

Botero-Trujillo, Ricardo, and Oscar F. Francke. 2009. A new species of troglomorphic leaf litter scorpion from Colombia belonging to the genus *Troglotayosicus* (Scorpiones: Troglotayosicidae) [Nueva especie de escorpión troglomórfico de hojarasca de Colombia perteneciente al género *Troglotayosicus* (Scorpiones: Troglotayosicidae)]. Texas Memorial Museum Speleological Monographs, 7. Studies on the cave and endogean fauna of North America, V. Pp. 1-10.

A NEW SPECIES OF TROGLOMORPHIC LEAF LITTER SCORPION FROM COLOMBIA BELONGING TO THE GENUS *TROGLOTAYOSICUS* (SCORPIONES: TROGLOTAYOSICIDAE)

Ricardo Botero-Trujillo

Laboratorio de Entomología, Unidad de Ecología y Sistemática,
Departamento de Biología,
Pontificia Universidad Javeriana,
Bogotá, Colombia.
Email: pachyurus@yahoo.com

and

Oscar F. Francke

Colección Nacional de Arácnidos,
Departamento de Zoología,
Instituto de Biología,
Universidad Nacional Autónoma de México,
Apartado Postal 70-153,
México D. F. 04510, México.
Email: offb@ibiologia.unam.mx

ABSTRACT

Troglotayosicus humiculum, n. sp., is described from a specimen collected by Winkler trap in La Planada Natural Reserve, Nariño Department, southwestern Colombia. With this description, both the number of described species and known specimens in the genus is raised to two. The new species was collected from leaf litter, rather than inside a cave as was the only other known species, *Troglotayosicus vachoni* Lourenço, 1981; and differs from it particularly in the arrangement of the ventral setae of the telotarsi and the metasomal carination. This finding represents the first record of the family and genus from Colombia, and it is the first troglomorphic leaf litter scorpion reported from South America.

