

Geographic distribution of *Cercosaura vertebralis* O'Shaughnessy, 1879 (Reptilia: Squamata: Gymnophthalmidae) and the status of *Cercosaura ampuedai* (Lancini, 1968)

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ABSTRACT: We report new locality records of *Cercosaura vertebralis* O'Shaughnessy, 1879 in Peru, after more than 40 years since the discovery of the single known Peruvian specimen. The Peruvian range of *Cercosaura vertebralis*, which was previously restricted to Piura, is extended into the Cajamarca region (Tabaconas Namballe and La Granja). We also examined intraspecific variation of the species throughout its range and provide a hemipenial description from the new specimens. In addition, we comment on the population status of *C. vertebralis* in Peru, and provide data supporting the synonymy of *C. ampuedai* with *C. vertebralis*.

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The taxon *Cercosaura vertebralis* O'Shaughnessy, 1879 is a poorly known lizard species of the family Gymnophthalmidae with a variety of junior synonyms. Uzzell (1973) synonymized *Prionodactylus palmeri* Boulenger, 1908, *P. marianus* Ruthven, 1921, and *Euspondylus ampuedae* Lancini, 1968 with *P. vertebralis*. The synonymies of *P. palmeri* and *P. marianus* have not been disputed, but La Marca and García-Pérez (1990) resurrected *E. ampuedae* from within *P. vertebralis*, accepting the transfer to *Prionodactylus* and emending the ending to create *P. ampuedai*. Mijares-Urrutia (2000) presented new data relevant to the *P. ampuedai* question and considered it a valid taxon, but Doan (2003) and Doan and Lamar (2012) still considered the taxon to be a junior synonym. Doan (2003) transferred all *Prionodactylus* (and *Pantodactylus*) into *Cercosaura* based on evidence that *Prionodactylus* and *Pantodactylus* rendered *Cercosaura* paraphyletic. This generic change was accepted by all subsequent authors to date.

Cercosaura vertebralis has a wide geographic range which includes Panama, Colombia, Ecuador, Venezuela, and Peru (Uzzell 1973). As such, it is the only species in the genus to extend into Central America (Doan and Lamar 2012). The southernmost extent of its range occurs in Peru, with, to date, a single specimen from Piura region. Recent expeditions revealed two populations of *C. vertebralis* in Cajamarca, Peru: one from Santuario Nacional Tabaconas Namballe (SNTN), northern Cajamarca, and the other one from La Granja village, central Cajamarca (Figure 1). These new data not only extend the range of the taxon, but also allow a re-examination of the synonymies of the included junior taxa.

At the SNTN, the search for this lizard species was

conducted with a combination of two collecting methods: (1) Visual Encounter Survey (VES) and (2) Pitfall traps with drift fences. All possible microhabitats were examined in

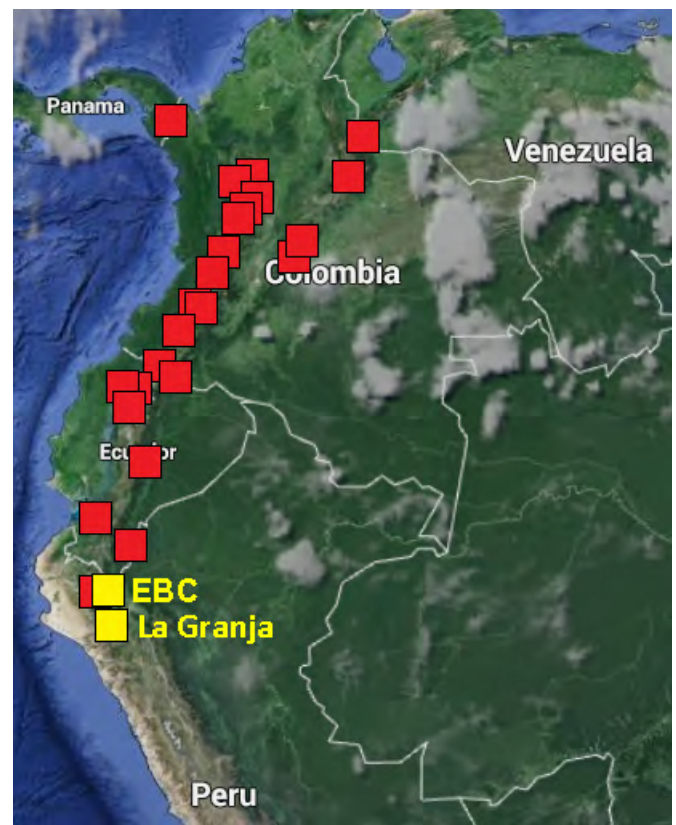


FIGURE 1. Map of northwestern South America showing the geographic distribution of *Cercosaura vertebralis*. Red squares represent previously known localities whereas yellow squares indicate the new Peruvian localities. EBC = Estación Biológica Chichilapa.

