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A New Species of *Pristimantis* (Amphibia: Strabomantidae) from the Cloud Forest of Sangay National Park, Ecuador

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ABSTRACT.—We describe *Pristimantis tinguichaca* sp. nov., a member of the *Pristimantis unistrigatus* species group, from the cloud forests of Sangay National Park located on the eastern slopes of the Andes in southeastern Ecuador. The new species was collected in cloud forests and cattle pastures at 2,750–2,830 m elevation. It differs from other members of the *P. unistrigatus* group by the presence of small conical tubercles on the upper eyelids and heels, as well as by its reddish-colored iris. It is further distinguished by its small conical ulnar and tarsal tubercles. A single sharp metallic note composed of a modulated frequency characterizes the call. Stomach content analysis revealed a diet composed principally of beetles (51.7%).

RESUMEN.—Describimos a *Pristimantis tinguichaca* sp. nov. del grupo *Pristimantis unistrigatus*, de los bosques nublados del Parque Nacional Sangay de las estribaciones orientales de los Andes en el sureste de Ecuador, a elevaciones de 2,750–2,830 m. Difiere de otros miembros del grupo *unistrigatus* por la presencia de tubérculos cónicos pequeños en el párpado y talón, tubérculos ulnares y tarsales cónicos pequeños, e iris rojizo. El canto se caracteriza por un sonido metálico, grave; presenta llamados de frecuencia modulada, los mismos que están compuestos de una sola nota. El análisis de los contenidos estomacales reveló una dieta basada principalmente en coleópteros (51.7%).

Ecuador has some of the greatest amphibian diversity in the world, with 560 described species (Ron et al., 2014). Frogs of the genus *Pristimantis* represent 31.7% of the Ecuadorean total with 178 recognized species (Ron et al., 2014). Projected estimates for Ecuadorean frog species richness suggest that it will increase significantly (Ron et al., 2006), especially in the tropical Andes where new species have been recognized recently with some regularity (e.g., *Pristimantis bambu* Arteaga and Guayasamin, 2011; *Pristimantis bellae* Reyes-Puig and Yáñez-Muñoz, 2012; *Pristimantis bicantus* Guayasamin and Funk, 2009; *Pristimantis gagliardoi* Bustamante and Mendelson, 2008; *Pristimantis loujosti* Yáñez-Muñoz et al., 2010; *Pristimantis minimus* Terán-Valdez and Guayasamin, 2010; *Pristimantis tungurahua* Reyes-Puig et al., 2010; *Pristimantis latericius* Batallas and Brito, 2014).

In *Pristimantis*, the *unistrigatus* group is the most diverse, composed of over 193 species, distributed from the lowland Amazon Basin to the high Andes in northeastern South America (Hedges et al., 2008). The majority of the members of this polyphyletic group do not fit clearly into any other species groups. A thorough taxonomic revision of morphological and molecular analysis is needed to clarify the equivocal relationships of this large and widely distributed group (Hoyos et al., 2014).

Recent species discoveries illustrate the lack of thorough inventories, especially in diverse mountain habitats that are logistically difficult to sample. This is likely the case in Sangay National Park, located on the eastern slopes of the Andes in southern Ecuador, in a mountain range known as the Cordillera Oriental. Sangay National Park is a UNESCO World Heritage Site that encompasses two active volcanoes, pristine forest, and high elevation grassland. The park has a dramatic elevation gradient ranging from 800–5,230 m. Increased road building and associated land colonization have opened access for biological research, but increased pressure on the land threatens

biologically diverse forest habitats. A series of inventory efforts focusing on small vertebrates in the park began in 2010 and resulted in the discovery of a new species in the genus *Pristimantis*, as well as a new species of small mammal (Ojala-Barbour et al., 2013). The new *Pristimantis* is described herein. We include natural history descriptions of the call and stomach contents to help further differentiate the new species from sympatric taxa.

MATERIALS AND METHODS

Collection.—Specimens were collected in Tinguichaca in Sangay National Park as part of an inventory effort to sample poorly understood habitats of that park. Collected specimens were euthanized (Chen and Combs, 1999) and preserved (Simmons, 2002). Our collection (Appendix 1) was deposited in the Museo de Historia Natural Gustavo Orcés de la Escuela Politécnica Nacional (MEPN) and División de Herpetología del Museo Ecuatoriano de Ciencias Naturales (DHMECN). GPS coordinates for each specimen were determined using a Garmin 76CSx GPS unit (WGS 84 datum, Garmin, Wichita, KS).

Morphology.—We employed the morphometric variables, terminology, and diagnostic characters established by Lynch and Duellman (1997) and Duellman and Lehr (2009). The following morphological measurements were taken with digital calipers (Buffalo Tools, O'Fallon, MO) to the nearest 0.01 mm and are reported using the following abbreviations: snout–vent length (SVL), head width (HW), head height (HH), head length (HL), tibia length (TL), foot length (F)—measured as the distance from the inferior edge of the inner metatarsal tubercle to the tip of disc of Toe IV—eye diameter (ED), eye–nostril distance (END), eye–tympanum distance (ET), internarial distance (ID), interorbital distance (IOD), tympanum diameter (TY), hand length (H)—measured as the distance from the proximal edge of the interior palmar tubercle to the tip of Finger III—and length of Finger I (LFI).