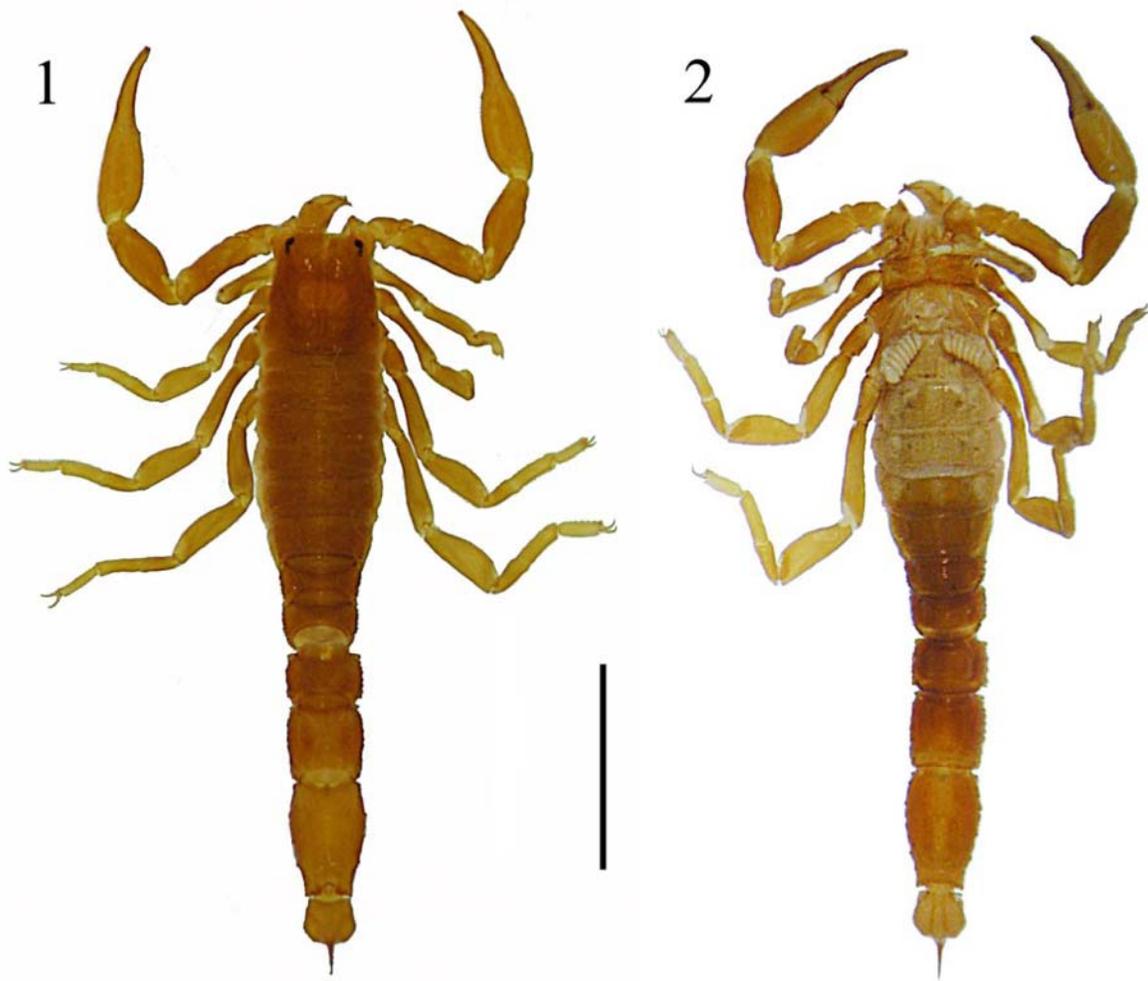
RESUMEN

Se describe *Troglotayosicus humiculum*, n. sp., con base a un ejemplar colectado con trampa Winkler en la Reserva Natural La Planada, Departamento de Nariño, Colombia suroccidental. Con esta descripción, el número de especies descritas y ejemplares conocidos en el género se incrementa a dos. La nueva especie habita en hojarasca, en lugar de una cueva como la única otra especie conocida, *Troglotayosicus vachoni* Lourenço, 1981; y difiere de esta particularmente en la disposición de sedas ventrales de los telotarsos y la carinación del metasoma. Este hallazgo representa el primer registro de esta familia y género de escorpiones para Colombia, y es el primer escorpión troglomórfico de hojarasca conocido de Suramérica.

INTRODUCTION

Recording scorpions from caves is a relatively frequent phenomenon, but troglobite scorpions are very rarely found. Troglobites are not the only ones exhibiting troglomorphies such as the loss or reduction of eyes, depigmentation, and appendage attenuation, since there are troglomorphs that occur outside caves, i.e., among leaf litter in montane forests. There are four known non-cavernicolous scorpion species with pronounced troglomorphies, *Belisarius xambeui* Simon, 1879 from the Pyrenees of France and Spain; *Typhlochactas mitchelli* Sissom, 1988 and *Typhlochactas sylvestris* Mitchell and Peck, 1977 from the Mexican State of Oaxaca; and *Typhlochactas sissomi* Francke, Vignoli and Prendini (in press) from the State of Querétaro, also in Mexico (Mitchell and Peck, 1977; Sissom, 1988; Volschenk and Prendini, 2008; Francke, et al., in press; Vignoli and Prendini, in press).

The concepts of cavernicolous, troglobitic and troglomorphic scorpions were recently revised and discussed by Volschenk and Prendini (2008), according to whom there are 21 unequivocally recognizable troglobitic scorpions. Two troglobitic scorpion genera, each with a single species, have been described from South America: *Trogloorhopalurus* Lourenço, Baptista and Giupponi, 2004 from Brazil; and *Troglotayosicus* Lourenço, 1981 from Ecuador (Lourenço, 1981; Lourenço, et al., 2004). The latter genus has been the subject of different opinions regarding its phylogenetic placement, having been repeatedly transferred among the families Chactidae Pocock, 1893, Superstitioniidae Stahnke, 1940 and Troglotayosicidae Lourenço, 1998 (Lourenço, 1981, 1998; Lourenço and Francke, 1985; Stockwell, 1989; Sissom, 1990; Fet and Sissom, 2000; Soleglad and Fet, 2003; Coddington, et al., 2004; Fet and Soleglad, 2005; Prendini and Wheeler, 2005; Volschenk and Prendini, 2008). Indeed, it was recently



Figs. 1–2.—Holotype of *Troglotayosicus humiculum*, n. sp. 1. Dorsal view. 2. Ventral view. Scale bar = 3 mm.

suggested that it should be considered *incertae sedis* (Lourenço, 2006). The classification followed in the present paper is that accepted by Prendini and Wheeler (2005).

Troglotayosicus was created by Lourenço (1981) for the species *Troglotayosicus vachoni* Lourenço, 1981, known from a single female collected in the cave of Los Tayos, Ecuador. This genus has remained monotypic and no other specimens have been found, thus being a remarkably rare and poorly known genus. Even though *Troglotayosicus* may have been thought to have evolved after long-time isolation in that cave, a specimen recently found from leaf litter in Colombia is clearly recognized as a member of this genus. The specimen was found through the examination of several arthropod samples obtained from a permanent plot in La Planada Natural Reserve, southwestern Colombia (Map 1). The specimen, unequivocally a new species, is described herein.

METHODS

The specimen is currently preserved in 70% ethanol, and the internal organs are quite dehydrated (rendering dissections inappropriate). Terminology follows Stahnke (1970), except for metasomal carinae after Francke (1977) and trichobothrial terminology after Vachon (1973). Measurements were obtained following

the methodology of Sissom, et al. (1990) with an ocular micrometer calibrated at 30X with a Nikon SMZ 800 stereomicroscope. Illustrations were prepared with the aid of a camera lucida with the same stereomicroscope. The distribution map was produced with the program ArcView GIS version 3.2. [Environmental Systems Research Institute (ESRI), Redlands, California].

