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Redescription, distribution and mating call of *Pristimantis colomai* (Lynch and Duellman, 1997) (Anura, Craugastoridae)

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We redescribe *Pristimantis colomai* (Lynch & Duellman, 1997) on the basis of new specimens from Colombia and Ecuador. Also provide a new diagnosis, reassess its distribution, and describe the mating call for the first time. Besides the data in the original description, only is available for this species: (i) new records from Ecuador (Yáñez-Muñoz *et al.* 2011) and (ii) molecular phylogenetic inferences that place this species in the *Pristimantis ridens* series (Hedges *et al.* 2008; Padial *et al.* 2014). *Pristimantis colomai* is currently classified as endangered due to its restrict distribution and habitat quality (Castro *et al.* 2004).

Specimens used in this study are deposited at the Universidad del Valle (UVC), Instituto de Ciencias Naturales of the Universidad Nacional de Colombia (ICN), Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH-Am), and Museo Ecuatoriano de Ciencias Naturales (DHMECN). The following specimens were studied (*specimens studied for morphological comparisons and ψ new records):

COLOMBIA: NARIÑO: Barbacoas, Km 18 Altarquer-Tumaco road (*ICN 36809–12: 1°25'26"N, 78°13'58" W; 545m). VALLE DEL CAUCA: Buenaventura: Anchicaya, Parque Nacional Natural Farallones de Cali (* ψ IAvH-am 7180, 11386: 3°26'N, 76°48'W; 900m); Bajo Anchicaya (* ψ UVC 5613, 5859: 3°36'49"N, 76°54'39"W; 291m); Bajo Anchicaya, vereda Guaimia (* ψ UVC 13653: 3°43'7"N, 76°57'47"W; 28m); Bajo Anchicaya, vereda Bellavista (* ψ UVC 13657: 3°38'46"N, 76°56'28"W; 191m); Rio Cajambre, El Piñuelal (* ψ UVC 7261: 3°27' 35"N, 77°11'18"W; 500m); Rio Cajambre, Quebrada Caimancito (* ψ UVC 7195: 3°27'26"N, 77°10'16"W; 75m); Corregimiento de Triana (* ψ UVC 16165: 3°51'6"N, 76°47'15"W; 537m). ECUADOR: CARCHI: Cabecera del Rio Baboso (QCAZ 49523, 49527: 0°52'55"N, 78°27'43"W; 550m). ESMERALDAS: Lote Ventanas (* DHMECN 3284–85: 0°54'59"N, 78°34'59"W; 680m); Alto Tambo (holotype: QCAZ 1289: 0°55'12"N, 78°33'39"W; 695m); Alto Tambo (QCAZ 1296: 1°0'0"N, 79°0'0"W; 58m). PICHINCHA: Bosque Protector Mashpi (* DHMECN6787: 0°9'50"N, 78°52'15"W; 1068m).

Specimens were assigned to *Pristimantis colomai* following the original description and ICN material from Altarquer-Tumaco road (Nariño, Colombia) that are part of the referred material listed by Lynch & Duellman (1997). Morphological characters not listed in the original description by Lynch & Duellman (1997) are here described following Duellman & Lehr (2009). Morphometric measurements follow Duellman & Lehr (2009): snout-vent length (SVL); head length (HL), from the edge of the articulation of the maxilla to the tip of the snout; head width (HW), at the level of the articulation of the maxilla; internarial distance (IND); interorbital distance (IOD); width of upper eyelid (EW); eye-nostril distance (E–N), from the front edge of the cornea to the center of the nostril; Eye diameter (ED); tympanum diameter (TD); and length of the tibia (TL), from the front edge of the knee to the heel. Measurements were taken with a digital caliper (± 0.01 mm) and rounded to 0.1 mm to avoid pseudoprecision. Geographical distribution is based on vouchers, published records (Lynch & Duellman 1997; Yáñez-Muñoz *et al.* 2011) or specimens observed in the field but not collected (uploaded photographs are available at calphotos.berkeley.edu). Field observations were conducted between March and June of 2014 in the surroundings of Corregimiento de Triana, municipality of Buenaventura, Valle

del Cauca, Colombia (3°51'6"N, 76°47'15"W). Specimens were detected along transects from 19:00h to 23:00h. We measured, photographed and released 14 individuals of *P. colomai* (11 males and 3 females). On 19 May 2014 between 18:00h – 19:00h we recorded the mating calls of two males (SVL= 17.46 and 19.31 mm; temperature of calling male = 18.7 °C; recording distance one meter) using a Sony ICD-AX412 recorder. Twenty calls were analyzed using RAVEN software 1.3, to generate spectrograms (fft size = 1024 with Hamming function) and oscillograms.

