



## A new *Pristimantis* (Anura, Terrarana, Strabomantidae) from Churi-tepui in the Chimanta massif, Venezuelan Guayana

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### Abstract

A new species of the genus *Pristimantis* is described from Churi tepui, in the Chimanta massif, Estado Bolívar, Venezuela. The new species was discovered during the Muchimuk Expedition 2009, an ongoing speleological exploration of the Charles Brewer cave system, the largest sandstone cave on Earth. The species is known from only one female, collected near the mouth of the Muchimuk cave, in “non-gramineous tubiform meadows”. The new species can be distinguished from other *Pristimantis* on the highlands of the Guiana Shield by its unique coloration, indistinct tympanum, dorsal and ventral skin smooth, well-developed lateral fringes on the fingers and toes, and basal webbing on Toes III–V.

**Key words:** *Pristimantis*, new species, Guiana Shield, Venezuela, tepui, Chimanta massif

### Resumen

Se describe una nueva especie del género *Pristimantis* del tepuy Churi, en el macizo del Chimantá, estado Bolívar, Venezuela. La nueva especie fue descubierta durante la Expedición Muchimuk 2009, una exploración espeleológica del sistema de cuevas Charles Brewer, que conforma el sistema en arenisca más voluminoso del planeta. La especie se conoce solamente por una hembra, que se hallaba cerca de la boca de la cueva Muchimuk, sobre el hábitat “herbazal tubiforme no-gramíneos”. La nueva especie puede distinguirse de otros *Pristimantis* de zonas altas y medias del Escudo de la Guayana por su coloración única, tímpano indistinto, piel dorsal y ventral lisa, dedos de pies y manos con quillas laterales bien desarrolladas, y membrana basal en dedos del pie III al V.

### Introduction

In recent years, a major event in cave exploration was the discovery of the Charles Brewer cave system in Churi-tepui, part of the Chimanta massif. Since its discovery in 2004 (Smida et al. 2004, 2005; Brewer-Carías 2005; Chacón et al. 2006), more than 23 km of subterranean galleries have been mapped; to date this is the largest sandstone cave system in the world (Marek Audy, pers. comm; to be published). Aspects of the herpetofauna of Chimanta have been treated by Roze (1958), Gorzula (1988, 1992), Ayarzagüena et al. (1992), Señaris et al. (1996) Gorzula & Señaris (1999), and revisited by McDiarmid & Donnelly (2005). During several expeditions from 2004 to 2009, a few specimens of reptiles and amphibians were observed or collected (Barrio-Amorós, unpublished data), including little known species such as *Stefania ginesi*, *Allobates rufulus*, *Tepuihyla edelcae*, *Anadia* sp. (Gorzula 1992), *Arthrosaura* sp. nov., *Thamnodynastes chimanta*, *Anolis carlostoddi*, and a new species of *Pristimantis*, which we describe herein.

## Materials and methods

Measurements were taken with a calliper to the nearest 0.1 mm. Morphological terms follow Lynch and Duellman (1997). Comparative data was taken from Duellman (1997), Barrio-Amorós & Brewer-Carías (2008), Rödder & Jungfer (2007), Fuentes & Barrio-Amorós (2004), and Myers & Donnelly (1996, 1997, 2008). We follow Hedges *et al.* (2008) with regard to generic, familiar and suprafamiliar classification. Sex was determined by dissection.

Adult measurements follow Barrio-Amorós *et al.* (2006) and are: SVL: straight length from tip of snout to vent; ShL: shank length from outer edge of flexed knee to heel; FL: foot length from inferior edge of inner metatarsal tubercle to the tip of disc on Toe IV; HeL: head length from tip of snout to the posterior border of skull (posterior edge of prootic, noted through the skin); HW: head width between angle of jaws; InD: internarial distance between centers of nares; EN: distance of anterior edge of eye to nostril; ED: horizontal eye diameter; TD: horizontal tympanum diameter; ETS: distance between the anterior edge of the eye to the tip of snout; FD: disk width of Finger III; T4D: disk width of Toe IV; 1FiL: length of Finger I from inner edge of thenar tubercle to tip of disk; 2FiL: length of Finger II from the junction of Finger I and III to the tip of finger disk. Institutional acronyms follow Frost (2010).

## Results

Hedges *et al.* (2008) list the following selected characters as diagnostic for *Pristimantis*: head as wide as body, tympanic membrane differentiated, dentigerous process of vomers present, terminal discs of digits expanded, bearing well defined circumferencial grooves, toe V longer than toe III. *Pristimantis* is a genus not known to have synapomorphies, and therefore the assignation is tentative until molecular data confirms its final location.

