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A new species of *Alacran* (Scorpiones: Typhlochactidae) from a cave in Oaxaca, Mexico

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Abstract

Alacran chamuco **sp. nov**., a new eyeless, troglobitic scorpion from Te Cimutaa, Valle Nacional, is described. This is the second known species in the genus; sharing with *Alacran tartarus* a very similar trichobothrial pattern and the lack of "petite" trichobothria—both unique characters in the family Typhlochactidae. The new species differs from *A. tartarus* in the pedipalp finger dentition and the relative size of the telson. The two cave systems in Oaxaca where the two species of *Alacran* occur are approximately 75 kilometers apart.

Key words: Scorpion, troglobite, eyeless, Typhlochactidae, Alacraninae

Resumen

Se describe *Alacran chamuco* **sp. nov**., nueva especie de escorpión troglobio de Te Cimutaa, Valle Nacional. Esta es la segunda especie conocida del género, compartiendo con *Alacran tartarus* un patrón tricobotrial muy similar y la ausencia de "petite" tricobotrias—ambos caracteres únicos en la familia Typhlochactidae. La nueve especie difiere de *A. tartarus* en la dentición de los dedos de los pedipalpos y en el tamaño relativo del telson. Los dos sistemas de cuevas en Oaxaca donde existe *Alacran* están separados por 75 km.

Palabras clave: Escorpión, troglodita, ciego, Typhlochactidae, Alacraninae

Introduction

The monotypic genus *Alacran* Francke, was described in 1982 from a handful of specimens collected in four very deep caves in the Huautla System, Oaxaca. The family Typhlochactidae Mitchell, 1971 was recently revised (Vignoli & Prendini, 2009), and up-to-date descriptions and identification keys are available for the subfamilies and genera included in it; in addition, the monophyly of these troglomorphic scorpions has been rigorously tested (Prendini *et al.*, in press). Noteworthy additions are (a) the description of a new troglomorphic, non-troglobitic species of *Typhlochactas* Mitchell, 1971, from the state of Queretaro, Mexico (Francke *et al.*, 2009), and the discovery of a second species of troglobitic *Alacran* from the state of Oaxaca (Vignoli & Prendini, 2009), formally described here.

Methods

Nomenclature and mensuration for the most part follow Stahnke (1970); except for the metasomal carinal terminology after Francke (1977), and the pedipalp carinal terminology after Acosta *et al*. (2009).

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Observations, measurements and drawings were made using a Nikon SMZ800 stereomicroscope fitted with 10X ocular micrometer and camera lucida; photographs were made using a Nikon Coolpix S10 camera attached to the same microscope. Photographs were edited with Adobe Photoshop ver. 7.0.

An adult female of *A. tartarus* was borrowed from the American Museum of Natural History (AMNH), for comparisons; it was collected in Sotano Li Nita, Municipio de Huautla de Jimenez, Oaxaca, Mexico; 1 April 1981, M. Minton, L. Wilk, R. Simmons; -916m at sump in White Room Lead. Previous depth records for this species were -720m, -760m and -812 m (Francke, 1982), making this a new depth record for troglobitic scorpions.

The right leg IV was removed from the holotype of the new species for DNA analysis. It is deposited at the AMNH (AMCC[LP 8571]).

The probability that the holotype of the new species belongs morphometrically to *A. tartarus* was calculated by the formula $C= (X_n – M_t)/S.D._t$, where X_n is the measurement of the new species, M_t is the mean value for *A. tartarus* and $S.D._t$ is the standard deviation for *A. tartarus* (Woolf,1968) .

Taxonomy

Family Typhlochactidae Mitchell, 1971

Subfamily Alacraninae Vignoli & Prendini, 2009

Genus *Alacran* Francke, 1982

Type species.—*Alacran tartarus* Francke, 1982, by monotypy.

Diagnosis. *Alacran* is the only genus of Typhlochactidae with incremental neobothriotaxy: the patella has 26–27 trichobothria, including three on the ventral aspect (other genera in the family have two ventral trichobothria) (Prendini *et al.*, in press, Table 3); and the chela has 29 trichobothria, including five on the ventral aspect (other genera have four) (Prendini *et al.*, in press, Table 4). All the trichobothria are the same size; there are no “petite” trichobothria in this genus (Vignoli & Prendini, 2009). The two known species are eyeless troglobites from caves in the state of Oaxaca, Mexico.

Alacran chamuco, new species
(Figs. 1–16, 18, 20)

Alacran sp.: Vignoli & Prendini, 2009: 4 (Fig. 1A), 8 (Table 2), 35.

Type data. Holotype female, and only known specimen, from Te Cimutaa (NAD 27 777899 1987404) [N 17° 54’ 14.5” W 96° 22’ 37.6”, elev 944 m.], Municipio de Valle Nacional, Oaxaca, Mexico (Fig. 1); 25 April 2008, Paul Bryant; approximately 50 m. from the cave entrance. Deposited in the Colección Nacional de Arácnidos (CNAN T-0401), Instituto de Biología, UNAM. “Te” means “cave” in Chinanteco, the native language of the inhabitants of the Valle Nacional region.

Distribution. Known only from the holotype.

Etymology. The specific epithet is a noun in apposition, a name given in parts of Mexico (including the Chinanteca region) to the devil—which inhabits in the underworld.

