

Just met and already threatened? A new species of *Paratrechalea* Carico, 2005 from the Brazilian Cerrado (Araneae: Trechaleidae), with new distribution records for the genus

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Abstract

A new species of trechaleid spider, *Paratrechalea murphyi* sp. n. (♂♀), is diagnosed, described, and illustrated. The species is based on the male and female specimens collected 20 years ago in a conservation unit in the Cerrado biome of Brazil. An attempt to find new specimens in the type locality and in a few nearby locations failed, raising the possibility that the species is threatened with extinction. We provide a complete picture of the distribution of *Paratrechalea*, including new records for all previously known species, and discuss the implications of our results in face of current threats to the Cerrado biota.

Keywords: Lycosoidea • Neotropics • savannas • Taxonomy

Introduction

We are living a biodiversity crisis generated by anthropogenic changes in natural habitats, which makes taxonomy an extremely important discipline. Since only a small fraction of currently living species have been described, it is fair to say that most species might be threatened of extinction in nature, but cannot be protected because they are not even formally named (Cardoso *et al.* 2011). Moreover, only a fraction of the known species has had its threat status formally evaluated, a situation particularly acute for invertebrate animals, arthropods in particular (Cardoso *et al.* 2011; Cowie, Bouchet & Fontaine 2022). This deficit in conservation evaluation is a consequence of the scarcity of information on species geographic distribution, population size and ecological requirements, as most arthropod species are known only from its original taxonomic description, and is often recorded only from its type locality. The only way out of this hindrance would be an increase in descriptive taxonomy studies and fieldwork directed at describing species geographic distribution and natural history (Hochkirch *et al.* 2021).

The spider genus *Paratrechalea* Carico, 2005 comprises seven species, all endemic to South America (World Spider Catalog 2022). The genus is known mostly from Brazil, with only three species represented by a few records in Argentina and Uruguay (Figs. 18–20). As recorded for other trechaleid genera, *Paratrechalea* species are considered semiaquatic spiders, because some of its species have been

recorded inhabiting the margins of rivers and streams, where they are capable of walking over the water, diving when threatened, and feeding on aquatic animals (Carico 2005; Silva *et al.* 2006a; V. Diniz, pers. obs.). The genus is also well known as a model for studying nuptial gift giving, an elaborate courtship behaviour that has been reported for three species (Costa-Schmidt & Araújo 2008; Costa-Schmidt, Carico & Araújo 2008 Brum, Costa-Schmidt & Araújo 2012; Albo & Peretti 2015).

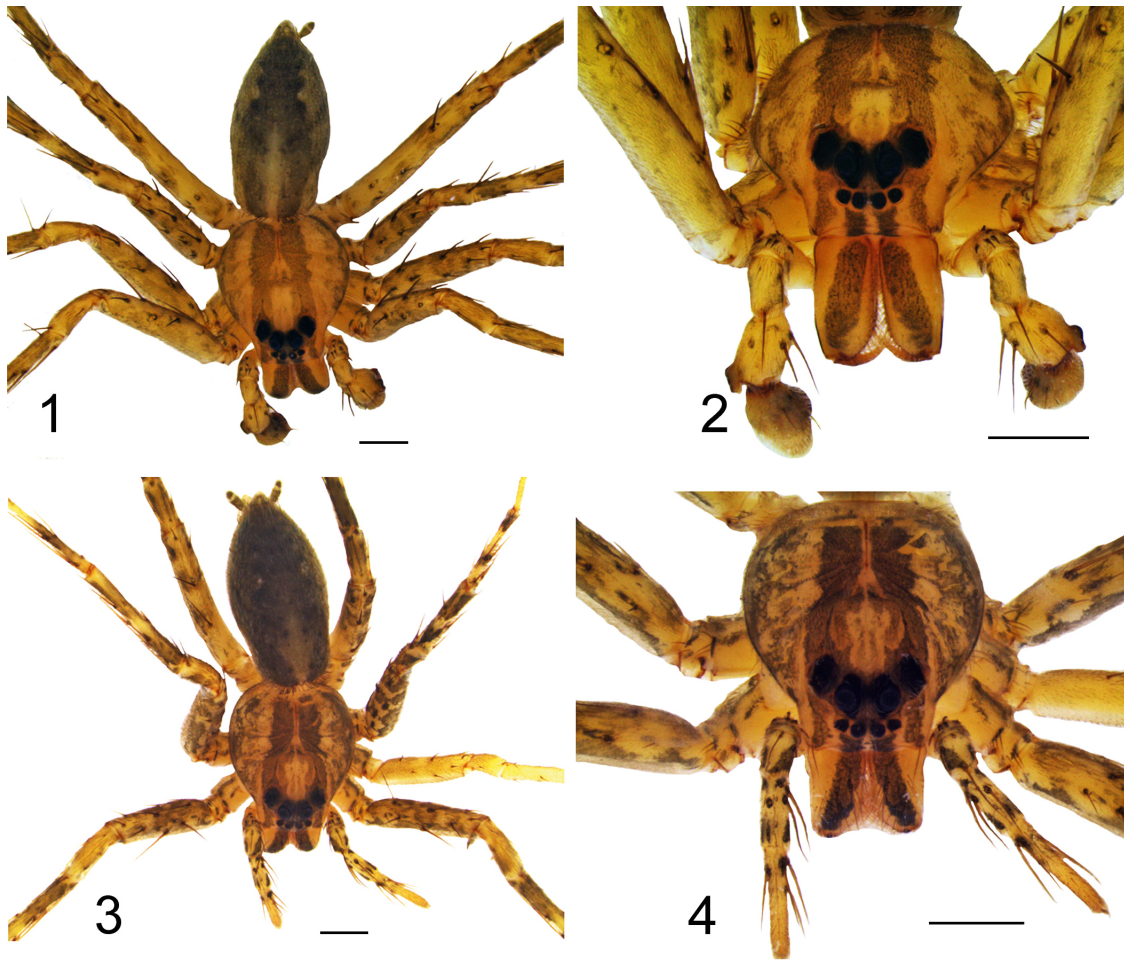
Most distribution records of *Paratrechalea* are concentrated in the Brazilian Atlantic Forest (Figs. 18, 20). Four species—*P. galianoae* Carico, 2005, *P. longigaster* Carico, 2005, *P. saopaulo* Carico, 2005, and *P. wygodzinskyi* (Soares & Camargo, 1948)—occur in the Brazilian savannas (the Cerrado biome), and they are known from only a few distribution records. This information is particularly relevant because the Cerrado is one of the two Brazilian biodiversity hotspots, which means it holds high species diversity and endemism, but has also been suffering intense habitat degradation (Myers *et al.* 2000). Badly enough, its biota is also relatively poorly sampled, if compared to other Brazilian biomes (Oliveira *et al.* 2016).

In this study, we describe a new species of *Paratrechalea*, which is known only from a single locality in a Cerrado protected area. Additionally, we provide new records for all species of the genus, and discuss the conservation situation of our new species in light of our failed attempt of finding it in and nearby the type locality, and considering the distribution of *Paratrechalea* species as a whole.