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Call Analysis.—Calls were recorded using an Olympus WS-750 (Olympus, Center Valley, PA) with a unidirectional Sennheiser K6-C microphone (Sennheiser, Old Lyme, CT). Acoustic analysis was conducted using Adobe Audition 3.0 with a sampling frequency of 44.1 KHz and 16-bit resolution, as suggested by Almendáriz and Batallas (2012), and a sonogram and oscillogram were generated using Raven 1.4 (Charif et al., 2010). Temperature and humidity readings were taken using a Springfield environmental thermometer (Taylor Precision Products, Oak Brook, IL). Vocal recordings correspond to voucher specimen MEPN 14600 and were recorded on 11 April 2012 in a pasture with a temperature of 11°C and 96% relative humidity.

The following acoustic parameters were analyzed (Cocroft and Ryan, 1995; Wells, 2007): dominant frequency (frequency of highest energy determined by the Fourier calculation); fundamental frequency (frequency with the lowest pitch); number of harmonics (number of harmonic frequencies present in the calls); frequency of harmonics (highest frequency that is a multiple of the fundamental frequency); number of notes per call (number of distinct acoustical signals recognizable in a call); call length (time from beginning to end of on call); and interval between calls (time between distinct calls).

Stomach Content Analysis.—The stomach contents of 18 specimens were analyzed using guidelines established by Muñoz-Guerrero et al. (2007) and Martínez-Coronel and Pérez-Gutiérrez (2011). Intact and fragmented prey were identified to order, family, and when possible, genus. In the case of Lepidoptera and Coleoptera, we differentiated between larval and adult forms. Unidentified material in an advanced state of digestion was categorized as “undeterminable arthropods” and all plant remains were grouped into a single category.

RESULTS

Pristimantis tinguichaca sp. nov.

Suggested Standard English name: Tinguichaca Striped Rain Frog
Suggested Spanish name: Cutín rayado de Tinguichaca

Holotype.—MEPN 14418, an adult female from Tinguichaca, Sangay National Park (78°25'29"W, 02°12'49.8"S), Zuñac, Morona, Morona Santiago Province, Ecuador, elevation 2,830 m, collected by J. Brito, R. Ojala-Barbour, and F. Anaguano on 22 October 2011.

Paratypes (N = 25).—Eight paratopotypes: MEPN 14416 and 14445–46, adult males; MEPN 14419–21, subadult males; MEPN 14422–23 subadult females, all collected by J. Brito, R. Ojala-Barbour, and F. Anaguano on 22 October 2011. Eight specimens from an open pasture, 100 m east of the Tinguichaca Ranger Station, Sangay National Park (78°26'42.1"W, 02°13'48.7"S, elevation 2,750 m), Zuñac, Morona, Morona Santiago Province, Ecuador: MEPN 14436–38 and 14440, adult females; MEPN 14439 and 14441–43, adult males, all collected on 29 February 2012 by J. Brito and R. Ojala-Barbour. Nine specimens also collected at the second locality: MEPN 14598–99 and 14601–03, adult females; MEPN 14596–97, 14600, and 14604, adult females, collected on 11 April 2012 by J. Brito, R. Ojala-Barbour, and G. Pozo.

Diagnosis.—A member of the polyphyletic *Pristimantis unistrigatus* group (Hedges et al., 2008) characterized by 1) skin on dorsum smooth; dorsolateral fold absent; skin on venter areolate; discoidal fold present; 2) tympanum and tympanic annulus present; tympanum small, circular, its superior border partially covered by a supratympanic fold, size about one-third eye diameter, tympanic membrane undifferentiated; 3) snout sub-

acuminate in dorsal view, short, rounded in lateral view, one or two small conical tubercles in the parietal region of the head (in life), canthus rostralis straight; 4) upper eyelid with a medium conical tubercle and various dispersed minute tubercles, upper eyelid width narrower than IOD; 5) dentigerous processes of vomers present, oblique in outline; each vomer with 3–5 teeth in a linear arrangement; 6) male vocal slits and small nuptial pads on FI present; 7) FI shorter than FII, digital discs on outer fingers large, broadly rounded; 8) fingers with narrow lateral fringes; 9) ulnar tubercles small, conical; 10) heel with small conical tubercle, outer surfaces of tarsus with minute rounded tubercles, inner tarsal fold absent; 11) inner metatarsal tubercle ovoid, external metatarsal tubercle round, supernumerary plantar tubercles conspicuous; 12) toes with lateral fringes, basal toe membrane extended between TII–TIII, TIII–TIV, and TIV–TV; TV longer than TIII, toe discs broad, rounded, smaller than discs on fingers; 13) dorsum reddish-brown to dark brown (grayish in ethanol) with cream, irregular, longitudinal stripes, venter reddish to yellowish-cream, iris red, lower half darker; 14) SVL in adult males 21.2–24.7 mm (average = 23.4 ± 1.1 mm, N = 11), females 28.1–31.7 mm (average = 29.7 ± 1.5 mm, N = 9).

