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TYPHLOCHACTAS SYLVESTRIS, A NEW EYELESS SCORPION FROM MONTANE FOREST LITTER IN MEXICO (SCORPIONIDA, CHACTIDAE, TYPHLOCHACTINAE)

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ABSTRACT

A new species of eyeless scorpion, *Typhlochactas sylvestris*, is described from a montane forest litter habitat in the Sistema Montañoso Poblano Oaxaqueño, Oaxaca, México. It is compared to the other three species, all cave dwellers, in the genus. A revised diagnosis of the genus *Typhlochactas* Mitchell is given, and *T. rhodesi* Mitchell, 1968, is designated as its type-species.

INTRODUCTION

The purpose of this paper is to present the description of yet another blind and depigmented scorpion of the genus *Typhlochactas* Mitchell, 1968.

Typhlochactas is the only scorpion genus to contain species entirely devoid of eyes and is the only genus in the subfamily Typhlochactinae, family Chactidae. To date, there are three species, all Mexican cave forms, referred to this genus: *T. rhodesi* Mitchell, 1968, from La Cueva de la Mina in Tamaulipas; *T. reddelli* Mitchell, 1968, from La Cueva del Ojo de Agua de Tlilapan in Veracruz; and *T. elliotti* Mitchell, 1971, from El Sótano de Yerbaniz in San Luis Potosí.

In May of 1971, a single individual of another, and quite distinct, species (Fig. 1) was found in montane forest litter in the state of Oaxaca during a field trip undertaken by one of us (SBP) as part of a long-term study of the distribution and ecology of scavenging and litter-inhabiting arthropods of tropical American forests. Thus, the scorpion described herein is unique in that it is the only known eyeless epigean scorpion.

Typhlochactas sylvestris, new species
Figs. 1-13

Coloration.—Uniformily pale yellowish-brown in life and similar, but somewhat paler, in alcoholic preservative.

Carapace (Fig. 2).–Poorly sclerotized and smooth. Anterior corners rather sharply rounded. Length approximately equal to width. Anterior margin with poorly defined epistome. Lateral margins diverging posteriorly. Very slight median groove. Median and lateral eyes lacking.

Preabdomen (Fig. 1).–Tergites weakly sclerotized and smooth. Lateral and posterior margins and surfaces with small setae. Sternites weakly sclerotized, smooth, and with small setae. All sternites with essentially straight posterior margins. Small, circular spiracles.

Postabdomen (Figs. 1, 10).–Segments with weak dorsal keels; no ventral or lateral keels. Few small granulations on dorsal keels. Many setae on all surfaces of segments. Each segment of greater length than preceding one, this most exaggerated with segment V. Segments I through IV progressively decreasing in width. Segments I through III each wider than long. Segment IV very slightly longer than wide. Segment V nearly twice as long as wide, more than one-third length of postabdomen, and approximately same length as carapace.

Telson (Fig. 1, 10).–Telson rather large, slightly longer than caudal segment IV. Aculeus moderately sclerotized. Vesicle flat dorsally, bulbous ventrally, and width exceeding depth. Many rather long setae occurring laterally, ventrally, and posteriorly on vesicle.

Pectines (Fig. 3).–Essentially unsclerotized. Each comb of five distinctly separate pieces, three marginal and two middle lamellae, fulcra absent. Five teeth on each comb, distal tooth largest, followed in size by proximal one. Remaining three teeth slender and of approximately same size. Each tooth bearing on anterior two-thirds of ventral surface several small setae and on posterior one-third patch of dense sensory tubules. Basal piece with pair of long setae.

Sternum (Fig. 3).–Pentagonal, with lateral margins converging slightly anteriorly; length about same as width. With posteromedial depression. Several small setae and paired long setae near anterior and posterior corners.

Genital Operculum (Fig. 3).–Female operculum much wider than long; with a strong anteromedial depression. Opercular halves fused into a single plate with no indication of suture. Several small setae on surface.

