



### The taxonomic status of the “forgotten” Bolivian snakes, *Atractus balzani* Boulenger 1898 and *Atractus maculatus* (sensu Boulenger 1896) (Serpentes: Dipsadidae)

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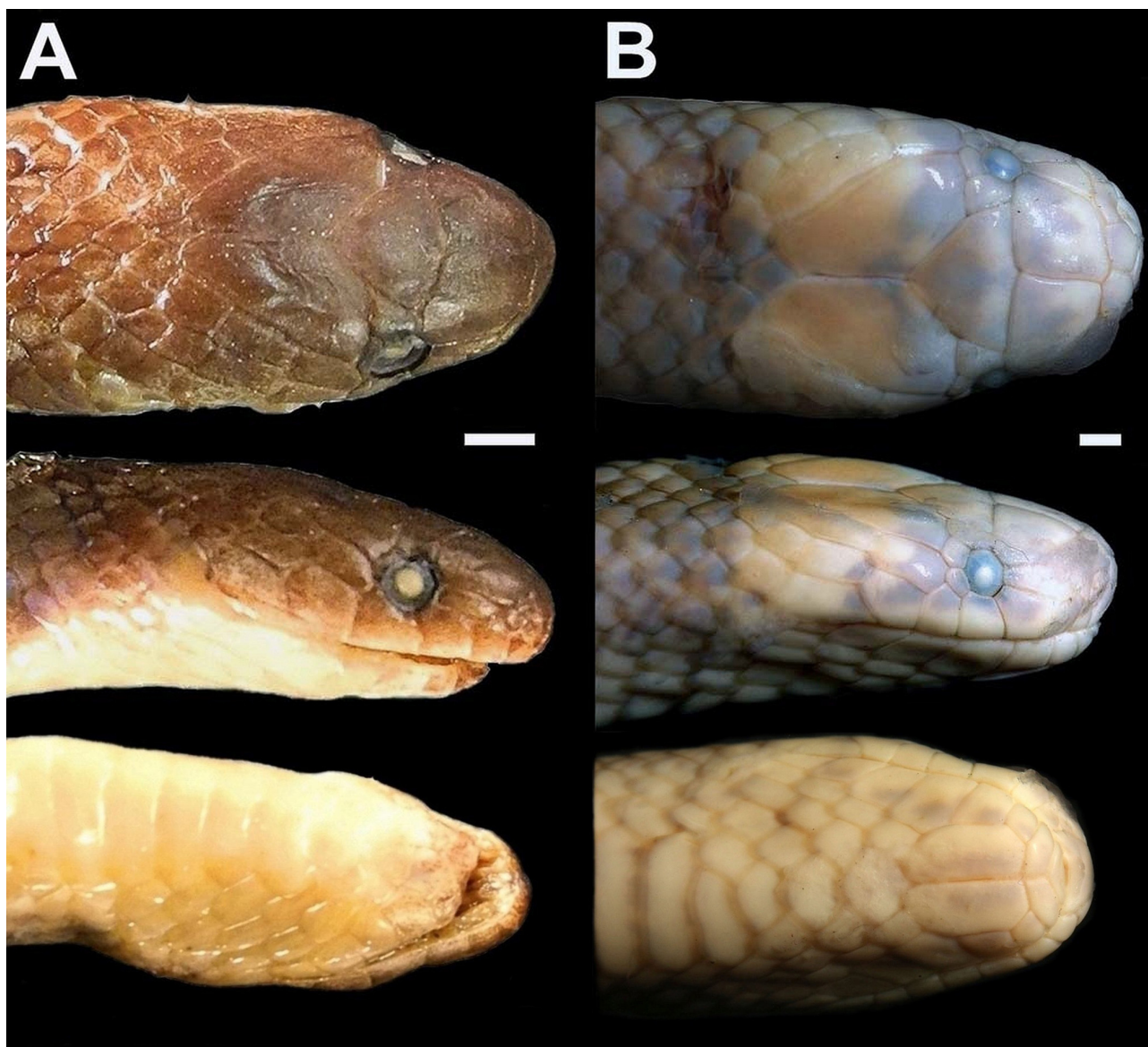
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The genus *Atractus* Wagler 1828 comprises almost 150 currently recognized species of cryptozoic snakes widespread in the Neotropics, occurring from Panama to northeastern Argentina (Passos *et al.* 2016a). Despite the publication of the descriptions of several new species within the last decade, the taxonomy of the genus is unclear in some instances. This is mainly due to the fact that a number of poorly delimited taxa still exist (Passos *et al.* 2018). The most frequent problem faced by taxonomist working with the genus *Atractus* is the lack of specimens available for several species, most of them only still being known from their types, a situation that considerably weakens the definition of species boundaries between closely related taxa (Passos *et al.* 2010a, 2013). More importantly, many of the previously recognized species may represent aberrant individuals with unusual or abnormal scale counts, anomalous azygous or fused cephalic plates, infrequent polychromatic patterns, or any combination of these states (see Passos *et al.* 2016b). In the course of a thorough taxonomic review of the genus (Passos 2008; Passos *et al.* 2018), an effort has been made to examine all of the available types (including those apparently lost or misplaced in collections) and material of historical importance that was previously referred to the genus in the literature, and these were then compared to newer samples collected more recently. During the examination of the collections of the Natural History Museum of London and the Museo Civico di Storia Naturale of Genova, we found important specimens of *Atractus* from Bolivia. However, in order to better understand all the problems related to these old and “forgotten” Bolivian snakes, we need to examine their history.

