



The advertisement call of three highland endemic species (Anura: Craugastoridae) from the Andean mountains of Colombia

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We describe the unknown advertisement call of three high Andean frog species endemic to Colombia: *Niceforonia adenobrachia* (Ardila-Robayo, Ruiz-Carranza & Barrera-Rodriguez, 1996), *Pristimantis uranobates* (Lynch, 1991), and *P. simoterus* (Lynch, 1980). Additionally, we report a new locality for *N. adenobrachia*. Advertisement calls were recorded during fieldwork conducted along the Cordillera Central in Departamento del Tolima, Colombia, between 2012 and 2013. Calls were recorded at 44.1 kHz sampling rate and 16 bits resolution with a unidirectional microphone (Rode) connected to a digital recorder (Marantz PMD 661 or Zoom H4N) at approximately 30–50 cm from the calling frogs. Microhabitat air temperature was measured at the time of recording with a portable digital thermometer. Digital copies of the calls (.wav format) are deposited at the Laboratory of Herpetology, University of Tolima, Ibagué, Colombia. Calls were analyzed with Raven Pro 1.4 for Windows (Bioacoustics Research Program, 2011) configured at 256 DFT size, 50% overlap, hop size 128 samples and grid spacing 188 Hz. Call terminology follows Bernal *et al.* (2004) and Dautel *et al.* (2011), although we report here the peak frequency (the frequency at which maximum power occurs within the call), and 5% and 95% frequencies (frequencies that contain 5% and 95% of the call energy, respectively). Measurements are given as mean, standard deviation, and range. Recorded animals were photographed, collected, fixed in 10% formalin and preserved in 70% ethanol. Voucher specimens are deposited at the Zoological Collection of the University of Tolima. A copy of the audio files were deposited at Fonoteca Zoológica (www.fonozoo.com) of the Museo Nacional de Ciencias Naturales, Madrid, Spain.

Niceforonia adenobrachia (Fig. 1A). A calling male was recorded on August 15th 2013 at 14:20 hours near “Campamento 4000”, municipality of Ibagué, Tolima (04°38'08.8"N, 75°19'45.3" W; 3872 masl). This finding represents a new and noteworthy distributional record, as this species was only known from the vicinity of Albania, municipality of Herveo, also in the department of Tolima, Colombia (Ardila-Robayo *et al.* 1996). The calling frog was hidden within grasses (*Calamagrostis* sp.). Air temperature was 13.7°C. The call consists of a single multipulsed note (9.4 ± 2.6 pulses/note), with amplitude modulation and multiple harmonics (Fig. 1A), emitted at a rate of 66 calls/minute. The duration of the note is 105 ± 13 ms (range: 82–129 ms, $n = 11$ calls) with a frequency between 1.55 (5% frequency) and 3.79 kHz (95% frequency), and a peak frequency of 2.69 ± 0.08 kHz. Voucher specimen: CZUT-A 1599. Snout vent length: 16.24 mm. Fonoteca Zoológica sound code: 9420.

Pristimantis simoterus (Fig. 1B). A calling male was recorded on August 15th 2013 at 19:30 hours near “La Cueva”, municipality of Ibagué, Tolima (04°37' 59.4"N, 75°19' 46.7"W; 3786 masl). Air temperature was 10.7°C. The frog was calling on a leaf of *Rhizocephalum* sp. at approximately 100 cm above ground. The call consists of a single non-pulsed note with amplitude modulation and three harmonics (Fig. 1B), emitted at a rate of 12 calls/minute. The duration of the note is 60 ± 18 ms (range: 40–119 ms, $n = 37$ calls) with a frequency between 1.72 (5% frequency) and 2.41 kHz (95% frequency), and a peak frequency of 2.09 ± 0.14 kHz. Voucher specimen: CZUT-A 1600. Snout vent length: 25.56 mm. Fonoteca Zoológica sound code: 9421.

Pristimantis uranobates (Fig. 1C). A calling male was recorded on October 27th 2012, at 20:19 hours at “El Silencio”, municipality of Ibagué, Tolima (04°37'13.04"N, 75°17'36.17"W; 2600 masl). The frog was perching at approximately 1 meter above the ground on the leaves of a fern. Air temperature was 12.3°C. The call consists of a single non-pulsed note with amplitude modulation but without clear harmonics (Fig. 1C), produced at a rate of 24 calls/minute. The duration of the note is 22 ± 6 ms (range: 10–39 ms, $n = 66$ calls) with a frequency between 3.79 (5% frequency) and 4.48 kHz (95% frequency) and a peak frequency of 4.13 ± 0.074 kHz. Voucher specimen: CZUT-A 1586. Snout vent length: 19.45 mm. Fonoteca Zoológica sound code: 9422.