

## Correspondence

Advertisement calls of two species of *Microhyla*  
(Anura: Microhylidae) from Borneo

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The microhylid genus *Microhyla* TSCHUDI, 1838 is distributed from India and Sri Lanka to China, Taiwan, and the Japanese Ryukyu Archipelago, and southeastwards to the Greater Sunda Islands, Bali, and the Philippine Sulu Archipelago. Currently, 30 species are considered valid (FROST 2009). Five species have been reported from Borneo (INGER & STUEBING 2005), but another, undescribed one has already been identified (*Microhyla* sp.; DAS et al. 2007, MALKMUS & DEHLING 2008). All but one (*M. berdmorei* [BLYTH, 1856]) of these species are endemic to the island. Due to their small size and the secretive lifestyle, species of *Microhyla* are comparatively rarely found during field work. In some places, however, certain species can be quite common. So far, there have been no bioacoustic studies of Bornean members of the genus except for an analysis of the call of a population of *M. berdmorei* from Northern Thailand (HEYER 1971).

During field work in Borneo from February to April 2009, I had the opportunity to record the advertisement calls of *Microhyla borneensis* PARKER, 1928 (Fig. 1) and *M. petrigena* INGER & FROGNER 1979 (Fig. 2), which are described in the following.

Calls were recorded with an Olympus LS-10 PCM digital stereo audio recorder at 96 kHz/24 bit as uncompressed wav-files. Recordings were analysed using Adobe Audition 1.5 software and Syrinx 2.6h sound analysis program (John Burt, www.syrinxpc.com). Temporal data were obtained from the oscillograms and frequency information was obtained from the audiospectrograms using Fast Fourier Transformation (1024 point Blackman window). Measurements are given as mean  $\pm$  standard deviation and range in parentheses. Definitions of acoustic parameters follow DUELLMAN & TRUEB (1986) and LITTLEJOHN (2001). Vouchers of males of both species are deposited in the collection of the Naturhistorisches Museum der Burgergemeinde Bern (NMBE), Switzerland.

*Microhyla borneensis* is a medium-sized member of the genus (SVL 17–21 mm in males, up to 23 mm in females; INGER & STUEBING 2005). It lives on the forest floor and breeds in small pools of standing water. I recorded the ad-

vertisement call of *M. borneensis* on the nights of the 8 to 10 April 2009 at the “frog pond” in the Kubah National Park near Kuching, Sarawak, Malaysia (01°36'23" N, 110°11'19" E, ca. 300 m above sea level). Air temperature was 23.5–24.7°C. A total number of 76 calls were analysed. Because males of *M. borneensis* called in a dense chorus, it was impossible to determine the exact number of calling males recorded. The chorus did not call continuously. After often long pauses, calling was initiated by a single male which induced the other members of the chorus to start calling as well. Bouts of calling lasted up to several minutes.

The short, rattling call consists of a single pulsed note and is emitted in series. Call repetition rate was  $1.2 \pm 0.1$  (1.1–1.4) per second. Notes consisted of  $5.7 \pm 1.1$  (4–8) pulses and lasted  $169 \pm 37$  (104–242) ms (Fig. 3.). Pulse length was  $6.7 \pm 0.5$  (6–7) ms. Pulse repetition rate was  $30.3 \pm 1.4$  (27.7–32.2) per second. There was no marked frequency modulation within and between the single pulses. Dominant frequency spectrum was at 1400–2900 Hz with an energy maximum at  $2404 \pm 94$  (2250–2530) Hz. The pulses in the middle of the note had a greater amplitude than the ones at the beginning and the end.

*Microhyla petrigena* is one of the smallest species of the genus (SVL 14–16 mm in males, 15–18 mm in females; INGER & FROGNER 1979). Adults live in the leaf litter of primary lowland rainforests. The species breeds in small pot-holes on rocky banks of streams and rivers.

On the night of 6 March 2009, I recorded the advertisement calls of six males of *M. petrigena* in the Batang Ai National Park, Sarawak, Malaysia, at rocky sidepools of the small stream that crosses the Bebyong trail after 200 m (01°18'08" N, 112°04'25" E, ca. 107 m above sea level). Air temperature was 24.1°C. The sidepools were used as breeding sites. Recently deposited clusters of eggs were found floating on their surfaces the following day and some tadpoles were collected from the pools. Breeding appears to occur only in certain nights. On the three nights following the night of the call recording I found no adult specimens near the sidepools nor anywhere else along the small stream.



Figure 1. Calling male of *Microhyla borneensis* in Kubah National Park, Sarawak, Malaysia.

