

# Predation of a Jararaca Lancehead, *Bothrops jararaca* (Wied-Neuwied, 1824), by a Yellow Cururu Toad, *Rhinella icterica* (Spix, 1824), in Atlantic Forest, southeastern Brazil

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The highly venomous pitvipers of the genus *Bothrops* are endemic and conspicuous components of the Neotropical reptile fauna, occurring throughout South and Central America (Campbell and Lamar, 2004; Alencar et al., 2016). These snakes are important predators in tropical ecosystems, consuming a wide variety of prey, such as frogs, lizards, and mammals (Martins et al., 2002). Despite being venomous, *Bothrops* species can also be preyed upon by other top predators, particularly birds and mammals (Sazima, 1992; Schalk and Cove, 2018). Experiments using plasticine replicas of triangular-headed snakes (similar to *Bothrops*) support the idea that birds and mammals are the main predators of *Bothrops* in the Atlantic Forest (Siqueira and Marques, 2018).

In addition to several potential predators, snake-eating hawks (such as *Herpetotheres cachinnans* (Linnaeus, 1758)) and snake-venom tolerant mammals (such as opossums, *Didelphis* spp.) are known to prey on *Bothrops* (Sazima, 1992; Oliveira and Santori, 1999; Voss and Jansa, 2012; Souza et al., 2023). Animals other than birds and mammals (e.g., snakes such as *Clelia* spp., lizards such as *Salvator* spp. and large anurans) can also prey on *Bothrops* (Sazima, 1992; Kasperoviczus et al., 2015; Maciej, 2021). However, there is limited information on snake predation by these animal groups and no estimates of the predation pressure they exert on *Bothrops* populations. Here, we report the predation of *Bothrops jararaca* (Wied-Neuwied, 1824) by an anuran

*Rhinella icterica* (Spix, 1824) in the Atlantic Forest, southeastern Brazil. The event was captured on video and the images were used to illustrate the predation. The complete recording sequence is available at <https://photos.app.goo.gl/hMP5pDqFYR6xeF6W8>.