Cherlicerae (Figs. 6, 7).–Length of basal portion of second joint slightly longer than width. Length of fixed finger slightly more than one-half that of movable finger. Fixed finger with only three teeth on superior margin: distal, median, and basal. Subdistal tooth, present in all other scorpions, absent. Median and basal teeth not combining to form compound tooth. Inferior margin lacking teeth. Tuft of long hairs on basal half of medial surface of fixed finger; ventral surface with long hairs sweeping onto venter of basal portion of joint. Movable finger with strong distal tooth on inferior margin; remainder of this margin without teeth. Superior margin with four teeth: distal, subdistal, median, and basal. Subdistal, median, and basal united to form a single compound tooth. [In holotype, and only specimen of this species, this dentition represented only on right movable cheliceral finger; on left finger projection representing basal tooth absent.] Distal tooth of superior margin of movable finger well removed from tip of finger. All teeth of both fingers, other than distals, quite small. Serrula present on venter of movable finger extending three-fourths length of finger. Basal three-fourths of venter of movable finger clothed by long hairs. Several setae on dorsal surface of second joint and on movable finger.

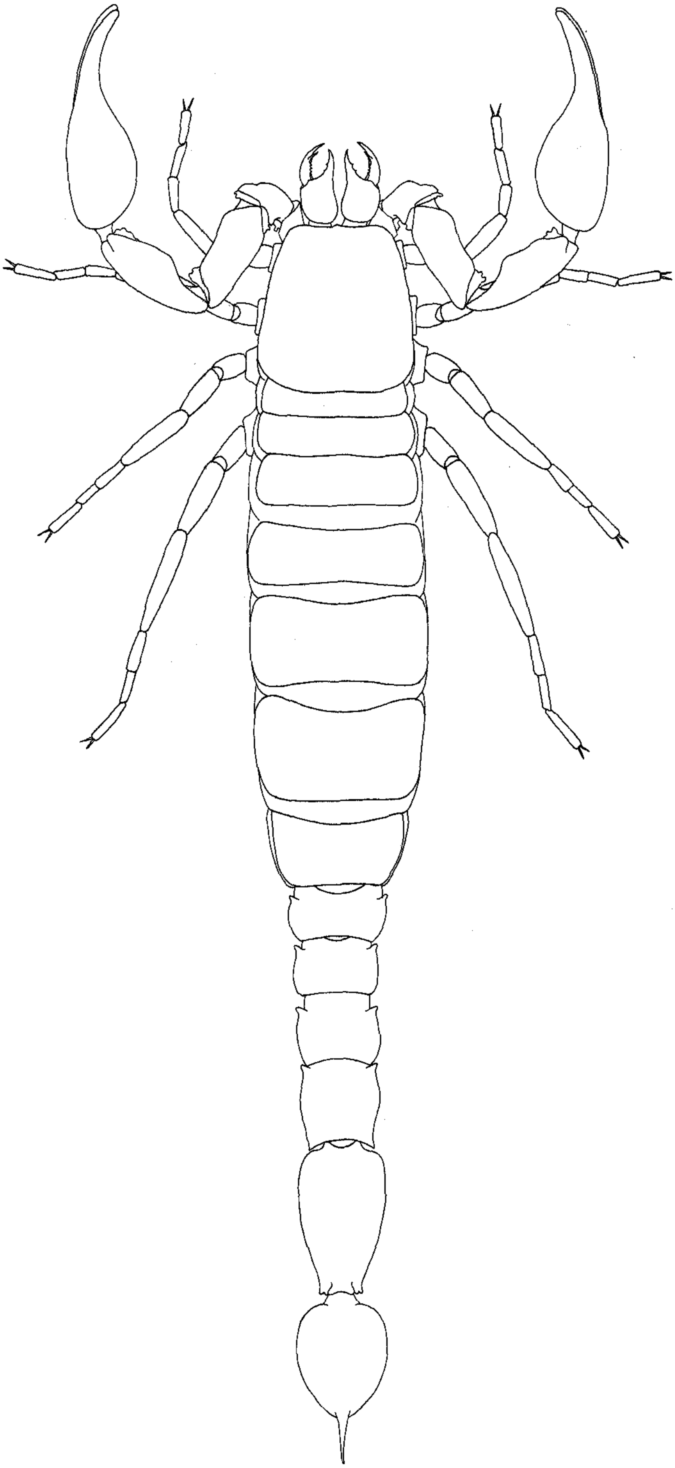
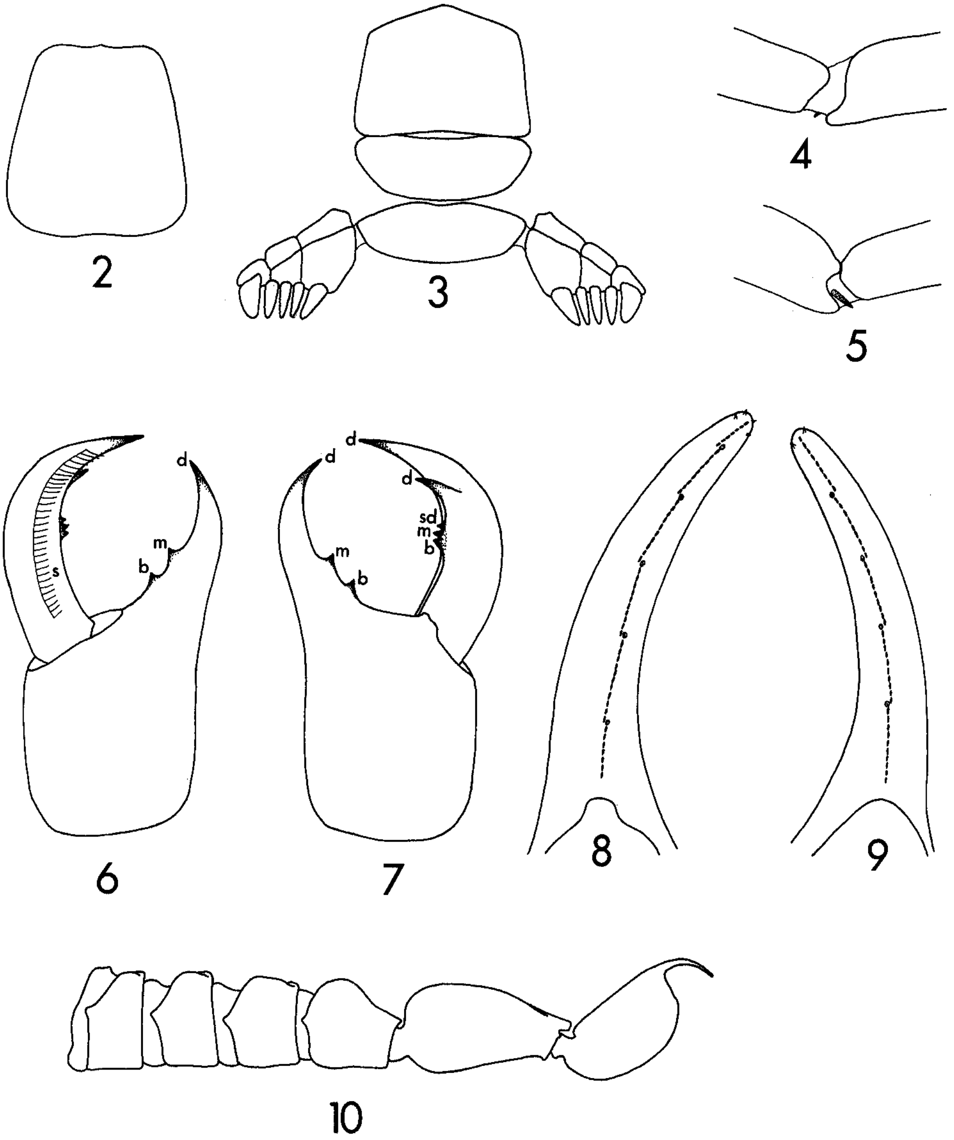