### *Pristimantis muchimuk* sp. nov.

(Figures 1–3)

Common name in English: Muchimuk rain frog. Common name in Spanish: Ranita muchimuk.

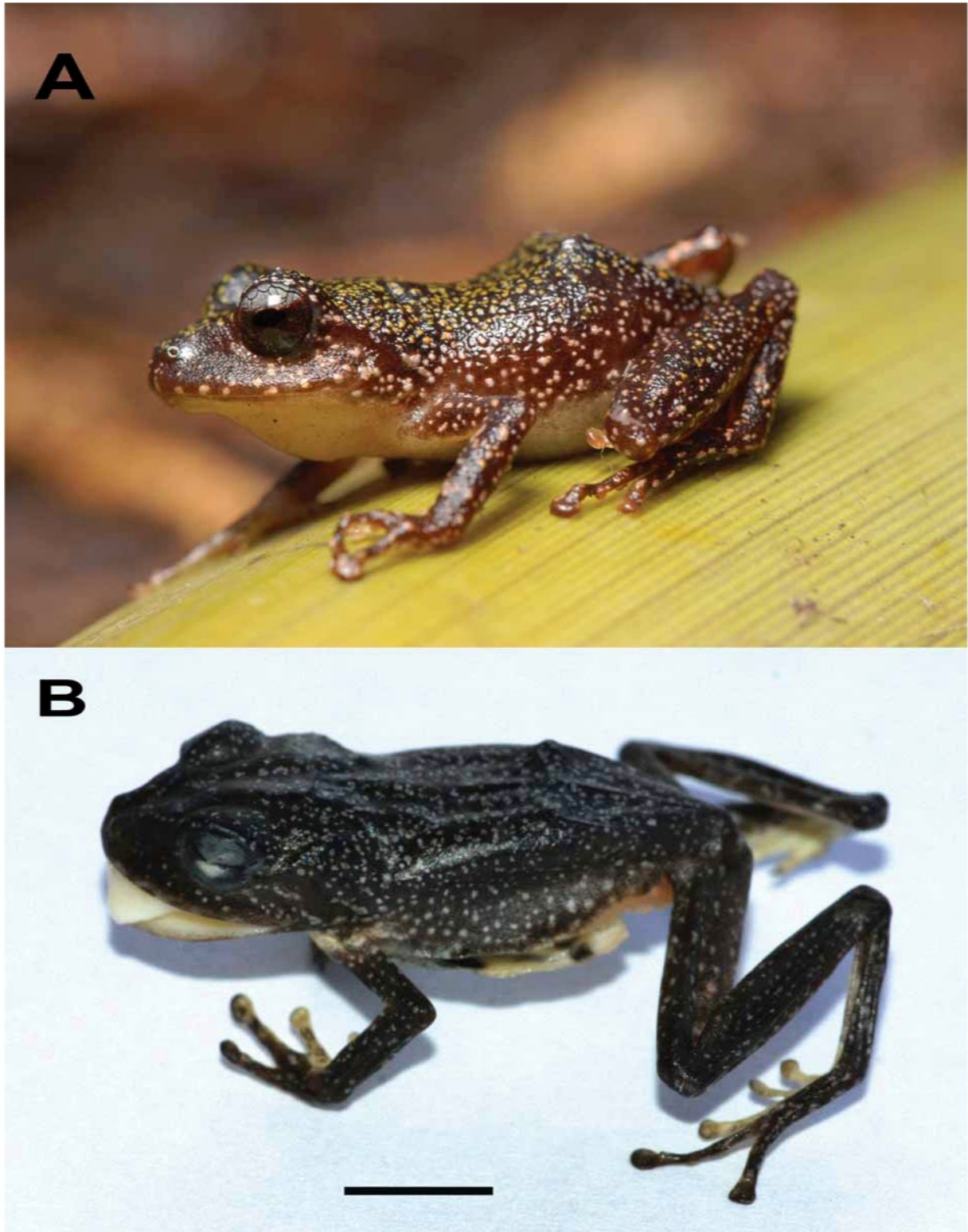
**Holotype.** MHNLS 19652, an adult female from the base camp of the Muchimuk-Expedition 2009, collected by Igor Elorza, Javier Mesa and Charles Brewer-Carías on a step of the northern face of Churi-tepui, 05° 16' 45" N, 62° 00' 56" W, 2325 masl, Estado Bolívar, Venezuela (Fig. 4–5).

