

Article

Two New Species of *Pristimantis* (Anura: Strabomantidae) from Amazonas Department in Northeastern Peru

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Abstract: We describe two new species of terrestrial-breeding frogs in the genus *Pristimantis* from the Andes of northeastern Peru, Amazonas Department. Both species share several characters with other congeners from northern Peru, such as the presence of prominent conical tubercles on their eyelids and heel, prominent conical tubercles along the outer edge of the tarsus, and discs on fingers and toes widely expanded. However, both species can be diagnosed from morphologically similar *Pristimantis* in the region. *Pristimantis kiruhampatu* has axillae, groins, and hidden surfaces of hindlimbs that are cherry with white minute flecks, tympanic membrane and tympanic annulus evident, conical tubercles along the edge of snout and outer edge of tibia, and \ / shaped folds in the scapular region. *Pristimantis paulpittmani* has yellow or dirty cream groins and hidden surfaces of hindlimbs, whitish cream irises with scattered dark brown reticulations, and a thin vertical dark brown streak at the middle of the eye, snout subacuminate with a conical tubercle at the tip, and lacks a tympanic annulus and membrane. Additionally, we provide a short description of the advertisement call of *P. kiruhampatu*.

Keywords: advertisement call; cloud forest; Cordillera de Colán; montane forest; new species; Peruvian Yungas; taxonomy



Citation: Venegas, P.J.; García-Ayachi, L.A.; Catenazzi, A. Two New Species of *Pristimantis* (Anura: Strabomantidae) from Amazonas Department in Northeastern Peru. *Taxonomy* **2022**, *2*, 20–40. <https://doi.org/10.3390/taxonomy2010002>

Academic Editor: Christophe Piscart

Received: 9 November 2021

Accepted: 19 December 2021

Published: 23 December 2021

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1. Introduction

The genus *Pristimantis* is the most species-rich genus of frogs, with 569 species named to date [1]. The genus occurs in southern Central and South America, where it reaches elevations from sea level in the Caribbean and Lesser Antilles up to 4000 m a.s.l. in the Andes. The genus is exceptionally diverse in the Tropical Andes of Colombia, Ecuador, and Peru [2–4]. Many more species are described every year, on average over a dozen every year [1]. Since 2010, researchers have named 138 species of *Pristimantis*, nearly three times the number in the second genus with the most descriptions (*Leptobranchella* from southern Asia), and nearly 8% of all new species of amphibians described. The rate of new *Pristimantis* descriptions has increased noticeably in 2019 and 2020 (19 and 18 new species, respectively) [1].

Since 2010, Peru has ranked second in terms of new *Pristimantis* species described (15% of all new *Pristimantis*), ranking between Ecuador and Colombia [1]. Twenty of the 142 species known to occur in Peru have been described since 2010 [1]. These numbers suggest that we are far from reaching saturation in terms of the number of species of *Pristimantis* in Peru, and more generally for the genus across the Tropical Andes. As for other terrestrial-breeding frogs in the Andes, many species of *Pristimantis* are endemic to small montane areas and valleys, many of which remain poorly explored [5–8].

We contribute to increasing our knowledge of the diversity of *Pristimantis* by describing two species from the Amazonas Department in northeastern Peru. We provide diagnostic characters to differentiate the new species from similar congeners in northern Peru and Ecuador, and we describe the call of one of the new species.

2. Materials and Methods

2.1. Ethics and Field Research

This study was carried out in accordance with the guidelines for the use of live amphibians and reptiles in field research [9], compiled by the American Society of Ichthyologists and Herpetologists (ASIH) and the Society for the Study of Amphibians and Reptiles (SSAR). Specimens collected for this study are covered by the following research permits (given by the Ministerio de Agricultura) that include the permanent scientific collection of live specimens: 0581-2011-AG-DGFFS-DGEFFS, 013-2013-AG-DGFFS-DGEFFS, and 067-2019-MINAGRI-SERFOR-DGGSPFFS.

Specimens were collected during four field surveys conducted in August 2012, November 2018, and August 2019 in the Amazonas Department. The frogs were captured manually via the complete species inventory technique [10] during slow diurnal (900 to 1200 h) and nocturnal (2000 to 200 h) walks along trails and through the forest. Coordinates and elevation were taken with a GPS (Garmin, WGS84). We euthanized voucher specimens with 20% benzocaine gel, fixed them in 10% formalin for 24 h, and stored them permanently in 70% ethanol.

Voucher specimens were deposited at the herpetological collection of the Centro de Ornitología y Biodiversidad (CORBIDI) in Lima, Peru.

2.2. Morphology

The format for the descriptions follows Lynch and Duellman [11]. The terminology and definition of diagnostic characters follow Duellman and Lehr [2]. Sex was determined by the presence of vocal slits and by direct gonadal inspection. Measurements were taken with digital calipers and rounded to the nearest 0.1 mm. We measured SVL (snout–vent length), TL (tibia length), FL (foot length, distance from proximal margin of inner metatarsal tubercle to tip of Toe IV), HL (head length, obliquely from angle of jaw to tip of snout), HW (head width, at level of angle of jaw), ED (eye diameter, distance between the anterior and posterior borders of the visible eye), IOD (interorbital distance, distance between the medial edge of the orbits), EW (upper eyelid width, length of the visible eye along the outer edge of eyelid), IND (internarial distance, distance between the inner edges of nares), EN (eye–nostril distance, distance between the anterior corner of orbit and the posterior margin of nares). Fingers and toes are numbered preaxially to postaxially from I to IV and I to V, respectively. Comparative lengths of Toes III and V were determined when both were adpressed against Toe IV; lengths of Fingers I and II were compared when adpressed against each other. Specimens examined for comparisons are listed in the Appendix A and belong to CORBIDI and Museo de Zoología, Pontificia Universidad Católica del Ecuador (QCAZ), Quito, Ecuador.

2.3. Bioacoustics

We recorded the advertisement call of *Pristimantis kiruhampatu*, male CORBIDI 11683 at the type locality on 7 August 2012 at an air temperature of 10.9 °C and 84% of relative air humidity (taken with a digital thermo hygrometer to the nearest 0.1 °C). We used a digital recorder (Marantz PMD661MK2 and unidirectional microphone Sennheiser ME64, recording at 48 kHz, 24-bit, WAV format) for field recording, and Raven Pro version 1.4 (Cornell Laboratory of Ornithology, Ithaca, NY, USA) to analyze call variables. We analyzed six calls. The following variables were measured from oscillograms: note, duration and rate, interval between notes or calls, number of pulses, and presence of amplitude modulation. Variables measured from spectrograms included dominant frequency and presence of frequency modulation or harmonics. Spectral parameters were calculated through fast

Fourier transform (FFT), set at a length of 512 points (Hann window, 50% overlap). Averages are reported as value \pm SD.

2.4. Species Delimitation

The taxonomic conclusions of this study are based on the observation of morphological features and color patterns as evidence to infer the existence of species [12–14]. This information is considered as species delimitation criteria following a general lineage or unified species concept [12,13].

2.5. Nomenclatural Act

The electronic version of this article in Portable Document Format (PDF) will represent a published work according to the International Commission on Zoological Nomenclature (ICZN), and hence the new name contained in the electronic version is effectively published under that Code from the electronic edition alone. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed through any standard web browser by appending the LSID to the prefix <http://zoobank.org/>. The LSID for this publication is: urn:lsid:zoobank.org:pub:703D5E02-F1C5-45E0-BC09-5EDA5C3730B5.

3. Results

3.1. Systematics

Family Strabomantidae Hedges, Duellman and Heinicke 2008

Genus *Pristimantis* Jiménez de la Espada 1871

Pristimantis kiruhampatu sp. nov. Venegas, García-Ayachi and Catenazzi, 2021

LSID: urn:lsid:zoobank.org:act:2F4B6085-E80B-46E1-B0F7-CB1BCCC4A22D
(Figures 1–3)

3.1.1. Holotype

CORBIDI 11713, an adult female, from Vista Alegre (Quebrada Salas), Rodriguez de Mendoza Province, Amazonas Region, Peru (6.111916 S, 77.440000 W; 2577 m a.s.l.) obtained on 7 August 2012 by Pablo J. Venegas.

3.1.2. Paratypes

Twenty paratypes: CORBIDI 11677 and 11746, two adult females; CORBIDI 11667, 11684–85, 11697–99, 11705–06 and 11714, nine adult males; CORBIDI 11683, 11704, 11709, 11710, 11715, 11718–20 and 11739, nine juveniles, collected with the holotype by Pablo J. Venegas.

3.1.3. Diagnosis

(1) Skin on dorsum shagreen with scattered conical tubercles heterogenous in size, more abundant on the posterior half of dorsum; flanks with several low conical tuberculate; \/-shaped scapular and sacral transversal ridge present; ventral surface areolate with scattered enlarged warts, discoidal fold absent; dorsolateral ridge, present, short; (2) tympanic membrane and tympanic annulus present, distinct, supratympanic fold present, ill-defined; (3) snout short, subacuminate in dorsal and profile views with a terminal conical tubercle on tip of the snout; conical tubercles along the jaw, present, distinct; (4) upper eyelid with one enlarged conical tubercle and numerous small conical tubercles; interorbital fold present; EW 70% of IOD; cranial crests absent; (5) dentigerous processes of vomers absent; (6) males with vocal slits and small vocal sac; nuptial pads absent; (7) Finger I shorter than Finger II; discs of digits widely expanded, rounded; (8) fingers bearing lateral fringes; with circumferential grooves; (9) ulnar tubercles present, conical, distinct or prominent; (10) heel bearing a conical tubercle, prominent; outer edge of tarsus and tibia with conical tubercles,

distinct; inner tarsal fold present, short; (11) inner metatarsal tubercle, elliptical, prominent, slightly larger than the distinct elongate outer metatarsal tubercle; distinct supernumerary plantar tubercles at the base of toes present; (12) toes bearing broad lateral fringes; basal toe webbing absent; Toe V longer than Toe III (disc on Toe III reaching proximal subarticular tubercle on Toe IV); toe discs slightly smaller than on fingers; (13) in life, dorsum can be pale brown to dark brown or green with dark brown marks; flanks with or without dark diagonal streaks; axillae, groins and hidden surfaces of hindlimbs cherry with white flecks; venter tan with dark brown flecks, spots or irregular blotches; iris golden tan with thin dark brown reticulations and a brownish streak in the middle; (14) SVL in adult females 19.5–23.5 mm (n = 4), in adult males 13.0–17.3 mm (n = 14).

