UNIVERSITY OF SOUTHERN CALIFORNIA
THE GRADUATE SCHOOL

ORAL EXAMINATION

OF

ROY WALLACE McDIARMID
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FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY
(BIOLOGY)

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HANCOCK SUITE
ALLAN HANCOCK FOUNDATION

DISSertation COMMITTEE
Professor Savage, Chairman
Professor Hyman
Professor Naffaktitis
Professor Wright
Professor Hogue
OUTLINE OF GRADUATE STUDIES

Major: Biology

Invertebrate Zoology
Ichthyology
Special Problems in Biology
Seminar (Zoogeography)
History of Biology
Ornithology
Seminar (Tropical Biology)
General Entomology
General Embryology
Seminar (Vertebrate Speciation)
Biology of Tropical Vertebrates
Evolutionary Osteology

Zimmer
Savage
Savage
Savage
Mohr
Stager
Savage
Hogue
Kluge
Savage
Hooper
Savage

Supplementary Studies

General Biochemistry

Saltman

PUBLICATIONS


Atelopodid frogs are one of the most diverse groups of Neotropical Anura. As previously delimited, the group includes approximately 40 species in five genera, Atelopus, Dendrophryniscus, Melanophryniscus, Oreophrynella and Brachycephalus. Their systematic status and evolutionary history are poorly understood. The purpose of this study was to analyze available knowledge of the morphology and biology of these frogs in order to clarify their evolutionary relationships and history.

Representative specimens of all genera and most species were examined. Information concerning myology, osteology, and reproductive morphology was gathered. All available literature was reviewed and pertinent information was assimilated into this report.

Detailed descriptions of thigh and jaw musculature and osteology of the five genera are presented. Skulls, pectoral girdles, and hyoid apparatuses are described and illustrated. Components of the auditory apparatus, certain aspects of their external morphology, reproductive biology and ecology are described.

Each genus is defined according to 43 characters. Their geographical distributions are stated briefly and their included and referred species are listed. Atelopus minutus Melin and Atelopus proboscideus Boulenger are placed in the genus Dendrophryniscus. Atelopus rubriventris Vellard is placed in the genus Melanophryniscus.

Brachycephalus is discussed in detail and is shown not to be closely related to the other genera. It is compared with other frog families and shown to be closest to the Leptodactylidae and Dendrobatidae. Arguments are presented for its recognition as a separate family, the Brachycephalidae, which is redefined.

The remaining four genera are discussed and their character states compared. Melanophryniscus has the greatest number of primitive states and the least number of advanced states and is probably most similar to the ancestral stock. Atelopus also has many primitive states but possesses the greatest number of advanced states. Atelopus and Melanophryniscus were derived from the same lineage, but Atelopus has undergone a significant radiation at the species level and exhibits several advancements not found in the other genera. Dendrophryniscus was derived from the Melanophryniscus line. Oreophrynella has more advanced character states than either Melanophryniscus or Dendrophryniscus and only one less than Atelopus. However, Oreophrynella has the highest number of unique states and the lowest number of primitive states. Oreophrynella apparently was derived from the ancestral stock at a different time from the Melanophryniscus-Atelopus-Dendrophryniscus line and has become greatly specialized, subsequently.

Major evolutionary trends and morphological character shifts apparently are associated with changes in locomotion; others are the result of differential metamorphosis. Biological modifications associated with the loss of the middle ear and the development of aposematic coloration also are important. The familial status of the Atelopodidae is discussed and rejected. The genera Atelopus, Dendrophryniscus, Melanophryniscus and Oreophrynella are placed in the family Bufonidae which is redefined.

The ancestral stock from which the four genera were derived probably was present in South America before the Tertiary. The ancestral Melanophryniscus-Dendrophryniscus-Atelopus stock probably occurred in a savanna or deciduous forest habitat. Melanophryniscus has retained many of the generalized ancestral characteristics and currently is found in the same general type of habitat. Dendrophryniscus was derived from the Melanophryniscus stock and has adapted to the wet tropical forest of Eastern Brazil and the Amazon Basin. Atelopus has adapted to a stream-side habitat and moved into montane areas which became available with the uplift of the Andes in late Cretaceous and early Tertiary. This new habitat has been successfully exploited by Atelopus and has been a major factor contributing to their specific radiation. Oreophrynella is a very specialized frog that was derived from an old stock. It subsequently became restricted to Mount Roraima, an ancient part of the Guiana Shield.
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1967—Research Associate, Los Angeles County Museum of Natural History