**Diagnosis.** *Pristimantis muchimuk* is a small (SVL 25.2 mm) species that we place in the diverse *Pristimantis unistrigatus* group *sensu* Hedges *et al.* (2008), distinguished by Finger I shorter than Finger II, Toe V longer than Toe III, extending to the distal subarticular tubercle on Toe IV, cranial crests absent, and vomerine teeth present. *Pristimantis muchimuk* is characterized by: (1) dorsal skin smooth to warty, warts smooth, low and flat (smooth in preservative), with a barely distinguishable middorsal raphe; ventral skin smooth; (2) tympanic annulus and membrane absent; (3) snout rounded in dorsal view, nearly truncate in profile; canthus rostralis rounded; (4) upper eyelid smooth, with one barely discernible tubercle on each eyelid; (5) choanae small, oval; vomerine dentigerous processes horizontal, small, posterior and medial to choanae, each bearing 3 teeth; tongue rounded posteriorly; (6) presence of vocal slits and nuptial pads not known; (7) Finger I shorter than Finger II; (8) fingers with lateral keels; (9) ulnar tubercles absent; (10) tarsal tubercles and calcars absent; (11) inner metatarsal tubercle oval, three times the size of the round outer metatarsal tubercle; (12) toes with lateral fringes; basal webbing between Toes III-IV-V; Toe V longer than Toe III; (13) in preservative, dorsal surfaces of body and limbs dark brown, almost black, with many small whitish spots; ventral surfaces dirty white, with brown melanophores concentrated on chin and throat. In life: dorsum black with many small yellow spots; flanks dark brown with pinkish white flecks; venter white.

**Comparison with other species.** *Pristimantis muchimuk* (Fig. 1A) is unique among congeners inhabiting the highlands and mountain slopes in the Western Guiana Shield (Venezuela and Guyana) by the following

combination of characters: tympanum absent, skin on dorsum and venter smooth, only one ill-defined tubercle on each upper eyelid, fingers and toes with well-developed lateral fringes, basal webbing between Toes III–V, and dorsum dark brown with small yellow and pink spots (in life), which become white in preservative. The following Guayanan *Pristimantis* are compared with *P. muchimuk* (characters of the new species in parentheses), as all are endemics from granitic or sandstone uplands or highlands (tepui). *Pristimantis auricarens* (Myers & Donnelly) from Auyantepui has tubercular dorsal skin (slightly warty to smooth) and areolate ventral skin (smooth), snout truncate to acutely rounded dorsally (rounded), rounded in profile (nearly truncate). *Pristimantis avius* (Myers & Donnelly) from Tamacuari, has tubercular dorsal skin (slightly warty to smooth), distinct tympanum (absent), no lateral fringes on fingers (present), and females are larger, up to 33 mm (25 mm). *Pristimantis cantitans* (Myers & Donnelly) from Cerro Yaví, has a visible tympanum (absent), upper eyelid with small warts (smooth, with only one barely distinguishable tubercle), small, low nonconical calcar tubercles (absent), lip bars present (absent), larger size, females up to 45 mm (25 mm), and an axillary tubercle (absent). *Pristimantis dendrobatoides* Means & Savage, from Wokomung, Guyana, has verrucose dorsal skin (slightly warty to smooth), distinct tympanum (absent), black dorsum with several large red spots, ventral parts of hind limbs bright red in life (no red color). *Pristimantis inguinalis* (Parker) from the Guianas, has granular dorsal skin (slightly warty to smooth), tubercles on eyelids (absent), and a yellow-orange ocellus in cloacal region (absent). *Pristimantis jester* Means & Savage, from Wokomung, Guyana, has a snout dorsally subovoid (rounded), and laterally rounded (nearly truncate); a concave canthus rostralis (rounded), no fringes on fingers or toes (present), the coloration include red on the flanks (no red). *Pristimantis marahuaka* (Fuentes & Barrio-Amorós) from Cerro Marahuaka is most similar morphologically (see Fuentes & Barrio-Amorós 2004); though it lacks webbing between toes (basal webbing present between toes III–V), subarticular tubercles are prominent (little notable), ventral skin areolate to granular (smooth), disc on finger II 2.4 times wider than adjacent phalanx (2.0), and different color, dorsum pale brown to yellowish brown in preservative, garnet brown in life with or without small silvery spots (dark brown with white spots); venter is dirty white or reticulated with brown (white). *Pristimantis marmoratus* (Boulenger) from lowlands, uplands and highlands of the Guiana Shield, has a tubercular dorsal skin (slightly warty to smooth), tympanum distinct (absent), limbs barred (without bars), and a different habitat, rain to cloud forests in lowland and uplands up to 1400 m of the Guiana Shield (vs. non-gramineous tubiform meadows on rocky summit on a single tepui at 2325 m). *Pristimantis memorans* (Myers & Donnelly) from Tamacuari has tubercular dorsal skin (slightly warty to smooth) and areolate venter (smooth), tympanum distinct (absent), dark lip bars (absent), truncate finger discs (rounded). *Pristimantis pruvinatus* (Myers & Donnelly) from Cerro Yaví, has granular dorsal skin (slightly warty to smooth) and areolate venter (smooth), tympanum small but visible (absent), lateral keels on fingers absent (present), and small, non-conical calcar tubercles (absent). *Pristimantis pulvinatus* (Rivero) from Sierra de Lema has many tubercles on dorsal surfaces (smooth), tympanum evident (absent), fingers and toes without lateral fringes (present), ulnar tubercles present (absent). *Pristimantis saltissimus* Means & Savage, from Wokomung, Guyana, has snout profile subelliptical dorsally (rounded) and acuminate laterally (nearly truncate); canthus rostralis concave (rounded); fringes on fingers and toes absent (present) and no webbing between toes (present). *Pristimantis sarisarinama* Barrio-Amorós & Brewer-Carías from Sarisariñama-tepui, has dorsal skin shagreened (slightly warty to smooth), ventral skin areolate (smooth), evident tympanum (absent), fingers without lateral keels (present), toes without webbing (present) and keels (present). *Pristimantis yaviensis* (Myers & Donnelly) from Cerro Yaví, has flat tubercles on the upper eyelid (absent), and scattered warts on the dorsal skin (slightly warty to smooth, warts absent), fingers and toes lacking fringes (present). *Pristimantis yuruaniensis* Rödder & Jungfer from Yuruani-tepui lacks vomerine dentigerous processes (present), has a small but distinct tympanum (absent), and fingers and toes lack lateral fringes (present).