3.1.4. Comparison with Other Species

Pristimantis kiruhampatu is similar to 19 Andean species from Ecuador and Peru that are characterized by the presence of a prominent conical tubercle on the eyelids and heel, and prominent conical tubercles along the outer edge of tarsus, i.e.: *P. albuja* Brito-M., Batallas-R., and Yáñez-Muñoz, 2017; *P. bellae* Reyes-Puig and Yáñez-Muñoz, 2012; *P. bustamante* Chaparro, Motta, Gutierrez, and Padial, 2012; *P. colonensis* Mueses-Cisneros, 2007; *P. corrugatus* Duellman, Lehr, and Venegas, 2006; *P. crucifer* Boulenger, 1899; *P. eriphus* Lynch and Duellman, 1980; *P. gualaceno* Urgilés, Sánchez-Nivicela, Nieves, and Yáñez-Muñoz, 2014; *P. inusitatus* Lynch and Duellman, 1980; *P. katoptroides* Flores, 1988; *P. llanganati* Naverrete, Venegas, and Ron, 2016; *P. leucorrhinus* Boano, Mazzotti, and Sindaco, 2008; *P. lucasi* Duellman and Chaparro, 2008; *P. prolatus* Lynch and Duellman, 1980; *P. roni* Yáñez-Muñoz, Bejarano-Muñoz, Brito-M., and Batallas-R., 2014; *P. rufoviridis* Valencia, Yáñez-Muñoz, Betancourt-Yépez, Terán-Valdez, and Guayasamin, 2011; *P. wiensi* Duellman and Wild, 1993; and *P. yanezi* Naverrete, Venegas, and Ron, 2016; in addition to *P. paulpittmani* sp. nov. described below.

Among these species, *P. corrugatus*, *P. katoptroides*, and *P. paulpittmani* inhabit the humid montane forest of the northern portion of Central Andes in Amazonas and San Martín departments [15,16], close to the type locality of *P. kiruhampatu* (see Figure 4). *Pristimantis kiruhampatu* is most similar to the syntopic *P. corrugatus*. However, *P. kiruhampatu* differs from *P. corrugatus* by having well-defined conical tubercles along the snout and outer edge of the tibia (absent or indistinct in *P. corrugatus*) and a transversal ridge on the sacrum (absent). Furthermore, the axillae, groins, and hidden surfaces of hindlimbs are cherry with white minute flecks in *P. kiruhampatu* and red in *P. corrugatus*. *Pristimantis paulpittmani* is easily distinguished from *P. kiruhampatu* by having the groins and hidden surfaces of the hindlimbs yellow or dirty cream, and by lacking a tympanic annulus and membrane (evident in *P. kiruhampatu*). *Pristimantis katoptroides*, despite having a green dorsum like some individuals of *P. kiruhampatu*, differs from *P. kiruhampatu* by having the groins and hidden surfaces of hindlimbs blue and the venter white or green with white blotches (venter tan with dark brown flecks or irregular blotches in *P. kiruhampatu*). Furthermore, *P. katoptroides* lacks conical tubercles along the ulnar region, the edge of the snout, and the outer edge of the tibia.

Other similar species from the Peruvian Andes, such as *P. bustamante*, *P. leucorrhinus*, *P. lucasi*, *P. vilcabambae*, and *P. wiensi* [2], can be easily distinguished from *P. kiruhampatu* (except *P. bustamante* and *P. wiensi*) by their lacking tympanic annulus and membrane. *Pristimantis wiensi* has a green dorsum, like some individuals of *P. kiruhampatu*; however, the new species differs by the presence of an interorbital fold, \/-shaped sacral transversal ridge, characters also absent in *P. bustamante*, *P. leucorrhinus*, *P. lucasi*, and *P. vilcabambae*. Additionally, *P. bustamante* has groin and hidden surfaces of hindlimbs with bold black sinuous bars separated by white stripes and red or orange marks, while *P. leucorrhinus* is black with white spots, *P. lucasi* is yellowish cream with brown streaks, and the groin is cream with brown mottling or brown with cream spots in *P. wiensi*.

Species of *Pristimantis* from the Andes of Ecuador with a green dorsum, such as *P. crucifer*, *P. eriphus*, *P. gualaceno*, *P. inusitatus*, *P. llanganati*, *P. roni*, *P. rufoviridis*, and some

individuals of *P. bellae* can be distinguished from *P. kiruhampatu* by lacking the coloration pattern consisting of cherry with minute white flecks on the groin and hidden surfaces of hindlimbs. *Pristimantis kiruhampatu* can be distinguished from *P. crucifer*, *P. eriphus*, *P. gualaceno*, *P. inusitatus*, *P. llanganati*, and *P. rufoviridis* by having conical tubercles along the edge of the snout and outer edge of the tibia. Furthermore, *P. eriphus* and *P. crucifer* possess red irises (iris golden tan with thin dark brown reticulations and a brownish streak in the middle in *P. kiruhampatu*). *Pristimantis roni* and *P. bellae* possess conical tubercles along the edge of the snout, as in *P. kiruhampatu*. However, *P. roni* has the venter greenish cream or grayish with gray or white blotches, and *P. bellae* is black with white spots.

Other species of *Pristimantis* from the Andes of Ecuador with similar skin texture and brown dorsum are *P. albuja*, *P. colonensis*, *P. prolatus*, and *P. yanezi* [7,17–19]. Except for *P. albuja*, the other two species can be easily distinguished from *P. kiruhampatu* by lacking the cherry with white fleck coloration in the groins and hidden surfaces of hindlimbs. *Pristimantis colonensis* has conical tubercles on the dorsum and along the edge of the snout; however, this species differs from the new species by having a paravertebral (-shaped fold (absent in *P. kiruhampatu*), and the groin and posterior surface of thighs are cinnamon with narrow white streaks. *Pristimantis prolatus* differs from *P. kiruhampatu* by having an H-shaped fold on the scapular region (\/-shaped in the new species) and lacking a transversal fold on the sacrum. *Pristimantis yanezi* differs from *P. kiruhampatu* (state of characters in parenthesis) by having a low conical tubercle on the heel and outer edge of tarsus (a prominent conical tubercle on heel and prominent conical tubercles along the outer edge or tarsus), and the iris is reddish coppery (iris golden tan with thin dark brown reticulations and a brownish streak in the middle). *Pristimantis albuja* has the groins and hidden surfaces of hindlimbs reddish, similar to the cherry coloration of *P. kiruhampatu*; however, the former species differs by having a prominent dorsolateral fold (weak in the new species) and a weakly areolate venter (areolate with scattered enlarged warts).

3.1.5. Description of the Holotype

An adult female with slender body (Figure 2); head narrow, not as wide as body, wider than long; head width 40% of SVL; head length 30% of SVL; snout short, bearing a terminal pointed conical tubercle on the tip, subacuminate in dorsal and lateral view; eye-nostril distance 90% of eye diameter; nostrils elliptical, slightly protuberant, directed laterally; canthus rostralis curved in dorsal view, straight in profile; loreal region slightly concave; conical tubercles, heterogeneous in size on head and margin of lower jaw; upper eyelid bearing a distinct enlarged conical tubercle and numerous subconical tubercles; upper eyelid width 70% of IOD; tympanic annulus present; supratympanic fold absent; tympanum diameter 57% of eye diameter, tympanic membrane smooth; enlarged conical postrectal tubercles present. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers absent; tongue much longer than wide, notched behind, free posteriorly for three-quarters of its length.

Skin on dorsum shagreen with scattered tubercles, more abundant on the posterior half of dorsum; pointed tubercles on the top of snout and margin of lower jaw; a tubercle dorsally at the middle of head and an interorbital tubercle; irregular sinusoidal and dorsolateral ridges; sacral transversal ridge present, discontinuous; skin on flanks finely tuberculated, with several small conical tubercles; upper surface of forelimbs conical tuberculate, heterogeneous; skin on throat areolate, chest and belly coarsely areolate, with low scattered tubercles; ventral surfaces of thighs, anteriorly smooth and posteriorly coarsely areolate, with scattered low tubercle; discoidal fold absent; cloacal sheath short; skin of cloacal region with scattered tubercles. Ulnar tubercles present, conical, heterogeneous in size; palmar tubercles present, weakly defined, outer palmar tubercle bifid, weakly defined, thenar tubercle present, elliptical, more distinct than palmar tubercle; low subarticular tubercles, round in ventral and lateral view; supernumerary tubercle at base of fingers present, weakly defined; fingers bear broad lateral fringes; Finger I shorter than Finger II; disc on Finger I, slightly dilated and round, disc on Fingers II, III, and IV dilated and

rounded; ventral pads on fingers well defined by circumferential grooves on all fingers (Figure 2).

Hind limbs slender, tibia length 50% of SVL; foot length 50% of SVL; upper surfaces of hind limbs conical tuberculate, outer edge of tibia with evident conical tubercles, heterogeneous in size; posterior surfaces of thighs coarsely areolate; heel bearing one enlarged conical tubercle surrounded by numerous lower conical tubercles; outer surface of tarsus bearing conical tubercles; inner tarsal fold present, short; inner metatarsal tubercle low, elliptical, slightly bigger than the distinct, oval, outer metatarsal tubercle; plantar surface tuberculate; subarticular tubercles evident, oval, low, round in ventral and lateral view; toes bearing broad lateral fringes; basal webbing between toes absent; discs nearly as large as those on fingers, most prominent on Toe IV; discs on all toes dilated and rounded more evident in Toes IV and V; toes having ventral pads well defined by circumferential grooves; relative lengths of toes: $1 < 2 < 3 < 5 < 4$ (Figure 2); Toe V longer than Toe III (disc on Toe III reaching proximal subarticular tubercle on Toe IV, tip of the disc on Toe V reaching to proximal border of distal subarticular tubercle on Toe IV).

