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GEOGRAPHIC VARIATION OF THE BRAZILIAN ATLANTIC RAIN
FOREST SNAKE *ATRACTUS MACULATUS* (GÜNTHER, 1858)
WITH THE REVALIDATION OF *RHABDOSOMA ZEBRINUM* JAN, 1862
(SERPENTES: COLUBRIDAE) ⁽¹⁾

(With 2 figures)

RONALDO FERNANDES ⁽²⁾
ELIZA MARIA XAVIER FREIRE ⁽³⁾
Museu Nacional
Universidade Federal do Rio de Janeiro
GIUSEPPE PUORTO ⁽⁴⁾
Instituto Butantan

The colubrid snake genus *Atractus* is a taxonomically complex assemblage of species, containing as much as 80 species, widely distributed over South America. Most species of *Atractus* have restricted ranges and are therefore considerably sensitive to human disturbance. This is especially critical to the species inhabiting the Brazilian Atlantic Rain Forest, which now occupies no more than 8% of its original area due to the intense and not organized human exploitation. Thus, the many species of *Atractus* that are restricted to the Atlantic Rain Forest, *A. maculatus* (Günther, 1858), *A. guentheri* (Wucherer, 1861), *A. potschi* Fernandes, 1995, *A. serranus* Amaral, 1930, and *A. trihedrurus* Amaral, 1926 (FERNANDES & PUORTO, 1994; FERNANDES, 1995a, 1996) are among the ones most threatened by the forest devastation.

GÜNTHER (1858) described a new genus and species, *Isoscelis maculata*, based in one specimen from an unknown locality, although both BOULENGER (1894) and the records of the Natural History Museum in London indicate the snake as from "Brazil?". GÜNTHER (1858) was very impressed by the length of the anterior teeth, which appeared to be much longer than the remaining. Later in his appendix, GÜNTHER (1858), after the opportunity of examining additional specimens from the vicinities of Rio de Janeiro, corrected his earlier observation on teeth length, which then appeared to him to be of the same size, and synonymized *Isoscelis* with

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² Fellow researcher of the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). E-mail: ronnie@acd.ufrj.br

³ Museu de História Natural, Universidade Federal de Alagoas, Rua Aristeu de Andrade 452, Maceió, AL 57021-090, Brazil

⁴ Instituto Butantan, Museu, Av. Vital Brazil 1500, São Paulo, SP 05503-900, Brazil.

Rhabdosoma Duméril, Bibron, and Duméril, 1853. JAN (1862), described and illustrated *Rhabdosoma zebrinum* from a single specimen of unknown locality. Finally, BOULENGER (1894) synonymized *Rhabdosoma* with *Atractus* and relegated *Rhabdosoma zebrinum* to the synonymy of *Atractus maculatus*.

The examination of the holotype of *Isoscelis maculata* Günther, 1858, the supplementary specimens available to Günther and Boulenger, and additional specimens from several localities along the Atlantic Rain Forest indicated the possibility of two different forms being recognized under the name *Atractus maculatus*, which prompted us to this study.

MATERIAL AND METHODS

We examined specimens referred to *Atractus maculatus* in the following museums: The Natural History Museum, London (BMNH), Departamento de Zoologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro (DZUFRJ), Instituto Butantan, São Paulo (IB), Museu de História Natural Capão da Imbuía, Curitiba (MHNCI), Museu Nacional, Rio de Janeiro (MNRJ), Museu de História Natural, Universidade Federal de Alagoas, Maceió (MUFAL), Museu de Zoologia, Universidade de São Paulo, São Paulo (MZUSP), and Museum für Naturkunde, Universität Humboldt, Berlin (ZMB). Terminology for *Atractus* cephalic shields follows SAVAGE (1960), whereas the method of counting ventrals follows Dowling (1951). Hemipenis description follows DOWLING & SAVAGE (1960), as augmented by MYERS & CAMPBELL (1981). We took morphometric measurements with a dial caliper to the nearest 0.1mm for cephalic distances, and with a ruler to the nearest millimeter for body lengths. All statistical tests were performed with a significance index of 0.05. ANOVAs and ANCOVAs were employed to study the variation (morphometric measurements log transformed), all factors considered fixed. Univariate normality and homoskedasticity were verified with the Kolmogorov-Smirnov's test and the Levene's test, respectively.

