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A NEW *TARSOPOROSUS* FRANCKE, 1978 ESPECIES (SCORPIONES: DIPLOCENTRIDAE) FROM THE SOUTH OF CÓRDOBA DEPARTMENT IN THE COLOMBIAN CARIBBEAN REGION

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Abstract: We describe the novel species *Tarsoporosus tizopedrosoi* **sp. n.**, based on two individuals collected from a humid forest in southern Córdoba, in the Colombian Caribbean region. This new species is distinguished by its smooth, shiny surface without granules, pectinal tooth counts, telotarsi spiniform macrosetae formula, and measurements of its morphological structures. A distribution map, ecological comments, and a taxonomic key are provided.
Key words: Scorpiones, Diplocentridae, taxonomy, zoogeography, humid forest, Colombia, Tierralta.

Una especie nueva de *Tarsoporosu*s Francke, 1978 (Scorpiones: Diplocentridae) del sur del departamento de Córdoba, en el Caribe colombiano
Resumen: Describimos la nueva especie *Tarsoporosus tizopedrosoi* **sp. n.**, a partir de dos individuos colectados en un bosque húmedo del sur de Córdoba, en el Caribe colombiano. Esta nueva especie se distingue por su superficie lisa, brillante y sin gránulos, conteo de dientes pectinales, fórmula de macrosetas espiniformes de los telotarsos y medidas de sus estructuras morfológicas. Se aportan un mapa de distribución, comentarios ecológicos y clave taxonómica.
Palabras clave: Scorpiones, Diplocentridae, taxonomía, zoogeografía, bosque húmedo, Colombia, Tierralta.

Taxonomy / Taxonomía: *Tarsoporosus tizopedrosoi* **sp. n.**

Introduction

Tarsoporosus Francke, 1978 is a Neotropical genus of scorpions recorded only in Colombia and Venezuela in the South American continent (Teruel & Roncallo, 2007). Initially, this genus only contained the species *Tarsoporosus kugleri* (Schenkel, 1932), based on specimens from Venezuela (Francke 1978). In Venezuela, González-Sponga (1984), classified *T. kugleri* under the genus *Diplocentrus* Peters, 1861 and described two new *Diplocentrus* species without recognizing the genus *Tarsoporosus* as valid. Later, these three species were transferred to the *Tarsoporosus* genus (Sissom & Fet, 2000; Rojas-Runjaic & Sousa, 2007). In Colombia, *Tarsoporosus* populations were recorded in the Chocó subregion, and another species, *T. anchicaya,* Lourenço & Flórez, 1990 was also described (Lourenço & Flórez 1990, 1995). The number of described *Tarsoporosus* species increased to five, with two species found in Colombia (*T. macuira* Teruel & Roncallo, 2007). Phylogenetic analysis by Santibáñez-López *et al*. (2017) suggested that *Tarsoporosus* was not a valid genus; however, future diplocentrid revisions are needed to support this hypothesis.

Five families, 19 genera, and approximately 91 species currently represent the scorpion fauna of Colombia (Flórez, 2001; Teruel & Roncallo, 2007; Gomez *et al*., 2013; Moreno-Gonzalez *et al*., 2019). However, the scorpion fauna in some Colombian regions has not been fully explored. For example, few scorpion records currently exist in the Córdoba Department (Lourenço & Flórez, 1990; Lourenço, 1997; Flórez, 2001; Teruel & Roncallo, 2010; Moreno-Gonzalez *et al*., 2019; Bedoya-Roqueme & Quirós-Rodríguez, 2020). Recently, Bedoya-Roqueme & Quirós-Rodríguez (2020) created a checklist for the Córdoba Department and recorded five species of scorpions. However, these data are underestimations when the different subregions and ecosystems present in this Department are considered and because new scorpion species have been recently described from Colombia (e.g., Ythier, 2019; Moreno-Gonzalez *et al*., 2019).

A population of *Tarsoporosus* was recorded during recent fieldwork in the tropical humid forest areas in the Department of Córdoba. Here, we describe *Tarsoporosus tizopedrosoi* n. sp. This species corresponds to the second species in the Colombian Caribbean region and the third species registered in Columbia. Ecological comments on the new species and a taxonomic key to the species from the genus *Tarsoporosus* are also presented.

