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# Predation of *Amphisbaena darwinii* (Duméril and Bibrón, 1839) by *Phalotris lemniscatus* (Duméril, Bibrón, and Duméril, 1854): a contribution to trophic interaction data in squamate reptiles

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## Resumo

Registros detalhados de história natural formam a base fundamental para a calibração de modelos ecológicos e evolutivos complexos. Este estudo documenta uma interação predador-presa entre a serpente *Phalotris lemniscatus* e a anfisbena fossorial *Amphisbaena darwinii*, com base em material preservado do sul do Brasil. A presa, consumida pela cabeça, representava mais de 50% do comprimento e 68% da circunferência corporal do predador, evidenciando a capacidade de *P. lemniscatus* para consumir presas alongadas e relativamente grandes. A descrição minuciosa deste evento, com dados morfométricos e contexto ecológico explícito, fornece um ponto de dados empírico crucial para superar o "Eltonian shortfall" – a escassez de dados sobre interações ecológicas. Documentações como esta são essenciais para validar a plausibilidade ecológica de interações em modelos de redes tróficas, refinar inferências evolutivas sobre a dieta em squamatas e ressaltar o valor permanente das coleções científicas.

## Palavras-chave

Amphisbenidae; Elapomorphini; Eltonian Shortfall; História Natural; Répteis fossoriais.

## Abstract

Detailed natural history records constitute the fundamental basis for calibrating complex ecological and evolutionary models. We document a predator-prey interaction between the dipsadid snake *Phalotris lemniscatus* and the fossorial amphisbaenian *Amphisbaena darwinii* from southern Brazil. The snake had ingested the amphisbaenian head-first; the prey measured over 50% of the predator's length and 68% of its body circumference, confirming the consumption of large, elongate prey. The meticulous description of this event, with explicit morphometric and ecological data provides a crucial empirical data point to address the Eltonian shortfall — the scarcity of species interaction data. Such documented records are essential for validating the ecological plausibility of interactions in food-web models, refining evolutionary inferences about squamate diet, and highlighting the enduring value of scientific collections..

## Keywords

Amphisbenidae; Elapomorphini; Eltonian Shortfall; Fossorial reptiles; Natural History.

Accurate documentation of predator-prey relationships is essential for advancing our understanding of ecological and evolutionary processes. Yet, empirical data on species interactions remain disproportionately scarce, particularly among secretive or fossorial organisms, a deficit known as the Eltonian shortfall (Hortal et al., 2015; Caron et al., 2022). This shortfall restricts our ability to generate, test, and calibrate models of food webs, niche occupation, and trait evolution (e.g., Adams & Nistri, 2010; Grundler & Rabosky, 2010). Trait-based interaction models and stochastic approaches such as Markov process models (Grundler & Rabosky, 2020) rely heavily on the availability of confirmed trophic links and habitat associations to reconstruct past transitions and forecast future dynamics. Thus, each verified interaction contributes significantly to a more mechanistic and spatially grounded ecological synthesis.

Squamate reptiles, with over 12,000 described species (Uetz et al., 2025), have diversified into nearly all ecological niches, including arboreal, aquatic, terrestrial, and fossorial habitats (e.g. Pellegrin et al., 2021). Within this clade, the repeated evolution of limblessness, at least 25 times independently, has resulted in highly specialized morphologies and feeding behaviors (Wiens et al., 2006). Two striking examples of such extreme specialization are snakes and amphisbaenians. Snakes include macrophagous species presenting a kinetic skull adapted to consuming relatively large or elongate prey (Cundall & Greene, 2000), while amphisbaenians constitute a strict fossorial, cryptozoic squamate group that generally consumes small invertebrates (Gans, 1974; Reiche et al., 2024).

Confirming trophic interactions involving these groups, and especially verifying habitat overlaps, is critical to defining the ecological contexts in which such interactions are likely to occur. Here, we document a poorly recorded predator–prey interaction between the opisthoglyphous dipsadid snake *Phalotris lemniscatus* (Duméril, Bibron & Duméril, 1854) and the amphisbaenid *Amphisbaena darwinii* Duméril, Bibron & Duméril 1839, based on preserved material, housed at the Museu de Ciência e Tecnologia da Pontífica Universidade Católica do Rio Grande do Sul (MCP-PUCRS), originating from the municipality of Caçapava do Sul, Rio Grande do Sul, south Brazil (30°33′00″ S, 53°27′00″ W; Fig. 2).

According to the information available in the collection's logbook, an adult female *P. lemniscatus* (MCP 13250) was collected on 21 March 2002 in an open grassland habitat. The material was examined by us in October 2023. The dissection of the specimen revealed a partially digested *A. darwinii* ingested head-first (Fig. 1). The snake measured 520 mm snout-vent length (SVL) and weighed 26 g, while the amphisbaenid measured 280 mm SVL and 14 g representing over 53% of the snake's total length and 68% of its body circumference. This finding indicates that *P. lemniscatus* can consume relatively large and elongate prey, consistent with previous, but mostly anecdotal, reports of similar feeding behavior (Duarte, 2006; Achaval & Olmos, 2007; Abegg & Entiauspe-Neto, 2012). All dissections were performed under a stereomicroscope, and morphometric data were obtained using a flexible ruler and a digital caliper with 0.01 mm accuracy.