diurnal VES, including movement of logs, rocks, shrubs, and the mossy ground cover. Pitfall traps were arranged in Y-shaped arrays with one central bucket and three peripheral buckets spaced 10 m apart along a fence 30 cm high (Figure 2A). Three pitfall trap arrays, separated by about 500 m, were installed at SNTN and checked thrice daily, especially after rains. This arrangement was adopted because of the irregularity of the surface, installation effort, and higher capture probability. At La Granja village, we used diurnal VES only, along a riparian forest. The study was conducted under permit number 002-2012-SERNANP-SNTN issued by Ministerio del Ambiente, SERNANP. Specimens captured were fixed in 10% formalin and preserved in 70% ethanol; they were subsequently deposited in the herpetological collection of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (MUSM) in Lima, Peru. Body proportions were measured with a digital caliper (to the nearest 0.1 mm) under a stereomicroscope (Table 1). The preparation and staining of the hemipenes of one specimen of *C. vertebralis* (MUSM 32489) followed Pesantes (1994) and Zaher and Prudente (2003).

In addition to six new specimens (2 male and 4 juvenile) from Tabaconas Namballe and La Granja, we also examined 38 additional preserved specimens from Panama, Colombia, Ecuador, and Peru from the collections of AMNH and LACM.

Four of the new specimens (Figures 3, 4) were captured at the Estación Biológica Chichilapa (EBC) within the Santuario Nacional Tabaconas Namballe. The SNTN is a natural protected area located in the northernmost region of the Peruvian occidental Andes, Cajamarca, near the Peru-Ecuador border. It covers an area of 295 km² with an elevational gradient from 1800 to 3600 m and it is a unique Peruvian natural area that conserves the Andean páramos and montane forests (Amanzo *et al.* 2003; INRENA 2007). The EBC (05°16'45.4" S, 79°18'35.0" W, 2273 m) is situated in the Tabaconas river valley, with a steep slope and rugged mountains, surrounded by montane scrub and montane forest. That is, it is a transitional area between grassland

TABLE 1. Summary of standard measurements (in mm) for *Cercosaura vertebralis* from Cajamarca, Peru (Range, Mean). Abbreviations are: Snout-vent length (SVL), head length (HL), head width (HW), head height (HH), interlimb length (IL), humerus length (HUL), radius-ulna length (RUL), metacarpus length (MCL), length of the longest finger (LFIN), femur length (FL), tibia-fibula length (TFL), metatarsus length (MTL) and length of the longest toe (LTOE).

	<i>Cercosaura vertebralis</i> , males (n=2)	<i>Cercosaura vertebralis</i> , juveniles (n=4)
SVL	(43.03–43.74) 43.39	(26.53–29.20) 28.21
HL	(10.30–10.77) 10.54	(7.35–7.87) 7.57
HW	(6.67–7.10) 6.89	(4.52–5.17) 4.86
HH	(3.90–4.43) 4.17	(2.56–3.49) 3.01
IL	(19.14–20.63) 19.89	(12.58–14.83) 13.80
HUL	(4.09–4.99) 4.54	(2.48–3.67) 3.08
RUL	(4.97–5.16) 5.07	(2.72–3.56) 3.15
MCL	(1.91–2.12) 2.02	(1.30–1.74) 1.50
LFIN	(4.53–4.85) 4.69	(2.99–3.41) 3.16
FL	(5.58–5.92) 5.75	(3.81–4.26) 4.02
TFL	(6.48–6.68) 6.58	(4.18–4.67) 4.37
MTL	(2.81–2.98) 2.90	(1.68–2.16) 1.97
LTOE	(6.68–7.76) 7.22	(4.33–5.26) 4.75

