



## Advertisement and territorial calls of *Brachycephalus pitanga* (Anura: Brachycephalidae)

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The genus *Brachycephalus* Fitzinger, 1826 comprises 17 tiny species, eight of which were described only in the past 10 years (Frost 2012). Vocal communication is still poorly studied in this group, and despite its importance for taxonomic studies (e.g. Padial & De La Riva 2009) only two species of the group have had their calls described (Pombal *et al.* 1994; Verdade *et al.* 2008).

The pumpkin toadlet *Brachycephalus pitanga* Alves, Sawaya, Reis and Haddad, 2009, is a small orange diurnal frog (male SVL 10.8–12.1 mm, female 12.6–14.0 mm) that lives in high altitude forests of the Serra do Mar mountain range in Brazil. We observed and recorded calls of *B. pitanga* at its type locality (Alves *et al.* 2009; S 23°21'58", W 44°50'89") during a short field trip. Herein we describe the advertisement and territorial calls of *B. pitanga*.

We recorded individuals on February 9th and 10th between 06:00 to 10:00 h with a Marantz PMD 670 digital recorder coupled with a Sennheiser ME66 shotgun microphone, with a 44.1 kHz and 16 bits resolution. We were able to estimate sound pressure level of advertisement calls with the use of a sound source of known intensity. We analyzed data with Cool Edit Pro, and constructed sonograms with Sound Ruler (using a FFT size of 512 on both). Data is presented as mean  $\pm$  standard deviation.

Individuals only called under the leaf litter, and during recordings air temperature varied between 18–22°C (data from PESM-Santa Virgínia meteorological station). We recorded 14 specimens and placed recordings at Fonoteca Neotropical Jacques Vielliard, Unicamp, Brazil; FNVJ11119–FNVJ11133. However, we only used six advertisement and two territorial recordings on the analysis.

The advertisement call (Figure 1A, 1C) consists of low-intensity (56–66 dB at one meter recording distance; n = 4) pulsed notes uttered in a long series. We did not detect any macro organization on the advertisement call, probably due to the small duration of our recordings. Advertisement calls presented a number of pulses =  $11.1 \pm 1.2$ , note rate (notes/min) =  $159 \pm 11$ , pulse rate (Hz) =  $62 \pm 8$ , dominant frequency (kHz) =  $4.9 \pm 0.2$  and note duration (ms) =  $170 \pm 13$ .

Territorial calls (Figure 1A, 1D) preceded an agonistic encounter (Figure 1B), what helped us to insure proper call classification. The territorial call exhibits clusters of  $27 \pm 9$  notes per call, with a call duration of  $4.4 \pm 1.3$  seconds and calling rate of  $11.9 \pm 2.3$  calls per minute (n = 5; Figure 1A). While advertisement calls present little variation in pulse number within a recording, territorial calls starts with additional pulses (maximum of 7 pulses per note) that diminishes throughout the call, sometimes to a single pulse per note. The notes of the territorial call presented number of pulses =  $2.7 \pm 1.2$ , note rate (notes/min) =  $401 \pm 20$ , pulse rate (Hz) =  $48 \pm 16$ , dominant frequency (kHz) =  $5.3 \pm 0.2$  and note duration (ms) =  $45 \pm 19$ .

Overall, we found large differences in the pulse number, note rate and note duration between advertisement and territorial calls (Figure 1). The species exhibits advertisement calls with higher dominant frequencies than presented by *B. hermogenesi* (Verdade *et al.* 2008), and longer notes than *B. ephippium* (Pombal *et al.* 1994). Calling behavior could be important for taxonomy, as some species of the genus call on the leaf litter while others (such as *B. pitanga*) seem to call exclusively under it (Verdade *et al.* 2008). The vocalizations described here could aid in further studies of the genus' taxonomy, but unfortunately most species of the genus still await accurate call descriptions.