

## Distribution extension of *Amphisbaena lumbricalis* Vanzolini, 1996 with its first predation record by snake *Erythrolamprus viridis* (Günther, 1862)

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### ABSTRACT

We expand the geographical distribution of *Amphisbaena lumbricalis* throughout the first record for a semiarid Caatinga area in the Paraíba state, northeastern Brazil. Furthermore, we report the first predation report of *A. lumbricalis* by the snake *Erythrolamprus viridis*. Our findings contribute with information about the habitats occupied by a hitherto considered “Data Deficient” species, beyond to reveal the potential of *E. viridis* to prey upon reptiles.

Key Words: Geographical Distribution; Predator-Prey Interaction; Caatinga.

Data on geographic distribution is essential to support conservation actions and effective species management. Although representing about 20% of the world's reptiles and amphibians, the fossorial herpetofauna is still poorly known (Measey, 2006). Fossorial reptiles have received relatively little attention, and the lack of knowledge about these animals is usually attributed to their secretive habits, which leads to several sampling difficulties (Frey, 2006; Filho *et al.*, 2013). *Amphisbaenia* is one of the major groups of fossorial reptiles, and like any secretive species, studies on several aspects, such as natural history, ecology, and distribution, are still scarce (Pearse and Pogson, 2000; Macey *et al.*, 2004).

Currently, *Amphisbaenia* congregates approximately 200 described species, from six families (*Amphisbaenidae*, *Bipedidae*, *Blanidae*, *Cadeidae*, *Rhineuridae*, and *Trogonophidae*) with a wide geographical distribution, since the Neotropical region,

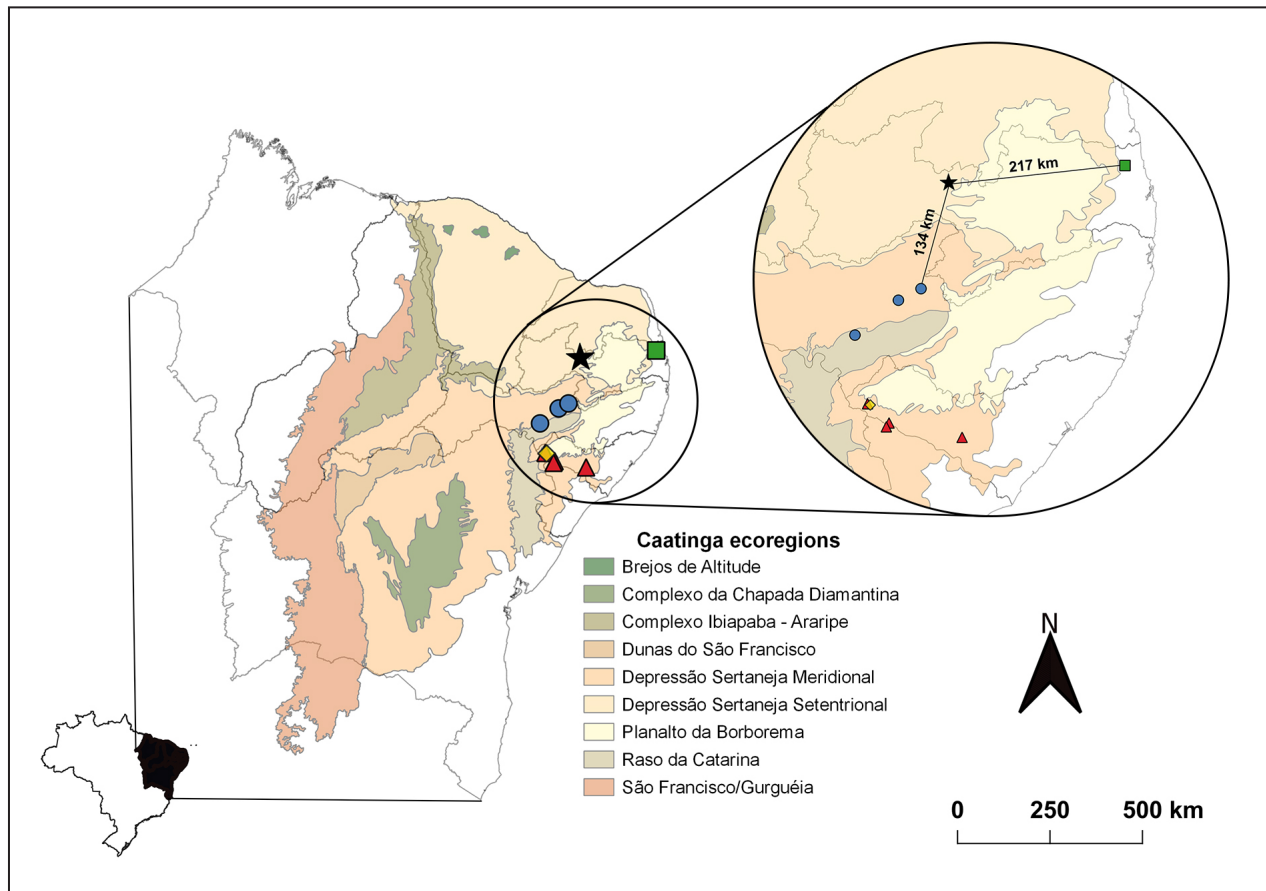
sub-Saharan Africa, parts of the Mediterranean region, Baja California, and Florida (Vitt and Caldwell, 2014; Longrich *et al.*, 2015; Uetz *et al.*, 2020). *Amphisbaenidae*, the most diverse family (ca. 170 species), is distributed throughout South America and Africa (Gans, 2005; Vidal *et al.*, 2008; Uetz *et al.*, 2020). Around 40% (80 species) of all *amphisbaenids* occur in Brazil, and 27 species along the semiarid Caatinga (Almeida *et al.*, 2018; Costa and Bérnils, 2018; Ribeiro *et al.*, 2018, Uetz *et al.*, 2020).

