Adding a puzzle piece to the scorpion distribution: expanding the records of *Tityus* (*Tityus*) *confluens* Borelli, 1899 (Scorpiones, Buthidae) in southern Brazil

Adicionando uma peça do quebra cabeça da distribuição do escorpião: expansão dos registros dos *Tityus* (*Tityus*) *confluens* Borelli, 1899 (Scorpiones, Buthidae) no sul brasileiro

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Abstract: New records for the species *Tityus* (*Tityus*) *confluens* Borelli, 1899, previously known from the states of Ceará, Mato Grosso, Mato Grosso do Sul, Piauí, and Tocantins in Brazil, are made for the state of Paraná. In addition, an updated map with these new records from Brazil is provided.

Keywords: Neotropical. Paraná. South America. Scorpiofauna. Buthidae.

Resumo: Novos registros para a espécie *Tityus* (*Tityus*) *confluens* Borelli, 1899, anteriormente conhecida para os estados de Ceará, Mato Grosso, Mato Grosso do Sul, Piauí e Tocantins, no Brasil, são feitos para o estado do Paraná. Além disso, um mapa atualizado com esses novos registros para o Brasil é fornecido.

Palavras-chave: Neotropical. Paraná. América do Sul. Escorpiofauna. Buthidae.

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INTRODUCTION

The arachnids of the order Scorpiones C. L. Koch, 1837, are widely distributed on all continents, except Antarctica, with most species found in tropical and subtropical forests (Polis, 1990). They are found in various microhabitats, such as beneath the bark of dead logs, in cracks in stones, within leaf litter, and inside termite mounds, for instance (Polis, 1990). Currently, the order comprises approximately 2,800 species, but their phylogenetic relationships and taxonomy are still broadly discussed (Prendini & Wheeler, 2005; Sharma et al., 2015; Ojanguren-Affilastro et al., 2017; Santibanez-Lõpez et al., 2019, 2020, 2023).

In Brazil, approximately 180 species of scorpions are found, mostly belonging to the families Ananteridae, Bothriuridae, Buthidae, Chactidae, and Hormuridae (Porto et al., 2010; Bertani et al., 2024; Ythier, 2024). Within Buthidae, the genus *Tityus* Koch, 1836 is distributed in the West Indies, Central, and South America (Fet & Lowe, 2000; Lourenço, 2006). The genus stands out for having most of the species of medical interest across nearly all of South America (Borges et al., 2010, 2020). In this context, studies of its species have increased due to their medical importance, primarily involving research in toxinology, animal behavior, and public health services (Francke & Stockwell, 1987; Fet & Lowe, 2000; Souza et al., 2009; Lourenço, 2015; Borges et al., 2020). However, despite the genus' importance, its taxonomy is confusing and still needs to be reviewed, mainly with updates on the species distribution (Fet & Lowe, 2000; Borges et al., 2010; Lourenço, 2006, 2015).

Among this fauna, *Tityus* (*Tityus*) *confluens* Borelli, 1899 was firstly described as a subspecies of *Tityus trivittatus* Kraepelin, 1898 based on two female specimens from Bolivia (Borelli, 1899; Lourenço et al., 2004). Subsequently, Maury (1974, p. 86) elevated it to species rank. Nowadays, the species is divided into two subspecies: *T. confluens confluens* Borelli, 1899 and *T. confluens bodoquena* Lourenço, Cabral & Ramos 2004 (Lourenço et al., 2004). To date, *T. confluens* Borelli, 1899 has been the main point of disagreement and doubts surrounding its taxonomy and distribution with records in the Chaco region, particularly in Bolivia, Paraguay, Argentina, and Brazil (Lourenço et al., 2004; Bertani et al., 2005; Lourenço & Aparecida-da-Silva, 2006, 2007; Mattos et al., 2013, 2014; Carvalho et al., 2017). In Brazil, the species distribution has been debated, with some authors arguing in favor of its presence in states of Ceará, Mato Grosso, Mato Grosso do Sul, Paraná, Piauí, and Tocantins (see Bertani et al., 2005; Lourenço & Aparecida-da-Silva, 2006, 2007; Porto et al., 2014; Carvalho et al., 2017; Braga et al., 2022).

Particularly in Paraná, Mello-Leitão (1945) recorded the species in Foz do Iguaçu, and Bücherl (1959) recorded it in Rio Branco (= Rio Branco do Sul). Later, Maury (1974), Lourenço (1980), and Lourenço and Aparecida-da-Silva (2006) questioned the record in Foz do Iguaçu, suggesting it might actually be *T. trivittatus* rather than *T. confluens*, while Lourenço and Aparecida-da-Silva (2006) considered the record in Rio Branco do Sul as misidentification.

In this context, the occurrence of the species in Paraná has remained uncertain until now. To fill this gap in the distribution of *T. confluens* in Brazil, we confirmed the presence of adults and immatures in the state of Paraná. This finding confirms those of previous authors and significantly expands the geographic distribution of the species in the country. We also provide figures of adults and an updated map of the species' distribution in Brazil.