Comparisons.—*Pristimantis tinguichaca* is the only species from southern Ecuador on the eastern flank of the Andes with small conical tubercles on the eyelids, ulnar tubercles, longitudinal stripes, and a red iris. No other species in Sangay National Park or the surrounding area is similar to *P. tinguichaca* (Brito and Almendáriz, 2013). Comparisons are based on similar species present in the other cloud forests of Ecuador with which this species could be confused. The dorsal pattern of *P. tinguichaca* is similar to that of *Pristimantis atratus* (Lynch, 1979; Lynch and Duellman, 1980) from the eastern slope of the Ecuadorean Andes and *Pristimantis yumbo* (Yáñez-Muñoz et al., 2010) from the western slope of the Andes in northern Ecuador. Both of these species have tubercles on the heels, tarsus, and upper eyelid, features they share with *P. tinguichaca*. Their dorsal coloration is reddish-brown to dark brown with irregular longitudinal cream-colored stripes and a smooth dorsal texture that transitions to weakly granular on the venter. In *P. tinguichaca*, the groin and hidden surfaces of the thigh are reddish in females and dark brown in males, whereas those of *P. yumbo* are yellowish-cream in females and without pigmentation in males; and those of *P. atratus* are black in both sexes. In *P. tinguichaca*, the iris is red, bisected by a darker reddish stripe, whereas the iris of *P. yumbo* is gold, bisected by a reddish copper stripe and that of *P. atratus* is homogeneously yellow cream. The conical tubercles on the heels and upper eyelids of *P. tinguichaca* are less elevated than in *P. atratus* and *P. yumbo*. The new species also is similar to *Pristimantis w-nigrum* (Boettger, 1892) from the Andes of Colombia and Ecuador (Frost, 2015), by the presences of stripes on the flanks and extremities and absence of dorsolateral and tarsal folds. However, *P. tinguichaca* is distinguished by the presence of tubercles on the upper eyelid and FI is longer than FII. Some color pattern variants of the new species are similar to those of *Pristimantis delius* (Duellman and Mendelson, 1995) with respect to the presence of brown longitudinal dorsal stripes. However, *P. tinguichaca* is distinguished by the presence of minute supernumerary tubercles (absent in *P. delius*). *Pristimantis gagliardoi* (Bustamante and Mendelson, 2008) is similar to the new species in the presence of transversal bands in the extremities and flanks, but *P. gagliardoi* has large conical tarsal and upper eyelid tubercles, whereas those of *P. tinguichaca* are small or medium.

Description of Holotype.—Head smaller than body (HL 35.9% of SVL), head as wide as long; snout short, subacuminate in dorsal

