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A NEW SPECIES OF SALAMANDER (*BOLITOGLOSSA*: PLETHODONTIDAE) FROM THE CORDILLERA ORIENTAL OF THE COLOMBIAN ANDES

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ABSTRACT

Eight species of salamanders are recognized to Cordillera Oriental of Colombia. Here we describe a new species of the genus Bolitoglossa, named Bolitoglossa guaneae sp. nov. The highest number of species of this genus is found in the cloud forests located in the western flank of the Cordillera Oriental.

KEY-WORDS: Caudata; *Bolitoglossa*; New species; Cordillera Oriental.

INTRODUCTION

Colombia has the second highest number of amphibians in the world. Rainfall and altitude may have played an important role in the processes of speciation and endemism, which are concentrated in the mountains (Lynch *et al.*, 1997). The salamanders of the genus *Bolitoglossa* Duméril, Bibron & Duméril, 1854 are no exception; the country hosts 18 of 26 species found in South America. Four species (*B. biseriata* Tanner, 1962, *B. medemi* Brame & Wake, 1972, *B. silverstonei* Brame & Wake, 1972 and *B. sima* (Vaillant, 1911)) are widely distributed in the lowlands of the Pacific region, including Ecuador and Panamá (Acosta-Galvis, 2000, 2007; Brame & Wake, 1962; Tanner, 1962; Cisneros-Heredia, 2006; Ibáñez *et al.*, 2000; Mueses-Cisneros *et al.*, 2007; Parra-Olea *et al.*, 2004; Rivera-Correa & Gutierrez-C., 2006). Four species are endemic from Cordillera Occidental, of which two (*B. hiemalis* Lynch, 2001 and *B. hypacra* (Brame & Wake, 1962)) are distributed in *paramos* (Brame & Wake, 1963; Lynch, 2001; Acosta-Galvis,

2007) and the other species (*B. tatamae* Acosta-Galvis & Hoyos, 2006 and *B. walkeri* Brame & Wake, 1972) inhabit the cloud forests (Acosta-Galvis & Hoyos, 2006; Brame & Wake, 1963, 1972). On the other hand, for the Central Cordillera of Colombia three endemic species for Middle and Highlands are recognized, *B. valleculea* Brame & Wake, 1963 from Andean forest and *paramos* and two endemic species from cloud forest of the eastern slope, *B. phalarosoma* Wake & Brame, 1962 (records from Panamá need to be confirmed), and *B. ramosi* Brame & Wake, 1972 known from three localities in Andean forests in Antioquia-Caldas regions (Wake & Brame, 1962; Brame & Wake, 1963, 1972; Raffaelli, 2007; Acosta-Galvis, 2007). An isolated species, *B. savagei* Brame & Wake, 1963, from Sierra Nevada de Santa Marta, is restricted to cloud forests, and the populations in Venezuela may represent an undescribed species (Acosta-Galvis, 2000, 2007; Brame & Wake, 1963; Ruiz-Carranza *et al.*, 1996; Schargel *et al.*, 2002). In Cordillera Oriental about 37% of the diversity of salamanders recorded in Colombia can be found.

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Six species are recognized in the Cordillera Oriental, two of them occurring in lowlands: *B. lozanoi* Acosta-Galvis & Restrepo, 2001, endemic from wet forests of Magdalena valley (Acosta-Galvis, 2004), and *B. altamazonica* (Cope, 1894), distributed in the east flank of the Cordillera Oriental and through the Amazon basin.

In Andean and Sub-Andean forests of western flank of the Cordillera Oriental another four endemic species were recorded: *B. capitana* Brame & Wake, 1963, known from the type locality (Brame & Wake, 1963; Rueda-Almonacid & Acosta-Galvis, 2004), *B. pandi* Brame & Wake, 1963, known from two localities in the humid Andean forests, *B. nicefori* Brame & Wake, 1963 (Brame & Wake, 1963; Acosta-Galvis, 2007; Ortega *et al.* 2009), and one species from the highlands, *B. adspersa* (Peters, 1863), found in *paramos* and Andean forests (Dunn, 1926, 1944; Nicéforo-María, 1958; Brame & Wake, 1963; Wake & Brame, 1966; Hoyos, 1992; Acosta-Galvis & Rueda-Almonacid, 2004).

Recently the increase of information available in the reference collections allowed us to reassess the taxonomy and distributional records (Acosta-Galvis & Restrepo, 2001; Acosta-Galvis, 2004; Acosta-Galvis & Hoyos, 2006; Chavés-Portilla *et al.* 2006; Rivera-Correa & Gutierrez-C., 2006; Acosta-Galvis, 2007; Raffaëlli, 2007). In this contribution, we report the first record of *B. palmata* for the country and describe a new species endemic from cloud forests of the western slope of the region of Santander in Colombia.

MATERIAL AND METHODS

Comparative data was obtained from 992 individuals collected from the Cordillera Oriental, deposited in the following collections: Universidad Nacional de Colombia (ICN), Bogotá; Museo Universidad de la Salle (MLS), Bogotá; Natural History Museum from Pontificia Universidad Javeriana (MUJ), Bogotá; Research institute from Alexander von Humboldt (IAvH), Villa de Leyva; Natural History Museum from Universidad Industrial de Santander (UIS), Bucaramanga; Amphibian collection from Universidad del Valle (UVC), Cali; Universidad de Antioquia (MHUA) and Colegio San José de Medellín (CSJ), Medellín. Uncatalogued material is cited in the appendix with the acronyms from the original collectors. A small incision in the region of the groin region was made in order to identify sex and sexual maturity through macroscopic observation of the gonads. Additionally, sexual structures are apparent in the

external morphology such as mental gland (Highton, 1962; Brame & Wake, 1963; Crump, 1977) and premaxillary teeth. Premaxillary teeth protruding beyond the outer lip margin were observed only in males. Morphologic description was done according to the terminology proposed by several authors such Wake & Brame (1962, 1969); Brame & Wake (1962, 1963, 1972); Acosta-Galvis & Restrepo (2001); Lynch (2001); Ehmcke *et al.* 2004; Acosta-Galvis & Hoyos (2006). Osteology description was based on Restrepo (1995) and Acosta-Galvis & Hoyos (2006). Differential staining techniques for osteology followed Dingerkus & Uhler (1977). Morphometric measurements follows Acosta-Galvis & Restrepo (2001), Brame *et al.* (2001), Hanken *et al.* (2005), Acosta-Galvis & Hoyos (2006), Acosta-Galvis (2007); Measurements were taken using a digital caliper (Mitutoyo 0.1 mm). We measured the following structures (in mm): Snout vent length (SVL), Head width (HW), Head length (HL), Orbital Diameter (OD), interorbital distance (IOD), Eyes-nares distance (END), Rostral length (RL), Rostral width (RW), Eyelid width (EW), Internarial distance (IN), Snout gular fold distance (SGD), Tibial Length (TL), Femur length (FEL), Foot length (FL) and Hand width (HDW).

RESULTS

Bolitoglossa guaneae sp. nov. (Fig. 1)

Holotype: Adult female, ICN-MHN 54440 (field number ARA 4984), collected by Benjamin Tapley and Andrés Acosta, on 8 December 2008, deposited in the Amphibian collection, Institute of Natural Sciences, Universidad Nacional de Colombia.

Type Locality: Colombia, Department de Santander, Municipality of Encino, Cartagena stream, enlargement area of Flora and Fauna Sanctuary Guantán, Alto Río Fonce, vereda La Chapa, Department of Santander, west flank from Cordillera Oriental, Colombia, elevation 1836 m. 06°06'58.2"N and 73°07'34.4"W.

Paratypes: (9) ICN-MHN 34230, UIS-A 2203, UIS-A 2320, UIS-A 2324, UIS-A 2897 adult males from Municipality of Charalá, km 38 Hacienda La Sierra Santuario de Fauna y Flora Guantán, Alto Río Fonce, vereda Santa Helena, Departamento de Santander Colombia, elevation 2400 m. Collected by Claudia Vélez, Jeannette Nieto, Doris Gutiérrez, Ruth Estupiñán, and Sandy Arroyo; MUJ 7193-4

adult males, Boyacá, Municipality of Moniquirá, site El Arizal elevation 2050 m. ICN-MHN 12772 adult female Guillermo river, Bogotacito 55-56 km. along the road from Duitama to Charalá; ICN-MHN 8557 adult female, from Municipality of Charalá, Virolín, Departamento of Santander.

Etymology: The specific epithet of this new salamander is allusive to the native Guanes who lived within the distribution range of the species. They inhabited the area since 600 B.C and in 1586 they almost disappeared after fighting with the Spanish. Nowadays they live in Guane, a town of Santander in a small Indian area.

Referred Specimens: (43) ICN-MHN 12770-1, ICN-MHN 19558, ICN-MHN 4418 (Cleared and stained skeleton) Bogotacito 55-56 km. along on the road from Duitama to Charalá by the Guillermo river, Department of Santander, Colombia elevation 2340 m. ICN-MHN 8555, ICN-MHN 8556 (Cleared and stained skeleton), ICN-MNH 5197 Virolín, Vereda El Reloj, Cañaverales, Municipality of Charalá, Departamento of Santander Colombia, elevation 1750-2200 m. Adult males: UIS-A 1307, UIS-A 2026, UIS-A 2079, UIS-A 2325, UIS-A 2891, UIS-A 2898. Adult females: UIS-A 1369, UIS-A 2078, UIS-A 2082, UIS-A 2179, UIS-A 2316-7, UIS-A 2326, UIS-A 2893, UIS-A 2895, UIS-A 2899. Young males: UIS-A 2070, UIS-A 2184, UIS-A 2321. Juvenile females: UIS-A 1366, UIS-A 1890, UIS-A 1891, UIS-A 2048, UIS-A 2081, UIS-A 2318, UIS-A

2894, UIS-A 2896, UIS-A 2900, ICN-MNH 26325 70 km. along the road from Duitama to Charalá, Departamento of Santander Colombia, elevation 1760 m. All UIS-A were collected at La Sierra farm, Santuario de Fauna y Flora Guanentá, Alto Río Fonce, vereda Santa Helena, Departamento of Santander, Colombia elevation 2400 m.