Diagnosis. The most conspicuous differences between *A. chamuco* and *A. tartarus* are: (1) the former has five inner denticles on the fixed finger of the pedipalp chela, and six inner denticles on the movable finger, whereas the latter has six and seven inner denticles, respectively; (2) in *A. chamuco* the telson is proportionately smaller: the ratio telson length/carapace length in *A. chamuco* is 1.08, and in *A. tartarus* it is

1.25 (n=5, range 1.24–1.27) (16% shorter); the ratio telson width/carapace length in *A. chamuco* is 0.47, and in *A. tartarus* it is 0.58 (n=5, range 0.55–0.62) (23% narrower); and the ratio of telson depth/carapace length in *A. chamuco* is 0.43, and in *A. tartarus* it is 0.57 (n=5, range 0.55–0.62) (32% less deep).

Description. Based on holotype and only known specimen.

Color: Dorsum pale yellow-brown, venter and legs pale yellow; pedipalps orange-brown; granules on metasomal and pedipalpal carinae reddish brown.

Prosoma: Carapace subquadrangular, anterior margin straight; without distinct furrows or ridges; lacking median and lateral ocelli; with scattered, moderately dense small granulation (Fig. 2). Sternum longer than wide; with a shallow, broad posteromedian furrow (Fig. 3).

