

The advertisement call of the robber frog *Pristimantis peraticus* in a population from the eastern slope of the Colombian central Andes

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Acoustic communication is widely used by anurans in different social contexts, such as male-male agonistic interactions and mating. Among the diverse acoustic signal types in anurans, the advertisement call is the most conspicuous signal. It serves to attract mates and transmit territorial information to conspecifics (Wells, 2007; Köhler et al., 2017). Moreover, knowing the advertisement call traits may be useful for studying taxonomic and phylogenetic relationships, natural history, behaviour, ecology, and eventually, conservation (Myers & Daly, 1976; Dias et al., 2019; Patiño-Ocampo et al., 2022a; Zaffaroni-Caorsi et al., 2023). However, for many anurans the advertisement call is still unknown. Colombia has one of the richest anuran faunas in the world (818 spp, Acosta-Galvis, 2024), the advertisement call is only known for about 39% of anuran species, and of the 225 species of *Pristimantis* known in Colombia it is known only for 25 of them (Rivera-Correa et al., 2021; 2022; Patiño-Ocampo et al., 2022a; 2022b; Cuellar-Valencia et al., 2023). This is of concern since most species in this clade have a restricted distribution in the Andean region of the country, which is subject to high rates of deforestation and transformation of its original vegetation cover with the concomitant negative consequences on species diversity (Mesa-Joya & Torres, 2016; Arnesto & Señaris, 2017; Agudelo-Hz et al., 2019).

Pristimantis peraticus (Lynch, 1980) is strambomantid frog distributed between 2600 and 3460 m a.s.l. in the central Andes of Colombia (Lynch, 1980; Castro-Herrera & Vargas-Salinas, 2008; Buitrago-González et al., 2016). Individuals of this species are usually found on herbaceous vegetation, bromeliads and the necromass of frailejones (*Espeletia* spp.), at 0–30 cm height above ground (Buitrago-González et al., 2016). Little has been published about the natural history of this species, including its activity pattern and acoustic signalling. Herein, I describe for the first time the advertisement call of *P. peraticus* based on seven males recorded in a population located on the eastern slope of the central Andes of Colombia.

In July 2023, I undertook an 11 day field trip to Paramo La Yerbabuena, in the 'Loros Andinos' natural reserve (4° 4'34.3" N, 75° 42'54.9" W; altitude 3420 m a.s.l.), municipality of Roncesvalles, department of Tolima, central Andes of Colombia. Three people performed visual and auditory encounter surveys (Crump & Scott, 1994), looking for anurans in all available microhabitats (e.g. leaf litter,

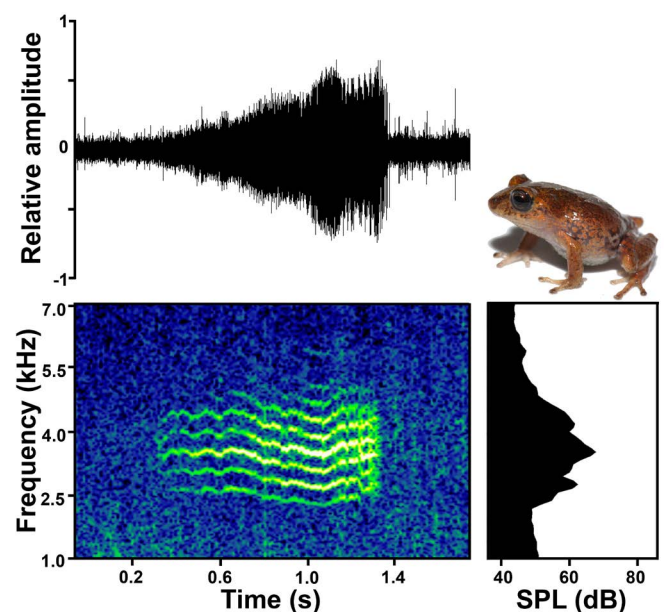


Figure 1. Oscillogram, spectrogram and power spectrum for one advertisement call of *Pristimantis peraticus*. This call was emitted by the male #1 (Table 1). SPL = sound pressure level

necromass of frailejones, leaves) from 8:00–16:00 h and 19:00–00:00 h. When a calling male was observed, I recorded its advertisement calls from a maximum distance of one metre, using a Sennheiser ME62/K6 unidirectional microphone connected to a handheld recorder Marantz PMD661. The body size (snout-vent length, SVL) of the signaller was measured with a digital calliper (± 0.1 mm). Recordings were digitized with 16-bit resolution and a sampling frequency of 44.1 kHz. Oscillograms and spectrograms were analysed with a 512-point Fourier Transformation window and the Blackman algorithm using the software RAVEN Pro 1.6.5 (Bioacoustics Research Program, 2024). The procedures and terminology used for the following measures and descriptions of call traits were according to Köhler et al. (2017) using a call-centered definition to describe the call. The unit for the descriptive analysis was the individual recorded. Digital copies of the calls (in WAV format) were deposited at the Colección de Sonidos Ambientales of the Instituto Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia (see Table 1 for voucher numbers). Three individuals euthanised with 2% lidocaine, fixed in 10% formalin and preserved in 70%

Table 1. Advertisement call features for each male of *Pristimantis peraticus* recorded at municipality of Roncesvalles, department of Tolima, Central Andes of Colombia. Values are reported as mean \pm standard deviation (minimum-maximum). Body size (snout-vent length, SVL), voucher numbers of the Colección de Sonidos Ambientales of the Instituto Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia (IAvH-CSA), and Colección de Anfibios y Reptiles de la Universidad del Quindío, Colombia (ARUQ) are shown.

