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A NEW GENERIC AND FAMILY POSITION FOR  
BUFO BORBONICA

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Recent studies, as yet unpublished, have revealed that Bidder's organ—the small structure lying in front of the gonads in certain salientians—is an organ peculiar to the Bufonidae. Among many species of bufonids and leptodactylids examined in this connection, I have found but one exception to this rule. The long-legged East Indian toad *Bufo borbonica* lacks both Bidder's organ and the elongation of the testes characteristic of toads. Further examination reveals that these features are by no means the most extraordinary points in the anatomy of this animal, since in addition it is found to have a fully firmisternal pectoral girdle (fig. 8).

Through the courtesy of Mr. Arthur Loveridge I have been able to examine the series of this species in the Museum of Comparative Zoology, consisting of four specimens from Kuan Nieng Province, Siam. I am also indebted to Dr. Leonhard Stejneger for the loan of five specimens from Trong, Lower Siam, in the collections of the National Museum, and for much-appreciated advice on the status of the name *Hylaplesia*. Mr. H. W. Parker, of the British Museum (Natural History), has been kind enough to examine specimens of *Bufo borbonica* for me. He confirms my findings, pointing out some additional characters, which I have incorporated in the description. A great deal of invaluable advice and criticism has been given by Mr. Karl P. Schmidt, Assistant Curator of Amphibians and Reptiles in Field Museum, and to him I am especially grateful.

The taxonomic history of this toad has been decidedly erratic, and since it has resulted in some confusion in the literature, it may well be clarified here.

The generic name *Hylaplesia* was listed by Schlegel (1826a and b) in two papers published simultaneously in German and French.<sup>1</sup>

<sup>1</sup> In the French edition the name appears as *Hysaplesia*, apparently through a misprint.

His report was based largely on an unpublished manuscript by Boie, who in turn had drawn freely on a manuscript by his associates Kuhl and van Hasselt. Schlegel credits the genus *Hylaplesia* to Boie and, following Boie's manuscript, the species *borbonica* to Kuhl and van Hasselt. Schlegel's *borbonica*, however, is a nomen nudum without status. Tschudi (1839) next lists *borbonica*, together with sufficient description to validate the name, again referring it to *Hylaplesia*. Tschudi is therefore the author of the name *borbonica*, but the generic name *Hylaplesia* is a synonym of *Dendrobates*, and cannot be revived for *borbonica*, in spite of Peters's attempt to do so (Peters, 1863, p. 81). The species was referred to the genus *Bufo* by Cope (1867, p. 193), in which he was followed by Boulenger (1882, p. 286). *Bufo borbonica* was transferred later to *Nectophryne* by van Kampen (1911, p. 75) and returned by Smith (1925, p. 30) to *Bufo*, where it has since remained.

The structure of the pectoral girdle, the urogenital system, and other less conspicuous features of its anatomy, show that the species *borbonica* cannot be retained in any of the genera to which it has heretofore been referred; nor does it show affinities close enough to warrant allocating it to any other genus, as will be shown below. Since it cannot be referred to any existing genus, it is necessary to erect for it a new one.

### **Cacophryne gen. nov.**

Type, *Hylaplesia borbonica* Tschudi, from the East Indies.

*Diagnosis*.—Vertebral column procoelous. Pectoral girdle completely firmisternal; sternum slender and cartilaginous; omosternum absent. Sacral diapophyses widely expanded; coccyx and sacrum fused. Maxillary and vomerine teeth lacking; prevomer small, ethmoid entire, palatine present. Ear complete. No palatal folds; eustachian tubes present. Terminal phalanges simple. No intercalary cartilages. Pupil horizontal. Narrow, inconspicuous, parotid glands present. Habitus slender, with elongated limbs.

### **Cacophryne borbonica (Tschudi).**

*Hylaplesia borbonica* Schlegel, Isis, 20, p. 294, 1826—nomen nudum.