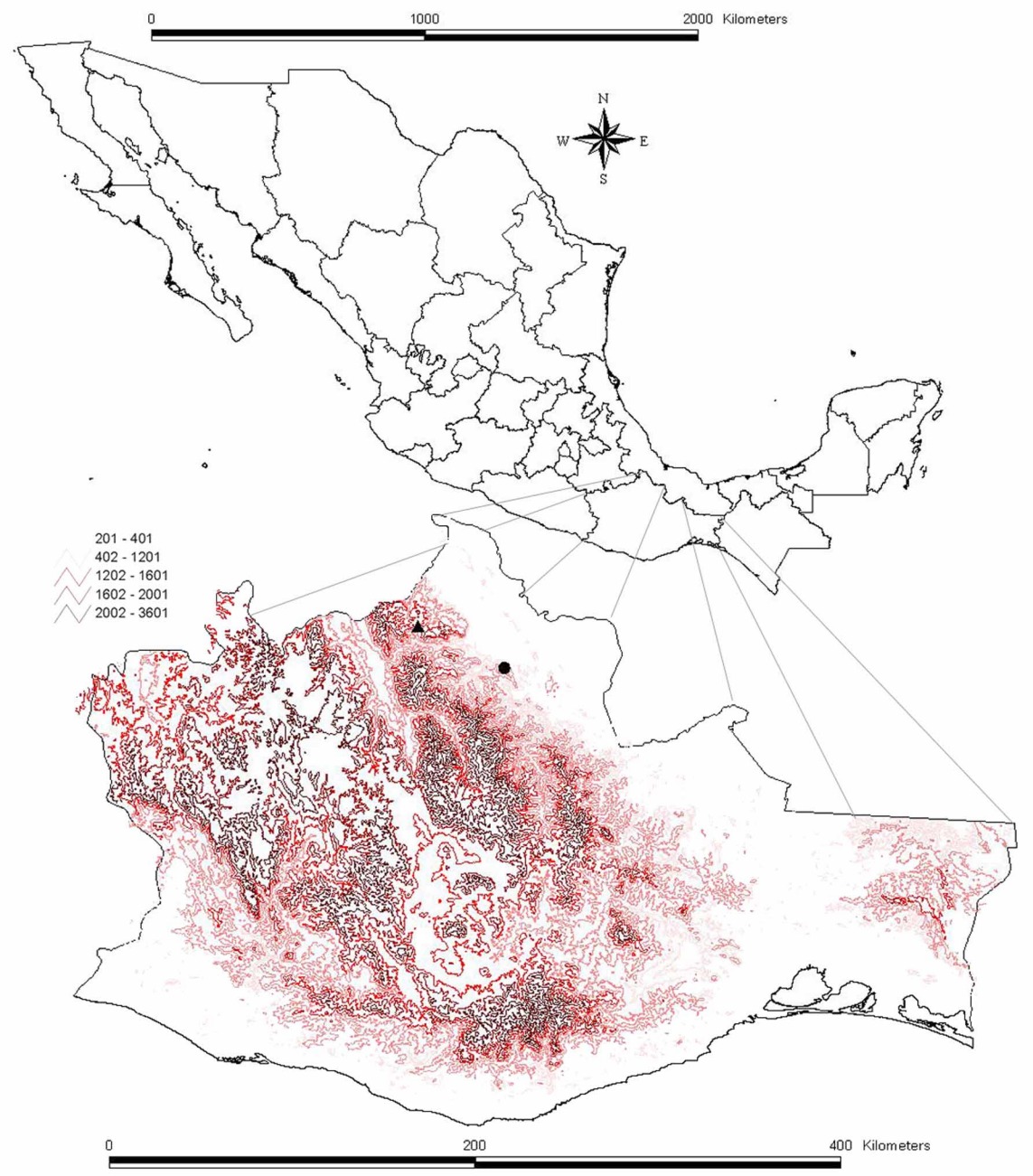
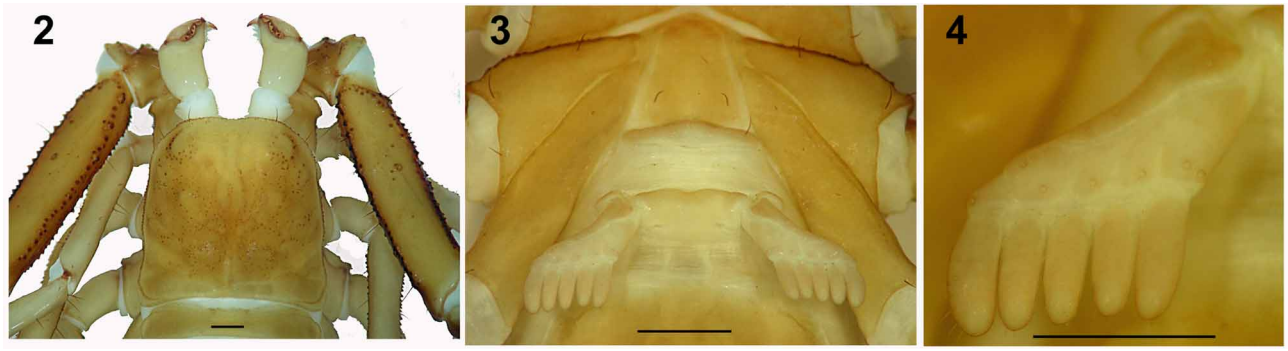
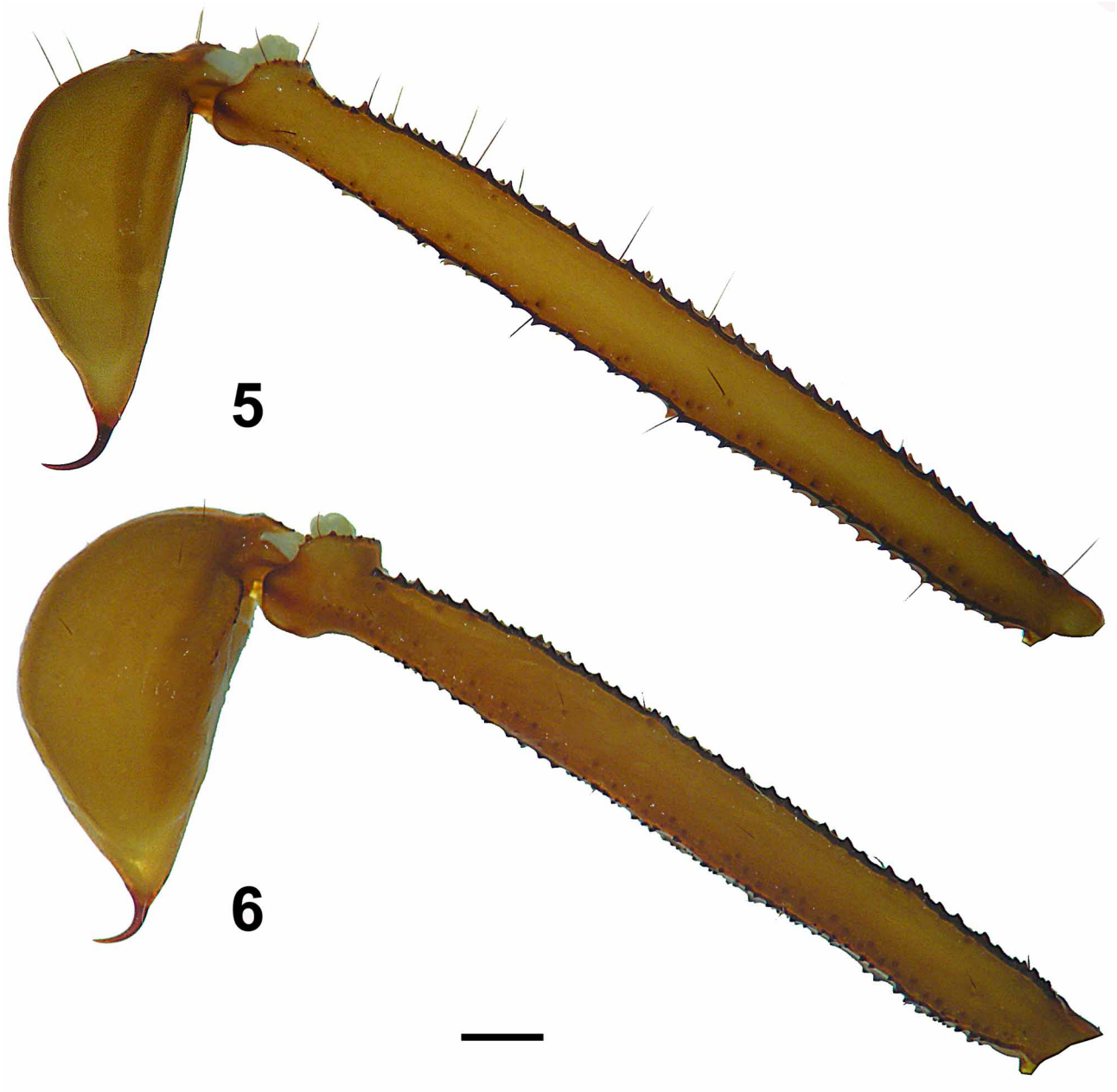


FIGURE 1. Map of the state of Oaxaca, Mexico, indicating the known distributions for the troglobitic *Alacran chamuco*, **sp. nov.** (circle), and *Alacran tartarus* Francke (triangle).



