

Research article

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(Araneae, Sicariidae) from Brazilian caves**Rogério BERTANI ^{*},¹ Maria Elina BICHUETTE ²,
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Abstract. Three new species of recluse spiders are described from Brazilian caves with both males and females. *Loxosceles boqueirao* Bertani & Gallão sp. nov. is found in the State of Bahia, in the Serra do Ramalho karst area, it belongs to the *rufescens* species group, and is closely related to *L. cardosoi* Bertani, von Schimonsky & Gallão, 2018 and *L. carinhanha* Bertani, von Schimonsky & Gallão, 2018 from the same karst area. Thus, there are now three species in the Serra do Ramalho karst area closely related, but noticeably distinct morphologically from other species of *Loxosceles*. *Loxosceles planetaria* Bertani & Gallão sp. nov. and *L. bodoquena* Bertani & Gallão sp. nov. are found in the State of Mato Grosso do Sul, in the Serra da Bodoquena karst area. They belong to the *gaucho* species group and are closely related to *L. gaucho* Gertsch, 1967. These are the first species of *Loxosceles* described from this karst area in the State of Mato Grosso do Sul. *Loxosceles boqueirao* sp. nov. and *L. bodoquena* sp. nov. bear some troglomorphisms and are, herein, proposed as troglobitic species, whereas *L. planetaria* sp. nov. is proposed as a troglophilic species. Brazil has now 22 described species of *Loxosceles*.

Keywords. Serra da Bodoquena, Serra do Ramalho, troglobite, troglophile.

Bertani R., Bichuette M.E., Cordeiro L.M. & Gallão J.E. 2024. Three new species of *Loxosceles* Heinecken & Lowe, 1832 (Araneae, Sicariidae) from Brazilian caves. *European Journal of Taxonomy* 921: 98–115.
<https://doi.org/10.5852/ejt.2024.921.2419>

Introduction

The genus *Loxosceles* Heineken & Lowe, 1832, known as brown, violin or recluse spiders, are infamous for their venom, which can cause severe necrosis in humans after a bite (Gertsch 1967; Isbister & Fan 2011; Vetter 2015). To date, 143 species of *Loxosceles* were described from the Americas, Africa, Europe, and Asia (World Spider Catalog 2023). In Brazil, nineteen species are known, not considering the new species described herein. They are distributed in four species groups delimited by Gertsch (1958, 1967) for South America: *gaucho*, *laeta*, *spadicea*, and *amazonica*. The *gaucho* group has nine species in Brazil: *L. adelaida* Gertsch, 1967, *L. chapadensis* Bertani, Fukushima & Nagahama, 2010, *L. ericsoni* Bertani, von Schimonsky & Gallão, 2018, *L. gaucho* Gertsch, 1967, *L. karstica* Bertani, von Schimonsky & Gallão, 2018, *L. muriciensis* Fukushima, Gonçalves-de-Andrade & Bertani, 2017, *L. niedeguidonae* Gonçalves-de-Andrade, Bertani, Nagahama & Barbosa, 2012, *L. similis* Moenkhaus, 1898, and *L. troglobia* Souza & Ferreira, 2018. The *spadicea* group has three species: *L. anomala* (Mello-Leitão, 1917), *L. hirsuta* Mello-Leitão, 1931, and *L. intermedia* Mello-Leitão, 1934. The *laeta* group is the most diverse in the Americas, but only two species were recorded in Brazil, the native *L. puortoi* Martins, Knysak & Bertani, 2002 and the introduced *L. laeta* (Nicolet, 1849). The *rufescens* group (see Fukushima *et al.* 2017) has four species: *L. amazonica* Gertsch, 1967, *L. cardosoi* Bertani, von Schimonsky & Gallão, 2018, *L. carinhanha* Bertani, von Schimonsky & Gallão, 2018, and *L. willianilsoni* Fukushima, Gonçalves-de-Andrade & Bertani, 2017. *Loxosceles immodesta* (Mello-Leitão, 1917) is a poorly known species that cannot be assigned to any of these groups. Of these species, seven were recorded in caves: *L. adelaida*, *L. similis*, *L. willianilsoni*, *L. karstica*, *L. carinhanha*, *L. cardosoi*, and *L. troglobia* (Bertani *et al.* 2018). The majority of *Loxosceles* spiders found in caves are troglaphiles (facultative cave-dwellers), since they can complete their life cycle both inside and outside caves. Up to now, *L. troglobia* is the only troglobitic (restricted and exclusively cave-dweller) species from Brazil.

The most used classification of subterranean fauna follows Schiner (1854), emended by Racovitza (1907). It encompasses three categories: troglaxenes, troglaphiles, and troglobites. Recently, Trajano (2012) added metapopulation concepts to the Schiner-Racovitza system as follows: troglaxenes are a source population in epigeal habitats using subterranean resources; troglaphiles are source populations both in epigeal and hypogean habitats, with a gene flow between habitats; troglobites (emended by Trajano & Carvalho 2017) correspond to exclusively and obligatory subterranean source populations; sink populations may be found in surface habitats, but they are unable to turn into source populations under present-day conditions. It is noteworthy that there is a consensus on the definition of troglobites as animals restricted to subterranean habitats, but there is a misconception that troglobitic species must be characterized by the presence of morphological cave-related traits, called troglomorphisms (Trajano & Carvalho 2017).

Herein, we describe three new species of *Loxosceles* from caves in Brazil, one troglobitic, from the Serra do Ramalho karst area, State of Bahia, northeastern Brazil, and two (one troglaphilic and one troglobitic) from the Serra da Bodoquena karst area, State of Mato Grosso do Sul, Central Western Brazil.

Material and methods

Study areas

The new species of *Loxosceles* studied herein occur in two karst areas in Brazil: Serra do Ramalho in Bahia State and Serra da Bodoquena in Mato Grosso do Sul State (Fig. 1).

