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First record of *Victorwithius similis* (Beier, 1959) (Pseudoscorpiones: Withiidae) from Brazil

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Abstract: During a study of mesodiverse arachnids in the Brazilian Central Cerrado, individuals belonging to the species *Victorwithius similis* (Beier, 1959) were collected associated with bark in urban forests and riparian forest areas in the state of Goiás. The occurrence of the species *V. similis* is recorded for the first time in the country, increasing its known distribution to include Brazil.
Keywords: Arachnida, Brazilian Cerrado, Microhabitat, Zoogeography.

Primer reporte de *Victorwithius similis* (Beier, 1959) (Pseudoscorpiones: Withiidae) in Brasil
Resumen:. Durante un estudio de arácnidos mesodiversificados en el Cerrado Central Brasileiro, se colectaron individuos pertenecientes a la especie *Victorwithius similis* (Beier, 1959) asociados a cortezas en Bosques urbanos y áreas de Bosques de ribera en el estado de Goiás. Se registra por primera vez la ocurrencia de la especie *V. similis* en el país, incrementando su distribución conocida para incluir Brasil.
Palabras claves:. Arachnida, Cerrado Brasileño, Microhábitat, Zoogeografia.

Introduction

Pseudoscorpions are arachnids that inhabit all terrestrial ecosystems (Weygoldt, 1969; Judson, 1994; Del-Claro & Tizo-Pedroso, 2009). Relatively more abundant in the tropics and subtropics; some with circumpolar distribution (Weygoldt, 1969; Del-Claro & Tizo-Pedroso, 2009). Most live in leaf litter, under stones, in the bark of trees and fallen logs, and in forests and jungles of tropical and temperate regions (Weygoldt, 1969; Adis & Mahnert, 1985; Mahnert & Adis, 2002; Aguiar *et al*., 2006). They appear associated with many microhabitats such as bat guano, ant and bee nests, and plant parts; they are also known to perform phoretic behaviors on birds, insects, and mammals (Weygoldt, 1969; Zeh & Zeh, 1992a, 1992b; Cole *et al*., 1995; Poinar *et al*., 1998; Andrade & Gnaspini 2002; Aguiar & Bührnheim, 2003; Francke & Villegas, 2006, González *et al*., 2007).

The Cerrado is the most diverse domain in the world and, except for some tropical forest regions, has the richest vascular plant flora on the planet (Eiten, 1994; Colli *et al*., 2020). The Cerrado exhibits intricate biogeographic patterns, shaped by local configurations and regional constraints, such as proximity or isolation from neighboring domains and areas with contiguous relief (Werneck, 2011). Its biodiversity is still poorly known, and many new species are described each year, indicating that significant biodiversity remains to be discovered (Diniz-Filho *et al*., 2005; Colli *et al*., 2020). This is exacerbated by accelerating habitat conversion, about 40-55% of the Cerrado has already been converted into agricultural land, pastures, and planted forests (Machado *et al*., 2004; Sano *et al*., 2010; Ganem *et al*., 2013; Monteiro *et al*., 2020; Coelho *et al*., 2020; Colli *et al*., 2020).

The pseudoscorpion fauna of Brazil is currently represented by 176 species distributed in 15 families (Von Schimonsky *et al*., 2022; World Pseudoscorpiones Catalog, 2023). However, the species composition and taxonomic status of pseudoscorpion from most regions of Brazil are poorly known (Marques & Lamas, 2006; Von Schimonsky & Bichuette, 2019). Previous species reports are mostly for the northwestern and southwestern regions of Brazil (Harvey, 2013; Mendes, 2020; Lira *et al*., 2020). However, the central region is poorly documented (Mendes, 2020). Consequently, reports of pseudoscorpions are scarce from the Brazilian central Cerrado domain (Bedoya-Roqueme *et al*., 2020). Therefore, it is considered essential to initiate studies oriented to knowing the fauna of pseudoscorpions present in this important Brazilian biome. The present study records the occurrence of the species *Victorwithius similis* (Beier, 1959) in urban forests and riparian forests of Brazil.