FIGURES 2–4. Holotype female of *Alacran chamuco*, **sp. nov.** 2. Dorsal aspect of prosoma. 3. Ventral aspect of prosoma + metasoma. 4. Detail of right pectinal tooth (scales = 1mm).



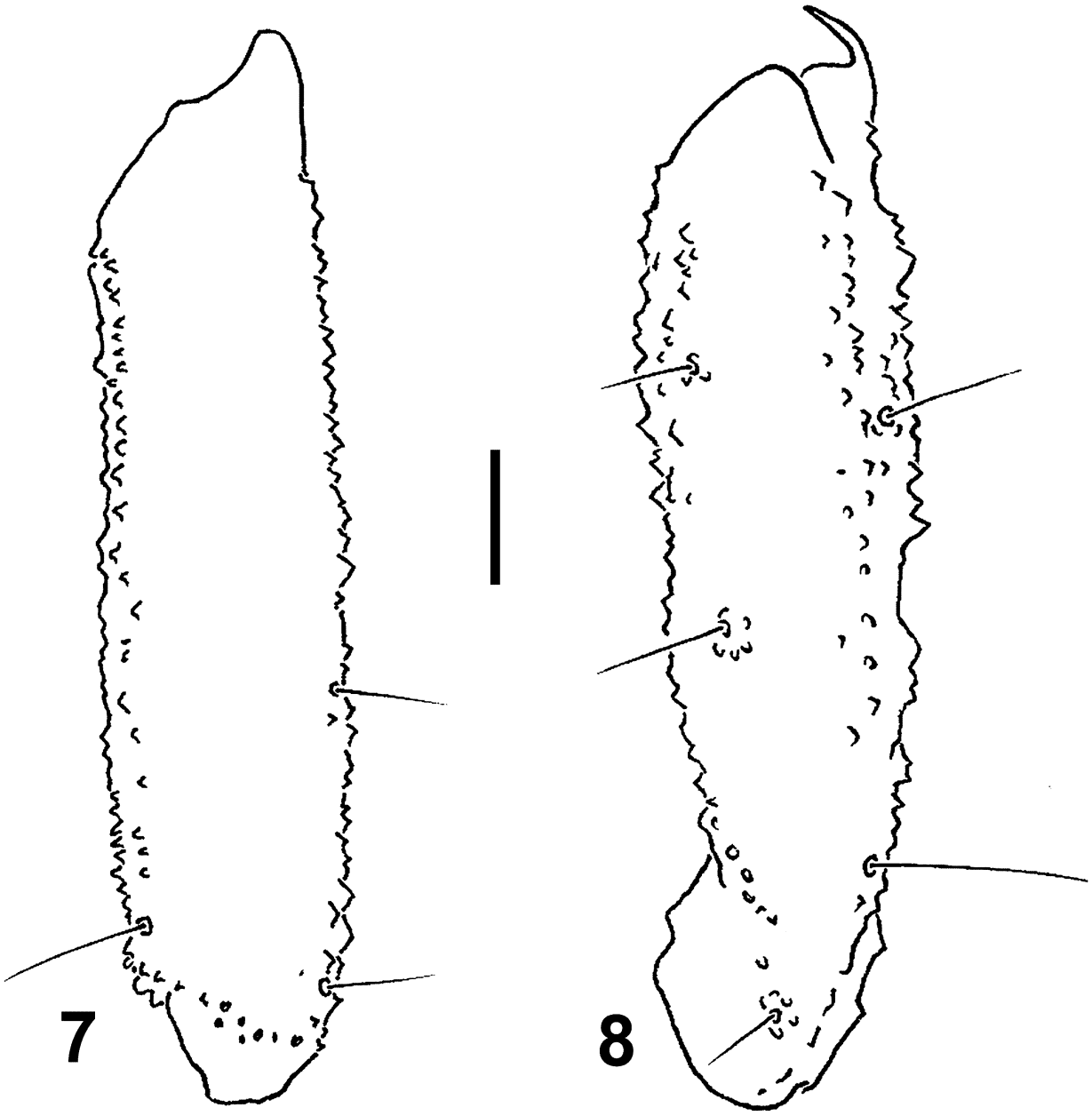
FIGURES 5–6. Metasomal segment V and telson. 5. Holotype female of *Alacran chamuco*, **sp. nov.** 6. Adult female of *Alacran tartarus* Francke (scale = 1mm).

TABLE 1. Measurements (in mm.) of the holotype female of *Alacran chamuco*, **sp. nov.**, from Te Cimutaa, Valle Nacional, Oaxaca, Mexico. L=length, W=width, D=depth.

Total	L	57.5
Carapace	L/W	5.3/5.5
Mesosoma	L	15
Metasoma	Total L	37.2
I	L/W	4.5/2.5
II	L/W	5.3/2.2
III	L/W	6.2/2.0
IV	L/W	8.6/1.6
V	L/W	12.6/1.3
Telson	L/W/D	5.7/2.5/2.3
Pedipalp	Total L	28.2
Femur	L/W/D	7.9/1.8/1.0
Patella	L/W/D	7.2/1.9/1.8
Chela	L/W/D	13.1/2.8/3.2
Movable finger	L	8.1
Fixed finger	L	6.8
Femur I	L	5.1
Femur II	L	6.1
Femur III	L	7.6
Femur IV	L	8.5
Patella I	L	4.5
Patella II	L	5.1
Patella III	L	5.9
Patella IV	L	6.2

TABLE 2. Morphometric comparisons between the holotype female of *Alacran chamuco*, **sp. nov.,** and five adult females of *Alacran tartarus* Francke, including the holotype. Abbreviations are L=length, W=width and D=depth. Measurements in the first two columns are from Francke (1982); the second two are the WDS specimens measured by Vignoli & Prendini (2009, Table 6, pp.36–37).