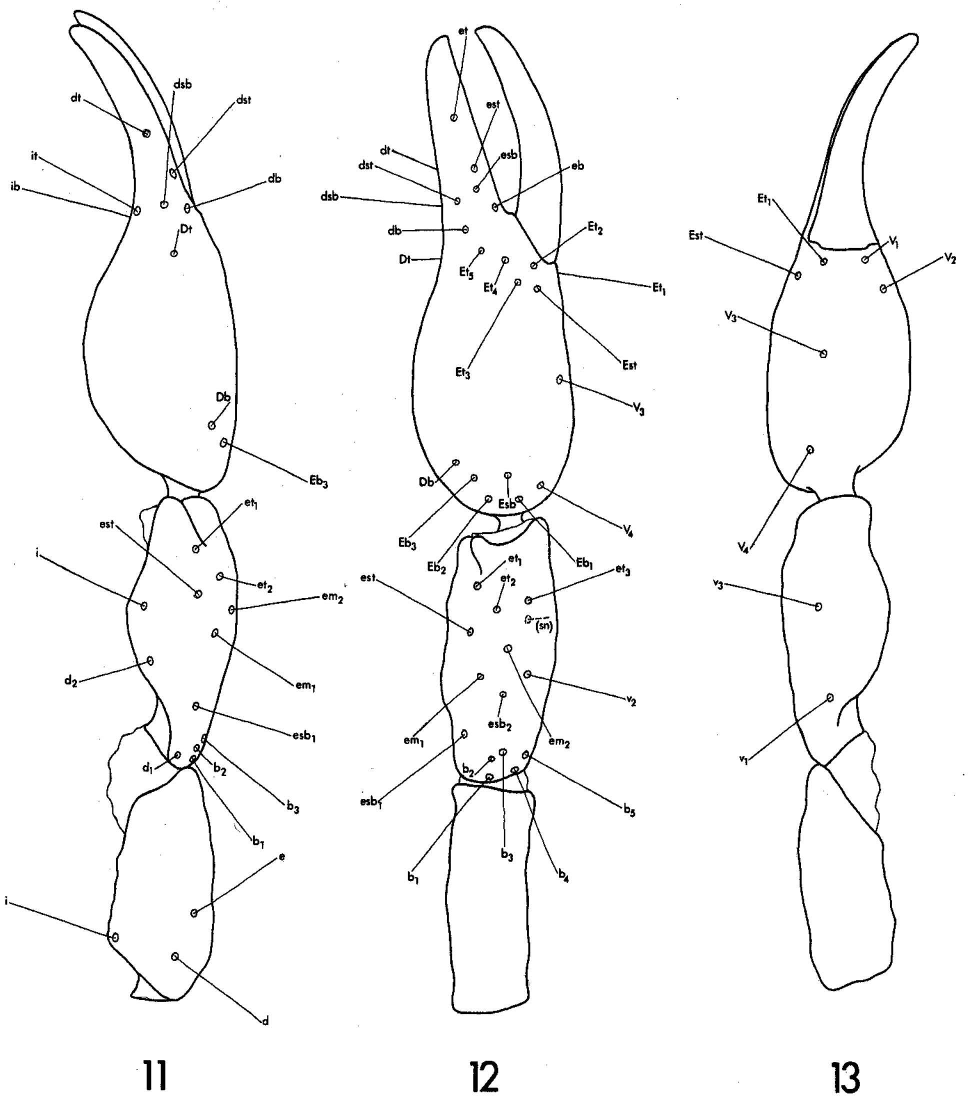
Fig. 1.–*Typhlochactas sylvestris*.