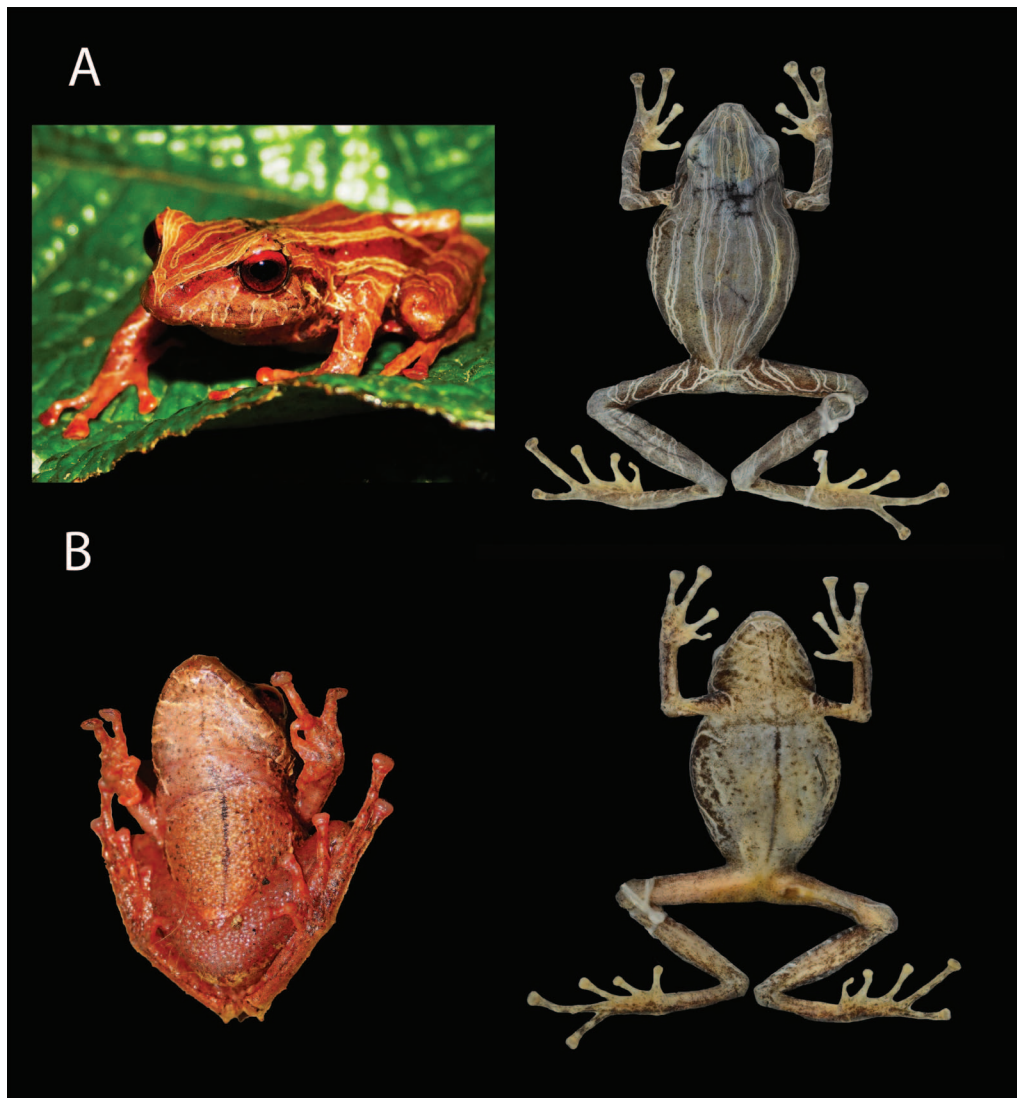


FIG. 1. Dorsal and ventral view of the adult female holotype of *Pristimantis tinguichaca* sp. nov. (MEPN 14418). (A) Dorsal view in life and in preservative. (B) Ventral view in life and in preservative. Photographs in life by J. Brito, in preservative by V. Carvajal.

view (Fig. 1A), rounded in lateral view; END slightly larger than ED (110.7%); nostrils protrude laterally; canthus rostralis slightly angular; loreal region slightly concave; a medium-sized conical tubercle surrounded by small round tubercles on the upper eyelid; small tubercles on the middle part of the head; cranial crests absent; supratympanic fold present, upper margin of tympanum visible; postrictal tubercles absent; tympanic membrane not differentiated, directed laterally; tympanic ring visible; tympanum round and covered partially by the supratympanic fold; diameter 46.4% ED; choanae medium, ovoid, not concealed by palatal shelf or maxillary arch; dentigerous processes of vomers present, oblique in outline with each vomer bearing 3–5 linearly arranged teeth, anteromedial to choanae; tongue slightly longer than wide, bilobed at posterior margin, posterior half free.

Skin of the dorsum smooth; dorsolateral folds absent; ventral surfaces areolate; discoidal folds present; cloacal sheath short, surrounded by small flat tubercles; forearm and elbow with small disperse conical tubercles; palmar tubercle bifid, elongated; tubercles supernumerary small; thenar tubercle wide and elongated, similar in width to palmar; subarticular tubercles round in dorsal and lateral view; fingers with thin flanges without interdigital membranes; FI shorter than FII; disc on FI slightly

expanded; disc on FII expanded; discs on FIII and FIV expanded to at least twice the width of the adjacent digits and somewhat truncated distally; ventral pads on fingers well defined, with circumferential groove (Fig. 2D); TL 56% of SVL; one or two small conical tubercles on the heels, external edge tubercle oval while interior tubercle small and conical; row of small conical tubercles along the edge of tarsus; internal metatarsal tubercle slightly elevated and elongated, twice the size of round external metatarsal tubercle; supernumerary plantar tubercles elevated; subarticular tubercles well defined, round in dorsal and lateral views; viewed ventrally, toes with lateral fringes; basal membrane present between TII–TIII, TIII–TIV, and TIV–TV; discs of the toes slightly smaller than those of the fingers, with well-defined circumferential grooves; relative length of toes $I < II < III < V < IV$; TIII shorter than TV (disc of TIII smaller than disc of TV); TIII reaches the distal border of the penultimate subarticular tubercle of TIV (Fig. 2C).

Measurements of Holotype (mm).—SVL 28.1; HW 10.2; HH 5.2; HL 10.1; TL 15.4; F 21.5; ED 3.2; END 3.1; ET 1.3; ID 2.9; IOD 3.6; TY 1.3; H 8.6; LFI 4.1. The measurements and proportions of the type series are presented in Tables 1 and 2, respectively.

Variation.—Morphometric variation is summarized in Table 1. Sexual dimorphism is present, with females reaching a SVL up to

