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## A new species of terrestrial-breeding frog *Pristimantis* (Anura: Strabomantidae) from the Cordillera del Cóndor, Zamora Chinchipe, Ecuador

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### ABSTRACT

We describe a new species of *Pristimantis* from the Comunidad Río Blanco, Cordillera del Cóndor, Ecuador. *Pristimantis ledzeppelin* sp. nov. is characterized by a snout–vent length of 23.9–24.6 mm in adult males ( $n = 2$ ) and 36.1 mm in one adult female and is compared morphologically with *Pristimantis muscosus* and other similar species of *Pristimantis*. The new species is characterized by having skin on dorsum and flanks finely tuberculate to tuberculate, a distinctive scapular fold, skin on venter coarsely areolate; snout rounded with a small rostral papilla; discs on the digits truncate, three times the width of the digits; groin and hidden surfaces of thighs yellowish-cream with distinctive brownish-black marks and/or orange irregular blotches; and coppery red iris.

### RESUMEN

Describimos una nueva especie de *Pristimantis* de la Comunidad de Río Blanco, Cordillera del Cóndor, Ecuador. *Pristimantis ledzeppelin* sp. nov. es caracterizada por una longitud rostro-cloacal de 23.9–24.6 mm en machos adultos ( $n = 2$ ), 36.1 mm en una hembra adulta, y es comparada morfológica con *Pristimantis muscosus* y con otras especies similares de *Pristimantis*. La especie nueva se caracteriza por tener la piel del dorso y flancos finamente tuberculada a tuberculada, un pliegue escapular distintivo, piel en el vientre fuertemente aerolada; hocico redondeado con una pequeña papila rostral; discos de los dígitos truncados, tres veces el ancho de los dígitos; ingles y superficies ocultas de los muslos crema amarillentas con marcas distintivas café-negruzcas o negras con manchas irregulares crema amarillentas y naranja; e iris rojo-cobrizo.

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### Palabras clave

Bosque montano;  
*Pristimantis ledzeppelin* sp. nov.; comunidad Río Blanco; Terrarana

### KEYWORDS

Montane forest; *Pristimantis ledzeppelin* sp. nov.; Comunidad Río Blanco; Terrarana

## Introduction

The terrestrial frogs of the genus *Pristimantis* Jiménez de la Espada 1870 are an extremely diverse group of vertebrates. Currently, 569 formally described species are known [1,2]. Ecuador is the country with the highest richness of *Pristimantis*, with the latest description of 14 new species from the Ecuadorian Andes and lowlands [3,4]. Only in the last two years twenty-eight species of this genus have been described in Ecuador [3–10], of which 14 are from the southern Andean slopes. This region has proven to be one of the most diverse in small vertebrates, with high endemism [3,9,11–13]. The Cordillera del Cóndor is a mountain chain with a rugged topography, located in southeast Ecuador and north Peru, just east of the main body of the eastern Andes. The biodiversity of this region is still unknown, although in recent years there have been several discoveries of amphibians restricted to this endemic area [14–17]. Here we describe a new species of terrestrial frog of the genus *Pristimantis* from the montane forest of the Comunidad Río Blanco, Cordillera del Cóndor, Ecuador.

## Materials and methods

### Morphological data

We follow the standardized format of Lynch & Duellman [18] for description, measurements and terminology, and Duellman & Lehr [19] for the definitions of diagnostic characters. We sacrificed the specimens with lidocaine, fixed them in 10% formalin and preserved them in 70% ethanol [20]. We determined the sex and age by the presence of secondary sexual characteristics (nuptial pads, vocal slits, and size) and direct inspection of the gonads through a dorsolateral incision. The following measurements were taken with calipers to the nearest 0.1 mm: snout-vent length (SVL), tibia length (TL), foot length (FL), head width (HW), head length (HL), interorbital distance (IOD), width of the upper eyelid (EW), internarial distance (IND), eye-nostril distance (EN), tympanum diameter (TD), and eye diameter (ED). We recorded the life coloration pattern of the specimens with field notes and in-field color photography, the description of color patterns followed a standardized color palette [21]. We determined the localities, coordinates, and

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elevations from field notes of the collectors and with a GPS receiver. We deposited the examined specimens at the Vertebrate Section of the Museo de Zoología, Universidad San Francisco de Quito (ZSFQ) in Quito, Ecuador. We made morphological comparisons with similar species based in specific literature as Lynch [22], Duellman & Pramuk [23], Yáñez-Muñoz et al. [24], Brito & Almendariz [16]; and with specimens' collections at ZSFQ, Instituto Nacional de Biodiversidad (INABIO) and BOWEB online repository.

## Results

### Systematic accounts

*Pristimantis ledzeppelin* sp. nov.

Figures 1–7

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Taxonomic act LSID: urn:lsid:zoobank.org:act:0E9FCE26-29CC-4634-AF71-DD13AF4B2DED

Proposed standard English name. Led Zeppelin's Rain Frog

Proposed standard Spanish name. Cutín de Led Zeppelin

**Holotype.** ZSFQ 1872 (field no. DBZ 198; Figures 4, 5), adult female, collected by David Brito-Zapata and Juan Hurtado on 20 February 2019 at Comunidad Río Blanco, Cordillera del Cóndor, Cantón Paquisha, province of Zamora Chinchipe, Ecuador (3.914297°S, 78.502472°W; 1723 m elev. Figure 2).

