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Scientific Note

New Records of *Loxosceles amazonica* Gertsch, 1967 (Arachnida: Araneae: Sicariidae) from Tocantins, Brazil with Description of Female Genitalia Variation

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Abstract. The knowledge of arachnofauna from Tocantins, Brazil, is still incipient. The present communication expands the known geographical distribution of *Loxosceles amazonica* Gertsch, 1967 (Arachnida: Araneae: Sicariidae) in Brazilian Cerrado. The brown spider specimens were sampled in Dianópolis municipality and Cristalândia municipality both in Tocantins State, Brazil, between 2022 and 2024. Also, we describe a new variation of the epigynum of *L. amazonica*. Mapping the distribution of *Loxosceles* Heineken & Lowe, 1832 species in Brazil is crucial for public health, aiding in prevention and timely treatment of loxoscelism caused by brown spider bites.

Keywords: Spider; Cerrado, Epigynum; Haplogynae; Loxoscelism.

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Spiders of the genus *Loxosceles* Heineken & Lowe, 1832 are considered of medical interest due to their potentially lethal toxins and their contributions to pharmacology, medicine, and biochemistry (Lüddecke *et al.* 2022). Loxoscelism is the condition caused by the venom of *Loxosceles* spiders. Symptoms typically do not appear until several hours after envenomation and may progress to include local reactions, such as dermonecrosis, as well as systemic effects like intravascular hemolysis, coagulation disorders, and renal failure (Tambourgi *et al.* 2010).

Currently, a total of 147 species of *Loxosceles* have been described worldwide, of which 22 species have been recorded in Brazil (World Spider Catalog 2024) (Figure 1): *Loxosceles adelaida* Gertsch, 1967, *Loxosceles amazonica* Gertsch, 1967, *Loxosceles anomala* (Mello-Leitão, 1917), *Loxosceles bodoquena* Bertani & Gallão, 2024, *Loxosceles boqueirao* Bertani & Gallão, 2024, *Loxosceles cardosoi* Bertani, von Schimonsky & Gallão, 2018, *Loxosceles carinhanha* Bertani, von Schimonsky & Gallão, 2018, *Loxosceles chapadensis* Bertani, Fukushima & Nagahama, 2010, *Loxosceles ericsoni* Bertani, von Schimonsky & Gallão, 2018, *Loxosceles gaucho* Gertsch, 1967, *Loxosceles hirsuta* Mello-Leitão, 1931, *Loxosceles imodesta* (Mello-Leitão, 1917), *Loxosceles intermedia* Mello-Leitão, 1934, *Loxosceles karstica* Bertani, von Schimonsky & Gallão, 2018, *Loxosceles laeta* (Nicolet, 1849), *Loxosceles muriciensis* Fukushima, de Andrade & Bertani, 2017, *Loxosceles niedeguidonae* de Andrade, Bertani, Nagahama & Barbosa, 2012, *Loxosceles planetaria* Bertani & Gallão, 2024, *Loxosceles puortoi* Martins, Knysak & Bertani, 2002, *Loxosceles similis* Moenkhaus, 1898, *Loxosceles troglobia* Souza & Ferreira, 2018 and *Loxosceles willianilsoni* Fukushima, de Andrade & Bertani, 2017.