Diagnosis: A endemic *Bolitoglossa* recognizable from the other species of the genus by a combination of the following characters: small size of the adult males (SVL = 31.53-41.56 mm) and adult females (SVL = 39.76-46.08 mm); extensively interdigital webbing with free digital tips on the fingers and toes (Type D in South American species, *sensu* Brame & Wake, 1963, and category D, *sensu* Wake & Brame, 1969) (Fig. 2); ventral surface of digit tips without terminal flattened tubercles (Fig. 2); snout short and rounded in lateral profile, head length 2.0-2.92 mm in adult males, 1.88-2.88 mm in adult females; snout rounded in dorsal view; protruding eyes on dorsal view; well-defined postcephalic constriction (Fig. 3). Ventral surfaces (in alcohol) brown with numerous tiny cream guanophores with irregular spots; nasolabial grooves cream on preserved specimens; males have white testis; adult males 1 or 2 premaxillary teeth pierce the lip; copper iris; Snout in profile lack numerous tiny cream guanophores; terminal phalanges of digits not expanded; pelvic girdle without posterolateral projections.

Bolitoglossa guaneae differs from other Colombian salamanders in morphologic and chromatic



FIGURE 1: Lateral (A) and dorsal (B) view of Holotype (adult female; ICN-MHN 54440) of *Bolitoglossa guaneae*. Photos by Andrés Acosta.

characteristics. From species with basal webbing with free digital tips on the fingers and toes (Type A in South American species, *sensu* Brame & Wake, 1963, and type slightly and moderately webbed *sensu* Wake & Brame, 1969), as *B. adspersa*, *B. hiemalis*, *B. hypacra*, *B. ramosi*, *B. savagei*, *B. tatamae*, *B. walkeri* and *B. valleculea* (Fig. 4), by having extensively interdigital webbing with free digital tips on the fingers and toes (Type D in South American species, *sensu* Brame & Wake, 1963, and category D, *sensu* Wake & Brame, 1969) (Fig. 2). From species with extensively or completely webbing (*sensu* Wake & Brame, 1969 and Types C, D, E and F *sensu* Brame & Wake, 1963), *Bolitoglossa guaneae* can be differentiated from *B. altamazonica*

in having extensively interdigital webbing with a longer and triangular third finger (completely webbing and tips rounded in *B. altamazonica*) (Fig. 5); differs from *B. biseriata* and *B. silverstonei* in having a ventral surface brown with white dots (ventral surface cream intensified by numerous small irregular light brown spots in *B. biseriata* and *B. silverstonei*), white testes in males (usually black testes in *B. biseriata* and *B. silverstonei*) and extensively interdigital webbing with free digital tips on the fingers and toes (being completely webbing without free digital tips in *B. biseriata* and *B. silverstonei*); from *B. medemi* in the absence of digital depressions (present in *B. medemi*); *B. guaneae* can be differentiated from *B. lozanoi* and *B. nicefori*

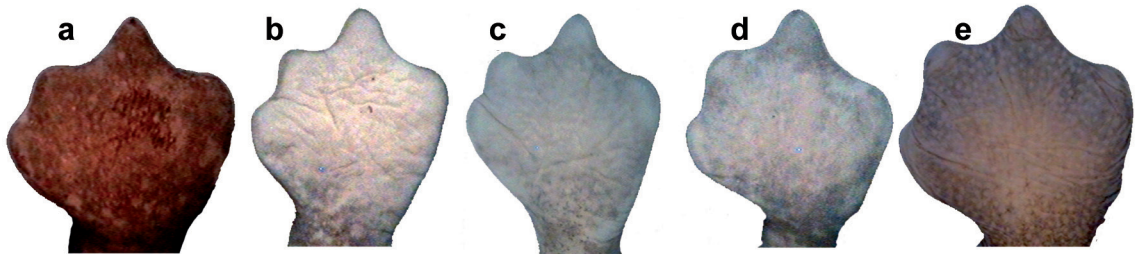


FIGURE 2: Ventral surfaces showing extensively interdigital webbing with free digital tips on the fingers and toes (Type D in South American species, *sensu* Brame & Wake, 1963, and category D, *sensu* Wake & Brame, 1969), in species of the genus *Bolitoglossa* in the Cordillera Oriental of Colombia. *Bolitoglossa pandi*: a) ICN 45500; *Bolitoglossa guaneae*: b) ICN 8557, c) ICN 12772, d) ICN 19558; *Bolitoglossa capitana*: e) ICN 9221.

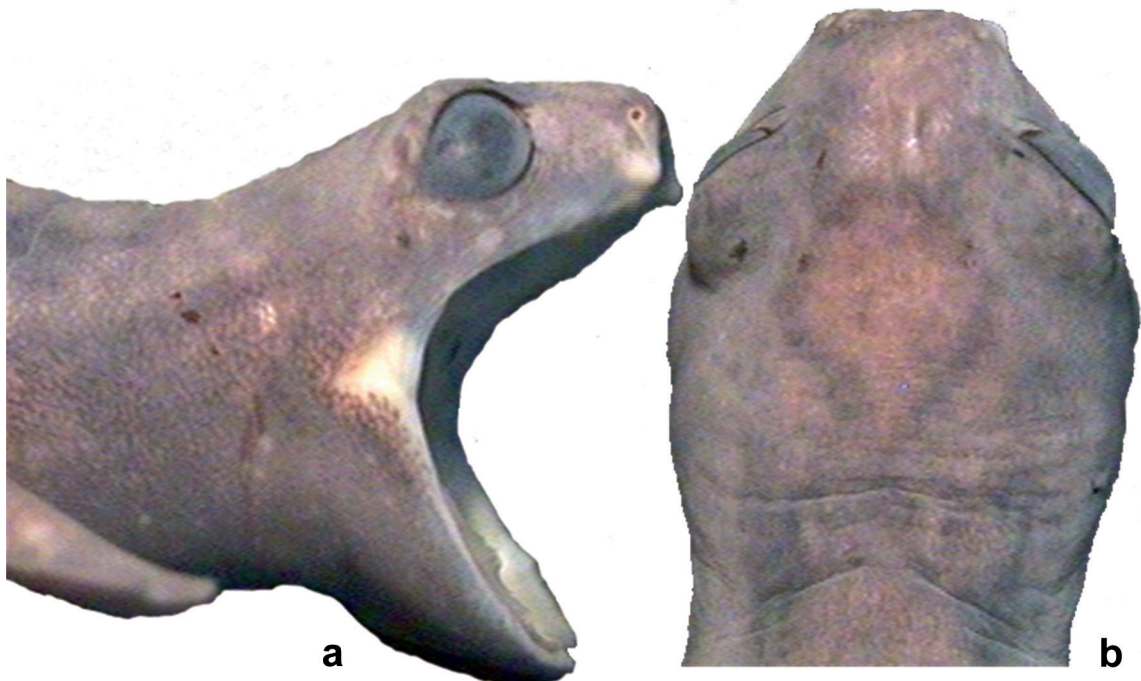


FIGURE 3: Paratype (ICN-MNH 8557) of *Bolitoglossa guaneae* (A) Head in right lateral view, (B) Head in dorsal view. Photos by Andrés Acosta.

in having extensively interdigital webbing with free digital tips on the fingers and toes (being completely webbing without free digital tips in *B. lozanoi* and *B. nicefori*) (Fig. 5) and more protruding eyes (not protruding in *B. lozanoi* and *B. nicefori*) (Fig. 6); from *B. phalarosoma* in being dorsal and lateral surfaces is dark brown (usually dorsal surfaces of head and body reddish brown with a cream patch which covers the surface of the face in *B. phalarosoma*); *B. guaneae* can be differentiated from *B. sima* by less extensive webbing (being completely webbing *sensu* Wake & Brame, 1969 and types F *sensu* Brame & Wake, 1963); from *B. pandi* in adult size (SVL = 39.76-46.08 mm in adult females in *B. guaneae*, versus SVL = 44.71-50.4 mm in adult females in *B. pandi*) and less protruding eyes on dorsal view (more protruding eyes on dorsal view in *B. pandi*) (Fig. 6); from *B. capitana*, in adult size (SVL = 31.53-41.56 mm in adult males and SVL = 39.76-46.08 mm in adult females in *B. guaneae*, versus SVL = 62.78-62.83 in adult males and SVL = 74.19-77.39 mm in adult females of *B. capitana*).