Günther (1858), in his Catalogue of “Colubrinae” in the British Museum, described the genus *Isoscelis* to accommodate *I. maculata* based on a single specimen from an unknown locality. Günther also examined additional specimens from the vicinities of Rio de Janeiro, Brazil, and amended his earlier observations, proposing the synonymy of *Isoscelis* Günther 1858 with *Rhabdosoma* Duméril, Bibron & Duméril 1854. Jan (1862) described and illustrated *R. zebrinum* based on a single specimen from an unknown locality. Boulenger (1894) transferred *R. maculatum* (Günther 1858) to *Atractus* and synonymized it with *R. zebrinum* Jan 1862 (see Passos *et al.* 2010b for additional information on the concept of *A. maculatus* and the resurrection of *A. zebrinus*). In the last volume of his “Catalogue of Snakes”, Boulenger (1896) recognized additional specimens from Bolivia as belonging to *A. maculatus* (Günther 1858). Later, Boulenger (1898) described *A. balzani* based on a single specimen collected by L. Balzan in “Misiones Mosetenes”, Bolivia. As far as we know, no additional specimen or data related to *A. balzani*, and the original description is still the only known source of information on this species.

We examined the holotype of *Atractus balzani*, an adult male (MSNG 28873), collected by L. Balzan in 1892 at “Misiones Mosetenes” (= Covendo Mission range; 15°47'S, 66°58'W, ca. 517 m above sea level; hereafter asl), province of Sud Yungas, Department of La Paz, Bolivia. We provide a redescription of this species as follows [terminology follows Passos *et al.* (2010b)]: snout-vent length (SVL, hereafter) 354 mm; midbody diameter 8.4 mm (2.37% SVL); tail length 51 mm (14.4% SVL); head length 11.3 mm (3.19% SVL); head width 6.91 mm (61.1% head length). Head arched in lateral view; snout rounded in dorsal view; canthus rostralis poorly defined. Interocular distance 4.3 mm; snout-orbit distance 4.0 mm; rostral 1.2 mm high, 2.1 mm wide, visible in dorsal view; internasal 1.9 mm long, 0.9 mm wide, internasal suture sinistral with respect to prefrontal suture; prefrontal 3.2 mm long, 2.1 mm wide; supraocular subtrapezoidal, 1.2 mm long, 1.0 mm wide; frontal subpentagonal, 2.8 mm long, 3.1 mm wide; parietal 4.7 mm long, 2.9 mm wide; nasal divided, nostril restricted to anterior nasal; anterior nasal 0.65 mm long, 0.95 mm high; posterior nasal 1.1 mm long, 1.1 mm high; loreal long (2.3 mm long, 0.7 mm high); second and third supralabials contacting loreal; eye diameter 1.5 mm; pupil rounded; one small postocular (0.4 mm long, 1.2 mm high); temporals 1+2; anterior temporal 2.1 mm long, 1.1 mm high; anterior temporal in contact with parietal, postocular, and fourth–fifth