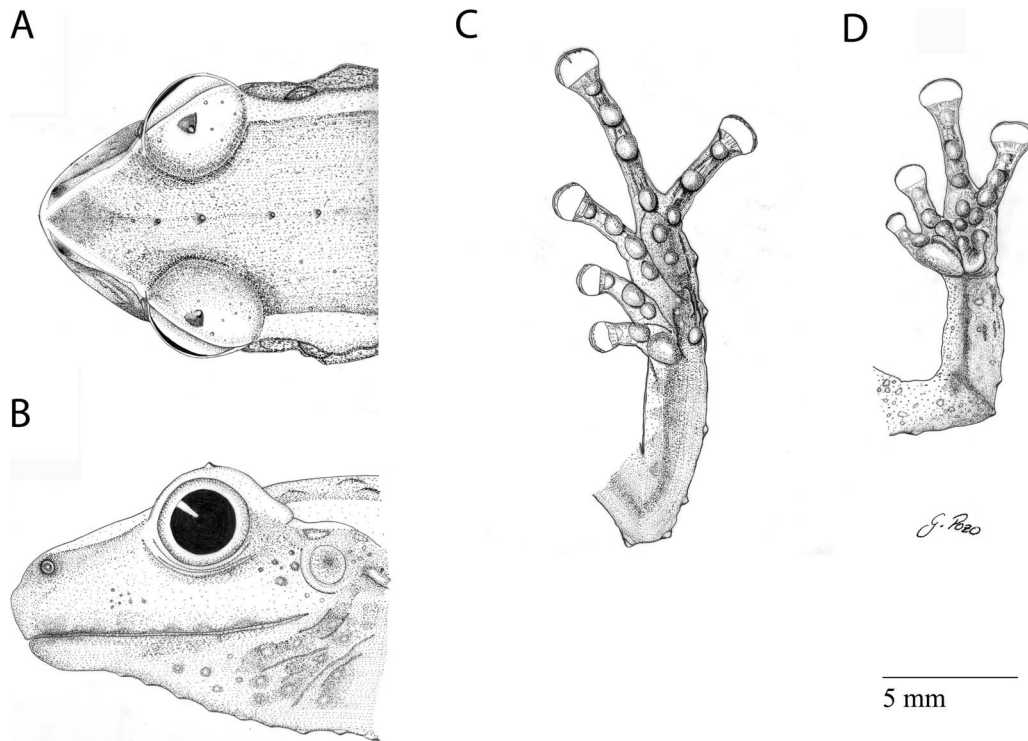


FIG. 2. Adult male paratype of *Pristimantis tinguichaca* sp. nov. (MEPN 14439). (A) Lateral and (B) dorsal view of the head. (C) Plantar view of the pes. (D) Palmar view of the manus.

33% greater than that of males (Table 1). Color patterns, especially dorsal coloration, are highly variable (Fig. 3).

Coloration in Life.—Dorsum varies from dark brown to reddish-brown or beige with cream longitudinal stripes of irregular width; flanks with longitudinal or diagonal cream bands separated by brown; venter dominantly reddish or yellow-cream with dark spots and black midline, sometimes only faintly visible, that terminates at neck; neck region has irregular dark brown markings that reach the lips; canthal and supratympanic stripe dark brown to black; extremities with a faint cream or dark brown transversal band in females, barely visible in males; iris red in the majority of specimens or rarely reddish-brown and always bisected by a dark band (Figs. 1, 3A).

Coloration in Preservative.—Viewed dorsally, head and trunk light gray or dark brown with lighter irregular longitudinal stripes; sides of head light gray with diagonal beige stripes;

flanks with longitudinal cream bands; venter homogenously dark to pale cream with a dark brown midline; extremities with whitish or dark cream diagonal stripes, dark gray interspacing; neck region light cream to dark with dark brown or cream markings (Figs. 1, 3B).

Etymology.—The epithet is a noun in apposition that references Tinguichaca, the type locality. It is a sector of Sangay National Park, a UNESCO World Heritage Site, that is rapidly being encroached upon by cattle pastures attributable to a recently constructed highway.

Call Description.—The call is composed of pulses of a modulated frequency of a single note that produces a metallic sound. The call, recorded at a temperature of 11°C, has an average duration of 32.33 ± 8.33 msec. *Pristimantis tinguichaca* presents low vocal activity, emitting three or four pulses separated by about 9,000 msec followed by prolonged silence (Table 3; Fig. 4).

Distribution and Ecology.—This species is only known from the type locality (Tinguichaca) located in the Cordillera Oriental of the Andes in Sangay National Park, Ecuador between 2,750 and 2,830

TABLE 1. Measurements (in mm) of adult *Pristimantis tinguichaca* sp. nov. Range, mean, and standard deviation are indicated.

Character	Females (N = 9)	Males (N = 11)
SVL	28.1–31.7 (29.7 ± 1.5)	21.2–24.7 (23.4 ± 1.1)
HW	10.1–11.5 (11.0 ± 0.5)	7.9–9.4 (8.6 ± 0.5)
HH	5.1–6.8 (5.4 ± 0.6)	4.1–5.8 (4.7 ± 0.5)
HL	10.1–11.0 (10.6 ± 0.4)	8.2–9.2 (8.7 ± 0.3)
TL	15.3–17.8 (16.4 ± 0.8)	11.6–14.1 (13 ± 0.7)
FL	12.5–15.9 (14.2 ± 1.4)	11.4–13.7 (12.5 ± 0.7)
ED	2.8–3.7 (3.3 ± 0.3)	2.3–3.3 (2.8 ± 0.4)
END	3.1–3.7 (3.3 ± 0.2)	2.4–2.9 (2.6 ± 0.2)
ET	1.0–1.3 (1.1 ± 0.1)	0.7–1.3 (1.1 ± 0.2)
IND	2.8–3.2 (3.0 ± 0.1)	2.1–2.7 (2.4 ± 0.2)
IOD	3.1–3.9 (3.6 ± 0.2)	2.7–3.6 (3.0 ± 0.3)
TY	1.3–1.7 (1.4 ± 0.1)	1.1–1.6 (1.3 ± 0.2)
H	8.5–10.2 (9.5 ± 0.7)	6.4–7.8 (7.3 ± 0.4)
LFI	4.1–5.2 (4.6 ± 0.4)	3.1–3.9 (3.5 ± 0.3)

TABLE 2. Body size ratios (in percent) for adults of *Pristimantis tinguichaca* sp. nov.

