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FIRST REPORT OF *Trichonephila clavipes* (LINNAEUS, 1767) (ARANEAE: ARANEIDAE) PREDATION ON AN AMPHIBIAN (ANURA) IN SOUTHERN BRAZIL

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Abstract: The golden silk orb-weaver *Trichonephila clavipes* (Linnaeus, 1767), renowned for its remarkable web-building behavior, inhabits a diverse range of habitats across the Americas. Its diet is typically associated with insects. However, previous studies suggested its potential to predate amphibians although direct observations of such predation are lacking. The first record of *T. clavipes* preying on an amphibian is documented herein. The event occurred in a preserved area in southern Brazil. The precise taxonomic identification of the amphibian could not be carried out because of its decomposition, but it belongs to the order Anura. I also recorded another spider species present on the web, which appears to be feeding on the amphibian as well. This study sheds light on the ecological role of *T. clavipes* and underscores the importance of further research to understand its habits and predatory behaviors, contributing to our comprehension of predator-prey dynamics in natural ecosystems.

Keywords: Anura, Arachnida, Araneophagy, Kleptoparasites associated, Neotropical, South America.

The golden orb-web weaving spider *Trichonephila clavipes* (Linnaeus, 1767), commonly known as the "golden silk orb-weaver," is a captivating species within the family Araneidae (Clerk, 1757 - World Spider Catalog 2024). This species is notable not only for its striking appearance and intricate web-building behavior but also for its significant intraspecific morphological variation. *T. clavipes* exhibits a range of physical differences among its populations, which can be observed in body size, coloration, and web structure. These morphological variations can be crucial for taxonomic studies, as they may correspond with specific behavioral traits. For example, variations in web architecture and silk properties can provide insights into the ecological adaptations and evolutionary processes of the species. *T. clavipes* inhabits a diverse range of habitats across the Americas, from the southern United States to Argentina, and adapts to different environmental conditions (Clerck 1757 - World Spider Catalog 2024, Platnick 2014). This adaptability further underscores the importance of understanding species morphological and behavioral diversity in taxonomic and ecological research.

T. clavipes is renowned for its remarkable silk, which possesses exceptional strength and durability, making it one of the most resilient natural fibers known in science (Hormiga *et al.* 1995, Vollrath and Porter 2009, Schult *et al.* 2021). The distinctive golden hue of its silk has captured the imagination of researchers and artists alike, inspiring investigations into its unique properties and potential applications in various industries, including textiles and biomedicine (Eisoldt *et al.*

2010). This species typically has an annual life cycle, in which the females are born, reach reproductive maturity, copulate, build their ootheca and die in less than a year. *Trichonephila* presents strong sexual dimorphism (Ramos *et al.* 2005). The female measures between 23 and 40 mm and is characterized by an orange abdomen with yellow spots, that are cylindrical and elongated. The cephalothorax is silvery, and the legs have yellow and brown bands, with tufts of bristles on the distal end of the tibia and on the femur of pairs I, II and IV. The male, unlike the female, is not very striking, measures between 4 and 8 mm and is reddish brown (Ramos *et al.* 2005).

Furthermore, *T. clavipes* plays a crucial role in regulating insect populations within their respective ecosystems (Blamires *et al.* 2017) strength, and extensibility makes spider major ampullate (MA. In addition, there is an intriguing aspect of their webs, which are often subject to kleptoparasites by smaller spiders, such as those from the genus *Argyrodes*, which steal prey caught in the larger spider's web (Grostal and Walter 1997).

The diet of *T. clavipes* is typically associated with insects (Robinson and Mirick 1971, Rocha 2016). Still, the study by Nyffeler and Altig (2020) suggests the possibility of *T. clavipes* preying on larger organisms under certain circumstances. Moreover, in Walther (2016) study, there is a documented case of a related species, *Nephila pilipes*, capturing and consuming a bird in its web. While direct observations of vertebrate predation by *T. clavipes* are rare, these findings indicate that the species might have the capacity to prey on a broader range of organisms, including vertebrates. Regarding the consumption of amphibians, while there is a documented case by Ganong and Folt (2015), of a dead frog found on the web of a *T. clavipes* in Costa Rica, this observation does not conclusively prove active predation by the spider, as the spider was not present on the web at the time. The possibility remains that the frog was already deceased before becoming entangled in the web, leaving the nature of this interaction uncertain. Although such cases suggest the potential for vertebrate predation, further evidence is needed to confirm whether *T. clavipes* can actively prey on amphibians or if these incidents represent scavenging behavior.

Here, I present the first record of direct predation by *Trichonephila clavipes* on an amphibian documented in southern Brazil. This new record extends our understanding of the dietary plasticity and predatory behavior of *T. clavipes*, demonstrating its ability to prey on a broader range of organisms. This finding has significant implications for our knowledge of food web dynamics and predator-prey interactions in ecosystems where *T. clavipes* is present. By documenting such behavior, we can better appreciate the ecological roles these spiders play and how they may influence the populations of various prey species, including amphibians. This observation also encourages further research into the adaptive strategies and ecological impacts of orb-weaving spiders, shedding light on the complex interrelationships within their habitats.

