

## The advertisement call of *Guibemantis pulcher*, a phytotelmic frog from Madagascar

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Frogs in the family Mantellidae form a species-rich radiation, endemic to Madagascar and Mayotte. Despite intensive field work and numerous taxonomic revisions in the past years, these amphibians are still incompletely known, with many undescribed species (Vieites et al., 2009) and only rudimentary data available on the natural history of many taxa. One mantellid subgroup, the subgenus *Pandanusicola* in

the genus *Guibemantis* (see Glaw and Vences, 2006), previously called the *Mantidactylus pulcher* group (see Blommers-Schlösser, 1979), is particularly poorly understood. Most *Pandanusicola* inhabit the leaf axils of *Pandanus* plants and their tadpoles develop within these phytotelmes. One remarkable exception is *Guibemantis liber* which breeds in ponds similar to species in the subgenus *Guibemantis*, but is genetically nested within the subgenus *Pandanusicola* (Lehtinen et al., 2007). This species has loud, conspicuous and relatively complex advertisement calls consisting of series of notes of variable structure (Vences et al., 2006), and its white subgular vocal sac is highly distensible. Many genetic lineages of *Pandanusicola* have been identified (Lehtinen et al., 2007), but revisionary work

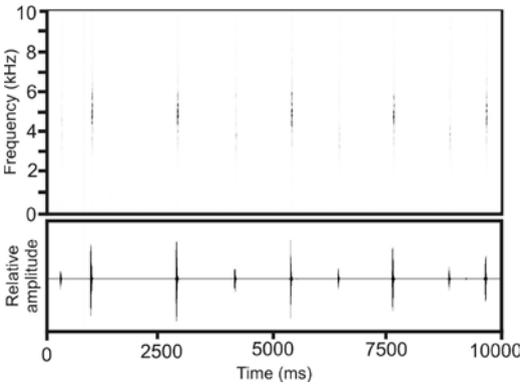
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**Figure 1.** Male of *Guibemantis pulcher* from the captive group that served for call recordings. The inset picture shows the ventral side, with white colour on the throat marking the vocal sac which is of paired subgular shape when inflated.



**Figure 2.** Sonagram and oscillogram of a part of the advertisement calls (note series) of two males of *Guibemantis pulcher* calling in alternation (the more and less intense calls corresponding to these two specimens, respectively).

on their taxonomy has begun only recently (Lehtinen *et al.*, 2011). Besides *G. liber*, advertisement calls, which generally are considered good taxonomic characters in frogs, have so far been reported from only very few *Pandanusicola* (Vences *et al.*, 2006) and the shape of the inflated vocal sacs of calling males was only described recently for two additional species (Lehtinen *et al.* 2011). Here we describe the calls and the shape of the inflated vocal sac of another species, *Guibemantis pulcher*.

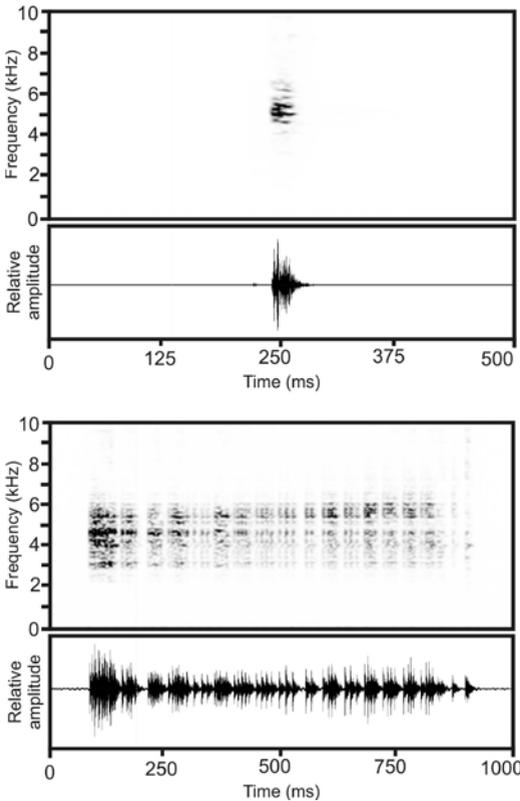
Several specimens were obtained from the pet trade in Germany in May 2011 (Fig. 1). They were assigned to *G. pulcher* based on their diagnostic coloration (translucent green body, with some reddish-brown markings on the flanks; Glaw and Vences, 2007) and on the basis of a partial sequence of the mitochondrial 16S rRNA gene (GenBank accession number JN039373) obtained from one of them using standard methods (e.g., Vieites *et al.*, 2009). Vocalizations were recorded inside a terrarium using an Edirol R-09 digital recorder with an internal microphone. Recordings obtained in May 2011 were saved as uncompressed files, re-sampled at 22.05 kHz and 16-bit resolution and computer-analysed using the software CoolEdit 98. Frequency information was obtained through Fast Fourier Transformation (FFT; width 1024 points). Spectrograms were obtained at Hanning window function with 512 bands resolution. Temporal measurements are given as range, with mean  $\pm$  standard deviation in parentheses.