Pedipalps (Figs. 8, 9, 11, 12, 13).–Trichobothrial pattern basically that of Vachon's Orthobothriotaxia, Type C (Vachon, 1974). Ventral tibial trichobothrium v_2 present on external face of tibia. [This is true for all species of *Typhlochactas* as Vachon (1974:932) has pointed out for *T. reddelli.*] [On the right tibia of the holotype there occurs an additional, short trichobothrium proximal to et_3 (*sn* of Fig. 12). This trichobothrium is not present on the left tibia. We attach no significance to the occurrence of such a



Figs. 2-10.–*Typhlochactas sylvestris*: 2, carapace; 3, sternum, genital operculum, pectines; 4, articulation of left basitarsus and tarsus, leg IV, retrolateral; 5, articulation of right basitarsus and tarsus, leg IV, prolateral, showing basitarsal spur; 6, right chelicera, ventral. Tooth designations in this and Fig. 7 as follows: *d*, distal; *sd*, subdistal; *m*, median; *b*, basal; *s* indicates serrula; 7, right chelicera, dorsal; 8, movable finger of left pedipalp showing tooth files; 9, fixed finger of left pedipalp showing tooth files; 10, postabdomen, lateral.

supernumerary trichobothrium.] Femur slightly shorter than tibia; slightly more than twice as long as deep. Few granules on inner face. Dorsal carinae poorly developed. All surfaces with setae. Tibia only slightly more than twice as long as deep; less granulated than femur. All surfaces with small setae. Hands short, one and one-third times length of carapace. All carinae poorly developed, few prominent granules. All surfaces with moderate setation. Movable finger six times as long as midpoint width, shorter than carapace, only slightly longer than palm. Dentate margin unscalloped, armed with six very slightly oblique files of teeth. Distal file shortest, followed in length by basal file. Other four files longer and of approximately same length. Fixed finger six times as long as midpoint width; slightly shorter than movable finger. Dentate margin unscalloped and with five tooth files, each about same length.