The predation record of *T. clavipes* on the amphibian specimen (31°48'56"S, 52°25'54"W) occurred in a trail inside Horto Botânico Irmão Teodoro Luis, a permanent preservation area (APP) under the responsibility of the Botanic Department at the Federal University of Pelotas (UFPel) (Figure 1).

Horto is located in the municipality of Capão do Leão, situated in the state of Rio Grande do Sul, in the geomorphological region of the coastal plain on the southern coast (Veloso *et al.* 1991). This municipality is part of the Campos Sulinos Brazilian biome and presents a characteristic landscape of pioneer formations, with a significant influence of semi-deciduous forests (Veloso *et al.* 1991) (Figure 2). The climate is classified as mesothermal, always humid, with hot summers (Moreno 1961), with average temperatures and precipitation of 23°C and 125 mm in summer, 18°C and 100 mm in autumn, 13°C and 123 mm in winter, and 17°C and 108 mm in spring (EMBRAPA 2010).

A photographic record (Figure 3) was taken on April 8, 2013, at 10:00 am during the route, which was carried out twice a week as part of my undergraduate thesis project. The primary objective of these routes was to evaluate habitat overlap between two sympatric canid species, *Cerdocyon thous* and *Pseudalopex gymnocerus*, in the region. This route was continuously carried out for one year, totaling 104 visits to the location where the record was made. However, out of these 104 visits, there was a single observation of such predation.

I was unable to make a precise taxonomic identification of the specimen being preyed upon as much of its body had already been consumed, and the remaining parts were in the early stages of