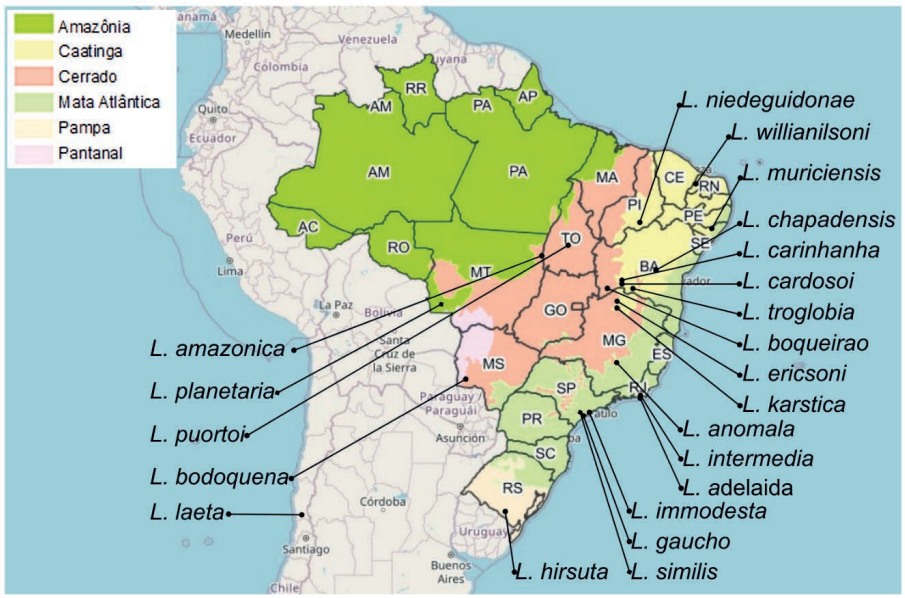

Figure 1. Distribution of Brazilian *Loxosceles* species based on their type localities. Note: *Loxosceles laeta* occurs in Brazil but was originally described from Chile.

Of these 22 species in Brazil, 15 are found in states with the presence of the Cerrado biome (World Spider Catalog 2024). And among these, *L. amazonica* has the widest distribution. It was first described by Gertsch (1967) with specimens collected in Santa Isabel, Mato Grosso and in Gurupa, Amazonas; and is currently found in the states of Amazonas, Mato Grosso, Rio Grande do Norte, Ceará, Paraíba, Pernambuco, Maranhão (Silveira 2015; Almeida *et al.* 2017), and now also in the state of Tocantins.

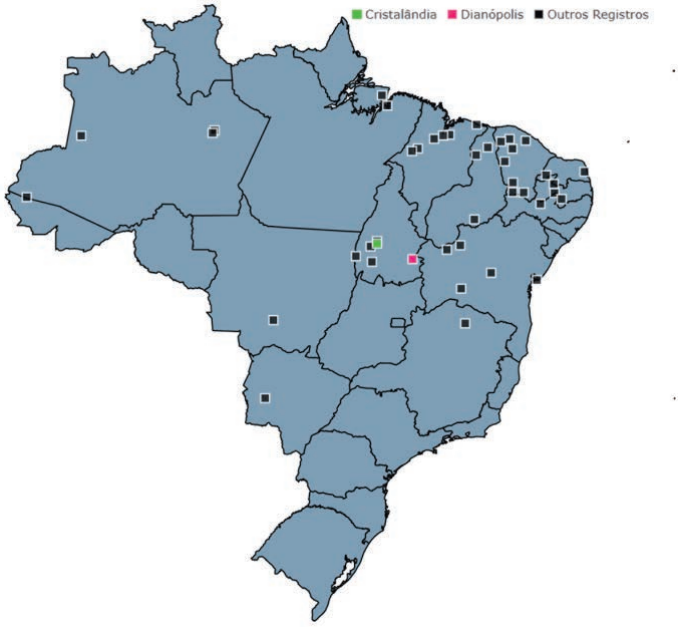

Figure 2. Documented distribution of *Loxosceles amazonica* in Brazil (black squares) and new records in the state of Tocantins (Cristalândia municipality, green squares, and Dianópolis municipality, pink squares).

Fukushima *et al.* (2017) provided a redescription of *Loxosceles amazonica* and discussed its morphological variation and natural distribution. Males can be identified by an incrassated palpal tibia, longer than cymbium, and a shorter embolus with a mild retrolateral curvature along its length; and females have spermathecae with large seminal receptacles and dark sclerotized lateral bands, and a cluster of globular lobes on apex of seminal receptacles.

The actual distribution of *L. amazonica* is still being documented as new collections and studies are conducted (Figure 2). This is particularly relevant for understanding its occurrence in Brazil, given its potential health risk and its inclusion in a group of spiders of medical interest. Beyond its toxicity, the toxins of *Loxosceles* species have contributed to advances in toxicology, biomedical research, and molecular biology, providing valuable insights for the development of new treatments and a deeper understanding of fundamental biological mechanisms (Silva-Magalhães *et al.* 2024).

