

Voice of a giant: bioacoustic data for *Mantidactylus guttulatus* (Amphibia: Mantellidae)

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The endemic radiation of mantellid frogs from Madagascar (Richards et al., 2000; Vences and Glaw, 2001; Vences et al., 2002) includes a large diversity in terms of morphological and ecological adaptations (Blommers-Schlösser and Blanc, 1991). The smallest species have adult snout-vent lengths of only 11–16 mm, while the two largest species reach more than 100 mm: *Mantidactylus guttulatus* (up to 120 mm) and *M. grandidieri* (up to 108 mm). In the large genus *Mantidactylus* (currently about 75 species in 12 subgenera), *M. guttulatus* is the type species of the subgenus and genus *Mantidactylus* (Andreone, in press). These giant Malagasy frogs are widespread in the rainforests of the island and are relative easy to observe. They are quite regularly consumed for food (under the local name of “radakabe” or “radaka”) and can be seen for sale on markets. However, their ecology is so far largely unknown. They are semiaquatic species living in small to medium-sized brooks and torrents but their reproductive behaviour, eggs, tadpoles and vocalizations remained undescribed except for the observation of large oocytes (4–5 mm) in dissected gravid females. Glaw and Vences (1994) described distress calls of *M. grandidieri* and hypothesized that, regarding advertisement calls, *M. guttulatus* may be a non-calling species. In this paper we describe for the first time the advertisement calls of a representative of the subgenus *Mantidactylus*.

Our observations were made in the Manarikoba forest in the Tsaratanana Massif in north-western Madagascar, at a campsite locally called Antsahamanara, at the occasion of a herpetological survey carried out on 4–9 February 2001. This site (located at 14°02'42" S/48°47'04" E; altitude ca. 1000 m above sea level) is characterized by steep slopes covered by primary rainforest, with small brooks (1–2 m width) flowing at the bottom of the valleys. Recordings were made using a Vivanco microphone connected to a Sony Professional Walkman WM D6C, digitised on a Pentium computer (sampling rate 32 kHz) and analysed using CoolEdit96 software (Syntrillium corp.). The call was not subjected to any filtering during recording or digitalization. After completion of call recordings the calling specimen was captured, euthanised by chlorobutanol solution, fixed in 5% formalin and preserved in 70% ethanol, and deposited in the collection of the Zoologische Staatssammlung München as ZSM 644/2001.

Table 1. Temporal characteristics of calls of *Mantidactylus guttulatus* from Antsahamanara (in milliseconds). All data refer to recordings of the same individual (ZSM 644/2001) on 7 February 2001, at 19°C water temperature and 20.5°C air temperature. *s*, standard deviation; *n*, number of measured units.

	Min	Max	Mean	<i>s</i>	<i>n</i>
Call duration [ms]	619	805	716.2	76.1	6
Pulse duration [ms]	7	21	15.5	3.5	31
Inter-pulse interval [ms]	24	38	29.1	3.4	30
Pulses per call	13	18	16.0	1.9	6

During our stay at Antsahamanara, we several times heard short and loud guttural sounds. The sounds were only heard at night. Approaching their presumed origin, we observed large specimens of *Mantidactylus guttulatus* or heard the splashing of large frogs jumping into the water. Close to our campsite, one male was observed several times at the same spot, close to a small natural pool in the brook of ca. 1.5-2 m in diameter and up to 20 cm depth, and the characteristic sounds were often heard from this area. On 7 February 2001 around 20 h we obtained recordings of these sounds. Because the specimen was very shy, it was necessary to remain motionless close to the pool during more than one hour before observing its calling behaviour. The vocal sac was subgular and slightly distensible. It could not be verified whether the vocal sac was single or possibly slightly bilobed, but a paired subgular state can be excluded. Searches in the more than 80 cm deep horizontal holes under the pool edge that probably had been partly washed out by the brook and that were used as refuge by the specimen resulted in no discovery of eggs or tadpoles. The collected specimen had a snout-vent length of 95.5 mm and very distinct, semicircular femoral glands of 19.0 mm length and 9.5 mm width. Femoral glands are typical for males of many species of *Mantidactylus* (Glaw et al., 2000), and their presence confirms that the specimen was mature.

The calls were recorded at an air temperature of 20.5°C and a water temperature of 19.0°C; because the specimen was partly sitting in shallow water, and partly on a log above the water, its body temperature can be estimated as 20°C. Calls (fig. 1) were short guttural blasts emitted singly or in pairs after long, irregular intervals of 27-71 seconds ($n = 3$), resulting in a call rate of 0.8-2.2 per minute. Calls consisted of single notes that were composed of unharmonious pulses, with a pulse rate of 21-23 per second. Temporal characteristics of the calls are summarized in table 1. The intensity and duration of notes increased during the beginning of the call and decreased again towards the end. Frequency ranged between 400 and 3100 Hz, dominant frequency was 700-1700 Hz. Between 1800-2800 Hz very low or no signal was recorded, so that the frequency band at 2800-3100 Hz gives the impression of a harmonic (fig. 1).

Our observation demonstrates that at least one species of the subgenus *Mantidactylus* is not mute but rather has very secretive calling habits. Single *M. guttulatus* calls at Tsaratanana were heard from different widely spaced sites along the brook, and the recorded specimen was seen and heard from exactly the same spot during at least four

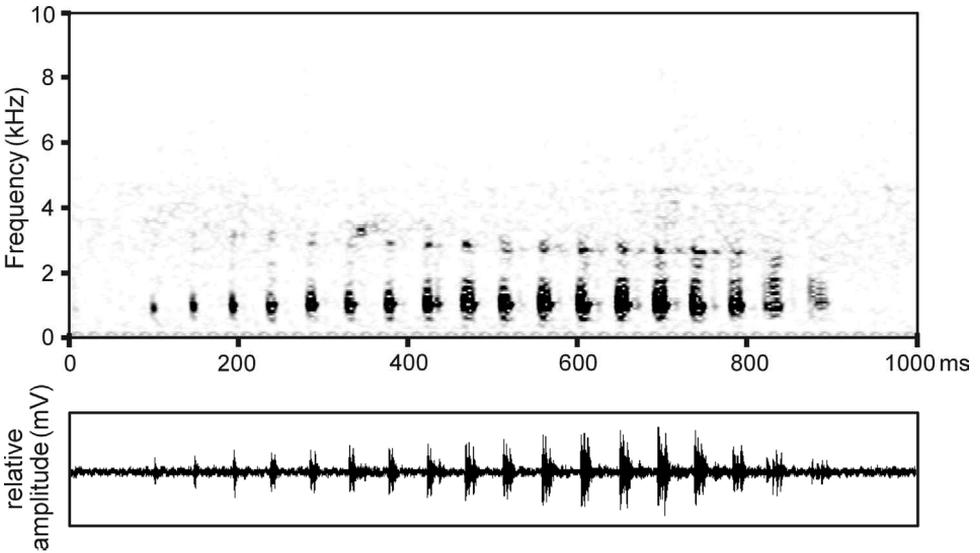


Figure 1. Sonogram and oscillogram of a call of *Mantidactylus guttulatus* (ZSM 644/2001), recorded on 7 February 2001 around 20 h, at 19°C water temperature and 20.5°C air temperature.

days. Specimens of *M. guttulatus* and *M. grandidieri* are usually seen in regular distances along brooks according to our observations, and we never saw aggregations of more than two adult individuals at the same spot. We therefore assume that males of these frogs have a rather territorial behaviour and do not form choruses.

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