MATERIAL AND METHODS

The examined material is deposited in the following institutions (curators in parentheses): Instituto Butantan (IBSP), São Paulo, Brazil (A. D. Brescovit); Coleção Aracnólogica, Secretaria de Saúde do Estado do Paraná (SESA), Paraná, Brazil (J. C. Cequinel). The examined material was identified based on the descriptions provided by Maury (1974), Lourenço et al. (2004), and Bertani et al. (2005). A taxonomically conservative approach was employed in determining the examined material, considering the broad context regarding the "*Tityus confluens* complex" (see Mattos et al., 2013). All measurements and specimens

examination were conducted in 70% ethanol using a Leica MZ16A stereomicroscope. The photographs were taken with a Leica DFC 500 digital camera mounted on a Leica MZ16A stereomicroscope, and the extended focal range images were composed with Leica Application Suite version 2.5.0 (Leica Microsystems, Canton de Saint-Gall, Switzerland). The geographical coordinates were obtained directly from the original label of the examined specimens. The distribution map was made using the free software DIVA-GIS ver. 7.5.0. (Hijmans et al., 2001), and the heatmap was made using the Flourish Studio (Seligman, 2013), with the values adjusted to minimum = 1, maximum = 150, and downsampling = 4x.

RESULTS

TAXONOMY

Family Buthidae C. L. Koch, 1837
Genus *Tityus* C. L. Koch, 1836
Tityus (*Tityus*) *confluens* Borelli 1899
(Figures 1–2)

Identification. Adapted from Bertani et al. (2005). Adults range from 52 to 53 mm. in total length (Figure 1). General coloration of prosoma and mesosomal tergites I–VI almost uniformly yellowish to blackish-brown; tergites VII yellowish, with a single median blackish spot, metasomal segments I to III light yellow to brownish, IV and V light brownish; pedipalps yellowish, with yellowish to brownish fingers; legs yellowish. The fixed and movable fingers of pedipalps with 17-16 rows of granules. Pectinal tooth count in females 23-24.

Descriptive notes. Females and immatures, see in Bertani et al. (2005, p. 2).

Material examined. BRAZIL. Paraná: Ivatuba [-23.620457, -52.219657], 07.xi.2022, Ademir coll., ♀ (IBSP 9905); 06.xi.2022, Vania leg., ♀ (IBSP 9908); 12.vii.2022, Antonina leg.; ♀ (IBSP 9910), 18.x.2022, Salim leg. ♀ (IBSP 9926); ♀ (IBSP 9931); 1.xi.2021, Vânia leg., ♀ (IBSP 9938); i.2023, Bruno leg., ♀ (IBSP 9664); 20.i.2023, Jaiton leg., ♀ (IBSP 9672); 23.i.2023, A. Requena leg., ♀ (SESA 9644); 26.viii.2022, ♀ (SESA 9314); 02.iv.2021, M. Bellun leg., ♀ (SESA 9110); 09.viii.2021, Adotino leg., ♀ (SESA 9109); 15. ix.2022, L. Dandoline leg., ♀ (SESA 9394); 06.iv.2022. H. Oliveira leg., ♀ (SESA 9240); 19.viii.2022, A. Pelissari leg., ♀ (SESA 9313); 11.viii.2020, D. Bortoti leg., ♀ (SESA 8171); 09.vi.2020, PMS leg., ♀ (SESA 8169); 25.ii.2021, O. Melo leg., ♀ (SESA 8488); 04.vi.2020, Lurdes leg., ♀ (SESA 8166); 02.ix.2020, A. Marques leg., ♀ (SESA 8450); 02.ii.2021, Prefeitura Municipal de Ivatuba leg., 1 immature (SESA 8491); 17.vii.2019, R. Sagrilo leg., ♀ (SESA 8054); 19.i.2021, E. Mattia leg., ♀ (SESA 8494); 14.x.2020, Nei leg., ♀ (SESA 8451); 23.v.2020, M.U. Silva leg., ♀ (SESA 8167); 30.xi.2020, S. Cardoso leg., ♀ (SESA 8493); 16.viii.2020, Prefeitura Municipal de Ivatuba leg., ♀, 1 immature (SESA 8453); 19.i.2021, E. Mattia leg., ♀ (SESA 8494); 14.iii.2019, A. Zola leg., ♀ (SESA 8001); 24.iv.2019, L. Dandolini leg., ♀ (SESA 7996); 10.xi.2017, ♀ (SESA 7615); 16.xi.2016, C. Parma leg., 1 immature (SESA 7217); 13.viii.2016, M. Tenedine leg., ♀ (SESA 7345); 09.ix.2016, S. Mattia leg., ♀ (SESA 7311); 09.v.2016, A. Valentini leg., ♀ (SESA 7198); 28.ii.2016, P. Mori leg., ♀ (SESA 7183); 04.v.2016, S. Mattia leg., ♀ (SESA 7200); 21.vi.2016, SISCRED leg., ♀, 1 immmature (SESA 7218); 29.iii.2016, J.E.R. Gimenes leg., ♀ (SESA 7186); 14.iv.2016, L.C. Santini leg., ♀ (SESA 7182); 13.iv.2016, J.E.R. Gimenes leg., ♀ (SESA 7187); 28.xi.2016, ♀ (SESA 7395); 24.xi.2018, P. Oliveira leg., ♀ (SESA 7942); 30.xi.2018, Prefeitura Municipal de Ivatuba leg., ♀ (SESA 7941); 05.ii.2019, Iva leg., ♀ (SESA 7943); 17.iii.2018, M. Semprebom leg., 1 immature (SESA 7729); 22.v.2017, I. Teodoro leg., ♀ (SESA 7535); 11.iv.2018, I. Duminelli leg., ♀ (SESA 7730); 28.vi.2018, V. Nazari leg., ♀ (SESA 7869); 28.i.2016, E.L. Ruiz leg., ♀ (SESA 7130); 15.vii.2015, S. Campanholo leg., ♀ (SESA 6924); 15.ix.2015, M.G. Araújo leg., ♀ (SESA 7013); 17.xii.2015, A. Zola leg., ♀ (SESA 7129); 23.vii.2015, V. Vercei leg., ♀ (SESA 6925); 04.vii.2015, M. Gomes leg., ♀ (SESA 6926); 25.vii.2015, H. Lavezo leg., ♀ (SESA 6929); 02.viii.2013, Romeu leg., ♀ (SESA 6005); 15.ii.2014; S. Celestino leg., ♀