**Paratypes (2 males).** ZSFQ 1877–1878, adult males, with the same information as the holotype.

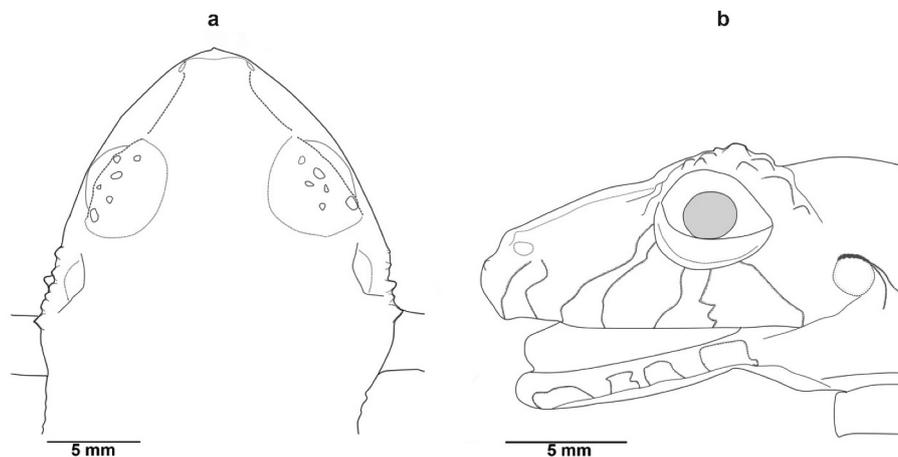
### Generic placement

We assign the new species within the genus *Pristimantis* by having head as wide as body, tympanic membrane differentiated, cranial crests usually absent, dentigerous process of vomers present, "S" condition

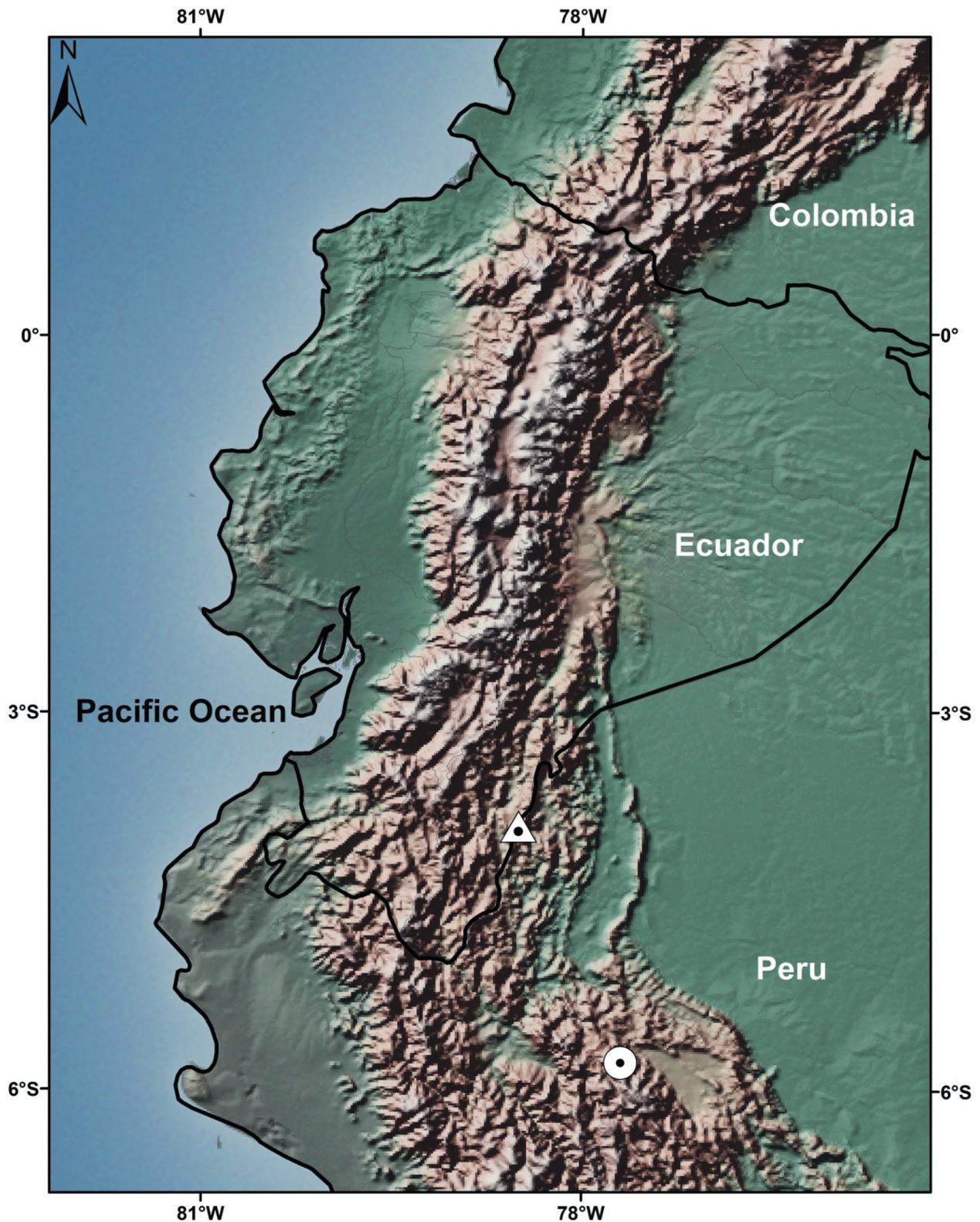
of the adductor muscles, terminal discs on digits expanded and bearing well-defined circumferential grooves, comparative lengths of Fingers I and II variable, Toe V as long as or longer than Toe III, texture of skin on dorsum variable, and venter areolate [25].

