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Trichonephila sexpunctata (Araneae: Nephilidae): New Record from Rio Grande do Sul State, Southern Brazil

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Abstract

Araneae order has almost 51,500 described species in the world, distributed in 135 families. Nephilidae is one of those families and presents 58 species, but only three in South America. Specifically southern Brazil there are two representants of this family: *Nephilingis cruentata, Trichonephila clavipes*. In this way, we aim to record the *Trichonephila sexpunctata* (Giebel, 1687) species from Rio Grande do Sul state, southern Brazil. For this, we observed, collected, fixed, preserved, analyzed, and deposited in the institutional zoological collection six specimens between 2017 and 2018. They were also seen in later years in the region. Our survey indicates that this species, commonly called golden orbweaving spiders, appears to have a limited distribution. In fact, there are few records of *T. sexpunctata*, totalizing 15 records. Therefore, the ecology of *T. sexpunctata* is not fully determined. Thus, we record *T. sexpunctata* from southwest of Rio Grande do Sul, region characterized by Brazilian Pampa biome presence. Moreover, our observations suggest that these spiders can be well adapted in anthropic environmental.

Keywords: *Nephila; Nephilingys*; Uruguai River

Introduction

Arachnida group include the Araneae order, which today has almost 51,500 described species in the world, distributed in 135 families. In this context, Brazil presents 3,210 records of species observed, about 6% of international spider diversity. Nevertheless, it is estimated that only 27% of the Brazilian area was covered by studies focused on spider. And we know that the spider species richness is strongly influenced by the sampling effort [1,2].

Here, we will talk about a species from the Nephilidae group, which is a small family in the order mentioned above with 58 species distributed by seven genera such as *Clitaetra* (5), *Herennia* (11), *Indoetra* (1), *Nephila* (9), *Nephilengys* (2), *Nephilingis* (4), and *Trichonephila* (26) [2]. Their origins are Gondwan, approximately 130 Ma ago, in ancestral range as Indomalaya and Australasia [3]. Now, nephilids are renowned for their female-biased sexual size dimorphism, which represent the most extreme case of sexual size dimorphism among all terrestrial animals because with females up to 500 times heavier than males (Figure 1) [4,5].

Figure 1: Comparison between females and males of *Trichonephila sexpunctata*. On the left a female and on the right a male.

Among species of *Trichonephila* genus there is *T. sexpunctata* [16], previously belonged to the *Nephila* genus. Species of these genera are commonly called golden orbweaver spiders and are also characterized by its beautiful cobwebs [7]. Moreover, *T. sexpunctata* occurs in Brazil, Paraguay and Argentina [2]. But Nephilidae group presents others two species in South America: *T. clavipes* and *Nephilingis cruentata*. We highlight that *N. cruentata* is African spider introduced in Colombia, Paraguay, and Brazil [2,8]. On the other hand, literature reports *T. clavipes* as a common species from Brazil to United States, including in anthropic environments. This spider was also introduced in São Tomé e Príncipe [2,9,10].

These two golden orbweaving spiders - *T. clavipes* and *N. cruentata* - also have been recorded in Rio Grande do Sul (RS) state, situated in southern Brazil, in which presents its territory divided into two biomes. In northern half there is the Atlantic Forest biome, while Pampa biome is present in the southern half. We see that *T. clavipes* is widely distributed throughout the state, whereas *N. cruentata* was recorded only in Rio Grande city. Meanwhile *T. sexpunctata* had been reported in the states belonging to the southeast and central-west regions of Brazil, such as São Paulo, Goiás, Mato Grosso and Mato Grosso do Sul. In this way, they appear are associated with Cerrado biome and adjacent dry forests until now [9-16]. Therefore, to contribute with knowledge of *T. sexpunctata* species, we record this spider for the first time in the literature for southern Brazil, especially for south half of RS. Thus, we also indicate that *T. sexpunctata* can be related to Brazilian Pampa biome and anthropic environment.

Material and Methods

Study Area

The study was conducted in a Pampa biome area in the Federal University of Pampa - UNIPAMPA (29°49'49.2''S and 57°06'07.1''W) located in the municipality of Uruguaiana, state of RS, Brazil. The university has approximately 247 hectares and its vegetation is marked by areas of pastures with a steep slope, streams and woods. It contains a dam and livestock farming predominates in its surroundings [11-17]. The climate in the region is subtropical, classified as Cfa according to Köppen [18]. The average temperature is 18.6°C and the annual average rainfall is 1567.8 mm.

