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Research Article

Description of two new species of *Pristimantis* (Anura: Strabomantidae) from northern Peru, previously confused with *P. phoxocephalus* Lynch 1979

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Abstract: Based on morphological and previously published molecular evidence, herein we describe two new species of *Pristimantis* from the Andes of northern Peru; *Pristimantis* sp. nov. 1 from Cañaris in the northern region of the Cordillera Occidental of the Andes, at an elevation of 3200 m.a.s.l., Lambayeque Department, northwestern Peru, and *Pristimantis* sp. nov. 2 from the Huarmicocha to Cochabamba trail in the northern region of the Cordillera Central, at an elevation of 3376 m.a.s.l., Amazonas Department, northeastern Peru. Both new species are morphologically similar to and were previously confused with *Pristimantis phoxocephalus*, because they shared (i) the presence of a pointed rostral papilla, (ii) acutely or acuminate shaped snout in dorsal view, and (iii) in life, distinctive coloration on groin and concealed surfaces of thighs. However, the new species are not closely related to species from the *P. phoxocephalus* group and can be readily diagnosed from morphologically similar *Pristimantis* from Peru and Ecuador by the combination of the following characters: snout shape, tuberculate or coarsely tuberculate dorsum, and the color of concealed surfaces of thighs and groin.

KEYWORDS: Amazonas; Lambayeque; Cordillera Central Paramo; Peruvian Yunga; taxonomy; Tropical Andes.

Resumen: Con base en evidencia morfológica y molecular previamente publicada, describimos dos nuevas especies de *Pristimantis* de los Andes del norte de Perú; *Pristimantis* sp. nov. 1 de Cañaris en la porción norte de la Cordillera Occidental de los Andes, a una altitud de 3200 m s.n.m., en el departamento de Lambayeque, noroeste de Perú, y *Pristimantis* sp. nov. 2 del camino de Huarmicocha a Cochabamba en la porción norte de la Cordillera Central, a una altitud de 3376 m s.n.m., en el departamento de Amazonas, noreste de Perú. Ambas nuevas especies fueron confundidas anteriormente con *P. phoxocephalus* por ser morfológicamente similares y porque comparten (i) la presencia de una papila rostral puntiaguda, (ii) hocico de forma aguda o acuminada en vista dorsal, y (iii) en vida, coloración distintiva en las ingles y superficies ocultas de los muslos. Sin embargo, las nuevas especies no están estrechamente relacionadas con las especies del grupo *P. phoxocephalus* y pueden diagnosticarse fácilmente de otros *Pristimantis* morfológicamente similares de Perú y Ecuador por la combinación de los siguientes caracteres: forma del hocico, dorso tuberculado o toscamente tuberculado y color de las superficies ocultas de muslos e ingle.

PALABRAS CLAVE: Amazonas; Andes tropicales; Lambayeque; Páramos de la Cordillera Central; Yunga Peruana; taxonomía.

Introduction

With 614 species, the new world direct-developing genus *Pristimantis* Jimenes de la Espada 1870, is the most speciose group among tetrapods (AmphibiaWeb 2023). The genus *Pristimantis* is distributed from southern Central and South America, from sea level in the Caribbean and Lesser Antilles up to 4000 m.a.s.l. in the Andes (Duellman & Lehr 2009; Frost 2023), and reaches highest diversity in the Tropical Andes of Colombia, Ecuador, and Peru (Duellman & Lehr 2009; Reyes-Puig & Mancero 2022). With 151 named species, Peru currently ranks third as the country with the highest species richness of the genus *Pristimantis*, behind Ecuador and Colombia with 262 and 220 species, respectively (AmphibiaWeb 2023).

The taxonomy of *Pristimantis* is complex, due to the genus being large and phenotypically diverse with most species only described by external morphology. In fact, recent studies indicate that species richness of *Pristimantis* is underestimated and that several cryptic species or species complexes hide within taxa with wide geographic distribution (e.g., Elmer & Cannatella 2008; Hutter & Guayasamin 2015; Ortega-Andrade et al. 2015; Padial & de La Riva 2009; Páez & Ron 2019).

A remarkable example is *Pristimantis phoxocephalus* Lynch, 1979, a species described from the Pacific slope of central and southern Ecuador (Lynch 1979). Its known geographic range was later extended to the Andes of northern Peru (Duellman & Lehr 2009; Duellman & Pramuk 1999; Duellman & Wild 1993). Despite some authors recognizing the morphological variation between Ecuadorian and Peruvian populations, *P. phoxocephalus* was considered a single highly polymorphic species with a wide distributional range (Páez & Ron 2019) in the Andean slopes, from central Ecuador to northern Peru and from 1800 to 3100 m.a.s.l. (Duellman & Lehr 2009; Ron et al. 2022). Duellman & Lehr (2009) highlighted the variation in coloration between the Peruvian and Ecuadorian populations, and suggested that additional specimens and molecular data were needed to determine if the Peruvian and Ecuadorian populations were conspecific.

After a deep systematic review using molecular and morphological data, Páez & Ron (2019) showed that most populations previously assigned to *P. phoxocephalus* represent other species, described six new species (i.e., *Pristimantis atillo*, *P. jimenezi*, *P. teslai*, *P. torresi*, *P. totoroi*, and *P. verrucolatus*), and restricted *P. phoxocephalus* to its type locality, Pilaló, at elevations of 2340–2820 m in the Pacific slope of Ecuador. In addition, Páez & Ron (2019) included in their analysis sequences of “*P. phoxocephalus*” from two localities of Peru, which turned out not to be related to *P. phoxocephalus*, and likely are two undescribed species (see Suppl. Material 3 in Páez & Ron 2019).

In order to increase our understanding of the diversity of *Pristimantis* from Peru, here we describe the two aforementioned new species identified in the phylogenetic analysis of Páez & Ron (2019). One of which, the new species from Cañaris was previously considered as cryptic with *P. phoxocephalus* by Duellman & Lehr (2009) (see Fig. 188 in op. cit.).

Materials and methods

Ethics and field research

Specimens collected for this study are covered by the following research permits (issued by the Ministerio de Agricultura from Peru) that include scientific collection of live specimens: 110-2007-INRENA-IF-FS-DCB and 0581-2011-AG-DGFSS-DGEFFS. Specimens were collected during two field surveys in the Andes of northern Peru. The first survey was conducted during May, 2007 in Cañaris, Lambayeque Department, as part of a series of expeditions documenting the herpetofauna of a relict forest in the northern region of the Cordillera Occidental. The second herpetological survey was conducted during July, 2014 as part of a biological inventory carried out by the local NGO Ucumari in the headwaters of Utcubamba River, Amazonas Department.

The frogs were collected manually via the complete species inventory technique (Scott 1994) during slow, diurnal (0900 to 1200 hours) walks along trails and in 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 hours, 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.

Morphology

The format for the descriptions follows Lynch & Duellman (1997). The terminology and definition of diagnostic characters follows Duellman & Lehr (2009). 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, taken from the tip of snout to posterior end of the body), TL (tibia length, distance from the knee to the distal end of the tibia), 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 addressed against Toe IV; lengths of Fingers I and II were compared when addressed against each other.