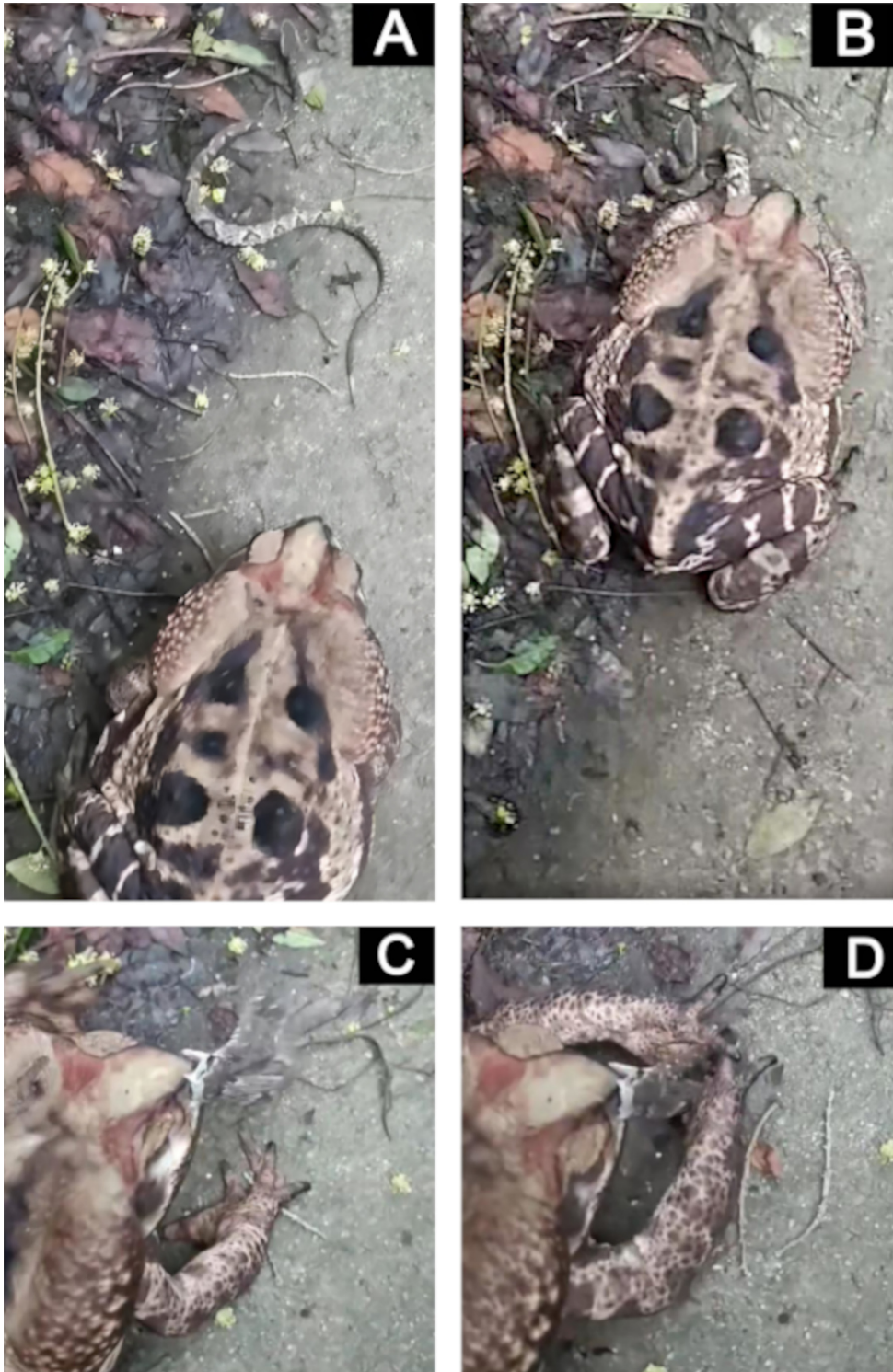
The predatory toad resides close to the residence of one of the authors (SR) and is often seen around his house in the municipality of Mairiporã, São Paulo, Brazil (-23.3183°N, -46.5867°E; elevation 790 m). On 20 October 2023, at 17:00 h, one of us (SR) found the toad near the house on the ground, approximately 10 cm away from a newborn Jararaca Lancehead (*B. jararaca*). Both were motionless for 30 seconds until the snake was gently touched with a hook, causing it to move. The toad immediately approached the snake and again, they both remained motionless (Fig. 1A). After about 10 seconds, the snake was moved a few centimetres away from the toad using the hook. As the snake passed in front of the toad, it immediately grabbed it by the rear with its mouth (Fig. 1B) and began swallowing it. The toad used both forelimbs at a time to push the snake's head away, as the snake successfully bit the toad three times. During the first bite, the snake's fangs got stuck in the toad's head (Figure 1C), and the toad freed itself using its forelimbs (Fig. 1D). The entire event lasted approximately four minutes from capture to complete ingestion of the snake. The toad is still alive and healthy to this day, showing no signs of envenomation.

We found another report of a small *B. jararaca* being swallowed by *R. icterica* (Amaral, 1934). However, this record is limited to a photo without any comment on the behaviour or circumstances of the predation. There is also a record of a juvenile *B. jararaca* in the stomach of an exotic frog *Aquarana catesbeiana* (Camargo-Filho et al., 2008), but we are unaware of other anurans that naturally prey on *Bothrops* species. *Rhinella* spp. are known to feed on snakes (Schalk and Cove, 2018), but records of ingesting venomous species such as *B. jararaca* was poorly reported until now.

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**Figure 1.** (A) Snake (*Bothrops jararaca*) and toad (*Rhinella icterica*) motionless in front of each other. (B) Toad beginning to swallow the snake after capturing it. (C) Snake bites the toad and fangs get stuck in the toad's head. (D) Toad trying to free itself from the snake bite using its forelimbs. Photos by Sergio Rangel.

Therefore, the importance of this predator on Jararaca Lancehead populations is also unknown and difficult to evaluate. Plasticine replicas used in experiments to quantify snake predators can only identify the marks left by birds and mammals (Brodie III, 1993). Attacks by toads, such as *R. icterica*, may be underestimated in these experiments, as it is not possible to recognise marks left by their bites, and the motionless replicas may also discourage their attacks. It is well-known that anurans find prey based on visual motion cues (Satou and Shiraishi, 1991; Zlotnik and et al., 2018) and our observation also showed that the toad was motivated to attack the snake due to its movement. Individuals of *R. icterica* can be easily found in certain locations in the Atlantic Forest (Titon and Gomes, 2015) and can be locally abundant (Fiorillo et al., 2018). Therefore, it can be an important predator of *B. jararaca* and many other species of snakes. Since the toad has suffered no effects from the snake's venom, we suggest it could be tolerant to juvenile *B. jararaca* venom, which may be added to the list of effective pit viper predators such as several species of hawks and opossums.

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