supralabials; lower posterior temporal longer than upper posterior temporal; upper posterior temporal 2.0 mm long, 1.0 mm high; lower posterior temporal 2.4 mm long, 1.0 mm high; supralabials 6/6, third–fourth with orbit; second supralabial higher than first supralabial, and similar in size to third and fourth; fifth supralabial higher and sixth longer than remaining supralabials; symphyseal damaged; infralabials 7 (right side) and damage in the right side, first four infralabials contacting chinshields; chinshields 1.9 mm long, 1.3 mm wide; ventrals 164; subcaudals 32; dorsal scale smooth in 14/17/16 rows; maxillary teeth 6/6. Dorsum of head dark brown; dorsal ground color of body reticulate dark brown, except for the first dorsal scale row mostly pale brown; dorsal scales with the center of each scale lighter (pale brown) and edges darker (dark brown); belly cream with few dispersed, small brown dots along body; dots concentrated on the lateral portion of ventral scales anteriorly to midbody; small brown dots on the posterior third of the body; tail creamish white heavily pigmented with dark brown spots on its ventral surface with yellowish cream background (Fig. 1A).



**FIGURE 1.** Detailed dorsal (upper), lateral (middle) and ventral (below) views of head of the holotype of *Atractus balzani* (MSNG 28873) from Covendo Mission range, province of Sud Yungas, Department of La Paz, Bolivia (A); and detailed dorsal (upper), lateral (middle) and ventral (below) views of head of the lectotype of *Atractus emmeli* (SMF 19364) from Mapiri River, department of La Paz, Bolivia. Photos of the lectotype of *A. emmeli* by G. Köhler.

We performed detailed comparisons between the holotype of *A. balzani* (Fig. 1; Table 1) and two species reported as occurring in the Yungas region of Bolivia, *Atractus emmeli* (Boettger 1888) and *A. major* Boulenger 1894 (Boulenger 1896: 645; Fig. 3). We can distinguish *A. balzani* from *A. major* by having an inconspicuous canthus rostralis, six supralabials, and the first four infralabials contacting chinshields (vs. very conspicuous canthus rostralis, seven supralabials, and first three infralabials contacting chinshields). By contrast, there is no feature in external morphology

that unequivocally distinguishes *A. balzani* from *A. emmeli*, and Boulenger (1898) based his description of *A. balzani* mainly on its general color pattern, the presence of one postocular and 17 dorsal scales rows (supposedly counted on the midbody). Although inconsistent in the *A. emmeli* populations, all these features are polymorphic certainly in the Bolivian and Peruvian samples (Figs. 1–2; Table 1). In addition, the taxonomy of the *Atractus emmeli* complex was recently reassessed through an integrated approach (P. Passos *et al.* in prep.), with a considerable increase of the phenotypic variability range previously reported for the nominal species (e.g., McCoy 1971; Salazar-Bravo *et al.* 2010). Nonetheless, in the aforementioned studies, the authors were not able to examine the holotype of *A. balzani*, but now, with new data made available from its holotype, it is possible to infer the taxonomic status of the species. The only apparent difference distinguishing both species is the number of dorsal scale rows at midbody, being 15 in *A. emmeli* and 17 in *A. balzani*. However, Peters & Orejas-Miranda (1970: 25) reported one individual female of *A. emmeli*—from an unknown origin—with 17 dorsal scale rows, seven supralabials, two postoculars, 188 ventrals and 22 subcaudals. Additionally, we also corroborated the presence of polymorphic dorsal scale rows counts in *A. emmeli* based on two other specimens from Peru (MUSM 2313 provenance unknown and MUSM 27402 from Trompeteros, department of Loreto), which retained 17/17/17 and 15/17/17 dorsal scales, respectively. The *A. balzani* holotype is also polymorphic with respect to its dorsal scale rows, displaying 14/17/16. In addition, the differences in color pattern between the *A. balzani* holotype, the lectotype of *A. emmeli* (Fig. 1) and additional specimens of *A. emmeli* from Bolivia, being the pale occipital band, a dorsum which is uniformly black and belly which is almost fully cream are also polymorphic in the Bolivian populations of *A. emmeli* (Fig. 2). Thus, it is not possible to distinguish both species based on any of the traits mentioned above, and we conclude that the best taxonomic decision to be made at this time is to place *A. balzani* in the synonymy of *A. emmeli*.

