate complex within the *mexicanus* group.

pecki group

Schizomus firstmani Rowland

Schizomus firstmani Rowland, 1973a:16-19, figs. 14-16, table 1. For complete synonymy see Rowland and Reddell, 1977:98.



Figs. 1-11.–*Schizomus* n.spp.: Figs. 1-5: *S. palaciosi* n.sp., holotype male: 1, pedipalp, lateral view; 2, flagellum, dorsal view; 3, flagellum, ventral view; 4, flagellum, lateral view; 5, fixed finger of chelicera, lateral view. Figs. 6-10: *S. hoffmannae* n.sp., holotype male: 6, pedipalp, lateral view; 7, pedipalp femur, submesal view; 8, fixed finger of chelicera, lateral view; 9, flagellum, dorsal view; 10, flagellum, lateral view. Fig. 10: *S. palaciosi* n.sp., paratype female, spermathecae, ventral view. Scale lines = 0.1 mm for Figs. 1-10; 0.05 mm for Fig. 11.

New records.—MEXICO: *Veracruz*: Grutas de Atoyac, no date (C. Bolívar y Pieltain), 2 females (AMNH); 13 November 1941 (C. Bolívar y Pieltain, F. Bonet), 1 female, 1 immature (AMNH); Atoyac, 6 December 1981 (V. Granados), 1 female (UNAM).

Schizomus sbordonii Brignoli

Schizomus sbordonii Brignoli, 1973:7, 8, 9, fig. 4. For complete synonymy see Cokendolpher and Reddell, 1984:241.

New record.—MEXICO: *Veracruz*: Grutas de Atoyac, 7 December 1981 (V. Granados), 1 female (UNAM).

Schizomus pecki Rowland

Schizomus pecki Rowland, 1973a:7, 16, 19-23. For complete synonymy see Rowland and Reddell, 1980:29.

New record.—MEXICO: *Tabasco*: Grutas del Coconá, 13 April 1960 (collector unknown), 1 female (UNAM).

Schizomus sp., OTU No. 7

Schizomus sp., OTU No. 7: Rowland and Reddell, 1980:32, figs. 63, 72, 78.

New records.—MEXICO: *Chiapas*: Ruinas de Palenque, 18 July 1983 (J. Reddell), 1 female, 3 immatures (TMM); Cascada Motiepa, Ruinas de Palenque, 18 July 1983 (J. Reddell), 2 females (TMM).

Schizomus palaciosi, new species
Figs. 1-5, 11

Type-data.—Male holotype (UNAM) and male paratype (TMM) from Gruta de Acuitlapán, 12 km NE of Taxco, Guerrero, México, 1470 m, 26 May 1978 (J. Palacios); female paratype from Gruta de Acuitlapán, 23 May 1980 (J. Palacios) (UNAM).

Etymology.—This species is named for M. de C. José Palacios-Vargas of the Laboratorio de Acarología, Universidad Nacional Autónoma de México, the collector of this species, in recognition of his contributions to the biospeleology of Mexico.

Description.—Holotype male (length from apical margin of propeltidium to base of flagellum, 3.64 mm). Orangish-brown; abdomen and legs lighter.

Cephalothorax: Propeltidium 1.8 mm long, 0.62 mm wide; with three apical and two pair dorsal setae. Apical margin of propeltidium drawn to sharp downturned point. Eyespots absent. Mesopeltidia separated by slightly more than the width of one plate. Metapeltidium undivided. Anterior sternum with eight bifid setae and two long anteriorly directed setae arising from front edge of sternum; posterior sternum triangular, with six setae.

Abdomen: Sternite V about 3.3 times as wide as long. Tergite I with one pair dorsal setae; tergite II with three pair small anterior setae and one pair large posterior dorsal setae; tergites III-VIII with one pair dorsal setae each; tergite IX with one pair dorsolateral and one pair lateral setae. Segment X with two lateral and seven ventral setae; segment XI with two lateral and six ventral setae; segment XII with two dorsal, six lateral, and two ventral setae. Segment XII without posterior dorsal process. Flagellum (Figs. 2-4) 0.36 mm long, 0.22 mm wide; trilobate with lateral lobes projected above level of median lobe and shaft; with six dorsal and ten ventral setae.

Pedipalps (Fig. 1): Trochanter produced distally to triangular point; with row of seven spinose setae on ventral margin; four setae on lateral surface near ventral margin; five setae on mesal surface. Femur with eight setae on or near dorsal margin; two setae on lateral surface; two spinose setae on ventrolateral margin; three spinose setae on or near ventromesal margin; one spinose seta on mesal surface near distal end. Patella, tibia, and basitarsus-tarsus with scattered setae laterally, dorsally, and ventrally; with long plumose setae mesally. Claw about 1/2, spurs about 1/4 as long as dorsal length of basitarsus-tarsus.

Chelicerae (Fig. 5): Fixed finger with three teeth between two large outer teeth. Chelicera with the following setation (terminology after Lawrence, 1969): Three type 1 setae; four type 2 setae; two type 3 setae; two type 4 setae (plus five long plumose dorsal setae); seven type 5 setae; and one type 6 seta. Serrula with 15 teeth.

Legs: Lengths of segments in Table I. Leg I, including coxa, 5.8 mm long; basitarsal-tarsal segment proportions: 17:3:4:4:5:5:10. Leg I very slender. Femur IV about 2.5 times as long as deep.

Male paratype: Total length, 3.90 mm; propeltidium length 1.28 mm. Flagellum 0.36 mm long, 0.22 mm wide. As in holotype except for minor setational differences of the pedipalps. Leg segment measurements in Table I.

Female paratype: Total length 3.50 mm; propeltidium length 1.18 mm. Flagellum length 0.28 mm; with three segments. Leg I, including coxa, 4.62 mm long; more robust than in male. All legs proportionately shorter and more robust than in male; leg segment measurements in Table I.

Spermathecae (Fig. 11): Median lobes straight, without apical enlargement, slightly longer than lateral lobes; lateral lobes without apical enlargement, very slightly curved.

Other records.—MEXICO: *Guerrero*: Gruta de Acuitlapán, Estación V, s/suelo, 2 August 1980 (J. Palacios), 1 immature (UNAM); 19 July 1980 (C. Morales), 1 immature (UNAM).

Discussion.—The long slender legs and lack of eye-spots indicate that this species is probably a troglobite. The distinctly trilobate flagellum serves readily to separate this species from males of all other species of the *pecki* group. The spermathecae are most similar to an undescribed species from Chiapas (*Schizomus*, OTU No. 7; see Rowland and Reddell, 1980:fig. 71) but the median lobes in *S. palaciosi* are not curved as they are in the Chiapas species. The presence of three pair of dorsal setae in *S. palaciosi* versus two pair in *S.* sp., OTU No. 7, also serves to separate the two species.

Table 1.—Measurements (mm) of *Schizomus* n.spp.: 1-3: *S. palaciosi*: 1, male holotype; 2, male paratype; 3, female paratype. 4: *S. hoffmannae*, male holotype.

	1	2	3	4
Pedipalp				
Trochanter	0.20	0.16	0.14	0.10
Femur	0.60	0.66	0.46	0.82
Patella	0.58	0.68	0.52	0.84
Tibia	0.52	0.60	0.40	0.54
Basitarsus-tarsus	0.28	0.30	0.22	0.30
Total	2.18	2.40	1.74	2.60
Leg I				
Trochanter	0.20	0.30	0.30	0.24
Femur	1.20	1.30	0.92	1.12
Patella	1.56	1.70	1.16	1.38
Tibia	1.16	1.34	0.92	1.02
Basitarsus	0.38	0.42	0.34	0.32
Tarsus	0.60	0.70	0.52	0.46
Total	5.10	5.76	4.16	4.54
Leg II				
Trochanter	0.10	0.14	0.16	0.22
Femur	0.86	0.94	0.52	0.82
Patella	0.50	0.54	0.40	0.44
Tibia	0.60	0.72	0.52	0.48
Basitarsus	0.46	0.54	0.36	0.46
Tarsus	0.40	0.44	0.36	0.40
Total	2.92	3.32	2.32	2.82
Leg III				
Trochanter	0.22	0.20	0.14	0.22
Femur	0.78	0.84	0.66	0.66
Patella	0.30	0.40	0.32	0.32
Tibia	0.50	0.54	0.40	0.32
Basitarsus	0.50	0.58	0.42	0.44
Tarsus	0.42	0.44	0.38	0.42
Total	2.72	3.00	2.32	2.36
Leg IV				
Trochanter	0.28	0.36	0.26	0.30
Femur	1.12	1.20	0.98	1.10
Patella	0.48	0.48	0.44	0.48
Tibia	0.82	1.14	0.70	0.70
Basitarsus	0.70	0.80	0.60	0.62
Tarsus	0.46	0.48	0.46	0.46
Total	3.86	4.46	3.44	3.56

Schizomus spp.

New records.—MEXICO: *Chiapas*: Chacamax River Road, at stream ford, berlese of rotting log, 3 February 1976 (C. Alteri), 1 immature (AMNH); 5 mi. NE of Chiapa, 22 August 1966 (J. & W. Ivie), 1 male, 1 female (AMNH); La Esperanza (?Motoquintla, coll. Musgos), 8 January 1940 (F. Bonet), 1 desiccated immature (AMNH); Ocosingo, deciduous leaf litter around waterfall, 2 June 1969 (J.M. Campbell), 1 immature (AMNH); Ruinas de Palenque, soil no. 13, 9 July 1949 (collector probably C.J. Goodnight), 1 abdomen (AMNH); cruising, 15 July 1949 (collector probably C.J. Goodnight), 1 female (AMNH); soil no. 24, 18 July 1949 (C.J. Goodnight), 1 immature (AMNH); 25 July 1973 (J. Reddell, J.M. Rowland), 4 immatures (TMM); 28 September 1974 (J. Reddell), 3 immatures (TMM); 18 July 1983 (J. Reddell), 1 female (TMM); 6 mi. S of Tuxtla Gutiérrez, W93.07, N16.42, 21 August 1966 (J. & W. Ivie), 4 immatures (AMNH); rim of gorge NE of Tuxtla Gutiérrez, 2 mi. S of Sumidero, W93.04, N16.48, 19 August 1966 (J. & W. Ivie), 1 immature (AMNH); Jardín Botánico, Tuxtla Gutiérrez, 27 September 1979 (A. Hoffmann), 1 immature (UNAM); Unión Juárez, 11 August 1950 (Goodnights), 4 immatures (AMNH). *Guerrero*: 62 mi. N of Acapulco, 18 June 1936 (A.M. & L. Irby Davis), 2 immatures (AMNH); Grutas de Cacahuamilpa, under rotting stick behind inner restroom, 16 November 1983 (M. Reyes & J. Reddell), 1 immature (TMM); Desviación a Pto. Oscuro, Taxco-Tetipec, 2310 m elev., 24 January 1981 (J. Palacios), 1 female, 1 immature (UNAM); Grutas de Juxtlahuaca, 16 October 1982 (J. Palacios), 1 immature (UNAM). *Hidalgo*: Cueva de San José, San José, 18 March 1981 (J. Reddell, D. McKenzie, T. Archey, F. Endres), 1 immature (TMM). *Nuevo León*: El Carrizal, 16 July 1942 (collector unknown), 1 ?female (AMNH). *Oaxaca*: Centipede Cave, Río Iglesia Dolina, Huautla de Jiménez, 26 March 1981 (A. Grubbs, S. Zeman), 1 male, 2 females, 2 immatures (TMM); Huautla de Jiménez, May-June 1978 (A.G. Grubbs), 1 male, 2 females (TMM); jungle trail 25-30 km E of Huautla de Jiménez on way to Cerro Rabón, 23 March 1981 (A. Grubbs), 2 immatures (TMM); 3.5 mi. S of Suchixtepec, 8,000 ft. elevation, berlese (B no. 208) of leaf litter (39 litres), 3 June 1971 (S. Peck), 1 immature (FMNH no. 71-346), 3 ?immatures (TMM); Cave of 30 Skulls, Huautla de Jiménez, 25 March 1981 (A. Grubbs), 1 immature (TMM). *Puebla*: Unnamed cave-sinkhole, 10 m E of road to Derramadero, 200 m N of Hwy. to Izucar de Matamoros, 50 m SE of railroad, 31 December 1981 (D. McKenzie), 1 female (TMM); Yohulichan, 5.6 mi. (by road) N of Cuetzalan, 19 December 1976 (J. Reddell), 1 female (TMM). *Quintana Roo*: Cobá, 1 February 1984 (B. & V. Roth), 1 female (CAS). *San Luis Potosí*: Agua Fría, 10 km S of Tamán, 27 March 1981 (J. Reddell, T. Archey), 1 male (TMM); Tamazunchale, sifted from debris in banana plantation, 5 March 1948 (C.H. Seevers), 1 immature (FMNH); La Cueva (=Sótano) de la Tinaja, 10.5 km NE of Ciudad Valles, 20 February 1973 (J.P. Webb), 1 immature (TMM). *Tabasco*: surface near Grutas del Coconá, Teapa, 25 August 1972 (collector unknown), 2 immatures (TMM). *Veracruz*: Atoyac, 6 December 1981 (V. Granados), 1 female (UNAM); Grutas de Atoyac, date unknown (C.B.P.), 3 fragmented immatures (AMNH); 13 November 1941 (C.B., F.B.), 3 fragmented immatures (AMNH); 7 December 1981 (V. Granados), 1 immature (UNAM); Balzapote, berlese sample of rain forest litter, 7 July 1976 (A. Newton), 5 immatures (MCZ); Lago Catemaco, on brush along lake, 28 December 1983 (V. & B. Roth), 1 female (CAS); 12 February 1984 (V. & B. Roth), 2 males, 3 females, 7 immatures (CAS); 5 km N of Cuitlahuac, 4 January 1977 (J. Reddell), 1 female (TMM); El Nacimiento, Paraje Nuevo, Córdoba, tropical evergreen forest, berlese no. 176 of soil and litter, 56 lbs., 7 August 1969 (S. & J. Peck), 1 immature (AMNH); Cueva Pintada, Ixhuatlán del Café, near Coscomatepec, 4 January 1982 (D. McKenzie, M. Shumate, L. Elliott), 3 males (TMM); Playa Escondida, lot 57, 12 January 1976 (J. Richter), 3 immatures (TMM); Nacimiento del Río Tonto "Huizkla," Zongolica, dry section in Big Room, 30 December 1986 (S. & L. Robertson, J.L. Soberanes), 1 male (TMM); 13 km NW of Sontecomapan, 19 August 1975 (E. & J. Fisher), 1 male, 1 female (AMNH); 31 August 1975 (E.M. & J.L. Fisher), 1 male, 5 females, 1 immature (UCR); 29 August 1975 (E. & J. Fisher), 1 male, 1 female (AMNH). *Yucatán*: Chichén Itzá, 27 June 1951 (L.J. Stannard), 1 larva (AMNH).

Comments.—Much of the above material is inadequate for further identification. Most of the adult specimens are representative of undescribed species to be considered later.

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THE SPIDER GENUS *METAGONIA* (ARANEAE: PHOLCIDAE) IN NORTH AMERICA, CENTRAL AMERICA, AND THE WEST INDIES

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ABSTRACT

The pholcids of the genus *Metagonia* are sedentary types that spin their tangled webs in and under objects and detritus on the soil or inside ground openings and caves; a few find appropriate habitats well above the ground in foliage. A listing and general review of the 46 species now known from continental and insular North America are presented with analyses of their features and relationships. As a result of recent collections, many of these from caves of eastern Mexico, 19 new species have been discovered and these are the principal reason for this review. A list of the new taxa from their respective countries and states follows: from Mexico: ***lepida*** and ***joya*** from Tamaulipas, ***modesta, guagua, cuate, oxtalja,*** and ***luisa*** from San Luis Potosí, ***faceta*** from Nuevo León, ***bella*** from Veracruz, ***puebla*** from Puebla; from Belize: ***cara*** and ***belize***; from Panama: ***panama***; from Guatemala: ***modica***; from Costa Rica: ***selva, osa, rica,*** and ***turrialba***; and from Jamaica, West Indies: ***jamaica.*** Six of these species are eyeless troglobites and increase the number of blind species in the area under consideration to 12.

INTRODUCTION

The present paper supplements earlier ones dealing with cavernicole and epigean spiders from continental and insular North America. In previous ones (Gertsch, 1971, 1973, 1977; Brignoli, 1972) the rich cave fauna of Mexico and Central America has been described and analyzed in terms of the many taxa. This contribution deals exclusively with the American genus *Metagonia* which has been enriched by recent new material from surface and cave habitats. *Metagonia* has undergone remarkable adaptive radiation in North and Central America, from which area 46 species are now known. It is also clear that many more will be found in the numerous habitats of this diverse region. A high percentage of the new taxa has been discovered in caves of Mexico, from which many eyed troglophiles and 10 eyeless troglobites are now known. An eyeless representative from the island of Jamaica is so far the only member of the genus from the West Indies, but it is certain that others will be found in suitable habitats of those islands.

The principal objective of this paper is to bring up to date the genus *Metagonia* by presenting a systematic review of the known taxa from the cited area. Each previously described species is listed with its literature citations, is briefly characterized in terms of type-locality and distribution, and provided with any new records or data. Only supplementary data are offered for those already rather fully described taxa. The numerous new species are described and illustrated now from a fuller knowledge of the known taxa and their usable characters. Since identification of the many closely allied species is possible only with critical perusal of the genitalia of each sex, it has been concluded that keys to the taxa would be relatively useless. The name of the cave habitat is almost a specific identification for most of the species. In only one or two instances is an eyed species found in the same cave as an eyeless one. Brignoli (1972) has expressed some doubt that the North American *Metagonia* are congeneric with the type of the genus, *Metagonia bifida* Simon of Rio de

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Janeiro. American students have followed O. Pickard-Cambridge (1895), Mello-Leitão (1946), and others in holding *bifida,* based on a single female, to be congeneric with our North American taxa. Mello-Leitão listed five species from eastern South America, including his own *argentinensis,* and this latter and undescribed species have been studied by me. The South American taxa are somewhat stouter than those of North America but their genitalic features mark them as fully congeneric.

SYSTEMATIC SECTION

Genus *Metagonia* Simon

Metagonia Simon, 1893:470, 472. F. Pickard-Cambridge, 1902:365. Petrunkevitch, 1939:158. Mello-Leitão, 1919:109, 111: 1946:67. Bonnet 1957:2808. Gertsch, 1971:82; 1977:105. Brignoli, 1972:141-145.

Diagnosis.—American pholcid genus of subfamily Pholcinae (Petrunkevitch, 1939:158): small spiders 1.8 mm to 6 mm long with suboval to elongate caudate abdomens. Carapace suboval: pars cephalica moderately elevated with prominent sloping clypeus; pars thoracica with weak cephalic sutures and inconspicuous linear median groove. Eyes six in two moderately to well separated triads; anterior median eyes lost; posterior eye row recurved. Chelicerae of male with mostly trivial facial spinules, rarely with spurs or horns (*torete, panama*). Legs very long and thin with formula 1243 or 1423; first leg in females from 14 to 32 times, in males 23 to 33 times as long as carapace; second and fourth legs subequal in length. Genitalia of haplogyne type: epigynum elevated, erectile lobe with wide genital orifice and internal sperm receptacles; male palpus with voluminous bulb bearing long, pale, finger-like embolus with tiny pore adjacent to long spine at the tip, and tarsus comprising a hinged process and principal apical process at its apex formed to a fringe bearing series of spurs, membranes and teeth on each lateral surface. Stridulatory device lacking in both sexes.

Type of genus.—*Metagonia bifida* Simon, of Rio de Janeiro, Brazil.

Description.—The principal structural features of *Metagonia* have been mentioned in previous papers (Gertsch, 1971:82; 1977:105) and these are again reviewed here with additional observations coming from the present study. The subround, moderately convex carapace is notable for the prominent, downwardly projecting clypeus (Figs. 18, 29) in both sexes. In females and many males the front margin of the clypeus is straight transversely or moderately produced forward (Fig. 70). In some males the clypeus is much inflated, rounded and thickened at the apex or produced into a prominent central spur, lobe or spine; these are here called horns in the verbal descriptions. The suboval pars cephalica is delimited by shallow cephalic grooves and an inconspicuous linear cervical groove. The six eyes in two separated triads are quite prominent but rest on low connate tubercles only slightly raised above the pars cephalica. The eyes are larger in epigean taxa, are usually ringed with black and each triad is variously well separated from the other (Figs. 40, 48); in cavernicoles the eyes are typically smaller with narrow black rings or none and the triads are often more widely separated. The frontal faces of the chelicerae of the females are generally smooth, lightly covered with inconspicuous hairs, but completely devoid of spinules or spurs: those of the males bear distinctive patches of spines and in a few (such as *panama*, Fig. 66) stout spines are present. The legs in both sexes, usually pale white to yellowish with trivial brown rings on the patellae and at ends of tibiae (rarely absent even in cavernicoles), are long and thin, those in some cavernicoles and even in foliage types sometimes exceeding thirty times the length of the carapace. The legs of these and some other pholcids are often pulled free and lost during capture and later museum study.

The abdomen is similar in both sexes, is usually suboval and as high as broad, bluntly rounded behind or produced to a conical or elongated caudal projection. In some taxa the carapace or abdomen bears distinctive dark patches or spotting but these marks are only incidentally useful in diagnosing the species. The epigynum of the female (the entire internal and external features of the secondary reproductive system for holding the sperm) is shown in two views for most of the taxa; the pattern of both valves is diagnostic for each species. The epigynum (Gertsch, 1977:105) is an inflatable or erectile appendage which lies at rest as a rounded lobe against the abdomen most of the time but is inflated to a prominent lobe or projecting process during courtship or mating. The orifice of the epigynum is a wide transverse groove which opens into a voluminous chamber covered by concave valves bearing more or less distinct sclerotized receptacles and tubules. The dorsal or internal surface bears ridges and grooves presumed to aid in guiding the embolus to the receptacles during mating. The external or ventral view of the epigynum shows the general shape of the organ, which is longitudinally suboval but in some cases laterally oval, bearing the laterally directed genital groove and behind it minor or even prominent structural process of the organ. The ventral view also offers a vague or distinct pattern of the internal organ which though very superficial is a visible appraisal of some usefulness.

The large geographic area treated in this paper can conveniently be divided into two faunal segments as follows: 1, the Mexican Fauna (p. 41); and 2, the Central American and West Indian Faunas (p. 53).

The Mexican Fauna

The 34 Mexican species of *Metagonia* have been found in a relatively narrow, mountainous belt from Tamaulipas and Nuevo León in the north southweard into Puebla and Chiapas and eastward from there broadly into the Yucatan Peninsula. The species *caudata* heads the list as probably the largest one, averaging about 5 mm in body length, ranging from San Luis Potosí to Yucatán and Belize, and is one of the few species not so far found in caves. Furthermore, it is the only species with a United States record, having been carried on bananas into Edinburg, Texas. Two other surface species, *bella* of Veracruz and *goodnighti* of Chiapas, are large-eyed types with bright coloration and dark markings; it is likely that a few known or undescribed species from tropical Mexico live both inside and outside of caves. Nevertheless, it is more than a coincidence that nearly 30 species of Mexico have been taken only in cave habitats, and this brings implication of failure to collect fully surface stations in the distribution area. Whereas it is true that James Reddell and his colleagues have emphasized cave habitats, much surface material has been taken around and well away from caves. Not a single *Metagonia* has been taken in surface habitats in northeastern stations even though these have been favorable for other genera of pholcids. This parallels the situation in *Anopsicus* (Gertsch, 1982:107) where no cavernicole is known from an epigean habitat.

The cavernicole Mexican *Metagonia* are represented by sexes as follows: 16 males are assigned to females collected with them in the same cave; five males are without known females; and 11 females are without known males. A question arises as to how to classify the taxa so far available from cave stations. The nine eyeless species are obviously troglobites by virtue of their pallid coloration, elongated legs, and especially by loss of their eye tubercles and eyes. All others are called troglophiles in spite of their preference for a single cave or seeming restriction to it. The Sierra de El Abra and adjacent regions of San Luis Potosí and Tamaulipas are a hotbed of speciation harboring 16 allied species of *Metagonia*. These represent a single phyletic line probably derived from a single taxon; the name *tinaja* group seems appropriate for the complex. *Metagonia tinaja* occurs in six caves of San Luis Potosí and three in adjacent Tamaulipas; no other species occurs in any of the caves inhabited by *tinaja*. The remaining 15 allied species occur mostly in single caves or in few, and six are eyeless troglobites. An exception to the generalization of exclusion of close relatives is that of *Metagonia pura*, an eyeless troglobite living in Cueva de la Capilla with the large-eyed *Metagonia capilla*.

Metagonia caudata O. Pickard-Cambridge
Figs. 1-2

Metagonia caudata O. Pickard-Cambridge, 1895:150; 1898:246. F. Pickard-Cambridge, 1902:370. Bonnet, 1957:2808. Gertsch, 1977:105.

Type-data.—Female type from Teapa, Tabasco, México, in British Museum (Natural History) (not seen).

Distribution.—Yucatan Peninsula to Chiapas and San Luis Potosí.

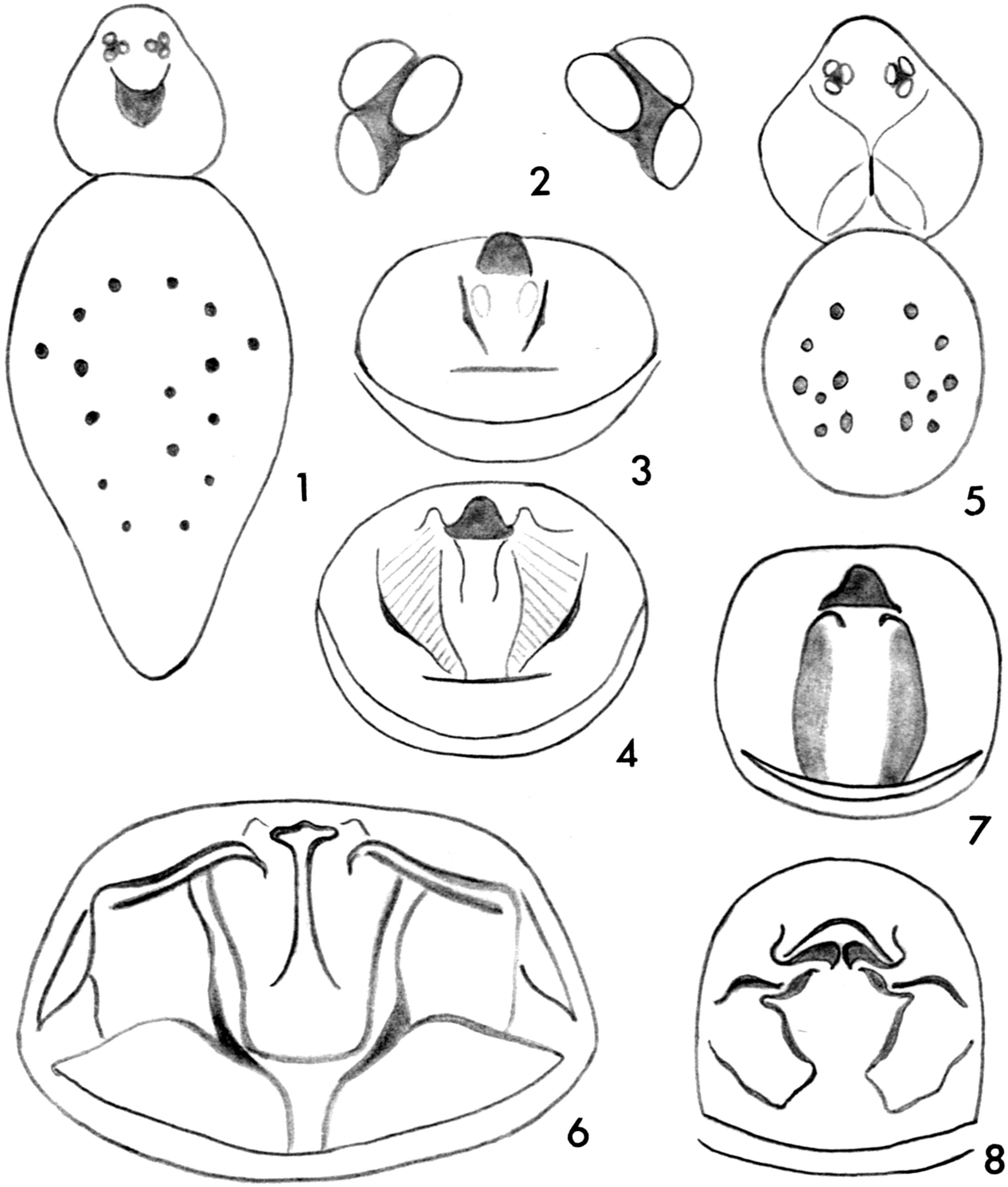
Known records.—BELIZE: *Toledo District*: Columbia Forest, 7 April 1974 (C.M. Goodnight), female. MEXICO: *Tabasco*: Teapa (H.H. Smith), female type of *caudata* "Found on lower side of a large leaf about seven feet from the ground in a damp, shady cacao-orchard. No web of any kind. . ."; 16 July 1947 (C. and M. Goodnight), male from along river. *Chiapas:* Pichacales, 18 July 1947 (C. and M. Goodnight), immature. 1 km N Palenque, 25 July 1973 (J. Reddell, R.W. Mitchell), female; (J. Reddell et al.), female. *San Luis Potosí*: Tamazunchale, 20 July 1947 (C. and M. Goodnight), immature; 20 May 1952 (W.J. Gertsch), immature; 19 April 1963 (W.J. Gertsch, W. Ivie), 3 males, 2 females. UNITED STATES: *Texas*: Edinburg, 1 April 1936 (S. Mulaik), female from Mexican banana bunch.

Metagonia suzanne Gertsch

Metagonia suzanne Gertsch, 1973:152.
Metagonia suzannae: Brignoli, 1983:164 (unjustified emendation).

Type-data.—Troglophile femae holotype from Sumidero de El Jineo, 1 km NW of Gómez Farías, Tamaulipas, México, 24 November 1971 (T. Raines, L. McNatt), in AMNH.

Distribution.—Known only from above specimen. Male unknown.



Figs. 1-8.—Species of *Metagonia*: Figs. 1-2: *M. caudata*, female: 1, carapace and abdomen, dorsal view; 2, eyes. Figs. 3-4: *M. lepida*, epigynum: 3, ventral view; 4, dorsal view. Figs. 5-6: *M. capilla*: 5, carapace and abdomen of male; 6, epigynum, dorsal view. Figs. 7-8: *M. joya*, epigynum: 7, ventral view; 8, dorsal view.

Metagonia joya, new species
Figs. 7-8

Diagnosis.—Eyeless troglobite from Sótano de la Joya de Salas, distinguished by epigynum (Figs. 7-8). Male unknown.

Etymology.—Specific name from Spanish *joya*, jewel.

Description.—Female holotype: Length 2.4 mm. Carapace 1 mm long and wide. Abdomen 1.5 mm long, 1.2 mm wide. Abdomen gray with pale hastate marking from base to near apex. Carapace as broad as long; pars cephalica convex, without trace of eye tubercles or eyes. Abdomen suboval, longer than wide, broadly rounded behind. First leg: femur 1.3 mm, patella, 9.4 mm, tibia 6.3 mm, metatarsus 9.6 mm, tarsus 1.5 mm; total length 24.1 mm: first leg 26 times, first femur 6 times as long as carapace.

Epigynum (Figs. 7-8): posterior margin gently rounded as viewed from ventral side.

Type-data.—Female holotype from Sótano de la Joya de Salas, Tamaulipas, México, March 1978 (Jean Jancewicz), in AMNH.

Metagonia pachona Gertsch

Metagonia pachona Gertsch, 1971:88. Brignoli, 1983:163.

Type-data.—Male holotype with small eyes, probable troglobite, from Cueva de El Pachón, 7.5 km NE of Antiguo Morelos, Tamaulipas, México, 1 September 1946 (C. J. Goodnight), in AMNH. Female unknown.

Distribution.—Known only from Cueva de El Pachón.

Metagonia capilla Gertsch
Figs. 5-6

Metagonia capilla Gertsch, 1971:84. Brignoli, 1983: 163.

Diagnosis.—Large species with blackish pattern on carapace and abdomen; epigynum (Fig. 6). Female described as follows.

Description.—Female: Length 3.4 mm. Carapace 1.5 mm long, 1.4 mm wide. Abdomen 2 mm long, 1.2 mm wide. Coloration and structure like those of male. Cephalothorax and appendages whitish to dusky yellow: carapace with dusky patches on each side of pars thoracica (like those of male, Fig. 5): eyes narrowly ringed with black; legs with brown patellae and brown rings at ends of tibiae. Abdomen grayish; dorsum with faint pattern of bluish spots. Eyes large, subequal in size, about 0.12 mm in long diameter; anterior lateral eyes separated by more than two diameters (10/25), posterior laterals by three diameters (10/32). First leg: femur 8 mm, patella 0.3 mm, tibia 8 mm, metatarsus 13.5 mm, tarsus 2.2 mm; total length 32 mm; first leg 21 times, first femur 5.5 times as long as carapace.

Epigynum (Fig. 6) very large, broader than long and widely rounded behind.

Type-data.—Male holotype from Cueva de la Capilla, El Porvenir, 13.5 km NW Gómez Farías, Tamaulipas, México, 13 January 1971 (J. Reddell, R. Mitchell, and group), in AMNH.

New record.—Cueva de la Capilla (no collection data), female.

Metagonia pura Gertsch

Metagonia pura Gertsch, 1971:87. Brignoli, 1972:138; 1983:163.

Type-data.—Male holotype, troglobite, from Cueva de la Capilla, 13 km NW of Gómez Farías, El Porvenir, 12 January 1971 (J. Reddell, R. Mitchell, F. Rose, J. George), in AMNH.

New record.—Cueva de la Capilla, 2 July 1969 (S. Peck, R. Norton), female.

Metagonia lepida, new species
Figs. 3-4

Diagnosis.—Eyeless troglobite with distinctive epigynum (Figs. 3-4). Male unknown.

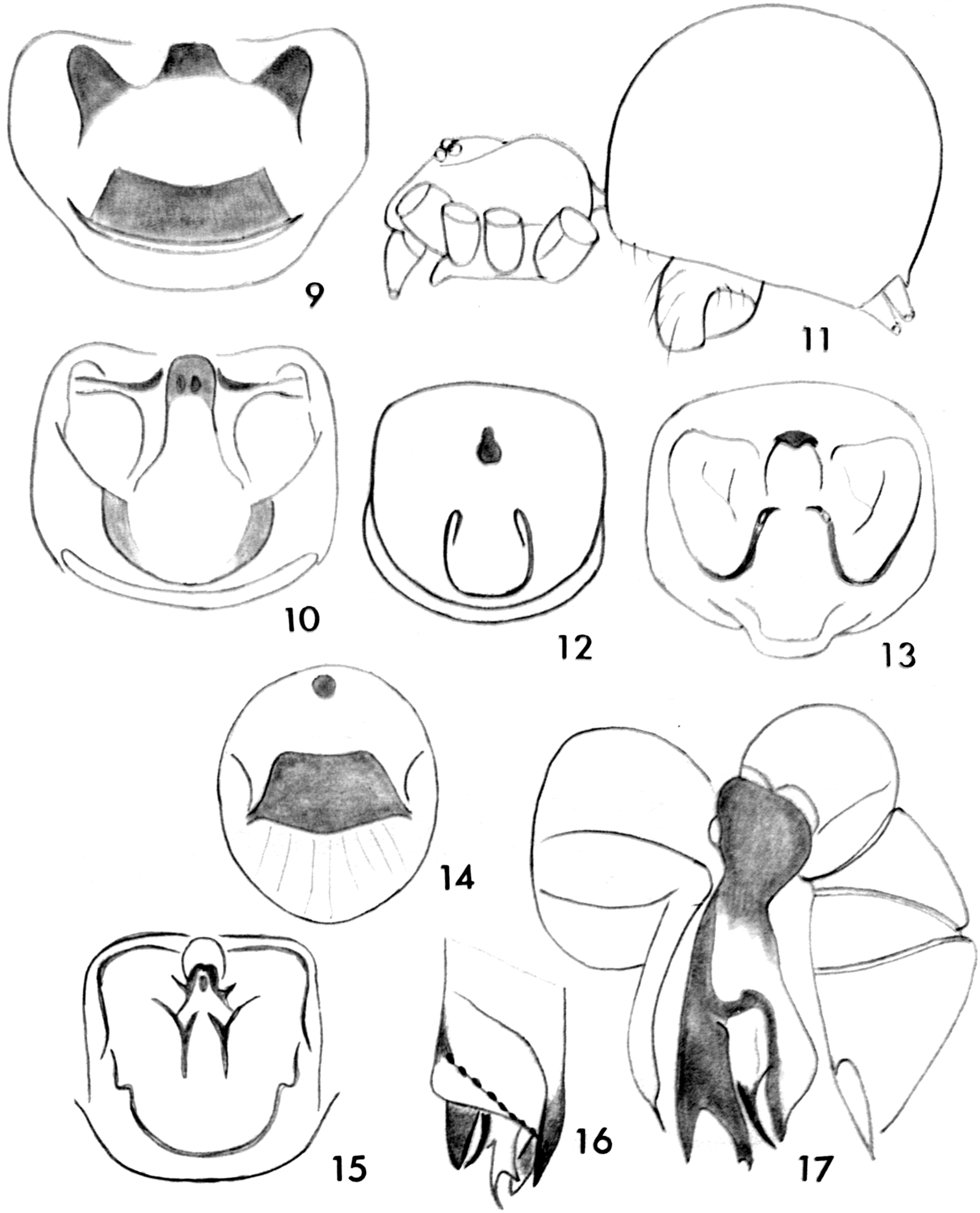
Etymology.—Specific name from Latin *lepidus*, pleasant.

Description.—Female holotype: Length 2.8 mm. Carapace 1 mm long, 0.8 mm wide. Abdomen 2 mm long, 1.6 mm wide. Base color of carapace and legs whitish to pale yellow, without any darker pattern; abdomen grayish. Carapace slightly broader than long; pars cephalica elevated with obsolete eye tubercles and without trace of eyes. Abdomen suboval, longer than broad, broadly rounded behind. Legs fragmented: presumed first leg: femur 4.5 mm, patella 0.3 mm, tibia 4.7 mm, metatarsus 7.8 mm, tarsus 1.6 mm; total length 18.9 mm: first leg 19 times, first femur 4.5 times as long as carapace.

Epigynum (Figs. 3-4) with posterior margin widely rounded and inner receptacle visible in front.

Type-data.—Female holotype, female and immature from Cueva del Ojo de Agua de Manantiales, Tamaulipas, México, January 1979 (F. Endres, W. Elliott), in AMNH.

Distribution.—Known only from above specimen.



Figs. 9-17.–Species of *Metagonia*: Figs. 9-10: *M. oxtalja*, epigynum: 9, ventral view; 10, dorsal view. Figs. 11-13: *M. tinaja*, female: 11, carapace and abdomen, lateral view; 12, epigynum, ventral view; 13, epigynum, dorsal view. Figs. 14-17: *M. luisa*: 14, epigynum, ventral view; 15, epigynum, dorsal view; 16, tarsal process of left palpus, prolateral view; 17, left male palpus, retrolateral view.

Metagonia secreta Gertsch

Metagonia secreta Gertsch, 1971:86. Brignoli, 1983: 163.

Type-data.—Female holotype from Cueva del Nacimiento del Río Frío, 7 km S of Gómez Farías, Tamaulipas, México, 18 April 1965 (J. Fish, J. Reddell), in AMNH. Male unknown.

Distribution.—Known only from cited cave.

Metagonia tinaja Gertsch
Figs. 11-13

Metagonia tinaja Gertsch, 1971:83. Brignoli, 1983: 164.

Metagonia pasquinii Brignoli, 1972:144; 1983:163. NEW SYNONYMY.

Diagnosis.—Typical species with pallid coloration and small eyes; lateral view of female showing erect epigynum (Fig. 11); ventral and dorsal views of epigynum (Figs. 12-13).

Type-data.—Male holotype of *Metagonia tinaja* Gertsch from Sótano de la Tinaja, 10.5 km NE of Valles, San Luis Potosí, México, 18 February 1970 (J. A. L. Cooke), in AMNH. Male holotype of *Metagonia pasquinii* Brignoli from Cueva de los Sabinos, San Luis Potosí, México, 21 November 1969 (R. Argano, V. Sbordonii), in Zoological Institute, University of Rome (not seen).

Distribution.—Caves of San Luis Potosí and northern Tamaulipas.

New records.—MEXICO: *San Luis Potosí*: Sótano de la Tinaja, 11 km N Valles, 16 March 1972 (J. A. L. Cooke), 2 males, 2 females, immature from 1500 feet into cave; 16 October 1972 (V. Roth, B. Firstman), 3 males, 9 females. Sótano de Matapalma, 20 km N Valles, 30 December 1972 (R. Fieseler), female. *Tamaulipas*: Sótano de Venadito, 36 km S Ciudad Mante, 7 April 1971 (D. Honea), female. Sótano de Santa Elena, 25 km S Ciudad Mante, 6 January 1970 (W. Elliott, W. Russell), male. La Cueva Grande del Arroyo Seco, 27 km S Ciudad Mante, 5 January 1970 (W. Elliott, R. Harmon, W. Russell), female.

Metagonia tlamaya Gertsch

Metagonia tlamaya Gertsch, 1971:83. Brignoli, 1983: 164.

Type-data.—Male holotype from Sótano de Tlamaya, San Luis Potosí, México, 26 November 1964 (T. Raines, R. Bell), in AMNH.

Distribution.—Troglobite known only from cited cave.

Metagonia punctata Gertsch

Metagonia punctata Gertsch, 1971:86. Brignoli, 1983:163.

Type-data.—Male holotype from Cueva de Carnicerías, San Francisco, San Luis Potosí, México, 4 August 1966 (J. Reddell, D. McKenzie), in AMNH.

Distribution.—Known from four caves of San Luis Potosí.

New records.—MEXICO: *San Luis Potosí*: Cueva de las Rusias, 4 August 1975 (D. McKenzie, S. Wiley, A. Grubbs), 3 females. Cueva de la Puente, 50 km E San Luis Potosí, Municipio de Zaragoza, 3,000 m, 16 May 1972 (R. Ralph, W. Elliott, M. McEachern), 2 females. Cueva de la Entrada Chica, 4 August 1966 (J. Fish), female, immature.

Metagonia amica Gertsch

Metagonia amica Gertsch, 1971:84. Brignoli, 1983: 162.

Type-data.—Male holotype from Cueva de El Jobo, El Jobo, San Luis Potosí, México, 8 December 1945 (C. Bolívar, F. Bonet), in AMNH.

Distribution.—Known from two caves of San Luis Potosí.

Metagonia cuate, new species
Figs. 18-20, 23-24

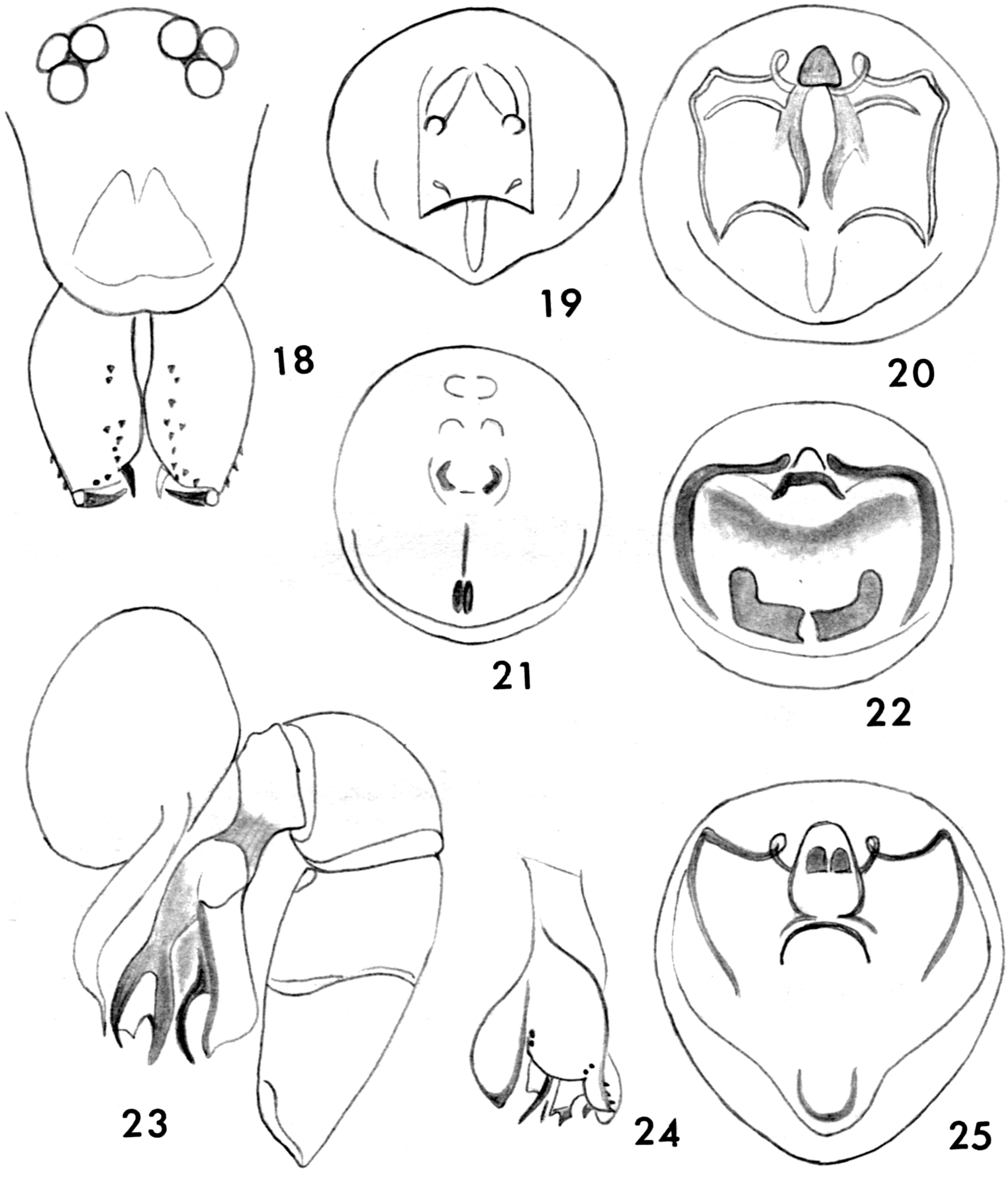
Diagnosis.—Troglophile species from Cueva de los Cuates; epigynum (Figs. 19-20); male palpus (Figs. 23-24).

Etymology.—Specific name from Mexican *cuate*, unmatched, named for Cueva de los Cuates.

Description.—Female holotype: Length about 2 mm. Carapace 1 mm long, 0.8 mm wide. Abdomen 1 mm long, about 0.8 mm wide. Base color of cephalothorax and appendages dull yellow; carapace with dusky bars at center of pars thoracica; abdomen gray. Carapace longer than broad; pars cephalica convex with triads of eyes on low tubercles; eyes subequal in size, about 0.07 mm each, with rounded posterior medians separated by more than diameter (10/7). Abdomen suboval, partially missing, rounded behind. First leg: femur 5 mm, patella 0.3 mm, tibia 5 mm, metatarsus 8.3 mm, tarsus 1.8 mm; total length 20.4 mm; first leg 20 times, first femur 5 times as long as carapace.

Epigynum (Figs. 19-20) with slight triangular angle behind, distinctive ventral pattern and receptacles near front end.

Male: Carapace 0.9 mm long, 0.7 mm wide. Abdomen and most of legs missing. Apex of clypeus inflated, forming thick, slightly curved projection.



Figs. 18-25.—Species of *Metagonia*: Figs. 18-20: *M. cuate*: 18, female, frontal view; 19, epigynum, ventral view; 20, epigynum, dorsal view. Figs. 21-22: *M. guaga*, epigynum: 21, ventral view; 22, dorsal view. Figs. 23-24: *M. cuate*, left male palpus: 23, retrolateral view; 24, tarsal process, prolateral view. Fig. 25: *M. modesta*, epigynum, dorsal view.

Male palpus (Figs. 23-24): apical lobes of distinctive form.

Type-data.—Female holotype and male from Cueva de los Cuates, 16 km SW Valles, San Luis Potosí, México, 29 May 1974 (J. Prentice), in AMNH.

Distribution.—Known only from above material.

Metagonia luisa, new species
Figs. 14-17

Diagnosis.—Long-legged eyeless troglobite from Sótano de Huitzmolotitla; epigynum (Figs. 13-14); male palpus (Figs. 16-17).

Etymology.—Specific name for Spanish *Luisa*, a girl's name, also named for the state.

Description.—Female holotype: Length 3.1 mm. Carapace 1.5 mm long, 1.4 mm wide. Abdomen 2.6 mm long, 2 mm wide. Base color of cephalothorax and legs dusky yellow to whitish; patellae and tips of tibiae brown; abdomen gray. Carapace about as broad as long; pars cephalica without traces of eye tubercles or eyes. Abdomen suboval, longer than broad, arched above and broadly rounded behind. First leg: femur 9.6 mm, patella 0.7 mm, tibia 10.5 mm, metatarsus, 14.5 mm, tarsus 3 mm; total length 38.3 mm; first leg 25.5 times, first femur 6.4 times as long as carapace.

Epigynum (Figs. 13-14) convex, strongly arched even in resting position; posterior margin straight with indistinct pattern of internal sclerotized elements.

Male: Carapace 1.5 mm long, 1.4 mm wide. Abdomen missing. Structure much like that of female. Chelicera with series of 15 spinules along length of inner face. First leg: femur 10 mm, patella 0.6 mm, tibia 9.5 mm, metatarsus 17.5 mm, tarsus 5 mm; total length 42.6 mm; first leg 28 times, first femur 7 times as long as carapace.

Male palpus (Figs. 16-17): hinged process of tarsus a broad blade drawn to a sharp point.

Type-data.—Female holotype and damaged male from Sótano de Huitzmolotitla, San Luis Potosí, México, 4 January 1982 (O. Kukal), in AMNH.

Distribution.—Known only from above specimens.

Metagonia guaga, new species
Figs. 21-22

Diagnosis.—Troglophile species with eyes of medium size from Hoya de las Guaguas, distinguished by epigynum (Figs. 21-22). Male unknown.

Etymology.—Specific name from Mexican *guaga*, a kind of insect.

Description.—Female holotype: Length 2.4 mm. Carapace 1 mm long, 0.8 mm wide. Abdomen 1.5 mm long, 1 mm wide. Carapace whitish, with pair of dusky marks on pars thoracica; dark eyes narrowly ringed with black; legs yellow with dusky patellae; abdomen gray, with faint traces of small subintegumental spots above just beyond middle. Carapace nearly as broad as long; pars cephalica slightly elevated with eyes on low tubercles; eyes subequal in size, about 0.1 mm each, with posterior medians separated by long diameter. Abdomen suboval, broadly rounded behind. First leg: femur 4.3 mm, patella 0.35 mm, tibia 4.7 mm, metatarsus 7 mm, tarsus missing; total length about 17 mm; first leg about 17 times, first femur 4.3 times as long as carapace.

Epigynum (Figs. 21-22) moderately rounded behind, with receptacles near front end.

Type-data.—Female holotype and one juvenile from Hoya de las Guaguas, Aquismón, San Luis Potosí, México, 5 July 1977 (A. Grubbs, B. Stone, S. Edigar, B. Steele), in AMNH.

Distribution.—Known only from above specimens.

Metagonia oxtalja, new species
Figs. 9-10

Diagnosis.—Eyeless troglobite from Cueva de Oxtalja; first leg 19 times as long as carapace; epigynum (Figs. 9-10).

Etymology.—Named for the type-locality.

Description.—Female holotype: Length 2.7 mm. Carapace 1 mm long, 1.2 mm wide. Abdomen 1.7 mm long, 1.3 mm wide. Whole spider whitish to dull yellow, without darker pattern. Carapace about as long as broad; pars cephalica convex, moderately elevated, with no trace of eye tubercles or eyes. Abdomen suboval, strongly arched above, with posterior margin narrowly rounded. First leg: femur 4.5 mm, patella 0.5 mm, tibia 4.3 mm, metatarsus 6.5 mm, tarsus 3 mm; total length 18.8 mm; first leg 19 times, first femur 4.5 times as long as carapace.

Epigynum (Figs. 9-10) with prominent dusky pattern showing through the integument in ventral view.

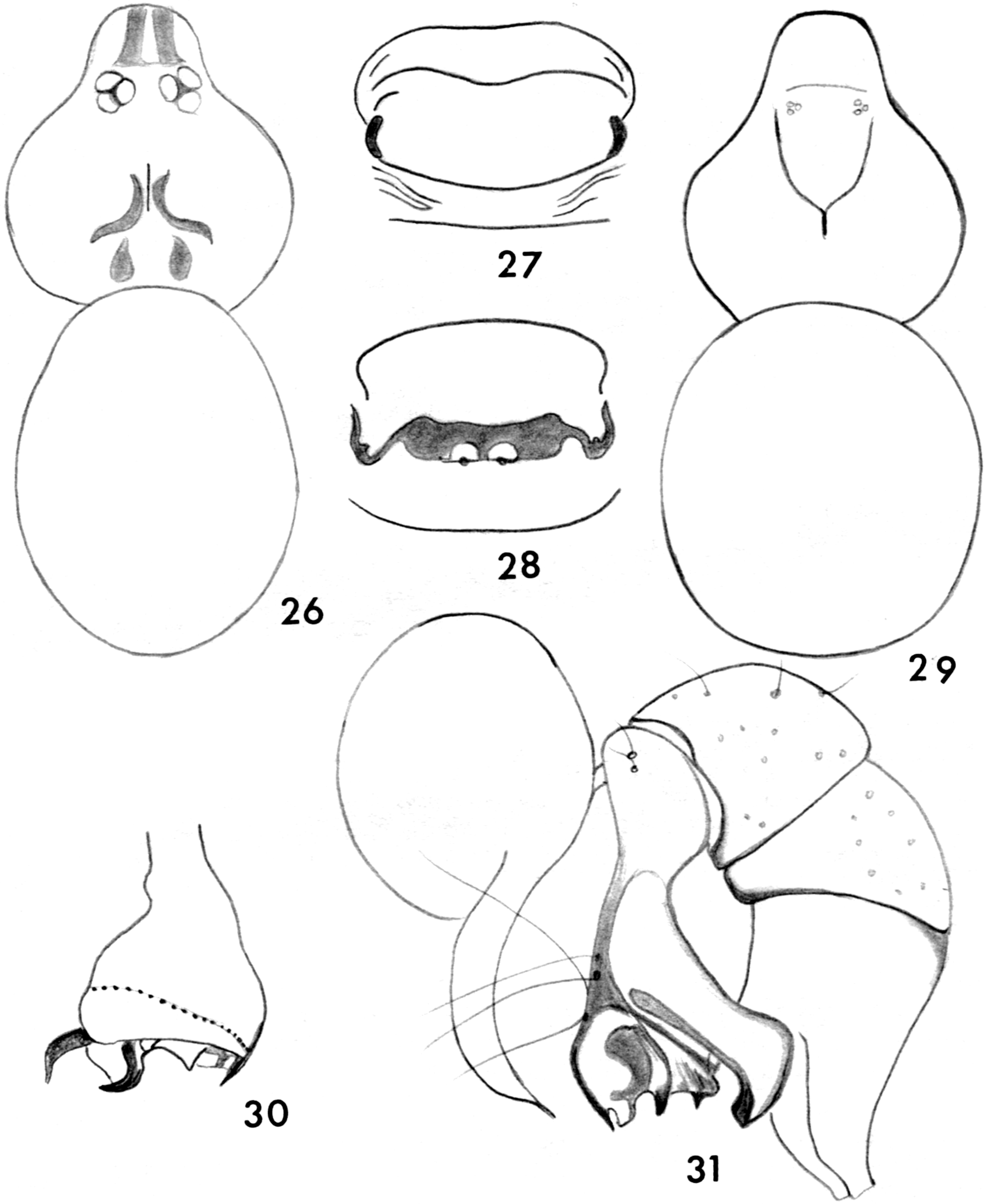
Type-data.—Female holotype, three juveniles from Cueva de Oxtalja, Tamapatz, San Luis Potosí, México, 18 March 1983 (C. Atkinson, D. Whitis, B. Wilson), in AMNH.

Distribution.—Known only from above specimens.

Metagonia modesta, new species
Fig. 25

Metagonia amica: Gertsch, 1971:85, fig. 136 (not Figs. 115-116, male).

Diagnosis.—Troglophile species from Cueva de



Figs. 26-31.—Species of *Metagonia*: Fig. 26: *M. faceta*, male, carapace and abdomen, dorsal view. Figs. 27-29: *M. puebla*, female: 27, epigynum, ventral view; 28, epigynum, dorsal view; 29, carapace and abdomen, dorsal view. Figs. 30-31: *M. faceta*, male palpus: 30, tarsal process, prolateral view; 31, retrolateral view.

Poca Ventana with distinctive epigynum (Fig. 25). Male unknown.

Etymology.—Specific name from Latin *modestus*, moderate.

Description.—Female holotype: Length 2.3 mm. Carapace 0.9 mm long, 0.8 mm wide. Abdomen 1.4 mm long, 0.9 mm wide. Cephalothorax and appendages whitish to pale yellow; carapace with dusky smudges on pars thoracica; eyes narrowly ringed with black; abdomen whitish. Pars cephalica convex with eyes on sessile triads; eyes subequal in size, about 0.09 mm each, with anterior laterals separated by nearly two diameters and posterior medians separated by diameter. Abdomen suboval, broadly rounded behind. First leg: femur 4.3 mm, patella 0.3 mm, tibia 4.6 mm, metatarsus 7 mm, tarsus 1.4 mm; total length 17.6 mm; first leg 19 times, first femur about 5 times as long as carapace.

Epigynum (Fig. 25) strongly rounded behind, with tubules and receptacles near front end.

Type-data.—Female holotype from Cueva de Poca Ventana, 1 km W Xilitla, San Luis Potosí, México, January 1969 (T. Raines), in AMNH.

Distribution.—Known only from above specimen.

Metagonia coahuila Gertsch

Metagonia coahuila Gertsch, 1971:91. Brignoli, 1983: 163.

Type-data.—Female holotype from Cueva de Cuevacillas, 16 km NE of Arteaga, Coahuila, México, 26 July 1965 (J. Reddell, J. Fish), in AMNH.

Distribution.—Known from three caves of Coahuila.

New record.—MEXICO: *Coahuila*: Pozo de El Potrero, 10 km SE Músquiz, 24 June 1965 (J. Reddell), 2 immature females on ceiling.

Metagonia placida Gertsch

Metagonia placida Gertsch, 1971:91. Brignoli, 1983: 183.

Type-data.—Male holotype from Cueva de la Boca, 6 km SE of Villa Santiago, Nuevo León, México, 13 July 1942 (C. Bolívar), in AMNH.

Distribution.—Caves of Nuevo León.

New records.—MEXICO: *Nuevo León*: La Cueva de la Boca, 6 km SW Villa Santiago, 10 February 1973 (C. McConnell), male, immature; 17 February 1973 (W. Graham), male; 1 May 1966 (J. Fish, E. Alexander), male, immature. Cueva de Chorros de Agua, 3 km W Montenegro, 19 June 1969 (S. and J. Peck), male, 5 females. Resumidero de Pablillo, Hacienda Pablillo, near Galeana-Doctor Arroyo, 4 June 1966 (J. Reddell), penultimate male.

Metagonia serena Gertsch

Metagonia serena Gertsch, 1971:88. Brignoli, 1983: 163.

Type-data.—Male holotype from Grutas de García, Nuevo León, México, 19 September 1942 (C. Bolívar), in AMNH.

Distribution.—Known only from Grutas de García.

Metagonia faceta, new species
Figs. 26, 30-31

Diagnosis.—Large troglophile from Cueva Pajaritos with brown pattern on carapace (Fig. 26) and distinctive palpus (Figs. 30-31). Female unknown.

Etymology.—Specific name from Latin *facetus*, elegant.

Description.—Male holotype: Length 3.1 mm. Carapace 1.35 mm long, 1.25 mm wide. Abdomen 2 mm long, 1.6 mm wide. Base color of cephalothorax and appendages pale yellow; carapace with brown pattern (Fig. 26) on pars cephalica and dark eyes narrowly ringed with black; sternum with small triangular mark next to each coxa; patellae and tips of leg segments with brown rings and faint dusky rings near ends of femora. Abdomen gray; dorsum with many blusih spots showing through integument; venter pale. Eyes of medium size with triads close together, eyes subequal, each about 0.11 mm in long diameter; lateral eyes separated by more than diameter (11/9); posterior medians separated by third of diameter. Chelicera with about 20 spinules forming three irregular rows from base to apex. Abdomen elongate oval, broadly rounded behind. First leg: femur 10 mm, patella 0.7 mm, tibia 10 mm, metatarsus 17.5 mm, tarsus 1.8 mm; total length 40 mm; first leg 30 times, first femur 7.3 timas as long as carapace.

