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## A New Genus of Genyophryne Microhylid Frogs from New Guinea

THOMAS C. BURTON<sup>1</sup> AND RICHARD G. ZWEIFEL<sup>2</sup>

### ABSTRACT

*Albericus*, new genus, is erected to accommodate three species removed from the genus *Cophixalus* Boettger 1892: *Albericus darlingtoni* (Loveridge) 1948, the type species; *Albericus tuberculatus* (Richards et al.) 1992; and *Albericus variegatus* (van Kampen) 1923. The fifth toe being longer than the third and the M. depressor mandibulae arising

mostly or entirely from the otic ramus of the squamosal and the adjacent prootic bone are apomorphic characters distinguishing *Albericus* from *Cophixalus*. The closest relative of *Albericus* is the monotypic genus *Choerophryne* with which it shares certain derived characters.

### INTRODUCTION

For several decades following the publication of Parker's (1934) monograph of the Microhylidae, both generic- and specific-level taxonomy of the two Australopapuan subfamilies changed little. With the advantage of much new material obtained by expeditions and individual collectors both before

the Second World War (but unstudied at that time) and continually since, researchers have shown that the conservative generic arrangement devised by Parker is inadequate to represent the systematics of these frogs. Here we erect a new genus for several species now included in *Cophixalus* but which several au-

<sup>1</sup> Lecturer and Head of Biology, Division of Biological and Chemical Sciences, La Trobe University, Bendigo, P.O. Box 199, Bendigo, Victoria, 3550, Australia.

<sup>2</sup> Curator Emeritus, Department of Herpetology and Ichthyology, American Museum of Natural History.

thors recognized informally as a distinctive unit, the “*variegatus* group.”

#### MATERIALS AND METHODS

One of us (TCB) examined the external morphology of 39 specimens of the *Cophixalus variegatus* group: 21 *Cophixalus* spp.,<sup>3</sup> 14 *C. darlingtoni*, the *C. tuberculus* holotype, and three *Choerophryne rostellifer* (Wandolleck). The musculature of two of the *Cophixalus* sp. and one *C. darlingtoni* was examined in detail with the aid of topical applications of the iodine–potassium iodide stain of Bock and Shear (1972). These specimens were subsequently prepared for skeletal examination: one *Cophixalus* sp. (*variegatus* group, AUZ D739) was cleared and the skeleton dried; the other (*variegatus* group, AUZ B719) was double stained by the alcian blue–alizarin technique of Dingerkus and Uhler (1977); *darlingtoni* AUZ B735 also was double stained.

TCB examined the superficial musculature of the jaw region and the extent of the rami of the squamosal in ten *Cophixalus* spp., five *darlingtoni*, the *tuberculus* holotype, and two *Choerophryne rostellifer*. The last two are rare species, and no representatives of these were dissected further. In addition, TCB examined externally 37 specimens of ten *Cophixalus* species not of the *variegatus* group, and studied the jaw musculature of 30 specimens representing all these species. The musculature of seven specimens representing the species *Cophixalus neglectus* Zweifel, *C. ornatus* (Fry), and *C. riparius* Zweifel was dissected in detail and their skeletons prepared for examination.

Additional information comes from notes on and drawings made by RGZ of pertinent specimens in several museums. Abbreviations used are: AMNH (American Museum of Natural History, New York), AUZ (Adelaide University Zoology, Adelaide), and SAMA (South Australian Museum, Adelaide).

#### BRIEF RÉSUMÉ OF GENYOPHRYNINE GENERIC NOMENCLATURE SUBSEQUENT TO PARKER, 1934

Parker’s (1934) monograph established a basis for the generic arrangement of New Guinean microhylid frogs that lasted for more than two decades with only the addition of the asterophryine genus *Barygenys* Parker, 1936. For the subfamily Genyophryninae (Sphenophryninae in his usage), Parker relied solely on the pectoral girdle for characters diagnostic of the five genera he recognized: *Aphantophryne* Fry 1917, *Cophixalus* Boettger, 1892, *Microbatrachus* Roux 1910, *Oreophryne* Boettger, 1895, and *Sphenophryne* Peters and Doria, 1878. He lacked specimens of *Aphantophryne* and *Microbatrachus*, and therefore had to rely on published descriptions.

Zweifel (1956a), with new material available, reinterpreted the morphology of the pectoral girdle and synonymized *Aphantophryne* with *Cophixalus*. Zweifel (1971) showed that *Genyophryne* Boulenger 1890 was not an asterophryine but fitted better within the Sphenophryninae.<sup>4</sup>

Menzies and Tyler (1977) resurrected the genera *Choerophryne* van Kampen, 1914 and *Copiula* Méhelÿ, 1901, from the synonymy of *Cophixalus*. Tyler (1978) referred *Microbatrachus*, a questionable genus based on a single tiny juvenile specimen, to the synonymy of *Sphenophryne*. Zweifel and Parker (1989) resurrected *Aphantophryne* upon finding that *A. pansa* and two new species were unique in the Genyophryninae in possessing seven rather than eight presacral vertebrae.