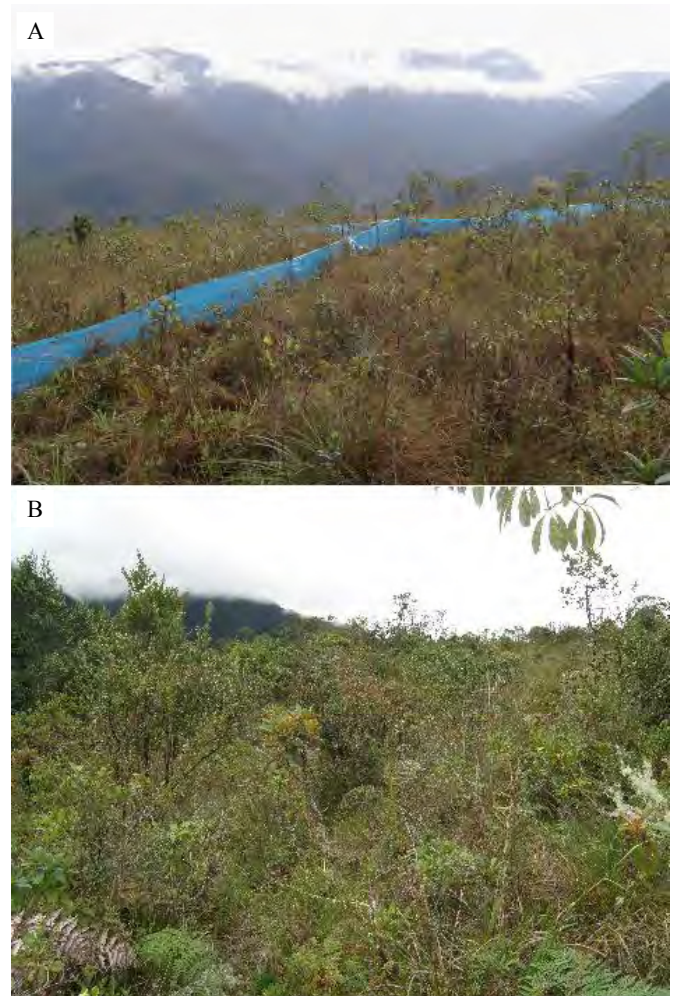


FIGURE 2. (A) Pitfall traps with fences in Y-shaped arrays placed in montane scrub. (B) Composition of montane scrub in Tabaconas river valley, Cajamarca, Peru.

(*Jalca*) and montane forest. The vegetation is dominated by bushes (1–2 m) of the families Clusiaceae, Ericaceae, and Melastomataceae and also herbaceous plants of the families Eriocaulaceae, Poaceae, and Cyperaceae. The most representative genera and species of vegetation of the area are: *Meriania*, *Vaccinium*, *Cavendishia*, *Chelonanthus alatus*, *Olyra*, *Paepalanthus*, *Epidendrum secundum* (orchid), *Blechnum* (hard fern) and *Lycopodium thyoides* (Figure 2B).

An additional two specimens were collected at Checos creek, La Granja, Querocoto in Cajamarca, Peru. La Granja is a village located in the interandean valley of the Río Chotano, Querocoto, Chota and covers an elevational range from 2200 to 2800 m. Checos creek (06°22'31.33" S, 79°07'01.12" W, 2247 m) is surrounded by disturbed areas, secondary forest, and patches of montane forest. The terrain has a moderate to steep slope, with rocky outcrops and scarce soil. Disturbed areas (agricultural fields and grassland) are dominated by grasses and Asteraceae, while secondary forest has abundant bamboo *Chusquea scandens*, trees, and shrubs. Fragments of montane forest are characterized by Lauraceae, Myrsinaceae, Myrtaceae, and Melastomataceae, an elevated proportion of epiphytes (*Tillandsia complanata*, *Blechnum fragile*, *Anthurium* sp., and mosses), and scarce woody lianas. Understory plants include the genera *Niphidium*, *Blechnum*, and other grasses. It is an area with a high



FIGURE 3. Male individual of *Cercosaura vertebralis* (MUSM 31845) from Tabaconas Namballe. (A) Head in lateral view showing the lateral ocelli, orange spots, and white labial bar. (B) Dorsal color pattern of a live specimen.



FIGURE 4. (A) Male individual of *Cercosaura vertebralis* (MUSM 32489) from La Granja. Note the absence of the white labial bar. (B) Juvenile of *Cercosaura vertebralis* (MUSM 32490) from La Granja showing absence of orange spots that are typical in adult individuals.

level of anthropogenic habitat loss.

