



SHORT NOTE

Predation on Eggs of *Dendropsophus haddadi* (Bastos & Pombal, 1996) (Anura: Hylidae) by the Social Wasp *Angiopolybia pallens* (Lepelletier, 1836) (Hymenoptera: Vespidae: Polistinae)

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Abstract

Trophic relations are paramount in understanding the dimensions of a species' niche. While we commonly perceive insects as natural prey for amphibians, the reverse is also true. This study shows how wasps can exploit amphibian spawnings as a food resource. Specifically, we present unprecedented predation events, where the social wasp *Angiopolybia pallens* prey upon the eggs of the anuran *Dendropsophus haddadi*. These remarkable observations occurred within the cocoa agroforestry system (cabruca) in the Atlantic Rainforest area in southern Bahia, Brazil. This research contributes significantly to our understanding of trophic interactions in the region by revealing such particular predation dynamics in this biodiversity hotspot.

Anurans are preyed upon by various organisms (Pombal, 2007; Dos Santos, 2009; Moura & Azevedo, 2011), including both invertebrates (e.g., ants, aquatic arthropods, arachnids, and water beetles) and vertebrates (e.g., amphibians, birds, fish, mammals and, non-avian reptiles) (Ghizoni-Jr et al., 2000; Dos Santos, 2009; Cavalcante et al., 2019). Despite employing defensive strategies (Toledo et al., 2011), anurans are vulnerable to predation due to certain morphological, behavioral, and reproductive traits. For instance, their thin and sensible tegument, as well as the occurrence of aquatic larvae in most species, make anurans particularly susceptible to predation during their ontogenetic development, especially during the transition between aquatic and terrestrial stages (Toledo, 2005; Fadel et al., 2019; Valdez, 2020).

Anurans exhibit several adaptations that facilitate the successful development of their offspring, such as breeding site selection, egg quantity, and parental care (Haddad & Prado, 2005; Valdez, 2020). However, predation events targeting immature stages are frequently reported in the literature, particularly involving arachnids and aquatic insects (Toledo, 2005; Santana et al., 2009; Moura & Azevedo, 2011; Fadel et al., 2019). Among anurans, the Hylidae family stands out as the group with the highest number of records of predation by invertebrates (Valdez, 2020). Such susceptibility to predation can be attributed to the extensive species diversity within this family (approximately 1047 species), as well as the occurrence of both aquatic larvae and arboreal adults. These characteristics expose hylids to predators, making them



more vulnerable to predation at different life cycle stages (Valdez, 2020).

Dendropsophus haddadi (Bastos & Pombal, 1996) is a small hyliid species endemic to the Atlantic Forest whose adults are nocturnal and arboreal (Mageski & Silva-Soares, 2014). This species lays its eggs on the leaves of shrubs and trees above bodies of water. These eggs are encapsulated within a gelatinous mass, protecting them against desiccation and predators (Toledo et al., 2012). Upon hatching, the exotrophic tadpoles fall directly into the water, undergoing further biological development (Mageski & Silva-Soares, 2014). The timing of hatching can be influenced by exposure to predators, including snakes and wasps (Warkentin, 1995, 2000). Early hatching appears to be associated with a complex anti-predation strategy observed in some arboreal anurans (Warkentin, 1995, 2000).

Angiopolybia pallens (Lepelletier, 1836) is a Neotropical swarm-founding social wasp (Polistinae: Epiponini) that has a disjunct geographical distribution, being found in both the Amazon and the Atlantic Forests (Carvalho et al., 2014, 2021). Consequently, *A. pallens* occurs in sympatry with *D. haddadi* in eastern South America, particularly in the coastal region spanning from the states of Espírito Santo to Pernambuco,

Brazil (Amorim et al., 2009; Frost, 2021; Barroso et al., 2022). Notably, there is a record of predation by *A. pallens* on eggs and tadpoles of the frog *Engystomops pustulosus* (Anura, Leptodactylidae) within a forested area in Trinidad and Tobago (Starr et al., 2020). These observations indicate that *A. pallens* is a potential predator of immature anuran forms.

This study reports a predatory spawning event of *D. haddadi* by the wasp *A. pallens* in Ilhéus, Bahia, located in Northeastern Brazil. The predation event occurred in a pond situated in a cabruca area (e.g., cocoa plantation shaded by Atlantic Forest trees), located on the Campus of the Universidade Estadual de Santa Cruz (UESC) (14°47'47.37" S e 39°10'25.38" W), on June 8, 2021, between 9:00 am and 10:00 am. After recording the predation event, we carefully collected the spawn and transferred it to an aquarium containing dechlorinated water to allow the remaining embryos to develop. Posteriorly, we used the fully developed tadpoles for taxonomic identification with the help of the identification key proposed by Dubeux et al. (2020) and the formal description of *D. haddadi* tadpoles provided by Lourenço-de-Moraes et al. (2012). We utilized the identification key outlined by Barroso et al. (2022) to identify the social wasps.



Fig 1. The spawn of *Dendropsophus haddadi* deposited on a leaf of *Heliconia* sp. was subjected to a predation attempt by an individual of the social wasp *Angiopolybia pallens*.

We recorded a spawning event of *D. haddadi* on a leaf of *Heliconia* sp., positioned approximately 1.5 meters above the water surface in a semi-permanent pond. During our observations, we noticed frequent visits by individuals of *A. pallens* to the spawning area. Interestingly, we observed that after the wasp landed on the oviposition, *D. haddadi* embryos moved to the innermost part of the spawn to evade potential predation (see Fig 1). After multiple attempts, one of the wasps successfully removed an embryo and carried it away. Unfortunately, we were unable to locate the nest of *A. pallens*. Additionally, we observed similar predation behavior involving more than one individual of *A. pallens* in four other spawnings found in the same location.

This study presents the first published record of spawning predation involving the species *D. haddadi* by *A. pallens* within the Atlantic Forest region. However, previous records exist of this insect preying on spawns and tadpoles in foam nests of the species *Leptodactylus pentadactylus* (Anura, Leptodactylidae) and gelatinous nests of the species *Dendropsophus brevifrons* (Anura, Hylidae) in the Amazon region (Lacey, 1979; Penhaceck, 2017). Our observations highlight the remarkable efficiency of *A. pallens* in accessing and preying on anuran embryos with arboreal spawning, suggesting that this behavior may represent a trophic resource for this wasp species.

Records of prey-predator interactions play a crucial role in understanding local population dynamics. However, these events are typically captured in fortuitous records, potentially underestimating the currently available data (Santana et al., 2009; Fadel et al., 2019; Valdez, 2020). Therefore, comprehensive studies investigating prey-predator interactions and their impact on population dynamics are important, particularly when considering the various ontogenetic stages involved.

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Author's Contribution

BTC: Conceptualization, Data curation, writing (original draft, review, and editing).

LMCF: Conceptualization, writing (original-draft, review, and editing).

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