

## Anurophagy by the snake *Thamnodynastes phoenix* (Squamata: Dipsadidae: Tachymenini) in dry forested areas of Northeastern Brazil

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Although one of the most important attributes of any assemblage structure is the study of its ecological traits, a central gap in assemblages of snakes is the lack of information about the autecology of many species (Martins et al., 2002). Undoubtedly, diets are an important and dynamic component of the interaction of a snake with its environment and with other co-existing species (Bellini et al., 2015). Once again, because diet is one of the main niche axes in snake communities, it is key to better understand the feeding habits of the component species to evaluate the impact of ecological and phylogenetic factors on their diet (França et al., 2008).

*Thamnodynastes* Wagler, 1830 is a genus of small to medium-sized, opisthoglyphous, and viviparous snakes (Bailey, 1967; Franco, 1999). It comprises 20 species widely distributed in South America, from Colombia to Argentina (Franco and Ferreira, 2002), of which 11 occur in Brazil (Costa and Bérnills, 2015; Franco et al., 2017). A twelfth species, referred to as *Tamnodynastes* cf. *nattereri*, still holds a controversial taxonomic status and distribution records (Franco et al., 2017). Nonetheless, at least three species can be found in sympatry in the semiarid Northeastern region of Brazil (Coelho et al., 2013): *T. almae*, *T. sertanejo* and *T. phoenix* (previously mentioned as *Thamnodynastes* sp. 2 by Franco and Ferreira, 2002). This biological aspect can be the starting point for future studies on overlap

in their trophic niche. Regarding diet, these snakes are generalist predators of small vertebrates including anurans, fish, lizards and small mammals (e.g. Rufatto et al., 2003; Manzanilla and Sanchez, 2005; Maffei et al., 2011; Bellini et al., 2013; Dorigo et al., 2014). We report three anuran species from two semiarid areas of Northeastern Brazil, all new to the diet of the recently described *Thamnodynastes phoenix*, thus expanding the knowledge about the feeding ecology of this snake. Additionally, we review the anurans species known as part of the diet of *Thamnodynastes* snakes.

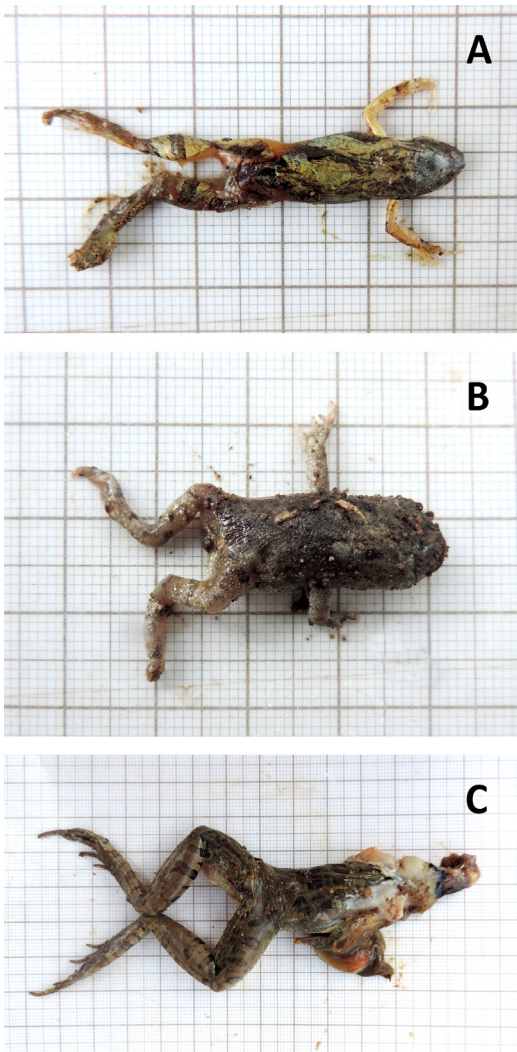
*Thamnodynastes phoenix* (Figure 1) has a known distribution in dry forested areas of central and northeastern Brazil, with maximum snout-vent length recorded of 495 mm (Franco and Ferreira, 2002; Coelho et al., 2013; Franco et al., 2017). Since *Thamnodynastes* is a genus taxonomically complex of Neotropical snakes, several problems and confusion about its distribution, ecology and natural history are possible to occur by misidentification. In this sense, *T. phoenix* can be distinguished from all its congeners by 19 dorsal rows of smooth scales on the midbody, the smallest



**Figure 1.** *Thamnodynastes phoenix* from the semiarid region of northeastern Brazil. Photo by Helânio Pergentino.

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**Figure 2.** Anurans predated and regurgitated by *Thamnodynastes phoenix*: (A) *Physalaemus cicada* (ca. 20 mm of snout-vent length: SVL), (B) *Rhinella granulosa* (ca. 22 mm of SVL) and (C) *Leptodactylus* cf. *macrosternum* (ca. 60 mm of SVL). A and B were prey items of the same snake. Photos by Helânio Pergentino.

number of subcaudals in the genus (40 to 66), and a distinct hemipenial morphology and its immaculated gular region (Coelho et al., 2013; Franco et al., 2017).

Between March 30 and April 15, 2016, we captured two injured *T. phoenix* individuals during fauna rescue activities for installation of water dams in the framework of the Project to Integrate the São Francisco River

with the Hydrographic Basins of Northern Northeast Brazil (PISF). The individuals were collected in the municipalities of Custódia, Pernambuco (8°15'14" S, 37°42'19" W) and Brejo Santo, Ceará (7°36'38" S, 38°54'39" W). These two areas are situated in the Sertaneja depression, which exhibits a hot semiarid climate (BSh), according to the Köppen climate classification system (Pell et al., 2007).

