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And the Oscar goes to: Death-feigning behavior in *Stenocercus squarrosus* Nogueira & Rodrigues, 2006 (Squamata, Tropiduridae)

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Resumo

Este estudo apresenta o primeiro registro do comportamento defensivo de tanatose (fingimento de morte) em *Stenocercus squarrosus*, observado durante um inventário herpetofaunístico realizado no município de Caldeirão Grande do Piauí, estado do Piauí, Brasil. Ao perceber a aproximação do observador ou após um leve toque, o indivíduo correu rapidamente cerca de 10–15 cm e, em seguida, lançou-se ao solo, achatando o corpo dorsoventralmente contra o substrato e estendendo os membros alternadamente em cada lado do corpo. Tal comportamento defensivo, observado sem manuseio direto do lagarto, é especialmente raro. Este registro fornece novas informações comportamentais que ampliam o conhecimento sobre a história natural de *S. squarrosus*, uma espécie considerada elusiva e rara.

Palavras Chave: Caatinga, Comportamento defensivo, Lagartos, Tanatose

Abstract

This study provides the first record of thanatosis (death-feigning behavior) in *Stenocercus squarrosus*, observed during a herpetofaunal inventory in the municipality of Caldeirão Grande do Piauí, state of Piauí, Brazil. Upon detecting the observer's approach or following a slight touch, the individual rapidly fled approximately 10–15 cm before abruptly dropping to the ground, pressing its body dorsoventrally against the substrate, and extending its limbs alternately along each side of the body. Such a defensive display occurring without direct handling is particularly rare among lizards. This observation contributes novel behavioral information to the natural history of *S. squarrosus*, a species regarded as both elusive and rare.

Key-words: Caatinga, Defensive Behavior, Lizards, Thanatosis

Defensive behavior in animals is characterized by a set of elements and strategies used to avoid or reduce situations of threats or risk of predation (Bauder et al., 2015; Santos et al., 2010). These behaviors have been shaped throughout the evolutionary process, some being simpler and others quite complex. In lizards there is a wide variety of defensive behaviors involving active and passive strategies (Miranda et al., 2022; Montoya-Cruz & Díaz-Flórez, 2023). Flight is the most common active strategy, used when the lizard seeks to escape quickly; other behaviors include biting the aggressor or using the tail in defense, and many resort to caudal autotomy to distract and escape predators (Montoya-Cruz & Díaz-Flórez, 2023). Among passive strategies, cryptic coloration, which allows camouflage with the surroundings, and death feigning, tonic immobility, or thanatosis, in which the lizard simulates death to discourage potential attacks (Miyatake, 2001). These adaptive behaviors vary among species, demonstrating the diversity of defense mechanisms within the group (Rocha, 1993; Rocha & Van Sluys, 2008). This diversity results from the evolutionary and adaptive process between predator and prey to survive predation attempts (Rocha, 1993; Santos et al., 2010; Sannolo et al., 2014).

Thanatosis may be the last effective defensive resort in situations of extreme threat, mainly when the individual is captured. Stress is likely one of the factors determining this process, forcing the animal to assume an immobility posture, appearing dead (with rigid muscles and, in some cases, closed eyelids) (Bertoluci et al., 2006; Humphreys & Ruxton, 2018; Miranda et al., 2022; Montoya-Cruz & Díaz-Flórez, 2023). Thanatosis has been investigated repeatedly due to its occurrence in various animal groups (Arduino & Gould, 1984). Death simulation apparently aims to confuse predators that do not usually ingest dead prey (Travaglia-Cardoso, 2014), avoiding direct confrontations and thus reducing risk for the prey. Therefore, this behavior is especially effective against predators that rely on visual capture of prey and also in situations where chances of escape are minimal (Machado-Filho et al., 2018).

According to records cited in the literature, thanatosis is observed in arthropods (Oliver, 1996; Miyatake, 2001), fish (Resende et al., 2025), anurans (Sazima, 1974; Vrcibradic & Van Sluys, 2000), and snakes (Jelić & Vilaj, 2011; Fuentes et al., 2021). Among lizards, this behavior was recorded in several families: Crotaphytidae (e.g. Gluesing, 1983), Liolaemidae (e.g. Rocha, 1993), Scincidae (e.g. Langkilde et al., 2003), Dibamidae (e.g. Torres-Cervantes et al., 2004), Gymnophthalmidae (e.g. Mesquita et al., 2018; Alves & Cavalcanti, 2024), and Tropiduridae (e.g. Galdino & Pereira, 2002).