Materials and Methods

Scorpions were collected via free search without restriction using ultraviolet (UV) light and sifting leaves in a Winkler sieve with a diameter of 16 mm. The leaf material was then reviewed in white plastic trays using entomological clamps. The specimens were preserved in 70% alcohol. Finally, the collected specimens were deposited at the Entomology Laboratory of the University of Córdoba (LEUC).
The scorpion specimens were identified following the proposed keys by González-Sponga (1984; 1996); Lourenço & Flórez (1990) and Teruel & Roncallo (2007). The specimens were studied using a Carl Zeiss Axiostar Plus microscope. Multiple multifocal images under visible light at different focal lengths were taken at the Microscopy Laboratory of the

University of Córdoba, Colombia, with an HD digital camera attached to a Carl Zeiss Axiostar stereomicroscope. These were then fused by the AxioVision image stacking software (Rel.4.9.1. SE64 SP3).

Measurements were performed using a micrometer attached to a Carl Zeiss Axiostar stereomicroscope (Rel.4.9.1. SE64 SP3). Trichobothrial notations and morphological terminology primarily followed that of Vachon (1952, 1974), San Martín (1963), Francke (1977), Santibáñez-López *et al*. (2013), and Santibáñez-López *et al*. (2017).

Results

Family Diplocentridae Karsch, 1880

Genus ***Tarsoporosus*** Francke, 1978

***Tarsoporosus tizopedrosoi* sp. n.**
Figs. 1-7, Table I

Material examined. Holotype: ♂, Colombia, Córdoba, Tierralta: Finca Tuti Fruti 8°2'2.88"N 76°5'29.99"W, 175m asl, 3-XII-2014, humid forest (deposited in LEUC; Esc-007). Paratype: 1♂, Colombia, Córdoba, Tierralta: Finca Tuti Fruti 8°2'2.881" N; 76°5'29.993" W, [175m asl] 3-XII-2014, humid forest, A. Santos Morales; E. Bedoya-Roqueme leg (deposited in LEUC; Esc-007).

Diagnosis based on male holotype. Overall color uniform, blackish-brick red. Pedipalp chela with a smooth dorsal external surface. The tegument has the same basic sculpture of the carapace, without a well-defined carina, except for tergite VII of the mesosoma with incomplete median carinae, integument smooth to subgranulate, flanked by an inconspicuous depression. Tergite VII with a moderately bilobed latero-posterior region and two incomplete, more granular carinae integuments, metasomal segment I wider than long. Prosoma and tergites with granulation are less developed. Modal telotarsal spiniform macrosetae formulae 5/5: 5/5: 6/6: 7/7. Genital operculum rounded anterior margin, oval shape; genital papillae moderately developed and strongly exposed. Pectines, moderately setose, with 13/13 teeth; basal plate much wider than long; anterior margin notched; posterior margin moderately rounded; hemispermatophore Lamelliform, weakly sclerotized; total length 4.5 mm; distal lamella, length 2.4 mm; capsular region, width 1.7 mm; median lobe narrow, margin entire.

Description. (Adult male holotype, unknown female): Coloration in alcohol. Prosoma, tergites, pedipalps, and metasoma (segment V and telson darker) brick-red color with carinae outlined in the dark to blackish brick-red (Fig. 1A); Ocular tubercle blackish, pearly eyes, blackish brick-red pectines (Fig. 1A). Legs burnt orange, with clearer basitarsus and tarsus (Fig. 1B).

Prosoma. Longer than wide, anterior margin with several macrosetae in the frontal lobules, broad and rounded, front notch relatively wide but not deep (Fig. 2A). Tegument polished, with fine and external tegument smooth and scarcely granulose areas symmetrically interspersed (Fig. 2A). Medium eyes larger than lateral eyes and very close to each other, moderately elevated medium tubercle; three pairs of lateral eyes (Fig. 2A). Moderate median furrows on the posterior region.

