

**Alive or dead?
Thanatosis in
Leptodeira annulata
(Serpentes: Dipsadidae)**

Thanatosis is a defensive behaviour in which potential prey feign death to avoid predation (Toledo et al. 2011, Humphreys & Ruxton 2018). While demonstrating this behavior, the animal adopts a posture that appears to be dead, which may deflect an attack from a potential predator (Toledo et al. 2011). In the species of herpetofauna, thanatosis is found in a wide variety of anurans (Pedroso-Santos et al. 2022), lizards (Costa-Campos & Anaissi 2020), and snakes (Fuentes et al. 2021).

The banded cat-eyed snake, *Leptodeira annulata* (Linnaeus, 1758), is a dipsadid snake found throughout most of the Neotropical region, with wide occurrence in the Amazon rainforest (Nogueira et al. 2019, Costa et al. 2022). This snake is nocturnal and semi-arboreal, typically found in primary and secondary forests, gallery forests, and disturbed areas near the edges of water bodies in humid environments (Martins & Oliveira 1998, Bernarde & Abe 2010). Here we report the first record of thanatosis behaviour in *L. annulata* in the eastern Amazon and compiled the available information in the literature on this defensive behaviour in Brazilian snakes.

We conducted a literature review of previous surveys on Google Scholar using the following keywords: thanatosis, defensive behavior, death-feigning, Brazilian, and snakes. In addition, we searched editions of the papers Herpetological Bulletin, Herpetological Review, Herpetology Notes, Mesoamerican Herpetology, and Reptiles & Amphibians, which traditionally publish natural history notes.

On 23 September 2022, at 19:56 h, during fieldwork at flooded area, we recorded a *L. annulata* adult male (snout-vent length = 740 mm, TL = 140 mm; Fig. 1A) in riverside community known locally as Ariri (0.2993°N, 51.1298°W)

located north of the municipality of Macapá, Amapá state, in the eastern Brazilian Amazon. The area is flooded by the blackwater river of the Matapi River basin and is composed of Amazonian savanna, with large areas of gallery forest and flooded forest (Silva et al. 2016).



Figure 1. Live specimen of *Leptodeira annulata* from riverside community known locally as Ariri, municipality of Macapá, Amapá state, Brazil: (A) dorsal view, (B) exhibiting thanatosis behaviour. Photos by Carlos E. Costa-Campos.

When we manipulated the snake to photograph, it turned its belly upwards, exposing the ventral scales (Figure 1B), putting itself in a thanatosis posture for approximately 45 seconds. During this behavior, the snake remained motionless, with its mouth closed, and returned to its normal position after this period.

The specimen was deposited in the Coleção Herpetológica of the Universidade Federal do Amapá under the number CECC 3909. Snakes exhibiting thanatosis include members of the families Dipsadidae, Elapidae, and Viperidae (Table 1, Figure 2).

Table 1. Records of thanatosis reported for Brazilian snake species.

Family/Species	Source
Dipsadidae	
<i>Leptodeira annulata</i> (Linnaeus, 1758)	This study
<i>Erythrolamprus miliaris</i> (Linnaeus, 1758)	Muscat et al. 2016
<i>Taeniophallus brevirostris</i> (Peters, 1863)	Anaissi et al. 2023
<i>Adelphostigma occipitalis</i> (Jan, 1863)	Fiorillo et al. 2019
<i>Hydrodynastes gigas</i> (Duméril, Bibron & Duméril, 1854)	Marques et al. 2013
<i>Pseudablabes patagoniensis</i> (Girard, 1858)	Tozetti et al. 2012
Elapidae	
<i>Micrurus frontalis</i> (Duméril, Bibron & Duméril, 1854)	Roze 1996
<i>Micrurus hemprichii</i> (Jan, 1858)	Almeida et al. 2016
<i>Micrurus ortonii</i> Schmidt, 1953	Gonzales & de Oliveira 2020
<i>Micrurus paraensis</i> Cunha & Nascimento, 1973	Almeida et al. 2016
<i>Micrurus remotus</i> Roze, 1987	Almeida et al. 2016
Viperidae	
<i>Bothrops erythromelas</i> Amaral, 1923	Santos & Silva Muniz 2012
<i>Bothrops jararacussu</i> Lacerda, 1884	Muscat & Entiauspe-Neto 2016

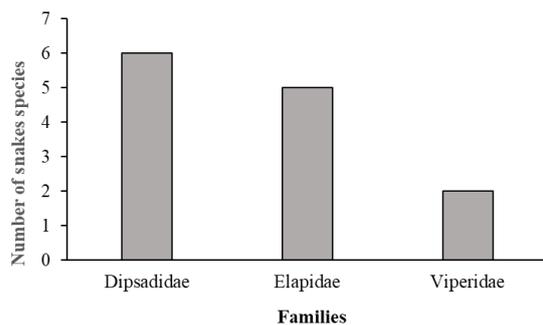


Figure 2. Records of thanatosis reported for Brazilian snake families.

In snakes, defensive behaviours are diverse and complex (Tozetti et al. 2012). They can be effective against predators that do not feed on dead prey, as well as against predators that

require movement cues to capture their prey (Toledo et al. 2011). Most previously reported behaviours of thanatosis are based on observations in captivity or controlled situations (Humphreys & Ruxton 2018); therefore, observations in natural conditions and habitats are scarce. Although thanatosis is known in a wide range of Dipsadidae species (six species), this behavior was not previously reported in *L. annulata*, adding another record to the Dipsadidae family (Fuentes et al. 2021). The present observation expands the number of species known for the family Dipsadidae that exhibit this defensive behavior, contributing to our knowledge of the species and also encouraging further studies with other ecologically related species.

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