

Are there threatened snakes at the end of the rainbow? Notes on the distribution and morphology of *Epicrates cenchria*, Rainbow Boa, in the Brazilian Atlantic Forest

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Recibida: 16 Setiembre 2019

Revisada: 29 Abril 2020

Aceptada: 17 Julio 2020

Editor Asociado: A. Prudente

doi: 10.31017/CdH.2020.(2019-030)

ABSTRACT

We report on new voucher specimens of *Epicrates cenchria* to the meridional limits of its distribution in the Atlantic Forest. We provide data on the meristic, morphometric and hemipenial morphology features for this southernmost population. We review the recent published record of *E. cenchria* for the locality of Iguará, state of São Paulo, Brazil, and reidentify it specimen herein to as *E. crassus*. Finally, we comment on the niche models available to *E. cenchria* and other congeners, suggesting outstanding issues that require additional studies.

Key Words: Boidae, Conservation, *Epicrates* spp. distribution, *Epicrates cenchria*, Southern Atlantic Forest.

The genus *Epicrates* Wagler, 1830 comprises five species popularly known as Rainbow Boas due to the general iridescence effect of their dorsal scales under sunlight (Fig. 1). It is endemic to the Neotropical region, occurring from Nicaragua to northwestern Argentina (Passos and Fernandes, 2009; Reynolds and Henderson, 2018; Uetz *et al.* 2019), and all its species feed preferably on small mammals (marsupials and rodents) and birds (Pizzatto *et al.*, 2009). *Epicrates cenchria* occurs along the Amazonian rainforest with a disjunct set of populations in the Brazilian Atlantic rainforest spreading from Pernambuco to Rio de Janeiro states (Passos and Fernandes, 2009).

To date, the occurrence of *Epicrates cenchria* in the state of Rio de Janeiro, southeastern Brazil, requires voucher specimens. Passos and Fernandes (2009) reported the species to the municipality of Rio das Flores, in the boundary between Rio de Janeiro and Minas Gerais states following Passos (2003), without a detailed explanation justifying this record. In fact, such a record referred to a specimen donated alive to Instituto Vital Brazil (located in the municipality of Niterói, state of Rio de Janeiro, Brazil), that escaped from the captivity on a weekend (Aníbal Melgarejo pers. comm. to P. Passos in July 2002). Since then, no other records of the species in

Rio de Janeiro came to light.

In the course of curatorial work of the herpetological collection of Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ), we found new specimens of *Epicrates cenchria* from three different localities of Rio de Janeiro that corroborates the presence of this species in the state and represents the southernmost area of its occurrence in the Atlantic Forest domain. Thus, we herein provide details on the localities of occurrence, the distribution of *E. cenchria* in southeastern Brazil, as well as additional information on meristic, morphometric and hemipenial morphology of this population.

The new records are from the municipality of Macaé, RJ-168 Highway, 22°21'20"S; 41°54'52"W (MNRJ 20349), and RJ-106 Highway, 22°18'44"S; 41°43'38"W (MNRJ 20350), both collected on February 26 2011 by Adriano Lima Silveira and team; and Cachoeiras de Macacu, Km 35 of the BR-116 Highway, 22°30'26.64"S; 42°41'16.8"W (MNRJ 27233), collected in August 2018 by Cecília Bueno and team (Appendix 1). The meristic and morphometric data of the individuals is synthesized in Table 1. The hemipenial morphology of the specimen MNRJ 27233 resembles the organs of other specimens from Amazonia and Atlantic Forest, but



Figure 1. General view in life of a specimen of *Epicrates cenchria* (MNRJ 9805; male 1250 mm SVL) from Reserva Biológica Santa Lúcia, municipality of Santa Teresa, state of Espírito Santo, Brazil. Photo by B. Pimenta.

differs from these populations (see Passos and Fernandes, 2009) by having the hemipenial body similar in size to the papillate lobes, transversal flounces (=horizontally continuous) more conspicuous on the sulcate face and more numerous on the asulcate face of the organ (Fig. 2).