RESULTS

Two clearly distinct color patterns were identified in the sample, one representative of the holotype of *Atractus maculatus* and specimens of the eastern Brazilian State of Alagoas, whereas the other represented the southeastern and southern Brazil populations. Despite the occurrence of a small overlap, the segmental counts of the males (the female sample was too small to allow statistical tests) were dimorphic, the difference being significant in the case of the ventrals ($F_{1,14}=8.03$, $p=0.013$).

Considering the distinctness of the two populations, we propose to recognize both of them as distinct species, as follows:

Atractus maculatus (Günther, 1858)
(Fig. 1a)

Isoscelis maculata Günther, 1858

Rhabdosoma maculata – Günther, 1858 (in part)

Atractus maculatus – Boulenger, 1894 (in part)

Diagnosis - This species is distinguished from its congeners by the following combination of characters: a much longer than high loreal scale, seven supralabials, temporal formulae 1+2, 17 dorsal scale rows, a capitate hemipenis, and a distinct dorsal color pattern of irregularly connected bands forming reticulation (Tab.1).

TABLE 1

SELECTED CHARACTERS OF *ATRACTUS MACULATUS* AND *A. ZEBRINUS*

	N	<i>Atractus maculatus</i> (1♀ / 3♂)	<i>Atractus zebrinus</i> (17♀ / 13♂)
Ventral scales	♀ ♂	167 147-156	145-161 137-150
Subcaudal scales	♀ ♂	20 27-30	15-22 20-28
Dorsal color pattern		Irregularly connected bands forming reticulation	Transversal bands connected in opposition or alternation, never forming reticulation

Holotype - BMNH 1946.1.6.46, an adult male from "Brazil?", originally catalogued as BMNH 51.3.18.15

Description (4 specimens) - Maximum SVL 290mm in females and 330mm in males; tail length 0.063 of the SVL in the female specimen, 0.11-0.15 (N=3) in males; head width 0.45 of the head length in the female specimen, and 0.47-0.63 (N=3) in males. Head not distinct from the body; rostral broader than high; internasals as broad as long; prefrontals slightly broader than long; frontal as broad as long; parietals longer than high; nasal divided; loreal much longer than high; eye small; preocular absent; pupil round; postocular 1 (1 side) or 2 (7 sides); temporals 1+2; supralabials 7, with numbers 3-4 contacting orbit; mental much wider than long, separated from chinshields by the first pair of infralabials; infralabials 7, with numbers 1-4 contacting with chinshields; anterior chinshields about twice as long as wide; posterior chinshields absent. Dorsal scales in 17-17-17 rows, scales smooth without apical pits. Ventrals 167 in the female specimen, 147-156 (\bar{x} =151.7, s^2 =4.5, N=3) in males; anal single; subcaudals 20 in the female specimen, 27-30 (\bar{x} =28.3, s^2 =1.5, N=3) in males.

Coloration - Dorsum reddish brown in live specimens, faded to grayish brown or pale in preserved specimens; rostral, internasals, prefrontals, frontal, and parietal speckled of black, specially in adults; supralabials creamish white in adults, white in juveniles. Dorsal pattern of black, one up to two scales wide bands, irregularly connected, forming reticulations (Fig.1a); at the anteriormost and posteriormost regions of the body, the bands are thicker and organized transversally; small brown spots form slim dorsolateral stripes over the first or second row of dorsals. Venter creamish white in adults, white in juveniles.

Hemipenis - The hemipenis is capitate, bilobate with a centrolineal sulcus, with the basal region covered by small spines and the distal portion covered by spinulate calyces. Spines on the lateral sides are slightly larger than those on the sulcate size.

Distribution (Fig.2) – An Atlantic Rain Forest species that occurs in the few remaining dense forest patches in the State of Alagoas, Brazil. The two known localities of occurrence are relatively close to the coast with altitudes from 16m (São Miguel dos Campos) to 650m (Murici).

Material Examined – BRAZIL: Unknown Locality: (BMNH 1946.1.6.46) (holotype); ALAGOAS: Murici (Mata da Bananeira) (MUFAL 474, 475); São Miguel dos Campos (MNRJ 3977).

Atractus zebrinus (Jan, 1862) nov.comb.
(Fig.1b,c)

Rhabdosoma zebrinum Jan, 1862

Atractus maculatus – Boulenger, 1894 (in part)

Diagnosis – This species is distinguished from its congeners by the following combination of characters: a much longer than high loreal scale, seven supralabials, temporal formulae 1+2, 17 dorsal scale rows, a capitate hemipenis, and a distinct color pattern of black transversal bands anteriorly and posteriorly bordered by white, medially connected in opposition or alternation, over a dark brown ground; it can be further distinguished from *Atractus maculatus* by the smaller number of ventrals (137-150 vs. 147-156) (Table 1).