*Amphisbaena lumbricalis* Vanzolini, 1996 was described to the Xingó Hydroelectric Power Plant located in the lower São Francisco River, which divides the states of Alagoas and Sergipe in the Northeast region from Brazil (Vanzolini, 1996). Initially, its distribution was in Delmiro Gouveia and Piranhas's municipalities in Alagoas state, and in Canindé de São Francisco in Sergipe state (Vanzolini, 1996). In 2015, it was recorded for Traipu municipality in Ala-

goas state (100 km to its southeast site), in an ecotone between Atlantic Forest and Caatinga environments, including a non-sandy area (Galdino *et al.*, 2015). Subsequently, it was extended to the Pernambuco state, for the municipalities of Custódia, Floresta and Sertânia associated with several soil types (Tavares *et al.*, 2017). The last distribution update was recorded to the Reserva Biológica Guaribas (hereafter REBIO Guaribas) in the Mamanguape municipality, Paraíba state, an integral protection unit inserted in the Atlantic Forest domain (Mesquita *et al.*, 2018). Herein, we expand the geographical distribution of *A. lumbricalis* throughout the first record for a Caatinga area in the Paraíba state, beyond to report the first predation case of *A. lumbricalis* by the snake *Erythrolamprus viridis* (Günther, 1862).

During a snake ecology study in several herpetological collections in the northeastern Brazil, we found one specimen of *A. lumbricalis* in exami-

ning gut contents of a specimen of *Erythrolamprus viridis* housed in the herpetological collection of the Universidade Federal da Paraíba – CHUFPB. The predator (CHUFPB 17237) was an adult male with 403 mm of snout-vent length collected at São Mamede municipality, Paraíba state (Fig. 1). The predator's identity was determined by a combination of following meristic characters: 19/19/17 dorsal, 185 ventral, divided subcaudal, and eight supralabial scales. The prey consisted in the anterior region of an individual of *A. lumbricalis* with 57.2 mm of length, and 3.2 mm of diameter, which was housed in the scientific collection Coleção Herpetológica do Semiárido – CHSA at Universidade Federal Rural do Semi-Árido. Despite this material (CHSA R 1714) was in an advanced degree of deterioration, we were able to precisely identify the target species by its slender body diameter and typical cephalic scutellation. In comparison with other slender am-



