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Systematics of the endangered toad genus *Andinophryne* (Anura: Bufonidae): phylogenetic position and synonymy under the genus *Rhaebo*

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Abstract

Bufonidae is one of the most diverse amphibian families. Its large-scale phylogenetic relationships are relatively well understood with the exception of few Neotropical genera that may have diverged early in the evolution of the family. One of those genera is *Andinophryne*, a poorly known group of three toad species distributed in the western slopes of the Andes of northern Ecuador and southern Colombia. Their phylogenetic position is unknown due to lack of genetic data. We estimated a new phylogeny (over 200 species) of the family Bufonidae based on DNA sequences of mitochondrial and nuclear genes to assess the phylogenetic position of *Andinophryne* based on recently collected specimens of *A. colomai* and *A. olallai* from Ecuador and Colombia. We also examined external and internal morphology of *Andinophryne* to explore its congruence with the new phylogeny. The mtDNA and nuclear phylogenies show that *Andinophryne* is embedded within *Rhaebo*, a genus that belongs to a large clade characterized by the presence parotoid glands. Morphological characters confirmed the affinity of *Andinophryne* to *Rhaebo* and a close relationship between *Andinophryne colomai* and *Andinophryne olallai*. *Rhaebo* was paraphyletic relative to *Andinophryne* and to solve this problem we synonymize *Andinophryne* under *Rhaebo*. We discuss putative morphological synapomorphies for *Rhaebo* including *Andinophryne*. We provide species accounts for *R. atelopoides* new comb., *R. colomai* new comb. and *R. olallai* new comb. including assessments of their conservation status. We suggest that the three species are Critically Endangered. Their altitudinal distribution and association with streams are characteristic of endangered Andean amphibians.

Key words: Bufonidae, Colombia, conservation status, Ecuador, *Rhaebo*, synonymy, systematics

Resumen

Bufonidae es una de las familias de anfibios más diversas. Sus relaciones filogenéticas a gran escala están relativamente bien entendidas, con la excepción de algunos géneros Neotropicales que pueden haber divergido temprano en la evolución de la familia. Uno de esos géneros es *Andinophryne*, un grupo pobremente conocido de tres especies de sapos distribuidos en la vertiente occidental de los Andes en el norte de Ecuador y el sur de Colombia. Su posición filogenética es desconocida por falta de datos genéticos. Estimamos una nueva filogenia (casi 200 especies) de la familia Bufonidae basada en secuencias de ADN de genes mitocondriales y nucleares para evaluar la posición filogenética de *Andinophryne* utilizando especímenes recientemente colectados de *A. colomai* y *A. olallai* en Ecuador y Colombia. También examinamos la morfología externa e interna de *Andinophryne* para explorar su congruencia con la nueva filogenia. Las filogenias con los ADN mitocondriales y nucleares mostraron que *Andinophryne* está anidado dentro de *Rhaebo*, un género que pertenece a un clado grande caracterizado por la presencia de glándulas parotoideas. Los caracteres morfológicos confirmaron la afini-

diversification patterns within Bufonidae because there is a marked difference in diversification rates between *Rhaebo* and the other bufonids with parotoid glands.

An additional synapomorphy for *Rhaebo* seem to be the coloration pattern of juveniles. With few exceptions (e.g. *R. haematiticus*), juveniles of *Rhaebo* have dorsal coloration consisting of a dark background with contrasting thin clear stripes or dots (Figs. 3–4). This coloration pattern, which disappears in the adults, is absent in other bufonids suggesting that it is derived in *Rhaebo* (see also Mueses-Cisneros 2008 and Mueses-Cisneros 2009: Fig 3).

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