### Diagnosis

A new species of *Pristimantis* having the following combination of characters: (1) skin on dorsum and flanks finely tuberculate to tuberculate, with "W" shaped scapular fold (reduced by preservation effects); dorsolateral folds absent; skin on venter coarsely areolate; discoidal fold present; (2) tympanic membrane and tympanic annulus present, round, equivalent to 31.4% of ED; supratympanic fold present, extending from the eye insertion towards the posterior edge of the tympanum, covering 1/8 of the tympanum; with several conical to subconical postrictal tubercles, prominent; (3) snout rounded with a small rostral papilla in dorsal view, moderate in length and rounded in lateral view (Figure 1); a row of subconical tubercles on the lower jaw; (4) upper eyelid with one evident subconical tubercle on the center of eyelid, surrounded by several lower subconical tubercles (less evident in preserved specimens) (Figure 1); EW 89% of IOD; cranial crests absent; (5) dentigerous processes of vomers, prominent, triangular in outline, with three to four teeth, moderately separated, posteromedial to choanae; (6) vocal slits absent, nuptial pads present; (7) Finger I shorter than Finger II, discs of digits broadly expanded, truncate; three times the width of the digits on Fingers II to IV; (8) fingers with narrow lateral fringes; (9) ulnar tubercles present, subconical; (10) heel bearing one conical tubercle surrounded by two to five subconical low tubercles (less evident in preserved specimens), outer edge of tarsus bearing 4–6 subconical tubercles, inner tarsal fold absent; (11) inner metatarsal tubercle oval, 6X times the outer metatarsal



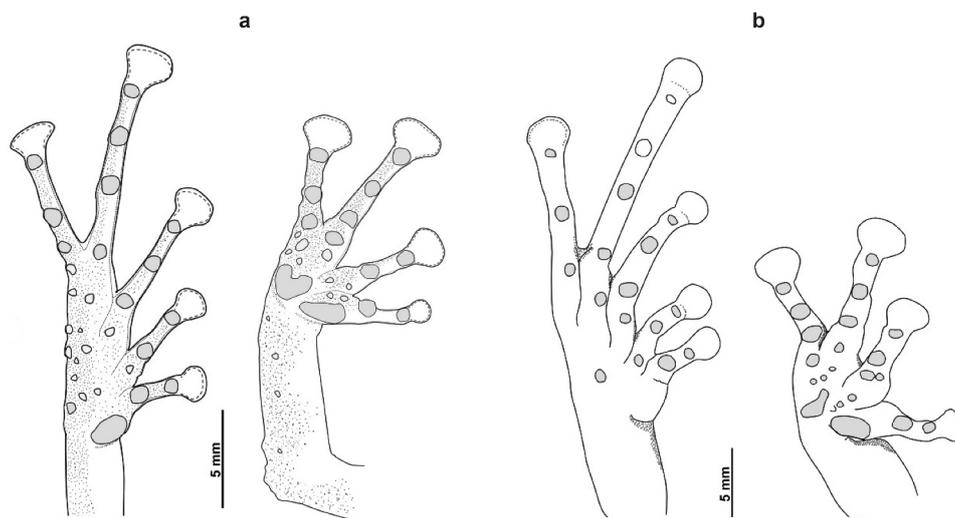
**Figure 1.** Preserved holotype of *Pristimantis ledzeppelin* sp. nov., ZSFQ 1872, adult female, SVL = 36.1 mm (a) Head detail in dorsal view (b) Head detail in lateral view. Illustration by Carolina Reyes-Puig.