**Figure 1.** Updated distribution map of *Amphisbaena lumbricalis*. Black star constitutes the new record to São Mamede municipality in Paraíba state. Colorful symbols correspond to the previously known records: yellow diamond (type-locality; Xingó - Alagoas; Vanzolini, 1996), red triangles (Delmiro Gouveia, Piranhas and Traipu - Alagoas; Canindé do São Francisco - Sergipe; Galdino *et al.*, 2015), blue circles (Custódia, Floresta, Sertânia - Pernambuco; Tavares *et al.*, 2017), and green square (Mamanguape - Paraíba; Mesquita *et al.*, 2018). Caatinga ecoregions follows Silva *et al.* (2017).

phisbaenian species, the size and shape of posterior edge of frontal scales allow to distinguish *A. lumbricalis* from *A. hastata* Vanzolini, 1991 (greater angle between two smaller frontal scales) and *A. heathi* Schmidt, 1936 (smaller angle between two larger frontal scales); the shape of anterior edge of frontal scales allows to distinguish *A. lumbricalis* from *A. ignatiana* Vanzolini, 1991 (arched anterior edge and greater angle between two frontal scales); and the size and shape of prefrontal scales allow to

distinguish *A. lumbricalis* from *A. carvalhoi* Gans, 1965 (smaller and shorter prefrontal scales).

Our record of *A. lumbricalis* to São Mamede municipality in Paraíba state extends its distribution (Fig. 1, Table 1) by 134 km Northeast from the nearest previously recorded locality (Sertânia municipality, Pernambuco state), and by 217 km W from the northeast known occurrence site (Mamanguape municipality, Paraíba state). This latter was the first record of *A. lumbricalis* to Paraíba state,

**Table 1.** Detailed information of all known geographical records of *Amphisbaena lumbricalis*. Acronyms: CHSAR - Coleção Herpetológica do Semiárido, MFCH - Coleção de Herpetologia do Museu de Fauna da Caatinga, MUFAL - Museu de História Natural da Universidade Federal de Alagoas, MZUSP - Museu de Zoologia da Universidade de São Paulo, and RT Coleção Herpetológica da Universidade Federal da Paraíba em Rio Tinto.

Municipality	State	Ecoregion	Latitude	Longitude	Voucher	Source
Hydroelectric of Xingó, on the left bank of the Rio São Francisco (type locality)	Alagoas	Depressão Sertaneja Meridional	-9.400	-37.967	MZUSP 79433 MZUSP 79434-79490 MZUSP 79419-79432	Vanzolini, 1996
Delmiro Gouveia	Alagoas	Depressão Sertaneja Meridional	-9.386	-37.997	MUFAL 2790	Galdino <i>et al.</i> , 2015
Piranhas	Alagoas	Depressão Sertaneja Meridional	-9.600	-37.759	MUFAL 2785, 2786, 2787, 2802, 2803, 2804, 2805; 2493	Galdino <i>et al.</i> , 2015
Traipu	Alagoas	Depressão Sertaneja Meridional	-9.759	-36.948	MUFAL 9071; 9812	Galdino <i>et al.</i> , 2015
Canindé do São Francisco	Sergipe	Depressão Sertaneja Meridional	-9.642	-37.789	MUFAL 2777; 2778; 2779; 2780; 2781; 2782; 2783; 2784; 2789; 2796; 2797; 2798; 2800; 2806; 2807; 2808; 2809; 2811; 2812; 2813; 2814; 2815; 2816; 2817; 2818; 2819	Galdino <i>et al.</i> , 2015
Custódia	Pernambuco	Depressão Sertaneja Meridional	-8.237	-37.655	MFCH 2183	Tavares <i>et al.</i> , 2017
Floresta	Pernambuco	Raso da Catarina	-8.624	-38.137	MFCH 2180	Tavares <i>et al.</i> , 2017
Sertânia	Pernambuco	Depressão Sertaneja Meridional	-8.109	-37.404	MFCH 2163	Tavares <i>et al.</i> , 2017
Mamanguape	Paraíba	Atlantic Forest	-6.742	-35.142	RT 0267	Mesquita <i>et al.</i> , 2018
São Mamede	Paraíba	Depressão Sertaneja Setentrional	-6.932	-37.097	CHSAR 1714	Present study

in the REBIO Guaribas, despite there is no detailed information on the habitat in which voucher specimens were collected (Mesquita *et al.* 2018). However, REBIO Guaribas is inserted in the Atlantic Forest domain, including complex vegetation formations throughout its range (Barbosa *et al.*, 2011; Melo

and Vieira, 2017; Costa-Lima and Alves, 2018), as the *Tabuleiros*, and Stational Semidecidual Forest (Oliveira-Filho and Carvalho, 1993; Mesquita *et al.*, 2018). Therefore, our findings constitute the second record of *A. lumbricalis* for the Paraíba state and the first record for the semiarid Caatinga in this state.