TAXONOMY

Family Troglotayosicidae Lourenço, 1998

Genus *Troglotayosicus* Lourenço, 1981

Troglotayosicus humiculum, new species

Map 1; Figs. 1–24; Table 1

Type data.—Holotype male from La Planada Natural Reserve, permanent plot at 01°15'N 78°15'W, 1885 m elevation, Nariño Department, Colombia, Winkler trap, 16–20 May 2000, col. G. Oliva. Deposited in the Instituto de Investigación de Recursos Biológicos Alexander Von Humboldt, Villa de Leyva, Colombia (IAvH-E 100809). No additional specimens are known.

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

Diagnosis.—*Troglotayosicus humiculum*, n. sp., differs from the only other species described in the genus, *T. vachoni*, by the following: i) the setae on the telotarsus



Map 1.—Known distribution of the genus *Troglotayosicus*.

of all legs are arranged in two longitudinal rows (Fig. 24); ii) the anterior margin of the carapace is very slightly convex (Fig. 3); iii) lateral ocular areas have three ocelli each (Fig. 3); and iv) metasomal segments I–IV have six carinae with ventral submedian and ventral lateral carinae completely absent (Figs. 7–9). In contrast, in *T. vachoni* the setae on the telotarsi are not arranged in rows (see Lourenço, 1981: fig. 43), the anterior margin of the carapace is markedly convex (see Lourenço, 1981: figs. 37, 40), lateral ocular areas have two ocelli each (see Lourenço, 1981: fig. 40), and metasomal segments I–IV have eight carinae with only the ventral submedian carinae absent (Lourenço, 1981) (see “Remarks” for further comments on the metasomal carination of *T. vachoni*).

Description of the holotype.—*Color*: Entire body and appendages yellow to orange and immaculate. Carapace orange with an ovoid yellowish median region and each lateral ocellus (except for the tiny medio-external one) surrounded by black pigment. Tergites orange throughout. Coxosternal region predominantly orange with some diffuse yellowish areas; sternum predominantly yellow. Genital operculum, pectinal basal piece, pectines and sternites III–V completely yellow; sternites VI and VII orange medially and entirely, respectively. Metasomal segments orange; segment V lighter than the preceding; telson vesicle yellowish. Chelicerae yellow, teeth orange. Pedipalps uniformly orange throughout. Legs yellowish, each turning lighter distally.

Carapace. Smooth, with a shallow median longitudinal furrow; other furrows and carinae absent; anterior margin with three pairs of setae; anterior and posterior margins very slightly convex; lateral margins not parallel (carapace narrowing anteriorly); median eyes completely absent; lateral ocular tubercles each with three ocelli, anteriormost greater in size, the posterior of medium size, and the medio-external very small (Fig. 3).

Tergites. With very few small setae; I–VI completely smooth and acarinate; VII also without any vestige of median or submedian carinae but with two/three conspicuous granules located posteriorly on the position of the lateral carinae.

Coxosternal region. Smooth and with very few small setae; sternum subpentagonal, almost flat with very shallow median depression posteriorly, wider than long and with posterior margin concave (Fig. 4).

Genital operculum and pectines. Genital operculum divided longitudinally, formed by small subtriangular plates; pectinal basal piece wider than long, notched anteriorly, posterior margin slightly convex (Fig. 4). Pectines as long as coxae IV, with few setae, devoid of fulcra; with 7 thick teeth each, of which the distal one is markedly rounded; marginal lamellae symmetrical, with 3:3 pieces; middle lamellae asymmetrical, with 1:2

(right:left) pieces (Fig. 4).

Sternites. Smooth and shiny; with few setae especially on the posterior and lateral margins; without any vestige of submedian or lateral carinae; spiracles small and rounded (Fig. 4); sternite V posterior margin with a broad white inverted V-shaped patch.

Metasoma. With few setae; segments I–IV with complete dorsal lateral and lateral supramedian carinae formed by conspicuous aligned granules; lateral inframedian carinae only present posteriorly, represented by two to four granules; ventral lateral and ventral submedian carinae completely absent (Figs. 7–9); dorsal lateral carinae elevated and converging distally (Fig. 7); lateral supramedian carinae parallel to the longitudinal axis of the metasoma (Fig. 8); lateral inframedian cari-

Table 1.—Meristic data for *Troglotayosicus humiculum*, n. sp., holotype male. Measurements in millimeters. ¹Sum of prosoma, mesosoma and metasoma. ²Sum of tergites I–VII. ³Sum of metasomal segments I–V and telson. ⁴Sum of femur, patella and chela. ⁵Measured from the commissure of the junction with the movable finger to the finger tip.