The study was conducted from May 2022 to March 2023, in areas of the urban forest in the Environmental Park Antonio Marmo Canedo (Parque da Matinha) located in the city of Anápolis (16º18'34.53 "S, 48º57'15. 06 "W), which corresponds to riparian forest fragments, also, the study was conducted in riparian forest, located in the area of Morrinhos (17°47'07.1 "S 49°12'53.9 "W), both localities located in the state of Goiás (Fig. 1). The samples occurred in trees of the family Fabaceae, which are known to harbor corticolous pseudoscorpions (Ribeiro *et al*., 2018). Entomological tweezers were used to remove the bark from the trees and with the use of brushes moistened with alcohol, the individuals were collected without damaging them (Mahnert & Adis, 2002). A total of 10 adult individuals were collected, seven males and three females, which were preserved in 70% ethyl alcohol for later study and identification in the laboratory (Bedoya-Roqueme & Tizo-Pedroso, 2020).

The specimens (female and a male) were cleared by slow diffusion (Judson, 1992) with 70% lactic acid at room temperature for approximately 24 hours after dissection of a chelicera, a leg I, and IV, the left pedipalp and its chela, or submerged in 5–10% of KOH for internal genital examination (Mahnert, 1975). The specimens were temporarily mounted in glycerin and studied with the help of a compound microscope Zeiss Axiostar (Carl Zeiss, Germany). After the study, the specimens were rinsed in water and transferred to 70% ethanol, and the dissected parts were stored in a microvial together with the original specimens. Multifocal photographs were taken at the Laboratory of Behavioral Ecology of Arachnids, State University of Goiás, Anápolis, Brazil, using an HD digital camera connected to the compound microscope, and then fused using software stack images AxioVision Carl Zeiss (Rel. 4.9.1. SP2)

The measurements were taken at the highest possible magnification using the same software and calibrated with an ocular graticule attached to the compound microscope. The terminology and measures mainly followed Chamberlin (1931), except for the nomenclature of pedipalps, legs and with some minor modifications in the terminology of trichobothria (Harvey, 1992; 2004), chelicerae (Judson, 2007; Harvey & Edward, 2007) and the faces of the appendices (Harvey et al. 2012), morphological male genitalia nomenclature mainly follows Legg (1974). The measurements are expressed in millimeters (mm). The specimens were deposited in the collection of the Laboratory of Behavioral Ecology of Arachnids, State University of Goiás, Anápolis, Brazil (LECA).