Description (30 specimens) – Maximum SVL 630mm in females and 370mm in males; tail length 0.063-0.097 (N=17) of the SVL in females, 0.097-0.14 (N=13) in males; head width 0.46-0.63 (N=14) of the head length in females, 0.47-0.71 (N=12) in males. Head not distinct from the body; rostral broader than high; internasals as broad as long; prefrontals slightly broader than long; frontal as broad as long; parietals longer than high; nasal divided; loreal much longer than high; eye small; preocular absent; pupil round; postoculars 2; temporals 1+1 (1 side) or 1+2 (59 sides); supralabials 6 (1 side), 7 (56 sides), or 8 (3 sides), with numbers 2-3 (1 side), 3-4 (57 sides), 3-5 (1 side), or 4-5 (1 side) contacting orbit; mental much wider than long, separated from chinshields by the first pair of infralabials; infralabials 7, with numbers 1-3 (1 side) or 1-4 (59 sides) contacting chinshields; anterior chinshields about twice as long as wide; posterior chinshields absent. Dorsal scales in 17-17 rows, scales smooth without apical pits. Ventrals 145-161 (\bar{x} =153.2, s^2 =4.6, N=17) in females, 137-150 (\bar{x} =144.5, s^2 =3.8, N=13) in males; anal single (29 specimens) or divided (1 specimen); subcaudals 15-22 (\bar{x} =18.2, s^2 =1.7, N=17) in females, 20-28 (\bar{x} =24.9, s^2 =2.7, N=13) in males.

Sexual Dimorphism – The sexes are dimorphic in terms of segmental counts ($F_{1,36}$ =21.8, p =0.0004, for the ventrals, and $F_{1,35}$ =79.9, p <0.0001, for the subcaudals). An ANCOVA of the log of tail length, using the log of SVL as covariate, also showed significant differences between the sexes ($F_{1,27}$ =76.3, p <0.0001), whereas similar tests with the head measurements failed to show any significant difference.

Coloration – Dorsum dark brown in live specimens. Head brown with scattered black spots, especially over the frontal and parietals; supralabials and infralabials creamish white. Dorsal pattern of 31 to 37 (plus 5-7 over the tail) transverse two scale wide black bands, connected medially in alternation or opposition; bands anteriorly and posteriorly bordered by white; small brown spots occasionally

between the bands, sometimes forming a slim dorsolateral stripe (Fig.1b). Venter creamish white. Preserved adults possess a similar coloration, being slightly darker. Preserved juveniles are pale, poorly pigmented, the bands being much slender than in adults (Fig.1c).

Hemipenis – The hemipenis is capitata, bilobate with a centrolineal sulcus, with the basal region covered by small spines and the distal portion covered by spinulate calyces. Spines on the lateral side are slightly larger than those on the sulcate size.