Sampling

Collections were carried out between December and March of 2017 and 2018. These collections always took place in the summer through random walks in UNIPAMPA, in which two collectors participated. Then, when the spider of interest was seen, it was captured with the aid of a small sweeping net and stored in pots with date and localization identification. Thus, collected specimens *T. sexpunctata* were taken to the Biology and Animal Diversity Laboratory of the UNIPAMPA, where they were fixed (2% formaldehyde) and preserved (70% alcohol) for analysis [19-22].

Morphological identification was performed through comparison with specialized literature. The images and measurements were made under a stereoscopic microscope with a digital camera attached to it. The live animals were photographed with a Sony HX400V camera. Afterwards, the specimens were deposited in the zoological collection of the laboratory.

Results

Between 2017 and 2018, six specimens of *Trichonephila sexpunctata* (Giebel, 1867) were collected and identified by authors in the UNIPAMPA – Campus Uruguaiana: four females and two males. Then they were deposited at institutional zoological collection (Table 1). It was highlighted these specimens were observed in trees, shrubs of pasture

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areas (Figures 2A, 2B), as well anthropic environments at UNIPAMPA (Figures 2C, 2D). In 2019 and 2020, there were other visual records of the species in the region, including on the banks of the Uruguay River and downtown (Figure 3). These encounters with golden orbweaving spiders always occurred in the summer.

Species	Country/Region	GPS Coordinates	Sex/Voucher	Collection date
Trichonephila sexpunctata	UNIPAMPA, Uruguaiana, Brazil	29°49'53.32"S, 57°06'01.48"W	1♀, LBDA Arac_159	March 13, 2017
Trichonephila sexpunctata	UNIPAMPA, Uruguaiana, Brazil	29°49'53.32"S, 57°06'01.53"W	1♂, LBDA Arac_160	March 13, 2017
Trichonephila sexpunctata	UNIPAMPA, Uruguaiana, Brazil	29°49'48.57"S, 57°06'05.58"W	2♀, LBDA Arac_167/168	Dec 21, 2017
Trichonephila sexpunctata	UNIPAMPA, Uruguaiana, Brazil	29°49'52.40"S, 57°06'01.85"W	1♀, LBDA Arac_170	Jan 30, 2018
Trichonephila sexpunctata	UNIPAMPA, Uruguaiana, Brazil	29°49'52.40"S, 57°06'01.85"W	1♂, LBDA Arac_171	Jan 30, 2018

Table 1: Information about specimens collected, identified, and deposited in zoological collection of Biology and Animal Diversity Laboratory by authors.

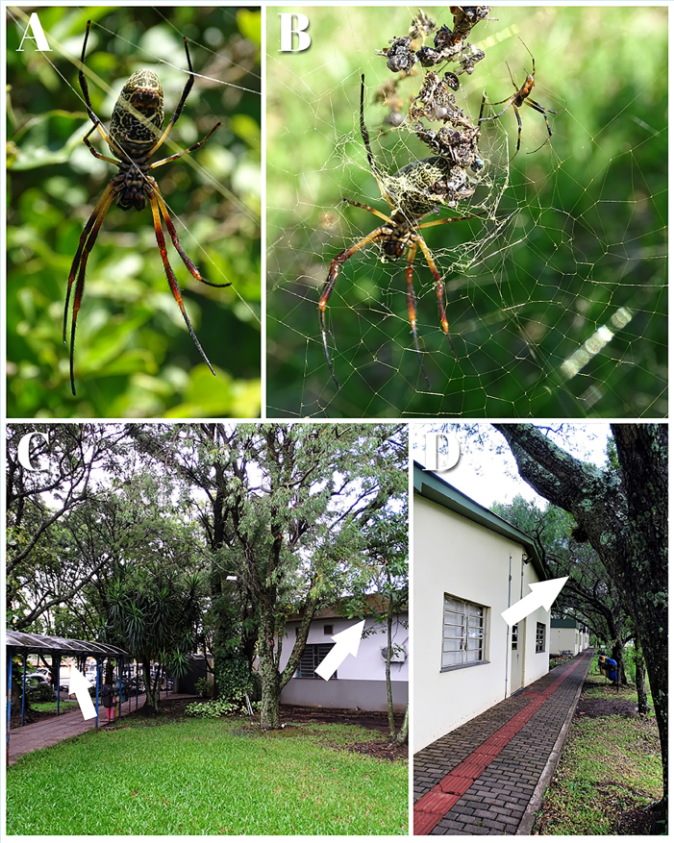

Figure 2: Location of *Trichonephila sexpunctata* in Campus Uruguaiana of Federal University of Pampa. A, B) Observed in trees, shrubs of pasture areas. C, D) Observed in anthropic environments.