In Brazil, *Epicrates cenchria* occurs in sympatry with *E. assisi* in the states of Alagoas, Bahia, Minas Gerais and Pernambuco; with *E. crassus* in the

states of Bahia, Goiás, Mato Grosso, Minas Gerais, and Tocantins, and with *E. maurus* in the states of Amapá, Pará and Roraima (Passos and Fernandes, 2009). Beyond the borders of Brazil, *E. cenchria* also co-occurs with *E. maurus* in Venezuela, in the states of Táchira, Amazonas and Bolívar (Barrio-Amorós and Díaz de Pascual, 2008). All these regions represent ecotonal areas between rainforest and open formations, riparian forests associated with rivers

Table 1. Meristic and morphometric characters for the three specimens of *Epicrates cenchria* recorded in the state of Rio de Janeiro, Brazil. We report bilateral counts as “right side/left side”.

Specimen	MNRJ 20349	MNRJ 20350	MNRJ 27233
Sex	Male	Male	Male
Snout-vent length (SVL)	1007 mm	1100 mm	1346 mm
Tail length	173 mm	160 mm	213 mm
Dorsals (near the head/midbody)	37/49	38/50	36/46
Ventrals	261	257	261
Subcaudals	13	13	12
Supralabials	13/13	13/13	12/12
Infralabials	14/13	13/13	14/14
Number of ocelli (right side of body)	36	44	40

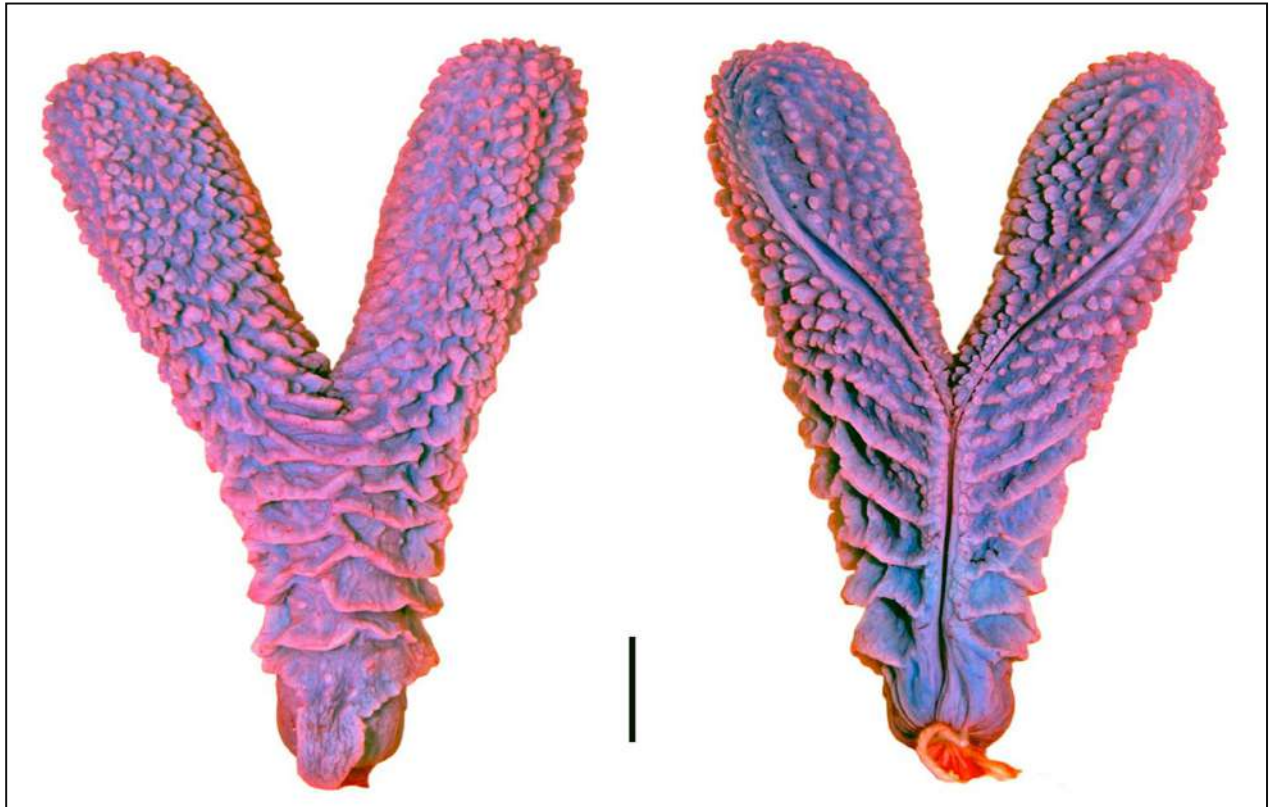


Figure 2. Asulcate (left) and sulcate (right) faces of the hemipenis of *Epicrates cenchria* (MNRJ 27233) from municipality of Cachoeiras de Macacu, state of Rio de Janeiro, Brazil. Scale bar= 10 mm.