Measurements of the holotype (in mm): SVL 22.0; tibia length 11.9; foot length 11.2; head length 7.6; head width 8.7; eye diameter 2.1; tympanum diameter 1.2; interorbital distance 2.7; upper eyelid width 2.1; internarial distance 2.1; eye-nostril distance 2.7.

Color of holotype in life (Figure 1A–C). Dorsal surface green with the top of snout tan and a dark brown mantle covering the head and first half of dorsum; sides of head green with brown labial bars and a dark brown supratympanic fold; flanks with scattered brown speckles and minute white flecks; axillae, groins, and hidden surfaces of hindlimbs cherry with minute white flecks; dorsal surface of limbs with brown speckles; fingers and toes brown or tan. Ventral surface tan with dark brown irregular blotches, including a V-shaped mark on the chin and red speckles on the belly; palms and soles creamy tan with brown speckles. Iris golden tan with thin dark brown reticulations and a brownish streak in the middle.

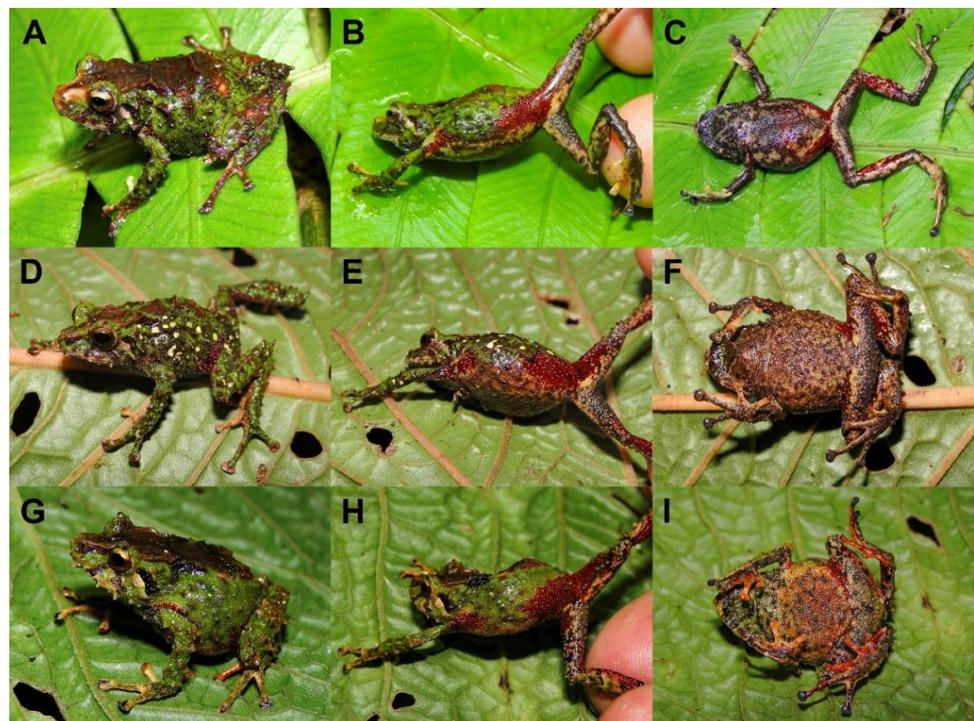


Figure 1. Dorsolateral, lateral (hidden surfaces details), and ventral views of three living female specimens of *Pristimantis kiruhampatu* sp. nov.: (A–C) holotype, CORBIDI 11713, 22 mm SVL; (D–F) paratype CORBIDI 11746, 22.3 mm SVL; and (G–I) paratype CORBIDI 11677, 23.5 mm SVL. Photographs by Pablo J. Venegas.

Color of holotype in preservative (Figure 2). Dorsal surface turns brown with tan and dark brown marks; Fingers I and II, and Toes I to III creamy tan; cherry coloration on hidden surfaces turns yellowish tan with whitish flecks. Ventral surface turns tan to creamy tan with dark brown blotches.

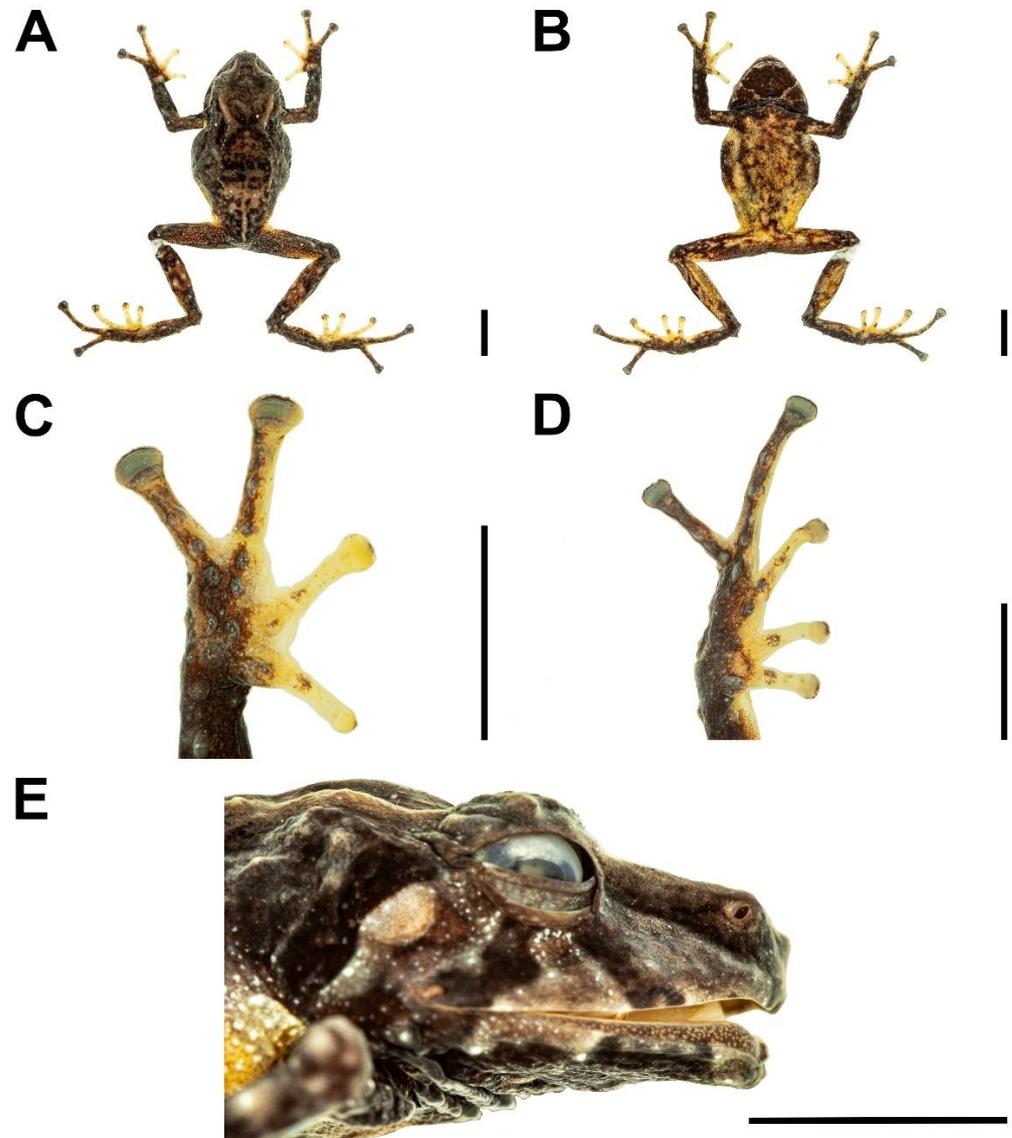


Figure 2. Preserved specimens of *Pristimantis kiruhampatu* sp. nov. (holotype) in dorsal view (A), ventral view (B), palm (C), sole (D), and head in lateral view (E). Scale 5 mm. Photographs by LAGA.

3.1.6. Intraspecific Variation

In the type series, adult males (SVL = 11.8–13.8 mm) are smaller than females (22.0–23.5 mm) and possess vocal slits. See Table 1 for measurements and proportions of the type specimens. The skin texture lacks sexual dimorphism; however, the dorsum is green in females (Figure 1) and brown in most males (see Figure 3). The skin on the dorsum is strongly tuberculate in most specimens, but it is smooth in one male (CORBIDI 11684). Ulnar tubercles and conical tubercles along the snout are usually prominent (e.g., CORBIDI 11713), but they are low in some specimens (CORBIDI 11684 and 11704). Dorsal markings are highly variable, from dark brown solid blotches (Figure 1A) to triangular marks (Figure 3A). One specimen (CORBIDI 11709) presents a distinct interorbital and sacral bar (Figure 3E). One female possesses scattered white spots on the dorsum (CORBIDI 11746). Dark brown lateral diagonal streaks can be faint (CORBIDI 11704) or distinct

(CORBIDI 11683). Ventral patterns vary from brown flecks (CORBIDI 11746) to irregular brown blotches (CORBIDI 11684).



Figure 3. Variation in five male specimens of *Pristimantis kiruhampatu* sp. nov. (A–C) CORBIDI 11704, 17.3 mm SVL; (D) CORBIDI 11710, 15.5 mm SVL; (E–G) CORBIDI 11709, 18.3 mm SVL; (H–J) CORBIDI 11683, 16.6 mm SVL; and (K–L) CORBIDI 11684, 13.1 mm SVL. Photographs by Pablo J. Venegas.

Table 1. Variation of measurements (in mm) and proportions of the type series of *Pristimantis kiruhampatu* sp. nov. and *P. paulpittmani* sp. nov. Mean \pm SD is given with range in parentheses. See text for abbreviations.