Table I. Measurements (mm) of male holotype and paratype of *Tarsoporosus tizopedrosoi* **sp. n.**

Dimensions		♂ Holotype	♂ Paratype
Total length		51.3	46.8
Carapace	Length	5.2	4.7
	Anterior width	3.6	3.3
	Posterior width	5.7	5.2
Mesosoma	Length	21.1	19.2
Metasoma	Length /width		
	Segment I	2.9/4.1	2.6/3.7
	Segment II	3.3/4.1	3.0/3.7
	Segment III	3.1/4.1	2.8/3.7
	Segment IV	3.1/3.8	2.8/3.4
	Segment V	5.1/4.1	4.6/3.7
Telson	Length	5.4	4.9
	Width	3.2	2.9
	Depth	2.3	2.1
Pedipalp			
	Patella length/width	4.9/2.2	4.4/2.1
	Femur length/width	3.8/1.8	3.4/1.6
	Chela length/width/depth	8.7/3.7/3.1	7.9/3.3/3.1
	Movable finger length	4.1	3.7

Tergites. Tegument with the same basic structure as the prosoma (Fig. 2B), without well-defined carina, except for tergite VII of the mesosoma with incomplete carinae, integument smooth to subgranulate, flanked by an inconspicuous depression (Fig. 2B). Tergite VII moderately bilobed latero-posterior region with two incomplete carinae, integument, and more granular.

Chelicerae. With typical *Tarsoporosus* dentition, completely smooth and polished integument.

Pedipalps. Integument smooth and polished, scarcely granulose; orthobothriotaxic C (Figs. 3). Chela is not very robust, smooth, polished, and prismatic integument in section much wider than deep (Table I); hand with very weak carina, very faint and smooth digital carina, weak external secondary carina, smooth and uniformly convex, weak external carina, internal ventral, lateral and directed towards the respective joint condyle (Figs. 3A-B); weak dorsal marginal and dorsal internal carina (Fig. 3); dorsal and external integument smooth, without granular reticulations that cross some of the carinae, smooth internal surface, with distal third moderately concave just above the mobile joint of the finger (Fig. 3C-D). Fingers short (Table 1), weakly carinate and sparsely setose, opposable edges with few granulations not arranged in rows, internally fixed finger with some granules aligned (Figs. 3A-B). Femur longer than wide, dorsal surface straight; dorsal internal and ventral internal carina well-defined, irregularly granular, ventral external carina absent (Fig. 3D); ventral and external integument smooth and polished, dorsal, and internal integument scarcely granulose on basal portion, dorsal surface with several coarse granules proximal to middle zone of segment (Fig. 3D). Patella, smooth and polished integument, internal surface scarcely granulated, with all carinas weakly developed, except the dorsal internal surface, slightly marked, sub-granulate, and distally folded; similarly, the ventral internal surface poorly visible (Fig. 3E-F).

Legs. Smooth and polished integument; enlarged and thinned tarsomeres; telotarsal spiniform macrosetae formula 5/5: 5/5: 6/6: 7/7; basitarsi spiniform macrosetae pattern: Leg I pst, rst, rm, pm; leg II pt, vt, rst, pst, pm, rm; Leg III pt, rt, pst, vst, vm; Leg IV pt, rt, pst, vt, vs, vm. *Sternum*, pentagon-shaped, rounded apical margin with slightly divergent sides.