or secondary open areas that replaced original ombrophilous forests (cf. Barrio-Amorós and Díaz de Pascual, 2008; Passos and Fernandes, 2009). Rivera *et al.* (2011) performed a molecular phylogeny and a detailed niche modeling analysis to the genus *Epicrates*, broadly corroborating the species boun-

daries proposed by Passos and Fernandes (2009). Nonetheless, except for *E. alvarezii* and *E. maurus*, the occurrence probability maps for the genus presented some inconsistencies (Rivera *et al.*, 2011:1-6; Figs. 2, 3, 4 [in part] and 6 [in part]). Rivera *et al.* (2011) did not recover areas of Atlantic Forest as suitable habitats to occurrence of *E. cenchria*, suggesting that these populations would be geographically isolated and ecologically divergent from other populations of the region. We argue that such models should be revisited considering the past environmental conditions, as well as the current levels of massive deforestation on this biome (Andrade-Junior. *et al.* in prep.). Despite putative problems with dataset labels or analyses in the course of modeling, our data confirm that *E. cenchria* distribution in fact occurs in Brazilian Atlantic Forest (see figure 8 of Passos and Fernandes, 2009), including broadly impacted areas in the domain (Fig. 3).

More recently, Marques *et al.* (2019: 217) reported a specimen of *Epicrates crassus* misidentified as *E. cenchria* to the locality of Ipiгуá, state of São Paulo, Brazil. Thus, the southernmost records of *E. cenchria* on the Brazilian coast are those from the above-mentioned records of Rio das Flores from the

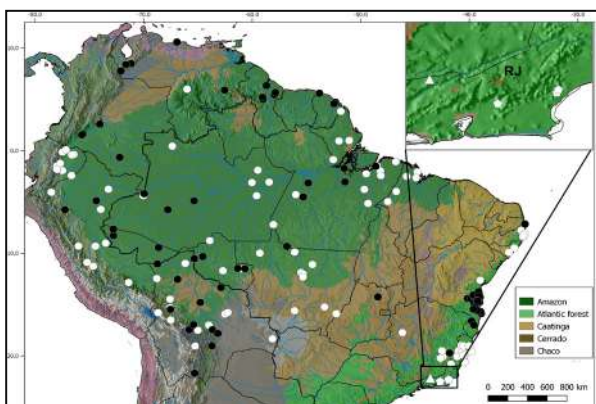


Figure 3. Geographic distribution of *Epicrates cenchria*, comprising the new and southernmost records within the species' corology. The symbols are as follows: white circles= specimens examined (cited in Passos and Fernandes, 2009, increased by Appendix 1); black circles= literature data (see Appendix 2); white pentagons= new records with voucher specimens; and white triangle= record without voucher specimen.

