

# PREDATORY INTERACTION BETWEEN TWO ANURAN SPECIES WITH *Thamnodynastes chaquensis* (COLUBRIDAE) IN THE BRAZILIAN CERRADO

## Interacción depredatoria entre dos especies de anura con *Thamnodynastes chaquensis* (Colubridae) en el Cerrado brasileño

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### ABSTRACT

Although predatory events are uncommon to be recorded in nature, these data are important tools for understanding prey-predator interaction of the involved species. Snakes of genus *Thamnodynastes* are known for having an anuran diet, including some species of hylid frogs in their diet. Despite this, this pattern does not include *T. chaquensis* since there are no records on predation or trophic interaction with hylid frogs. Here, we report the first predatory interaction between *T. chaquensis* and two hylid frogs in Brazilian Cerrado. The first predation event with treefrog *Boana caiapo* occurred with success but, the second with *B. albopunctata* did not. Connecting trophic links within an ecosystem requires in-depth knowledge of its species and their intraspecific interactions. In this context, records of the predation and predation attempts such as these may help to connect unknown trophic links, which helps to understand aspects of the natural history of the species involved.

**Keywords:** anurans, diet, reptile, predator-prey

### RESUMEN

Aunque los eventos depredatorios son poco comunes de registrar en la naturaleza, estos datos son herramientas importantes para comprender la interacción presa-depredador de las especies involucradas. Las serpientes del género *Thamnodynastes* son conocidas por su dieta basada en anuros y, aunque algunas especies incluyen ranas hílidas en su dieta, esto no ocurre en la especie *T. chaquensis* porque no hay registros de depredación o interacción trófica con los hílidos. Aquí informamos sobre la primera interacción depredatoria entre *T. chaquensis* y dos ranas hílidas del Cerrado brasileño. El primer evento de depredación con la rana *Boana caiapo* fue exitoso, pero el segundo con *B. albopunctata* no. Conectar los enlaces tróficos dentro de un ecosistema requiere conocer íntimamente sus especies y sus interacciones intraespecíficas. En este contexto, los registros de depredación y de intentos de depredación como estos pueden ayudar a conectar enlaces tróficos no conocidos, lo cual ayuda a comprender los aspectos de la historia natural de las especies involucradas.

**Palabras clave:** anuros, dieta, depredador-presa, reptil.

Studies of snake ecology are difficult to do in the wild due to their secretive habits; research on diet and trophic ecology usually are carried out with snakes deposited in scientific collections (Bernarde, 2012; Santana *et al.*, 2019). Even if these studies provide data to understand their evolutionary characteristics (*e.g.* some species of Xenodontinae tribe snakes have morphological modifications, possessing large post-diastruma teeth and a short, rotating maxilla for eating anurans) and how occurs the prey-predator interactions of these animals (Vitt, 1983; Kardong *et al.*, 1997), for many species of snakes these data are unknown. Besides, predatory events help to understand prey-predator interaction of the species involved but registers in the wild are uncommon and depend on fortuitous observations (Yves *et al.*, 2018).

In general, the snakes are known for eating a wide variety of prey, from invertebrates (*e.g.* arthropods, mollusks) to vertebrates (*e.g.* eggs, frogs, lizards, other snakes, birds, and mammals) and the anurans can be occupying most of the diet of various snake species (Greene, 1976; Fadel *et al.*, 2019). That is because anurans are the most abundant group, occur in the most diverse habitats, and are considered as prey that provides a low risk of retaliation during prey-predator interaction (Canhete *et al.*, 2018). Also, within the various taxonomic groups (*i.e.* spider (Pedrozo *et al.*, 2017), water bug (Taffarel *et al.*, 2019) snake (Preuss and Tozetti, 2008), bird (Smith and Atkinson, 2017), mammal (Hernández-Gallegos *et al.*, 2019)) that prey on anurans, snakes are considered dominant predators (Canhete *et al.*, 2018; Fadel *et al.*, 2019).

The newly discovered species in the Goiás state, *Boana caiapo* Pinheiro, Cintra, Valdujo, Silva, Martins, Silva and Garcia (2018), has similar morphological features to *B. albopunctata* (Spix, 1824) and *B. pulchella* (Duméril and Bibron, 1841). Besides, the Goiás state, *B. caiapo* can be found in Mato Grosso and Tocantins states, in areas with typical Cerrado vegetation (Pinheiro *et al.*, 2018).