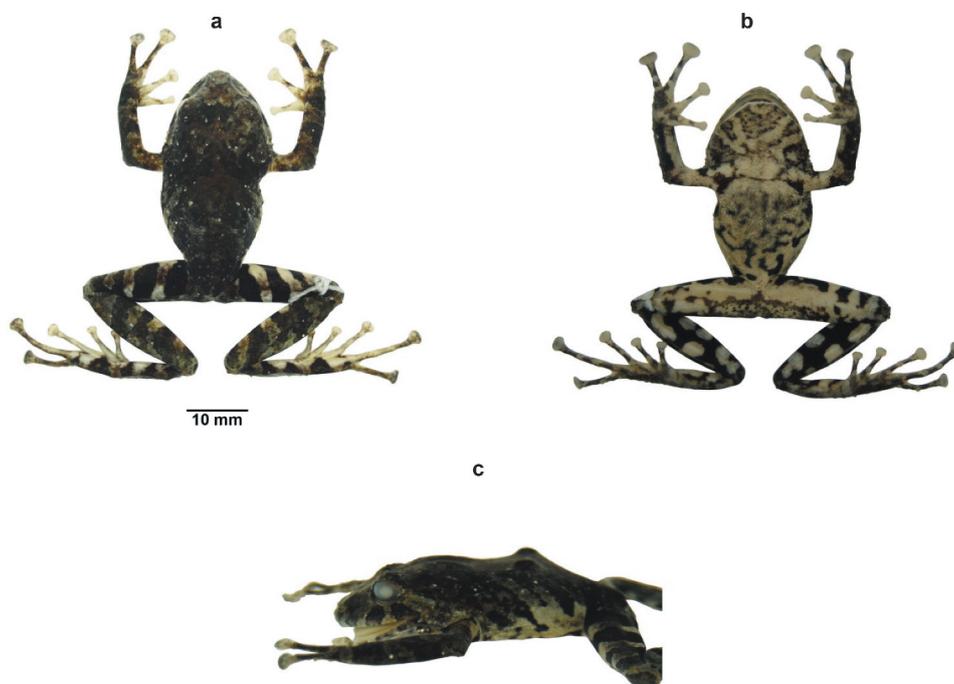
**Figure 2.** Map showing localities based in specimens deposited at the ZSFQ and KU collections. Triangle represents the type locality of *Pristimantis ledzeppelin* sp. nov.; circle represents the type locality of *Pristimantis muscosus*.

tubercle that is subconical; supernumerary plantar tubercles present, evident, distributed throughout the plantar surface (Figure 3); (12) toes with narrow lateral fringes, discs slightly less wide than those of fingers, discs of digits broadly expanded, truncate; three times the width of the digits on toes II to V, webbing basal; Toe V longer than Toe III, disc on Toe

V reaches and exceeds the distal subarticular tubercle on Toe IV; (13) in life, dorsum from background beige with irregular transversal dark brown marks to greenish-brown with scattered cream dots; groin and hidden surfaces of thighs yellowish-cream with distinctive brownish-black marks (more widespread in males) and/or orange irregular blotches; venter yellowish-



**Figure 3.** Palmar and plantar surfaces (a) Preserved holotype of *Pristimantis ledzeppelin* sp. nov., ZSFQ 1872, adult female, SVL = 36.1 mm, (b) Preserved holotype of *Pristimantis muscosus*, KU 219,482, adult female. Illustration (a) by Carolina Reyes-Puig, (b) modified from Duellman & Pramuk 1999 with permission.



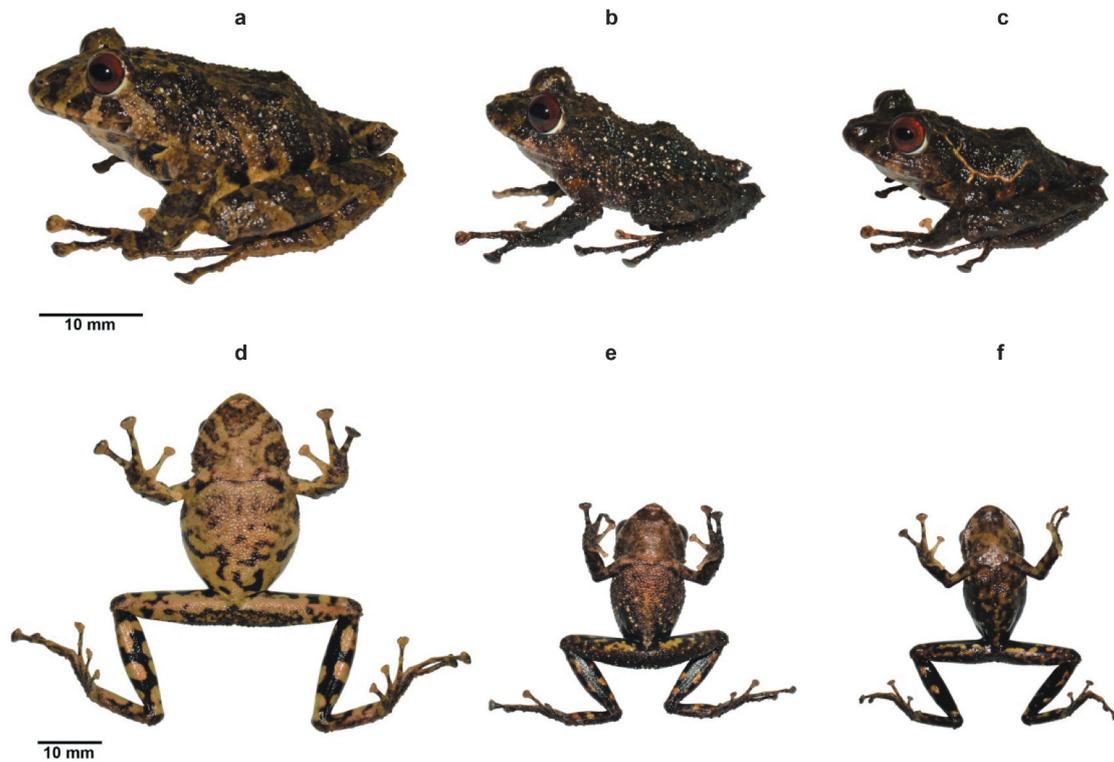
**Figure 4.** Preserved holotype of *Pristimantis ledzeppelin* sp. nov., ZSFQ 1872, adult female, SVL = 36.1 mm (a) Dorsal view (b) Ventral view (c) Lateral view. Photographs by David Brito-Zapata.