Body: ¹	total length:	1.90
Carapace:	length:	1.83
	anterior width:	1.00
	posterior width:	1.77
Mesosoma:	total length: ²	3.20
Metasoma:	total length: ³	6.97
Metasomal segment I:	length:	0.67
	width:	1.27
	depth:	1.00
Metasomal segment II:	length:	0.70
	width:	1.17
	depth:	0.97
Metasomal segment III:	length:	0.80
	width:	1.17
	depth:	0.97
Metasomal segment IV:	length:	1.13
	width:	1.17
	depth:	1.00
Metasomal segment V:	length:	1.90
	width:	1.17
	depth:	0.93
Telson:	length:	1.77
	vesicle width:	0.83
	vesicle depth:	0.60
Pedipalp:	total length: ⁴	5.90
Pedipalp femur:	length:	1.40
	width:	0.47
	depth:	0.54
Pedipalp patella:	length:	1.77
	width:	0.57
	depth:	0.57
Pedipalp chela:	length:	2.73
	width:	0.63
	depth:	0.73
Pectines:	fixed finger length: ⁵	1.20
	movable finger length:	1.50
	palm length:	1.33
	teeth count (left/right):	7/7

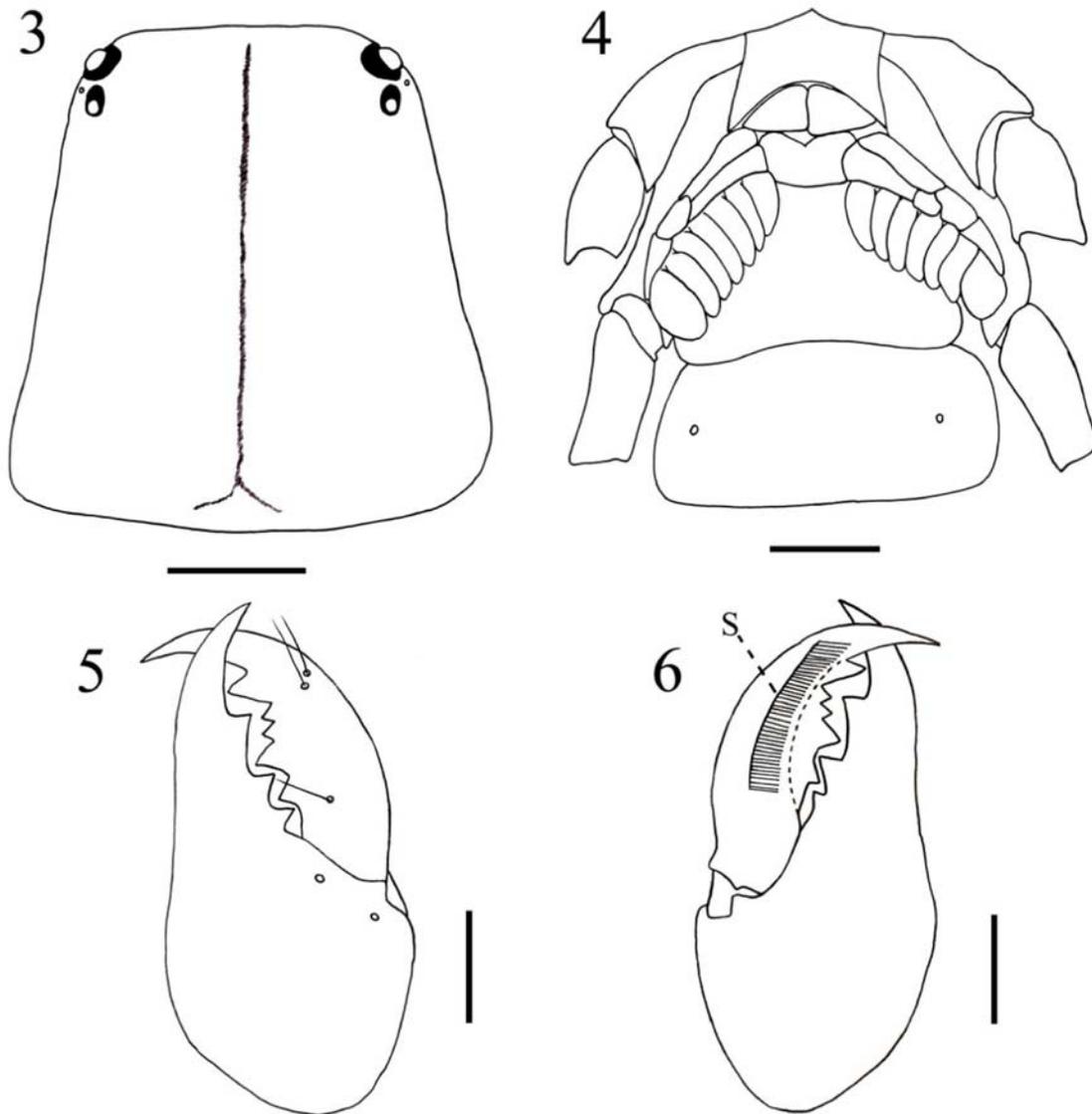
nae obliquely inclined (Fig. 8); intercarinal spaces of segments I–IV smooth; segment V with only the dorsal lateral carinae present, complete and granulose, with strong granules on the ventral surface and a deep dorsal depression (Figs. 7–9). Telson smooth dorsally (Fig. 10); vesicle sparsely granular with two longitudinal ventral submedian smooth areas (Figs. 11–12); subaculear tubercle completely absent; aculeus short, slightly curved, thick basally, and lacking laterobasal aculear serrations (Figs. 10–12).