Material and methods

This study is based on specimens deposited in the following Brazilian collections (abbreviations and curators in parentheses): Centro de Coleções Taxonômicas, Universidade Federal de Minas Gerais, Belo Horizonte (UFMG, A. J. Santos); Coleção de Aracnídeos, Departamento de Zoologia, Universidade de Brasília, Brasília (DZUB, P. C. Motta); Instituto Butantan, São Paulo (IBSP, A. D. Brescovit); Museu de Zoologia, Universidade de São Paulo, São Paulo (MZSP, R. Pinto-da-Rocha). The species described herein is known from only 16 specimens collected at the Estação Ecológica de Itirapina, a 2300 ha conservation unit of native Cerrado. The Estação Ecológica is contiguous with the Estação Experimental de Itirapina, a 3212 ha experimental forestry station covered mostly by pine and eucalyptus plantations, with a few Cerrado patches (Silva *et al.* 2006b).

In an attempt to obtain fresh specimens for DNA extraction, we sampled seven sites inside and near the Estação Ecológica and Estação Experimental de Itirapina, between 31 October–03 November 2019 (Fig. 22). We also searched for the species in two relatively well preserved riparian forests outside the stations (Fig. 22). We actively searched for specimens at night, at the margins of streams, the type of habitat where we have usually found *Paratrechalea* specimens throughout Brazil. Despite the attempt at sampling in



Figs. 1–4: *Paratrechalea murphyi* sp. n., habitus. **1** male (IBSP, 282913), dorsal view; **2** same, frontal view; **3** female (IBSP, 282912), dorsal view; **4** same, frontal view. Scale bars = 1 mm.

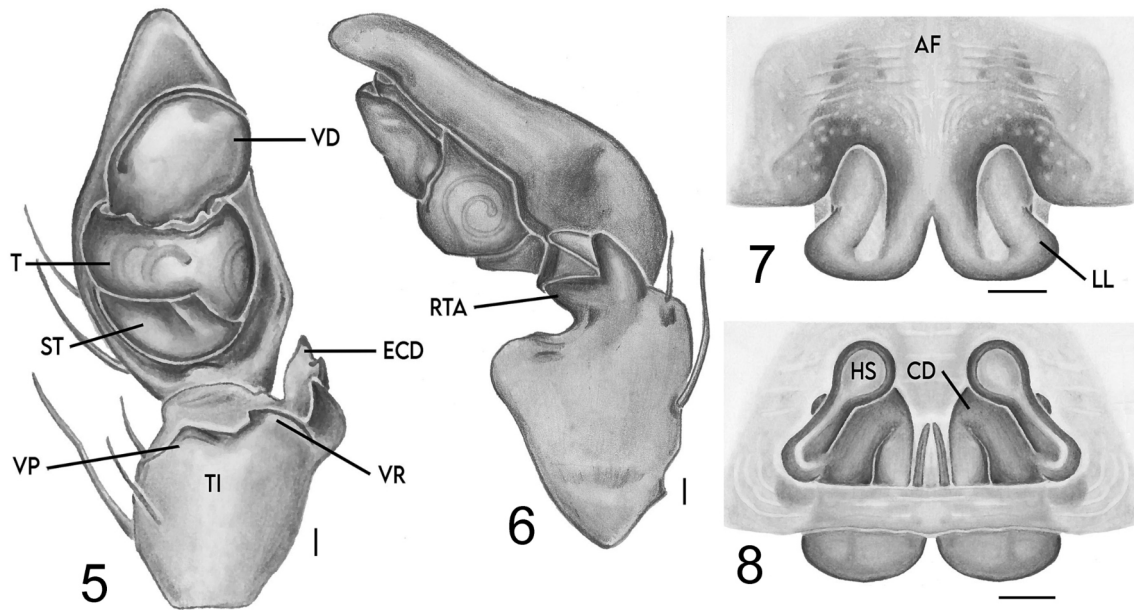
the field, we did not obtain any specimens of *Paratrechalea murphyi* sp. n. (for more details see Discussion).

Specimens were examined, measured, and illustrated using an Olympus SZ40 stereomicroscope. We also photographed specimens using a Leica DFC500 digital camera attached to a Leica M205C stereomicroscope. Photos taken at several focal planes were combined using Leica Applications Suite Version 3.3.0. The female epigynum was removed from the specimens using entomological pins and tweezers, and chemically cleaned in a pancreatin solution (Álvarez-Padilla & Hormiga 2008) for observation of internal structures. The illustrations were edited in the GIMP-GNU Image Manipulation Program v. 2.10.6.

Description format and terminology follow Carico (2005), Silva *et al.* (2006a), and Sierwald (1989), and all measurements are in millimetres. The following abbreviations were used in species descriptions: AE row = width of anterior eye row, AF = anterior field of female epigynum, ALE = anterior lateral eyes, AME = anterior median eyes, BL = basal lobe of the ectal division of the retrolateral tibial apophysis, CD = copulatory duct, DD = dorsal division of median apophysis, DL = distal lobe of ectal division of retrolateral tibial apophysis, ECD = ectal division of retrolateral tibial apophysis, END = ental division of retrolateral tibial apophysis, FD = fertilization duct, HS = head of sper-

mathecae, MA = median apophysis, MF = median field of epigynum, OQA = anterior width of ocular quadrangle, OQH = height of ocular quadrangle, OQP = posterior width of ocular quadrangle, PE row = width of posterior eye row, PLE = posterior lateral eyes, PME = posterior median eyes, RTA = retrolateral tibial apophysis, ST = subtegulum, T = tegulum, TI = tibia, VCM = ventral cymbio-tibial membrane, VD = ventral division of median apophysis, VP = ventral protuberance of palpal tibia, VR = tibial ventral rim. The names of the main collectors are abbreviated as follows: BF = B. T. Faleiro, EA = E. S. S. Álvares, EM = E. O. Machado, LC = L. S. Carvalho, LS = L. E. C. Schmidt, MM = M. D. F. Magalhães, MT = M. O. Tomasi, VD = V. S. R. Diniz.

Geographic distribution records of *Paratrechalea* species were obtained from the literature (Mello-Leitão 1943, 1947; Soares & Camargo 1948; Carico 2005; Silva *et al.* 2006a; Costa-Schmidt & Araújo 2010; Silva & Lise 2010), from museum collections, and our own fieldwork. Geographic coordinates were taken in loco using a GPS (our samples) and from collection labels. In the absence of any georeferencing information, we obtained approximate coordinates in SpeciesLink (<http://splink.cria.org.br/geoloc>) or Google Earth. The distribution maps were generated in ArcGIS® 10.3.



Figs. 5–8: *Paratrechalea murphyi* sp. n. **5** male (UFGM, 25656), left palp, ventral view; **6** same, retrolateral view; **7** female (IBSP, 282911), epigyne, ventral view; **8** internal genitalia, dorsal view. Scale bars = 0.1 mm

***Paratrechalea murphyi* sp. n.** (Figs. 1–17)

Types: Holotype ♂ (IBSP, 282913), BRAZIL, São Paulo, Itirapina, Estação Ecológica de Itirapina, 22°14'33.45"S 47°51'51.40"W (approximate coordinates), 01 November 2002, A. A. Nogueira. Paratypes: 1 ♀ (IBSP, 282912), same data as the holotype; 1 ♂, 1 ♀ (UFGM, 25656 and 25657, respectively), same data as the holotype.

Other material: BRAZIL: 10 ♂, 2 ♀ (IBSP, 52844, 52846, 52847, 282911), São Paulo, Itirapina, Estação Ecológica de Itirapina, 22°14'33.45"S 47°51'51.40"W (approximate coordinates), 01 November 2002, A. A. Nogueira.