cream to light brown with coppery tones and marbling with dark brown; ventral surfaces of the calf brownish-black enclosing yellowish-cream to yellowish-orange blotches. Coppery-red iris with thin brown reticulations; (14) SVL in two adult males  $24.3 \pm 0.3$  (23.9–24.6 mm); in one adult female 36.1 mm.

### Comparisons with other species

*Pristimantis ledzeppelin* is morphologically most similar to *P. muscosus* [23] (characters in parentheses) from the eastern slopes of the northern part of the Cordillera

Central in northern Peru. However, *P. ledzeppelin* can be easily distinguished by having a snout rounded with a small rostral papilla (papilla absent) (Figure 1); skin on venter coarsely aerolate (aerolate); discs on the digits truncate, three times the width of the digits (nearly truncate and more than twice width of the digits) (Figure 3); ulnar tubercles evident, subconical (low and diffuse); supernumerary tubercles evident distributed throughout the plantar surface (prominent in a single row on each digit) (Figure 3); outer edge of tarsus bearing 4–6 subconical tubercles (one or two subconical tubercles proximally); groin and hidden

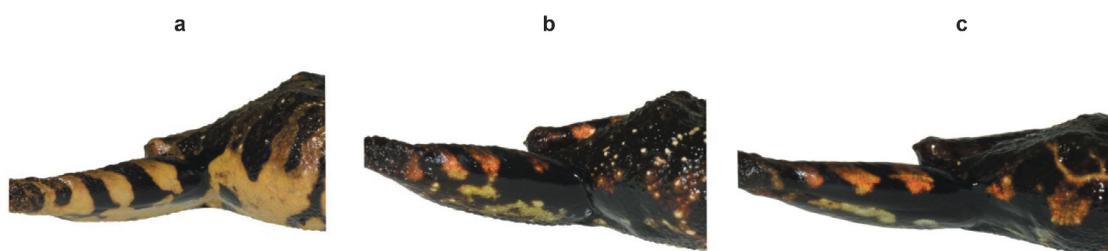


**Figure 5.** Coloration in life of *Pristimantis ledzeppelin* sp. nov. Dorsal view. (a) ZSFQ 1872, SVL = 36.1 mm, holotype, adult female; (b) ZSFQ 1878, SVL = 24.6 mm, paratype, adult male; (c) ZSFQ 1877, SVL = 23.8 mm, paratype, adult male. Ventral view (d) ZSFQ 1872, SVL = 36.1 mm, holotype, adult female; (e) ZSFQ 1878, SVL = 24.6 mm, paratype, adult male; (f) ZSFQ 1877, SVL = 23.8 mm, paratype, adult male. Photographs by David Brito-Zapata.

surfaces of thighs yellowish-cream with distinctive brownish-black marks -more widespread in males- and/or orange irregular blotches (groin and lower surfaces of hind limbs with orange-yellow spots) (Figure 6).

Another species of *Pristimantis* morphologically similar to *Pristimantis ledzeppelin* is *P. spinosus* [22] from the central south eastern slopes of Ecuador. Nevertheless, the new species can be easily distinguished by having one evident subconical tubercle on the center of eyelid, surrounded by several lower subconical tubercles (two to three elongate tubercles in *P. spinosus*); cranial crests absent (present, low in *P. spinosus*); groin and hidden surfaces of thighs yellowish-cream with distinctive brownish-black marks -more widespread in males- and/or orange

irregular blotches (black enclosing white spots in *P. spinosus*). Other species of *Pristimantis* that have tones of red coloration on the iris are *P. barrigai* [16] and *P. nigrogriseus* [26] from the central eastern slopes of Ecuador. However, the venter of *P. ledzeppelin* is yellowish-cream to light brown with coppery tones and marbling with dark brown (olive to brownish-olive in *P. barrigai* and light brown or gray with white, cream or brown fringes in *P. nigrogriseus*); groin and hidden surfaces of thighs yellowish-cream with distinctive brownish-black marks -more widespread in males- and/or orange irregular blotches (olive to brownish-olive in *P. barrigai* and black with bright-yellow spots in *P. nigrogriseus*). *Pristimantis cryptomelas* [22] from the eastern Andean slopes of southern Ecuador, the



**Figure 6.** Coloration in life of *Pristimantis ledzeppelin* sp. nov. Groin. (a) ZSFQ 1872, SVL = 36.1 mm, holotype, adult female; (b) ZSFQ 1878, SVL = 24.6 mm, paratype, adult male; (c) ZSFQ 1877, SVL = 23.8 mm, paratype, adult male. Photographs by David Brito-Zapata.

northern ridges of the Cuenca de Loja and on the western slopes of the Cordillera Huancabamba in Peru, can be similar to *P. ledzeppelin* by its ventral coloration. Nonetheless, the new species is characterized by having “W” shaped scapular fold (postocular and interorbital ridges present in *P. cryptomelas*), and skin on dorsum finely tuberculate to tuberculate (shagreen bearing conical warts and ridges in *P. cryptomelas*). See Table 1.