For species comparisons, we considered only morphologically similar congeners with Andean or Amazonian distribution recorded in Peru and Ecuador, as well as phylogenetically close species. The genus *Pristimantis* has more than 614 species, and it would impractical and confusing to compare the new species to all congeneric species. Examined specimens for comparison are listed in the Appendix 1 and belong to CORBIDI, Museo de Historia Natural San Marcos (MUSM), and Museo de Zoología, Pontificia Universidad Católica del Ecuador (QCAZ), Quito, Ecuador. Descriptions of species of *Pristimantis* used in the comparisons but for which we were unable to examine specimens were taken from Duellman & Lehr (2009); Lynch (1979); Páez & Ron (2019); Lehr et al. (2021); and Sánchez-Nivicela et al. (2022).

Species delimitation

The taxonomic conclusions of this study are based on the observation of morphological features and color patterns, as well as on previously inferred phylogenetic relationships based on molecular data (Páez & Ron 2019). We consider this information to fulfill the species delimitation criteria following a general lineage or unified species concept (de Queiroz 1998, 2007).

Nomenclatural act

The electronic version of this article in a 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 its nomenclatural acts 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:8E946DC4-2A71-46CE-930C-A7388273E790.

Results

Pristimantis rameshpateli sp. nov.

<https://zoobank.org/4B87B347-7FB7-4EF3-B16D-4F2241F6815C>

Figs. 1-2.

Pristimantis phoxocephalus - Duellman and Lehr 2009: 217 (Fig. 188).

Pristimantis sp. - CORBIDI 2848 PE Ferrenafe in Páez and Ron (2019): Suppl material 3.

Holotype

CORBIDI 2839 an adult female, from Cañaris, Ferreñafe Province, Lambayeque Department, Perú (-6.084992, -79.310935; 3200 m) obtained on 20 May, 2007 by P.J. Venegas.

Paratypes

CORBIDI 2840-41 adult females, CORBIDI 2842-46 adult males, CORBIDI 2847-48 juvenile females, collected with the holotype by P.J. Venegas.

Diagnosis

A new species of *Pristimantis* not assigned to any species group having the following combination of characters: (1) skin on dorsum tuberculate or coarsely tuberculate, prominent on flanks and with a heterogeneous appearance, skin on venter areolate; discoidal fold absent or weakly defined posteriorly and thoracic folds present, weak; dorsolateral folds absent or present as an incomplete row of tubercles; lateral fold present, short, segmented or not; (2) tympanic membrane and tympanic annulus present, prominent; (3) snout short, acutely rounded in dorsal view, bearing a pointed papillae at the tip of snout, and acuminate in profile; upper edge of rostrum depressed in profile; (4) upper eyelid covered by round tubercles; EW slightly shorter than IOD; cranial crests absent; (5) dentigerous processes of vomers present in females, oblique and evident, and absent or weakly defined in males; (6) males with vocal slits but lacking delimited subgular vocal sac; nuptial pads present; (7) Finger I shorter than Finger II; discs of digits well expanded, elliptical; (8) fingers bearing lateral fringes; (9) ulnar and tarsal tubercles present, low and rounded; (10) heel bearing round tubercles, one larger than the rest; inner tarsal fold present, distinct, short or long; (11) inner metatarsal tubercle ovoid, prominent, one or two times as large as outer; outer metatarsal tubercle round, prominent; numerous low, supernumerary plantar tubercles; (12) toes bearing broad lateral

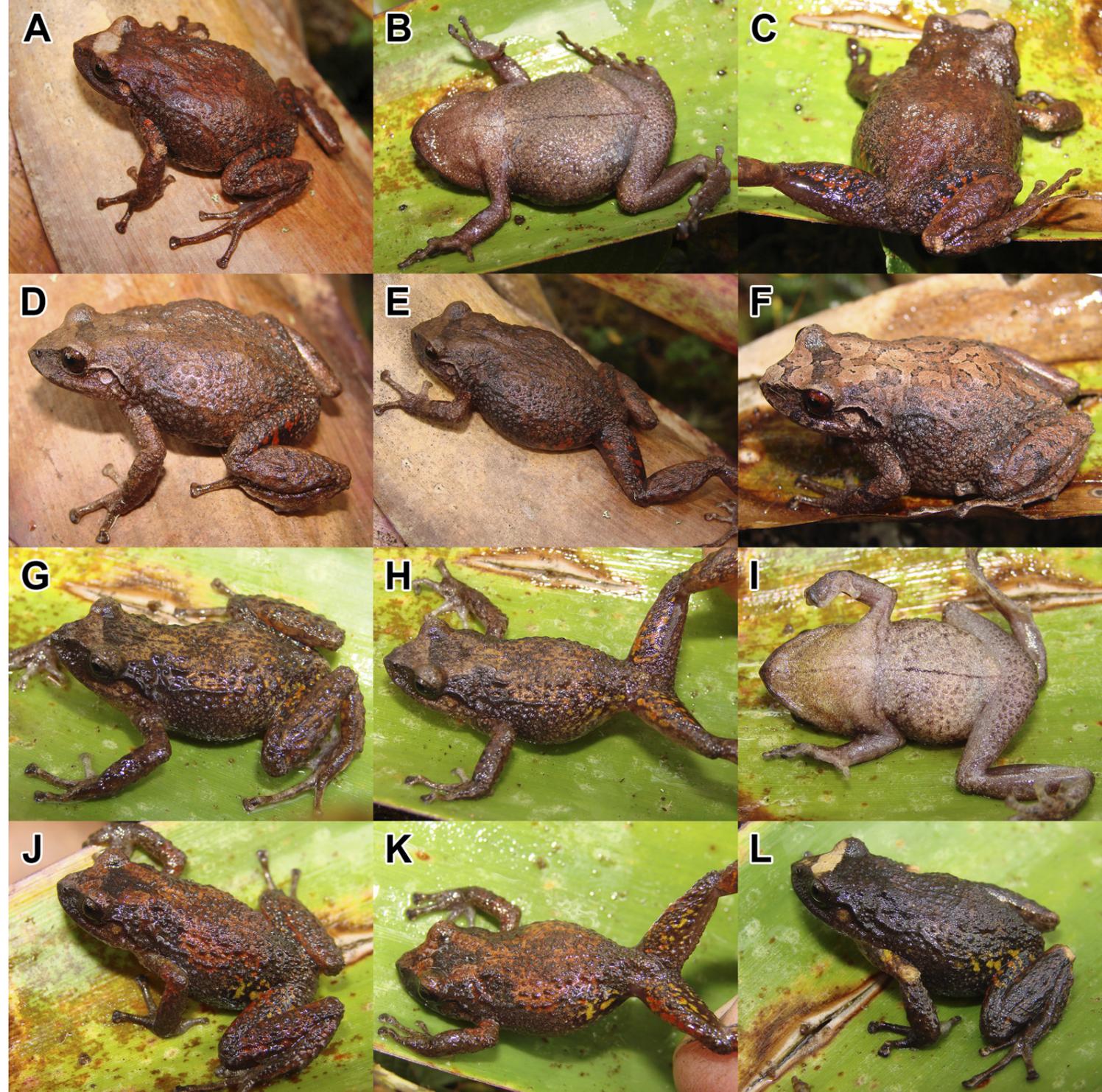


Figure 1.
Pristimantis rameshpateli sp. nov. in life: (A-C) Dorsolateral, ventral and posterior views of adult female holotype CORBIDI 2839, 36 mm SVL; (D & E) Dorsolateral views of adult female CORBIDI 2841, 36 mm SVL; (F) Dorsolateral view of adult female CORBIDI 2840, 33 mm SVL; (G-I) Dorsolateral, dorsal, and ventral views of adult male CORBIDI 2842, 26 mm SVL; (J & K) Dorsolateral and dorsal views of adult male CORBIDI 2845, 23 mm SVL; and (L) Dorsolateral view of adult male CORBIDI 2843, 24 mm SVL. Photos by Pablo J. Venegas.