**Figure 1.** Overview of the specimens of *Phalotris lemniscatus* (MCP 13250) and *Amphisbaena darwinii.* (A) General view of the sample with stomach contents; (B) Dorsal view of both specimens; (C) Ventral view of both specimens. Scale bar = 10 mm. Photos by authors.

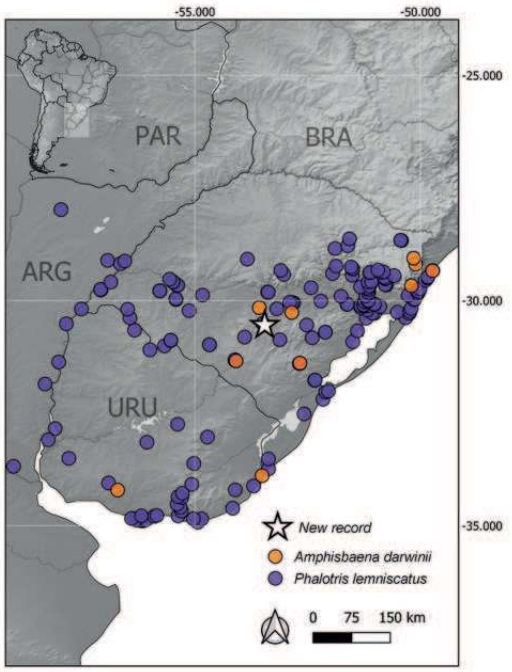


**Figure 2.** Geographic distribution of *Phalotris lemniscatus, Amphisbaena darwinii,* and the record presented here. The records follow Perez and Borges-Martins (2012) for *A. darwinii* and Nogueira et al. (2019) for *P. lemniscatus.* Map by authors.

With the objective of verifying the relevance of this record, we conducted an extensive and systematic literature review drawing on multiple major academic databases and historical repositories, following van den Burg (2020). Our search encompassed Google Scholar, SciELO, Web of Science, the database R package *SquamateBase* (Grundler, 2020), and the Biodiversity Heritage Library (BHL). We surveyed a wide range of sources, including peer-reviewed papers from current and discontinued journals, as well as thesis, dissertations, technical reports, and relevant anecdotal or unpublished records.

Although this interaction is not unprecedented (see Table 1), the present record remains important because it expands the empirical basis for predator-prey relationships among fossorial reptiles. Its main value lies in the level of detail: both predator and prey are confidently identified to species level, providing a spatially explicit data point that can be integrated into ecological databases such as *SquamateBase* and into modeling frameworks exploring the evolution of diet, skull morphology, and habitat use in squamates (e.g., Caron et al., 2022).

Previous studies documenting similar prey for *P. lemniscatus* often lack precise measurements or photographic evidence (Lema, 1989). By presenting morphometric and ecological details, this report contributes more robustly to reducing the Eltonian shortfall for fossorial reptiles and underscores the continuing importance of natural history collections for biodiversity and interaction research. Additionally, documenting this event contributes to validating the frequency of this feeding behavior, which is crucial for comparative frameworks that employ, for example, hidden Markov models (HMMs) to analyze multivariate ecological count data sensu Grundler & Rabosky (2020). Finally, this record enriches the known dietary spectrum of *P. lemniscatus*, a species that overlaps with several amphisbaenians throughout its range (e.g., *A. prunicolor* Cope, 1885; *A. nana* Perez et al., 2019; *A. tiaraju* Perez et al., 2019). Incrementally adding such well-documented interactions refines trait-based ecological models and strengthens evolutionary interpretations.

**Table 1.** Feeding records of *Phalotris lemniscatus* reported in the literature. When available, the quantities of contents are indicated in the "N" column, after the identified prey species. An asterisk (*) indicates predation events observed in captivity. [1]Reported as *Leimadophis poecilogyrus pictostriatus* by Lema (1983); [2]Reported as *Liophis poecilogyrus pictostriatus* by Lema (1989); [3]Reported as *Leptotyphlops* sp. by Achaval et al. (1978) – apud Vidal 2002.

| **Dietary content** | **N** | **Reference** |
|---|---|---|
| **Reptilia** | | |
| **Squamata** | | |
| Amphisbaenia | | |
| Amphisbaenidae | | |
| *Amphibaena darwinii* | 1 | *This study* |
| *Amphibaena darwinii darwinii* | 2 | Lema (1989) |
| *Amphisbaena* sp. | 1 | Werner (1909) |
| *Amphisbaena* sp. | 1 | Serié (1919) |
| Serpentes | | |
| Dipsadidae | | |
| *Erythrolamprus poecilogyrus*[1] | | Lema et al. (1983) |
| *Erythrolamprus poecilogyrus*[2] | | Lema (1989) |
| *Helicops carinicaudus infrataeniatus* | | Lema et al. (1983) |
| Leptotyphlopidae | | |

| Dietary content | N | Reference |
|---|---|---|
| *Epictia* sp.[3] (apud Vidal 2002) | | Achaval et al. (1978) |
| **Clitellata** | | |
| **Haplotaxida** | | |
| Megascolecidae | | |
| *Pherethima* sp.* | | Lema et al. (1983) |
| *Pherethima* sp.* | | Lema (1989) |
| **Probably secondary intestinal contents** | | |
| Worms (apud Lema 1989) | | Prado (1945) |
| *Larvae and adults of mollusks, oligochaetes, and insects (apud Lema 1989)* | | Vanzolini (1948); Abalos et al. (1964); Amaral (1977) |
| *Insects and frogs (apud Lema 1989)* | | Merti (1959) |

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