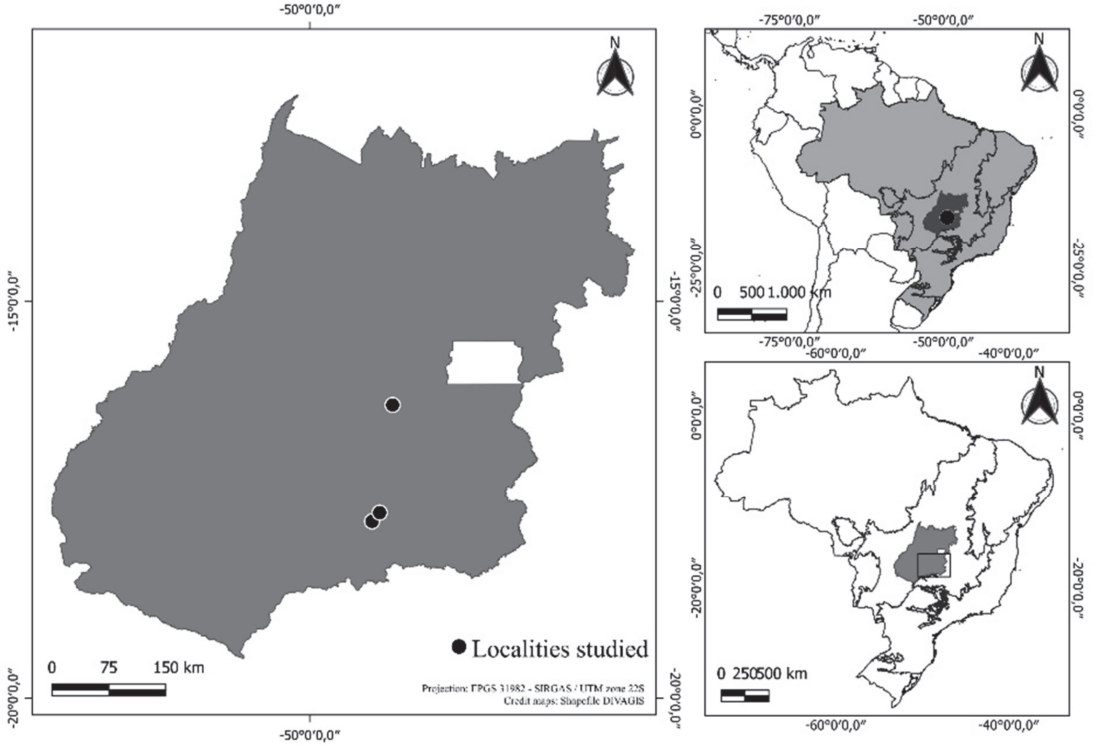


Fig. 1. *Victorwithius similis* (Beier, 1959): Different localities studied in the State of Goiás, Central Brazilian Cerrado.

Results

Family Withiidae Chamberlin, 1931

Genus *Victorwithius* Feio, 1944

***Victorwithius similis* (Beier, 1959)**

Parawithius (*Victorwithius*) *similis*: Beier, 1959: 218, fig. 27; Harvey, 1991: 653.

Victorwithius similis: Harvey, 2004: 440, 443; Ceballos & Ferradas, 2008: 115; Mahnert, Di Iorio, Turienzo & Porta, 2011: 24; Bollatti & Ceballos, 2014: 14.

Figs. 1-11.

MATERIAL EXAMINED. 3♀, 5♂. Brazil. Goias: Anápolis, Antonio Marmo Canedo Environmental Park, [16º18´34.53"S, 48º57´ 15.06"W, 1027 m.a.s.l.], 6-IV-2022, Riparian zone, E. Bedoya-Roqueme & T. López leg. (Deposited in LECA; Ps-053). 1♂. Brazil. Goias: Morrinhos, Ribeirão da Serra-Morrinhos, [17°47'07.1"S, 49°12'53.9"W, 753 m.a.s.l.], 16-III-2023, Riparian zone, E. Bedoya-Roqueme; R. Barroso; J. Reis leg. (Deposited in LECA; Ps-056). 1♂, Brazil. Goias: Morrinhos, Fazenda Congo, [17°40'33.8"S, 49°07'08.0"W, 711 m.a.s.l.], 16-III-2023, Riparian zone, E. Bedoya-Roqueme; R. Barroso; J. Reis leg. (Deposited in LECA; Ps-063).

DESCRIPTION SHORTS (Adults). Habitus male, live specimen (Fig. 2). Female and male (Figs. 3-6). According to the description by Beier (1959) and the specialized taxonomic key proposed by Mahnert et al. (2011). Pseudoscorpions of *Victorwithius similis* (Beier, 1959) can be easily distinguished from the other species of the genus by the present combination of characters such as: Carapace 1.3× longer than wide (females 1.4×), densely granulated carapace metazone, coarse granules close together (Fig. 7), two strongly marked furrows in both female and male, the second proximal to the posterior margin (Figs. 3, 5), two distinct eyespots, with 45-47 setae on the carapace, including four setae on the anterior margin and eight on the posterior margin. Tergites completely divided in females, while in males tergites I-III undivided, all setae clavate, tergites I-III with six setae, tergites IV-XI with seven marginal setae, one discal, one lateral, and one medial, tergite XI with two tactile setae, males with the lateral border of tergites with ridges (Figs. 2-3). Sternites divided, all setae simple and acuminate (Figs. 4, 6), sternites VI-IX with glandular setae on the posterior margin (Fig. 8), male sternite VIII with a circular patch of 20-21 glandular setae (Fig. 9).

Cheliceral hand with five setae, acuminate; rallum with four blades, the distal two denticulate; fixed finger with five small teeth, the third larger than the others; movable finger with took-like subapical lobe; male galea elongate with six short apical branches, female galea elongate; outer serrula with 18 blades. Genital region of the female with nine long acuminate setae on each side of the operculum on the anterior region, and the posterior operculum with ten setae on the margin. Genital region of male, anterior operculum with six long acuminate setae on each side of operculum on anterior region, posterior operculum with 10-12 acuminate setae on margin. Genital of male (Figs. 10-11), with dorsal apodeme sclerotized and with convex margin (Fig. 10), with variable width, lateral apodemes ellipsoidal in shape, occupying a large part of the ejaculatory atrium (Fig. 11), ejaculatory duct long and sclerotized, in dorsal view of uniform width and lateral view with curved and sclerotized margin (Fig. 11).