The treefrog *B. albopunctata* has a wide geographical distribution, occurring in open areas and in preserved environments from the states of Rio Grande do Sul, Santa Catarina, Paraná, Rio de Janeiro, Espírito Santo, Minas Gerais, Goiás, Mato Grosso and Mato Grosso do Sul, Bahia, Tocantins and Rondônia (Araújo *et al.*, 2007). It is a medium to large size hylid frog, associated with lotic, permanent and medium water bodies that present grass and shrub vegetation, this species reproduces every month of the year (Guimarães *et al.*, 2011).

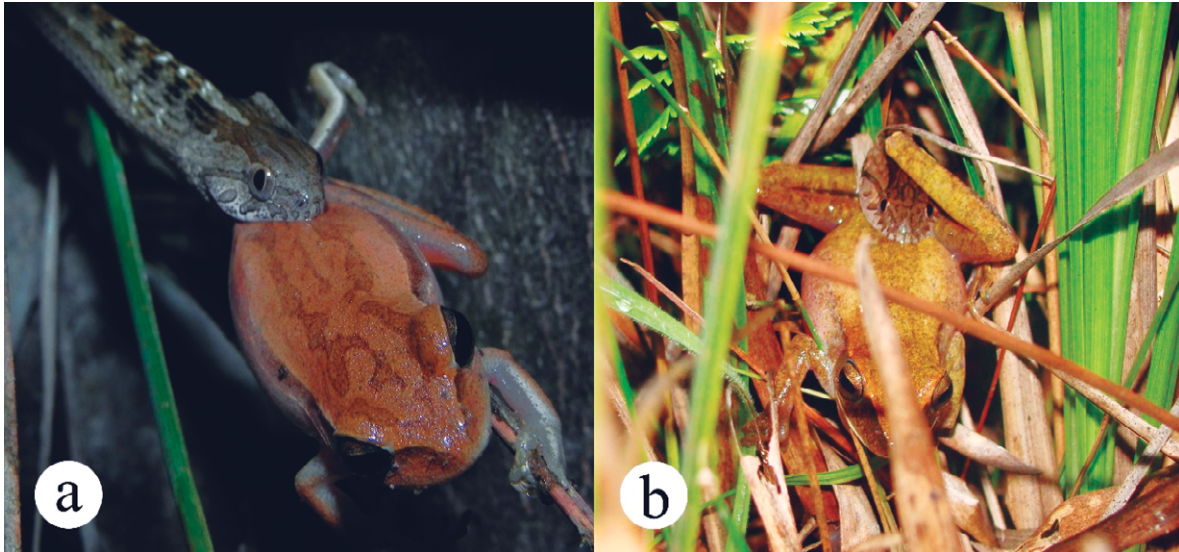
Belonging to the family Colubridae, the genus *Thamnodynastes* (Wagler, 1830) currently has 12 species in Brazil (Costa and Bérnils, 2018). Among its main features, they stand out for being small opisthognathic snakes with nocturnal habits (Dorigo *et al.*, 2014). The species *Thamnodynastes chaquensis* (Bergna and Alvarez, 1993) has a wide distribution in South America, occurring in the countries of Bolivia, Paraguay, Argentina, Uruguay, and

Brazil (Alves and Albuquerque, 2017). Although some authors mentioned this species as anurophagous (Bellini *et al.*, 2014; Carrillo, 2017), there is no research on its diet and trophic ecology. The only prey known of *T. chaquensis* has come from observations in the wild: *Leptodactylus chaquensis* (Ceil, 1950) (Dorado-Rodrigues *et al.*, 2012), *L. podicipinus* (Cope, 1862) (Alves and Albuquerque, 2017) and *Elachistocleis matogrosso* (Caramaschi, 2010) (Carrillo, 2017). To date, there are no reports in the literature of prey-predator interaction between *T. chaquensis* and hylid frogs. Herein, we report the first predation event between *T. chaquensis* and *B. caiapo*, and the first predation attempt of *T. chaquensis* upon *B. albopunctata*.

On 17 August 2013, at 11:00 h, during a fieldwork in the Municipality of Ribeirão Cascalheira, Mato Grosso state (12°53' N and 51°6' W), we observed a *T. chaquensis* individual preying on a *B. caiapo* male (Fig. 1a). The anuran was vocalizing on a tree at the edge of a temporary pond when *T. chaquensis* came towards it and attacked the anuran, biting the hind limbs. The snake started jaw movements to inject a toxin into its prey and a few minutes later, it began to ingest the frog who made few moves to try to break free. The anuran was killed in five minutes and *T. chaquensis* began the ingestion of its prey from the posterior members and finish in the head of the frog. It was not possible to deposit the *T. chaquensis* in the collection, because it escaped soon after the recording but were collected other two individuals of *B. caiapo* that were perched next to where the event took place (10 cm), these specimens were deposited as a voucher in the Coleção Zoológica da Universidade Federal do Rio Grande do Sul, Municipality of Porto Alegre, Rio Grande do Sul state, Brazil (UFRGS 7086, 7124).