	<i>Pristimantis kiruhampatu</i> sp. nov.		<i>Pristimantis paulpittmani</i> sp. nov.	
	Females (n = 4)	Males (n = 14)	Females (n = 10)	Males (n = 8)
SVL	19.5–23.5 (21.8 \pm 1.7)	13.0–18.3 (14.7 \pm 1.8)	18.1–23.8 (21.7 \pm 1.7)	15.2–17.4 (16.1 \pm 0.7)
TL	10.8–11.9 (11.4 \pm 0.5)	6.7–10.6 (8.3 \pm 1.1)	10–12.6 (11.2 \pm 0.6)	8.1–9.5 (8.7 \pm 0.4)
FL	9.7–11.2 (10.7 \pm 0.7)	5.3–9.3 (7.0 \pm 1.2)	8.3–10.9 (9.7 \pm 0.8)	6.7–7.7 (7.2 \pm 0.4)
HL	6.9–8.1 (7.6 \pm 0.5)	4.9–6.6 (5.5 \pm 0.6)	6.1–8.2 (7.4 \pm 0.6)	5.2–6.3 (5.6 \pm 0.3)
HW	7.8–8.7 (8.3 \pm 0.4)	4.8–7.5 (5.6 \pm 0.8)	7.4–9.7 (8.7 \pm 0.6)	6.1–6.8 (6.4 \pm 0.3)
ED	2.1–2.7 (2.4 \pm 0.3)	1.2–2.6 (2.0 \pm 0.3)	2.2–3.3 (2.6 \pm 0.3)	2.0–2.8 (2.3 \pm 0.2)
IOD	2.5–2.8 (2.7 \pm 0.1)	0.8–2.2 (1.7 \pm 0.4)	2.1–3.3 (2.6 \pm 0.3)	1.9–2.3 (2.0 \pm 0.1)
EW	2.0–2.5 (2.3 \pm 0.2)	0.5–2.0 (1.5 \pm 0.4)	1.5–2.3 (1.9 \pm 0.2)	1.4–2.0 (1.7 \pm 0.2)
IND	1.9–2.1 (2.1 \pm 0.1)	0.3–1.7 (1.3 \pm 0.4)	1.9–2.4 (2.2 \pm 0.1)	1.6–1.8 (1.7 \pm 0.1)
E-N	2.3–2.7 (2.4 \pm 0.2)	1.1–2.1 (1.5 \pm 0.3)	2.1–2.8 (2.5 \pm 0.2)	1.6–2 (1.8 \pm 0.1)

Table 1. Cont.

	<i>Pristimantis kiruhampatu</i> sp. nov.		<i>Pristimantis paulpittmani</i> sp. nov.	
	Females (n = 4)	Males (n = 14)	Females (n = 10)	Males (n = 8)
TL/SVL	0.50–0.55 (0.52 ± 0.03)	0.52–0.60 (0.56 ± 0.03)	0.46–0.55 (0.52 ± 0.02)	0.51–0.57 (0.54 ± 0.03)
FL/SVL	0.46–0.51 (0.49 ± 0.02)	0.40–0.51 (0.47 ± 0.03)	0.41–0.49 (0.45 ± 0.02)	0.44–0.46 (0.45 ± 0.01)
HL/SVL	0.32–0.36 (0.35 ± 0.02)	0.32–0.40 (0.37 ± 0.02)	0.33–0.36 (0.34 ± 0.01)	0.34–0.36 (0.35 ± 0.01)
HW/SVL	0.35–0.40 (0.38 ± 0.02)	0.36–0.41 (0.38 ± 0.02)	0.38–0.43 (0.40 ± 0.02)	0.38–0.42 (0.40 ± 0.01)
HW/HL	1.05–1.14 (1.10 ± 0.04)	0.92–1.15 (1.02 ± 0.07)	1.12–1.23 (1.18 ± 0.04)	1.07–1.24 (1.14 ± 0.05)
E–N/ED	0.85–1.29 (1.05 ± 0.20)	0.50–1.00 (0.74 ± 0.17)	0.79–1.09 (0.96 ± 0.12)	0.63–0.92 (0.78 ± 0.09)
EW/IOD	0.74–0.96 (0.84 ± 0.10)	0.63–0.95 (0.84 ± 0.10)	0.60–0.97 (0.74 ± 0.11)	0.76–0.90 (0.83 ± 0.04)

3.1.7. Advertisement Call

The call of CORBIDI 11709 was recorded shortly after capture on 7 August 2012 (Figure 4). At a $T_{\text{air}} = 10.9\text{ }^{\circ}\text{C}$, the advertisement call averaged 378 ± 87 ms in duration (range 224–432 ms) and consisted of 3–5 pulses (one call each with three and four pulses, and four calls with five pulses) produced at a rate of 0.12 calls/s (six calls in ~50 s). Peak frequency averaged 4469 ± 216 Hz (range 4218–4594 Hz, $n = 3$) in the three longest calls, but coincided with the fundamental frequency averaging 2469 ± 54 Hz (range 2437–2531 Hz, $n = 3$) in the two shortest calls, and in the first of the five-pulsed long call. The fundamental frequency of all calls averaged 2453 ± 38 Hz (range 2437–2531 Hz, $n = 6$). In addition to the band of peak amplitude around 4469 Hz, there was at least one additional harmonic around ~7 kHz, but the quality of the recording is not sufficient to describe this feature.

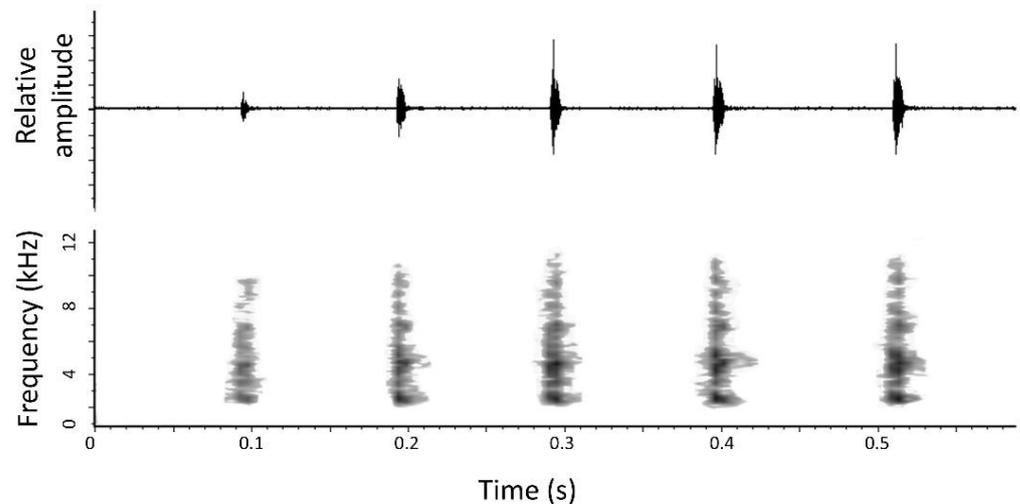


Figure 4. Advertisement call of male CORBIDI 11683 (SVL 18.3 mm), paratype of *Pristimantis kiruhampatu* sp. nov., recorded at the type locality on 7 August 2012 ($T_{\text{air}} = 10.9\text{ }^{\circ}\text{C}$).

3.1.8. Distribution and Ecology

Pristimantis kiruhampatu is known only for the type locality, a cloud forest in the upper basin of Río Salas, a tributary of Río Mayo, at an elevation of 2577 m a.s.l., in the northern portion of the Central Andes, Amazonas Department, Peru (Figure 5). The new species was collected at night along trails that crossed primary and secondary cloud forests. All specimens were found perched on leaves at heights from 20 to 50 cm from the ground. The type locality lies within the Peruvian Yungas ecoregion, according to Olson et al. [20]. Following the vegetation formation categories for the Andes of northern Peru, proposed by Duellman and Pramuk [21], *P. kiruhampatu* inhabits the very humid montane forest or cloud forest.

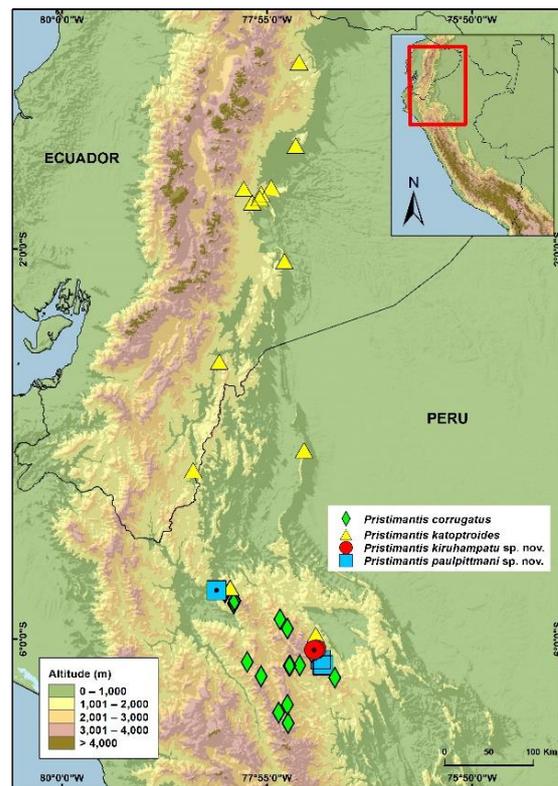


Figure 5. Distribution of *Pristimantis corrugatus*, *P. katoptroides*, *P. kiruhampatu* sp. nov., and *P. paulpittmani* sp. nov. Symbols with dots correspond to the type locality of each species.

Other anurans collected with *P. kiruhampatu* were *Phrynopus mariellaleo*, *P. corrugatus*, *P. schultei*, and *P. wagteri*.

3.1.9. Etymology

The specific name *kiruhampatu* is composed of two Quechua nouns, *kiru* meaning “tooth”, and *hampatu* meaning “frog”, used in apposition. The specific name refers to the tubercles along the snout that looks like teeth.

3.2. Systematics

Family Strabomantidae Hedges, Duellman and Heinicke 2008

Genus *Pristimantis* Jiménez de la Espada 1871

Pristimantis paulpittmani sp. nov. Venegas, García-Ayachi and Catenazzi, 2021

LSID: urn:lsid:zoobank.org:act:E3DF6C84-3A8B-4D44-9B94-535A8A9139FF

(Figures 6–8)

3.2.1. Holotype

CORBIDI 20833, an adult female, from Uriarte (5.498794 S, 78.363872 W; 2116 m a.s.l.), Aramango district, Bagua province, Amazonas department, Peru, collected by P.J. Venegas, L.A. García-Ayachi, J. C. Chávez, and A. Marchelie on 15 August 2019.