fringes; basal toe webbing absent; Toe V longer than Toe III; toe discs slightly smaller than those on fingers; (13) in life, dorsum light brown, dark brown, or reddish brown, rarely with irregular dark brown marks; interorbital bar present, cream or brown; dark labial bars and bars on limbs barely defined or absent, flanks without diagonal stripes; groin and concealed surfaces of thighs dark brown with bright yellow or orange speckles; ventral surface brownish cream or dirty cream with or without scattered brown flecks, throat in males with a yellowish hue; iris copper or smoky brown, rarely red, with dark brown reticulations and a median brown longitudinal streak; (14) SVL 20.8-26.6 mm (n = 5) in adult males and 33.1-36.5 mm (n = 3) in adult females.

Comparison with other species

Pristimantis rameshpateli **sp. nov.** shares some characters with several species of the *P. phoxocephalus* group from the Andes of Ecuador, such as: *P. atillo*, *P. atratus*, *P. jimenezi*, *P. multicolor*, *P. percultus*, *P. phoxocephalus*, *P. teslai*, *P. toloroi*, and *P. verrucolatus*. These shared characters include having a snout with a fleshy keel of papilla, tympanic annulus and tympanic membrane prominent, and in life, groin and concealed surfaces of thighs decorated with bright speckles.

From the aforementioned species, *P. phoxocephalus* is the most similar species to *P. rameshpateli*. However, *P. rameshpateli* differs from *P. phoxocephalus* (state of character between parentheses) by having the skin of the dorsum tuberculate or coarsely tuberculate (shagreen with scattered small tubercles), basal webbing between toes absent (present), and groin and concealed surfaces of hindlimbs brown with orange or yellow speckles (yellow with brown reticulations). The presence of small round tubercles on eyelids and a round enlarged tubercle on heel surrounded or not by smaller round tubercles distinguishes *P. rameshpateli* from *P. atratus*, which possesses conical tubercles on eyelids and a prominent conical tubercle on heel. In the case of *P. multicolor* and *P. percultus*, both species can be easily separated from *P. rameshpateli* by having the snout rounded in profile (acuminate in the new species) and dorsum, more evident posteriorly and on flanks, covered by enlarged flattened warts (tuberculate or coarsely tuberculate in *P. rameshpateli*).

The dorsal skin texture is the most obvious difference between *P. atillo*, *P. jimenezi*, and *P. toloroi* (shagreen with scattered tubercles) and *P. rameshpateli* (tuberculate or coarsely tuberculate). Alternatively, *P. teslai* and *P. verrucolatus* possess a tuberculate skin on the dorsum and a similar color pattern on the groin and concealed surfaces of thighs, as *P. rameshpateli* but

P. teslai can be distinguished by lacking a lateral fold (present in the new species), and *P. verrucolatus* by having enlarged flattened warts on flanks.

Another structurally similar species of *Pristimantis* from the Andes of Ecuador is *P. morlaco*. Both new species possess tuberculate skin dorsum and similar snout shape with a pointed papilla on the tip of snout. However, *P. rameshpateli* is readily distinguished by having the groin and concealed surfaces of thighs dark brown with bright yellow or orange speckles, whereas in *P. morlaco* the hidden surfaces are pink.

The Peruvian species most similar to *P. rameshpateli* are *P. ceuthospilus* Duellman and Wild, 1993, *P. rhodoplichus* Duellman and Wild, 1993, and *P. sternothylax* Duellman and Wild, 1993, because all three share an acute or subacute snout shape in dorsal view, tympanic annulus and membrane prominent, and distinctive bright coloration (red, yellow or orange) on the groin and posterior surface of thighs. *Pristimantis rameshpateli* is easily distinguished from the former three species (state of characters between parentheses) by having a pointed papilla on the tip of snout (absent), a distinct depression between nostrils and tip of snout (absent), and the skin on dorsum tuberculate or coarsely tuberculate (shagreen or coarsely shagreen). Furthermore, *P. sternothylax* possesses a dorsum with contrasting dark brown marks such as labial bars, canthal stripe, interorbital bar, X, H or W shaped mark on scapular region, and chevrons, absent or barely defined in *P. rameshpateli*.

Pristimantis rameshpateli differs from *P. anemerus* and *P. cordovae* from the Andes of northern Peru (Duellman & Lehr 2009) by dorsum tuberculate or coarsely tuberculate and the groin and concealed surfaces of thighs are dark brown with bright yellow or orange speckles, in *P. anemerus* the dorsum is finely tuberculate, the groin, and concealed surfaces of thighs dull yellow or green without marks. From *P. cordovae*, *P. rameshpateli* differs by the well-expanded and elliptical discs on outer fingers and toes, barely expanded and emarginated in *P. cordovae*.

Pristimantis rameshpateli differs from another species with a similar snout shape and orange speckles or flecks on the groin and concealed surfaces of thighs, *P. aquilonaris* (state of characters between parentheses) by having dorsum tuberculate or coarsely tuberculate (shagreen with numerous small spiculae), the venter brownish cream or dirty cream with or without scattered brown flecks (mottled dark brown and tan), and larger size with a SVL of 20.8–26.6 mm in adult males and 33.1–36.5 mm in adult females (SVL 13.7–17.6 mm in males and 19.4–23 mm in females).