Thus, the *Cophixalus* species of Parker (1934) along with numerous species described subsequently, are distributed among *Choerophryne* (still monotypic), *Cophixalus*, and *Copiula*. This arrangement is a more natural one, but *Cophixalus* in its present restricted state is still not a monophyletic assemblage.

<sup>3</sup> Although there are many references in the literature to *Cophixalus variegatus*, there are numerous undescribed species in this group, and probably few if any references to frogs other than the holotype pertain to *variegatus*.

<sup>4</sup> Dubois (1983) showed that this revision of relationships required the replacement of Sphenophryninae by Genyophryninae, an earlier higher category name.

### THE *VARIEGATUS* SPECIES GROUP

Zweifel (1956a, 1956b) pointed out that in only three species of *Cophixalus*, as then constituted, the fifth toe is longer than the third: *darlingtoni*, *variegatus*, and *rostellifer*, the last being the type of the subsequently resurrected *Choerophryne* (Menzies and Tyler, 1977). Fieldwork in Papua New Guinea in 1964, 1968, 1969, and 1987 made it evident that several undescribed and morphologically similar species of this group existed (Zweifel, 1976, 1980, 1985). Menzies (1976: 57–59) also recognized the morphological unity and unresolved specific diversity of this “*Cophixalus variegatus* group” and provided an incisive discussion. Burton (1986), in his study of the Asterophryinae, observed that *Choerophryne* and the “*darlingtoni* group” (equivalent to the *variegatus* group) share an apomorphic condition of the M. depressor mandibulae that distinguishes them from all other genyophrynines. In his investigations of relationships, this and other characters led him to treat this group, together with *Choerophryne*, as separate from *Cophixalus*.

Recently, Richards et al. (1992) described a third species, *Cophixalus tuberculus*, that is closely related to *C. darlingtoni* and *C. variegatus*. We think it appropriate to formalize the recognition of the *variegatus* group as a genus distinct from *Cophixalus*.

#### *Albericus*, new genus

**TYPE SPECIES:** *Cophixalus biroi darlingtoni* Loveridge, 1948 (*C. darlingtoni*: Zweifel, 1956a), by present designation.

**DIAGNOSIS AND DEFINITION:** A genus of microhylid frogs of the subfamily Genyophryinae with the appressed fifth toe longer than the third; a rounded-to-truncate snout; lacking clavicles, procoracoids, and omosternum; and has the otic ramus of the squamosal bone elongated, overlying the crista parotica, with the M. depressor mandibulae arising mostly from the otic ramus of the squamosal and adjacent prootic region of the skull.

Other characteristics of *Albericus*, not necessarily diagnostic, are small size (maximum of about 27 mm SVL; Zweifel, 1956b: 6), terminal phalanges broadly T-shaped (fig. 1), and terminal discs of fingers broader than, or

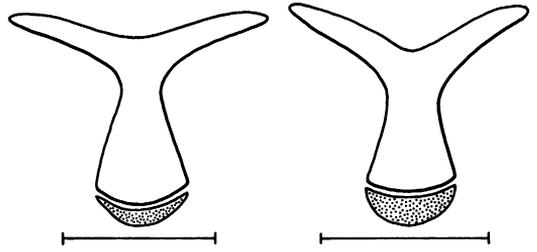


Fig. 1. Terminal phalanges of third fingers of *Albericus darlingtoni* (AMNH A88541, left) and *Albericus* sp. (AMNH A88557). Scale lines span 0.5 mm.

rarely equal to, those of toes. The sacral diapophyses of *Albericus* are broadly expanded and in some instances fused to the urostyle by a sheet of bone (fig. 2).

The following features distinguish *Albericus* from *Cophixalus*: The fifth toe is longer than the third in *Albericus*, whereas the reverse holds in *Cophixalus*; the M. depressor mandibulae of *Cophixalus* arises, as in most microhylid frogs (Burton, 1986), mostly from the dorsal fascia (fig. 3B), whereas in *Albericus* the bulk of the muscle arises from the otic ramus of the squamosal and adjacent areas of the skull, few if any fibers arising from the dorsal fascia (fig. 3A); small sesamoids occur in the extensor musculature at the head of the fibulare in *Albericus* but not in *Cophixalus*.