3.2.2. Paratypes

Twenty-three paratypes, all from Amazonas Department, Peru: CORBIDI 20819, adult female, respectively, collected with the holotype; CORBIDI 20776–20777, adult males, respectively, from Uriarte (5.492985 S, 78.364249 W; 2137 m a.s.l.); CORBIDI 20823, 20831, 20832, adult females, respectively, from Uriarte (5.495672 S, 78.362875 W; 2134 m a.s.l.), Aramango district, Bagua province, collected by P.J. Venegas, L.A. García-Ayachi, J. C.

Chávez, and A. Marchelie on 14 August, 2019; CORBIDI 20093, 20097, adult and juvenile females, CORBIDI 20094–95, adult males, CORBIDI 20096, 20098, juveniles, respectively, from Fundo los cedros (6.209005 S, 77.373120 W; 1995 m a.s.l.), Vista Alegre district, Rodríguez de Mendoza province, collected by P.J. Venegas, L.A. García-Ayachi on 9 November, 2018; CORBIDI 20099–101, and adult male and two juveniles, respectively, from Fundo Los Cedros (6.209155 S, 77.373798 W; 2000 m a.s.l.), Vista Alegre district, Rodríguez de Mendoza province, collected by P.J. Venegas, L.A. García-Ayachi on 10 November, 2018; CORBIDI 20128, a juvenile, from Fundo Playas del Inca (6.262610 S, –77.347717 W; 1864 m a.s.l.), Vista Alegre district, Rodríguez de Mendoza province, collected by P.J. Venegas, L.A. García-Ayachi on 12 November, 2018; CORBIDI 20166, an adult male, CORBIDI 20167–68, 20170, an adult and two juvenile females, CORBIDI 20169, a juvenile, respectively, from Fundo Playas del Inca (6.267912 S, 77.358436 W; 2078 m a.s.l.), Vista Alegre district, Rodríguez de Mendoza province, collected by P.J. Venegas, L.A. García-Ayachi on 14 November, 2018; CORBIDI 20180–81, adult females, respectively, from Fundo Playas del Inca (6.272572 S, 77.347410 W; 1867 m a.s.l.), Vista Alegre district, Rodríguez de Mendoza province, collected by P.J. Venegas, L.A. García-Ayachi on 15 November, 2018.

3.2.3. Diagnosis

Pristimantis paulpittmani is diagnosed by the following combination of characters: (1) skin of dorsum smooth or finely tuberculate with scattered conical and round tubercles; flanks with scattered conical tubercles; \wedge -shaped scapular folds present and longitudinal middorsal fold present or absent; ventral surface areolate with scattered enlarged warts; discoidal fold absent; dorsolateral ridges present or absent, when present, short; (2) tympanic membrane and tympanic annulus not visible, supratympanic fold weak; (3) snout short, subacuminate in dorsal and lateral view with a pointed tubercle at the tip of the snout; (4) upper eyelid bearing one prominent conical tubercle surrounded by some conical small tubercles; interorbital fold present; EW 78% of IOD; cranial crest absent; (5) dentigerous processes of vomer present, lower, oblique, positioned posterior to the level of choane, broadly separated from each other, bearing 4 to 10 vomerine teeth; (6) males with vocal slits and small vocal sac; nuptial pads absent; (7) Finger I shorter than Finger II; discs of digits broadly expanded, rounded and with well-defined circumferential grooves; (8) fingers bearing broad lateral fringes; (9) ulnar tubercles conical, low; (10) heel bearing one prominent conical tubercle; outer edge of tarsus bearing conical tubercles; inner tarsal fold present, short; (11) inner metatarsal tubercle, elliptical, distinct, about three times the size of the ill-defined outer metatarsal tubercle; distinct supernumerary plantar tubercles at the base of the toes; (12) toes bearing broad lateral fringes; basal toe webbing absent; Toe V longer than Toe III (disc on Toe III reaching the middle of second subarticular tubercle on Toe IV, tip of the disc on Toe V reaching the middle of first subarticular tubercle on Toe IV); toe discs equal in size or slightly smaller than those on fingers; (13) in life, dorsum can be brown to dark brown or creamy brown with tan or dark brown irregular marks; flanks with or without diagonal streaks; axillae, groins and hidden surfaces of hind limbs yellow in males (groins and anterior surface of thighs forming a single yellow blotch) and yellowish tan or dirty cream in females; ventral surface brown, tan or dirty cream with dark brown irregular blotches; iris whitish cream with scattered dark brown reticulations and a thin vertical dark brown stripe at the middle of the eye; (14) SVL in adult females 18.1–23.8 mm (n = 10), in adult males 15.2–17.4 mm (n = 5).

3.2.4. Comparison with Other Species

Pristimantis paulpittmani is not assigned to any species group, but it is morphologically similar to other species from the Andes of Ecuador and Peru that possess a prominent conical tubercle on the eyelids and heel, prominent conical tubercles along the outer edge of the tarsus, and discs on fingers and toes widely expanded, such as *P. albujaui*, *P. bellae*, *P. bustamante*, *P. colonensis*, *P. corrugatus*, *P. gualacenio*, *P. inusitatus*, *P. katoptroides*, *P. kiruhampatu* sp. nov., *P. leucorrhinus*, *P. lucasi*, *P. prolatus*, *P. roni*, and *P. wiensi*.

Among these species, *P. corrugatus* and *P. kiruhampatu* occur in proximity with *P. paulpittmani* (Figure 5) in the Amazonas Department, at elevations from 2347 to 3281 m a.s.l. [15]. However, in life, *P. paulpittmani* is easily distinguished from both species by having yellow or dirty cream groins and hidden surfaces of hindlimbs, and whitish cream irises with scattered dark brown reticulations and a thin vertical dark brown streak at the middle of the eye. Whereas, in *P. corrugatus*, the groins and hidden surfaces of the hindlimbs are red, and their irises are usually bicolored (sky blue above and coppery below with a reddish-brown longitudinal streak in the middle). In *P. kiruhampatu*, the groins and hidden surface of hindlimbs are cherry colored, and the iris is gold or golden tan with thin dark brown reticulations and a brown longitudinal streak on the middle. In addition, *P. kiruhampatu* and *P. corrugatus* possess a distinct tympanic annulus and membrane, absent in *P. paulpittmani*. *Pristimantis katoptroides* from Ecuador and northern Peru [16] occurs at lower elevations than *P. paulpittmani* (1500 to 1600 m) in the northern portion of Cordillera de Colan. *Pristimantis katoptroides* can be confused with the new species by having a tympanic annulus and membrane weakly defined or partially canceled by the skin, and conical tubercles on eyelids and heel. However, *P. katoptroides* is easily distinguished from *P. paulpittmani* by having blue groins and posterior thigh surfaces, and the venter is white with green reticulations or green with white blotches. Additionally, the conical tubercle on the eyelids and heel of *P. paulpittmani* are prominent, while in *P. katoptroides*, they are lower and less noticeable. Although the tympanic annulus and membrane are partially concealed by skin in *P. katoptroides*, the tympanic annulus is distinguishable, whereas, in *P. paulpittmani*, it is not visible externally.

Pristimantis leucorrhinus, *P. lucasi*, *P. vilcabambae*, and *P. wiensi* from Peru [2] also resemble *P. paulpittmani* by lacking the tympanic annulus and membrane. However, *P. leucorrhinus* differs from *P. paulpittmani* (characters in parenthesis) by having the groins and anterior surface of thighs being black with white spots (yellow or dirty cream suffused with yellow), while the venter is grayish-brown with black tubercles and white spots (brown or dirty cream with dark brown irregular blotches), and the irises are grayish-brown with dark brown reticulations (whitish cream with scattered dark brown reticulations and a thin vertical dark brown stripe at the middle); *P. lucasi* differs by having the snout rounded in dorsal view and bluntly rounded in profile (subacuminate in dorsal and lateral views with a conical tubercle on the tip of snout); and *P. wiensi* differs by having the snout rounded in profile (subacuminate with a conical tubercle on the tip of snout), and venter cream with brown spot or reticulations (brown or dirty cream with dark brown irregular blotches). Additionally, *P. lucasi* lacks the dentigerous processes of vomer (present). *Pristimantis bustamante* from Cajamarca Department in the Andes of northern Peru [22] differs from *P. paulpittmani* by having the tympanic annulus and membrane visible (tympanic annulus and membrane externally absent), groins and anterior surface of thighs black (groins and anterior surface of thighs yellow or dirty cream), and the iris red (whitish cream with scattered dark brown reticulations).

Morphologically similar species of *Pristimantis* from the Andes of Ecuador such as *P. albujaí*, *P. bellae*, *P. colonensis*, *P. gualacenio*, *P. inusitatus*, *P. prolatus*, and *P. roni* [17–19,23–25] can be easily distinguished from *P. paulpittmani* by having the tympanic annulus and membrane, which is prominent in *P. inusitatus* and *P. prolatus*, and visible externally in all other species. Furthermore, *P. gualacenio*, *P. inusitatus*, and *P. roni* are green dorsally, *P. roni* has a cranial crest (absent in the new species), *P. prolatus* bears H-shaped dermal ridges on the scapular region (absent in *P. paulpittmani*), *P. gualacenio* possesses yellow with black marked groins and hidden surfaces of hindlimbs, *P. albujaí* and *P. bellae* possess dorsolateral folds, while *P. colonensis* has (-shaped paravertebral folds (both dorsolateral and paravertebral folds absent in *P. paulpittmani*). Finally, the coloration of and posterior thigh surface is red in *P. albujaí*, black with white spots in *P. bellae*, and cinnamon with narrow white streaks in *P. colonensis*.

3.2.5. Description of the Holotype

Adult female with slender body (Figure 7); head narrow, not as wide as body, wider than long; head width 43% of SVL; head length 35% of SVL; snout short, bearing a terminal pointed tubercle, subacuminate in dorsal view and in profile; eye–nostril distance 108% of eye diameter; nostrils slightly protuberant, directed laterally; canthus rostralis curved in dorsal view, straight in profile; loreal region slightly concave; conical tubercles along the margin of lower jaw present; upper eyelid bearing one prominent conical tubercle and some scattered small subconical tubercles; upper eyelid width 62% of IOD; tympanic annulus not visible; supratympanic fold weak; tympanic membrane absent; an enlarged conical postrictal tubercles present. Choanae small, rounded, not concealed by palatal shelf of the maxillary; dentigerous process of the vomers present; tongue much longer than wide, notched behind, free posteriorly for three-quarters of its length.