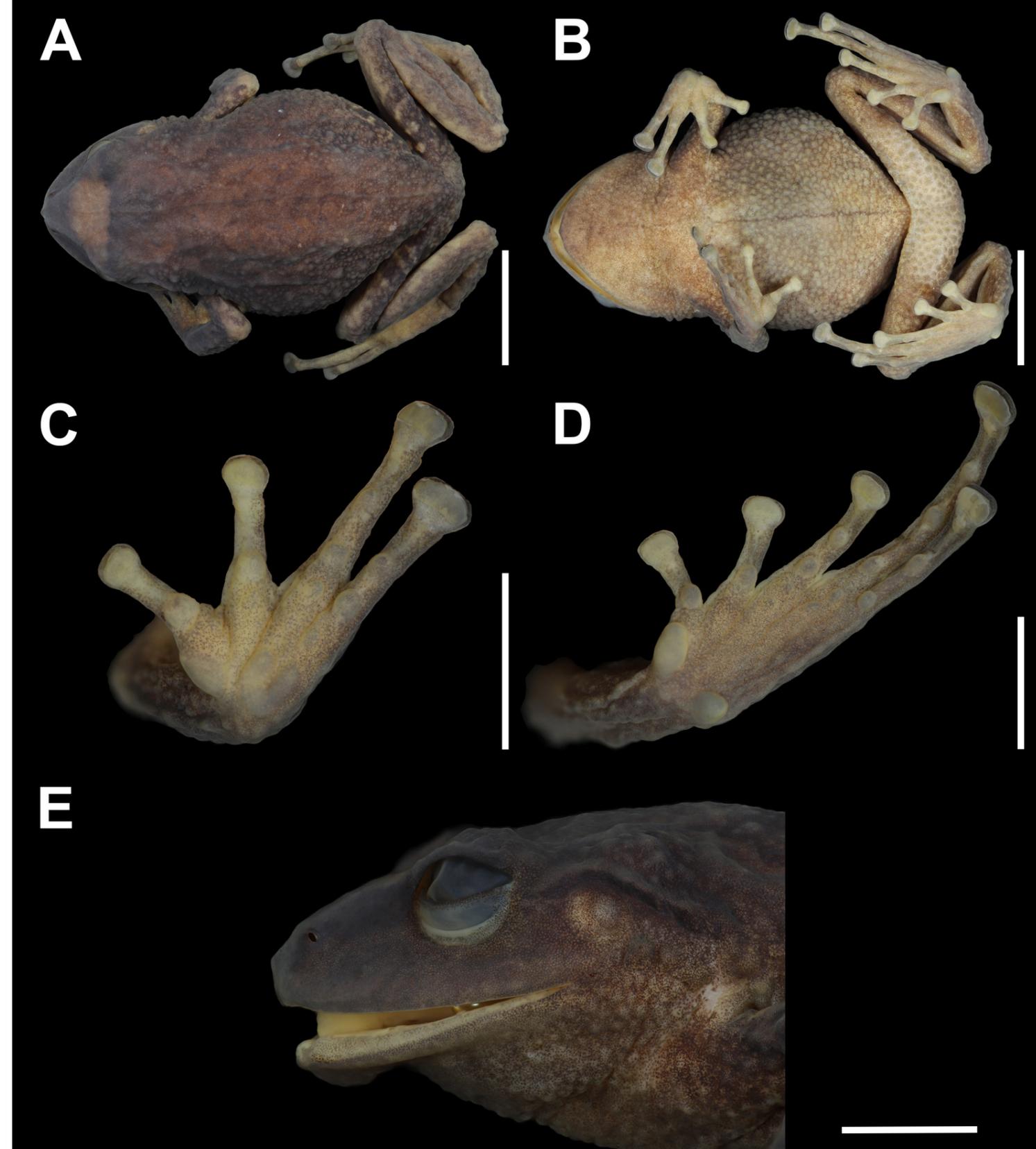


Figure 2.
Preserved *Pristimantis rameshpateli* **sp. nov.** (holotype) in ethanol 70%. (A) Dorsal view, (B) ventral view, (C) palm, (D) sole, and (E) head in lateral view. Scale 10 mm. Photographs by Luis A. García-Ayachi.

Pristimantis rameshpateli is easily distinguished from other species from the Peruvian Andes that also live in bromeliads, *P. achupalla*, *P. mendax*, *P. pardalinus*, *P. pluvialis*, *P. pulchridormientes*, *P. rhodostichus*, and *P. schultei*, by having the dorsum tuberculate or coarsely tuberculate and the groin and concealed surfaces of thighs dark brown with bright yellow or orange speckles. Except for *P. achupalla* that has a rugose dorsum, the aforementioned species have the dorsum shagreen with scattered tubercles or spicules (as in *P. mendax*) or smooth (as in *P. pluvialis*), and except for *P. pulchridormientes*, by lacking contrasted bright marks on the groin and concealed surfaces of hind limbs (groin and concealed surfaces of thighs flash red in *P. pulchridormientes*).

Description of the holotype

An adult female (CORBIDI 2839) with head narrower than body, slightly longer than wide; head width 39% of SVL; head length 36% of SVL; cranial crests absent; snout short, acutely rounded in dorsal view with a conical papillae on the tip of snout, acuminate in lateral view with the rostrum depressed between nostril and papilla (Fig. 2E); eye-nostril distance 93% of eye diameter; nostrils not protuberant, directed dorsolaterally; internarial space flat; canthus rostralis concave in dorsal view, barely curved in profile; loreal region concave; lips rounded, not flared; upper eyelid with several small rounded tubercles; upper eyelid width 78% of interorbital distance; tympanic membrane and tympanic annulus present, prominent; upper and dorsolateral margins of tympanic annulus concealed by the supratympanic fold, tympanum 49% of eye diameter; three right and two left, rounded postrectal tubercles, present. Choanae large, teardrop-shaped, partially concealed by palatal shelf of maxilla; dentigerous processes of vomers present, evident, oblique, narrowly separated with several cuspids; tongue width is two-thirds of the tongue length, posteriorly notched, posterior half free.

Skin on dorsum tuberculate; skin on flanks strongly tuberculate by tubercles heterogenous in size; dorsolateral fold present, weak, incomplete; lateral fold present, distinct and short, formed by a ridge of merged tubercles; skin on throat and chest weakly areolate, and on belly areolate; discoidal fold absent and thoracic fold present, weakly defined; cloacal sheath short, surrounded by small rounded tubercles.

Outer surface of ulnar with small rounded tubercles; outer palmar tubercle deeply bifid, both halves elongate, its inner slightly smaller than outer, but both halves similar in size to the ovoid inner palmar tubercle; supernumerary tubercle ill-defined, ovoid; subarticular tubercles well defined, most prominent

on base of fingers, round in ventral view, subconical in lateral view; fingers with lateral fringes, outer fringe of Finger IV undulated and extending along outer hand surface to the level of outer palmar tubercle; Finger I shorter than Finger II; discs on digit of Finger I slightly expanded, and on fingers II-IV expanded and ellipticals (Fig. 2C), all fingers bearing well defined circumferential grooves. Hind limbs long, slender, tibia length 43% of SVL; foot length 46% of SVL; upper surfaces of hind limbs tuberculate with some long tubercles forming low ridges on tibia; anterior surface of thighs smooth, posterior surface of thighs finely tuberculate on proximal half and smooth on distal half, and ventral surfaces of thighs areolate; heels with rounded tubercles, one distinctly larger than the rest; outer surface of tarsus with four rounded tubercles, two of them in the middle elongate on each side; inner tarsal fold long covering approximately half of tarsus; inner metatarsal tubercle present, prominent, ovoid, two times larger than outer metatarsal tubercle; outer metatarsal tubercle, round, prominent; subarticular tubercles well defined, round in ventral view, subconical in lateral view; plantar supernumerary tubercles indistinct, giving an areolate appearance to the soles; toes bearing lateral fringes, outer fringe of Toe V undulated in the edge of foot, extending laterally close to the level of outer tarsal tubercle; basal webbing present, distinct only between toes III and V; discs expanded, ellipticals, bearing well defined circumferential grooves, less expanded than those on fingers; relative length of toes: $1 < 2 < 3 < 5 < 4$; Toe V longer than Toe III, disc on Toe III reaching to the distal subarticular tubercle of Toe IV and disc on Toe V reaching to the middle of distal subarticular tubercle on Toe IV (Fig. 2D).