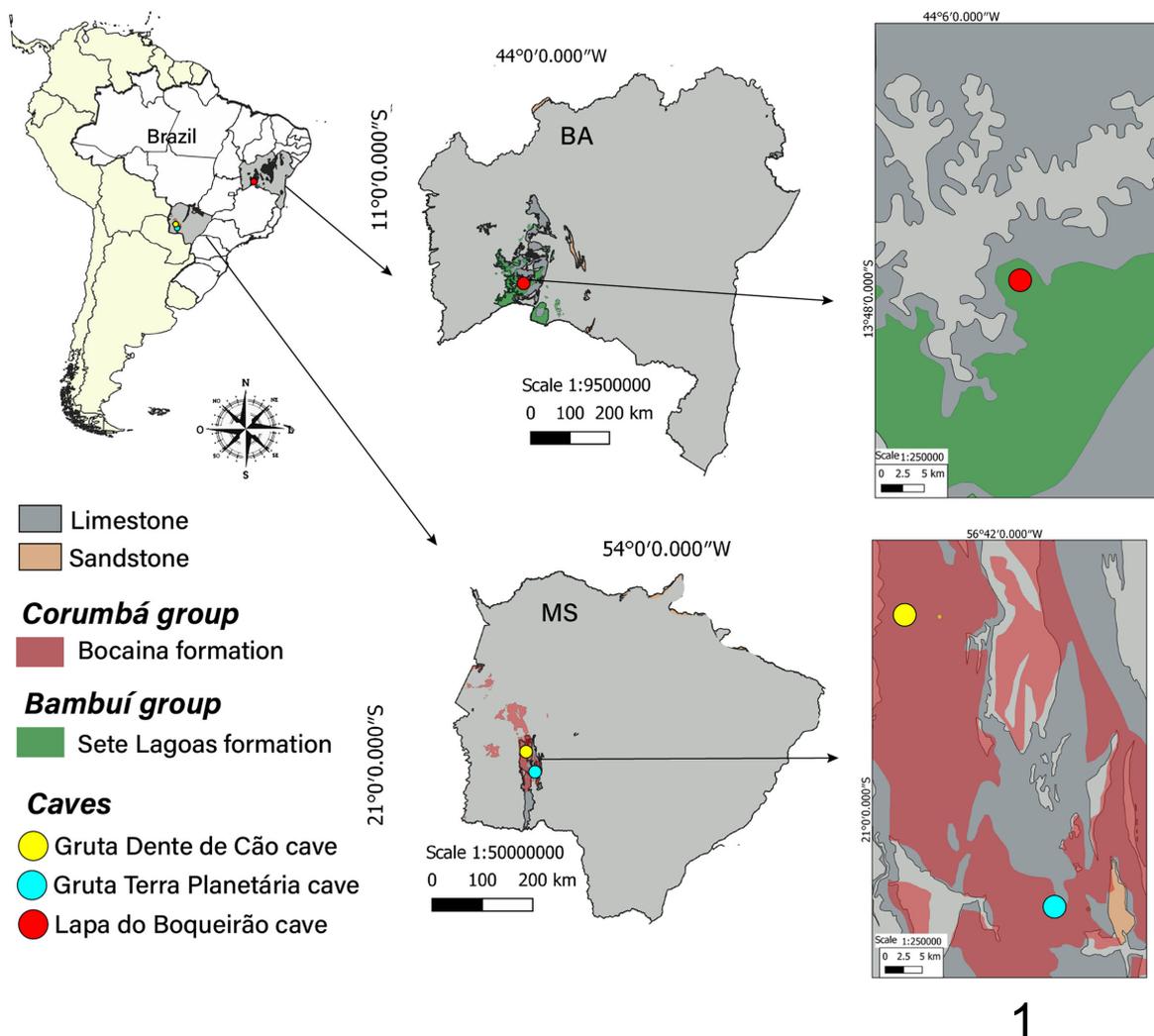
The Serra do Ramalho karst area belongs to the Bambuí geomorphological group, the largest in Brazil. The Serra do Ramalho is formed by extensive limestone areas with huge caves, some reaching a length of more than 15 km (Rubbioli *et al.* 2019) (Figs 16–19). This region is already known as a hot spot

considering the cave fauna (Bichuette & Trajano 2004; Trajano *et al.* 2016; Gallão & Bichuette 2018), mainly for troglobitic fauna (restricted and exclusively cave-dwelling); however, the troglomorphic (facultative cave-dwelling) is emerging as relevant and diversified too (Bertani *et al.* 2018).

The Serra da Bodoquena karst area is inserted into the Corumbá geomorphological group, and is one of the most continuous karst areas in Brazil (Cordeiro *et al.* 2014; Rubbioli *et al.* 2019). At around 800 m of altitude, it consists of an important water divisor. There are many limestone caves encompassing the municipalities of Bodoquena, Bonito, and Jardim with some caves within the Parque Nacional da Serra da Bodoquena. Gruta Dente de Cão Cave is the largest cave in the region, with hypogenic features (Rubbioli *et al.* 2019) (Figs 44–47).

Specimens

Specimens were collected inside caves and fixed in ethanol 70%. Descriptions are based in Gertsch (1967). All measurements are in millimeters. Structures from the left side of the specimens are used in



1

Fig. 1. Map showing the occurrences in the caves of *L. boqueirao* Bertani & Gallão sp. nov., *L. planetaria* Bertani & Gallão sp. nov., and *L. bodoquena* Bertani & Gallão sp. nov. Abbreviations: BA = State of Bahia, Brazil; MS = State of Mato Grosso do Sul, Brazil.

descriptions. A Leica M205C dissecting microscope with a DFC 450 camera attached, combined with a Leica LAS Montage and LAS 3D modules were used to examine and obtain images and measurements. Legs and palps were measured from the dorsal aspect, unless appendages were lost, damaged, or obviously regenerated. Spermathecae were dissected and digested to clean the soft tissue around the spermathecae with a commercial protein remover for contact lenses (with subtilisin) for at least 3 hours allowing to observe the internal structure. They were deposited at LES – Laboratório de Estudos Subterrâneos, Universidade Federal de São Carlos, São Carlos (curator M.E. Bichuette). Maps were produced with QuantumGis Desktop ver. 3.10.12 (QGis Open Source Geospatial Foundation).

Abbreviations

ALE = anterior lateral eye
PLE = posterior lateral eye
PME = posterior median eye.

Results

Taxonomy

Class Arachnida Cuvier, 1812
Order Araneae Clerck, 1757
Family Sicariidae Keyserling, 1880
Genus *Loxosceles* Heineken & Lowe, 1832

Loxosceles boqueirao Bertani & Gallão sp. nov.

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Figs 2–19

Diagnosis

Males resemble those of *L. carinhanha* and *L. cardosoi* by palpus shape, embolus roughly straight with a curvature close to apex (Figs 3–5), and carapace mostly reddish (Fig. 2). They differ by the longer and slender embolus and the longer palp tibia (Figs 3–8). Females resemble those of *L. cardosoi* by the spermathecae large and weakly sclerotized with two large receptacles on their distal portion (Figs 11–15). They differ by the smaller sclerotized bar and by the less sclerotized transverse plate and bursa copulatrix and lacking a sclerotized triangular area (see Bertani *et al.* 2018). Additionally, both males and females of *L. boqueirao* sp. nov. differ from those of *L. carinhanha* and *L. cardosoi* by the longer legs.

Etymology

The specific name is in apposition and refers to the Lapa do Boqueirão Cave, at Serra do Ramalho region (State of Bahia) where the type specimens were collected.

Type material

Holotype

BRAZIL • ♂; Bahia, Carinhanha, Lapa do Boqueirão Cave; 13°46'51" S, 44°02'18" W; 26 Apr. 2022; M.E. Bichuette, L. Senna-Horta, F. Chaimowicz and J.E. Gallão leg.; day collecting; LES 0028817.

Paratypes

BRAZIL • 2 ♀♀, 1 ♂; same collection data as for holotype; LES 0028818 to LES 0028820.

Other material examined

BRAZIL • 1 ♂, 1 ♀, 1 immature; same collection data as for holotype; 25 Apr. 2022; LES 0028821, LES 0028822.

Description

Male holotype (LES 0028817)

Total length 7.15. Carapace 3.17 long, 3.02 wide (Fig. 2). Eye sizes and interdistances: ALE 0.20, PME 0.20, PLE 0.16, PME–PLE 0.06, PME–ALE 0.23; clypeus 0.26. Leg formula II, IV, I, III. Leg lengths: leg I: femur 8.25, patella 1.30, tibia 10.09, metatarsus 9.94, tarsus 1.92, total 31.50; II: 11.24, 1.51, 14.16, 14.29, 2.15, 43.35; III: 8.61, 1.29, 9.18, 10.54, 1.48, 31.10; IV: 9.07, 1.37, 10.10, 12.48, 1.94, 34.96. Palp: femur 2.29 long, 0.37 wide; patella 0.58 long, 0.39 wide; tibia 1.51 long, 0.55 wide; cymbium 0.69 long, 0.45 wide. Labium 0.74 long, 0.42 wide. Sternum 1.78 long, 1.45 wide. Femur I 2.60 times as long, tibia I 3.18 times as long, and leg I 9.94 times as long as carapace. Palpal femur 6.19 times as long as wide; tibia 2.74 times as long as wide; cymbium oval (Figs 3–8). Bulb suboval and slightly shorter than cymbium. Embolus slender and straight, with a curvature on apex, approximately 2.45 times as long as bulb length in retrolateral view, without carina (Figs 3–8). Femur I prolateral median area with two enlarged setae. Metatarsus I straight on its basal portion. Distal tibia I unmodified.