Skin of dorsal surfaces finely tuberculate with scattered enlarged tubercles, more abundant on the posterior half of dorsum; occipital fold /\-shaped and short dorsolateral folds present, discontinuous; sacral transverse ridge present, complete, elevated posteriorly; skin on flanks finely tuberculate, with several small conical tubercles; upper surface of forelimbs bearing conical tubercles, heterogeneous; skin on throat shagreen, chest and belly areolate with enlarged scattered warts; ventral surfaces of thighs smooth anteriorly and areolate posteriorly, with scattered low tubercles; discoidal fold present posteriorly; cloacal sheath short; skin in cloacal region with scattered tubercles. One ulnar tubercle present, conical; palmar tubercles present, weakly defined, outer palmar tubercle bifid, weakly defined, thenar tubercle present, low elliptical, more distinct than palmar tubercle; prominent subarticular tubercles, round in ventral and lateral view; supernumerary tubercles at base of fingers present, numerous, distinct; fingers bearing broad lateral fringes; Finger I shorter than Finger II; disc on Finger I, slightly dilated and round, disc on Fingers II, III, and IV dilated and rounded; ventral pads on fingers well defined by circumferential grooves on all fingers (Figure 7).

Hind limbs slender, tibia length 51% of SVL; foot length 48% of SVL; upper surfaces of hind limbs with conical tubercles, outer edge of tibia with distinct conical tubercles, heterogeneous; posterior surfaces of thighs coarsely areolate; heel bearing one enlarged conical tubercle surrounded by numerous lower conical tubercles; outer surface of tarsus bearing conical tubercles; inner tarsal fold present, short; inner metatarsal tubercle low, elliptical, slightly bigger than the distinct, oval, ill-defined outer metatarsal tubercle; plantar surface tuberculate; subarticular tubercles evident, prominent, round in ventral and lateral view; toes bearing broad lateral fringes; basal webbing between toes absent; discs nearly as large as those on fingers, most prominent on Toe IV; discs on all toes dilated and rounded, more evident in Toes IV and V; toes having ventral pads well defined by circumferential grooves; relative lengths of toes: $1 < 2 < 3 < 5 < 4$ (Figure 7); Toe V longer than Toe III (disc on Toe III reaching the middle of second subarticular tubercle on Toe IV, tip of the disc on Toe V reaching the middle of first subarticular tubercle on Toe IV).

Measurements of the holotype (in mm). SVL, 22.7; tibia length 11.6; foot length 10.9; head length 7.9; head width 9.7; eye diameter 2.6; tympanum diameter 0.7; interorbital distance 3.3; upper eyelid width 2.0; internarial distance 2.1; eye–nostril distance 2.8.

Color of holotype in life (Figure 6A,B). Dorsal surface dark brown, snout pale brown with a squarish cream blotch on the top; sides of head with the labial region paler than dorsum with dark brown labial bars and a dark brown supratympanic mark; flanks gradually paler than dorsum toward ventrolateral region, with a short light brown dorsolateral stripe, groins pale brown suffused with yellow; anterior surface of thighs and hidden surface of shanks dirty cream, posterior surface of thighs dark brown with numerous minute white flecks and a faint yellow blotch on the distal half; dark transversal bars on limbs indistinct. Ventral surface brown with large dark brown irregular blotches on throat and belly, limbs dark brown; palms and soles brown with the inner fingers and toes creamy brown. Iris whitish cream with scattered dark brown reticulations and a thin vertical dark brown stripe at the middle of the eye.

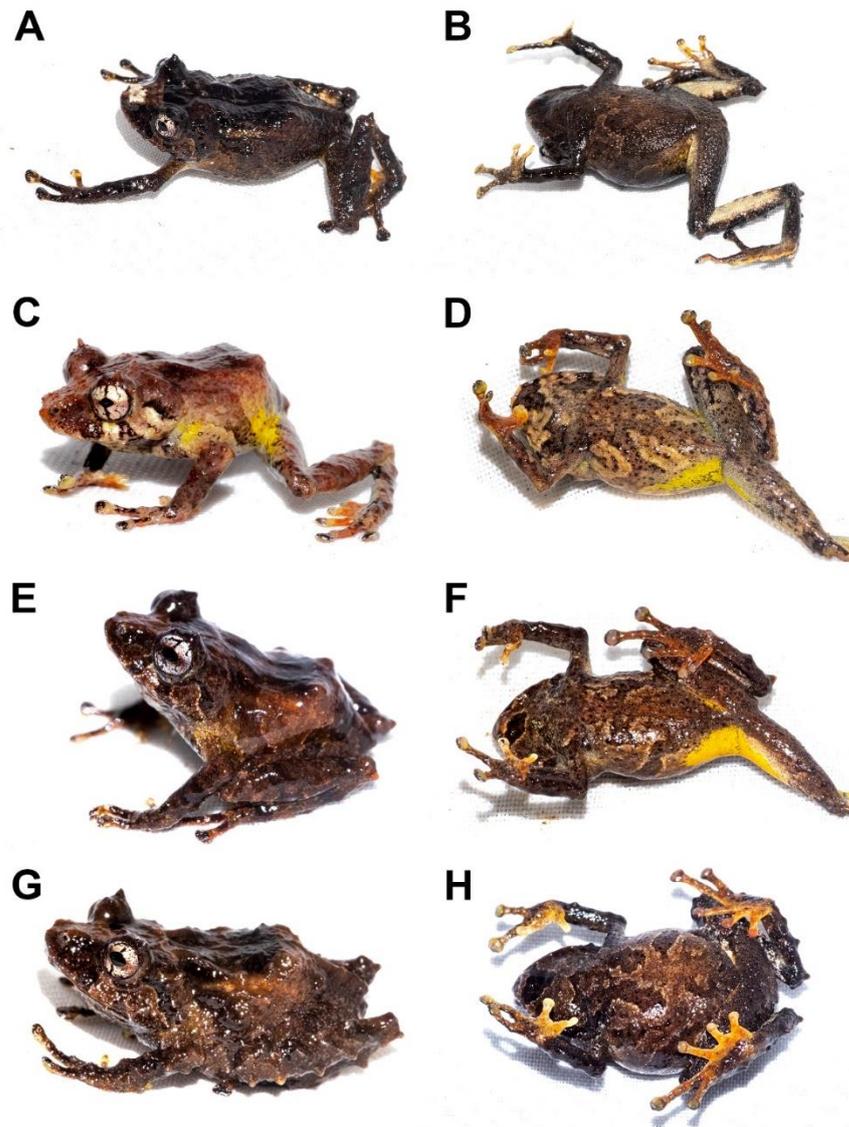


Figure 6. Dorsolateral and ventral views of four living specimens of *Pristimantis paulpittmani* sp. nov. from the type locality: (A,B) holotype, CORBIDI 20833, 22.7 mm SVL; (C,D) adult male, CORBIDI 20776, 15.2 mm SVL; (E,F) adult male, CORBIDI 20777, 16.1 mm SVL; and (G,H) adult female, CORBIDI 20823, 21.1 mm SVL. Photographs by Axel Marchelie.

Color of holotype in preservative (Figure 7). Dorsal surface dark brown with a squarish cream blotch on the top of snout present, and numerous white minute flecks on limbs, including hands and feet. Ventral surface identical as in life but with numerous minute white flecks.

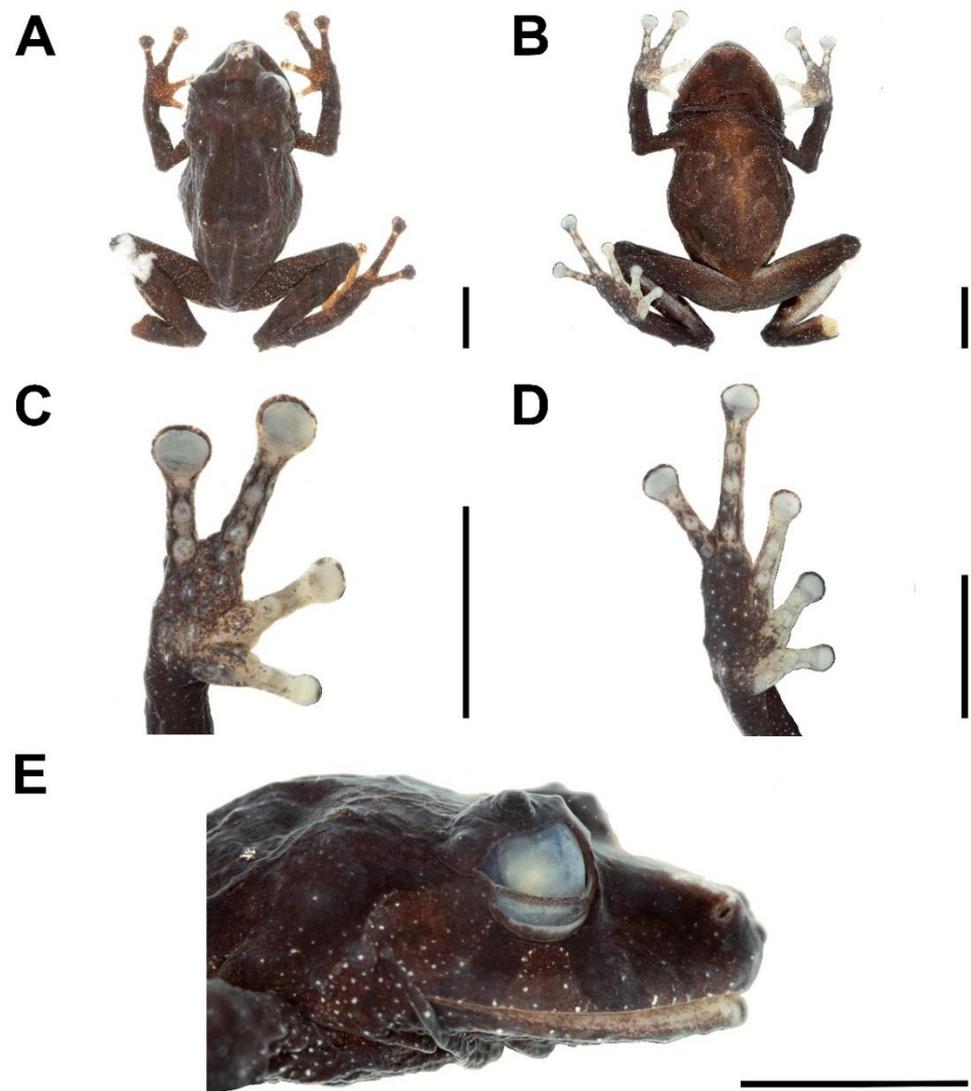


Figure 7. Preserved specimens of *Pristimantis paulpittmani* sp. nov. (holotype) in dorsal view (A), ventral view (B), palm (C), sole (D), and head in lateral view (E). Scale 5 mm. Photographs by LAGA.

