First record of constriction behavior during predation by an Echinantherini snake (Dipsadidae: Xenodontinae)

Henry Miller Carneiro Alexandre, Lucas Machado Botelho*, Matheus de Toledo Moroti, Mariana Pedrozo, Edelcio Muscat

Projeto Dacnis, Estrada do Rio Escuro 4754, Sertão das Cotias, 11680-000 Ubatuba, SP, Brazil

* Corresponding author. E-mail: lucasbotelho77@gmail.com
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Vertebrates have developed various behaviors to subdue and kill dangerous prey to minimize their own risks during predation (Boback et al., 2015). As legless predators, snakes developed toxins and constriction as forms of immobilization to reduce their exposure to injury and the chance of prey escape (Shine & Schwaner, 1985; Boback et al., 2015). When using constriction, the snake applies two or more turns of its body, immobilizing its prey while exerting strong pressure (Mehta & Burghardt, 2008).

The snakes in the Echinantherini tribe are non-venomous aglyphous species that prey on small lizards (Marques et al., 2001; Gomes, 2012), snakes (Marques et al., 2001; Balestrin & Di-Bernardo, 2005), anuran eggs and adults (Marques et al., 2001; Moura-Leite et al., 2003; Pontes & Rocha, 2008), and even earthworms (Marques, 1996; Lucas et al., 2011). While some Echinantherini may be diet specialists, such as *Echinanthera cephalostriata* Di-Bernardo, 1996, *Echinanthera melanostigma* (Wagler *in* Spix, 1824), *Echinanthera undulata* (Wied, 1824) (anurans), and *Sordellina punctata* (earthworms), species of *Taeniophallus* Cope, 1895 are generalists (Marques et al., 2001) although they feed mainly on lizards (Gomes, 2012). This type of prey can injure the predator due to its bite, muscle strength, and claws (Abdala & Moro, 1996; Herrel et al., 1997; Gomes, 2012). Therefore, it would be reasonable to kill the prey before consuming it (Willard, 1977). However, we are unaware of published records on how the species of *Taeniophallus* subdue their prey, especially lizards.

Here we present the first documented use of constriction by an Echinantherini snake. On 03 February 2022, at 12:05h, we observed a *Taeniophallus affinis* (Günther, 1858) preying on a *Placosoma glabellum* (Peters, 1870), a lizard species endemic to the Brazilian Atlantic Forest (Tozetti et al., 2017). The event happened in the Projeto Dacnis private reserve (23°27′56.2″ S, 45°07′38.3″ W; WGS-84; 139 m above sea level), located in the municipality of Ubatuba, north coast of the state of São Paulo, Brazil. The area consists mostly of secondary lowland Atlantic Forest, with some primary forest patches with steep terrain. The air temperature was 27° C, with relative humidity of 95%, data measured with a Hikari HTH-913 thermo-hygrometer.

Taeniophallus affinis is a dipsadid snake endemic to the Atlantic Forest and widely distributed in the southeastern and southern regions of Brazil; it also occurs in the Northeast, especially in Atlantic Forest enclaves in the Caatinga (Nogueira et al., 2019). Like most species of Echinantherini, *T. affinis* has a slender body, large eyes with round pupils, and a total length between 16,6 and 75,8 cm (Di-Bernardo & Lema, 1988; Gomes, 2012). The species has diurnal habits and is often found in the leaf litter (Gomes, 2012), where it forages for small prey such as amphibians, lizards, amphisbaenians, and occasionally small rodents (Barbo & Marques, 2003; Zacariotti & Gomes, 2010; Gomes et al., 2012).

We found the animals in the leaf litter. The snake had already caught the lizard: its mouth was attached to the lizard's belly, close to the pelvic region, and its body constricted the lizard's entire thorax, upper limbs, and head (Fig. 1). The lizard resisted with erratic tail movements, flexion and tension of the fingers and hind limbs, while its body spasmed. According to the standards established by Heinrich & Klaassen (1985), the constriction had a counterclockwise pattern and dorsal coil with the right side contacting the prey. The prey stopped moving after 14 minutes of constriction. The snake then moved through the leaf litter dragging the prey with its mouth until it reached a fallen tree trunk, where it began the process of ingestion, beginning with the lizard's head. The snake pressed the lizard against the substrate to position it for ingestion (de Queiroz, 1984; Sazima & Haddad, 1992). Complete ingestion of the prey required 20 minutes, and the entire encounter took 34 minutes. We recorded the predation event on video and deposited it at the Fonoteca Neotropical Jacques Vielliard under vouchers ZUEC-VID 984-985.

We did not collect the individuals, nor took biometric measurements to avoid interfering with predation, but we were able to reliably identify both taxa with

the help of specialized literature. According to Nogueira (2019), three species of *Taeniophallus* (*T. affinis, T. persimilis*, and *T. bilineatus*) occur in Ubatuba. We used the identification key proposed by Di-Bernardo (1992) to determine the species: the snake exhibited a bright line over the *canthus rostralis*, in a broad and diffuse form exclusive to *T. affinis* (Di-Bernardo, 1992). Three species of *Placosoma* are present in the state of São Paulo (Zaher et al., 2011): *P. champsonotus*, *P. cordylinum*, and *P. glabellum*. Only *P. glabellum* is found in the study area, and has been identified in previous work (Muscat et al., 2016). The identification was confirmed following the diagnoses proposed by Uzzell (1959), especially the brown lateral coloration and cream belly.

Species of *Taeniophallus* have a greater number of vertebrae than other Echinantherini (Gomes, 2012). As previously hypothesized by Gomes (2012), this should, in theory, favor constriction, since more vertebrae give the snake more flexibility and greater ability to engage prey (Jayne, 1982; Lindell, 1994). However, there was no documentation about what methods *Taeniophallus* use to immobilize prey. Our record of constriction by *Taeniophallus affinis* reinforces the hypothesis that a greater number of vertebrae may be related to the immobilization strategy of the genus.

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Figure 1. Taeniophallus affinis preying on *Placosoma glabellum* by constriction in Ubatuba, São Paulo, Brazil.