Description and Definition: This is tiny species, recognized as one of the smallest species among the Colombian species of *Bolitoglossa*. Males are 31.53-41.56 (mean = 37.6, SD = 4.53, *n* = 12) mm and females are 39.76-46.08 (mean = 37.7 mm, SD = 4.5, *n* = 11) mm of SVL. The snout is short in profile, rounded, sloping ventrolaterally and projects ahead of the upper jaw; *canthus rostralis* not prominent; postcephalic constriction clearly distinguished; fingertips and toe tips without a tubercle; nearly oval mental gland in males, transversally located and posteriorly prominent, 30-45.9% (mean = 37.7) the of head width in males. In profile, nasolabial grooves short, prominent (Fig. 3); curved towards the labial region being more prominent in males. Diameter of the eye versus head length, 30.80-36.80% (mean = 33.63, *n* = 12) in males, and 18.04-29.85% (mean = 23.98, *n* = 11) in females. The upper lip is neither prominent nor wide. The ratio of head width versus head length ranges from 73.34-92.18% (mean = 85.02, *n* = 12) in adult males, and 72.16-88.18% (mean = 82.77, *n* = 11) in adult females; postiliac glands absent; gular fold

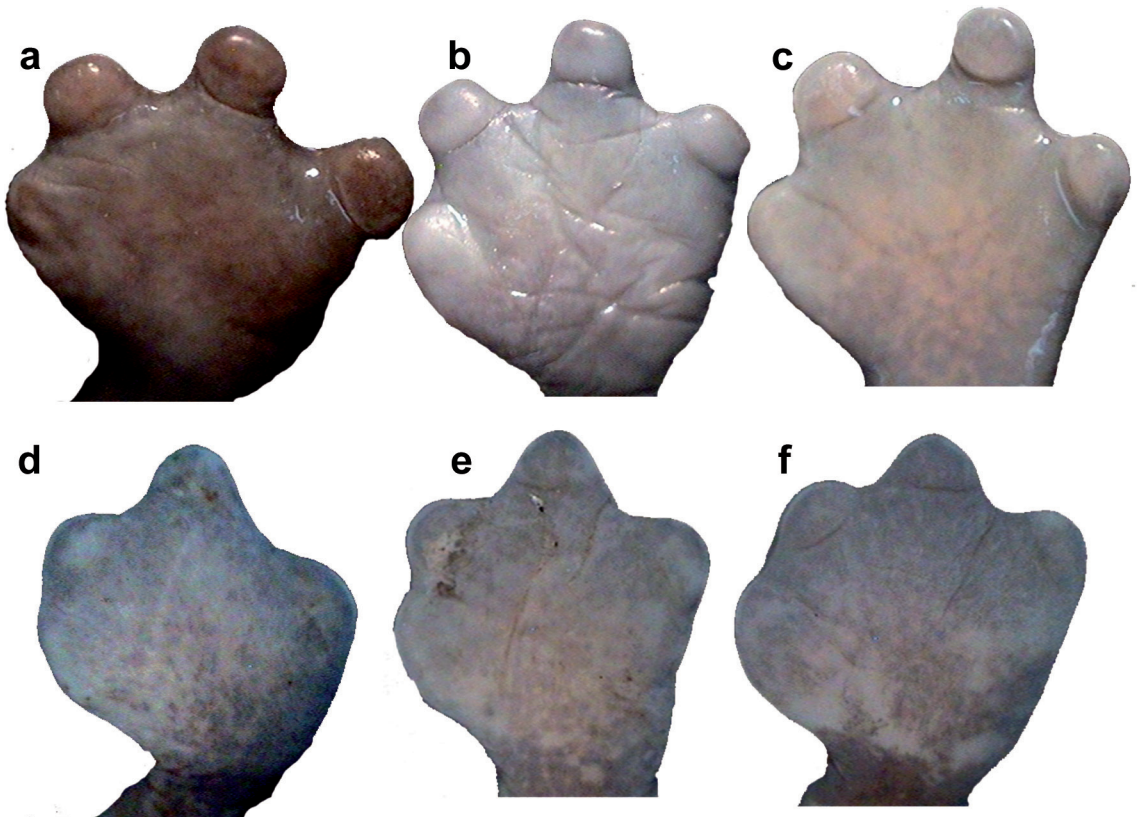


FIGURE 4: Ventral surfaces showing basal webbing with free digital tips on the fingers and toes (Type A in South American species, *sensu* Brame & Wake, 1963, and type slightly and moderately webbed *sensu* Wake & Brame, 1969); in species of the genus *Bolitoglossa* in the Cordillera Oriental of Colombia. *Bolitoglossa adspersa*: Parque Nacional Natural Chingaza, **a**) MUJ 267, Fomeque (Cundinamarca), **b**) MUJ 1907, **c**) MUJ 720; *Bolitoglossa palmata* from border Huila-Caqueta Departments **d**) ICN 20792, **e**) ICN 20793, **f**) ICN 20794.

prominent, projected towards ventrolateral cephalic region; the upper lip of males bears two teeth between the nasolabial grooves (= premaxillary teeth piercing lip *sensu* Ehmcke *et al.* 2004); tongue enlarged and rounded in its anterior tip, with a notch. Relative length of fingers III > II \geq IV > I; extensively interdigital webbing with free digital tips on the fingers (Type D in South American species, *sensu* Brame & Wake, 1963, and category D, *sensu* Wake & Brame, 1969) (Fig. 2); tips of digits are triangular and short (Fig. 2); hand width versus head length, 26.55-48.71% (mean = 40.23, $n = 12$) in males, and 28.79-42.09% (mean = 37.08, $n = 11$) in females.

Hindlimbs short and robust; relative length of digits are III > IV > II > V > I, with extensively interdigital webbing with free digital tips on the toes (Type D in South American species, *sensu* Brame & Wake, 1963, and category D, *sensu* Wake & Brame, 1969); foot length versus head length between 38.63-53.84%

(mean = 46.91, $n = 11$) in adult males, and between 35.2-48.0% (mean = 43.19, $n = 11$) in adult females. Fingers and toes without terminal flattened tubercles.

A very distinct constriction at the base of the tail with a slight lateral compression; tail length versus SVL 67.08-89.96% (mean = 78.50, $n = 9$) in males, and 60.71-79.53% (mean = 72.04, $n = 9$) in females. Skin of dorsum with lateral and ventral smooth surfaces.

Color in Life: The dorsal and lateral ground color is dark brown, sometimes mottled or streaked with white, diffuse paled blue and cream guanophores, in some individuals reddish marks are also present. Hindlimbs are dark brown with reddish; Tail is light to dark brown, in occasions mottled with white; ventral surfaces are Brown with dense white cream irregular spots and guanophores blue very faint, sometimes mottled white, tail is ventrally mottled white in some

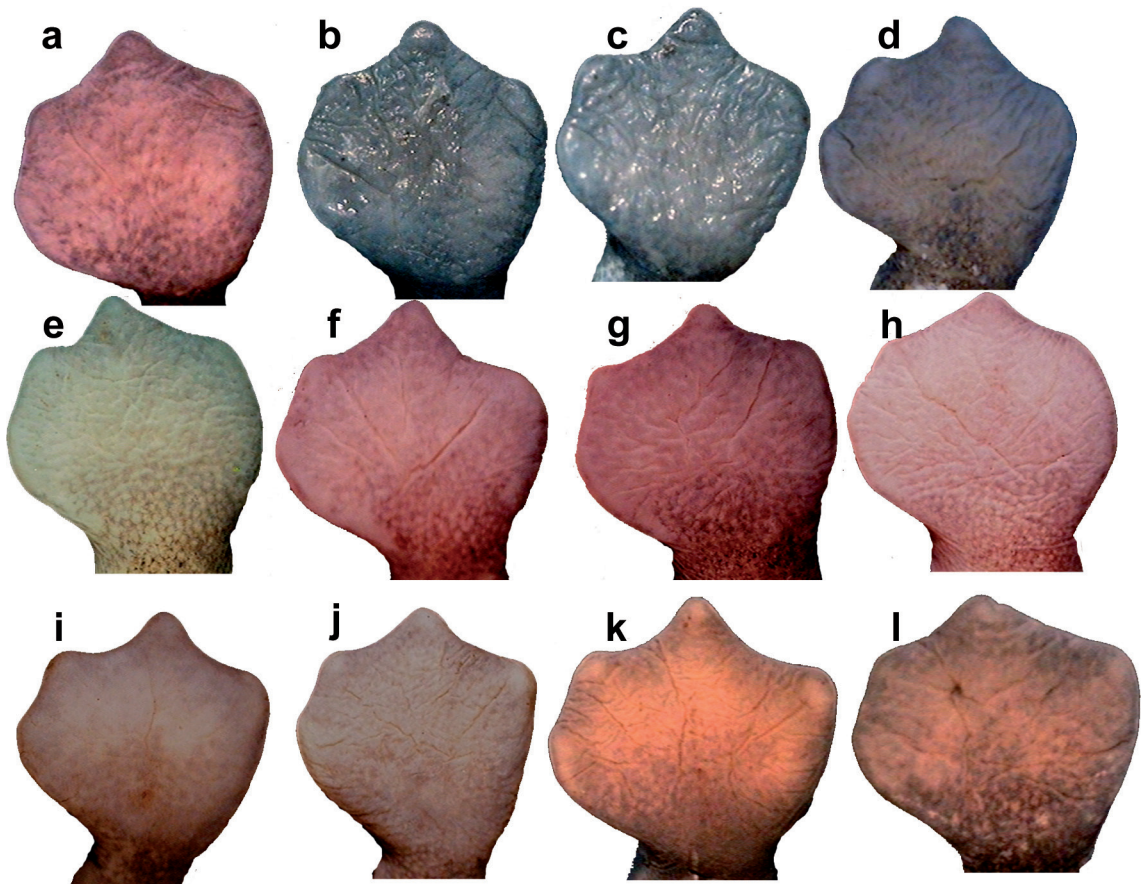


FIGURE 5: Ventral surfaces extensively or completely webbing (*sensu* Wake & Brame, 1969 and Types C, D, E and F *sensu* Brame & Wake, 1963), in species of the genus *Bolitoglossa* in the Cordillera Oriental of Colombia. *Bolitoglossa altamazonica*: Villavicencio (Meta), **a**) MUJ 4096, **b**) MUJ 4101, **c**) MUJ 4097, Leticia (Amazonas), **d**) ICN 46852, Leticia (Amazonas). *Bolitoglossa lozanoi*: **e**) MO 589, **f**) MOM 587, **g**) MOM 588, **h**) MOM 590; *Bolitoglossa nicefori*: Mesa de los Santos (Santander), **i**) MUJ 2445, **j**) MUJ 2377, **k**) ICN 50000, **l**) ICN 50001.

individuals; copper iris without black reticulations (Fig. 1).

Coloration in Alcohol: The ground color of head, trunk, and tail of the type series is dark brown, with palmar and plantar surfaces light brown. Venter dark brown with a few cream patches and cream guanophores.

Variation: The type series presents in general terms, a uniform color in all adult specimens; the dorsal color pattern with inconspicuous paler brown dorsolateral stripe, extending from posterior edge of eyelid dropping towards the base of thighs.