Remarks: All the specimens were collected in a riparian forest of a small stream, but no exact geographic coordinates were taken in loco (A. A. Nogueira, pers. comm.). As two small streams cross the Estação Ecológica de Itirapina, above we have provides approximate coordinates.

Etymology: The species name honours the late British arachnologist John A. Murphy (1922–2021), for his significant contributions to the spider taxonomy worldwide.

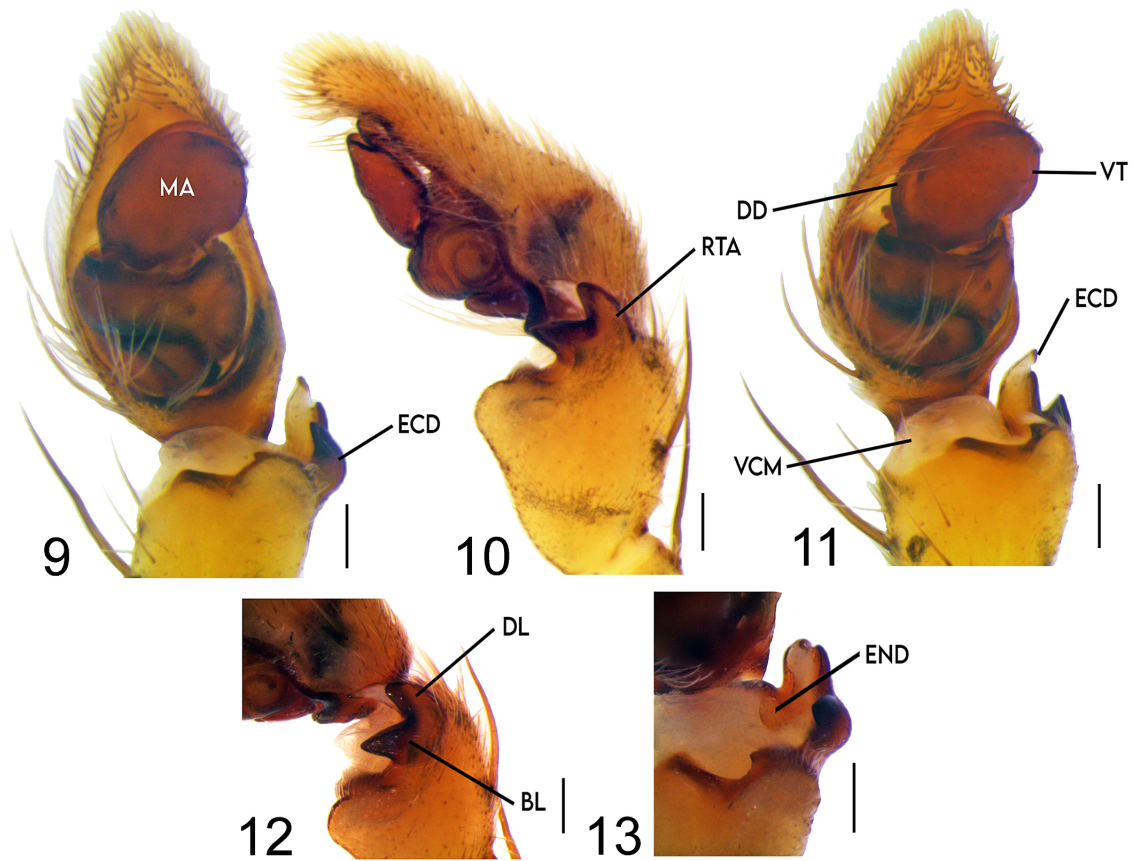
Diagnosis: In the rounded and expanded ventral division of the median apophysis, the male of *P. murphyi* sp. n. resembles that of *P. ornata* (Mello-Leitão, 1943) (Carico 2005: fig. 18), but can be distinguished from it, as well as from all other congeners, by having both the basal and the distal lobes of the ectal division of the RTA tapering (Figs. 6, 10, 12). Additionally, *P. murphyi* sp. n. can be recognized by the bifid distal lobe of the ectal division of the RTA, which has an internal hyaline tip (Figs. 6, 10–12). The female of *P. murphyi* sp. n. can be distinguished from all the congeners by the combination of laterally projected lateral lobes, which are divided by a wide median field, and a deep median furrow in the posterior margin of the median field

(Figs. 7, 14). Additionally, the median field of the epigyne is delimited by wide, sclerotized keels (Fig. 14).

Distribution: Known only from the type locality (Fig. 17).

Description of holotype male: Total length 6.75. Carapace 2.9 long, 2.8 wide, reddish-brown, with a pair of dark brown median bands and the margins suffused in dark brown (Fig. 1). Clypeus 0.2 high, 1.4 wide, reddish-brown, with a marginal and a median pairs of dark brown bands (Fig. 2). Sternum 1.3 long, 1.5 wide, light yellow, with scattered black dots. Labium 0.5 long, 0.5 wide, light yellow, endites light yellow. Anterior and posterior eye rows slightly recurved. Eye sizes and intesdistances: AE row 0.69; PE row 1.27; OQA 0.36; OQP 0.71; OQH 0.51; PLE 0.2; PME 0.23; ALE 0.15; AME 0.14; PLE-PME 0.31; PME-PME 0.15; ALE-AME 0.04; AME-AME 0.9. Chelicerae reddish brown, with an anterior, median dark brown band (Figs. 1–2), three promarginal teeth subequal in size, the subproximal the largest; three retromarginal teeth subequal in size. Legs reddish-brown, suffused in dark-brown. Leg measurements (femur/patella-tibia/metatarsus/tarsus/total): I 4.0/ 5.2/ 3.7/ 1.7/14.6; II 4.2/ 5.1/ 3.8/ 1.6/ 14.7; III 2.6/3.5/ 2.7/ 1.0/ 9.8; IV 4.3/ 4.7/ 4.4/ 1.8/ 15.2. Ventral macrosetae pairs on tibiae I-5, II-4, III-3, IV-3. Abdomen 5.5 long, dark brown dorsally and laterally, with a median darker, folium-like band (Fig. 1), venter yellow. Palp tibia approximately half as long as the cymbium, anteriorly delimited by a ventral rim. Bulb with VD flattened, rounded, and large, covering the guide, and the tegulum rounded and large (Figs. 5, 6, 9–13).

Description of paratype female (IBSP, 282912): Total length 7.3. Carapace 3.1 long, 2.8 wide, reddish-brown, with a pair of dark brown median bands and the margins suffused in dark brown (Fig. 3). Clypeus 0.2 high, 1.5 wide,