Carapace reddish on anterior half gradually fading towards posterior and lateral edges, chelicerae uniformly reddish (Fig. 2). Abdomen, legs, and palp light brown, covered by short, greyish setae. Coxae and sternum light brown; labium and endites slightly darker.

Female paratype (LES 0028818)

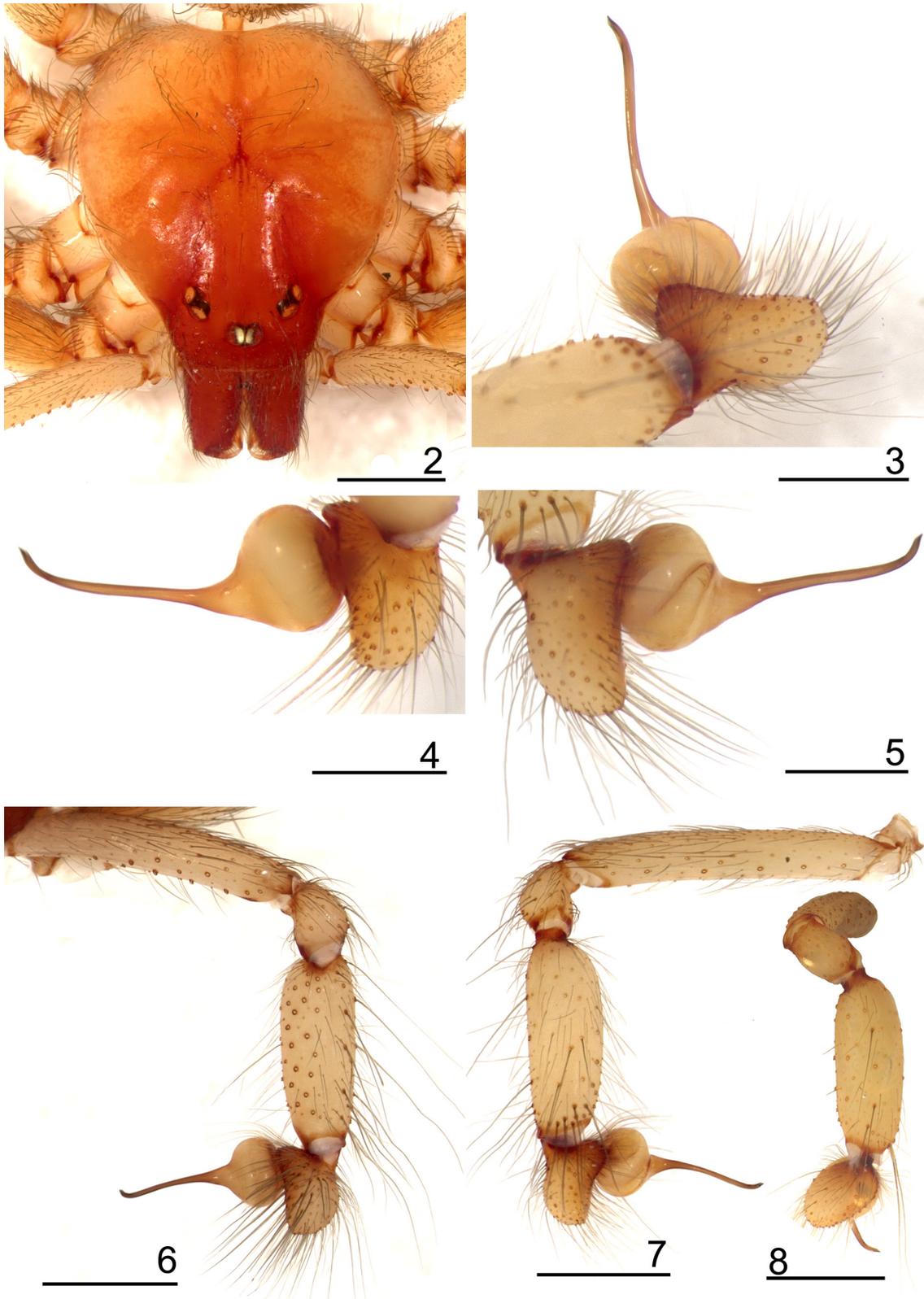
Total length 10.17. Carapace 3.96 long, 3.36 wide (Fig. 9). Eye sizes and interdistances: ALE 0.19, PME 0.23, PLE 0.20, PME–PLE 0.04, PME–ALE 0.35; clypeus 0.33. Leg formula II, IV, I, III. Leg lengths: leg I: femur 8.36, patella 1.37, tibia 9.59, metatarsus 8.87, tarsus 1.78, total 29.97; II: 10.08, 1.40, 11.28, 11.28, 2.03, 36.07; III: 7.94, 1.37, 7.77, 8.93, 1.55, 27.56; IV: 8.83, 1.28, 8.69, 10.92, 1.78, 31.50. Palp: femur 1.88 long, 0.28 wide; patella 0.48 long, 0.37 wide; tibia 1.33 long, 0.28 wide; tarsus 1.82 long, 0.23 wide. Labium 0.67 long, 0.58 wide. Sternum 1.97 long, 1.77 wide. Femur I 2.11 times as long, tibia I 2.42 times as long, and leg I 7.57 times as long as carapace. Palpal femur 6.71 times as long as wide, tibia 4.75 times as long as wide, tarsus not incrassate (Fig. 10). Spermathecae are large, weakly sclerotized pouches with two large receptacles on their distal portion. Dorsal parts of bursa copulatrix have a small, sclerotized triangular area (Figs 11–14). Carapace with some sparse, long, greyish setae (Fig. 9). Carapace light brown, cephalic area and fovea slightly darker (Fig. 9). Chelicerae reddish-brown. Abdomen greyish, legs light brown, both covered with short greyish setae. Palp femur and patella light brown, tibia and tarsus reddish-brown (Fig. 10). Coxae and sternum light brown, labium and endites reddish brown.