Osteology: The description is based on two specimens (ICN-MNH 8556, ICN-MNH 4418). Skull is oval and well formed, anterior elements are generally well ossified and articulated. *Pars dentalis* of the premaxilla are short with four to five teeth. The internasal fontanelle is relatively narrow. Nasal bones are protrusive anteriorly and articulate with maxillaries, frontals, and premaxillaries. Prefrontal bones are nearly rectangular, with irregular edges, slightly longer along the posterior rather than the anterior ridge. Frontal bones occupy nearly half the length of the skull, irregular in shape; they overlap each other and the parietal bones. Irregular parietal



FIGURE 6: Dorsal view of heads from species of the genus *Bolitoglossa* from the Eastern Cordillera of Colombia: *Bolitoglossa adspersa*: a) ICN 37863, Municipality San Antonio de Tena (Cundinamarca), b) ICN 12774, Páramo of Rusia, Municipality of Duitama Boyacá (Cundinamarca), c) ICN 37563, Alto del tigre (Meta); *B. altamazonica*: Villavicencio (Meta), d) MUJ 4095, e) MUJ 4097, f) MUJ 4096, Leticia (Amazonas), g) ICN 36510, h) ICN 46852; *B. capitana*: i) ICN 9221; *B. lozanoi*: j) MO 589, k) MOM 587, l) MOM 588; *B. nicefori*: Mesa de los Santos (Santander), m) MUJ 2377, Tona, n) ICN 50001; *B. palmata*: Political limits from Caquetá-Huila, o) ICN 20792, p) ICN 20793, q) ICN 20794; *B. pandi*: Municipality of Pandi, r) ICN 45500, Municipality of San Francisco (Cundinamarca), s) MUJ 7921; *B. guaneae*: Santander, t) UIS-A 2203, u) UIS-A 2184, v) UIS-A 2324.

bones; lateral parietal spur short, spreading to the level of both frontal and orbitosphenoid bones, separating their posterior edges. Parietals overlap

each other mesially, and are overlapped by frontal bones. Occipital condyles rectangular, posterolaterally directed.

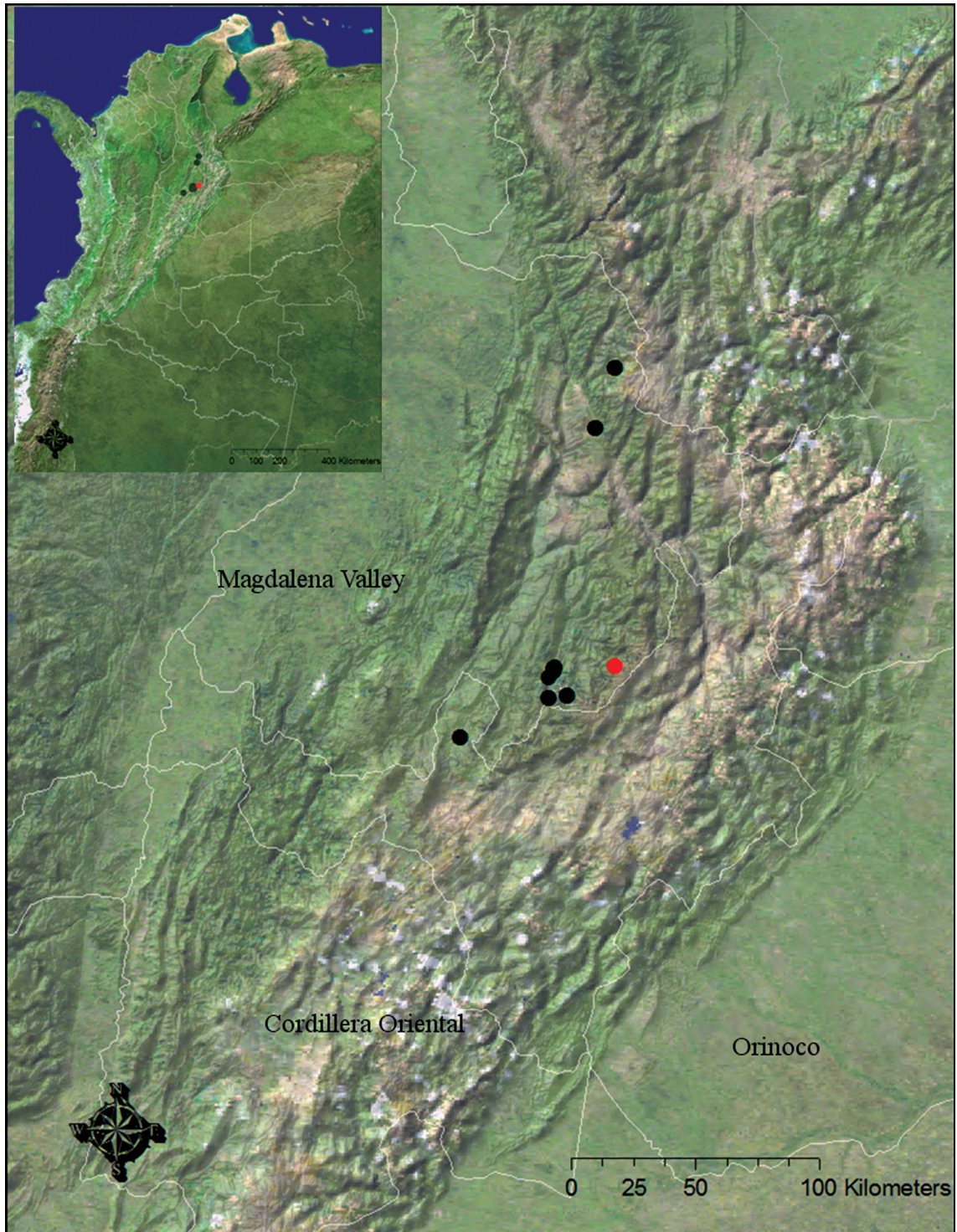


FIGURE 7: Localities of *Bolitoglossa guaneae* from western slopes of Cordillera Oriental from Colombia, red dot corresponds at type locality.

The right maxilla bears 13-21 teeth and the left one 16-24. Vomers triangular and rounded, bearing 19-28 teeth transversely positioned on the proximal end of the vomer, and wide internal nares. Antorbitalis cartilage is articulated to the posterior edge of the vomer, laterally to the maxilla and posteriorly to the orbitosphenoid bone. A large triangular parasphenoid bone making part of the cranial vault, extended from the vomer interspace to the ear capsules, bearing two plates covered with teeth arranged in short and oblique rows: the right plate bears 13-14 rows with 70-122 teeth, and the left one supports 12-13 rows with 73-138 teeth. Orbitosphenoid rectangular, with articular processes at anterior and posterior rims, and articulating with antorbitalis and pterygoid cartilages anterior and posterior, respectively. A large optic *fenestrum*; squamosal rectangular, irregular, and thin, investing the palatoquadrate laterally and articulating with the skull roof. The palatoquadrate is small, distally articulating with the articular by cartilaginous process, while the proximal end articulates to the posterior branch of the pterygoid. The right dentary bears 26-42 teeth and the left one 22-46. Fourteen presacral vertebrae, two caudosacral and 24 caudal. The neural arch of the atlas bears a cartilaginous spine. Transverse process forked, perpendicular to the body axis on the posterior vertebrae. Ribs curved; at the

distal end of the second vertebra is a V-shaped cartilaginous plate. There are no carpal or tarsal fusions nor reductions. Metacarpi are robust. The phalangeal formula in hands is 1-2-3-2; in feet is 1-2-3-2-2; wide foot and robust metatarsi.

Hyobranchial apparatus cartilaginous; basibranchial cylindrical, with a rectangular posterior end articulating with the visceral arches while its anterior end is laterally extended; ceratobranchial is anteroposteriorly directed from the medial region of the basibranchial, having a wider and more irregular base; the origin of ceratobranchial II is at the posterior end of the basibranchial. The ceratohyal articulates with the distal end of the hypohyal, having narrow plates at the base, and cylindrical ones on the posterior half.

Measurements of Holotype: All measures in mm. SVL: 38.01; HW: 5.86; HL: 6.02; OD: 2.03; IOD: 1.61; END: 1.21; RL: 1.66; RW: 1.61; EW: 1.26; IN: 1.68; SGD: 8.30; TL: 3.55; FEL: 3.56; FL: 4.85 and HDW: 3.02.

Distribution: *Bolitoglossa guaneae* is a species restricted to the central region of the west flank of the Colombian Cordillera Oriental, in Andean forests; its distribution is based on political geography and is known from the Departamentos of Santander

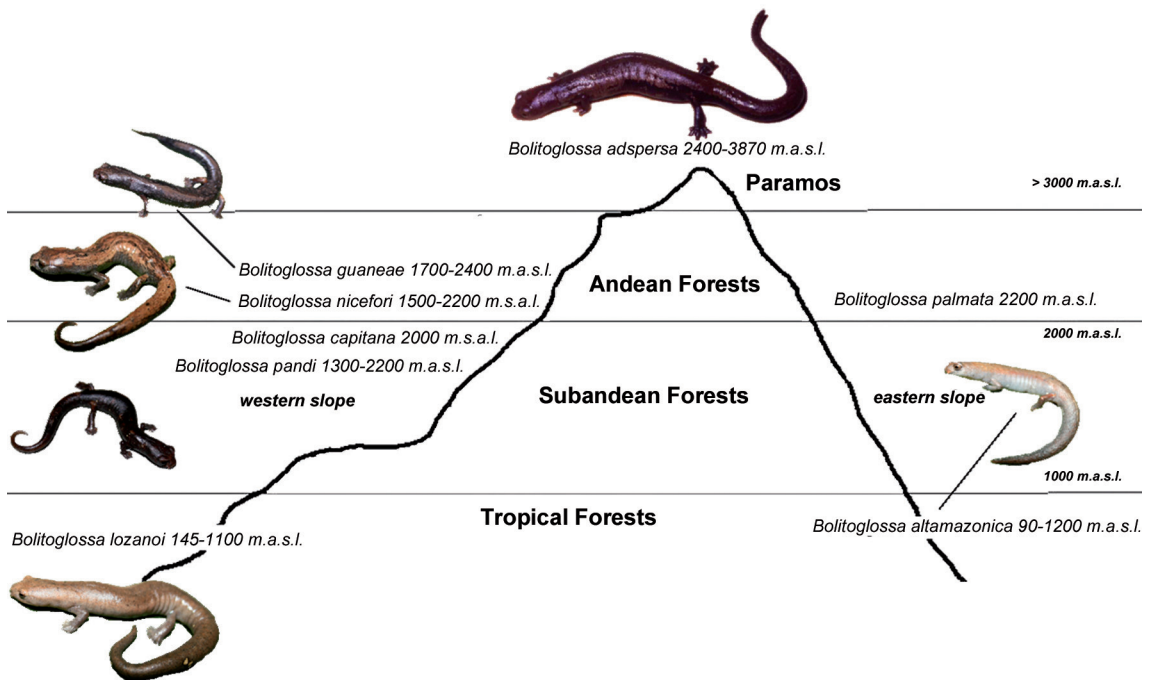


FIGURE 8: Altitudinal distribution of species of the genus *Bolitoglossa* in the Cordillera Oriental of Colombia.

and Boyacá from elevations between 1700-2400 m. Annual rainfall ranges between 1400-2000 mm (Fig. 7).

