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A striking new species of phytotelm-breeding tree frog (Anura: Rhacophoridae) from central Vietnam

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Abstract

We describe a distinctive new species of phytotelm-breeding rhacophorid frog from central Vietnam. *Gracixalus lumarius* sp. nov. is distinguished from all other rhacophorids in Indochina by a combination of (1) medium body size (adult males 38.9–41.6 mm; adult female 36.3 mm), (2) dorsum brown diurnally and yellow nocturnally, (3) venter pink, (4) tympanum and supratympanic fold indistinct (5) iris dark gold with a dense, relatively uniformly distributed network of black reticulations, (6) dorsum with distinctive white conical tubercles in males, and (7) eggs deposited on wall of a phytotelm. The new species is known from montane bamboo and montane evergreen forest in Ngoc Linh Nature Reserve in Kon Tum Province, between ~1845–2160 m elevation.

Key words: Amphibian, montane, Southeast Asia

Introduction

The family Rhacophoridae contains over 300 species of mostly arboreal frogs distributed throughout Sub-Saharan Africa, China, Southeast Asia, Japan, Taiwan, the Philippines, and the Greater Sunda Islands (Frost 2014). At present, ten genera of rhacophorids occur in Indochina; *Chiromantis* Peters, *Feihyla* Frost, *Gracixalus* Delorme, *Kurixalus* Yet *et al.* *Nytixalus* Boulenger, *Philautus* Gistel, *Polypedates* Tschudi, *Pseudophilautus* Laurent, *Rhacophorus* Kuhl & van Hasselt, and *Theloderma* Tschudi. Due to the high species diversity and morphological conservatism, infrageneric classification has been controversial. The validity, species composition, and evolutionary relationships within and among genera remain unclear.

During field work at high-elevations in central Vietnam, we discovered a medium-sized phytotelm-breeding rhacophorid superficially resembling *Gracixalus* ‘Clade II’ of Rowley *et al.* (2011), but with a distinctive tuberculate dorsal texture and striking yellow dorsal and pink ventral nocturnal colouration. Here we describe this charismatic species as new.

Materials and methods

Specimens were deposited at the Australian Museum (AMS). Some specimens currently at the AMS will be deposited at the University of Science, Ho Chi Minh City (UNS) and have been cross-catalogued at both institutions. In these instances, voucher numbers are reported as UNS/AMS. We recorded morphological data from adult specimens fixed in 10% formalin and then stored in 70% ethanol and eggs fixed in 10% formalin and stored in 5% formalin. Morphometric data were taken (to the nearest 0.1 mm) with digital callipers. Measurements include snout-vent length (SVL); head length from tip of snout to rear of jaws (HDL); head width at commissure of

Frogs that breed in phytotelmata represent only ~2% of currently recognized anuran taxa (Lehtinen *et al.* 2004). Within the family Rhacophoridae, at least nine species of obligate phytotelm breeders with free living larvae are known (Lehtinen *et al.* 2004). These species currently fall within the genera *Chiromantis*, *Kurixalus*, *Nyctixalus* and *Theloderma*. Although tadpoles were not observed, *Gracixalus lumarius* **sp. nov.** is almost certainly an obligate phytotelm breeder and has free-living tadpoles, given the observed oviposition above water, and relatively small, pigmented ova (R. Altig pers. comm). Phytotelm breeding is generally interpreted as a strategy to avoid predation, competition, or unfavourable abiotic conditions in the ancestral water body (Crump 1982; Duellman & Trueb 1986). However, the relatively high availability of water-filled tree-holes and rarity of streams or pools above 1800 m in the study area may indicate that the species is simply taking advantage of the most available water source.

The distinctive, white conical asperities on the dorsum of the new species are unique among known species in the family Rhacophoridae, however similar conspicuous asperities on the dorsum of males are known in some species of *Afrixalus* (Hyperoliidae), *Boophis* (Mantellidae), and *Osteocephalus* (Hylidae). Previous authors have speculated that sexual dimorphism in skin texture may facilitate sex recognition in frogs (Jungfer & Hoedl 2002), and at least in *Osteocephalus*, males only display tuberculate dorsal skin with keratinized spicules during the breeding season, while females have a more or less smooth dorsum (Jungfer *et al.* 2013). Based on the type series, it appears that only male *Gracixalus lumarius* **sp. nov.** have a tuberculate dorsum with distinctive, white conical asperities, and that the size of asperities may be associated with breeding readiness. The male holotype collected in the dry season (April) with distinct nuptial pads and found with conspecific eggs also had the most distinctive asperities. In contrast, the two adult males collected in the wet season (July), had no distinct nuptial pads and less obvious (but still very distinct) white conical asperities, suggesting that the asperities remain present but are less distinct in the non-breeding season.

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APPENDIX. Comparative material examined.

- Gracixalus* cf. *ananjevae*: Vietnam, Nghe An Province, Pu Hoat Proposed Nature Reserve (VNMN 03012).
- Gracixalus* cf. *jinxuensis*: Vietnam, Nghe An Province, Pu Hoat Proposed Nature Reserve (AMS R 173454).
- Gracixalus gracilipes*: Vietnam, Ha Giang Province (AMNH A163894–163898, 5 adult males).
- Gracixalus supercornutus*: Vietnam, Quang Nam Province, Song Thanh Nature Reserve (AMS R 171537–171539). Vietnam, Kon Tum Province, Ngoc Linh Nature Reserve (AMS R 173735, UNS 00353/AMS R 173839, UNS 00354/AMS R 173840, AMS R 173886–173888, AMS R 173395, AMS R 173396).
- Gracixalus quangi*: Vietnam, Nghe An Province, Pu Hoat Proposed Nature Reserve (AMS R 173410–173420, 173422–173423, NCSM 78277, VNMN 03000–03010).
- Rhacophorus orlovi*: Vietnam, Nghe An Province, Pu Mat National Park (AMS R 171731–171735).
- Rhacophorus robertingeri*: Vietnam, Kon Tum Province, Ngoc Linh Nature Reserve (AMS R 173193, 173609–173611, 173614, 173641).
- Rhacophorus rhodopus*: Vietnam, Binh Thuan Province, Nui Ong Nature Reserve (AMS R 173327, AMS R 173328, UNS 00419/AMS R 173329).