Chelicerae. With long transparent setae on the internal and ventral surfaces. Movable finger dorsally with one basal tooth, one sub-basal pronounced, two subdistal small, and one distal tooth (Fig. 5); ventrally without

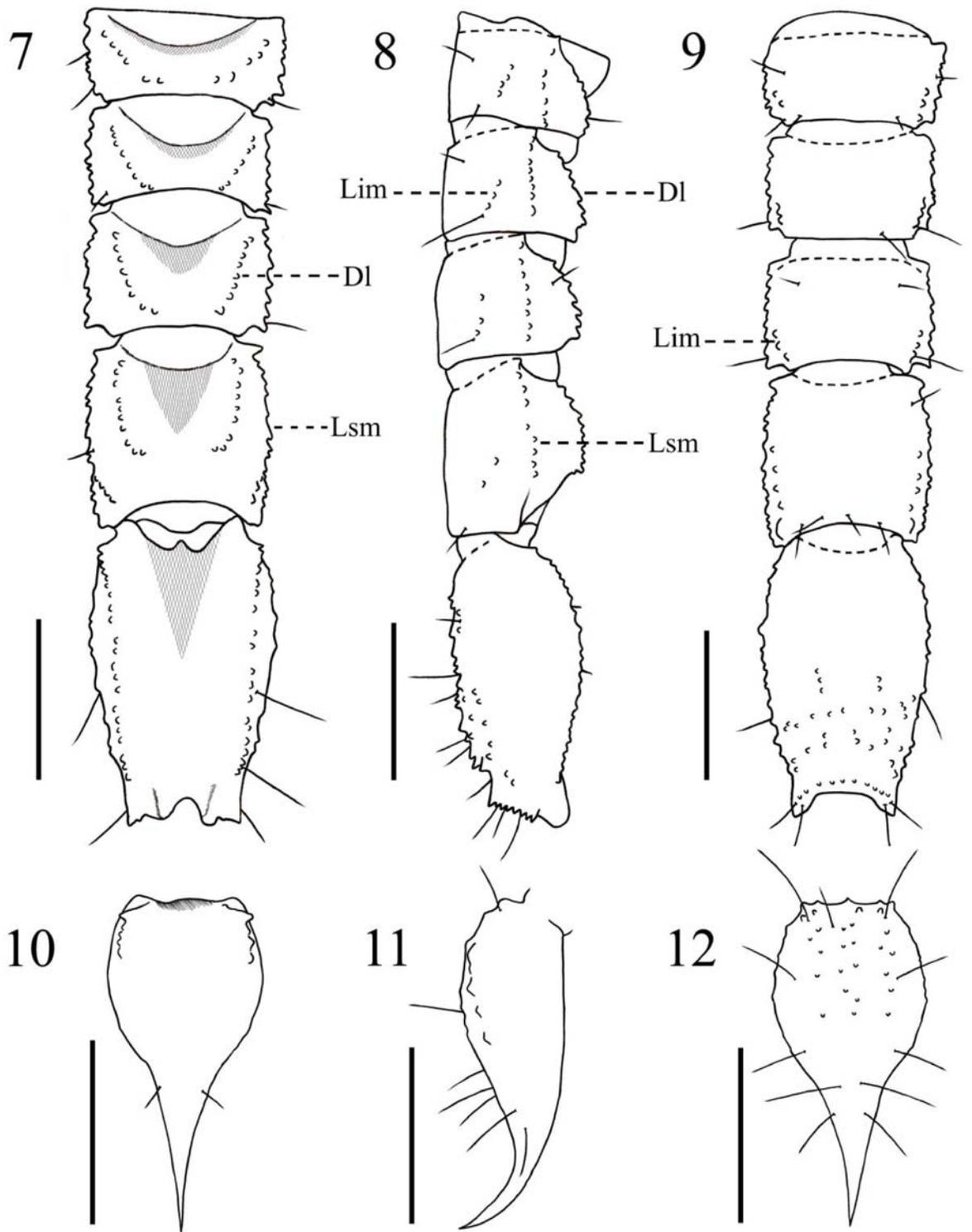
teeth and with well developed serrula (Fig. 6). Fixed finger dorsally with one basal and one median tooth not forming a bicuspid, one subdistal, and one distal tooth (Fig. 5); ventrally without teeth.

Pedipalps. Femur with few setae, smooth, and without clearly defined carinae (Fig. 17); patella with few setae, acarinate (Figs. 18–20), and with very few and inconspicuous granules internally; chela acarinate, with abundant setae on the fingers (Figs. 13–16); both movable and fixed fingers of both pedipalps with a well developed terminal hook and 7/6 very slightly imbricate rows of granules, respectively (Figs. 13–16, 21, 22).