Male palpus (Figs. 30-31) with broad hinged accessory process broadly curved at apex.

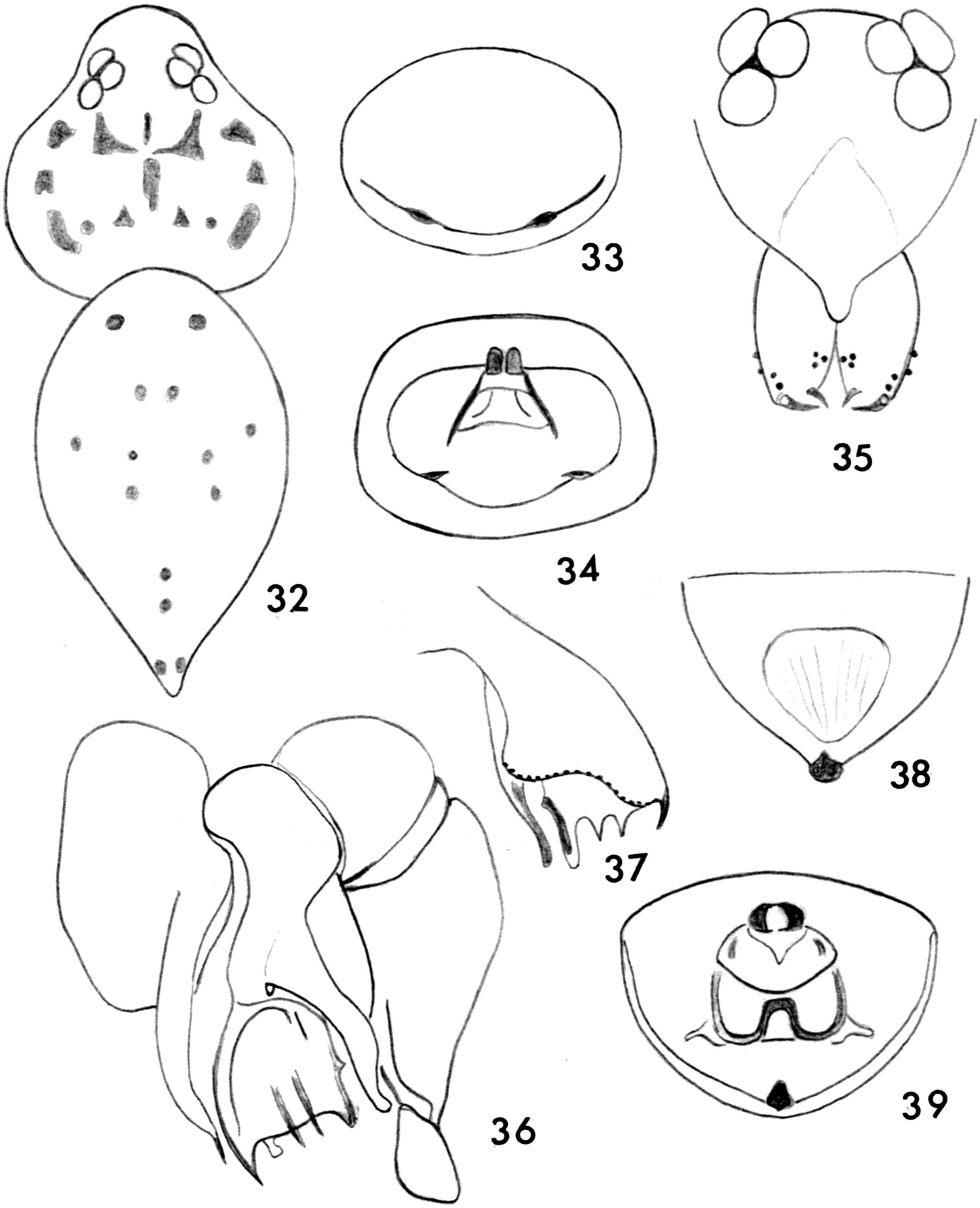
Type-data.—Male holotype from Cueva Pajaritos, Nuevo León, México, 29 August 1973 (R. Jameson, D. McKenzie), in AMNH.

Distribution.—Known only from above specimen.

Metagonia candela Gertsch

Metagonia candela Gertsch, 1971:90. Brignoli, 1983: 163.

Type-data.—Male holotype from Cueva del Carrizal, near La Candela, Nuevo León, México, 16 July 1942 (C. Bolívar, F. Bonet), in AMNH.



Figs. 32-39.–Species of *Metagonia*: Figs. 32-37: *M. bella*: 32, carapace and abdomen of female, dorsal view; 33, epigynum, ventral view; 34, dorsal view; 35, frontal view of male; 36, left male palpus, retrolateral view; 37, tarsal process of left male palpus, prolateral view. Figs. 38-39: *M. belize*, epigynum: 38, ventral view; 39, dorsal view.

Distribution.—Known only from two caves in Nuevo León.

New record.—MEXICO: *Nuevo León*: Unnamed cave, 4 km W Bustamante, 30 September 1972 (Paul Duncan), male.

Metagonia maximiliani Brignoli

Metagonia maximiliani Brignoli, 1972:141: 1983: 163.

Type-data.—Male holotype from Cueva del Madroño, El Jobo, Querétaro, México, 17 November 1969 (R. Argano, V. Sbordoni), in Zoological Institute, University of Rome.

Distribution.—Known only from Cueva del Madroño.

Metagonia atoyacae Gertsch

Metagonia atoyacae Gertsch, 1971:87. Brignoli, 1983:163.

Type-data.—Male holotype from Grutas de Atoyac, Atoyac, Veracruz, México, 13 November 1931 (C. Bolívar, F. Bonet), in AMNH.

Distribution.—Known only from caves of Veracruz.

New records.—MEXICO: *Veracruz*: Grutas de Atoyac, 2 km E Atoyac, 21 December 1972 (D. McKenzie), female; 19 July 1953 (C. J. Goodnight), 4 females. Cueva de Corral de Piedra, 3 km SE Corral de Piedra, 5 January 1977 (J. Reddell, A. Grubbs, C. Soileau, D. McKenzie), 4 females, immature. Cueva del Nacimiento Grande, 10 km N Potrero Viejo, 29 August 1965 (J. Reddell, J. Fish, W. Bell), 1 female, no abdomen.

Metagonia bella, new species
Figs. 32-37

Diagnosis.—Epigean species from Veracruz with spotted legs and caudate abdomen, distinguished by male palpus (Figs. 36-37) and epigynum (Figs. 33-34).

Etymology.—Specific name from Latin *bellus*, pretty, handsome.

Description.—Female holotype: Length 3 mm. Carapace 1 mm long, 0.8 mm wide. Abdomen about 1.5 mm long and wide. Base color of cephalothorax and appendages grayish to dull yellow; carapace (Fig. 32) with series of small dusky spots and narrow dusky rings around eyes; sternum unmarked: patellae of legs dusky and all femora with six, all tibiae with four black spots of variable size on their venters; abdomen grayish with two rows of tiny spots above and single spot below close behind spinnerets. Eyes large, subequal in size, each about 0.1 mm in long diameter; anterior lateral eyes separated by two diameters, posterior medians by one diameter. Abdomen longer than broad, rounded in front and on side, produced behind into elevated triangular, caudate projection drawn to fine point, its tip above the spinnerets distance as long as abdomen. First leg: femur 3.2 mm, patella 0.35 mm, tibia 3.3 mm, metatarsus 4.5 mm, tarsus 1 mm; total length 12.35 mm; first leg 12 times, first femur 3 times as long as carapace.

Epigynum (Figs. 33-34) broader than long, rounded behind and in ventral view presenting no distinctive markings.

Male: Length 2.1 mm. Carapace 0.85 mm long, 0.8 mm wide. Abdomen 1.35 mm long, 0.8 mm wide. Coloration and structure like those of female. Chelicera smooth with cluster of four brownish spinules on inner side near apex and two additional ones nearer apex on outer side. Abdomen moderately elevated. First leg: femur 3.8 mm, patella 0.25 mm, tibia 3.6 mm, metatarsus 4.5 mm, tarsus 1 mm; total length 13.15 mm; first leg 13 times, first femur 3.8 times as long as carapace.

Male palpus (Figs. 36-37) with accessory process gradually narrowed to apex: apical lobe broad with few apical spines.

Type-data.—Female holotype from tropical forest at Córdoba, Veracruz, México, 30 July 1965 (R. X. Schick, D. Schroeder), in AMNH.

Distribution.—Known only from Córdoba.

Record.—MEXICO: *Veracruz*: Córdoba, 13 May 1946 (J. C. and D. L. Pallister), male.

Metagonia martha Gertsch

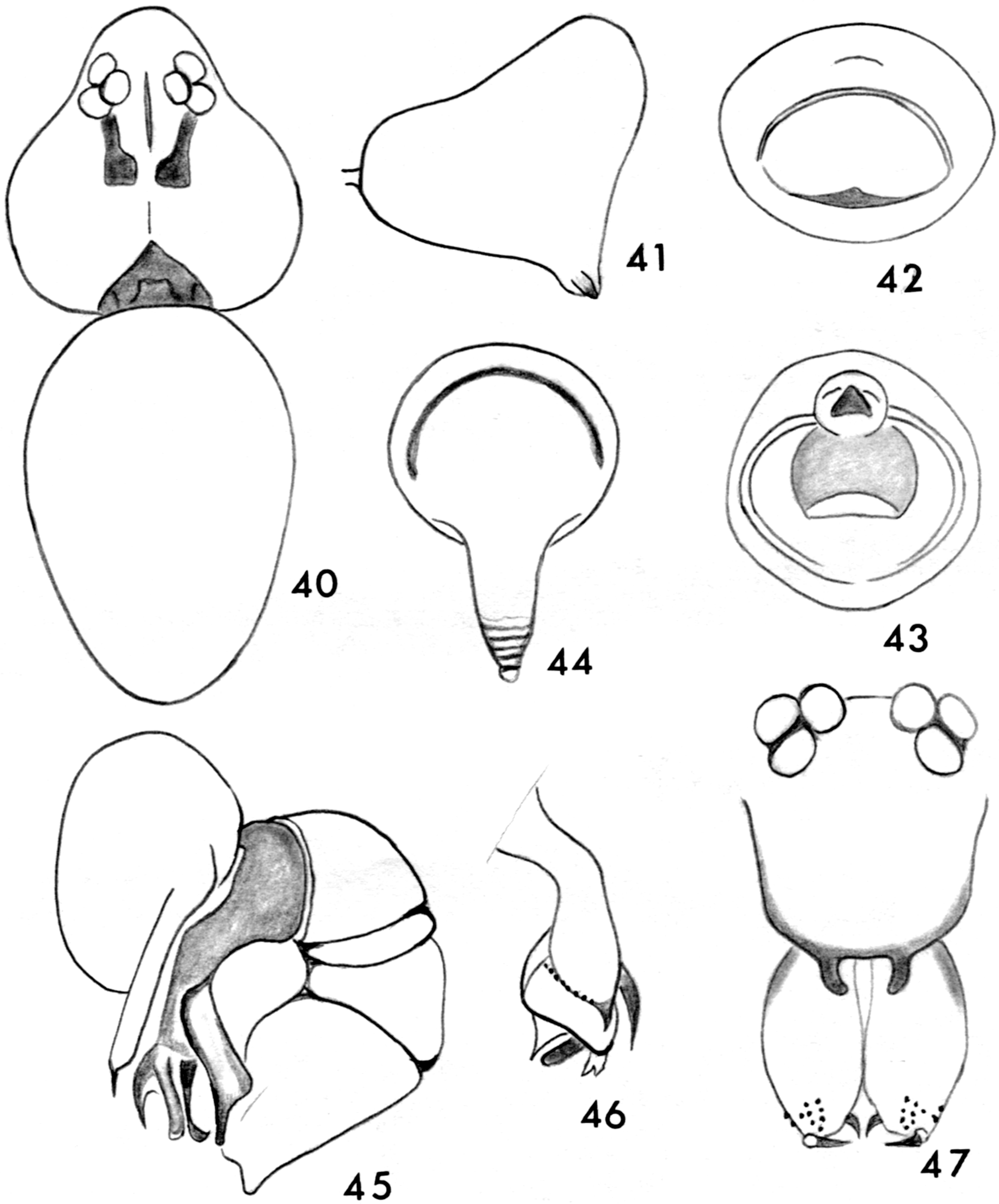
Metagonia martha Gertsch, 1973:153. Brignoli, 1983: 163.

Type-data.—Female holotype, troglobite with rudimentary eyes, from Cueva del Nacimiento del Río San Antonio, 10 km SW Acatlán, Oaxaca, México, 26 December 1972 (J. Reddell, D. and M. McKenzie, S. Murphy), in AMNH.

Distribution.—Known only from above specimen. Male unknown.

Metagonia puebla, new species
Figs. 27-29

Diagnosis.—Essentially eyeless troglobite from Grutas de Atepolihuit with distinctive epigynum (Figs. 27-28). Male unknown.



Figs. 40-47.—Species of *Metagonia*: Figs. 40-43: *M. modica*, female: 40, carapace and abdomen, dorsal view; 41, abdomen, lateral view; 42, epigynum, ventral view; 43, epigynum, dorsal view. Fig. 44: *M. cara*, epigynum, ventral view. Figs. 45-47: *M. rica*, male: 45, left male palpus, retrolateral view; 46, tarsal process, prolateral view; 47, frontal view of male.

Etymology.—Specific name from Spanish *puebla*, town, people, named for state of Puebla.

Description.—Female holotype: Length 1.5 mm. Carapace 1 mm long, 0.7 mm wide. Abdomen 1.2 mm long, 1 mm wide. Dorsal view of carapace and abdomen shown in Fig. 29. Base color of cephalothorax and appendages pale yellow with brown tinting at junctures of sclerites, chelicerae and patellae of legs; abdomen gray. Carapace longer than broad; pars cephalica with eye tubercle obsolete and eyes present as small whitish vestiges. Abdomen subglobose, broadly rounded behind. First leg: femur 4.7 mm, patella 0.3 mm, tibia 5 mm, metatarsus 7.7 mm, tarsus 1.7 mm; total length 19.4 mm; first leg 19 times, first femur 4.7 times as long as carapace.

Epigynum (Figs. 27-28) broader than long, with posterior margin slightly curved and pair of receptacles at middle.

Type-data.—Female holotype from Grutas de Atepolihuit, 5 km SW Cuetzalan, Puebla, México, 18 December 1976 (J. Reddell, D. McKenzie, C. Soileau), in AMNH.

Metagonia mcnatti Gertsch

Metagonia mcnatti Gertsch, 1971:91. Brignoli, 1983: 163.

Type-data.—Troglophile female holotype from Cueva de los Pinos, Tuxtla Gutiérrez, Chiapas, México, 19 August 1967 (J. Reddell, J. Fish, T. R. Evans), in AMNH.

Distribution.—Known from two caves in Chiapas.

Metagonia goodnighti Gertsch

Metagonia goodnighti Gertsch, 1977:106. Brignoli, 1983:163.

Type-data.—Male holotype from Finca Cuahtemoc, Cacahuatán, Chiapas, México, 5 August 1950 (C. and M. Goodnight), in AMNH.

Distribution.—Epigean species of Chiapas.

Metagonia torete Gertsch

Metagonia torete Gertsch, 1977:108. Brignoli, 1983: 164.

Type-data.—Male holotype from Cueva Sodzil, 5 mi. W Sucopo, Yucatán, México, 31 March 1973 (J. Reddell, M. McKenzie, S. Murphy), in AMNH.

Distribution.—Probable troglobite of Yucatán caves.

Metagonia chiquita Gertsch

Metagonia chiquita Gertsch, 1977:109. Brignoli, 1983:163.

Type-data.—Female holotype from Cenote Chen Mul, Ruinas de Mayapán, Yucatán, México, 2 May 1973 (J. Reddell, R. W. Mitchell), in AMNH.

Distribution.—Eyeless female known only from cited cave.

Metagonia yucatana Chamberlin and Ivie

Metagonia yucatana Chamberlin and Ivie, 1938:132. Gertsch, 1977:110.

Metagonia yucatanensis Bonnet, 1957:2808. (Unjustified emendation)

Metagonia viabilis Chamberlin and Ivie, 1938:133. Bonnet, 1957:2808.

Type-data.—Male holotype of *yucatana* from Loltún Cave near Nakab Mouth, Oxkutzcab, Yucatán, 26 July (A. S. Pearse), in AMNH. Female holotype of *viabilis* from inner part of Ziz Cave, Oxkutzcab, Yucatán, México, 24 July (A. S. Pearse), in AMNH.

Distribution.—Epigean and cavernicole species of Yucatán and Chiapas.

Metagonia maya Chamberlin and Ivie

Metagonia maya Chamberlin and Ivie, 1938:132. Bonnet, 1957:2808. Gertsch, 1977:109.

Type-data.—Male holotype from Chac Mol Cave, Tohil, Yucatán, México, in AMNH.

Distribution.—Caves of Yucatán; possible troglobite.

Metagonia iviei Gertsch

Metagonia iviei Gertsch, 1977:112. Brignoli, 1983: 163.

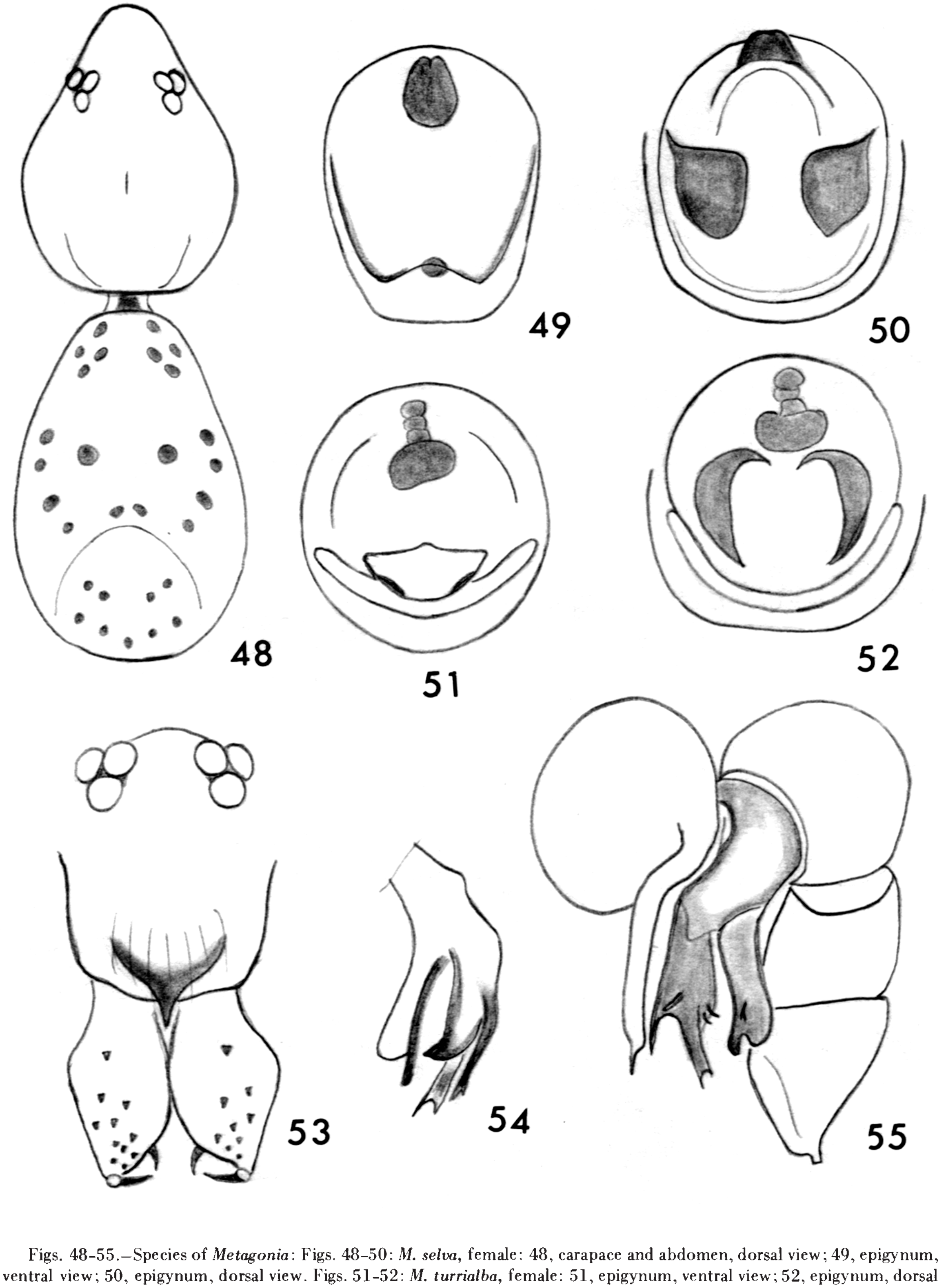
Type-data.—Female holotype from Quarried Cave, N of Champotón, Campeche, México, 27 August 1972 (R. W. Mitchell, W. Russell, J. Cooke), in AMNH.

Distribution.—Yucatán and Campeche.

New record.—MEXICO: *Campeche*: Ruins of Chicanná, Xpujil, male, 2 females.

The Central American and West Indian Faunas

The 11 species of *Metagonia* so far known from Central America represent a meager sample of what may eventually be found to be a more representative fauna of a little exploited area with a wide range of habitats. The first known species, *panama* of this



Figs. 48-55.—Species of *Metagonia*: Figs. 48-50: *M. selva*, female: 48, carapace and abdomen, dorsal view; 49, epigynum, ventral view; 50, epigynum, dorsal view. Figs. 51-52: *M. turrialba*, female: 51, epigynum, ventral view; 52, epigynum, dorsal view. Figs. 53-55: *M. selva*, male: 53, frontal view; 54, tarsal process of left male palpus, prolateral view; 55, left male palpus, retrolateral view.

paper, was collected in large numbers by the late Dr. A.M. Chickering and other biologists on Barro Colorado Island; the taxon was misidentified as *caudata* by Nathan Banks and various cataloguers. The probable wealth of the Central American fauna may be better indicated by the eight specimens from a limited area of Costa Rica herein regarded as four well marked species.

The Central American *Metagonia* are represented by sexes as follows: four males are assigned to associated females; one male is without known female; and five females are without known males. The five known cavernicoles come from countries bordering Mexico and differ little from those of that fauna in general appearance. The only eyeless taxon, *jarmila* of Belize, may indicate only a limited number of caves or investigation of them. The remaining Central American taxa are all epigean types collected by sweeping of foliage. In general they are larger, more brightly and distinctively marked, and often with very long thin legs.

The single *Metagonia* from the West Indies, *jamaica*, is a stereotype of species of the Mexican fauna.

Metagonia belize, new species
Figs. 38-39

Diagnosis.—Troglophile species from Belize with widely separated triads of eyes and distinctive epigynum (Figs. 38-39).

Etymology.—Specific name for the country of Belize, used in apposition.

Description.—Female holotype: Length about 2 mm. Carapace 0.9 mm long, 0.75 mm wide. Abdomen mostly lost. Carapace brown, without pattern; eyes narrowly ringed with black; legs yellowish with brownish patellae. Eyes of medium size, subequal, each about 0.6 mm in long diameter, set in widely separated triads on short tubercles; anterior lateral eyes separated by five diameters; posterior row strongly recurved, with median eyes separated by less than three diameters. First and second legs missing. Third leg: femur 2.25 mm, patella 0.25 mm, tibia 1.8 mm, metatarsus 2.75 mm, tarsus 0.75 mm; total length 7.8 mm.

Epigynum (Figs. 38-39) broader than long, widely curved behind where produced into small corneous lobe; internal receptacles near front.

Type-data.—Female holotype from unnamed fissure near Mountain Cow Cave, Cayo District, Belize, May 1977 (L. McNatt), in AMNH.

Distribution.—Known only from damaged specimen.

Metagonia jarmila Gertsch

Metagonia jarmila Gertsch, 1973:154. Brignoli, 1983: 163.

Type-data.—Male holotype from Bucks Bypass Cave, Caves Branch, Belize, 14 August 1972 (S. Peck), in AMNH.

Distribution.—Eyeless troglobite known only from two Belize caves.

Metagonia cara, new species
Fig. 44

Diagnosis.—Troglophile species from Balam's Cave, Belize: epigynum (Fig. 44) with long apical projection. Male unknown.

Etymology.—Specific name from Latin *carus*, loved.

Description.—Female holotype: Length 3.25 mm. Carapace 1.25 mm long, 1.25 mm wide. Abdomen 2 mm long, 1.3 mm wide. Base color of cephalothorax and appendages pale yellow to whitish; pars thoracica with median black markings on base; eyes narrowly ringed with black; legs with brownish marks on patellae and tips of all tibiae; abdomen grayish, without darker pattern. Carapace moderately convex, as broad as long; pars cephalica with eye triads separated by long diameter of anterior median eye. Abdomen suboval, of medium height, broadly rounded behind. First leg: femur 7.5 mm, patella 0.7 mm, tibia 8 mm, metatarsus 13 mm, tarsus 2.5 mm; total length 31.7 mm; first leg 25 times, first femur 6 times as long as carapace.

Epigynum (Fig. 44) with tubular process projecting at right angles to abdomen.

Type-data.—Female holotype from Balam's Cave (Uchen Balam), Cayo District, Belize, 23-26 March 1979 (L. McNatt), in AMNH.

Distribution.—Known from single female example.

Metagonia striata Schmidt

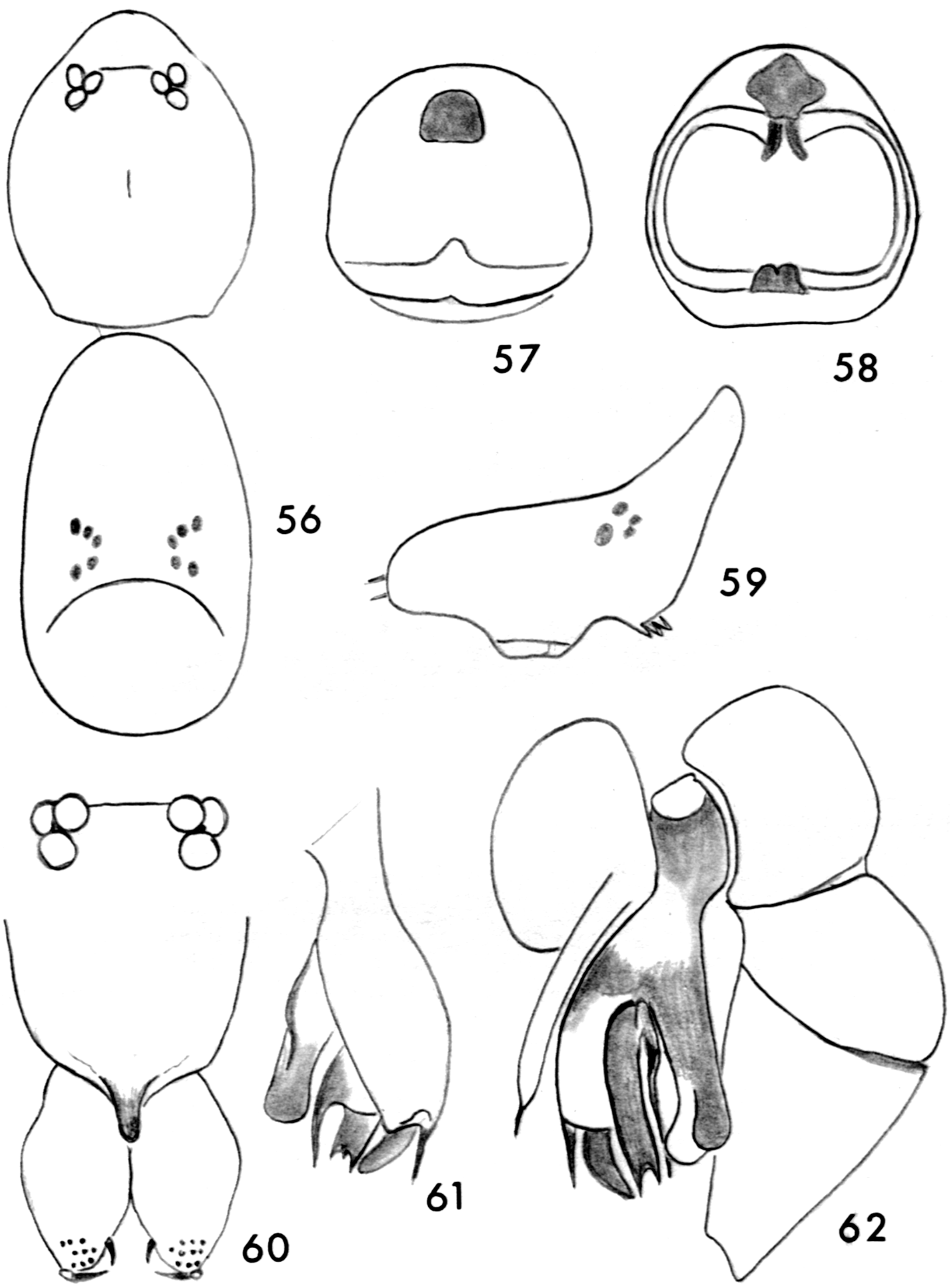
Metagonia striata Schmidt, 1971:425. Brignoli, 1983:163.

Type-data.—Female holotype and immature from Guatemala, in Hamburger Zoologischen Museum.

Distribution.—Known only from above specimens intercepted in Hamburg from Guatemala banana shipment.

Metagonia modica, new species
Figs. 40-43

Diagnosis.—Epigean species from Guatemala with pattern of brown lines on pars cephalica, triangular



Figs. 56-62.—*Metagonia osa*: 56, carapace and abdomen of female, dorsal view; 57, epigynum, ventral view; 58, epigynum, dorsal view; 59, abdomen of female, lateral view; 60, frontal view of male; 61, tarsal process of left male palpus, prolateral view; 62, left male palpus, retrolateral view.

abdomen, and distinctive epigynum (Figs. 42-43). Male unknown.

Etymology.—Specific name from Latin *modicus*, moderate.

Description.—Female holotype: Length 2.5 mm. Carapace 1 mm long, 0.8 mm wide. Abdomen 1.5 mm long, 1 mm wide. Base color of cephalothorax and appendages yellow; carapace (Fig. 40) with pattern of three dark stripes behind eyes and dusky median patch on pars thoracica; legs pale but patellae and tips of tibiae with brown rings; abdomen grayish. Eyes of medium size, each about 0.1 mm in long diameter; anterior lateral eyes separated by two diameters, posterior lateral eyes by two diameters. Abdomen (Fig. 41) longer than broad, subtriangular, as high as long, produced at tip to rounded lobe. First leg missing. Second leg: femur 3.3 mm, patella 0.3 mm, tibia 2.7 mm, metatarsus 4 mm, tarsus 1.85 mm; total length 12.15 mm; second leg 12 times, second femur 3.3 times as long as carapace.

Epigynum (Figs. 42-43) broader than long, with oval pattern in ventral view, and showing dusky receptacles in dorsal view.

Type-data.—Female holotype from Capetilla, Guatemala, 20 August 1947 (C. and P. Vaurie), in AMNH.

Distribution.—Known from single female.

Metagonia blanda Gertsch

Metagonia blanda Gertsch, 1973:152. Brignoli, 1983: 163.

Type-data.—Female holotype from Gruta de Silvino, Izabal, 34 km W Puerto Barios, Guatemala, 20-22 August 1969 (S. and J. Peck), in AMNH.

Distribution.—Known from four Guatemala caves.

Metagonia selva, new species
Figs. 48-50, 53-55

Diagnosis.—Epigean species with abdomen with numerous small black spots; epigynum (Figs. 49-50); accessory process of male palpus (Fig. 55) bifid at apex.

Etymology.—Specific name from Spanish *selva*, forest, after Finca La Selva.

Description.—Female: Length 3.4 mm. Carapace 1.4 mm long, 1.1 mm wide. Abdomen 2 mm long, 1 mm wide. Base color of cephalothorax and appendages whitish to pale yellow. Abdomen (Fig. 48) gray; dorsum with series of small black spots. Eyes large with triads separated by 1.5 times diameter of anterior median eye. Abdomen strongly elevated to form high, apically rounded tubercle. Legs fragmented; fourth leg: femur 4.5 mm, patella 1 mm, tibia 3.6 mm, metatarsus 4.5 mm, tarsus 1 mm; total length 14.6 mm; fourth leg 10.5 times, fourth femur 3.2 times as long as carapace.

Epigynum (Figs. 49-50) longer than broad with ventral and dorsal patterns distinctive.

Male holotype: Length 3.7 mm. Carapace 1.5 mm long, 1.2 mm wide. Abdomen 2.2 mm long, 1.1 mm wide. Coloration and structure like those of female. Eye triads separated by 1.5 times long diameter of anterior median eye. Clypeus broadly rounded and armed in front (Fig. 53) with single pointed horn. First leg: femur 5 mm, patella 0.5 mm, tibia 4.4 mm, metatarsus 5.8 mm, tarsus 1.5 mm; total length 17.2 mm; first leg 11.5 times, first femur 3.3 times as long as carapace.

Male palpus (Figs. 54-55): accessory process of tarsus bifid at apex.

Type-data.—Male holotype and two females from Finca La Selva (50 m elevation), Heredia, near Puerto Viejo, Costa Rica, January 1978 (W. Eberhard), in MCZ.

Distribution.—Known only from above material.

Metagonia osa, new species
Figs. 56-62

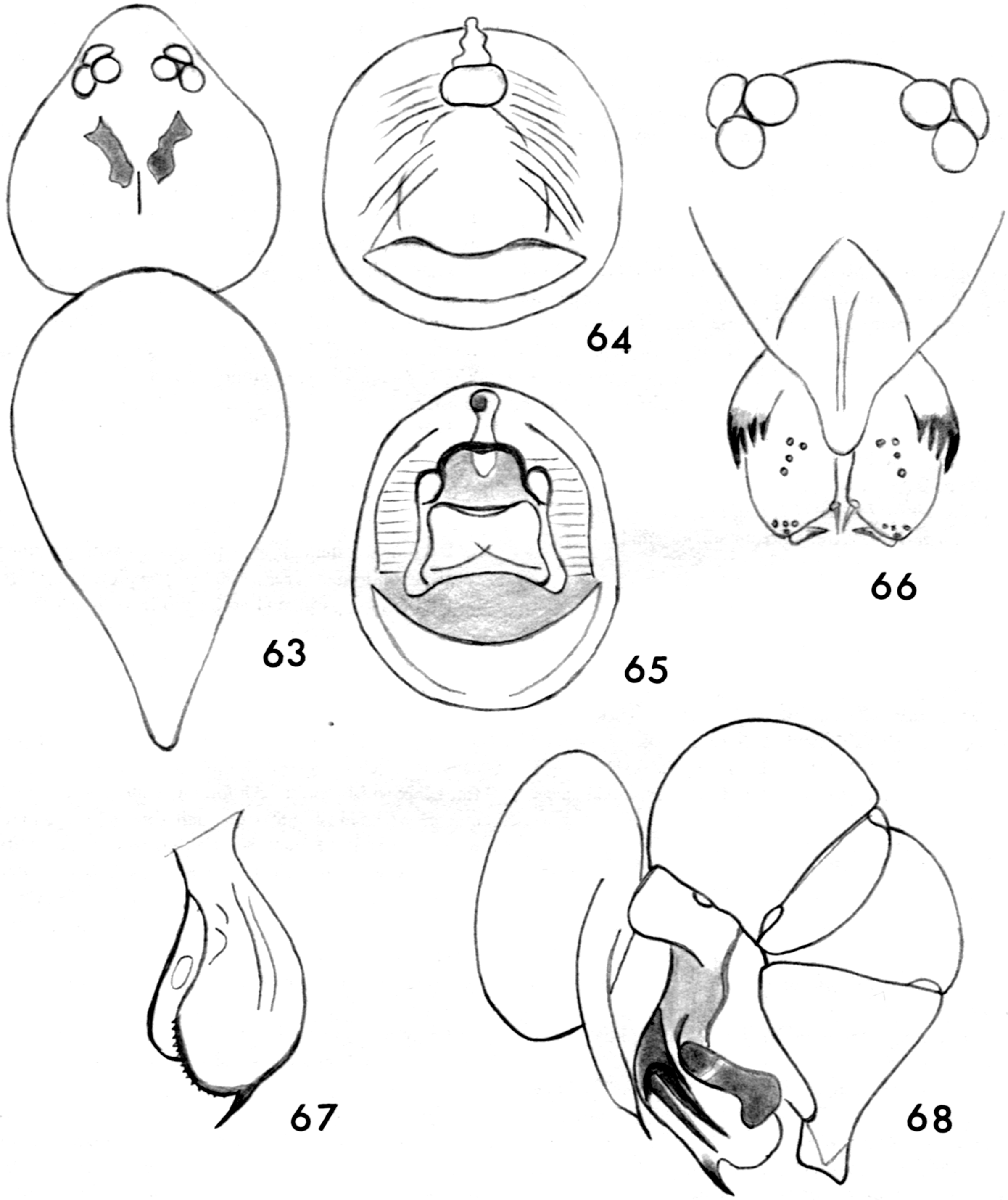
Diagnosis.—Slender epigean species with rounded caudate abdomen (Figs. 56, 59); epigynum (Figs. 57-58); male palpus (Figs. 61-62) with accessory process lobular at apex.

Etymology.—Named for the Osa Peninsula.

Description.—Female: Length 3.5 mm. Carapace 1.5 mm long, 1.3 mm wide. Abdomen 2 mm long, 1 mm wide. Base color of cephalothorax and appendages pale yellow; patellae and tips of tibiae with distinct brownish rings. Abdomen yellow with small cluster of blackish spots on each side below caudate projection (other female without spots and with much lower abdomen). Eyes large on triads separated by two diameters of anterior median eye. First leg: femur 7.7 mm, patella 0.8 mm, tibia 7.2 mm, metatarsus 13 mm, tarsus 2.5 mm; total length 31.2 mm; first leg 26 times, first femur 6.4 times as long as carapace.

Epigynum (Figs. 57-58) nearly as broad as long; large anterior receptacles visible in ventral and dorsal views.

Male holotype: Length 4 mm. Carapace 1.5 mm long, 1.4 mm wide. Abdomen 2.7 mm long, 1.5 mm wide. Coloration like that of female; abdomen without blackish spots on dorsum. Clypeus (Fig. 60) with single apically rounded horn. First leg: femur 9.5 mm, patella 1.2 mm, tibia 9 mm, metatarsus 14 mm, tarsus 2.5 mm; total length 26.2 mm; first leg 17.5 times, first femur 6.3 times as long as carapace.



Figs. 63-68.—*Metagonia panama*: 63, carapace and abdomen of female, dorsal view; 64, epigynum, ventral view; 65, epigynum, dorsal view; 66, frontal view of male; 67, tarsal process of left male palpus, prolateral view; 68, left male palpus, retrolateral view.

Male palpus (Figs. 61-62): heavy accessory process lobed and enlarged at apex.

Type-data.—Male holotype and two females from 2.5 km SW Rincón, Osa Peninsula, Puntarenas Province, Costa Rica, 8-12 March 1967, in MCZ.

Distribution.—Known only from above specimens.

Metagonia rica, new species
Figs. 45-47

Diagnosis.—Epigean forest species sympatric with *selva*; clypeus with two horns (Fig. 47); male palpus (Fig. 45). Female unknown.

Etymology.—Specific name from Spanish *rico*, rich, pleasing, noble, having reference to Costa Rica.

Description.—Male holotype: Length 3.5 mm. Carapace 1.3 mm long, 1.1 mm wide. Abdomen 2.2 mm long, 1.3 mm wide. Coloration and structure like those of *turrialba*; pars cephalica with large eyes on well elevated pars cephalica, eye triads separated by one diameter of anterior median eye. Clypeus rounded, moderately inflated, armed in front with pair of small rounded horns. First leg: femur 6.7 mm, patella 0.6 mm, tibia 6.3 mm, metatarsus 10 mm, tarsus 1.5 mm; total length 25.1 mm; first leg 19 times, first femur 5 times as long as carapace.

Male palpus (Figs. 45-46): accessory process of tarsus drawn to slender finger at apex.

Type-data.—Male holotype from Finca La Selva, Heredia, near Puerto Viejo, Costa Rica, January 1978 (W. Eberhard), in MCZ.

Distribution.—Known only from above male.

Metagonia turrialba, new species
Figs. 51-52

Diagnosis.—Epigean species possible female of *rica*; first leg 4.6 times as long as carapace; epigynum (Figs. 51-52). Male unknown.

Etymology.—Named for the type-locality.

Description.—Female holotype: Length 3.9 mm. Carapace 1.4 mm long, 1.2 mm wide. Abdomen 2.5 mm long, 1.3 mm wide. Base color of cephalothorax and abdomen whitish to pale yellow; pars thoracica and cephalic grooves pale brownish; patellae and tips of tibiae of legs with brownish rings; abdomen gray with few small scattered dark spots. Eyes large with triads separated by only width of anterior median eye. Abdomen with caudal projection produced to narrow point. First leg: femur 6.5 mm, patella 1.3 mm, tibia 6 mm, metatarsus 9.5 mm, tarsus 2.5 mm; total length 25.8 mm; first leg 18 times, first femur 1.8 times as long as carapace.

Epigynum (Figs. 51-52) longer than wide with widely curved genital orifice.

Type-data.—Female holotype from Turrialba, Costa Rica, 25 July-15 August 1965 (A. M. Chickering), in MCZ.

Distribution.—Known only from above female.

Metagonia panama, new species
Figs. 63-68

Metagonia caudata: Petrunkevitch, 1911:159. Banks, 1929:56. Bonnet, 1957:2808.

Diagnosis.—Epigean species with prominent triangular projection of abdomen (Fig. 63); epigynum (Figs. 64-65); male palpus (Figs. 67-68).

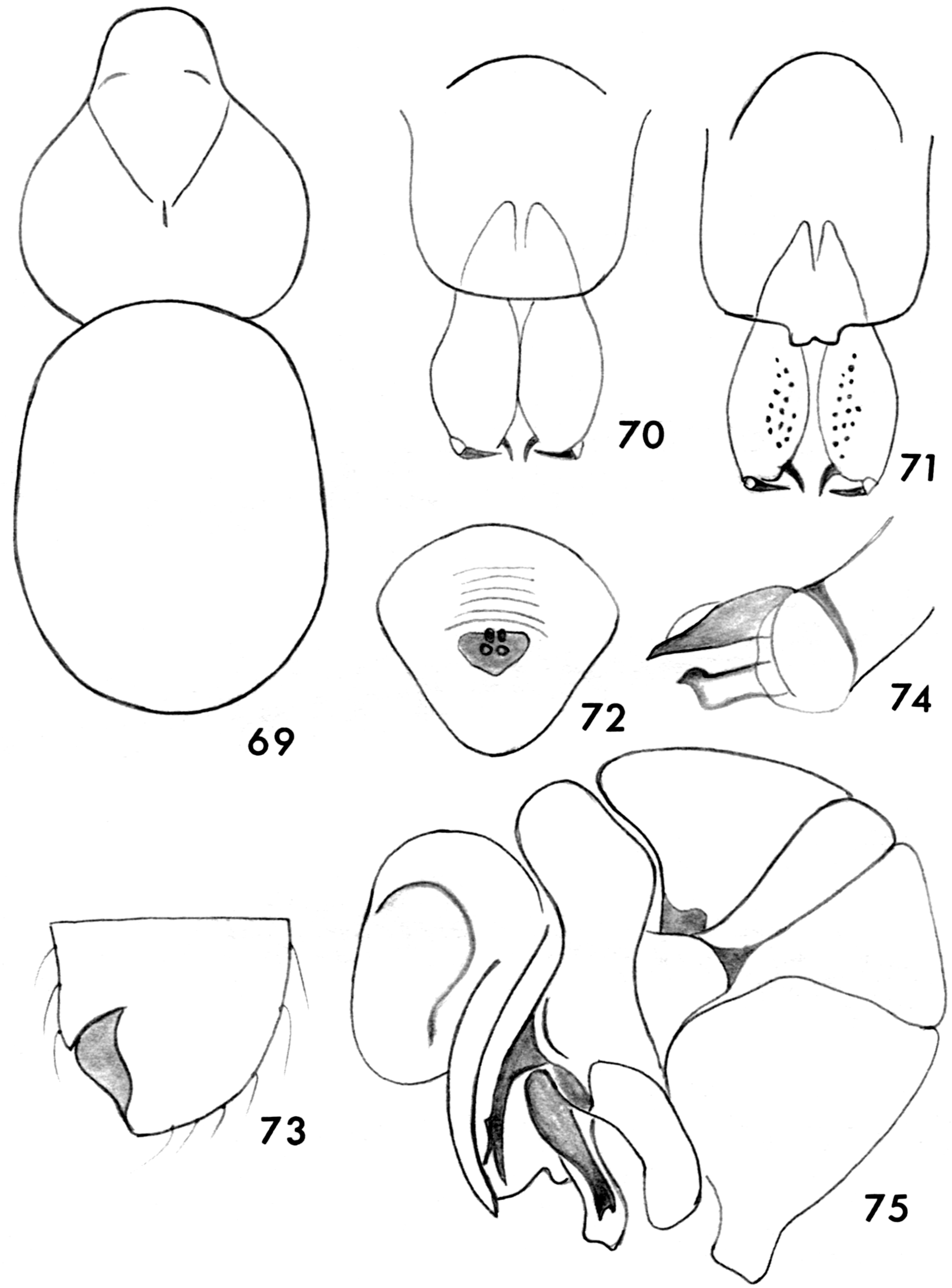
Etymology.—Named for the country of Panama.

Description.—Female holotype: Length 2.5 mm. Carapace 1 mm long, 0.8 mm wide. Abdomen 1.5 mm long, 1.3 mm wide. Base color of cephalothorax and appendages dull yellow; carapace with dark bar behind eyes (Fig. 63) on each side of pars cephalica and eyes narrowly ringed with black; sternum with dusky pattern; legs pale but patellae and tips of tibiae with brown rings; abdomen gray with faint dusky points on dorsum. Eyes of medium size, subequal, each about 0.7 mm in long diameter; anterior lateral eyes separated by three, posterior laterals by about four diameters. Abdomen longer than broad, produced behind into thin, apically pointed projection of variable height in individual specimens, forming acute, obtuse or longer triangle. First leg: femur 5.2 mm, patella 0.47 mm, tibia 5.2 mm, metatarsus 9 mm, tarsus 1.5 mm; total length 21.3 mm; first leg 21 times, first femur 5 times as long as carapace.

Epigynum (Figs. 64-65) broadly rounded behind, somewhat longer than broad, with complicated ventral and dorsal pattern of receptacles.

Male: Length 2.5 mm. Carapace 0.9 mm long, 0.8 mm wide. Abdomen 1.5 mm long, 0.75 mm wide. Coloration and structure essentially like those of female. Carapace usually without darker markings. Abdomen with or without series of small round spots at middle. Clypeus produced forward into conspicuous rounded process overhanging chelicerae (Fig. 66) which bears five stout spinules and series of four spines on middle face and others just above fang. Abdomen with bluntly pointed projection. First leg: femur 5.5 mm, patella 0.3 mm, tibia 5.25 mm, metatarsus 9 mm, tarsus 1.5 mm; total length 21.55 mm; first leg 24 times, first femur 6 times as long as carapace.

Male palpus (Figs. 67-68) with rounded tarsal lobe bearing stout retrolateral spur and single spike on prolateral side; hinged accessory process short, widely rounded at end.



Figs. 69-75.—*Metagonia jamaica*: 69, carapace and abdomen of female, dorsal view; 70, frontal view of female; 71, frontal view of male; 72, epigynum, ventral view; 73, epigynum, lateral view; 74, tarsal process of left male palpus, prolateral view; 75, left male palpus, retrolateral view.

Type-data.—Female holotype from Barro Colorado Island, Canal Zone, Panama, 3 April 1946 (T. S. Schneirla), in AMNH.

Distribution.—Widespread in Canal Zone of Panama.

Records.—PANAMA: *Canal Zone*: Barro Colorado Island, 5 February 1936 (W. J. Gertsch), males, females; 10 February 1936 (W. J. Gertsch), males; 20 April 1953 (A. M. Nadler), male; 20 March, 3 April 1946 (T. C. Schneirla), males, females; 1939-1965 (A. M. Chickering), numerous males, females, immature from Barro Colorado and many parts of Canal Zone.

Metagonia jamaica, new species
Figs. 69-75

Diagnosis.—Eyeless troglobite from Jackson Bay Cave, Jamaica, with distinctive genitalia: epigynum (Fig. 72); male palpus (Figs. 74-75).

Etymology.—Named for the country of Jamaica.

Description.—Female holotype: Length 2.5 mm. Carapace 1 mm long and wide. Abdomen 1.5 mm long, 1.4 mm wide. Base color of cephalothorax and appendages whitish to pale yellow with duskiness at junctures of sclerites, tips of chelicerae and patellae of legs; abdomen whitish. Carapace as broad as long; pars cephalica convex with ocular tubercles obsolete, without traces of eyes. Chelicerae essentially smooth. Abdomen suboval, about as broad as long, broadly rounded behind. First leg: femur 5.3 mm, patella 0.3 mm, tibia 6 mm, metatarsus 8.5 mm, tarsus 0.8 mm; total length 20.9 mm; first leg 21 times, first femur 5.3 times as long as carapace.

Epigynum (Figs. 72-73) with thick, inflated tubercular appendage rounded behind, with central dark figure at middle above.

Male: Length 2.5 mm. Carapace 0.85 mm long and wide. Abdomen 1.5 mm long, 1.1 mm wide. Coloration and structure like those of female. First leg: femur 5.5 mm, patella 0.4 mm, tibia 6 mm, metatarsus 9.8 mm, tarsus 1.5 mm; total length 23.3 mm; first leg 27 times, first femur 6.4 times as long as carapace. Clypeus with trivial bilobed projection at apex and series of small spinules from near base to near apex (Fig. 71).

Male palpus (Figs. 74-75) with three principal apical lobes.

Type-data.—Female holotype from Jackson Bay Cave, Clarendon Parish, Jamaica, 2 August 1974 (S. Peck), in AMNH courtesy of Dr. Peck.

Distribution.—Known only from Jackson Bay Cave.

Records.—JAMAICA: *Clarendon Parish*: Jackson Bay Cave, 2 August 1974 (S. Peck), male, 3 females, juvenile; 22 December 1972 (S. and J. Peck), male.

ACKNOWLEDGMENTS

The material on which this study is based has been made available by colleagues, students and friends whose names are listed with the locality information. I am grateful to the following Museum caretakers for loans of types and specimens under their care and for many special favors: Dr. Herbert W. Levi of the Museum of Comparative Zoology (MCZ), Harvard University, Cambridge, Massachusetts, for much material collected by the late Dr. A. M. Chickering in Panama and uncommon specimens from Costa Rica; Dr. Norman I. Platnick of the American Museum of Natural History (AMNH) in New York where, unless otherwise indicated, most of the material is deposited; and Dr. W. G. Reeder of the Texas Memorial Museum (TMM), University of Texas at Austin. Other important contributors were the following: Dr. Stewart Peck of Carleton University, Ottawa, Ontario, who donated a notable series of cavernicoles from Jamaica along with the eyeless *Metagonia jamaica*; and the late Mr. Wilton Ivie, collecting companion during various trips to Mexico. Finally, I mention the name of Mr. James Reddell of the Texas Memorial Museum at Austin who, with the aid of colleagues and friends during many years, has been responsible for exploiting the rich cave faunas of Mexico and Central America.

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MILLIPEDS FROM CAVES IN MEXICO AND CENTRAL AMERICA. V. NEW SPECIES AND RECORDS OF GLOMERIDAE, TRICHOPETALIDAE, CLEIDOGONIDAE, FUHRMANNODESMIDAE, CRYPTODESMIDAE, CAMBALIDAE, TYPHLOBOLELLIDAE, RHACHODESMIDAE, AND SPHAERIODESMIDAE

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ABSTRACT

This article is the fifth in a series based on collections made in Mexican and Central American caves by members of the Association for Mexican Cave Studies, the expeditions of the Zoological Institute of the University of Rome, Italy, and by Dr. Stewart Peck, Carleton University, Ottawa, Canada. In addition to the new records provided for species of the families listed in the title, the following new species are described: ***Glomeroides seamay***, ***G. sabinus***, ***G. comitan***, ***G. purulus***, ***G. maculatus***, ***G. chiapensis***, ***G. cooki***, ***G. pecki***, ***G. orator*** (Glomeridae), ***Mexiterpes sangregorio*** (Trichopetalidae), ***Cleidogona chac***, ***C. arco***, ***C. pochteca***, ***C. revilla***, ***C. coatlicue*** (Cleidogonidae), ***Sphaeriodesmus sprousei***, ***S. grubbsi***, ***S. iglesia***, ***S. robertsoni***, ***S. cotzalostoc***, ***S. rabonus***, ***S. sanjose***, and ***S. tortus*** (Sphaeriodesmidae). The new genus ***Pozodesmus*** (Fuhrmannodesmidae) is based on the new species ***Pozodesmus poco***. Some remarks on the taxonomy of *Glomeroides*, *Mexicambala* and *Sphaeriodesmus* are included.

INTRODUCTION

My fifth report in what is becoming a long series of papers on Mexican and Central American cave millipeds presents the results of studies of new material of the same families as described in Part IV, and adds the families Cryptodesmidae (newly, but not surprisingly, reported from Mexican caves), Cambalidae, Typhlobollelidae, and the subfamily Sphaeriodesminae of the family Sphaeriodesmidae. Records of two well known species of the family Rhachodesmidae are also presented. This new material came from the collections of the Association for Mexican Cave Studies, and from the Istituto Zoologica, Universitá di Roma.

As usual, a number of species collected on the surface in karst regions are included, as they bear on the relationships of troglophiles and troglobites.

PROJECTED FUTURE WORK

Even though the rhachodesmid millipeds are among the most frequently collected millipeds from Mexican caves, taxonomic problems there cannot be dealt with constructively outside the context of a revision of the entire family, now in progress.

AMCS collectors have likewise amassed many specimens in the spiroboloid families Atopetholidae, Messicobolidae, Spirobolidae, and Allopocockiidae. In my judgement, none of these families contain troglobitic species in Mexico, at least no troglobites have been taken so far in the hundreds of caves all over Mexico visited by biologists. These specimens are slowly being worked up and identified to whatever level possible, and eventually will be returned to the Texas Memorial Museum.

The knotty puzzles in the taxonomy of the Mexican and Central American Spirostreptidae are daunting indeed, but most of them have been created by hasty taxonomists–ignoring the literature and going entirely by specimens has resulted in some progress. However, at best only one or two Yucatán species of *Orthoporus* are troglobitic, so the treatment of the family would be out of place in a series devoted primarily to cave millipeds. But what a wonderful thesis topic *Orthoporus* and the other New World spirostreptids would be for a student eager to do something original in biogeography!

Perhaps the *summa difficilis* in the AMCS collections is presented by many collections of the genus *Rhysodesmus*, of the family Xystodesmidae. A recent immigrant to Mexico from the Appalachians of North America, this prolific genus found fertile soil in the subtropical and tropical forests and evidently has speciated exuberantly. At least we think that is what has happened–the male gonopods, upon which much of milliped taxonomy is based, are bewilderingly similar in what must be many different species of *Rhysodesmus*, judging from the body forms ranging from small, arched, narrow species through broader, flat ones to a few (i. e., *R. dasypus*) that are really gigantic, the largest known xystodesmids. Many names (more than 80) have been proposed, based on size, shape, and color differences, and when gonopods were illustrated at all, they were drawn from a variety of odd angles. Only Hoffman (1970), in a brief treatment of the genus which, however, goes a long way in making sense of the situation, carefully drew gonopods from the same angle for all species studied. There are either a lot of species of *Rhysodesmus* with relatively small ranges, or only a dozen or so widespread, polytypic species. Of interest in the present context is the question of the existence of troglobitic species. While unpigmented, soft-bodied, longlegged animals have been taken in caves in southern Tamaulipas and in Puebla, similar forms also have been found on the surface. Likewise, animals in full color and obviously not cave-adapted occur deep within food-rich tropical caves. Only when the species problems are sorted out can it perhaps be demonstrated that one, two, or several species of *Rhysodesmus* may be limited to caves.

The following abbreviations are used for collections in which specimens are deposited:

AMNH–American Museum of Natural History, New York
TMM–Texas Memorial Museum, The University of Texas at Austin
USNM–United States National Museum of Natural History, Smithsonian Institution, Washington, D.C.
ZIUR–Zoological Institute, University of Rome

TAXONOMY

ORDER GLOMERIDA

Family Glomeridae Leach

Genus *Glomeroides* Chamberlin

New species of this genus of small, rare glomerids continue to turn up in Mexican caves, and as they do, it becomes more difficult to identify them as such. Earlier (Shear, 1982) I have suggested that the hypogean species might all be related, in view of their general uniformity compared to the few known epigean species. This is probably not a tenable hypothesis biogeographically if one insists on a single or a few ancestral species. The distribution of the cave forms suggests as many as four separate origins.

In order to aid in the separation of material of the five known troglobitic species, I present a summary table (Table 1). I also want to document my previous statements about the epigean forms by redescribing the type-species of the genus as well as some new epigean species. Some important meristic characters of these epigean forms are given in Table 2.

It is difficult to differentiate species in the Glomeridae, though genera are usually distinct. With material available only from a few scattered collections, I have had no opportunity to assess intraspecific variation in all of the species described below. However, in the few cases where several specimens of each sex of a species were available, I found little variation in size and color pattern. For this reason, I have been guided by these characters in naming species. Nonetheless, some of my names might prove to be redundant.

The posterior leg complex of the male, used in mating as claspers, not gonopods, is quite uniform throughout the genus *Glomeroides*, except for variation in the degree of reduction of the seventeenth and eighteenth legs. These have lost more segments in some of the cave species, with leg 17 having two telopodite segments in *grubbsi*, *caecus*, and *promiscus*, while three would appear to be the typical number in the other cave species and all epigean species except the Californian *primus*, where there are four. The eighteenth legs always have four segments, except in *pellucidus*, in which there are five. Clearly this is a degenerating character of little value in establishing relationships among the species. However, the form of the last legs, the functional claspers, unites all the species. There is a mesal process on the second telopodite segments and sometimes a low, mesal swelling on the third (this is sometimes entirely absent). In the system proposed by Mauriés (1971), these characters would place *Glomeroides* near *Apiomeris* of Sumatra and *Onychoglomeris* of the western Alps. Mauriés places these genera in two different tribes, including *Onychoglomeris* and *Glomeroides* both in the Onychoglomerini. But there may be errors in Mauriés' system; *Onomeris* and *Trichomeris* are placed in separate tribes, but are in my opinion synonymous.

Glomeroides patei Shear

Glomeroides patei Shear, 1982:147, figs. 1-5.

New records.—*Nuevo León*: Sótano de las Tres Ventanas, Cuautemoc, 29 November 1981 (P. Fambro), female.

Tamaulipas: Cueva de las Papitas, 800 m SE of Revilla, 17 April 1980 (P. Sprouse, T. Treacy, D. Pate, D. Honea), male, female; Cueva de Guadalupe, 8 March 1981 (D.C. Rudolph, J.A. Matos, R. Collins), male. (all TMM)

Notes.—The specimens from Cueva de Guadalupe and Sótano de las Tres Ventanas have faint pigment on the antennae, head, and anterior part of the body. This species is now known from at least seven caves in the general area, and may occur in others.

Glomeroides caecus Causey

Glomeroides caecus Causey, 1964b:65, figs. 1-5.

New record.—*San Luis Potosí*: Sótano de Huitzmolotitla, 2 km NNW Xilitla, 4 April 1982 (Olga Kukal), males, females (TMM).

Glomeroides seamay, new species
Fig. 8

Diagnosis.—A probable troglobitic species differing from epigean ones in its light pigment, somewhat reduced ocelli, and small size. Distinct from previously described troglobites in its far southerly distribution, darker pigment, and more distinct ocelli.

Types.—Female holotype from Seamay (near Senahú), Alta Verapaz, Guatemala, collected June 1904 by O. F. Cook (USNM).

Etymology.—The species epithet, a noun in apposition, refers to the type-locality.