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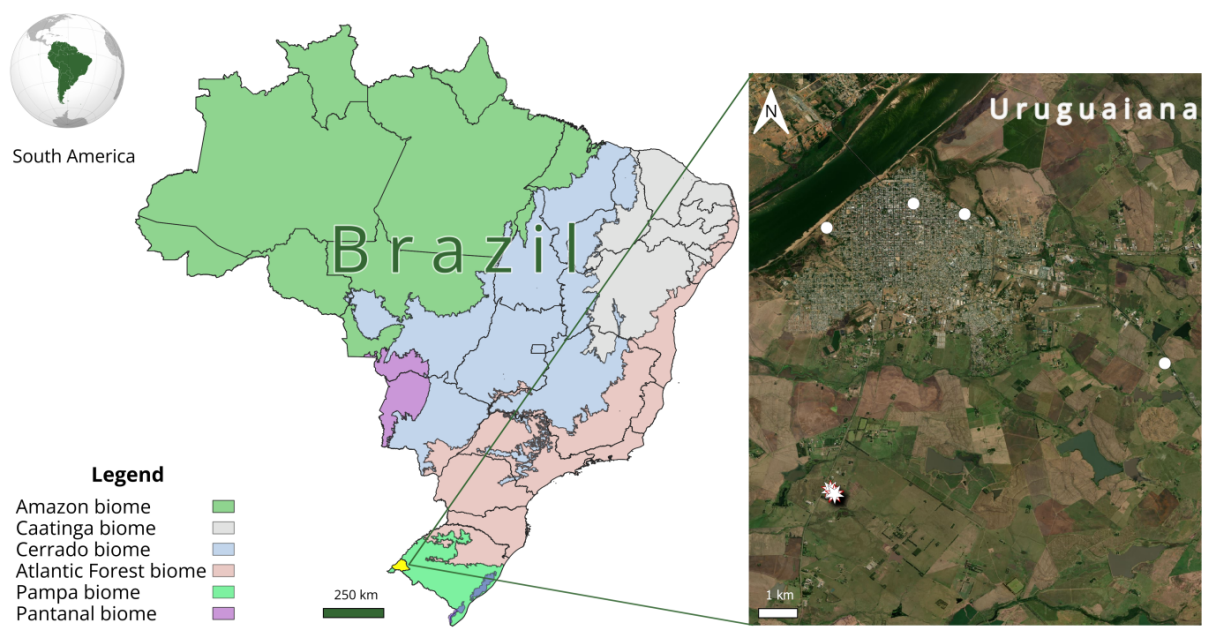

Figure 3: Geographic map showing the municipality of Uruguaiana, Rio Grande do Sul state, Brazil. The white stars indicate area where we collected specimens of *Trichonephila sexpunctata* which were analyzed (2017 and 2018). White circles indicate observation areas for the species in later years (2019 and 2020).

Morphological Identification

Analysis of these found specimens were performed shortly after the capture once the color patterns may disappear over time. In this sense, their identification was based on the characteristics according to Giebel [6], Levi and Eickstedt [9], and Kuntner et al. [19].

Basically, the specific taxonomic level of *T. sexpunctata* was identified mainly by presence of female oval abdomen, marbled and not overhanging spinnerets (Figure 4A). Moreover, the epigynum is an oval depressed plate with a groove on each side into anterior (Figure 4B). The entire upper part of their cephalothorax is densely covered with small white hairs, which leaves only two bare black spots in the middle and two round black spots on each side near the edge, which gave the species of *sexpunctata* its name. Their eyes are spherical and positioned on the rounded edge of the cephalothorax. Forehead eyes are the slightly larger and stay on the sides of a bulge. The other eyes closer together and are below those mentioned above, on the sides of a small central protuberance on the cephalothorax. Carapace without horns (Figure 1). *T. sexpunctata* does not present a frontal unpaired elevation of the female sternum, which is elongated and heart-shaped, yellow anteriorly, black-brown, and densely covered throughout with old-yellow hair (Figure 4C). These spiders also do not have a pair of tubercles on mid carapace.