Tropidurid lizards of the genus *Stenocercus* Duméril & Bibron, 1837 are found in South America, inhabiting both lowlands and high altitudes. *Stenocercus* is the most diverse genus within Tropiduridae, including 80 species (Uetz et al., 2025) distributed across several vegetation domains (Torres-Carvajal. 2000). *Stenocercus squarrosus* Nogueira and Rodrigues, 2006 (Fig.1A) is a terrestrial, diurnal species with a relictual distribution in Caatinga and Caatinga-Cerrado transition areas (Carrasco) in the states of Ceará and Piauí at elevations ranging from 259 to 919 meters (Nogueira & Rodrigues, 2006; Ribeiro et al., 2009; Cavalcanti et al., 2014; Magalhães et al., 2016). Its biology remains poorly known; it is oviparous and primarily feeds on arthropods. Because of its small size, it can be preyed upon by birds, mammals, and reptiles (Torres-Carvajal et al., 2006, 2007). In this study, we present the first recorded case of thanatosis in a juvenile of *S. squarrosus*.

On June 21, 2013, during a herpetofauna survey in the municipality of Caldeirão Grande do Piauí, Piauí state, Brazil (7.392°S, 40.408°W), in an area characterized by native vegetation predominantly of *carrasco* and shrubby-arboreal Caatinga, a juvenile specimen of *S. squarrosus* (39 mm snout-vent length and 33 mm tail length) was captured in a pitfall trap with drift fence. The traps were checked in the morning (approximately 19 hours since last inspection). Immediately after collection, the specimen was kept in the shade for three hours, then transported to the field laboratory, where its behavior was observed later that same afternoon. We assume that the specimen did not experience significant stress, such as dehydration or other environmental stressors, prior to the observations. The lizard was placed in a plastic bag with sand and leaf litter from the capture site and was taken to the field lab, where it was placed in a tray (50x30 cm) with sand for photography. During this procedure, the lizard exhibited unusual thanatosis behavior with curious characteristics differing from those reported in other lizards, including display of gestures simulating death.

When the specimen recognized an observer approaching or after a light touch, it quickly ran in the opposite direction for about 10-15 cm and threw itself onto the substrate, flattening its body dorsoventrally against the ground with limbs stretched alternately on each side of the body (Fig. 1B-C), maintaining the same position even when lifted and placed in the observer's palm (Fig. 1D),. In some but not all instances, it completely closed its eyes. The lizard was handled ten times and repeated the behavior each time until it seemed to tire and stopped repeating the pattern, remaining merely immobile after short locomotion, without throwing itself onto the ground (which prevented us from recording it). Subsequently, the specimen was euthanized with lidocaine, fixed in 10% formalin, preserved in 70% alcohol, and deposited in the herpetology collection of the Regional University of Cariri, cataloged as URCA-H-5906.

Remarkably, the behavior occurred on the ground without direct handling. Although thanatosis manifests in natural