Habitat and Behavior: *Bolitoglossa guaneae* is a rare nocturnal species, restricted to near streams in primary or secondary forests with little anthropic intervention.

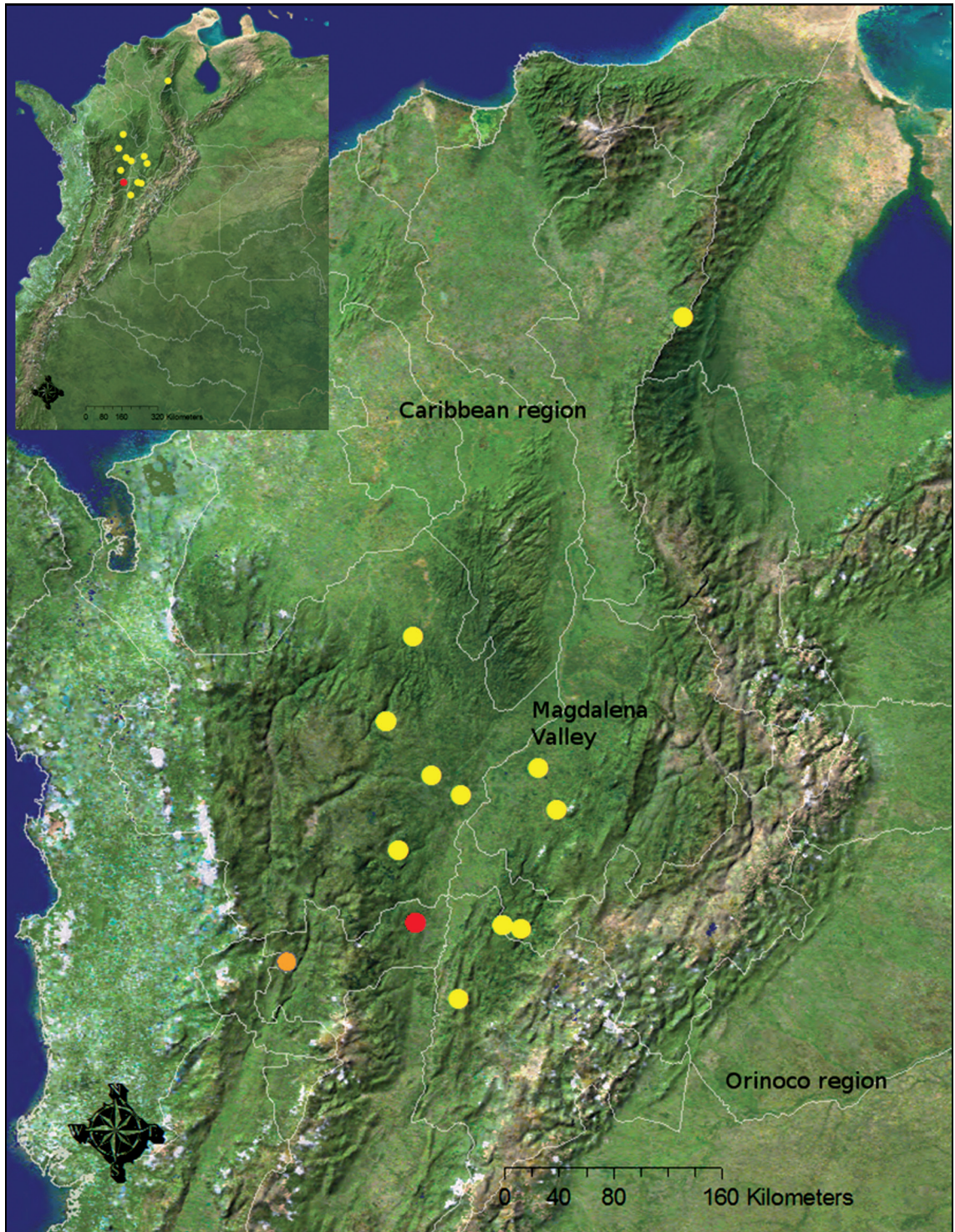


FIGURE 9: Distribution of *Bolitoglossa lozanoi* from Cordilleras Oriental and Central of Colombia, yellow dots correspond to localities, red dot is the type locality *sensu* Acosta and Restrepo, 2001; orange dot shows erroneously the distribution proposed by IUCN red List.

(“low montane humid forest” (bh-mb) *sensu* Holdridge 1996, see also Gutiérrez-Lamus *et al.* 2004). This species was found standing on low leaves (0,50-1,30 m

of Araceae, Melastomataceae, and ferns. The Holotype was collected on a leaf 0.5 m above ground at 22:06 h, with temperature of 21.1°C and 91% relative humidity.

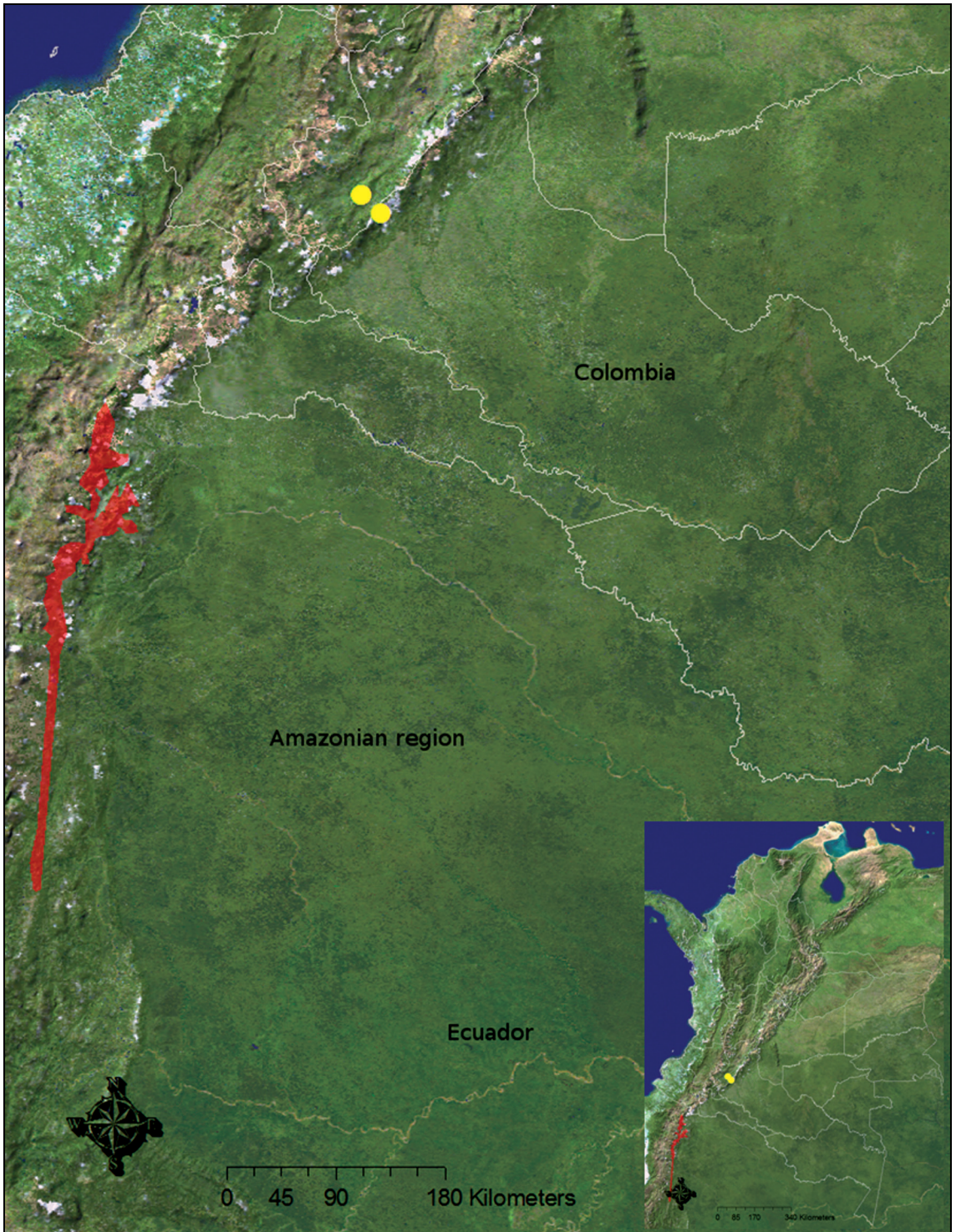


FIGURE 10: Distribution of *Bolitoglossa palmata* (southeastern of Cordillera Oriental). Red polygon corresponds the distribution proposed by IUCN red List.