### Description of the holotype

Adult female. Measurements (in mm): SVL 36.1; tibia length 22.42; foot length 20.6; head length 15.6; head width 16.2; eye diameter 5.4; tympanum diameter 1.82; interorbital distance 4.71; upper eyelid width 4; inter-narial distance 3.5; eye–nostril distance 4.73. Head slightly wider than long (16.24 mm vs 15.63); head width 45% of SVL; head length 43.29% of SVL; snout rounded with a small rostral papilla in dorsal view, moderate in length and rounded in lateral view (Figure 4); eye–nostril distance 13.1% of SVL; canthus rostralis concave in lateral view, nostrils directed laterally; interorbital area flat, wider than the upper eyelid; cranial crests absent; upper eyelid with one evident subconical tubercle on the center of eyelid, surrounded by several lower subconical tubercles (reduced by preservation effects); upper eyelid width 84.9% of IOD; tympanic membrane differentiated, tympanic annulus present, with a supratympanic fold which extends from the eye insertion to the posterior edge of the tympanum, covering 1/8 of the tympanum; tympanum diameter 45.5% of eye diameter; with four conical to subconical postrictal tubercles, prominent. Choanae moderate in size, with a round-shaped outline, not concealed by palatal shelf of maxilla; denticulous processes of vomer prominent, triangular in outline, moderately separated, posteromedial to choanae, with three to four teeth; tongue wider than long, notched posteriorly, approximately 40% of it fixed to the mouth floor.

Skin on dorsum finely tuberculate to tuberculate, with “W” shaped scapular fold (reduced by preservation effects); dorsolateral folds absent; skin on venter coarsely areolate; discoidal fold present; cloaca with rounded warts on the outline margin. Forearms slender, ulnar tubercles present, subconical; palmar tubercle heart-shaped, bilobed, approximately one and a half the size of oval thenar tubercle; subarticular tubercles rounded, defined, prominent, supernumerary tubercles present, distinctive; fingers with narrow lateral fringes; Finger I shorter than Finger II; disc on Finger I slightly wider than the digit three times the width of the digits on Fingers II to IV, truncate; pads on fingers well defined by circumferential grooves on all fingers (Figure 3).

Hindlimbs slender, tibia length 62% of SVL; foot length 57% of SVL; upper surfaces of hindlimbs shagreen; posterior surfaces of thighs smooth, ventral surfaces coarsely areolate heel bearing one conical tubercle surrounded by three subconical low tubercles (less evident by preservation effect); inner tarsal fold absent; inner oval, 6× times the outer metatarsal tubercle that is subconical; supernumerary plantar tubercles present, evident, distributed throughout the plantar surface; toes with narrow lateral fringes; webbing basal; discs of digits broadly expanded, truncate; three times the width of the digits on toes II to V; all toes with ventral pads well defined by circumferential grooves; disc on Toe V reaches and exceeds the distal subarticular tubercle on Toe IV (Figure 3).

### Color of holotype in life (based on digital photographs) (Figs. 5–6)

Dorsum background beige with irregular transverse dark brown marks, with scattered cream dots; dorsal surface of hindlimbs with transversal brownish-black bars; flanks beige with diagonal dark brown stripes; head with subocular and labials diagonal brown bars. Venter yellowish-cream with coppery tones, marbled with dark brown; throat yellowish-cream with “V”-shaped brown mark and two lateral diagonal brown bars; ventral surfaces of the calf brownish-black enclosing yellowish-cream blotches; groin and hidden surfaces of the thigh yellowish-cream with distinctive brownish-black marks. Coppery-red iris with thin brown reticulations.

### Color of holotype in ethanol 70% (Fig. 4)

Dorsum light brown to gray with irregular dark brown marks, dorsal surface of the snout gray; dorsal surface of hindlimbs with transversal black and white bars; with subocular and labials diagonal brown bars; flanks light brown with diagonal dark brown stripes; groin and hidden surfaces of the hindlimbs white with black marks. Venter and throat white marbled with dark brown, throat with “V”-shaped light brown mark and two lateral diagonal light brown bars; ventral surfaces of the calf black enclosing white blotches. Coppery iris.