Figs. 11-13.–*Typhlochactas sylvestris*, right pedipalp showing trichobothria. Symbols as follow: *b*, basal; *D*, *d*, dorsal; *E*, *e*, external; *i*, internal; *m*, median; *s*, sub-; *t*, terminal; *V*, *v*, ventral; *sn* indicates supernumary trichobothrium. First letter of symbols for palm trichobothria capitalized. 11, dorsal view; 12, external view; 13, ventral view.

Legs (Figs. 4, 5).—All surfaces with moderate setation. No tibial spurs. Prolateral basitarsal spurs present; no retrolateral spurs. Venter of tarsi with two irregular rows of rather stout setae; no midventral row of spines or spicules. Median claw very well developed.

Etymology.—Specific name from *sylvestris*, Latin indicating living in the woods.

Type Locality.—25 km S village of Valle Nacional at 1200 m along Highway 175, which connects Oaxaca and Tuxtepec, Oaxaca, México, across the Sistema Montañoso Poblano Oaxaqueño. Holotype and only known specimen taken on 21 May 1971 by Stewart B. Peck from a Berlese sample (#204) comprised of a total of 27 l of sifted leaf litter.

Type Deposition.—Holotype, female, deposited in the Museum of Texas Tech University.

TRICHOBOTHRIAL DESIGNATIONS

This paper employs Vachon's (1974) latest system for the designation of pedipalpal trichobothria and consequently there are considerable changes from those designations used by Mitchell (1968, 1971) for the three previously described species of *Typhlochactas*. The changes from former usage to the present usage are as follows: Femur: change d_1 to d and d_2 to e. Tibia: change b_1 to b_5, b_2 to b_4, b_4 to b_1, b_5 to b_2, sb to esb_1, m_3 to esb_2, m_4 to em_1, m_2 to em_2, m_1 to v_2, st_3 to est, st_1 to et_3, st_2 to et_2, t to et_1, and v_2 to v_3.

REVISED GENERIC DIAGNOSIS

The original diagnosis of the genus *Typhlochactas* Mitchell, 1968, has been outdated by the subsequent discovery and description of *T. elliotti* Mitchell, 1971, and *T. sylvestris* Mitchell and Peck. No diagnosis of the genus *Typhlochactas* written in such a manner as to include all four presently described species can be entirely satisfactory. Each species presents its own unique features, features of considerable importance in scorpion taxonomy. For example, *T. sylvestris* has an entire genital operculum; the other species, a divided operculum. *T. rhodesi* and *T. elliotti* lack basitarsal spurs; the other two species have a prolateral spur. *T. reddelli* has the median and basal teeth fused to form a compound tooth on the superior margin of the fixed cheliceral finger; the other species have these teeth separated. Thus, it seems at present that there are but two reasonable alternatives, maintain a single genus—perhaps one so heterogeneous as to be artificial, or separate each species into its own genus. For the present, we choose the former course.

Typhlochactas Mitchell, 1968

Revised Diagnosis.—Color pale. Sclerotization weak. Keel and granule development poor. Eyes absent. Spiracles subcircular to circular. Caudal segments with weak dorsal keels; other keels absent. Pectines reduced, combs of few pieces; with four or five teeth. Sternum large, pentagonal. Female genital operculum entire or of two valves. Superior margin of fixed cheliceral finger with three or four teeth, subdistal may be lacking; median and basal teeth separate or forming compound tooth; inferior margin lacking teeth. Superior margin of movable cheliceral finger with four or five teeth: distal, one or two subdistals, median, and basal; inferior margin with only large distal tooth. Serrula present on venter of movable cheliceral finger. Pedipalpal trichobothrial pattern basically that of Vachon's Orthobothriotaxia Type C (Vachon, 1974). Prolateral basitarsal spur present or basitarsal spurs absent. Venter of tarsus with two regular to irregular rows of bristles.

Type species.–Typhlochactas rhodesi Mitchell, 1968. (by subsequent designation.)