On 13 December 2016, at 22:30 h, during a fieldwork in the Municipality of Três Lagoas, Mato Grosso do Sul state (20°47' N and 51°42' W), we observed an individual of *T. chaquensis* in a predation-attempt on a *B. albopunctata* (Fig. 1b). We found the *T. chaquensis* on the banks of a marsh that contained calling frogs, the snake climbed up the stem of the vegetation (50 cm from the water) wrapping part of the body in the vegetation until it reached the height where the treefrog *B. albopunctata* was perched. *T. chaquensis* grasping and biting the anuran by the posterior region and tried to jaw movements to inject a toxin into its prey. At the moment of the snake's bite, the frog emitted a distress call, clung to the bushes, and began to make sudden movements against the snake and to enter the vegetation to escape from the predator. After that, the snake, could not wrap itself around the branches and keep the prey in its mouth, releasing it. The anuran jumped into the water and scape swimming while the snake went away after its predation failed. Observation and photographic recording lasted approximately five minutes.

*Thamnodynastes* species have a generalist diet, preying on most vertebrates (*e.g.* fish, frogs, lizards, eggs of lizards, and rodents) but the most important category is frogs that



**Figure 1.** (a) Predation of *Boana caiapo* by *Thamnodynastes chaquensis*, Ribeirão Cascalheira municipality, Mato Grosso state, Brazil. (b) Predation-attempt of *Boana albopunctata* by *Thamnodynastes chaquensis*, Três Lagoas municipality, Mato Grosso do Sul state, Brazil. Photos credit: (a) Guilherme Brad Adams and (b) Rodney Murillo Peixoto Couto.

make up 71 % of the diet (Bernarde *et al.*, 2000a). Most anurans do not represent a risk to snakes during predator-prey interaction because their defensive behaviors are thanatosis, inflate the body, distress calls, or try to escape using the forelimbs (Martins, 1990). Although these species of snakes have a generalist diet, the *T. chaquensis* species has an anuran diet that differs from co-distributed species such as *T. hypoconia* (Cope, 1860) and *T. strigatus* (Günther, 1858) (Alves and Albuquerque, 2017; Carrillo, 2017).

We found *T. chaquensis* foraging behavior close to water, already registered for other species of the genus (Bernarde *et al.*, 2000b; Protázio *et al.*, 2017). This behavior considerably increases the chance of encountering anurans and feeding (Protázio *et al.*, 2017). Strategically, the feeding behavior of *Thamnodynastes* species occurs from head to hind limbs and these snakes use poisoning (ophistoglyphus) to successfully capture their prey (Bernarde *et al.*, 2000b; Alves and Albuquerque, 2017; Protázio *et al.*, 2017). There are records of two species of *Thamnodynastes* ingesting their prey by posterior limbs: one successful in *T. striatus* (Preuss *et al.*, 2018) and one failed in *T. hypoconia* (Manoel and Almeida, 2017). The fact that the predation attempt on *B. albopunctata* by *T. chaquensis* had failed might be related to the size of the prey, this attempt feeding behavior has already been observed for *T. hypoconia* (Manoel and Almeida, 2017).

According to Greene (2000), the morphological diversity in snakes allows them to succeed during the search, capture, and ingestion of specific prey. Anurophagous snakes have the feeding behavior of ingesting their prey upside down because since most frogs have a defensive behavior of inflating their bodies and this position allows them to pierce the vocal

sacs facilitating the ingestion of their prey (Vitt, 1983; Vaz and Chinchilla, 2019). Successful predatory reports of *T. chaquensis* occurred on small anurans (*Leptodactylus chaquensis*, *L. podicipinus*, and *Elachistocleis matogrosso*), and the snake began to ingest its prey by its head (Dorago-Rodrigues *et al.*, 2012; Alves and Albuquerque, 2017; Carrillo, 2017). However, in our first observation, the snake could ingest its prey through posterior limbs, therefore, its predatory behavior is similar to the observed in *T. striatus* (Preuss *et al.*, 2018).

Events of predation and competition are decisive factors in structuring community composition (Arribas *et al.*, 2018). Connecting trophic links within an ecosystem require intimate knowledge of its species and their intraspecific interactions (Fadel *et al.*, 2019). Within this context, predation records and/or predation attempts such as the ones showed in this study may help to connect previously non-existent trophic links, helping to understand aspects of the natural history of the species involved.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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