Description.—Female holotype: Total length 4.6 mm, width 1.8 mm. Head 1.17 mm long, 0.49 mm wide. Penultimate antennal segment 0.26 mm long, 1.10 mm wide. Structure (Fig. 8) typical. Ocelli 6 + 1, individual ocelli reduced in size, very lightly pigmented. Head and antennae entirely light colored, collum light with faint dusky border. Segment 2 with broad dusky band on posterior half, pale gray spots laterally. Segments 3 and 4 entirely light, segments 5-7 with faint dusky borders; on segment 6 the dusky border encloses two light spots; segments 8-11 entirely light. Pygidium light with faint paired dusky spots.

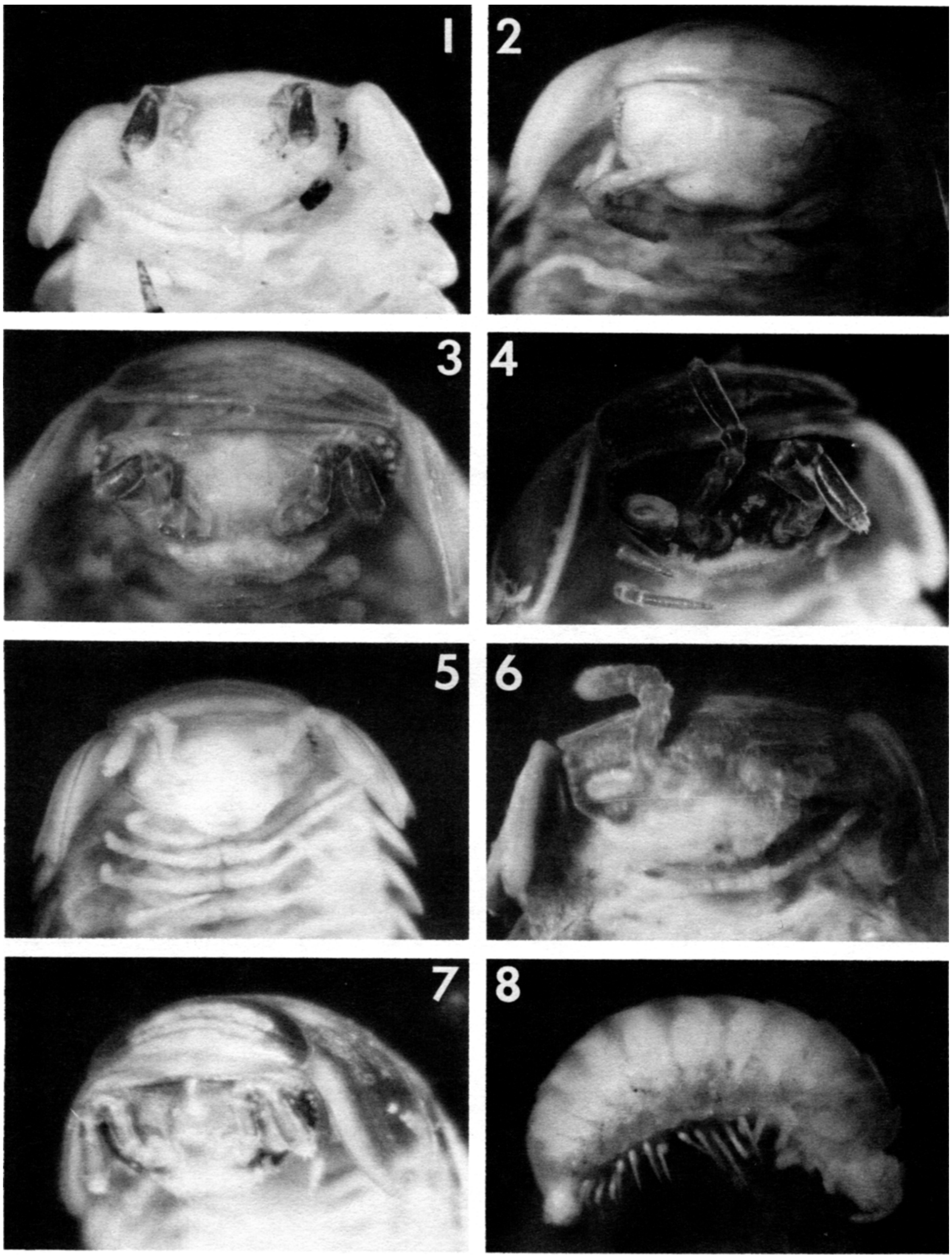
Male not collected.

Distribution.—Known only from the type-locality.

Notes.—This specimen was in the same vial with the *G. centralis* specimen from Seamay. As I pointed out in 1977, Seamay, near Senahú, is an area rich in caves. Visiting the region in 1904, Cook collected not only this glomerid species, but *Tridontomus procerus* Loomis and Hoffman and *Aenigmopus*

Table 1.—*Glomeroides* in Mexican and Guatemalan caves.

Species name	L/W	Ocelli	Pigment	♂ leg 17	♂ leg 18	Distribution
pellucidus Shear	4.2/2=2.1	4-5	none	3 segs., apical one long	5 subequal segs.	cave near Córdoba, Ver.
patei Shear	6.3/2.9= 2.17	5	none or slight?	3 segs.	4 segs.	Purificación area, Tamps.
grubbsi Shear	6.1/3.3- 1.86	0	none	2 segs.	4 segs.	Cuetzalan area, Pue.
addititius Causey	5.3/3=1.77	0	none (slight in ♀?)	3 segs., apical	4 segs.	cave near Tezonapa, Ver.
caecus Causey	7.3/3=2.4	0	none	2 segs.	4 segs.	Xilitla region, S.L.P.
promiscus Causey	4/2.2=1.8	5	none	2 segs.	4 segs.	Gómez Farías region, Tamps.
seamay, n.sp. (♀ only)	4.6/1.8= 2.56	7	slight	——	——	Senahú region, Guatemala



Figs. 1-7.—Anteroventral views of heads of *Glomeroides* species: 1, *G. sabinus,* male; 2, *G. centralis,* holotype male; 3, *G. maculatus,* male; 4, *G. comitan,* male; 5, *G. purulus,* male; 6, *G. orator,* male; 7, *G. cooki,* male. Fig. 8.—Lateral view of holotype female *G. seamay.*

Table 2.—Characteristics of some epigean *Glomeroides* species: Abbreviations: W = width; L = length; A seg = penultimate antennal segment.

Species	Width	Head L/W	A seg L/W	Head W/A seg L	Body W/Head W	Ocelli
sabinus ♂	4.47	0.5	2.0	4.0	1.8	6 + 1
comitan ♂	4.16	0.5	2.4	4.3	1.8	6(7) + 1
centralis ♂	4.00	0.70	1.9	4.0	1.9	6 + 1
♀	5.46	0.53	2.2	4.8	2.0	8 + 1
purulus ♂	3.98	0.56	1.9	4.0	2.0	6 + 1
chiapensis ♂	3.38	0.56	2.0	4.0	1.8	6 + 1
cooki ♂	2.86	0.45	2.17	4.67	1.57	5 + 1
♀	3.90	0.50	2.40	5.32	1.67	5(6?) + 1
pecki ♂	2.4	0.50	2.17	3.67	1.68	5 + 1
♀	3.25	0.59	2.1	4.02	1.84	6 + 1
maculatus ♂	2.34	0.56	1.63	5.00	1.8	5 + 1
♀	3.51	0.53	2.00	5.42	1.8	5 + 1
orator ♂	2.29	0.5	2.6	3.5	1.57	6 + 1
♀	2.73	0.44	2.0	5.0	1.5	6 + 1

alatus Loomis and Hoffman (Polydesmida, Tridontomidae) as well. Later (1977), I described *T. loomisi* from Cueva Seamay in the same area. *Glomeroides seamay*, as well as Cook's two tridontomids, was probably collected in a cave.

Glomeroides sabinus, new species
Figs. 1, 17

Diagnosis.—Closest in color pattern to *G. chiapensis*, but nearly twice as large; *G. comitan*, also found in Chiapas, and similar in size to *G. sabinus*, has a color pattern that is quite different (Figs. 11, 17).

Types.—Male holotype (AMNH) from Cueva del Sabín, Rancho El Sabín, Ocozocoautla, Chiapas, México, collected 8 September 1973, by R. Argano.

Etymology.—The species epithet refers to the type-locality.

Description.—Male holotype: Total length 9.5 mm, width 4.47 mm. Head 1.3 mm long, 2.47 mm wide. Penultimate antennal segment 0.62 mm long, 0.31 mm wide. Six marginal ocelli, single ocellus at top of head (6 + 1). Structure of body (Fig. 17) typical, including claspers and 17th and 18th legpairs. Head (Fig. 1) off-white, antennae dark gray-brown, eyes near black. Collum off-white. Segment 2 off-white, with two paramedian elongate dark spots; segment 3 light with two small paramedian dark spots; on segments 4–8, dark spots larger, including lateral light spots and light stripe in midline. Segment 9 with dark spots smaller again, segments 10 and 11 all light with faint dusky shadings at lateral ends. Pygidium light, with paired subtriangular dark spots. Legs and venter white.

Female not collected.

Distribution.—Known only from the type collection.

Notes.—Although the holotype was collected in a cave, the distinct pattern of pigmentation and the presence of large, pigmented, functional eyes tell us that *G. sabinus* is not cave-adapted and is probably an accidental.

Glomeroides comitan, new species
Figs. 4, 11

Diagnosis.—Closest in size to *G. sabinus*, but distinct in color pattern as illustrated in Figs. 11 and 17.

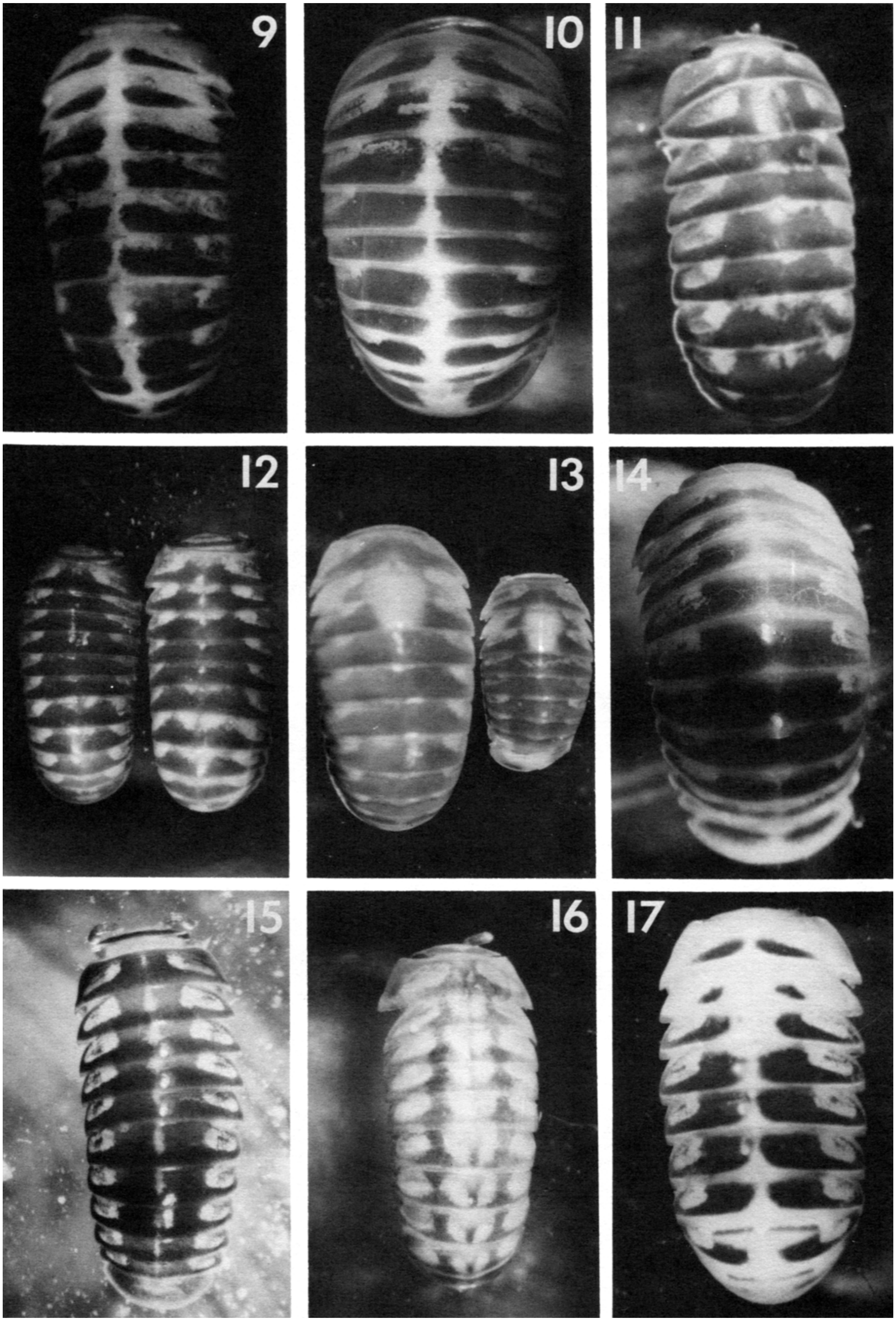
Type.—Male holotype (AMNH) from Cueva de las Florecillas, San Francisco, Comitán, Chiapas, México, collected 18 March 1971 by R. Argano.

Etymology.—The species name refers to the type-locality, and is a noun in apposition.

Description.—Male holotype: Total length 9.5 mm, width 4.16 mm. Head 1.2 mm long, 2.37 mm wide. Penultimate antennal segment 0.55 mm long, 0.23 mm wide. Marginal ocelli 6 on right side of head, 7 on left, single angular ocellus (6 + 1/7 + 1). Structure of body (Fig. 11) and posterior legs typical. Head (Fig. 4) dark with scattered lighter spots, labrum white, antennae entirely dark. Collum dark with median area of light speckles divided transversely into three areas with two strong transverse striae. Segment 2 dark with a light margin and paired light spots. Segments 3, 8, and 9 with weakly indicated anterior median light spot; all segments with paired light spots and light margins. Pygidium nearly all dark with paired light spots close to median line, more faintly indicated median light spot posterior to these. Legs white, dusky on last two segments.

Female not collected.

Distribution.—Known only from the type collection.



Figs. 9-17.—Dorsal views of *Glomeroides* species: 9, holotype male of *G. centralis;* 10, another male of *G. centralis;* 11, *G. comitan,* male; 12, *G. cooki,* male on left, female on right; 13, *G. maculatus,* female on left, male on right; 14, *G. purulus,* male; 15, *G. pecki,* male; 16, *G. orator,* male; 17, *G. sabinus,* male.

Glomeroides centralis Chamberlin
Figs. 2, 9, 10

Glomeroides centralis Chamberlin, 1922:60-61, pl. 24, figs. 5-8, pl. 25, figs. 1-4.

Diagnosis.—The type-specimens (male holotype, Fig. 9) are faded from long preservation, but details of the color pattern inferred from a newly collected specimen (Fig. 10) make this species distinct from the foregoing: *G. sabinus'* collum is entirely light colored, while that of *G. centralis* is dark with a median light spot. Segment 2 of *G. centralis* is light, with two dark spots, as opposed to segment 2 of *G. comitan*, which is dark with paired light spots. The heads of *G. centralis* males are likewise less broad in proportion to their width than in the other two species (Table 2).

Types.—Male holotype (USNM) and male and female topoparatypes (MCZ) from "Trece Aguas," Guatemala, collected 6 July 1907 by O. F. Cook. This place is undoubtedly Finca Treceaguas, 3 km E of Senahú, Alta Verapaz.

Description.—Male: Length 7.2 mm, width 4.0 mm. Head 1.45 mm long, 2.08 mm wide. Penultimate antennal segment 0.52 mm long, 0.28 mm wide. Ocelli 6 + 1. Structure of body and posterior legs typical (see also Chamberlin, 1922). Head (Fig. 2) light, antennae basally light, distal segments progressively darker. Collum dark with median light spot, or in some specimens dusky-light, with dark posterior margin and thinner dark anterior line. Segment 2 light with two elongate dark spots on each side. Segments 3-10 dark with paramedian light spots, segment 11 nearly all light, with paramedian dark areas. Pygidium light with two large subtriangular dark spots. Legs and venter white.

Female: Total length 10.0 mm, width 5.46 mm. Head 1.46 mm long, 2.73 mm wide. Penultimate antennal segment 0.57 mm long, 0.26 mm wide. Ocelli 8 + 1, ocellus at ventral end of row small, irregularly shaped. Color pattern essentially as described for male.

New record.—GUATEMALA: *Alta Verapaz*: Seamay, June 1904 (O. F. Cook), female. For information on the location of Seamay, see the account of *G. seamay* above, and Shear (1977).

Glomeroides purulus, new species
Figs. 5, 14

Diagnosis.—*Glomeroides maculatus* occurs nearby, but is smaller, about 4 mm long, as opposed to the 7 mm length of *G. purulus*: the color patterns are also distinct (compare Fig. 13 with Fig. 14).

Types.—Male holotype from "Purula," Guatemala, collected June 1904 by O. F. Cook. This place is probably Purulhá, a village located at 15°12'N, 90°11"W, not far from Cobán.

Etymology.—The species name refers to the type-locality and is an adjective.

Description.—Male holotype: Total length 7.0 mm, width 3.98 mm. Head 1.09 mm long, 1.95 mm wide. Penultimate antennal segment 0.49 mm long, 0.26 mm wide. Structure of segments (Fig. 14) and posterior legs typical. Ocelli 6 + 1. Head and antennae (Fig. 5) both entirely light colored, except for some slight darkening around the black ocelli. Collum all light. Segment 2 light with darker marginal bands; on midbody segments the dark band gets wider and includes paramedian light spots. There is also a narrow median light stripe. Segment 10 with marginal dark band, segment 11 all light with two dark spots laterally. Pygidium light with two large oval, dark spots that nearly touch the midline.

Females not collected.

Distribution.—Known only from the type collection.

Glomeroides maculatus, new species
Figs. 3, 13

Diagnosis.—This species differs from the other Guatemalan forms in the large central light areas on the dark ground of segments 4 and 5, giving the impression of a dark animal with a light spot on its back.

Types.—Male holotype and male and female paratypes (USNM) from "Coban-Tactic," Guatemala, collected June 1904 by O. F. Cook. Cobán is on most maps of Guatemala: Tactic is a small village not far away (15°20'N, 90°18'W). The specimens were probably collected enroute from Cobán to Tactic.

Etymology.—The specific epithet, an adjective, refers to the prominent light spot on the midline of segments 4 and 5.

Description.—Male holotype: Total length 4.2 mm, width 2.34 mm. Head 0.73 mm long, 1.30 mm wide. Penultimate antennal segment 0.25 mm long, 0.16 mm wide. Ocelli 5 + 1. Structure of segments and posterior legs typical of the genus. Head and antennae (Fig. 3) both slightly dusky. Collum dark, with median light spot. Segment 2 dark with two large lateral white spots, lighter areas at lateral margins. Segment 3 dark with two light spots, same pattern repeated on segments 6-9, but segments 4 and 5 with large median light areas. Segments 10 and 11 entirely light. Pygidium light with ill-defined dark areas laterally, no well-defined dark spots (Fig. 13).

Female paratype: Total length 6.5 mm, width 3.51 mm. Head 1.04 mm long, 1.95 mm wide. Penultimate antennal segment 0.36 mm long, 0.18 mm wide. Ocelli 5 + 1. Color pattern (Fig. 13) as described for male, but segments 10 and 11 patterned as described for segments 6-9.

Distribution.—Known only from the type collection.

Notes.—Two male paratypes with identical color patterns were collected with the holotype.

Glomeroides chiapensis, new species
Fig. 18

Diagnosis.—Similar in color pattern to *G. sabinus*, but only about half the size of that species.

Types.—Male holotype (AMNH) and male paratype (TMM) from Yochib, Chiapas, México, collected 8 March 1977 by Carmen Soileau.

Etymology.—The species epithet, an adjective, refers to the state of Chiapas.

Description.—Male holotype: Total length 5.5 mm, width 3.38 mm. Head 1.04 mm long, 1.87 mm wide. Penultimate antennal segment 0.47 mm long, 0.23 mm wide. Ocelli 6 + 1. Structure of segments and of posterior legs typical. Head light tan except for dusky, thin line at posterior edge, antennae dark purplish gray. Collum entirely light. Segment 2 entirely light except for a dusky posterior marginal line and two faint regions of dark speckles on either side of midline. Segment 3 all light, segment 4 with vague paramedian dark spots, segment 5 with dark spots and light midline, segments 6-9 dark with paired light spots. Segments 10-11 shaded dusky laterally. Pygidium light with paired dark spots (Fig. 18).

Females not collected.

Distribution.—Known only from the type collection.

Notes.—The male paratype has the same basic color pattern but is somewhat darker, including dusky shadings on the collum and second segment; the dark spots on the pygidium are more distinct.

Glomeroides cooki, new species
Figs. 7, 12

Diagnosis.—As in *G. pecki*, the head and antennae are dark, but whereas *G. pecki*'s collum is dark with two light spots, the collum in *G. cooki* has a single, median light spot. Males of *G. cooki* are about 20% larger than those of *G. pecki*.

Types.—Male holotype and female paratype, and many additional specimens of both sexes (USNM) from "Hoyas de Santa María, México," collected 5 June 1906 by O. F. Cook. Though there are more than 300 places in Mexico with "Santa María" as a part of their names, the Gazeteer of Mexico published by the U. S. Government Commission on Geographic Names does not list "Hoyas de Santa María." Since Cook often spelled Spanish names phonetically, I also checked "Jolas" and "Jollas," as well as every entry for "Santa María," without results.

Etymology.—The species epithet honors the late O. F. Cook, a founder of modern myriapodology as well as an authority on palm trees.

Description.—Male holotype: Total length 6.0 mm, width 2.86 mm. Head 0.83 mm long, 1.82 mm wide. Penultimate antennal segment 0.39 mm long, 0.18 mm wide. Ocelli 5 + 1; below the angular ocellus are two round, ocellus-sized white spots. Head (Fig. 7) and antennae dark, labrum white. Collum dark with central light spot; all body segments (Fig. 12) dark with paramedian light spots. Pygidium all dark with central light spot.

Female paratype: Total length 8.0 mm, width 3.9 mm. Head 1.17 mm long, 2.34 mm wide. Penultimate antennal segment 0.44 mm long, 0.18 mm wide. Ocelli 5 or 6 + 1. Structure typical. Color pattern (Fig. 12) as in male.

Distribution.—Known only from the type collection.

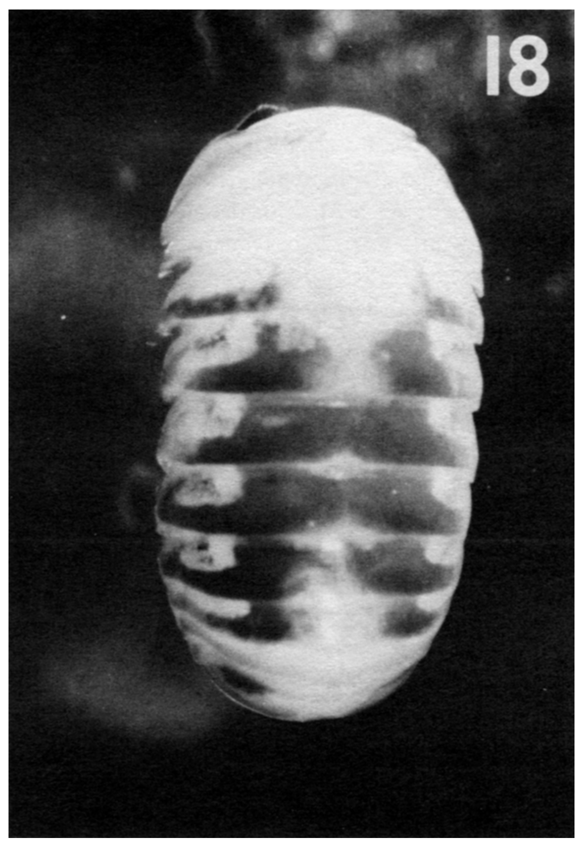


Fig. 18.—Dorsal view of *Glomeroides chiapensis*, male.

Notes.—I found no significant variation in color pattern among the males of the type series, but some females were paler in pigmentation, while retaining the basic pattern. Juvenile specimens are also lighter in color.

Glomeroides pecki, new species
Fig. 15

Diagnosis.—See under *G. cooki.*

Types.—Male holotype and male and female paratypes (AMNH) from a Berlese sample of leaf litter, 7,000 ft. elevation, 32 mi. S of Valle Nacional, Oaxaca, México, collected 22 May 1971 by S.B. Peck.

Etymology.—The species name recognizes Stewart Peck's contributions to the study of tropical litter arthropods.

Description.—Male holotype: Total length 5.0 mm, width 2.4 mm. Head 0.70 mm long, 1.43 mm wide. Penultimate antennal segment 0.39 mm long, 0.18 mm wide. Ocelli 5 + 1. Structure (Fig. 15) typical of genus. Head and antennae both dark, labrum white. Collum and all body segments dark with paramedian light spots and a light median line. Pygidium all dark with vague lighter central area.

Female paratype: Total length 7.0 mm, width 3.25 mm. Head 1.04 mm long, 1.77 mm wide. Penultimate antennal segment 0.44 mm long, 0.21 mm wide. Ocelli 6 + 1; ventralmost of the 6 marginal ocelli is very small. Color pattern (Fig. 15) as in male, but darker; segmental light spots are relatively smaller.

Distribution.—Known only from the type collection.

Notes.—The male paratype is darker than the holotype, and nearly all segments lack the median light line.

Glomeroides orator, new species
Figs. 6, 16

Diagnosis.—The color pattern of this species (Fig. 16) is unique in the genus.

Types.—Male holotype and female paratype (USNM) from "G(?)obules Pass," Guatemala, collected June 1906 by O. F. Cook. The Gazeteer of Accepted Geographic Names in Guatemala (U. S. Govt. Commission on Geographic Names) has no listing for "Cobules," "Gobules," or "Corbules" so the type-locality cannot be placed definitively at this time. Without any real evidence, I suspect this is somewhere in the vicinity of Volcán Tajmulco, a favorite site with early collectors in Central America.

Etymology.—The specific epithet is a noun in apposition, and pays tribute to Orator Frederick Cook.

Description.—Male holotype: Total length 5.0 mm, width 2.29 mm. Head 0.73 mm long, 1.46 mm wide. Penultimate antennal segment 0.42 mm long, 0.16 mm wide. Ocelli 6 + 1. Structure of segments (Fig. 16) and posterior legs typical. Head (Fig. 6) and antennae dark, labrum white. Collum with central light area surrounded by dark marginal band, marginal band wider on posterior border. Segment 2 dark with paired light spots. Segments 3-11 predominantly light with dark marginal bands, other dark pigment so distributed as to suggest three dark stripes on a light ground. Pygidium almost entirely light, with dark margins laterally.

Female paratype: Total length 7.0 mm, width 2.73 mm. Head 0.80 mm long, 1.82 mm wide. Penultimate antennal segment 0.36 mm long, 0.18 mm wide. Structure typical: color pattern as in male, but median dark stripe is much narrower.

Distribution.—Known only from the type-locality.

Glomeroides boneti (Chamberlin)
New Combination

Glomeris boneti Chamberlin, 1943:69-70, fig. 171.

Types.—The female holotype of this species (USNM) came from El Parque Nacional de Zempoala, Morelos, México, and was collected under a log in a pine-fir forest at an elevation of 3,000 m by F. Bonet, 3 May 1941.

Notes.—On geographic grounds this is undoubtedly a species of *Glomeroides*, not *Glomeris*, and Chamberlin gave no indication of why he placed it in the European genus, rather than in his own genus *Glomeroides*, which he had described 21 years earlier. His description of the color pattern suggests a relationship to *G. pecki.*

Glomeroides prima (Silvestri)
New Combination

Sonoromeris prima Silvestri, 1929:200, figs. 1-1 to 1-13, figs. 11-1 to 11-5.

Types.—Male holotype (Lab. Entomol. "Filipo Silvestri," Portici) from Mill Valley, Marin Co., California, collected by F. Silvestri, 9 September 1929.

Notes.—I have examined specimens of this form from S.P. Taylor State Park (Marin Co.) and from Pfeiffer Big Sur (Monterrey Co.): all agree well with Silvestri's detailed original description and excellent drawings. The seventeenth legpair of the males differs from all other *Glomeroides* species in having four postcoxal segments, not three. Otherwise the posterior legs of the males are perfectly typical of *Glomeroides.*

ORDER CHORDEUMATIDA

Family Trichopetalidae Verhoeff

Mexiterpes Causey

Mexiterpes fishi (Causey)

Poterpes fishi Causey, 1969:47, figs. 6, 11-16.
Mexiterpes fishi: Shear, 1982:153.

New record.—*San Luis Potosí*: Sótano de Trinidad, 7 km WNW Xilitla, 29 December 1982 (G. Atkinson), male (TMM).

Mexiterpes calenturas Shear

Mexiterpes calenturas Shear, 1982:153, figs. 30-33.

New records.—*Tamaulipas*: Sistema Purificación, Entrada de los Franceses, Conrado Castillo, 3 May 1981 (P. Sprouse), male; Cueva del Vandalismo, 0.5 km SE Rancho Nuevo, 5 March 1982 (D. Honea), males, females. All TMM.

Mexiterpes sangregorio, new species
Figs. 19, 20

Diagnosis.—The male gonopods are most similar to those of *M. fishi*, but the colpocoxites are shorter and the telopodites of a different form.

Types.—Male holotype and male and female paratypes (AMNH, TMM) from Resumidero de la Joya San Gregorio, Guerrero, México, collected 23 February 1981 by S. Robertson.

Etymology.—The species name is a noun in apposition, after the type-locality.

Description.—Male holotype: Length probably near 8.0 mm (all specimens badly broken), width 1.09 mm; antennal segment three 0.029 mm long. Three or four small, colorless ocelli are arranged in a row at the posterior margin of the head. Segments are of typical structure, with strong shoulders around closely grouped segmental setae, dorsum nearly flat. Cuticle colorless and leathery. Pregonopodal legs not as crassate as in other species, without modifications. Anterior gonopods (Fig. 19) with large, cupped sternum; colpocoxites basally fused, sharply angled posteriad, in lateral view apically blade-like, anterior surface covered with dense, decurved setae. Telopodites complex, with sharp, mesally curved tips. Posterior gonopods (Fig. 20) typical for genus, femora flask-shaped, with terminal articles bulbous, set off by definite constrictions, and clawed.

Female paratype: Length 8-9 mm (all specimens fragmented), width 1.13 mm. Antennal segment three 0.03 mm long. Nonsexual characters as in male.

Distribution.—Known only from two caves in Guerrero.

Records.—*Guerrero*: Resumidero del Isote, Acuitlapán, 10 March 1981 (S. Robertson, J. Ramírez), male (TMM). This specimen has five ocelli with some pigment behind them.

Family Cleidogonidae Cook

Cleidogona Cook

Few genera of millipeds can surpass *Cleidogona* in number of described Mexican species. I published a revision of the genus in 1972, and have added new species in papers published in 1974, 1977, and 1982, but undescribed forms continue to turn up in collections.

Cleidogona baroqua Shear

Cleidogona baroqua Shear, 1972:209, figs. 197-200; 1982:149.

New records.—*Oaxaca*: Cueva del Molino de Carne, 5 km ESE Huautla de Jiménez, 20 May 1978 (A. Grubbs), males; Cueva de los Pájaros, 5 km SE Huautla de Jiménez, 24 December 1976 (R. Jameson), male. All TMM.

Cleidogona yerbabuena Shear

Cleidogona yerbabuena Shear, 1982:151, figs. 18-20.

New records.—*Nuevo León*: Sótano de las Tres Ventanas, Cuautemoc, Purificación Area, 29 November 1981 (P. Fambro), male. *Tamaulipas*: Pozo del Peso, 5 km N Rancho Nuevo, 22 April 1981 (P. Sprouse), male; Pozo de las Rudistas, 800 m NE Rancho Nuevo, 15 March 1982 (P. Sprouse), male. All TMM.

Notes.—This species seems to be common in caves in the Purificación Area, but shows no troglobitic modifications. Surface collecting has not been extensive in the area, but should produce specimens of *C. yerbabuena*.

Cleidogona chac, new species
Figs. 21, 22

Diagnosis.—This species is a member of the *godmani* group and seems closest to *C. huautla*, the type-locality of which is nearby. However, the gonopods are much narrower in anterior view (Fig. 21), and the coxa of the posterior gonopod is entirely different from that of *C. huautla*.

Types.—Holotype male (AMNH) from jungle trail 25-30 km from Huautla de Jiménez, on way to Cerro Rabón, Oaxaca, México, collected 23 March 1981 by A. Grubbs.

Etymology.—The species epithet is a noun in apposition, the name of the Mayan rain god.

Description.—Male holotype: Length 22 mm, width 2.6 mm. Antennal segment three 0.94 mm long. Ocelli 25, well pigmented, in subtriangular patch of 5 horizontal rows (7-6-5-4-3). Segments subcylindrical, with small rounded segmental shoulders, segmental setae short, acute. Anterior gonopods in anterior view (Fig. 21) rather narrow, colpocoxites arching laterally, tips bifid; telopodites nearly same length as colpocoxites, slightly sinuous at distal ends. Posterior gonopods (Fig. 22) with coxae completely lobed, strongly excavate at base: second segment not much widened distally, last segment relatively long. Coxae 10 and 11 with glands, otherwise unmodified. Process of sternum 12 simple acute spike. Coloration typical of epigean species.

Female not collected.

Distribution.—Known only from the type collection.

Cleidogona arco, new species

Figs. 23, 24

Diagnosis.—This species seems to be the closest relative of *C. crucis* (Chamberlin), a troglobite known from caves in the Córdoba region of Veracruz. The anterior gonopod telopodites are of a very different from in *C. arco*, however, each one bearing a long anterior branch that extends lateral to the colpocoxites (Fig. 23).

Types.—Male holotype (AMNH) from Sótano del Arco, Cotlaixco, Zongolica, Veracruz, México, collected 24 January 1983 by S. Robertson, F. Ackermann, and G. Rouillon.

Etymology.—The species is a noun in apposition, after the type-locality.

Description.—Male holotype: Length 18 mm, width 2.08 mm, antennal segment three 1.09 mm long. Ocelli 21, unpigmented, reduced in size, regularly arranged in triangular eyepatch. Segments with pronounced shoulders, dorsum highly arched between nearly horizontal surfaces of segmental shoulders; segmental setae short, many appear blunt-tipped. Anterior gonopods (Fig. 23): colpocoxites with broad, flaring lateral wings, distal process with 4-6 finger-like projections above fimbriate region; telopodites widely separated, each with long, curved anterio-lateral branch curving laterally around colpocoxites. Posterior gonopods (Fig. 24) not much modified, coxa with large basomesal lump probably representing vestige of coxal gland; second segment nearly cylindrical. Coxae 10 and 11 with glands, otherwise not modified. Sternum 12 with long, rod-like process extending anteriad to between coxae of posterior gonopods. Pigmentation lacking, specimen opaque white, cuticle well sclerotized.

Female not collected.

Distribution.—Known only from the type collection.

Notes.—This interesting troglobite is close to *C. crucis*, especially in the multibranched apical process of the anterior gonopod and in the relatively unmodified posterior gonopods. The long, curving telopodites, however, suggest that my original (1972) hypothesis relating the *forficula* and *crucis* groups of *Cleidogona* might be correct; such telopodites are characteristic of *C. forficula*.

Cleidogona pochteca, new species

Figs. 25-27

Diagnosis.—A member of the *godmani/maculata* complex, distinct in the highly reduced posterior gonopods bearing a very large, curved coxal process (Fig. 27).

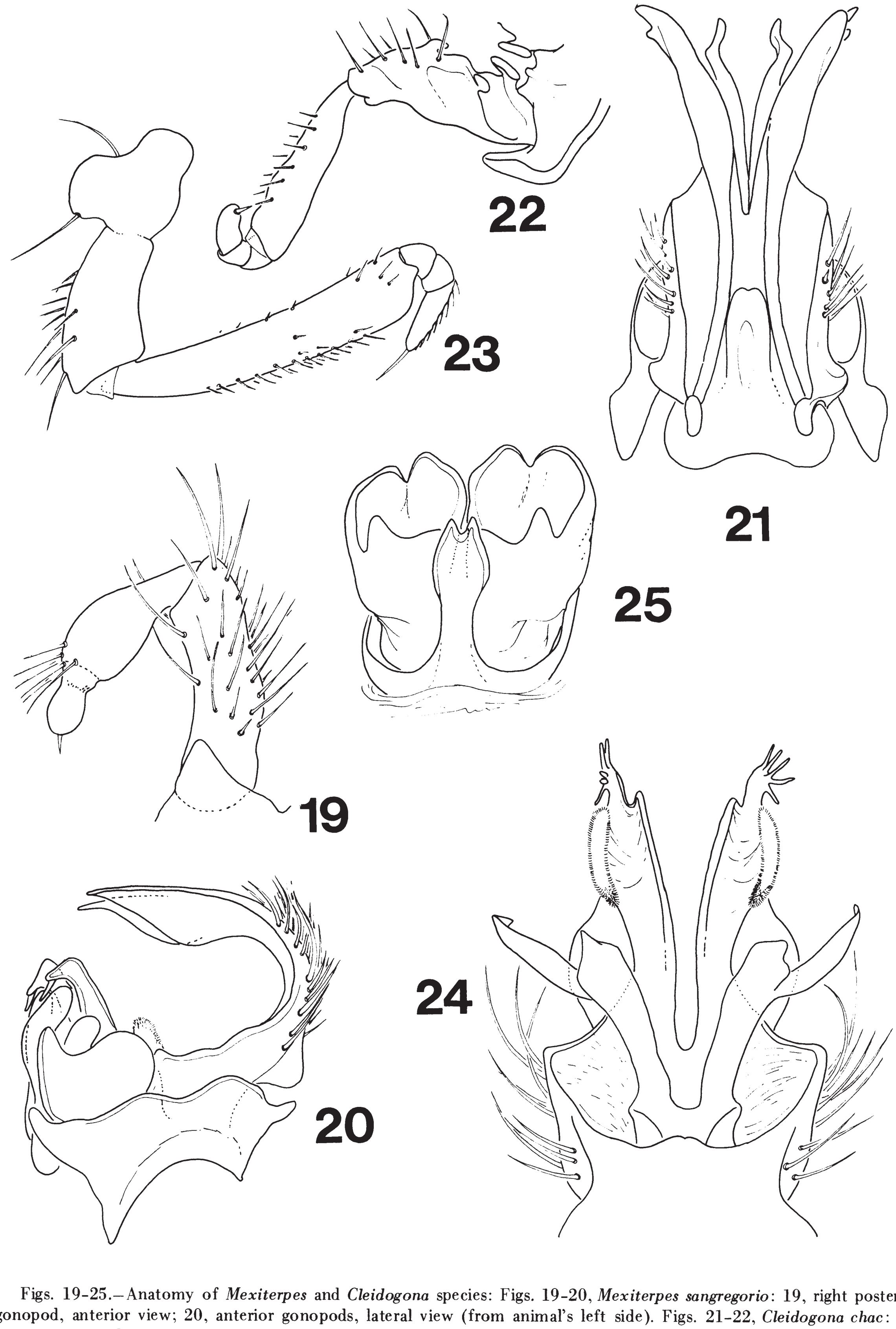
Types.—Male holotype (AMNH) and male and female paratypes (AMNH, TMM) from Sótano de la Torre, 4 km SE Rancho Nuevo firetower, Tamaulipas, México, collected 30 November 1982 by P. Sprouse.

Etymology.—A noun in apposition, a Nahuatl word referring to culturally important itinerant vendors who spread ideas as well as goods through pre-Columbian Mexico.

Description.—Male holotype: Length 18.5 mm, width 2.47 mm, third antennal segment 0.86 mm long. Ocelli 29, pigmented, well-formed, arranged in a triangular patch. Segments without shoulders, nearly cylindrical, segmental setae typically short and acute. Anterior gonopods (Fig. 26) relatively simple; colpocoxites smoothly curved, with flattened apical lamella distal to fimbriate branch; telopodites of normal proportions, broadest about in midlength, basally fused. Posterior gonopods (Fig. 27) highly modified, coxa short, subglobose, with very long curved mesal process, more distal segments very much reduced, apical segment button-like, lacking a claw. Coxa 10 not modified except for presence of gland, coxa 11 with broad shelf projecting above gland. Process of sternum 12 a short, triangular spike pointing straight ventrally. Very darkly pigmented with typical pattern.

Female paratype: Length 20 mm, width 2.5 mm, third antennal segment 0.84 mm long. Nonsexual characters as in males. Cyphopods (Fig. 25) with valves seemingly fused, shallowly excavate distally, with small toothy projections on posterior rim, postgenital process spatulate, apically notched.

Distribution.—Known only from the type collection.



Figs. 19-25.—Anatomy of *Mexiterpes* and *Cleidogona* species: Figs. 19-20, *Mexiterpes sangregorio*: 19, right posterior gonopod, anterior view; 20, anterior gonopods, lateral view (from animal's left side). Figs. 21-22, *Cleidogona chac*: 21, anterior gonopods, anterior view; 22, right posterior gonopod, anterior view. Figs. 23-25, *Cleidogona arco*: 25, right posterior gonopod, anterior view; 24, anterior gonopods, posterior view; 25, female genitalia, posterior view.

Notes.—This species and the two following are closely related, and the form of both the anterior and posterior gonopods strongly suggest relationships to the *godmani* and *maculata* species groups as I described them in 1972. Both of these groups are probably very rich in species and occur right across central Mexico; they are characterized by fairly simple anterior gonopods and strongly modified posterior gonopods, with elaborate coxae and much reduced distal segments. I suspect that as more species are discovered and described, these two groups will have to be resorted, possibly into three or four clusters of closely related forms.

Cleidogona revilla, new species
Figs. 28–30

Diagnosis.—A member of the *maculata* group, with characteristically decurved anterior gonopod colpocoxites (Fig. 28), but differing from all others in the group in having very large telopodites on the anterior gonopods and in the dramatically reduced distal segments of the posterior gonopods.

Types.—Male holotype (AMNH) and female paratypes (AMNH, TMM) from 3 km SE of Revilla, Tamaulipas, México, collected 1-3 April 1982 by P. Sprouse and J. Atkinson.

Etymology.—The species epithet is a noun in apposition referring to the type-locality.

Description.—Male holotype: Length 13 mm, width 1.06 mm, third antennal segment 0.36 mm long. Twenty-five pigmented ocelli arranged in triangular eyepatch. Segments nearly cylindrical, with very low shoulders only on the anteriormost few. Anterior gonopods (Fig. 28) with colpocoxites broad when seen in lateral view, bent at midline at about a right angle, distally apical lamella is median, leaving fimbriate branch exposed laterally. Coxa with low, subtriangular posterior process. Telopodites large, laterally expanded about in midlength, telopodite tips inserted between apical lamella and fimbriate branch on each side. Posterior gonopods (Fig. 29) with subcylindrical coxae bearing basal lobe (probably remnants of coxal gland), short apical process; second segment cylindrical, distal segments much reduced, without claw. Coxa 10 not modified, coxa 11 with shelf above gland. Process of sternum 12 short, typical.

Female paratype: Length 15 mm, width 1.17 mm, antennal segment three 0.38 mm long. Nonsexual characters as in male. In posterior view, cyphopod valves (Fig. 30) with two posterior teeth each, postgenital process evidently absent.

Distribution.—Known only from type collection.

Cleidogona coatlicue, new species
Figs. 31–33

Diagnosis.—Clearly related to the foregoing two new species, but distinct in details of the anterior gonopods (Fig. 31) and in the form of the coxae of the posterior gonopods (Fig. 32).

Types.—Male holotype and female paratype (AMNH) from Pozo del Arrecife, 800 m NE of Rancho Nuevo, Tamaulipas, México, collected 15 March 1982 by T. Treacy-Sprouse.

Etymology.—Coatlicue is the mother of the gods in Aztec mythology. A colossal statue of this deity is on view in the Mexican Anthrolopological Museum in Mexico City. The name here is a noun in apposition.

Description.—Male holotype: Length 20 mm, width 2.26 mm, antennal segment three 0.94 mm long. Ocelli 26, arranged in a regular series of rows forming triangular eyepatch. Robust animal, with pronounced segmental shoulders. Anterior gonopods (Fig. 31) typical for species group, but with shorter telopodites than usual; telopodites with small acute lamella just beyond midlength. Posterior gonopods (Fig. 32) with large coxae bearing relatively short mesoapical process; second segment somewhat clavate, distal segments much reduced, claw lacking. Coxae 10 and 11 without modifications; sternal process 12 as in Fig. 33. Pigmentation typical of epigean species.

Female paratype: Length 22 mm, width 2.3 mm, antennal segment three 0.90 mm long. Twenty-four ocelli in subtriangular patch. Female genitalia nearly identical to those of *C. pochteca* (Fig. 25), but postgenital process is not apically notched.

Distribution.—Known only from the vicinity of Rancho Nuevo, Tamaulipas.

Record.—*Tamaulipas*: Surface at Rancho Nuevo, 15 March 1982 (T. Treacy-Sprouse, P. Sprouse), male (TMM).

ORDER SPIROBOLIDA

Family Typhlobollelidae Hoffman

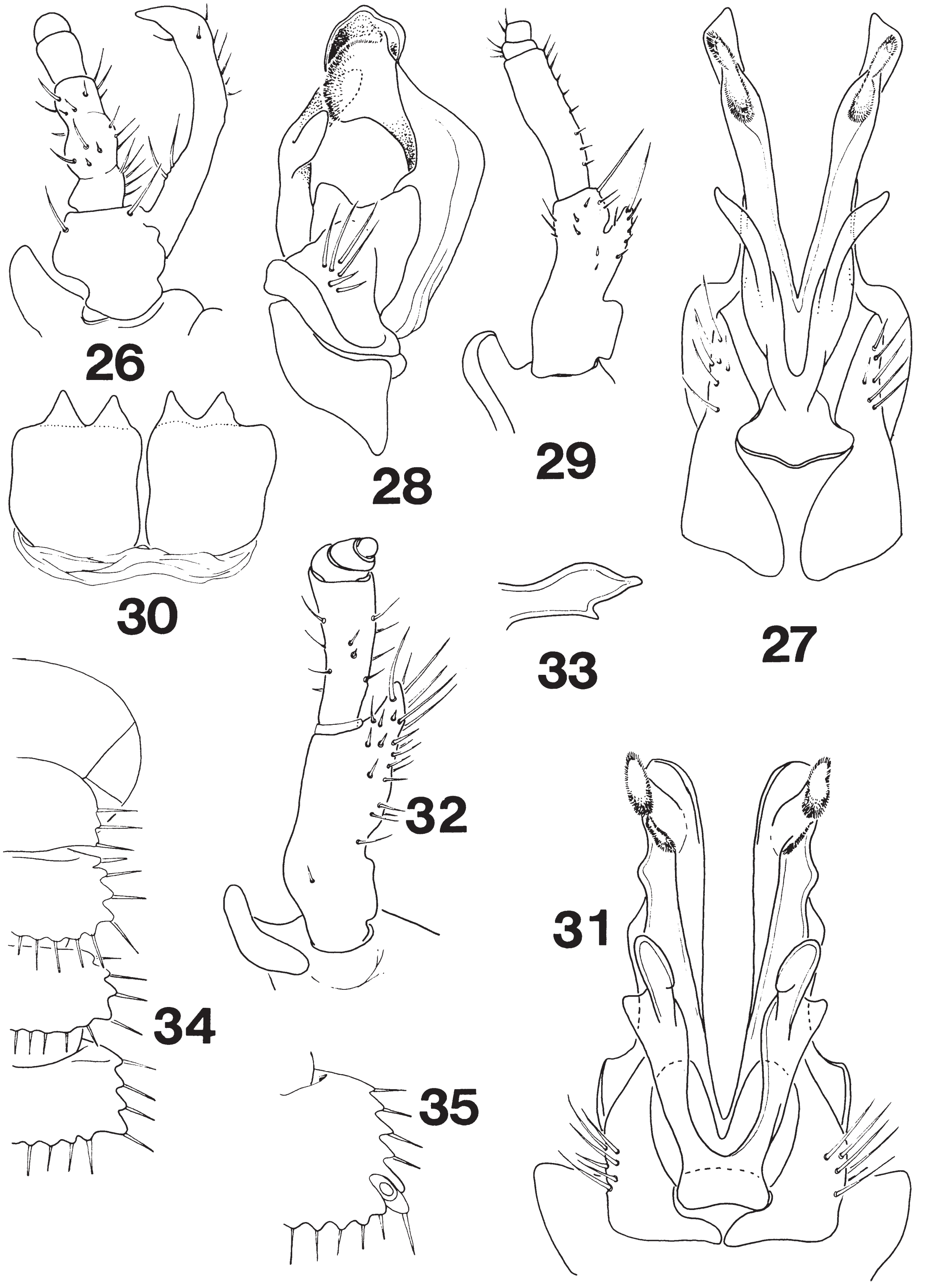
Ergene Chamberlin

Ergene setosus Chamberlin

Ergene setosus Chamberlin, 1943:5, figs. 3, 4; Causey, 1974:336, figs. 6, 7.

New records.—*Tamaulipas*: Cueva X, 300 m N Conrado Castillo, 15 April 1980 (D. Pate), female; Cueva de la Boca, 0.5 km N Conrado Castillo, 6 April 1982 (P. Sprouse), females.

Notes.—At best, this species is troglophilic, with no obvious troglobitic modifications. Most members



Figs. 26-35.—Anatomy of *Cleidogona* species and *Pozodesmus poco*: Figs. 26-27, *Cleidogona pochteca*: 26, right posterior gonopod, anterior view; 27, anterior gonopods, posterior view. Figs. 28-30, *Cleidogona revilla*: 28, anterior gonopods, lateral view (from animal's left side); 29, right posterior gonopod, anterior view; 30, female genitalia, posterior view. Figs. 31-33, *Cleidogona coatlicue*: 31, anterior gonopods, posterior view; 32, right posterior gonopod, anterior view; 33, process of sternum 12, lateral view (ventral side is down). Figs 34-35, *Pozodesmus poco*: 34, right side of head and anterior four segments, dorsal view; 35, right side of fifth segment, dorsal view.

of this family seem to be deep soil inhabitants that frequently find their way into caves.

Reddellobus Causey

Reddellobus troglobius Causey

Reddellobus troglobius Causey, 1974:334-336, figs. 1-6.

New records.—*Puebla*: Cueva de Octimaxal Sur n. 1, 3 km SSW Cuetzalan, 2 March 1981 (J. Atkinson), juvenile; Sima de la Cruz Verde, 1 km W Cuetzalan, 28 December 1980 (S. Robertson), juveniles; Cueva de la Providencia, Cuetzalan, 4 February 1980 (B. Liebman), male; Sumidero de Atepolihuit de San Andres, N of Cuetzalan, 2 January 1980 (A. Grubbs, J. Liebertz, B. Richards), female, juveniles; Sistema Cuetzalan (Sumidero de Chichicasapan section), 0.8 km S Cuetzalan, February 1980 (J. Jancewicz), male, females; Sistema Cuetzalan (Sumidero de Tzitzicazapan section), Cuetzalan, 15 January 1981 (J. Liebertz), female; Cueva Tecolo, Jonotla, 13 April 1981 (S. Robertson), males, females. All TMM.

Notes.—This unique species, nearly four times as large as the four others incuded in its family, is perhaps a troglobite, most certainly a deep soil inhabitant. All records are from caves in the vicinity of Cuetzalan, Puebla.

ORDER SPIROSTREPTIDA

Family Cambalidae Bollman

Progress has been made recently in understanding the taxonomy and evolution of this ancient group of millipeds. Based on the important study by Loomis (1938), new work by Hoffman (1979) and Shelley (1979, 1981) has cleared up longstanding problems concerning North and Central American cambalids. Examining large collections of *Mexicambala* assembled by members of the AMCS now enables me to make my own modest contribution to the task.

I can confirm without much doubt that *Mexicambala* deserves separate generic status from *Cambala*, though the two are very likely each other's closest relatives. The major consistent difference between the two genera is in the anterior gonopods. In *Cambala*, the mesal processes of the coxae curve posteriorly to the telopodites, so that they appear clasped by the more distal segment. In *Mexicambala*, the coxal processes are entirely free.

Distinctions in the anterior gonopods, which I also found very valuable at the species level in both *Cambala* and *Mexicambala*, have led me to disagree with Shelley's 1981 assertation that the "configuration of the posterior gonopods of the males is the only reliable character for species identifications. . . ." It seems to me wiser to use all available characters to the extent that they are useful. I examined mateial of five of the *Cambala* species studied by Shelley (1979) and found the anterior gonopods of each to be perfectly distinct, and with more easily recognizable species differences than in the posterior gonopods, where Shelley (1979) seems mostly to have relied upon the shape of the posterior coxal lobe.

Mexicambala Causey

Causey (1964, 1971b) used differences in segmental ornamentation and the form of the anterior gonopods to distinguish four species in this genus. The differences in the posterior coxal lobes of the posterior gonopods are of little value, being very slight, and all resemble *Cambala speobia* (Chamberlin) of Coahuila and Texas in this regard. While my own examination of *Mexicambala* species has confirmed the value of the use of anterior gonopod characters in their taxonomy, I have doubts about the value of the segmental ornamentation, which I found to be far more variable than Causey (1971b) indicated. I found a group of *M. russelli* populations from caves in the Purificación area with quite a difference in dorsal crest form from that illustrated by Causey and seen in specimens from the Xilitla region in San Luis Potosí, despite having anterior and posterior gonopods essentially identical to these populations. Further, while good differences exist between the anterior gonopods of *M. fishi*, *M. russelli*, and the two nominal species at the northern end of the range, *M. blanda* and *M. inopis*, I was unable to find similar differences between *M. blanda* and *M. inopis* themselves, and the differences in sculpture alluded to by Causey (197b1) in her original descriptions simply do not hold up when large collections from caves throughout the region are examined.

Therefore, I am treating *M. blanda* and *M. inopis* as synonyms; guided by page priority I use the name *M. inopis*. Further, I will not describe the specimens from the Purificación region as new (as would be dictated by reliance on the sculptural differences *a la* Causey), but include them under *M. russelli*. These records are listed separately in case future work shows my present judgement to be in error.

A thorough study of *Mexicambala* carefully examining such things as meristic characters, range of segment numbers, segmental ornamentation, and the form of the gonopods would be very instructive and would make an ideal thesis for a student with ready access to the karst regions of eastern Mexico. Clearly this group of species has been in caves for a long time, and it would not surprise me to find that different cave systems supported populations with subtle but constant differences, suggesting speciation. For the present, though, I think our interests are best served by applying to *Mexicambala* the general standards of taxonomic judgement in wide use in milliped studies. To do so in this case leads to biogeographically coherent results.

Mexicambala inopis Causey

Mexicambala inopis Causey, 1971b:276, fig. 1b; Shear, 1974:250.
Mexicambala blanda Causey, 1971b:276-277, figs. 1c, 2b, 3a-d; 1973:121; Shear, 1974:250. **New Synonymy.**

New records.—*Tamaulipas*: Cueva del Ojo de Agua (Norte and Sur sections), El Ojo de Agua, 2.5 km E Gómez Farías, 28 March 1981 (J. Reddell, D. McKenzie, T. Archey, F. Enders), males, females; Cueva de las Peñitas, 12 km S Gómez Farías, 29-30 December 1980 (W. Elliott, D. Harris, J. Brooks), male, females; Cuevacita El Cerro Partido (lava cave), 13 km SW Ocampo, 8 January 1980 (W. Elliott, D. C. Rudolph), male; Sótano de Vásquez, 20 km E Ocampo, March 1981 (R. Jameson, P. Mothes-Jameson), females; Cueva del Ojo de Agua de Manantiales, 13.5 km NE Ocampo, 3 September 1979 (D. C. Rudolph), juvenile. All TMM.

Mexicambala russelli Causey

Mexicambala russelli Causey, 1964a:244-246, figs. 7-13; 1971b:279-280, figs. 1d, 2c; 1973:121; Shear, 1974:250.

New records.—The following records are of the typical form with deeply notched dorsal crests. *San Luis Potosí*: Cueva de Oxtalja, Tamapatz, 2 August 1980 (P. Sprouse, T. Treacy, S. Balsdon), males, females; Cueva de los Caracoles No. 1, Municipio de Aquismón, 19 March 1980 (D. Pate), male, females.

The following records are of a form with gonopods identical to the foregoing, but with crests lacking notches. *Tamaulipas*: Cueva de Revilla, Revilla, 19 May 1980 (T. Treacy), male; Cueva del Borrego, 0.5 km S Conrado Castillo, 6 April 1979 (P. Sprouse), male; Cueva del Moro, 2 km SE Yerbabuena, 22 November 1979 (J. Reddell, J. Lieberz), female; Cueva de Abril, 3 km SE Revilla, 2 April 1982 (D. Honea), female; Entrada de Viento Alta, Conrado Castillo, 29 June 1978 (L. Wilk), male; Cueva X, 300 m N Conrado Castillo, 4 April 1981 (P. Sprouse), males; 28 March 1978 (P. Sprouse, T. Treacy), male. All TMM.

Mexicambala fishi Causey

Mexicambala fishi Causey, 1971b:280, figs. 1e, 2d, 4a, b.

New records.—*Oaxaca*: Centiped Cave, Río Iglesia Dolina, 5 km SE Huautla de Jiménez, 26 March 1981 (A. Grubbs, S. Zeman), male, female; Cueva Cerca de la Puente Sobre El Río Huautla, 28 December 1977 (R. Jameson), males, females; Cueva de los Pájaros, 5 km SE Huautla de Jiménez, 24 December 1976 (R. Jameson), males, females; Cueva del Molino de Carne, 5 km ESE Huautla de Jiménez, 20 May 1978 (A. Grubbs, M. McEachern), males, females; Sistema Huautla (La Grieta section), 5 km E Huautla de Jiménez, 23 May 1977 (T. Johnson), female.

ORDER POLYDESMIDA

Family Fuhrmannodesmidae Brolemann

Tylogoneus Causey

Tylogoneus rainesi Causey

Tylogoneus rainesi Causey, 1973:121, figs. 27-31.

New record.—*Hidalgo*: Cueva de San José, San José, 18 March 1981 (J. Reddell, D. McKenzie, T. Archey, F. Enders), male, females.

Sumidero Shear

Sumidero sp.

Record.—*Tamaulipas*: Purificación area, Cueva de Galindo, 7 May 1981 (P. Sprouse), females.

Sumidero pecki (Shear)

Speodesmus pecki Shear, 1974:273, figs. 55-58.
Sumidero pecki: Shear, 1982:157.

New record.—*Tamaulipas*: Cuevacita de El Cerro Partido (lava cave), 13 km SW Ocampo, 8 January 1980 (W. Elliott, D. Rudolph), males, female (TMM).

Pozodesmus, new genus

Diagnosis.—A fuhrmannodesmid genus with relatively simple gonopods consisting of a single piece with an unbranched termination carrying the seminal canal. Proximal to this is a lateral shelf-like process, bearing a large seta on its posterior edge; the prefemoral region carries a group of smaller setae. The type-species has 19 segments, as in *Sumidero* and *Tylogoneus,* but in both of those genera the gonopod tibiotarsus is strongly branched and some of the animals are three to four times larger than in the present genus. *Caramba* species are only about one-fourth to

KEY TO FUHRMANNODESMID GENERA FROM CAVES IN TEXAS AND MEXICO

1a. Twenty segments in adults . . . . *Speodesmus* Loomis
1b. Nineteen or eighteen segments in adults. 2

2a. Eighteen segments . . . . *Caramba* Shear
2b. Nineteen segments. 3

3a. Gonopods strongly 3-branched. . . . . *Tylogoneus* Causey
3b. Gonopods essentially of a single piece 4

4a. Gonopods with three terminal branches; males 5-10 mm long; Tamaulipas, Puebla, San Luis Potosí. . . . . *Sumidero* Shear
4b. Gonopods without terminal branches; males less than 5 mm long; Hidalgo . . . . . *Pozodesmus*, new genus

one-third larger than the type-species of *Pozodesmus* and have 18 segments. The gonopods of *Caramba enbecausius* Shear somewhat resemble those of the new species described below in bearing a lateral shelf-like process.

The name of the new genus should be treated as masculine.

Type-species.—*Pozodesmus poco* Shear.

Range.—Known only from the type collection of the type-species, a cave in Hidalgo, México.

Pozodesmus poco, new species
Figs. 34-37

Diagnosis.—At present the only known species of its genus; see the generic diagnosis.