Natural history

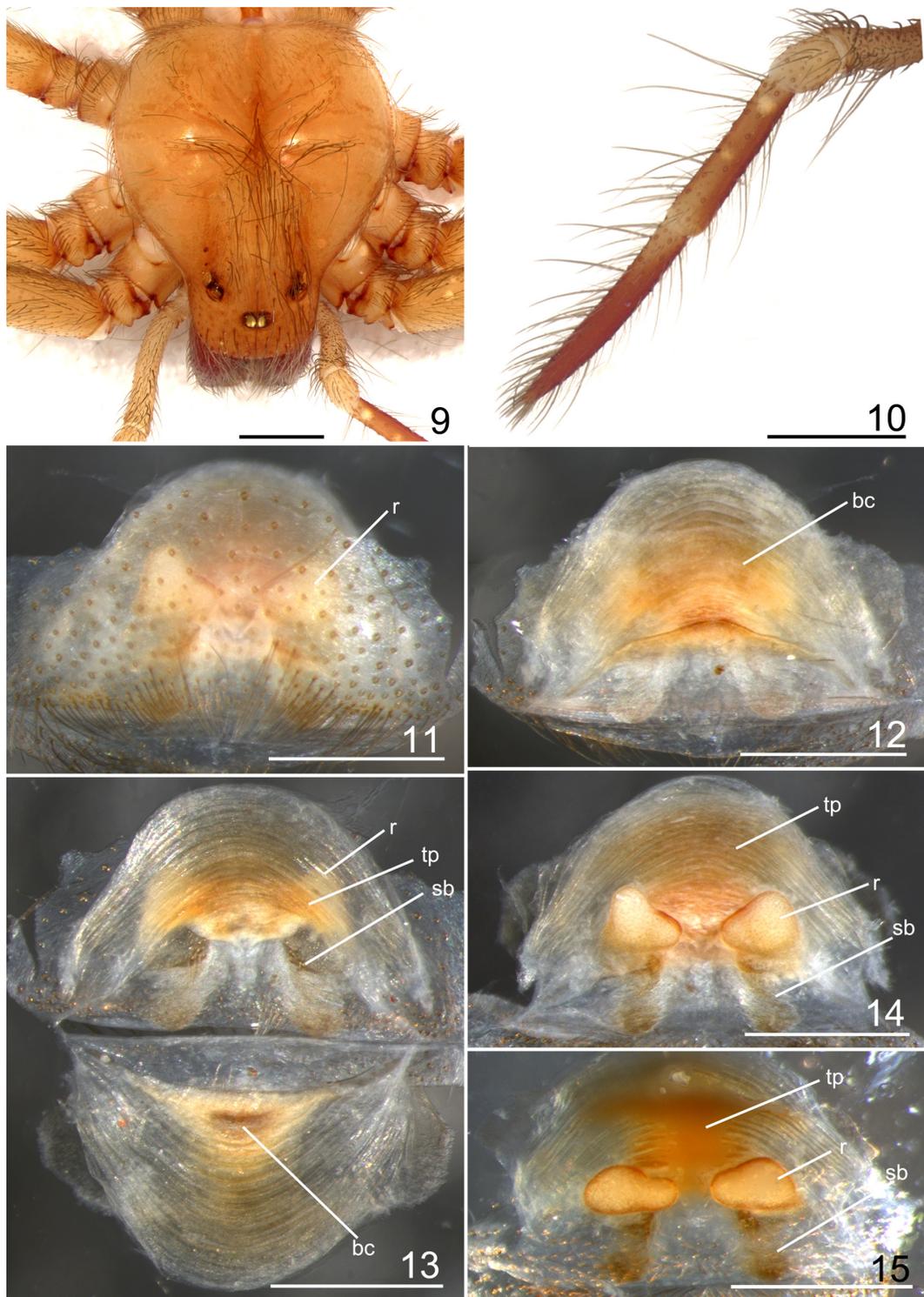
Specimens of *Loxosceles boqueirao* Bertani & Gallão sp. nov. were only found in the aphotic zone in the deep zones of the Lapa do Boqueirão Cave. Most of the specimens were found on the cave wall very close to the ground, solitary in their webs. Only one male was found on the cave wall near the ceiling, approximately 2 meters off the ground. The relative humidity was >90%. Collection efforts, both in caves and in epigeal environments, have been made in the Serra do Ramalho karst area for at least ten years, and no specimen of *L. boqueirao* has been found.

Distribution

BRAZIL: State of Bahia (Fig. 1).



Figs 2–8. *Loxosceles boqueirao* Bertani & Gallão sp. nov., holotype, ♂ (LES 0028817). 2. Carapace. 3–5. Left palp bulb. 3. Dorsal view. 4. Retrolateral view. 5. Prolateral view. 6–8. Left palp. 6. Prolateral view. 7. Retrolateral view. 8. Dorsal view. Scale bars: 2, 6–8 = 1 mm; 3–5 = 0.5 mm.



Figs 9–15. *Loxosceles boqueirao* Bertani & Gallão sp. nov., paratypes, ♀♀. **9–14.** LES 0028818. **9.** Carapace. **10.** Left palp, dorsal view. **11–14.** Spermathecae. **11.** Ventral view, cuticle not removed. **12.** Dorsal view, with bursa copulatrix over receptacles. **13.** Dorsal view, bursa copulatrix unfolded below. **14.** Ventral view, cuticle removed. **15.** LES 0028819, spermathecae, ventral view, cuticle removed. Abbreviations: bc = bursa copulatrix; r = receptacle; sb = sclerotized bar; tp = transverse sclerotized plate. Scale bars: 9–10 = 1 mm; 11–15 = 0.5 mm.

Remarks

The new species is closely related to *L. cardosoi* and *L. carinhanha*, two species noticeably distinct morphologically from other species of *Loxosceles* (see Bertani *et al.* 2018) that were putatively included in the *Loxosceles rufescens* species group (Bertani *et al.* 2018). The discovery of a third species strengthens the importance of the Serra do Ramalho karst area. There are now three species of a distinct evolutionary branch of species of *Loxosceles* that diversified in that area. *Loxosceles boqueirao* sp. nov. shows some troglomorphisms such as slightly longer legs (Fig. 16). We propose it herein as a troglitic species.



Figs 16–19. *Loxosceles boqueirao* Bertani & Gallão sp. nov., in the wild. **16.** Male. **17–18.** Lapa do Boqueirão cave, microhabitat of *Loxosceles boqueirao*, surroundings and cave entrance. Photo 16 by A.O. Lobo.

Loxosceles planetaria Bertani & Gallão sp. nov.

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Figs 20–31

Diagnosis

Males resemble those of *L. gaucho*, *L. similis*, *L. adelaida*, *L. variegata*, *L. troglobia* and *L. bodoquena* Bertani & Gallão sp. nov. by the cymbium more than half length of tibia of palpus (Figs 24–26). They differ from *L. troglobia* and *L. bodoquena* by the shorter embolus and normal body pigmentation (Figs 20–26); from *L. gaucho* by the longer and less incrassate palp tibia (Figs 24–26); from *L. similis* by the slender and straighter embolus (Figs 24–26), from *L. variegata* by the shorter embolus (Figs 24–26), and from *L. adelaida* by the shorter and slender embolus (Figs 24–26). Females resemble those of *L. gaucho*, *L. similis*, *L. variegata* Simon, 1897 and *L. bodoquena* by the well-developed and sclerotized transverse plate of the spermathecae (Figs 29–30). They differ from *L. similis* by the shorter receptacles, from *L. gaucho* by the shorter and straighter receptacles, and from *L. variegata* and *L. bodoquena* by the longer receptacles (Figs 29–30).

Etymology

The specific name is a name in apposition and refers to the Terra Planetária Cave, where the type specimens were collected.

Type material

Holotype

BRAZIL • ♂; Mato Grosso do Sul, Bonito, Terra Planetária Cave; 21°07'48" S, 56°35'28" W; 15 Jun. 2022; M.E. Bichuette, D.F. Torres, L.M. Cordeiro, D.M. Borges, S.G. Jimenez, A. Chagas-Jr and J.E. Gallão leg.; LES 0028823.

Paratypes

BRAZIL • 3 ♀♀, 1 ♂; same collection data as for holotype; LES 0028824 to LES 0028827.