*Hysaplesia borbonica* Schlegel, Bull. Sci. Nat. Férussac, 9, p. 239, 1826—nomen nudum.

*Hylaplesia borbonica* Tschudi, Mem. Soc. Sci. Nat. Neuchâtel, 2, p. 70, 1839; Peters, Monatsber. Berlin Akad., 1863, p. 81.

*Bufo borbonicus* Cope, Jour. Acad. Nat. Sci. Phila., 6, p. 193, 1867; Boulenger, Cat. Batr. Sal. Brit. Mus., p. 286, 1882; Horst, Notes, Leyden Mus., 5, p. 236, 1883.



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*Bufo borbonica* M. A. Smith, Sarawak Mus. Jour., 3, p. 30, 1925; Bull. Raffles Mus., 3, p. 130, 1930.

*Nectophryne borbonica* van Kampen, Notes, Leyden Mus., 34, p. 75, 1911; Amphibia Indo-Austr. Arch., p. 70, fig. 7, 1923.

*Nectophryne sumatrana* van Kampen, Natuurk. Tijdschr. Ned.-Ind., 69, p. 19, pl. 1, fig. 1, 1910.

*Bufo jerboa* Boulenger, Proc. Zool. Soc. Lond., 1890, p. 328, pl. 25, fig. 3; Vert. Fauna Malay Pen., Rept. and Matr., p. 271, 1912; van Kampen, Amphibia Indo-Austr. Arch., p. 76, 1923; Noble, Biol. Amphibia, p. 502, fig. 161, 1931.

The problem of the allocation of this genus to the proper family is far from simple. The structure of the urogenital system alone

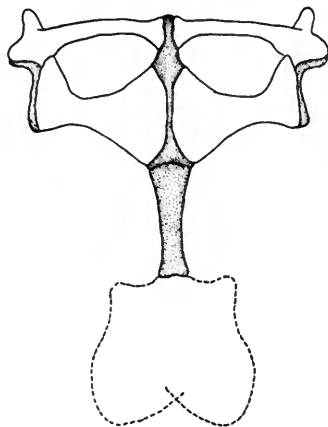


FIG. 8. Ventral view of shoulder girdle of *Cacophryne borbonica*. U. S. National Museum No. 24040.

seems sufficient evidence to warrant the exclusion of *borbonica* from the family Bufonidae. On examination I find, furthermore, that the pectoral girdle is completely firmisternal, which not only reinforces this conclusion, but also eliminates the possibility of a reference to the Leptodactylidae. The procoelous vertebrae ally it clearly to these families, although Parker (1934) has shown that this condition of the vertebral column is found also in many microhylid genera. Examination of the thigh musculature, however, shows that the tendon of the semitendinosus overlies that of the gracilis, thus throwing out the diplasiocoelous families Ranidae, Polypedatidae, and Microhylidae as possible relatives (Parker, 1934, p. 6). By elimination, a single family, the Atelopodidae, remains, and here apparently is its true relationship. The species under con-

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sideration has in fact a somewhat striking external resemblance to members of the genus *Atelopus*.

The reference of *Cacophryne* to the Atelopodidae results in what seems to be a distributional anomaly, since all atelopodids hitherto known are neotropical. However, the presence in the Indo-Malayan region of forms allied to the neotropical fauna is not wholly without parallel. The American and Indian tapirs are probably the best-known examples. The well-known resemblance between the faunas of eastern North America and eastern Asia is continued by a less sharply defined series of related forms in the tropics of Central America and southeastern Asia. This is shown in particular by such well-marked snakes as *Trimeresurus* and *Sibynophis*, and by the ophidian family Achrochordidae, which has a single Central American representative (*Nothopsis*), and the family Aniliidae, which is represented in tropical America by the well-known genus *Anilius* (*Ilysia* of authors), and in southeastern Asia by *Cylindrophis* and *Anomalochilus*. The same parallel is exhibited by numerous fresh-water turtles of the East Indies and North and Central America. The situation among amphibians is less clear, being obscured by the presence of several world-wide genera, such as *Rana* and *Bufo*, as dominant types.