Measurements (in mm) of the holotype

SVL 36.5; tibia length 15.8; foot length 17.1; head length 13.1; head width 14.4; eye diameter 3.9; tympanic diameter 1.94, IOD 4.9; upper eyelid width 3.9; internarial distance 3.1; eye-nostril distance 3.6.

Coloration in life

Dorsum reddish brown with a conspicuous broad cream interorbital bar; sides of head, flanks, and limbs darker than dorsum; canthal stripe and labial bars absent, supratympanic stripe black, thin, and bars on limbs barely defined; elbows and heels cream; groin, anterior and posterior surfaces of thighs dark brown with dark orange speckles (Figs. 1A & C). Ventral surface brownish cream with a thin dark brown median stripe, calves, palms and soles brown. Irises smoky brown with dark brown reticulations and a dark brown median streak (Fig. 1B).

Coloration in preservative (ethanol 70%)

Coloration as in life but with a dusty hue dorsally and paler in the ventral surface, and the dusty cream speckles on groin, anterior and posterior surfaces of thighs (speckles were red in life) (Fig. 2).

Intraspecific variation

Adult males are smaller (SVL = 20.8–26.6 mm) than females (SVL = 33.1–35.5 mm). See Table 1 for measurements and proportions of the type specimens. Adult males possess vocal slits, nuptial pads on Finger I, and the dorsal surface more coarsely tuberculate than females. Moreover, there is sexual dimorphism in coloration: males can be distinguished from females by having yellow speckles on the groin and concealed surfaces of thighs (dark orange in females), and a yellowish throat and a paler hue on the belly (see Fig. 1).

Dorsal coloration varying from light cinnamon brown (Fig. 1D) to dark brown (Fig. 1L). The interorbital bar can be brown or cream. Only the female paratype (CORBIDI 2840) presents irregular dark marks on dorsum and red irises (Fig. 1F). Only the male paratype (CORBIDI 2842) presents dark brown flecks on belly (Fig. 2I).

Distribution and natural history.

Pristimantis rameshpateli is only known from the type locality at an elevation of 3200 m.a.s.l. in the northern region of the Cordillera Occidental in northwestern Peru, Ferreñafe Province, Lambayeque Department, Peru (Fig. 3). The type locality is located in the headwaters of Chamaya River, a tributary of the Marañón River and belongs to the Cordillera Central Páramo ecoregion, according to Olson et al. (2001). The general landscape is a summit covered by páramo with patches of elfin forest in the slopes. All specimens were collected by day, at heights from 0.50 to 3 m, inside bromeliads in a patch of elfin forest. The only sympatric frog was *Gastrotheca aratia*.

Etymology.

The specific epithet rameshpateli is a noun in genitive case and is a patronym for Ramesh M. Patel (1935-1992), a barrister-at-law called to the Bar at Middle Temple in 1960. Born in Mwanza, Tanganyika (now Tanzania), his deep love of the natural world and the outdoors was born during his childhood in Mwanza and across East Africa, and he instilled it in his larger family and his three daughters who in turn passed it on to his seven grandsons. His family honors his legacy and his generous and philanthropic spirit by supporting the Texas-based nonprofit organization

Rainforest Partnership and its important work in protecting the natural world.

Pristimantis yanahampatu sp. nov.

<https://zoobank.org/C02058BD-2E4A-4EBD-8B9A-BC439CF9F50D>.

Figs. 4-5.

Pristimantis sp. - CORBIDI 14804–05 PE Chachapoyas in Páez and Ron (2019): Suppl material 3.

Holotype

CORBIDI 14805 an adult male, from Warmicocha-Cochabamba trail, Chachapoyas Province, Amazonas Department, Perú (-6.902111, -77.874111; 3376 m) obtained on 25 July, 2014 by L.Y. Echevarría.

Paratypes

CORBIDI 14804, 14806 and 14807, three adult males, collected with the holotype by L.Y. Echevarría.

Diagnosis

A new species of *Pristimantis* not assigned to any species group having the following combination of characters: (1) Skin on back finely tuberculate with some scattered enlarged tubercles specially on the posterior half; flanks and hindlimbs strongly tuberculate; dorsolateral fold present, complete or incomplete, and formed by a row elongate tubercles; lateral row of tubercles present, distinct; skin on belly coarsely areolate; discoidal fold present only as thoracic fold; (2) tympanic membrane and annulus present, distinct; (3) snout short, acuminate in dorsal view and protuberantly rounded in profile with a subtle depression between the nostrils and the tips of the snout; (4) upper eyelid with some small flattened tubercles; EW 70% of IOD; cranial crests absent; (5) dentigerous processes of vomers present, oblique, inconspicuous, broadly separated; (6) males with vocal slits and vocal sac with clearly defined borders, nuptial pad absent; (7) Finger I shorter than Finger II; discs of digits expanded, truncate; (8) fingers bearing narrow lateral fringes; (9) ulnar tubercles present, rounded, low; tarsal tubercles present, rounded and weakly defined; (10) heel bearing round low tubercles; inner tarsal fold present, long and discontinuous; (11) inner metatarsal tubercle elliptical, distinct, two times the size of the outer subconical tubercle; distinct supernumerary plantar tubercles at the base of toes, present; (12) toes bearing narrow lateral fringes; basal toe webbing absent; Toe V longer than Toe III; toe discs slightly smaller than on fingers; (13) in life, dorsum dark brown with a light brown interorbital bar or with or



Figure 3.

Distribution of three species of *Pristimantis*. Red circle = *Pristimantis rameshpатели* **sp. nov.**, sky blue triangle = *P. yanahampatu* **sp. nov.**, green square = *P. phoxocephalus* (*sensu stricto*), blue diamond = *P. phoxocephalus* reported by Duellman and Wild (1993), and yellow diamonds = *P. phoxocephalus* reported by Duellman & Lehr (2009).

without light brown patch on the back; darker brown marks canthal stripe, labial bars or diagonal bars on limbs are absent or inconspicuous; axilla, groin and posterior surface of thighs and concealed surface of shanks black with pale yellow, white or yellowish cream spots or blotches, and anterior surface of thighs brown with cream blotches or flecks; ventral surface is dark brown with minute cream mottling; iris dark coppery-brown with dark brown reticulations; (14) SVL in adult males 20.9–26.7 mm ($n = 4$).

Pristimantis yanahampatu is structurally similar to some species of the *P. phoxocephalus* group by having an acuminate snout in dorsal view and the groin and hidden surfaces of thighs ornamented with contrasting marks. However, *P. yanahampatu* lacks the pointed papilla or fleshy keel on the tip of snout that distinguishes most species of the *P. phoxocephalus* group (e.g., *P. atillo*, *P. chomskyi*, *P. gloria*, *P. jimenezi*, *P. lutzae*, *P. multi-color*, *P. percutus*, *P. phoxocephalus*, *P. teslai*, *P. torresi*, *P. totoroi*, *P. versicolor*, *P. verrucolatus*) according to Páez & Ron (2019).