DISCUSSION

The recognition of *Bolitoglossa guaneae* as a new species is justified by morphological characters such as small size, extensively interdigital webbing with free digital tips on the fingers and toes, triangular toe in third finger, well defined postcephalic constriction and terminal phalanges of digits not expanded. It seems that *B. guaneae* is more closely related to *B. pandi* (from southwest of Cordillera Oriental of Colombia) and *B. phalarosoma* (Cordillera Central of Colombia; Acosta-Galvis, 2007). It is endemic to humid relict forests on the western slopes of the Cordillera Oriental, and its known extent of occurrence is about 176.2 km. This distributional pattern is similar to several species of *Bolitoglossa* restricted in the cloud forests of the western slopes of Cordillera Oriental region as *B. capitana*, *B. pandi* and *B. nicefori*. *Bolitoglossa guaneae* is should be considered as Vulnerable (A4ce+B2ab(i,iii)+D1; IUCN, 2001). The population remains stable, but there is a rapid reduction and fragmentation of their habitats, and the presence of the pathogenic fungus *Batrachochytrium dendrobatidis* in its area of distribution (Ruiz & Rueda-Almonacid, 2008).

For other species associated to the Cordillera Oriental as *Bolitoglossa altamazonica*, it is was found to be common from July to December, associated to the vegetation next to creeks or occasionally under roots of bushes. Brame & Wake (1963) consider that the geographic distribution of this species spreads out to the Magdalena river valley; nevertheless, it is probable that the specimen observed by them belongs to *B. lozanoi*, which has been recorded at 1100 m in the Municipality of Yacopí, close to Muzo (1200 m) by the authors mentioned above (Fig. 8). Besides, Crump (1977) studied populations from the Peruvian Amazon and related them to the substrate of the interior of "terra firme" and "varzea" forests in the Amazon basin perching on shrubs. Almendáriz *et al.* (2004) and Cisneros-Heredia (2006) misidentified the Colombian specimens deposited in ICN-MNH collection as *B. ecuatoriana*.

A recent review of the specimens of *B. capitana* deposited in the collection of the Universidad de la Salle reveals that the numbers used by the reference collection for the original description of this species must be reassigned as follows: the holotype which used to be MLaS 1 *sensu* Brame & Wake (1963) (= MLS 119 Nicéforo-María, 1958) is now MLS 183; both paratypes (one male and one female) recognized by Brame & Wake (1963) as MLaS 1 and MLaS 1b are now MLS 182, and MLS 184 respectively. With reference to its large size it is important to note that

other species geographically related to *B. capitana*, such as *B. adpersa* and *B. nicefori* can be almost as large as this species. *Bolitoglossa capitana* is considered as critically endangered by IUCN and has no records since 1975. A specimen deposited at the Natural Sciences Institute of Bogotá (ICN-MNH 9221) exhibits subtle differences from the type specimens collected in 1945 by Brother Nicéforo-María, in which the ventral surfaces, the throat, chest and belly is colored purplish brown with dark brown guanophores diffuse; palms and soles brown, clear guanophores with cream. Chavés-Portilla *et al.* (2006) mistakenly identified an undescribed species of this genus as *B. capitana*; this new species differs from *B. capitana* by its ventral color pattern, more extensive webbing of hand and feet and its smaller size.

Bolitoglossa lozanoi is a nocturnal and arboreal species related to the interior of the underbrush of primary forest close to streams. Specimens were observed perching on Araceae and shrubs between 0.10-2 m above the ground. This species has a seasonal reproduction pattern and is commonly found between August and November. Considered as vulnerable by the red list of Colombian amphibians (Acosta-Galvis, 2004), it is actually widely distributed in the Magdalena valley (Fig. 9). It was erroneously recorded as *B. altamazonica* in the Muzo area by Brame & Wake (1963), while this locality is close to the collection place of *B. lozanoi* by Acosta-Galvis (2004) in the Department of Cundinamarca.

Finally, *Bolitoglossa palmata* is first reported to Colombia based on five specimens of (Fig. 10). It is a nocturnal and arboreal species related to primary or secondary forest, being collected perched on shrubs in open vegetation between 0.20-1 m meters above the ground. It is well known from the Municipality of Florencia in the Department of Caquetá. *B. palmata* occurs in the eastern flank in the southern part of Colombian Cordillera Oriental; it has been recorded in two subandean forest localities on the border between the Department of Caquetá and Huila, distributed in elevations between 2020-2360 m.

RESUMEN

Basados en las colecciones nacionales de referencia, ocho especies del género Bolitoglossa son reconocidas y una nueva especie Bolitoglossa guaneae sp. nov. es descrita para la Cordillera oriental de Colombia. En términos relativos a la distribución altitudinal la mayor riqueza en la cordillera Oriental se centra en las tierras medias asociadas a los bosques de niebla del flanco occidental.

PALABRAS-CLAVE: Caudata; *Bolitoglossa*; Nueva especie; Cordillera Oriental; Distribución geográfica.

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APPENDIX

Specimens examined

Bolitoglossa adpersa ($n = 911$): COLOMBIA Boyacá, Municipality Duitama, Páramo de La Rusia, 3220 m. Adult males: ICN 4299, 4301-02, 4304, 4307-10, 4314. Adult females: ICN 4298, ICN 4305-06, ICN 4311. Youngs: ICN 4303; Paramo de La Rusia km 19-21 road between Duitama-Charalá, 3650 m. Adult males: ICN 12775-76, ICN 12782-86. Adult females: ICN 12773-74, ICN 12777, ICN 12779-81. Undetermined sex: ICN12778; Duitama Páramo de La Rusia, 3220 m. Adult female: ICN 4312. Young males: ICN 4300, ICN 4313; km 16-17 road between Duitama Charala, Páramo La Rusia, 3200 m. Adult females: ICN 9641-42; km 4 road between Duitama-Susacón km 17, Belén Susacón, 3400 m. Adult male: ICN 23133-35. Adult female: 23136. Hembra young: ICN 23137-8; Municipality Ramiriquí, km 11-12 road between Ramiriquí-Zetaquirá Páramo de Vijagual, 3080 m. Adult males: ICN 10998-1003. Young female: ICN 11002, ICN 40478; Municipality Sogamoso, Vadohondo km 71-77 road between Municipalities of Sogamoso-Pajarito. Adult males: ICN 5382-83. Adult females: ICN 5384-85, ICN 5268, Páramo de Toquilla km 75-76, road between Sogamoso-Pajarito, 2800 m. Young male: ICN 9496-7. Young female: ICN 9494-5, Páramo de Toquilla km 78, road between Sogamoso-Pajarito, 2610-2830 m. Adult male: ICN 9487, ICN 9489. Adult female: ICN 9486. Young male: ICN 9488, ICN 9490, ICN 9498-9. Young female: ICN 9491-93, ICN 9500; Municipality Susacón, road between Santa Rosita-Onzaga site "El Desayunadero", Páramo de Guantiva, 3240 m. Adult male: ICN 5872, ICN 37651. Adult female: ICN 5862, ICN 5873-4, ICN 37650, ICN 37652. Young male: ICN 5871, ICN 37648. Young females: ICN 37647, ICN 37649; Cundinamarca, Municipality Bojacá, Vereda San Pedro, 2400 m. Young male: ICN 47979; Municipality Caqueza, Vereda Monteredondo, Chingaza, Natural Park, 3200 m a.s.l. Adult male: MUJ 357. Adult females: MUJ 351, MUJ 356, Chingaza, Natural Park, North of Monteredondo, 3200 m. Female, Chingaza, Natural Park, Río Frio region, 3200 m. Young males: MUJ 504-505, Municipality of Carmen de Carupa, 8 km northwestern Páramo of Suae, 3380 m. Adult males: ICN 10971, ICN 10974, ICN 10976-78, ICN 10981-2, ICN 10985. Adult females: ICN 10970, ICN 10973, ICN 10975, ICN 10979-80, ICN 10983. Young males: ICN 10984, ICN 10986, Municipality of Choachí, road between Bogotá-Choachí near of Guadalupe, 3200 m. Adult males: ICN 498, ICN 507. Adult females: ICN 496, ICN 506. Hembras juveniles: ICN 499, ICN 501-2, ICN 505, Páramo de Cruz Verde, 3300 m. Adult males: ICN 258, ICN 260-2, ICN 3654, ICN 3658, ICN 3663, ICN 3666-7, ICN 3669, ICN 3672, ICN 3674, ICN 3676-7, ICN 3680, ICN 3684-5, ICN 3688, ICN 3691, ICN 3694, ICN 3695-8, ICN 3701-03, ICN 3705-8, ICN 3710, ICN 3712, ICN 3717, ICN 3719-20, ICN 3722-24, ICN 3727-28, ICN 3731-2, ICN 3734, ICN 3736, ICN 3737, ICN 3739, ICN 3740-41, ICN 3743-44, ICN 3747, ICN 524. Adult females: ICN 256-7, ICN 259, ICN 3655-57, ICN 3660, ICN 3662, ICN 3664-5, ICN 3670-1, ICN 3673, ICN 3679, ICN 3681-3, ICN 3686-7, ICN 3689-90, ICN 3692-3, ICN 3699-700, ICN 3704, ICN 3711, ICN 3714-6, ICN 3718, ICN 3730, ICN 3735, ICN 3738, ICN 3742, ICN 3745, ICN 516, ICN 525, ICN 530. Young males: ICN 3675, ICN 3707, ICN 3726, ICN 3733, ICN 523. Young females: ICN 3659, ICN 3661, ICN 3668, ICN 3678, ICN 3713, ICN 3721, ICN 3725, ICN 3729, ICN 3746, ICN 518, ICN 521-2. Undetermined sex: ICN 513-4, ICN 517, ICN 519-20, ICN 526-29, ICN 531-2, ICN 3709, Municipality of Fómeque, Chingaza Natural Park, 3200 m. Adult males: MUJ 363, MUJ 365, MUJ 368. Young males: MUJ 366. Young females: MUJ 361, Chingaza Natural Park, forest near to border of Babilonia stream, 3010 m. Clearing and staining: MUJ 2326, Chingaza Natural Park, Chingaza lake, 3200 m. Adult male: MUJ 354. Young female: MUJ 355, MUJ 510, km 28.6 road Chingaza lake, 3240 m. Adult males: ICN 4881, ICN 4883, ICN 4885, ICN 4887, ICN 4889-90. Adult females: ICN 4886, ICN 4891. Young male: ICN 4882. Young female: ICN 4880, 4884. Undetermined sex: ICN 4888, Chingaza, Natural Park, Retén La Paila, end of Chingaza Natural Park, 3300 m. Adult males: MUJ 291, MUJ 301, MUJ 304-6. Adult females: MUJ 302, MUJ 371-2. Clearing and stained: MUJ 2324-25, Chingaza Natural Park, La Playa, 3140 m. Adult males: MUJ 622, MUJ 911. Adult females: MUJ 281, MUJ 312, MUJ 370, MUJ 910. Undetermined sex: MUJ 1583, Chingaza Natural Park, Valle del Frailejón, 3215 m. Adult males: MUJ 285-286; Chingaza Natural Park, near Chuza river camp, 2967 m. Left margin of the Chuza river. Adult female: MUJ 314. Young male: MUJ 313. Young female: ICN 37935, Chingaza Natural Park, Golillas Reservoir 2 km before, 3000 m. Adult male: MUJ 295, MUJ 576. Adult female: MUJ 296. Young male: MUJ 294. Young female: MUJ 298. Clearing and stained: MUJ 2323, Municipality of Fusagasugá, km 50 road Fusagasugá-La Florida. Adult males: ICN 39095. Young males: ICN