Published figures and descriptions show that several species of long-legged East Indian toads are suspiciously similar to *borbonica* in external appearance. It is altogether possible that such species as *Bufo penangensis*, *B. cruentatus*, and *B. leptopus* will be found on dissection to be referable to the genus *Cacophryne*.

The necessity of referring *Cacophryne* to the Atelopodidae brings up the question of the status of this family. As defined by Noble (1931) it is a polyphyletic assemblage of convergent types. He states (p. 505) that "the Brachycephalidae [=Atelopodidae] show more clearly than any other family of Salientia the details of their origin. Each subfamily has arisen from a different stock of bufonids, but as all the ancestral stocks were bufonids residing in the same general region, the Brachycephalidae may be considered a natural, even though a composite family." This curious line of reasoning leads to difficulties. By definition, a "composite" family is an inconceivable anomaly, since a family is a group of related genera, derived from a common ancestor, in the same sense that a genus is a group of related species of common origin. Indeed, a few pages farther on Noble reverses his view completely. In speaking of the hylid genera *Hylella* and *Nyctimystes* he says: "But as these genera are poly-

phyletic assemblages scarcely distinct from *Hyla*, they are not recognized here." (p. 508.)

The only possible view that is compatible with modern taxonomic conceptions is that if, as Noble contends, the three "subfamilies" Rhinodermatinae, Dendrobatinae, and Atelopodinae have each arisen independently from different stocks, whether these stocks resided in the same general region or not, and no matter how similar the derived groups may appear to be, they must be accorded full family status, or else absorbed in the parent family. The latter course hardly seems indicated in this case, since each of the three groups differs from the Leptodactylidae in one or more fundamental respects. I propose, therefore, that the subfamilies Rhinodermatinae, Dendrobatinae, and Atelopodinae be accorded full family status, forming, together with the Bufonidae and the Leptodactylidae, the superfamily Bufonoidea.

Regarding the family relations of the new genus, Mr. Parker writes me: "Comparison of the characters I give for the various firmisternal groups puts it at once in the Atelopodidae. Concerning this group I am still very uncertain, but *B. borbonica* seems to me to bear exactly the same relation to *Pedostibes* as *Didynamipus* does to *Nectophryne*."<sup>1</sup> This alternative, that *Cacophryne* is still a fourth independent derivative from the arciferal Bufonoidea, seems to be negatived by its complete agreement in essential characters with the South American genera. If the view suggested by Parker were adopted, the natural assumption would be to look upon the geographically close *Pedostibes* as the parent stock from which *Cacophryne* has been derived. It is well known that the firmisternal condition of the pectoral girdle has been assumed upon numerous occasions by various salientians, and the firmisternal pectoral girdle in *Cacophryne* would by no means rule out the arciferal *Pedostibes* as the ancestral stock.

The morphology of the urogenital organs is still more significant. All available evidence, as yet unpublished, indicates that Bidder's organ, once developed, has persisted in all derived types of Bufonidae. Closely related forms (e.g., *Leptodactylus*) have the elongated testes, but never possess a Bidder's organ. In *Cacophryne*, however, not only is Bidder's organ lacking, but the testes are of the oval form typified by *Rana*. The derivation of *Cacophryne* from any bufonid genus, in spite of the fact that it would greatly simplify the situation

<sup>1</sup> Parker (1931, p. 1247) has shown that the firmisternal *Didynamipus* should be regarded as independently derived from the arciferal *Nectophryne*.

from the standpoint of geographical distribution, seems highly improbable.

*Cacophryne* must be assumed to have originated from an unknown leptodactylid stock when this was more extensively represented in the northern hemisphere. This genus then takes its place in the restricted family Atelopodidae, which can thus no longer be regarded as an endemic South American family.

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