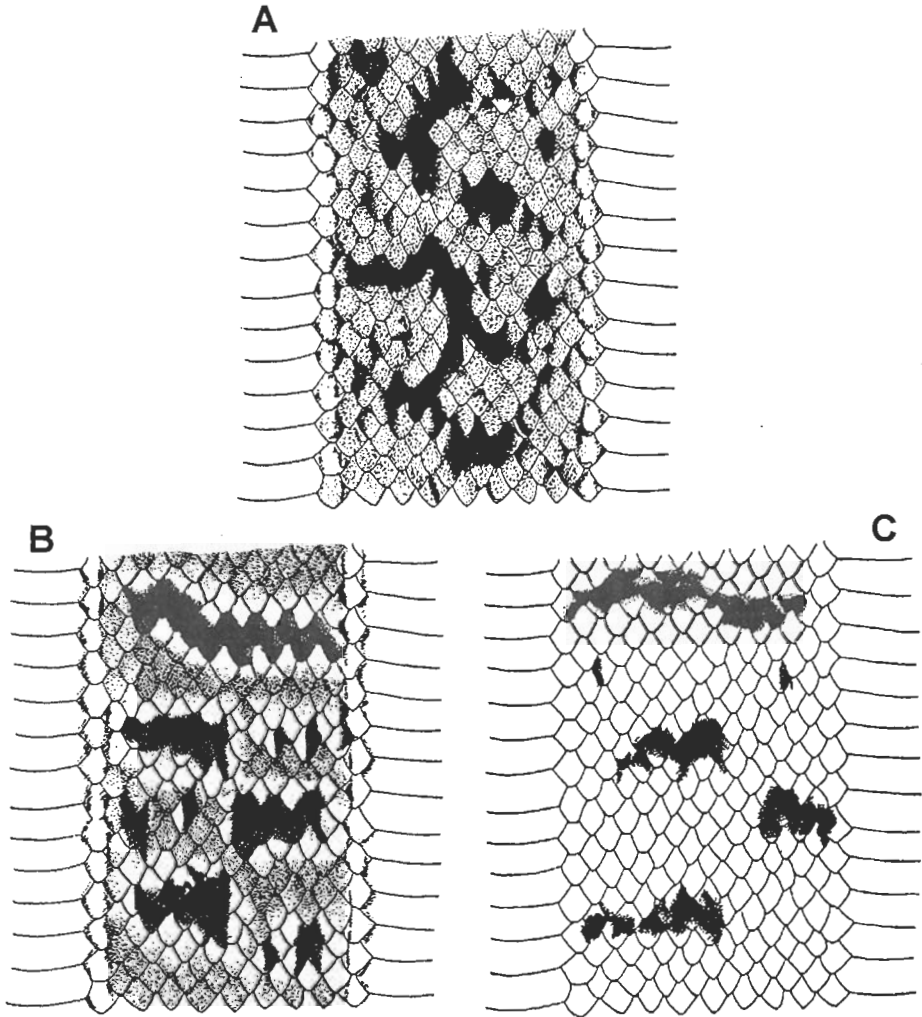


Fig. 1: Dorsal coloration pattern of (A) *Atractus maculatus* and (B) adults and (C) juveniles of *A. zebrinus*.

Distribution (Fig.2) An Atlantic Rain Forest species that occurs in the dense forests of Brazil, in the states of Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina.

Material Examined – BRAZIL: Unknown Locality: (BMNH 61.4.18.12, 61.4.18.13); BAHIA: Porto Seguro: (IB 57202); MINAS GERAIS: Camanducaia: (Fazenda Cruzeiro do Sul) (IB 45620, 45622), (Fazenda Monte Verde) (IB 45691), (Floresta Negra) (IB 45431), (Sítio Azul) (IB 40106), (Monte Verde) (IB 51491, 51683); ESPÍRITO SANTO: Santa Tereza: (MNRJ 733, 744); RIO DE JANEIRO: Itaboraí: (MHNCI 1295); Nova Friburgo: (ZMB 7448); Petrópolis: (MNRJ 4467-70, DZUFRJ 497, 563); Rio de Janeiro: (BMNH 55.4.18.12, ZMB 6006); SÃO PAULO: Apiaí: (IB 52316); Boracéia: (MZUSP 2194); Campos do Jordão: (IB 54326); Cubatão: (IB 45193); Engenheiro Lefèvre: (IB 16435); Guapiara: (Fazenda Oriente) (IB 33717); Ribeira: (Fazenda Cobalto) (IB 43733); Tapiraí: (IB 42222, 46605, 52636, 56938); PARANÁ: Campo Largo: (MHNCI 4818); Votuverava: (IB 12893); SANTA CATARINA: Peritiba: (IB 44049).