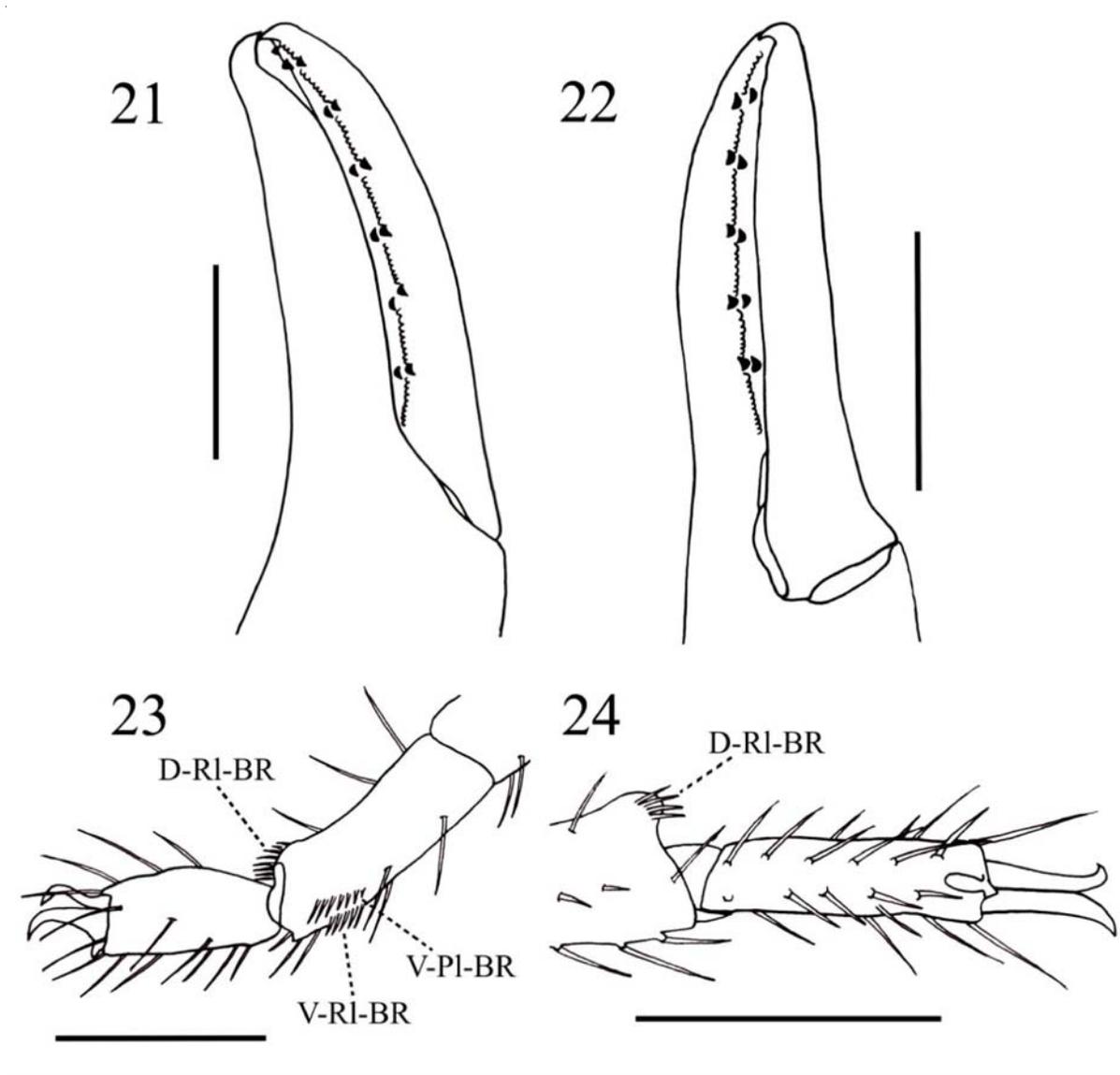
Trichobothria. Orthobothriotaxic C pattern



Figs. 3–6.—Holotype of *Troglotayosicus humiculum*, n. sp. 3. Carapace. 4. Sternum, pectinal basal piece, pectines and sternites III–IV. 5. Right chelicera, dorsal view. 6. Right chelicera, ventral view. S = Serrula. Scale bars = 0.5 mm (Figs. 3–4); 0.25 mm (Figs. 5–6).



Figs. 7–12.—Holotype of *Troglotayosicus humiculum*, n. sp. 7–9. Metasomal segments I–V. 7. Dorsal view. 8. Lateral view. 9. Ventral view. 10–12. Telson. 10. Dorsal view. 11. Lateral view. 12. Ventral view. Dl = Dorsolateral carina; Lsm = Lateral supramedian carina; Lim = Lateral inframedian carina. Scale bars = 1 mm.