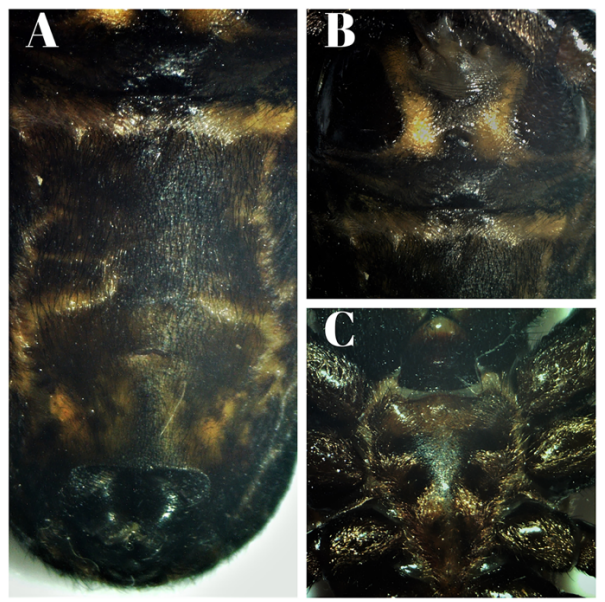

Figure 4: *Trichonephila sexpunctata*. A) Female abdomen, ventral view. B) Female, detail of epigynum. C) Female sternum.

Discussion

Brazil is a country rich in biodiversity, so new species from different groups are recorded every year [20,21]. When

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talking about spiders, the country has more than 3,210 species [1]. RS has a list of 808 species of spiders, included in 51 families. Among these families Nephilidae is represented to date by two species: *T. clavipes* and *N. cruentata* [13]. Now, with this record, the family has three representative species in southern Brazil. We highlight that this species is only found as an adult between late spring, summer and early autumn. Making your study difficult.

But the diagnosis of the females of *T. sexpunctata* are easily detected, because they are larger than the *T. clavipes* and *N. cruentata*. Another characteristic is that its abdomen is more oval and less cylindrical. In addition, the males present dark carapaces (see Figure 1) while *T. clavipes* males are bright yellow [9].

On the other hand, individuals of *T. sexpunctata* were observed in trees, shrubs of pasture areas (Figure 2A, B) and anthropic environments (Figure 2C, D), showing similar habits with *T. clavipes* [9,10]. This fact may have aided in success of this species in the Brazilian Pampa biome, besides justify the observation of *T. sexpunctata* on the banks of the Uruguay River and downtown.

Until now, 15 locations are cited in South America for the presence of *T. sexpunctata* (Appendices, Table 1), 04 of them are in Brazil, 09 in Argentina and 02 in Paraguay [9,22-26]. Thus, we emphasize that there are few records of this arachnid. Some studies date from the 1920s, as in Paraguay. Therefore, the ecology of *T. sexpunctata* is not fully determined. Lastly, this species is classified as Least Concern [9,22-27].

Hence present paper also demonstrates the potential aerial dispersion in nature of *T. sexpunctata* and its expansion capacity, since this ability allows overcome physical barriers such as rivers and transition zones [28]. This significant dispersal capacity of *T. sexpunctata* is compatible with the new niche occupied by their, because until now all the points where the golden orbweaving *T. sexpunctata* occurs are distributed in the central part of South America.

Conclusion

This study reported for the first time in literature the record of *T. sexpunctata* in Brazilian Pampa biome, southern Brazil. The species appears well adapted in anthropic environmental, which may partially explain its expansion. However, more studies are necessary to elucidate its ecology and possible risks in this habitat.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1

Country	State/Province	Locality	Biome	Reference
Brazil	Rio Grande do Sul	Uruguaiana	Pampa	This paper
	São Paulo	Tupã	Cerrado	Araujo, et al. [22], Bartoleti, et al. [23]
	Goiás	Pirenopolis	Cerrado	Bartoleti, et al. [23]
	Goiás	Catalão	Cerrado	Bartoleti, et al. [23]
	Mato Grosso do Sul	Campo Grande	Cerrado	Bartoleti, et al. [23]
Argentina	Entre Ríos	Paraná	Espinal	Bartoleti, et al. [23]
	Entre Ríos	Federal	Espinal	Bartoleti, et al. [23]
	Buenos Aires	Mercedes	Espinal	Bartoleti, et al. [23]
	Catamarca	Santa Maria	Chaco	Bartoleti, et al. [23]
	--	Pq. Nacional del Chaco	Chaco	Bartoleti, et al. [23]
	Chaco	Basail	Chaco	Bartoleti, et al. [23]
	Mendoza	Mendoza	Monte	Levi, et al. [9]
	Salta	La Viña	Chaco	Mello-Leitão [24,25]
	Cidade autônoma	Buenos Aires	Pampa	Araujo, et al. [22], Bartoleti, et al. [23]
Paraguay	Presidente Hayes	Makthlawaiya	Chaco	Badcock, et al. [26]
	Presidente Hayes	Paraguay - Nanahua	Chaco	Badcock, et al. [26]

Table 2: Information about specimens collected, identified, and deposited in zoological collection of Biology and Animal Diversity Laboratory by authors.

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