

SHORT COMMUNICATION

Predation on *Hylodes phyllodes* (Anura: Hylodidae) by the harvestman *Heteromitobates discolor* (Arachnida: Opiliones)

Rafael Costabile Menegucci, Edelcio Muscat, Rafael Mitsuo Tanaka, and Daniel Stuginski

Projeto Dacnis. 11680-000, Ubatuba, SP, Brazil. E-mail: daniel.stuginski@gmail.com.

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Anurans are considered an important part of the trophic networks of several ecosystems (Wells 2007). Adult frogs are mostly generalist carnivores that consume a large number of invertebrate prey as well as small vertebrates (Duellman and Lizana 1994, Duellman and Trueb 1994). Furthermore, anurans are also part of the diet of a wide variety of animals such as birds, mammals, reptiles, fish, and some groups of invertebrates (Toledo *et al.* 2005, 2007). Arthropods are the most prominent invertebrate group that has been reported preying on anurans (Toledo 2005). Among them, spiders (Muscat *et al.* 2014), ants (Allen *et al.* 2004), and giant water bugs (Toledo 2003) are particularly prone to consume adult frogs and tadpoles regularly. Other groups of arthropods, such as beetles, wasps, and harvestmen also prey on anurans, but these predatory interactions seem to be less frequent (Warkentin 2000, Castanho and Pinto-da-Rocha 2005, Wizen and Gasith 2011). There is only one report of a predatory interaction

between a harvestman and an anuran (Castanho and Pinto-da-Rocha 2005). Given the similar microhabitats of frogs and harvestmen, one might expect encounters between different species of both taxa; a predatory interaction is a possible because harvestmen are opportunistic feeders.

Hylodes phyllodes (Heyer and Crocoto, 1986) is a small, endemic frog of the Atlantic Forest of southeastern Brazil. It is closely associated with small rocky streams of coastal forests in the states of Rio de Janeiro and São Paulo (Heyer *et al.* 1990). This diurnal species forages and vocalizes on rocks located in streams or even on rocks near stream banks (Hartmann *et al.* 2006). They are locally abundant and are part of the diet of different vertebrate and invertebrate species (pers. obs.). When threatened, *H. phyllodes* usually take refuge in stone crevices (Hartmann *et al.* 2006), but they also have a series of defensive behaviors that can be used when they are attacked by a predator (Toledo *et al.* 2011). At night, individuals perch on the broad leaves of small trees or bushes, or even on tree trunks, usually close to the ground and never far away from their activity site (pers. obs.).

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The harvestman *Heteromitobates discolor* (Soerensen, 1884) is a medium-sized arachnid, endemic to a long system of mountain ranges and escarpments called Serra do Mar, in the Atlantic Forest Biome (Silva and Gnaspini 2010). *Heteromitobates discolor* usually is nocturnal, spending the day hidden in rocky crevices near rocky streams. At night, individuals forage on rocks and in low vegetation; they stand upright with their bodies raised and leg pair number two extended to detect any possible prey (Silva and Willemart 2015).

In the southeastern Atlantic Forest, *Hylodes phyllodes* and *Heteromitobates discolor* share the same microhabitat. Although both species are commonly found along rocky streams, this is the first report of a predatory event involving *Hy. phyllodes* by *He. discolor*. On two different nights we observed two distinct events that, together, constitute a full predatory event. First, we observed an individual *Hy. phyllodes* being subjugated by *He. discolor*; second, we observed a harvestman consuming a frog. Both events were recorded during fieldwork developed by the Projeto Dacnis (Atlantic Forest preservation and research NGO) research team in its lowland Atlantic Forest private reserve located in Ubatuba, state of São Paulo, southeastern Brazil. Both events took place in the same area (23°27'50.70" S, 45°07'48.50" W, 70 m a.s.l.) along the margins of one of the many small, rocky streams in the area. The sizes of the animals were estimated visually to avoid interfering with the predation event.

On 08 June 2017, at 20:00 h, an adult *Heteromitobates discolor* (~9-mm dorsal shield and ~100-mm leg span) was found grasping and carrying an adult *Hylodes phyllodes* (SVL ~ 30 mm) on a moist vertical rock (Figure 1A). After walking along the rocky surface, the harvestman entered one of the rock crevices with the anuran trapped between its legs. The frog was still alive (the gular region moving slightly, accompanied by muscular body spasms) but apparently, it was unable to escape. Owing to the depth of the rock crevice and its small opening, we could not see the harvestman consuming the frog.