39096-7, Municipality of Guasca. Adult males: ICN 4500, ICN 4502, ICN 4509-10, ICN 4512-13, ICN 4515, ICN 4518-21, ICN 4523, ICN 4527, ICN 4529-31, ICN 4536-37, ICN 4543-44, ICN 4546, ICN 4549, ICN 4551, ICN 4561-62, ICN 4564-5, ICN 4567, ICN 4570-74. Adult females: ICN 4503-04, ICN 4507-8, ICN 4514, ICN 4516, ICN 4524-25, ICN 4532-3, ICN 4538-39, ICN 4548, ICN 4550, ICN 4552-53, ICN 4556-58, ICN 4560, ICN 4566, ICN 4568. Young males: ICN 4534, ICN 4540, ICN 4563. Young females: ICN 4501, ICN 4505-6, ICN 4511, ICN 4517, ICN 4522, ICN 4528, ICN 4541-42, ICN 4545, ICN 4547, ICN 4554-55, ICN 4559, ICN 4569, ICN 4575, Páramo de Guasca. Young males: ICN 37877, Chingaza Natural Park, Buitrago lake, 3200 m. Adult male: MUJ 453. Young female: MUJ 290, Municipality of Junin, Nature Reserve Carpanta, Páramo de Chingaza, 3080 m. Young females: ICN 22354-55, Municipality of La Calera, Páramo of Palacio, 3300 m. Adult male: ICN 511. Adult female: ICN 229. Young female: ICN 510, Chingaza Natural Park, 3200 m. Adult male: MUJ 349, Chingaza Natural Park near of the Piedras Gordas creek, 3200 m. Adult males: MUJ 315, MUJ 317, MUJ 319, MUJ 322-3, MUJ 329, MUJ 334, MUJ 338-9, MUJ 341-42, MUJ 369. Adult females: MUJ 267, MUJ 316, MUJ 321, MUJ 325, MUJ 330-1, MUJ 336-7, MUJ 344, MUJ 346, MUJ 367. Young males: MUJ 343, 348. Young females: MUJ 318, MUJ 324, MUJ 326-28, MUJ 332-33, MUJ 335, MUJ 345. Clearing and stained: MUJ 320, MUJ 340, MUJ 347; Chingaza Natural Park between, Piedras Gordas Buitrago lake area, 3200-3250 m. 04°32'N, 73°45'W. Adult males: MUJ 162, MUJ 268, MUJ 287, MUJ 373, MUJ 399, MUJ 903, MUJ 906-7, MUJ 1043-44, MUJ 1047, MUJ 1051, MUJ 1056, MUJ 1058. Adult females: MUJ 297, MUJ 904-5, MUJ 908, MUJ 1042, MUJ 1046, MUJ 1052, MUJ 902. Young males: MUJ 1049. Young females: MUJ 309, MUJ 311, MUJ 586, MUJ 711, MUJ 909, MUJ 1045, MUJ 1048, MUJ 1050, MUJ 1053-4, MUJ 1054, MUJ 1055, MUJ 1057, MUJ 1059, km 21 road between Chingaza Natural Park, Municipality of La Calera. Adult males: UVC 5469-71, UVC 5475, UVC 5483, UVC 5488, UVC 5494, UVC 5496-97. Adult females: UVC 5467-8, UVC 5476-77, UVC 5480, UVC 5482, UVC 5485, UVC 5487, UVC 5489, UVC 5491-93, UVC 5495. Young female: UVC 5474, UVC 5490, Municipality of Quetame, Las Brisas farm km 22 between Villavicencio-Alto del Tigre, 2800 m. Adult males: ICN 7121-3, ICN 7128. Young males: ICN 7124, ICN 7132, ICN 7134, ICN 7138. Young females: ICN 7125-7, ICN 7129-31, ICN 7133, ICN 7135, ICN 7137. Undetermined: ICN 7139, Municipality of San Antonio de Tena, Las Mercedes forest, 2600 m. Adult male: ICN 37863, Municipality of San Francisco, 6 km near NW El Rosal, La Quebrada farm, El Vino creek 2530 m. Adult male: ICN 18356, Municipality of Soacha, Hacienda El Soche, 2600 m. Adult male: ICN 3546, ICN 3549. Adult females: ICN 3544-5, ICN 3547-8. Young male: ICN 3550. Undetermined sex: ICN 512, Municipality of Zipaquirá, Páramo of Guerrero, 3590 m. Adult female: ICN 14034, Meta: Alto El Tigre, 3870 m. Adult males: ICN 37556, ICN 37559-60, ICN 37563, ICN 37565. Adult female: ICN 37566. Young males: ICN 37562, ICN 37564. Young females: ICN 37558, ICN 37561. Undetermined sex: ICN 37557, Santander: Municipality of Guapotá, Vereda Moraré. Adult female: MLS 109.

Bolitoglossa altamazonica ($n = 144$): COLOMBIA Amazonas, Municipality of Leticia, Rodolfo's Mesa House, 04°7'N, 69°56'W. Adult male: ICN 48050. Young male: ICN 48045, Punpuña river. Adult male: ICN 35785. Young male: ICN 35784, Imani, forests km 2 road to Tarapacá. Adult: ICN 47617. Young female: ICN 47616, road to La Tonina creek. Adult female: ICN 36506. Young males: ICN 36506-07, Indigenous community of km 11 road to Tarapacá, 04°7'N, 69°57'W. Adult female: ICN 48049. Young males: ICN 48047, ICN 48052. Young female: ICN 49046, Manifue-Amena-Jusia Community, km 98 road between Leticia-Tarapaca, 150 m. 04°06'S, 69°55'W. Adult females: ICN 50654-55, Monilla-Amena Community km 9 road to Tarapacá, 100 m. 04°07'S, 69°56'W. Adult male: ICN 47388, ICN 47390. Adult females: ICN 47387, ICN 48048. Young male: ICN 47394. Young female: ICN 47389, ICN 47391-93, Vereda La Pedrera, Tamanitagua Community. Adult male: ICN 36510. Adult females: ICN 36503-05. Young males: ICN 36511, ICN 36513, Jitoma Community, to Tacaná River, 04°09'S, 69°56'W. Adult males: ICN 48043, ICN 48058-59, ICN 48062-63. Young male: ICN 48044. Young females: ICN 48042, ICN 48060-62, Los limones faro, km 21, 04°03'S, 69°59'W. Adult female: ICN 48051, km 10 road to Cananguche. Adult female: ICN 48053. Young male: 48057. Young female: ICN 48054, km 10 road to Cantadera Tacana. Adult female: ICN 48056, km 11 road between Leticia-Tarapaca. Adult male: ICN 48064. Adult female: ICN 48065, ICN 48067. Young females: ICN 48066, ICN 48068-69, km 13 road to Leticia-Tarapaca. Adult female: ICN 48055, corregimiento Calderón, right margin of the Calderón River. Young male: ICN 35786, Amacayacu Natural Park, way to San Martin, 100 m. Young female: ICN 38089, Amacayacu Natural Park, area Mata-Mata creek 04°09'S, 73°38'W. Adult male: ICN 20444, ICN