Types.—Male holotype and female paratype (AMNH) from Sótano del Tres Pozos, Ejido El Sótano, Hidalgo, México, collected 23 March 1981 by J. Reddell.

Etymology.—The specific epithet is a Spanish word meaning "little," treated here as a Latin adjective.

Description.—Male holotype: Nineteen segments. Length 4 mm, width 0.52 mm. Head setose, about 50 percent wider than collum. Antennae moniliform (Fig. 36), distal segments much enlarged; penultimate segment by far the largest, with prominent accessory sensory region bearing two sensory cones. Collum oval, with small acute posteriorlateral corners, a single small marginal tooth, and three marginal setae (Fig. 34). Segment 2 narrower than head: segments do not reach width of head until midbody (Fig. 34). Dorsum strongly arched, paranota relatively thick. Paranota of segments 2-4 with four marginal teeth and setae; segment 5 (Fig. 35) and subsequent segments with five marginal teeth and setae. Metazonites with 4-5 transverse rows of setae, including posterior marginal row. Pores dorsal on paranota of segments 5, 7, 9, 10, 12, 13, and 15-18; pore swellings relatively small for this group of genera, torical. Gonopods (Fig. 37) very small. Coxae subglobose, with prominent distal rim and large solenite. Prefemora only slightly swollen, elbowed so that gonopods lie parallel to long axis of body, group of 5-6 setae about in midlength, single large seta at ventral apex near tibiotarsus. Tibiotarsus short, with shelf-like process on lateral side; solenomerite curves sharply laterad, tip coarsely toothed. Pregonopodal and postgonopodal legs swollen, with subglobose joints, femora especially so. Unpigmented, cuticle well-sclerotized, rather brittle.

Female paratype: Length about 3.8 mm, width 0.54 mm. Nonsexual characters as in male.

Distribution.—Known only from the type collection.

Notes.—This species is among the very smallest polydesmoid millipeds known, being in the size range of the 18-segmented *Hexadesmus latridens* Loomis, from Cuba, Haiti, Curaçao, and St. Kitts (Loomis, 1934).

Family Cryptodesmidae Karsch

Peridontodesmus Silvestri

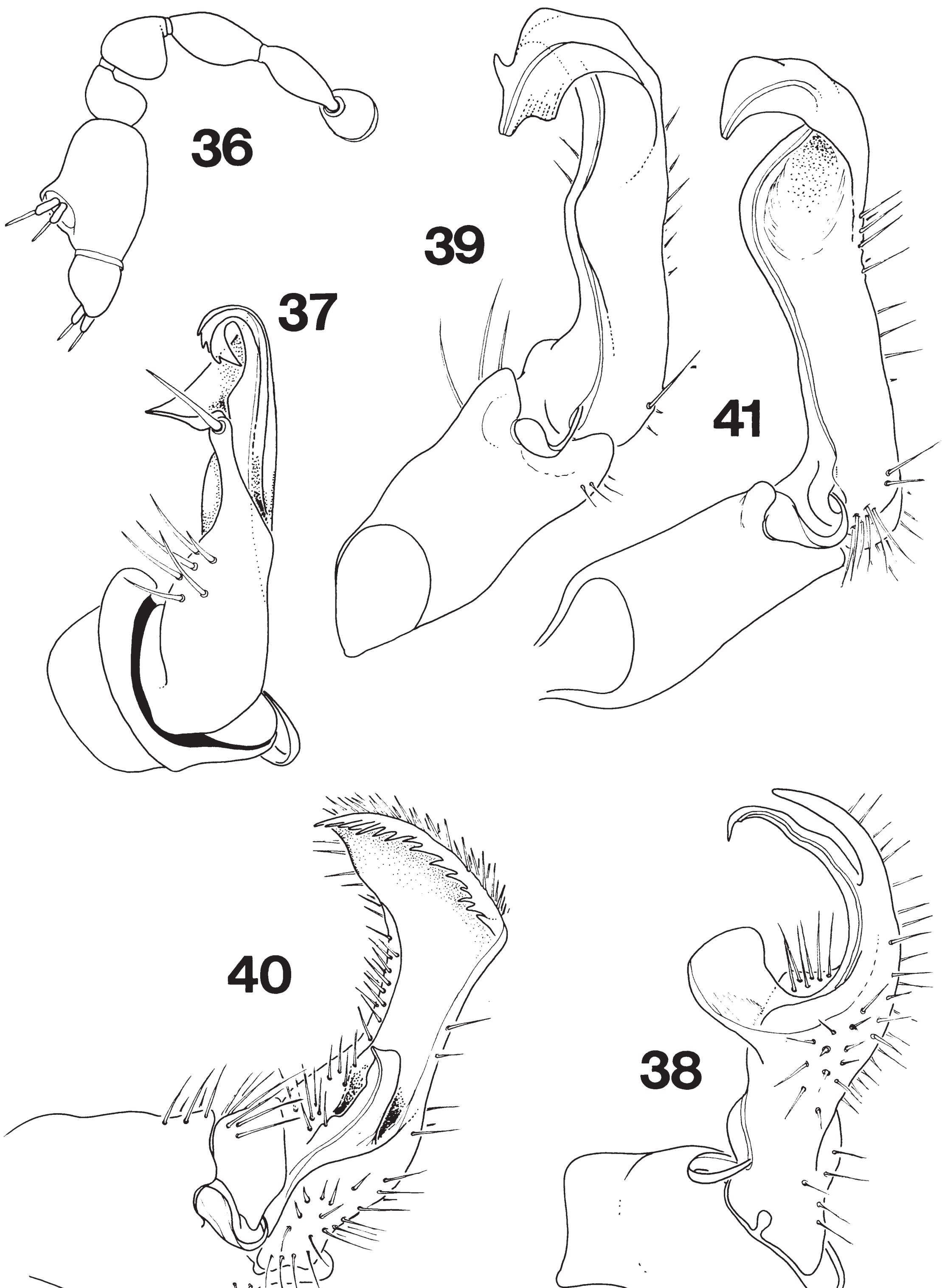
Theleura Loomis, 1966:12. Type-species by monotypy, *Theleura punctata* Loomis. **New Subjective Synonymy.**

Peridontodesmus punctatus (Loomis)
New Combination

Theleura punctata Loomis, 1966:12, figs. 4-6.

New record.—*San Luis Potosí*: Sótano de las Golondrinas, Main Pit floor, 10 km W Aquismón, 5 September 1981 (P. Sprouse), male, females (TMM).

Notes.—This surface species, known heretofore only from the type collection at El Salto, San Luis



Figs. 36-41.–Anatomy of *Pozodesmus poco* and *Sphaeriodesmus* species: Figs. 36-37, *P. poco*: 36, right antenna, anterior view; 37, right gonopod, ventral view. Figs. 38-41, right gonopods, mesal views: 38, *Sphaeriodesmus sprousei*; 39, *S. grubbsi*; 40, *S. iglesia*; 41, *S. robertsoni*.

Potosí, represents the first record of its family from a cave in Mexico. Hoffman (1979) reduced Pocock's family Peridontodesmidae to tribal status under Cryptodesmidae, and synonymized four of the genera under *Peridontodesmus*; here I add *Theleura*, and further venture to suggest that *Kalesmus* Chamberlin may also be a synonym of *Peridontodesmus*.

Family Rhachodesmidae Pocock

Unculabes Causey

Unculabes crispus Causey

Unculabes crispus Causey, 1971a:31, figs. 18-20; 1973:118.
Unculabes versatilis Causey, 1971a:32.

New records.—*San Luis Potosí*: Cueva de la Reina, 3 km SE Tampaxal, 16 March 1983 (D. Whitis), male, females; Cueva del Llano Chiquito, 10 km W Xilitla, 17 May 1977 (R. Jameson), male; Cueva de Cerro Pilón, 6 km NW Xilitla, 8 January 1983 (M. Minton), male; Sótano de El Ranchito, 1 km N Ejido La Silleta, 2 September 1981 (P. Sprouse, T. Treacy), males, female; Cueva de Potrerillos, 2 km WSW Ahuacatlán, 31 August 1981 (P. Sprouse, T. Treacy), males, females; Sótano de La Silleta, La Silleta, 30 March 1980 (P. Sprouse), male, female.

Querétaro: Sótano del Rincón, La Lagunita, 11 km SSW San Joaquín, 21 November 1977 (R. Jameson), male, female.

Tamaulipas: Cave 1 km S Manantiales, 1 January 1982 (O. Kukal), male, females. All TMM.

Notes.—At the locality south of Manantiales, this species is syntopic with *Strongylodesmus harrisoni* Causey (Rhachodesmidae).

Unculabes colombinus Causey

Unculabes colombinus Causey, 1973:118, fig. 23.

New records.—*San Luis Potosí*: Cueva de La Silleta, 600 m S La Silleta, 30 March 1980 (D. Honea), male; Cueva de los Ladrones, La Silleta, 29 March 1980 (P. Sprouse), male.

FAMILY SPHAERIODESMIDAE HUMBERT AND DE SAUSSURE

Subfamily Sphaeriodesminae Humbert and de Saussure

Sphaeriodesmus Peters

Working with large numbers of specimens and the literature on this genus, I find it possible to recognize four species groups, at least tentatively; some species are difficult to assign and may represent other groups. Because of the very great uniformity in body design in this genus (the species, except for the wildly varying structure of the male gonopods and the degree of modification of the male first legs, differ only in size), the species groups are defined entirely on the basis of the male gonopod anatomy.

The *mexicanus* group includes species with the simplest gonopods. The prefemoral and tibiotarsal regions are nearly equal in length, and evenly curved (in *S. cotzalostoc* nearly forming a circle); the tibiotarsus may be nearly rodlike, or flattened, and there is often a definite shoulder on the mesal side where the two divisions of the gonopod meet. The termination of the tibiotarsus may be bifid, presenting a solenomerite and a parasolenomerite, or there may be a definite "kink," or cingulum, near the tip. Species of the group are found in Veracruz, Tamaulipas, San Luis Potosí, Guatemala, Belize, Honduras, and some West Indies localities. I propose to include the following species (dubious assignments indicated by a question mark): *mexicanus, medius, saussurei, coriaceus, nortoni, salto, griseus* (?), and the new species (see below) *cotzalostoc* and *robertsoni*.

Gonopods of the *longitubus* group are similar in many respects to those of the species listed above, but at the point of the distal prefemoral shoulder, the base of the tibiotarsus bears a flat, squarish, plate-like process. Again, the tip of the gonopod may be bifid, and there may be dorsomesad torsion. Species of the group are presently known from Guerrero, Veracruz, Nuevo León, Honduras, and Guatemala; I include *longitubus, hondurasanus, bukowinus, oniscus, digitatus, prehensor* (?), *neglectus* (?), *angustus* (?), *griseus* (?), and the new species (see below) *sanjose* and *rabonus*.

Species of the *cobanus* group have highly complex gonopods often resembling a hand with the palm and fingers formed from the tibiotarsus and the thumb by a prefemoral process. The solenomerite is much smaller than the very large parasolenomerite, which is always present. In addition to a prefemoral process, the tibiotarsal process is large and often divided, adding additional "fingers" to the "hand." The gonopod has also undergone about 60° of torsion mesally. In two species, *trullatus* and *iglesia*, we have either primitive representatives of the group, or secondary simplification. Species of the group are found in Chiapas and Guatemala, and include *cobanus, trullatus, redondo, golondrinensis, zontehuitz, cruzbelem, prehensor* (?), *neglectus* (?), and the new species (see below), *iglesia*.

The last and smallest group in number of species I call the *stilifer* group. Here, the gonopods bear some resemblance to those of the *longitubus* group, but have a very elongate prefemur, so that the solenomerite, parasolenomerite, and tibiotarsal process are all clustered near the gonopod apex; there is no prefemoral process. Species of this group occur in Costa Rica and El Salvador. Included are *stilifer*, *longiramus*, *nodulosus*, and *digitatus* (?).

The evolutionary relationships between these groups are unclear. It is tempting to consider the *mexicanus* group, with their simple gonopods, as the stem group: from them it is easy to derive the *longitubus* group's species. Via *S. bukowinus*, one can see a possible transition to the complex gonopod structure of the *cobanus* group. I think the *stilifer* group is a specialized southern derivative of *cobanus*-type species—so distinct as to perhaps deserve recognition as a separate genus (the name *Eusphaeriodesmus* is available).

Because the other genera of the subfamily are so poorly known it is also hard to link them up with *Sphaeriodesmus* in some coherent way. *Colobodesmus* species of Central America have very complicated gonopods, with an even more basally situated solenomerite than is found in the *cobanus* group of *Sphaeriodesmus*; in *Cylionus* the gonopod appears to have undergone great torsion: *Haplocyclodesmus* and *Lophocyclus*, from the Carribean, have exceedingly simple gonopods, and include many species.

It is difficult to say if any species of *Sphaeriodesmus* are troglobitic, though a number are known only from caves. Some of these are weakly sclerotized and have translucent, unpigmented cuticle. Specimens taken outside of caves, though often not of the same species, are usually well sclerotized, and opaque, chalky white.

Sphaeriodesmus neglectus Carl

Sphaeriodesmus neglectus Carl, 1902:676, pl. 12, fig. 107, 108; Pocock, 1909:126; Attems, 1940: 365, fig. 513.

New record.—*Oaxaca*: Centiped Cave, Río Iglesia Dolina, 5 km SE Huautla de Jiménez, 26 March 1981 (A. Grubbs, S. Zeman), males, females (TMM).

Sphaeriodesmus bukowinus Chamberlin

Sphaeriodesmus bukowinus Chamberlin, 1952:553.

New record.—*Quintana Roo*: Ruinas de Cobá, 22 July 1983 (J. Reddell), male, female (TMM).

Note.—This species was originally described from Honduras, so this new record represents a substantial range extension.

Sphaeriodesmus coriaceus Pocock

Sphaeriodesmus coriaceus Pocock, 1909:125, pl. 9, fig. 4; Attems, 1940:362, fig. 506; Chamberlin, 1952:551.

New record.—*Quintana Roo*: Ruinas de Cobá, 22 July 1983 (J. Reddell), males, females (TMM).

Notes.—Originally described from San Juan, Alta Verapaz, Guatemala, this species was also recorded by Chamberlin (1952) from Volcán Tajmulco. At the new locality reported above, it is syntopic with *S. bukowinus*; the two species were mixed in the same collecting vial.

Sphaeriodesmus nortoni Shear

Sphaeriodesmus nortoni Shear, 1974:276, figs. 59-61.

New record.—*Tamaulipas*: 3 km S Gómez Farías, 15 March 1972 (R. Mitchell), male (TMM).

Sphaeriodesmus cruzbelem Shear

Sphaeriodesmus cruzbelem Shear, 1974:279-280, figs. 71-75.

New records.—*Chiapas*: Cueva Oscura, Finca San Nicolas, San Cristóbal de las Casas, 13 September 1975 (V. Sbordoni, A. Zullini), males, females; Cueva Clara, Finca San Nicolas, San Cristóbal de las Casas, 8 September 1975 (V. Sbordoni, A. Zullini, V. Vomero), males, females; Sótano de Casa Clara and Cueva Encantada, San Cristóbal de las Casas, 21 August 1975 (V. Sbordoni, A. Zullini, A. Vomero, R. Argano), males, females; Las Piedrecitas, Il Resorgenza de la Planta, San Cristóbal de las Casas, 5 September 1975 (V. Vomero), male. All ZIUR.

Sphaeriodesmus sprousei, new species
Fig. 38

Diagnosis.—A species of the *longitubus* group (see above) with the tibiotarsus deeply divided apically, and a prominent shelflike process at the distal end of the prefemur. It is closest to *S. longitubus* Loomis of Chipinque Mesa, Nuevo León, but is about 25 percent larger than that species.

Types.—Male holotype (AMNH) and male and female paratypes (AMNH, TMM) from Cueva de Galindo, 500 m S Galindo, Tamaulipas, México, collected 7 May 1981 by P. Sprouse.

Etymology.—The species name honors Mr. Peter Sprouse.

Description.—Male holotype: Length 19.5 mm, width 6.3 mm. Structure typical for genus. First legs modified, prefemur crassate and curved. Cuticle colorless, muscle insertions visible dorsally. Gonopods (Fig. 38) robust, curved. Prefemur setose, large shelf-like process at junction of prefemur and tibiotarsus; process appears to be tibiotarsal. Solenomerite longer than parasolenomerite, slightly sinuous.

Female paratype: Length 24 mm, width 7.0 mm. Nonsexual characters as in male.

Distribution.—Known only from caves in the Purificación Area, Tamaulipas.

Records.—*Tamaulipas*: Cueva de los Allarines, 0.8 km N Conrado Castillo, 13 October 1979 (P. Sprouse, T. Treacy), males; Sistema Purificación (Cueva de Oyamel Section), Conrado Castillo, 19 March 1978 (P. Sprouse et al.), males, females; Sótano de las Calenturas, 0.7 km S Yerbabuena, 19 November 1979 (P. Sprouse et al.), male, female. All TMM.

Sphaeriodesmus grubbsi, new species
Fig. 39

Diagnosis.—A species of the *mexicanus* group, but with a lower shoulder at the juncture of the prefemur and tibiotarsus, and a small, retrorse process near the gonopod tip (Fig. 39).

Types.—Male holotype (AMNH) from Sótano del Río Iglesia, 5 km SE Huautla de Jiménez, Oaxaca, México, collected 6 April 1978 by A. G. Grubbs.

Etymology.—The species name honors Mr. Andrew G. Grubbs.

Description.—Male holotype: Length 28 mm, width 8.0 mm. Structure typical for genus. Legs 1 with usual modifications. Cuticle opaque, specimen light brown in preservative. Gonopods relatively long, sharply curved in tibiotarsal region, prefemur straight. Tibiotarsus bladelike, abruptly narrowed at tip, with ventral oblique angle and dorsal thumblike process.

Female not collected.

Distribution.—Known only from the type collection.

Sphaeriodesmus iglesia, new species
Fig. 40

Diagnosis.—Closest to *S. trullatus*, of the *cobanus* group, but differing in the more distinct basal solenomerite and the decurved, expanded, and serrate parasolenomerite.

Types.—Male holotype and female paratype (AMNH) from Sótano del Río Iglesia, 5 km SE Huautla de Jiménez, Oaxaca, México, collected 6 April 1978 by A. G. Grubbs.

Description.—Male holotype: Length 15 mm, width 4.0 mm. Structure typical for genus. First legs not strongly modified, only a little thicker than other legs. Gonopods (Fig. 40) large, spatulate, tibiotarsus much longer than prefemur. Solenomerite basal, below midlength of gonopod, shaped rather like the head of a small bird. Parasolenomerite broadly expanded, abruptly at apex, and sharply curved mesally; mesal edge finely serrate.

Female paratype: Length 17.2 mm, width 5.6 mm. Nonsexual characters as in male.

Distribution.—Known only from the type collection.

Note.—This species and the foregoing are evidently syntopic. As seems usual in such a situation in *Sphaeriodesmus*, one species is large and the other small.

Sphaeriodesmus robertsoni, new species
Fig. 41

Diagnosis.—Belonging to the *mexicanus* group, but with a much longer prefemoral division than is usually seen in that group.

Types.—Male holotype (AMNH) and male and female paratypes (AMNH, TMM) from Sumidero de Cotzalostoc, 3 km E Totolacatla, Zongolica, Veracruz, México, collected 16 February 1983 by S. Robertson, G. Provin, and E. Loubié.

Etymology.—The specific epithet honors Mr. Steven Robertson.

Description.—Male holotype: Length 15 mm, width 6.1 mm. Structure typical. First legpair not modified. Cuticle colorless, transparent. Gonopod (Fig. 41) almost suggestive of *stilifer* group, with long prefemur narrower than basal region of tibiotarsus, which is deeply excavated mesally; solenomerite curves over almost meeting dorsal base of tibiotarsus.

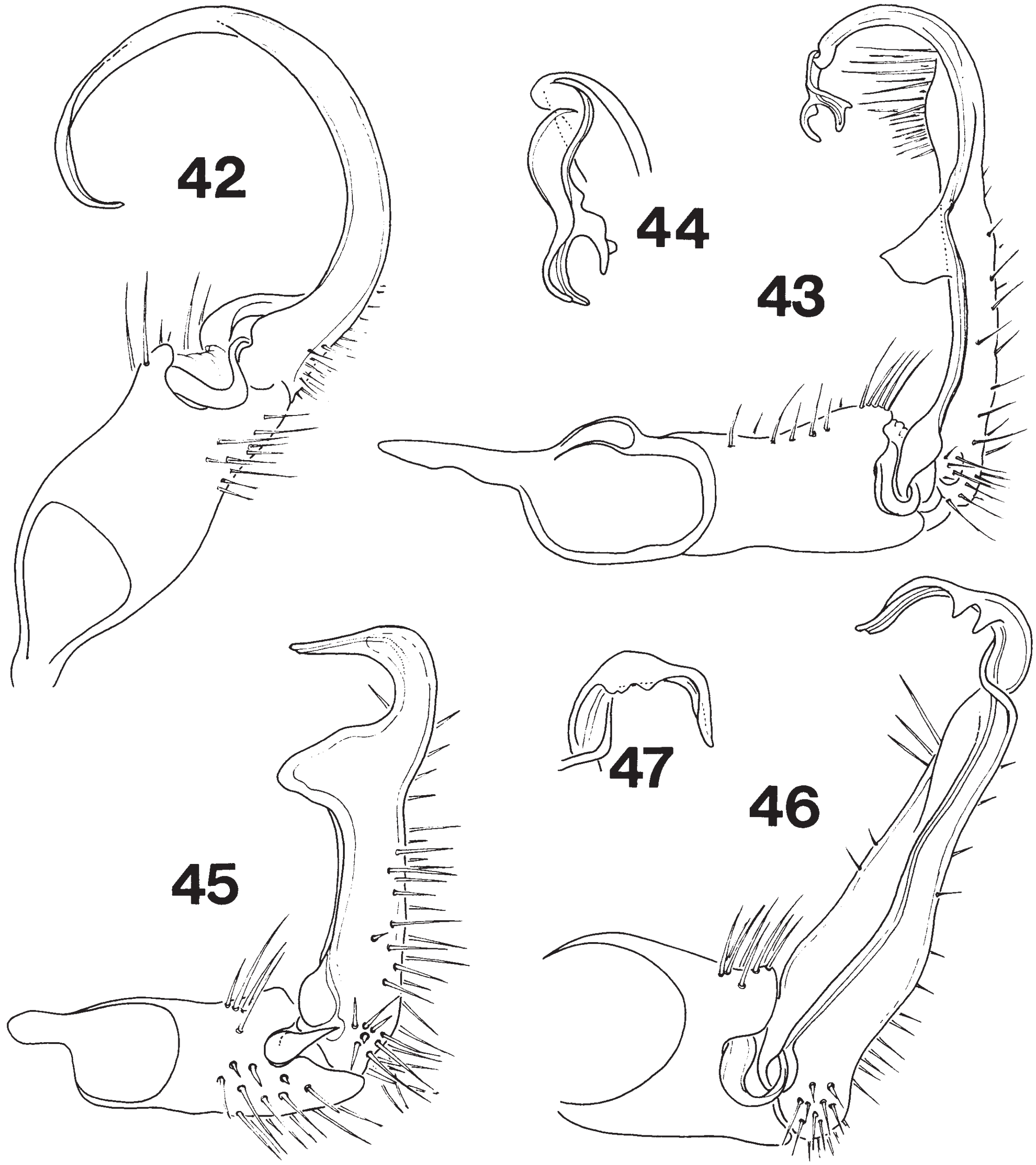
Female paratype: Length 16 mm, width 6.0 mm. Nonsexual characters as in male. The lack of sexual dimorphism in size (females are usually significantly larger in *Sphaeriodesmus*) is unusual.

Distribution.—Known only from the type-locality, but in addition to the type specimens, two males (TMM) were taken there by S. Robertson on 1 February 1983, and a male and two females (TMM) by P. Ackermann on 23 March 1983.

Sphaeriodesmus cotzalostoc, new species
Fig. 42

Diagnosis.—A unique species probably belonging to the *mexicanus* group, but with a much more slender gonopod than previously found in that group, curved in a broad, nearly complete circle.

Types.—Male holotype (AMNH) and male and female paratypes (AMNH, TMM) from Sumidero de



Figs. 42-47.—Gonopods of *Sphaeriodesmus* species: 42, right gonopod of *S. cotzalostoc,* mesal view. Figs. 43-44, *S. rabonus*; 43, right gonopod, mesal view; 44, gonopod tip, dorsal view. Fig. 45, right gonopod of *S. sanjose,* mesal view. Figs. 46-47, *S. tortus*: 46, right gonopod, mesal view; 47, left gonopod tip of Belize specimen, mesal view.

Cotzalostoc, 3 km E Totolacatla, Zongolica, Veracruz, México, collected 16 February 1983 by S. Robertson, G. Provin, and E. Loubié.

Etymology.—The species epithet is a noun in apposition and refers to the type-locality.

Description.—Male holotype: Length 13.4 mm, width 3.3 mm. Structure typical, but seemingly more highly arched than the large species; cuticle opaque white, finely punctate all over. Legs 1 not modified. Gonopod (Fig. 42) simple and slender, evenly curved in almost a complete circle.

Female paratype: Length 16 mm, width 4.0 mm. Nonsexual characters as in male.

Distribution.—Known only from the type collection.

Notes.—Here is another case in which two species of *Sphaeriodesmus* are found in the same cave, but the size difference is much less striking. In fact it would be difficult to place females from this cave in one of the two species except that *S. cotzalostoc* is more highly arched dorsally than *S. robertsoni*, and the metazonites are covered with fine punctations.

Sphaeriodesmus rabonus, new species
Figs. 43, 44

Diagnosis.—This species seems to bridge the gap between the *mexicanus* and *longitubus* species groups. In size and general gonopod form, it indeed resembles *S. mexicanus*, but there is a thin basal process on the tibiotarsus, as well as a promiment "kink" or cingulum in the tibiotarsus just basal to the division into solenomerite and parasolenomerite.

Types.—Male holotype and female paratype (AMNH) from a jungle trail 25-30 km E of Huautla de Jiménez, on the way to Cerro Rabón, Oaxaca, México, collected 23 March 1981 by A. G. Grubbs.

Etymology.—The species name, an adjective, refers to nearby Cerro Rabón.

Description.—Male holotype: Length 31 mm, width 10 mm. Structure typical of genus. First leg-pair strongly and typically modified. Cuticle smooth and polished, chalk-white, opaque, with dark gray bands on posterior margins of metazonites. A large gonopod sternum is present. Gonopods (Fig. 43) with unusually long coxae; acropodite thin, of uniform diameter through most of its length. Prefemur straight, with a slight shoulder distally near thin, almost membranous basal process of tibiotarsus. Tibiotarsus basally as broad as prefemur, distally narrowing and smoothly curved; just before tip (Fig. 44) there is a prominent cingulum. Solenomerite and parasolenomerite subequal, broadly separated at bases, then curving towards one another.

Female paratype: Length 34 mm, width 11.2 mm. Nonsexual characters as in male.

Distribution.—Known only from the type collection.

Notes.—I hesitated before naming this species because the gonopod looks a lot like that figured by Attems (1940) for *S. mexicanus*, which has been reported from the same region.

Sphaeriodesmus sanjose, new species
Fig. 45

Diagnosis.—Differs from others of the *longitubus* group in the thick and bulky tibiotarsal process and the lack of a very clear division between the tibiotarsus and the prefemur.

Types.—Male holotype and female paratype (AMNH) from Cueva de San José, San José, Hidalgo, México, collected 18 March 1981 by J. Reddell, D. McKenzie, T. Archey, and F. Enders.

Etymology.—The specific epithet, a noun in apposition, refers to the type-locality.

Description.—Male holotype: Length 8.0 mm, width 2.0 mm. Structure typical for genus; cuticle unpigmented, translucent. First legs not modified. Gonopods (Fig. 45) small but robust and stout, abruptly wider at distal part of prefemur, where there is a blunt, subtriangular tibiotarsal process. The simple, tubular solenomerite bends over in a sharp curve and is smoothly narrowed distally.

Female paratype: Length 9.2 mm, width 2.4 mm. Nonsexual characters as in male.

Distribution.—Known only from the type collection.

Sphaeriodesmus tortus, new species
Figs. 46, 47

Diagnosis.—Probably closest to *S. coriaceus*, but with subapical teeth on the solenomerite, and a strong twist at the distal cingulum.

Types.—Male holotype (AMNH) and male and female paratypes (AMNH, TMM) from Actún Loltún, 7 km SW Oxkutzcab, Yucatán, México, collected 25-26 July 1975 by A. Grubbs, D. McKenzie, and J. Reddell.

Etymology.—The species name is an adjective referring to the twisted apex of the gonopod.

Description.—Male holotype: Length 12.1 mm, width 3.0 mm. Structure typical for genus. First leg-pair not modified. Cuticle white and opaque, shining. Gonopod (Fig. 46) with prefemoral division much longer than tibiotarsus, division between the two indistinct. Tibiotarsus with a cingulum (Fig. 47) at which it is not only twisted 180°, but bends sharply dorsad; mesal side beyond cingulum variously toothed.

Female paratype: Length 14 mm, width 3.4 mm. Nonsexual characters as in male.

Distribution.—Known from Yucatán, México, and Cayo District, Belize.

Record.—BELIZE: *Cayo District*: Caves Branch, July-August 1976 (L. McNatt), male (AMNH). This is an epigean collection.

ACKNOWLEDGMENTS

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SYMPHYLA FROM THE UNITED STATES AND MEXICO

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ABSTRACT

This paper summarizes and surveys the taxonomic and distributional knowledge of the Symphyla of the United States and Mexico. Many incompletely described genera and species are discussed or rejected. A systematic section accounts for collections containing 281 specimens from two families, six genera, and 21 species. Keys to North American families and genera are presented. Five taxa are described as new to science: the genus *Scopoliella* (Scutigerellidae) and four species, *Symphylella reddelli* (Scolopendrellidae) and *Scutigerella acicularis, Scutigerella aduncus*, and *Scopoliella crenatus* (Scutigerellidae). *Symphylella pusilla* (Hansen) and *Hanseniella vandykei* Michelbacher are redescribed. The two species *Scutigerella palmonii* and *S. nodicercus* described by Michelbacher are combined under the first mentioned name and the characters of the taxon are discussed and the description is emended. Two species are reported for the first time from the United States and eight from Mexico.

All of the 35 species known to occur in the area are listed with statements of their distribution at the state level. The distributional patterns indicate that the Nearctic symphylans consist of at least two different elements. One belongs to a widespread Holarctic fauna penetrating mainly from the northeast and the other a southern element entering the southern and western regions. Several species collected in caves are discussed.

INTRODUCTION

There has been no comprehensive study of the North American Symphyla although a long sequence of miscellaneous papers has been published over more than a hundred years. Looking at what has been done, one can discern roughly three approaches: (1) early investigations based on questions posed by an initial interest in the structure and affinities of the group (Packard, Ryder, Scudder, Williams); (2) later studies dealing with the composition and diversity of the fauna (Hilton, Michelbacher, Waterhouse, Scheller); and (3) reports on different aspects of the destructiveness, control, biology, and population dynamics of the garden symphylan *Scutigerella immaculata* (Newport). (The literature is considerable, vide e.g. Michelbacher, 1938; Waterhouse, 1967, 1968, 1970; Berry, 1972).

Because no real contributions to an understanding of the taxonomy of the North American species were made until the end of the 1930s when Michelbacher published a series of valuable papers, and because almost nothing of a taxonomic character has since appeared, a revised systematic account of all the symphylans in North America is needed. At present a complete revision is not possible, but as far as the accessible collections permit, this paper will supply the need. The original purpose was to give a report of the study of some collections from the United States and Mexico which had been sent to the author for identification, but in the course of the work the program had to be extended to comprise also an abridged review of all the species of these countries existing in the literature. This review became necessary for the following reasons: first, the occurrence of several poorly defined generic and specific names; second, the appearance among the studied specimens of species of unusual interest from both taxonomic and distributional standpoints; and third, a, for the most part, scattered and very old literature.

However, the picture of the fauna that emerges is fuzzy with only a few clear spots. This is because the early investigators were not aware of the diversity within the group and because interest in the twentieth century has been focused on the damage caused by the garden symphylan. Moreover, the collections studied below cover only small areas of the vast North American continent.

PREVIOUS KNOWLEDGE OF THE SYMPHYLA IN THE UNITED STATES AND MEXICO

United States

The history of the investigations of the symphylans goes back to 1763 when Scopoli described the first species of the class from Europe. Most later studies have also been centered on the European fauna.

The first record of an American symphylan is that of Packard (1873:111), who reported "a specimen of *Scolopendrella*, detected Sept. 8, (1871) by Mr C.A. Walker, under a board in the grounds of the Museum" of the Peabody Academy of Science, Massachusetts. He thought it was related to *Scolopendrella immaculata* Newport (now in *Scutigerella*), but he also suggested that "if new [it] may be called *S. Americana.*" The identity of his species is unknown but the first symphylan and probably the first representative of the genus *Scutigerella* had been reported from the United States. Later (1881:699) he reported the same species from Salem, Massachusetts, and from two localities near Mammoth Cave, Kentucky, viz. "under stones at the mouth of a small cave (White's cave, Jr.)" and "in a cave near Dismal creek." These specimens were compared to material of *Scutigerella immaculata* from Bohemia, and Packard therefore regarded *S. Americana*, which was undescribed, as a synonym of *S. immaculata.* It is uncertain, however, whether his material belonged to *S. immaculata* in the modern sense. His figure (1881:700) shows the tergal view of the specimens from White's Cave, Jr., and some details from the posterior part of the body from the Salem specimens. The former does not permit any species identification but the latter suggests *S. silvestrii* Michelbacher because of the long and slender cerci and the additional seta on one of the styli. However, reliable determinations are not possible from these drawings.

In 1880 Ryder erected a new order based on *Scolopendrella* and reported *Scolopendrella notacantha* Gervais and a new *Scutigerella*, *S. gratiae*, from Pennsylvania. However, Ryder may not have seen *S. notacantha* because his later drawing (1881: 85, fig. 2) does not show the tergal pattern typical of that species. *Scolopendrella notacantha* has not been reliably documented in North America and Ryder's material probably belonged to *Scolopendrellopsis*, which is widely distributed in North America. Ryder's second species, *Scutigerella gratiae*, was treated in more detail in 1881, but Hansen (1903:61) showed that it does not belong to *Scutigerella.* The posteriorly rounded tergites, the long lateral macrochaeta on each side of the tergites, and the pointed cerci (Ryder, 1881:85, fig. 1) show that *Scutigerella gratiae* belongs in *Hanseniella.* The discovery of the wide range of *H. vandykei* (see below, p. 112) suggests that *S. gratiae* is more likely identical to *H. vandykei* than a synonym of *Hanseniella nivea* (Scopoli), from whose synonymy it had already been removed by Latzel (1884). *Scutigerella gratiae* was reported by Ryder from Fairmount Park, NW of Philadelphia, and in Franklin County, Pennsylvania; in Washington, D.C.; and at Havre de Grace, Maryland.

Both Packard and Ryder sought to enhance the taxonomic and phylogenetic knowledge of Symphyla, but the basis they had to build upon was weak. Therefore it is understandable that none of their species has been definitely identified in more recent times. Their contributions are nonetheless valuable.

Forbes (1883:91) reported Packard's *Scutigerella* from Illinois, and Scudder (1883:64-65) described *Scolopendrella latipes* from a single juvenile collected near Boston. The latter cannot be identified with certainty and must be deleted, as indicated by Hansen (1903:61). Hansen (1903:77-78, 85-87) also described the first unquestioned representatives of the Scolopendrellidae from North America, two new species from Austin, Texas, which he named *Symphylella texana* and *S. pusilla.* Neither has been rediscovered but both are valid species. The former was redescribed by Scheller (1974:243-245), and the latter is redescribed herein. They are the first two definitely recognized species from the United States.

During the late nineteenth and early twentieth centuries it became apparent that symphylans could cause serious damage to crops. In a paper concerned with the economic importance of the Symphyla, Woodworth (1905) described a new American species, *Scutigerella californica*, which, however, may be a synonym of *S. immaculata.* This was one of the few papers published on the North and Central American symphylan fauna in the period around the turn of the century.

Recent works have mostly dealt with the destructiveness, control, and biology of the garden symphylan *Scutigerella immaculata*; few papers have focused on taxonomy and systematics. It was not until 1931 that more new American species were collected. Hilton reported nine species from California and New York in 1931 and one species each from Iowa and New Mexico in 1933. These papers included six new species and two new genera. Unfortunately, Hilton's descriptions are lacking in care and exactitude both in text and drawings, and his identifications of known species are most often doubtful. Only one of his two new genera has been recognized; Michelbacher

(1941:140) demonstrated that *Pseudoscutigerella* Hilton (1931:539-540) was a synonym of *Geophilella.* Hilton reported his species *G. americana* from both California and New York, indicating an extensive range for the species which has been confirmed by new discoveries. Hilton's second new genus, *Scolopendrellina* (1931:544), represented by the species *S. californica,* is incompletely described and unrecognizable. This is also true of *Hanseniella californica, Scolopendrellopsis sensiferis,* and *Symphylella santa* in the paper from 1931 and *Scolopendrella notella* and *Scolopendrella numexta* from 1933. All of the taxa described in these two papers with the exception of *Pseudoscutigerella americana* are *nomina dubia.*

Hilton's 1931 paper also records four described species: *Scutigerella immaculata* and *Symphylella brevipes* (Hansen) from California and New York and *Symphylella vulgaris* (Hansen) and *Symphylella isabellae* (Grassi) from California. The identifications of *Scutigerella immaculata* and *Symphylella brevipes* are very doubtful. Hilton gives no characters which can be used to verify his identifications. The former species has often been confused with other members of the genus, while the latter species is known only from southern Asia. As for *Symphylella vulgaris* and *S. isabellae,* some characters mentioned by Hilton prove that other species were at least partly involved. Since Hilton's descriptions and identifications are almost without exception valueless, his statements must be disregarded in the future.

One species described by Hilton has since been reported from Missouri by Fischer, Langille, and Keaster (1974) who recorded *Scolopendrellopsis santa* Hilton, presumably a new combination for *Symphylella santa.* The present author has tried unsuccessfully to obtain specimens of this species. Hilton's species is very incompletely described, and because it does not appear from Fischer, Langille, and Keaster's paper that the Missouri specimens were compared with the type material, the identification has to be rejected.

Although the taxonomy, systematics, and biology of North American symphylans had been treated by several authors between 1873 and 1933, only three identifiable species were recorded in the United States when Michelbacher's first studies appeared. Michelbacher was a serious worker who made reliable identifications and careful studies with rather detailed descriptions. Besides his exhaustive review of the biology of *Scutigerella immaculata* and some papers concerned with ecological and economic problems connected with injuries caused by symphylans, he listed and described many species from North America and some from abroad. In a series of papers (1939a, 1939b, 1941, 1942a, 1942b) based mainly on his own collections, he described one new species of *Scolopendrellopsis* from California; nine species of *Symphylella* of which all but two are from California; seven species of *Scutigerella* of which two are from California, one from North Carolina, and four are extra-American; and one species of *Hanseniella* from California—in all, twelve new species from the United States. With those excellent studies at hand we might have expected further investigations in the same directions but unfortunately these have not appeared.

Mexico

The Mexican symphylan fauna has received little attention apart from sporadic collections and descriptions of some species by a few investigators. Knowledge of both species composition and geographic distribution is still in an early stage of development. Not only are many species yet to be described or named, but the complete distribution is unknown for all the species recorded.

The first specimens reported from Mexico were collected about a hundred years ago by Packard (1881:383) in a coffee plantation at Córdoba, Veracruz. He placed them in *Scutigerella immaculata* and stated that they differed from specimens of that species from the United States only in being longer and having longer antennae and cerci. Based on the taxonomic knowledge of the 1880s, Packard's identification was correct, but it is now doubtful that these specimens belonged to the mentioned species. This uncertainty is increased by its absence in later reports with the exception of Hilton's (1931:539) records from two unnamed localities in the Valley of Mexico. Like many of his taxonomic statements, these identifications must be questioned. Even if it now seems impossible to assign Packard's material to a known species it probably belonged to the genus *Scutigerella.* Hilton (1931:548, 550) also reported two additional species from Mexico: *Symphylella isabellae* (Grassi) from three localities in Baja California (about 50 miles from Tijuana, below Ensenada on the bay, and near Santo Tomas) and *S. brevipes* (Hansen) from the Valley of Mexico. The records for both species were repeated by Hinschberger (1950a:256) and the former record by Michelbacher (1942a:154). The taxonomic characters utilized by Hilton are not sufficient for including these species, probable misidentifications, in the Mexican fauna.

Some years later Hilton (1938:13-16) described two new species from Yucatán, *Scutigerella maya* from Uxmal and *Symphylella itza* from Uxmal and Chichén Itzá. A third species, *Symphylella vaca*, was also described from mountains near Cuernavaca, Morelos. The diagnoses consist only of some randomly selected and incompletely described characters. Since the type specimens are no longer in existence, Hilton's names must be considered to be *nomina dubia*.

A more serious and successful attempt to collect and describe symphylans was made by Michelbacher in the late 1930s. After having searched at four places in Baja California he was able to describe two new species from there: *Symphylella rossi* from Comondu (1942a:156-157) and *Symphylella capicola* from about three miles south of Triunfo (1942a: 154-156). He also found (1942a:157) material from the latter locality which was close to *S. rossi*, but for want of sufficient material he reported it as *Symphylella* sp. He also collected the first Mexican representative of *Geophilella* (1942a:154) from a mile or two south of Triunfo but did not name the single specimen on hand.

Finally Hinschberger (1950a, 1950b) added five more species, three of which were new. She reported *Hanseniella* sp. cf. *caldaria* (Hansen) (1950b:370), the first representative of the genus from Mexico, from Motozintla and El Vergel, Chiapas. She also described *Scutigerella boneti* (1950a:256-260) from the same locality in Chiapas and *Scutigerella mexicana* (1950a:260-262) from Ajusco, El Xitle, Federal District. Her material also included (1950b:370) *Scolopendrellopsis alba* Michelbacher from single localities in the Federal District and in Hidalgo and a new species, *Scolopendrellopsis remyi*, from single localities in Veracruz, Tabasco, and Guerrero.

MATERIAL

The following systematic section includes all species the occurrence of which has been documented by collections of the author or by study of specimens sent to him for identification. A total of 281 specimens have been examined. The principal contributors have been Mr. James Reddell of the Texas Memorial Museum, The University of Texas at Austin, and Dr. Robert W. Mitchell of Texas Tech University, Lubbock. Other collections examined have been put at my disposal by Prof. Richard L. Hoffman, Radford University; Prof. Barry D. Valentine, Ohio State University; and Dr. Henrik Enghoff, University of Copenhagen.

Observations from the study of many type specimens have also been included, and pertinent published accounts have been used.

COLLECTION, PRESERVATION, AND MICROSCOPY

Symphylans are easily obtainable. They can be picked up with a fine brush from the underside of moist stones and branches, or they can be extracted from litter and soil samples with automatic methods. Most funnels will provide results but the Tullgren funnels, particularly recent modifications, are good for collecting the agile Scutigerellidae. The slow-moving Scolopendrellidae are more susceptible to changes in moisture, temperature, and light so that a gentle application of heat and light to extract the animals from the sample is necessary. Another sampling technique of great value is flotation, especially for quantitative estimation in soils with a low content of organic matter.

The animals have to be fixed and preserved in fluids which keep them soft and stretched. Strong ethyl alcohol often gives irregular contraction, and a better result is obtained with diluted alcohol, such as 70%, possibly mixed with small amounts of acetic acid and formaldehyde. Before microscopy the animals must be cleared, such as in lactic acid. The use of slide mountants, such as PVA, are of low value since the mounting most often gives strong flattening or considerable distortion.

SYSTEMATICS

In the collections studied, two families are represented: the Scolopendrellidae with three genera and eight species, one of which is new; and the Scutige-

Key to Families of Symphyla

1. Paired sense calicles with smooth margin of pit; tergites either with pointed posterior projections or reduced in size; styli at base of legs small or reduced; first pair of legs less than half as long as following pair; usually slow-moving with slender body . . . . Scolopendrellidae Bagnall

   Paired sense callicles with many setae around margin of pit; tergites large with rounded posterior margins; styli large; first pair of legs more than half as long as following pair; usually swift runners with stout body . . . . .Scutigerellidae Bagnall

Key to North American Genera of Scolopendrellidae

1. 17 tergites or less; tergites usually large and distinct, most often with posterior triangular processes 2
   22 tergites; tergites except first one indistinct, represented only by paired oval plaques bearing few setae; no posterior triangular proceses . . . . *Geophilella* Ribaut

2. First pair of legs vestigial, represented only by small protuberances with a few setae . . . . *Symphylella* Silvestri
   First pair of legs 3-jointed, with claws . . . . *Scolopendrellopsis* Bagnall

rellidae with three genera, one of which is new, and 13 species, three of which are new. Thus there a total of 21 species recorded in this paper. Two species are herein reported for the first time from the United States and one genus and eight species are added to the Mexican fauna.

SCOLOPENDRELLIDAE BAGNALL

In the above key two genera have been omitted which were reported earlier from North America. One is *Scolopendrellina*, erected by Hilton (1931: 544) for specimens from South Hills near Pomona, California, but the genus is unrecognizable. The other genus is *Scolopendrella*, mentioned by both Hilton and Michelbacher and including two unrecognizable species described by Hilton: *S. notella* from Iowa (1933:557) and *S. numexta* from New Mexico (1933:558-559). Neither species seems to belong to *Scolopendrella*. Michelbacher's record of this genus (1939:748) was in error (Michelbacher, 1941:139).

Symphylella Silvestri

Symphylella Silvestri, 1902:10.

Symphylella longiseta Michelbacher

Symphylella longiseta Michelbacher, 1941:147-150, pl. II, figs. 1*a-g*.

New record.—USA: *Louisiana*: Livingston County: 2 mi. E Livingston, 29 November 1964 (A.W. Romano), 1 subad. 11[1] female.

Discussion.—*Symphylella longiseta* has not been reported previously outside the type-locality, near Calaveras Dam, Alameda County, California. Michelbacher (1941) found only two specimens, one adult and one subadult.

[1]Abbreviations: ad., a specimen with the maximum number of legs; subad. and juv. ...., a subadult or juvenile specimen with the number of pairs of legs indicated. These numbers include the rudimentary first pair of legs in *Symphylella*.

Symphylella oviceps Michelbacher

Symphylella oviceps Michelbacher, 1939:748-751, figs. 2*a-g*.

New records.—USA: *California*: Calaveras County: 4 mi. N Columbia, SW 1/4, Sec. 22, T3N, R14E, 22 March 1979 (D. Rudolph, B. Martin, S. Winterath, W. Elliott, J. Reddell), 1 ad. female. Tuolumne County: 2 km N Columbia, 31 March 1979 (J. Reddell), 1 ad. male, 1 ad. female; 3.7 km N Columbia, from tailings of Transplant Mine (48° F), 10 January 1978 (W. R. Elliott, A. G. Grubbs, S. A. Winterath), 1 ad. male.

MEXICO: *Yucatán*: 7 km SW Oxkutzcab, in litter, Berlese extraction, 31 July 1973 (R. W. Mitchell, J. R. Reddell), 1 ad. male, 1 juv. 10; 3 km S Libre Unión, 21 July 1975 (J. Reddell, A. Grubbs), 1 ad. female.

Discussion.—*Symphylella oviceps* was previously known only from the type-locality, California Packing Corporation Ranch, near Planata, Merced County, California.

The adult Mexican specimens are shorter and more sparsely setose than the type specimens and the end-swellings of the tips of the triangular processes may be more prominent. In the material studied here the setae of the tergites, particularly the anterolateral macrochaetae, seem to be proportionately longer than in the types.

In the figures of the original description showing tergites 2-4 Michelbacher depicted a seta more prominent than the others inserted near the inner base of the triangular processes but he did not mention it in the text. These setae, however, seem to be typical of the species and present a good diagnostic character.

Symphylella reddelli, new species
Figs. 1-2

Type-data.—Holotype male from 7.5 mi. N Boerne, Kendall County, Texas, U.S.A., 15 March 1969 (J. Reddell) (in author's collection).

Etymology.—Dedicated to Mr. James Reddell, Texas Memorial Museum, Austin.

Key to Species of *Symphylella* Reported Herein

1. Primary setae on inner side of basal antennal segments twice longer than those of outer side; tarsus of last pair of legs 5-6 times longer than wide; setae on tergites in general very long . . . . *longiseta* Michelbacher
   Primary setae on inner side of basal antennal segments at most 1.5 times as long as those of outer side; tarsus of last pair of legs 3-4 times longer than wide; setae on tergites of medium size 2

2. First rudimentary tergite with at least 4 + 4 setae 3
   First rudimentary tergite with 3 + 3 setae. 4

3. First rudimentary tergite with 4 + 4 to 5 + 5 setae; tips of triangular processes of tergites 2 and 3 with distinct but small endswellings; styli 1.5-2.0 times as long as wide . . . . *oviceps* Michelbacher
   First rudimentary tergite with 6 + 6 setae; tips of triangular processes of tergites 2 and 3 blunt without endswellings; styli 3 times longer than wide . . . . *reddelli* n.sp.

4. Triangular processes of tergites 2-4 with a seta on inner side between apical and basal setae; tergal setae numerous and of normal size . . . . *vulgaris* (Hansen)
   Triangular processes of tergites 2-4 without setae between inner basal and apical setae; tergal setae sparse, short and very thin . . . . *pusilla* (Hansen)

Description.–*Length:*[2] 2.64 mm.

Head: 1.3 times as long as broad with broadest part a little behind articulating points of mandibles. The latter concealed under rounded margins of head. Only posterior part of central rod distinct, 0.3 of length of head; frontal branches vestigial, median ones lacking. Dorsal surface of head covered with short, straight, thin setae of subequal length. Three setae at inner base of antenna and a few lateral setae are about twice longer than inner setae. Diameter of postantennal organ 0.4 of greatest diameter of 3rd antennal segment; length of tube between the organ and the head surface almost 0.3 of diameter of organ. Palp of first maxilla conical, very pointed, outer side straight. Cuticle of head glabrous.

Antennae: Antennae with 18 segments; they are 0.3 of the length of body. First segment thinner than following ones, almost 1.2 times as wide as long; it is as long as 2nd segment and its diameter is 0.8 of the diameter of that segment; there are 6 setae, all but an outer ventral one in the primary whorl; inner setae longest, 1.3 times as long as outer seta and 0.6 of the greatest diameter of segment. Second segment 1.2 times as wide as long with 8 evenly distributed setae of about the same length as setae of preceding segment; inner setae a little longer than outer ones. Third segment with 10 setae almost evenly distributed around the segment; inner setae slightly longer than outer ones, 0.5 of diameter of the segment. Setae longest on proximal segments; inner setae longer than outer ones. Longest setae of outer side of the proximal segments 1.7 times as long as corresponding setae of the distal segments. Proximal part of antennae with one whorl of setae on each segment, secondary whorl well developed on 10th segment but disappears on distal segments. Circular sensory organs on dorsal side of segments 9-10 to 17. Bladder-shaped organs on 7-8 segments next to the apical one. Small spined organs are on dorsal side of most segments from segment 2 to 13 and on the apical one. They are most marked on proximal segments. Apical segment subsphaerical with many short, thin, almost straight setae; it seems to have only one spined organ in an apical cavity. All antennal segments with a fine pubescence.

Tergites: First tergite rudimentary with 12 setae arranged in two groups of 6 setae. Most lateral seta on each side longest. Thirteen tergites have triangular posterior processes. Second tergite complete. The ratio of the distance between the processes (measured along posterior margin of tergite) to their length is 1.3 on 2nd tergite, 0.6 on 3rd and 1.9 on 4th tergite. Third tergite larger than preceding one. Processes of posterior tergites have broader bases than those anteriorly. Tips of triangular processes everywhere short, blunt, without endswellings. Longest anterolateral seta of 2nd tergite 0.7 of the length of the processes; on tergites 3 and 4 this ratio is 0.5 and 0.8 respectively. Anterior tergites with 1-2 marginal

[2]Length of body except antennae and cerci.

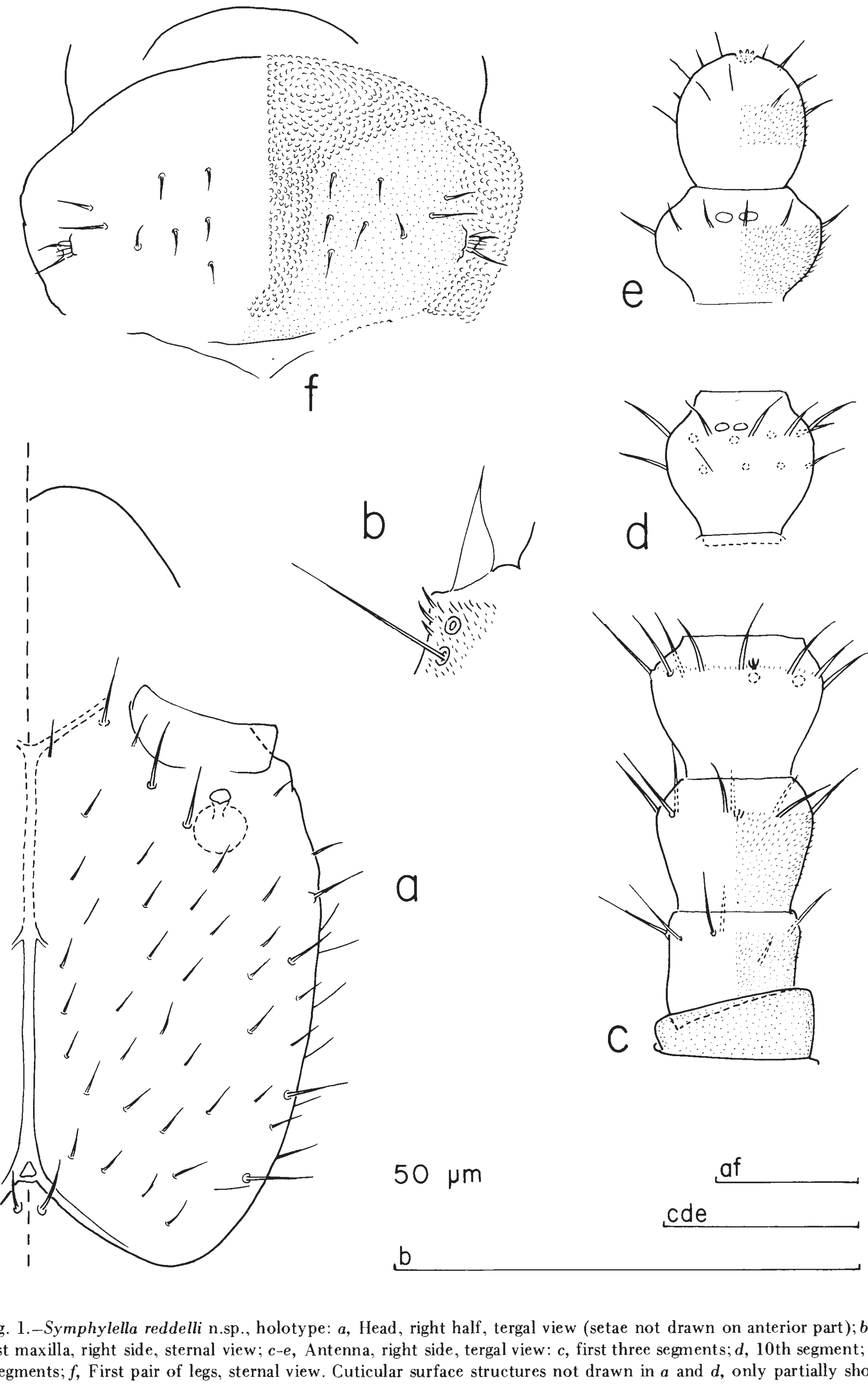

Fig. 1.–*Symphylella reddelli* n.sp., holotype: *a*, Head, right half, tergal view (setae not drawn on anterior part); *b*, Palp of first maxilla, right side, sternal view; *c-e*, Antenna, right side, tergal view: *c*, first three segments; *d*, 10th segment; *e*, last two segments; *f*, First pair of legs, sternal view. Cuticular surface structures not drawn in *a* and *d*, only partially shown in *c*, *e*, and *f*.

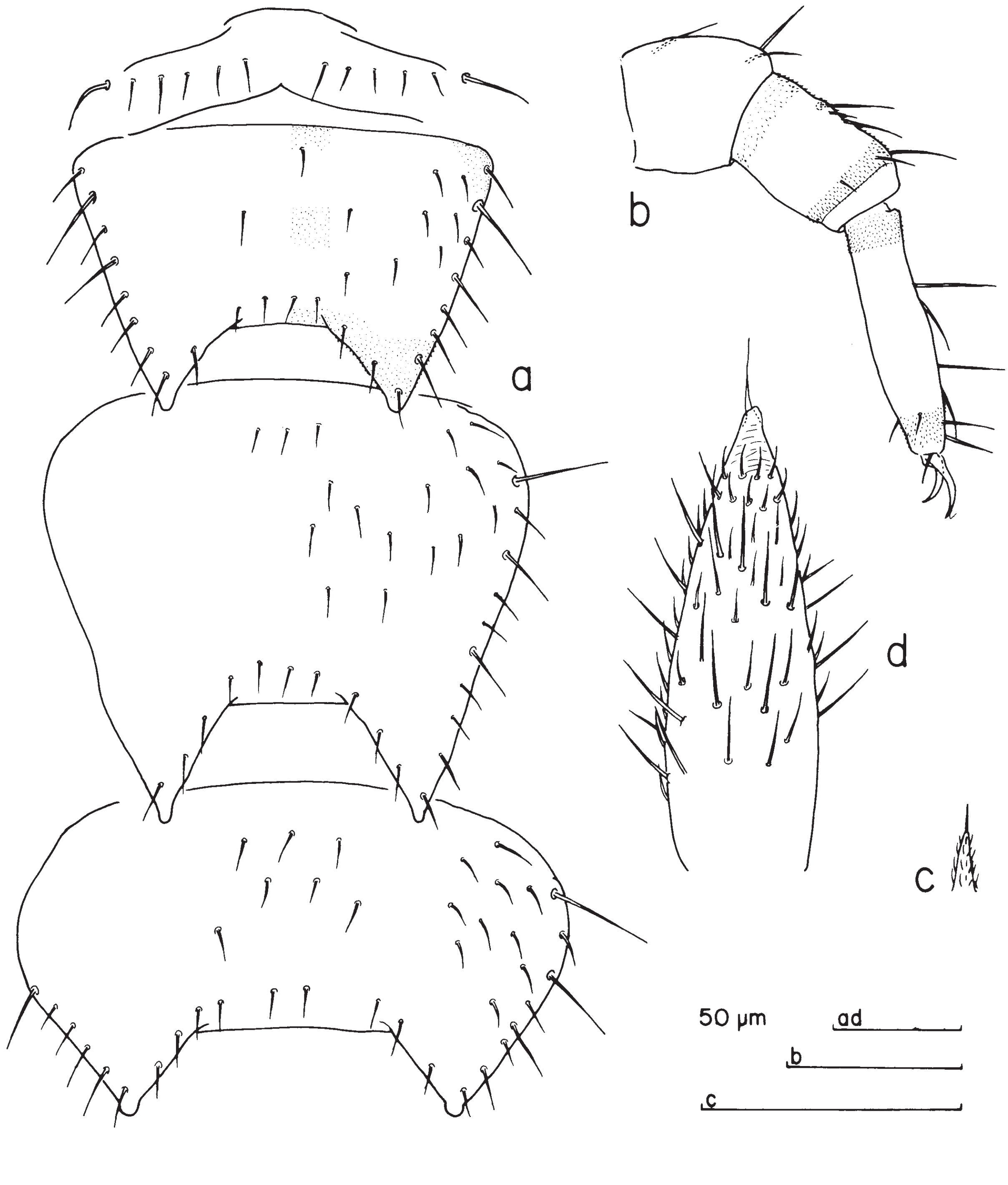

Fig. 2.–*Symphylella reddelli* n.sp., holotype: *a*, Tergites 1-4 (setae only partially drawn to the left); *b*, 12th leg, left side, anterior view; *c*, Stylus, 12th leg; *d*, Cercus, right side, tergal view. Pubescence only partially drawn in *a* and *b*.

setae between apical and inner basal setae. Number of posteromarginal setae (between inner basal setae) on different tergites varies: 2 on 2nd, 3 on 3rd, 4 on 4th. Number of lateromarginal setae (apical or subapical and anterolateral setae included): 7 on 2nd, 10 on 3rd, 8 on 4th. Anterolateral setae longer than other marginal setae. Cuticle of tergites granular or even shortly pubescent. Setae thin, insertion areas most often indistinct.