According to the Brazilian Ministry of Health (Brasil 2023), the state of Tocantins reported a total of 23,832 spider-related incidents between 2018 and 2022, with *Loxosceles* spiders responsible for 207 of these cases. The observed prevalence of *Loxosceles* spider bites in Tocantins may be linked to the limited research on these arachnids across many regions in Brazil, particularly within the Cerrado biome.

For example, in the microregion of Dianópolis, 2,874 spider-related incidents were recorded over the past five years, with 27 attributed to *Loxosceles*. However, the specific species responsible in each case was not identified, highlighting the need for comprehensive studies to document medically significant species and assess overall biodiversity.

Therefore, recent fieldwork in the municipality of Dianópolis and Cristalândia led to the collection of *Loxosceles* specimens (Figures 2-3). Detailed examination of these specimens revealed a variation in the epigynum of *L. amazonica*.

The municipality of Dianópolis (-13.62806, -46.82139) is situated in the southeastern region of Tocantins, approximately 420 km from the state capital, Palmas, and 650 km from Brasília. And the municipality of Cristalândia (-10.59833, -49.19417) is situated in the southwestern region and approximately 154 km from Palmas and 501 km from Brasília. The predominant biome in Tocantins is the Cerrado, also known as the Brazilian Savanna, characterized by eleven phytophysiognomic variations.

Between 2022 and 2023, *Loxosceles* specimens were collected from both enclave area of Savanna and Seasonal Semideciduous Forest within the Cerrado, as well as through household collections by local residents of Dianópolis. In Cristalândia, the specimens were collected in an urban area. The collected specimens were preserved in 70% ethanol. The material was identified following the diagnostic criteria established by Fukushima *et al.* (2017).

The voucher material is deposited in the entomological collection of the Federal University of Tocantins (UFNT). The specimens were examined and photographed under a Leica M165C stereomicroscope. The epigynum of females were detached for better visualization of their structures, with the epigyna being clarified with 10% KOH. The online tool SimpleMappr was used to create the map (Shorthouse 2010).

Abbreviations used: CD - copulatory duct; CO - copulatory opening; PL -Posterior lobe; S - spermatheca.

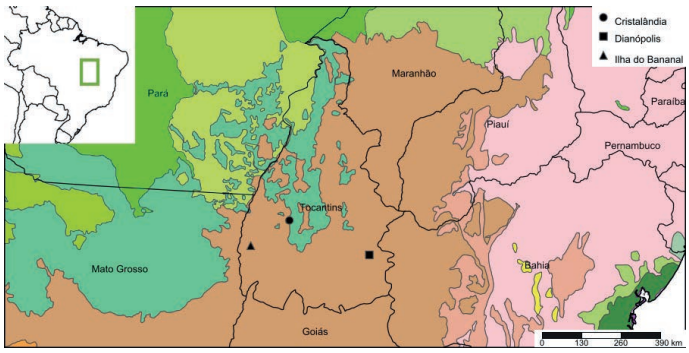

Figure 3. New records of *Loxosceles amazonica* Gertsch, 1967 in the municipality of Cristalândia (black circle) and in the municipality of Dianópolis (black square), Tocantins, Brazil. Black triangle indicates the Ilha do Bananal, the type-locality of *Loxosceles amazonica*.

Two adult females, one adult male, and three juvenile specimens of *Loxosceles amazonica* were collected at tree locations (enclave area in Dianópolis: -11.6319, -46.809083; -11.633297, -46.80226; urban area in Cristalândia: -10.59848, -49.1942) (Figures 4, 5A-E). The species can be easily identified as females of *L. amazonica* have a cluster of globular lobes on the apex of the seminal receptacles (Figures 5A-C), and males have a shorter embolus with a mild curvature apex (Figures 5D-E).