Most lizard specimens were found under rocks, under moss, and active on the ground, with two caught in the pitfall arrays. From the nearest locality in Canchaque, Piura, Peru, the EBC is a range extension of approximately 16 km ENE and La Granja is approximately 123 km SSE. These are the first records of the species in Cajamarca region. Features of the new specimens agree broadly with other known specimens of this species, with minor exceptions (mentioned below).

Cercosaura vertebralis O'Shaughnessy, 1879
Cercosaura (Pantodactylus) vertebralis O'Shaughnessy, 1879: 298.

Prionodactylus vertebralis: Boulenger, 1885: 394.

Prionodactylus palmeri Boulenger, 1908: 518.

Prionodactylus marianus Ruthven, 1921: 1.

Euspondylus vertebralis: Dunn, 1944: 103.

Euspondylus ampuedae Lancini, 1968: 4.

Prionodactylus ampuedai: La Marca & García-Pérez, 1990: 111.

Cercosaura vertebralis: Doan, 2003: 110.

Cercosaura ampuedai: Hernández Ruz, 2005: 1.

Diagnosis: A medium-sized lizard of the genus *Cercosaura* with keeled hexagonal dorsal scales arranged

in transverse series only, in 25–37 transverse rows. Scales around midbody 26–45. Frontonasal equal in length or shorter than frontal. Supraoculars 3–4, including fusion of the first supraocular/supraciliary in all individuals. Genial scales two. Six or eight longitudinal rows of ventral scales. Subdigital lamellae of Toe IV 13–24.

Table 2 contains a summary of relevant morphological data of *Cercosaura vertebralis* throughout its range. The new specimens from Cajamarca, Peru differ from most of the specimens from Ecuador, Colombia, Venezuela, and Panama by lacking prefrontal scales. As pointed out by Uzzell (1973), the single specimen from El Oro, Ecuador and the single specimen previously known from Piura, Peru also lack these scales, but all other specimens known from throughout the range of the species have prefrontal scales present. In all other characters, the Cajamarca specimens are quite similar to those from Panama, Ecuador, and Colombia, with meristic character states being within the typical ranges of the species (Table 2). Surprisingly, the Cajamarca specimens have little in common with the single previously known Peruvian specimen from Piura, sharing only the absence of prefrontal scales. The one way that the EBC Cajamarca specimens are unique is that all of the specimens possess an oblique white bar that begins on the final infralabial and continues posteroventrally onto the proximal preular scale (Figure 3A). This white bar is

TABLE 2. Summary of relevant morphological characters of *Cercosaura vertebralis* throughout its range. Partial data on *Cercosaura ampuedai* from La Marca and García-Pérez (1990), Mijares-Urrutia (2000), and Hernández Ruz (2005).

Character	Piura, Peru (1)	Tabaconas, Cajamarca, Peru (4)	La Granja, Cajamarca, Peru (2)	Ecuador (10)	Colombia (24)	Panama (3)	" <i>C. ampuedai</i> " La Marca and García-Pérez (1990)	" <i>C. ampuedai</i> " Mijares-Urrutia (2000)	" <i>C. ampuedai</i> " Hernández Ruz (2005)
Transverse rows of dorsal scales	31	26	27	25-30	27-34	29		32-37	33-37
Longitudinal rows of dorsal scales	18	11-15	12-13	14-20	11-19	15-19		11-16	
Transverse rows of ventral scales	22	18-20	20-21	17-22	19-23	17-19		18-22	20-23
Scales around midbody	29	33-38	32-36	31-39	38-40	35-43		26-31	26-30
Prefrontal presence/suture	absent	absent	absent	absent/no suture/long/point	no suture/long/point/3 prefrontals	long/no suture		long	long in drawing
Palpebral eye disc	undivided	divided	divided	divided	divided	divided		divided	undivided
Subdigital lamellae of Toe IV	21	20	21	20-24	20-22	21-22		17-22	17-22
Femoral pores Males (per leg)	0	0	0	6	4	5		9-11	7-10
Femoral pores Females (per leg)	unknown	unknown	unknown	4-5	0-7	5		3-9	0-4
% with curved pale lip line	100	33	50	43	100	50		0	0
% with pale vertebral line	0	100	100	100	100	100		straight in photograph	0
Lateral ocelli	0	2-3	2	0-3	0-5 (95% 0)	2-3		0	0
Oblique infralabial-pregular bar	0	100	0	0	0	0		0	0

not found on any of the La Granja specimens (Figure 4) or other specimens examined from throughout the range of the species.