The other genyophrynine genera lacking clavicles and procoracoids are *Aphantophryne*, *Choerophryne*, and *Copiula*. *Aphantophryne* has seven rather than eight presacral vertebrae and has rounded rather than expanded digital tips (Zweifel and Parker, 1989). *Choerophryne* possesses elongate and anteriorly directed alary processes of the premaxillae and enlarged nasals supporting a long, pointy snout, whereas the snout of *Albericus* is truncate or rounded. *Copiula* has a characteristic pad of connective tissue on the snout, giving it a white tip, toe discs are broader than finger discs (Menzies and Tyler, 1977), and it possesses a unique configuration of the deltoid musculature (Burton, 1990).

**ETYMOLOGY:** *Albericus* is a latinized form of Alberich, the dwarf of Scandinavian mythology and Wagner's Ring Cycle, who was able to change form by use of the Tarnhelm,

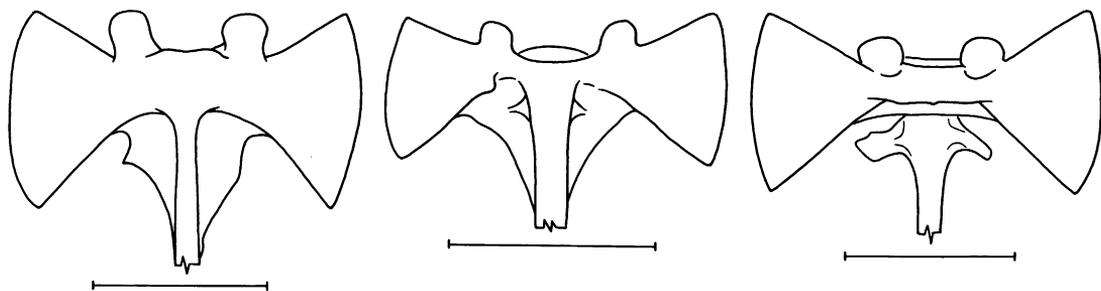


Fig. 2. Sacral vertebrae of *Albericus* in ventral aspect: *A. darlingtoni* (AMNH A88543, left), *A. sp.* (AMNH A88555, middle), *A. sp.* (AMNH A88557, right). Scale lines span 2.0 mm.

a magic helmet. The name is chosen because of the diminutive taxa that make up the genus, and because of the confusion surrounding their identities.

**COMPOSITION OF THE GENUS:** Three described species comprise the genus, though several additional species await description: *Albericus darlingtoni* (Loveridge), *Albericus*

*tuberculus* (Richards, Johnston, and Burton), and *Albericus variegatus* (van Kampen).

**HABITS:** Frogs of this genus are typically encountered at night in rainforest, sometimes in ear-shattering abundance, calling from elevated perches such as the upper surfaces of fern fronds or pandanus leaves up to 2 m aboveground. Daytime retreats include "clumps of fruit growing on the trunks of *Ficus* trees, and . . . in cut bamboo stems" (Zweifel, 1980: 410–411).

## RELATIONSHIPS

With the breakup of *Cophixalus* and the description of *Albericus*, there are now five genyophrynine genera that share the character once diagnostic of *Cophixalus*: reduction of the ventral bony elements of the pectoral girdle to the coracoids alone, and loss of the cartilaginous procoracoids. These are unquestionably apomorphic character states, but whether they are synapomorphic is far from certain. Identical reduction of pectoral elements apparently has taken place several times within the Microhylidae (see Zweifel, 1986, for examples in the American Microhylinae).

*Choerophryne* and *Albericus* share apomorphic character states that set them apart from other genyophrynines with reduced pectoral elements: 1) fifth toe longer than third; 2) the same derived condition of the *M. depressor mandibulae*; 3) a tendency to fusion of the urostyle and sacrum (Menzies and Tyler, 1977, fig. 8). There can be little doubt that these two genera form a monophyletic group. The question is where, if at all, their

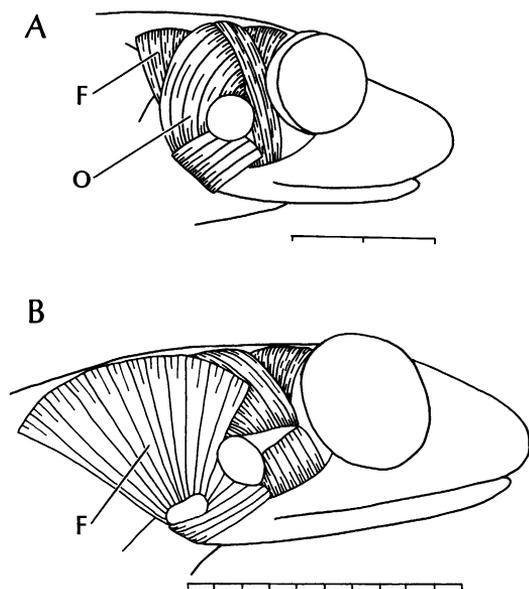


Fig. 3. A. Jaw musculature of *Albericus* sp., AUZ D739, scale bar spans 2 mm. B. Jaw musculature of *Cophixalus riparius*, SAMA 5216, scale bar spans 1 cm. F = component of *M. depressor mandibulae* arising from dorsal fascia, O = component of *M. depressor mandibulae* arising from otic ramus of squamosal.