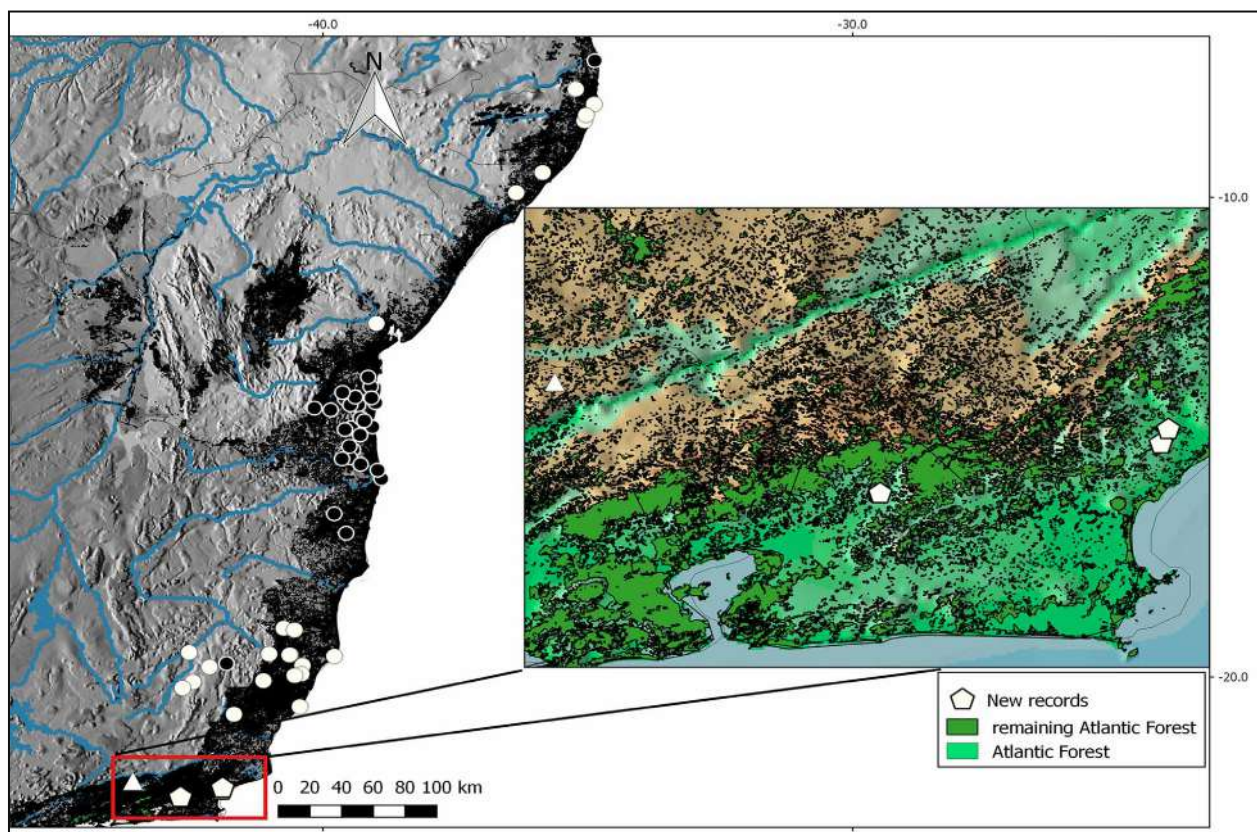


Figure 4. Atlantic Forest remnants based on SOS Mata Atlântica foundation 2016-2017, showing in detail the southernmost records for *Epicrates cenchria*. The symbols are as follows: white circles= specimens examined (cited in Passos and Fernandes, 2009, increased by Appendix 1); black circles= literature data (see Appendix 2); white pentagons= new records with voucher specimens; and white triangle= record without voucher specimen.

Instituto Vital Brazil (lacking voucher specimen) and Cachoeiras de Macacu (voucher MNRJ 27233; Fig. 3). The meridional limits of distribution of *E. cenchria* in the coastal Brazilian Atlantic Forest follows the pattern of other booid taxa such as *Boa constrictor*, which southernmost record lies in Ilha Grande, southern of the state of Rio de Janeiro, Brazil (Rocha *et al.*, 2018). Therefore, considering the high levels of deforestation on the Atlantic and Amazonian rainforests (see Escobar, 2019), the conservation status of species restricted to such biomes, as *E. cenchria*, are deserve attention. Such a threat is especially alarming from the point of view of unique biogeographic patterns associated with threatened areas (see Funk *et al.*, 2002), illustrated by the progressive fragmentation on the southern portions of the Atlantic Forest (Fig. 4).

During execution of this study, we faced great political and economic difficulties by lack of political representativeness and research financing in Brazil. More seriously, the new Brazilian environmental legislations revealed unable to exchange of scientific information with other countries by erroneous or

malicious interpretations of international biodiversity conventions (Alves *et al.*, 2018). To complicate matters, the Brazilian federal government has dismantled the control apparatus of IBAMA agency, weakening the fight against environmental crimes along the country, in parallel with permissions to exploit fully protected reserves. In the face of so many difficulties, the Atlantic Forest that had been registering a recent drop in deforestation, unfortunately returned to suffer a major impact between 2018-2019 with about 30% deforestation growth (SOS Mata Atlântica Foundation and INPE, 2020).