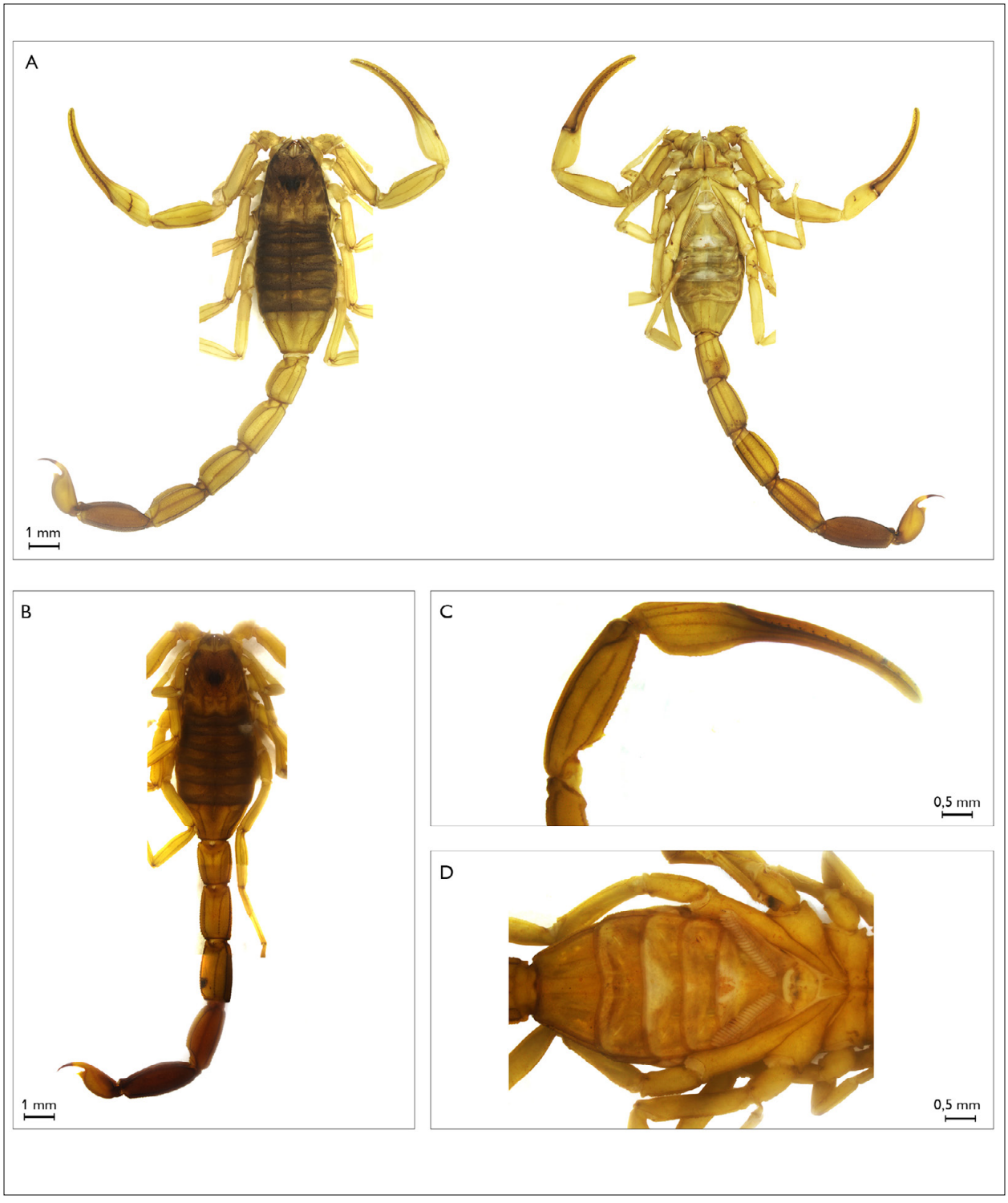

Figure 1. Habitus *of Tityus confluens* Borelli, 1899, from Foz do Iguaçu, Paraná, Brazil: A) dorsal and ventral view, female (IBSP 10182); B) dorsal view, male (IBSP 12544); C) detail of left pedipalp in dorsal view, male (IBSP 12544); D) detail of ventral view, male (IBSP 12544).

(SESA 6613); 26.iv.2014; S. Mattias leg., ♀ (SESA 6590); 13.xii.2013, M.A. Valentim leg., ♀ (SESA 6124); 29.xi.2013, E.L. Ruiz leg., ♀ (SESA 6114); Guaíra [-24.084028, -54.249948], 18.xi.2021, L.A. Miranda leg., ♀ (IBSP 9651); 08.iii.2023, M.C. Brum leg., ♀ (SESA 9089); 27.viii.2021, Reinaldo leg., ♀ (SESA 8781); 01.iv.2009, Wagner leg., ♀ (SESA 2056); 22.ii.2017, Correio leg., ♀ (SESA 7440); 21.v.2018, Barão do Rio Branco leg., ♀ (SESA 7717); 05. iii.2018; Ezequiel leg., ♀ (SESA 7680); 07.iv.2015, L.F. Fernandes leg., ♀ (SESA 6829); 04.xii.2014, E.P. Santos leg., ♀ (SESA 6741); Maripá [-24.417795, -53.829040], 24. viii.2023, M.A. Santos leg., ♀ (IBSP 10436); 17.iii.2023, G. Koch leg., 1 immature (SESA 9756); 22.iv.2021, G. Oenning leg., ♀ (SESA 8497); Santa Helena [-24.905643, -54.283102], 30.xi.2023, E.M. Marechal Deodoro da Fonseca leg., ♀ (IBSP 12493); 28.v.2022, J. Maldaner leg., 2 ♀♀ (SESA 9425); 28.v.2022, S.R.L. Ortiz leg., ♀ (SESA 9428); Ponta Grossa [-25.085080, -50.163495], 16.i.2024, Bianca leg., ♀ (IBSP 12180); Terra Roxa [-24.166232, -54.097836], 12.vi,2023, M.R. Oliveira leg., ♀ (IBSP 10492); 22.i.2023, A.L. Andrade leg., ♀ (SESA 8984); Foz do Iguaçu [-25.517890, -54.563184], 16.xii.2022, Lisete – CCZ 7743-22 leg., ♂ (IBSP 9271); 12.xi.2023, CCZ-77552-23 leg., ♂ (IBSP 12544); 3.xi.2022, Maria leg., ♀ (IBSP 8482); 3.x.2022, Eluzia leg., ♀ (IBSP 8569); Letícia leg., 06.xii.2022, ♀ (IBSP 9257); 06.xii.2022, Cláudia leg., ♀ (IBSP 9310); 08.xii.2022, M. Oliveira leg., ♀ (IBSP 9260); 10.xi.2022, ♀ (IBSP 9283); 11.x.2022, Sara leg., ♀ (IBSP 8483); 11.xi.2022, CCZ de Foz de Iguaçu leg.; 12.xi.2022, Edilene leg., ♀ (IBSP 9272); 14.xi.2022, 1 immature (IBSP 8754); ♀, 1 immature (IBSP 9256); 15. xii.2022, Nice leg., ♀ (IBSP 9039); 17.x.2022, José leg., ♀ (IBSP 8557); 17.xii.2017, Venerio leg., 1 immature (IBSP 9021); 18.x.2022, Cristiane leg., ♀ (IBSP 8810); 18.xi.2022, D. Camargo leg., ♀ (IBSP 9154); 19.xii.2022, Ketlin leg., ♀ (IBSP 9043); 19.xii.2022, José leg., ♀, 1 immature (IBSP 9053); 20.x.2022, Luana leg.