Pedipalps slender, including hand and coxae densely granulated, setae on medial aspect of femur weak, but distinctly clavate; femur ♂, 4.5-4.6× (♀, 4.1-4.5×); patela ♂, 2.9-3.0× (♀, 3.0-3.2×); chela with pedicel ♂, 4.1-4.2× (♀, 3.5-3.6×), chela without pedicel ♂, 4.0-4.1× (♀, 3.3-3.4×), movable finger ♂, 0.455-0.457 (♀, 0.465-0.467). Fixed finger on both male and female with approximately 52-54 strongly triangular chelal teeth, the more basal ones flattened, movable finger with 50-52 strongly triangular chelal teeth, fingers as long as hand with pedicel. According to Harvey (2004), trichobothria *isb* proximal to *est*, trichobothria *it* midway between *est* and *et*. Venom apparatus present in both chelal fingers, venom ducts long, terminating in *nodus ramosus* near *est* in fixed finger and near *t* in movable finger. All legs light yellow, slender, in both male and female strongly granulated surface, acuminate and clavate silk, tactile silk on tarsus IV in distal position, undivided arolium shorter than the claws.

DIMENSIONS (mm). Females in parentheses: Body length: 1.858-1.861 (1.873-2.102). Carapace: 0.712-0.715/0.538-0.540 (0.772-0.799/0.547-0.551). Pedipalps: Trochanter: 0.335-0.337/0.193-0.197 (0.343-0.346/0.176-0.178), Femur: 0.646-0.648/0.138-0.140 (0.639-



Fig. 2. *Habitus*, live specimen, male. *Victorwithius similis* (Beier, 1959) from Brazilian Central Cerrado.



Fig. 3-6. *Victorwithius similis* (Beier, 1959) from Brazilian Central Cerrado. 3-4, male: 3, dorsal view. 4, ventral view. 5-6, female: 5, dorsal view. 6: ventral view. Scale line = 1 mm.

0.683/0.141-0.164), Patela: 0.550-0.553/0.185-0.187 (0.547-0.569/0.180-0.81), Chela with pedicel: 1.057-1.059/0.253-0.255 (1.036-1.084/0.286-0.308), Chela without pedicel: 1.019-1.021/0.253-0.255 (0.995-1.031/0.286-0.308), Hand with pedicel: 0.543-0.547/0.253-0.255 (0.567-0.603/0.286-0.308), Hand without pedicel: 0.497-0.4501/0.253-0.255 (0.492-0.528/0.286-0.308), Movable finger: 0.455-0.457 (0.465-0.467). Leg I: Trochanter: 0.135-0.137/0.104-0.106 (0.124-0.139/0.105-0.116), Femur: 0.119-0.121/0.024-0.026 (0.179-0.189/0.125-0.127), Patela: 0.238-0.240/0.094-0.096 (0.253-0.268/0.105-0.132), Tibia: 0.239-0.240/0.076-0.078 (0.252-0.272/0.092-0.081), Tarsus: 0.248-0.501/0.051-0.052 (0.250-0.279/0.054-0.052). Leg IV: Trochanter: 0.208-0.210/0.143-0.145 (0.184-0.203/0.136-0.138), Femur+ Patela: 0.512-0.514/0.153-0.155 (0.427-0.464/0.129-0.154), Tibia: 0.328-0.330/0.095-0.097 (0.389-0.402/0.104-0.089), Tarsus: 0.205-0.207/0.081-0.083 (0.302-0.305/0.058-0.065).

DISTRIBUTION. Argentina, Brazil* (World Pseudoscorpiones Catalog, 2023).