Morphological redescription. The following character states observed differ from those reported by Lynch & Duellman (1997), their observations in parenthesis. (i) Presence of small tubercles in the upper eyelid (lacking). (ii) Lateral fringes on all fingers and toes (observed only at the base of fingers II and III of QCAZ 1296; not mentioned for toes). (iii) Complete grooves on discs (absent). (iv) Middorsal and dorsolateral tubercles present (not mentioned). (v) Dorsolateral folds present (not mentioned). Below we provide a more complete description of the variation of this species and a new diagnosis. It should be stated in advance that *Pristimantis colomai* shows (i) a high phenotypic plasticity in skin tubercles, a condition that has been previously described for *P. mutabilis* and *P. sobetes* (Guayasamin *et al.* 2015), (ii) a high degree of color polymorphism; (iii) considerable sexual dimorphism in size.

Morphometric measurements and proportions for males and females are listed in Table 1. Females are 10% larger than males (Table 1, Fig. 1A–B). *Pristimantis colomai* is characterized by: head narrower than body, slightly longer than wide, HL nearly 0.4 times SVL; snout with small papilla at the tip (Fig. 1A–B); lips not flared, with or without a row of five tubercles along the lip; upper eyelid with four conical tubercles, medially more prominent; head with or without scattered non-conical tubercles; supratympanic fold conspicuous, starting behind eye orbit and almost reaching the upper part of the arm; postrictal tubercles small or absent. Vomerine processes with four to eight teeth in transverse rows. Dorsal surfaces usually smooth or shagreen with scattered low granules; low middorsal tubercle present; usually a row of tubercles forming a dorsolateral line or discontinuous fold from behind the eye to the cloaca. Skin of flanks smooth or with scattered low granules (Fig. 1A–B). Skin on throat and belly areolate; thoracic and discoidal fold usually present (Fig. 1A–B).

Upper and lower surfaces of limbs smooth; two to three ulnar tubercles in a row; relative length of the fingers: III>IV>II>I (Fig. 1A–B); lateral fringes present in all fingers; finger discs broadly expanded, rounded, bearing broad pads with complete round grooves; single nuptial pad white (Fig. 3B); heel with fold and a short calcar, with or without adjacent tubercles; outer edge of tarsus bearing a row of two or three indistinct tubercles; toes length: IV>V>III>II>I (Fig. 1A–B); toes bearing broad lateral fringes; discs broadly expanded, elliptical with defined round grooves.

TABLE 1. Mean, standard deviation and ranges of morphometric measurements and proportions of males and females of *Pristimantis colomai* studied in collections and in life (near Corregimiento de Triana, Buenaventura, Colombia).