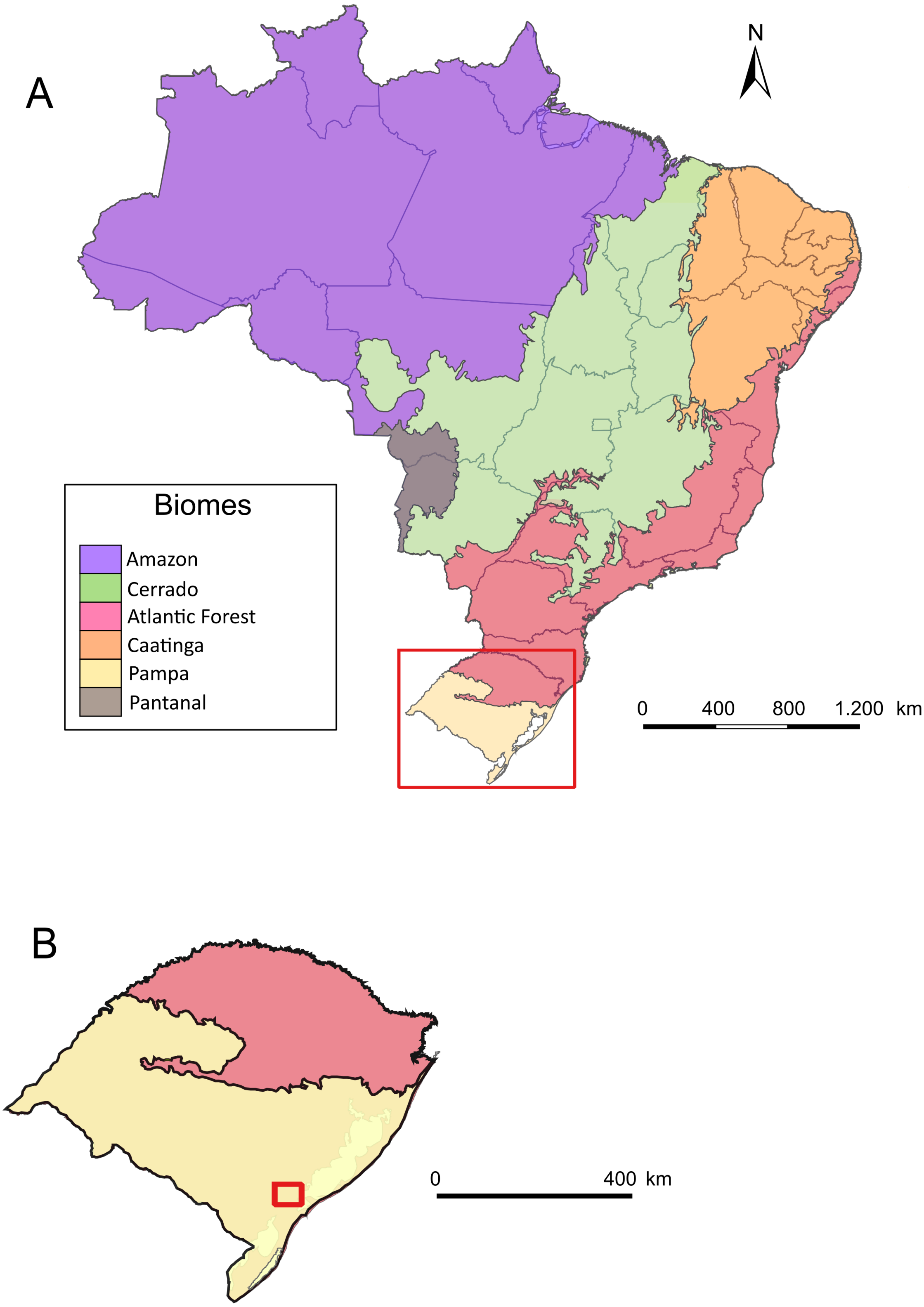

Figure 1. Map showing the location of the predation of *Trichonephila clavipes* on an amphibian (red square), situated in southern Brazil (A), in the southern portion of the state of Rio Grande do Sul (B). Brazilian biomes are represented in the image by different colors.

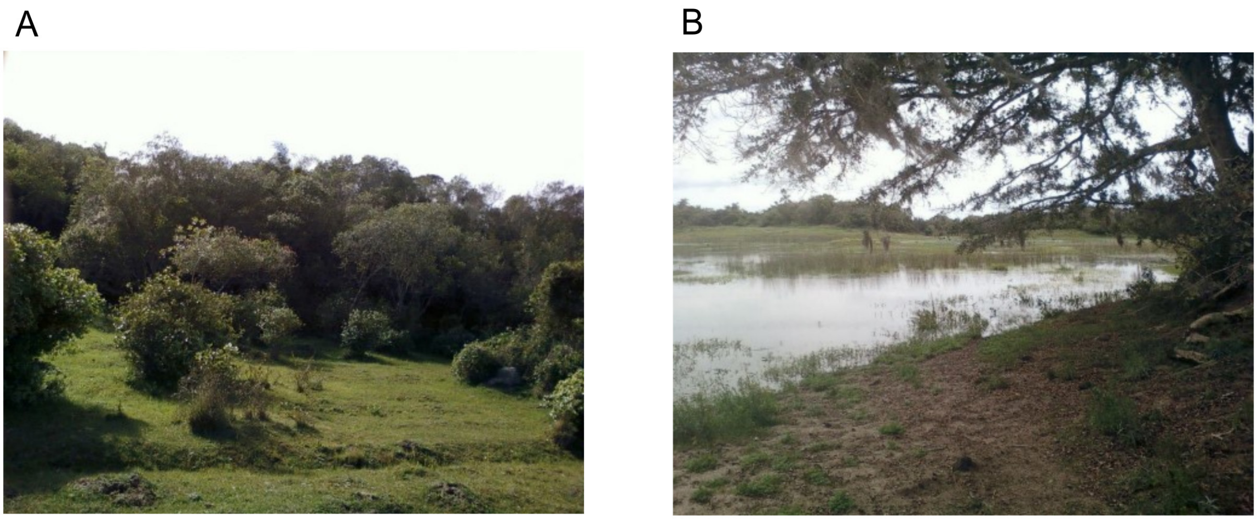

Figure 2. View of Horto Botânico Irmão Teodoro Luis (A and B), Capão do Leão, state of Rio Grande do Sul, southern Brazil, to illustrate the type of environment in which a predation of *Trichonephila clavipes* (Linnaeus, 1767) (Araneae: Araneidae) on an amphibian was observed.

Figure 3. Photographic record of *T. clavipes* actively preying an amphibian in the municipality of Capão do Leão, state of Rio Grande do Sul, Brazil. The white arrow indicates the long and slender leg of the amphibian specimen, which was retracted and already in a state of decomposition. The red arrow indicates the kleptoparasite species. Photo: Lucas Porto. https://www.inaturalist.org/observations/234569826.

decomposition. However, on the basis of the image and the identification at the location the photo was taken, it was certainly an amphibian, belonging to the order Anura, due to the presence of long and slender legs, which were retracted and already in a state of decomposition, visible as the dark region on the animal's body (Figure 3).

In Figure 3, the spider can be seen tearing into the ventral part of the specimen with its fangs. Notably, another spider species is present on the web, which does not resemble a male or a juvenile *T. clavipes* but appears to be feeding on the amphibian as well. This spider is likely a kleptoparasite, such as a male of the genus *Argyrodes* or *Faiditus* (Theridiidae), known for its kleptoparasitic behavior (Meira *et al.* 2021). Among the kleptoparasites associated with *T. clavipes*, the Theridiidae family is the most abundant, with *Argyrodes elevatus* being a prominent representative. According to Henaut *et al.* (2005) and Agnarsson (2006), the Theridiidae family includes many kleptoparasitic species that feed exclusively on host webs.

This study provides new valuable information about the ecology of the golden silk orb-weaver. While previous studies have suggested the potential for *T. clavipes* to feed on amphibians, this article reports the first direct observation of such predation. Understanding the dietary habits and predatory behaviors of *T. clavipes*, in addition to its interactions with kleptoparasites, is crucial for elucidating its role within its ecosystem and its interactions with other species regulating populations of a wide range of taxa.

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