In comparison to the hemipenis drawings of Hernández Ruz (2005) and Hernández Ruz and Bernal González (2011), a detailed examination of MUSM 32489 from SNTN reveals that the clavate bilobed hemipenes possess four rows of inverted V-shaped flounces in basal position of the asulcate surface with a naked region separating those flounces from the 14 longitudinal rows of flounces surrounding the lobules (Figure 5). This differs from the hemipenial drawing of Hernández Ruz and Bernal González (2011), which depicted the flounces as continuous on the asulcate surface, whereas Hernández Ruz (2005) depicted a large naked region on the asulcate surface of "*Cercosaura ampuedai*". Each flounce has transverse diminutive spicules as pinnate structures. On the sulcate surface, the sulcus spermaticus is bifurcate and the medial region is naked.

Prefrontal scales are absent in specimens from the

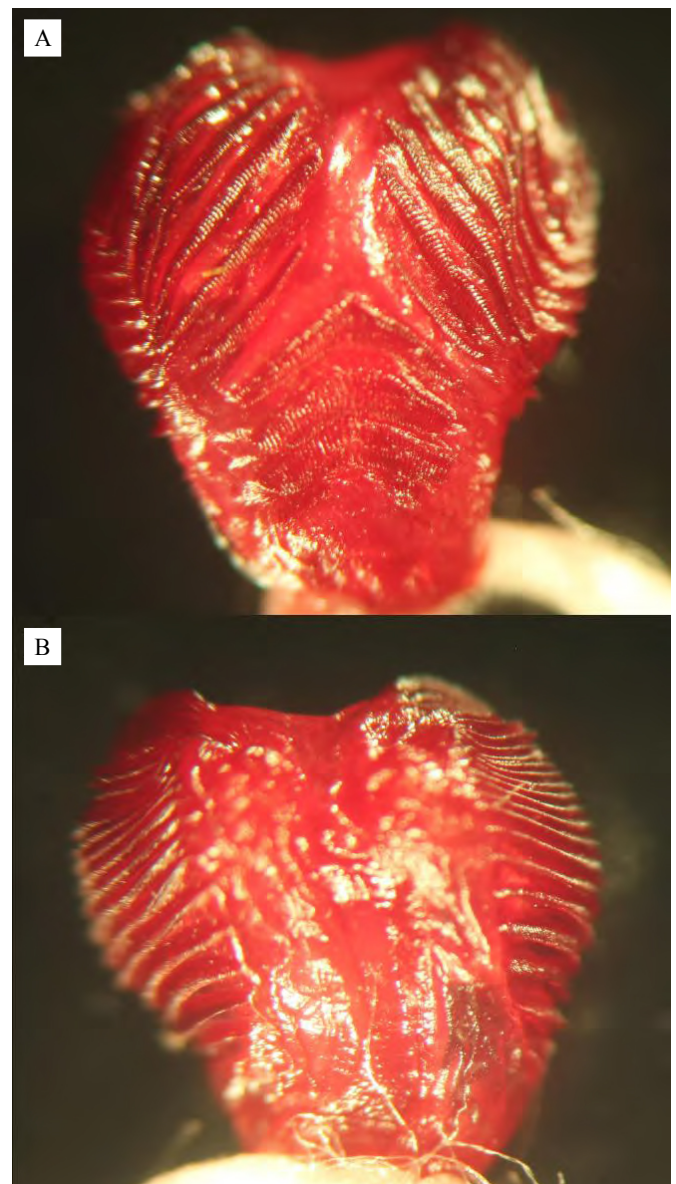


FIGURE 5. Hemipenis of *Cercosaura vertebralis* (MUSM 31845). (A) Frontal view of asulcate surface of the right organ, showing longitudinal flounces. (B) Frontal view of sulcate surface, showing the bifurcate sulcus spermaticus.

southernmost part of the range (N=8, 19% of the 42 specimens with prefrontal data). Specimens from central Ecuador to Venezuela have a wide variety of contacts of their prefrontal scales from a tiny point suture (N=2, 5%), to a longer suture (N=22, 52%), to having no contact between the two prefrontal scales (N=10, 24%) (see Fig. 6). One specimen has three prefrontal scales, which includes a tiny third scale medial to the larger lateral scales (Figure 6). There does not appear to be any trend associated with locality for prefrontal suture contact.

