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# Two new species of fanged frogs from Peninsular Malaysia (Anura: Dicroglossidae)

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## Abstract

Taxonomic status of fanged frogs from the Peninsular Malaysia, previously assigned to *Limnonectes kuhlii*, is assessed using genetic and morphological approaches. Phylogenetic relationships inferred from sequences of the mitochondrial and nuclear genes revealed that the fanged frogs from the Peninsula form a monophyletic group and are clearly divergent from other species previously, or even now, assigned to *L. kuhlii* from Mainland Southeast Asia. In both mtDNA and nuDNA phylogeny, the Malay Peninsula clade diverges into two lineages, one from north (Larut Hill, Perak, and Hulu Terengganu, Terengganu) and another from south (Genting Highlands, Pahang, and Gombak, Selangor). These lineages are separated by large genetic distances, comparable with those observed between some other species of *L. kuhlii*-like frogs. Although the two lineages are very similar morphologically, they are distinguishable in several morphological traits and are considered heterospecific. We therefore describe them as *L. utara* **sp. nov.** and *L. selatan* **sp. nov.** These new species differ from all other species of *kuhlii*-like frogs from Mainland Southeast Asia by the surface of tibia, which is densely covered by large warts.

**Key words:** *Limnonectes*, mitochondrial DNA, nuclear DNA, phylogeny, new species, Malaysia, biogeography

## Introduction

Recent studies on fanged frogs that were long assigned to a single species, *Limnonectes kuhlii* (e.g. Boulenger 1920; Inger 1966), have revealed that this 'species' is composed of at least six distinct species in mainland Southeast Asia: Ye & Fei (1994) and Ye *et al*. (2007) described Chinese populations as *L. fujianensis* and *L. bannaensis*, while McLeod (2008), McLeod *et al.* (2012) and Matsui *et al*. (2010b) described Thai populations as *L. megastomias*, *L. taylori*, *L. jarujini*, and *L. isanensis*. In contrast, the taxonomic status of populations occurring on the Peninsular Malaysia (Berry 1975) remains undetermined. Because the region connects Thailand and Sunda islands, where there are many more undescribed species of *L. kuhlii*-like frogs (Matsui *et al*. 2013; Matsui and Nishikawa, 2014; Matsui *et al*. 2014), it is necessary to clarify exact status of the Peninsular Malaysia populations in both a taxonomic and geographical sense so as to discuss various issues concerning biodiversity and biogeography of this region.

In this study, we examine samples of fanged frogs hitherto called *L. kuhlii* from Peninsular Malaysia using mitochondrial (mt) DNA and nuclear (nu) DNA sequence data, and morphological data to determine their taxonomic status.

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