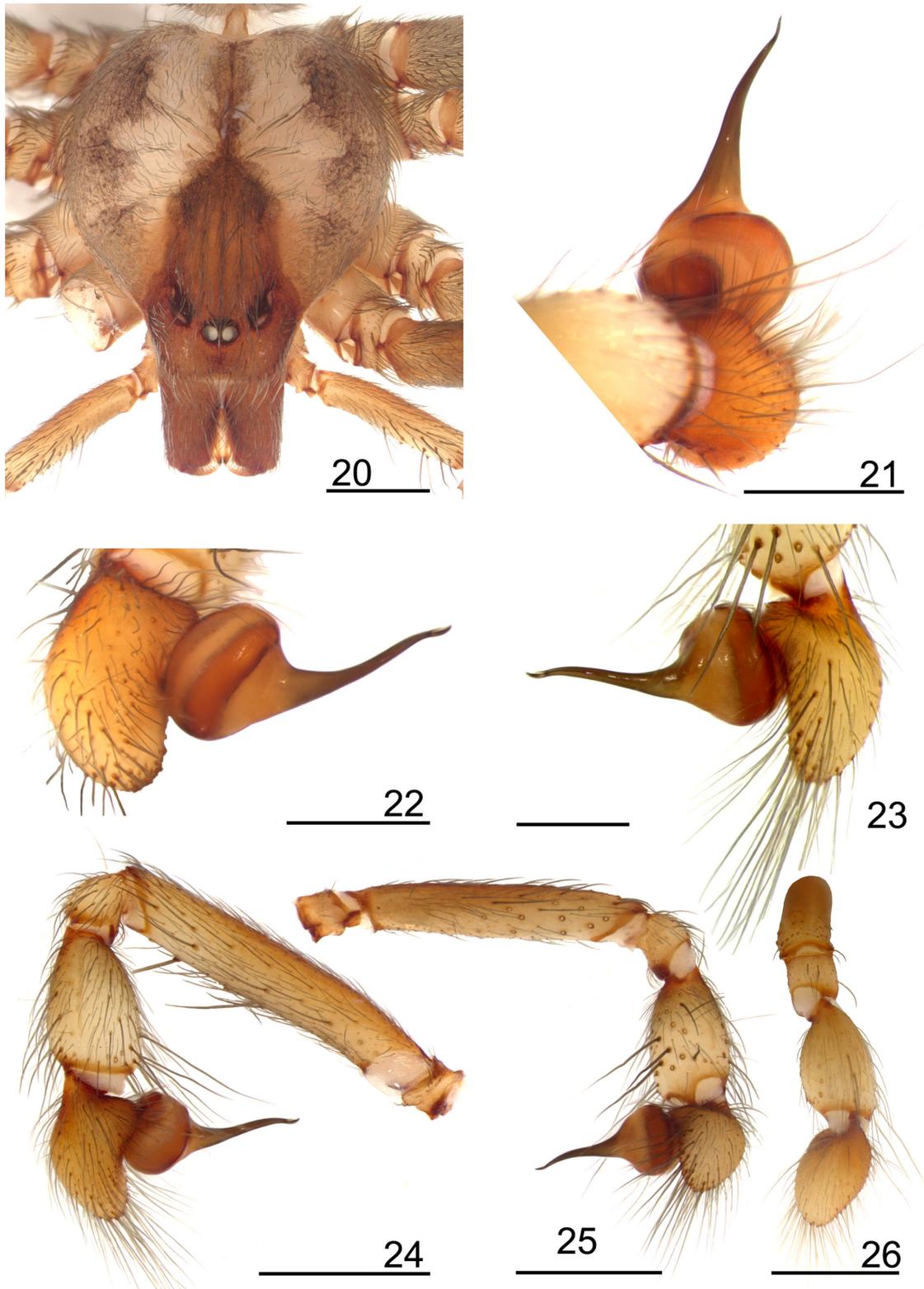
Other material examined

None.

Description

Male holotype (LES 0028823)

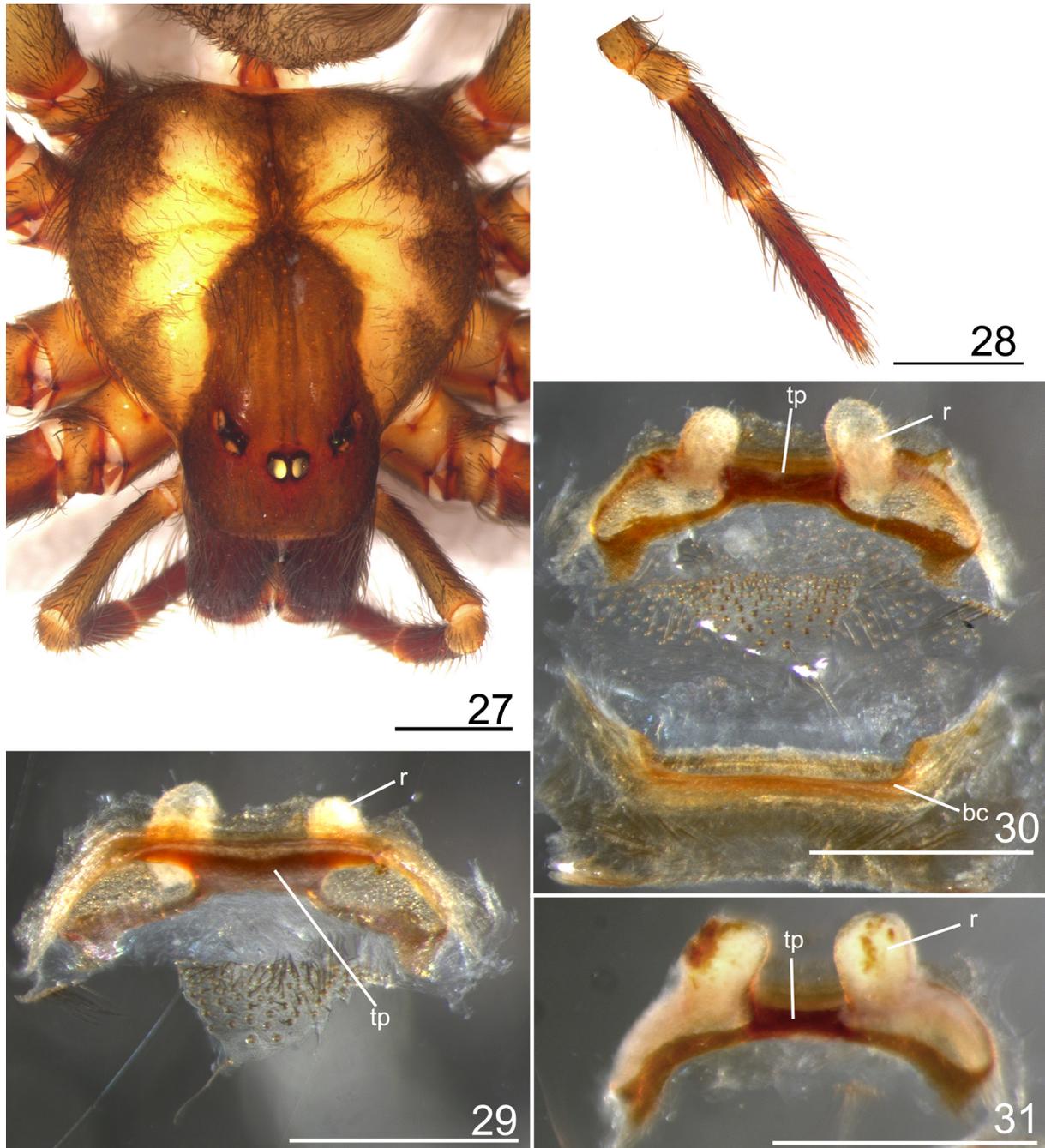
Total length 7.63. Carapace 3.37 long, 3.18 wide (Fig. 20). Eye sizes and interdistances: ALE 0.18, PME 0.21, PLE 0.20, PME–PLE 0.07, PME–ALE 0.18; clypeus 0.38. Leg formula II, I, IV, III. Leg lengths: leg I: femur 8.74, patella 1.44, tibia 10.28, metatarsus 10.84, tarsus 1.97, total 33.27; II: 10.34, 1.42, 12.04, 13.72, 2.20, 39.72; III: 7.53, 1.34, 7.20, 8.52, 1.30, 25.89; IV: 8.53, 1.31, 8.48, 9.88, 1.57, 29.77. Palp: femur 2.06 long, 0.37 wide; patella 0.40 long, 0.39 wide; tibia 0.88 long, 0.54 wide; cymbium 0.87 long, 0.49 wide. Labium 0.95 long, 0.47 wide. Sternum 1.95 long, 1.69 wide. Femur I 2.6 times as long, tibia I 3.05 times as long, and leg I 9.9 times as long as carapace. Palp femur 5.6 times as long as wide, tibia 1.63 times as long as wide, cymbium oval (Figs 24–26). Bulb suboval, about half cymbium length. Embolus curved from its base, approximately 2 times as long as bulb length in retrolateral view, without carina (Figs 21–23). Carapace covered by some greyish sparse setae (Fig. 20). Thoracic region of carapace light brown, marginated with brown. Cephalic region darker and reddish (Fig. 20). Legs and palps brown. Endites, coxae, sternum, and labium light brown. Labium and endites a little darker. Abdomen greyish.



