

Thanatosis in the Gold-striped Frog *Lithodytes lineatus* (Anura: Leptodactylidae) in the tropical dry forest of northeastern Colombia

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ABSTRACT

Predation forces prey to develop multiple forms of evasion, including thanatosis, as a behavior that leads to the adoption of a posture where the animal appears to be dead. In this study we report for the first time thanatosis as a strategy present in the genus *Lithodytes* and the species *L. lineatus*, adding one more behavior to a list that includes Batesian mimicry, Müllerian mimicry, deimatic behavior and chemical mimicry.

Key Words: Predator-prey, North of Santander, Behavioral defenses, Antipredator behavior, Anurans.

RESUMEN

La depredación obliga a las presas a desarrollar múltiples formas de evasión, entre estas se incluye la tanatosis, como un comportamiento que conduce a la adopción de una postura donde el animal parece muerto. En este estudio se reporta por primera vez la tanatosis como una estrategia presente en el género *Lithodytes* y la especie *L. lineatus*. Por tanto, se suma un comportamiento más a la lista que incluye mimetismo Batesiano, mimetismo Mülleriano, conducta deimática y mimetismo químico.

Palabras Claves: Depredador-presa, Norte de Santander, Comportamiento defensivo, Comportamiento antipredatorio, Anuros.

Many amphibian species develop different behavioral strategies to avoid predation (Cloudsley-Thompson, 1999; Haynes and Sen, 1995; Humphreys and Ruxton, 2018; Toledo *et al.*, 2011). Anurans thwart predation with defensive adaptations such as immobility, crouching down, contracting, chin-tucking, phragmosis, puffing up the body, body-raising, cloacal discharge, defensive vocalisation, production of secretions, mimicry, thanatosis and many others. (Pedroso-Santos *et al.*, 2022; Santos *et al.*, 2016; Toledo *et al.*, 2011). Thanatosis, also known

as “death feigning”, is a response to predation events where individuals remain immobile, increasing the chances of survival by dissuading predators (Rogers and Simpson, 2014; Toledo *et al.*, 2010). Despite the fact that these strategies are well documented in anurans, there are no previous reports of this behavior in *Lithodytes lineatus* (Escobar-Lasso and González-Duran, 2012; Toledo *et al.*, 2010).

Lithodytes lineatus (Schneider, 1799) is a monotypical species of small frogs (SVL: 38.1-52 mm ♀; SVL: 34.9-47 mm ♂), distributed from

northern Bolivia to northwestern Colombia (Frost, 2024). On 30 October 2024 at 11:00 pm, were recorded two individuals of *L. lineatus* (SVL: 45.3 mm ♀ and 37.5 mm ♂) in a tropical dry forest fragment, San Cayetano municipality, Cúcuta, North of Santander, Colombia (7.845193° N, 72.666591° W, datum WGS84, 783 m a.s.l.) (Fig. 1). The species was identified from the original descriptions of Duellman

(2005) and the thanatosis was documented under the key criteria proposed by Rogers & Simpson (2014). The two individuals of *L. lineatus* were found at the edge of a nest (Nest area = 15m²) of ants of the genus *Atta*. Both individuals were captured, measured, photographed and then released in the same area (Fig. 1. A). When released it was observed that both individuals remained motionless, with the abdomen