Among species of the *P. phoxocephalus* group, *P. yanahampatu* is most similar to species with robust body and coarsely tuberculate or warty skin such as *P. chomskyi*, *P. gloria*, *P. lutzae*, *P. multicolor*, and *P. verrucolatus*. However, *P. yanahampatu* differs from *P. chomskyi*, *P. gloria*, *P. lutzae*, *P. multicolor*, and *P. verrucolatus* by having the groin and posterior surface of thighs black with pale yellow, white or yellowish cream spots or blotches (groin and posterior surface of thighs chocolate brown suffused or not with orange, with or without small cream flecks in *P. chomskyi*; brown, creamish brown, pinkish brown, or purplish brown with irregular cream to brown flecks or spots in *P. gloria*; pinkish, purplish or reddish brown, suffused or not with orange, with cream or light brown spots in *P. lutzae*; cream, orange, brown, or black with or without cream to yellow spots in *P. multicolor*; and reddish brown with small light brown, orangey-brown or yellow spots in *P. verrucolatus*). Additionally, the snout in lateral view is protruding in *P. yanahampatu*, but rounded in all other species except *P. verrucolatus*.

The species most similar to *P. yanahampatu* are distributed in the Andes of northern Peru and are *P. astralos*, *P. chimu*, *P. cordovae*, *P. mariaelena*, *P. melanogaster*, and *P. pinguis* (Duellman & Lehr 2009; Duellman & Pramuk 1999; Lehr et al. 2021; Venegas & Duellman 2012). All these species share with *P. yanahampatu* a robust body, tuberculate skin on dorsum or flanks, and groin and/or posterior surface of thighs black or dark brown with light marks. *Pristimantis cordovae* also possesses a gently pointed snout in dorsal view, similar to *P. yanahampatu* (state of characters in parentheses), but differs by having

a small rostral papilla on the tip of snout (absent), and outer fingers and toes barely expanded and emarginated (expanded and truncated). *Pristimantis astralos*, *P. chimu*, *P. mariaelena*, *P. melanogaster*, and *P. pinguis* can be readily distinguished by having the snout rounded in dorsal view and in profile, whereas in *P. yanahampatu* the snout is acuminate in dorsal view and protruding in profile. Discs on outer fingers and toes are round in *P. astralos*, *P. chimu*, *P. melanogaster*, and *P. pinguis*, but truncated in *P. yanahampatu*. Moreover, *P. chimu*, *P. mariaelena*, *P. melanogaster*, and *P. pinguis* lack lateral fringes, which are present in *P. yanahampatu*.

Pristimantis leucorrhinus from the montane forest of Yanachaga in central Peru (Chavez et al. 2012; Duellman & Lehr 2009) shares with *P. yanahampatu* the same coloration pattern on the groin and posterior surface of thighs (black background with white spots), but differs from the new species by having prominent conical tubercles on eyelids, heels and outer edge of tarsus.

Description of the holotype

Adult male with robust body; head slightly narrower than body, wider than long; head width 37% of SVL; head length 31% of SVL; snout short, acuminate in dorsal view and protuberantly rounded in profile with subtle depression between the nostrils and the tip of the snout (Fig. 5E); eye–nostril distance 103% of eye diameter; nostrils rounded, directed dorsolaterally; internarial space concave; canthus rostralis slightly concave in dorsal view, barely curved in profile; loreal region concave; lips rounded, not flared; upper eyelid with few flattened small tubercles; upper eyelid width 82% of interorbital distance; tympanic annulus and tympanic membrane distinct with the dorsal and posterior margins concealed by supratympanic fold; tympanum diameter 36% of eye diameter; two enlarged rounded postrectal tubercles present. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers prominent, oblique, narrowly separated with indistinct number of cusps, situated posteromedial to choanae; tongue unknown (removed for tissue sample).

Measurements of the holotype (in mm)

SVL 25.8; tibia length 13.0; foot length 12.6; head length 8.1; head width 9.7; eye diameter 2.5; tympanum diameter 0.9; interorbital distance 3.1; upper eyelid width 2.6; internarial distance 2.3; eye–nostril distance 2.6.

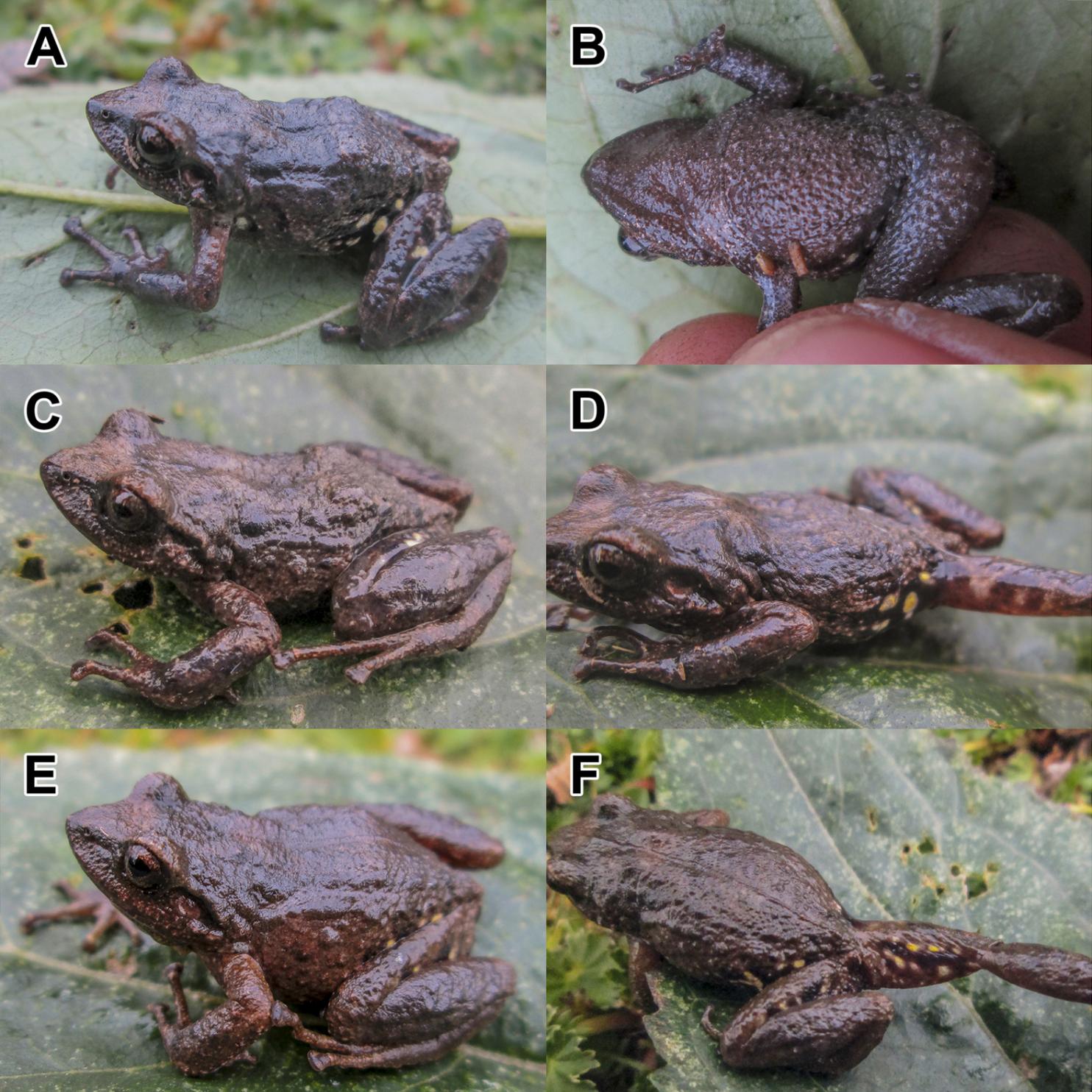


Figure 4.
Pristimantis yanahampatu **sp. nov.** in life: (A-B) Dorsolateral and ventral views of adult male holotype CORBIDI 14805, 25 mm SVL; (C & D) Dorsolateral and lateral views of adult male CORBIDI 14804, 26 mm SVL; and (E & F) Dorsolateral and posterior views of adult male CORBIDI 14807, 20 mm SVL. Photos by Lourdes Y. Echevarria.