**TABLE 1.** Meristic and morphometric range of variation for *Atractus balzani*, *A. emmeli* and *A. major*. The abbreviations correspond to SVL (snout–vent length), CL (caudal length), and IFCH (infralabials–chinshields contact). The numbers in parenthesis represent the total number of specimens available in collections for each sex, as well as the frequency for each character state and, in the case bilateral counts, from each side independently. We presented separately the ranges for the variables usually displaying secondary sexual dimorphism in the genus (see Passos *et al.* 2010b). Data on the holotype of *Atractus balzani* is marked in bold. The hyphen (-) represents lacking data.

	<i>Atractus balzani</i> (holotype)	<i>Atractus emmeli</i>		<i>Atractus major</i>	
Sex	<b>Male (1)</b>	Males (24)	Females (28)	Males (27)	Females (26)
Ventrals	<b>164</b>	147–169	154–187	144–173	155–185
Subcaudals	<b>32</b>	20–31	14–27	29–46	24–35
Maximum SVL	<b>354 mm</b>	304 mm	382 mm	505 mm	745 mm
CL/SVL	<b>14.4%</b>	9.2–14.7%	5.7–9.6%	13.5–20.4%	10.5–16.2%
MidDorsals	<b>14/17/16</b>	15 (50) or 17 (2)		15 (2) or 17 (51)	
Postoculars	<b>1/1</b>	1 (2) or 2 (50)		1 (4) or 2 (100)	
Supralabials	<b>6/6</b>	5 (1), 6 (16), 7 (67) or 8 (1)		6 (5) or 7 (95)	
Infralabials	<b>7/-</b>	7 (103) or 8 (3)		6 (13) or 7 (93)	
IFCH	<b>4</b>	4		3	
Gulars	<b>3</b>	3 (4) or 4 (56)		2 (2), 3 (96) or 4 (2)	
Preventrals	<b>3</b>	3 (3), 4 (47) or 5 (2)		1 (6), 2 (37) or 3 (5)	
Maxillary teeth	<b>6</b>	6 (11), 7 (55) or 8 (3)		5 (3), 6 (68) or 7 (11)	

Interestingly, during the course of this study, we received photos and data from specimens previously identified by Boulenger (1896: 645) as *Atractus maculatus* from Aschiquiri (= Achiquiri, province of Larecaja; ca. 15°10'S, 68°14'W), Charobamba (ca. 14°37'S, 68°43'W) and Yungas (ca. 16°02'S, 67°13'W), Bolivia. We believe that all five specimens belong to *A. major* (Fig. 3; Table 1) based on the unique combination of the following morphological features: canthus rostralis laterally very conspicuous; 17/17/17 smooth dorsal scale rows; two postoculars; loreal moderately long; six (rarely) or seven supralabials, with third and fourth contacting the orbit; usually seven infralabials, first three contacting chinshields; gular scale rows three; usually two preventrals; usually six maxillary teeth; ventrals 155–185 in females, 144–173 in males; subcaudals 24–35 in females, 29–46 in males; dorsum beige with broad transversal dark brown blotches white bordered (half scale to one scale wide) on the flanks; belly uniformly cream or cream covered with dark brown spots on the center of ventral scales, comprising a conspicuous midline; large body-size, with females reaching 745 mm SVL, males 505 mm SVL; tail moderately long in females (10.5–16.2% SVL) and long in males

(13.5–20.4% SVL) [see Schargel *et al.* (2013) for additional data of *A. major*]. Considering all these major characteristics from the Bolivian specimens of *A. major* (*A. maculatus* in parenthesis), there is no overlap with the conditions of conspicuous canthus rostralis (vs. inconspicuous in *A. maculatus*), first three contacting chinshields (vs. first four contacting chinshields in *A. maculatus*), large body-size (> 500 mm of maximum length in *A. major*) in males and females (vs. < 400 mm in both sexes of *A. maculatus*), moderately long tail (vs. small tail-size in females [< 10% SVL] and moderately long in males [< 16% SVL] in *A. maculatus*) and dark brown transversal blotches conspicuous and white bordered (vs. dorsal blotches lacking conspicuous light margins in *A. maculatus*) [see Passos *et al.* (2010b) for additional data of *A. maculatus*]. For this reason, the name *Atractus maculatus* (sensu Boulenger 1896) should appear in the chresonymy list of *A. major* (as currently understood) and the name *A. maculatus* must be excluded from the Bolivian snake fauna.