Figs. 21–24.—Holotype of *Troglotayosicus humiculum*, n. sp. 21. Granulation on the internal surface of movable finger. 22. Idem for fixed finger. 23. Basitarsus and telotarsus of right leg II, prolateral view. 24. Basitarsus and telotarsus of right leg III, ventral view. D-Rl-BR = Dorsal Retrolateral Brush; V-Pl-BR = Ventral Prolateral Brush; V-Rl-BR = Ventral Retrolateral Brush. Scale bars = 0.5 mm

(Vachon, 1973) (Figs. 13–20). Total number of trichobothria per pedipalp, 48: Femur with 3 (1 *d*, 1 *i*, 1 *e*), patella with 19 (2 *d*, 1 *i*, 13 *e*, 3 *v*) of which *esb*₂ and *et*₂ are petite (Fig. 19), chela with 26 (2 *D*, 10 *E*, 4 *V*, 4 *d*, 4 *e*, 2 *i*) of which *Esb*, *Et*₄, *Db* and *Dt* are petite (Figs. 13, 14).

Legs. Basitarsi I–IV with a dorsal brush of spinules located distally on the retrolateral surface (Figs. 23, 24), vestigial in leg IV; basitarsi I–III with a second brush located ventro-subdistally on the prolateral surface (Fig. 23), which is absent on leg IV; basitarsi I and II with a third brush located ventro-subdistally on the retrolateral surface (Fig. 23), which is absent on legs III and IV. Legs I–IV with prolateral pedal spur present; tibial spur and retrolateral pedal spur absent in all the legs; tibiae, basitarsi and telotarsi with abundant setae (Figs. 23, 24). Telotarsi with ventral setae arranged in two longitudinal rows (Fig. 24), one prolateral and one retrolateral, with apparent number of setae as follows (some setae appear to have fallen off): prolateral row made up of 6 setae on legs I and II, 7 setae on legs III and IV; retrolateral row apparently made up of 5 setae on legs I and II, 6 setae on legs III and IV.

Etymology.—Latinized adjective referring to the habitat of the species, leaf litter.

Ecology and sympatric species.—The holotype of *T. humiculum*, n. sp., was extracted from leaf litter using Winkler trap, suggesting that this species is a leaf litter dweller. The new species was found in sympatry with the buthids *Tityus cuellari* Lourenço, 1994, and *Ananteris dorae* Botero-Trujillo, 2008. Curiously, all these three species share La Planada Natural Reserve as the type locality (Lourenço, 1994; Botero-Trujillo, 2008) and have not been recorded elsewhere, suggesting that this area may be a center of scorpion endemism.

Collection locality.—La Planada is a private natural reserve located in the municipality of Ricaurte, western slope of the Andes in southwestern Colombia (Map 1). It contains 3200 ha of Humid Premontane Forest according to the classification of Holdridge (1987), that cover an altitudinal range of 1300 to 2100 m. La Planada is enclaved into one of the most diverse ecoregions, the Northwestern Andean Montane Forests. Ecosystems of this ecoregion exhibit a diverse array of distinctive communities with unusual high levels of species endemism, due to Andean topography and pronounced glacial period of isolation (National Geographic Society, 2001). Inside the reserve lies the 25 ha La Planada Permanent Plot, where the holotype of *T. humiculum*, n. sp., was collected.

Remarks.—While this paper was being revised, L. Prendini (pers. comm.) made us aware of a discrepancy in Lourenço's (1981) description of the holotype and only known specimen of *T. vachoni*: in the description

of the metasoma Lourenço (1981: 654) stated that the “carénes... latéro-dorsales” (= lateral supramedian carinae) are incomplete, the “intermediaires” (= lateral inframedian carinae) are complete, and the “latéro-ventrales” (=ventrolateral carinae) are incomplete. However, judging from his figure 37 it is likely that that author may have mistakenly switched “latéro-dorsales” and “intermediaires” in the text of the description, since this figure shows the lateral supramedian carinae complete, at least on segments III and IV. According to L. Prendini (pers. comm.) it is doubtful that the lateral inframedian carinae would be complete and the lateral supramedian incomplete. Under these considerations, there is room for the possibility that the metasomal segments I–IV of the holotype of *T. vachoni* actually have the dorsolateral and lateral supramedian carinae complete, and the lateral inframedian and ventrolateral keels incomplete.

ACKNOWLEDGMENTS

We are most grateful to the personnel (directors, researchers and assistants) of the Instituto de Investigación de Recursos Biológicos Alexander Von Humboldt (Villa de Leyva, Colombia) for the loan of the holotype. Special thanks are due to Dr. Lorenzo Prendini (American Museum of Natural History, New York, U.S.A.) and Dr. W. David Sissom (West Texas A&M University, Canyon, Texas, U.S.A.) for reviewing the manuscript and making valuable comments that led to its improvement. Finally, thanks are due to Giovanni Fagua (Pontificia Universidad Javeriana, Bogotá, Colombia) for the loan of some laboratory equipment and material.