Character	Females (N = 9)	Males (N = 11)
HL/SVL	34.7–35.9	37.2–38.6
HL/HH	100.0–104.5	97.4–103.7
H/SVL	30.2–32.1	30.1–31.5
LFI/H	48.2–50.9	48.4–50.0
TL/FL	81.6–83.3	97.1–98.2
SVL/FL	199.3–224.8	180.2–185.6
TL/SVL	54.4–56.1	54.7–57.1
END/ED	100.0–110.7	104.3–113.7
IND/IOD	82.1–90.3	75.0–77.7
TY/ED	46.0–46.4	47.8–48.4

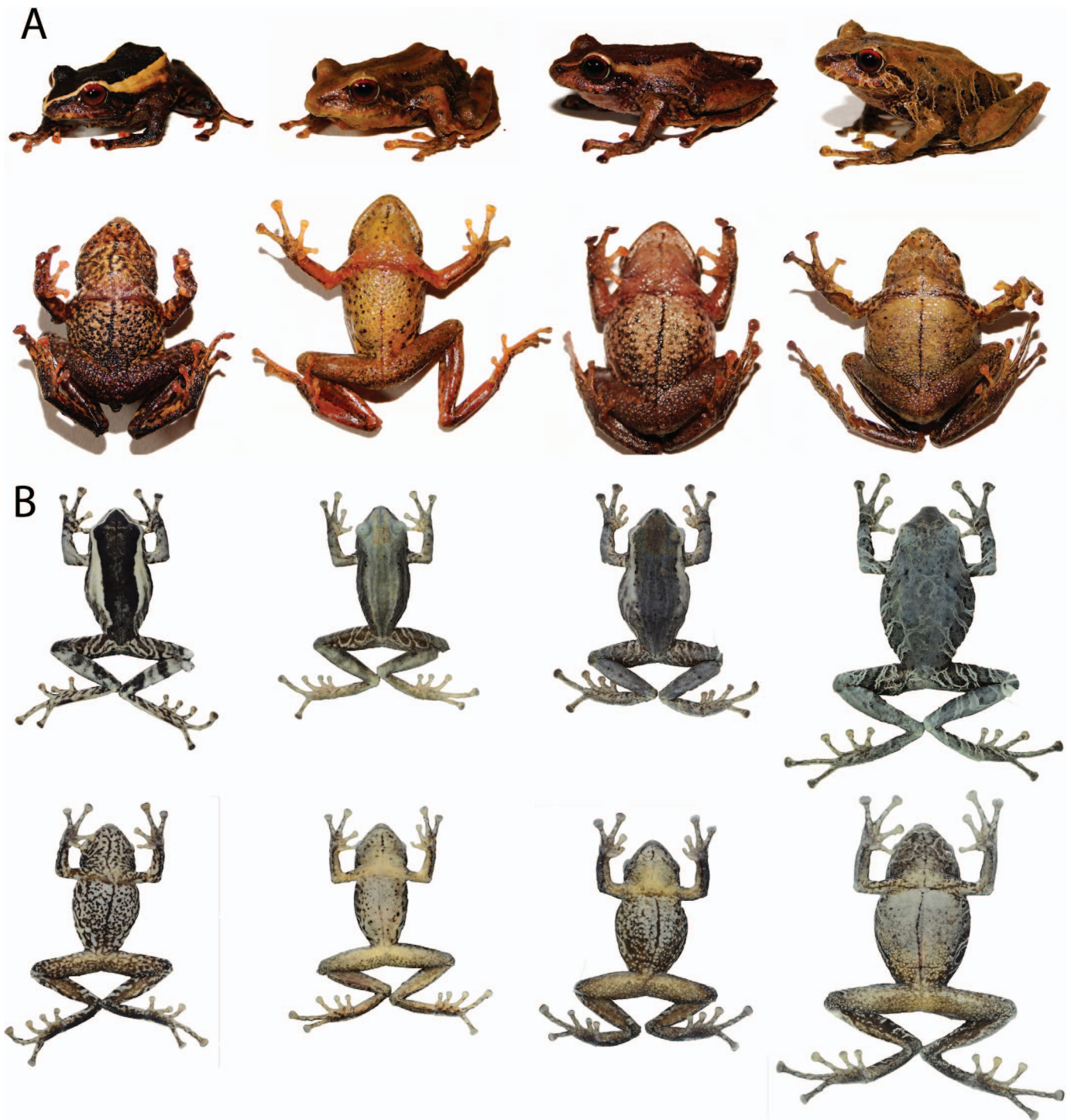


FIG. 3. Color variation of *Pristimantis tinguichaca* sp. nov. (A) Dorsal and ventral coloration in life. (B) Dorsal and ventral coloration in preservative. From right to left: MEPN 14443, male, SVL = 24.2; MEPN 14597, male, SVL = 23.3; MEPN 14439, male, SVL = 25.4; MEPN 14437, female, SVL = 30.9. Photographs in life by J. Brito, in preservative by V. Carvajal.

m. The locality is situated in the headwaters of the Upano River (Fig. 5). *Pristimantis tinguichaca* is known from cloud forest ecosystems characterized by trees that reach 25 m in height with abundant moss, orchids, ferns, and bromeliads. Some of the specimens were collected in steeply sloped primary forest with abundant bamboo (*Chusquea* sp.) and plants of the family *Araceae*. Several individuals were located in the bracts of terrestrial bromeliads (*Guzmania* sp.). On 29 February 2012, several males were collected in a pasture, at heights between 0.5 m and 1.3 m

above the ground, while vocalizing around a female on a night with light rain. *Pristimantis tinguichaca* is sympatric with *P. gagliardoi* (MEPN 14405–08) and *P. latericius* (Batallas and Brito, 2014; MEPN 14427–30). Although all specimens were collected in Sangay National Park, the species is likely found in other middle elevation cloud forests of southeastern Ecuador adjacent to the park.