♀ (IBSP 9275); 21.x.2022, Vanilda leg., ♀ (IBSP 9003); 21.xi.2022, Beatriz leg., ♀ (IBSP 8540); 21.xii.2022, Denise leg.,2 ♀♀ (IBSP 9011); 22. xi.2022, Joélcio leg., ♀ (IBSP 8936); 23.ix.2022, Juliana leg., ♀ (IBSP 8508); 23.xii.2022, Andressa Pita leg., ♀ (IBSP 10182); 24.xi.2022, Agnes leg., ♀ (IBSP 8594); 25.x.2022, Alan leg., ♀ (IBSP 10027); 26.x.2022, Lindamar leg., 5 ♀♀ (IBSP 8605); 26.xii.2022, David leg., ♀ (IBSP 9269); 27.x.2022, Inês Pereira leg., ♀ (IBSP 9073); 27.x.2022, Amanda leg., ♀ (IBSP 9136); 27.x.2022, João leg., ♀ (IBSP 9284); 27.x.2022, Aparecida leg. ♀ (IBSP 9311); 28.x.2022, Lucas leg., ♀ (IBSP 8895); 28.xii.2022, Dayane leg., ♀ (IBSP 9041); 28.xii.2022, Yasmin leg., ♀ (IBSP 9049); 28.xii.2022, Cláudio leg., ♀ (IBSP 9312); 29.ix.2022, Cláudio leg., ♀ (IBSP 8509); 29.ix.2022, Alexandra leg., ♀ (IBSP 8575); 30.xi.2022, Sueli leg., ♀ (IBSP 8989); 30.xi.2022, Francisco leg., ♀ (IBSP 9313); 30.xii.2022, Ione leg., ♀ (IBSP 9037); 30.xii.2022, Devanir leg., ♀ (IBSP 9259); 30.xii.2022, C. Silva leg., ♀ (IBSP 10060); 31.x.2022, Leonardo leg., ♀ (IBSP 8674); 01.iii.2023, José leg., ♀ (IBSP 9741); 01.iv.2023, Aparecida leg., 8 ♀♀ (IBSP 9825); 02.ii.2023, Fabieli leg., ♀ (IBSP 10156); 02.iii.2023, Conceição leg., ♀ (IBSP 9752); 03.ii.2023, Cecília leg., ♀ (IBSP 9871); 03.i.2023, Roselaine leg., ♀ (IBSP 9014); 03.iii.2023, Eva leg., ♀ (IBSP 9885); 03.iv.2023, Angélica leg., ♀ (IBSP 9748); 03.v.2023, Prefeitura Municipal de Foz de Iguaçu leg., ♀ (IBSP 9538); 03.iv.2023, ♀ (IBSP 9837); 03.iv.2023, Lucas leg., ♀ (IBSP 9853); 04.ix.2023, CMEI leg., ♀ (IBSP 10942); 04.vii.2023, M. Carvalho leg., ♀ (IBSP 10963); 05.i.2023, Sônia leg., ♀ (IBSP 9683); 05.v.2023, Karla leg., ♀ (IBSP 9518); 06.i.2023, José leg., 5 ♀♀ (IBSP 9918); 06.ii.2023, Terezinha leg., ♀ (IBSP 9663); 02.vi.2023, Roberto leg., ♀ (IBSP 10061); 02.vi.2023, Lucas leg., 3 ♀♀ (IBSP 10141); 03.vi.2023, Kelly leg., ♀ (IBSP 9870); 09.vi.2023, Rafaela leg., ♀ (IBSP 10955); 02.vii.2023, Cleia Lima leg., ♀ (IBSP 10165); 02.vii.2023, Carlos leg., ♀ (IBSP 10177); 02.vii.2023, Ana Luiza leg., ♀ (IBSP 10204); 03.vii.2023, Evandro leg., ♀ (IBSP 9762); 08.vii.2023, L. Multilog leg., ♀ (IBSP 10967); 02.viii.2023, Cristiane leg., ♀ (IBSP 10154); 02.viii.2023, M. Maia leg., ♀ (IBSP 10208); 08.iii..2023, Lilian leg., ♀ (IBSP 9738); 03.viii.2023, Cleonice leg., ♀ (IBSP 9849); 04.viii.2023, Jennifer leg., ♀ (IBSP 10961); 01.ix.2023, Sofia leg., ♀ (IBSP 9659); 05.ix.2023, Jocélia leg., ♀ (IBSP 9515); 05.ix.2023, Edwin leg., ♀ (IBSP 9526);