20446. Adult females: ICN 20446, JDL 20444. Young males: ICN 20445, MUJ 426, Natural Reserve Aguas Claras, 04°05'S, 70°01'W. Adult male: ICN 48070, Puré river, 02°07'N, 69°37'W. Adult male: ICN 46852. Adult female: ICN 46854. Young male: ICN 46853, Boyacá, Municipality of Santa María, way Chivor-Cueva las Moyas, 1080 m. Adult male: ICN 40724, Vereda Cahipay, alto Cachicama, Montenegro creek, 1200 m. Young male: ICN 48079, Vereda San Rafael, 1160 m. Adult males: ICN 40725-6, Caquetá, Municipality San José de Fragua, Vereda La Esmeralda, Buena Esperanza farm, 782 m. Adult males: TAG 1843, TAG 1862, TAG 1867. Adult females: TAG 1884, TAG 1883, TAG 1842, TAG 1865, TAG 1885, TAG 1866, TAG 1864, TAG 1863. Young: TAG 1931, TAG 187; Cundinamarca, Municipality of Medina, Vereda Choapal, road Medina-Gachalá km 7, 600 m. Adult males: ICN 14681, ICN 14683, ICN 14685, ICN 14690-2, ICN 14696, ICN 14699. Adult females: ICN 14676-79, ICN 14684, ICN 14686, ICN 14688, ICN 14694-95. Young males: ICN 14697, ICN 14800. Young females: ICN 14680, ICN 14682, ICN 14687, ICN 14689, ICN 14693, ICN 14698, Municipality of Acacias, 05°32'N, 74°06'W MLS 3, Vereda Loma del Pañuelo, El Sahagu creek, 720 m. Adult female: ICN 39595. Young males: ICN 39596-97, Municipality of Restrepo, Vereda Santa Lucia, Del Ortiz creek, 980 m. Adult male: ICN 37911, Municipality of Villavicencio, Vereda El Carmén, road Vereda el Carmén, 700 m. 04°09'N, 73°38'W. Adult females: MUJ 4095-7, MUJ 4099, MUJ 4101. Young male: MUJ 4100. Young female: MUJ 4098, Caño Blanco. Adult female: MUJ 3828. Young female: MUJ 3827, Villavicencio Botanical Garden, 580 m. Adult female: MUJ 358. Young male: MUJ 177, MUJ 359. Young female: MUJ 178. Undetermined sex: MUJ 390, Bavaria forests km 3 older road Villavicecno-Restrepo, 650 m. Adult females: ICN 37910, ICN 48076-78, near 5 km older road Villavicencio-Restrepo, Pozo Azul, 600-560 m. Adult females: ICN 26269, ICN 37909, ICN 48084, Putumayo, Municipality of Mocoa. Adult female: ICN 48080. Young male: ICN 48081, Serranía del Churumbelo, opening between Indiyaco river above Caquetá river, 400 m. 01°57'N, 76°34'W. Adult male: ICN 39861-62, Vaupés, Municipality of Taraira, Caparú Biological station, 150 m. Young males: ICN 36508-9, Serranía de Taraira, 240 m. Adult male: ICN 33672. Young male: ICN 33673. Undetermined sex: ICN 33671.

Bolitoglossa capitana ($n = 4$): COLOMBIA, Cundinamarca: Municipality of Albán, forest near the Padre Luna farmer, 1900 m. Adult males: ICN 9221, MLS 182. Adult females: MLS 183, MLS 184.

Bolitoglossa guaneae ($n = 65$): COLOMBIA, Boyacá: Municipality of Moniquirá, site El Arizal 2050 m. Adult males: MUJ 7193-4; Santander, Municipality of Charalá, Cuchilla de Fara, 3,5 km near Cañaverales, JDL 19093, km 38 road to Duitama Charalá, Hacienda La Sierra, ICN 34229, ICN 34230, UIS-A 2893-5, UIS-A 2897-9; km 56 road between Duitama-Charalá, ICN 19558; km 70 road between Duitama Charalá, ICN 26325; Municipality Gámbita, Bogotacito km 55-56 road between Duitama-Charalá, left margin Guillermo river, 2350 m. ICN 12770-2 ICN-MHN 19558, ICN-MHN 4418 (Cleared and stained skeleton); Municipality Piedecuesta, Vereda Las Ventas, UIS-A 2979, UIS-A 2982, UIS-A 2987, UIS-A 2991, UIS-A 2999; Municipality of Tona, site La Plazuela, LRS 012, LLR 001, PRC 001, AB 001, RC 210; Municipality of Virolin, site Cañaverales 1750-2200, ICN 8555-6, near of site Bogotacito road between Duitama-Charalá, ICN 5197; site El Taladro km 88 road between Duitama-Charalá, ICN 8557. Municipality of Encino, Cartagena stream, vereda La Chapa enlargement area of Flora and Fauna Sanctuary Guanentá, Alto Río Fonce, 1836 m. MUJ 9000.

Bolitoglossa lozanoi ($n = 46$): COLOMBIA, Antioquia: Municipality of Maceo, Las Brisas, 500 m. MHUA 2681, Municipality of Puerto Berrio, La Cristalina, MHUA 3269, Municipality of San Luis, Rio Claro Inspeccion de Policia El Vergel, 420 m. Young male: MUJ 1196, 700 m. MHUA 788, Boyacá: Municipality of Puerto Boyacá, Vereda La Fiebre, Inspección de Policia Puerto Romero, 500 m. Adult female: ICN 44546, Caldas: Municipality of La Victoria, Vereda Corinto, Sitio Charco Azul, right margin of the La Miel river, 510 m. Adult males: ICN 43770-2, ICN 43779, ICN 43783. Adult females: ICN 43767, ICN 43769, ICN 43781. Young male: ICN 43780. Young females: ICN 43766, ICN 43773-6, ICN 43778, ICN 43782, Municipality of Norcasia, CHEC camp, Moro river. Adult male: ICN 40267, Municipality of Samaná, Cañaverál, MHUA 1611, Cariaño, 475 m. MHUA 2773, Corregimiento Norcasia, El Tigre creek, La Miel I, project 520 m. Adult male: ICN 53448. Adult females: ICN 53447, ICN 53449, ICN 53450, road between Norcasia-Puente de Hierro, El Tigre creek 11.8 km, 440 m. Adult female: ICN 53451, Cesar, Municipality of la Jagua de Ibirico, Serranía del Perijá, La Victoria, Alto de las Florez School, Tucuy creek, 1000 m. Young female: ICN 38691, Cundinamarca:

Municipality of Yacopi, Vereda Sardinas, Inspección de Policía Guadualito, 05°34'N, 74°18'W, 1100 m. Adult female: ICN 37886, UIS-A-563, 1 km road between Guadualito-El Lamal. Adult males: ICN 37888-9. Adult females: ICN 37887, ICN 37890, ICN 37892. Adult female: ICN 37885, Municipality of Cimitarra, Vereda Perdida Alta, 450 m. MHUA 1762, Municipality of Mesa de los Santos, UIS-A-234-5, Municipality of Puerto Parra, La Olinda, 145 m. MHUA 1763, Municipality of Sabana de Torres, UIS-A-560. Tolima, Municipality Mariquita, Vereda Albania, Albania Forests, 939 m.

Bolitoglossa nicefori ($n = 47$): COLOMBIA Norte de Santander: Municipality of Cucutilla, Sisavita, 2250 m. MHUA 1835-48, MHUA 1873-89, MHUA 2305, Santander: Municipality of Charalá, Vereda Virolin, 1800 m. Adult females: MLS 110-1. Young: ICN 5546, Municipality of Encino, Alto Río Fonce, Sanctuary of Fauna y Flora Guanentá, 2300 m. Young: UIS 2326, Municipality of Floridablanca, Vereda El Mortíoño, Quebrada Torrentosa, 1500 m. Adult female: ICN 50000, Municipality of Los Santos, Vereda La Granja, El Roble farm, 1570-1700 m. 06°51'N. 73°02'W. Adult females: MUJ 2377, ICN 47959-60, UIS-A 234-235. Youngs: ICN 47959-60, MUJ 2460. Young females: MUJ 2445, MUJ 2462. Youngs: MUJ 2378, MUJ 2460. Postmetamorphics: MUJ 2886, Municipality of Puente Nacional, vereda Medios, 1800 m. MLS 232. Young: Municipality of Piedecuesta, Quebrada Las Ventas, 2000-2400 m. 06°58'N, 73°01'W. Adult male: UIS-A 2991. Adult females: UIS-A 2979, UIS-A 2982. Youngs: UIS-A 2987, UIS-A 2999, Municipality of Suaita, Corregimiento de San José de Suiata, San José farm, Forest Reserve San Cipriano, 1650, 06°09'N, 73°27'W. Young female: ICN 40743, Municipality of Tona, site La Plazuela, 1800 m. 07°00.9'N. 72°59.0'W. Adult males: LLR 001, AB-001. Adult females: RC 210, 12 km de Tona, 1870 m. Young females: ICN 50001-2, PRC 001, LRC 012.

Bolitoglossa pandi ($n = 2$): COLOMBIA Cundinamarca: Municipality of Pandi, Vereda Buenos Aires, 2200 m. Adult female: ICN 45500. Municipality of San Francisco road between San Francisco-Supatá, 1800 m. Adult male: MUJ 7921.

Bolitoglossa palmata ($n = 5$): COLOMBIA Caquetá Municipality Florencia: road between Departamentos of Huila and Caquetá, 2360 m. Adult females: ICN 20792, ICN 20794, adult males ICN 20793. Young: ICN 20796; Caquetá Municipality Florencia, above Tunnel, km 46.8, near road between Florencia-Suaza 2020 m. TG 174.

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(1) **Title Page:** This should include the **Title, Short Title, Author(s) Name(s) and Institutions**. The title should be concise and, where appropriate, should include mention of families and/or higher taxa. Names of new taxa should not be included in titles.

(2) **Abstract:** All papers should have an abstract in **English** and another in **Portuguese or Spanish**. The abstract is of great importance as it may be reproduced elsewhere. It should be in a form intelligible if published alone and should summarize the main facts, ideas, and conclusions of the article. Telegraphic abstracts are strongly discouraged. Include all new taxonomic names for referencing purposes. Abbreviations should be avoided. It should not include references. Abstracts and key-words should not exceed 350 and 5 words, respectively.

(3) **Body of Text:** The main body of the text should include the following sections: **Introduction, Material and Methods, Results, Discussion, Conclusion, Acknowledgments, and References at end**. Primary headings in the text should be in capital letters, in bold and centered. Secondary headings should be in capital and lower case letters, in bold and centered. Tertiary headings should be in capital and lower case letters, in bold and indented at left. In all the cases the text should begin in the following line.

(4) **Literature Cited:** Citations in the text should be given as: Silva (1998) *or* Silva (1998:14-20) *or* Silva (1998: figs. 1, 2) *or* Silva (1998a, b) *or* Silva & Oliveira (1998) *or* (Silva, 1998) *or* (Rangel, 1890; Silva & Oliveira, 1998a, b; Adams, 2000) *or* (Silva, *pers. com.*) *or* (Silva *et al.*, 1998), the latter when the paper has three or more authors. The reference need not be cited when authors and date are given only as authority for a taxonomic name.

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