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Predation of a scorpion (Scorpiones: Buthidae) by an assassin bug (Heteroptera: Reduviidae) in the Brazilian Atlantic Forest

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Abstract: Litter-dwelling arthropods comprise about three-fourths of the total animal biomass in tropical forests. These invertebrates are involved in many interspecific interactions, from mutualism to predation. We report herein the predation of a scorpion by an immature assassin bug (Harpactorini) during a nocturnal manual search for scorpions in a fragment of the Brazilian Atlantic Forest. The specimens were found 15 cm above the ground on a seedling, and the prey was two-fold larger than the predator. The assassin bug had its rostrum inserted into the pleura of a juvenile *Tityus pusillus* Pocock, 1893 scorpion, between the first and second segments of the mesosoma; when disturbed, the predator jumped to the leaf litter without releasing its prey. To the best of our knowledge, this is the first report of juvenile predator–prey interactions between a heteropteran and a scorpion in this biome.

Key words: Harpactorini, intraguild predation, natural history, *Tityus pusillus*

Scorpions are top predators, capturing a great variety of prey exerting direct influence on the energy flow through predation of different invertebrates (Polis, 1990; McCormick and Polis, 1990). However, scorpions are also subjected to predation by vertebrates and invertebrates (Polis et al., 1981). Predation of scorpions by invertebrates, mainly ants, coleopterans, heteropterans, chilopods, solpugids, other scorpions, and spiders, causes a high rate of mortality among juveniles and smaller species of scorpions (Cloudsley-Thompson, 1960; Williams, 1966; Cloudsley-Thompson, 1977; McCormick and Polis, 1990; Punzo, 1998; Melic, 2000; Moreno-González and Hazzi, 2012; Stevenson and Stohlgren, 2015). Here, we report the first case of scorpion predation by a juvenile assassin bug (Heteroptera, Reduviidae, Harpactorinae, Harpactorini), during a nocturnal collection of scorpions in the Brazilian Atlantic Forest; this is the second reported case of scorpion predation in this biome (Lira and Costa, 2014).

Because of the difficulty in identifying juveniles, the assassin bug was classified to the tribe level, Harpactorini. The immature assassin bug preyed on a juvenile *Tityus pusillus* Pocock, 1893 (Scorpiones: Buthidae), which is the most abundant and widely found scorpion in the northeastern region of the Brazilian Atlantic Forest (Lourenço, 2002; Porto et al., 2010; Lira and Albuquerque, 2014; Lira et al., 2015) and is capable of causing injuries to humans (Albuquerque et al., 2009). This scorpion is a sedentary predator commonly found in the leaf litter layers; its abundance increases in the dry season, and it shows a positive relationship with dry litter mass (Lira et al., 2013, 2015; Lira and DeSouza, 2014).

Despite the smaller size (8.6 mm) of the predator in comparison with the size of its prey (14.3 mm), the assassin bug managed to insert its rostrum into the pleura of the scorpion, between the first and second segments of the mesosoma (Figure). The predation was observed in Reserva Biológica de Saltinho (08°43′43″S, 35°10′39.8″W), Tamandaré, southern coast of Pernambuco state, Brazil. The reserve has a total area of 562.25 ha composed of the Ombrophilous Dense Forest (Lisboa et al., 2011; ICMBio, 2015). In previous studies of other Atlantic Forest fragments, *T. pusillus* has been observed only as the predator of spiders, crickets, cockroaches, and moths (Lira pers. obs.). The specimens of our study were found on a seedling (~45 cm), on which the assassin bug was oriented vertically 15 cm above the ground with its head facing upward. When disturbed, the predator jumped to the leaf litter with the scorpion in its mouthparts without releasing

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Figure. Nymph of assassin bug (Harpactorini) preying a *Tityus pusillus* Pocock, 1893 juvenile.

its prey. Both animals were collected, and the voucher materials have been deposited in the Arachnological Collection of the Universidade Federal de Pernambuco.

The predation of *T. pusillus* by an assassin bug that belongs to Harpactorini described in this study differs from previously reported predations by animals that belong to Heteroptera; adult, not juvenile, scorpions that belong to Buthidae have been reported to exhibit such behavior (Stevenson and Stohlgren, 2015). An adult *Microtomus purcis* (Drury, 1782) (Heteroptera: Reduviidae) was found feeding on juvenile and adult *Centruroides hentzi* (Banks, 1900) (Scorpiones: Buthidae) under a pine bark in the coastal plain of the United States. Both species are characteristically bark-dwelling species (Horn and Hanula, 2002; Stevenson et al., 2012), and the interactions between *M. purcis* and *C. hentzi* were attributed to the similar microhabitats of both species (Stevenson and Stohlgren, 2015).

Nevertheless, both studies agree about the predator–prey size for assassin bugs that feed on larger prey. It is important to note that assassin bugs are the largest group of predatory hemimetabolous insects (~6800 species) and one of the more numerous animal predators (Hwang and Weirauch, 2012). Assassin bugs that exhibit extraoral digestion, such as the specimen reported in the present study, may consume relatively large prey, allowing them to prey on a large variety of animals as predicted by Cohen (1995). Assassin bugs use venomous saliva that paralyzes their prey within a short duration of time, after which the bugs use their forelegs to hold the prey and suck the body juices (Evangelin et al., 2014). In addition, some members of the tribe Harpactorini have developed a novel predation strategy called sticky trap predation, as they have sticky glands on the legs that secrete a sticky substance used to capture their prey (Barth, 1952; Ambrose, 1999; Weirauch, 2006; Zhang and Weirauch, 2013).

Despite their capacity to capture larger prey, nonhematophagous assassin bugs prefer to capture smaller prey. Cogni et al. (2002) investigated the influence of prey size on predation success in the assassin bug *Zelus longipes* (Linnaeus, 1767) (Heteroptera: Reduviidae). According to these researchers, the fact that successful attacks were more frequent in small prey reduces the risk of injury to the predator. In fact, scorpions can be dangerous prey because of their venom, and the predator can easily become potential prey. Thus, the venomous saliva of assassin bugs is very useful for capturing dangerous prey such as scorpions.

The observation reported in this study extends the list of invertebrate predators of scorpions, and, to our knowledge, it is the first report of an assassin bug preying on a scorpion in the Brazilian Atlantic Forest. Further studies are required to obtain more and detailed information on predator–prey interactions between assassin bugs and scorpions and to understand the ecological implication of this interaction.

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