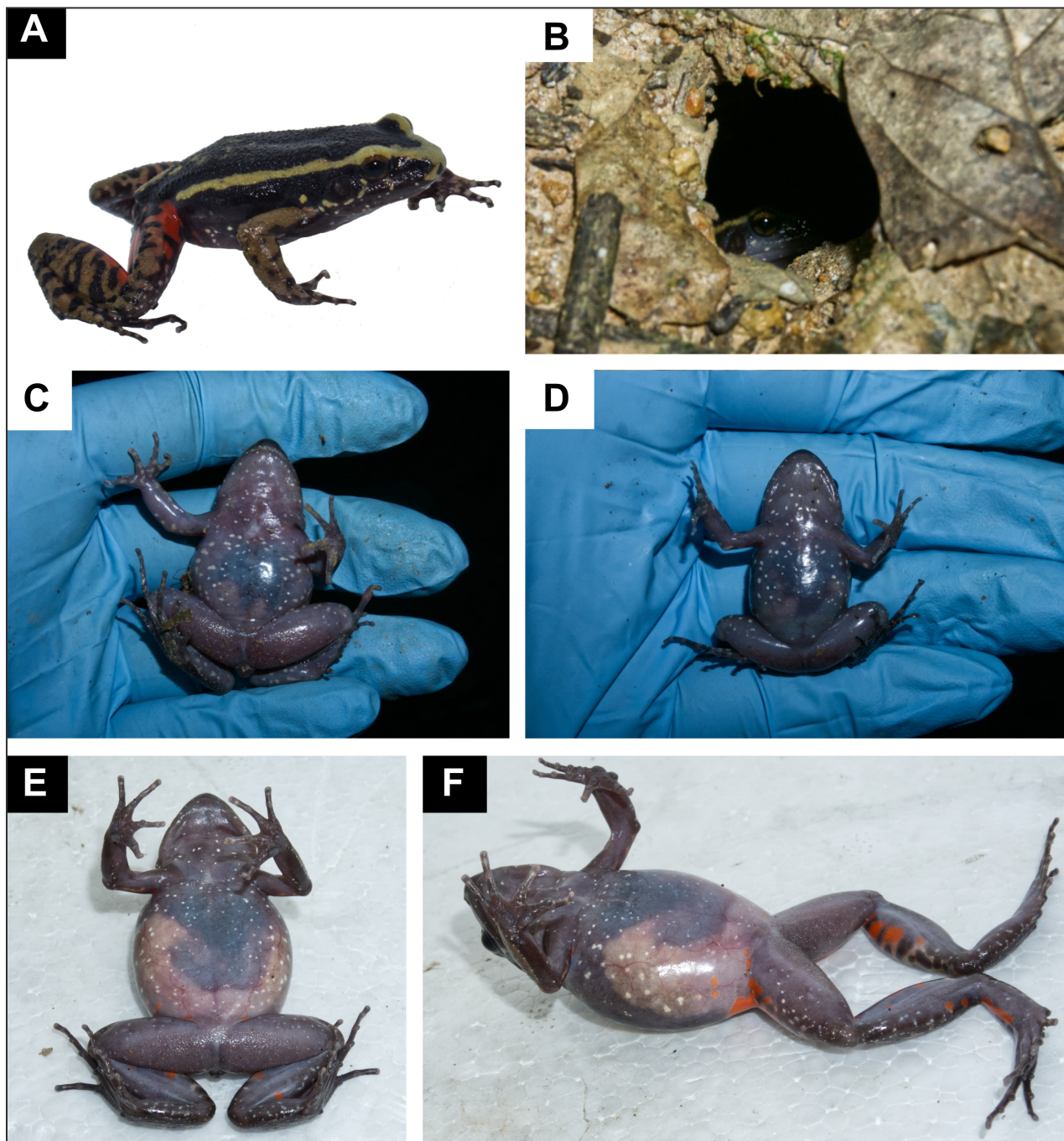


Figure 1. Photographic record of *Lithodytes lineatus* in a fragment of tropical dry forest, San Cayetano municipality, North of Santander, Colombia. A) Male in dorso-lateral view, B) Male hiding in the anthill after release, C) Female individual thanatosis when handled by the researcher and D) Male thanatosis when handled by the researcher. E and F) Female in a state of thanatosis or death feigning on a different substrate (styrofoam box).

turned upwards, widely separated fingers, partial or fully extended phalanges, eyes closed and forelimbs stretched away from the trunk (Fig. 1. C, D, E, F). Even when manipulated they did not exhibit any movements or escape attempts (Fig. 1. C, D). After manipulation, the frogs maintained this posture for approximately 2 minutes and 38 seconds (male), and 1 minute and 43 seconds (female) (Fig. 1. E, F), then recovered their normal posture rapidly, seeking refuge in the nearest entrance of the nest (Fig. 1.B). These observations suggest that the two individuals of *L. lineatus* display a typical thanatosis behavior.

Generally, this strategy is present in species that do not perform any other defensive response (Humphreys and Ruxton, 2018). However, *L. lineatus* presents a wide repertoire of strategies such as Batesian mimicry (similar to *Allobates femoralis*; Cintra *et al.*, 2014), Mullerian mimicry (similar to *Ameerega picta*; Cintra *et al.*, 2014), chemical mimicry (similar to *Atta spp*; de Lima-Barros *et al.*, 2016) and deimatic behavior (Bernarde and Kokubum, 2009; Nelson and Miller, 1971; Prates *et al.*, 2011; Toledo *et al.*, 2010), to which this new record of death feigning or thanatosis is added. Other examples of thanatosis within the family Leptodactylidae are reported in *Leptodactylus macrosternum*, *L. vastus*, *L. cunicularius*, *L. labyrinthicus*, *L. fuscus*, *L. marambaiae*, *L. mystacinus*, *L. latrans* and *L. plaumanni* (de Oliveira-Santos *et al.*, 2023; Lourenço-de-Moraes *et al.*, 2014; Toledo *et al.*, 2010).

Thanatosis in *L. lineatus* is similar to that mentioned in other of the Leptodactylidae species, but with its own particularities such as the anterior and posterior extremities extended, and the slightly more extended fingers (Fig. 1. E, F). In addition, as with other strategies such as Batesian mimicry and deimatic behavior (Cintra *et al.* 2014), it would be worth considering a more in-depth evaluation of this behavior, including a wide range of individuals, populations and a precise experimental design. These observations constitute the first records of thanatosis for the monotypic genus *Lithodytes* and add one more defensive strategy for its repertoire.

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