### Variation. Preserved individuals (Fig. 7)

In the type series, adult males (23.9–24.6 mm) are smaller than one female (36.1 mm). See Table 2 for measurements of the type specimens. Males have cream nuptial pads located in the lower external portion of the Finger I. The “W”-shaped scapular fold is present in all individuals but is less evident on the female (ZSFQ 1872) (Figure 7). One male (ZSFQ 1878) shows more prominent and evident tubercles (Figure 7). Background coloration varies

**Table 1.** Main characters used for morphological comparisons of the new species and similar species.

Species	Upper eyelid tubercles	Rostral papilla	Venter coloration	Skin on venter	Discs on digits	Ulnar tubercles	Outer edge of tarsus	Groin	Source
<i>Pristimantis ledzeppelin</i> sp. nov	One evident subconical tubercle on the center of eyelid, surrounded by several lower subconical tubercles	Present	Yellowish cream to light brown with coppery tones and marbling with dark brown	Coarsely aerolate	Three times the width of the digits	Evident, subconical	4–6 subconical tubercles	Groin and hidden surfaces of thighs yellowish-cream with distinctive brownish-black marks and/or orange irregular blotches.	This description
<i>P. muscosus</i>	One or two round tubercles	Absent	Dark Brown with cream spots	Aerolate	Twice width of the digits	low and diffuse	One or two subconical tubercles proximally	Groin and lower surfaces of hind limbs with orange-yellow spots.	[23]
<i>P. spinosus</i>	Two to three elongate tubercles	Absent	Dull cream with heavy brown reticulations	Coarsely aerolate	Not mentioned	Subconical	Subconical	Black enclosing white spots.	[22]
<i>P. barrigai</i>	Small conical tubercle	Not mentioned	Olive to brownish-olive	Aerolate	Not mentioned	Small and rounded	2–3 small conical tubercles	Olive to brownish-olive.	[16]
<i>P. nigrogriseus</i>	Absent	Not mentioned	Light brown or gray with white, cream or brown fringes	Aerolate	Not mentioned	Present	Absent	Black with bright-yellow spots.	[26]



**Figure 7.** Preserved individuals of *Pristimantis ledzeppelin* sp. nov. showing dorsal (a-c) and ventral (d-f) variation . (a, d) ZSFQ 1872, SVL = 36.1 mm, holotype, adult female; (b, e) ZSFQ 1878, SVL = 24.6 mm, paratype adult male; (c, f) ZSFQ 1877, SVL = 23.8 mm, paratype, adult male. Photographs by David Brito-Zapata.

**Table 2.** Measurements (in mm) of type series of *Pristimantis ledzeppelin* sp. nov. Ranges followed by mean and standard deviation in parentheses.

Characters	Females	Males
	(n = 1)	(n = 2)
SVL	36.1	23.9–24.6 (24.3 ± 0.5)
HL	15.6	9.9–10.5 (10.2 ± 0.4)
HW	16.2	9.9–11.0 (10.5 ± 0.8)
ED	5.4	3.6–3.9 (3.7 ± 0.2)
EN	4.7	2.8–3.3 (3.0 ± 0.3)
MWE	4	2.6–3.1 (2.8 ± 0.4)
TD	1.8	1.0–1.2 (1.1 ± 0.1)
MIOD	4.7	2.9–3.2 (3.1 ± 0.2)
LH	13.5	8.1–8.9 (8.5 ± 0.5)
LS	22.4	14.9–15.4 (15.1 ± 0.3)
LF	20.6	13.1–13.7 (13.4 ± 0.4)

from light brown to gray with irregular dark brown marks (ZSFQ 1872) to grayish-brown (ZSFQ 1877) to black (1878). Groin and hidden surfaces of thighs white with black marks, these marks are more widespread on the males (ZSFQ 1877–1878) [Figure 7](#). Venter from white (ZSFQ 1872), cream (1877), and light brown (1878) marbling with dark brown. All specimens present a “V” shaped brown mark on the throat ([Figure 7](#)) and coppery iris.

### Coloration in life (based on digital photographs of the type specimens) ([Figs. 5–6](#))

Dorsum background beige with irregular transversal dark brown marks (ZSFQ 1872) to greenish-brown (ZSFQ 1877–1878), with scattered cream dots; one male (ZSFQ 1877) shows irregular brownish-cream lines ([Figure 5](#)); groin and hidden surfaces of thighs yellowish-cream with distinctive brownish-black marks (more widespread in males [Figure 6](#)) and/or orange irregular blotches ([Figure 6](#)); venter yellowish-cream (ZSFQ 1872) to light brown (1877–1878) with coppery tones and marbling with dark brown; ventral surfaces of the calf brownish-black enclosing yellowish-cream (ZSFQ 1872) to yellowish-orange (ZSFQ 1877–1878) blotches. Coppery-red iris with thin brown reticulations ([Figure 5](#)).

### Distribution and natural history

*Pristimantis ledzeppelin* is only known from the type locality of Comunidad Río Blanco, Cordillera del Cóndor, Cantón Paquisha, province of Zamora Chinchipe, Ecuador ([Figure 2](#)). This locality is comprised of low montane cloud forest with a canopy 15 m to 20 m high; trees are covered by moss and there is much leaf litter on the ground [27]. The elevation of the type series is 1723 m above sea level.

