



The advertisement call of *Stumpffia be Köhler, Vences, D’Cruze & Glaw, 2010* (Anura: Microhylidae: Cophylinae)

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We describe the calls of *Stumpffia be Köhler, Vences, D’Cruze & Glaw, 2010*. This is the first call description made for a species belonging to the large-bodied northern Madagascan radiation of *Stumpffia* Boettger, 1881. *Stumpffia* is a genus of small (~9–28 mm) microhylid frogs in the Madagascar-endemic subfamily Cophylinae Cope. Little is known about their reproductive strategies. Most species are assumed to lay their eggs in foam nests in the leaf litter of Madagascar’s humid and semi-humid forests (Glaw & Vences 1994; Klages *et al.* 2013). They exhibit some degree of parental care, with the males guarding the nest after eggs are laid (Klages *et al.* 2013). The bioacoustic repertoire of these frogs is thought to be limited, and there are two distinct call structures known for the genus: the advertisement call of the type species, *S. psiloglossa* Boettger, 1881, is apparently unique in being a trill of notes repeated in short succession. All other species from which calls are known emit single, whistling or chirping notes (Vences & Glaw 1991; Vences *et al.* 2006).

A taxonomic revision of *Stumpffia* is currently underway (Rakotoarison *et al.* submitted) and it seems that this genus harbours the largest fraction of known but undescribed taxa of any frog genus in Madagascar (Vieites *et al.* 2009; Klages *et al.* 2013; Perl *et al.* 2014; Scherz *et al.* 2016a). Recently, a radiation of relatively large *Stumpffia* species was described from the north of the island (Köhler *et al.* 2010). These four taxa are unusual in their size and ecology, but no bioacoustic data are available from any of them (except the distress call of *S. staffordi* Köhler, Vences, D’Cruze & Glaw, 2010).

On 9 November 2014, MM discovered a single calling male of *Stumpffia be Köhler, Vences, D’Cruze & Glaw, 2010* in Ankarana National Park (formerly a Special Reserve) at 12.9571 S, 49.1182 E. The species could be unambiguously identified by its size and the bright orange inner legs of the specimen (Fig. 1a, b), which are unique to this species. In addition, the observation was made near the type locality. The specimen was not disturbed during the collection of call data. The air temperature at the time of recording was approximately 25°C.

The individual was filmed at a distance of ca. 10 cm using a Canon EOS 70D (with Canon EF 100 mm f/2.8 Macro USM lens mounted), with audio recorded through its built-in stereo microphone. Sampling rate was 48 kHz at 16-bit depth. Audio was separated from the video file for analysis in VLC media player v2.1.5 (VideoLAN Organization, Paris, France). Analysis was done in MATLAB v7.11.0.584 (The Mathworks, Inc. Natick MA, USA). Frequency information was obtained by performing a Discrete Fourier Transformation (DFT) with a Fast Fourier Transformation (FFT) algorithm in MATLAB. Spectrograms were calculated with a Hanning window length of 512 and overlap length of 510. The video recording is available at <https://youtu.be/ueMjgsBaR3g>.

The individual called for several minutes from a crack in the limestone karst (‘tsingy’) along a dry riverbed, but only 7.68 s were recorded, consisting of seven calls. Whilst calling, the individual remained stationary on its calling site with its single subgular vocal sac well distended. Spectrograms, waveforms, and a frequency spectrum of the call are presented in Fig. 1c–g. Estimated call parameters were as follows ($n = 7$ in all cases except inter-call and call intervals, where $n = 6$): fundamental frequency was 1957 ± 4 Hz (mean \pm standard deviation; range: 1952–1965 Hz); dominant frequency was 3912 ± 11 Hz (second harmonic; range: 3899–3928 Hz); call duration: 174 ± 3 ms (range: 170–179 ms); inter-call interval: 919 ± 84 ms (range: 784–1053 ms); call interval: 1071 ± 95 (range: 957–1233 ms). All calls exhibit an attenuation of call energy around the fifth harmonic (~10 kHz).