Figs. 9–13: *Paratrechalea murphyi* sp. n., male (UFMG, 25656), left palp. **9** ventro-apical view; **10** retrolateral view; **11** ventral view; **12** RTA, retrolateral view, **13** same, ventro-apical view. Scale bars = 0.2 mm

reddish brown, with a marginal and a median pairs of dark brown bands (Fig. 4). Sternum 1.5 long, 1.6 wide, light yellow, with scattered black dots. Labium 0.5 long, 0.5 wide, light yellow, with scattered black dots, endites light yellow. Anterior and posterior eye rows slightly recurved. Eye sizes and interdistances: AE row 0.76; PE row 1.39; OQA 0.36; OQP 0.76; OQH 0.53; PLE 0.2; PME 0.25; ALE 0.15; AME 0.15; PLE-PME 0.31; PME-PME 0.17; ALE-AME 0.04; AME-AME 0.08. Chelicerae reddish brown, with an anterior, median dark brown band (Figs. 3–4), three promarginal teeth subequal in size, the subproximal the largest; three retromarginal teeth subequal in size. Legs reddish brown, suffused in dark brown. Leg measurements (femur/patella-tibia/metatarsus/tarsus/total): I 4.0/ 5.0/ 3.7/ 1.7/ 14.6; II 4.0/ 4.8/ 3.4/ 1.7/ 14.1; III 2.9/3.1/ 2.6/ 1.1/ 9.7; IV 4.0/ 4.2/ 3.9/ 1.7/ 13.8. Ventral macrosetae pairs on tibiae I-5, II-4, III-3, IV-3. Abdomen 4.3 long, dark-brown dorsally and laterally, with a median darker, folium-like band (Fig. 3), venter yellow, with scattered black dots. Palp yellow, suffused in black. Internal genitalia with a pair of sclerotized median ridges near the copulatory ducts (Figs. 8, 15). Copulatory ducts strongly sclerotized and wider than the stalk of the spermathecae (Figs. 8, 15–16). Head of spermathecae small and rounded (Figs. 8, 15–16). Fertilization ducts thin, posteriorly positioned and dorsally directed (Fig. 16).

Variation: Carapace length, mean and range, males 3.1, 2.9–3.4 (N = 12), females 3.17, 3.1–3.3 (N = 4).

Natural history: All the specimens were collected in a riparian forest (A. A. Nogueira, pers. comm.), which indicates the species is probably semiaquatic, as other species of the genus.

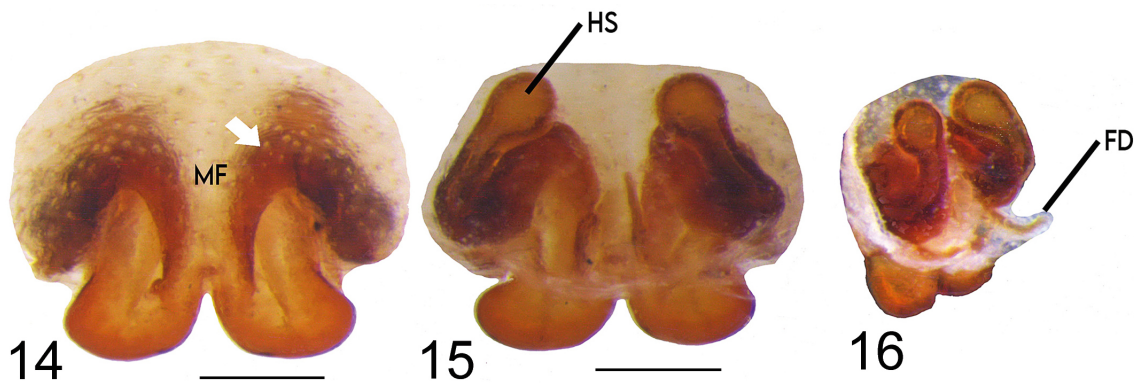
New records

Paratrechalea azul Carico, 2005 (Fig. 17)

Paratrechalea azul Carico, 2005: 809, figs 28–29 (female holotype from Água Azul, Vila Oliva, Caxias do Sul, Rio Grande do Sul, Brazil, A. A. Lise coll., 15 January 1975, deposited in Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCTP, 2551), not examined).

Distribution: Previously known from southern and south-eastern Brazilian Atlantic Forest. Additional records within that range, and new distribution records from southern state of Minas Gerais are presented below (Fig. 17).

New records: BRAZIL: Minas Gerais: 1♂ (UFMG, 23291), Carmo da Cachoeira, waterfall near the train station, 21°26'38.3"S 45°12'19.3"W, 898 m, 03 October 2015, VD & BF. Rio de Janeiro: 1♀ (UFMG, 23221), Nova Friburgo, Lumiar, near Riacho das Pedras, 22°21'2.6"S 42°23'15.8"W, 22 September 2015, VD & BF. São Paulo: 9♀ (UFMG, 23250-22254, 22261-22263, 22266), São Luiz do Paraitinga, Parque Estadual da Serra do Mar, Núcleo



Figs. 14–16: *Paratrechalea murphyi* sp. n., female (IBSP, 282911). **14** epigyne, ventral view, white arrow indicates sclerotized keel of median field; **15** internal genitalia, dorsal view; **16** ventro-lateral view. Scale bars = 0.2 mm.

Santa Virgínia, Corredeira do Ipiranga, 23°20'38.7"S 45°8'14"W, 903 m, 26 September 2015, VD & BF. Paraná: 1♀ (UFMG, 22777), Paranaguá, Parque Nacional de Saint-Hilaire, Mata Atlântica Park Hotel, 25°40'10.4"S 48°36'4.8"W, 288 m, 12 October 2014, VD; 1♂ (UFMG, 22779), Parque Nacional de Saint-Hilaire, Fazenda Niteroi, 25°39'38.1"S 48°35'45.1"W, 80 m, 11 October 2014, LC. Santa Catarina: 1♂, 2♀ (UFMG, 22773, 22782, 22793), Urubici, Parque Nacional de São Joaquim 28°8'34.7"S 49°37'15.6"W, 28 August 2014, VD; 3♂, 7♀ (UFMG, 22774, 22794–22802), Praia Grande, Parque Nacional da Serra Geral, Cânion Churriado, 29°7'48"S 49°57'56.2"W, 246 m, 20 October 2014, LC; 2♂, 2♀ (UFMG, 22783–22786), Parque Nacional da Serra Geral, near Cânion Churriado, 29°8'15.3"S 49°57'5.9"W, 128 m, 20 October 2014, LC; 2♀ (UFMG, 22790, 22792), Blumenau, Parque Nacional da Serra do Itajaí, Setor Parque das Nascentes, Trilha da Chuva, 27°3'23"S 49°5'12"W, 320 m, 15 October 2014, VD. Rio Grande do Sul: 4♂ (UFMG, 2866, 2871, 22919, 22933, 22959), Maquiné, 29°32'46.51"S 50°18'35.42"W, 31 January–05 February 2014, LS; 10♂, 10♀ (UFMG, 22805, 22808, 22822, 22853, 22870, 22897, 22902, 22911, 22914, 22920, 22921, 22924, 22932, 22945, 22948, 22951, 22955, 22958, 22967, 22970), Maquiné, 29°34'28.68"S 50°16'50.19"W, 31 January–05 February 2014, LS.