Four publications plus the new data collected in this study come to bear on the question of validity of *Cercosaura ampuedai* (La Marca and García-Pérez 1990; Mijares-Urrutia 2000; Hernández Ruz 2005; Hernández Ruz and Bernal González 2011). From those publications, five potentially diagnostic characters may be gleaned: sexual dimorphism of femoral pores, shape of the pale lip line, presence of pale paravertebral line, number of scales around the midbody, and division of palpebral eye scales. La Marca

and García-Pérez (1990), Mijares-Urrutia (2000), and Hernández Ruz (2005) state that *C. ampuedai* has sexual dimorphism in the number of femoral pores but that *C. vertebralis* does not display sexual dimorphism. Our examination of 44 specimens from Panama, Colombia, Ecuador, and Peru found no sexual dimorphism (with 0–6 per leg in males and 0–7 in females). Although there does seem to be a difference in ranges between males and females in the specimens allocated to *C. ampuedai*, and the overall number of femoral pores appears to be slightly higher in those specimens than in the *C. vertebralis* specimens, the ranges are overlapping, which makes the utility of this feature as a diagnostic character questionable. La Marca and García-Pérez (1990) discussed the shape of a pale lip line as important, with *C. ampuedai* having a straight line and *C. vertebralis* possessing a curved line. In our current sample of 44 specimens, we found a wide variety of curvature among the samples, without a clear trend that correlates with