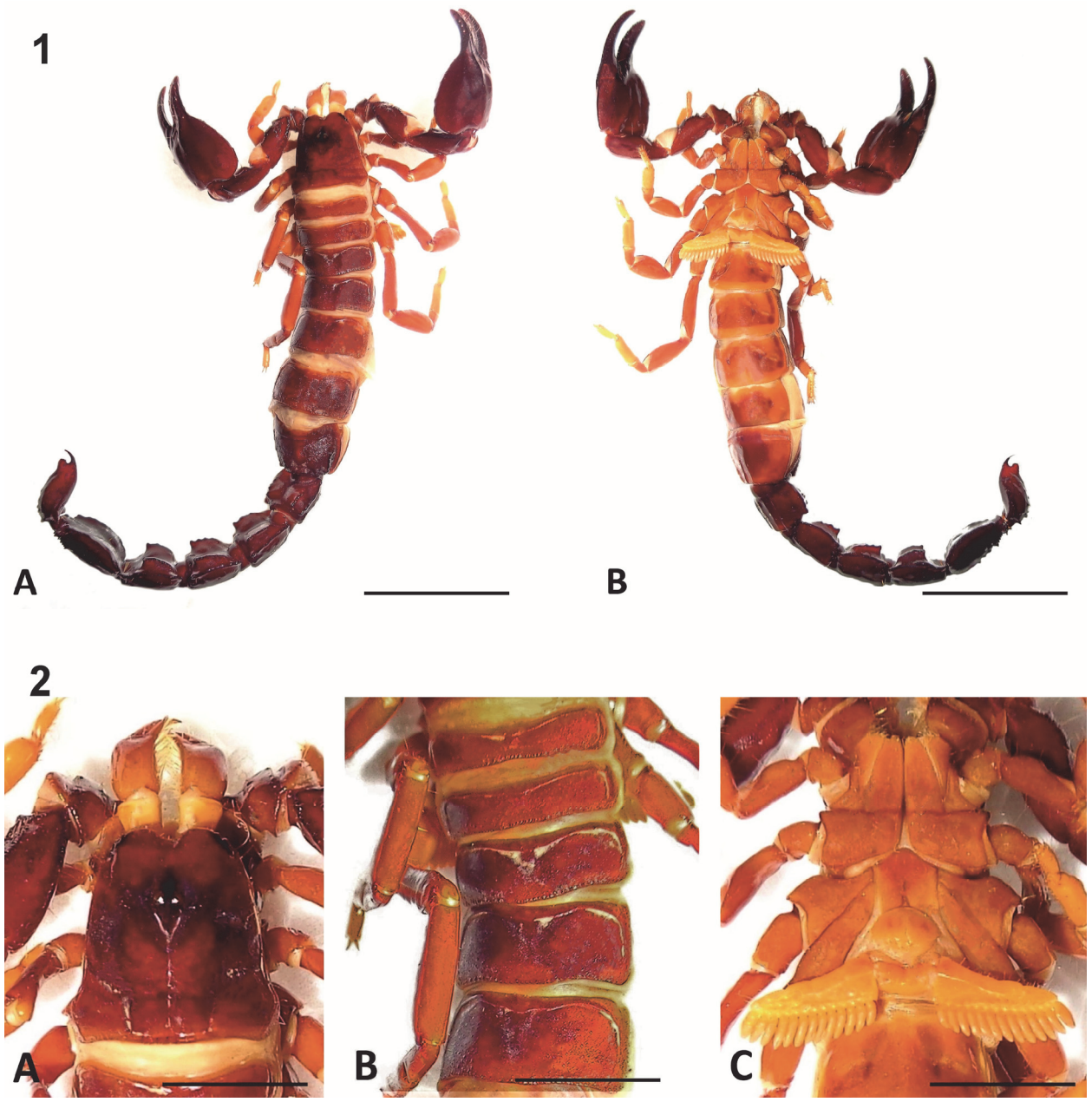


Fig. 1. Habitus of *Tarsoporosus tizopedrosoi* **sp. n.** male holotype: **A**, dorsal view, aspect; **B**, ventral view, aspect. Scale = 1 cm. **Fig. 2.** *Tarsoporosus tizopedrosoi* **sp. n.** male holotype: **A**, prosoma, dorsal view; **B**, tergites I-V, dorsal view; **C**, sternopectinal region. Scale = 1 cm.

Genital Operculum. With a rounded anterior margin, oval shape; genital papillae moderately developed and strongly exposed (Fig. 2C).

Pectines. Moderately setose, with 13/13 teeth; basal plate much wider than long; anterior margin notched; posterior margin moderately rounded (Fig. 2C).

Sternites. Smooth and polished, with several scattered setae; sternites VII with two pairs of parallel, smooth, and not very visible carinae, external sternites weak and long, internal sternites vestigial and short; spiracles narrow and elongated, almost elliptical in shape (Fig. 1B).

Metasoma. Depressed and almost bare, with segments I–IV each wider than long (Fig. 4A); intercarinal integument smooth and polished, with scattered granules on the dorsal and lateral surfaces of V (Fig. 4A); segments I–IV with eight carinae (scarcely visible in segment IV), V with six; dorsolateral carina well marked and granular in I–IV (absent in V) (Fig. 4B); lateral supramedian carina strong and crenulate and subserrate in all segments (Fig. 4B); complete and moderate lateral inframedian carina, weak and almost smooth in III, vestigial and smooth in IV, weak and irregularly in V (Fig. 4C); ventrolateral carina weak and not very visible in I–III, moderate and smooth in IV, moderate and irregular in V, without merging with the ventral transverse carina, strongly dentate and uniformly arched, shield-shaped; submedian ventral carinae, moderate in I, weak in II, vestigial in III and absent in IV–V (Fig. 4C); ventromedial carina in V absent, integument with several irregularly scattered granules; segment V slightly longer than telson, with denticulate anal arch, triangular lateral lobes (Fig. 4C).