Legs: First pair of legs reduced to two small two-parted knobs; anterior part largest with a short seta, posterior part smaller but with a longer seta; the latter seta 3 times longer than height of the knob. There are 16 setae between the legs. Last pair of legs with a subcylindrical tarsus which tapers towards distal end. It is 3.9 times as long as wide with 6 setae on dorsal side, 4 of which are erect and straight and 2 are depressed and curved. Longest seta on proximal part of dorsal side: it is nearly 1.4 times as long as greatest diameter of tarsus and 0.5 of the length of tibia. Tibia 1.6 times as long as wide with 6 setae, 5 of them on dorsal side; 2 of the latter are protruding, 0.4 of the greatest diameter of joint and almost as long as longest seta on the tarsus. Femur about as long as wide with 4 setae. Anterior claw 1.2 times as long as posterior claw, the latter more curved but not distinctly more slender than the former: anterior claw a little shorter than greatest diameter of tarsus. All segments pubescent. Styli conical, about 3 times longer than greatest width, densely pubescent; apical hair thin, pointed. There are 7 pairs of fully developed coxal sacs at bases of 3rd-9th pair of legs. Number of setae on coxal plates varies: 4-5 at 10th pair of legs, 4 at 11th, 2 at 12th.

Cerci: Cerci 3.0 times longer than wide with outer, inner and ventral sides distinctly convex. They reach 1/15 of the length of body and 0.7 of the length of 12th pair of legs. Setae either short, slightly curved, depressed or longer, straight, erect; both types are on all sides. Dorsal side has about 7 long setae, outer side 6, ventral 7-8, inner 3 ones; the longest of them are 3.0 times longer than shortest setae which are at distal end of cercus; longest setae 0.6 of greatest diameter of cercus. Basal fourth not setose. Terminal area short. Apical seta nearly 0.2 of the length of cercus.

Affinities.—*Symphylella reddelli* is closely related to *S. texana* (Hansen) which is known only from Austin, Texas. *Symphylella texana* was described by Hansen in 1903 and later redescribed and a lectotype selected by the present author (Scheller, 1974:243-245). The two species are generally similar but the new species is readily distinguished from *S. texana* by the chaetotaxy of the cerci, the tarsus of the last pair of legs and the first tergite. Good diagnostic characters are also found in the shape of the styli, the first pair of legs, and the processes of the tergites.

Symphylella vulgaris (Hansen)

Scolopendrella notacantha Latzel, 1884.
Scolopendrella vulgaris Hansen, 1903:79-81, pl. VI, figs. 6*a*-*d*, pl. VII, fig. 1*a*.
Symphylella delicatula Bagnall, 1913.
Symphylella horrida Bagnall, 1913.
Symphylella minutissima Bagnall, 1913.
Symphylella vulgaris: Bagnall, 1913.

New records.—USA: *Florida*: Volusia County: Bank of Halifax River, Ormond, in sand and marine shells 2 m from living oyster bed, 25 March 1980 (J. B. Holmquist), 1 ad. male.

Georgia: Gilmer County: 3 mi. NE Ellijay, at creek in dense deciduous forest, 11 August 1981 (Loc. 13, U. Scheller), 1 juv. 9, 1 juv. 8.

Kentucky: Laurel County: 3 mi. S Sublimity City, at creek in dense deciduous forest, under stone in leaf litter, 13 August 1981 (Loc. 10, U. Scheller), 1 juv. 9.

New York: Syracuse, sugar maple stand, nest of great horned owl, *Bubo virginianus virginianus* (Gmelin), from pellets, October-November 1973 (J. R. Philips), 1 juv. 10.

North Carolina: Buncombe County: Black Mountain, under *Liriodendron* and maples in depression, S Ash Street, water flotation, 10 August 1981 (Loc. 12, U. Scheller), 3 juv. 9, 1 juv. 8.

Ohio: Franklin County: Upper Arlington, Columbus, 4 September 1976 (B. D. Valentine), 1 juv. 10 female.

Virginia: Wythe County: Ewing Mountain, N side, Rt. 643, ca. 4 mi. W Ivanhoe, 29 May 1978 (R. L. Hoffman), 1 ad. male, 1 ad. femle, 1 subad. 11 female. Rockbridge County: 2 mi. SW Lexington, shady mixed deciduous forest, 16 August 1981 (Loc. 23, U. Scheller), 1 juv. 8; Blacksburg, Virginia Polytechnic University, lawn, 6 August 1981 (Loc. 3, U. Scheller), 1 ad. female, 1 juv. 8. Giles County: Mountain Lake, deciduous forest near the hotel, 6 August 1981 (Loc. 1, U. Scheller), 2 ad. females.

West Virginia: Mingo County: 2 mi. SE Kermit, dense deciduous forest with mosses and ferns, steep slope, soil rich in humus, 14 August 1981 (Loc. 7, U. Scheller), 1 subad. 11 male. Wayne County: Fort Gay, 0.5 mi. S Sinbaddi, open and steep herbaceous slope with deciduous forest nearby, 13 August 1981 (Loc. 29, U. Scheller), 2 juv. 10 females.

MEXICO: *Tamaulipas*: 6 mi. NW Gómez Farías, Rancho del Cielo, 24 March 1967 (R.W. Mitchell), 1 subad. 11 male; 9 March 1969 (J. Reddell), 4 ad. males, 1 ad. female, 2 subad. 11 males, 2 subad. 11 females, 1 subad. 11 unknown sex; 3 June 1967 (R.W. Mitchell), 2 ad. males, 5 ad. females, 1 subad. 11 male.

General Distribution.—*Europe*: Norway, Sweden, Finland, USSR, Denmark, Ireland, Great Britain, Germany FRG, Germany GDR, France, Switzerland, Austria, Spain, Italy, Yugoslavia, Albania, Roumania, Greece.

Asia: USSR, India, Sri Lanka, Sumatra, Japan.

Africa: Morocco, Algeria, Egypt, Azores, Madeira, St. Helena, Zaire, Angola, Kenya, Tanzania, Ruanda Urundi, Madagascar, Reunion.

Australasia: New Zealand.

Discussion.—Although *S. vulgaris* is one of the most widely distributed symphylans, it has not been reported previously from Mexico, and records of its occurrence in the United States are nearly non-existent. Hilton (1931:538) reported it from southern California but his identification is most doubtful and has to be omitted. However, the above list of new localities from Mexico and eight states in the United States ranging from Florida to New York, together with a report from Michigan (Loring, 1980: 16), show that *S. vulgaris* is probably common in North America, at least in its eastern part.

Symphylella pusilla (Hansen)
New Combination
Fig. 3

Scolopendrella pusilla Hansen, 1903:85-87, pl. VII, figs. 4*a–c*.

Introductory remarks.—Apparently the first members of the family Scolopendrellidae to be described scientifically from North America were *Symphylella texana* and *S. pusilla*, both described by Hansen (1903) from material collected by W.M. Wheeler from Austin, Texas. Both species were incompletely treated by Hansen and neither has been rediscovered. The former species was redescribed by Scheller (1974:243-245, fig. 3); the type-material of the latter species, now in the Zoologisk Museum, Copenhagen, has now been studied.

There are three specimens labeled *S. pusilla*, the adult type and two defective specimens. One of the latter, an adult male, resembles the type in many respects, but it cannot be considered here because it has no cerci and no legs on the posterior part of the body. The other is probably an adult specimen lacking the hind part of the body: it is certainly not *S. pusilla* but may be a specimen of *Symphylella capitata* Michelbacher.

The type-specimen is no longer in the best condition but since a redescription is desirable it has been studied to the extent possible.

Redescription (Hansen's characterizations in parentheses.).—*Length*: 1.73 mm.

Head: 1.1 times as long as broad (scarcely one-fourth longer than broad) with broadest part a little behind articulating points of mandibles. Central rod very thin, not interrupted (interrupted at the middle); frontal branches thin, indistinct. Dorsal surface of head sparsely set with short, very thin, pointed setae; a few setae at the base of the antenna and some lateral ones longer, at most about twice longer than inner setae. Diameter of postantennal organ 0.5 of greatest diameter of the 3rd antennal segment. Palp of first maxilla conical, very pointed. Cuticle of head faintly granular.

Antennae: Only left antenna complete: 26 (27) segments of which the most distal one is not fully developed. Right antenna broken beyond first segment. First segment thinner than following ones, subcylindrical, about 1.3 times as wide as long; it seems to be 5 setae, inner ones longest, 1.8-2.0 times as long as outer seta and 0.5 of greatest diameter of the segment. Second segment 1.6 times as wide as long with 8 evenly distributed setae; inner ones of about the same length as on preceding segment, outer ones 1.6-2.0 times as long as corresponding setae on that segment. Third segment with 9 setae; inner setae only slightly longer than outer ones, 0.4 of diameter of the segment. Setae longest on proximal segments; inner setae longer than outer ones on proximal half of the antennae. Longest setae of outer side of proximal segments about twice longer than corresponding setae of distal segments. Proximal part of antennae with one whorl of setae on each segment, secondary whorl begins on inner side of 9th (below on the 14th) segment. Circular and bladder-shaped organs not studied. Small spined organs begin on 4th segment. Apical segment subsphaerical with a moderate number of short and almost straight setae; it has at least 3 short, subglobular spined organs in shallow cavities on distal half. All segments with a fine pubescence.

Tergites: First tergite rudimentary with 6 setae arranged in two groups of 3 setae; most lateral seta on each side longest. Thirteen tergites have triangular posterior processes. Second tergite complete. The ratio of the distance between the processes, measured along posterior margin of tergite, to their length is 1.0 on 2nd tergite, 0.8 on 3rd and 2.0 on 4th tergite. Third tergite larger than preceding one. Processes of posterior tergites are broader and proportionately shorter than those anteriorly. Tips of

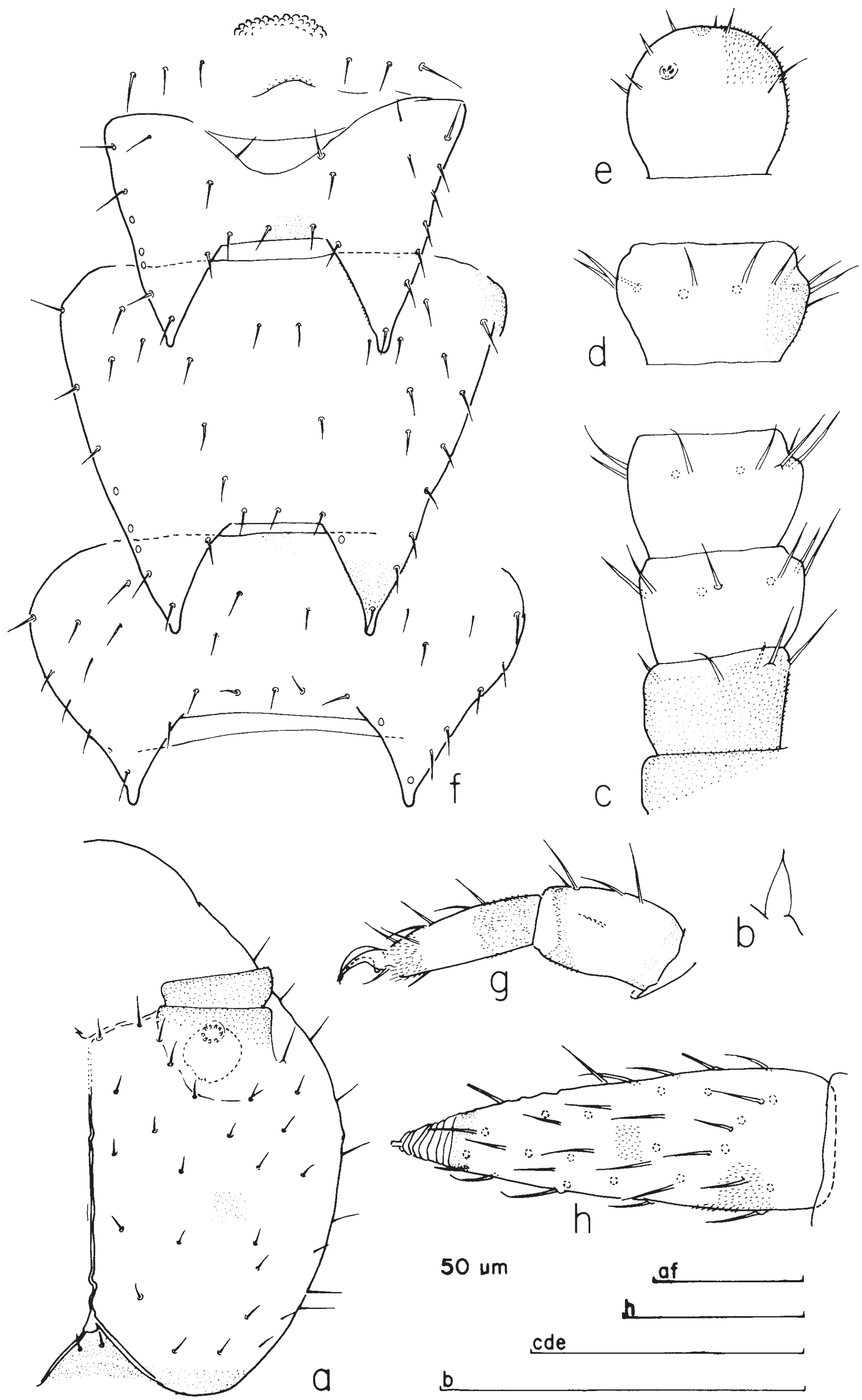

Fig. 3.–*Symphylella pusilla* (Hansen), holotype: *a*, Head, right half, tergal view (setae not drawn on anterior part); *b*, Palp of first maxilla, left side, sternal view; *c-e*, Antenna, left side, tergal view: *c*, first three segments; *d*, 10th segment; *e*, apical segment; *f*, Tergites 1-4; *g*, 11th leg, tarsus and tibia, left side, posterior view; *h*, Cercus, left side, tergal view. Pubescence only partially drawn in *a* and *c-h*.

processes straight, blunt, without endswellings. Longest anterolateral setae of tergites 2-4 0.3 of (not half as long as) the length of the processes. No seta between inner basal and apical setae. Number of posteromarginal setae between inner basal setae on different tergites varies: 3 on 2nd and 3rd, 5 on 4th. Number of lateromarginal setae including the apical or subapical and the anterolateral setae: 7 on 2nd, 7-?9 (7-8) on 3rd, 6 (4) on 4th. Anterolateral setae only very little longer than other marginal setae. Cuticle of tergites faintly granular or shortly pubescent. Setae very thin, insertion areas indistinct.

Legs: First pair of legs reduced to two small knobs. Last pair lacking. Penultimate pair of legs with a subcylindrical tarsus which tapers towards distal end. It is 3.0 times longer than wide with 6 setae on dorsal side, 4 of which are erect and straight and 2 depressed and curved; longest seta on distal part of dorsal side; it is 0.7 of (somewhat shorter than) greatest diameter of the tarsus and 0.3 of length of the tibia. Tibia 1.7 times as long as wide with 6 setae, 5 of them on dorsal side; 2 or 3 (2) of the latter are erect and protruding, 0.6 of greatest diameter of the joint and 1.5 times as long as longest seta on the tarsus. Claws subequal in length, posterior one more curved but not distinctly more slender than anterior one; the latter as long as greatest diameter of the tarsus. Legs pubescent. Styli conical, 3 times longer than greatest width, densely pubescent; apical hair thin, pointed.

Cerci: Cerci 3.0 (not fully 4) times longer than wide with outer sides distinctly convex. They reach 1/14 of length of the body. Setae not very different in length, either slightly curved and depressed or straight and oblique; 3 of the latter are found on outer side; longest one may be >0.4 of the greatest width of the cerci. The terminal area 0.4-0.5 of (more than two-thirds as long as) the greatest depth of the cerci.

Discussion.—In his original description of *S. pusilla* Hansen considered it to be closely allied to his *S. vulgaris*, but the restudy of the holotype of *S. pusilla* shows that there are many distinct characters separating the two species; this indicates that *S. pusilla* is an easily recognized form. In general the setae of *S. pusilla* are shorter, much thinner, and less numerous on the head and inner parts of the tergites. The anterolateral setae on tergites 2-4 are much shorter than in *S. vulgaris. Symphylella pusilla* is also very clearly distinguished by the absence of setae on the inner side of the posterolateral processes of the tergites between the apical seta and the inner basal one.

Scolopendrellopsis Bagnall

Scolopendrellopsis Bagnall, 1913:198.

Scolopendrellopsis (Symphylellopsis) Ribaut

Symphylellopsis Ribaut, 1931:463-464.

Scolopendrellopsis (Symphylellopsis) alba (Michelbacher)

Symphylellopsis alba Michelbacher, 1941:142-145, pl. I, figs. 1*a–j*.

New record.—USA: *California*: Berkeley, University Campus, 5 January 1967 (S. L. Tuxen), 1 juv. 10.

Discussion.—This species is otherwise known only from the type-locality, a garden in Riverside, California (Michelbacher, 1941:144), and in single localities in the Federal District and in Hidalgo, Mexico (Hinschberger, 1950b:370). It is a very small species and certainly easily overlooked, so it may be more common and more widely distributed—at least in the West—than these few localities indicate.

Scolopendrellopsis (Symphylellopsis) subnuda (Hansen)

? *Scolopendrella pygmaea* Silvestri, 1902.
Scolopendrella subnuda Hansen, 1903:70-72, pl. VI, figs. 2*a–g*; Bagnall, 1914.
Scolopendrellopsis subnuda: Bagnall, 1913.
Symphylellopsis subnuda: Ribaut, 1931.
Scolopendrellopsis (Symphylellopsis) subnuda: Scheller, 1971.

New records.—USA: *North Carolina*: Buncombe County: Black Mountain, under *Liriodendron* and maples in depression, S Ash Street, water flotation, 10 August 1981 (Loc. 12, U. Scheller), 1 juv. 8.

Key to Species of *Scolopendrellopsis* Reported Herein

1. Tergite 2 divided; cerci subcylindrical, densely setose . . . . *remyi* Hinschberger
   Tergite 2 undivided; cerci subconical, sparsely setose 2

2. Tergite 3 divided . . . . *alba* Michelbacher
   Tergite 3 undivided . . . . *subnuda* (Hansen)

Virginia: Blacksburg, Virginia Polytechnic University, lawn, 6 August 1981 (Loc. 3, U. Scheller), 2 juv. 10. Bland County: Jefferson National Forest, Cascade Recreation Area, ravine, at creek in deciduous forest, poison ivy and mosses, 3 August 1981 (Loc. 8, U. Scheller), 1 subad. 11 male.

Discussion.—This species has previously been reported from the United States only from Hawaii (Scheller, 1961:443-444) and Michigan (Loring, 1980:15) but its occurrence in Virginia and North Carolina indicates a wider range.

It seems to be indigenous in Europe and northwestern Africa but has been considered to be introduced outside these areas. Whether it is indigenous in North America is uncertain. All the American localities except one are man-modified, but the investigated localities are few and the species has a high capacity for adapting to different habitat conditions. The species is known from many populations and, considering also the wide range in western Palaearctica, it most likely belongs to an old northern element inhabiting primary habitats in North America as well.

General distribution.—This species is quite common and very widespread in western Palaearctica but has also been collected on some islands far from continents.

Europe: Norway, Sweden, Finland, Denmark, Ireland, Great Britain, Germany FRG, Germany GDR, France, Switzerland, Austria, Spain, Italy, Yugoslavia, Roumania, Greece.

Africa: Morocco, Algeria, Azores, Madeira, Reunion.

Scolopendrellopsis (Symphylellopsis) remyi (Hinschberger) Fig. 4

Symphylellopsis Remyi Hinschberger, 1950b:370-373, figs. 6-7.

New records.—MEXICO: *Yucatán*: 7 km SW Oxkutzcab, in litter, Berlese extraction, 31 July 1973 (R. W. Mitchell, J. Reddell), 2 ad. females.

Discussion.—This species has not previously been reported outside those localities in the states of Veracruz, Tabasco, and Guerrero, Mexico, listed in the original description (Hinschberger, 1950b:370). It seems to be a widely distributed species in southern Mexico.

Taxonomic remarks.—One of the specimens from Yucatán has longer antennae (17 segments) than stated in the description and both specimens have a thick-based, curved, proximal seta on the inner side of the cerci not mentioned by Hinschberger. The palp of the first maxilla, which was not described by Hinschberger, is three times longer than wide, straight and conical, with two subequal pointed tips.

Geophilella Ribaut

Geophilella Ribaut, 1913:77.

Geophilella americana (Hilton)

Pseudoscutigerella americana Hilton, 1931:540-541, pl. I, fig. 1.
Geophilella americana: Michelbacher, 1941.

New records.—USA: *Georgia*: Gilmer County: 3 mi. NE Ellijay, at creek in dense deciduous forest, 1 subad. 11 female, 1 juv. 9, 11 August 1981 (Loc. 13, U. Scheller).

Virginia: Bland County: Jefferson National Forest, Cascade Recreation Area, ravine, at creek in deciduous forest, poison ivy and mosses, 3 August 1981 (Loc. 8, U. Scheller), 1 juv. 9, 2 juv. 8.

West Virginia: Mingo County: 2 mi. SE Kermit, dense deciduous forest with mosses and ferns, steep slope, soil rich in humus, 14 August 1981 (Loc. 7, U. Scheller), 1 juv. 9.

Discussion.—The first report of the genus *Geophilella* from North America was made by Hilton (1931: 537, 541-542). He described the new species *G. americana* on material from Evey Canyon, near Claremont, California, and also reported representatives of the species from Laguna Beach, California, and from Ellis Creek and The Glen, New York. Michelbacher (1941:140-143) confirmed the presence of this species in California and reported it from "Point Reys,

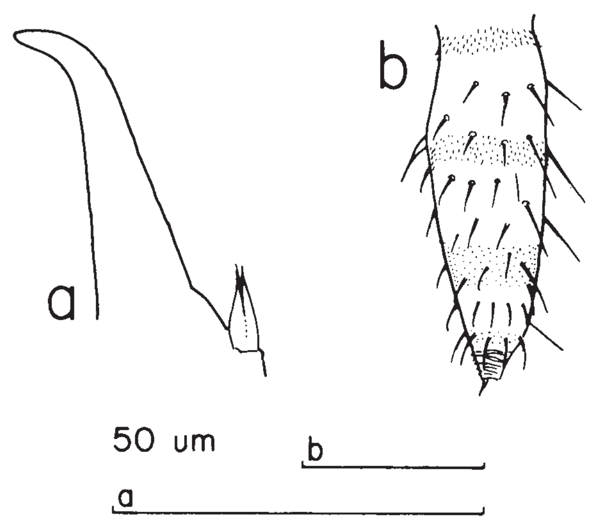

Fig. 4.—*Scolopendrellopsis remyi* Hinschberger: *a*, First maxilla with palp; *b*, Left cercus, sternal view. Pubescence only partially drawn in *b*.

Calaveras Dam, Moraga, Briceburg, Idyllwild and several other localities" and emended Hilton's incomplete and defective description. Michelbacher later (1949:6) stated that the species was widely distributed in California. The present study also shows that it occurs in the eastern United States as well.

In a short note Michelbacher (1942:154) mentioned that "a single specimen [of *Geophilella*] . . . was collected on a hillside a mile or two south of Triunfo" in Baja California. Considering the wide range of *G. americana*, from California to Georgia, Virginia, West Virginia, and New York, the Mexican specimen may have also belonged to it.

General distribution.—*Geophilella americana* is known only from the localities mentioned above.

SCUTIGERELLIDAE BAGNALL

Scutigerella Ryder

Scutigerella Ryder, 1882:234.

Scutigerella causeyae Michelbacher

Scutigerella causeyae Michelbacher, 1942:280-283, pl. III, figs. *2a-k*.

New records.—USA: *California*: Calaveras County: 3 mi. N Columbia, Cave of Skulls, NE 1/4, Sec. 33, T3N, R14E, 29 March 1979 (D.C. Rudolph, B. Martin, S. Winterath, W. Elliott, J. Reddell), 1 ad. female; 4 mi. NW Columbia, Porcupine Cave, SW 1/4, Sec. 22, T3N, R14E, 17 February 1979 (D.C. Rudolph, S. Winterath), 1 ad. male. Tuolumne County: 2 mi. NW Columbia, McLean's Cave, NE 1/4, Sec. 34, T3N, R14E, 28 January 1978 (W.R. Elliott, A. Grubbs), 2 ad. males; 2 mi. NW Columbia, Mine Cave, SW 1/4, Sec. 34, T3N, R14E, 1 April 1979 (D.C. Rudolph, S. Winterath, B. Martin), 1 ad. female; 2.5 mi. N Columbia, mine, NW 1/4, Sec. 35, T3N, R14E, 22 February 1979 (D.C. Rudolph, S. Winterath, B. Martin, 1 ad. male.

Florida: Liberty County: Torreya State Park, along trail near campsite, mixed forest, dry soil, 25 January 1965 (N.B. Causey), 1 ad. male.

Georgia: Gilmer County: 3 mi. NE Ellijay, at small creek in dense deciduous forest, 11 August 1981 (Loc. 13, U. Scheller), 1 ad. male.

New Mexico: Taos County: Twining, Williams Lake Trail, alt. 10,000 ft., 3 July 1967 (R.W. Mitchell), 2 ad. females.

North Carolina: Haywood County: Waterville Lake, deciduous forest, 10 August 1981 (Loc. 14, U. Scheller), 1 subad. 11 female.

Virginia: Smyth County: Iron Mountain, ca. 6 mi. SE Chilhowie, alt. 1300 m, 19 May 1979 (R.L. Hoffman), 2 ad. males, 3 ad. females. Grayson County: ca. 4 mi. W Troutdale, rich woods along Va. Hwy. 741, alt. ca. 3,500 ft., 20 July 1968 (R.L. Hoffman), 1 ad. of unknown sex. Montgomery County: near Radford, 2 August 1981 (H. Enghoff), 1 ad. male.

West Virginia: Pocahontas County: 4 mi. N Marlington, shady ravine with oaks and maples, poison ivy, *Impatiens*, ferns, 15 August 1981 (Loc. 22, U. Scheller), 1 ad. male, 1 ad. female.

Discussion.—*Scutigerella causeyae* was described on material from Durham, North Carolina, and has since been reported by Waterhouse (1970:392-393) from Washoe, Lander, and Lincoln Counties, Nevada, Muscatine and Lander, Iowa, and Knox County, Tennessee. The new localities listed above are from four new states and greatly extend the range in the south and east. It might be supposed that the species is considerably more common than previous reports indicate. *Scutigerella causeyae* is also closely related to *S. immaculata* and thus may have been overlooked by early authors.

General distribution.—Outside the United States this species seems to be widely distributed in Europe, where it is also probably often overlooked.

Key to North American Genera of Scutigerellidae

1. Posterior margin of last tergite with a median indentation or projection; anterolateral setae of tergites not very prominent, directed mainly backwards-outwards. 2
   Posterior margin of last tergite straight; at least anterior tergites with anterolateral macrochaetae, usually long, directed mainly forwards-outwards . . . . *Hanseniella* Bagnall

2. Last tergite with a deep posteromedian caudal cavity . . . . *Scutigerella* Ryder
   Last tergite with a posteromedian rounded disciform projection. . . . . *Scopoliella* n. gen.

Key to Species of *Scutigerella* Reported Herein

1. At least some styli with additional setae 2
   Styli without additional setae 6

2. Anterior claw sickle-shaped . . . . *aduncus* n. sp.
   Anterior claw of normal shape 3

3. Tergites 2-4 with very long anterolateral macrochaetae directed forwards-outwards; tarsus of last pair of legs at most 3.2 times as long as wide . . . . *acicularis* n. sp.
   Tergites 2-4 without distinct anterolateral macrochaetae; tarsus of last pair of legs >3.5 times as long as wide 4

4. Tergites 2-4 with triangular posterior processes; styli about twice longer than broad . . . . *mexicana* Hinschberger
   Tergites 2-4 with rounded posterolateral corners; styli about 3 times longer than broad 5

5. Almost all styli with additional setae; no long lateral setae on tergites 5-10; cerci long, slender . . . . *silvestrii* Michelbacher
   Anterior styli without additional setae; long lateral setae occur on tergites 5-10; cerci shorter . . . . *inculta* Michelbacher

6. Tergite 2 only slightly emarginate 7
   Tergite 2 distinctly emarginate 8

7. Coxal plates of 11th pair of legs with 4-5 setae; posterior margin of tergite 2 almost straight . . . . *causeyae* Michelbacher
   Coxal plates of 11th pair of legs with 1-2 setae; posterior margin of tergite 2 shallowly emarginate . . . . *palmonii* Michelbacher

8. Submedian posterior lobes of tergites 2-3 low and well separated; cerci and tarsi densely setose . . . . *immaculata* (Newport)
   Submedian posterior lobes of tergites 2-3 distinct and close to each other; cerci and tarsi sparsely setose . . . . *linsleyi* Michelbacher

Scutigerella immaculata (Newport)

Scolopendrella immaculata Newport, 1845:373-374, pl. XL, figs. 4*a-c*.
?*Scolopendrella Americana* Packard, 1873.
?*Scolopendrella immaculata* Ryder, 1882.
?*Scutigerella californica* Woodworth, 1905.
?*Scutigerella biscutata* Bagnall, 1914.
?*Scutigerella spinipes* Bagnall, 1914.

New record.—USA: *Washington*: Seattle, 15 February 1939 (E. Daily), 1 ad. male, 1 ad. female.

Discussion.—*Scutigerella immaculata* has been reported from 32 states in the United States, particularly in the west and northeast. A detailed distributional analysis at the county level was published by Waterhouse (1970). Most of his statements, however, were based on reports in the literature or on personal communications, and it seems as if in only a few cases did Waterhouse himself make the identifications. The species is probably widespread, at least in cultivated soils, but Waterhouse's list should be read with caution. Before Michelbacher's (1942b) synopsis of the genus a specimen of symphylan was generally reported as *S. immaculata* (Newport), and Waterhouse's map of the distribution of the species may be regarded more as a picture of the distribution of damage to crops caused by members of the genus *Scutigerella* than of the range of *S. immaculata.*

General distribution.—There are numerous reports of the species not only from most European countries and from North America but also from Africa and South America. Since no modern estimate of the range has been made, we know very little of the true range of the species. It may be widely distributed but probably less so or at least more scattered than most workers have supposed.

Scutigerella mexicana Hinschberger

Scutigerella mexicana Hinschberger, 1950:260-262, figs. 4-5.

New records.—MEXICO: *Tamaulipas*: 10 km SW Aldama, Cueva de los Cuarteles, 11 January 1977 (J. Reddell, A. Grubbs), 1 ad. female, 1 juv. 10; under rocks outside entrance to Cueva de los Cuarteles, 11 January 1977 (J. Reddell, A. Grubbs), 1 ad. female, 1 juv. 10.

General distribution.—The only previous record of this species was from the type-locality, El Xitle, Ajusco, Federal District, Mexico.

Scutigerella acicularis, new species
Figs. 5-6

Type-data.—Holotype female (author's collection) and paratype female (TMM) from 6 mi. NW Gómez Farías, Rancho del Cielo, Tamaulipas, México, 9 March 1969 (J. Reddell), paratype male (author's collection) from 6 mi. NW Gómez Farías, Rancho del Cielo, Tamaulipas, México, 4,200 ft., 3 June 1961 (R. W. Mitchell); 3 paratype males, 1 paratype female (author's collection) from Mine Cave, Tamaulipas, México, 3 June 1961 (R. W. Mitchell); paratype male (author's collection) from 5 km SE Actopan, Puente Actopan, Veracruz, México, under rocks on sloping hillside, 25 December 1976 (J. Reddell, A. Grubbs).

Etymology.—From Latin *acus*, needle.

Description.—*Length*: (2.4-)3.3(-4.6)[3] mm.

Head: About as broad as long (to 1.2 times as broad as long) with broadest part in the posterior third. Articulating points of mandibles concealed. Central rod indistinct, 0.3 of length of the head; frontal branches distinct, median ones lacking. Dorsal surface of head covered with straight thin setae of several lengths; (3-)4 setae at inner base of the antennae are longest and a few posterolateral ones are prominent too. Diameter of postantennal organ about 0.4 of diameter of the 3rd antennal segment. Longest seta inserted between postantennal organ and spiracle; it is (1.2-)1.3-1.4 times as long as diameter of the 3rd antennal segment. Palp of first maxilla conical, pointed, (2-)3-cuspidate. Cuticle of head glabrous.

[3]Range of variation (paratypes included) is given in parentheses.

Antennae: 20-28(-36) segments. First segment with wide base, at least as long as wide; it has a single primary whorl of 4 setae of normal length and 1(-3) short flattened ones; the former are 3 thin ones on inner tergal and inner sides and a thick one on outer part of tergal side and the latter are inserted on sternal (or on sternal and tergal) side(s). An additional thin seta protrudes perpendicularly on middle part of inner side. Second segment (1.4-)1.8(-1.9) times as wide as long with 8(-10) primary setae evenly distributed around the segment: 3 thin, (1-)4 thick and 1(-4) small ones. Outer and inner setae of 10th segment of about the same length. Apical segment ovoid, 1.2(-1.3) times as long as wide; setae directed anteriorly, most of them are long but a few are short and thin; longest seta 0.9 of longest setae on proximal segments. Apical spined organ with a conical base and 4 distal curved spines around a central pillar; length of organ 0.2 of length of the segment; there are 2 small subapical spined organs.

Each proximal segment with a single primary whorl of setae; secondary whorl begins on inner (-sternal) side of segment 6(-8). A rudimentary 3rd whorl of setae occurs mainly on sternal side of the distal half of the antennae. Short sticklike setae often occur in the primary whorl.

First segment with a fine small-scaly cuticular pattern, glabrous (or with a few pubescent hairs on a level with the primary whorl); 2nd segment with a more large-scaly pattern and more pubescent hairs. Pubescence still incomplete on 3rd segment, more outwards covering all sides.

Tergites: First tergite rudimentary with (7-)8(-10) setae, 4 of which are more prominent than the others. Second tergite complete, (1.7-)2.0 times as broad as long; posterior margin moderately emarginate, anterolateral angles distinct, each with a macrochaeta; setae thin and of several lengths; (31-)36(-46) marginal setae, 8 of which are prominent; anterolateral macrochaetae point outwards and forwards and reach 0.3 of the breadth of the tergite; 2 submedian posterior setae are prominent; 4(-6) inner surface setae longer than the others. Third tergite similar to the preceding one but longer and broader, 1.5(-1.8) times as broad as long; (34-)about 60 marginal setae; anterolateral corners rounded; anterolateral macrochaetae longer than on 2nd tergite, 0.3 of the breadth of the tergite; there are (4-)5 long lateral setae and 2 long setae on posterior margin and about 10 longer inner surface setae. Fourth tergite 2.3(-2.6) times as broad as long; shape and arrangement of setae as on tergites 2 and 3; (34-)about 48(-54) marginal setae, length of anterolateral macrochaetae 0.3 of the breadth of the tergite. A pair of prominent posterior setae is to be found on

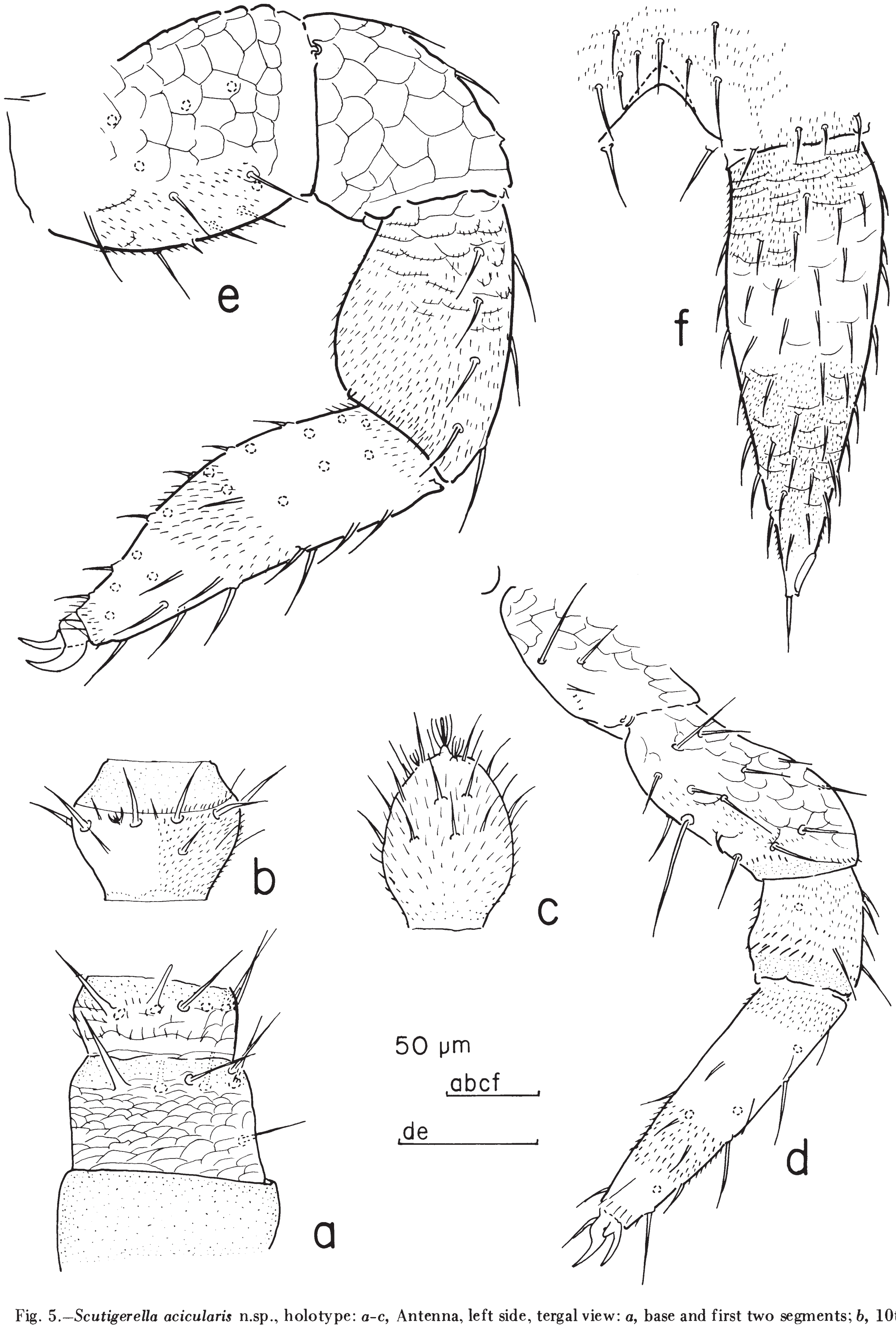

Fig. 5.–*Scutigerella acicularis* n.sp., holotype: *a–c*, Antenna, left side, tergal view: *a*, base and first two segments; *b*, 10th segment; *c*, last segment; *d*, First leg, left side, posterior view; *e*, 12th leg, right side, posterior view; *f*, Right cercus and caudal cavity, tergal view. Pubescence only partially drawn in *b* and *f* and on the in *e* and *d*.

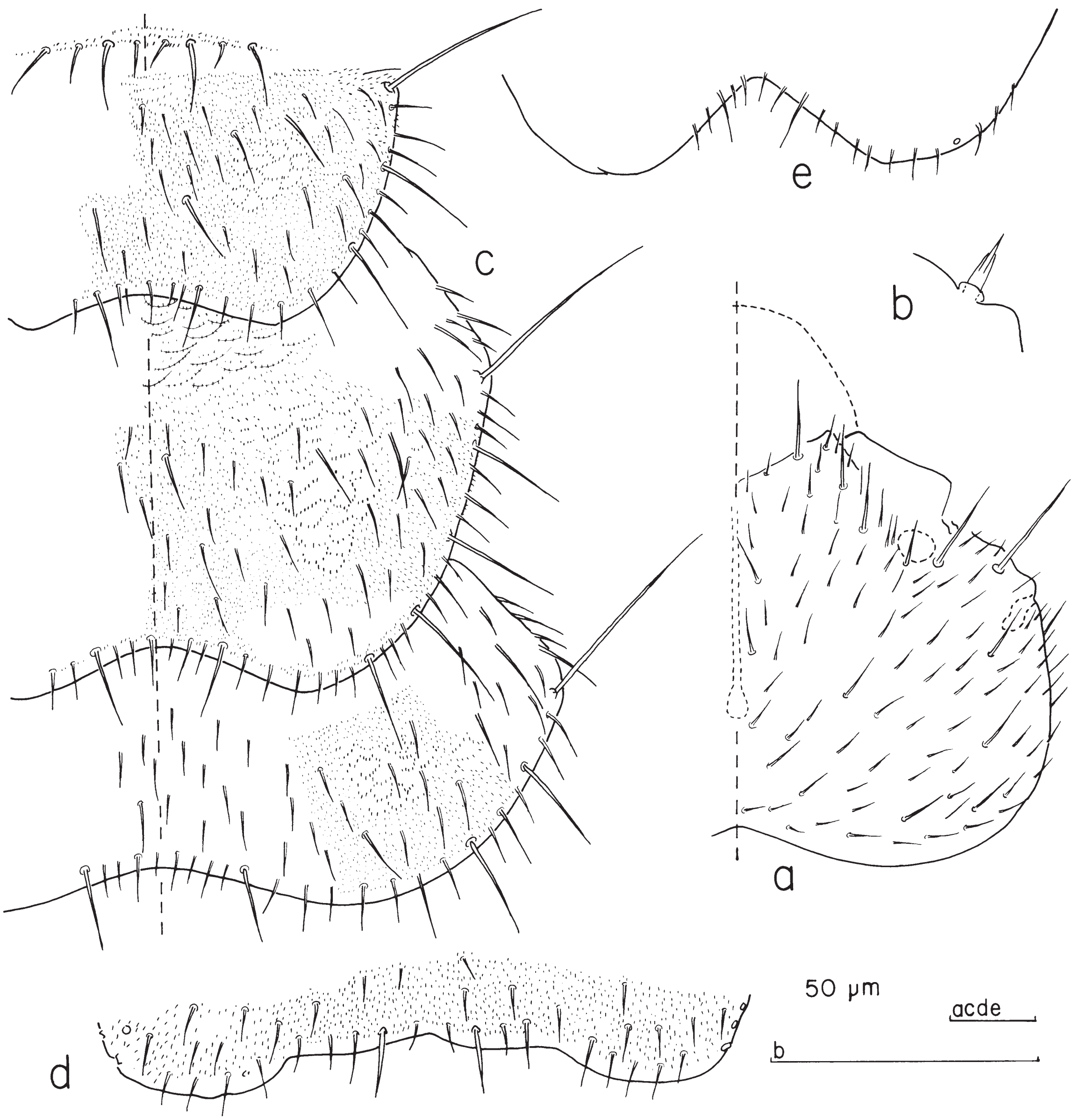

Fig. 6.–*Scutigerella acicularis* n.sp. (a–d holotype, *e* paratype): *a,* Head, right side, tergal view; *b,* Palp of first maxilla, right side, sternal view; *c,* Tergites 1-4; *d,* Penultimate tergite, posterior part; *e,* Penultimate tergite, posterior part (paratype). Setae only partly drawn in *a, c,* and *e*; pubescence not drawn in *e,* only partly in *c.*

tergites 2-4; long anterolateral macrochaetae protrude from at least the tergites 2-4 and 6-9, most often longest on tergite 4 and shorter on posterior tergites than on anterior ones. Penultimate tergite in two paratype specimens with a deep broadly V-shaped incision between two rounded posterolateral lobes. In the other specimens the posterolateral corners are scalloped as in the eighth molt of *S. immaculata.* Most specimens studied here have probably not passed the last molt. A pair of prominent submedian setae similar to that on tergites 2-4 protrudes from the posterior margin. Caudal cavity broadly V-shaped. Pubescence of tergites short, fine, dense, not reaching the posterior and posterolateral margins. The central part of each half of the tergites with very sparse pubescence arranged in a scaly pattern.

Legs: Tarsus of first pair of legs 3.7(-4.0) times as long as wide, tapering distally; setae increase in length distally and are arranged in 5(-6) rows lengthways, longest row on tergal side has (4-)5(-6) setae, longest seta in the most distal one is 0.8(-0.9) of greatest diameter of the segment; pubescence distinct and dense on all sides. Tibia short with 7(-10) mainly tergal setae; pubescence dense on anterior side, on posterior side sparser, partly in a scaly pattern. Femur with (13-)14(-17) setae inserted on posterior and sternal sides only; longest seta about as long as greatest diameter of the segment; sternal side very sparsely pubescent, posterior one glabrous, scaly. Coxa has (2-)3 setae. Anterior claw 1.4 times as long as posterior one; the former almost straight, the latter distinctly curved.

Tarsus of 12th leg (2.9-)3.0(-3.2) times as long as wide, distal third tapering. There are 6(-7) rows of setae lengthways, longest is a tergal one with 5(-6) setae; sternal rows with (4-)5 setae, in all (19-)21(-23) setae which are subequal and shorter than tergal setae. Longest tarsal seta is a tergal one which reaches 0.5(-0.7) of the greatest diameter of the segment. Tibia (1.5-)1.6(-2.0) times as long as wide, 0.7(-0.8) of length of the tarsus; setae concentrated to tergal and anterior sides; longest tergal row has 3(-5) setae, distal setae longest reaching 0.5 of greatest diameter of the segment. Femur about as long as wide, setose only on tergal and anterior sides, longest tergal row with 3 setae. Trochanter proportionately short with setae on anterior, sternal (and tergal) sides. Pubescence of anterior side dense on tarsus and tibia, sparser but distinct on femur, sparse and partly in a scaly pattern on trochanter; on posterior side it is dense on tarsus, sparser and partly in a scaly pattern on tibia but femur and trochanter are glabrous with cuticular thickenings in a scaly pattern. Claws of subequal length, anterior one very little curved, posterior one distinctly.

Stylus of 12th pair of legs 2.4(-3.5) times as long as wide, 0.3(-0.4) of length of the tarsus. Of its two apical setae the longer one is (0.4-)0.5 of length of the stylus and the shorter one about 0.5 of the longer seta. Styli most often provided with additional setae on their anterior side; the number of them varies: 0(or 1) on those of legs 3-6 and 1(or 2) on those of legs 7-12. There are 8 pairs of fully developed coxal sacs at bases of legs 3-10. Coxal plates of leg 12 with 1(-3) setae, those of leg 11 have 2(-5) setae.

Cerci: Moderately slender, (2.7-)2.9(-3.9) times as long as wide; rather densely setose, setae subequal, longest setae are (0.2-)0.3 of depth of the cercus and longest one of the two apical setae about 0.1 of the length of the cercus. Pubescence short, dense.

Affinities.—The occurrence of distinct anterolateral macrochaetae gives the tergites a general appearance very close to that most often met with in the genus *Hanseniella.* This character serves to separate *S. acicularis* from all other species in the genus.

One species, however, *S. mexicana* Hinschberger, has a slight tendency to produce anterolateral macrochaetae but they are proportionately much shorter and not directed forwards-outwards in the typical *Hanseniella* manner. A few other characters connect *S. acicularis* with *S. mexicana,* but they are easily distinguished by several characters, such as the length of the setae of the tergites (particularly the anterolateral ones), the shape of the tergites, and the chaetotaxy of the styli.

Scutigerella aduncus, new species
Figs. 7-8

Type-data.—Holotype female (author's collection) from Cueva de la Finca, 10 km SW Acatlán, Oaxaca, México, 31 December 1976 (J. Reddell, D. McKenzie, A. Grubbs); paratype (TMM) from Cueva de Tres Manantiales, 8 km NNE Chamal, Tamaulipas, México, 27 May 1968 (J. Reddell).

Etymology.—From Latin *aduncus,* crooked (posterior claw).

Description.—*Length*: (2.9-)3.2 mm.

Head: Rounded, 1.1 times as long as broad, broadest just behind the middle; lateral angle at articulating point of mandible almost concealed. Central rod indistinct, anterior branches vestigial and posterior ones not recognizable; ovoid posterior endswelling small. Longest seta at mandibular basis 1.2 times as long as the largest diameter of 3rd antennal segment. Tergal surface of head densely covered with setae of varying length. Apart from 5 long setae at base of antenna a few longer setae are scattered on the posterolateral half. Longest posterolateral setae about 0.7 of the largest diameter of 3rd antennal segment. Palp of first maxilla 3-cuspidate, strongly pointed. Cuticle of head glabrous.

Antennae: Broken in holotype. Right antenna in the paratype in good condition with 34 segments. First segment with wide base, 1.3(-1.4) times as wide as long; it has a single primary whorl of 4 setae of normal length and shape and 2 very short flattened ones; the former are 3 thin ones on inner tergal and inner sides and a thick one on outer part of tergal side, the latter are inserted on inner part of sternal side. An additional thin seta protrudes perpendicularly from middle part of inner side. Second segment (1.5-)1.8 times as wide as long with 9 primary setae rather evenly distributed around the segment: 3 thin, (4-)5 thick and 1(-2) small ones. Apical segment (paratype only) ovoid, 1.7 times as long as wide with about 18 setae, a few of them short and very thin; setae mostly anteriorly directed, longest ones 0.8 of longest setae on proximal segments. Apical spined organ with a short cylindrical base and 4 distal spines; length of organ 0.2 of length of the segment. There are 2 small subapical spined organs.

Each proximal segment with a single primary whorl of setae; secondary whorl begins on inner side of segment 9 and a rudimentary 3rd whorl of setae occurs (only paratype) on sternal side of some distal segments; these segments have also many short sticklike setae in the primary whorl.

First segment glabrous (or with a few pubescence hairs on outer side) with a fine small-scaly pattern of cuticular thickenings; 2nd segment similar but the scales are large; pubescence distinct but sparse on 3rd segment; from 4th segment forth it is denser but distal fourth of apical segment is glabrous.

Tergites: First tergite rudimentary with (9-)10 setae, 4 of which are more prominent than the others. Second tergite complete, 1.5 times as broad as long; posterior margin with two triangular lobes separated by a broad, V-shaped, median indentation; setae thin, there are about (41-)55 marginal setae; 2-3 lateromarginal ones are a little longer than the others but not exceeding twice the length of shortest setae. Surface of tergite with a moderate number of setae similar to marginal ones, 6 of them are prominent. Third tergite 1.2 times as broad as long with about (50-)64 marginal setae of which 3 lateromarginal ones are longer than the others. Fourth tergite about 2.7 times as broad as long; shape and arrangement of setae as on tergites 2 and 3. All the following tergites up to and including the penultimate tergite have posterior triangular lobes. Fifteenth tergite with a V-shaped posteromedian cavity. Pubescence of tergites short, fine, dense, not reaching posterior and posterolateral margins; just anterior to the anteromedian part of each triangular lobe there is an area without setae within which occurs a spot with sparse pubescence arranged in a scaly pattern.

Legs: Tarsus of first pair of legs (3.6-)4.1 times as long as wide and tapering distally; setae increase in length distally and are arranged in (4-)5 rows lengthways, longest row on tergal side has (4-)5 setae; longest seta as long as greatest diameter of the segment; pubescence very sparse on distal half. Tibia short with (6-)11 mainly tergal setae; pubescence sparse, on anterior side on a scaly cuticle. Femur with 18 setae inserted on posterior and sternal sides only; longest seta about as long as greatest diameter of the segment; sternal side pubescent, posterior one glabrous, scaly. Coxa has 4 setae. Anterior claw 1.2 times as long as the posterior one; the former almost straight, the latter strongly curved, sickle-shaped.

Tarsus of 12th leg (3.1-)3.5 times as long as wide with distal fourth tapering. There are at least 6 rows lengthways of setae, longest is a tergal one with (5-)6 setae; sternal rows with (2-)4 setae which are shorter than corresponding tergal setae. Longest seta is a tergal distal one which is as long as greatest diameter of the segment. Tibia twice longer than wide, as long as tarsus; setae concentrated to tergal and anterior sides; longest tergal row has (4-)5 setae, distal setae longest, 0.4(-0.5) of greatest diameter of the segment. Femur about as long as wide, setose only on tergal and anterior sides; longest tergal row has 4 setae. Trochanter with many setae on anterior and sternal sides, 2 sternal ones longest. Pubescence short, dense, sparser on posterior side. Claws large, anterior one strongly curved, sickle-shaped.

Stylus of 12th leg (3.1-)3.4 times as long as wide, about 0.4 of the length of the tarsus. Of its two apical setae the longer one is 0.4 of the length of the stylus and the shorter one about 0.5 of the longer seta. Styli most often provided with additional setae the number of which varies: leg 3–0 or 1, leg 4–0(or 1), leg 5–0 or 1, leg 6–1, leg 7–1, leg 8–1, leg 9–1, leg 10–1, leg 11–(1 or)2, leg 12–(1 or)2. There are 8 pairs of fully developed coxal sacs at bases of legs 3-10. Coxal plates of leg 12 with 2 setae, those of leg 11 have 6-7 setae.

Cerci: They are slender, (3.7-)3.8 times as long as wide, tergal side straight; densely setose, setae subequal; longest setae 0.2(-0.3) of the depth of the cercus and longest one of the two apical setae less than 0.2 of length of the cercus. Pubescence short, dense.

Affinities.—*Scutigerella aduncus* is most closely related to *S. boneti* Hinschberger since the shape and

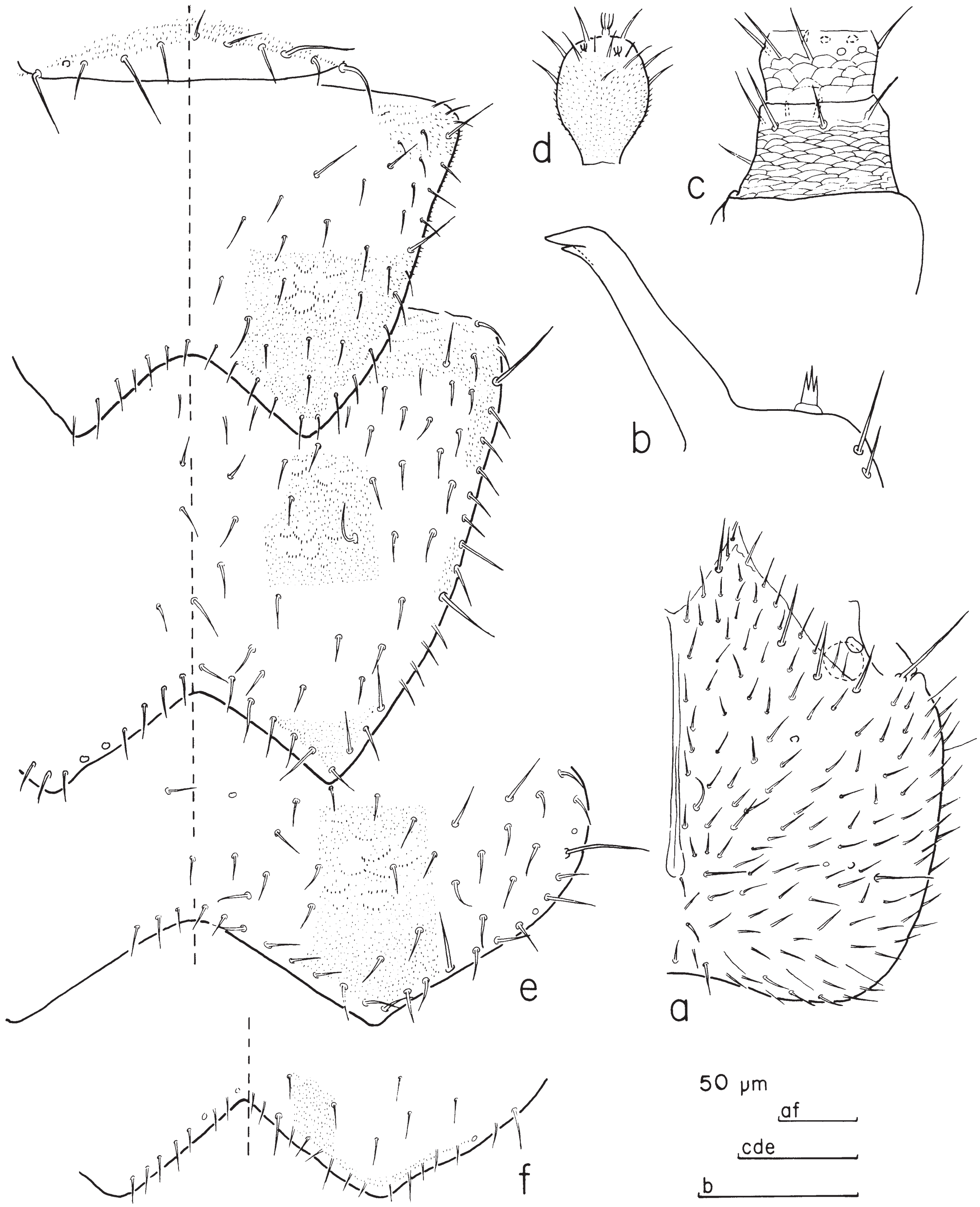

Fig. 7.–*Scutigerella aduncus* n.sp. (*a–c*, *e*, and *f* holotype, *d* paratype): *a*, Head, right half, tergal view; *b*, First maxilla with palp, left side, sternal view; *c*, Antenna, first two segments, right side, tergal view; *d*, Antenna, last segment, tergal view; *e*, Tergites 1-4; *f*, Penultimate tergite, posterior part. Pubescence and setae only partly drawn in *e* and *f*.

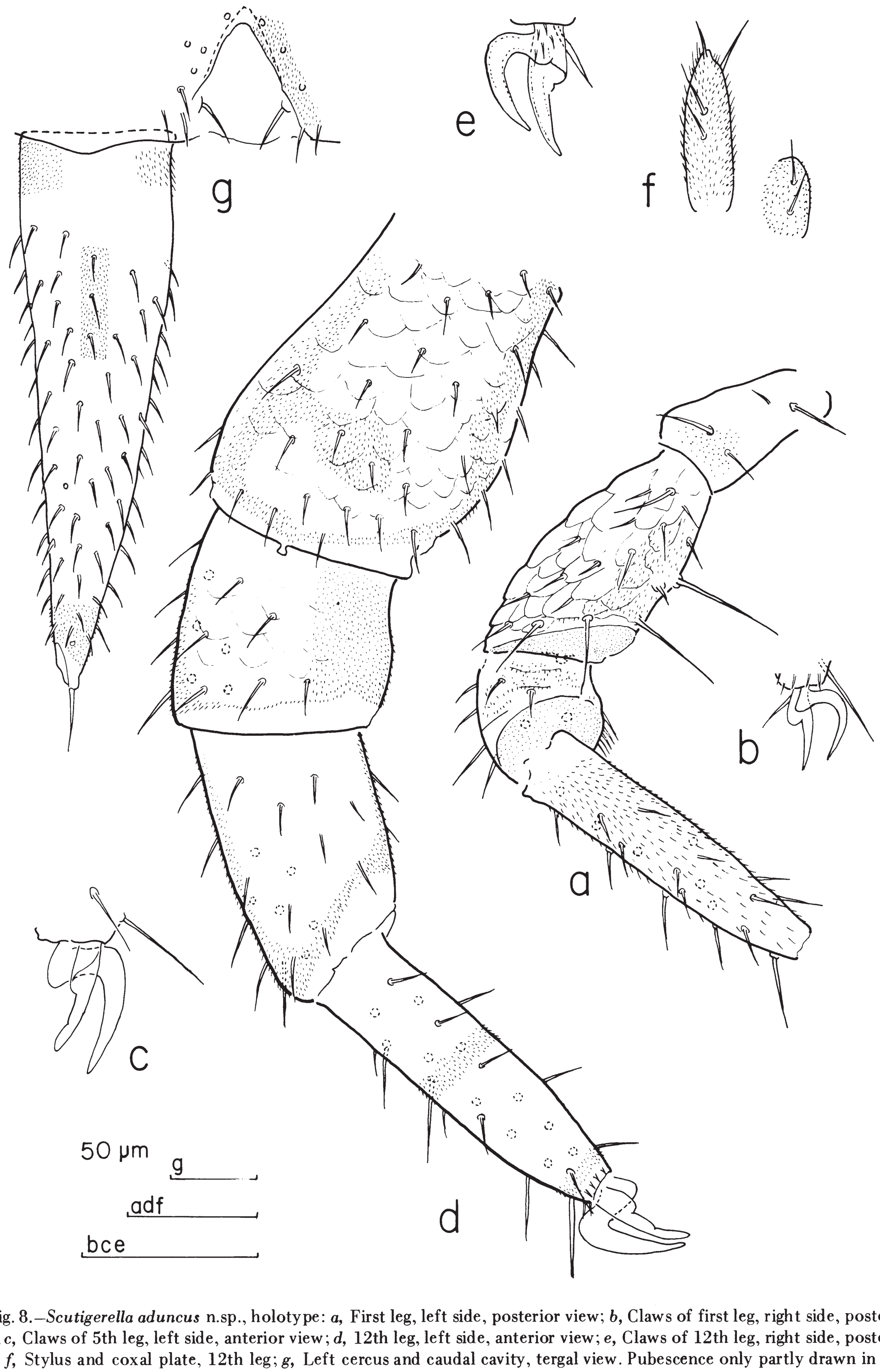

Fig. 8.–*Scutigerella aduncus* n.sp., holotype: *a,* First leg, left side, posterior view; *b,* Claws of first leg, right side, posterior view; *c,* Claws of 5th leg, left side, anterior view; *d,* 12th leg, left side, anterior view; *e,* Claws of 12th leg, right side, posterior view; *f,* Stylus and coxal plate, 12th leg; *g,* Left cercus and caudal cavity, tergal view. Pubescence only partly drawn in *a, d,* and *g.*

chaetotaxy of the legs, most tergites, and the styli are similar. They are easily separated by the sickle-shaped posterior claws and the longer posterior claw of leg 1 of *S. aduncus.* Moreover, the distribution of the postantennal macrochaetae, the number of setae on the first tergite, and the shape of the marginal setae on tergite 4 are different. *Scutigerella boneti* is known from a single specimen collected at Motozintla, Chiapas. Because the two species are isolated both geographically and taxonomically, they may belong to an original Mexican element.