This new site is a typical Caatinga area located in the Depressão Sertaneja Setentrional ecoregion (Fig. 1, Table 1), constituted by hyperoxerophilous vegetation and deciduous forest patches. Thus, we contributed with information about the mesohabitats occupied by *A. lumbricalis*, which still remains categorized as “Data Deficient “ for conservation purposes (Mott, 2010).

Regarding the predation record, the genus *Erythrolamprus* belongs to an anuran-eating snakes guild, whose the most species from Caatinga can be considered anuran specialists (Vitt, 1983). One of them is *Erythrolamprus viridis*, a small diurnal and terrestrial snake whose ecology remains poorly studied. A pioneering study described that *E. viridis* feed on frogs, treefrogs, and toads (Vitt and Vangilder, 1983), but recently, it was recorded that it can also prey lizards (Mesquita *et al.*, 2013). An *Amphisbaena* recorded in the digestive tract of *E. viridis* expands its prey list, reinforcing its ability to preying reptiles. Although this event might be considered fortuitous, further studies on ecology of *E. viridis* are required to a better understanding of its dietary preferences. However, due to their secretive habits, these occasions provide a unique opportunity to acquire natural history data on such species guild.

Despite its fossorial habits, amphisbaenians are preyed by a sort of predators, as such as many birds (Folly *et al.*, 2015; Hayes *et al.*, 2015), mammals (Oliveira *et al.*, 2004; Soibelzon *et al.*, 2007) and snakes (Marques and Sazima, 1997; Maschio *et al.*, 2010). Many fossorial snakes commonly prey on amphisbaenians, like elapids (Zamprogno and Sazima, 1993; Cisneros-Heredia, 2005) and Elapomorphini species (Duarte, 2006; Caramaschi and Niemeyer, 2012). However, the consumption of worm lizards by terrestrial snakes is much scarcer. Dixon (1989) reported this behavior for the Xenodontini *Erythrolamprus poecilogyrus* (Wied-Neuwied, 1825) and Barbo and Marques (2003) for the Echinantherini *Taeniophallus affinis* (Günther, 1858). Our finding for *E. viridis* reveals its potential on preying amphisbaenians, allowing us to consider that this behavior is less rare than expected between Xenodontini snakes.