Stomach Content Analysis.—Stomachs from 18 specimens (nine males, nine females) were analyzed, two of which (11%) were empty. Sampled frogs were insectivorous, preying primarily on

TABLE 3. Summary of the acoustic analysis of calls issued by *Pristimantis tinguichaca* sp. nov. Calculated values shown include minimum and maximum; mean and standard deviation are in parentheses.

Parameter	Values (N = 3)
Temperature	11°C
Relative humidity	96%
Dominant frequency (kHz)	1.98–2.02 (1.99 ± 0.02)
Fundamental frequency (kHz)	1.47
Number of calls	1
Frequency of harmonics (kHz)	3.94–4.36 (4.06 ± 0.18)
Notes/call	1
Pulse duration (msec)	23–39 (32.33 ± 8.33)
Interval between calls (msec)	9,219

beetles. Of the analyzed stomach contents, 69% of prey items were consumed by females and 31% by males. Of identifiable prey items, female specimens contained 75% Coleoptera, 17% Homoptera, 8% Hemiptera, whereas male specimens contained 12.5% Blattodea, 50% Coleoptera, 25% Lepidoptera larva, and 12.5% Aranaeida. In some specimens, prey was found nearly intact allowing identification to genus (Table 4).

Remarks.—We propose that *P. tinguichaca* could be the sister species to *P. atratus*. The two species could be closely related because they have similar external morphologies and are both distributed in the Cordillera Oriental of the Andes at similar elevations in cloud forest. Based on their distribution, the two species are likely separated by physical barriers of the Andean landscape. In their revision, Hedges et al. (2008) maintain that *P. atratus* belongs to the *P. unistrigatus* group although they did not use molecular data. It will be necessary to complete taxonomic studies supported by molecular data to reorganize the extensive *P. unistrigatus* group and to better understand its biogeography and evolution.

The ethological characteristic of sexual selection most important to anurans is their call and, through this, reproductive isolation (Narins et al., 2007). Batallas and Brito (2014), describe the call of *P. latericius*, a species sympatric with *P. tinguichaca*. The call of *P. latericius* is composed of a single note of a constant frequency that is slightly modulated at the beginning of the call. The dominant frequency is 4.26–4.47 kHz (4.36 ± 0.06) rather than 1.98–2.02 kHz (1.99 ± 0.02) exhibited by *P. tinguichaca*. In addition, calls of *P. latericius* were emitted

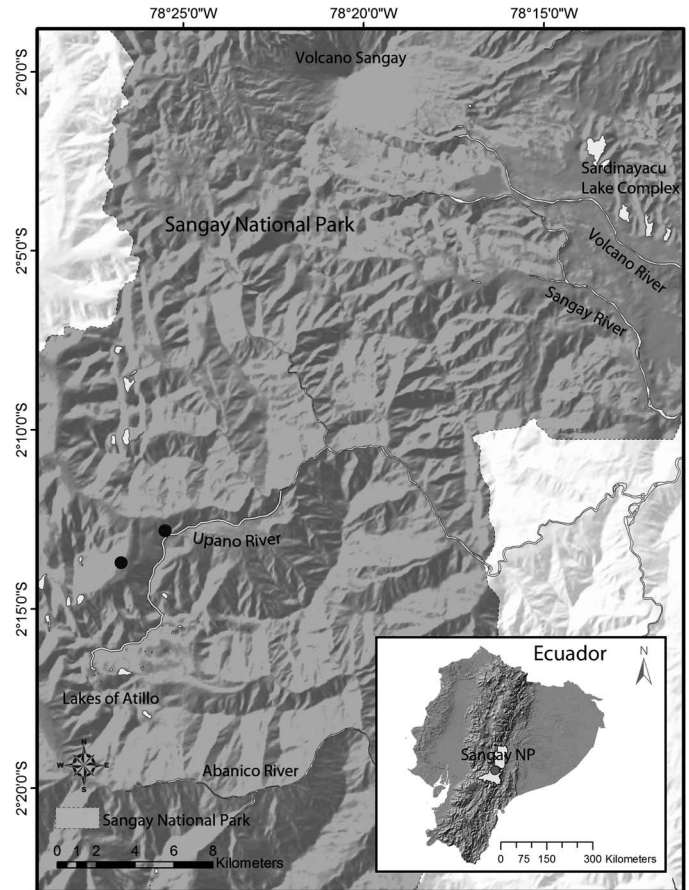


FIG. 5. Map of collection sites of *Pristimantis tinguichaca* sp. nov. in Ecuador.

from herbaceous vegetation below 90 cm in height, whereas the calls of *P. tinguichaca* are normally emitted from taller shrubs.