Scutigerella inculta Michelbacher

Scutigerella inculta Michelbacher, 1942:284-287, pl. IV, figs. 2*a-i.*

New records.—USA: *California*: Santa Clara County: San Antonio Valley, 11 March 1948 (S. G. Larsson), 1 ad. female. Tuolumne County: 2.5 mi. NW Columbia, Tube Cave, SW 1/4, Sec. 34, T3N, R14E, 8 April 1979 (D. C. Rudolph, S. Winterath, B. Martin), 1 ad. male.

General distribution.—This species is known only from the three counties around San Francisco (Alameda, Marin, and Napa) (Michelbacher, 1942), and from the above two counties.

Scutigerella palmonii Michelbacher
Fig. 9

Scutigerella palmonii Michelbacher, 1942:274-276, pl. II, figs. 1*a-i.*
Scutigerella nodicercus Michelbacher, 1942. NEW SYNONYMY.
Scutigerella nodicerca: Hinschberger, 1953:92; Rochaix, 1954:108; Jupeau, 1957:27.

Discussion.—In his synopsis of the genus *Scutigerella* Michelbacher described seven new species, three from the United States and four from central Europe and the Mediterranean area. Most are easily distinguished by good characters but the considerable intraspecific variation, both geographically and depending on the developmental stage, has sometimes caused confusion. In particular the separation of *S. nodicercus* and *S. palmonii* has been difficult. These species were described on two series of specimens collected from different continents. The type-locality of *S. nodicercus* is "Salsburg, Germany" (?Salzburg, Austria), while that of *S. palmonii* is "Palestine, Jordan River near its emergence from the Lake of Galilee. Elevation about 200 M. below sea level." Probably influenced by the huge geographic gap which separated the two samples, Michelbacher convinced himself to overestimate the taxonomic differences between them.

A close study of the descriptions yielded about 15 differences, but most are not diagnostic characters because they are quantitative and do not fall into sharply divided classes without overlap. Examples are the number of antennal segments and the number of setae on the margins of the tergites, on the legs, and on the cerci.

Michelbacher also mentioned characters which possibly could be used as diagnostic characters. They have now been studied in the holotypes of both species and are listed below with comments on their usefulness.

1. The site of the insertion points of the two tergal posterior macrochaetae (a_1,a_2) at the antennal base (in line with the horizontal axis of the head in *S. nodicercus*, but not in *S. palmonii*). Although this character has been used in species diagnosis, it is of dubious value. The position of the points of insertion varies often within a species, and the direction of their connecting line is often difficult to fix, particularly in mounted specimens. The holotypes, which are mounted, do not confirm Michelbacher's statement.

2. The number of marginal setae on tergum 4 (38-40 in *S. nodicercus*, 45-55 in *S. palmonii*). The variation in the former species is broader than stated in the description, and the character may fall in the category of unreliable characters.

3. The occurrence of setae on the sternal side of the tibia of the last pair of legs (none in *S. nodicercus*, one row in *S. palmonii*). The holotype of the former species has a sternal row of two setae while the latter species has three. As both species have these setae in about the same number, the character must be omitted.

4. The shape of the caudal cavity (U-shaped in *S. nodicercus*, V-shaped in *S. palmonii*). In the holotype of *S. nodicercus* the cavity seems to be U-shaped but the V-shape in *S. palmonii* is misleading. In the latter species the mounting which has strongly deformed the body has certainly had a distorting effect also on the shape of the cavity. What shape it had in the fresh *S. palmonii* type is unknown. The character is often difficult to recognize and has to be omitted here.

5. The shape of the most distal part of the cerci (expanded in *S. nodicercus*, not in *S. palmonii*). The very slight expansion visible in the holotype of *S. nodicercus* is too insignificant to be used as a diagnostic character. In the holotype of *S. palmonii* the cerci are so strongly flattened that no details of their shape are obtainable. Experience from other speci-

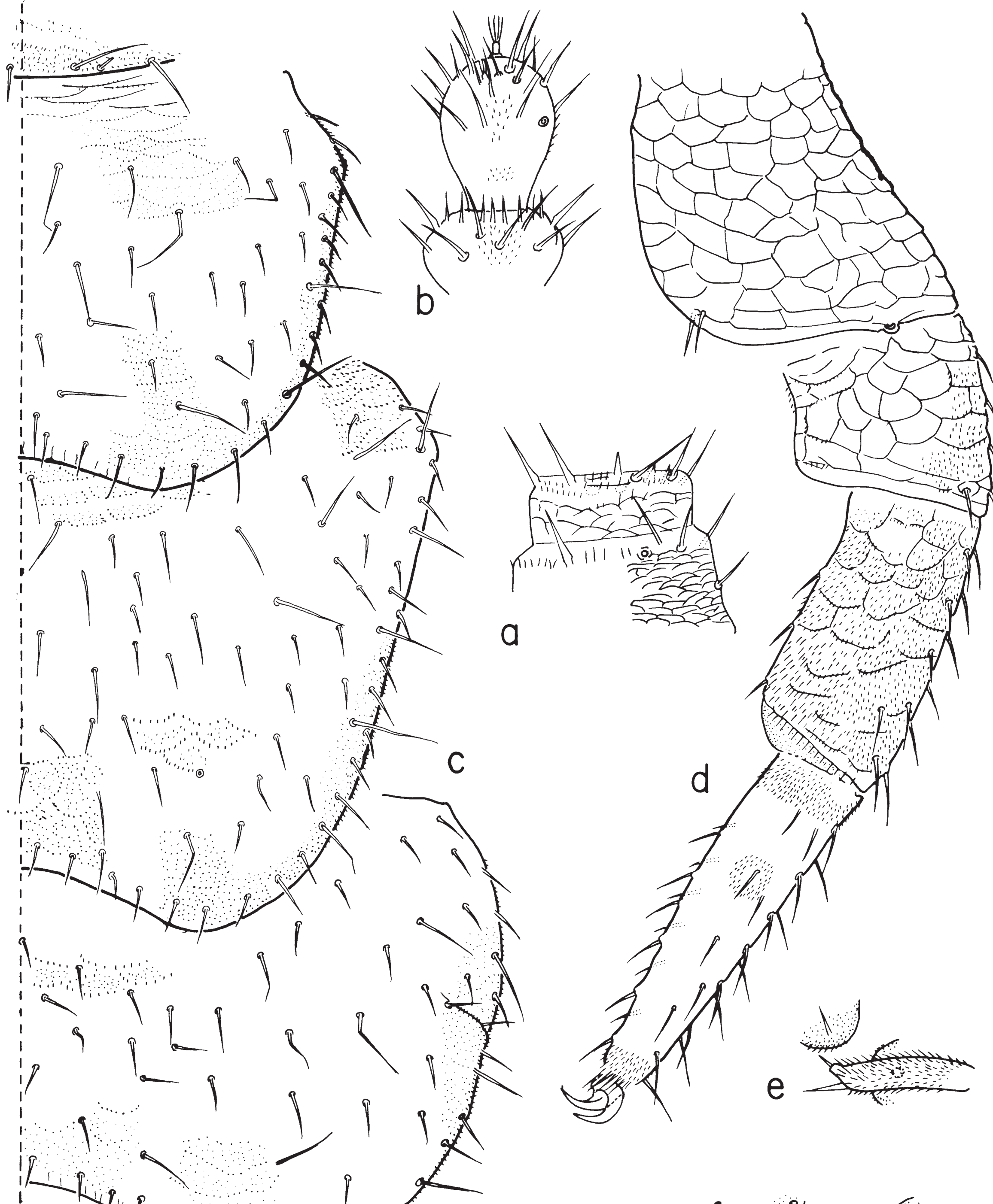

Fig. 9.–*Scutigerella palmonii* Michelbacher, holotype: *a*, Antenna, first two segments, left side, tergal view; *b*, Antenna, last two segments, left side; *c*, Tergites 1-4, right halves; *d*, 12th leg, right side, posterior view; *e*, Stylus and coxal plates, 12th leg; *f*, Coxal plates, 11th leg. Pubescence only partly drawn in *b*, *c*, and tarsus in *d*, cuticular scaly pattern in *a*.

mens and other species also shows that the shape of the distal part of the cerci is of extremely small value for the taxonomist.

The lack of distinctive diagnostic characters between *S. palmonii* and *S. nodicercus* must lead to their union in a single taxon. The name *S. palmonii* is chosen because *S. nodicercus* alludes to an unusable character and because in Michelbacher's paper the description of *S. palmonii* precedes that of *S. nodicercus*.

A composite description is not required, but the set of drawings accompanying the original description is partly incomplete and is improved in Fig. 9.

New records.—USA: *California*: Calaveras County: 3 mi. N Columbia, Cave of Skulls, NE 1/4, Sec. 33, T3N, R14E, 29 March 1979 (D.C. Rudolph, B. Martin, S. Winterath, W. Elliott, J. Reddell), 1 ad. male, 1 ad. of unknown sex.

New Mexico: Taos County: Twining, Williams Lake Trail, alt. 10,000 ft., 3 July 1967 (R.W. Mitchell), 1 ad. male.

Ohio: Franklin County: Columbus, Upper Arlington, 4 September 1976 (B.D. Valentine), 1 ad. female, 1 juv. 9.

Texas: Kendall County: 7.5 mi. N Boerne, March 1969 (J. Reddell), 1 ad. female. Kerr County: Mingus Root Cave, 28 April 1968 (J. Reddell, S. Fowler), 1 ad. male. Medina County: Sixty Minute Cave, 17 October 1964 (J. Reddell, D. McKenzie), 1 ad. female.

Virginia: Bland County: Jefferson National Forest, Cascade Recreation Area, in ravine, at creek in deciduous forest, poison ivy and mosses, 3 August 1981 (Loc. 8, U. Scheller), 1 ad. male.

West Virginia: Mingo County: 2 mi. SE Kermit, dense deciduous forest with mosses and ferns, steep slope, soil rich in humus, 14 August 1981 (Loc. 7, U. Scheller), 1 ad. male.

General distribution.—This is the first time that *S. palmonii* has been reported from the above states, with the exception of Ohio (Gould and Edwards, 1968:214). It was earlier known from Indiana (Waterhouse, 1970:393). The species has often been encountered within Central Europe and also occurs in the Mediterranean area. It is also known from the Caucasus and a specimen from Japan (Rochaix, 1954:108) may indicate a wide Palaearctic range.

Scutigerella linsleyi Michelbacher

Scutigerella linsleyi Michelbacher, 1942:283-286, pl. IV, figs. 1*a-i*.

New record.—USA: *Texas*: Kendall County: 7.5 mi. N Boerne, March 1969 (J. Reddell), 2 ad. males, 1 ad. female.

Discussion.—The above locality is the first record for the species in North America outside of the type-locality at Idyllwild, California.

General distribution.—*Scutigerella linsleyi* also occurs in the western Palaearctic. Many localities are known from Yugoslavia and one each from Great Britain, Germany FRG, Italy, and the southern USSR.

Scutigerella silvestrii Michelbacher

Scutigerella silvestrii Michelbacher, 1942:272-274, pl. I, figs. 2*a-i*.

New records.—USA: *Texas*: Bandera County: Fossil Cave, 23 March 1966 (D. McKenzie, J. Reddell), 1 ad. male. Kendall County: 7.5 mi. N Boerne, 15 March 1969 (J. Reddell), 3 ad. males, 9 ad. females. Menard County: Powell's Cave, 30 September 1967 (J. Reddell), 1 ad. male. Williamson County: Beck Sewer Cave, 27 September 1965 (J. Calvert, J. Reddell), 1 ad. female.

MEXICO: *Puebla*: 8 km S Cuetzalan, Sima Esteban, 24-25 December 1973 (J. Reddell, D. McKenzie, R. Jameson, W. Elliott, R. Harr), 1 ad. female. 5.6 mi. N Cuetzalan, Yohulichan, 19 December 1976 (J. Reddell), 1 subad. 11 female.

Discussion.—*Scutigerella silvestrii* is herein reported for the first time from North America. The few localities probably do not show much about the Nearctic distribution, but like the European specimens the North American material comes from southern regions. It is one of the very few symphylans which has adapted to cavernicole habitats, but it seems not to be a true troglobiont.

General distribution.—Although many *Scutigerella* species have been reported from a large number of localities in both Europe and North America, *S. silvestrii* has previously been known only from the type-locality at Portici, Italy.

Taxonomic remarks.—The specimens reported here deviate often in quantitative characters from Michelbacher's Italian specimens. They are shorter, 4.2-5.7 mm (the types 7-9 mm), and sometimes more densely setose. The number of additional setae on the styli is strongly varying, from 1-2 to 5-6 (the types 1), the cerci are always slender but their length/width ratio varies between 3.4 and 5.3 (the types about 4.2). There is also a similar variation of the length/width ratio of the tarsi of the last pair of legs, 3.2-5.0 (the types at least 3.5).

The most aberrant specimens are particularly difficult to assign to Michelbacher's species, but at present they are best placed there. The considerable variation observed indicates that *S. silvestrii* may be a collective category. It is in need of further consideration which, however, requires a series of well-preserved specimens from many localities.

Hanseniella Bagnall

Hanseniella Bagnall, 1913:197.

Hanseniella vandykei Michelbacher
Figs. 10-11

Hanseniella vandykei Michelbacher, 1939:753-757, pl. II, figs. 1*a–m*, 2*a–l*.
?*Scutigerella gratiae* Ryder, 1880. NEW SYNONYMY.

New records.—USA: *California*: Calaveras County: 4 mi. NW Columbia. Bobcat Cave, SW 1/4, Sec. 22, T3N, R14E, 25 February 1979 (D. C. Rudolph, S. Winterath, B. Martin), 1 ad. female. Contra Costa County: Berkeley, Redwood Canyon, 24 February 1967 (S. L. Tuxen), 1 ad. female. Tuolumne County: 3.5 km N Columbia, from tailings of Transplant Mine (48° F), 10 January 1978 (W. R. Elliott, A. G. Grubbs, S. A. Winterath), 1 ad. male, 2 ad. females.

Florida: Marion County: Juniper Springs, 26 February 1960 (H. A. Denmark), 2 ad. females.

Georgia: Gilmer County: 3 mi. NE Ellijay, at creek in dense deciduous forest, 11 August 1981 (Loc. 13, U. Scheller), 1 juv. 9.

North Carolina: Macon County: Norton, Coweeta Hydrological Laboratory, alt. 3,250 ft., 27 September 1964 (H. R. Steeves, Jr.), 1 ad. female.

Virginia: Fayette County: Anstead, 0.6 mi. NW Gauley Mountain, 15 August 1981 (Loc. 20, U. Scheller), 1 ad. female. Montgomery County: Brush Mountain, 1 mi. W Blacksburg, oak forest, 20 March 1976 (R. L. Hoffman), 21 ad. males, 17 ad. females, 1 ad. of unknown sex, 3 subad. 11 males, 1 subad. 11 female, 1 juv. 10 male, 3 juv. 10 females. Rockbridge County: 2 mi. SW Lexington, shady mixed deciduous forest, 15 August 1981 (Loc. 23, U. Scheller), 1 ad. female, 2 juv. 9. Smyth County: Iron Mountain, ca. 6 mi. SE Chilhowie, alt. 1,300 m, 19 May 1979 (R. L. Hoffman), 10 ad. males, 13 ad. females, 2 ad. of unknown sex, 3 subad. 11 males, 2 subad. 11 females. Wythe County: Ewing Mountain, N side, Rt. 643, ca. 4 mi. W Ivanhoe, 29 May 1978 (R. L. Hoffman), 14 ad. males, 24 ad. females.

West Virginia: Mingo County: 2 mi. SE Kermit, dense deciduous forest with mosses and ferns, steep slope, soil rich in humus, 14 August 1981 (Loc. 7, U. Scheller), 1 juv. 10. Wayne County: Fort Gay, 0.5 mi. S Sinbaddi, open and steep herby slope with deciduous forest nearby, 13 August 1981 (Loc. 29, U. Scheller), 1 ad. male.

Distribution.—This species was previously known from a few places in California (see below under taxonomic remarks). Hinschberger (1950b:373) reported eight specimens "d'une *Hanseniella* voisine d'*H. vandykei*" from Alabama, but it is unknown whether they belonged to *H. vandykei* or to some other species. The new localities reported above from Florida, Georgia, North Carolina, Virginia, and West Virginia indicate a wide range and it is likely that it also occurs in Alabama.

Taxonomic remarks.—This species was described in 1939 by Michelbacher from the following California localities: Woodacre (type-locality), Lagunitas, Vichy Springs, near Berkeley and Oakland, and Briceburg. The specimens from the last locality deviated from the typical form in having at least partly proportionately longer setae on the head and the tergites and also proportionately longer cerci and tarsi of the last pair of legs. Michelbacher rightly hesitated to describe these specimens as a new species. He was also correct when he suspected that the deviations observed could be due to difference in age. Very often large specimens which have molted one or more times after having reached the adult stage show deviations like those mentioned. Some specimens in the collection studied here are similar to the Briceburg material.

Michelbacher's original diagnosis is partly incomplete, his drawings are poor in details, and some characters now used in symphylid taxonomy are not

Key to Species of *Hanseniella* Reported Herein

1. Anterolateral macrochaetae on tergites 2 and 3 only; marginal setae on anterior tergites lanceolate; ventral appendages on coxal sacs of legs 3–9 . . . . *appendicofera* Scheller
   Anterolateral macrochaetae at least on tergites 2, 3, 4, 6, 7 and 9; marginal setae on anterior tergites thin and pointed; coxal sacs without appendages 2

2. Cerci glabrous, sparsely setose with long setae . . . . *vandykei* Michelbacher
   Cerci pubescent, densely setose with short setae . . . . *orientalis* (Hansen)

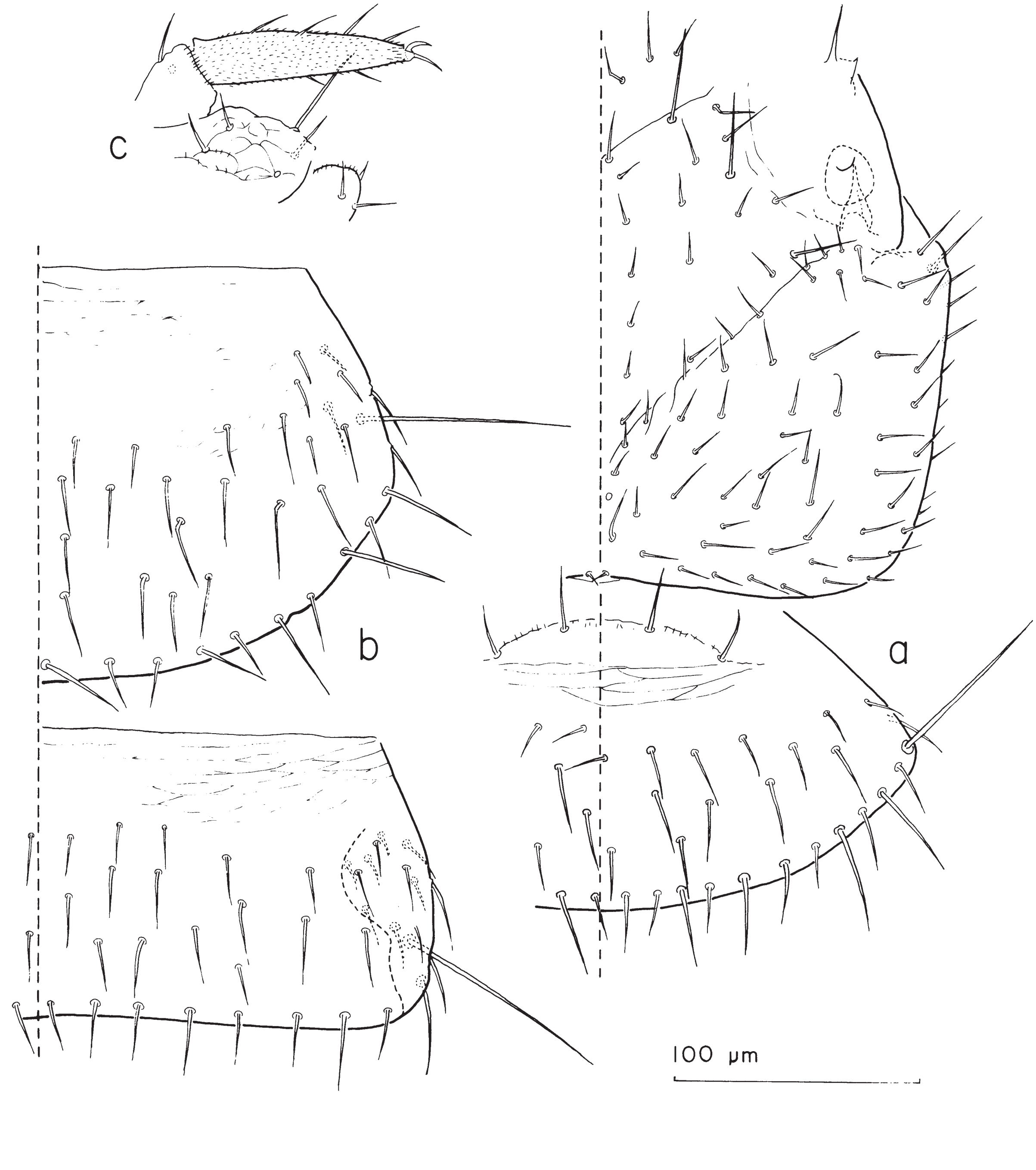

Fig. 10.—*Hanseniella vandykei* Michelbacher, holotype: *a*, Head and first two tergites, right side, tergal view; *b*, Tergites 3 and 4, right side, tergal view; *c*, First leg, anterior view.

figured at all. For these reasons an emended description has been prepared. It is based on the following adult mounted specimens from the Michelbacher collection housed in the Department of Entomology, California Academy of Sciences, San Francisco:

Holotype male: CAS type no. 4828, "California, Woodacre, 1936.III.27."

Paratype: Male, same data as holotype; two females, same locality, "under trees near creek, 1938.I.30." Female, "California, Lagunitas, hillside in creek canyon, mixed live oak, Calif. Buckeye, Calif. Laurel. Just under leaf mold. 1938.I.30."

Some characters vary considerably or were not easily studied in the type-specimens. In such cases the studies of the fresh adult specimens from the eastern states have been included. If deviations from the holotype were present, either in the paratypes or in other adults, they have been added in parentheses.

Redescription.–*Length*: (1.8-)3.2(-4.8) mm. In the fresh material adults range between 1.8 and 3.3 mm with a mean value of 2.4 mm.

Head: Head short, 0.9(-1.1) times as long as broad with a prominent lateral angle at point of articulation of the mandible. Central rod indistinct (distinct posteriorly, with the branching point of the lateral sutures marked); anterior branches vestigial. Dorsal surface of head covered with very thin, pointed, almost straight setae of different length; most are short but a few longer setae are irregularly scattered on or near anterior, lateral and posterior margins. The longest seta in front of the lateral angle (0.5-)0.6(-0.7) of length of diameter of the first antennal segment. There are 3 long subequal postantennal setae. (Postantennal organ ovoid, 1.5-1.7 times as long as wide.) Palp of first maxilla conical with its distal pointed part bent outwards. Head cuticle glabrous.

Antennae: Antennae with (18-)22(-32) segments; (length 0.4-0.5 of length of the trunk). First segment (1.5-)2.0 times as wide as long with a single primary whorl of ?3(3-4) strong and 3(-4) thin setae. (There is also a thin inner seta behind the primary whorl; its length 0.5-0.6 of length of inner primary setae.) The latter are thin, about as long as other setae; they reach 0.4(-0.5) of width of the segment. Second segment (1.4-)1.5 times as long as wide with 8(-9) setae in the primary whorl, 3 of which are thin and inserted on inner side; inner setae about as long as outer ones (but more depressed); a short flattened seta is inserted on tergal side just anterior of the primary whorl. Small spined organs begin on (outer or) tergal side of segment 2 or 3; their position alternates between tergal and outer-tergal. Secondary whorl of setae begins on sternal side of segment (4-5)6. Third whorl of setae on distal (third-)fourth of antenna, best developed in large specimens. Apical segment (1.3-)1.5(-1.6) times as long as wide with setae on distal two-thirds. These setae are mainly anteriorly directed and of different length, longest ones as long as longest setae on proximal segments. Large spined organ at apex of the segment is 0.3(-0.4) of length of the segment; length of branches and stalk subequal. (Near the base of the large spined organ there are 1-2 very short spined organs consisting of a central pillar and surrounding curved spines.) First segment glabrous; cuticle with a delicate fine-scaly pattern; 2nd segment very sparsely pubescent. Proximal segments from 3rd segment forth with a dense short pubescence, on last segment sparser.

Tergites: First tergite rudimentary with 4 setae subequal in length. Second tergite complete, (2.2-)2.6(-3.2) times as broad as long, posterior margin rounded. It has very distinct lateral angles with long anterolateral macrochaetae which are directed outwards and forwards. These setae are 1.4(-2.4) times as long as diameter of the first antennal segment. There are (13-)20 posteromarginal very pointed setae between anterolateral macrochaetae, longest ones 0.6(-0.7) of length of the anterolateral macrochaetae, shortest ones 0.2 of this length. Surface of tergite with setae of different length, equal in shape to posteromarginal ones. Cuticle glabrous. Third tergite 1.7(-2.2) times as broad as long, posterior margin rounded; anterolateral macrochaetae as on preceding tergite but 1.1-1.2(-1.3) times as long as on preceding tergite; (14-)19 posteromarginal setae between anterolateral macrochaetae. Surface setae and cuticle as on 2nd tergite. Fourth tergite bent downwards in holotype (in other specimens 1.1-1.2 times as broad as head, 2.9-3.3 times as broad as long); its posterior margin shallowly emarginate; (16-)ca. 17(-18) posteromarginal setae; surface setae as on 2nd tergite. Penultimate tergite posteriorly straight (with 8-14 setae between longest posterolateral setae). Distinct anterolateral or lateral macrochaetae on tergites 2, 3, 4, 6, 7, 9, 10, 12, often on 13 and 14 as well; they are most often longest on tergites 6, 7, 9, 10, and 12.

Legs: Tarsus of first pair of legs (3.9-)4.2(-4.6) times as long as wide, slowly tapering distally. Tergal setae in two rows lengthways each with 2(-4) setae; longest setae as long as(-1.2 times as long as) greatest diameter of the tarsus. Sternal side with 2(-5) setae. Tibia short with 2(-3) setae. Femur with (4-)5(-6) setae on anterior and sternal sides; one seta distinctly longer than the rest, (1.4-)1.9 times as long as longest tarsal seta. Anterior claw acuminate, almost straight, its length 0.2 of length of the tarsus and (1.5-)1.8 times as long as posterior claw. The latter as long as

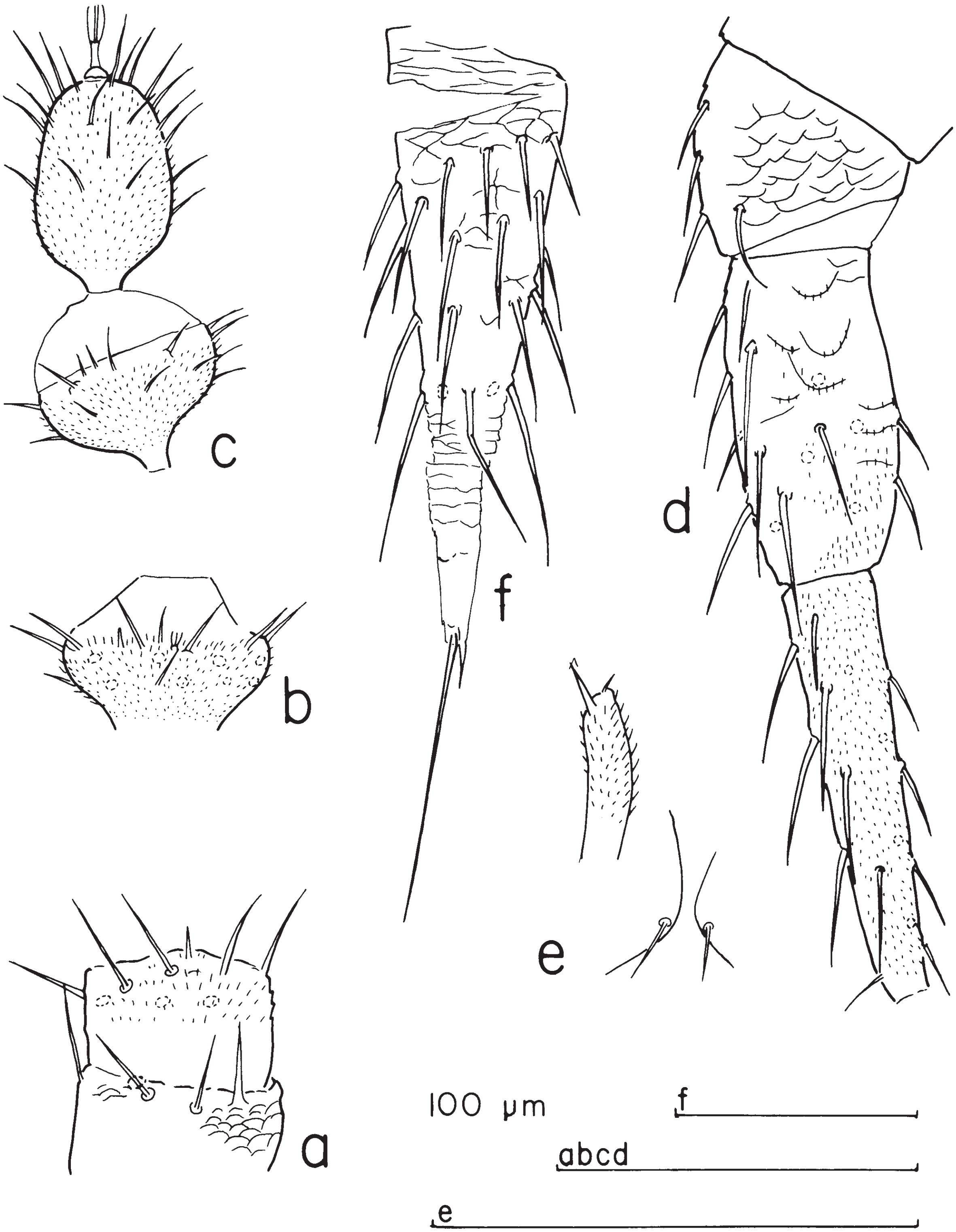

Fig. 11.–*Hanseniella vandykei* Michelbacher, holotype: *a-c*, Antenna, right side, tergal view: *a*, first two segments; *b*, 10th segment; *c*, last two segments; *d*, 12th leg, left side, posterior view; *e*, Stylus and coxal plates, 12th leg; *f*, Cercus, right side, tergal view.

the front seta. Pubescence dense and distinct on tarsus.

Tarsus of 12th leg (4.0-)4.7(-5.2) times as long as wide, slowly tapering distally. Setae of tergal side in two rows lengthways with 4(-5) and (3-)4 setae respectively; middle setae of anterior row longest, (1.2-)1.3(-1.4) times as long as greatest diameter of the tarsus. Sternal side with 2(-3) rows of setae, (3-)4(-8) setae in longest row. Tibia (1.6-)2.0(-2.1) times as long as wide, its length (0.7-)0.8(-0.9) of length of the tarsus. Its tergal side with (6-)7 strong setae, sternal wide with 6(-many) shorter setae; length of setae decreasing proximally, posterodistal setae of tergal side longest, about as long as diameter of the tibia. Femur short with a few setae only, one anterodistal seta longest, about 0.5 of diameter of the femur. Trochanter sparsely setose on anterior side. (Anterior claw acuminate, 1.3-1.4 times as long as posterior one.) Pubescence sparse on anterior side of femur and tibia, densest on anterior side of tarsus. Tergal side of trochanter glabrous like also posterior side of femur and trochanter. Cuticular scaly pattern on posterior side of trochanter, femur and tibia.

Stylus of 12th leg (3.5-)3.8(-3.9) times as long as wide, 0.3(-0.4) of length of the tarsus and (1.3-)1.4 times as long as greatest diameter of the tarsus. Subapical seta 0.4(-0.6) of length of the stylus, apical one 0.5 of length of the subapical setae. There are 7 pairs of fully developed coxal sacs at bases of legs 3-9. Coxal plates (of leg 11 with 2-3 setae), those of leg 12 with 1(-2) setae.

Cerci: Cerci slender, posteriorly narrow, extended, not fully 0.1 of length of the body, (2.9-)3.4(-4.5) times as long as wide. There are (3-)4(-5) setae in longest tergal row. Length of setae increases distally, those in the most distal whorl 1.1(-1.4) times as long as the depth of the cercus. Terminal part slowly tapering distally, subcylindrical. Long apical seta (0.3-)0.5 of length of the cercus and the short one 0.2 of length of the long seta. Cuticle with scaly pattern of thin thickenings on all sides.

Hanseniella orientalis (Hansen)

Scutigerella orientalis Hansen, 1903:38-41, pl. II, figs. 4*a-f*, pl. III, figs. 1*a-f*.

New records.—MEXICO: *Campeche*: Cumpich, Actún Chen, 1 November 1974 (J. Reddell, S. Wiley), 1 ad. male, 3 ad. females, 1 juv. 9. 1 km N Cantemo, Cenote de Cantemo, 18 December 1974 (J. Reddell, D. McKenzie, L. Elliott), 1 ad. female; 31 July 1975 (J. Reddell, A. Grubbs, D. McKenzie), 2 ad. females.

Yucatán: Oxkutzcab, 31 July 1973 (J. Reddell), 2 ad. females. 3 km S Mérida, Cueva Luchil, October 1974 (J. Reddell, S. Wiley), 2 ad. females. 3 km S Libre Unión, 21 July 1975 (J. Reddell, A. Grubbs), 1 ad. female.

General distribution.—This species has earlier been reported from south and southeast Asia and the Samoa and Marquesas Islands. The species is here reported from the Americas for the first time.

Hanseniella appendicofera Scheller

Hanseniella appendicofera Scheller, 1971:127-130, fig. 11.

New record.—MEXICO: *Yucatán*: Cenote Hunto Chac (Cueva Mamey), 12 April 1973 (D. McKenzie, S. Wiley), 1 ad. female.

General distribution.—This is the first record of the species from North America. *Hanseniella appendicofera* belongs to a small group of species known previously only from Sri Lanka (Scheller, 1970:129-130, 171). The species, which now has been discovered in Mexico, has a very wide distribution and is abundant in Sri Lanka indicating that it may also occur in other places outside Sri Lanka.

Discussion.—The group to which this species occurs is characterized by a very low number of anterolateral macrochaetae on the tergites, a very rare character, and ventral appendages on the coxal sacs, a character not known outside the group. Another species probably having a similar distributional pattern is *H. longisetis* Juberthie-Jupeau, which was described on a few specimens from Petropolis in Brazil and afterwards proved to be the most frequent of all the symphylans in Sri Lanka. These two species may have a considerably wider range in the tropics than the present localities indicate.

Scopoliella, new genus

Diagnosis.—The new genus is distinguished from all others in the family by the following combination of characters:

1. The posterior margin of the last tergite (15th) forms a rounded disciform lobe projecting backwards between the cerci (Fig. 13*a,b,c*).
2. The posterior and posterolateral margins of tergites 2-14 are crenate (Figs. 12*f*, 13*a*).
3. The inner side of the proximal part of the cerci have some short, thick, conical, setiform teeth (Fig. 13*g*).
4. The subapical seta of the styli consists of a conical, proximal, section and a tapering, pointed, distal one separated by a knee-like flexure (Fig. 13*e,f*).

All of these characters are peculiar to the new species described below, but the two latter may be of less value in defining the genus. Short, conical, teeth-like structures very similar to those on the inner sides of the cerci are to be found on the antennae in, for example, *H. brachycerca* Adam and Burtel from New Zealand and *H. conisetosa* Scheller from Sri Lanka. In the former species they seem to be thickened pubescence hairs, in the latter, transformed setae. Such a character may be used in distinguishing species but not genera. So also character 4, the shape of the subapical seta of the styli. It varies sometimes a little from species to species within the family, and even if the shape occurring here has not yet been described in any species, it may be suspected to be a diagnostic character of low rank.

On the other hand characters 1 and 2 can be suggested to work on the generic level. The shape of the posterior margin of the last tergite yields very useful distinctions between the genera *Scutigerella* and *Hanseniella* but is of little value at the species level. The posteromedian lobe in *Scopoliella* is probably neither subject to wide variation between specimens nor influenced by the environment. Because its shape is also easily visible, it can readily identify the genus, particularly if combined with the unique character 2.

Etymology.—The genus is dedicated to the Italian naturalist G.A. Scopoli (1723-1788) who described the first species in the order Symphyla.

Type-species.—*Scopoliella crenatus* n.sp.

Scopoliella crenatus, new species
Figs. 12-13

Type-data.—Holotype female from 0.8 km N Ruinas de Palenque, Chiapas, México, 25 July 1973 (R.W. Mitchell) (author's collection). Three paratype males, 1 paratype female, 1 paratype subad. 11 male with same data as holotype (3 specimens in author's collection, two in the collection of the Texas Memorial Museum).

Etymology.—From Latin *crena*, notch.

Description.—*Length*: (1.8-)1.9(-2.2) mm.

Head: Rounded, about as long as broad, broadest in its posterior part; lateral angle at articulating point of mandible concealed. Central rod short, anterior and posterior branches not visible; posterior end-swelling small, circular. Longest seta at mandibular basis almost 0.7 of largest diameter of the 3rd antennal segment. Tergal surface of head very densely covered with short, very thin setae of subequal length; only 3 setae at base of the antenna and a few lateral setae are longer. Palp of first maxilla small, pointed, strongly curved (sometimes like an onion). Cuticle of head glabrous.

Antennae: All antennae broken, in holotype left one outside segment 12, right one outside segment 22. First segment cylindrical, (1.3-)1.5 times as wide as long; it has a single primary whorl of 3 thin inner setae and 2(-4) thicker ones; an additional very thin seta protrudes perpenciularly on inner side behind the primary whorl. Second segment (1.2-)1.5 times as wide as long with 8 primary setae evenly distributed around the segment, 3 thin and 5 thicker ones; inner and outer setae of about the same length and about 1.5 times as long as corresponding setae on the 10th segment which has 10 thick and about 5 thin setae in the primary whorl. Small spined organs begin on 3rd segment. Each proximal segment with a single primary whorl of setae; secondary whorl begins on 5th segment. First segment with a short sparse pubescence growing denser outwards.

Tergites: 15 thin tergites. First one rudimentary with (7-)9 setae. Second tergite complete, 1.6(-2.0) times as broad as long; it has two distinct posterolateral rounded lobes separated by a median indentation; margin of lobes crenated and with a row of short, very thin, pointed setae inwards and short but distinct pubescence hairs on outer margin; there are (28-)31(-32) marginal setae; no macrochaetae, longest setae less than twice longer than shortest ones; short setae on anterolateral margins claw-like; surface of tergite with a moderate number of setae similar to the marginal ones. Tergites 3-14 in their general shape and chaetotaxy similar to the described tergite. Third tergite (1.6-)2.0 times as broad as long with (39-)44 marginal setae. Fourth tergite (2.3-)2.7 times as broad as long with (39-c. 46 marginal setae. Fifteenth tergite 1.4(-1.5) times as broad as long with a posteromedian, rounded, disciform lobe projecting backwards; setae sparse and only on posterior half. Pubescence of tergites short and partly arranged in short, curved, indistinct, transverse rows. Tergites 2, 4, 5 and 7 seem to be shortest, 6, 8, 9, 12 and 14 longest.

Legs: Tarsus of first pair of legs 4.0(-4.5) times as long as wide, subcylindrical, tapering distally; there are 5 short thin setae of subequal length, 2 of them on tergal side; longest seta 0.5 of greatest diameter of the segment. Tibia short with only 2 setae, both on tergal side. Femur with 6 setae: 3 short distal ones, 2 somewhat longer proximal ones and a very short reduced one in between. Coxa has 2 short setae. Pubescence distinct on all the segments, shortest on coxa. Anterior claw (1.5-)1.6 times as long as posterior one, both claws very pointed, the former almost straight, the latter sickle-shaped.

Tarsus of 12th leg 3.8(-4.0) times as long as wide, slowly tapering; tergal side with 8 setae of which 4 are straight and erect and 4 are curved and depressed,

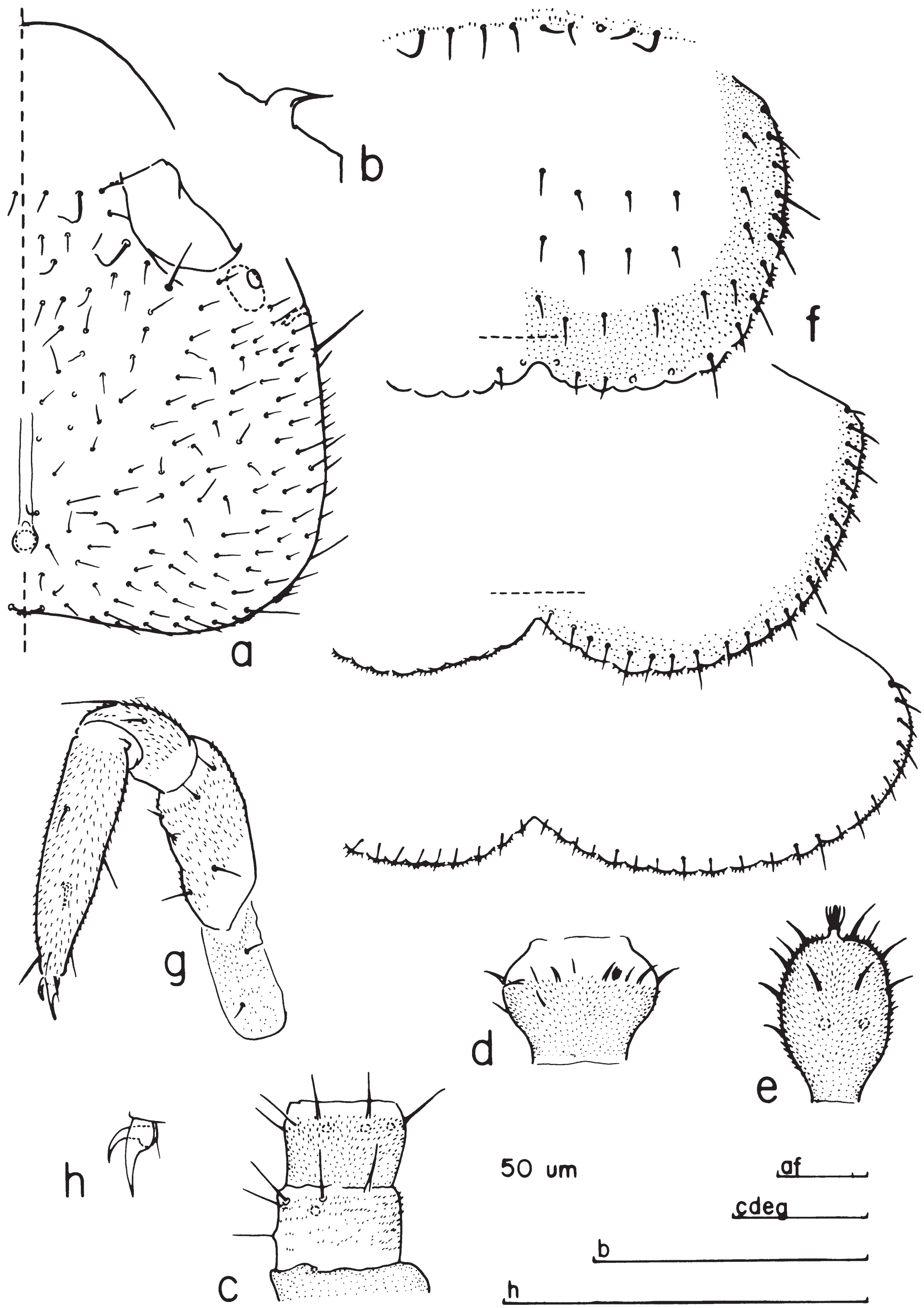

Fig. 12.–*Scopoliella crenatus* n.gen., n.sp. (*a-d* and *f-h* holotype, *e* paratype): *a*, Head, right half, tergal view; *b*, Palp of left maxilla, sternal view; *c-e*, Antenna, right side, tergal view: *c*, first two segments; *d*, 10th segment; *e*, last segment; *f*, Tergites 1-4; *g*, First leg, anterior view; *h*, Claws of first leg, anterior view. Setae and pubescence only partly drawn in *f*.

Fig. 13.–*Scopoliella crenatus* n.gen., n.sp. (*a* and *d-g* holotype, *b-c* paratypes): *a*, Tergites 14-15; *b-c*, Posterior lobe of tergite 15 in two paratypes; *d*, 12th leg, anterior view; *e*, Stylus, 4th leg; *f*, Stylus and coxal plate, 12th leg; *g*, Cercus, left side, tergal view. Setae only partly drawn in lower left part of *a*, pubescence in *a-d*.

longest one (as long as or) a little longer than greatest diameter of the segment; sternal side with (8-)11 short, thin, subequal setae. Tibia 1.9(-2.0) times as long as wide, (0.7-)0.9 of length of the tarsus; setae mainly on tergal and anterior sides; longest tergal row has (3-)4 setae, distal ones longest, at most 0.8(-1.1) times as long as greatest diameter of the segment. Femur about as long as wide with about 5 tergal setae, longest one (0.6-)0.7 of greatest diameter of the segment. Trochanter with about 20 thin setae on anterior and sternal sides. Pubescence dense on anterior side, on posterior one more sparse. Anterior claw curved and slender, posterior one sickle-shaped, very slender, pointed.

There are 10 pairs of styli located at legs 3-12. Stylus of 12th leg (3.4-)3.8(-4.0) times as long as wide, (0.3-)0.4 of length of the tarsus. Subapical seta 0.3(-0.4) of length of the stylus with a conical proximal section and a tapering, pointed, distal one separated by a knee-like flexure; apical seta very short and thin. Styli at anterior legs shorter and proportionately thicker. There are 7 pairs of fully developed coxal sacs at bases of legs 3-9. Coxal plates of leg 12 with (1-)2 setae, those of leg 11 have 3, those of leg 10 have (3-)5.

Cerci: Slender (4.5-)4.7 times as long as wide, tergal side nearly straight, sternal one slightly curved. There are a moderate number of setae the length of which increases distally: the longest ones are the most distally located on tergal side and their length is as long as greatest diameter of the cercus, they are (2.0-)2.3 times as long as shortest proximal setae. Longest tergal, outer and sternal rows have 4-5 setae, longest inner one (3-)5 setae. Distal third of cerci very slender, subcylindrical. Longest apical seta is 0.2 of length of the cercus, shorter one 0.1(-0.2) of length of the longer one. Only proximal fourth of cerci pubescent, hairs distinct, sparse, on inner side thickened, conical.

GENERA AND SPECIES OF SYMPHYLA IN THE UNITED STATES AND MEXICO

Taxonomic knowledge of the American symphylans is still very incomplete. It is likely that less than half of the existing species have been described. Certain regions have not been visited by collectors and many others are almost as neglected. Under these circumstances it would be premature to draw up a definitive list of species or comprehensive lists of species occurring in different habitats. However, collecting over the last approximately 20 years has provided much information so that a preliminary list of the genera and species is given in Table 1.

This list includes 35 species in six genera. Where there is a more detailed description than the original one or a good complementary one, it is added in brackets after the species name. The distribution is given on the state level.

Among those species having southern ranges some may be more northern than the present ranges indicate, for example, some species in *Symphylella*, *Scolopendrellopsis remyi*, and perhaps some species of *Scutigerella*. On the other hand the ranges of *Hanseniella vandykei* and *Geophilella americana* probably are not restricted to the United States but include at least northern Mexico as well.

DISTRIBUTIONAL PATTERNS

The existing knowledge about the systematics and distribution of symphylans is poor and the main part of it has originated in Europe. Except for *Scutigerella immaculata* most earlier records are from Europe and northern Africa. In addition, symphylans are fairly well-known for Madagascar and Sri Lanka, but elsewhere collecting has been insufficient to provide information for accurate biogeographical comparisons.

Symphylans have always been neglected by the student of distribution, which seems peculiar since the group has features which make it of great interest to the biogeographer. The symphylans are probably geologically old, and they are soil inhabiting and in general also adapted to a moist stable environment which permits the young stages to survive. The adults, too, are highly sensitive to dryness and in all stages they are most intolerant of exposure to sea water. They ought to represent an almost perfect group for distributional studies, limited only by difficulties in identification caused by their uniform external structure.

Keeping in mind the imperfect knowledge of the systematics and of the ranges of individual taxa, we may yet try to present some conclusions about the distribution patterns of the Nearctic symphylans on the basis of those taxa which have been studied in recent years.

Family Scolopendrellidae

The family now has three genera and 18 species in the United States and Mexico. All of the genera occur also outside of these countries, but most species have limited ranges. Only *Symphylella vulgaris* and *Scolopendrellopsis subnuda* are widely distributed. The former species may be subcosmopolitan

Table 1.—Families, genera and species of Symphyla in the United States and Mexico.

FAMILIES, GENERA AND SPECIES	DISTRIBUTION UNITED STATES	MEXICO
Family Scolopendrellidae		
Symphylella		
capicola Michelbacher, 1942a		B.C.
capitata Michelbacher, 1939a	Ca.	
essigi Michelbacher, 1939a	Ca.	
geum Michelbacher, 1941	Ca.	
longiseta Michelbacher, 1941	Ca., La.	
oviceps Michelbacher, 1939b	Ca.	Yuc.
pusilla (Hansen, 1903) [this paper]	Tx.	
reddelli n.sp.	Tx.	
rossi Michelbacher, 1942a		B.C.
sierrae Michelbacher, 1939b	Ca.	
subterranea Michelbacher, 1939a	Ca.	
tenella Scheller, 1961	Hi.	
texana (Hansen, 1903) [Scheller, 1974]	Tx.	
vulgaris (Hansen, 1903)	Fl., Ga., Ky., N.C., N.Y., Oh., Va., W.Va.	Tamps.
Scolopendrellopsis		
alba Michelbacher, 1941	Ca.	D.F., Hgo.
remyi Hinschberger, 1950a		Ver., Gro., Tab., Yuc.
subnuda (Hansen, 1903)	Hi., Mi., N.C., Va.	
Geophilella		
americana (Hilton, 1931) [Michelbacher, 1941]	Ca., Ga., N.Y., Va., W.Va.	
Family Scutigerellidae		
Scutigerella		
acicularis n.sp.		Tamps., Ver.
aduncus n.sp.		Oax., Tamps.
boneti Hinschberger, 1950a		Chis.
causeyae Michelbacher, 1942b	Ca., Fl., Ga., Ia., N.C., N.M., Nv., Tn., Va., W.Va.	
immaculata (Newport, 1845) [Michelbacher, 1942b; Edwards, 1959]	Ca., Co., Ct., De., Id., Il., In., Ia., Ks., Ky., La., Md. Ma., Mt., Mi., Mn., Ms., Ne., N.H., N.J., N.Y., Oh., Or., Pa., S.C., Ut., Vt., Va., W.Va., Wa., Wi., Wa.D.C.	
inculta Michelbacher, 1942b	Ca.	
linsleyi Michelbacher, 1942b	Ca., Tx.	
mexicana Hinschberger, 1950a		D.F., Tamps.
palmonii Michelbacher, 1942b [this paper]	Ca., In., N.M., Oh., Tx., Va., W.Va.	
sakimurai Scheller, 1961	Hi.	
silvestrii Michelbacher, 1942b	Tx.	Pue.
Hanseniella		
appendicofera Scheller, 1971		Yuc.
cf. *caldaria* (Hansen, 1903)		Chis.
orientalis (Hansen, 1903)		Camp., Yuc.
unguiculata (Hansen, 1903)	Hi.	
vandykei Michelbacher, 1939b [this paper]	Ca., Fl., Ga., N.C., Va., W.Va.	
Scopoliella		
crenatus n.sp.		Chis.

with a particularly wide distribution in the north temperate zone, while the latter is common to the western Palaearctic.

The small ranges of the other species may be an artifact of collecting. In many cases they certainly have been overlooked because almost all are very small and slow moving. However, there are a couple of species which have been collected from a few localities very distant from each other and hence may belong to a more widely distributed element.

Family Scutigerellidae

This family now has three genera and 17 species in the United States and Mexico. The new genus *Scopoliella* has not been collected outside of Mexico but the other two genera have very wide ranges. On the northern continents *Scutigerella* occurs from coast to coast in North America and is widely distributed in the western Palaearctic. Several species have been described from both areas and some are common. In the tropics and on the southern continents in general *Hanseniella* is the dominant genus and also the most diversified, much more than *Scutigerella* in the north.

Genus *Scutigerella*

Eleven species are known from the United States and Mexico. Four (*S. palmonii, S. causeyae, S. immaculata*, and *S. linsleyi*) have wide east-west distributions in the Holarctic. In addition to the United States they have been collected from many places in the western Palaearctic. *Scutigerella palmonii* also occurs in the Caucasus and possibly also in Japan. *Scutigerella silvestrii* has a similar range but seems to be rare and more warmth-dependent because it has been found only in Texas, Mexico, and southernmost Italy.

The remaining six species have more limited known ranges: *S. sakimurai* in Hawaii, *S. inculta* in California, and four species in Mexico (*S. acicularis, S. aduncus, S. boneti*, and *S. mexicana*).

In summary, in the Nearctic the *Scutigerella* species may be divided into two distributional groups: a northern series with very large east-west ranges and a more southern element which consists of species which may have limited ranges.

Genus *Hanseniella*

Although chiefly southern, *Hanseniella* penetrates northward in Europe and North America but, so far as we know, with only a few species. In Europe *H. nivea* (Scopoli) is widely distributed in the southern half and *H. balcanica* Remy and *H. graeca* Remy are southeastern but probably have limited ranges. The North American distribution of *H. vandykei* may parallel that of *H. nivea* in Europe. *Hanseniella vandykei* was formely reported from California only but the new localities enumerated above considerably widen its range. It has probably been overlooked and may be widely distributed in the United States.

There are three other species reported from North America but they all have much wider ranges. They seem to have penetrated northward from the tropics where the number of species in *Hanseniella* is considerable. One is the pantropical *H. unguiculata* which was probably introduced into Hawaii in recent times. The other two, *H. appendicofera* and *H. orientalis*, may also have entered from the tropics, but they seem to be more warmth-limited than *H. vandykei* since they have not penetrated so far northward.

The species composition and distribution patterns show the symphylan fauna of the eastern United States to be like that of the western Palaearctic, impoverished in the north and richer in the south, but still with a low number of species. On the other hand in the southwest and west, particularly in California, several species have differentiated, and six of them have not been found elsewhere, which may indicate a more diversified local fauna there than in the east.

The transition of the Nearctic and Neotropical faunas is extensive in many groups of animals, and a certain blend in Mexico is obvious in the Symphyla, too. It is formed mainly by northward extensions of tropical forms, for example, the two *Hanseniella* species, *H. appendicofera* and *H. orientalis* which have entered southern Mexico. The following taxa may also belong to this element: the new genus *Scopoliella* from Chiapas, *Scolopendrellopsis alba* and *Symphylella oviceps* from California and southern Mexico, and *Scolopendrellopsis remyi* from southern Mexico. It is also possible to discern a northern contribution. If widespread species are disregarded, four *Scutigerella* species may be remnants or descendants of an early northern invasion.

CAVE INHABITING SPECIES

The symphylans belong to the endogeans, the soil dwellers, and are all adapted to the environment by some morphological characters which have also been considered as typical of troglobites. They are eyeless and depigmented and most have proportionately long antennae, all qualities which make them well equipped to subterranean environments. But to what extent they have done so is almost unknown. Up to now only a few species have been found in caves, for example, in Europe but six: *Symphylella vulgaris*, *Symphylella major* Scheller, *Scolopendrellopsis pretneri* Juberthie-Jupeau, *Scutigerella immaculata* (in the broad sense), *Scutigerella* sp. cf. *remyi* Juberthie-Jupeau, and *Hanseniella nivea* (Scopoli). From the United States we have Packard's record (above, p. 000) of a *Scutigerella* in a cave near Dismal Creek near Mammoth Cave in Kentucky. Neither the long neglect of this group in cave zoology nor these finds, few in numbers and accidental it is true, have led to any systematic investigation of the occurrence of symphylans in caves. Consequently the collections made or initiated by J. Reddell and R. Mitchell and discussed above were most valuable. They have yielded new material (Table 2) which shows that the symphylans are more common in caves than was earlier expected. Ten species were found in caves, all belonging to the genera *Scutigerella* and *Hanseniella*, both major elements in the epigean fauna. The former was best represented with seven species while the latter has three.

The European cave symphylans are all, or all but one, species from the epigean fauna which have penetrated into the subterranean environment. None is a troglobite and most are probably accidental visitors, although *Scutigerella* sp. cf. *remyi* may be a troglophile. Of the ten North American species nine have also been collected in epigean habitats; the remaining species, *Scutigerella aduncus*, a new species hitherto unknown from the surface fauna, may belong to the same group, and when epigean habitats around the two caves in which it was found are investigated, it probably will be discovered there, too.

Most if not all cave symphylans in both Europe and North America are troglophiles, meaning that more such species certainly will appear. For instance, no representatives of the Scolopendrellidae have been collected in American or Mexican caves though they are sure to occur there. In general symphylans are so well adapted for subterranean environments that their occurrence in caves, particularly in entrance areas, is almost certainly greater than the records indicate. On the other hand it is scarcely likely that troglobites have developed to any larger extent because the group in its entirety is most conservative, not having differentiated into more than two families, both subcosmopolitan, with about 165 known species altogether.

Table 2.—Symphylans found in caves in the United States and Mexico.

SPECIES	DISTRIBUTION IN CALIFORNIA	TEXAS	MEXICO
Scutigerella			
causeyae	Cave of Skulls, Porcupine Cave, McLean's Cave, Mine Cave		
mexicana			Cueva de los Cuarteles
acicularis			Mine Cave
aduncus			Cueva de la Finca, Cueva de Tres Manantiales
inculta	Tube Cave		
palmonii	Cave of Skulls	Sixty Minute Cave, Mingus Root Cave	
silvestrii		Fossil Cave, Beck Sewer Cave, Powell's Cave	Sima Estéban
Hanseniella			
vandykei	Bobcat Cave		
orientalis			Cueva Luchil, Actún Chen, Cenote de Cantemo
appendicofera			Cenote Hunto Chac (Cueva Mamey)

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THE CAVE COLLEMBOLA OF MEXICO

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ABSTRACT

A review of the cavernicole collembola of Mexico is presented. All published and unpublished records are given for each species and distributional notes are provided for the more significant elements of the fauna. The following new species are described: *Pseudosinella cava, P. crypta, P. palaciosi, Oncopodura dura, O. susanae, Acherontiella (Acherontides) spina*, and *Neanura (Americanura) nova*.