The other species of *Pristimantis* in the Guiana region belong to the *Pristimantis conspicillatus* Group (*sensu* Lynch & Duellman 1997; Hedges et al. 2008). These are *P. chiastonotus*, *gutturalis*, *vilarsi*, and *zeuctotylus*, which are widely distributed throughout the lowlands. All have a long snout and the first finger longer than the second.

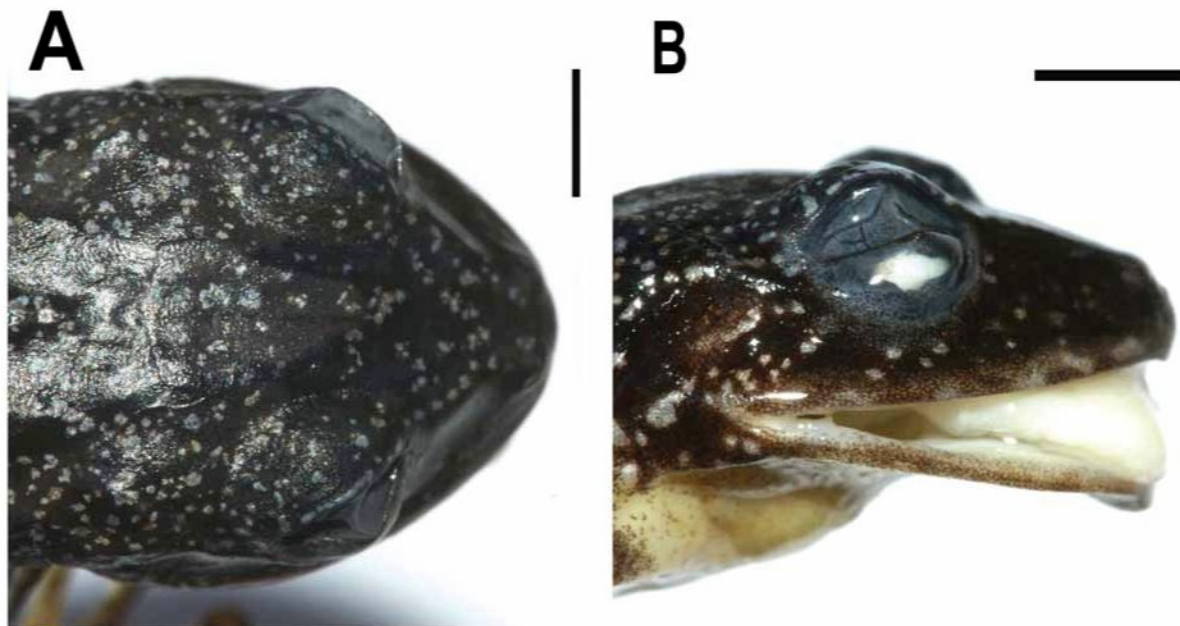


**FIGURE 1.** A) *Pristimantis muchimuk*, sp. nov, holotype in life. Photo: Javier Mesa. B) Dorsolateral view of the preserved holotype of *Pristimantis muchimuk*, sp. nov. Scale equals 5 mm.

