



Paraphyly of Chinese *Amolops* (Anura, Ranidae) and phylogenetic position of the rare Chinese frog, *Amolops tormotus*

HONG-XIA CAI^{1,2}, JING CHE², JUN-FENG PANG², ER-MI ZHAO^{1,4} & YA-PING ZHANG^{2,3,4}

¹Key Laboratory of Bio-resources and Eco-environment (Ministry of Education), College of Life Sciences, Sichuan University, Chengdu, China, 610064

²Laboratory of Cellular and Molecular Evolution, Kunming Institute of Zoology, the Chinese Academy of Sciences, Kunming, China, 650223

³Laboratory for Conservation and Utilization of Bio-resources, Yunnan University, Kunming, China, 650091

⁴Corresponding authors. E-mail: zhangyp1@263.net.cn; zem006@163.com

Abstract

In order to evaluate the five species groups of Chinese *Amolops* based on morphological characteristics, and to clarify the phylogenetic position of the concave-eared torrent frog *Amolops tormotus*, we investigated the phylogeny of *Amolops* by maximum parsimony, Bayesian Inference, and maximum likelihood methods using two mitochondrial DNA fragments (12S rRNA, 16S rRNA). Our results supported a sister group relationship of *Amolops ricketti* and *Amolops hainanensis*. However, the grouping of *Amolops mantzorum* and *Amolops monticola* needs to be resolved with more data. *Amolops tormotus* was nested in genus *Odorrana*. Thus, recognition of the *A. tormotus* group is unwarranted and *A. tormotus* should be referred to genus *Odorrana* as *O. tormota*. This species is the sister group of *O. nasica* plus *O. versabilis*. The new classification implies that the genus *Wurana* is to be considered as junior subjective synonym of *Odorrana*.

Key words: phylogeny, mitochondrial DNA, *Amolops*, *Amolops tormotus*, *Odorrana tormota*

Introduction

Among the Southeast Asian ranids, *Amolops* Cope, 1865 (sensu lato: Dubois, 1992) is characterized by the presence of an abdominal sucker in tadpoles and its peculiar occurrence in torrents. Since the taxonomy of this group was questioned (Inger, 1966), significant advances have been achieved in the past few years.

Yang (1991a) recognized three distinct genera including *Amolops* Cope, 1865, *Huia* Yang, 1991, and *Meristogenys* Yang, 1991. Later, Yang (1991b) united these genera into the subfamily Amolopinae within the Ranidae. However, Dubois (1992) did not accept these taxonomic schemes and merely relegated Yang's three genera as subgenera within his genus *Amolops*, along with the subgenus *Amo*. In China, Jiang et al. (1997) added *Pseudoamolops* to the Amolopinae, with *Rana sauteri* as the type species. However, the monophyly of *Amolops* or Amolopinae was not independently verified using molecular data until very recently (e.g., Matsui et al., 2006; Ngo et al., 2006; Frost et al., 2006).

Most species of *Amolops* sensu stricto, the type genus of Amolopinae (Yang, 1991b) or subgenus of *Amolops* sensu lato (Dubois, 1992), are distributed in China (Yang, 1991a; Frost et al., 2007). They are divided into five groups: *A. tormotus*, *A. monticola*, *A. mantzorum*, *A. marmoratus* and *A. hainanensis* groups (Fei et al., 2005). Matsui et al. (2006) and Ngo et al. (2006) studied some Chinese species of *Amolops*. However, data were lacking for the *A. tormotus* group.

The concave-eared frog *A. tormotus*, initially classified as *Rana tormotus* by Wu (1977), has ultrasonic