Measures	Preserved specimens		Live specimens (Buenaventura, Colombia)		Male (Holotype)
	Males (n=11)	Females (n=6)	Males (n=10)	Females (n=3)	
SVL	15.1 ± 3.2 (9.8–19.7)	16.5 ± 4.8 (9.4–21.2)	17.1 ± 1.9 (13.2–19.9)	26.2 ± 7.0 (21.1–34.1)	17.8
HW	5.3 ± 1.1 (3.5–7.1)	5.9 ± 1.6 (3.2–7.6)	6.3 ± 0.8 (4.7–7.4)	8.7 ± 1.7 (7.4–10.6)	6.3
HL	5.8 ± 1.0 (3.8–6.9)	6.4 ± 1.6 (3.4–8.1)	6.7 ± 0.9 (4.9–7.8)	8.8 ± 2.0 (7.2–11.1)	6
EW	1.4 ± 0.3 (0.8–1.8)	1.5 ± 0.5 (0.7–1.9)	1.6 ± 0.1 (1.3–1.7)	1.8 ± 0.2 (1.6–2.0)	
E–N	1.7 ± 0.4 (0.8–2.2)	2.0 ± 0.6 (1.0–2.5)	1.7 ± 0.2 (1.5–2.0)	2.5 ± 0.6 (2.0–3.2)	2.1
IND	1.5 ± 0.4 (1.0–2.1)	1.6 ± 0.3 (1.1–1.9)	1.6 ± 0.3 (1.1–1.9)	1.8 ± 0.3 (1.6–2.1)	
IOD	1.9 ± 0.4 (1.2–2.5)	2.1 ± 0.6 (1.1–2.6)	2.1 ± 0.4 (1.4–2.6)	3.0 ± 0.4 (2.6–3.5)	
ED	2.4 ± 0.4 (1.6–3.0)	2.8 ± 0.6 (1.9–3.6)	2.3 ± 0.3 (1.9–2.8)	2.9 ± 0.7 (2.4–3.6)	2.5
TD	0.6 ± 0.8 (0.1–1.0)	0.7 ± 0.2 (0.3–1.0)	0.7 ± 0.2 (0.43–1.0)	0.9 ± 0.5 (0.5–1.4)	0.8
LT	7.9 ± 1.6 (4.5–10.2)	8.5 ± 2.3 (4.5–10.3)	8.6 ± 1.0 (6.6–9.9)	11.0 ± 1.3 (10.0–12.5)	8.8
HL/SVL	0.4 ± 0.04 (0.3–0.5)	0.4 ± 0.1 (0.3–0.5)	0.4 ± 0.02 (0.4–0.4)	0.3 ± 0.01 (0.3–0.4)	0.34
HW/SVL	0.4 ± 0.03 (0.3–0.4)	0.4 ± 0.02 (0.3–0.4)	0.4 ± 0.02 (0.3–0.4)	0.3 ± 0.02 (0.3–0.4)	0.35
HW/HL	0.9 ± 0.1 (0.7–1.2)	0.9 ± 0.2 (0.8–1.2)	1.0 ± 0.03 (0.9–1.0)	1.0 ± 0.04 (1.0–1.03)	1.05
IND/HW	0.3 ± 0.04 (0.2–0.3)	0.3 ± 0.04 (0.2–0.3)	0.3 ± 0.02 (0.2–0.3)	0.2 ± 0.01 (0.2–0.22)	
TD/ED	0.2 ± 0.1 (0.1–0.4)	0.2 ± 0.04 (0.2–0.3)	0.3 ± 0.1 (0.2–0.4)	0.3 ± 0.1 (0.2–0.4)	0.32
EW/IOD	0.7 ± 0.1 (0.6–0.8)	0.7 ± 0.1 (0.6–0.8)	0.8 ± 0.2 (0.6–1.1)	0.6 ± 0.03 (0.6–0.64)	
E–N/ED	0.7 ± 0.1 (0.5–0.8)	0.7 ± 0.1 (0.5–0.8)	0.8 ± 0.1 (0.7–0.8)	0.9 ± 0.03 (0.8–0.9)	0.84
LT/SVL	0.5 ± 0.04 (0.5–0.6)	0.5 ± 0.1 (0.4–0.6)	0.5 ± 0.02 (0.5–0.5)	0.4 ± 0.1 (0.4–0.5)	0.49