HABITAT DESCRIPTION

The northeast facing slope of the outer range of the Sistema Montañoso Poblano Oaxaqueño is covered with forest ranging from lowland rain forest, through middle elevation montane cloud forest, to high elevation pine and fir forest. Additional description is given by Ball and Whitehead (1967). At a point 25 km south of Valle Nacional, Highway 175 travels along the southeast face of a ridge that it crosses through a saddle at 1200 m to then continue on the northwest face of the ridge. At the saddle, foot trails extend from each side of the road into a mixed-species cloud forest containing much oak (Fig. 14). In this area leaf litter was sifted and collected at two sites. The first site was an accumulation of loose decaying leaves lying along a log on a steep, well drained hill slope. About 12 l (about 25 kg) of sifted litter were collected here. The second site was a 3 m^2 flat area with poorer drainage. The litter here was about 5 cm thick and comprised of undecomposed and uncompacted leaves overlying a 10 to 14 cm thick spongy humus and root mat, which could be rolled like a rug from a light colored clay soil. About 15 l (about 30 kg) of litter were collected here.

The litter from these two sites was pooled into a single sample, which was placed into metal "Tulgren" Berlese funnels and then exposed to sunlight for eight hours for extraction of the fauna. The extracted litter was examined by hand the next day to determine what arthropods had not been driven out by the exposure to sunlight. The blind scorpion was found during this final hand sorting of the litter.

Fig. 14.–Characteristic montane litter habitat at the type locality of *Typhlochactas sylvestris* in the Sistema Montañoso Poblano Oaxaqueño, Oaxaca, México.

Table 1.–Measurements in mm of the holotype of *Typhlochactas sylvestris*.

Total length (=Carapace L + Preabdomen L + Postabdomen L + Telson L)	11.05
Carapace: length/width	1.22/1.25
Preabdomen: length	5.43
Postabdomen: length	3.06
Caudal segment I: length/width	0.32/0.83
Caudal segment II: length/width	0.40/0.70
Caudal segment III: length/width	0.45/0.67
Caudal semgent IV: length/width	0.68/0.63
Caudal segment V: length/width	1.21/0.68
Telson length (=Vesicle L + Aculeus L)	1.34
Vesicle: length/width/depth	0.88/0.72/0.52
Aculeus: length	0.46
Pedipalp length (Femur L + Tibia L + Hand L)	3.64
Femur: length/depth	0.91/0.41
Tibia: length/depth	0.99/0.45
Hand length (=Palm L + Fixed finger L)	1.74
Palm: length/width/depth	0.86/0.58/0.63
Fixed finger: length/width (midpoint)	0.88/0.14
Movable finger: length/width (midpoint)	0.95/0.16
Chelicera length (Chela L + Fixed finger L)	0.65
Chela: length/width	0.40/0.31
Fixed finger: length	0.25
Movable finger: length	0.43
Sternum: length/width	0.41/0.63
Pectines: basal piece width/comb length	0.50/0.45

Because the litter from the two sites was combined, it is not known from which area the scorpion came, but it was observed that arthropods were more diverse and abundant in the better-drained hillside location.

At the several elevations where samples were taken in the forest along the road above Valle Nacional, there was found a rich fauna of relict and endemic species, at least in the beetle families Scarabaeidae and Leiodidae, for which there exist the best collection and taxonomic data. This same road is also one of the two known localities for native terrestrial amphipods in continental North America (Peck, unpublished data). These occurrences, together with that of the blind scoprion, indicate that the region can well be expected to yield many other species of exceptional distributional and evolutionary interest.

Blind litter-inhabiting scorpions are no doubt scarce to rare as the blind cave scorpions also seem to be. The rarity of the single specimen can better be appreciated by documenting the amount of collecting, using the same methods, that preceded and followed its discovery. The field program of litter sampling (of Peck), between 1969 and 1972, has led to extraction of fauna from 816 kg (2035 l) of sifted forest litter in México, El Salvador, Guatemala, and Belize from low, middle, and upper elevation forests.

