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SHORT NOTE

Amphisbaena mertensii (Squamata: Amphisbaenidae): Notes on natural history, distribution, and morphology

Amphisbaena mertensii (Squamata: Amphisbaenidae): Notas sobre historia natural, distribución y morfología

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ABSTRACT

Amphisbaena mertensii is a worm lizard species from South America. Because of its subterranean lifestyle, data on its biology are scarce. In this paper, we present the first record of *A. mertensii* as prey of a bird, the wood rail *Aramides cajaneus*. We also review the geographic range of this species, reporting it for 114 localities from west-central Brazil to northeastern Argentina. We update the range of precloacal pores in *A. mertensii* from 5–8 to 4–8, and report the largest individual of this species with a 458 mm snout-vent length.

Keywords: Amphisbaenia, geographic range, predation, maximum size, worm lizard.

RESUMEN

Amphisbaena mertensii es una especie de anfisbaénido de América del Sur. Debido a su estilo de vida subterráneo, datos sobre su biología son escasos. En este trabajo, presentamos el primer registro de *A. mertensii* como presa de un ave, la cotara chiricote *Aramides cajaneus*. También revisamos el ámbito geográfico de *A. mertensii* reportándola en 114 localidades desde el centro-oeste de Brasil hasta el noreste de Argentina. Actualizamos el intervalo de poros precloacales en *A. mertensii* de 5–8 a 4–8 y registramos el individuo más grande de esta especie, con 458 mm de longitud hocico-cloaca.

Palabras clave: Amphisbaenia, depredación, distribución geográfica, lagarto gusano, tamaño máximo.

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INTRODUCTION

Natural history observations are critical to the development of relevant hypotheses that can led to a new understanding of biodiversity and its evolution (Vitt 2013). Similarly, species geographic ranges are important to understand biogeographical patterns and processes, ultimately impacting conservation assessments (Morrone 2001, Hortal *et al.* 2015, Peixoto *et al.* 2020). Despite recent advances (e.g., Roll *et al.* 2017, Meiri 2018), adequate information on natural history and geographic range are still lacking for many species of squamate reptiles, particularly worm lizards (Amphisbaenia) (Andrade *et al.* 2006, Vitt and Caldwell 2014, Longrich *et al.* 2015, Colli *et al.* 2016), a group with over 200 known species worldwide (Costa and Garcia 2019, Uetz *et al.* c2021). The paucity of information on the natural history and biogeography of amphisbaenians is in most part due to their fossorial habits, making them difficult to find. As result, this is one of the least known groups of Squamata (Vitt and Caldwell 2014, Costa and Garcia 2019, Navega-Gonçalves and Benites 2019).

Amphisbaena mertensii Strauch, 1881 is a worm lizard with a broad geographic range, occurring in southeastern and west-central Brazil, eastern Paraguay, and northeastern Argentina (Gans 1966, Corrêa and Meneses 2020). Among South American amphisbaenians, *A. mertensii* is relatively well-studied, including data on activity (Moraes and Recchia 2011), defensive behavior (Brito *et al.* 2001, Andrade *et al.* 2006, Navega-Gonçalves and Benites 2019), diet and feeding behavior (Cruz-Neto and Abe 1993, Pramuk and Alamillo 2003, Moraes and Recchia 2011, Navega-Gonçalves and Benites 2019), predation (Sazima and Abe 1991, Duarte 2006, Barbo and Sawaya 2008, Barbo *et al.* 2011, Rodríguez *et al.* 2018), reproduction (Pramuk and Alamillo 2003, Andrade *et al.* 2006, Aguirre *et al.* 2017), thermal ecology (Abe 1984), distribution and habitat (Pramuk and Alamillo 2003, Ribeiro *et al.* 2007, Moraes and Recchia 2011, Silveira *et al.* 2012, Corrêa and Meneses 2020), cytogenetics (Hernando 2005) and anatomy (Navega-Gonçalves and Souza 2001, Gans and Montero 2008).