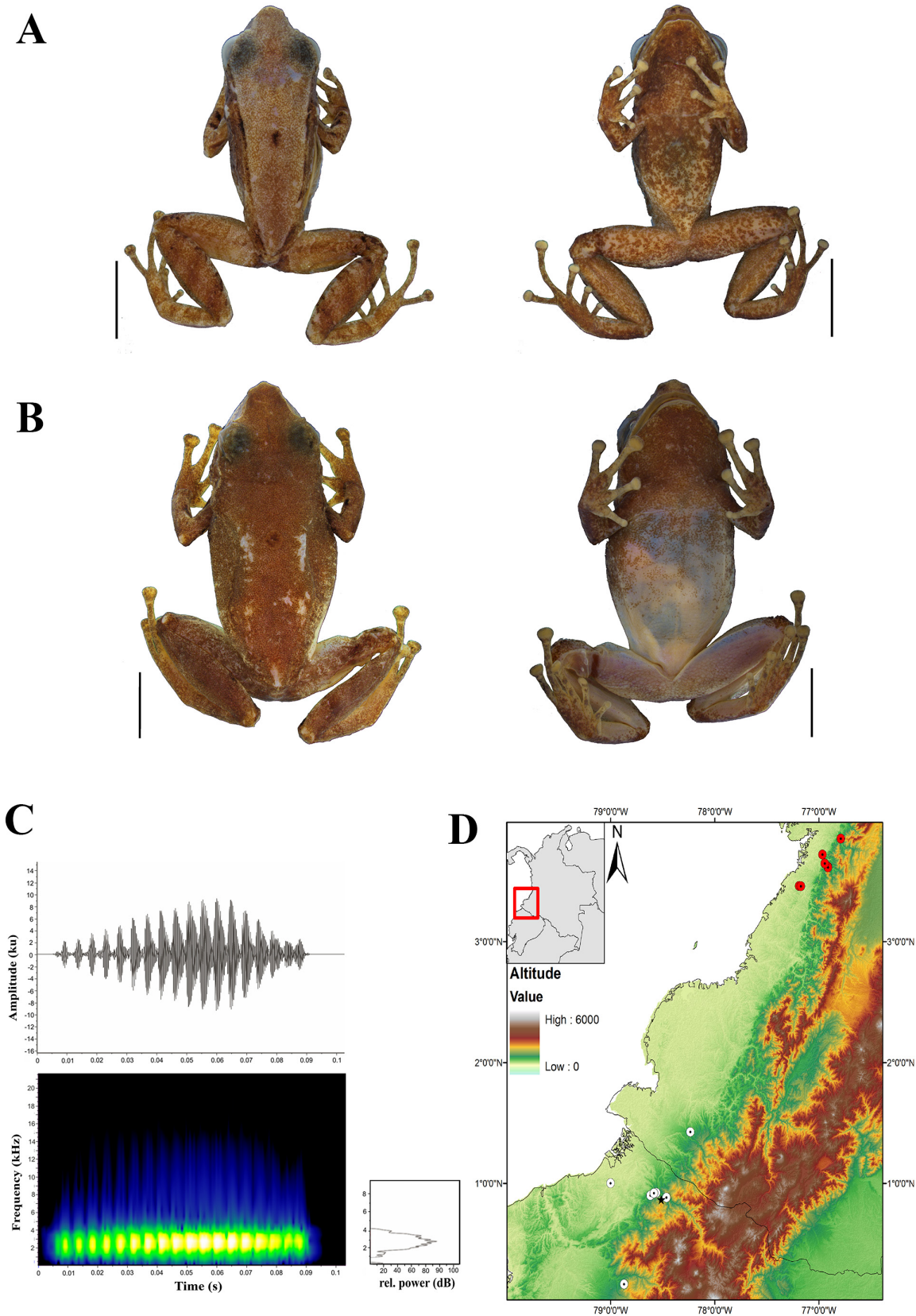


FIGURE 1. Dorsal and ventral view of (A) adult male UVC 7195 and (B) adult female UVC 5859 (scale bar = 5 mm) of *Pristimantis colomai*; (C) mating call showing the oscillogram (above), spectrogram (below), and power spectrum; and (D) geographic distribution showing the type locality (black star), historical records (white dots), and new records reported in this study (red dots).

All individuals observed alive in the field exhibited moderate skin tuberculation. Several tubercles were evident on the upper eyelid, lower lips, arms, legs, dorsolateral line and cloacal region. Skin texture changed markedly after capture. While handled, few tubercles were conspicuous on the upper eyelid and tubercles diminished in size along most parts of the body, with the skin becoming overall smooth.

Specimens in alcohol show color patterns as described by Lynch & Duellman (1997) but we also observed the following conditions: a dark middorsal spot; a thin brown facial mark extending laterally from nostril to the anterior corner of the eye; a diffuse dark brown dorsolateral line extending behind the eyes to the groin; dark brown arms and forearms with darker brown spots or oblique transversal bars; a brown ventral line or row of spots running along the posterior edge of the forearm; throat and chest cream with pale brown or dark brown flecks; males with the posterior part of belly and thighs pigmented with irregular brown blotches on a cream background (Fig. 1A), less densely pigmented in females (Fig. 1B).