**FIGURE 2.** General view of body (A), dorsolateral (B) and lateral (C) views of head of the specimen of *Atractus emmeli* from Los Lagos, Department of Beni, Bolivia. Photos by M. Jansen.



**FIGURE 3.** Dorsal (left) and ventral (right) general views of the specimens of *Atractus major* housed in the BMNH previously identified as *A. maculatus* (sensu Boulenger 1896): The Boulenger specimen's formerly 'c' (BMNH 1895.11.21.17 - A) from Charobamba; 'e' (BMNH 1895.11.21.19 - B) from Aschiquiri; and 'g' (BMNH 1895.11.21.21 - C) from Yungas, all in Bolivia. Scale = 10 mm.

Passos *et al.* (2016a) has previously reported one (supposedly anomalous) specimen of *Atractus major* with 15/15 dorsal scale rows (CBF 2288) from Yariapo, province of Abel Iturralde (12°54'55"S, 67°45'W; ca. 180 m asl), department of La Paz, Bolivia. We added herein another Bolivian specimen (CBF 2321) with the dorsal scale pattern (17/17/17) usually observed in *A. major* collected in the 'Laguna Piraña' (13°01'7.45"S, 68°51'18.6"W; 224 m asl), province of Abel Iturralde, department of La Paz. Therefore, based on these relatively new and very old records of *A. major* to Bolivia, we can infer that this species may be more widespread in the country and perhaps it has been previously confused with other congeners within museum collections as is occurring along with many other *Atractus* species (see Passos *et al.* 2017). Finally, we believe that with the ongoing review of the *Atractus emmeli* complex it will soon be possible for us to infer robust species boundaries, establish the phylogenetic relationships, establish distribution patterns and to access many aspects of natural history from one of the most confusing assemblies of snakes in the already taxonomically complex genus *Atractus*.

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## Appendix

### Material examined

We follow Sabaj Pérez (2016) for the institutional abbreviations, except for the ACF (field number) housed at CBF and Centro de Estudos de Pesquisas Biológicas (CEPB), Pontifícia Universidade Católica de Goiás, Goiânia, Brazil. Countries are given in bold capitals, states in plain capitals, municipalities in italics, and localities in plain text. We included only the Bolivian sample of *Atractus major* examined.

***Atractus balzani* (n = 1).** **BOLIVIA:** LA PAZ: *Sud Yungas*: Covendo Mission range (MSNG 28873, holotype).

***Atractus emmeli* (n = 43).** **BOLIVIA:** BENI: *José Ballivián*: San Marcos: Río Negro (MNKR 3718–19), *Moxos*: San Lorenzo (CBF 992), *Vaca Díez*: Guayaramerín (USNM 123971–72), *Yacuma*: Estación Biológica del Beni (CBF 434); LA PAZ: *Campolican* (BMNH 1895.11.21.26), Charobamba (BMNH 1895.11.21.22–24), *Iturralde*: (CBF 765a,b), Madidi (CBF 758), Yungas (BMNH 1895.11.21.25); PANDO: *Manuripi*: Reserva Nacional de Vida Silvestre Manuripi: Malecon camp (ACF 21); SANTA CRUZ: *Andrés Ibañez*: El Vallecito (CBF 008, 3717), 8.5 Km from Santa Cruz de la Sierra–Cochabamba road (MNKR 321), Campus Universitario: *Santa Cruz de la Sierra* (MNKR 17). **BRAZIL:** ACRE: *Porto Walter* (MZUSP 7386); RONDÔNIA: *Porto Velho*: Samuel: Hydroelectric Power Plant (CEPB 1700–01), Jirau Hydroelectric Power Plant (MZUSP four specimens not catalogued). **PERU:** Unknown locality: (MUSM 2313); CUSCO: *Convención*: Camisea (MUSM 3467); LORETO: *Coronel Portillo*: Pucallpa (MUSM 2653, 3101); HUÁNUCO: Tingo Maria, Universidad Agraria de la Selva, vicinity of the Huallaga River (USNM 193730–39); JUNÍN: *Tarma*: Yurinaqui Alto (MUSM 2644, 11144); LORETO: Trompeteros (MUSM 27402).

***Atractus major* (n = 5).** **BOLIVIA:** LA PAZ: *Larecaja*: Achiquiri (BMNH 1895.11.21.19), Charobamba (BMNH 1895.11.21.17–18), Yungas (BMNH 1895.11.21.20–21).