This species can be found in environments of native vegetation (Zaracho *et al.* 2014), pasturelands (Pramuk and Alamillo 2003), and even urban areas (Barbo and Sawaya 2008, Moraes and Recchia 2011, Silveira *et al.* 2012). Despite their fossorial habit, individuals may be seen foraging on surface at afternoon and night (Moraes and Recchia 2011), feeding mostly on invertebrates (Cruz-Neto and Abe 1993, Pramuk and Alamillo 2003). *Amphisbaena mertensii* is diagnosed by a series of morphological characters: 210–250 body annuli, 25–32 caudal annuli (with autotomy on annuli 5–8), 14–26 (usually 18 or 22) dorsal and 16–25 (usually 22) ventral segments to a midbody annulus, 5–8 (usually six) precloacal pores, and a medium to large size, SVL up to 410 mm (Gans 1966, Ribeiro *et al.* 2007, Silveira *et al.* 2012). This species has been recorded as prey of the highly venomous snakes *Micrurus altirostris* (Cope, 1860) (Rodríguez *et al.* 2018) and *M. frontalis* Duméril, Bibron and Duméril, 1854 (Sazima and Abe 1991). It is also prey to mildly venomous species such as *Phalotris mertensi* (Hoge, 1955) (Duarte 2006) and even non-venomous species as *Taeniophallus affinis* (Günther, 1858) (Barbo *et al.* 2011) – but see Barbo and Sawaya (2008) for a correction of a predation record by Barbo and Marques (2003). Although birds are common predators of amphisbaenians (Schalk and Cove 2018), they have not been recorded preying on *A. mertensii*. In this work, we present the first evidence of *A. mertensii* as prey of a bird, based on a field observation. Additionally, we review the species' geographic range, filling gaps from recent published maps (Colli *et al.* 2016, Corrêa and Meneses 2020). Finally, based on specimens housed in scientific collections, we add information on the morphology of *A. mertensii*.

MATERIAL AND METHODS

Natural history observation

On 11 March 2019, one of us (CLA) conducted fieldwork in Presidente Olegário (18°34′21″ South, 46°19′48″ West, WGS 84), Minas Gerais, Brazil. The region is in a transition between the Cerrado and the Bahia Interior Forests ecoregions (Dinerstein *et al.* 2017) and the vegetation is composed of small secondary forest and savanna fragments embedded in a mosaic of coffee plantations and pastures. During this fieldwork, CLA recorded an adult Grey-necked Wood-rail, *Aramides cajaneus* (Statius Müller, 1776) preying on an adult *Amphisbaena mertensii*. Following the observation, the worm lizard was collected, fixed in formalin, and stored in alcohol at the Museu de Zoologia João Moojen, Universidade Federal de Viçosa, Brazil (specimen label MZUFV 1449).

Literature review on geographic distribution

To review published records on the geographic range of *A. mertensii*, we gathered information from the species redescription (Gans 1966), followed by a search using the words "*Amphisbaena mertensii*" OR "*Amphisbaena mertensi*" in Google Scholar database (https://scholar.google.com/) in October 2020. We checked all issues of the journals Check List, Herpetology Notes, and Herpetological Review for notes on geographic distribution and natural history. We did not consider data from unpublished dissertations, theses, and technical reports.

Morphological data

We examined 11 specimens of *Amphisbaena mertensii* deposited in the following institutions: American Museum of Natural History, New York, USA (AMNH); The Field Museum, Chicago, USA (FMNH); Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Brazil (MCN); Museu de Zoologia, Universidade de São Paulo, Brazil (MZUSP); and Universidade Federal de Goiás, Goiânia, Brazil (UFG). Ten specimens are from Brazil (Mato Groso do Sul, AMNH 62145–46; Minas Gerais, MCN-R 6164, 6182–83, 6187–88, UFG 583, 585; São Paulo, MZUSP 96978), and one specimen is from Paraguay (Guairá, AMNH 25172). Species identification follows Gans (1966). We measured snout-vent length (SVL) and tail length (TL) with a ruler to the nearest 1 mm.

