

## Cannibalism in *Tityus metuendus* Pocock, 1897 (Scorpiones: Buthidae) from the Brazilian Amazon

Canibalismo en *Tityus metuendus* Pocock, 1897 (Scorpiones: Buthidae) de la Amazonia brasileña

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**Abstract.** Scorpions are an important predator group in the habitats where they live, due to their voracity. However, their predatory habits are not well recorded, particularly in Amazonian species. Here we report four intraspecific predation events involving *Tityus metuendus* Pocock, 1987. In all cases, larger individuals acted as predators of smaller ones. These are the first reports of cannibalism involving scorpions in the Brazilian Amazon. Our findings are important to allow a better understanding of intraspecific interactions in tropical scorpion assemblages.

**Key words:** Antagonistic interaction; arachnids; tropical forest.

**Resumen.** Debido a su voracidad los escorpiones son un grupo importante de depredadores en los hábitats donde viven. Sin embargo, sus hábitos depredadores no están bien registrados, especialmente en especies amazónicas. Aquí se informan cuatro eventos de depredación intraespecífica que involucran a *Tityus metuendus* Pocock, 1987. En todos los casos, los individuos de mayor tamaño actuaron como depredadores de los más pequeños. Estos son los primeros registros de canibalismo en escorpiones de la Amazonía brasileña. Estos hallazgos son importantes porque permiten una mejor comprensión de las interacciones intraespecíficas en los ensambles de escorpiones tropicales.

**Palabras clave:** Aracnídos; bosque tropical; interacción antagonica.

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Cannibalism is defined as an ecological interaction where individuals are eliminated because of their lower aptitude or competition for resources (Fox 1975). In this interaction, an individual kills and feeds on another individual of the same species, which can occur while fighting for survival or reproduction (e.g., Persson *et al.* 2000; DeVore *et al.* 2021). According to Polis (1980), this ecological interaction may contribute to population balance in the long term. For example, cannibalism regulates the predator population size, allowing for their maintenance in seasons with low prey availability (Wise 2006; Oliveira *et al.* 2022). This interaction has been reported in several arthropod groups (e.g., Wise 2006; Alabi *et al.* 2008; Clark *et al.* 2021), particularly in scorpions (Polis 1980; Moreira *et al.* 2022).

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Scorpions are considered generalist predators, preying on a wide range of invertebrates, and even small vertebrates (Polis 1990). These arachnids typically have sedentary and territorial habits, being aggressive to other scorpion species or their juveniles (Polis 1990; Moreira *et al.* 2022). Due to their cryptic habits, field interaction reports of scorpions with other animals are relatively scarce in the literature, particularly in the Amazon region (Lourenço *et al.* 2006; Battirola *et al.* 2015; Almeida *et al.* 2022). For example, in the southern Brazilian Amazon, an individual of *Tityus strandi* (Werner, 1939) was found preying on the spider *Ancylometes rufus* (Walckenaer, 1837) (Battirola *et al.* 2015). Recently, Almeida *et al.* (2022) described an unusual predation event where a *Hyperomerus* Redtenbacher, 1891 katydid was found preying on a *Chactopsis* Kraepelin, 1912 scorpion in the western Brazilian Amazon. These reports are useful for comprehension of food web dynamics in natural environments. Here we describe four cases of cannibalism involving individuals of *Tityus metuendus* Pocock, 1897 in the Brazilian Amazon.

*Tityus metuendus* is a large (80-90 mm) blackish-brown scorpion that is widespread in rainforest habitats, especially in the western Amazon (Lourenço 2011), typically found in leaf litter strata and palm trees (reviewed in Martins *et al.* 2021). Furthermore, *T. metuendus* together with *T. obscurus* (Gervais, 1843) and *T. silvestris* Pocock, 1897 are responsible for most cases of severe envenomation in the Amazon region (Martins *et al.* 2021).