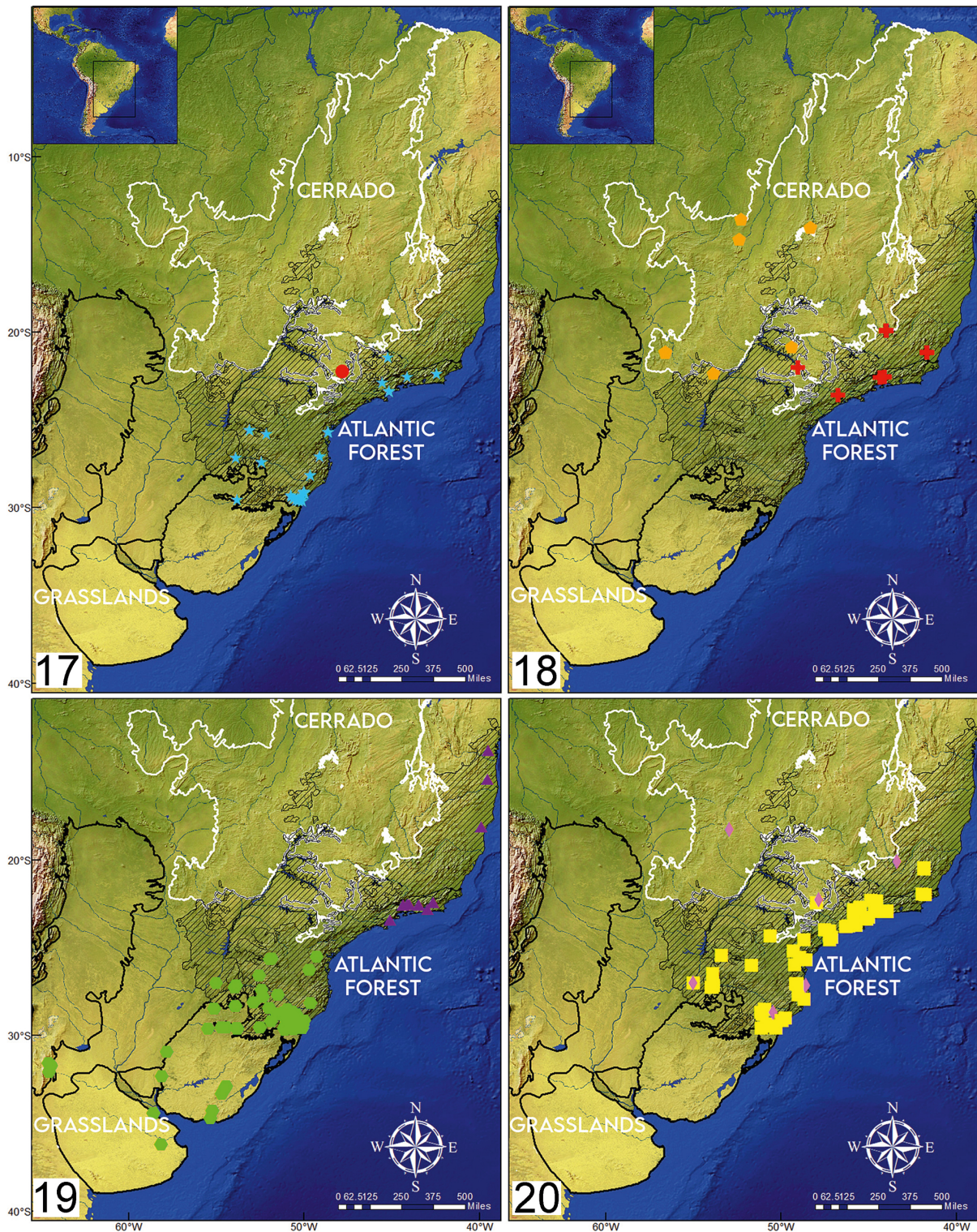
Paratrechalea galianoae Carico, 2005 (Fig. 20)

Paratrechalea galianoae Carico, 2005: 808, figs. 16, 26–27 (female holotype from General Manuel Belgrano, Misiones, Argentina, M. E. Galiano coll., January 1966, deposited in Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN, 15690), not examined).

Distribution: Previously known from northeastern Argentina and southern and southeastern Brazil, within the Atlantic Forest biome. New distribution records within this range are provided below (Fig. 20).

New records: BRAZIL: São Paulo: 1♀ (UFMG, 25623), Campos do Jordão, Parque Estadual Campos do Jordão, Trilha da Caiambora, 22°41'58.95"S 45°29'50.67"W, 1541

m, 10 March 2020, MT *et al.*; 16♂, 8♀ (UFMG, 23266–23289), same locality, trail to waterfall, 22°41'39.6"S 45°27'39.3"W, 1578 m, 01 October 2015, VD & BF; 1♂ (UFMG, 25624), Brotas, Cachoeira da Casorova, 22°24'55.6"S 47°59'28"W, 02 November 2019, VD & BF; 2♂, 4♀ (UFMG, 25639–25644), Santo André, Parque Municipal Nascentes do Paranapiacaba, trail to the Tanque do Gustavo, 23°46'16.8"S 46°17'42.2"W, 803 m, 23 November 2020, MM *et al.*; 1♀ (UFMG, 26645), Mogi das Cruzes, Parque das Neblinas, Cachoeira do Lava pé, 23°44'55"S 46°9'45.1"W, 756 m, 21 November 2020, VD *et al.*; 3♂, 12♀ (UFMG, 25646–26550), Parque das Neblinas, river in the Trilha da Cachoeira, 23°44'50.4"S 46°9'31.2"W, 692 m, 21 November 2020, MT *et al.*; 6♂, 6♀ (UFMG, 25651–26555), Parque das Neblinas, river near Trilha da Bike, 23°45'1.58"S 46°9'53.44"W, 732 m; 20 November 2020, MT *et al.*; 3♂, 2♀ (UFMG, 23293–23297), São Sebastião, Parque Estadual da Serra do Mar, Núcleo São Sebastião, 23°43'33.7"S 45°45'13.1"W, 25 m, 28 November 2015, VD & BF; 4♂, 12♀ (UFMG, 23218–23220, 23239–23248, 23339–23341), same locality, RPPN Rizzieri, 23°43'1.6"S 45°43'2.2"W, 25 m, 28 November 2015, VD & BF; 1♂, 1♀ (UFMG, 23229–23230), Pedro de Toledo, near Parque Estadual da Serra do Mar, Núcleo Itarirú, 24°16'5.6"S 47°13'50.2"W, 47 m, 29 November 2015, VD & BF; 1♂, 7♀ (UFMG, 23249, 23255–23259, 23263, 23264), São Luiz do Paraitinga, Parque Estadual da Serra do Mar, Núcleo Santa Virgínia, Corredeira do Ipiranga, 23°20'38.7"S 45°8'1.4"W, 903 m, 26 November 2015, VD & BF; 6♂, 8♀ (UFMG, 23298–23311), Iguape, Estação Ecológica de Juréia-Itatins, Cachoeira do Paraíso, 24°23'56.4"S 47°7'20.6"W, 20 m, 30 November 2015, VD & BF; 2♂, 8♀ (UFMG, 23312–23321), Cunha, Parque Estadual da Serra do Mar, Núcleo Cunha, 23°14'4.6"S 45°1'23.9"W, 1018 m, 25 November 2015, VD & BF. Minas Gerais: 5♂, 8♀ (IBSP, 52745), Alto Caparaó, Parque Nacional do Caparaó, 20°30'12.8"S 41°49'8.3"W, 01–07 May 2002, Equipe Biotá. Rio de Janeiro: 1♂ (UFMG, 23290), Itatiaia, Visconde de Mauá, road to the Vale do Pavão, 22°20'0.4"S 44°33'49.6"W, 1090 m, 23 November 2015, VD & BF; 6♂, 7♀ (UFMG, 23214–26217, 23231–23238, 23338), same locality, Vale da Grama, Rio



Figs. 17–20: Collecting localities of *Paratrechalea* species, based on literature data, museum collections, and recent fieldwork. **17** red circle = *P. murphyi* sp. n.; blue star = *P. azul* Carico, 2005; **18** orange pentagon = *P. wygodzinski* (Soares & Camargo, 1948); red cross = *P. saopaulo* Carico, 2005; **19** violet triangle = *P. julyae* Silva & Lise, 2006; green hexagon = *P. ornata* (Mello-Leitão, 1943); **20** yellow square = *P. galianoae* Carico, 2005; rose diamond = *P. longigaster* Carico, 2005.