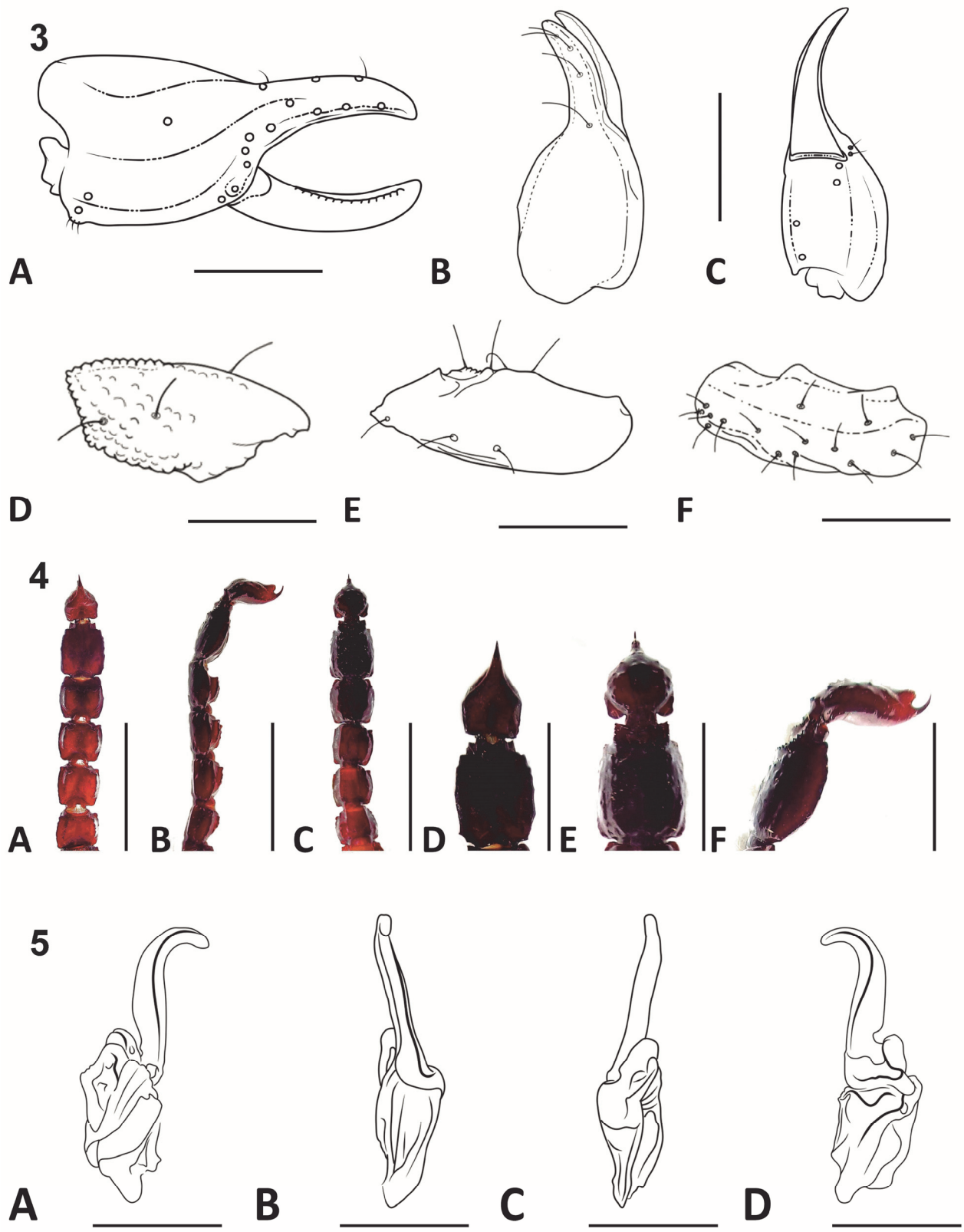


Fig. 3. *Tarsoporosus tizopedrosoi* **sp. n.**, male holotype. **A**, chela dorsal-external, aspect; **B**, chela dorsal aspect; **C**, chela ventral aspect; **D**, femur, dorsal aspect; **E**, patella ventral aspect; **F**, patella dorsal-external aspect. Scale = 1 cm. **Fig. 4.** *Tarsoporosus tizopedrosoi* **sp. n.** male holotype: **A**, metasoma, dorsal view; **B**, metasoma, lateral view; **C**, metasoma, ventral view; **D**, metasomal segment V and telson, dorsal view; **E**, metasomal segment V and telson, ventral view; **F**, metasomal segment V and telson, lateral view. Scale = 1 cm. **Fig. 5.** *Tarsoporosus tizopedrosoi* **n. sp.** male holotype, Hemispermatophore: **A**, ventral aspect; **B**, internal aspect; **C**, external aspect; **D**, dorsal aspect. Scale = 2 mm.