**Description.** Body slender (Fig. 1B). Head slightly wider than body, slightly longer than wide; HL 39.2% of the SVL; rounded in dorsal view (Fig. 2A), nearly truncate in profile (Fig. 2B); nares not protuberant, directed laterally; canthus rostralis rounded, soft; loreal region concave; lips not protruding; one barely discernible tubercle on each eyelid, remainder of head without tubercles; interocular region barely wider than upper eyelid width; temporal region almost vertical; supratympanic fold well defined, tympanic annulus and



membrane absent. Choanae small, oval, not concealed by palatal shelf of maxillary arch, vomerine denticulous processes barely distinguishable, transverse, posterior to level of choanae, bearing three teeth each; tongue rounded posteriorly.



**FIGURE 2.** A) dorsal view and B) lateral view of the head of the holotype of *Pristimantis muchimuk*, sp. nov. Scale equals 2 mm.

Skin on dorsum smooth, without tubercles; dorsal surfaces of limbs smooth, middorsal raphe barely distinguishable, anal sheath and tubercles in cloacal region absent; skin on flanks, throat, chest, belly and ventral surfaces of hind limbs smooth.

Hand (Fig. 3A) with a thenar tubercle ovoid; palmar tubercle deeply bifid; supernumerary tubercles present, large, low, non-protruding; subarticular tubercles round, little notable; fringes well developed on fingers; Finger I shorter than II (its length 87% of II); relative length of fingers III>IV>II>I; finger discs expanded, rounded, on Fingers III and IV twice width of adjacent phalange; on Finger II 1.5 the width of adjacent phalange, and on Finger I slightly wider than adjacent phalange; all discs with ventral pads. Ulnar fold and tubercles absent.

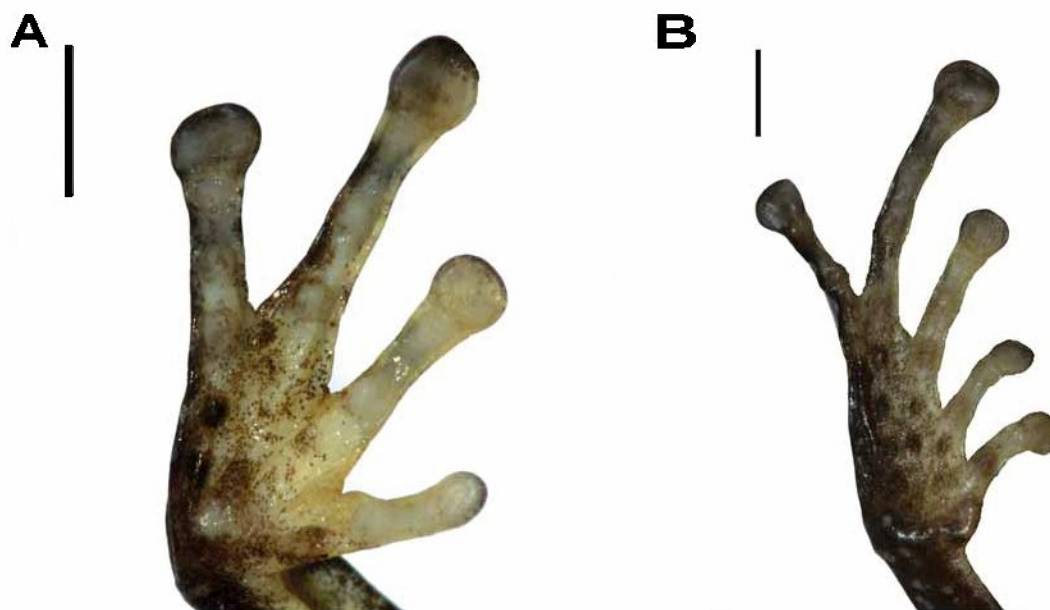
Foot length 40.4% of SVL (Fig. 3B); calcar, tarsal tubercles, and tarsal fold absent. Inner metatarsal tubercle oval, 3 times size of round outer metatarsal tubercle; supernumerary tubercles present, numerous, small; subarticular tubercles round, little notable; toes with well-developed dermal fringes; basal webbing between Toes III-IV-V; relative length of the toes IV>V>III>II>I; discs on toes round, smaller than those on fingers; disc on Toe IV slightly smaller than disc on Finger III. When adpressed, tip of disc on Toe V slightly surpasses distal subarticular tubercle of Toe IV; tip of disc on Toe III slightly surpasses penultimate subarticular tubercle of Toe IV.

