Zootaxa 2496: 49–62 (2010)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Species boundaries in the *Rana arfaki* group (Anura: Ranidae) and phylogenetic relationships to other New Guinean *Rana*

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Abstract

Allozyme electrophoresis is used to explore molecular genetic relationships within the *Rana arfaki* group and between this group and selected lineages of New Guinean *Rana*. *Rana jimiensis* is confirmed as a species distinct from *R. arfaki* and its range in Papua New Guinea is extended to the Southern Highlands Province and the north-coastal ranges in Sandaun Province. *Rana arfaki* and *R. jimiensis* show a high level of genetic differentiation maintained across a wide geographic area and show consistent morphological differences in head shape, tympanum size, degree of digital disc dilation and extent of sexual dimorphism. The two species occur syntopically on the Papuan Plateau, Southern Highlands Province, and are regionally sympatric in Sandaun Province. The observed level of genetic differentiation is equivalent to that reported previously between regionally sympatric members of the *Rana papua* group. Populations of *R. jimiensis* from north and south of the central cordillera show no obvious morphological and only minor genetic differentiation. In contrast, *R. arfaki* shows considerable geographic variation in both morphology and allozymes and may include two or more regionally distinctive forms.

Key words: Allozyme electrophoresis; Anura; frog; morphology; *Rana*; taxonomy; New Guinea

Introduction

New Guinean representatives of the vast and complex *Rana* Linnaeus, 1758 were last systematically reviewed by Menzies (1987) who recognised a total of ten species on the New Guinean mainland, and four other species on islands to the east and west. Menzies placed these species into two major groups, based on their apparent biogeographical affinities. One group of three eastern Indonesian species was regarded as having Asian affinities, with only "*Rana" grunniens* Daudin, 1801 extending to mainland New Guinea. The remaining eleven species were identified as an essentially "Papuan" assemblage, with one species extending west to Timor. Recently a further three species have been described from New Guinea (Günther 2003, Kraus and Allison 2007).

Menzies (1987) further divided the "Papuan" *Rana* into two groups. The first, designated the *Rana papua* group, was characterized by a slender build, raised dorso-lateral folds, mainly smooth skin and toes webbed to a varying degree but at least the terminal phalanx on the longest toe (the 4th) free of webbing. The second group was unnamed (hereafter referred to informally as the *Rana arfaki* group) but contained *Rana arfaki* Meyer, 1874 and "its sibling" *R. jimiensis* Tyler, 1963. The latter species are characterized by large size and heavy build, warty skin, lack of a dorsolateral fold and fully webbed toes.

Although Menzies (1987) retained *R. jimiensis* as a valid species, he expressed some doubt regarding its distinction from *Rana arfaki*. Tyler's (1963) original description, based on a single adult female from Manjim, Ganz River, Central Highlands of Papua New Guinea, emphasized the relatively broad head, relatively short tibiae and dilated toe discs of *R. jimiensis*, as well as its smaller, partially tubercular tympanum. Tyler (1963)

Accepted by M. Vences: 6 May 2010; published: 7 Jun. 2010