Figs 20–26. *Loxosceles planetaria* Bertani & Gallão sp. nov., holotype, ♂ (LES 0028823). **20.** Carapace. **21–23.** Left palp bulb. **21.** Dorsal view. **22.** Retrolateral view. **23.** Prolateral view. **24–26.** Left palp. **24.** Retrolateral view. **25.** Prolateral view. **26.** Dorsal view. Scale bars: 20, 24–26 = 1 mm; 21–23 = 0.5 mm.

Female paratype (LES 0028824)

Total length 8.25. Carapace 3.89 long, 3.52 wide (Fig. 27). Eye sizes and interdistances: ALE 0.20, PME 0.20, PLE 0.23, PME–PLE 0.07, PME–ALE 0.26; clypeus 0.54. Leg formula II, I, IV, III. Leg lengths: leg I: femur 7.25, patella 1.42, tibia 7.62, metatarsus 7.34, tarsus 1.52, total 25.15; II: 7.84, 1.45, 8.10, 8.37, 1.49, 27.25; III: 6.59, 1.40, 5.64, 6.52, 1.20, 21.35; IV: 7.19, 1.40, 6.77, 7.45, 1.38, 24.19. Palp:



Figs 27–31. *Loxosceles planetaria* Bertani & Gallão sp. nov., paratypes, ♀♀. 27–30. LES 0028824. 27. Carapace. 28. Left palp, dorsal view. 29–30. Spermathecae. 29. Dorsal view. 30. Ventral view, bursa copulatrix unfolded below. 31. LES 0028826, spermathecae, ventral view. Abbreviations: bc = bursa copulatrix; r = receptacle; tp = transverse sclerotized plate. Scale bars: 27–28 = 1 mm; 29–31 = 0.5 mm.

femur 1.47 long, 0.28 wide; patella 0.43 long, 0.34 wide; tibia 0.99 long, 0.29 wide; tarsus 1.48 long, 0.26 wide. Labium 0.90 long, 0.57 wide. Sternum 2.27 long, 1.89 wide. Femur I 1.86 times as long, tibia I 1.96 times as long, and leg I 6.46 times as long as carapace. Palpal femur 5.25 times as long as wide; tibia 3.41 times as long as wide; tarsus not incrassate (Fig. 28). Spermathecae transverse sclerotized plate short with almost-straight receptacles positioned at an angle of 45° to the inner side (Figs 29–30). Dorsal part of the bursa copulatrix medially sclerotized (Fig. 30). Carapace covered with some greyish sparse setae (Fig. 27). Thoracic region of carapace light brown, marginated with brown. Cephalic region darker and reddish (Fig. 27). Legs and palps greyish. Femora of leg I reddish brown on their basal portion. Coxae greyish, sternum light brown. Labium and endites reddish brown. Abdomen greyish.

Natural history

Specimens of *Loxosceles planetaria* Bertani & Gallão sp. nov. were found on the ground at the entrance and twilight zones of the cave as well as in the epigeal environment. In the cave, specimens were near each other. Due to the absence of morphological troglomorphisms and its distribution inside and outside caves, we propose that *L. planetaria* has troglophilic populations.

Distribution

BRAZIL: State of Mato Grosso do Sul (Fig. 1).

Loxosceles bodoquena Bertani & Gallão sp. nov.

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Figs 32–45

Diagnosis

Males resemble those of *L. gaucho*, *L. similis*, *L. adelaida*, *L. variegata*, *L. troglobia* and *L. planetaria* sp. nov. by the cymbium more than half length of tibia of palpus (Figs 41–43). They differ from *L. troglobia* by the shorter embolus, normal eyes and body pigmentation; from *L. gaucho* by the longer and less incrassate palp tibia, from *L. similis* by the slender and straighter embolus, from *L. variegata* by the shorter embolus, from *L. adelaida* by the shorter and slender embolus, and from *L. planetaria* by the longer embolus (Figs 39–40). Females resemble those of *L. gaucho*, *L. similis*, *L. variegata* and *L. planetaria* by the well-developed and sclerotized transverse plate of the spermathecae (Figs 34–36). They differ from *L. similis* and *L. planetaria* by the shorter receptacles, from *L. gaucho* by the shorter and straighter receptacles, and from *L. variegata* by the longer receptacles (Figs 34–36). Additionally, males and females differ from those of the species above, except *L. troglobia*, by the weakly pigmented tegument (Figs 32, 37, 44–45).

Etymology

The specific name is a name in apposition and refers to the type locality of the species, the Bodoquena mountain range (a huge karst area), in the State of Mato Grosso do Sul, Brazil.