05.ix.2023, Jocélia leg., ♀ (IBSP 9546); 05.ix.2023, Edwin leg., ♀ (IBSP 9572); 01.x.2023, Dedé leg., ♀ (IBSP 10058); 02.x.2023, S. Halem leg., ♀ (IBSP 10168); 03.x.2023, Aline leg., ♀ (IBSP 9829); 09.x.2023, Aline leg., ♀ (IBSP 10953); 01.xi.2023, Eliane leg., ♀ (IBSP 9682); 01.xi.2023, R. Draga leg., ♀ (IBSP 10025); 09.xi.2023, Lilian leg., ♀ (IBSP 10970); 05.xi.2023, Luciane leg., ♀ (IBSP 9540); 01.xii.2023, Helena leg., ♀ (IBSP 9913); 01.xii.2023, Isadora leg., ♀ (IBSP 10055); 07.xii.2023, Wilma leg., ♀ (IBSP 10951); 07.xii.2023, L. Multilog leg., ♀ (IBSP 10957); 13.iv.2023, Isabela leg., ♀ (IBSP 9881); 13.v.2023, Giovana leg., ♀ (IBSP 9517); 14.ii.2023, Beatriz leg., ♀ (IBSP 10017); 14.ii.2023, Douglas leg., ♀ (IBSP 10170); 14.ii.2023, Mariana leg., ♀ (IBSP 10174); 14.iii.2023, Clarice leg., ♀ (IBSP 9758); 14.iii.2023, Francieli leg., ♀ (IBSP 9835); 14.iii.2023, Gedimar leg., ♀ (IBSP 9847); 14.vii.2023, Ricardo leg., ♀ (IBSP 10959); 15.iii.2023, Sandra leg., ♀ (IBSP 9830); 15.iii.2023, P. Sérgio leg., ♀ (IBSP 9832); 15.v.2023, Lilian leg., ♀ (IBSP 9520); 16.i.2023, Elieri leg., ♀ (IBSP 9642); 16.i.2023, Marcos leg., ♀ (IBSP 9955); 16.iii.2023, Juliana leg., ♀ (IBSP 9875); 16.ix.2023, Asenat leg., ♀ (IBSP 10971); 17.i.2023, Lucineide leg., ♀ (IBSP 9669); 17.iv.2023, José leg., ♀ (IBSP 9575); 18.ii.2023, A. Cristina leg., 2 ♀♀ (IBSP 9709); 18.iii.2023, Edivaldo leg., ♀ (IBSP 9756); 18.iii.2023, Rogério leg., ♀ (IBSP 9854); 18.ix.2023, Fernando leg., ♀ (IBSP 10962); 18.ix.2023, Giane leg., ♀ (IBSP 10966); 19.iv.2023, B.C. Mouro leg., 5 ♀♀ (IBSP 9510); 19.iv.2023, Luana leg., ♀ (IBSP 9626); 19.ix.2023, Juliano leg., ♀ (IBSP 10960); 19.viii.2023, Ana Paula leg., ♀ (IBSP 10965); 20.ii.2023, Ana Paula leg., ♀ (IBSP 9693); 21.viii.2023, Kamila leg., ♀ (IBSP 10946); 22.iii.2023, M. Alves leg., ♀ (IBSP 9759); 22.iii.2023, Márcia leg., ♀ (IBSP 9844); 22.v.2023, Kary leg., ♀ (IBSP 10956); 23.v.2023, V. Lúcia leg., ♀ (IBSP 10952); 23.v.2023, Geisse leg., ♀ (IBSP 10958); 24.vii.2023, Felipe leg., ♀ (IBSP 10941); 25.iv.2023, Cibele leg., ♀ (IBSP 9610); 26.vi.2023, Cláudia leg., ♀ (IBSP 10950); 26.vii.2023, Nicolle leg., ♀ (IBSP 10969); 27.ii.2023, ♀ (IBSP 9843); 28.ii.2023, W.F. Cardoso leg., ♀ (IBSP 9704); 28.iii.2023, Luana leg., ♀ (IBSP 9694); 28.iii.2023, ♀ (IBSP 9732); 28.iii.2023, ♀ (IBSP 9890); 01.iv.2023, João leg., ♀ (IBSP 9607); 28.vi.2023, Jean leg., ♀ (IBSP 10949); 29.iii.2023, Aderbal leg., ♀ (IBSP 9833); 29.v.2023, Arnete leg., ♀ (IBSP 10945); 30.iii.2023, Jussara leg., ♀ (IBSP 9828); 30.iii.2023, Gesira leg., ♀ (IBSP 9840); 01.iii.2023, Paulo leg., 1 immature (IBSP 9851); 02.iii.2023, Bruno leg., 1 immature (IBSP 9751); 24.vii.2023, CCZ6257-23 leg., 2 ♀♀, 3 immatures (IBSP 10964); 07.xii.2006, L. Gonçalves leg., ♀ (SESA 1387); 11.xii.2006, Juliana leg., ♀, 1 immature (SESA 1388); 29.i.2009, A. Marcos leg., ♀ (SESA 1929); 18.ii.2009, William leg., ♀ (SESA 1981); 27.ii.2009, João leg., ♀ (SESA 2040); 28.iii.2009, Marcos leg., 3 ♀♀ (SESA 2053); 01.iv.2009, Rafael/Simone leg., ♀, 1 immature (SESA 2054); 02.iv.2009, 2 ♀♀, 4 immatures (SESA 2055); 01.iv.2009, Wagner leg., ♀ (SESA 2056); 21.v.2009, J. Gilberto leg., ♀ (SESA 2117); Joelcil leg., ♀ (SESA 2118); 05.viii.2009, Ozilia leg., 4 ♀♀, 3 immatures (SESA 2217); 20.viii.2009, Rafael leg., 1 immature (SESA 2219); 17.xii.2009, Silvana leg., ♀ (SESA 2463); 10.xii.2009, Marcos leg., ♀ (SESA 2464); 20.i.2010, Edwin leg., ♀ (SESA 2485); 11.i.2010, Rafael leg., ♀ (SESA 2486); 21.i.2010, Jussara leg., ♀ (SESA 2489); 03.iii.2010, ♀ (SESA 2553); 08.iii.2010, ♀ (SESA 2554); 08.iii.2010, 1 immature (SESA 2555); 16.iv.2010, Edwin leg., ♀ (SESA 2596); 21.vii.2010, Alessandro leg., 1 immature (SESA 2646); 09.vi.2010, Carolina leg., ♀ (SESA 2648); 07.xii.2010, Dorival leg., ♀ (SESA 3020); 26.iv.2011, Guarda Municipal leg., ♀ (SESA 3259); Apucarana [-23.555617, -51.431445], 13.xi.2020, Dirce leg., ♀ (SESA 8143); Cambará [-23.041876, -50.070898], 02.iv.2020, P. Massataro leg., ♀ (SESA 8150); 03.iii.2021, M.C. Lima leg., ♀ (SESA 8396); 11.ii.2020, Wagner leg., ♀ (SESA 8125); 25.ii.2021, M. Fonseca leg., ♀ (SESA 8414); 21.i.2020, E.G. Costa leg., ♀ (SESA 8126); 30.x.2019, H.C. Caetano leg., ♀ (SESA 8087); 20.v.2019, M.A. Almeida leg., ♀ (SESA 7968); 04.iv.2019, S.G. Justo leg., ♀ (SESA 7958); 24.iii.2022, D. Lopes leg., ♀ (SESA 9242); 04.iv.2016, L.C. Pereira leg., ♀ (SESA 7194); 27.xi.2018, CEMEI Caminho do Sabor leg., ♀ (SESA 7904); 22.xi.2015, M. Santana leg., ♀ (SESA 7113); 02.viii.2015, I.A. Rafagnin leg., ♀ (SESA 6928); 05.ii.2016, D.C. Nogueira leg., ♀ (SESA