Male ID	Voucher IAvH-CSA	Voucher ARUQ	Number of calls recorded	SVL (mm)	Call duration (ms)	Fundamental frequency (Hz)	Dominant frequency (Hz)	Number of harmonic bands
1	37825	1557	7	15.74	0.9 \pm 0.01 (0.9–1.0)	2745 \pm 246 (2343–3000)	3535 \pm 279 (2906–3656)	6 \pm 0.8 (5–7)
2	37826	-	2	-	1.27 \pm 0	3093 \pm 132 (3000–3187)	3515 \pm 66 (3468–3562)	6.5 \pm 0.7 (6–7)
3	37827	1558	1	19.18	1.27	2625	3562	7
4	37828	1559	5	18.76	1.6 \pm 0.21 (1.2–1.8)	2669 \pm 320 (2096–2812)	3449 \pm 78.4 (3375–3562)	5 \pm 0.7 (4–6)
5	37829	-	2	-	0.8 \pm 0.06 (0.8–0.9)	3093	3609 \pm 198 (3468–3750)	5
6	37830	-	1	-	1.05	2531	3281	5
7	37831	-	4	-	0.9 \pm 0.14 (0.7–1.0)	2929 \pm 89.7 (2812–3000)	3679 \pm 309 (3375–4031)	8.2 \pm 0.1 (7–10)

ethanol and deposited at the Colección de Anfibios y Reptiles, Universidad del Quindío, Armenia (ARUQ), Colombia (see Table 1 for voucher numbers).

A total of 71 individual *P. peraticus* were recorded (62 males, 2 females and 7 unsexed individuals). From 10:00–15:00 h we recorded 22 calls emitted by seven males calling from the base of the frailejón (*Espeletia hartwegiana*). The advertisement call of *P. peraticus* consisted of a pulsatile call composed of a dense harmonic single note with multiple harmonic bands (Fig. 1). The note or whole call lasted 1.1 ± 0.2 (0.8–1.5) s, and had a mean dominant frequency of 3599.5 ± 246.5 (3281.2–3679.6) Hz, and a fundamental frequency of 2812.5 ± 227.6 (2531.2–3093.7) Hz. Ninety percent of the call energy was located between 2496.8 ± 292.6 (1968.7–2929.6) Hz and 4888.8 ± 861.9 (3281.2–6656.2) Hz of the call. In the recordings it was possible to detect five to eight harmonic bands (Fig. 1).

This is the second description of the advertisement call for a species of the *P. leptolophus* group which is composed by nine species (sensu Lynch, 1991; González-Duran et al., 2017; Rivera-Correa et al., 2017). The other species of this group for which the advertisement call has been described is *P. acatallelus* (Lynch & Ruiz-Carranza, 1983), which has a very different call structure consisting of a group of 6 to 11 tonal notes (Cuellar-Valencia et al., 2023). The dominant frequency and call duration in *P. peraticus* is higher than in *P. acatallelus* (2265.6 Hz and 0.5 ms, respectively; Cuellar-Valencia et al., 2023). It should be noted that Romero-García et al. (2015) describe the advertisement call of what is alleged to be *Pristimantis uranobates*, a species nested within the *P. leptolophus* group. However, when comparing the photograph and the call provided by the authors, it is observed that it does not coincide with the external phenotypic characteristics of *P. uranobates* (González-Durán, unpublished data), but rather with those of *Pristimantis boulengeri* (Rios-Soto & Ospina-L, 2018), a species of the group *P. boulengeri* (sensu Gonzalez-Durn

et al., 2017). Clearly, more call descriptions are necessary before establishing patterns of the call structure within the *P. leptolophus* species group.

The advertisement call of species belonging to genus *Pristimantis* are predominantly composed of multiple tonal notes (e.g. *P. crepitaculus*, Fouquet et al., 2022; *P. campinarana*, Mónico et al., 2023) or a single pulsed note (e.g. *P. silverstonei* and *P. alius*, Arriaga-Jaramillo et al., 2023). The structure of the advertisement call of *P. peraticus* (i.e. dense harmonic single note) is unusual in the advertisement call of anurans, and tends to be more similar to an anuran distress call (Köhler et al. 2017) such as the tree frog *Smilisca baudinii* (Mendoza-Henao, 2021) and the rainy frog *Pristimantis racemus* (Pisso-Florez et al., 2023). To the best of my knowledge the advertisement calls of *P. peraticus* and *Pristimantis molybrignus* (Cuellar-Valencia et al., 2023), a species not yet assigned to any *Pristimantis* group, represent the first examples of advertisement calls with a dense harmonic single note structure in species of *Pristimantis* (608 spp, Frost, 2024).

Last but not least, *P. peraticus* is a species found below the necromasses of frailejones and it is very difficult to locate individuals. In the field, it was necessary to invest between 15 to 30 minutes by three people to find a former calling male. With a knowledge of the *P. peraticus* males call, we were able to detect other individuals quickly, obtaining 78% of our records from their calling. This underlines the effectiveness of passive acoustic monitoring as a crucial technique for the monitoring of populations of this and other similarly cryptic anuran species.

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