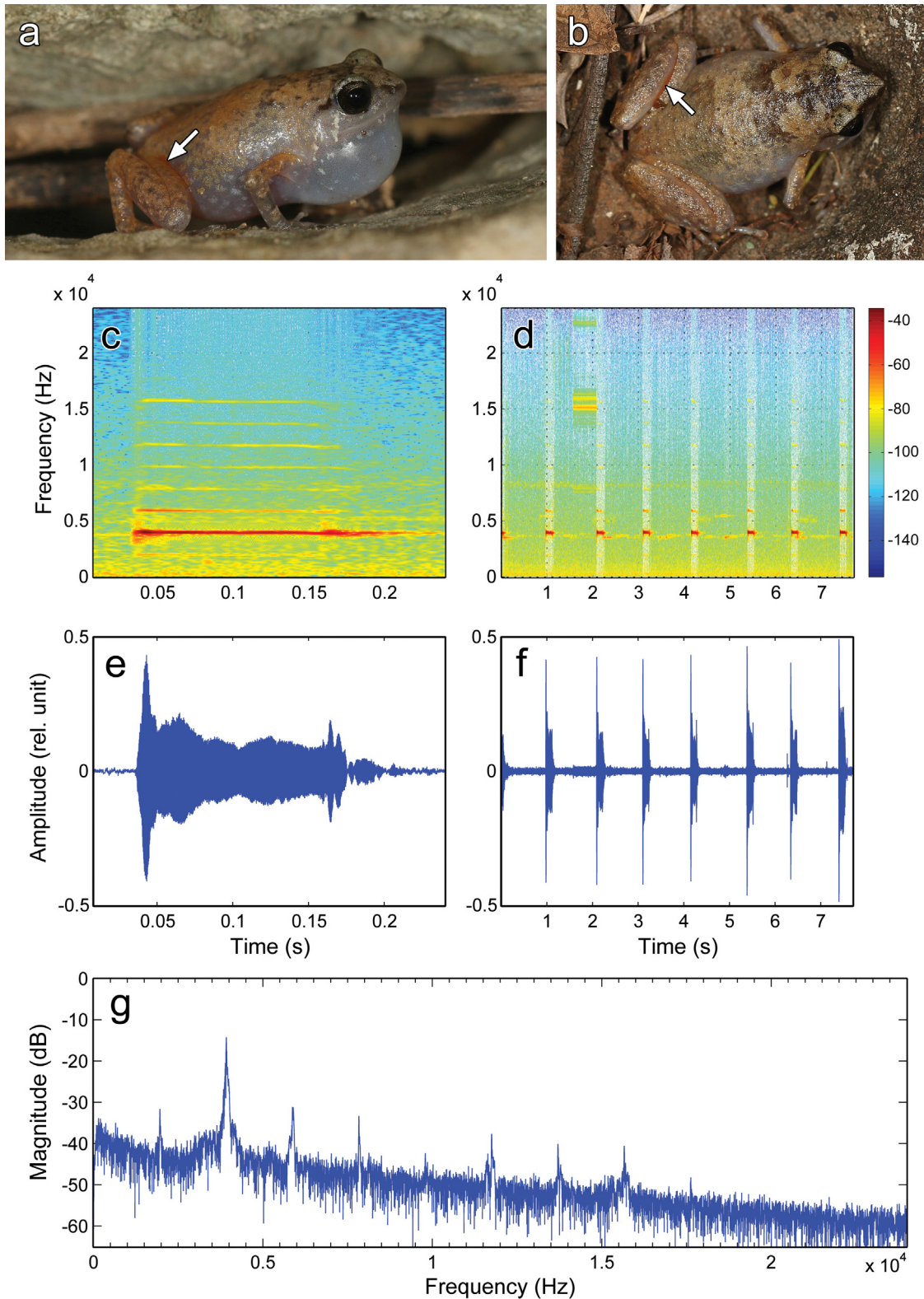


FIGURE 1. Calling specimen of *Stumpffia be* in (a) lateral and (b) dorsal view, with arrows indicating the diagnostic orangish-red colour on the hidden portions of the leg; Spectrograms of (c) a single call and (d) the full recorded call series; Waveforms (e) of a single call and (f) of the full recorded call; (g) Frequency spectrum of one call (FFT size 1024, Hanning window). (c), (e), and (g) refer to the same call (third in the series).

Two other species of *Stumpffia* currently under description (Rakotoarison *et al.*, submitted) co-occur in Ankarana (Vieites *et al.* 2009), and both can be distinguished from *S. be* by call parameters, size and coloration. Bioacoustics has

been shown to be highly valuable as a taxonomic tool in the Cophylinae (e.g., Ndriantsoa *et al.* 2013; Scherz *et al.* 2016b), but it is unfortunately rarely available, generally because calling individuals can be difficult to locate, and in *Stumpffia* in particular because they stop calling once disturbed or approached. However, as call databases expand, the possibility to use bioacoustics as a diagnostic taxonomic character source for this hyper-diverse, poorly known genus in the field increases.

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