7147); 28.vii.2015, S.P. Santos leg., ♀ (SESA 6927); 05.ii.2016, C. Lorenção leg., ♀ (SESA 7148); 16.v.2014, Pires leg., 1 immature (SESA 6624); 03.xi.2014, N.N. Diniz leg., ♀ (SESA 6727); 28.v.2014, E.G. Silva leg., 1 immature (SESA 6626); 06.i.2015, C. Freitas leg., ♀ (SESA 6771); Iporã [-24.002437, -53.709094], 08.iii.2023, Escola Dom Pedro leg., 1 immature (SESA 8350); Santa Terezinha do Itaipú [-25.438490, -54.404598], 13.ii.2023, J.A. Gonçalvez leg., ♀ (SESA 9692); 09.v.2022, P. Damiani leg., ♀ (SESA 9134); 07.iii.2023, Thalize leg., ♀ (SESA 9758); 03.vi.2021, A. Manente leg., 1 immature (SESA 8602); 11.xi.2019, C.A. Oliveira leg., ♀ (SESA 8076); Doutor Camargo [-23.557794, -52.2193617], 15.x.2020, C.L. Eleutério leg., 1 immature (SESA 8252); Japurá [-23.470137, -52.553501], 16.i.2023, R.R. Vale leg., ♀ (SESA 9605); Palmeira [-25.417400, -50.003198], 25.ii.2015, L.E. Wonsttret leg., ♀ (SESA 6784); Umuarama [-23.762125, -53.312704], 20.v.2019, Douglas leg., ♀ (SESA 7986); 10.xi.2020, V. Santos leg., ♀ (SESA 8284).