Color in preservative: dorsal surfaces of body and limbs uniform dark brown with profusely scattered small white spots; palmar surfaces of Fingers I and II dirty white, those of Fingers III and IV with many dark brown flecks; plantar surfaces of Toes I-III white, rest of plantar surfaces with dark brown flecks, darkest laterally; ventral surfaces dirty white with few brown flecks on belly and chest, and more profuse on throat. Iris gray; palpebral membrane with a profusion of melanophores inferiorly (Fig. 2B).

Color in life (from a color photograph; Fig. 1A): dorsal ground color uniform reddish brown, with many small yellow, mostly round, spots dorsally and many small pinkish white spots on flanks and limbs. Venter white. Iris gray with fine black reticulation.

**Measurements of the holotype.** SVL: 25.2; ShL: 12.4; FL: 10.2; HW: 9.1; HL: 9.9; UEW: 2.4; IOD: 2.6; ED: 3.0.7; FD: 1.2; T4D: 1.1; ETS: 4.1; 1Fil: 2.9; 2Fil: 3.3.

**Remarks.** The holotype is slightly dehydrated (Fig. 1B) because it was preserved directly in alcohol, without fixing it in formalin. Some characters are still easily observed (fringes on fingers and toes, folds on forearms and tarsi), but should be compared with future living conspecific individuals or specimens fixed in formalin.



**FIGURE 3.** A) palm of right hand and B) sole of right foot, of the holotype of *Pristimantis muchimuk*, sp. nov. Scale equals 2 mm.

**Distribution.** The species is known only from Churi-tepui (Fig. 4), one of the 12 tepuis forming the Chimanta massif. The summit area of Churi-tepui is 47.5 km<sup>2</sup>, whereas the total summit area of Chimanta is 623 km<sup>2</sup>, and the slope area is 915 km<sup>2</sup> (McDiarmid & Donnelly 2005). To date, *Pristimantis muchimuk* is the only species of the genus described for the Chimanta massif. The species *Eleutherodactylus* sp. I mentioned by McDiarmid & Donnelly (2005) from Murey (= Eruoda) tepui in the Chimanta massif probably represent a different undescribed species (see Discussion). Fig. 5 shows the distribution of *P. muchimuk* and the rest of Venezuelan species south of the Orinoco river except *P. vilarsi* (see distribution map in Barrio-Amorós & Molina 2006).

**Conservation.** We recommend that the IUCN status of *P. muchimuk* must be Data Deficient (DD) (according to Stuart et al. 2008). Much research about the population status must be done in the Chimantá massif, but the new species seems to be rare, as we only found one specimen in four visits and Gorzula (1992) never found it.

**Habitat and Natural History.** The single specimen was found after rain, during the day, on a leaf of a fallen *Brocchinia hechtoides* (Bromeliaceae). The frog was apparently disturbed by human activity, and consequently visible during daylight. The habitat is known as “Non-Gramineous tubiform meadows” (sensu Huber 1995) on a flat swampy surface, with a height of no more than one meter, and predominance of *Brocchinia hechtoides*, *Orectanthe ptaritepuyana*, *Heliophora heterodoxa*, *Pterozonium* sp., and *Drosera* sp. In the vertical crevices nearby there is a dwarf forest of the dwarf tree *Bonnetia roraimae* with intermittent streams running in the rainy season.

**Etymology.** *Muchimuk* refers to a demon in the mythology of the indigenous Pemon people. The demon has avian form, like a giant raptor, and takes humans and other beasts for food. It inhabits the summits of the Chimantá and Tramén tepuis. Muchimuk is also the name of the Expedition made in May 2009 to explore different galleries of the Charles Brewer cave system. The specific name is used as a noun in apposition.



**FIGURE 4.** Aerial view of the Churi tepui, picture taken from the northwest. The type locality appears as a white spot pointed by a white arrow. Photo: Charles Brewer-Carías.