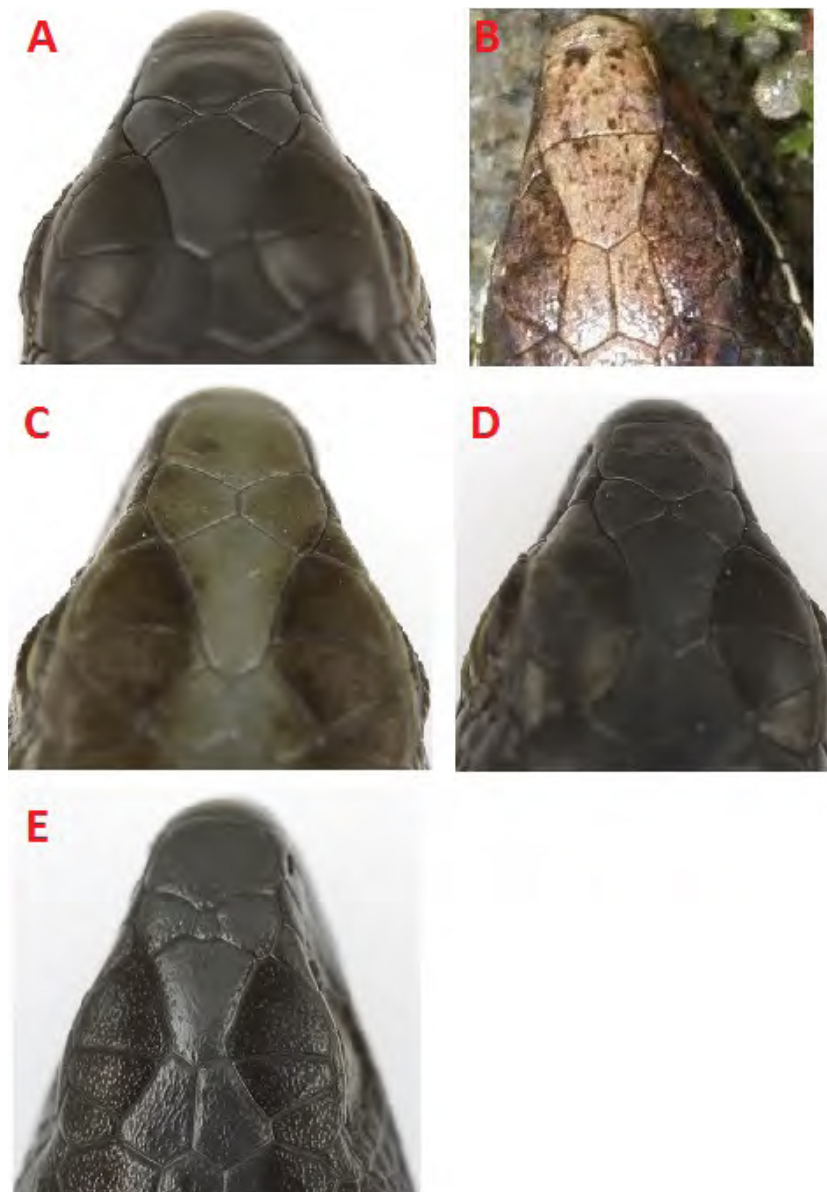


FIGURE 6. Five patterns of prefrontal scales found in *Cercosaura vertebralis*. (A) No suture between prefrontal scales (AMNH R-60591); (B) prefrontal scales absent (MUSM 31845); (C) long contact (AMNH R-119370); (D) point contact (AMNH R-60587); (E) anomalous three prefrontal scales (LACM 45019).

locality. Some *C. vertebralis* specimens had very straight lip lines (see Figure 3), while others curved to varying degrees. Therefore, we do not consider this character to be diagnostic for distinguishing between the species. A pale paravertebral line was found to be absent in *C. ampuedai* and present in *C. vertebralis* by La Marca and García-Pérez (1990), Hernández Ruz (2005), and Hernández Ruz and Bernal González (2011). Mijares-Urrutia (2000) found that *C. ampuedai* was variable in this character, with some specimens having it and some not. In our current sample of *C. vertebralis* we found the paravertebral line present in all specimens except for the one from Piura, Peru. La Marca and García-Pérez (1990) and Mijares-Urrutia (2000) stated that scales around the midbody of *C. ampuedai* (26–31) are lower than *C. vertebralis* (31–45). However, the specimen from Piura, Peru had 29 midbody annuli (Uzzell, 1973, counted 28) and the Colombian *C. vertebralis* sample of Hernández Ruz and Bernal González (2011) encompassed the entire scale range of both putative species (27–46), which discards that character as diagnostic. Hernández Ruz (2005) and Hernández Ruz and Bernal González (2011) stated that the palpebral eye disc is undivided in *C. ampuedai* but divided in *C. vertebralis*. Mijares-Urrutia (2000) found divided palpebrals in his *C. ampuedai* sample. In our sample of *C. vertebralis* all specimens had divided palpebrals except the one specimen from Piura, Peru.

Because all of the five putative diagnostic characters to distinguish *Cercosaura ampuedai* from *C. vertebralis* are variable within and among the putative species, we designate *C. ampuedai* as a junior synonym of *C. vertebralis*, following Uzzell (1973), Doan (2003), and Doan and Lamar (2012). Thus, the distribution of *C. vertebralis* includes populations in Peru, Ecuador, Colombia, Panama, and Venezuela (Figure 1).

Finally, we can point out that the SNTN populations of *C. vertebralis* are relatively stable and abundant, because in 2011 (unpublished data, N=9) and 2012–2013 (this article, N=4) it was possible encounter a large number of individuals of this species at SNTN. Tabaconas Namballe is a natural protected area where additional surveys could provide information about its natural history and ecology, including long-term monitoring of this species. On the other hand, La Granja is a village with many anthropogenic impacts, where habitat loss caused by agriculture and cattle grazing are factors that appear to disturb the population levels of these lizards.

Specimens examined: COLOMBIA: *Antioquia:* 10 km W Andes (town) (LACM 72790), San Pedro (AMNH R-32737–32744), Santa Rita (LACM 45017), Sonson (AMNH R-32725–32736); *Cundinamarca:* above Sasaima on Bogota-Honda road (LACM 45018–45019); ECUADOR: *El Oro:* El Chiral (AMNH R-18312); *Pastaza:* Mera, Río Pastaza (AMNH R-60587, 60589, 60591–60597); PANAMA: *Darién:* SW sector Cerro Tacarcuna massif (AMNH R-119367), Cerro Malí (AMNH R-119368, 119370); PERU: *Cajamarca:* Santuario Nacional Tabaconas Namballe (MUSM 31844–31846, 31862), Caserio La Granja (MUSM 32489–32490); *Piura:* 11 miles E Canchaque (on road), west slopes of Huancabamba Mountains (LACM 58811).

AUTHORS CONTRIBUTION STATEMENT: JCC conducted all field work, did morphological descriptions of some specimens, and contributed to the writing. TMD did most of the morphological descriptions and comparisons and wrote most of the manuscript.

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