



## Systematic reassessments of fanged frogs from China and adjacent regions (Anura: Dicroglossidae)

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### Abstract

Systematic relationships of fanged frogs usually associated with *Limnonectes kuhlii* are assessed using 15 samples from Japan, Chinese Mainland and Taiwan, Vietnam, Laos, Thailand, Malaysia (Borneo), and Indonesia. Phylogenetic relationship inferred from the mitochondrial 12S rRNA, tRNA<sup>val</sup>, and 16S rRNA gene sequences revealed that fanged frogs sampled are not monophyletic with the topotypic *L. kuhlii* from Java. Samples from Yunnan of southern China (*L. bannaensis*), northern Laos and central Vietnam, and those from Jiangxi of eastern China (*L. fujianensis*), Taiwan and Japan (*L. namiyei*), respectively, form monophyletic groups, and are collectively sister to the Thai sample (*L. megastomias*). All these samples, *L. fragilis* from Hainan of southern China, and a group of Bornean samples show unresolved relationships with Javanese *L. kuhlii*. From the resultant phylogeny and genetic distances found among samples, *L. "kuhlii"* from Taiwan and *L. fujianensis*, and *L. "kuhlii"* from northern Laos and central Vietnam and *L. bannaensis*, respectively, are surmised to be conspecific. These fanged frogs are morphologically similar to, but phylogenetically distant from, *L. kuhlii* sensu stricto. *Limnonectes namiyei*, *L. fujianensis*, and *L. bannaensis* are considered to have a common ancestor whose chromosome number was  $2n=22$ , unlike *L. fragilis*, *L. kuhlii* and many other frogs with  $2n=26$  chromosomes.

**Key words:** *Limnonectes*; mitochondrial DNA; phylogeny; species identity; Taiwan; Laos; Vietnam; chromosome

### Introduction

Recent studies on amphibians in various parts of the world have revealed that there are few single species in the tropics that are really wide-ranging in distribution (e.g. Wynn & Heyer 2001; Fouquet *et al.* 2007) while most amphibian species have quite small distribution areas. Frogs from the Oriental region are no exception, and presence of cryptic species has been increasingly reported in many lineages (e.g. *Polypedates leucomystax* [Gravenhorst]: Matsui *et al.* 1986; *Kalophrynus pleurostigma* Tschudi: Matsui *et al.* 1996; *Fejervarya limnocharis* [Gravenhorst]: Toda *et al.* 1998; *Microhyla ornata* [Duméril & Bibron]: Matsui *et al.* 2005; *Euphlyctis cyanophlyctis* [Schneider]: Alam *et al.* 2008; *Rana chalconota* [Schlegel]: Inger *et al.* 2009). There still remain, however, many species whose taxonomic status should be examined. One example is the fanged frogs that have long been assigned to a single species *Limnonectes kuhlii* (e.g. Boulenger 1920; Inger 1966).