On 20 November 2018, at 20:15 h, about 2 m away from the previous spot, an adult *Heteromitobates discolor* (~9-mm dorsal shield and ~100-mm leg span) was found ingesting a juvenile *Hylodes phyllodes* (~20 mm SVL). Feeding activity occurred 1.5 m from the stream edge, on the leaf of a fern (*Olfersia cervina*) attached to a rock. The frog was dead and part of fore- and hind limbs had already been consumed (Figure 1B).

Harvestmen are omnivores that are opportunistic, feeding on plant matter, fruit, fungi, small invertebrates, and sometimes, small, dead vertebrates (Acosta and Machado 2007). In fact, predation on vertebrates is rare event; there is only one record of the arachnid preying on live vertebrates (abandoned chicks). Thus, most of the data about harvestmen feeding on vertebrates is restricted to consumption of dead vertebrates (Benson and Chartier 2010). Castanho and Pinto-da-Rocha (2005) reported two events in which harvestmen consumed dead frogs; thus, no subjugation was observed. Our record of *Heteromitobates discolor* grasping and carrying a live frog to a shelter proves that these arachnids can subjugate relatively large vertebrates. Our second supports the findings of other authors (Castanho and Pinto-da-Rocha 2005) that harvestmen feed on frogs. It is important to note that both observations were made at night when *Heteromitobates discolor* is active and *Hylodes phyllodes* usually is inactive. Thus, the arachnids may employ an active hunting strategy that predisposes it to find an inactive frog.

Unlike spiders that prey most often on amphibians, harvestmen have no venom to subjugate their prey (Acosta and Machado 2007); they rely on the function and the strength of their legs to restrain prey. Anurans, on the other hand, have an incredible variety of defensive strategies to deal with potentially more dangerous predators than harvestmen, such as snakes, birds, and mammals (Toledo *et al.* 2011). The rich defensive repertoire of anurans combined with their large size relative to

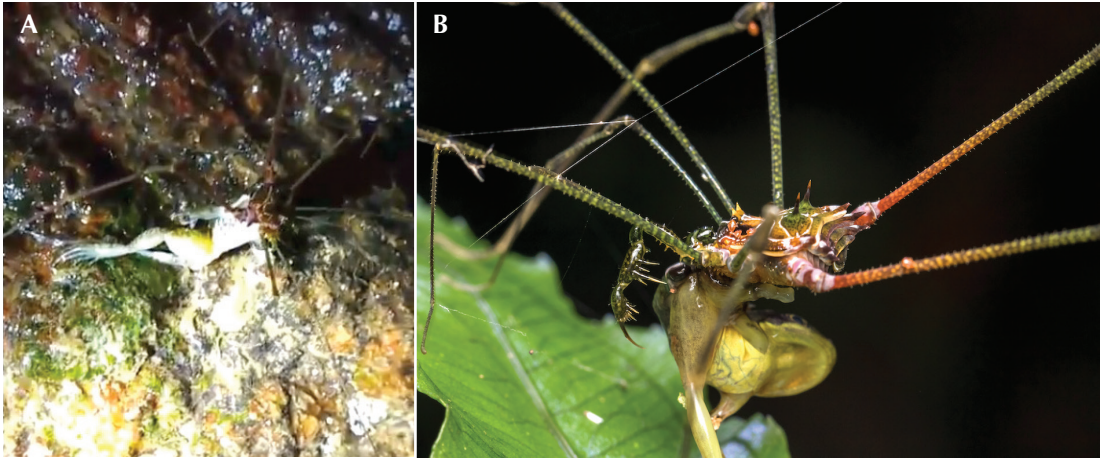


Figure 1. *Heteromitobates discolor* grasping and carrying a live *Hylodes phyllodes* to a rock crevice (A) and feeding on a dead individual (B)

harvestmen can frogs such as *Hylodes phyllodes* difficult to catch and potentially dangerous prey for a non-venomous arachnid such as *Heteromitobates discolor*, and may explain the rarity of this kind of predatory event in nature.

Predatory interactions are important ecological factors driving the evolution and population metrics of both prey and predator. However, as noted here, some predatory events are rare and observed only fortuitously. Future work exploring the effect of primary predators, as well as evaluating the importance of unusual and opportunistic predators, will be a useful asset to our understanding of the natural history of different taxa.

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