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Larval morphology and ontogeny of *Nasikabatrachus sahyadrensis* Biju & Bossuyt, 2003 (Anura, Nasikabatrachidae) from Western Ghats, India

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Abstract

The external, oral and buccopharyngeal morphologies of *Nasikabatrachus sahyadrensis* tadpoles were studied using stereoscopic and scanning electron microscopy. Using DNA barcodes, taxonomic identity of the tadpoles was established and tadpoles of *N. sahyadrensis* were reared in semi-natural conditions. Development in the species from hatching to metamorphosis was prolonged and it took about 100 days for the freshly hatched larvae to metamorphose. The tadpoles are exotrophic, torrent dwelling with a large ventral suctorial oral disc, broadly rounded snout, cylindrical body, and a funnel shaped vent tube opening medially. During development external and buccopharyngeal characters show extensive changes. During metamorphosis developmental asynchrony was observed.

Key words: Rheophilous tadpoles, Western Ghats, developmental stages, Scanning Electron Microscopy

Introduction

The rate of species discovery in amphibians is not at a comparable pace with the progress in resolving amphibian systematics. This could be attributed to extensive homoplasy of morphological characters during the diversification of amphibian lineages (Wake 1991). Most anurans are characterized by an aquatic larval stage, the tadpole, which has numerous morphological and ontogenic characters that could be used in resolving phylogeny (Orton 1957; Haas 2003; Grosjean *et al.* 2004). Though the significance of the larval morphology in anuran systematics has been explored since the 20th century (Noble 1931; Orton 1957; Sokol 1975; Sokol 1977), larval characters in comparative anuran phylogenetics were used only recently (Haas 1997, Larson & De Sá 1998; Maglia *et al.* 2001; Larson *et al.* 2003; Haas 2003). However tadpole morphologies of many anuran taxa remain poorly explored (Grosjean *et al.* 2011). A particular challenge to anuran systematists in the present scenario would be to characterize larval morphology of various anuran taxa and to make use of these characters to improve the empirical basis for phylogenetic reconstructions. Exploring larval morphology and ontogeny presents an opportunity to document new morphological characters in anurans (Larson 2005).

Unlike most anuran discoveries, the purple frog, *Nasikabatrachus sahyadrensis* (Biju & Bossuyt 2003; Dutta *et al.* 2004; Aggarwal 2004) attracted the attention of the scientific community. However, it did not stimulate investigation into the life history of the species, with the exception of Raj *et al.* (2011). This species was first known from a description of its larva “*incertae sedis*” of the family Cystignathidae by Annandale & Rao (1917). When *N. sahyadrensis* was described based on adults, no mention was made of the earlier work on the tadpoles that were assigned to as *N. sahyadrensis* by Das (2007). Annandale (1918) examined the tadpoles collected by Rao and placed it as *incertae sedis* after providing a detailed description of morphological features of the tadpole at Gosner stage 38. He also tentatively assigned it to the family Cystignathidae. This tadpole has been referred to as a remarkable example of “parallel evolution” of oral sucker between fishes and tadpoles in the mountain streams and