Telson. Rounded and not depressed (Fig. 4D); polished and sparsely granular vesicle, with some protruding granules; ventral basal margin with some granules; small subacular tubercle (Fig. 4E), laterally compressed and covered by small granules and some rigid setae; aculeus long, sharp, and curved (Fig. 4F).



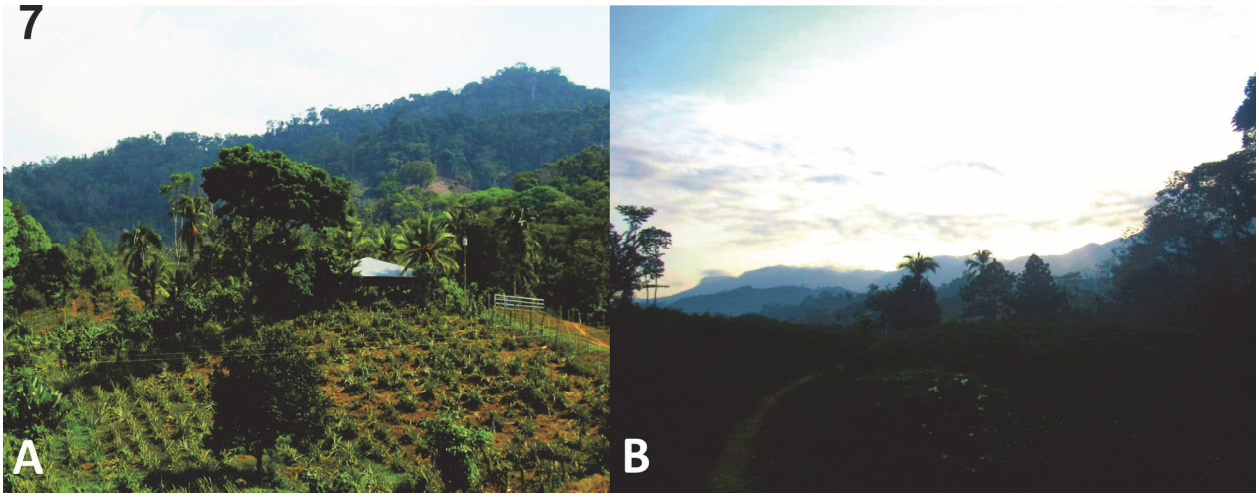


Fig. 6. Known geographical distribution species of genus *Tarsoporosus* Francke, 1978. Map credits: © OpenStreetMap contributors, base map, and data from OpenStreetMap and the OpenStreetMap Foundation (background only). **Fig. 7.** Habitat of *Tarsoporosus tizopedrosoi* **sp. n.** reported in this study: **A-B**, humid Forest of TuisTuis, Tierralta, Córdoba, Colombian Caribbean.

Hemispermatophore. Lamelliform, weakly sclerotized; total length 4.5 mm; distal lamella, length 2.4 mm; capsular region, width 1.7 mm; median lobe narrow, margin entire (Fig. 5).

Etymology. The specific epithet (*tizopedrosoi*) is in honor of Professor Dr. Everton Tizo Pedroso for his unconditional support and cooperation during the last few years and his great contribution to arachnology.

Comparative diagnosis. According to the descriptions made by González-Sponga (1984; 1996); Lourenço & Florez (1990) and the taxonomic key created by Teruel & Roncallo (2007), *Tarsoporosus tizopedrosoi* **sp. n.**, can be easily differentiated from *T. anchicaya* by its overall color (dark brown), metasomal segments I–IV granulose ventrolateral carinae; differs from *T. macuira*, and *T. flavus* by the more robust metasoma in *T. macuira* and slender metasoma in *T. flavus*, carinae conspicuously stronger, and dorsal tegument on segments I–IV smooth in *T. macuira*, and conspicuously weaker and with dorsal tegument on segments I–IV sparsely granulose in *T. flavus*; and differs from *T. yustizi* by the metasomal segment I which is wider than long, prosoma and tergites with granulation more developed. Pedipalp chela with a dorso-external surface smooth and overall color uniform, reddish to dark brown resembles *T. kugleri*; however, it can be differentiated by segments II–III, each wider than long (segments I–II wider than long in *T. tizopedrosoi* **sp. n.**), with carinae conspicuously stronger and with dorsal tegument on segments I–IV smooth (carina absent on segments I–VI and incomplete in segment VII in *T. tizopedrosoi* **sp. n.**).