		A. tartarus holotype	*A. tartarus* adult	*A. tartarus* adult WDS	*A. tartarus* adult WDS	*A. tartarus* adult	*A. tartarus* average	Standard Deviation	*A. chamuco* holotype
Carapace	L	5	5.3	6.3	5.5	5.6	5.54		5.3
Femur	L	7	7.6	7.4	8.3	8	7.66		7.8
Telson	L	6.2	6.6	7.8	7	7	6.92		5.7
	W	2.85	2.9	3.7	3.4	3.3	3.23		2.5
	D	2.75	2.9	3.5	3.4	3.1	3.13		2.3
RATIO:	Tel L/Car L	1.24	1.25	1.24	1.27	1.25	1.25	0.012247	1.08
	Tel W/Car L	0.57	0.55	0.59	0.62	0.59	0.584	0.026076	0.47
	Tel D/Car L	0.55	0.55	0.56	0.62	0.55	0.566	0.030495	0.43



FIGURES 7–8. Holotype female of *Alacran chamuco*, **sp. nov.** 7. Dorsal view of right pedipalp femur. 8. Dorsal view of right pedipalp patella (scale = 1mm).

Mesosoma: Tergites I–VI smooth, lustrous, acarinate. Tergite VII with scattered, medium-sized granules posterolaterally; without distinct carinae; lateral margins finely serrate. Genital operculum obovate, with a complete median longitudinal membranous connection. Pectines each with three distinct marginal lamellae, five teeth and no fulcra; teeth finger-like, 3–4 times longer than wide, with sensory pegs on distal 1/3 to ¼ only (Fig. 4). Sternites III–VI smooth, lustrous, with few scattered macrosetae; stigmata small, round. Sternite VII with very few scattered granules, acarinate.

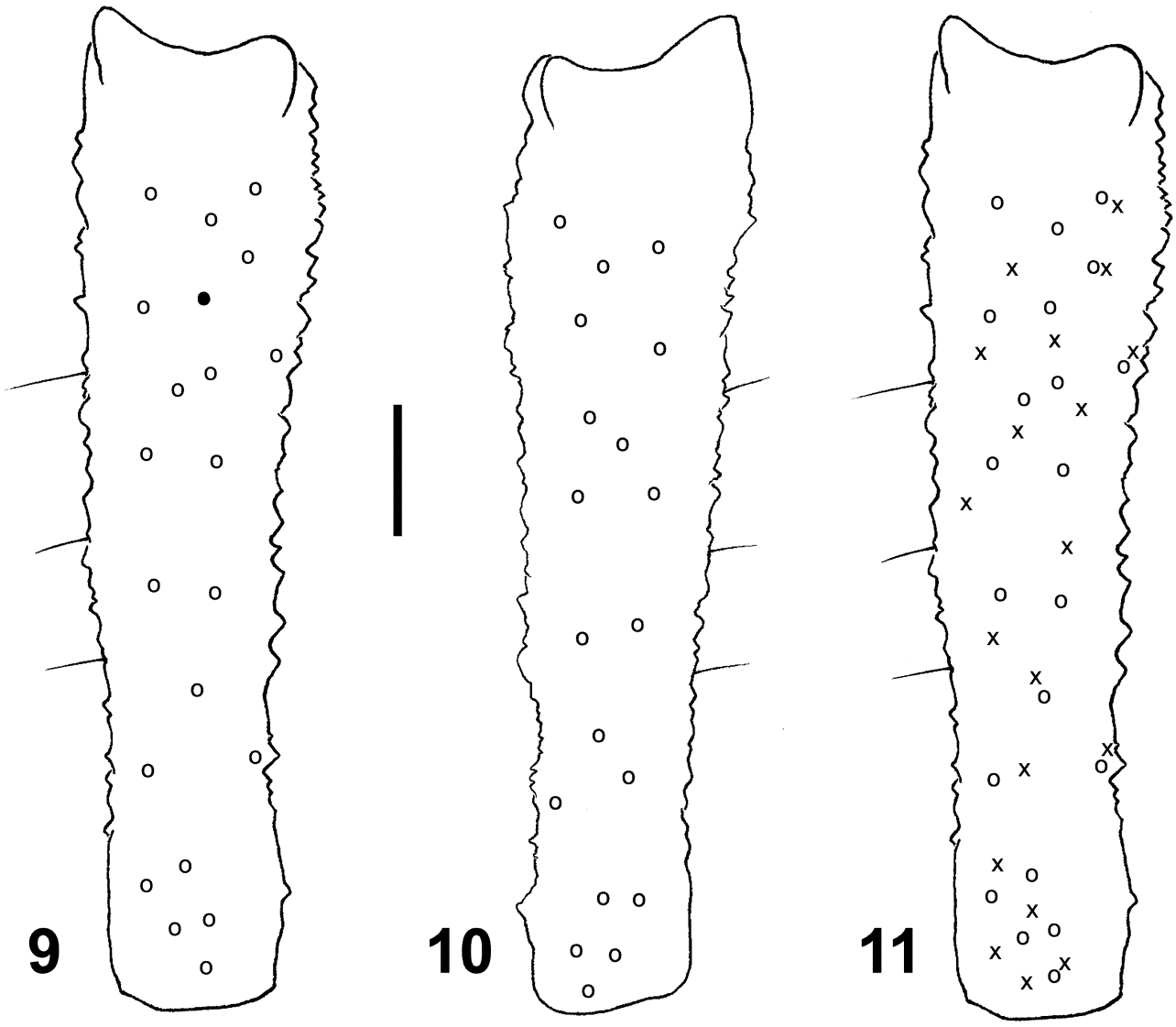
Metasoma: All segments longer than wide. I and II with three pairs of carinae each: Dorsolateral, ventrolateral and lateral supramedian keels moderately strong, granulose; III–V with two pairs of carinae each, dorsolateral and ventrolateral, all moderately strong, granulose. Intercarinal spaces smooth, lustrous. Telson globose, smooth, lustrous; aculeus short, strongly curved (Fig. 6), without lateral serrations.