## Discussion

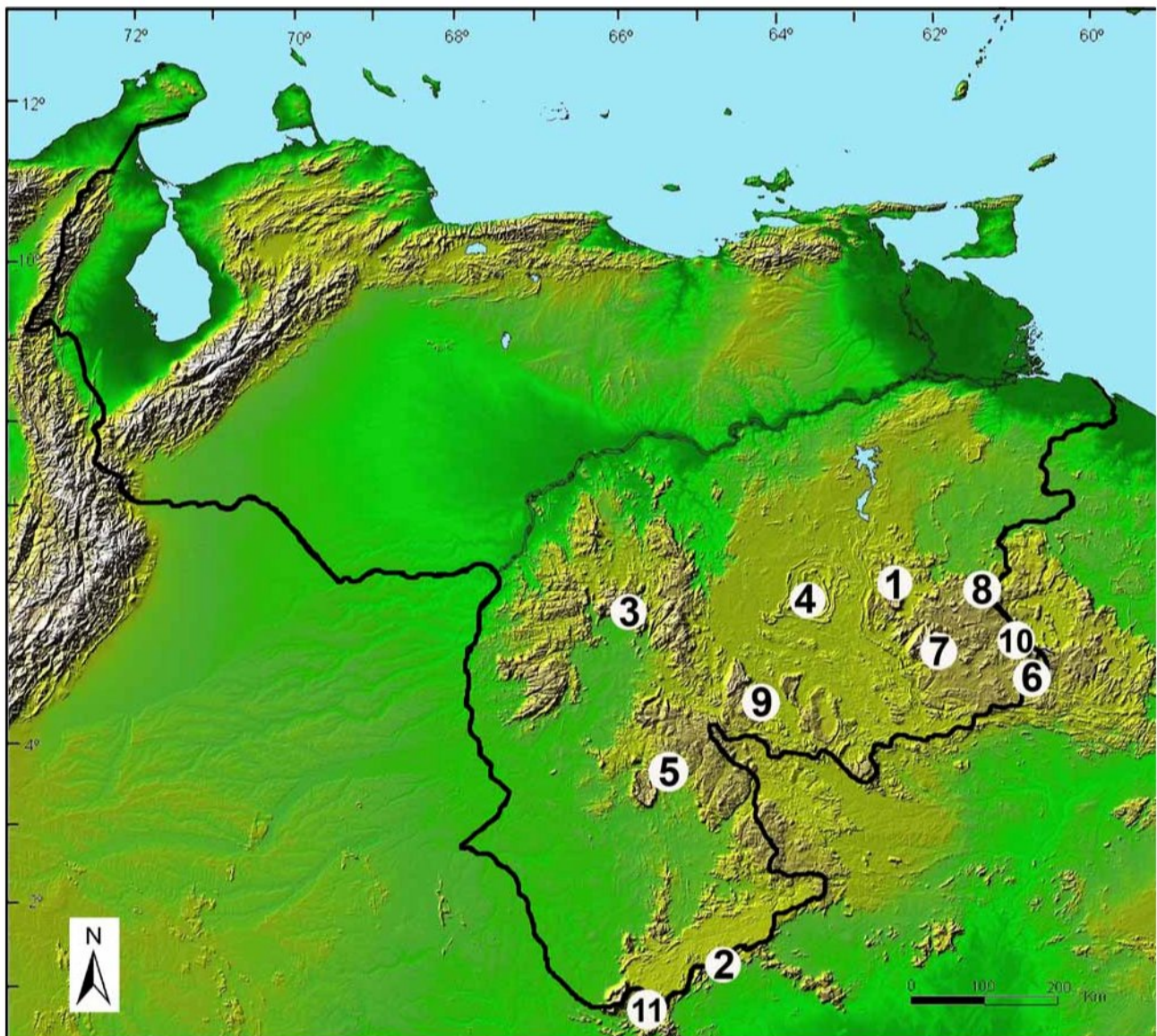
On 24 February 1978, one of us (RWM) participated in an early exploration of the Eruoda-tepui (also part of the Chimanta Massif), led by Charles Brewer-Carías, and collected one specimen of *Pristimantis* (then *Eleutherodactylus*) that was mentioned as *Eleutherodactylus sp. 1* by McDiarmid & Donnelly (2005). RWM examined the specimen USNM 550359, collected on 24 February 1978 at the north end of Eruoda (= Murey) tepui at about 2300 m. One of the helicopter pilots stepped on the bag with the animal, and it was a little damaged. Based on superficial comparison of the specimen with the holotype of *P. muchimuk* (absence of basal webbing and a very different color pattern: dorsum black with small light spots, white laterally; bright red spots on right dorsum; chin, chest belly and ventral surfaces of limbs bright red), seems that USNM 550359 still represents another undescribed species from the Chimanta massif; in any case, it is not possible with the damaged specimen at hand to discern if it belongs to the same species (RWM data).

Dayrat (2005) strongly suggest not naming putative new species with a single specimen. Although we agree in general terms, in this case, we believe the action is justified when in several expeditions to a single sandstone massif only one specimen of a distinctive new species has been collected, and there is no certainty that new expeditions are being to be arranged in a near future (due to the high costs and current politic instability of the country). Furthermore this species is the only *Pristimantis* species in a huge and biogeographically isolated massif of 623 km<sup>2</sup> with endemic relatives on some neighboring tepuis (Auyan, Guaiquinima, Yuruani); see Fig. 5.