Maribondo 22°20'50"S 44°33'01"W, 1075 m, 23 November 2015, VD & BF; 1♀ (UFMG, 25637), Parque Nacional do Itatiaia, Trilha do Lago Azul, 22°27'7.16"S 44°36'42.6"W, 784 m, 06 March 2020, MM *et al.*; 1♀ (UFMG, 25638), trail near housing, 22°27'15.5"S 44°36'30"W, 08 March 2020, MM *et al.*; 1♂ (UFMG, 23292), Santa Maria Madalena, Terras Frias, 21°55'36.3"S 41°57'1.3"W, 504 m, 21 Novem-

ber 2015, VD & BF; 6♂, 9♀ (UFMG, 23322–23336), Mangaratiba, Rio Sai, Cachoeira da Usina, near Parque Estadual Cunhambebe, 22°53'53.16"S 43°58'13.48"W, 487 m, 24 November 2015, VD & BF. Paraná: 5♂, 1♀ (MZSP, 17822), Boa Vista da Aparecida, Rio Jacutinga, 25°26'18.4"S 53°24'22.3"W, 13 October 1998, M. Oliveira da Silva & C. Gatto; 1♀ (UFMG, 22765–22770), Paranaguá, Parque

Nacional de Saint-Hilaire, Mata Atlântica Park Hotel, 25°40'10.4"S 48°36'4.8"W, 288 m, 12 October 2014, VD; 1♂, 6♀ (UFMG, 22760–22764, 22771, 23337), Parque Nacional de Saint-Hilaire, Fazenda, Niteroi 25°39'38.1"S 48°35'45.1"W, 80 m, 11 October 2014, LC; 1♀ (UFMG, 22774, 22794–22802), Praia Grande, Parque Nacional da Serra Geral, Cânion Churriado, 29°7'48"S 49°57' 56.2"W, 246 m, 20 October 2014, LC; 1♀ (UFMG, 22787), Parque Nacional da Serra Geral, near Cânion Churriado, 29°8'15.3"S 49°57'5.9"W, 128 m, 20 October, 2014, LC; 1♂, 2♀ (UFMG, 22788, 22789, 22791), Blumenau, Parque Nacional da Serra do Itajaí, Setor Parque das Nascentes, Trilha da Chuva, 27°3'23"S 49°5'12"W, 320 m, 15 October 2014, VD. Rio Grande do Sul: 1♂ (UFMG, 22923), Maquiné, 29°34'28.68"S 50°16'50.19"W, 31 January–05 February 2014, LS; 1♂, 1♀ (UFMG, 22982, 22984), Novo Machado, Parque Estadual do Turvo, stream near River Uruguai, 27°8'35.14"S 53°53'2.63"W, 153 m, 09 July 2015, VD & LS; 1♂ (UFMG, 22988), Ipê, 28°40'22.7"S 51°8'37.7W, 770 m, 11 July 2015, VD & LS; 3♂, 2♀ (UFMG, 23098, 23100, 23101, 23107, 23109), Derrubadas, 27°14'28.5"S 53°55'42.3"W, 296 m, 09 July 2015, VD & LS; 15♂, 10♀ (UFMG, 23176–23200), same locality, 27°14'56.4"S 53°58'20"W, 296 m, 09 July 2015, VD & LS; 2♂, 8♀ (UFMG 23146–23154, 23156, 23387), Parque Estadual do Turvo, near "área de visitantes", 27°8'19.8"S 53°52'47.9"W, 192 m, 09 July 2015, VD & LS; 1♂, 3♀ (UFMG 23134, 23139, 23141), Dois Irmãos, 29°34'59.8"S 51°7'11.4"W, 26 m, 03 July 2015, VD & LS.

***Paratrechalea julyae* Silva & Lise, 2006 (Fig. 18)**

Paratrechalea julyae Silva & Lise, 2006, in Silva *et al.* (2006a): 72, figs 1–6 (male holotype from Fazenda Paissandu, Mucuri, Bahia, Brazil, A. C. Niella coll., 15 June 1979, deposited in Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCTP, 10851), not examined).

Distribution: Previously known from the northeastern to southeastern Brazilian Atlantic Forest. New records southwards the known species range are provided below (Fig. 19).

New records: BRAZIL: Rio de Janeiro: 2♀ (UFMG, 25625, 25626), Nova Iguaçu, Reserva Biológica de Tinguá, 22°34'53"S 43°26'59"W, 428 m, 04 February 2020, VD; 3♂, 2♀ (UFMG, 25627–25630), Nova Friburgo, Parque Estadual Três Picos, Núcleo Jequitibá, near Casa do Pesquisador, 22°24'58.43S 42°36'27"W, 400 m, 26 January 2020, MM *et al.*; 3♀ (UFMG, 25631–25633), Volta Redonda, Área de Relevante Interesse Ecológico Floresta da Cicuta, 22°32'54.14"S 44°5'15.10"W, 387 m, 04 March 2020, MM *et al.*

***Paratrechalea longigaster* Carico, 2005 (Fig. 20)**

Paratrechalea longigaster Carico, 2005: 808, figs. 15, 24–25 (female holotype from Santa Maria, Misiones, Argentina,

M. J. Viana coll., 1956, deposited in Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", not examined).

Distribution: Previously known from the Atlantic Forest in northeastern Argentina and southern and southeastern Brazil. Here recorded for the first time in the Cerrado biome, in the Brazilian state of Goiás (Fig. 20).

New record: BRAZIL: Goiás: 1♂ (UFMG, 3447), Chapadão do Céu, Parque Nacional das Emas, 18°15'S 52°57'W, 10–12 October 2009, MM.