RESULTS AND DISCUSSION

The predation event of the bird *Aramides cajaneus* upon *Amphisbaena mertensii* (Fig. 1) happened at 10:30 a.m. on a rainy day. The predator was on a road at the edge of a forest fragment, holding the prey's head in its beak. With the approach of the observer, the bird abandoned its prey on the ground, still alive and fled. *Aramides cajaneus* occurs in aquatic and semi-aquatic environments from Costa Rica (Loaiza-Gómez 2017) south to Uruguay and northern Argentina (Marcondes and Silveira 2015), feeding on a variety of terrestrial and aquatic prey such as crabs, snails, arthropods, frogs, and lizards (Redondo and Quesada 2012, Hipólito and Sazima 2016, Silva e Silva and Olmos 2016). Since *Amphisbaena mertensii* is a fossorial species, the bird likely captured it while the worm lizard was foraging at the surface (Moraes and Recchia 2011) or because its burrows were flooded by the constant rain, forcing the reptile to come to the surface (Hayes *et al.* 2015).

It is likely that the predation of *A. cajaneus* on *A. mertensii* was opportunistic, as reported in other interactions between birds and worm lizards (Zamprogno and Sazima 1993, Hayes *et al.* 2015, Assis and Costa 2020).

Our review on the geographic range of *Amphisbaena mertensii* produced 183 records at 110 localities, from west-central Brazil to northeastern Argentina. Four new locations of occurrence were added through our analysis of specimens from scientific collections, plus the present predation record (Fig. 2; Supplement 1). The two most recent published maps of *A. mertensii* cited 57 (Corrêa and Meneses 2020) and 68 (Colli *et al.* 2016) locality records. Our localities represent twice and 1.6 times the number of records from these two maps. Corrêa and Meneses (2020) alleged that their record from Brasília, central Brazil, is the northernmost known record of *A. mertensii*, but they and Colli *et al.* (2016) did not include three localities north of Brasília from where *A. mertensii* is reported: Chapada dos Guimarães (Strüssmann and Mott 2009), Campo Novo dos Parecis (Ribeiro *et al.* 2019), and São Miguel do Araguaia (Moreira *et al.* 2009). Corrêa and Meneses (2020) also stated the specimen from Brasília was the first of *A. mertensii* from an urban area, but it is not (Barbo and Sawaya 2008, Moraes and Recchia 2011, Silveira *et al.* 2012).

The known range of *A. mertensii* is bounded by São Miguel do Araguaia (Goiás, Brazil) in the north, Presidente Olegário (Minas Gerais, Brazil) in the east, Saladas (Corrientes, Argentina) in the south, and Libertad

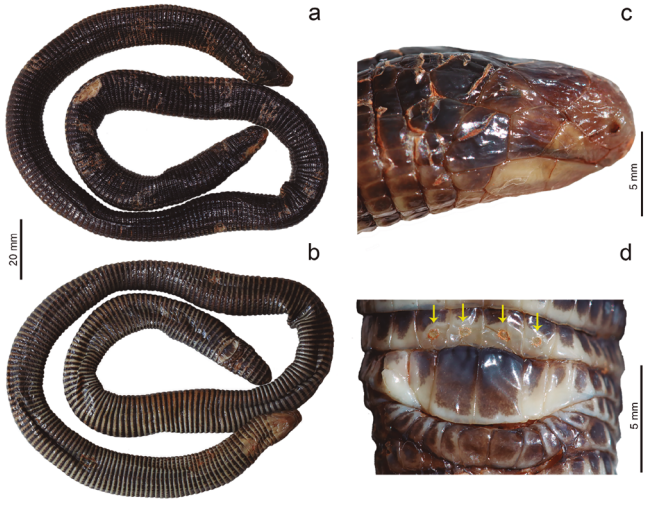

Figure 1. Details of the specimen *of Amphisbaena mertensii* (MZUFV 1449) preyed upon by *Aramides cajaneus* in Presidente Olegário, Minas Gerais, Brazil. **a**. dorsal view, **b.** ventral view, **c**. lateral view of the head, **d**. detail of the precloacal pores.