INTRODUCTION

The collembolan fauna of Mexican caves has been examined by Bonet (1943; 1944; 1945; 1946; 1947), Christiansen (1973; 1982a), and Palacios-Vargas (1981b; 1982; 1983a). In addition, a number of smaller contributions to our understanding of Mexican cave forms have been made (see Palacios-Vargas, 1983a). This literature, as well as many new collections by Reddell and others, makes it possible for us to get a good outline view of the makeup, distribution, and probable zoogeographic relationships of the Mexican collembolan cave fauna. This paper is an attempt to do that, concentrating upon the genera of greatest zoogeographical interest.

Type-specimens of the new species described here are retained in the collection of the senior author; they will eventually be deposited in the Museum of Comparative Zoology, Harvard University.

GROUPS FOUND

Mexican cave collembola belong to 41 genera which contain about 104 species. Almost half of these are epigeic forms with type 1 cave occupation (see Christiansen, 1982b and Table 1) and are of little interest from the biospeleological point of view. The species having types 4 and 5 cave occupations (Christiansen, 1982b and Table 1) belong to only 8 genera. The well developed cave forms fall into 4 groups: *Pseudosinella, Oncopodura*, troglopedetids, and hypogastrurids (*Schaefferia, Acherontiella*, and *Acherontides*). These are the groups we shall concentrate upon in this study, but we shall look at the known distribution of all cave forms.

FAMILY ENTOMOBRYIDAE

The members of this family are divided into 5 subfamilies (see Table II). All are represented in Mexican caves but the vast majority of collections are from the first three subfamilies. Members of these subfamilies make up more than 80% of all cave collections of collembola.

Table I.—Patterns of cave occupation of Mexican cave Collembola (figures represent numbers of species). Category definitions: 1, Epigeic forms with opportunistic cave occupations; 2, Troglophilic forms with opportunistic cave occupations; 3, Troglophilic and/or non-troglomorphic apparent troglobites with scattered successful cave invasions; 4 Troglomorphic troglobites with single cave invasions; 5. Troglomorphic troglobites with parallel speciation. Categories with ? have species which could shift one category either way.

	CATEGORY				
GENUS	1	2	3	4	5
Entomobryinae					
Pseudosinella	0	1	7	6	1
Lepidocyrtus	3	0	0	0	0
Metasinella	0	0	0	1	0
Seira	2	0	0	0	0
Sinella	0	1	0	0	0
Orchesella	2	0	0	0	0
Dicranorchesella	1	0	0	0	0
Dicranocentrus	0	0	1?	0	0
Neorchesella	0	0	1?	1	0
Tomocerinae					
Tomocerus	0	1	0	0	0
Cyphoderinae					
Cyphoderus	2	0	0	0	0
Oncopodurinae					
Oncopodura	0	0	3?	2?	0
Paronellinae					
Troglopedetes	0	2	0	0	0
Paronella	0	2	0	0	0
Isotomidae					
Cryptopygus	2	0	0	0	0
Folsomia	3	1	0	0	0
Folsomides	3?	0	0	0	0
Isotoma	2	0	0	0	0
Isotomiella	1?	0	0	0	0
Isotomurus	1	0	0	0	0
Proisotoma	5	0	0	0	0
Hypogastrurinae					
Acherontiella	0	0	0	1	0
Acherontides	0	0	0	3	0
Willemia	2	0	0	0	0
Schaefferia	0	0	0	2	0
Hypogastrura	5	0	0	0	0
Tafallia	1	0	0	0	0
Xenylla	2	0	0	0	0
Neanurinae					
Brachystomella	3	1?	0	0	0
Micranurida	1	0	0	0	0
Paranura	2?	0	0	0	0
Neanura	2	0	0	2	0
Pseudachorutes	1	0	0	0	0
Onychiuridae					
Onychiurus	0	4?	0	0	0
Tullbergia	0	4?	0	0	0
Sminthuridae					
Sminthurus	1	0	0	0	0
Temeritas	1	0	0	0	0
Dicyrtoma	1	0	0	0	0
Arrhopalites	0	1	1?	0	0
Pararrhopalites	1	0	0	0	0
Sminthurides	2?	0	0	0	0
Neosminthurus	1	0	0	0	0
Neelidae					
Neelus	0	2	0	0	0

Subfamily Entomobryinae

This is the dominant subfamily of cave collembola. Although 9 genera have been found in Mexican caves, most collections are members of *Pseudosinella.*

Pseudosinella

This genus includes all of the region's category 3–5 cave forms of the subfamily Entomobryinae except for the single species of *Neorchesella* and the one species of *Metasinella.* It is by far the largest and most varied genus of Mexican cave collembola and one of the larger genera of Mexican cave arthropods. There are 16 species known from Mexican caves and almost all of these are unknown outside of Mesoamerican caves. Their probable cave occupation types are shown in Table I.

The earlier known species of this genus largely fell into 4 species groups (Christiansen, 1982a). In this work a new species of the *petrustrinatii* group is described, and another new species which appears to represent an entirely new and undiscovered group is described, and the previously isolated *P. yuca* Christiansen is shown to be part of a series of species. The *Pseudosinella* species discussed in this paper can thus be classified into 6 groups:

1) *P. violenta,* which shows type 2 cave occupation and is the sole Nearctic element in the Mexican cave fauna;

2) *P. petrustrinatii, volca,* and *cava* (n.sp.);

3) *P. finca, huautla,* perhaps *bonita,* and sp. *BB*;

4) *P. reddelli, vera, voylesi,* and perhaps *leoni*;

5) *P. yuca,* sp. *QQ,* and *palaciosi* (n.sp.);

6) *P. crypta* (n.sp.).

The geographic distribution of each of these species groups (see Maps 1-6) show little or no geographic unity but the distribution of the individual species clearly does show this. It is also clear that the different species falling within one of the species groups are, with one exception, allopatric. The one exceptional case is of peculiar interest since the case of species group sympatry (*vera* and *voylesi*) shows apparent character displacement (Christiansen, 1982a). *P. violenta* and *P. finca* have the widely dispersed patterns characteristic of type 2 cave occupation; however, *P. finca* in each region occupied shows such striking morphological peculiarity that a type 3 occupation is indicated. *P. petrustrinatii* and *P. reddelli* appear to show single extensive cave occupations which either are secondarily fragmented by extinction or have unknown extant intermediate populations. *P. vera* could be the dissected remains of an earlier much more extensive distribution or a case

Table II.–Characteristics of Nearctic Representatives of Subfamilies of Entomobryidae.

Subfamily	Scales	Maximum Eye No.	Adult P.A.O.	Dental Spines	Mucro	Habitats
Entomobryinae	+ or -	8	-	+ or -	short 1-2 teeth	All
Paronellinae	- or +	8	-	+ or -	short 2-4 teeth	Litter, Vegetation, Caves
Oncopodurinae	+	4	+	+	elongate	Litter, Soil, Caves
Cyphoderinae	+	0	-	-	elongate	Ant nests, rarely Caves
Tomocerinae	+	6	-(+)	+	elongate hairy	Litter, Soil, Caves

of parallel speciation (Christiansen and Culver, 1968). The remaining species appear to be either highly evolved localized species (*P. volca, voylesi, huautla,* and *bonita*) or too poorly known to make any judgement (*P. cava, leoni, yuca, QQ, BB*). A unique situation is afforded by *P. crypta.* This highly evolved troglomorphic form shows some features seen in the most highly evolved members of the nearctic *P. hirsuta* group forms and appears to have evolved convergently. It seems almost certain that this form is part of a series of undiscovered species which probably inhabit an undiscovered cave system.

In the sections below we shall describe the previously unknown species and discuss the geographic distribution of each of the species groups in turn.

Species group 1 is represented in Mexican caves only by *P. violenta* (Map 1). This species is most frequently collected from arid regions and is apparently the only species in caves in the desert regions of northern and northwestern Mexico. Its presence in caves of the Purificación region of Tamaulipas probably represents a recent invasion.

Species group 2 (Map 2) includes the highly troglomorphic *P. volca* from a lava cave in Veracruz: *P. cava* from four caves, each geographically isolated from the other in the states of Hidalgo, Querétaro, and San Luis Potosí; and *P. petrustrinatii* from caves in the Sierra de El Abra and Sierra de Alvarez, San Luis Potosí, and the Sierra de Guatemala, Tamaulipas. The species group therefore ranges generally from an area somewhat south of Ciudad Victoria to near Pachuca, Hidalgo, in the Sierra Madre Oriental, with one isolated species near Las Vigas, Veracruz.

Species group 3 (Map 3) has a generally southern distribution with two species (*P. bonita* and *P. huautla*) known only from caves in the Huautla de Jiménez region of Oaxaca, one species (*P. finca*) ranging from Alta Verapaz, Guatemala, north to Querétaro, and one species (*P.* sp. *BB*) from a cave in the Sierra Madre Oriental south of Monterrey, Nuevo León. The two species from Oaxaca occur at comparatively high elevations and may well represent high-altitude relicts of the same ancestral species which gave rise to *P. finca.*

Species group 4 (Maps 4–5) occurs only in the Sierra Madre Oriental with one species (*P. reddelli*) largely limited to the central part of the Sierra; a single epigean record of this species in Oaxaca is known. *P. leoni* is known from two caves in the extreme northern Sierra Madre Oriental, and one collection from a cave in the Apoala region of Oaxaca. *P. voylesi* occurs only in the Cuetzalan region of Puebla. *P. vera* is a widely distributed form ranging from Veracruz to the Purificación area of Tamaulipas. Populations of *P. vera* in the Cuetzalan region are eyeless where it occurs with the eyed *P. voylesi,* but populations from other regions have eyes.

Species group 5 (Map 2) has an extreme southern distribution, with one species each in Yucatán (*P. yuca*), Morelos (*P.* sp. *QQ*), and Guerrero (*P. palaciosi*). All are eyed forms and presumably troglophiles.

Species group 6 (Map 2) contains only the highly troglomorphic *P. crypta* from the Potrero Redondo area in the northern Sierra Madre Oriental.

Considering our limited knowledge of *Pseudosinella* in Mexico and particularly the paucity of surface collections we felt it premature to draw any general conclusions or make further speculations about the zoogeography of this group. There is no doubt that numerous undescribed species, both cave and epigean, await discovery.

The morphological features of the 15 Mexican cave species of *Pseudosinella* are summarized in Table III and a key is given in Table IV. Of these species, *BB* from Cueva del Lencho Virgen, Oaxaca, and Cueva de la Boca, Nuevo León, and *QQ* from Cueva del Salitre, Morelos, have samples too poor to merit naming. Neither species is highly cave adapted and both may well be found among surface forms when these become better known in Mexico. *P.* sp.

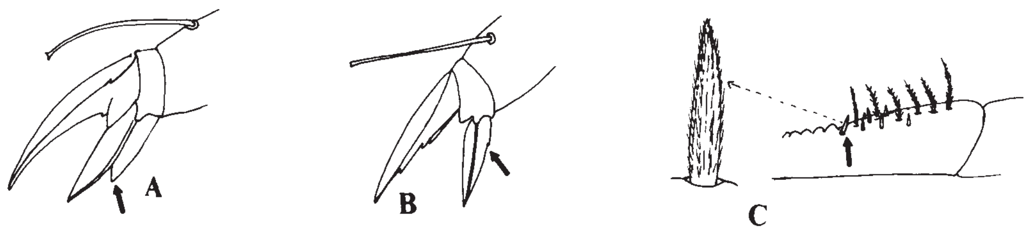
Table III. Characteristics of Mexican cave *Pseudosinella* (see Christiansen and Bellinger, 1981).

Species	Cephalic Setae S	T	M_1	M_2	r	E	L_1	L_2	2nd Abdominal Segment Chaetotaxy A	B	P	q_1	q_2	4th abd. Segment Dorsal macrochaetae	Seta supplementary	T.H.	Foot Complex Teeth	Ungual wing tooth	Unguiculus wing tooth	Eyes	Setae Manubrial plaque inner	outer
BB	0	1	M	M	0	E	L	L	A	B	+	q	q	1+2	+	cl	4	–	–	0	2	3--4
bonita	1 (0)	0 (1)	M	M	0	E	L	L	A	B	–	q	q	1+2	+	ac	2	–	–	0	3	6-10
cava	1	1	M	M	v	E	L	L	A	B	–	q	q	1+2	+	cl-ac	3-4	±	–	0	2	2
crypta	0	0	M +$\underline{m}$s	M	r	E	L	L	A	B	+	q	q	1+3	+	2c	3	–	–	0	3	8-10
finca	1	1	M	M	0	E	L	L	A	B	–	q	q	1+2	+	ac	2-3	+	-- to weak	0	2	2(4)
huautla	1	1	M	M	0	E	L	L	A	B	--	q	q	1+2	+	ac	2	–	–	0	2-3	2--6
leoni	0	0	M $\underline{M}$	M	r	E	L	L	A	B	– (+)	q	q	1+2	+	cl	3-4	–	minute	0	2	3-8
petrustrinatii	1 (0)	1 (0)	M	M	0	E	L	L	A	B	–	q	±	0+2	+	cl	3-4	+	–	0	2	2
palaciosi	0	0	–	$\underline{M}$	r	$\underline{E}$	$\underline{l}$	$\underline{L}$	a	B	–	q	q	0+2	+	ac	3	–	–	2	1	2
QQ	0	0	$\underline{M}$	$\underline{M}$	0	$\underline{E}$	$\underline{L}$	$\underline{L}$?	a	B	–	q	q	0+1	–	cl	3	–	--	5	0	2
reddelli	0	0	M (m)	M	0 (v)	E	L	L	a	B	–	q	q	1+2	3	cl	3-4	–	–	2(4)	3(2)	6-17
vera	0	0	M	M	0	E	L	L	A	B	--	q	q	1+2	+	ac	3	+	–	(3) 2-0	2	3(4,5,6)
violenta	0	0	M	M	0	E	L	L	A	B	+	Q	q	0+2	+	cl	3	+	+	0	1	2(3,1)
volca	0	1	M	M	r	E	L	L	A	B	--	q	q	0+2	+	ac	2	±	–	0	3?	5?
voylesi	0	0	M	M	r	E	L	L	A	B	–	q	q	1+2	+	ac	2	–	–	1-2	3	4-9
yuca	0	0	$\underline{M}$	$\underline{M}$	$\underline{v}$	$\underline{e}$	$\underline{l}$	$\underline{l}$	a	B	+	q	q	1+2	+	cl	3	--	–	2-3	2	2

Table IV.—Key to the Mexican cave species of *Pseudosinella*.

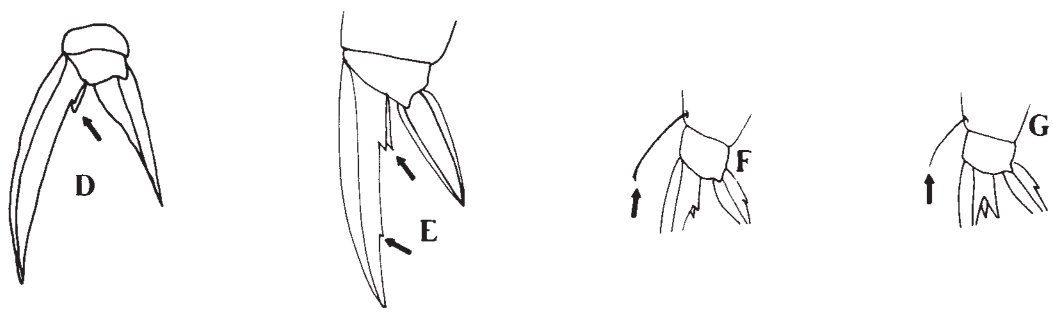
1. Unguiculus with wing tooth (see Fig. A) . . . . *P. violenta*
   Unguiculus without wing tooth (see Fig. B) 2

2. Base of dens with short spines (see Fig. C) 3
   Base of dens without short spines 4



3. Unguis slender with 2 inner teeth (see Fig. D) . . . . *P. bonita*
   Unguis broad with 3 inner teeth (see Fig. E) . . . . *P. crypta* n.sp.

4. Tenent hair clavate (see Fig. F) 5
   Tenent hair acuminate (see Fig. G) 12



5. Eyes present 6
   Eyes absent 9

6. Eyes five per side . . . . *P.* sp. *QQ*
   Eyes 3+3 or fewer 7

7. Some basal labial triangle setae ciliate . . . . *P. yuca*
   All basal labial triangle setae smooth 8

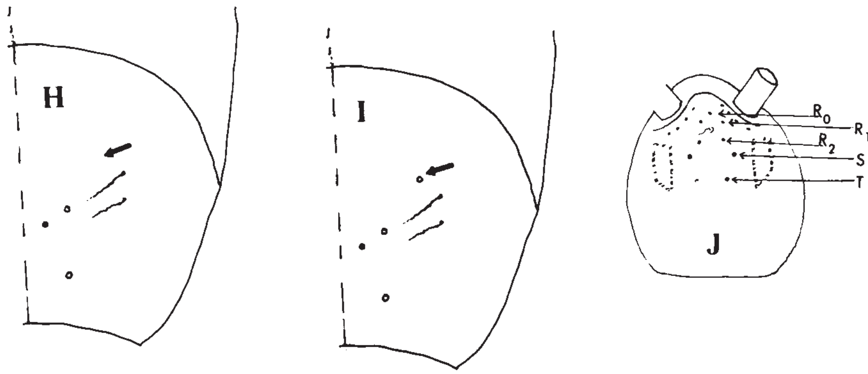
8. One basal ungual tooth much larger than other (see Fig. A) . . . . *P. vera*
   Basal ungual teeth subequal (see Fig. B) . . . . *P. reddelli*

9. Fourth abdominal macrochaetae 0+2 (see Fig. H) . . . . *P. petrustrinatii*
   Fourth abdominal macrochaetae 1+2 (see Fig. I) 10

10. With cephalic macrochaeta S or T present (see Fig. K) 11
    Without either of above (see Fig. J) . . . . *P. leoni*

11. Both macrochaetae S and T present (see Fig. J) . . . . *P. cava* n.sp.
    Only setae T present . . . . *P.* sp. *BB*

12. Eyes present 13
    Eyes absent 16



13. One basal ungual tooth much larger than other (see Fig. A) 14
Basal ungual teeth subequal (see Fig. B) 15

14. Cephalic macrochaetae S or T present (see Fig. J) . . . . *P. finca*
Cephalic macrochaetae S and T absent (see Fig. J) . . . . *P. vera*

15. Eyes 2+2, separate . . . . *P. palaciosi* n.sp.
Eyes 1+1 or 2+2 and close together . . . . *P. voylesi*

16. Both cephalic macrochaetae S and T absent (see Fig. J) . . . . *P. vera*
Cephalic macrochaetae S or T present (see Fig. J) 17

17. Fourth abdominal macrochaetae 0+2 (see Fig. H) . . . . *P. volca*
Fourth abdominal macrochaetae 1+2 (see Fig. I) 18

18. Antennae 2.4 or less times cephalic diagonal . . . . *P. finca*
Antennae 2.5 times or more cephalic diagonal . . . . *P. huautla*

QQ is similar to *P. yuca* in many respects but the peculiar 4th abdominal macrochaetae serves to separate it from all known New World forms.

Pseudosinella violenta (Folsom)
Map 1

Records.–*Coahuila*: Cueva de los Lagos (Christiansen, 1982a). *Durango*: Cueva del Guano (Christiansen, 1982a); Cueva de la Siguerita (Christiansen, 1982a). *Hidalgo*: Grutas de Tolantongo (Palacios-Vargas, 1982). *San Luis Potosí*: Sumidero de Piedra Paloma (Christiansen, 1982a). *Tamaulipas*: Cueva del Agua, 30 mi. SW Soto la Marina (Christiansen, 1982a); Cueva de los Cuarteles (Christiansen, 1982a); Sistema Purificación (Christiansen, 1982a); Entrada de Viento Baja (Christiansen, 1982a); Cueva X (Christiansen, 1982a).

New records.–*Durango*: Grutas de Mapimí, 15 km WSW Mapimí, 12 June 1980 (J. Reddell, D. McKenzie, M. Shumate). *Hidalgo*: Mina La Purisma, Pachuca, 270 m. deep, 16 June 1984 (B. Rives). *Nuevo León*: Cueva del Carrizal, 10 km SW El Candela, 7 June 1966 (J. Reddell, O. Knox, A. R. Smith). *Tamaulipas*: Cueva del Borrego, 0.5 km S Conrado Castillo, 9 April 1979 (P. Sprouse).

Remarks.–This species has also been collected from the surface at Ojo Zarco, Veracruz (Christiansen, 1982a), 8 mi. N Ciudad Valles, San Luis Potosí (Christiansen, 1982a), and K100 on the road from Creel to Batopilas, Chihuahua.

Pseudosinella crypta, new species
Figs. 1-9; Map 2; Table V

Type-data.–Cueva Sin Nombre, Potrero Redondo, Nuevo León, México, 24 May 1980 (W. R. Elliott).

Description.–Color white, without trace of pigment or eyes. Antenna without apical bulb but with expanded protruding subapical sense peg. Apical organ of 3rd antennal segment unclear but apparently of two curved expanded pegs. Lenticular organ of intersegmental membrane prominent. Cephalic and abdominal chaetotaxy as shown in Table 2. Thoracic "collar" of 4-5 rows of long (0.14 mm) slender (0.005 mm) pointed and minutely serrate setae.

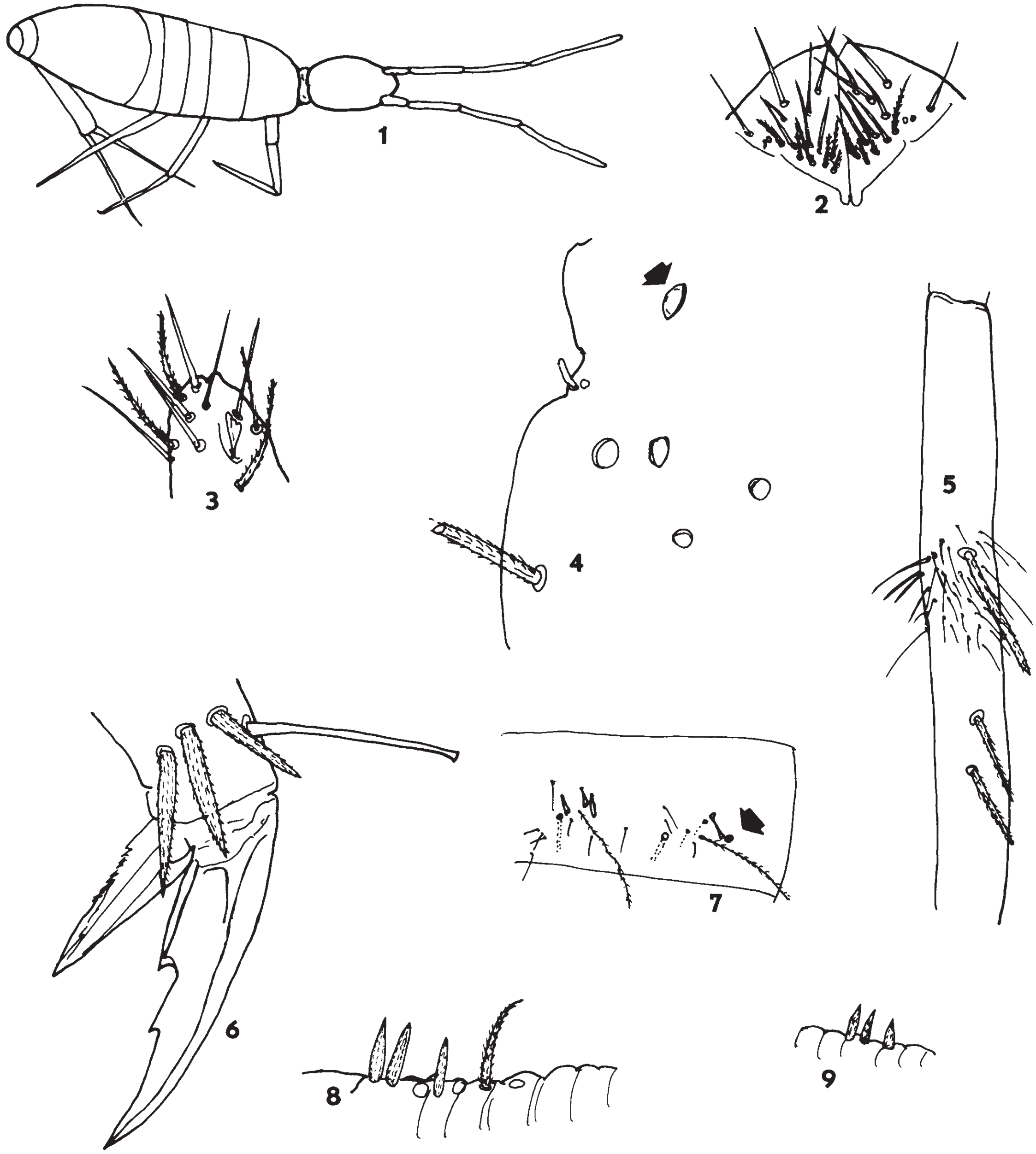
Clothing of extremely thin, colorless, rounded scales. Large specimens with 15+15, mostly ciliate, setae on the apex of the ventral tube. Projecting seta on latero-internal surface of tibiotarsus 1/4-1/5 distance from base, acuminate, and strikingly larger than other setae, present on all legs but best developed on hind pair. Tibiotarsus without clearly differentiated "smooth" setae. Trochanteral organ in large specimen with 30 setae arranged in a triangle and varying from 0.022-0.044 mm in length. Unguiculus weakly serrate externally. Unguis with three small distal inner teeth diminishing in size from base to apex. Tenent hair slightly to clearly clavate. Base of dens with 8-12 short striate spines on dorsal surface. Mucro with anteapical tooth clearly shorter than apical and basal spine not quite reaching the apex of the anteapical tooth. Mucro 1/8-1/5 as long as uncrenulate (smooth) dens. Manubrial plaque with three inner and nine outer setae. Maximum length 3.0 mm. Typical Gisin formula $R001/00/0201+3/M_1M_2M_s0EL_1L_2$.

Distribution.—Known only from the type-locality in the Potrero Redondo area in the northern Sierra Madre Oriental.

Remarks.—The position of the greatly enlarged tibiotarsal seta appears to vary from lateral to latero-internal.

This species shows a number of unique features. The supplementary M seta on the labial triangle, long

Map 1.—Distribution of *Pseudosinella violenta* in Mexican caves.



Figs. 1--9.–*Pseudosinella crypta* (all figs. but last of holotype): 1, habitus x 100; 2, Labial chaetotaxy; 3, apex of right antenna; 4, apex of third antennal segment showing lenticular organ (arrow); 5, hind tibiotarsus showing enlarged setae; 6, hind foot complex; 7, dorsal second abdominal chaetotaxy of left side (arrow shows pseudopore); 8, inner base of dens showing spines; 9, inner base of dens of paratype.

Table V.—Measurements (mm) of *Pseudosinella crypta*, new species.

Locality	Antennal Segments 1	2	3	4	Cephalic Diagonal	Hind Tibiotarsus	Hind Claw Unguis	Unguiculus	Furcula Manub.	Dens
Cueva Sin Nombre	.14	.36	.47	.65	.69	.66	.055	.034	.67	.74
Cueva Sin Nombre	.07	.15	.18	.32	.33	.26	.027	.017	.26	.32

legs and antennae, and general form are all indicative of a highly cave-adapted form; however, the foot complex remains primitive. The many unique features indicate a species far removed from all other U.S. or Mexican forms.

Pseudosinella petrustrinatii Christiansen
Map 3

Type-locality.—*Tamaulipas*: Crystal Cave (Christiansen, 1973).

Distribution.—Known from one cave in central Guerrero, and from caves in the Sierra de Alvarez, San Luis Potosí, the Sierra de El Abra, San Luis Potosí and Tamaulipas, and the Sierra de Guatemala, Tamaulipas.

Other records.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982). *San Luis Potosí*: Cueva Chica (Christiansen, 1973); Cueva de la Lagunita (Christiansen, 1973); Cueva de los Monos (Christiansen, 1982a); Cueva Pinta (Christiansen, 1973); Cueva de Taninul no. 1 (Christiansen, 1973); Sótano del Tigre (Christiansen, 1973); Sótano de la Tinaja (Christiansen, 1982a); Sótano de Yerbaniz (Christiansen, 1982a). *Tamaulipas*: Cueva de la Florida (Christiansen, 1973); Cueva de El Pachón (Christiansen, 1973); Cueva de San Rafael de los Castros (Christiansen, 1973).

New records.—*Tamaulipas*: Cueva de Ojo de Agua (Norte and Sur Sections), 2.5 km E Gómez Farías, 28 March 1981 (J. Reddell, D. McKenzie, T. Archey, F. Endres).

Remarks.—This species is represented by three distinct morphological forms. Form A occurs in the Sierra de El Abra, San Luis Potosí and Tamaulipas, the Sierra de Alvarez, San Luis Potosí, and the Sierra de Guatemala, Tamaulipas. Form B is known from the Sierra de El Abra and the Sierra de Alvarez. Form C has been collected only from the Sierra de Guatemala. All three of these ranges are broadly contiguous and the three forms all probably derived from separate invasions of the epigean ancestor.

Pseudosinella volca Christiansen
Map 3

Type-locality.—*Veracruz*: Cueva de Volcancillo (Christiansen, 1982a).

Distribution.—Known only from the type-locality.

Pseudosinella cava, new species
Figs. 10-17; Map 3; Table VI

Type-data.—Sótano Hondo del Pinalito, Hidalgo, México, March 1981 (J. Atkinson), from 30-90 m level.

Description.—Color white. Pigment and eyes absent. Fourth antennal segment elongate oval without trace of annulation. Apical bulb lacking and subapical sense peg simple and withdrawn into antenna. Apical organ of third antennal segment curved, rodlike, possibly with extremely narrow lateral flanges. Cephalic and abdominal chaetotaxy as shown in Table II. "Collar" of 2-4 rows of long (.065 mm), narrow (.002 mm), truncate setae. Body sparsely clothed with thin, unpigmented oval-elliptical scales. Ventral tube with 8-10 distal setae per side. Largest setae ciliate, smaller setae smooth. Inner differentiated seta of midtibiotarsi about 1/3-1/4 from base, and with apex more sharply tapered than remaining setae. Inner surface of tibiotarsi with a double row of "smooth" setae clearly distinguished from other setae. Trochanteral organ with 5 setae in dorsal and ventral arms and two external setae. Unguiculus without teeth and with weak basal serrations. Unguis with three teeth, with one basal tooth much larger than other. Tenent hair acuminate. Dens without spines but with a basal dorsal straight smooth seta, clearly distinguished from normal ciliate setae. Mucro with anteapical tooth slightly shorter than apical. Basal spine clear and just attaining apex of basal tooth. Uncrenulate (smooth) dens about 4x as long as mucro. Manubrial plaque setae 2+4. Typical Gisin formula $R111/11/0201+2/-ABq_1q_2M_1M_2rEL_1L_2$. Maximum length 1.5 mm.

Distribution.—Known from two caves in Hidalgo, and one cave each in Querétaro and San Luis Potosí.

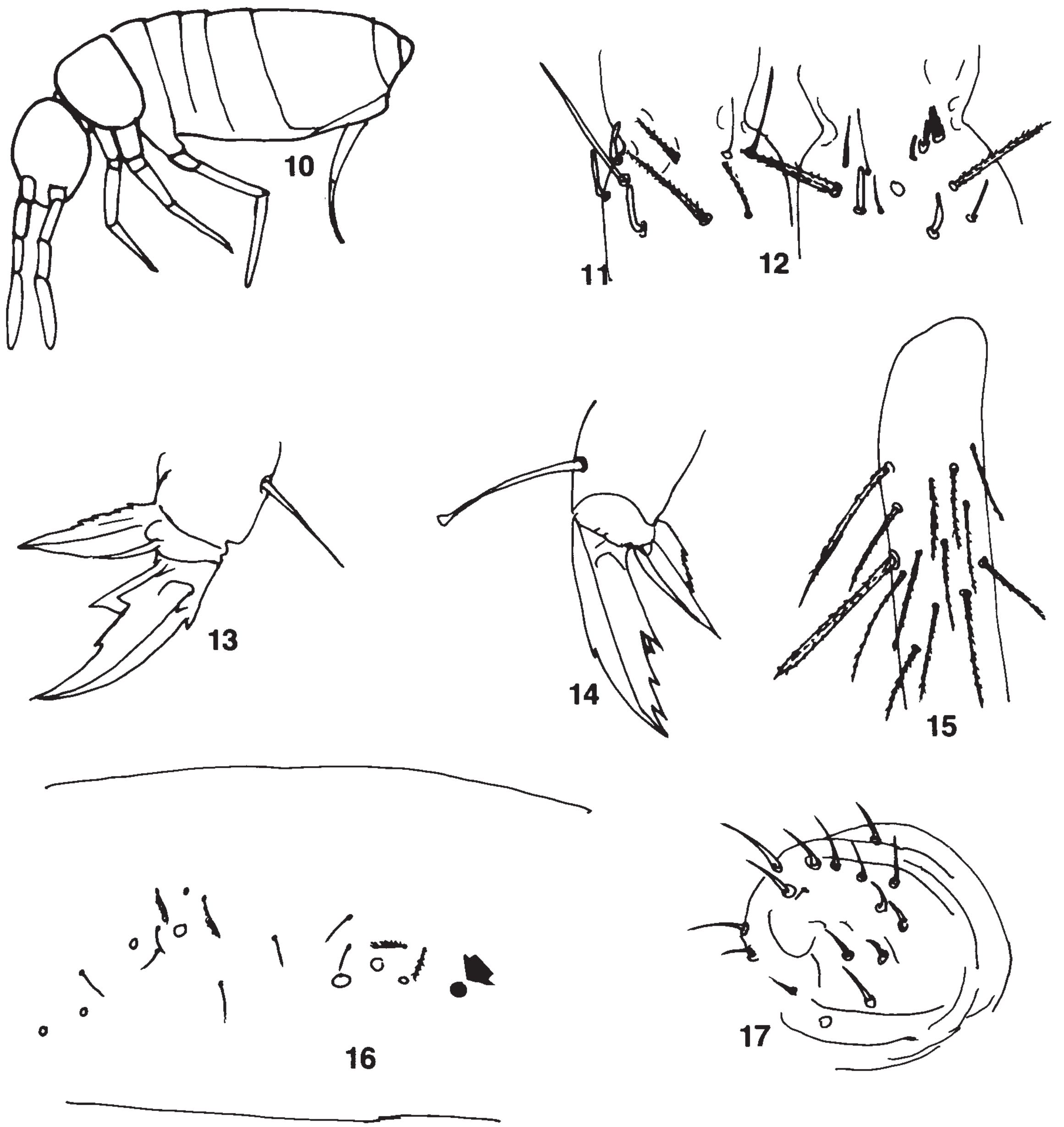
Other records.—*Hidalgo*: Cueva de San José, San José, 18 March 1981 (J. Reddell et al.). *Querétaro*: Cueva del Muerto, Esperanza, July 1982 (M. García). *San Luis Potosí*: Nacimiento del Río Huichihuayán, 22 October 1984 (L. P. Toledo).

Remarks.—The specimens described above are from the type-locality. Those from Cueva de San José differ from the type-specimen in having a clavate tenent hair and smaller basal ungual teeth. The large inner tibiotarsal seta on the hind leg seems to be more strikingly differentiated in the males than in the females. The species appears to be related to *P. petrustrinatii* but can be readily separated on the basis of the chaetotaxy. The specimens from Cueva del Muerto were reported by García Rendón L. (1983) as *Pseudosinella* sp. nr. *hirsuta* (Delamare Deboutteville).

Pseudosinella finca Christiansen
Map 4

Type-locality.—GUATEMALA: *Alta Verapaz*: Cueva Sepacuite no. 2 (Christiansen, 1973).

Distribution.—Known from caves in the Mexican



Figs. 10-17.—*Pseudosinella cava*: 10, habitus of type specimen x 100; 11, dorsal surface of apex of third antennal segment; 12, ventral surface of same portion; 13, hind foot complex of type specimen; 14, hind foot complex of specimen from Cueva de San José; 15, base of hind tibiotarsus of type specimen; 16, dorsal chaetotaxy of left side of second abdominal segment of type specimen (pseudopore shown by arrow); 17, male genital plate of type specimen.

Table VI.—Measurements (mm) of *Pseudosinella cava*, new species.

Locality	Antennal Segments 1	2	3	4	Cephalic Diagonal	Hind Tibiotarsus	Hind Claw Unguis	Unguiculus	Furcula Manub.	Dens
Sótano Hondo de Pinalito	.08	.17	.22	.25	.31	.28	.031	.022	.30	.31
Holotype	.06	.11	.09	.18	.26	.19	.025	.017	.19	.24
Cueva de San José	.05	.14	.14	.24	.28	.25	.026	.016	.24	.28
Cueva de San José	.05	.09			.29	.22	.028	.017	?	?

states of Morelos, Oaxaca, Puebla, Querétaro, and Veracruz; and from Alta Verapaz, Guatemala.

Other records.—MEXICO: *Morelos*: Cueva del Diablo (Christiansen, 1982a). *Oaxaca*: Cueva del Nacimiento del Río San Antonio (Christiansen, 1982a). *Puebla*: Grutas de Ateno (Christiansen, 1982a). *Querétaro*: Sótano del Buque (Christiansen, 1982a). *Veracruz*: Cueva del Diablo (Christiansen, 1982a).

GUATEMALA: *Alta Verapaz*: Lanquin Cave (Christiansen, 1973); Cueva Seamay (Christiansen, 1973).

Pseudosinella huautla Christiansen
Map 4

Type-locality.—*Oaxaca*: Sótano de San Agustín (Christiansen, 1982a).

Distribution.—Known only from the type-locality in the Huautla de Jiménez region, Oaxaca.

Pseudosinella bonita Christiansen
Map 4

Type-locality.—*Oaxaca*: Cueva Bonita del Presidente (Christiansen, 1973).

Distribution.—Known only from two caves near Huautla de Jiménez, Oaxaca.

New record.—*Oaxaca*: Centipede Cave, Río Iglesia Dolina, 5 km SE Huautla de Jiménez, 26 March 1981 (A. Grubbs, S. Zeman).

Pseudosinella reddelli Christiansen
Map 5

Type-locality.—*Tamaulipas*: Bee Cave (Christiansen, 1973).

Distribution.—Widely distributed in caves at higher elevations in the Sierra Madre Oriental from northern Querétaro to near Monterrey, Nuevo León; and from one epigean collection at Huautla de Jiménez, Oaxaca.

Other records.—*Coahuila*: Gruta de Cuevecillas (Christiansen, 1973). *Nuevo León*: Small caves, Chipinque Mesa (Christiansen, 1982a); Pozo del Maguey Verde (Christiansen, 1982a); Resumidero de Pablillo (Christiansen, 1973). *Oaxaca*: Huautla de Jiménez (Christiansen, 1982a). *Querétaro*: Cueva de la Milpa (Christiansen, 1982a). *San Luis Potosí*: Cueva de Cinquenta y Ocho (Christiansen, 1982a); Sótano de la Golondrina (Christiansen, 1973); Sótano del Ojo de Agua (Christiansen, 1973); Cueva de la Puente (Christiansen, 1982a). *Tamaulipas*: Cueva de los Allarines (Christiansen, 1982a); Cueva del Borrego (Christiansen, 1982a); Sótano de Las Calenturas (Christiansen, 1982a); Cueva del Camino (Christiansen, 1982a); Cueva de la Capilla (Christiansen, 1973); Cueva del Encino (Christiansen, 1982a); Cueva del Infiernillo (Christiansen, 1982a); Sótano de Jesús (Christiansen, 1982a); Cueva de la Mina (Christiansen, 1973); Sistema Purificación (Christiansen, 1982a); Pozo del Soyate Torcido (Christiansen, 1982a); Cueva de Tres Manantiales (Christiansen, 1973); Cueva del Viento Baja (Christiansen, 1982a); Cueva X (Christiansen, 1982a).

New records.—*Querétaro*: Sótano del Buque, 20 km N Pinal de Amoles, 2 June 1972 (T. Raines, R. Ralph). *San Luis Potosí*: Cueva de la Laguna, 6.5 km NNW San Francisco, 20 May 1972 (W. R. Elliott, P. Lynn, M. McEachern). *Tamaulipas*: Cueva de las Dos Boquillas, 700 m S Revilla, 22 November 1980 (P. Sprouse); Cueva de Galindo, Purificación area, 7 May 1981 (P. Sprouse); Sótano de Monumento, 26 km WNW Ocampo, 5 September 1979 (W. R. Elliott, D. C. Rudolph); Pozo del Peso, 5 km N Rancho Nuevo, 22 April 1981 (P. Sprouse); Sótano de la Rama, 5 km N Rancho Nuevo, 22 April 1981 (P. Sprouse).

Remarks.—Six distinct morphological forms of this species have been identified. There is no apparent geographic pattern to the variation and all six forms have been collected from the caves of the Purificación area of Tamaulipas, with three of the forms known only from this region. Furthermore, five of the forms have been collected in Sótano de Las Calenturas. The Purificación area includes an altitudinal range of more than 1,500 m, with caves known from all elevations. The Sistema Purificación contains an altitudinal range of almost 1,000 m and has a known length of more than 53 km. The existence of the considerable variation in this species may possibly be explained by multiple invasions of a surface ancestor either at progressively lower or high altitudes as climatic conditions changed, or it may represent different adaptations to different habitats within the cave systems. Extensive collections with detailed microhabitat information might help to clarify this intriguing situation.

Pseudosinella leoni Christiansen
Map 5

Type-locality.—*Nuevo León*: Cueva de Chorros de Agua (Christiansen, 1982a).

Distribution.—Known from two caves in Nuevo León and one cave in Oaxaca.

Other records.—*Nuevo León*: Grutas de García (Christiansen, 1982a). *Oaxaca*: Sótano de las Bellotas (Christiansen, 1982a).

Pseudosinella voylesi Christiansen
Map 5

Type-locality.—*Puebla*: Grutas de Olivares (Christiansen, 1982a).

Distribution.—Known only from caves in the Cuetzalan region, Puebla.

Other records.—*Puebla*: Grutas de Jonotla (Christiansen, 1982a); Sima Octimaxal Sur n. 1 (Christiansen, 1982a).

New records.—*Puebla*: Sumidero Atichayan (Sur),

Map 2.—Distribution of species groups 5 and 6 of *Pseudosinella* in Mexican caves: 1, *P. crypta*; 2, *P.* sp. *QQ*; 3, *P. palaciosi*; 4, *P. yuca*.

Cuetzalan, 20 January 1981 (Joseph Lieberz); Sumidero de Chichihuayaloll (Resistol), Cuetzalan, 25 January 1980 (Steve Robertson); Sima de la Cruz Verde, 1 km W Cuetzalan, January 1980 (A. Grubbs).

Pseudosinella vera Christiansen
Map 6

Type-locality.—*San Luis Potosí*: Cueva de la Laja (Christiansen, 1982a).

Distribution.—Known from caves in the Cuetzalan region, Puebla; the Xilitla region, San Luis Potosí; the Purificación region, Tamaulipas; and the Orizaba and Atoyac regions, Veracruz.

Other records.—*Puebla*: Grutas de Atepolihuit (Christiansen, 1982a); Sumidero de Atepolihuit de San Andrés (Christiansen, 1982a); Sumidero de Atepolihuit de San Miguel (Christiansen, 1982a); Cueva de los Camarones (Christiansen, 1982a); Cueva de Octimaxal Sur (Christiansen, 1982a); Grutas de Olivares (Christiansen, 1982a); Cueva de Tasalolpan (Christiansen, 1982a); Cueva de Xocoyolo (Christiansen, 1982a); Sima Zoquiapan (Christiansen, 1982a). *San Luis Potosí*: Cueva del Agua de La Silleta (Christiansen, 1982a); Cueva de la Barranca (Bonet, 1953); Sótano de Guadalupe (Christiansen, 1982a); Cueva de la Hoya (Bonet, 1953); Cueva de El Jobo (Bonet,

Map 3.—Distribution of species group 1 of *Pseudosinella* in Mexican caves: Unnumbered circles, *P. petrustrinatii*; 1, *P. cava*; 2, *P. volca*.

1953); Cueva de Potrerillos (Christiansen, 1982a); Cueva de la Selva (Christiansen, 1982a); Cueva de los Viet Cong (Christiansen, 1982a). *Tamaulipas*: Pozo del Soyate Torcido (Christiansen, 1982a). *Veracruz*: Cueva de la Charca I (Christiansen, 1982a); Sótano de la Palma (Christiansen, 1982a); Cueva de Sala de Agua Grande (Christiansen, 1982a); Cueva del Volcancillo (Christiansen, 1982a).

New records.–*Puebla*: Sótano de Agua, Mpo. de Chichiquila (C. Lazcano); Sumidero Atichayan (Sur), Cuetzalan, 20 January 1981 (Joseph Lieberz); Cueva Murciélago de Xocoyolo, 5.5 km SW Cuetzalan, 27 December 1973 (J. Reddell). *San Luis Potosí*: Cueva de Oxtalja, Tamapatz, 30 August 1980 (P. Sprouse, T. Treacy, S. Balsdon); Sótano de La Silleta, La Silleta, 30 March 1980 (P. Sprouse). *Veracruz*: Cueva del Ojo de Agua de Tlilapan, Tlilapan, 4 March 1973 (J. Reddell, D. and M. McKenzie, S. Murphy, M. Butterwick).

Remarks.–This is almost certainly the species reported by Bonet (1953) as *Pseudosinella* n.sp. from caves in the Xilitla region and listed above. This species has also been reported from leaf litter near Aquismón, San Luis Potosí (Christiansen, 1982a); it has recently been collected from the surface at 3 km N of Xochitlan, Puebla, and at Teocelo, Vera-

Map 4.–Distribution of species group 2 of *Pseudosinella* in Mexican caves: Unnumbered circles, *P. finca*; 1, *P.* sp. *BB*; 2, *P. bonita* and *P. huautla.*

cruz. This species is somewhat variable, especially with respect to eye number and claw type. The significance of the eye variation is mentioned above and appears to represent a rare case of double character displacement.

Pseudosinella yuca Christiansen
Map 2

Type-locality.—*Yucatán*: Actún Xpukil (Christiansen, 1982a).

Distribution.—Known only from the type-locality.

Pseudosinella palaciosi, new species
Figs. 18-26; Map 2; Table VII

Type-data.—Gruta de Acuitlapán, Guerrero, México, 12 December 1981 (J. Palacios-Vargas).

Description.—Body white except for eyepatches. Fourth antennal segment ovoid with a clear retractile apical bulb. Subapical sense peg rod-like and not in a pit. Apical organs of 3rd antennal segment simple and peg-like. Eyes 2+2, one in back of and separate from the other. Cephalic and abdominal chaetotaxy as shown in Table 2. Collar of 2-3 rows of truncate ciliate macrochaetae, between 0.02 and 0.033 mm in length. Laterally some of the macrochaetae are acu-

Map 5.—Distribution of species group 3 of *Pseudosinella* in Mexico: Unnumbered circles, *P. reddelli* cave records; 1, *P. leoni*; 2, *P. voylesi*; 3, *P. reddelli* epigean record.

minate and somewhat longer. Body clothed with thin circular to elliptical scales. Ventral tube with 5 disto-lateral setae per side, sparsely to uniformly serrate. Inner differentiated seta of hind tibiotarsus clearly truncate, about as long as the other acuminate ciliate setae and about 1/4 of way from base to apex of organ. Tibiotarsi lacking differentiated "smooth" inner setae. Trochanteral organ with 5 setae in dorsal arm and 4 in ventral. Unguiculus without teeth or serrations. Unguis with three small inner teeth, the distalmost longer than the others, and two small lateral teeth. Tenent hair acuminate or slightly truncate. Dens without spines but with a long smooth straight 'basal' seta. Apical and subapical mucronal teeth subequal with the basal spine just touching tip of subapical tooth. Uncrenulate (smooth) dens about twice as long as mucro. Manubrial plaque setae 1+2. Maximum length 0.8 mm. Typical Gisin formula R001/00/0100+2-$q_1 q_2 M_1 rEL_1 L_2$.

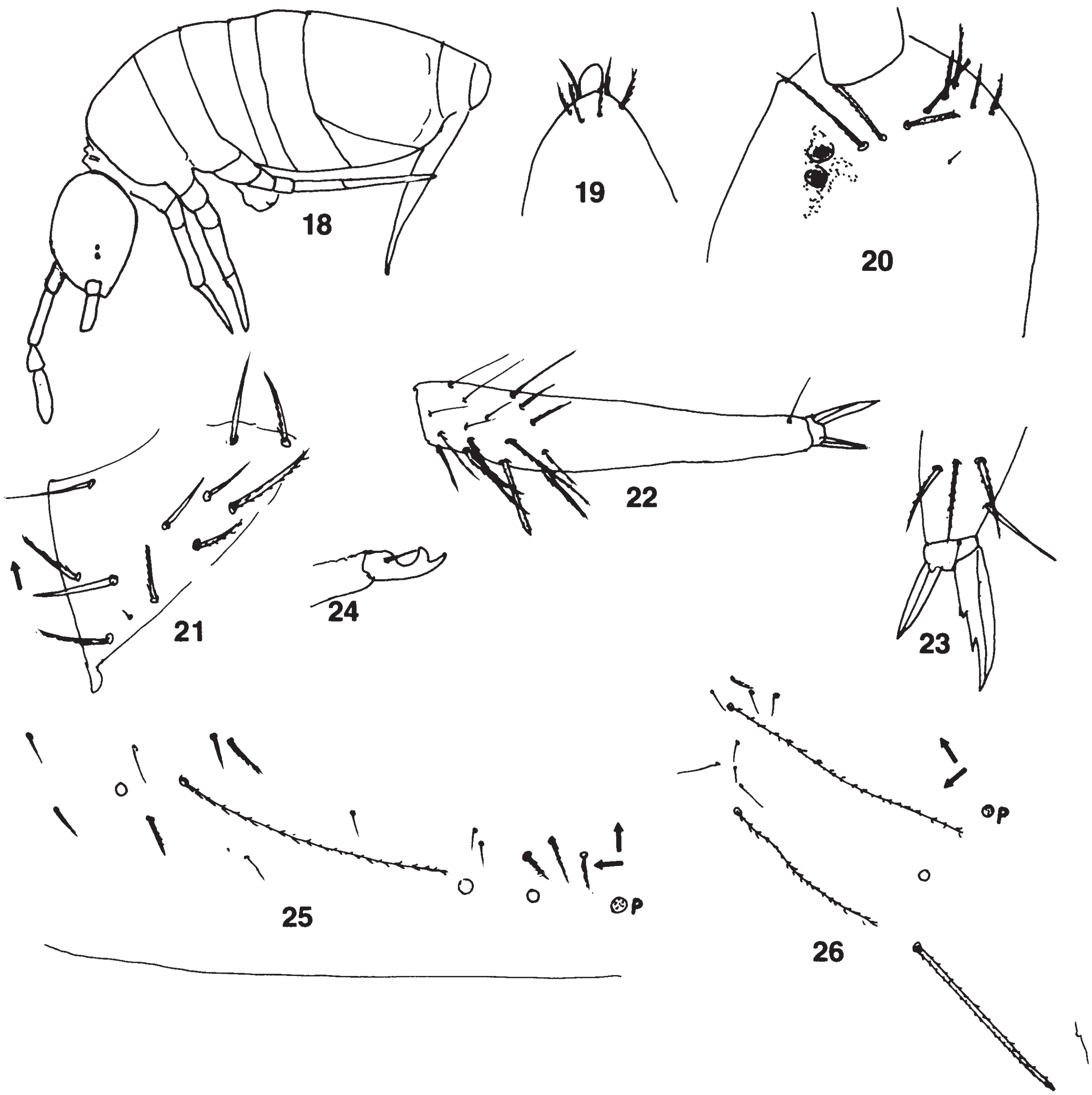
Distribution.—Known only from the type-locality in northern Guerrero.

Remarks.—This species is quite similar to *P. yuca* but differs strikingly in the labial and 4th abdominal chaetotaxy. It is probably a type 3 cavernicole.

Map 6.—Distribution of *Pseudosinella vera* in Mexican caves.

Table VII.—Measurements (mm) of *Pseudosinella palaciosi*, new species.

Locality	Antennal Segments				Cephalic	Hind	Hind Claw		Furcula	
	1	2	3	4	Diagonal	Tibiotarsus	Unguis	Unguiculus	Manub.	Dens
Holotype	.033	.060	.044	.075	.180	.109	.018	.011	.152	.125
Paratype	.027	.052			.190	.103	.018	.013	.169	.131
Paratype	.022	.033	.028	.071	.158	.086	.012	.009	.109	.098



Figs. 18-26.—*Pseudosinella palaciosi* (type specimens): 18, habitus x 200; 19, apex of antenna; 20, left side of head showing eyes; 21, left side of labial triangle; 22, hind tibiotarsus and foot, showing differentiated inner seta; 23, hind foot complex; 24, mucro; 25, chaetotaxy of second abdominal segment, left side; 26, median chaetotaxy of right side of fourth abdominal segment.

Undescribed Species

Pseudosinella sp. *1*

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a). *Morelos*: Cueva de la Poza de Moctezuma (Palacios-Vargas, 1981b).

Pseudosinella sp. *2*

Record.—*Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982).

Pseudosinella sp. *3*

Record.—*Morelos*: Cueva del Diablo (=Ocotitlán) (Hoffmann, Palacios-Vargas, and Morales, 1980).

Remarks.—This species was collected from bat guano.

Pseudosinella sp. *BB*

Record.—*Nuevo León*: Cueva de la Boca (Christiansen, 1982a).

Pseudosinella sp. *QQ*

Record.—*Morelos*: Cueva del Salitre (Palacios-Vargas, 1981b).

Lepidocyrtus

This epigeic genus is represented by a scattering of species almost certainly trogloxene in nature. The taxonomy of the genus in Latin America is so poorly understood that the only certain records are of the one U.S. species which has been found and *L. pearsei* described from Yucatán caves by Mills. Palacios-Vargas (1983a) reports *Lepidocyrtus* spp. from Guerrero, Querétaro, and San Luis Potosí.

Four species have been found:

Lepidocyrtus finus Christiansen and Bellinger

New record.—*Tamaulipas*: Sistema Purificación (Cueva del Brinco Section), 4 September 1978 (W. Elliott).

Remarks.—This species was collected from the entrance sink.

Lepidocyrtus pearsei Mills

Type-locality.—*Yucatán*: Cenote de Sambulá (Motul) (Mills, 1938).

Records.—*Yucatán*: Actún Góngora (Mills, 1938); Cueva Muruztún (Mills, 1938); Cueva Segunda del Camino a San Roque (Mills, 1938).

Remarks.—This species was collected from bat guano in Cenote de Sambulá (Motul) and Actún Góngora.

Lepidocyrtus sp.

Records.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982). *Querétaro*: Cueva del Madroño (Bonet, 1953); Cueva del Muerto (García Rendón L., 1983). *San Luis Potosí*: Cueva de los Cuchos (Bonet, 1953); Cueva del Jobo (Bonet, 1953); Cueva del Salitre (Bonet, 1953).

Remarks.—This species was collected from bat guano in Cueva del Salitre.

Lepidocyrtus sp. *A*

New records.—*Oaxaca*: Sótano Sin Hondo, 5 km S Acatlán, 28 December 1976 (R. Hemperly). *Puebla*: Sumidero de Atepolihuit de San Andrés, San Andrés, N of Cuetzalan, 28 December 1979 (H. Galindo, A. Manuel).

Remarks.—This species is allied to tropical forms.

Lepidocyrtus sp. *B*

New record.—*Morelos*: 6 Río Cacoyaquiu, 10 March 1973.

Lepidocyrtus sp. *C*

New record.—*Puebla*: Sumidero de Atepolihuit de San Andrés, San Andrés, N of Cuetzalan, 28 December 1979 (H. Galindo, A. Manuel).

Seira

This epigean genus has been found five times by us in Mexican caves; the populations are almost certainly trogloxenic. Two species have been identified:

Seira bipunctata (Packard)

New record.—*Veracruz*: Cueva del Río Atoyac, 3 km E Atoyac, 6 January 1977 (J. Reddell, D. McKenzie).

Seira mexicana Folsom

Record.—*Guerrero*: Grutas de la Estrella (Reddell, 1971).

New records.—*Guerrero*: Grutas del Río San Jerónimo, 16 km NNE Taxco, 1200 m, 19 March 1981 (S. Robertson). *Tamaulipas*: Spring 0.8 km N Conrado Castillo, 4 September 1978 (W. Elliott).

Remarks.—This species was reported by Reddell (1971) as *Lepidocyrtinus* sp.

Seira spp.

Records.—*México*: without locality (Palacios-Vargas, 1983a). *Morelos*: Cueva del Diablo (Palacios-Vargas, 1980). *Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982).

Remarks.—Palacios-Vargas (pers. comm.) reports that *Seira* is common in cave entryways.

Sinella

Sinella caeca Schött

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Remarks.—This is probably a trogloxene.

Metasinella

The single species of this largely Caribbean genus was found in Yucatán, and has not been recorded since its original description. It is clearly a highly troglomorphic form.

Metasinella falcifera (Mills)

Type-locality.—*Yucatán*: Actún Sazich (Mills, 1938).

Distribution.—Known only from the type-locality.

Remarks.—This species was reported from the "bottom of cave, 15 m. deep" (Mills, 1938). Mari Mutt and Gruia (1983) redescribed the species based on a syntype.

Orchesella

One species has been found in Mexican caves. It is probably a Type 1 cave form.

Orchesella sp. nr. *quinaria* Mari Mutt

New record.—*Tamaulipas*: Sótano de Las Calenturas, 0.7 km S Yerbabuena, 20 November 1979 (J. Reddell, D. McKenzie).

Neorchesella

Two species of this genus are known from caves.

Neorchesella boneti Mari Mutt

Type-locality.—*Tamaulipas*: Sistema Purificación (Mari Mutt, 1981).

Distribution.—Known only from the type-locality.

Neorchesella mexicana Mari Mutt

Record.—*Tamaulipas*: Sótano de Las Calenturas (Mari Mutt, 1981).

Dicranorchesella

Dicranorchesella fina Mari Mutt

Type-locality.—*Tamaulipas*: Cueva X (Mari Mutt, 1981).

Distribution.—Known only from the type-locality.

Subfamily Oncopodurinae

The members of this subfamily are much rarer in caves than the previous one but are very widely distributed. All belong to the genus *Oncopodura*.

Oncopodura

The genus is well represented in Mexican caves. Most of the species found represent a cluster of forms closely related to *O. prietoi*. We have not seen specimens of *O. atoyacensis* but this would seem to be a very different element of uncertain relationships. The genus has been well studied (see Bonet, 1945; Szeptycki, 1977; Christiansen and Bellinger, 1980-1981). The extreme fragility of many of the setae, spines, and scales used for identification makes the study of the genus difficult.

The described Mexican species of the genus are known only from caves and (except for *O. atoyacensis*) are so similar that we originally considered most of them part of one extremely variable taxon. Closer analysis shows four clear, and localized, species to occur. One of these (species *C*) is represented by only a single specimen and will not be described here. Each species, with the exception of *O. prietoi* appears to be very localized (see Table VII). Palacios-Vargas (pers. comm.) has discovered a species of the genus in leaf litter in Michoacán.

With the exception of *O. atoyacensis*, known only from a single cave in Veracruz, all the cavernicole populations of *Oncopodura* occur in the Sierra Madre Oriental and appear to be so closely related as to possibly have derived from a single common ancestor. *Oncopodura* sp. *C* is known only from a single cave near Potrero Redondo, Nuevo León. Three species occur in the Purificación area of Tamaulipas and Nuevo León, with two being present in the Sistema Purificación. One species, *O. prietoi*, is represented by four populations almost certainly representing three separate cave invasions. One population occupies Grutas del Palmito in the Sierra de Gomas, an isolated mountain range in northern Nuevo León; a second population occurs in the Sierra de la Silla, an isolated segment of the Sierra Madre Oriental south of Monterrey; the third occurrence is in two nearby caves on the western edge of the Purificación area and

Table VIII. Characteristics of Mexican *Oncopodura*. Characters: 1, Number of inner serrate dental spines; 2, P.A.O. lobes; 3, Unguis lateral lamina; 4, No. blunt setae on 2nd antennal segment; 5, No. differentiated thick setae on 3rd antennal segment; 6, Scale on mucro; 7, Total length median mesochaeta 5th abd. segment/length of segment; 8, Mucronal teeth.

	CHARACTERS								
Species	1	2	3	4	5	6	7	8	**Localities**
atoyacensis	0	6	–	?	2	–	?	4	Veracruz
dura	3	–	+	23-37	16-19	+	1--1.1	4	Tamaulipas
prietoi	3	–	+	6-8	3-5	+	0.5-0.6	4	Nuevo León
susanae	2	–	+	16-32	6-7	+	0.6--0.8	4-5	Tamaulipas
sp. *C*	3	1	+	9	5	+	0.5	4	Nuevo León

at an elevation of about 2,000 m. It appears that this species is the most northern known Mexican element in the genus, with the southern populations now limited to high elevations.