***Paratrechalea ornata* (Mello-Leitão, 1943) (Fig. 19)**

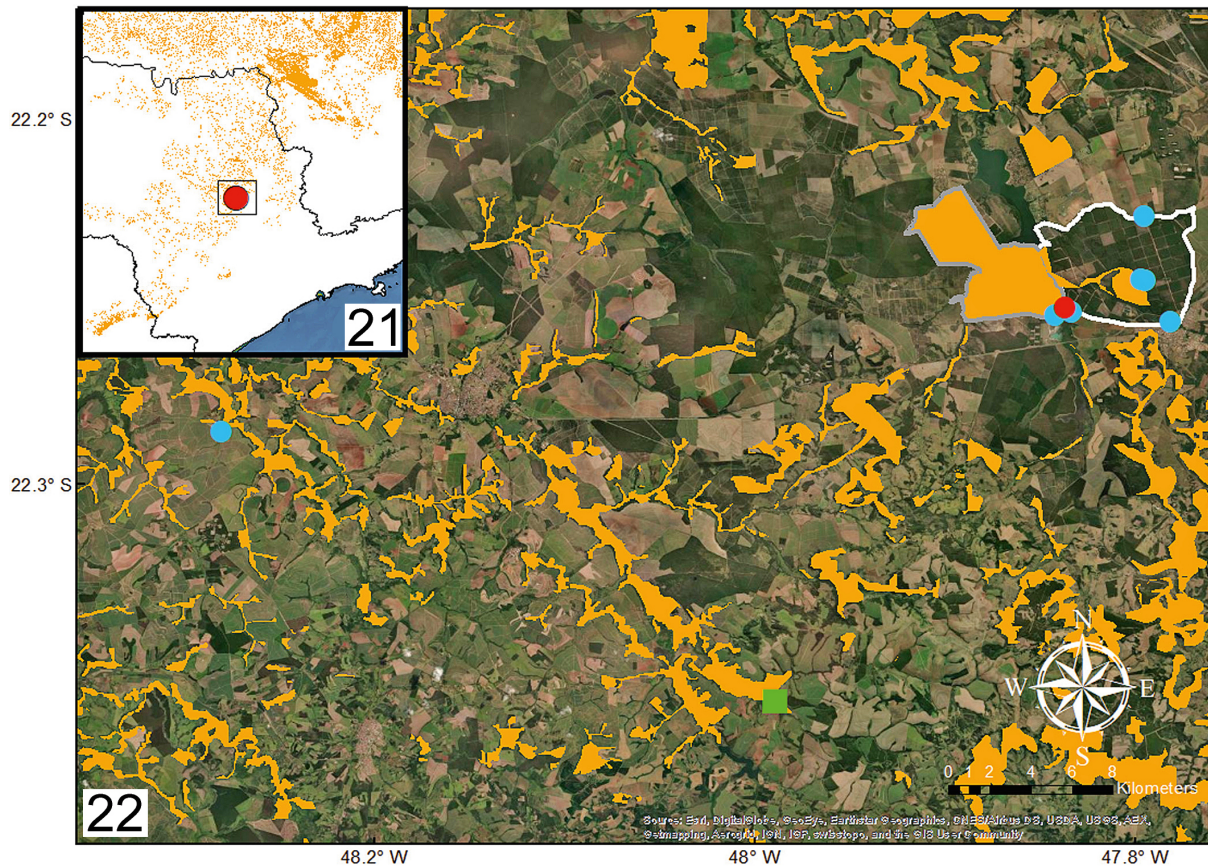
Trechalea ornata Mello-Leitão, 1943: 107, fig. 7 (female holotype from Bosque Alegre, Córdoba, Argentina, M. Birabén coll., January–March 1940, deposited in Museo de La Plata (MLP, 15690), not examined).

Paratrechalea ornata: Carico (2005): 805, figs. 13–14, 18–21.

For a complete set of references see World Spider Catalog (2022).

Distribution: Previously known from the Atlantic Forest and grassland areas in Argentina, southern Brazil and Uruguay. New distribution records within this range are provided below (Fig. 19).

New records: ARGENTINA: Córdoba: 7♂, 10♀ (UFMG, 23342–23358), La Bolsa, 31°43'11.46"S 64°25'10.6"W, November 2012, LS. BRAZIL: Santa Catarina: 1♂, 2♀ (UFMG, 22780, 22781, 23388), Urubici, Parque Nacional São Joaquim, 28° 8'34.7"S 49°37'15.6"W, 28 August 2014, VD; 1♂ (UFMG, 22803), Praia Grande, Parque Nacional da Serra Geral, Cânion Churriado, 29°7'48"S 49°57' 56.2"W, 246 m, 20 October 2014, LC. Rio Grande do Sul: 96♂, 15♀ (UFMG, 22804–22818; 22820–22825, 22827, 22828, 22830–28354; 22836, 22837, 22839–22846, 28848, 22849, 22851–22857, 22859–22868, 22872–22879, 22881, 22883–22905, 22908–22910, 22913, 22917–22928, 22931, 22934, 22935, 22937. 22939–22941, 22943, 22944, 22947, 22950, 22952, 22953, 22956, 22957, 22960–22962, 22964, 22966, 22971–22973), Maquiné, 29°32'46.51"S 50°18'35.42"W, 31 January–05 February 2014, LS; 24♂, 4♀ (UFMG, 22819, 22826, 22829, 22835, 22838, 22847, 22850, 22858, 22869, 22880, 22882, 22906–22907, 22912, 22914, 22829, 22830, 22936, 22938, 22942, 22946, 22949, 22954, 22963, 22965, 22968, 22969), Maquiné, 29°34'28,68" S 50°16'50,19" W, 31 January–05 February 2014, LS; 2♂, 1♀ (UFMG, 22974, 23128, 23129), Nova Prata, near old hydroelectric plant, 28°46'43.1"S 51°30'59.9"W, 426 m, 11 July, 2015, VD & LS; 3♂, 1♀ (UFMG, 22975, 22976, 23226–23228), Ijuí, Usina de Ijuí, 28°18'44.7"S 53°53'42.6"W, 246 m, 8 July 2015, VD & LS; 1♂ (UFMG, 22977), Manoel Viana, 29°35'42.8"S 55°28'45.5"W, 60 m, 06 July 2015, VD & LS; 4♂, 3♀ (UFMG, 22978–22981, 22983, 22985, 22986), Novo Machado, Parque Estadual do Turvo, stream near River Uruguai, 27°8'35.14"S 53°53'2.63"W, 153 m, 09 July 2015, VD & LS; 7♂, 5♀ (UFMG, 22987, 22989–22996, 23037–23039), Ipê, 28°40'22.7"S 51°8'37.7W, 770 m, 11 July 2015, VD & LS; 2♀ (UFMG, 23071, 23072), same



Figs. 21–22: Type locality of *P. murphyi* sp. n. and its surroundings. **21** Cerrado remnants (yellow) in the Brazilian state of São Paulo and neighbouring states, square shows the area in **22**. **22** Estação Ecológica de Itirapina (grey border), Estação Experimental de Itirapina (white border), and nearby localities. Areas in yellow represent remnants of Cerrado and riparian forest. Red circle shows the approximate collecting site of *P. murphyi* sp. n. type specimens. Other symbols show sites visited between 31 October–03 November 2019: blue circles = places where no *Paratrechalea* specimen were found; green square = site where a single *P. galianoae* was collected.

locality, 28°44'16.4"S 51°25'31.7"W, 370 m, 11 July 2015, VD & LS; 11♂, 6♀ (UFMG, 22997–23013), Jaguari, 29°32'53.9"S 54°41'54.5"W, 121 m, 06 July 2015, VD & LS; 14♂, 16♀ (UFMG, 23014–23036, 23064–23070), Gentil, 28°25'52.5"S 51°59'22.1"W, 594 m, 10 July 2015, VD & LS; 6♂, 3♀ (UFMG, 23040–23046, 23073, 23074), Bom Jesus, 28°47'53.1"S 50°25'37.4"W, 600 m, 11 July 2015, VD & LS; 20♂, 10♀ (UFMG, 23047–23062, 23075–23088), São Martinho da Serra, 29°33'30.2"S 53°49'58.7"W, 208 m, 06 July 2015, VD & LS; 1♂, 6♀ (UFMG, 23089–23095), Carazinho, 28°6'29.2"S 52°51'49.6"W, 480 m, 10 July 2015, VD & LS; 8♂, 4♀ (UFMG, 23096, 23097, 23099, 20102–23108, 23110–23112), Derrubadas, 27°14'28.5"S 53°55'42.3"W, 296 m, 09 July 2015, VD & LS; 1♂ (UFMG, 23155), same locality, Parque Estadual do Turvo, near “área de visitantes”, 27°8'19.8"S 53°52'47.9"W, 192 m, 09 July 2015, VD & LS; 11♂, 4♀ (UFMG, 23113–23127), Sinimbu, Rio Pardinho, 29°31'34.3"S 52°31'2.3"W, 60 m, 05 July 2015, VD & LS; 6♂, 7♀ (UFMG, 23130–23138, 23140, 23142–23145), Dois Irmãos, 29°34'59.8"S 51°7'11.4"W, 26 m, 03 July 2015, VD & LS; 13♂, 6♀ (UFMG, 23157–23175), Bossoroca, Clube de Caça e Pesca, 28°28'35.2"S 55°7'37.6"W, 104 m, 07 July 2015, VD & LS; 6♂, 10♀ (UFMG, 23201–23213, 23223–23225), Itaara, 29°37'1.4"S 53°48'30.5"W, 391 m; VD & LS. URUGUAY:

Lavalleja: 7♂, 13♀ (UFMG, 5877, 5878), Minas, Paso del Molito, Río Santa Lucia, 34°16'40.1"S 55°14'0.8"W, 2006–2007, LS. Treinta y Tres: 2♂, 1♀ (UFMG, 5879–5881), Quebrada de Los Cuervos, Río Yermal Chico, 32°55'30.5"S 54°27'33.1"W, 08 May 2007, LS.