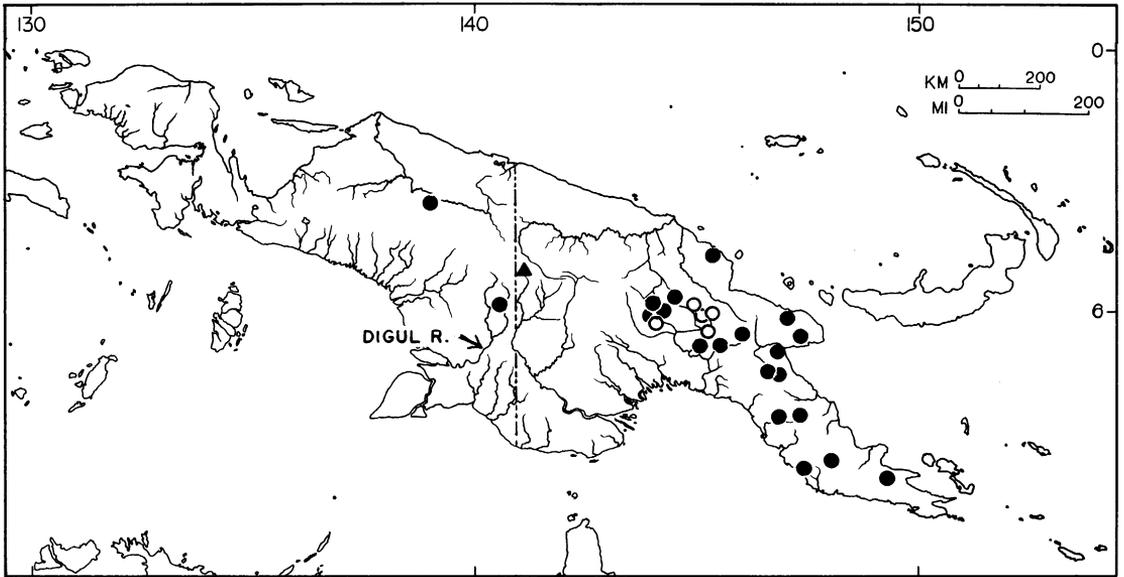


Fig. 4. Distribution of the genus *Albericus* in New Guinea. Digul River (no specific locality) is the type locality of *A. variegatus*; triangle marks the only known locality for *A. tuberculus*; solid circles mark localities for unassigned specimens of *Albericus*, most of which probably represent undescribed species; open circles denote localities for *A. darlingtoni*, some of which also harbor undescribed species.

closest relationship lies among the other genera with reduced pectoral girdles.

*Aphantophryne*, a terrestrial frog with rounded digital tips and a reduced number of presacral vertebrae, can be dismissed as a possible close relative. *Copiula*, too, is a terrestrial frog with somewhat reduced digital discs, and has an apomorphic state of the deltoid musculature that would require a reversal in the derivation of *Albericus*.

By default, *Cophixalus* and *Albericus* plus *Choerophryne* seem to be sister groups. But there is no assurance that their sharing of the reduced pectoral girdle is a synapomorphy. For instance, *Cophixalus* and *Albericus* plus *Choerophryne* could have been derived independently from *Oreophryne*, which is characterized by a pectoral girdle with greatly reduced clavicles and procoracoids and includes some species that, like *Albericus* and *Choerophryne*, have the fifth toe longer than the third. There are at present no data to suggest which alternative is correct.

Inasmuch as *Albericus* and *Choerophryne* share certain apomorphies that distinguish them from other genyophrynines, one may ask why they should not be referred to a single

genus. Our view is that whereas the many species (most undescribed as yet) of *Albericus* differ morphologically among themselves in only minor ways, *Choerophryne*, with its peculiar and unique snout region, represents a new evolutionary pathway warranting taxonomic recognition. *Choerophryne* has a known (though fragmented) range of about 1100 km along the north coast of New Guinea, and two localities (Menzies and Tyler, 1977; Menzies, personal commun.) south of the central dividing ranges. Limited information suggests that there may be more than one species, so the genus may not be a monotypic peculiarity.

#### DISTRIBUTION

Although at present only three species, two with only one locality each, are assigned to *Albericus*, several undescribed species define a wide but incompletely known generic range (fig. 4): the central mountainous spine of New Guinea from the eastern tip of the island into Irian Jaya at least as far as the Idenburg River, and the Huon Peninsula and Adelbert Mountains on the north coast of Papua New

Guinea. The known elevations are 1200 to 3000 m; there are no records for low elevations or for islands associated with New Guinea.

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