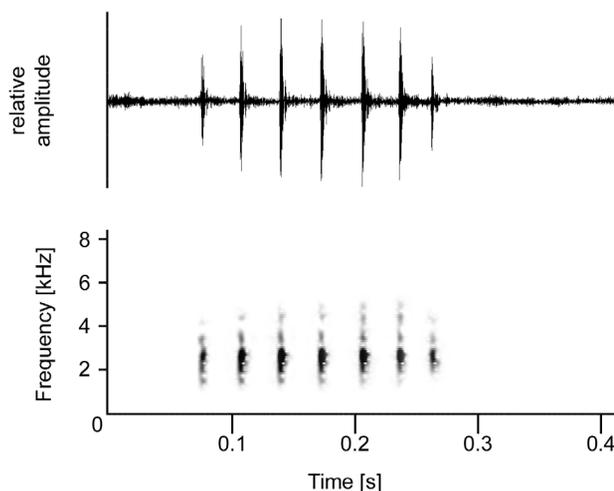


Figure 3. Oscillogram and corresponding spectrogram of an advertisement call of *Microhyla borneensis* recorded in Kubah National Park, Sarawak, Malaysia, at 23.5°C.



Figure 2. Male of *Microhyla petrigena* in Batang Ai National Park, Sarawak, Malaysia, in calling position.

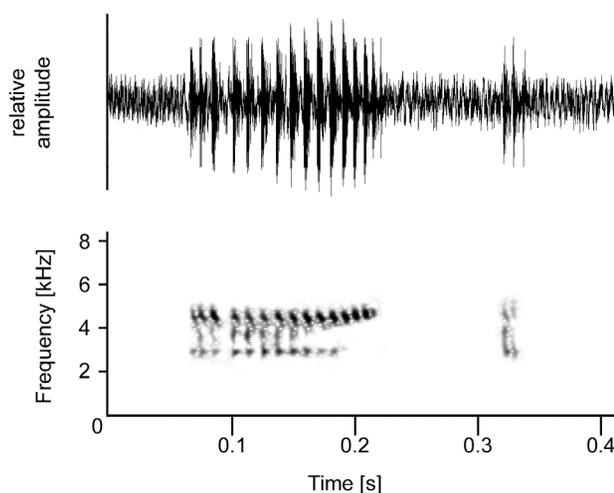


Figure 4. Oscillogram and corresponding spectrogram of an advertisement call of *Microhyla petrigena* recorded in Batang Ai National Park, Sarawak, Malaysia, at 24.1°C.

The advertisement call of *M. petrigena* is a single, pulsed note, emitted in short series. The longest series observed and recorded consisted of 15 calls. Call repetition rate within a series was  $0.66 \pm 0.08$  (0.52–0.83) per second. At the end of a call series, calls were repeated at a lower rate than at the beginning. The intervals between bouts of calling were variable, lasting up to several minutes. Notes consisted of  $12.1 \pm 3.0$  (6–17) pulses and lasted  $133 \pm 28$  (69–174) ms (Fig. 4). Average pulse repetition rate was  $89 \pm 5$  (80–100) per second. Pulse repetition rate tended to increase to up to 142 per second towards the end of long notes. Dominant frequency spectrum varied between and within individuals from 3800–4600 to 4500–5100 Hz. Energy maximum of the notes was at  $4430 \pm 322$  (3850–5050) Hz. Notes were not or only slightly frequency-modulated. In the latter case, the

frequency of the pulses at the end of the note was  $288 \pm 155$  (94–563) Hz higher than of those at the beginning. Prominent fundamental frequency was at 2600–3200 Hz. To approximately 65% of the calls, 1–3 additional short, pulsed secondary notes were added (Fig. 4). These consisted of 1–3 pulses, lasted 7–22 ms, and were repeated at a rate of  $8.4 \pm 1.1$  (6.2–10.1) per second. Frequency spectrum was similar to the main note, but the dominant frequency was in the range of the fundamental frequency in main notes. Length of the interval between the main note and the first additional note was  $111 \pm 22$  (92–206) ms.

The advertisement calls of a number of species of *Microhyla* have been analysed, mostly from Taiwan, the Ryukyu Archipelago, India, Vietnam, Thailand, and Peninsular Malaysia (HEYER 1971, DRING 1979, KURAMOTO 1987,

KANAMADI et al. 1994, ZIEGLER 2002, GROSSELET et al. 2004, KURAMOTO & JOSHY 2006). These calls are all composed of single pulsed notes, repeated in series.

The call of *Microhyla borneensis* is very similar to the call of *M. berdmorei*. The main difference is the lower dominant frequency (1500–1800 Hz) in calls of the latter (HEYER 1971). It is also similar to the human ear to calls of *Microhyla heymonsi* VOGT, 1911 from Peninsular Malaysia with the latter differing in a lower pulse repetition rate, higher number of pulses per note, and longer note duration (HEYER 1971, DRING 1979).

Interestingly, it is also very similar in duration, structure and frequency to the advertisement call of *Polypedates leucomystax* (GRAVENHORST, 1829). Both species occur sympatrically at the frog pond in Kubah National Park. The call of *P. leucomystax* differs in its pulse repetition rate (74/s), which is more than twice as high as in calls of *M. borneensis*. Furthermore, intervals between calls are much longer in *P. leucomystax* and usually last several minutes.

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