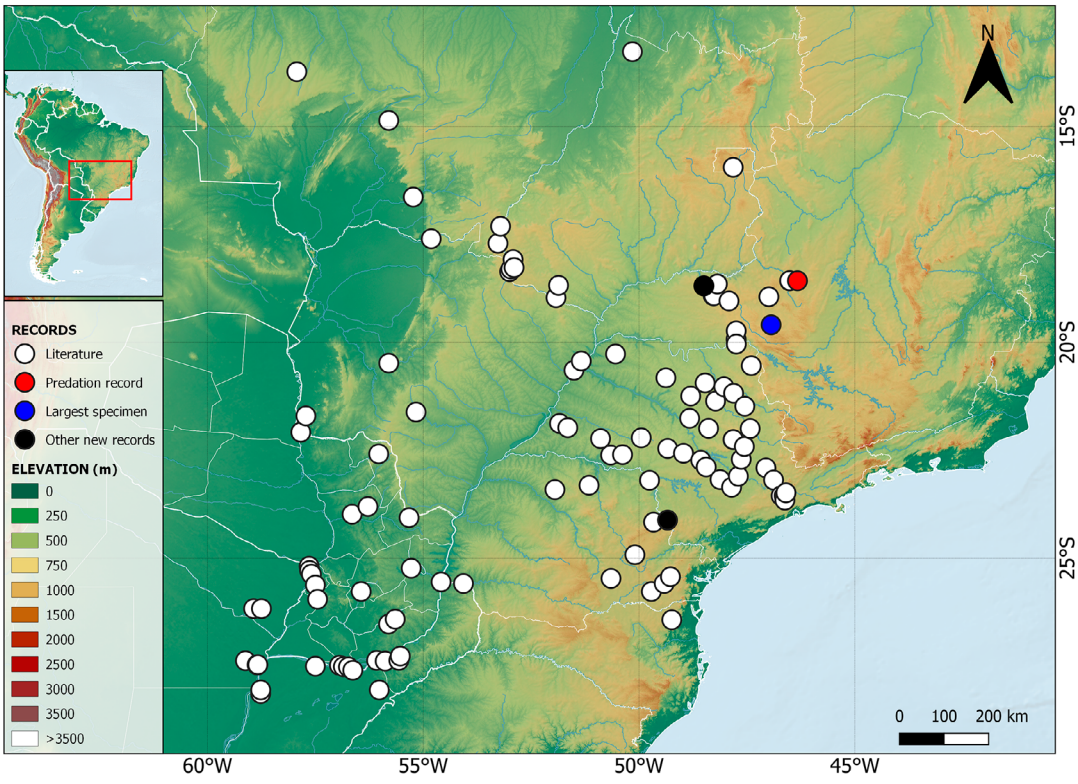

Figure 2. Known records of *Amphisbaena mertensii* based on a literature review and new records (largest specimen and predation). Topography data from http://srtm.csi.cgiar.org/

(Chaco, Argentina) in the west. The species can be found from low to mid-elevations, up to about 1000 m above sea level (Fig. 2). Its broad range reflects its capacity to inhabit a great variety of soil types, from loose sand to fine clay (FAO *et al.* c2012), although its skull type is not among those most specialized for burrowing (Gans 1968). This suggests that individuals of *A. mertensii* inhabit shallower soil depths and may forage on the surface more frequently (Gans 1968). The broad geographic range of *A. mertensii* may also suggest a cryptic diversity (Sampaio *et al.* 2015, Salvi *et al.* 2018) that deserves further attention and was previously suggested by Gans (1966).