Distribution. Records of the species in Brazil have so far been reported in the states of Ceará, Mato Grosso, Mato Grosso do Sul, Piauí, and Tocantins, although some of these have been questioned and still require reanalysis for confirmation. New records are now reported for the state of Paraná based on the examined material (municipalities of Apucarana, Cambará, Doutor Camargo, Foz do Iguaçu, Guaíra, Iporã, Ivatuba, Japurá, Maripá, Palmeira, Ponta Grossa, Santa Helena, Santa Terezinha do Itaipú, Sertaneja, Terra Roxa, and Umuarama) (Figure 2).

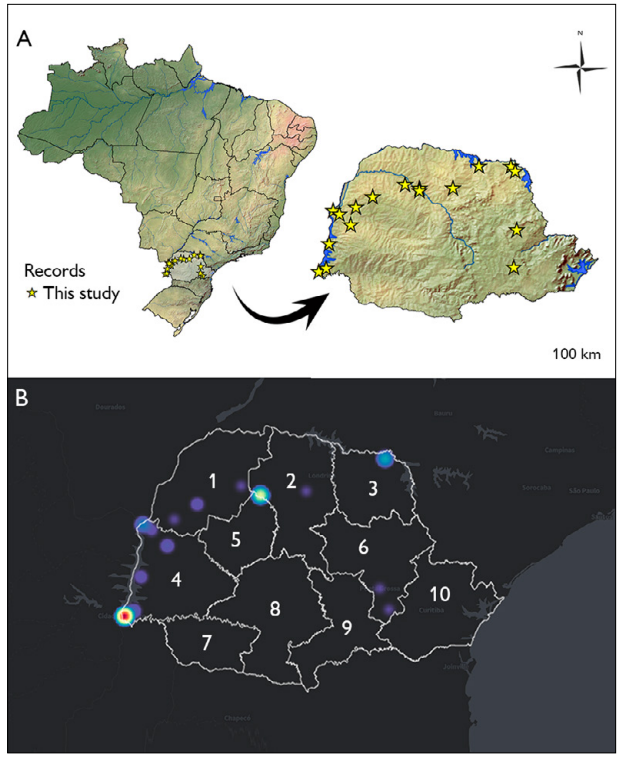

Figure 2. Distribution map of *Tityus confluens* Borelli, 1899, in Paraná based on the examined material from IBSP and SESA: A) occurrence points; B) heatmap of occurrences of *T. confluens*. The scheme of colors refers to the density of records of the species, with blue indicating low density and red high density. The numbers refer to the mesoregions of Paraná: 1) Northwest; 2) North-Central; 3) North Pioneer; 4) West; 5) Central-West; 6) Central-East; 7) Southwest; 8) Central-South; 9) Southeast; 10) Metropolitan Curitiba. Map: elaborated by the authors (2024).

DISCUSSION

The genus *Tityus* comprises approximately 220 species described in five subgenera (Lourenço, 2006, 2015), with 66 of these species with occurrence in Brazil (Bertani et al., 2024). To date, among these species, in Brazil only four are recognized by their medical importance: *Tityus serrulatus* Lutz & Mello, 1922; *Tityus bahiensis* Perty, 1833; *Tityus obscurus* Gervais, 1843; and *Tityus stigmurus* (Thorell, 1876). The species *Tityus confluens*, although not considered as medically significant in Brazil as the species mentioned above, has been involved in some human accidents over the last few decades (Roodt et al., 2009). In Argentina, for instance, there have been reports of accidents involving this species, including the record of children's deaths (Roodt et al., 2009; Ojanguren-Affilastro et al., 2019; López, 2021). In Brazil, there is no record of death involving directly accidents by *T. confluens*, although the species has been identified as a potential medical concern (Guerra-Duarte et al., 2023). Additionally, due to the superficial similarity of the species with other congenerics, particularly *T. serrulatus* and *T. trivittatus*, it is likely that in some cases the animal might have been misidentified, leading to an underreporting number of accidents in the country.

Considering the wide distribution of *T. confluens* in the Chaco region (Lourenço, 2006), it is not surprising its occurrence in other western and southern regions of Brazil. Based on a total of 2 males, 310 females, and 31 immatures of examined specimens of the species *T. confluens*, this study confirms its occurrence in Paraná, expanding its distribution to cover most of the state. The oldest record from Paraná dates back to 1954, suggesting that the species has occurred in the state for a long time. A high density of records is evident in both western and central regions of the state, particularly in the municipalities of Foz do Iguaçu (which borders both Argentina and Paraguay) and Ivatuba (located in the metropolitan region of Maringá) (Figure 2B). Although these reports are not standardized in sampling methods, including biases in sampling as a consequence of greater attention given by local health services, the number of occurrences of specimens in these areas warrants attention. In this context, as with other parthenogenetic species of *Tityus* (Seiter, 2012), it is highly recommended to monitor the distribution of *T. confluens*, not only within Brazil, but also in neighboring countries such as Bolivia, Paraguay, and Argentina, with a focus on public health policies related to the number of accidents and medical assistance.

It is important to highlight that most records of *T. confluens* in Brazil, particularly those from Ceará, Piauí, and Tocantins, still require reanalysis to confirm its occurrence. In this context, some authors have argued for a more conservative approach to species identification within the so-called "*Tityus confluens* complex" (see Mattos et al., 2013, 2014; Porto et al., 2014; Carvalho et al., 2017). This approach has proven to be the most appropriate, given the medical importance of *T. confluens* and the need for a taxonomic review of most *Tityus* species.

Despite the significant urban influence on the data in this work, the results reveal a broad distribution and notable abundance of the species in Paraná (Figure 2). These new records contribute to expanding our understanding of the scorpiofauna encountered by the population around their houses or in surrounding areas. Further studies focusing on medical reports involving scorpions and synanthropic surveys are important for enriching zoological collections and providing reliable data on species identification and distribution. Additionally, many specimens deposited in collections have been misidentified and still need further study to correct these errors, which has led to delays in improving public health and environmental preservation policies in many Brazilian states.

CONCLUSION

This study confirms the occurrence of *Tityus confluens* in the state of Paraná, with a high density of species records in the western and central regions of the state. It also highlights potential accidents caused by the species in Paraná and encourages the scientific community to collaborate with policymakers and the public to mitigate risks and raise awareness.

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AUTHORS' CONTRIBUTIONS

P. A. M. Goldoni contributed to the conceptualization, data curation, species identification, project administration, writing (original draft), and formal analysis; L. F. M. Iniesta contributed to the writing (review and editing), software, and supervision; E. Marques-da-Silva contributed to the data curation and writing (review and editing); and A. D. Brescovit contributed to the project administration, supervision, and acquisition of financing.