Coloration in life

Dorsal surface including flanks and limbs dark brown with light brown interorbital bar with thin black borders, dark canthal stripe, labial bars and diagonal bars on limbs inconspicuous; supratympanic fold black and tympanic membrane light brown; axilla, groin and posterior surface of thighs black with white and yellow spots; anterior surface of thighs brown with faint cream blotches (Fig. 4A). Ventral surface dark brown with minute cream mottling (Fig. 4B). The iris is dark coppery brown with dark brown reticulations.

Color in preservative (ethanol 70%)

Dorsal background coloration of body is dark brown as in life but without the light brown marks, the supratympanic fold and tympanic membrane are darker than the background coloration. Axilla, groin and hidden surfaces of hindlimbs are black with creamy tan blotches. Ventrally, throat is dark brown; chest, belly, limbs, palms and soles are creamy full of minute dark flecks giving a dark tan hue specially on the belly, tibias, palms and soles (Fig. 5).

Intraspecific variation

Female specimens are unknown. The four adult males have a SVL between 20.9 and 26.7 mm (Table 1). The three paratypes are identical to the holotype in coloration (see Fig. 4). In the case of specimens CORBIDI 14804 and 14806 the spots on the axilla, groin and posterior surfaces of thighs are creamy white with a yellowish hue (Figs. 4D & F).

Distribution and natural history

Pristimantis yanahampatu is known only from the type locality at an elevation of 3376 m.a.s.l. in the northern region of the Cordillera Central in the northeastern Peru, Chachapoyas Province, Amazonas Department (Fig. 3). The type locality is located above the tree line in the headwaters of Utcubamba River and belong to the Peruvian Yungas ecoregion according to Olson et al. (2001). The general landscape is a montane grassy area with patches of shrubs in the ecotone between elfin forest and wet páramo. The four specimens were collected under the rocks of a grassy bog in the transition between montane forest and wet páramo. No other sympatric amphibians were found.

Ulnar tubercles present, round, inconspicuous; palmar tubercles deeply bifid, fleshy, approximately twice the length of the elliptical, thenar tubercle; supernumerary palmar tubercles prominent at the base of fingers; subarticular tubercles distinct, round

in ventral and lateral views; fingers present narrow lateral fringes; Finger I shorter than Finger II; discs on Finger I barely expanded, elliptical, and on Fingers II to IV expanded, truncate, bearing well defined circumferential grooves (Fig. 5C).

Hind limbs slender, tibia length 50% of SVL; foot length 48% of SVL; upper surfaces of hind limbs strongly tuberculate with small and enlarged tubercles, some round and other subconical; posterior and ventral surfaces of thighs coarsely areolate; heel with one low subconical tubercle surrounded by tiny round tubercles; outer surface of tarsus with two inconspicuous low round tubercles; inner tarsal fold present, short; inner metatarsal tubercle distinct, elliptical, three times larger than the subconical outer metatarsal tubercle; plantar surface tubercular with some evident supernumerary tubercles; subarticular tubercles well defined, round in ventral view and subconical in lateral view; toes bearing narrow lateral fringes; basal webbing absent; discs on toes expanded, truncate, bearing circumferential grooves, slightly smaller than fingers (Fig. 5D); relative lengths of toes: $1 < 2 < 3 < 5 < 4$; Toe V longer than Toe III, disc on Toe III reaching to the proximal edge of the distal subarticular tubercle on Toe IV and disc on Toe V reaching to the proximal edge of the distal subarticular tubercle on Toe IV.

Etymology

The specific name *yanahampatu* is composed by the Quechua words *yana* meaning “black”, and *hampatu* meaning “frog”. The specific name refers to the dark brown dorsal coloration that gives this species a black appearance.

Discussion

Herein, based on the observation of morphological features and phylogenetic evidence published by Páez & Ron (2019), we describe two new species of *Pristimantis* previously misidentified as *P. phoxocephalus* (see Duellman & Lehr 2009).

Páez & Ron (2019) included in their phylogenetic analysis of species of the *P. phoxocephalus* group sequences of a paratype of *P. rameshpateli* (CORBIDI 2848) and sequences of two paratypes of *P. yanahampatu* (CORBIDI 14804–05). According to their results, the two new species are not part of the *P. phoxocephalus* species group, and do not belong to the *Huicundomantis* clade. In their phylogram, a maximum likelihood tree for genes 16S, ND1, RAG1 (see Appendix C in Suppl. material 3), the two new species are sister species with long branches and form a clade with *P. bicantus*. There seems to be convergent evolution between the new species and some species of the *P.*



Figure 5.
Preserved *Pristimantis yanahampatu* sp. nov. (holotype) in ethanol 70%. (A) Dorsal view, (B) ventral view, (C) palm, (D) sole, and (E) head in lateral view. Scale 10 mm. Photographs by Luis A. García-Ayachi.

phoxocephalus group in the structure and the pattern of coloration in the groin and concealed surface of thighs. For example, *P. rameshpatei* superficially resembles species that live in bromeliads (e.g., *P. atillo*, *P. jimenezi*, *P. phoxocephalus*), while *P. yanahampatu* resembles species from páramos that also live beneath rocks and are characterized by a robust body and tuberculate skin on the dorsum (e.g., *P. chomskyi*, *P. gloria*, *P. multicolor*, and *P. lutzae*).

There likely are additional new species in Peru that are cryptic and have been confused with *P. phoxocephalus*. The first record of *P. phoxocephalus* in Peru was reported by Duellman & Wild (1993) and was based on two specimens collected in the western slope of Cordillera de Huancabamba (Pacific slope of the Andes), at elevations from 1850 to 2770 m.a.s.l. in the Piura Department (see Fig. 3). Although we were unable to examine these specimens, we consider it very unlikely that these specimens are conspecific with *P. rameshpatei* inhabiting the eastern, Amazonian slope of the Andes at higher elevations. Moreover, the type locality of *P. rameshpatei*, Cañaris, is located south of the Huancabamba depression, which has long been recognized as a major biogeographic barrier for some Andean organisms (Cadle 1991; Duellman 1979; Torres-Carvajal et al. 2020; Vuilleumier 1969).