Specimens were kept in a terrarium with two bromeliad plants with water-filled leaf axils and males started calling from the bromeliad leaves a few days after placement in the terrarium. Calls were heard mainly

during the day, especially in the afternoon. Calling specimens were sitting exposed on the upper side of the leaves, typically in horizontal position, with their head tilted upwards, and displaying their white vocal sacs that are clearly of paired subgular shape.

Calls (recorded at an air temperature of 26.5°C; Figs. 2-3) of highly motivated males consisted of a series of short chirping notes, whereas in a second group of frogs kept under different conditions, only single chirping notes were heard. Two analyzed series contained 6 and 8 notes. Note duration was 33-39 ms ( $33.8 \pm 3.0$  ms,  $n=10$ ), inter-note interval duration was 2458-4645 ms ( $3800 \pm 779$  ms,  $n=10$ ). In two males, calling simultaneously probably due to increased sexual motivation, the inter-note interval was reduced and had durations of approximately 1800-2500 ms (Fig. 2). Notes were unharmonious and usually without clearly separated pulses, although sometimes ca. 5-7 pulses were recognizable. Frequency ranged from 3500-6500 Hz, with a dominant frequency of 5300 Hz. When two males were calling simultaneously inside the same terrarium, a second note type was sometimes heard, which we interpret as a possible territorial call. Two of these notes had a rather clearly pulsed structure and durations of 843 ms (approx. 50 poorly defined pulses) and 882 ms, respectively. Frequency was distributed between 2800-6000 Hz, with a dominant frequency of 4730 Hz.

Our data confirm that *Pandanus*-breeding *Pandanusicola* species have rather inconspicuous calls of low complexity, typically consisting of short, unharmonious notes, which agrees with calls known from *G. annulatus*, *G. wattersoni*, and two forms assigned to *G. bicalcaratus* (Blommers-Schlösser, 1979; Vences *et al.*, 2006; Lehtinen *et al.*, 2011). The existence of a second call or note type was also described for *G. wattersoni* by Lehtinen *et al.* (2011). On the contrary, the only nominal species of *Pandanusicola* that breeds in open lentic bodies of water, *G. liber*, has much louder calls, emitted largely during the night, and its calls are typically composed of notes of different structure (see Vences *et al.*, 2006). It is important to note that the inflated vocal sac of *G. liber* is single subgular (Glaw and Vences, 2007), whereas *G. annulatus* and *G. wattersoni* have a paired subgular sac (Lehtinen *et al.*, 2011). An unpaired vocal sac has been reported for several species of *Pandanusicola* based on external examination of preserved specimens and this character state was considered typical for the whole subgenus (Blommers-Schlösser, 1979; Glaw and Vences, 2007).



**Figure 3.** Sonograms and oscillograms respectively of one note from an advertisement call (note series) (top). One note of the second type (call of possible territorial function) emitted during alternating calling of two males of *Guibemantis pulcher* (bottom).

Our observation of a clearly paired inflated vocal sac in *G. pulcher* suggests that paired vocal sacs might be widespread in this subgenus and allows us to speculate that other *Pandanus*-breeding frogs of the subgenus *Pandanusicola*, such as *G. bicalcaratus*, *G. albolineatus* and *G. punctatus*, may also have a paired vocal sac.

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