We also highlight some questions about the type locality of *Amphisbaena mertensii*. The holotype this species was collected by Karl Heinrich Mertens (1796–1830) during a circumnavigation expedition between 1826 and 1829 (Lütke 1835, Strauch 1881). Strauch (1881) states that Mertens likely collected the specimen at some point on the coast of South America. Gans (1966) restricted the type locality of *A. mertensii* to the state of São Paulo, southeastern Brazil, based on the morphological affinities of the holotype with specimens from that region. However, the corvette Seniavine, of which Mertens was the chief naturalist, left Russia in September 1826, reaching Rio de Janeiro on the southeastern Brazilian coast on 7 January 1827, departing to Argentina and Cape Horn later that month (Lütke 1835). Apparently the Seniavine did not dock at any locality with known records of *Amphisbaena mertensii*, which raises some questions: Did Mertens receive the holotype from another person who collected it, in São Paulo? Did Mertens collect the specimen in Rio de Janeiro, from which no other specimen of *A. mertensii* is known? Was there a labeling mistake and the holotype is not actually linked to the Seniavine expedition? Further investigation is needed to resolve this issue.

While one of us (HCC) was examining worm lizard specimens in scientific collections, the largest known individual of *A. mertensii* was recorded: MCN-R 6182, from Araxá, Minas Gerais, Brazil. The specimen measures 458 mm SVL and 11 mm TL (autotomized), 11 % longer than the previous SVL record of 410 mm (Gans 1966). This data places *A. mertensii* as the 10th largest Neotropical amphisbaenian species, after *A. alba* Linnaeus, 1758 (810 mm; Colli and Zamboni 1999), *Leposternon infraorbitale* (Berthold, 1859) (635 mm; Gans 1971), *A. bolivica* Mertens, 1929 (569 mm; Montero 1996), *A. fuliginosa* Linnaeus, 1758

(555 mm; Vanzolini 1951, 2002b), *L. microcephalum* Wagler, 1824 (~550 mm; Gans 1971), *A. camura* Cope, 1862 (535 mm; Montero 1996), *L. scutigerum* Hemprich, 1820 (~500 mm; Gans 1971), *L. wuchereri* (Peters, 1879) (~500 mm; Gans 1971), and *L. polystegum* (Duméril, 1851) (470 mm; Gomes *et al.* 2009).

The specimen collected during the predation event is also interesting in its morphology. MZUFV 1449 measures 400 mm SVL and presents 242 body annuli, six caudal annuli (autotomized), 20 dorsal and 22 ventral midbody segments, three supralabials, three infralabials (Fig. 1), characteristics typical of *Amphisbaena mertensii* (Gans 1966). However, the number of precloacal pores (four) is outside the known range for this species, previously reported as five to eight, usually six (Gans 1966, Silveira *et al.* 2012). This is a rare condition that is noteworthy since the number of precloacal pores is a taxonomic character for amphisbaenians (Gans and Alexander 1962, Vanzolini 2002a).

Basic data on natural history, geographic range, and morphology expand the understanding of patterns and processes related to life on Earth (Vitt 2013, Hortal *et al.* 2015, Feldman *et al.* 2016, Schalk and Cove 2018). This is especially necessary for fossorial taxa such as amphisbaenians (Böhm *et al.* 2013, Colli *et al.* 2016). By reporting a previously unknown predator for *Amphisbaena mertensii*, compiling updated information about its geographic range, and recording new morphological data, we help to expose some secrets of those underground reptiles.

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AUTHOR'S CONTRIBUTION

CLA collected field work data, prepared images, and wrote the text; HCC examined specimens, gathered literature data, prepared the map, and wrote the text; LR gathered literature data and wrote the text; RNF reviewed the text.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

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