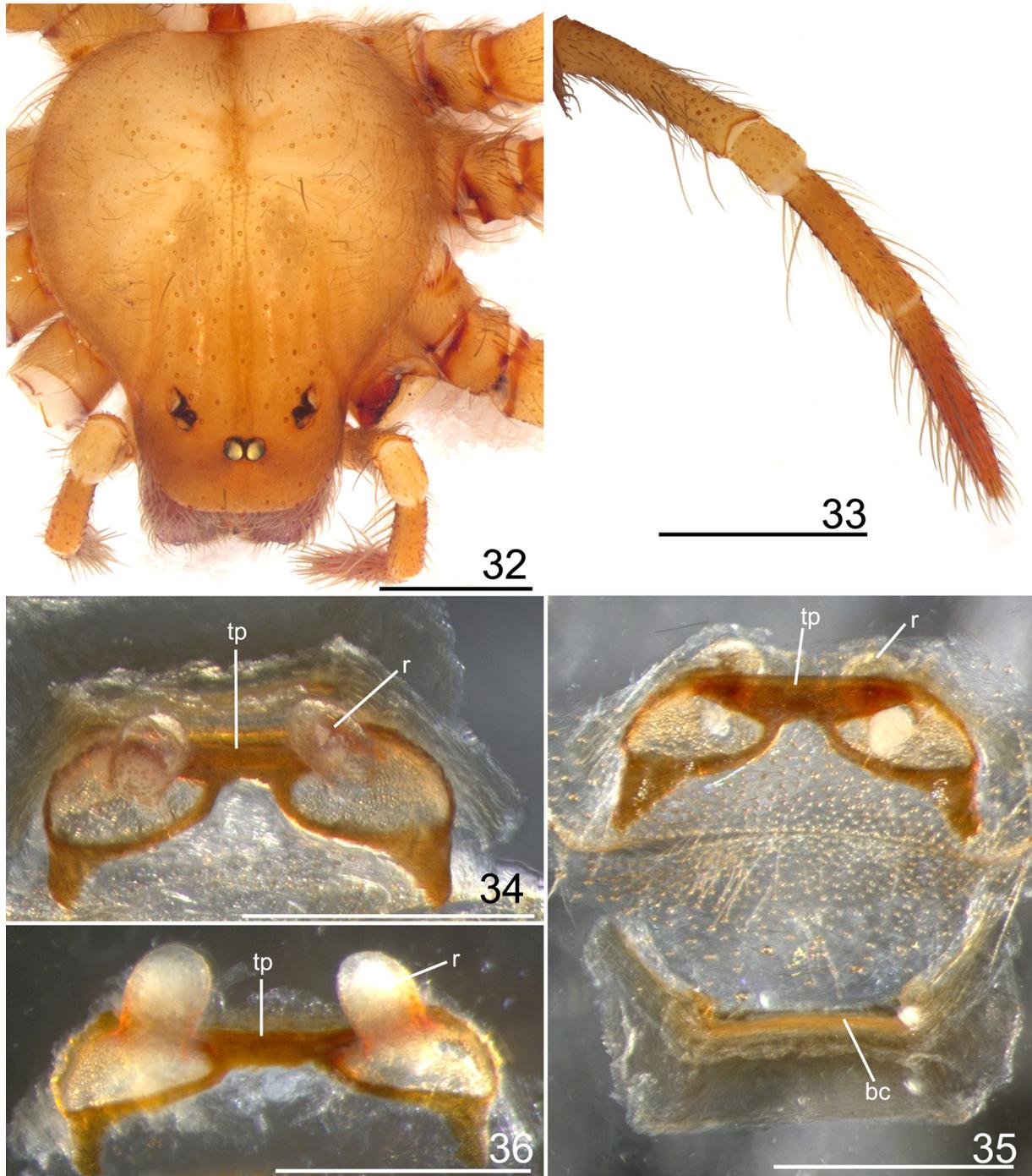
Type material

Holotype

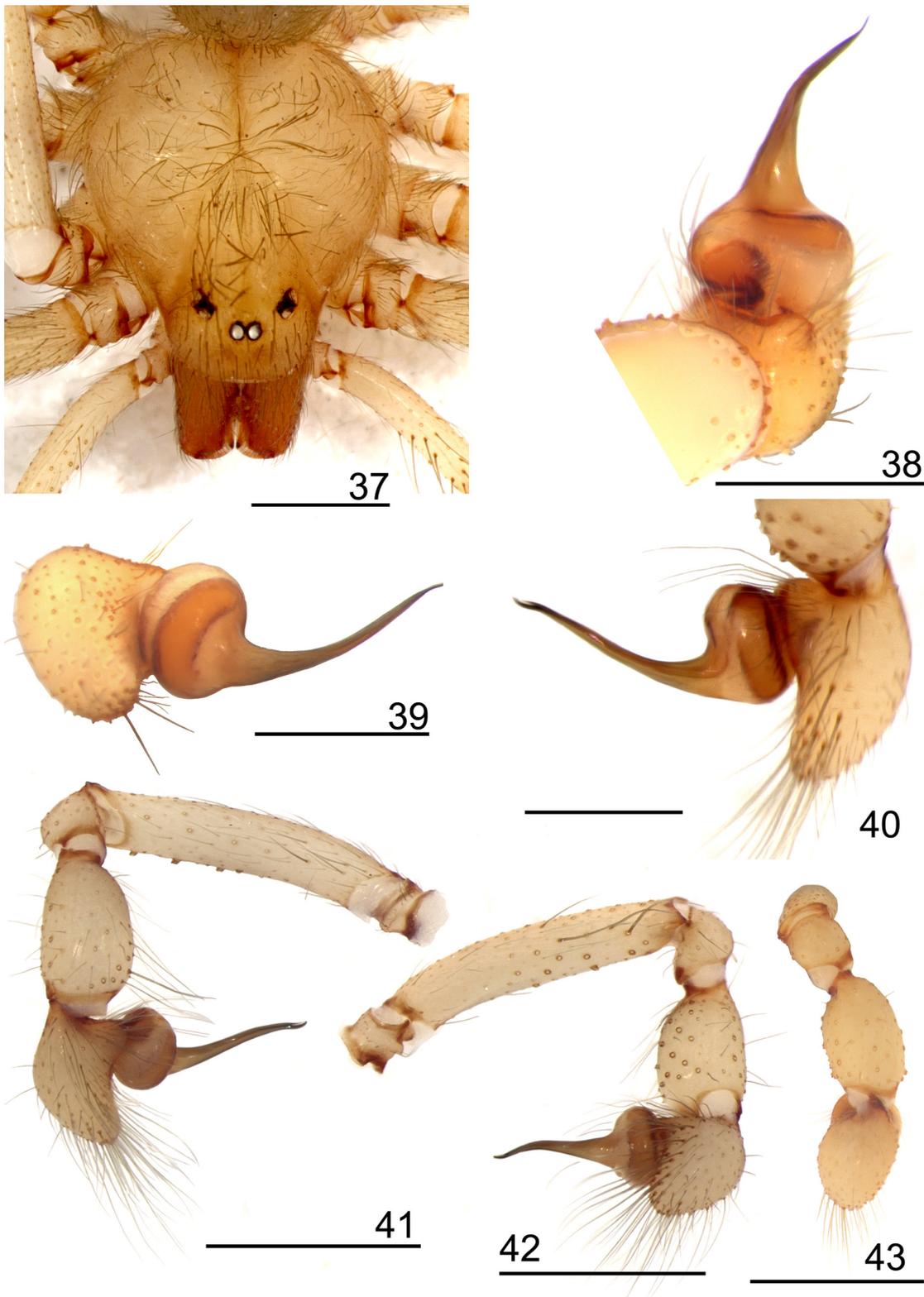
BRAZIL • ♀; Mato Grosso do Sul, Bodoquena, Dente de Cão Cave; 20°44'48" S, 56°47'04" W; 13 Jun. 2022; M.E. Bichuette, D.F. Torres, L.M. Cordeiro, D.M. Borges, S.G. Jimenez, A. Chagas-Jr and J.E. Gallão leg.; LES 0028828

Paratypes

BRAZIL • 1 ♂, 2 ♀♀, 1 immature; same collection data as for holotype; LES 0028829 to LES 0028831.



Figs 32–36. *Loxosceles bodoquena* Bertani & Gallão sp. nov. **32–35.** Holotype, ♀ (LES 0028828). **32.** Carapace. **33.** Left palp, dorsal view. **34–35.** Spermathecae. **34.** Ventral view. **35.** Dorsal view, bursa copulatrix unfolded below. **36.** Paratype, ♀ (LES 0028831), spermathecae, ventral view. Abbreviations: bc = bursa copulatrix; r = receptacle; tp = transverse sclerotized plate. Scale bars: 32–33 = 1 mm; 34–36 = 0.5 mm.



Figs 37–43. *Loxosceles bodoquena* Bertani & Gallão sp. nov., paratype, ♂ (LES 0028829). **37.** Carapace. **38–40.** Left palp bulb. **38.** Dorsal view. **39.** Prolateral view. **40.** Retrolateral view. **41–43.** Left palp. **41.** Retrolateral view. **42.** Prolateral view. **43.** Dorsal view. Scale bars: 37, 41–43 = 1 mm; 38–40 = 0.5 mm.