Chelicera: Fixed finger with four teeth; basal and middle teeth not forming a bicusp. Movable finger

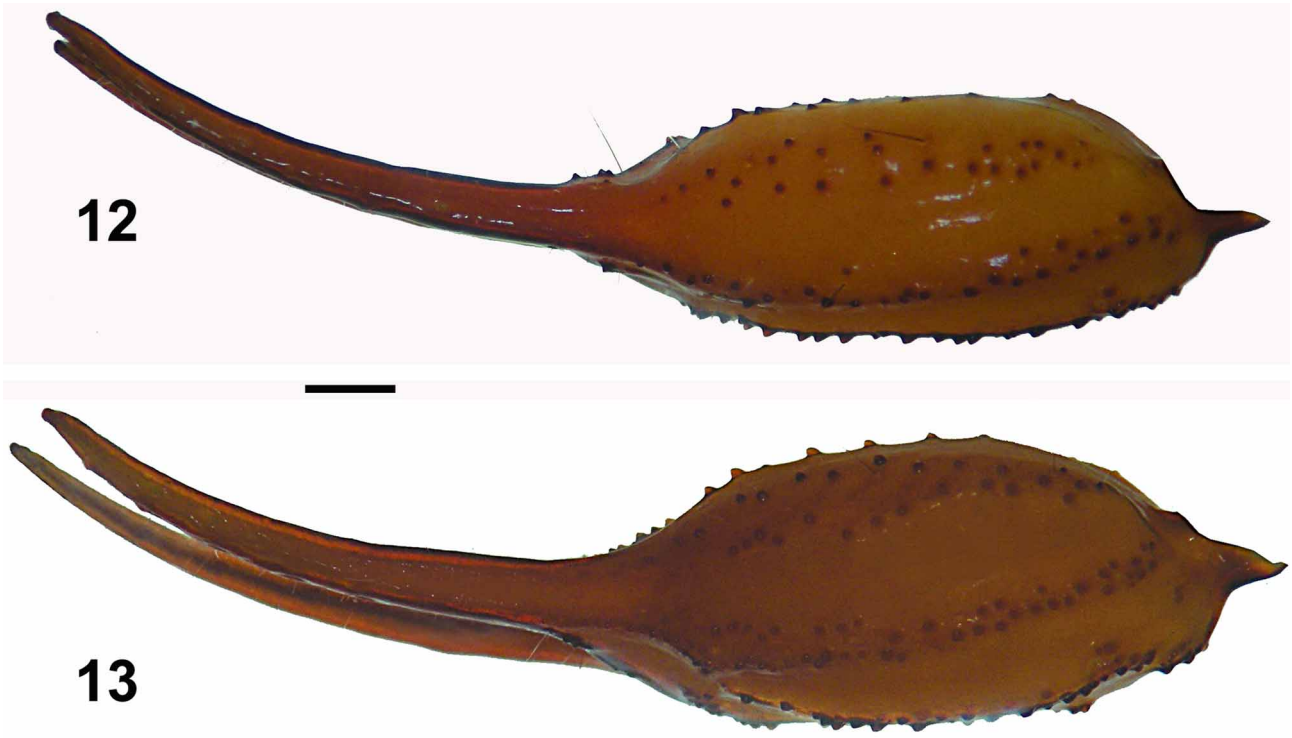
dorsal margin with five teeth; ventral margin distinctly ridged, with distal tooth twice as long as dorsal counterpart. Both fingers densely covered with long, white hairs ventrally.

Pedipalp femur: Strongly compressed dorsoventrally, about 3–4 times wider than deep; with five distinct, granular carinae (prodorsal, proventral, retrodorsal, retromedian and retroventral), and with three trichobothria (Fig. 7). Dorsal face with few scattered granules; ventral face with very few granules basally.

Pedipalp patella: Subquadrangular in cross-section, slightly wider than deep. Four distinct, granular carinae: prodorsal, proventral, retrodorsal and retroventral. Anterior face smooth, lustrous. Dorsal face with three trichobothria, each surrounded by scattered granules (Fig. 8). Posterior face with 19–20 trichobothria (Figs. 9, 10), each surrounded by granules. Ventral face with sparse scattered granules; with three trichobothria along posterior margin.