LITERATURE CITED

- Botero-Trujillo, R. (2008). The scorpion genus *Ananteris* in Colombia: comments on the taxonomy and description of two new species. *Journal of Arachnology*, 36(2):287-299.
- Coddington, J. A., G. Giribet, M. S. Harvey, L. Prendini, and D. E. Walter. 2004. Arachnida. Pp. 296-318 in: J. Cracraft and M. Donoghue, eds. *Assembling the Tree of Life*. Oxford University Press.
- Fet, V., and W.D. Sissom. 2000. Family Troglotayosicidae Lourenço, 1998. Pp. 501-502 in: V. Fet, W. D. Sissom, G. Lowe, and M. E. Braunwalder, eds. *Catalog of the Scorpions of the World (1758–1998)*. The New York Entomological Society, New York.
- Fet, V., and M. E. Sologlad. 2005. Contributions to scorpion systematics. I. On recent changes in high-level taxonomy. *Euscorpius*, 31:1–13.
- Francke, O. F. 1977. Scorpions of the genus *Diplocentrus* from Oaxaca, México. *Journal of Arachnology*, 4:145–200.
- Francke, O. F., V. Vignoli, and L. Prendini. (in press). A new species of *Typhlochaetas* (Scorpiones, Typhlochactinae) from eastern Mexico. *American Museum Novitates*.
- Holdridge, L. R. 1987. *Ecología basada en zonas de vida*. Instituto Interamericano de Cooperación para la Agricultura, San José, Costa Rica, 215 pp.

- Lourenço, W. R. 1981. Scorpions cavernicoles de l'Équateur: *Tityus demangei* n.sp. et *Ananteris ashmolei* n.sp. (Buthidae); *Troglotayosicus vachoni* n. gen., n.sp. (Chactidae), scorpion troglobie. Bulletin du Muséum national d'Histoire naturelle, Paris (Zoologie, Biologie et Écologie Animale), 3 :635–662.
- Lourenço, W. R. 1994. Scorpions Chelicerata de Colombie. VI. Quatre nouvelles espèces de Buthidae des régions Amazonienne, Sud-Pacifique et de la Cordillère Orientale. Revista de la Academia Colombiana de Ciencias, 19(73):387–392.
- Lourenço, W. R. 1998. Panbiogéographie, les distributions disjointes et le concept de famille relictuelle chez les scorpions. Biogeographica, 74:133–144.
- Lourenço, W. R. 2006. Further considerations on the genus *Troglotayosicus* Lourenço, 1981 (Scorpiones: Troglotayosicidae or *Incertae sedis*). Boletín de la Sociedad Entomológica Aragonesa, 39:389–395.
- Lourenço, W. R., R. L. C. Baptista, and A. P. de L. Giupponi. 2004. Troglotic scorpions: a new genus and species from Brazil. Comptes Rendus Biologie, 327:1151–1156.
- Lourenço, W. R. and O. F. Francke. 1985. Revision des connaissances sur les scorpions cavernicoles (troglobies) (Arachnida, Scorpions). Memoires de Biospéléologie, 11 :3–7.
- Mitchell, R. W., and S. B. Peck. 1977. *Typhlochactas sylvestris*, a new eyeless scorpion from montane forest litter in Mexico (Scorpionida, Chactidae, Typhlochactinae). Journal of Arachnology, 5:159–168.
- National Geographic Society. (2001). Terrestrial ecoregions of the world. Online at <http://www.nationalgeographic.com/wildworld/terrestrial.html> (accessed 30 July 2008).
- Prendini, L., and W. C. Wheeler. 2005. Scorpion higher phylogeny and classification, taxonomic anarchy, and standards for peer review in online publishing. Cladistics, 21:446–494.
- Sissom, W. D. 1988. *Typhlochactas mitchelli*, a new species of eyeless, montane forest litter scorpion from northeastern Oaxaca, Mexico (Chactidae, Superstitioninae, Typhlochactini). Journal of Arachnology, 16:365–371.
- Sissom, W. D. 1990. Systematics, biogeography, and paleontology. Pp. 64-160 in: G.A. Polis, ed., The Biology of Scorpions. Stanford University Press, Stanford, California.
- Sissom, W. D., G. A. Polis, and D. D. Watt. 1990. Field and laboratory methods. Pp. 445-461 in: G. A. Polis, ed., The biology of scorpions. Stanford University Press, Stanford, California.
- Soleglad, M. E., and V. Fet. 2003. High-level systematics and phylogeny of the extant scorpions (Scorpiones: Orthosterni). Euscorpius, 11:1–175.
- Stahnke, H. L. 1970. Scorpion nomenclature and mensuration. Entomological News, 81:297–316.
- Stockwell, S. A. 1989. Revision of the phylogeny and higher classification of Scorpiones (Chelicerata). Ph. D. Dissertation, University of California, Berkeley, California, 413 pp.
- Vachon, M. 1973 [1974]. Étude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriax et types de trichobothriotaxie chez les Scorpions. Bulletin du Muséum national d'Histoire naturelle, Paris (3) 104:857–958.
- Vignoli, V., and L. Prendini. (in press). Systematic revision of the troglomorphic scorpion subfamily Typhlochactinae (Chactioidea: Superstitioniidae). American Museum Novitates.