Description

Female holotype (LES 0028828)

Total length 7.78. Carapace 3.15 long, 2.69 wide (Fig. 32). Eye sizes and interdistances: ALE 0.15, PME 0.14, PLE 0.16, PME–PLE 0.04, PME–ALE 0.24; clypeus 0.34. Leg formula II, IV, I, III. Leg lengths: leg I: femur 7.54, patella 1.07, tibia 7.83, metatarsus 7.77, tarsus 1.67, total 25.88; II: 8.49, 1.07, 8.86, 9.36, 1.76, 29.54; III: 6.57, 1.05, 6.03, 7.31, 1.35, 22.31; IV: 7.41, 1.09, 7.16, 8.82, 1.64, 26.12. Palp: femur 1.30 long, 0.21 wide; patella 0.34 long, 0.29 wide; tibia 0.77 long, 0.22 wide; tarsus 1.02 long, 0.18 wide. Labium 0.73 long, 0.49 wide. Sternum 1.72 long, 1.55 wide. Femur I 2.39 times as long, tibia I 2.48 times as long, and leg I 8.21 times as long as carapace. Palp femur 6.19 times as long as wide; tibia 3.5 times as long as wide; tarsus not incrassate (Fig. 33). Spermathecae transverse sclerotized plate short with almost-straight receptacles positioned at an angle of 45° to the inner side (Figs 34–35).



Figs 44–47. *Loxosceles bodoquena* Bertani & Gallão sp. nov., in the wild. 44. Female. 45. Male. 46–47. Dente de Cão cave, general view.

Dorsal part of the bursa copulatrix medially sclerotized (Fig. 35). Cephalic region of carapace with some sparse, long greyish setae (Fig. 32). Carapace light brown with slightly darker pars cephalica and border (Fig. 32). Legs light brown, covered with short, greyish setae. Palp light brown, except for reddish-brown tibia and tarsus (Fig. 33). Coxae and sternum light brown. Endites and labium reddish brown.

Male paratype (LES 0028829)

Total length 5.80. Carapace 2.52 long, 2.23 wide (Fig. 37). Eye sizes and interdistances: ALE 0.12, PME 0.10, PLE 0.12, PME–PLE 0.04, PME–ALE 0.18; clypeus 0.32. Leg formula II, IV, I, III. Leg lengths: leg I: femur 7.25, patella 1.00, tibia 7.96, metatarsus 8.85, tarsus 1.77, total 26.83; II: 9.24, 1.04, 10.57, 12.67, 1.94, total 35.46; III: 6.65, 0.95, 6.40, 8.21, 1.42, 23.63; IV: 7.33, 0.96, 7.58, 9.88, 1.72, 27.47. Palp: femur 1.39 long, 0.29 wide; patella 0.37 long, 0.31 wide; tibia 0.69 long, 0.44 wide; cymbium 0.76 long, 0.42 wide. Labium 0.51 long, 0.38 wide. Sternum 1.48 long, 1.30 wide. Femur I 2.87 times as long, tibia I 3.16 times as long, and leg I 10.65 times as long as carapace. Palpal femur 4.79 times as long as wide, tibia 1.57 times as long as wide, cymbium oval (Figs 41–43). Bulb suboval, roughly half cymbium length. Embolus curved from its base, approximately 2.33 times as long as bulb length in retrolateral view, without carina (Figs 38–40). Cephalic region of carapace covered with some greyish sparse setae (Fig. 37). Carapace light brown. Cephalic region the same color of thorax. (Fig. 37). Legs, palps, endites, coxae, sternum, and labium light brown. Labium and endites a little darker. Abdomen greyish.

Natural history

Specimens of *Loxosceles bodoquena* sp. nov. were only found in the aphotic zones in the deep zones of the Dente de Cão Cave. Specimens were found under rock boulders in a moist clay substrate (Figs 44–45). The caves and the region were sampled for a long time and no specimen of *L. bodoquena* was ever found in the epigeal (Cordeiro *et al.* 2014). Relative humidity in the cave was >90%.

Distribution

BRAZIL: State of Mato Grosso do Sul (Fig. 1).

Remarks

The very similar genitalia morphology indicates *Loxosceles bodoquena* sp. nov. is closely related with *L. planetaria* sp. nov. and both are found in the same cave system. Interestingly, *L. bodoquena* shows some troglomorphisms as depigmentation and slightly longer legs (Figs 32, 37, 44–45), and we propose it as a troglobitic species.

Discussion

Both areas, the Serra do Ramalho and the Serra da Bodoquena karst areas (Fig. 1), are hotspots for cave-dwelling fauna (Trajano *et al.* 2016). The Serra do Ramalho harbors a remarkable cave-dwelling fauna with several troglobitic representatives such as amphipods, amblypygids, opilionids, millipedes, isopods, pseudoscorpions, gastropods, coleopterans, planarians, fish, among others (Trajano *et al.* 2016; Gallão & Bichuette 2018; Assis *et al.* 2021). In contrast, there is no legal protection for the Serra do Ramalho karst area and in addition to the obligatory cave-dwelling fauna, this region is also important considering the trogliphilic species, thus conservation actions are urgent. As pointed out by Bertani *et al.* (2018), the Serra do Ramalho karst area is an important center of occurrence of species of *Loxosceles*, and the description of a fourth species to this region is noteworthy. Furthermore, three of these species are closely related and seem to represent an evolutionary distinct branch in the evolution of *Loxosceles* (see remarks on *L. boqueirao* sp. nov. above).

The Serra da Bodoquena also harbors a large obligatory cave-dwelling fauna such as amphipods, spelaeogriphaceans, gastropods, collembolans, fish and even an onychophoran, some of them considered phylogenetic relicts (Cordeiro *et al.* 2014; Trajano *et al.* 2016). With this work, we describe two species closely related, one trogliphilic spider and one troglomorphic spider for the region, increasing the knowledge of its subterranean biodiversity. Some of the caves from the Serra da Bodoquena karst area are inserted in the Serra da Bodoquena National Park (Cordeiro *et al.* 2014), with legal protection.

Acknowledgments

We thank the Grupo Bambuí de Pesquisas Espeleológicas (GBPE) for sharing information about Serra do Ramalho and all support to MEB. Thanks to Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) for collecting permit in caves (SISBIO #28992), and for financial support for the project “Estudos para definição de áreas prioritárias para a Conservação de Proteção Espeleológico na Serra do Ramalho - BA”, executed by the Grupo Bambuí de Pesquisas Espeleológicas (GBPE), coordinated by Ezio Rubbioli and integrated by MEB. The Instituto Brasileiro de Desenvolvimento e Sustentabilidade (IABS)/ICMBio/Vale S.A. provided the postdoctoral scholarship to JEG and grants to MEB (TCCE ICMBio/Vale No. 02/2020): a speleological compensation agreement signed between Vale S.A. and ICMBio, with operational management by the IABS). MEB thanks FAPESP (process 2010/08459-4) for financial support in a project at Serra do Ramalho region. To LABART (UFMT) for all help during the field expedition to the caves of Serra da Bodoquena area (A. Chagas-Jr., D.M. Borges, and S.G. Jimenez) and to L. Senna-Horta and F. Chaimowicz for help with the collections at Lapa do Boqueirão Cave. To A.O. Lobo for pictures of *Loxosceles boqueirao* sp. nov. in the natural habitat.

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Manuscript received: 13 June 2023

Manuscript accepted: 14 September 2023

Published on: 5 February 2024

Topic editor: Magalie Castelin

Section editor: Rudy Jocqué

Desk editor: Pepe Fernández

Printed versions of all papers are also deposited in the libraries of the institutes that are members of the *EJT* consortium: Muséum national d’histoire naturelle, Paris, France; Meise Botanic Garden, Belgium; Royal Museum for Central Africa, Tervuren, Belgium; Royal Belgian Institute of Natural Sciences, Brussels, Belgium; Natural History Museum of Denmark, Copenhagen, Denmark; Naturalis Biodiversity Center, Leiden, the Netherlands; Museo Nacional de Ciencias Naturales-CSIC, Madrid, Spain; Leibniz Institute for the Analysis of Biodiversity Change, Bonn – Hamburg, Germany; National Museum of the Czech Republic, Prague, Czech Republic.