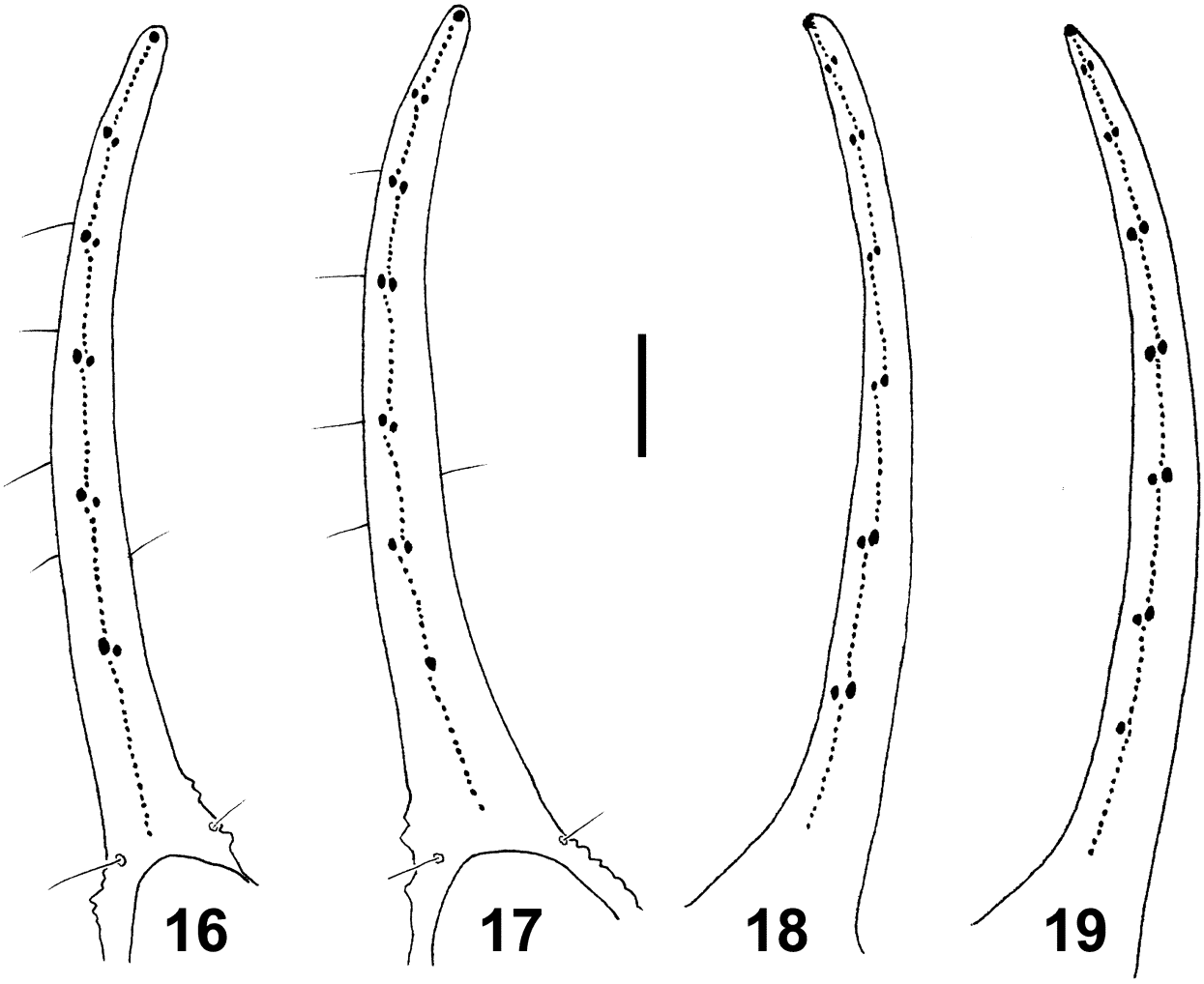


FIGURES 9–11. Trichobothrial pattern on external aspect of pedipalp patella. 9. Holotype female of *Alacran chamuco*, **sp. nov.,** left patella with 21 external trichobothria; trichobothrium not present on the right patella is highlighted in black; relative positions of the 3 ventral trichobothria also indicated. 10. Holotype female of *Alacran chamuco*, **sp. nov.,** right patella with 20 external trichobothria. 11. Composite illustration, prepared directly from the camera lucida (by drawing one pattern directly over the other), showing the trichobothrial patterns on external aspect of the pedipalp patella of the holotype female of *Alacran chamuco* **sp. nov.** (circles), and an adult female *Alacran tartarus* Francke (crosses) (scale = 1mm).



FIGURES 12–13. Dorsal view of left pedipalp chela. 12. Holotype female of *Alacran chamuco*, **sp. nov.** 13. Adult female *Alacran tartarus* Francke.

FIGURES 14–15. External view of left pedipalp chela. 14. Holotype female of *Alacran chamuco*, **sp. nov.** 15. Adult female *Alacran tartarus* Francke (scale = 1mm).



FIGURES 16–19. Dentition on pedipalp chela fingers. 16, 18. Holotype female of *Alacran chamuco*, **sp. nov.** 17, 19. Adult female *Alacran tartarus* Francke. 16, 17. Fixed finger. 18, 19. Movable finger (scale = 1mm).