The cannibalism events reported here were observed during a field study in 2019-2023 in an urban forest fragment on the campus of Universidade Federal do Estado do Amazonas (3°05'54"S, 59°58'19"W), in rural zone (3°01'15.4"S, 60°03'50.9"W), in Manaus, Amazonas state, and an upland ('terra firme') forest area located within the Mogno State Forest (7°50'27"S, 71°48'46"W), in the municipality of Tarauacá, Acre state, Brazil. Voucher specimens were deposited in the invertebrate collection of the Instituto Nacional de Pesquisas da Amazônia, Manaus. Our first record (September 2019) occurred at night (19:00-21:00 h) which we observed an adult male on the leaf litter preying on the prosoma of a subadult (Fig. 1A). In our second record (December 2019), we observed an adult female eating the mesosoma of an adult male in the morning (08:00-09:00 h) beneath a palm tree leaf (Fig. 1B). Both cannibalism events were recorded in an urban forest fragment on the campus of Universidade Federal do Estado do Amazonas. The third record (July 2021) occurred during the night (19:00-21:00 h) in Tarauacá, Acre state, where we observed an adult male on a tree trunk (ca. 100 cm in height) preying on the pedipalp of a juvenile of its species (Fig. 1C). In the last record, we found an adult male eating the prosoma of a juvenile at night (22:00-23:00 h) in leaf litter (Fig. 1D).

In all these episodes, larger *T. metuendus* individuals acted as predators of smaller ones. Previous studies have reported that intra and interspecific relationships in scorpions are size-mediated, with the larger individuals preying on smaller ones (*e.g.*, Moreira *et al.* 2022; Toprak *et al.* 2022). In an experimental study, Moreira *et al.* (2022) found that cannibalism in scorpions was lower between individuals of similar body size and was mitigated by habitat complexity when animals possess asymmetric size. In addition, scorpions are typically classified as having a low metabolic rate (Lighton *et al.* 2001; van Aardt *et al.* 2016). Thus, lower metabolic rates result in increases in population density, which can increase the probability of cannibalism (Lighton *et al.* 2001). Previous studies have shown that cannibalism is an important regulatory mechanism for scorpion populations, accounting for approximately 30% of the ingested biomass (Polis 1979, 1980, 1981). This interaction is a major cause of mortality in small-sized individuals (Polis 1979; Polis *et al.* 1981). Our records may suggest that larger *T. metuendus* individuals often feed on smaller ones, potentially serving as a mechanism to regulate the population size of this scorpion species. However, it is important to note that these findings are based on limited field observations and should be interpreted with caution. In this way, this hypothesis needs to be tested in future studies of scorpion food dynamics in Amazon region.



**Figure 1.** Cannibalism records involving the scorpion *Tityus metuendus* in Brazilian Amazon. **A.** Adult male individual preying on a subadult in an urban forest fragment, state of Amazonas. **B.** Adult female preying on an adult male in an urban forest fragment, state of Amazonas. **C.** Adult male individual preying on a juvenile in Mogno State Forest, state of Acre. **D.** Adult male individual preying on a juvenile in rural zone, state of Amazonas. / **Figura 1.** Registros de canibalismo que involucran al escorpión *Tityus metuendus* en la Amazonia brasileña. **A.** Macho adulto depredando a un subadulto en un fragmento de bosque urbano, estado de Amazonas. **B.** Hembra adulta depredando a un macho adulto en un fragmento de bosque urbano, estado de Amazonas. **C.** Macho adulto depredando a un juvenil en el estado de Mogno Bosque, estado de Acre. **D.** Individuo macho adulto depredando a un juvenil en zona rural, estado de Amazonas.

### Author Contributions

**JM:** Investigation, resources, data curation, writing - review & editing. **MA:** Investigation, resources, data curation, writing - review & editing. **RP:** Resources, funding acquisition, writing - review & editing. **AL:** Conceptualization, validation, visualization, writing - original draft.

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