DISCUSSION

The relationships of the new blind forest-litter scorpion to the blind cave-dwelling species is of obvious interest and significance. The epigean species differs in several morphological features. *Typhlochactas sylvestris* is the most robust species in the genus. This is most apparent in the pedipalps and body segments. In this general feature *T.*

sylvestris is most similar to *T. reddelli*. The trichobothrial pattern of *T. sylvestris* is also most similar to that of *T. reddelli*. This is probably nothing more than a reflection of similar degrees of pedipalp attenuation (or actually lack of it) between the species. Mitchell (1971) has already shown that the most disparate trichobothrial pattern in the genus (*T. elliotti*) is probably the result of pronounced pedipalpal elongation. In the cave species there is great loss of distinctness of the pieces of the pectinal combs, whereas five pieces are distinct in each pectinal comb of *T. sylvestris*. All species have five pectinal teeth except *T. elliotti*, which may have four or five. The number of teeth on the fixed and movable fingers of the chelicerae is fewest in *T. sylvestris*, where the subdistal tooth is lacking on the superior margin of the fixed finger and one subdistal tooth (sd_1) is lacking on the superior margin of the movable finger. The median and basal teeth of the superior margin of the fixed cheliceral finger are separate and distinct in *T. sylvestris* as they also are in *T. elliotti* and *T. rhodesi*. They are fused in *T. reddelli*. Prolateral basitarsal spurs are possessed by *T. sylvestris* and *T. reddelli*; basitarsal spurs are lacking in *T. rhodesi* and *T. elliotti*. In summary, *T. sylvestris* appears to be somewhat more similar to *T. reddelli* than to the other two species. *T. sylvestris* is distinct from all of the other species in having an entire genital operculum.

In attempting a speculative reconstruction of the evolutionary history of these eyeless scorpions, one must bear in mind that the four species appear to represent a rather compact morphological group, even though each has its own anomalous characteristics. There are at least sufficient similarities to suggest that the four species are of common descent, if not from a single ancestral species then from closely related ones. Based on the distribution and characteristics of the species of *Typhlochactas*, it is most plausible to argue that the ancestral species inhabited montane litter, where they were widespread. It is entirely possible that these ancestral species may have partially or wholly lost their eyes and pigment as a consequence of adaptation to a cool and moist litter habitat because these characteristics appear frequently in other taxa containing "litter adapted" species such as beetles, collembolans, and millipedes. Such "preadaptation" may have aided litter inhabitants in cave colonization provided that they could have also withstood behaviorally and physiologically the different set of selection pressures of the cave environments. At the least, the existence of *T. sylvestris* admits to the possibility that the ancestors of the cave species could have been eyeless and depigmented prior to their invasion of the cave environment. On the other hand, the recent discovery of an eyeless diplocentrid scorpion in Yucatán by J. Reddell, D. McKenzie, and S. Wiley (Francke, 1977) seem to refute the notion that a scorpion *must* have acquired eyelessness and depigmentation in montane litter prior to cave colonization because no such habitat has been available in Yucatán.

To whatever extent the ancestors of *Typhlochactas* may have been "preadapted" to cave existence, they must have been, at the very least, montane forest litter dwellers. This is the only argument consistent with *T. elliotti* showing the greatest degree of cave adaptation, as well as *T. sylvestris* the least (as reflected by slenderness of body and general appendage attenuation). One can easily visualize that during Pleistocene pluvial conditions the montane forests, with their litter fauna, moved to lower elevations. El Sótano de Yerbaniz, habitat of *T. elliotti*, lies at an elevation of 242 m in the Sierra de El Abra of Tamaulipas and San Luis Potosí and very near to the high elevation Sierra de Guatemala of Tamaulipas. The caves inhabited by *T. rhodesi* and *T. reddelli* lie, respectively, at elevations of 1527 m and about 1400 m. Consequently, the ancestor of *T. elliotti* could have been isolated the soonest as warming and drying caused upward movement of the montane forests and their litter species. [See also Mitchell and Kawakatsu (1972) for a discussion of the possible relationships between Pleistocene climatic fluctuations and the distrubution of cave and epigean planarians in the Sierra de Guatemala.] Ancestors of *T. rhodesi* and *T. reddelli* certainly could have colonized their respective caves as soon, or sooner, than the ancestor of *T. elliotti.* Because their habitats are at much higher elevations than that of *T. elliotti*, however, isolation from the parental stock probably occurred at a later date. Thus, divergence from the ancestral species and adaptation to the cave environment in *T. rhodesi* and *T. reddelli* would not have proceeded to the extent seen in *T. elliotti.*

In closing, we suggest that *T. sylvestris* is not likely a cave species accidentally discovered in litter. Although the Sistema Montañoso Poblano Oaxaqueño is principally limestone, there are no known caves, karst landscapes, nor limestone outcrops near the locality where the scorpion was collected.

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