Knowledge about Terraranans is rapidly increasing in many countries (Duellman & Lehr 2009). In Venezuela the number of described taxa also dramatically changed from 16 (Rivero 1961), 34 (La Marca 1992), 42 (Barrio-Amorós 1998) to the current number of 62 taxa, including the species herein described



(Barrio-Amorós 2009; Barrio-Amorós et al. 2010; this work). Concretely the most species-rich regions are the Andes and the Guiana highlands, where recently have been described 13 and 14 new taxa respectively (Barrio-Amorós 2009; Myers & Donnelly 1996, 1997, 2008; Fuentes & Barrio-Amorós 2004; Barrio-Amorós & Molina 2006; Barrio-Amorós & Brewer-Carías 2008, Schlüter & Rödder 2007; Rödder & Jungfer 2008). Two more species of Venezuelan Terraranans considered formerly *Pristimantis* have been moved to the new genus *Ceuthomantis* (Heinicke et al. 2009), *C. aracamuni* (Barrio-Amorós & Molina 2006) and *C. cavernibardus* (Myers & Donnelly 1997). Terraranans are also a diverse component of the anuran fauna of the Guiana Shield. They are being discovered on many tepuis where they were unknown previously. The Chimantá massif was well explored by Stefan Gorzula (1992), who found no *Pristimantis*. Like species of *Oreophrynella* (Bufonidae) on the high tepuis, *Pristimantis* can be extremely abundant on summits (e.g. *P. sarisarinama* on Sarisariñama, Barrio-Amorós & Brewer-Carías 2008), or so rare that they are easily overlooked (like *P. yuruaniensis* or *P. muchimuk*).



**FIGURE 5.** Distribution of *Pristimantis muchimuk* sp. nov. and relatives from the Guianan Venezuela. White circles with numbers correspond to: 1: *Pristimantis auricarens*: Auyan-tepui. 2: *P. avius* and *P. memorans*: Tamacuari. 3: *P. cantitans*, *P. pruvinatus* and *P. yaviensis*: Cerro Yavi. 4: *P. guaiquinimensis*, *P. stegolepis* and *P. tepuiensis*: Guaiquinima-tepui. 5: *P. marahuaka*: Cerro Marahuaka. 6: *P. marmoratus*: base of Roraima-tepui. 7: *P. muchimuk*: Churí-tepui in the Chimanta massif. 8: *P. pulvinatus*: Sierra de Lema. 9: *P. sarisarinama*: Sarisariñama-tepui. 10: *P. yuruaniensis*: Yuruani-tepui. 11: *P. zeuctotylus*: base of Cerro Neblina. The distribution of *P. vilarsi* is in Barrio-Amorós & Molina (2006).



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## Appendix: specimens examined

- Pristimantis auricarens*: EBRG 2725 (holotype), EBRG 2724, 2726–27 (paratypes), from summit of Auyantepui, 5° 54' N, 62° 29' W, 1750 m elevation, Estado Bolívar, Venezuela.
- Pristimantis cantitans*: EBRG 3003, Cima Cerro Yaví, 2150 m, 50° 43' N–65° 54' W, Estado Amazonas, Venezuela.
- Pristimantis marahuaka*: MHNLS 12854, 12856–58, Cumbre Sur Cerro Marahuaka, 2650 m. MA-21 (personal collection of José Ayarzagüena; to be deposited in MHNLS), from Marahuaka Summit, Estado Amazonas, Venezuela.
- Pristimantis pulvinatus*: MHNLS 4734 (paratype), carretera San Isidro-Santa Elena de Uairén, 800 m, Estado Bolívar, Venezuela, collected by J. Rivero.
- Pristimantis aff. pulvinatus*: EBRG 2730, Auyantepui, camp 4, 5° 58' N–62° 33' W, 1600 m, Estado Bolívar, Venezuela.
- Pristimantis sarisarinama*: EBRG 4668 (holotype), EBRG 4669–75 (paratypes), Sima Mayor, Sarisariñama-tepui, 4° 41' N; 64° 13' W, 1100 m, Estado Bolívar, Venezuela.
- Pristimantis yaviensis*: EBRG 3007, 3015 (paratypes), Cima Cerro Yaví, 50° 43' N–65° 54' W, 2150 m, Estado Amazonas, Venezuela.
- Pristimantis yuruaniensis*: MHNLS 12800, from Yuruani-tepui, Estado Bolívar, Venezuela.