3.2.6. Intraspecific Variation

In the type series, adult males (SVL = 15.2–17.4 mm) are smaller than females (18.1–23.8 mm). See Table 1 for measurements and proportions of the type specimens. Males have vocal slits and more tuberculate skin. The conical tubercle on the tip of the snout is more distinctly pointed in males than in females, and the males possess low conical tubercles along the edge of the snout, which are absent or barely visible in females. The longitudinal middorsal fold is present only in large females (CORBIDI 20167). In life, males differ from females by having the groins and hidden surfaces of hindlimbs usually yellow (Figure 6C–F), whereas, in females, they are dirty cream (see Figures 6B and 8).

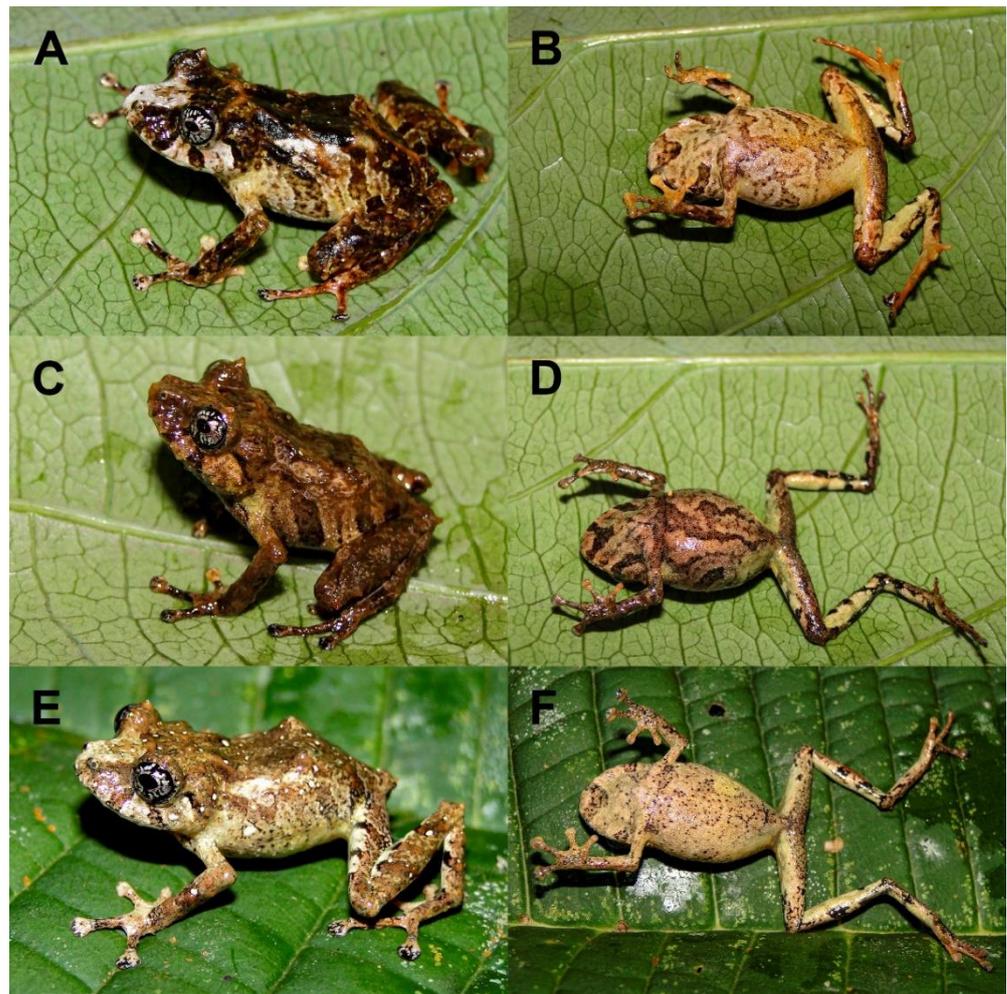


Figure 8. Dorsolateral and ventral views of three living specimens of *Pristimantis paulpittmani* sp. nov. from the locality of Vista Alegre: (A,B) CORBIDI 20167, 23.8 mm SVL; (C,D) CORBIDI 20166, 18.1 mm SVL; and (E,F) CORBIDI 20181, 21.9 mm SVL. Photographs by Pablo J. Venegas.

The skin texture of the dorsum varies from smooth to finely tuberculate with scattered conical and round tubercles. Interorbital fold and \backslash -shaped scapular fold present and evident in CORBIDI 20793 and barely defined in CORBIDI 20776. Dorsolateral ridges discontinuous and present only in some specimens (CORBIDI 20823). Dorsal coloration highly variable from dark brown, pale brown to creamy brown or dark brown dorsally, with contrasted cream flanks (Figure 7E). The dark brown dorsal marks, such as labial bars, lateral streaks, and bars on limbs, are distinct in individuals with cream flanks (Figure 8A) or pale brown background coloration (Figure 8C). Ventrally, the coloration varies from brown with dark brown irregular blotches (Figure 6F) to dirty cream with faint brown irregular blotches (Figure 8F).

3.2.7. Distribution and Natural History

Pristimantis paulpittmani is known from three localities (Uriarte, Fundo Los Cedros, and Fundo Playas del Inca) located in the Amazonas Department, from 1864 to 2134 m a.s.l., in northeastern Peru (Figure 5). Uriarte is located on the western slope of the northern edge of Cordillera de Colán in the basin of the Río Utcubamba, buffer zone of Santuario Nacional Cordillera de Colán, at elevation from 2116 to 2137 m a.s.l. Fundo Los Cedros and Fundo Playas del Inca are two localities close to each other located in the northern portion of the Central Andes, along the eastern slope of Cordillera Oriental in the basin of

the Río Salas (a tributary of Río Mayo), in the Área de Conservación Regional Vista Alegre, at elevations from 1864 to 2078 m a.s.l.

According to the terrestrial ecoregions of the world by Olson et al. [20], this species occurs in the Peruvian Yungas ecoregion. Following the vegetation formation categories for the Andes of northern Peru proposed by Duellman and Pramuk [21], *P. paulpittmani* inhabits the very humid montane forest or cloud forest in Uriarte and the humid montane forest in Fundo Playas del Inca and Fundo Los Cedros. All specimens were collected on leaves of understory forest between 30 cm to 100 cm of height in the edge of patches of primary montane forest and along trails inside the primary forest.

Other species of amphibians collected with *P. paulpittmani* in Uriarte were *Lynchius waynehollomona*, *Noblella* sp., *P. galdi*, *P. schultei*, two unidentified species of *Pristimantis*, and *Rhinella arborescandens*. In Fundo Los Cedros and Fundo Playas del Inca, the new species were collected with *Bolitoglossa* sp., *P. nephophilus*, *P. schultei*, *P. rhodostichus*, *P. galdi*, *P. sp.*, and *Strabomantis* sp.

3.2.8. Etymology

The specific epithet *paulpittmani* is a noun in the genitive case, and is a patronym for Paul Edward Pittman, an American biochemist (1955–2017) who was deeply concerned about climate change's effects on the biological diversity of tropical rainforests and cloud forests in the Americas. Mr. Pittman had extensive knowledge of the research and chemistry concerning climate change. In his last years, he volunteered with the conservation non-profit Rainforest Partnership to share his knowledge in support of conservation work in multiple Regions in the Amazon and Tropical Andes. Following his death, charitable bequests from his estate and by his family continue to support biodiversity conservation in Latin America's tropical forests. This new species was discovered in one of the regions where conservation efforts are supported by his family, and naming it after Mr. Pittman honors his deep concern for and commitment to the conservation of this region's biodiversity.

4. Discussion

The taxonomy of *Pristimantis* has always been complex. In recent years, molecular evidence revealed that several species could be hidden within the same taxon in several Andean [8,26] and Amazonian taxa [27]. These cryptic species can be so similar that some species can only be distinguished by their advertisement call and genetic data [26,28,29]. The Andes of northern Peru, i.e., the Departments of Lambayeque, Piura, Cajamarca, La Libertad, Amazonas, and San Martín, harbor 52 species of *Pristimantis* [2,21,30–32]. Sixty-seven percent of this species richness was described in the last three decades as a product of the herpetological exploration of remote places (i.e., Venegas and Duellman [32], Duellman and Wild [33], Lehr, et al. [34]) and systematics revisions (i.e., Duellman and Lehr [2], Duellman and Pramuk [21], Lehr [35]). Despite the major comprehensive reviews by Duellman and Pramuk [21] and Duellman and Lehr [2], our knowledge of *Pristimantis* diversity in this region remains poor. In fact, genetic data are available for only six species, and advertisement calls are unknown for most species.

Biodiversity research in the montane forest of northern Peru is a race against the clock, due to the current rate of habitat loss and fragmentation [36–38]. Among the 35 species described in the last three decades, three are known only for a single specimen (*P. coronatus*, *P. cuneirostris*, and *P. pataikos*), and 12 species are poorly represented in museum collections, being known for no more than six specimens and three localities (i.e., *P. amydrotus*, *P. anemerus*, *P. ardalonychus*, *P. atrabracus*, *P. exoristus*, *P. infraguttatus*, *P. melanogaster*, *P. muscosus*, *P. rhodostichus*, *P. stictoboubonus*, *P. stipa*, and *P. ventriguttatus*; see Duellman and Lehr [2]). The IUCN Red List lists the three species known only by the holotype and most of the other listed species (66%) as Data Deficient (DD), whereas four species (33%) are listed in other categories: *P. ardalonychus* as Endangered, *P. melanogaster*, and *P. muscosus* as Nearly threatened, and *P. rhodostichus* as Least Concern [39].