In life the dorsal patterns are highly variable, but generally specimens show a characteristic black or brown middorsal spot; flanks are olive-green with diagonal brown bars; a pale olive-yellowish or brown band is often observed running across the cloaca to the heel; lips usually present three brown or bright white labial bars, two of them in contact with the eye; a dark brown canthal and supratympanic stripe is always visible and the tympanum is usually ochre with brown spots. The hind-limbs are olive-green or brown to reddish-brown with oblique darker brown bars; the thighs are cream, with heavily mottled brown bars dorsally, and white or cream with dense brown or brown-reddish flecks ventrally. The throat is cream with brown or reddish flecks in females, cream with heavy dark brown flecks in males; while the chest and belly are white or cream with brown flecks; the posterior part of the belly and underside of limbs are flesh-colored to cream with brown flecks (olive green in some individuals); the inguinal region is usually cream, yellowish or reddish.

Advertisement call. Mating calls consist of a single short pulsed note (Fig. 1C). Amplitude modulation peaks at about to 2/3 of the note. The duration is 69.0–97.0 ms (mean = 84.0 ± 9.0 ms), and calls are emitted at a rate of 4.0–7.0 notes per minute (mean = 5.3 ± 2.2 notes per minute). The call is pulsed, with 13.0–27.0 pulses per call (mean = 17.6 ± 3.2 pulses). Each pulse is 2.0–6.0 ms long (mean = 3.7 ± 1.2 ms). The lower frequency ranges between 2072.3–2287.0 Hz (mean = 2137.6 ± 59.8 Hz), the upper frequency between 2851.9–3405.5 Hz (mean = 3093.7 ± 176.2 Hz), and the dominant frequency ranges between 2497.9–2799.3 Hz (mean = 2570.0 ± 64.5 Hz).

Diagnosis. (1) skin on dorsum smooth with scarce scattered tubercles, a middorsal tubercle and pair of suprainguinal tubercles usually non-prominent, dorsolateral folds present or absent; venter finely areolate with thoracic and discoidal folds; (2) tympanic membrane and tympanic annulus prominent, their diameter about 25% eye length; (3) snout subacuminate in dorsal view, protruding in profile, with a papilla usually present on the tip; (4) upper eyelid with small tubercles; (5) cranial crests absent; (6) vomerine odontophores elongate to oval, prominent; (7) males having subgular vocal sac, vocal slits and white nuptial pads, mesorchium white; (8) first finger shorter than second, fingers with lateral fringes, discs broad with complete grooves; (9) two or three ulnar tubercles; (10) heel bearing a fold and short calcar, outer edge of tarsus bearing indistinct tubercles, inner edge of tarsus lacking tubercles and folds; (11) inner metatarsal tubercle oval, outer metatarsal tubercle round, plantar surfaces areolate; (12) toes bearing lateral fringes, webbing absent, fifth toe much longer than third, discs with round grooves; (13) mating call composed of a single short (69.0–97.0 ms) pulsed note (13.0–27.0 pulses/call) modulated in amplitude (without observed harmonics) and a dominant frequency ranging from 2497.9–2799.3 Hz; (14) SVL in males 9.8–19.9 mm, females 9.4–34.1 mm.

Geographic distribution. New records extend the known distribution 330 km northward, reaching to Corregimiento de Triana (Buenaventura, Colombia) (Fig. 1D). The lower elevation range is also extended further down to 28 mals at the locality Vereda Guaimia, Bajo Anchicaya, Buenaventura, Colombia. *Pristimantis colomai* is currently known to occur at elevations from 28 to 1200 mals along the Choco and adjacent foothills of the Andes, from Buenaventura (El Salto, Triana, Alto and Bajo Anchicaya, Piñuelal and Quebrada Caimancito) in Valle del Cauca, and across Tumaco in Nariño (southwestern Colombia), as well as along the provinces Esmeraldas (Pote, Rio Santiago and Alto Tambo) and southern Pichincha (Bosque Protector Mashpi) in northwestern Ecuador.

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