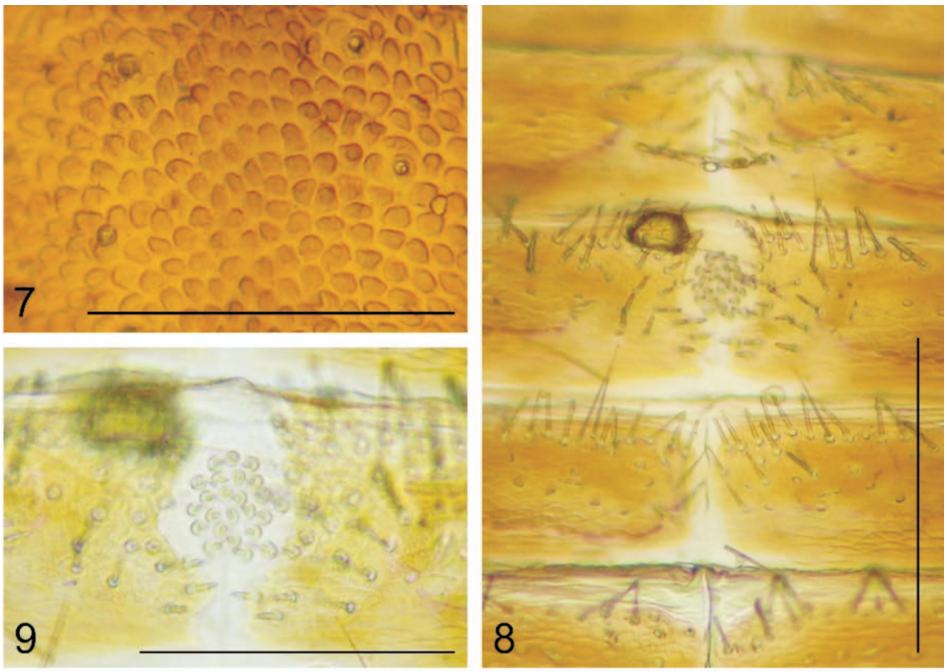


Fig. 7-9. *Victorwithius similis* (Beier, 1959) from Brazilian Central Cerrado, male: 7, granules of the metazone of the carapace. 8, glandular setae on sternites VI-IX. 9, Circular patches of the glandular setae on sternites VIII. Scale lines = Figure 7: 500 µm; Figure 8: 0.5 mm; Figure 9: 0.1 mm.



Fig. 10-11. Male genitalia of *Victorwithius similis* (Beier, 1959): 10, Ventral view; 11, Lateral view. **Abbreviations**: **da** = dorsal apodemes, **la** = lateral apodemes, **ejc** = ejaculatory canal, **ejca** = ejaculatory canal atrium. Scale lines = 100 µm.

ECOLOGICAL COMMENTS. *Victorwithius similis* (Beier, 1959) was collected under the bark of trees both in urban areas (*Myracrodruon urundeuva* M. Allemão, 1862 (Anacardiaceae) and in riparian forests, the typical vegetation of the Brazilian Cerrado domain. Likewise, in Argentina, *V. similis* has been recorded occurring under the bark of trees of species of the genera *Eucalyptus* (L'Hér., 1789) and *Platanus* L., 1753 (Platanaceae), a generalist microhabitat reported for this pseudoscorpion species (Manhert *et al*., 2011). Also, some species of the family Withiidae (e.g. *Victorwithius coniger* (Mahnert, 1979), *Victorwithius gracilimanus* (Mahnert, 1979)) have been commonly recorded in similar environments and/or microhabitats, occurring in tree trunks and microhabitats specialized as epiphytes (Mahnert & Adis, 1985; Aguiar & Bührnheim, 2011). The specimens collected represent the first record of the species in Brazil, which allows increasing its known distribution to include this country, initially recorded, and described in Argentina. Concerning arachnids, it is important to highlight that for Brazil, 53 species have been classified as endangered, with 27 critically endangered, 19 threatened, and 7 in a state of vulnerability, representing about 0.4% of the species (ICMBio-Brazil, 2018). Considering that the Cerrado, mainly in the state of Goiás, remains poorly researched, and considering the high endemism recorded for this Brazilian biome, the number of species at risk of extinction may be much higher, turning the new records, an important point for the design and delimitation of monitoring plans and conservation policies. Thus, the pseudoscorpion fauna in Brazil is now represented by 177 species, increasing the knowledge of the fauna of the Brazilian Cerrado.

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