Observation. The new species *T. tizopedrosoi* **sp. n.** is included in the genus *Tarsoporosus*, although Santibañez-Lopez *et al*. (2017) has shown a phylogenetic relationship with the genus *Heteronebo* Pocock, 1899. It is necessary for a new morphological and molecular review of the species in these two groups; involving a comparison of reliable diagnos-

tic characters such as the male genitalia to define the taxonomic status of the genus *Tarsoporosus* within the order Scorpiones.

Distribution. Only known from the type locality of Colombia, Córdoba, Tierralta, and TuisTuis Village (Fig. 6).

Ecological comments. The *Tarsoporosus tizopedrosoi* **sp. n.** specimens were collected during an active search with UV light in the early hours of the night (20:00 h), at the end of the rainy season in areas near houses that corresponded to humid tropical forests (Bh-T) at 180 m above sea level (Fig. 7A) in mountainous areas, with an average annual temperature of 26.6 °C, average annual relative humidity of 83%, and annual rainfall of 1,949 mm (Fig. 7B), associated with the intertropical convergence zone (ITCZ), and distributed in a monomodal regime (IGAC, 2016). This contrasts with some species within the genus that have been collected or are restricted and adapted in xeric environments, such as *T. flavus*, *T. kugleri*, *T. macuira*; and *T. yustizi*.

Likewise, *T. anchicaya* was recorded in the Pacific region corresponding to the Chocó bioregion in western Colombia and represents an indicator of the high endemism of scorpion species in the bioregion. The Córdoba Department is influenced by the foothills of the western mountain range and is framed by the biogeographical regions of Norandina, Chocó, Magdalena, and the Peri-Caribbean Barren Belt (Vásquez-V, 2005; Palencia-Severiche *et al*., 2006). This represents an indicator of the high endemism of scorpion species in the bioregion of Colombia.

Taxonomic key for species of the genus *Tarsoporosus* Francke, 1978.

Update of the original taxonomic keys provided by González-Sponga (1996) and Teruel & Roncallo (2007).

1 Overall color dark brown. Metasomal segments I–IV with granulose ventrolateral carinae. Modal tarsal spine formula 3/3: 3/3: 4/4: 4/4 .... *T. anchicaya* Lourenço & Flórez, 1990

– Overall color from yellow to reddish-brown. Metasomal segments I–IV with smooth ventrolateral carinae. The modal tarsal spine formula different from the above .. 2

2 Pedipalp chela with dorsal external surface covered by granular reticulations. Overall color yellow to light brown, with conspicuously darker carapace, tergites, and distal segments of metasoma and pedipalps..... 3

– Pedipalp chela with a smooth dorsal external surface. Overall color uniform, reddish to dark brown 4

3 Adult males with more slender metasoma (segments II–III each longer than wide), conspicuously weaker carinae, and dorsal tegument on segments I–IV sparsely granulose; larger species (42–50 mm)..... ..... *T. flavus* (González-Sponga, 1983).

– Adult males with metasoma much more robust (segments II–III each wider than long), with carinae conspicuously stronger and dorsal tegument on segments I–IV smooth; small species (40–41 mm)..... ..... *T. macuira* Teruel & Roncallo, 2007.

4 Carapace and tergites with limited developed granulation 5

– Carapaces and tergites with more developed granulation Overall color reddish dark .... *T. yustizi* (González-Sponga, 1983).

5 Overall color lighter, adult males with metasomal segment I longer than wider. Modal tarsal spine formula 3–4/3–4: 4–5/4–5: 6/6: 6/6. Larger size: 47–60 mm .... *T. kugleri* (Schenkel, 1932).

–Overall color blackish-brick-red, adult males with metasomal segment I wider than those with segment II. Modal tarsal spine formula 5/5: 5/5: 6/6: 7/7. Small size 46–51 mm..... *T. tizopedrosoi* **sp. n.**

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