The diet of *P. tinguichaca* is composed of a moderate variety of arthropods. We identified with mostly coleopterans and homopterans in the stomach contents, arthropods that are associated principally with shrubs, suggesting that *P. tinguichaca* prefers shrubs, and forages primarily in this microhabitat. This preference is similar to what has been reported in other species in the genus *Pristimantis* (e.g., Lynch and

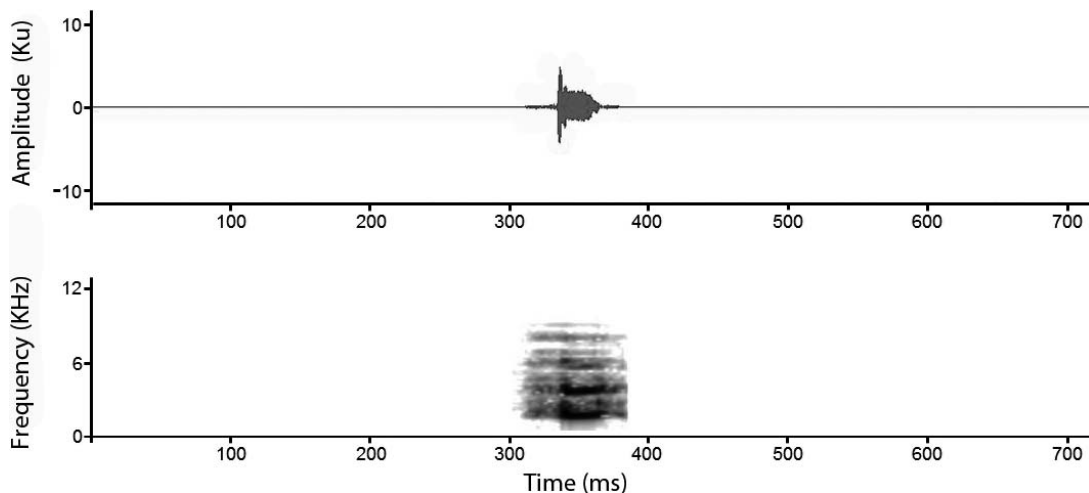


FIG. 4. Sonogram of the call of *Pristimantis tinguichaca* sp. nov. (MEPN 14600).

TABLE 4. Stomach content composition of *Pristimantis tinguichaca* sp. nov. The total for each order is listed in bold.

Stomach contents	Females (N = 9)	Males (N = 9)	Total
Insecta			
Blattodea		1	1 (3.4%)
Coleoptera			13 (44.8%)
Endomychidae	1		1 (3.4%)
Anticydea		1	1 (3.4%)
Melyridae	1		1 (3.4%)
Staphylinidae	1	1	2 (6.8%)
Elateridae		1	1 (3.4%)
Chrysomelidae			
<i>Aspistela</i> sp.	5		5 (17.2%)
<i>Caligrapha</i> sp.	1	1	2 (6.8%)
Homoptera			3 (10.3%)
Delphacidae	1		1 (3.4%)
Cicadellidae	1		1 (3.4%)
Coleoptera (larvae)	2		2 (6.8%)
Hemiptera	1		1 (3.4%)
Lepidoptera (larvae)		2	2 (6.8%)
Arachnida			
Araneida			
Tetragnathidae		1	1 (3.4%)
Undetermined arthropods	6		6 (20.6%)
Undetermined vegetation		1	1 (3.4%)
Total	20 (69%)	9 (31%)	29 (100%)

Duellman, 1997; Parmelee, 1999; Arroyo et al., 2008; García et al., 2012; Hoyos-Hoyos et al., 2012; Brito and Pozo-Zamora, 2013). *Pristimantis tinguichaca* could be considered an insectivorous generalist because of the 15 taxa found in the stomach content analysis.

The amount of time between capture and euthanasia affected the ability to identify prey material. In some cases, individuals euthanized immediately after capture allowed identification of two coleopterans to the genus level because the material was relatively intact (*Aspistela* sp. and *Caligrapha* sp., Chrysomelidae). However, the majority of specimens were not euthanized until the day following capture, creating difficulty in the identification of stomach contents, similar to reports by Garcia et al. (2012).

The discovery of various small vertebrates, *Noblella personina* (Harvey et al., 2013), *Pristimantis latericius* (Batallas and Brito, 2014), *Pristimantis roni* (Yáñez-Muñoz et al., 2014), and a new small mammal (*Caenolestes sangay* Ojala-Barbour et al., 2013) demonstrate the biological importance of montane forest in the Cordillera Oriental of the Andes in Ecuador. Such discoveries emphasize the importance of systematic inventories, especially in the middle elevation forests that are logistically difficult to access, and the need for the development of conservation planning in the Sangay National Park UNESCO World Heritage Site, where recent road construction and land conversion threaten the habitats near the type locality of this new species of frog.

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APPENDIX 1

Specimens Examined

Acronyms for institutions housing collections used in the analysis are Museo Ecuatoriano de Ciencias Naturales, Ecuador (DHMECN), and Escuela Politécnica Nacional, Ecuador (MEPN).

Pristimantis atratus.—Ecuador: Provincia de Pichincha, Cantón Quito, Parroquia Lloa, Bosque Protector Tandacato, elevation 2,940 m, DHMECN 4889–91, 4894.

Pristimantis delius.—Ecuador: Provincia de Sucumbios, Parroquia Gonzalo Pizarro, Lumbaqui, MEPN 281; Provincia de Pastaza, Pozo Shionayacu, MEPN 11790, 11792.

Pristimantis gliardi.—Ecuador: Provincia de Morona Santiago, Cantón Morona, Parroquia Zuñac, Sector Tinguichaca, Parque Nacional Sangay, elevation 2,820 m, MEPN 14405–08.

Pristimantis yumbo.—Ecuador: Provincia de Pichincha, Quito, Nono, Reserva Biológica Verdecocha, elevation 2,600 m, DHMECN 4124–25, 2127–28.