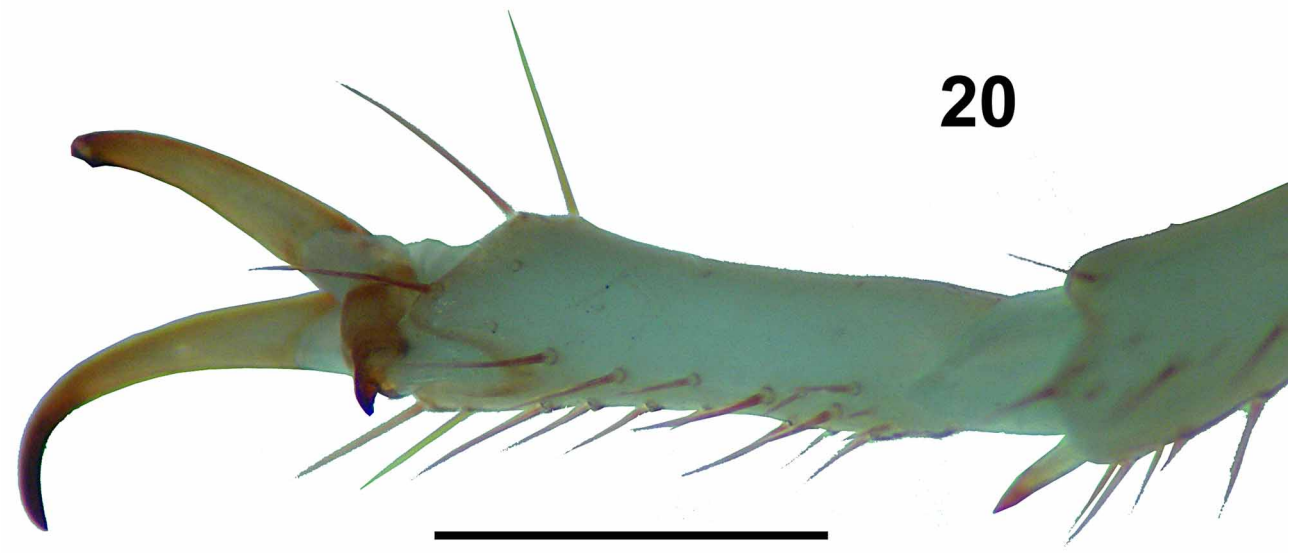


FIGURE 20. Telotarsus III of holotype female of *Alacran chamuco*, **sp. nov.** (scale = 1mm).

Pedipalp chela: Digital carina with fairly distinct, single row of medium-sized granules. Dorsal secondary carina with somewhat scattered medium-sized granules. Dorsal marginal carina with widely scattered medium-sized granules. Retrolateral secondary carina present only on basal one-half, with somewhat scattered medium-sized granules. Proventral and retroventral carinae with somewhat scattered, medium-sized granules. Prodorsal and proventral carinae weak, with few scattered granules (Figs. 12, 14). Trichobothrial pattern as in *A. tartarus*. Fixed finger with six distinct rows of granules, with five outer and five inner denticles (Fig. 16). Movable finger with seven rows of granules, with six outer and six inner denticles (Fig. 18).

Legs. Long and slender (selected measurements in Table 1). Tibial spurs absent. Prolateral pedal spurs present on all legs. Retrolateral pedal spurs absent. Telotarsus without ventromedian spinules (Fig. 20); ungues long and curved.

Comparisons. *A. chamuco* differs from *A. tartarus*, the only other known species in the genus, as follows: (1) on *A. tartarus* the fixed finger of the pedipalps has seven rows of granules (Fig.17) instead of six (Fig. 16) clearly separated by six outer denticles instead of five; (2) the movable finger has seven inner denticles (Fig. 19) instead of six (Fig. 18); (3) the telson is considerably larger (Table 2; Figs. 5, 6); (4) the carinae on metasomal segment V are more finely granulose (Figs. 5, 6); (5) the pedipalp chela is rounder and the carinae are more granulose (Figs. 12–15).

Although both species posses enlarged vesicles, a phenomenon known in several other troglobitic scorpions (Volschenk & Prendini, 2008), in the new species it is not as large as in *A. tartarus* (Table 2). Considering the five adult females of *A. tartarus* (mean and standard deviation) and comparing them against the single *A. chamuco* available we find statistically highly significant differences between them: (a) for the ratio telson L/carapace L C = (1.25–1.08)/0.0122=13.93 ($p<0.001$); (b) for the ratio telson W/carapace L C = (0.584–0.47)/0.0261=4.37 ($p<0.001$); and (c) for the ratio telson D/carapace L C = (0.566–0.43)/0.0305=4.46 ($p<0.001$).

Biogeographical considerations. The caves in which the two species of *Alacran* have been found are only about 75 km apart on a straight line (Fig. 1). However, those on the Huautla Plateau are located at about 2000 m in elevation, whereas Te Cimutaa is at 944 m. Furthermore two deep canyons separate the Mazateca and the Chinateca regions: in a straight-line intersect from Huautla to Valle Nacional the contour first climbs to about 2300m; then, the canyon of the Rio Santo Domingo has an elevation of approximately 300 m; the contour raises again to 1500 m in elevation before dropping once more, at the Rio Perfume, down to 100 m in elevation; finally, is the climb to Te Cimutaa (topographical contour lines shown in Fig. 1). The probability that the two cave systems are interconnected beneath the Sierra Madre is infinitesimal.

Acknowledgments

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