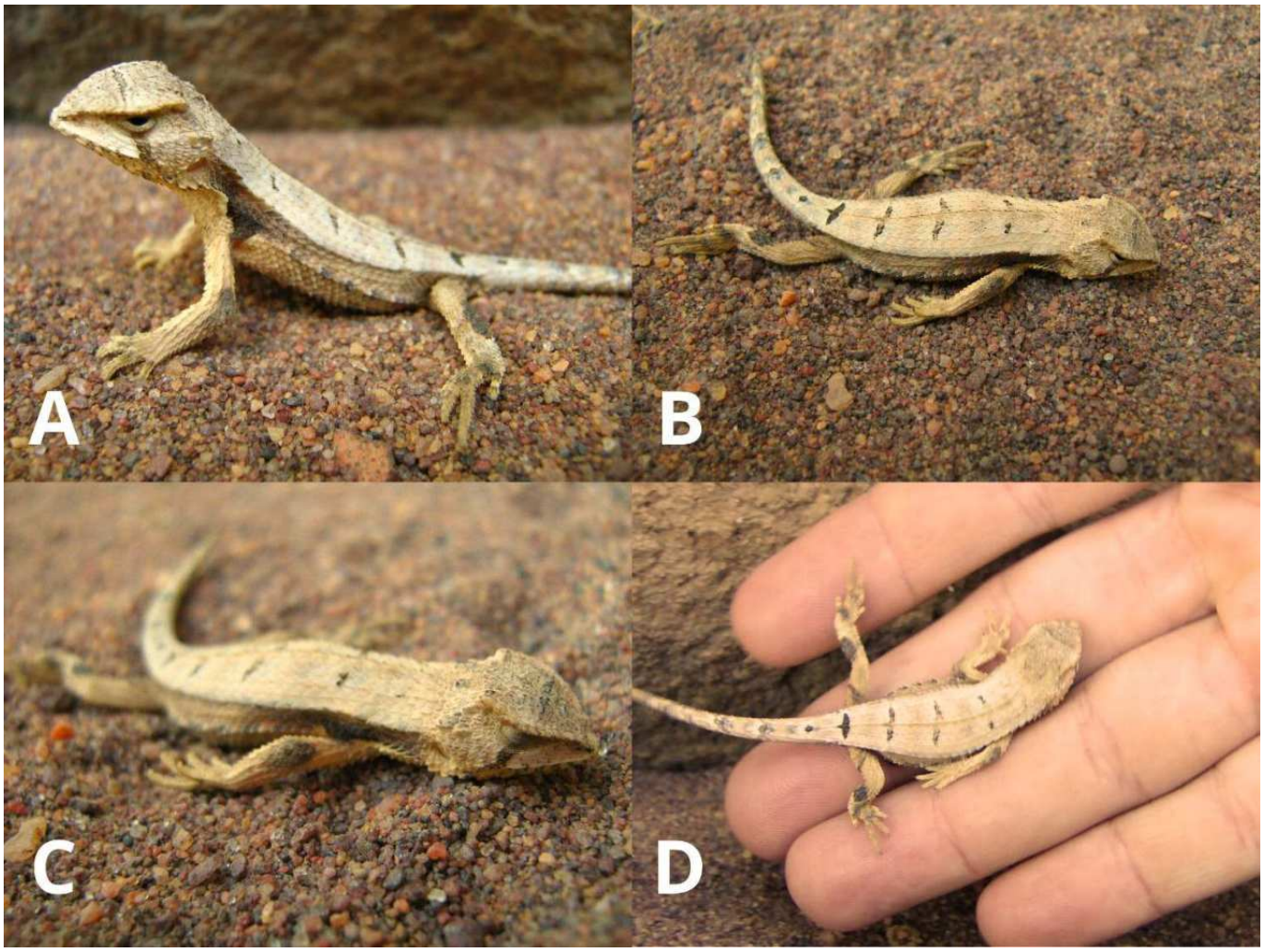


Figura 1. A: A juvenile *Stenocercus squarrosus*, municipality of Caldeirão Grande do Piauí, Piauí, Brazil. **B-C**: After being lightly touched and moving away from the observer, showing its theatrical performance of thanatosis behavior. **D**: The lizard maintaining the behavior even while being handled.

environments, most cases are recorded due to fear or stress induced by human manipulation, usually when the individual is being handled (Gerald, 2008; Ribeiro et al. 2010; Gomides & Sousa, 2011; Nunes et al., 2012; Damas-Moreira, 2021). This study reveals unprecedented data on the thanatosis behavior of *Stenocercus squarrosus*. Until now, no defensive behavior had been known for this species. Thanatosis involving running, throwing itself onto the ground, alternating limbs, and remaining in tonic immobility is little known in the genus. Rojas-Suárez et al. (2023) is the only description of a case of thanatosis in *S. erythrogaster* (Hallowell, 1856) in response to direct human handling.

There are some behavioral variations involving thanatosis in lizards, which are related to their responses to external stimuli. This may reflect different types of manipulation observed both in the laboratory and in the natural environment or in the presence of more active predators that feed on constantly moving prey (Machado-Filho et al. 2018; Matias et al. 2024). Furthermore, these physical contact interactions between predator and prey, as well as the duration of immobility, may vary, with longer or shorter periods of interaction (Arduino & Gould, 1984). At least one other case of thanatosis occurred spontaneously due to human proximity in *Podarcis siculus* (Rafinesque-Schmaltz, 1810) (Damas-Moreira, 2021), while the vast majority of thanatosis records have been documented during specimen handling (Carvalho et al. 2011; Travaglia-Cardoso, 2014; Santos et al. 2010; Ribeiro et al. 2010). This includes cases in Tropiduridae lizards (Galdino & Pereira, 2002; Gomes et al. 2004; Kohlsdorf et al. 2004; Bertoluci et al. 2006; Teles et al. 2018; Costa-Campos & Anaissi, 2020; Rojas-Suárez et al. 2023). In these cases, there do not appear to be significant variations in thanatosis behavioral patterns, which makes the behavior observed in *S. squarrosus* even more noteworthy.

Regarding death-feigning behavior in young lizards, some studies suggest that in certain environments with low temperatures, this behavior may serve as a useful strategy due to the reduction in metabolic activity and the difficulty in thermoregulation, which decreases agility during escape, thereby inducing the animal to remain motionless in the presence of a predator (Miyatake et al. 2008; Montoya-Cruz & Díaz-Flórez, 2023; Travaglia-Cardoso, 2014). However, considering the distribution of *S. squarrosus* in the Caatinga, a semi-arid climate environment, it is less likely that temperature influences this behavior, as the lizard was observed during the day. This suggests that other mechanisms must be involved. Future encounters with this still poorly known species should further our understanding of the biology of the *Stenocercus* group. This study presents a new behavioral discovery that may contribute to a better understanding of the natural history and behavior of lizards.

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