Oncopodura susanae is known from Bee Cave at 248.5 m in the Sierra de Guatemala, and from five caves at mid-elevations in the Purificación area. This distribution parallels that of *Mexicambala inops* Causey, a cambalid milliped, known both from the Sierra de Guatemala and the Purificación area.

Oncopodura dura is known only from the Cueva del Infiernillo section of the Sistema Purificación. This area of the cave is at an elevation of 1,100 m. Although both *O. susanae* and *O. dura* occupy the Sistema Purificación, *O. susanae* has been found only in the upper parts of the system, whereas *O. dura* is known from the lowest part of the system, about 700 m lower in elevation.

The scarcity of specimens and records of *Oncopodura* makes any analysis of their distribution premature, but it would appear that the caves of the Purificación area have been invaded three times, with one invasion occurring at high elevations along the eastern edge of the area, one occurring at mid-elevations, and a third at the lower parts of the system. The high-elevation element has a northern range, the mid-elevation element a southern range, and the lower element is presently endemic to the Purificación area. The ability of two species of troglomorphic *Oncopodura* to coexist in the Sistema Purificación is not surprising since this is the largest cave system in Mexico, with more than 50 km of surveyed passage and an altitudinal range of almost 1,000 m. The carabid beetle genus *Mexaphaenops* exhibits a similar distributional pattern in the Purificación area, with four species described from the region, two of which are sympatric in the Sistema Purificación. *M. mackenziei* includes three subspecies, one from the western edge of the area, one from the Sistema Purificación, and a third from the highest part of the area. The complex nature of the fauna of the Purificación area is both a reflection of the variety of habitats available in the caves of the area and of what must be a complex past climatic history.

Oncopodura susanae, new species
Figs. 27-33; Map 7; Table X

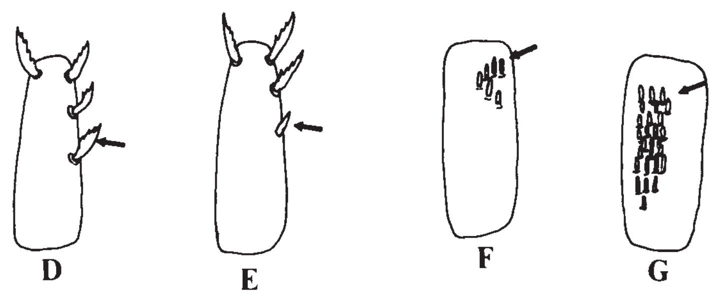
Type-data.—Bee Cave, 8.5 km NE Adolfo López Mateos (=Chamal Nuevo), Tamaulipas, México, 26 May 1968 (J. Reddell).

Description.—Color white. Eyes and P.A.O. absent. Fourth antennal segment without apical bulb and with 4 blunt setae arranged in one line and one blunt seta near base of segment. Third antennal segment without striated apical peg but with 6-7 short blunt setae along distal half of segment. Second antennal segment with 16-30 short blunt setae and 6-7 short broad acuminate setae. Midtibiotarsus with a strongly developed spoon-shaped seta slightly more than half way from base to apex of segment. Unguis untoothed but with a strong thin pointed basal lamina, reaching well beyond the mid-point. Unguiculus acuminate and usually internally excavate. Ventral tube with 4+4 disto-lateral smooth setae. Manubrium dorsally with 3+3 minute smooth setae, 5+5 smooth mesochaetae, 2+2 ciliated macrochaetae, 9+9 ciliated mesochaetae and 2+2 disto-lateral spines. Dens with outer margin having a distal curved serrate spine and a straight smooth spine near apex of basal subsection. Inner surface with 2 curved serrate spines on distal subsection and a much smaller straight spine near apex of basal subsection. Three smaller spines on the middle of the basal subsection, with the basalmost of these larger than the other two. Dens also with 5 large ciliate macrochaetae, 1 smooth mesochaeta, and 2 smooth microchaetae. Mucro with a large attached scale and with apical curved tooth, two stout erect teeth posterior to this and 1-2 slender teeth near the

Table IX.—Key to Mexican species of *Oncopodura.*

1.	With P.A.O. (see Fig. A)	2
	Without P.A.O. (see Fig. A)	3
2.	Unguis with lateral-basal claw-like lamella (see Fig. B)	*O.* sp. *C*
	Without such (see Fig. C)	*O. atoyacensis*

3.	With 3 serrate inner dental spines (see Fig. D)	4
	With 2 serrate inner dental spines (see Fig. E)	*O. susanae*
4.	II antennal segment with 4-6 blunt or short differentiated seta (see Fig. F)	*O. prietoi*
	II antennal segment with more than 16 or more differentiated setae (see Fig. G)	*O. dura*



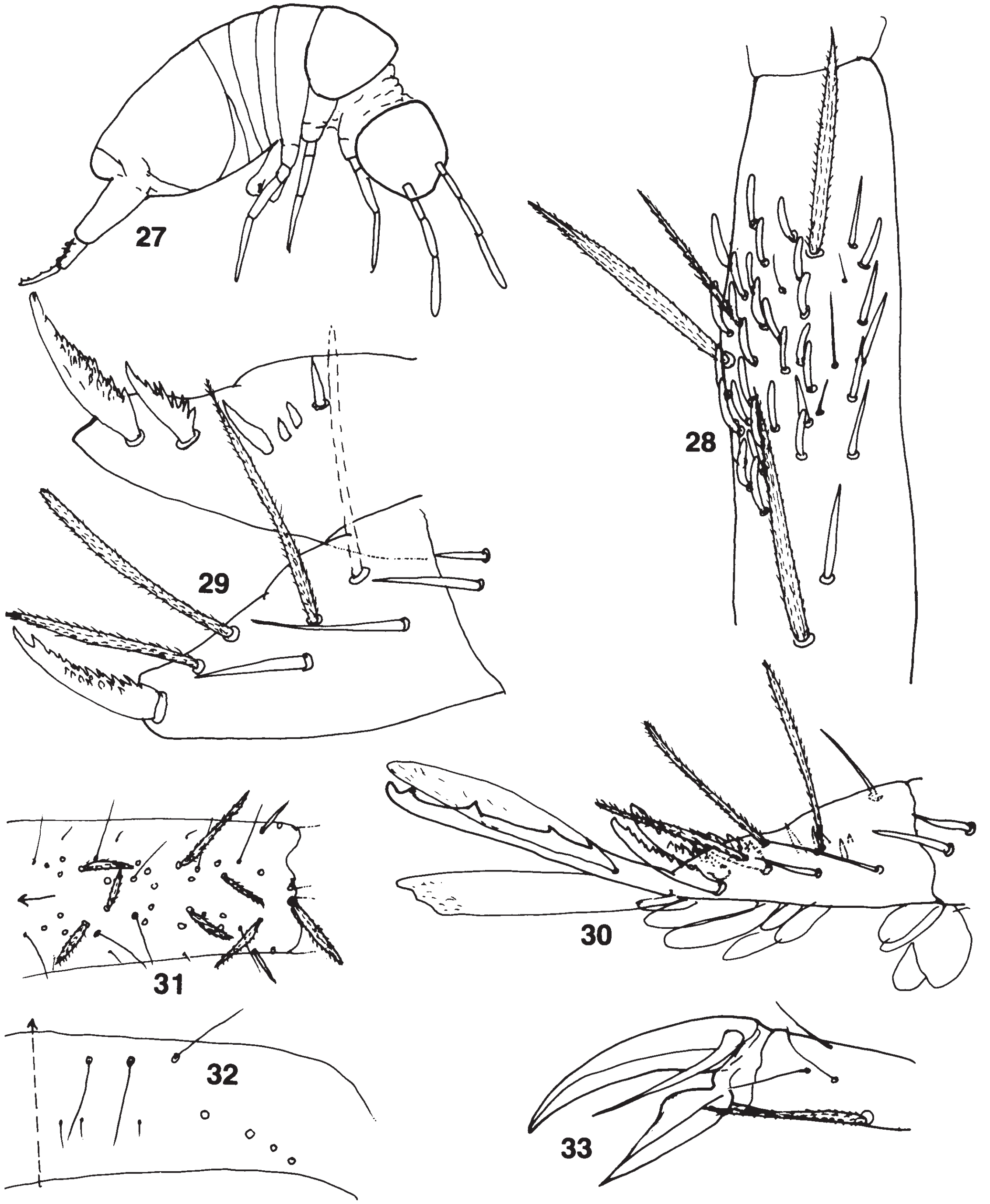
base and pointing towards apex. Dorsum of 5th abdominal segment with 3+3 anterior smooth mesochaetae and 3+3 posterior microchaetae. Segment also with 4+4 lateral ciliate macrochaetae. Male genital plate with about 40 smooth microchaetae arranged in 3-4 concentric rings. Maximum length 2.5 mm.

Distribution.—Known from one low-elevation cave in the Sierra de Guatemala and several caves in the Purificación area, Tamaulipas.

Other records.—*Tamaulipas*: Cueva del Arado, Yerbabuena, 21 November 1979 (J. Reddell, D. McKenzie); Sótano de Las Calenturas (Cueva del Blazer Section), 0.7 km S Yerbabuena, 1,460 m, 22 November 1979 (J. Reddell, P. Sprouse); Cueva de las Papitas, 0.8 km SE Revilla, 17 April 1980 (P. Sprouse et al.); Sistema Purificación (Cueva del Brinco Section), 28 April 1981 (P. Sprouse); Sistema Purificación (Sumidero de Oyamel Section), 20 April 1980 (L. Wilk, D. Pate); Cueva X, Conrado Castillo, 1,950 m, 28 March 1978 (A. Grubbs et al.); 21 April 1981 (P. Sprouse).

Remarks.—The amount of variability in this species is in doubt. Specimens with 4 and 5 mucronal teeth occur. There also appears to be some variability in dental spination; however, the extreme fragility of these organs combined with the great difficulty of their analysis made the variation questionable. It may be a question of condition of specimens. In any case, the apparent variation includes the size and shape of the heavy basal spine of the inner dental row. This may be large, straight and clearly socketed or short, heavy and fused with the dens. The small basal inner spines apparently vary from 2 to 3 with the basalmost generally, but not always, longest. There is considerable variation in the length, and the smooth mesochaetae on the 5th abdominal segment: the extreme in this condition occurs in the population from Bee Cave which also has 5 mucronal teeth. The unguiculus is not excavate on small specimens.

This species was previously cited by Reddell and Elliott (1973b) and Reddell (1981) as *Oncopodura prietoi.*



Figs. 27-33.—*Oncopodura susanae*: 27, habitus of paratype x 100; 28 ventral surface of third antennal segment of specimen from Cueva del Infiernillo, Tamaulipas; 29, inner (above) and outer (below) surfaces of dens, specimen from type-locality; 30, mucro dens, same locality; 31, dorsal chaetotaxy of manubrium of specimen from Cueva del Infiernillo; 32, dorsal chaetotaxy of fifth abdominal segment of specimen from Conrado Castillo, Tamaulipas; 33, hind foot complex of specimen from type-locality.

Table X.—*Oncopodura susanae*, n.sp.

Locality	Antennal Segments 1	2	3	4	Furcula Manub.	Dens	Mucro	Hind Unguis	Ungual Filament	Unguic-ulus	Cephalic Diagonal	Over-all
Sót. de las Calenturas	.09	.23	.34	.46	.48	.28	.28	.086	.067	.069	.65	2.2
Sumidero de Oyamel	.08	.25	.28	.39	.45	.27	.28	.089	.058	.072	.61	2.4
Sumidero de Oyamel	.10	.26	.31	.40	.53	.28	.28	.094	.067	.078	.72	2.5
Cueva X	.04	.09	.13	.20	.26	.13	.13	.033	.022	.022	.32	1.5
Cueva del Infiernillo	.10	.25	.28	.38	.48	.26	.26	.072	.055	.061	.67	2.1
Bee Cave	.04	.07	.11	.17	.19	.12	.14	.024	.017	.019	.31	1.0
Bee Cave	.04	.08	.12	.20	.22	.14	.14	.023	.019	.020	.35	1.2
Cueva del Arado	.06	.15	.19	.26	.28	.17	.18	.047	.038	.036	.44	1.4
Bee Cave	.09	.17	.28	.38	.39	.23	.24	.061	.045	.045	.51	1.8
Bee Cave	.09	.22	.26	.36	.39	.23	.26	.067	.050	.044	.50	1.8
Bee Cave	.09	.17	.22	.36	.39	.23	.25	.072	.048	.050	.55	1.9
Bee Cave	.09	.20	.22	.38	.35	.23	.24	.075	.050	.048	.55	1.8
Bee Cave	.08	.21	.25	.39	.40	.22	.24	.061	.047	.036	.53	1.9
Bee Cave	.10	.20	.25	.36	.36	.20	.22	.060	.040	.049	.52	1.7
	.04	.06	.08	.12	.21	.11	.11	.026	.015	.017	.29	0.9
Bee Cave	.05	.11	.17	.25	.25	.13	.14	.039	.028	.029	.32	0.9
Bee Cave	.07	.15	.18	.29	.29	.16	.18	.048	.036	.037	.43	1.5
Bee Cave	.06	.12	.14	.19	.25	.13	.16	.028	.019	.022	.36	1.2

Oncopodura prietoi Bonet
Map 7

Type-locality.—*Nuevo León*: Grutas del Palmito (Bonet, 1943).

Distribution.—Known from caves in the Sierra de Gomas, the Sierra de la Silla, and the western Purificación area, Nuevo León.

New records.—*Nuevo León*: Cueva de la Boca, 3 km E Villa Santiago, 540 m, 20-22 June 1969 (S. and J. Peck): Sótano de Cañada Verde, 3 km E Cañada Verde, 1 April 1981 (P. Sprouse); Sótano de las Peñuelas, 3 km SW Dulces Nombres, 2,010 m, 10 April 1974 (D. McKenzie, M. Wharton).

Remarks.—This species has been recorded from caves in Nuevo León and (mistakenly) New Mexico. The specimens we have are small and mostly in poor condition.

Oncopodura dura, new species
Figs. 34-38; Map 7; Table XI

Type-data.—Sistema Purificación (Cueva de Infiernillo Section), 41 km NW Ciudad Victoria, 1,100 m, Tamaulipas, México, 9 April 1979 (P. Sprouse).

Description.—Color white, without eyes or P.A.O. Fourth antennal segment without apical bulb but with four blunt setae in a line and one heavy short pointed seta near base of segment. Third antennal segment with apical organ in the form of a pair of broad granulate or wrinkled swollen pegs in deep pits. Outer 3/4 of segment with numerous short broad setae, 15 blunt and 7 pointed ones. Second antennal segment with 23-31 blunt setae. Midtibiotarsus with a strongly developed spoon-shaped seta. Unguis slender and untoothed with a thin pointed basal lamina reaching well beyond the mid-point. Unguiculus acuminate and internally excavate. Ventral tube with 4+4 distolateral smooth setae. Manubrium dorsally with 3+3 smooth microchaetae, 5+5 smooth mesochaetae, 11+11 ciliated meso-macrochaetae and 2+2 lateral distal smooth spines. Dentes with 3 serrate curved inner spines, 2 on distal subsegment and one on basal part. Outer surface with one large distal serrate curved spine and one short slender straight smooth spine on basal subsegment. Inner surface with 2 small spine-like setae on basal subsegment. Dens with 6 ciliate macrochaetae, 1 smooth mesochaeta and 2 smooth microchaetae. Mucro with 4 teeth, basalmost one pointing forward, and a large attached scale. Fifth abdominal segment with 3+3 anterior smooth mesochaetae, 3+3 smooth posterior microchaetae and 4+4 lateral ciliate macrochaetae.

Distribution.—Known only from the type-locality.

Remarks.—This species can readily be separated from *O. susanae* by the presence of a 3rd serrate inner dental spine as well as various features of chaetotaxy. The antennae sharply separate it from *O. prietoi*. A similar species has been found in Ft. Stanton Cave, New Mexico. This was earlier identified as *O. prietoi* (Christiansen and Bellinger, 1980-1981).

Oncopodura atoyacensis Bonet
Map 7

Type-locality.—*Veracruz*: Grutas de Atoyac (Bonet, 1943).

Distribution.—Known only from the type-locality.

Table XI.—*Oncopodura dura* n.sp. and *Oncopodura* sp. *C*.

Locality	Antennal Segments 1	2	3	4	Furcula Manub.	Dens	Mucro	Hind Unguis	Ungual Filament	Unguiculus	Cephalic Diagonal	Overall
Oncopodura dura												
Cueva del Infiernillo	.07	.16	.20	.35	.29	.16	.19	.056	.034	.042	.44	1.8
Cueva del Infiernillo	.06	.14	.18	.28	.25	.15	.16	.044	.033	.039	.39	1.6
Oncopodura sp. *C*												
Cueva Sin Nombre	.04	.08	.09	.13	.24	.11	.12	.024	.107	.022	.34	1.4

Map 7.—Distribution of *Oncopodura* species in Mexican caves: 1, *O. prietoi*; 2, *O.* sp. *C*; 3, *O. dura* and *O. susanae*; 4, *O. susanae*; 5, *O. atoyacensis*.

Oncopodura sp. *C*
Map 7

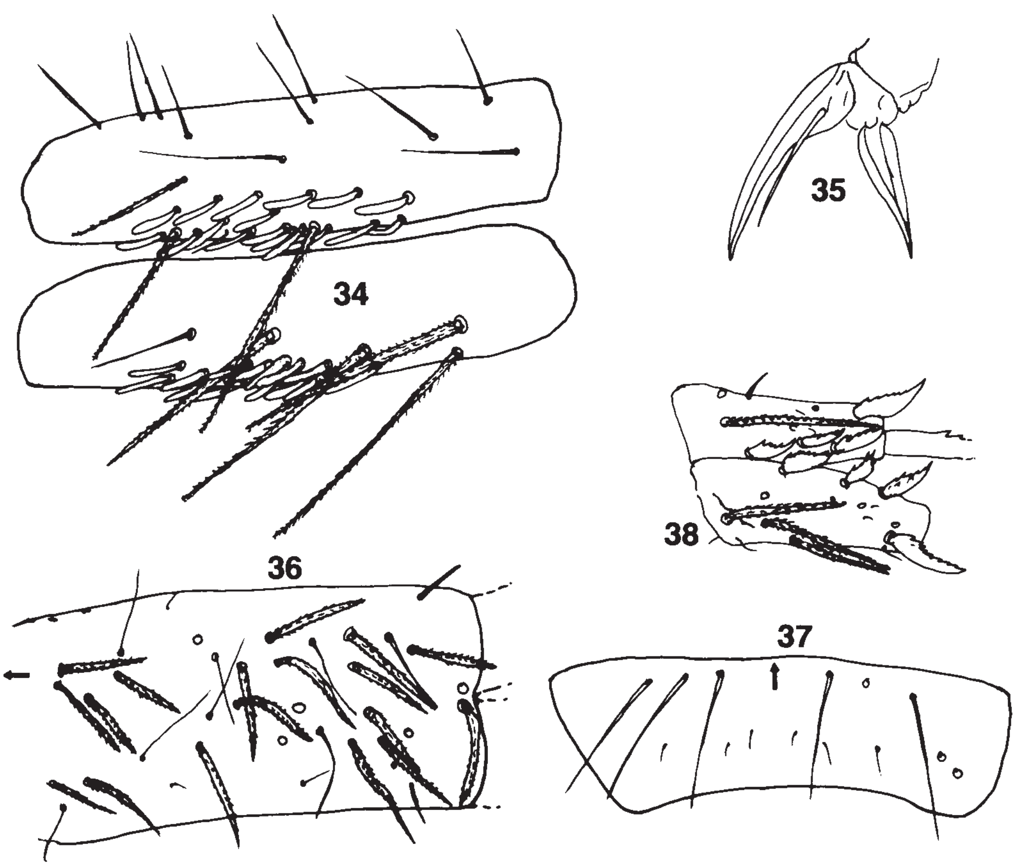
New record.—*Nuevo León*: Cueva Sin Nombre, Potrero Redondo, 24 May 1980 (W. R. Elliott).

Subfamily Paronellinae

We have seen a large number of Mesoamerican cave collembola belonging to the Paronellinae. While most of these come from the Antilles or Guatemala-Belize, a number occur in the caves of Mexico. We have made several futile attempts to have experts deal with these. In 1974 S. K. Mitra agreed to work with them but abandoned the project in 1978. In 1979 Dr. Massoud agreed to work with the material; however, after he received some 50 samples from the senior author in that year and later additional material from the junior author, it has been impossible to elicit any response concerning their nature or disposition. The collection includes eyed and eyeless species, and forms showing all levels of intermediacy in this feature. The eyed specimens have been variously ascribed to *Paronella, Dicranocentruga* or *Troglopedetina.* The eyeless forms have been ascribed to *Trogalophysa, Cyphoderopsis* and most recently *Troglopedetes* (Massoud and Gruia, 1974). At the present time Palacios-Vargas and the senior author are working on the remaining materials and detailed information must await analysis. Below we list the areas from which specimens of this group have been taken.

Paronella or *Troglopedetes*

New records.—*Chiapas*: Sótano de Cancuc, 11 km NE Tenejapa, 12 March 1977 (C. Soileau); Grutas de Rancho Nuevo, 10 km SE San Cristóbal de las Casas, 2,275 m, 13 August 1969 (S. Peck); Salida de Cruz Pilal, 14 km NNE Tenejapa, 13 March 1977 (C. Soileau). *Guerrero*: Resumidero del Izote, Acuitlapán, 10 March 1981 (S. Robertson, J. Ramírez). *Oaxaca*:



Figs. 34-38.—*Oncopodura dura* (type-specimens): 34, dorsal (above) and ventral (below) surfaces of second antennal segment; 35, hind foot complex; 36, dorsal surface of manubrium, specimen greatly distorted; 37, dorsal chaetotaxy of fifth abdominal segment; 38, dentes seen from above.

Cueva de Apoala, Santiago Apoala, 2,000 m, 2 January 1973 (J. Reddell, D. McKenzie, S. Murphy); Cueva del Guano, 8 km N Valle Nacional, 28 December 1972 (J. Reddell, D. and M. McKenzie, S. Murphy); Cueva del Guayabo, 12 km N Valle Nacional, 29 December 1972 (J. Reddell, D. McKenzie, S. Murphy); Cueva de Juan Sánchez, 10 km NW Acatlán, December 1976 (P. Sprouse); 26 December 1976 (J. Reddell, A. Grubbs, C. Soileau); Cueva del Lencho Virgen, 10 km SSW Acatlán, 2-3 January 1974 (J. Reddell, R. Jameson, D. McKenzie, W. Elliott); Cueva de Las Maravillas, 6 km SSW Acatlán, 29 December 1976 (J. Reddell, A. Grubbs, C. Soileau, D. McKenzie); Grutas de Monteflor, 6 km N Valle Nacional, 28 December 1972 (J. Reddell, D. McKenzie, S. Murphy); Cueva del Nacimiento del Río San Antonio, 10 km SSW Acatlán, 26 December 1972 (J. Reddell, D. and M. McKenzie, S. Murphy). *Puebla*: Sumidero de Atepolihuit de San Miguel, Cuetzalan, 24 December 1979 (L. Wilk). *San Luis Potosí*: Ventana Jabalí, 20 km NE Ciudad Valles, 12 July 1969 (S. and J. Peck); Cueva de la Puente, 17 km SSE San Francisco, 15 May 1972 (W. Elliott, R. Ralph, P. Lynn, M. McEachern). *Tamaulipas*: Cueva de la Paloma, 1 km NNE Gómez Farías, 18 May 1971 (W. Russell). *Veracruz*: Grutas de Atoyac, 2 km E Atoyac; Cueva de Corral de Piedra, 3 km SSE Corral de Piedra, 5 January 1979 (J. Reddell, A. Grubbs, C. Soileau, D. McKenzie); Sótano de las Golondrinas, 11 km N Potrero, 8 January 1977 (A. Grubbs); Cueva del Ojo de Agua Grande, 5 km N Potrero Viejo, 4 March 1973 (J. Reddell, D. McKenzie, R. Jameson, W. Elliott); Cueva de Sala Seca, 5 km N Cuitlahuac, 4 January 1977 (J. Reddell, A. Grubbs, C. Soileau, D. McKenzie); Cueva de Ungurria, 20 km WSW Tezonapa, 25 December 1972 (J. Reddell, D. and M. McKenzie, S. Murphy).

Remarks.—Epigean collections are also available from Ejido de El Sótano, Hidalgo; Huautla de Jiménez, Oaxaca; and Agua Fría, San Luis Potosí.

Paronella sp.

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Troglopedetes maya (Mills)

Type-locality.—*Yucatán*: Grutas de Balankanche (Mills, 1938).

Distribution.—Known only from two caves in Yucatán.

Other record.—*Yucatán*: Actún Xkyc (Mills, 1938).

Remarks.—Mills (1938) reported this species "under stones near the mouth" of Grutas de Balankanche, and "at bottom of [Actún Xkyc], 15 m. deep."

Troglopedetes oztotlicus Ojeda and Palacios-Vargas

Type-locality.—*Guerrero*: Grutas de Juxtlahuaca (Ojeda and Palacios-Vargas, 1984).

Distribution.—Known only from the type-locality.

Remarks.—This species was collected from soil and bat guano. It was reported by Reddell (1971) as *Trogolaphysa* sp.

Troglopedetes n.sp. *1*

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a); Grutas de Juxtlahuaca (Palacios-Vargas, 1982).

Remarks.—This species is being described by Palacios-Vargas and Christiansen. It was reported by Palacios-Vargas (1981a; 1982) as *Paronella* sp.

Troglopedetes n.sp. *2*

Record.—*Morelos*: Cueva del Salitre (Palacios-Vargas, 1981b).

Remarks.—This species is being described by Palacios-Vargas and Christiansen. It was reported by Palacios-Vargas (1981b) as *Paronella* sp.

Troglopedetes n.sp. *3*

Record.—*Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982).

Remarks.—This species is being described by Palacios-Vargas and Christiansen. It was reported by Reddell (1971) as *Trogolaphysa* sp.

Salina

In addition to the above group of forms a single collection of the genus *Salina* has been made.

Salina sp.

New record.—*Tamaulipas*: Entrada del Viento Baja, Conrado Castillo, 2,000 m, 17 March 1979 (G. Atkinson).

Subfamily Cyphoderinae

Cyphoderus innominatus Mills

Type-locality.—*Yucatán*: Cenote de Sambulá (Motul) (Mills, 1938).

Records.—*Yucatán*: Actún Góngora (Mills, 1938);

Cueva Muruztún (Mills, 1938); Cueva Segunda del Camino a San Roque (Mills, 1938).

Remarks.—This species was reported from bat guano in Actún Góngora and Cenote de Sambulá; it was collected 40 m from the entrance of Cueva Muruztún (Mills, 1938).

Cyphoderus n.sp.

Record.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982).

FAMILY HYPOGASTRURIDAE

This family is well represented in Mexican caves. Both Hypogastrurinae and Neanurinae are found but the former dominate.

Subfamily Hypogastrurinae

This group has speciated extensively in Mexican caves and has been studied extensively by Bonet (1945a; 1946).

Hypogastrura

Five species are found in Mexican caves. All are probably trogloxenes.

Hypogastrura sp.

Record.—*Morelos*: Cueva del Diablo (Palacios-Vargas, 1981b).

Hypogastrura (Ceratophysella) sp.

Record.—*Morelos*: Cave at Km. 104, 5 FFCC México-Cuernavaca (Palacios-Vargas, 1982).

Hypogastrura (Ceratophysella) sp. cf. *guthriei* (Folsom)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Hypogastrura (Ceratophysella) gibbosa (Bagnall)

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a). *Morelos*: without definite locality (Palacios-Vargas, 1983a).

Hypogastrura (Ceratophysella) succinea Gisin

New record.—*Puebla*: Cueva de Tasalolpan, 5 km SW Cuetzalan, 27 December 1973 (J. Reddell, D. McKenzie, R. Jameson, W. Elliott).

Hypogastrura (Schoettella) glasgowi (Folsom)

New record.—*Hidalgo*: Grutas de Xoxafí, 5.6 km N Lagunilla, 19 March 1981 (J. Reddell, T. Archey, F. Endres, D. McKenzie).

Schaefferia

Three species of *Schaefferia* have been collected, two of which are probably undescribed species.

Schaefferia (Schaefferia) guerrerensis (Bonet)

Type-locality.—*Guerrero*: Grutas de Cacahuamilpa (Bonet, 1945).

Distribution.—Known only from one cave each in Guerrero and Morelos.

Other record.—*Morelos*: Cueva del Diablo (=Ocotitlán) (Hoffmann, Palacios-Vargas, and Morales, 1980).

Remarks.—This species was described by Bonet (1945) in the new genus *Spalaeogastrura.*

Schaefferia (Schaefferia) sp. *A*

New record.—*Veracruz*: Cueva del Volcancillo, 5 km SE Las Vigas, 8 January 1974 (J. Reddell, R. Jameson).

Remarks.—This species will be described elsewhere by J. M. Thibaud and Palacios-Vargas.

Schaefferia (Schaefferia) sp. *B*

New record.—*Oaxaca*: Cueva de la Finca, 10 km SW Acatlán, 31 December 1976 (J. Reddell, D. McKenzie, A. Grubbs).

Remarks.—This apparent new species will be studied by Thibaud and Palacios-Vargas.

Acherontiella (Acherontiella)

Acherontiella (Acherontiella) sabina Bonet
Map 8

Type-locality.—*San Luis Potosí*: Cueva de Los Sabinos (Bonet, 1945).

Distribution.—This species ranges from Veracruz, México, north to New Mexico, U.S.A.

Other records.—*Nuevo León*: Cueva de la Boca (Bonet, 1945); Grutas del Palmito (Reddell, 1982a). *San Luis Potosí*: Ventana Jabalí (Reddell and Elliott, 1973a); Cueva de los Monos (Reddell and Elliott, 1973a). *Tamaulipas*: Cueva del Abra (Bonet, 1946); Cueva de los Cuarteles (Bonet, 1946); Crystal Cave (Reddell and Elliott, 1973b); Cueva del Infiernillo (Reddell and Elliott, 1973b); Cueva de El Pachón (Bonet, 1946); Sótano (=Cueva) de San Rafael de los

Castros (Reddell and Elliott, 1973a). *Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982).

New records.—*Oaxaca*: Cueva del Guayabo, 12 km N Valle Nacional, 29 December 1972 (J. Reddell, D. McKenzie, S. Murphy). *San Luis Potosí*: Sótano de Guadalupe, 10 km W Aquismón, 18 March 1980 (D. Pate); 21 March 1980 (P. Sprouse); Cueva de la Laja, 2 km E Ahuacatlán, 26 November 1970 (J. Reddell, T. Raines, J. White).

Remarks.—This is the only known Mexican cave species of the subgenus *Acherontiella*. It is the most common cave hypogastrurid in Mexico. Bonet (1946) found it on the surface near Cueva de los Cuarteles, Tamaulipas. It has also been taken from leaf litter 10 km W Aquismón, San Luis Potosí. Palacios-Vargas (1982) reported it in rat fur from Ajusco, Distrito Federal. The specimens from Oaxaca are slightly different from those seen in the other areas and may represent a distinct species. The species has also been found in rat nests in New Mexico, U.S.A. It is probably a type 3 troglophile. It was found on bat guano in Grutas de Atoyac.

Map 8.—Distribution of *Acherontiella (Acherontiella) sabina* in Mexican caves.

Acherontiella (Acherontides)

Bonet (1945) first described *Acherontides* as a genus from the caves of Veracruz. In 1946 he described a second species from caves in San Luis Potosí. A new species is described here. This appears to be a widespread subgenus with localized species. The members of the subgenus are extremely uniform in many features. They all have the same 4th antennal structure, foot complex, basic chaetotaxy, ventral tube structure, tenaculum, similar anal spines, and general body form.

This subgenus has a generally southern distribution with three described species: *A. (A.) atoyacensis* from caves and mammal burrows in Guerrero, Morelos, Querétaro, and Veracruz; *A. (A.) potosinus* from caves in the Xilitla region of San Luis Potosí, the Acatlán region of Oaxaca, and the Cuetzalan region of Puebla; and *A. (A.) spina* n.sp. from a single cave in the San Sebastián de las Grutas region of Oaxaca. In the absence of additional material from many parts of Mexico it is premature to speculate on the zoogeography of this group. The three Mexican species are keyed out in Table XII.

Acherontiella (Acherontides) atoyacensis (Bonet)
Map 9

Type-locality.—*Veracruz*: Grutas de Atoyac (Bonet, 1945).

Distribution.—This species is known from caves in Guerrero, Morelos, Querétaro, and Veracruz; and from mammal burrows in Estado de México.

Other records.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d); Gruta de Juxtlahuaca (Palacios-Vargas and Vázquez-Rojas, 1983). *Morelos*: Cueva del Derrame del Chichinautzín (Palacios-Vargas, 1981b). *Querétaro*: Cueva del Muerto (García Rendón L., 1983).

Remarks.—This species has also been reported by Palacios-Vargas (1982) from the nest of *Pappogeomys tylorhynus* at Venta de Carpio, Ecatepec, Estado de México. Specimens of this species have not been seen in this study.

Acherontiella (Acherontides) potosinus (Bonet)
Map 9

Type-locality.—*San Luis Potosí*: Cueva de El Jobo (Bonet, 1946).

Distribution.—This species is known from caves in the Acatlán region of Oaxaca, the Cuetzalan region of Puebla, and the Xilitla region of San Luis Potosí.

Other records.—*San Luis Potosí*: Cueva del Aire (Bonet, 1953); Cueva de los Cuchos (Bonet, 1953); Cueva de la Hoya (Bonet, 1953); Cueva del Salitre (Bonet, 1953).

New records.—*Oaxaca*: Cueva de Las Maravillas, 6 km S Acatlán, 29 December 1976 (J. Reddell, A. Grubbs, C. Soileau, D. McKenzie). *Puebla*: Cueva de los Camarones, 3 km NW Xochitlan, 29 December 1973 (J. Reddell).

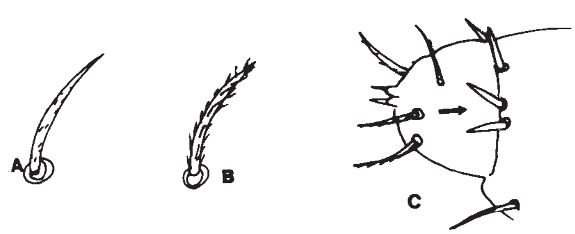
Remarks.—Bonet (1946) originally described this species from Cueva de El Jobo in San Luis Potosí. We have seen additional specimens from Oaxaca and Puebla. They show only minor variation from those described by Bonet. It was reportedly found on bat guano in Cueva del Salitre.

Acherontiella (Acherontides) spina, new species
Figs. 39-44; Map 9

Type-data.—Cueva del Llano Grande, 1 km S San Vicente Lachixio, 2,010 m, Oaxaca, México, 31 December 1972 (J. Reddell).

Table XII.—Key to Mexican species of *Acherontiella (Acherontides)*.

1. Common body setae smooth . . . . *A. atoyacensis*
   Common body setae serrate 2



2. With supplementary 6th abdominal segment spines (see Fig. C) . . . . *A. spina*
   Without such spines . . . . *A. potosinus*

Description.—White, without eyes or P.A.O. Fourth antennal segment typical of genus. Third and fourth antennal segments clearly separated. Third antennal segment apical organ with two minute inner knobs in shallow pits flanked by blunt curved subequal setae. Second antennal segment with 1 large, straight, heavy, sparsely serrate ventral seta, 5 dorsal and lateral heavy serrate setae, and 5 small smooth to sparsely serrate curved setae. First segment with 6 dorsal heavy serrate setae and one ventral microchaeta. Foot complex completely lacking trace of unguiculus, with two weakly clavate tenent hairs arising from same level. Unguis without lateral or external teeth and with a clear small inner tooth at about mid-level. Ventral tube with 4+4 setae. Tenaculum with 2+2 teeth and no setae. Furcula with mucro, dens and manubrium well developed. Mucro straight with hooked tip, fused to dens dorsally but clearly separate ventrally. Dens with 2+2 setae not quite reaching apex of mucro. Manubrium with 3+3 setae. Sixth abdominal segment with 10 heavy spine-like setae in addition to anal spines. Anal spines straight, thorn-like and on well-developed contiguous papillae which are subequal to or slightly shorter than anal spines. Shorter dorsal body setae are curved and serrate. Straight longer setae smooth and acuminate.

Map 9.—Distribution of *Acherontiella (Acherontides)* species in Mexican caves: 1, *A. (A.) potosinus*; 2, *A. (A.) atoyacensis*; 3, *A. (A.) spina.*

Male genital plate with about 22 setae. Female not observed. Maximum length 1.2 mm.

Distribution.—Known only from the type-locality.

Remarks .—The species resembles *A. potosinus* in many respects; however, the peculiar heavy spine-like setae serve to separate it readily from all other species of the genus.

Tafallia

Tafallia sp.

Record.—*San Luis Potosí*: Cueva del Huisache (det. D. L. Wray) (Reddell, 1981).

Willemia

Willemia bulbosa Bonet

Record.—*San Luis Potosí*: Cueva de Los Sabinos (Bonet, 1945).

Willemia persimilis Bonet

Record.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1982).

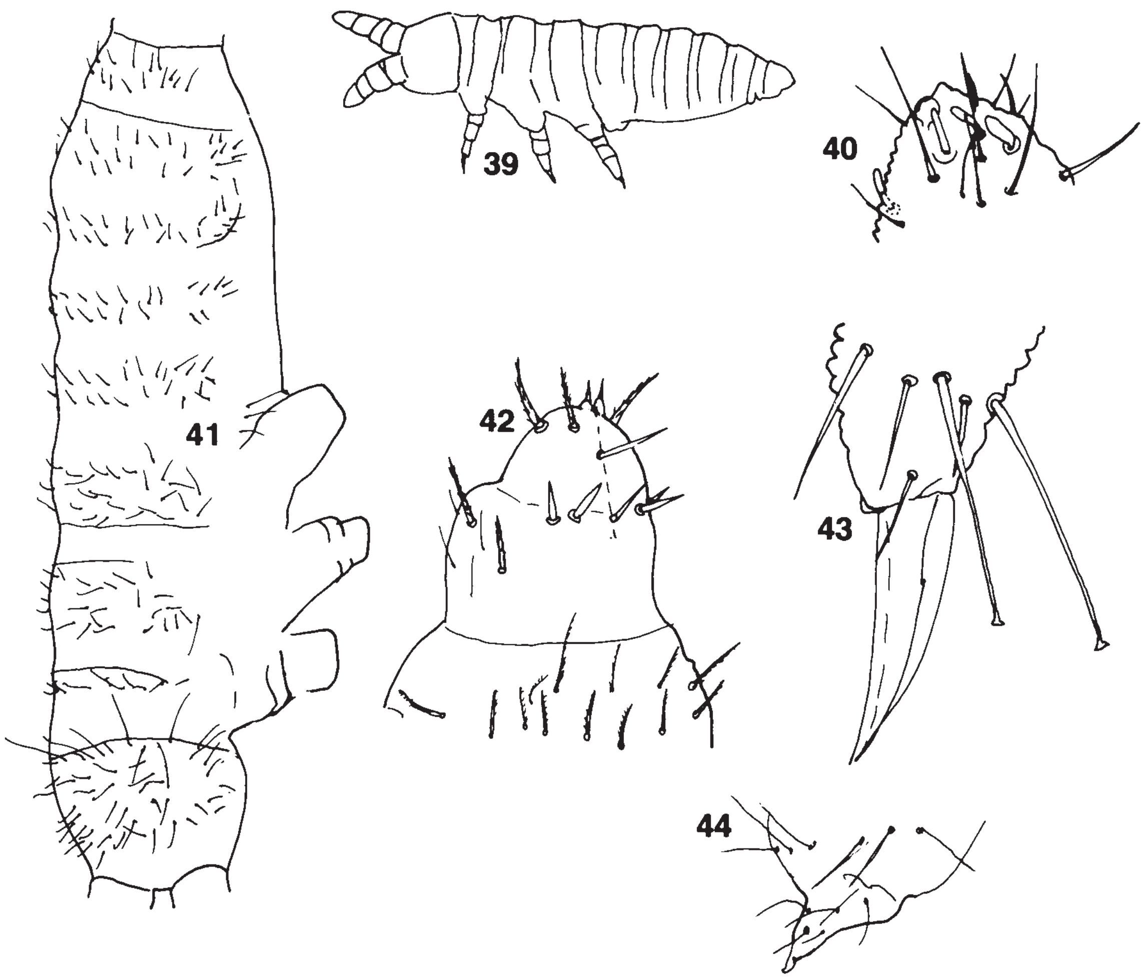
Remarks.—This species has also been reported by Palacios-Vargas (1982) from the nest of *Pappogeomys tylorhynus* at Venta de Carpio, Estado de México.

Xenylla

Two species of this genus have been reported, both of which are probably Type 1 cave species. Palacios-Vargas also reports a species of this genus from San Luis Potosí.

Xenylla humicola (O. Fabricius)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).



Figs. 39-44.—*Acherontiella (Acherontides) spina* (type-specimens): 39, habitus x 100; 31, 40 apex of antenna; 41, dorsal chaetotaxy; 42, detail of end of abdomen; 43, hind foot complex; 44, furcula.

Xenylla yucatana Mills

Type-locality.—*Yucatán*: Cenote de Sambulá (Motul) (Mills, 1938).

New record.—*Yucatán*: Actún Xpukil, 3 km S Calcehtok, 19 March 1973 (J. Reddell).

Remarks.—Mills (1938) reported this species from bat guano in Cenote de Sambulá.

Subfamily Neanurinae

The members of the subfamily Neanurinae are largely represented by surface species which are occasionally found in caves. Many genera have been found.

Brachystomella

Palacios-Vargas (1982) records four species from Mexican caves. No specimens were seen in this study.

Brachystomella contorta Denis

Records.—*Morelos*: Cueva de San Juan (Palacios-Vargas, 1981b); Cueva del Salitre (Palacios-Vargas, 1981b).

Brachystomella parvula (Schäffer)

Record.—*San Luis Potosí*: Cueva de la Hoya (Bonet, 1953).

Brachystomella taxcoana Palacios-Vargas and Najt

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas and Najt, 1981).

Remarks.—This species was collected from bat guano and soil in Gruta de Aguacachil.

Brachystomella sp. (*parvula* group)

Record.—*Querétaro*: Sótano Otates (Palacios-Vargas, 1982).

Anurida

Anurida n.sp.

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Anura (Micranurida)

No specimens of this genus were seen in this study.

Anura (Micranurida) sp. cf. *pygmaea* (Börner)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Odontella (Xenyllodes)

No specimens of this genus were seen in this study.

Odontella (Xenyllodes) armatus Axelson

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Pseudachorutes

No specimens of this genus were seen in this study.

Pseudachorutes subcrassoides Mills

Record.—*Querétaro*: Sótano de Tilaco (Palacios-Vargas, 1982).

Neanura

The only members of *Neanura* seen from Mexican caves belong to the subgenus *Amricanura* (see Cassagnau and Palacios-Vargas, 1983). One specimen ascribable to *N. (Americanura) mexicana* (n. comb.) has been found in Sótano del Buque, Querétaro. The other species is an undescribed form, *N. (A.) nova.* Palacios-Vargas (1982) has recorded specimens of other subgenera.

Neanura (Neanura) muscorum (Templeton)

New record.—*Chiapas*: Cave (Palacios-Vargas, pers. comm.).

Neanura (Neanura) n.sp.

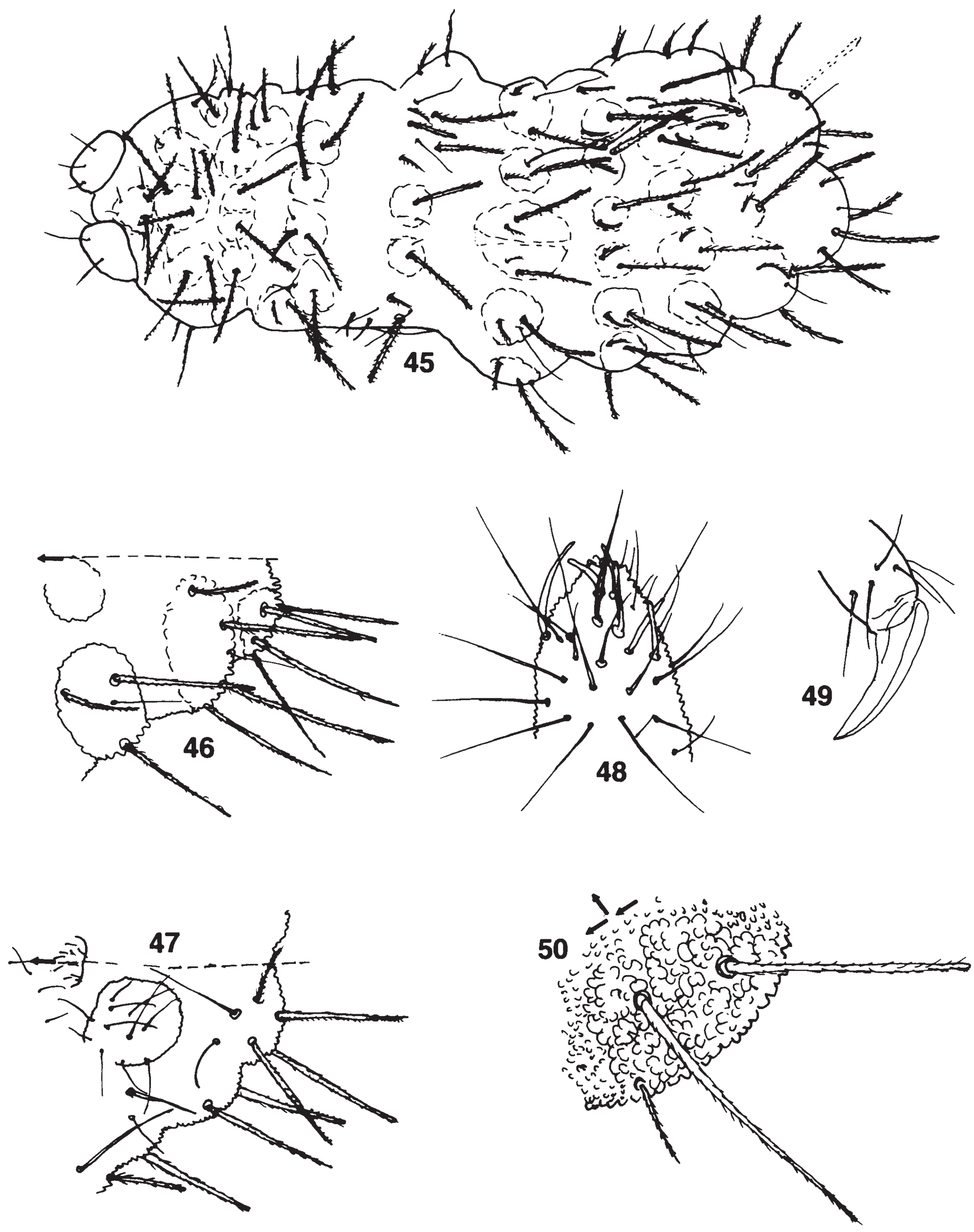
New record.—*Colima*: Cave (Palacios-Vargas, pers. comm.).

Neanura (Americanura) nova, new species
Figs. 45-50

Type-data.—Sistema Purificación (Sumidero de Oyamel Section), Conrado Castillo, Tamaulipas, México, 28 October 1979 (T. Treacy).

Description.—Color (mounted) white. Without eyes. Habitus typical of genus. Fourth antennal segment with a trilobed apical projection or knob, with four short slightly curved blunt setae and one much larger (S7) recurved blunt seta. Mouthparts typical of subgenus. Unguis without teeth. Ventral tube with 4+4 setae. Chaetotaxy formula (after Deharveng, 1983).

Head CL.:F,G. Fr:A,C, An:d
Oc:3 Suboc:9 DI(fused):2
De:3 D1+D1:4



Figs. 45-50.—*Neanura (Americanura) nova* (type-specimens): 45, dorsal chaetotaxy of immature specimen; 46, dorsal chaetotaxy of left side, posterior abdomen, of adult specimen; 47, same, ventral surfaces; 48, apex of antenna; 49, hind foot complex; 50, left ocular tubercle.

Knob segment	Di	De	Dl	l
th 1	0	1	2	1
2	3	2 + s	3 + s	3
3	3	2 + s	3 + s	3
Abd 1	2	2 + s	2	3
2	2	3 + s	3	3
3	2	3 + s	5	3
4	5 + s	——	——	——
5	6 + s	——	——	——
6	7	——	——	——

All body setae except for sensory setae serrate. Large setae often blunt and multilaterally serrate. Body tubercles clear and well developed. Integumentary granules elliptical to circular and ranging from 5-9 micra in longest measurement. Maximum length 2 mm.

Distribution.—Known only from the type-locality.

Remarks.—The species is readily distinguished from other species of the subgenus by the absence of eyes. There are only two specimens and in the smaller of these (probably 2nd instar) there are 3 asymmetrical microchaetae in the region of the first thoracic Di setae. These are clearly absent in the adult specimen. The species is close to *N. (A.) sotanofila.* The fact that the two specimens of this species bridge the gap between the subgenera *Americanura* and *Sensillanura* points up the need for more study of these groups.

Neanura (Americanura) mexicana Cassagnau and Palacios-Vargas

New record.—*Querétaro*: Sótano del Buque, 20 km N Pinal de Amoles, 2 June 1972 (T. Raines, R. Ralph).

Neanura (Americanura) sotanofila Cassagnau and Palacios-Vargas

Type-locality.—*Querétaro*: Sótano de Otates (Cassagnau and Palacios-Vargas, 1983).

Distribution.—Known only from the type-locality.

Neanura (Sensillanura) macgregori Cassagnau and Palacios-Vargas

Record.—*Morelos*: Cueva de San Juan (Palacios-Vargas, 1981b; Cassagnau and Palacios-Vargas, 1983).

Remarks.—This species was reported by Palacios-Vargas (1981b) as *N. (S.) banksi* (Denis).

Neanura (Vitronura) giselae (Gisin)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Paranura

Paranura n.sp.

Record.—*Guerrero*: Grutas del Mogote (Reddell, 1971).

Remarks.—A single specimen of this undescribed eyeless species was found. The species is close to but not conspecific with *P. anops* Christiansen and Bellinger of California. It was reported by Reddell (1971) and Palacios-Vargas (1983a) as *Paranura caeca* Folsom.

FAMILY ONYCHIURIDAE

Remarkably few finds of this family have been made from Mexican caves. It is probable that most Mexican forms belonging to the genus *Tullbergia* are so small that they are overlooked. The sole collections seen were two specimens of the genus *Onychiurus* and one of *Tullbergia*. Palacios-Vargas, however, has reported several species of both genera.

Onychiurus

Onychiurus sp.

Records.—*San Luis Potosí*: Cueva del Ahuate no. 2 (Bonet, 1953); Cueva de la Hoya (Bonet, 1953).

New record.—*Tamaulipas*: Sótano de Las Calenturas, 0.7 km S Yerbabuena, 1,460 m, 22-29 April 1980 (T. Treacy, P. Sprouse, D. Pate, L. Wilk).

Onychiurus (Onychiurus) acuitlapanensis Palacios-Vargas and Deharveng

Type-locality.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas and Deharveng, 1982).

Remarks.—This species was collected from the deepest part of the cave.

Onychiurus (Onychiurus) fimetarius Linnaeus

Record.—*Nuevo León*: Resumidero del Pablillo (det. D. L. Wray) (Reddell, 1981).

Remarks.—The identity of this species is questionable.

Onychiurus (Onychiurus) folsomi (Schäffer)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Onychiurus (Protaphorura) armatus (Tullberg)

Record.—*Morelos*: Cueva del Diablo (Palacios-Vargas, 1981b).

Onychiurus (Protaphorura) encarpatus Denis

Records.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d). *Morelos*: Cueva de San Juan (Palacios-Vargas, 1981b). *Querétaro*: Sótano de Otates (Palacios-Vargas, 1982).

Onychiurus (Protaphorura) sp. (*armatus* group)

New records.—*Nuevo León*: Cueva Sin Nombre, Potrero Redondo, 24 May 1980 (W. R. Elliott). *Veracruz*: Sótano de la Palma, 14 km N Potrero, 7 January 1977 (J. Reddell, D. McKenzie).

Tullbergia

Tullbergia (Mesaphorura) foveata Bonet

Record.—*San Luis Potosí*: Cueva Chica (Bonet, 1944).

Remarks.—This species was collected from bat guano in Cueva Chica and from the surface at El Pujal near Cueva Chica.

Tullbergia (Mesaphorura) granulata Mills

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Tullbergia (Mesaphorura) krausbaueri Börner

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a); Gruta de Aguacachil (Palacios-Vargas, 1983d); Grutas de Cacahuamilpa (Palacios-Vargas, 1982). *Morelos*: Cueva del Diablo (=Ocotitlán) (Hoffmann, Palacios-Vargas, and Morales, 1980); Cueva de San Juan (Palacios-Vargas, 1981b). *San Luis Potosí*: Cueva del Ahuate no. 2 (Bonet, 1953); Cueva de los Cuchos (Bonet, 1953); Hoya de Guaguas (Palacios-Vargas, 1982); Cueva del Salitre (Bonet, 1953).

Remarks.—This species was reported from bat guano in Cueva del Diablo and Cueva del Salitre.

Tullbergia (Mesaphorura) yosii Rusek

Records.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982). *Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982).

Tullbergia (Mesaphorura) sp.

Record.—*Guerrero*: Grutas de la Estrella (Palacios-Vargas, 1982).

FAMILY ISOTOMIDAE

There is a scattering of collections of this family from Mexican caves; however, the great majority are probably trogloxenes. The only clear exception to this is the troglophile *Folsomia candida* Willem.

Folsomia

Folsomia candida Willem

Records.—*Morelos*: Cueva del Diablo (=Ocotitlán) (Hoffmann, Palacios-Vargas, and Morales, 1980); Cueva de San Juan (Palacios-Vargas, 1981a).

New records.—*Hidalgo*: Mina la Purisma, Pachuca, 270 m deep, 16 June 1984 (B. Rives). *Oaxaca*: Sistema Huautla (La Grieta section), 5 km E Huautla de Jiménez, 8 January 1978 (J. Jancewicz, D. Lowery, S. Zeman). *San Luis Potosí*: Cueva Mosca, 16 km NE Ciudad del Maíz, 1,150 m, 16 July 1967 (J. Reddell, J. Fish). *Tamaulipas*: Sótano de Las Calenturas, 0.7 km S Yerbabuena, 1,460 m, 19 November 1979 (D. Pate et al.); Cueva X, Conrado Castillo, 28 March 1978 (A. Grubbs).

Remarks.—This species was collected from bat guano in Cueva del Diablo.

Folsomia stella Christiansen and Tucker

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Folsomia sp.

Record.—*San Luis Potosí*: Cueva de la Hoya (Bonet, 1953).

Proisotoma

Proisotoma (Appendisotoma) dubia Christiansen and Bellinger

Record.—*San Luis Potosí*: Hoya de Guaguas (Palacios-Vargas, 1982).

Proisotoma (Ballistura) sp.

Records.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982). *San Luis Potosí*: Sótano de Yerbaniz (Reddell and Elliott, 1973a).

Proisotoma (Proisotoma) centralis Denis

Record.—*Yucatán*: Cueva Yunchén (Mills, 1938).

Remarks.—This species was tentatively identified from one specimen collected in a tow net in Cueva Yunchén.

Proisotoma (Proisotoma) minuta (Tullberg)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Remarks.—This species has also been reported from the nest of *Pappogeomys tylorhynus* at Venta de Carpio, Estado de México (Palacios-Vargas, 1982).

Folsomides

Folsomides sp. cf. *marchicus* (Frenzel)

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Folsomides americanus Denis

Records.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d); Grutas de Juxtlahuaca (Palacios-Vargas, 1982). *Querétaro*: Sótano de Tilaco (Palacios-Vargas, 1982).

Folsomides angularis (Axelson)

Record.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982).

Folsomina

Folsomina onychiurina Denis

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a); Grutas de Juxtlahuaca (Palacios-Vargas, 1982). *Querétaro*: Sótano de Tilaco (Palacios-Vargas, 1982). *San Luis Potosí*: Cueva del Ahuate no. 2 (Bonet, 1953); Cueva del Jobo (Bonet, 1953). *Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1983c).

Cryptopygus

Cryptopygus thermophilus (Axelson)

Records.—*Durango*: Cueva de la Siguerita (Reddell, 1982). *Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d). *Morelos*: Cueva del Diablo (Palacios-Vargas, 1981b); Cueva de San Juan (Palacios-Vargas, 1981b). *Querétaro*: Sótano de Tilaco (Palacios-Vargas, 1982).

Remarks.—Material from Durango is only tentatively assigned to this species. It was reported from Cueva de la Siguerita by Reddell (1982) as *Cryptopygus* sp.

Cryptopygus sp.

Record.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a).

Isotoma

Isotoma sp.

New record.—*Guerrero*: Grutas de Juxtlahuaca, 6 km NNW Colotlipa, 15 August 1966 (J. Fish, J. Reddell).

Isotoma (Desoria) notabilis Schäffer

Record.—*Morelos*: Cueva de San Juan (Palacios-Vargas, 1981b).

Isotomiella

Isotomiella minor (Schäffer)

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a). *Morelos*: Cueva de San Juan (Palacios-Vargas, 1981b). *Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982).

Isotomurus

Isotomurus sp.

Record.—*Yucatán*: Cueva Yunchén (Mills, 1938).

Remarks.—A single specimen with the furcula missing was taken in a tow net in Cueva Yunchén.

FAMILY NEELIDAE

No specimens of this family have been seen in this study. A number of species have been recorded by Bonet (1947), Palacios-Vargas (1981a; 1982), and Palacios-Vargas and Vázquez-Rojas (1983).

Neelus

Neelus (Megalothorax) incertus Börner

Record.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas and Vázquez-Rojas, 1983).

Neelus (Megalothorax) minimus Willem

Records.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a). *Nuevo León*: Grutas del Palmito (Bonet, 1947). *Veracruz*: Grutas de Atoyac (Palacios-Vargas, 1982). *Yucatán*: Cenote de Hoctún (Bonet, 1947); Cueva de Santa Elena (Bonet, 1947).

Neelus (Neelus) murinus Folsom

Record.—*San Luis Potosí*: Cueva de Los Sabinos (Bonet, 1947).

Remarks.—This species was collected from bat guano.

Neelus (Neelus) murinus bolivari Bonet

Record.—*Yucatán*: Cueva de Santa Elena (Bonet, 1947).

Remarks.—This subspecies was collected from decaying plant remains in Cueva de Santa Elena. It was described from Cueva de Cotilla, Cuba, as *Neelus bolivari* Bonet.

FAMILY SMINTHURIDAE

This family is poorly represented in Mexican caves. With the possible exception of *Arrhopalites* all are probably Type 1 cave inhabitants.

Temeritas

Temeritas sp.

Record.—*San Luis Potosí*: Sótano de la Tinaja (Reddell and Elliott, 1973a).

Pararrhopalites

Pararrhopalites anops Bonet and Tellez

Type-locality.—*Nuevo León*: Grutas del Palmito (Bonet and Tellez, 1947).

Remarks.—This species was collected in "maderas podridas."

Sminthurus

Sminthurus n.sp.

Records.—*San Luis Potosí*: Cueva de los Cuchos (Bonet, 1953); Cueva de la Hoya (Bonet, 1953); Cueva de El Jobo (Bonet, 1953).

Remarks.—Bonet (1953) considered this species to be a troglobite and states that he had specimens from many caves in San Luis Potosí and Tamaulipas.

Neosminthurus

Neosminthurus sp.

Record.—*Morelos*: Cueva del Diablo (Palacios-Vargas, 1981b).

Sminthurides

Sminthurides (Sminthurides) sp.

Record.—*Guerrero*: Gruta de Aguacachil (Palacios-Vargas, 1983d).

Sminthurides (Sphaeridia) sp.

Record.—*Guerrero*: Grutas de Juxtlahuaca (Palacios-Vargas, 1982).

Arrhopalites

This genus is remarkably poorly represented in the caves of Mexico and Texas.

Arrhopalites sp. cf. *pygmaeus* (Wankel)

Record.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a).

Arrhopalites n.sp.

Record.—*Guerrero*: Gruta de Acuitlapán (Palacios-Vargas, 1981a).

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