According to Duellman & Lehr (2009), another locality recorded in Peru for *P. phoxocephalus* is San Andres de Cutervo at elevations from 2530 to 2800 m (see Appendix II in Duellman & Lehr 2009), Cajamarca Department, in the Amazonian slope of the northern region of Cordillera Occidental, approximately 67 km SE in a straight line from Cañaris (Fig. 3). Although elevations are moderately similar between Cañaris and San Andres de Cutervo, both localities are separated by the deep dry valley of the Chotano River, a tributary of the Marañón River located at elevations from 860 to 1600 m. The Chotano Valley has the vegetation type of the inter-Andean Seasonally Dry tropical Forest of Marañón River (ISDTFM) (Koch et al. 2018) and is inhabited by a herpetofaunal assemblage typical of dry forests (e.g., *Microlophus arenarius*, *Micrurus peruvianus*, *Polychrus peruvianus*, *Hyloxalus elachyhistus*, *Stenocercus arndti*, *S. huancabambae*) (PJV pers. obs.). The Chotano Valley is a well-known center of endemism in the Peruvian Andes for birds, reptiles, and plants (Angulo et al. 2008; Guzman et al. 2021; Koch et al. 2018; Stattersfield et al. 1998; Venegas et al. 2008), and the assemblages of amphibians, reptiles, and plants are conspicuously different to the flora and fauna of the wet montane forest at higher elevations in northwestern Peru (Venegas pers. obs.; Guzman et al. 2021; Linares-Palomino et al. 2011).

In conclusion, we agree with Páez & Ron (2019),

that *P. phoxocephalus* is endemic to Ecuador and needs to be removed from the Peruvian herpetofauna (Duellman & Lehr 2009; Duellman & Wild 1993; Rodriguez et al. 1993). However, the records of *P. phoxocephalus* reported from the Cordillera de Huancabamba by Duellman & Wild (1993) and from San Andres de Cutervo by Duellman & Lehr (2009) need to be treated with caution because they could represent new species that belong to the *P. phoxocephalus* species group. More specimens and a phylogenetic analysis of molecular data from these populations are needed to pursue this hypothesis.

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- 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 melanogaster*, PERU: DEPARTAMENTO AMAZONAS: Provincia Amazonas: Abra Barro Negro (6.71616°S, 77.86494°W), 3290 m, CORBIDI 11078-83. *Pristimantis phoxocephalus*, ECUADOR: PROVINCIA COTOPAXI: Pilaló, QCAZ 58461, 58463, 58468, 58470, 58472. *Pristimantis pinguis*, PERU: DEPARTAMENTO CAJAMARCA: Provincia de Hualgayoc: Hualgayoc, Cerro Las Gordas MUSM 27021; Celendín, El Punrei (82°35'20.6" W; S 59°43'20.9" W, 3772 m): MUSM 27313-15. *Pristimantis rhodoplichus*, PERU: DEPARTAMENTO PIURA: Provincia de Ayabaca: Bosque de Cuyas (4.666944°S, 79.573611°W), 2673 m, CORBIDI 448-49, 985-86. *Pristimantis sternothylax*, PERU: DEPARTAMENTO PIURA: Provincia de Huancabamba: El Tambo (5.36115°S, 79.55286°W), 2962 m, CORBIDI 22260-62, 22269, 22271-72, 22278-85.

Appendix 1: Examined specimens

Pristimantis anemerus, PERU: DEPARTAMENTO PIURA: Provincia de Morropón: Chalaco, 1800 m, CORBIDI 499, 500. *Pristimantis aquilonaris*, PERU: DEPARTAMENTO CAJAMARCA: C Jaén: Bosque de Huamantanga (5.67553°S, 78.97023°W), 2876 m, CORBIDI 12748-49, 12751-52, 12754-55, 12757-59, 12766, 12769-70, 12772, 12777-79, 12780-83. *Pristimantis ceuthospilus*, PERU: DEPARTAMENTO LAMBAYEQUE: Provincia Ferreñafe: Cerro La Punta (6.26640°S, 79.46038°W), 1958 m, CORBIDI 3547-50; DEPARTAMENTO PIURA: Provincia de Morropón: Chigña Alta (5.58377°S, 79.66780°W), 715 m, CORBIDI 4211. *Pristimantis chimu*: PERU: DEPARTAMENTO CAJAMARCA: Provincia de Chota: Bosque de Protección de Pagaibamba, 3000 m: CORBIDI 02838, CORBIDI 01598. *Pristimantis cordovae*: PERU: DEPARTAMENTO LA LIBERTAD: Provincia de Santiago de Chuco: ca. 8 km NE Quiruvilca, 3542 m: MUSM 21990 (holotype), MUSM 21991, 21998, 21999 (paratopotypes); road to El Sauce (7.90366°S, 78.21659°W), 3485m, CORBIDI 25828-31, 25837-38. *Pristimantis leucorrhinus*, PERU: DEPARTAMENTO PASCO: Provincia Oxapampa: Quebrada Misissipi-Chacos (10.62074°S,

Character	<i>Pristimantis rameshpateli</i>		<i>Pristimantis yanahampatu</i>
	Females (n = 3)	Males (n = 5)	Males (n = 4)
SVL	33.2–36.5 (35.3 ± 1.9)	20.1–26.6 (23.9 ± 2.4)	21.1–26.5 (24.4 ± 2.4)
TL	15.3–15.8 (15.5 ± 0.3)	9.9–12.7 (11.5 ± 1.0)	11.0–13.0 (12.4 ± 0.9)
FL	16.1–17.1 (16.7 ± 0.5)	9.6–12.9 (11.2 ± 1.2)	10.9–13.5 (12.2 ± 1.2)
HL	11.7–13.2 (12.5 ± 0.7)	7.6–9.2 (8.4 ± 0.6)	7.0–8.6 (7.9 ± 0.6)
HW	13.4–14.4 (13.9 ± 0.5)	7.4–10.1 (8.8 ± 1.0)	8.1–10.2 (9.19 ± 0.8)
ED	3.3–3.9 (3.6 ± 0.3)	2.1–2.7 (2.4 ± 0.3)	2–2.6 (2.4 ± 0.3)
TY	1.6–1.9 (1.7 ± 0.2)	0.9–1.2 (1.1 ± 0.1)	0.6–1.0 (0.8 ± 0.2)
IOD	4.4–5.0 (4.6 ± 0.3)	2.6–3.4 (3.1 ± 0.3)	2.4–3.2 (2.8 ± 0.4)
EW	3.4–3.9 (3.6 ± 0.3)	2.0–2.6 (2.3 ± 0.2)	2.0–2.7 (2.3 ± 0.2)
IND	3.0–3.2 (3.1 ± 0.1)	2.1–2.5 (2.3 ± 0.2)	2.0–2.5 (2.2 ± 0.2)
E-N	3.7–4.1 (3.9 ± 0.2)	2.6–3.6 (3.0 ± 0.4)	2.1–2.6 (2.4 ± 0.2)
TL/SVL	0.42–0.47	0.47–0.49	0.52–0.49
FL/SVL	0.44–0.51	0.45–0.48	0.51–0.50
HL/SVL	0.35–0.36	0.34–0.38	0.33–0.32
HW/SVL	0.38–0.4	0.35–0.39	0.38–0.38
HW/HL	1.09–1.15	0.97–1.09	1.2–1.2
E-N/ED	0.94–1.21	1.08–1.55	1.0–1.0
EW/IOD	0.78–0.8	0.68–0.77	0.83–0.84
TY/ED	0.44–0.5	0.36–0.5	0.30–0.38

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

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