Paratrechalea saopaulo Carico, 2005 (Fig. 18)

Paratrechalea saopaulo Carico, 2005: 810, figs. 30–33 (male holotype from São Paulo, Brazil, Moenkhaus coll., 1897, deposited in Peabody Museum of Natural History, Yale University, not examined).

Distribution: Previously known from the southeastern Atlantic Forest in Brazil. New records within the known geographic distribution are provided below and expand it northwards to the state of Minas Gerais (Fig. 18).

New records: BRAZIL: Minas Gerais: 1♀ (UFMG, 1315), Belo Horizonte, Estação Ecológica da UFMG, 19°52'38"S 43°58'16"W, 845 m, January 2001, EA; 2♂, 1♀ (UFMG, 1308), same locality, 02 October 2000, EM; 2♀ (UFMG, 1309), same locality, 03 March 2001, EM; 2♀ (UFMG, 1314), January 2001, EA & EM; 1♀ (UFMG, 5447), same locality, 08 January 2001, EA *et al.*; 1♂ (UFMG, 5448), same locality, 14 November 2000, EA *et al.* Rio de Janeiro: 1♀ (UFMG, 25634–35636), Rio de Janeiro,

Volta Redonda, Área de Relevante de Interesse Ecológico Floresta da Cicuta, trilha principal, 22°32'54.14"S 44°5'15.10"W, 387 m, 04 March 2020, MM *et al.*.

***Paratrechalea wygodzinskyi* (Soares & Camargo, 1948)**
(Fig. 18)

Trechalea wygodzinskyi Soares & Camargo, 1948: 358, figs. 6–7 (male holotype from Chavantina, Mato Grosso, Brazil, H. Sick coll., 1946, deposited in MZSP, 1293, not examined).

Paratrechalea wygodzinskyi: Carico (2005): 807, figs. 24–25.

For a complete set of references see World Spider Catalog (2022).

Distribution: Previously known from the Brazilian Cerrado in southeastern and central Brazil. New records within this range are provided below (Fig. 18).

New records: BRAZIL: Mato Grosso: 1♂ (DZUB, 6595), Canarana, 13°33'9"S 52°16'6"W, 19 December 2012, G. Caetano; 1♂ (IBSP, 52712), Ivinhema, 22°18'14.5"S 53°49'16.3"W, October 2004, K. dos Anjos & G. Skul. São Paulo: 1♂ (MZSP, 73282), São José do Rio Preto, Fazenda Felicidade, 20°49'11"S 49° 22' 45"W, 11 October 2005, Tereza & Fabrício.

Discussion

In this study we newly describe a potentially rare and threatened spider species. As mentioned above, the species is known only from a riparian forest in the Estação Ecológica de Itirapina, in southeastern Brazil (Figs. 21–22). We first discovered the species while searching spider collections in Brazilian institutions, for a species delimitation study on the genus *Paratrechalea*. Despite our extensive search in several collections, we could not find any *P. murphyi* sp. n. specimens besides the material listed herein. In an attempt to find additional specimens for DNA extraction, we carried out a field expedition in the Estação Ecológica de Itirapina, Estação experimental de Itirapina and nearby localities (Figs. 21–22). Despite our efforts, we did not obtain any specimens of *P. murphyi* sp. n., and could find only a single specimen of *P. galianoae* in a locality near the Estação Ecológica (UFMG, 25624, further details are given above).

The failure to find new specimens of *P. murphyi* sp. n. cannot be attributed to collector inexperience because the senior author of the present study (V. R. S. Diniz) has been collecting *Paratrechalea* in several localities throughout Brazil in the last eight years. In fact, most distribution records illustrated herein (Figs. 17–22) and listed above are results of such collecting efforts. Moreover, another species of *Paratrechalea* (*P. galianoae*) was found in a stream 23 km from the type locality. We can also discard a seasonality effect over the absence of *P. murphyi* sp. n. specimens in the type locality because our field expedition happened in November, the same month during which the examined specimens of *P. murphyi* sp. n. were collected, and which coincides with the rainy season in the Brazilian Cerrado.

Furthermore, our field experience suggests that at least juveniles could have been found during other times of the year.

The results presented in this study are insufficient to consider *P. murphyi* sp. n. as extinct in the wild, not only due to the lack of sampling attempts in most riparian forests within the Cerrado biome, but also because we could not sample the whole stream extension within the Estação Ecológica, due to transport limitations. At any rate, we think our results are at least indicative that the species can have a currently restricted distribution and might be considered of conservation concern. If we consider the entire extension of the Estação Ecológica de Itirapina as the known area of occupancy (AOO) of the species, it would mean it is restricted to less than 500 km². In addition, the species is known from a single location within a habitat in continuous decline (the Cerrado biome). Thus, *P. murphyi* sp. n. could be classified as 'endangered' according to the Criterion B of the IUCN (2022). Alternatively, the species could also be considered as 'data deficient', as it could occur in non-sampled localities in the Cerrado biome. In any case, it would mean *P. murphyi* sp. n. is an invertebrate species in need of conservation assessment.

The Cerrado is among the most threatened Brazilian biomes, since 45% of its original 2 million km² was already deforested by 2017 (Alencar *et al.* 2020), and only 3% of its remaining native vegetation is under strict protection (Françoso *et al.* 2015). The southeastern Brazilian Cerrado, especially in the state of São Paulo, was mostly converted to pasture and agriculture lands as early as 1985 (Alencar *et al.* 2020). The conservation status of the biome tends to become even worse, not only due to the advancement of the agriculture frontier (Alencar *et al.* 2020; Strassburg *et al.* 2017), but also because of potential effects of the global climate change on its vegetation (Hofmann *et al.* 2021). Assessing the conservation status of *P. murphyi* sp. n., and every other spider species in the Cerrado, is particularly difficult because the biome is among the least sampled in Brazil, with almost 75% of its area composing a wide sampling gap, with no published spider species record (Oliveira, Brescovit & Santos 2017). This problem is visible also on the much sparser distribution records of other *Paratrechalea* species in the Cerrado and South American grasslands (Figs. 17–20), if compared to the Atlantic Forest, which is the better sampled Brazilian biome (Oliveira, Brescovit & Santos 2017). The situation of *Paratrechalea murphyi* sp. n. only exemplifies a crisis in biodiversity knowledge and conservation, and perfectly illustrates the urgent need of more field work and taxonomic study on particularly neglected biomes and taxa.

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