All specimens were found on shrub vegetation surrounding streams inside mature forest, where they perched on bush leaves, between 170 and 300 cm above the water body. The specimens were collected

with other species of amphibians such as *Chimerella mariaelenae*, *Pristimantis quaquaversus*, *P. prolatus* and *P. galdi*. Stomach contents from specimen ZSFQ 1878 were identified as remnants of insects from families Curculionidae and Formicidae, and from the order Dermaptera and class Gastropoda.

### Etymology

The name honours Led Zeppelin and their extraordinary music. Led Zeppelin was a British rock band formed in London in 1968, one of the most influential bands throughout the 1970s, and progenitors of both hard rock and heavy metal [28].

### Discussion

The Cordillera del Cóndor is an important area of the Andes between south eastern Ecuador and north eastern Peru. Due to its geographical position, topography and environmental characteristics, this emblematic mountain range encompasses an extremely particular flora and fauna with high endemism [29–31]. Terrestrial frogs of the genus *Pristimantis* are one of the vertebrate taxa with the highest diversity and endemism in this area. In the last decade, five species of *Pristimantis* have been formally described: *Pristimantis minimus* [32], *P. paquishae* [14], *P. muranunka* [33], *P. yantzaza* [17], and *P. barrigai* [16], all of them endemic to Cordillera del Cóndor and only known from their type localities and nearby areas.

The most similar species to *Pristimantis ledzeppelin* is *P. muscosus* [23], however, the evidence we present confirms the morphological difference from topotypical populations. *Pristimantis ledzeppelin* can be easily distinguished by having a small rostral papilla, discs three times the width of the digits, and yellowish-cream or black groin and hidden surfaces of thighs with distinctive brownish-black marks or orange irregular blotches. The original description for *P. muscosus* illustrates a rostral papilla absent, digits nearly truncate and more than twice width of the digits, and groin and lower surfaces of hindlimbs with orange-yellow spots [23]. Considering the previous features, we suggest that reports made by Almendariz et al. [34] and Yáñez-Muñoz et al. [24], require an exhaustive morphological review, mainly because the ventral and groin coloration pattern does not match the original description of *P. muscosus* [23]. The specimens reported by Yáñez-Muñoz et al. [24] from Reserva Tapichalaca clearly exhibit a black groin coloration with well-defined white spots (for more life photographs see Ron et al. [35]). On the other hand, the report of Almendariz et al. [34] needs verification since it only shows a dorsolateral photo; the outer edge of tarsus of the recorded specimen presents four conical tubercles,

while topotypical *P. muscosus* are characterized by bearing one or two subconical tubercles proximally.

Further examination of this material is needed not just due to morphological variation but also due to the geographic distance between topotypical populations of *Pristimantis muscosus* and those reported by Yáñez-Muñoz et al. [24] and Almedáriz et al. [34] The specimen reported by Almedáriz seems to be more similar with *P. ledzeppelin* than with *P. muscosus* and also its recorded relatively near the topotypical locality of the new species.

The Cordillera del Cóndor is part of one of the most threatened ecoregions in the world [36], since it is part of tropical Andes. The main conservation threats that this area faces, according to Guayasamín and Bonaccorso [31] are: a) expansion of the agricultural and livestock borders, b) logging, c) small and large-scale mining, d) introduction of disease and e) the possible effects of climate change. Particularly in the type locality of *Pristimantis ledzeppelin* sp. nov. livestock activities, timber extraction, small-scale mining can be observed, and large-scale mining is likely to become active because the area is within a mining concession of a multinational company [37]. Due to the high endemism of the Cordillera del Cóndor, the new species here described is likely to be found only in this restricted area, therefore it is important to consider new long-term initiatives for small vertebrate conservation actions.

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### Author contributions

CRP and DBZ performed the experiments, contributed reagents/materials/analysis tools, authored or reviewed drafts of the paper, approved the final draft.

### APPENDIX I. Examined specimens

*Pristimantis cryptomelas*: ECUADOR-ZAMORA CHINCHIPE: Reserva Biológica Tapilchalaca (4°29'31.50"S; 79° 7'42.19"W; 2300–2400 masl) DHMECN 2517, 2520, 3039, 8111–8122.

*Pristimantis spinosus*: ECUADOR-ZAMORA CHINCHIPE: Reserva Biológica Tapilchalaca (4°29'31.50"S; 79° 7'42.19"W; 2700 masl) DHMECN 1788–1789.

*Pristimantis* aff. *spinosus* ECUADOR-ZAMORA CHINCHIPE: Yantzaza, Los Encuentros (3°54'51.47"S; 78°30'8.90"W; 2117 masl) ZSFQ 1130.

*Pristimantis nigrogriseus*: ECUADOR-MORONA SANTIAGO: Cordillera del Cóndor, 2–3 km SE de Comunidad Shuar Kunkuk (3°19'43.43"S; 78°11'58.06"W; 1570 masl) QCAZ 71,131–71,132. Parque Nacional Sangay, Sardinayacu, vertiente del Río Jurumbuno (2° 5'49.83"S; 78° 9'19.22"W; 1411 masl) QCAZ 58,902.

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No potential conflict of interest was reported by the author(s).

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