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### Literature cited

- Almeida, J.P.F.A.; Freitas, M.A.; Silva, M.B.; Valverde, M.C.C.; Rodrigues, M.T.; Pires, A. M. & Mott, T. 2018. A new four-pored *Amphisbaena* (Squamata: Amphisbaenidae) from northeastern Brazil. *Zootaxa* 4514: 553-562.
- Barbo, F.E. & Marques, O.A.V. 2003. Do aglyphous colubrid snakes prey on live amphisbaenids able to bite? *Phyllomedusa* 2: 113-114.
- Barbosa, M.R.V.; Thomas, W.W.; Zárate, E.L.P.; Lima, R.B.; Agra, M.F.; Lima, I.B.; Pessoa, M.C.R.; Lourenco, A.R.L.; Delgado Junior, G.C.; Pontes, R.A.S.; Chagas, E.C.O.; Viana, J.L.; Gadelha Neto, P.C.; Araújo, C.M.L.R.; Araújo, A.A.M.; Freitas, G.B.; Lima, J.R.; Silva, F.O.; Vieira, L.A.F.; Pereira, L.A.; Costa, R.M.T.; Duré, R.C. & Sá, M.G.V. 2011. Checklist of the Vascular Plants of the Guaribas Biological Reserve, Paraíba, Brazil. *Revista Nordestina de Biologia* 20: 79-106.
- Caramaschi, U. & Niemeyer, H. 2012. Unsuccessful predation of *Elapomorphus quinquelineatus* (Serpentes: Colubridae) on *Amphisbaena microcephala* (Amphisbaenia: Amphisbaenidae). *Herpetology Notes* 5: 429-430.
- Cisneros-Heredia, D.F. 2005. Predation upon *Amphisbaena fuliginosa* LINNAEUS, 1758 by *Micrurus ancoralis* (JAN, 1872). *Herpetozoa* 18: 93-94.
- Costa, H.C. & Bérnils, R.S. 2018. Répteis do Brasil e suas unidades federativas: lista de espécies. *Herpetologia Brasileira* 7: 11-57.
- Costa-Lima, J.L. & Alves, M. 2018. Flora da Reserva Biológica Guaribas, Estado da Paraíba, Brasil: Erythroxylaceae. *Hoehnea* 45(3): 372-378.
- Dixon, J. 1989. Prey items of 20 species of the neotropical colubrid snake genus *Liophis*. *Herpetological Review* 20: 139-141.
- Duarte, M.R. 2006. *Phalotris mertensi* (False coral snake) and *Amphisbaena mertensi* (NCN). Predation. *Herpetological Review* 37: 234.
- Filho, J.D.B.; Freitas, M.A.; Silva, T.F.S.; Valverde, M.C.C.; Loguercio, M.F.C. & Verissimo, D. 2013. On the Distribution and Habitat of *Leposternon octostegum* (Duméril, 1851) (Squamata: Amphisbaenidae). *Wildlife Biology in Practice* 9: 1-6.
- Folly, H.; Neves, M.O.; Pereira, E.A.; Hote, P.; Souza, R.A. & Santana, D.J. 2015. Predation on *Leposternon microcephalum* (Squamata, Amphisbaenidae) by *Cariama cristata* (Cariamiformes, Cariamidae). *Herpetology Notes* 8: 465-466.
- Frey, J. K. 2006. Inferring species distributions in the absence of occurrence records: An example considering wolverine (*Gulo gulo*) and Canada lynx (*Lynx canadensis*) in New Mexico. *Biological conservation* 30: 16-24.
- Galdino, J. Y.; Gonçalves, U.; Matias, G. & Torquato, S. 2015. *Amphisbaena lumbricalis* Vanzolini, 1996 (Squamata: Amphisbaenidae). Distribution extension and map. *Boletim do Museu de Biologia Mello Leitão* 37: 293-299.
- Gans, C. 2005. Checklist and Bibliography of the Amphisbaenia of the World. *Bulletin of the American Museum of Natural History* 289: 1-130.
- Hayes, F.E.; Capllonch, P. & Montero, R. 2015. Predation on *Amphisbaena heterozonata* (Squamata: Amphisbaenidae) by the whistling heron *Syrigma sibilatrix* (Pelecaniformes:



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- Ardeidae) in Tucumán, Argentina. *Revista Brasileira de Ornitologia* 23: 395-397.
- Longrich, N.R.; Vinther, J.; Pyron, R.A.; Pisani, D. & Gauthier, J.A. 2015. Biogeography of worm lizards (Amphisbaenia) driven by end-Cretaceous mass extinction. *Proceedings of the Royal Society B: Biological Sciences*, 282: 20143034.
- Macey, J.R.; Papenfuss, T.J.; Kuehl, J.V.; Fourcade, H.M. & Boore, J.L. 2004. Phylogenetic relationships among amphisbaenian reptiles based on complete mitochondrial genomic sequences. *Molecular Phylogenetics and Evolution* 33: 22-31.
- Marques, O.A.V. & Sazima, I. 1997. Diet and feeding behavior of the coral snake, *Micrurus corallinus*, from the Atlantic forest in Brazil. *Herpetological Natural History* 5: 88-93.
- Maschio, G.F., Prudente, A.L.D.C., Rodrigues, F.D.S. & Hoogmoed, M.S. 2010. Food habits of *Anilius scytale* (Serpentes: Aniliidae) in the Brazilian Amazonia. *Zoologia* 27: 184-190.
- Measey, G.J. 2006. Surveying biodiversity of soil herpetofauna: towards a standard quantitative methodology. *Journal of Soil Biology* 42: 103-110.
- Melo, J.I.M. & Vieira, D.D. 2017. Flora da Reserva Biológica Guaribas, PB, Brasil: Boraginaceae. *Hoehnea* 44: 407-414.
- Mesquita, D.O.; Alves, B.C.F.; Pedro, C.K.B.; Laranjeiras, D.O.; Caldas, F.L.S.; Pedrosa, I.M.M.C.; Rodrigues, J.B.; Drummond, L.O.; Cavalcanti, L.B.Q.; Wachlewski, M.; Nogueira-Costa, P.; França, R.C. & França, F.G.R. 2018. Herpetofauna in two habitat types (tabuleiros and Stational Semidecidual Forest) in the Reserva Biológica Guaribas, northeastern Brazil. *Herpetology Notes* 11: 455-474.
- Mesquita, P.C.M.D.; Passos, D.C.; Borges-Nojosa, D.M. & Cechin, S.Z. 2013. Ecologia e história natural das serpentes de uma área de Caatinga no Nordeste brasileiro. *Papéis Avulsos de Zoologia* 53: 99-113.
- Mott, T. 2010. *Amphisbaena lumbricalis*. The IUCN Red List of Threatened Species 2010. Available in: <https://www.iucnredlist.org/species/176227/7200503>. Last access: 30 October 2020.
- Oliveira, M.; Ribas, E.R. & Moura-Leite, J.C. 2004. *Leposternon microcephalum* (NCN). Predation. *Herpetological Review* 35: 170-171.
- Oliveira-Filho, A.D. & Carvalho, D.D. 1993. Florística e fisionomia da vegetação no extremo norte do litoral da Paraíba. *Revista brasileira de botânica* 16: 115-130.
- Pearse, D. & Pogson, G. 2000. Parallel evolution of the melanistic form of the California legless lizard, inferred from mitochondrial DNA sequence variation. *Evolution* 54: 1041-1046.
- Ribeiro, L.B.; Gomides, S.C. & Costa, H.C. 2018. A new species of *Amphisbaena* from Northeastern Brazil (Squamata: Amphisbaenidae). *Journal of Herpetology* 52: 234-241.
- Silva, J.M.C.; Leal, I.R. & Tabarelli, M. 2017. Caatinga - The Largest Tropical Dry Forest Region in South America. Springer. Switzerland.
- Soibelzon, E.; Daniele, G.; Negrete, J.; Carlini, A.A. & Plischuk, S. 2007. Annual diet of the little hairy armadillo, *ChaetophRACTUS vellerosus* (Mammalia, Dasypodidae), in Buenos Aires Province, Argentina. *Journal of Mammalogy* 88: 1319-1324.
- Tavares, A.P.G.; Carvalho, J.J.S. & Ribeiro, L.B. 2017. First record of *Amphisbaena lumbricalis* (Squamata, Amphisbaenidae) in the state of Pernambuco, Brazil: including a distribution map and soil classification of its occurrence. *Herpetology Notes* 10: 19-22.
- Uetz, P.; Freed, P. & Jiri, H. (eds.). 2020. The Reptile Database. Available in: <http://www.reptile-database.org>. Last access: 17 September 2020.
- Vanzolini, P.E. 1996. On slender species of *Amphisbaena*, with the description of a new one from northeastern Brazil (Reptilia, Amphisbaenia). *Papéis Avulsos de Zoologia* 39: 293-305.
- Vidal, N.; Azvolinsky, A.; Cruaud, C. & Hedges, S.B. 2008. Origin of tropical American burrowing reptiles by transatlantic rafting. *Biology Letters* 4: 115-118.
- Vitt, L.J. & Caldwell, J.P. 2014. Herpetology. An Introductory Biology of Amphibians and Reptiles. Elsevier.
- Vitt, L.J. & Vangilder, L.D. 1983. Ecology of a snake community in Northeastern Brazil. *Amphibia-Reptilia* 4: 273-296.
- Vitt, L.J. 1983. Ecology of an anuran-eating guild of terrestrial Tropical snakes. *Herpetologica* 39: 52-66.
- Zamprogno C. & Sazima, I. 1993. Vertebrate predation on the neotropical amphisbaenian *Leposternon wuchereri*. *Herpetological Review* 24: 82-83.

