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The breeding behaviour, advertisement call and tadpole of *Limnonectes dabanus* (Anura: Dicroglossidae)

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Abstract

Fanged frogs (*Limnonectes*) are a group of dicroglossid frogs from Asia that often have reversed sexual dimorphism with larger males. *Limnonectes dabanus* is a poorly known species of fanged frog from forested habitats in southern Vietnam and eastern Cambodia. Adult males exhibit an extreme degree of megacephaly and possess bizarre head ornamentation. *L. dabanus* breeds in shallow, non-flowing or very slow-flowing pools, puddles, and drainage ditches. Eggs are laid as a widely spaced array, and the larvae have a morphology typical of pond-dwelling tadpoles. Although males of the species lack vocal sacs, they produce a low-pitched (0.4–0.6 kHz), single-note advertisement call that sounds like a drop of water falling into water. Given the spacing of calling males, presence of multiple females near breeding sites, and reversed sexual dimorphism, the mating system of *L. dabanus* may be an example of resource-defense polygyny, and the massive head of the male is likely used in male combat.

Key words: acoustics, amphibian, larvae, reproductive behaviour, Southeast Asia

Introduction

Frogs in the genus *Limnonectes*, also known as fanged frogs, are a group of dicroglossid frogs from Asia. The 61 currently known species of fanged frogs are distributed from southeastern China, southern Japan, and the Philippines south to the Sundas and Timor (Frost 2014). Many of the species in the genus have conserved morphology, and new species are continuously being revealed, particularly from within species complexes previously thought to be a single species (e.g., McLeod *et al.* 2011, 2012). The common name of the genus is derived from the presence of odontoid processes, or “fangs” on the lower jaw of both sexes. Many fanged frogs also have reversed sexual dimorphism, with larger males (unusual in frogs) that have longer and wider heads than females and hypertrophied jaw muscles (Inger 1966). Males often lack vocal sacs (Boulenger 1920; Inger 1954, 1966; Smith 1922).

Despite an awareness of the surprising number of breeding modes that have been reported for this genus—including viviparity (Iskandar & Tjan 1996), nest attendance (Brown and Iskandar 2000), and nidicolous development in nests (Rowley & Altig 2012)—details of breeding biology are lacking for most species. Additionally, previous studies have reported on male territoriality and combat in closely related congeners (Emerson 1992; Orlov 1997; Tsuji & Lue 1998).

Limnonectes dabanus (Smith 1922) is a charismatic and poorly known species known only from forested habitats on the Langbian Plateau, Lam Dong Province, Vietnam, and tributaries of the Mekong and Krông No rivers in Cambodia and southern Vietnam, below 900 m elevation (Frost 2014). Males have among the most extreme degree of megacephaly in the genus, with the head making up nearly half the body length. In addition, they are one of four species in which adult males have head ornamentation; a swollen ‘cap’, or caruncle on the top of

TABLE 1. Measurements of advertisement call parameters for *Limnnectes dabanus*. Parameter values are given as means (and ranges).

	AMS R 173235	Non-vouchered
Dominant frequency kHz	0.56	0.38
Call duration (ms)	149 (141–156)	190 (182–197)
Intercall interval (s)	7.6 (3.8–14.0)	6.9 (5.5–8.5)
Temperature (°C)	27.2	24.3

Discussion

Limnnectes dabanus breeds in shallow, non-flowing or slow-flowing pools, puddles, and drainage ditches. This breeding habitat is similar to the sympatric *L. kochangae* and some species in the *L. cf. kuhlii* complex (R. Altig & J. Rowley, pers. obs.). The advertisement calls of most *Limnnectes* species remain unknown, and some species have been reported to be voiceless (Emerson 1992). Although *L. dabanus* lacks vocal slits and a vocal sac (J. Rowley, pers. obs.), males produce an audible advertisement call. Because the call sounds like a water drop and has relatively low amplitude, it is possible that similar calls of related species have been overlooked.

At all three instances where males were observed calling, no other male *L. dabanus* were heard or observed in the vicinity. This, and the presence of two females near the first male (AMS R 173212/UNS 0288) suggests that males defend oviposition sites and possibly mate with multiple females. The mating system of *L. dabanus* may therefore be an example of resource-defense polygyny as has been suggested in congeners (Emlen & Oring 1977; Sullivan *et al.* 1995). The massive head of the species may be used in male combat, and male *Limnnectes* of other species have been reported to butt heads during combat (Orlov 1997; Tsuji & Matsui 2002). Indeed, it has been predicted that there is a positive correlation between the intensity of male-male combat and the degree of male-biased head dimorphism (Tsuji & Matsui 2002). If this is the case, male combat in *L. dabanus* may be among the most intense in the genus.

At this time we have no explanation for the placement of eggs on the rock ceiling. The structure of the site would not result in the chamber flooding more than a few centimeters. Based on known behaviours of other frogs, the ovipositional behaviour of ovipositing *Mixophyes* (Myobatrachidae; Anstis 2013; Hoskins 2008) present a possible option. After egg deposition, these females kick the eggs onto nearby moist, terrestrial surfaces well above the water surface. If this were the case, the eggs on the floor either fell off the ceiling or were merely scattered about by the female's actions.

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