We handled the two *T. phoenix* individuals in the field at the mobile unit of the Wild Animal Screening Center of the Centro de Conservação e Manejo de Fauna da Caatinga (CEMAFAUNA). The specimen from Brejo Santo died in the field and was discarded because it was in a poor state of conservation. The individual from Custódia, after being sent to the Wild Animal Screening Center at the CEMFAUNA, in Petrolina, Pernambuco, also died, but was deposited in the Coleção Herpetológica [Herpetological Collection] of the Museu de Fauna da Caatinga at the CEMFAUNA (MFCH 4152).

While still in the field, we obtained three anuran species via regurgitation from the *T. phoenix* individuals while handling. For the snake from Custódia, *Physalaemus cicada* Bokermann, 1966 (Leptodactylidae), which presents a yellowish colour pattern on ventral surface of thighs and inguinal region, and *Rhinella granulosa* (Spix, 1824) (Bufonidae), characterized by having a small parotid gland, wart skin, and well-developed keratinized cranial crests. For the individual from Brejo Santo, *Leptodactylus* cf. *macrosternum* (Leptodactylidae) (Figure 2), already in advanced stage of digestion which hindered specific determination. The three anuran species are common and widely distributed in the Caatinga biome (Rodrigues, 2003; Borges-Nojosa and Santos, 2005; Nascimento et al., 2005; Andrade et al., 2012; Silva et al., 2013). All anurans were deposited in the Coleção Herpetológica (*P. cicada*: MFCH 4128, *R. granulosa*: 4129 and *Leptodactylus* cf. *macrosternum*: MFCH 4155).

Data on diet of *Thamnodynastes* snakes is available for only four of the 20 species of the genus (*T. chaquensis*, *T. hypoconia*, *T. cf. nattereri* and *T. strigatus*), with the last three representing the vast majority of the records. A total of 58 anurans are recognised as prey, including unidentified and identified species (see Dorigo et al. 2014; Carrillo, 2017). For families Leptodactylidae and Bufonidae there are 12 and five prey species recorded, respectively. *Leptodactylus* cf. *macrosternum*, *P. cicada* and *R. granulosa* represent the first records as preys of *Thamnodynastes* snakes (Table 1).

**Table 1.** Leptodactylid and bufonid anurans as prey of snakes of the genus *Thamnodynastes* in South America. Asterisks represent first records as prey for *Thamnodynastes phoenix*.

Anuran prey	Predator	Reference
<i>Leptodactylus chaquensis</i> , <i>L. gracilis</i> , <i>L. latrans</i> (= <i>ocellatus</i> ), <i>L. podicipinus</i> , <i>Leptodactylus</i> sp., <i>L. latrans</i> group, <i>Leptodactylus</i> cf. <i>macrosternum</i> * (Leptodactylidae, Leptodactylinae)	<i>Thamnodynastes chaquensis</i> , <i>T. hypoconia</i> , <i>T. phoenix</i> , <i>T. strigatus</i>	Bernarde et al., 2000; Rufatto et al., 2003; Hartmann et al., 2009; Dorado-Rodrigues et al., 2012; Bellini et al., 2013, 2014; Alves and Albuquerque, 2017
<i>Physalaemus</i> cf. <i>albonotatus</i> , <i>P. cuvieri</i> , <i>P. signifer</i> , <i>Physalaemus</i> sp., <i>P. cicada</i> * (Leptodactylidae, Leiuperinae)	<i>Thamnodynastes hypoconia</i> , <i>T. cf. nattereri</i> , <i>T. phoenix</i> , <i>T. strigatus</i>	Bernarde et al., 2000; Rufatto et al., 2003; Ariani et al., 2006; Bellini et al., 2013
<i>Rhinella</i> gr. <i>crucifer</i> , <i>R. cf. fernandezae</i> , <i>R. icterica</i> , <i>Rhinella</i> sp., <i>R. granulosa</i> * (Bufonidae)	<i>Thamnodynastes chaquensis</i> , <i>T. hypoconia</i> , <i>T. phoenix</i> , <i>T. strigatus</i>	Bernarde et al., 2000; Rufatto et al., 2003; Bellini et al., 2013

Snakes of the genus *Thamnodynastes* are known for foraging near aquatic environments, which corroborates the distribution of these dipsadids associated with areas containing a greater abundance of their prey items (Vitt and Vangilder, 1983; Vitt, 1987; Jennings et al., 1992; Bernarde and Kokubum, 1999). *Thamnodynastes chaquensis* is the most terrestrial species with its diet based on the more terrestrial Leptodactylidae and Bufonidae (Bellini et al., 2014). Our reported findings most likely reveal a similar behaviour for *T. phoenix*. Conversely, *T. hypoconia* is the congeneric snake most associated with aquatic habitats and has its diet mainly composed of hylids, which are abundant in wetlands (Arzamendia and Giraudo, 2009). Given traits of the snakes and those of the anuran preys here reported, the bufonid *R. granulosa* and leptodactylids *P. cicada* and *Leptodactylus* cf. *macrosternum* may be important food resources to *T. phoenix* in dry forested areas of central and northeastern Brazil. This highlights the importance of documenting such records about predator-prey relationships in the *Thamnodynastes* genus that remains poorly studied ecologically in South America, especially in the Brazilian semiarid region.

We call attention to the sympatry between *T. phoenix*, *T. almae*, and *T. sertanejo* within the Caatinga morphoclimatic domain (Coelho et al., 2013). However, for the last two species there is still a gap in data about their diet. According to Bellini et al (2014), similarities in diet may reflect close phylogenetic relatedness, while differences in habitat use may be related to differences in prey type frequencies or spatial niche partitioning. In this sense, the feeding habits in the three *Thamnodynastes* species aforementioned are promising to be investigated in future studies on structure of snake communities.

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