Spermatheca variations have been studied by Fukushima *et al.* (2017), who found differences in the number and size of lobes in specimens collected in different regions. In the specimen collected in Dianópolis, the following variation in the female spermatheca was observed: presence of six globular lobes at the apex of the receptacles, some of which are bilobed, and dark sclerotized lateral bands reaching the apex and forming a wider process in the median portion of the bands (Figures 5A-C). A comparative analysis, the specimen collected in Dianópolis showed greater similarity to *L. amazonica* specimens collected in São Raimundo Nonato, Piauí, Brazil

(MNRJ 6927, ref. GSB11A-17, as show in Fukushima *et al.* 2017).

Figure 4. *Loxoceles amazonica* Gertsch, 1967, habitus, female.

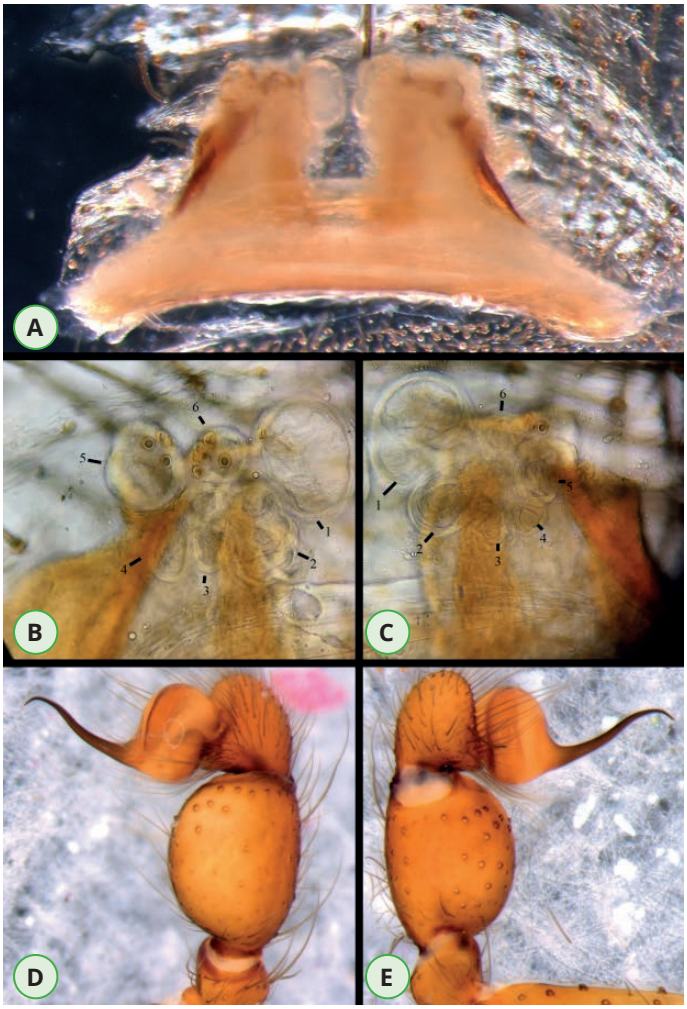

Figure 5. *Loxoceles amazonica* Gertsch, 1967. A - Epigynum, ventral view; B - Globular lobes of the left receptacles in the epigynum, dorsal view; C - Globular lobes of the right receptacles in the epigynum, dorsal view; D - Pedipalp, retrolateral view; E - Pedipalp, prolateral view.

Studying variations in the spermatheca is crucial for understanding comparative anatomy among spider species. The differences observed provide valuable insights into the morphological diversity within spider taxa. Variations in reproductive structures, such as the spermatheca, are often used to differentiate species and subspecies. Detailed anatomical comparisons help in accurate species identification and classification.

Analyzing anatomical differences can also reveal evolutionary relationships between species and might be related to mating behavior and ecological adaptations (specific reproductive strategies or environmental conditions). Identifying similarities and differences in reproductive morphology helps reconstruct phylogenetic trees and understand evolutionary processes.

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AUTHORS CONTRIBUTIONS

KM: Field work; KW and LS: Conceptualization and writing the first draft; LS: Performed and photographed the record. All authors have read and agreed to the published version of this manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors of this research declare that there is no conflict of interest.

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