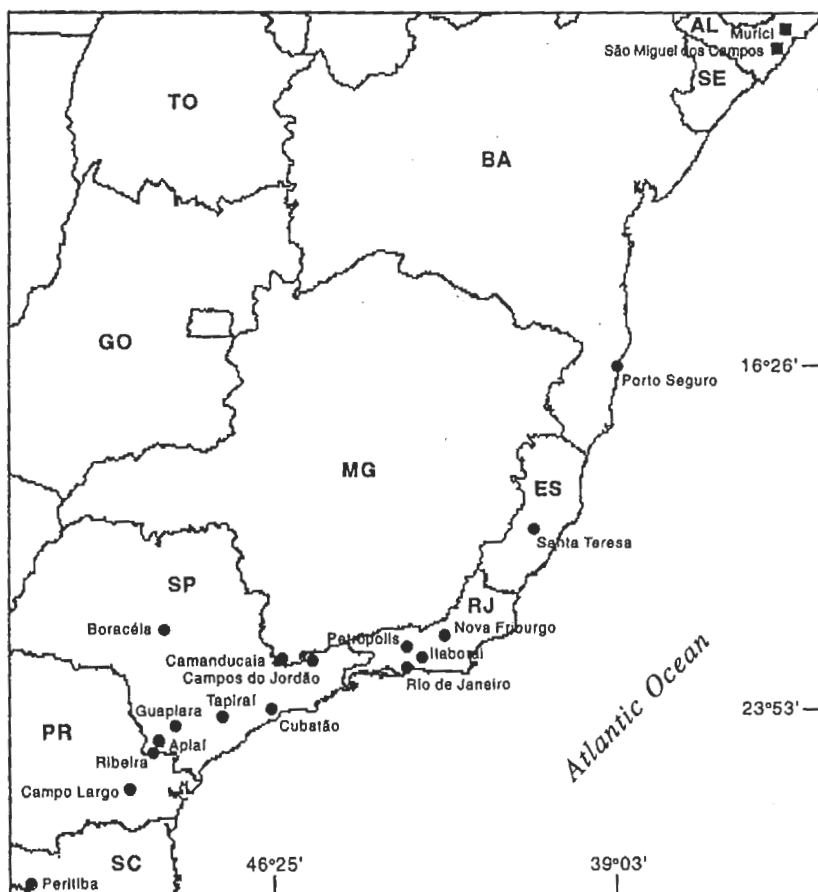


Fig.2: Map of distribution of *Atractus maculatus* (■) and *A. zebrinus* (●).

DISCUSSION

GÜNTHER (1858) examined specimens of both *Atractus maculatus* and *A. zebrinus*, as described in his appendix. However, possessing a single specimen of *A. maculatus* of uncertain locality, he preferred to regard his material as representative of a single species. Later, BOULENGER (1894) followed his opinion when synonymized *Rhabdosoma zebrinum* with *A. maculatus*. In fact, because of the overall similarity of the two species, it would be hard to these authors to support any other conclusion without the benefit of additional material of *A. maculatus*. Although the holotype of *Atractus zebrinus* is probably lost, JAN'S (1862) illustration leaves little doubt on the population from which the specimen was collected, turning unnecessary the designation of a neotype.

We are aware that the small sample of *Atractus maculatus* may mislead our statistical results. Specifically, the species' variation may not be sufficiently represented in our results. Therefore, we advise caution when interpreting the significant difference found in the means of ventral scale counts, even considering the very significant result and the similar standard deviations of both species. Even so, we are confident that the color pattern alone is sufficient to distinguish both species.

As already pointed out by FERNANDES (1996), a number of Brazilian species of *Atractus*, including *A. maculatus*, *A. zebrinus* (which was called *A. maculatus*), *A. reticulatus*, *A. serranus*, *A. taeniatus*, and *A. trihedrurus*, share the capitation of hemipenis. This character state is plesiomorphic within the Dipsadini (FERNANDES, 1995b) and, as such, cannot be used as evidence to this group. Within this group, *A. zebrinus* share the putative synapomorphy of accentuated ontogenetic color pattern change with *A. trihedrurus*; however, as pointed by FERNANDES (1996), this latter species is probably the sister species of *A. serranus*.

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RESUMO

VARIAÇÃO GEOGRÁFICA DA SERPENTE DA FLORESTA ATLÂNTICA
ATRACTUS MACULATUS (GÜNTHER, 1858), COM A REVALIDAÇÃO DE
RHABDOSOMA ZEBRINUS JAN, 1862 (SERPENTES: COLUBRIDAE)

Baseados na análise da variação geográfica das populações atualmente sob o nome de *Atractus maculatus*, propomos o reconhecimento de duas espécies. *Atractus maculatus* é restrita ao nordeste do Brasil, enquanto as populações do sul e sudeste do Brasil são reconhecidas como *Atractus zebrinum* (Jan, 1862), que pode ser distinguida da anterior pelo padrão de coloração diferente e número inferior de escamas ventrais.

Palavras-chave: Serpentes, Colubridae, *Atractus*, Brasil, taxonomia.

ABSTRACT

Based on the analysis of the geographical variation of the populations currently called *Atractus maculatus*, we propose that the name includes two species. *Atractus maculatus* is restricted to the northeastern Brazil, whereas the southeastern and southern Brazil populations are recognized as *Atractus zebrinum* (Jan, 1862) which may be distinguished from the former by a different color pattern and lower number of ventral scales.

Key words: Serpentes, Colubridae, *Atractus*, Brazil, taxonomy.

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Universidade Federal do Rio de Janeiro
Quinta da Boa Vista, São Cristóvão
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