Pristimantis muscosus and *P. rhodostichus* are considered non-threatened because their distribution reaches extreme southern Ecuador [40–43]. However, the occurrence of both species in Ecuador is questionable. *Pristimantis muscosus* was described from four poorly preserved (dehydrated) specimens from the type locality, near Venceremos in San Martín department, with some field notes about live coloration taken by R. Schulte [21]. The lack of detail in the live coloration combined with the poor preservation of type specimens undermines morphological comparisons with specimens from Ecuador. Moreover, the recently described *P. ledzeppeline*, a species morphologically related to *P. muscosus*, further erodes the validity of identifications of the Ecuadorian form of *P. muscosus*. In the case of *P. rhodostichus*, Ron et al. [29] and Carrión-Olmedo and Ron [28] showed that genetic data and advertisement calls are essential for species delimitation for species that are similar to *P. rhodostichus* and belong to the *P. lacrimosus* group. Thus, the identity of the Ecuadorian populations of *P. rhodostichus* needs to be confirmed by genetic and/or bioacoustics evidence.

In conclusion, the aforementioned species are only an example of how the poor knowledge about morphological variation in *Pristimantis* hinders field identification, assessment of threat status, and the description of new species. Limited knowledge about species distribution ranges prevents a correct assessment of their threat status and actions needed for their future conservation. A stable taxonomy for the *Pristimantis* diversity of northern Peru is still a far-distant accomplishment.

Author Contributions: Conceptualization, P.J.V. and L.A.G.-A.; methodology, A.C. and P.J.V.; software, A.C. and L.A.G.-A.; validation, P.J.V., L.A.G.-A., and A.C.; formal analysis, P.J.V. and A.C.; investigation, P.J.V. and L.A.G.-A.; resources, P.J.V.; data curation, L.A.G.-A.; writing—original draft preparation, P.J.V.; writing—review and editing, A.C. and L.A.G.-A.; visualization, P.J.V.; supervision, A.C.; project administration, P.J.V.; funding acquisition, P.J.V. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Critical Ecosystem Partnership Fund (CEPF), with the projects numbers CEPF-108792 and CEPF-109938, and Fondo de Promoción de las Áreas Naturales Protegidas del Perú (PROFONANPE).

Institutional Review Board Statement: The Florida International University IACUC (protocols #IACUC-18-009 and #IACUC-21-017) reviewed and approved animal capture, handling and collecting techniques used in this study.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We are grateful to the Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP), especially for the professional personnel of the Santuario Nacional Cordillera de Colán: Christian Olivera, Jhonny D. Ramos, Gerlys Fernandez, and Abner García for their logistic support in the Santuario Nacional Cordillera de Colán; and with Mariella Leo and Glen Seitz for their logistic support during the field work in the Área de Conservación Regional Vista Alegre-Omia. We also thank Juan C. Chavez-Arribasplata, Axel Marchelie, Vilma Duran, and Antonio Garcia-Bravo for their company and field assistance.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The following specimens were examined: *Pristimantis bellae*, ECUADOR: PROVINCIA PASTAZA: cantón Mera, Communal Reserve Ankaku at Llanganates National Park (1.2676° S, 78.0479° W), 1668 m, (QCAZ 45742, 45749, 45756); *Pristimantis colonensis*, ECUADOR: PROVINCIA SUCUMBÍOS: cantón Sucumbíos, El Playón de San Francisco (0.6415° N, 77.6198° W), 3450 m, (QCAZ 14541); 2600 m, (QCAZ 14546); 3600 m, (QCAZ 14545); Santa Bárbara (0.6436° N, 77.5323° W), 2586 m, (QCAZ 50030); PROVINCIA NAPO: cantón Archidona, Cordillera de Los Guacamayos (0.6584° N, 77.9353° W) 2200 m, (QCAZ 10799); Reserve Antisana: Las Cancheras (0.6296° N, 77.9176° W) 2400 m, (QCAZ 50262, 50263,

50267, 50271, 50272, 50277, 50282); *Pristimantis corrugatus*, PERU: DEPARTAMENTO AMAZONAS: Provincia Luya: Área de Conservación Privada Huiquilla (6.37583° S, 77.97667° W), 2941 m, (CORBIDI 365-71, 381-83, 386-89); San Pedro (Lonya Chico) (6.23389° S, 78.12167° W), 2826 m, (CORBIDI 12346, 12364, 12367); Provincia Chachapoyas: Sunipampa (near Leimebamba) (6.75361° S, 77.79972° W), 2521 m, (CORBIDI 549-52, 554-568); Molinopampa (6.26778° S, -77.58527° W), 2574m, (CORBIDI 10897-905); Provincia Rodríguez de Mendoza: Bagazán (6.13361° S, 77.46694° W), 3067 m, (CORBIDI 11653-56); Quebrada Salas (Vista Alegre) (6.11194° S, 77.44000° W), 2575 m, (CORBIDI 11674-76, 11678-82, 11686-87, 11690-91, 11700); Sedrusco (Vista Alegre) (6.10667° S, 75.41778° W), 2405 m, (CORBIDI 11723, 11743); PROVINCIA BONGARA: Hierba Buena (5.79552° S, 77.78692° W), 2563 m, (CORBIDI 18886-88); Chisquilla (5.89036° S, 77.71214° W), 2919 m, (CORBIDI 18906-10); DEPARTAMENTO SAN MARTIN: Provincia Mariscal Cáceres: Trail Las Piñas to Laurel (6.68667° S, 77.69667° W), 3281 m, (CORBIDI 10934-35); Quintecocha (6.85916° S, 77.70408° W), 3119 m, (CORBIDI 11018, 11024-11039); Provincia Huallaga: La Colpa (6.39361° S, 77.22861° W), 2347 m, (CORBIDI 12877-82, 12884); *Pristimantis crucifer*, ECUADOR: PROVINCIA PICHINCHA: cantón San Miguel de los Bancos, Mindo Biology Station (0.07805° S, 78.7319° W), 1601 m, (QCAZ 22322-22326); PROVINCIA IMBABURA: cantón Cotacachi, Reserve Siempre Verde (0.37167° N, 78.4218° W), 2468 m, (QCAZ 39331); *Pristimantis eriphus*, ECUADOR: PROVINCIA NAPO: Quijos, Yanayacu Scientific Station (0.599202° S, 77.889654° W) (QCAZ 16187, 16190); (0.600920° S, 77.890460° W), 2137 m, (QCAZ 19063); (0.599202° S, 77.889654° W), 2000 m, (QCAZ 22281, 22283-84, 22730-32, 22735, 22737, 22739); *Pristimantis inusitatus*, ECUADOR: PROVINCIA PASTAZA: cantón Mera, Communal Reserve Ankaku at Llanganates National Park (1.2792° S, 78.0779° W), 2300 m, (QCAZ 45893); 2350 m, (QCAZ 45864, 45867); (12676° S, 78.0479° W), 1668 m, (QCAZ 46300, 46302); *Pristimantis katoptroides*, PERU: DEPARTAMENTO AMAZONAS: Provincia Condorcanqui: Quebrada Katerpiza (4.02038° S, 77.58352° W), 1340 m, (CORBIDI 9451, 9455); Provincia de Bagua: Cataratas de Nueva Esperanza (5.48314° S, 78.34870° W), 1559m, (CORBIDI 20673, 20697, 20704, 20717, 20728); *Pristimantis llanganati*, ECUADOR: PROVINCIA NAPO: Cantón Tena, "La Cueva" at the confluence of the Mulatos and Langoa rivers (0.9663° S, 78.2224° W), 2483 m, (QCAZ 46140 holotype); Salcedo-Tena Road (0.9847° S, 78.1928° W), 2253 m, (QCAZ 46227); Salcedo-Tena road (0.9670° S, 78.2484° W), 2883 m, (QCAZ 46217); *Pristimantis leucorrhinus*, PERU: DEPARTAMENTO PASCO: Provincia Oxapampa: Quebrada Misissipi-Chacos (10.62074° S, 75.32504° W), 2125 m, (CORBIDI 10206-07); Palcazu, Abra Esperanza (10.53188° S, 75.34950° W), 2808 m, (CORBIDI 10297); Bosque de Shollet (10.61370° S, 75.28290° W), 2181 m, (CORBIDI 11522); Villarica, Repartición (10.61700° S, 75.28628° W), 2411 m, (CORBIDI 11581); *Pristimantis lucasi*, PERU: DEPARTAMENTO PASCO: Provincia Oxapampa: Palcazu, Abra Esperanza (10.53188° S, 75.34950° W), 2808 m, (CORBIDI 10298, 11612, 11622, 11629); Bosque de Shollet (10.61370° S, 75.28290° W), 2181 m, (CORBIDI 11519); Villarica, Repartición (10.61700° S, 75.28628° W), 2411 m, (CORBIDI 11582-86, 11592-94, 11596); *Pristimantis roni*, ECUADOR: PROVINCIA MORONA SANTIAGO: cantón Morona, Sangay National Park, Sardinayacu (2.0715° S, 78.2159° W), 1764 m, (QCAZ 59161); (2.0693° S, 78.2198° W), 1864 m, (QCAZ 59162); 1856 m, (QCAZ 59164); (2.0546° S, 78.2189° W), 1950 m, (QCAZ 58918-58926); (2.0472° S, 78.2252° W), 1874 m, (QCAZ 58928); 1798 m, (QCAZ 58929); (2.0825° S, 78.2054° W), 17919 m, (QCAZ 58935, 58879); *Pristimantis yanezi*, ECUADOR: PROVINCIA NAPO: Cantón Tena, on the road from Salcedo to Tena (1.0090° S, 78.1883° W), 2095 m, QCAZ 46257, 46258, 46259 (holotype); *Pristimantis wiensi*, PERU: DEPARTAMENTO PIURA: Ayabaca, Bosque de Cuyas (4.666944° S, 79.573611° W), 2673 m, (CORBIDI 447).

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