Acknowledgements

Paulo Passos is very indebted with Aníbal Melgarejo (*in Memoriam*) for detailed information with respect to the previous occurrence of *Epicrates cenchria* in the state of Rio de Janeiro, and Bruno Pimenta by the slides of *E. cenchria* from the Reserva Santa Lúcia. We thank the anonymous reviewers for the helpful comments on the early version of the manuscript. Albedi Andrade Jr. (88887.371704/2019-00), Viní-

cius Sudré (88887.201311/2018-00), and Matheus S. França (133011/2020-8) thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior and Conselho Nacional de Desenvolvimento Científico e Tecnológico for the scholarship. Financial support for Paulo Passos was provided by Conselho Nacional de Desenvolvimento Científico e Tecnológico (processes 306227/2015-0, 439375/2016-9, 302611/2018-5 and 309560/2018-7) and Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (E-26/202.737/2018).

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Appendix 1

Specimens examined beyond the sample cited by Passos and

Fernandes (2009). The Institutional acronyms follow Sabaj (2019), except for Coleção de Tecidos Animais do Departamento de Ciências Biológicas (UFES-CTA), Universidade Federal do Espírito Santo, Vitória, Brazil. Asterisks correspond to the specimen records with identification confirmed through photos. *Epicrates cenchria*.—Brazil. Rio de Janeiro: Macaé, RJ-168 Highway (MNRJ 20349), RJ-106 Highway (MNRJ 20350); Cachoeiras de Macacu, Km 35 of the BR-116 Highway (MNRJ 27233). Minas Gerais: Ipatinga (19°29'14.1"S; 42°31'33.0"W; MZUFV 1140*). Espírito Santo: Linhares (19°34'00.0"S; 39°47'00.0"W; MNRJ 23874), BR-101 Highway (19°01'16.9"S; 40°00'54.4"W; UFES-CTA 2703*).

Appendix 2

Literature records. Countries are given in bold capitals, states in plain capitals.

Epicrates cenchria.—**BRAZIL**. ACRE: Avila-Pires *et al.* (2009): Juruá. Bernarde *et al.* (2013): lower Moa river, Cruzeiro do Sul. Miranda *et al.* (2014): São José I Farm, Senador Madureira. AMAZONAS: Prudente *et al.* (2010): Petroleum Basin of Urucu, Coari. Leite & Dorado-Rodrigues (2017): Juruá River, Carauari. BAHIA: Martins *et al.* (2018): Ilhéus. MATO GROSSO: Carvalho *et al.* (2017): Nova Canaã. MINAS GERAIS: Palmuti *et al.* (2009): Reserva Particular do Patrimônio Natural Feliciano Miguel Abdala, Caratinga. PARAÍBA: Santana *et al.* (2008): Mata do Buraquinho, João Pessoa. PARÁ: Avila-Pires *et al.* (2009): Curuá-Una. Avila-Pires *et al.* (2018): Parque Estadual do Utinga, Belém. Fiorillo *et al.* (2019): Senador José Porfírio. Mendes-Pinto *et al.* (2011): Floresta Nacional do Trairão, Trairão. Silva *et al.* (2011): Barcarena. Santos-Costa *et al.* (2015): Floresta Nacional de Caxiuanã. Prudente *et al.* (2010): Estação Científica Ferreira Penna, Melgaço. RONDÔNIA: Bernarde & Abe (2006): Espigão do Oeste. Turci & Bernarde (2008): Cacoal. Avila-Pires *et al.* (2009): Guajará-Mirim. **GUYANA**: Cole *et al.* (2013): Dubuluary Ranch, Katarbo, Konawaruk Camp. **PERU**: Solis *et al.* (2015): Pacaya Samiria National Reserve, Confluence of the Marañon and Ucayali rivers, Ucamara depression, Loreto. **VENEZUELA**: Barrio-Amorós & Díaz de Pascual (2008): Uribante dam, Táchira.