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A SYNOPSIS OF THE BREVICIPITID TOADS OF MADAGASCAR

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The brevicipitid toads exhibit the greatest range of skeletal modification found in any family of Salientia. Different brevicipitid stocks have often undergone a rapid and parallel evolution, making it extremely difficult to recognize and define natural groups of species. The writers, having been independently studying the Malagasy representatives of the family, found themselves in agreement as regards the relationships of the genera. Much confusion exists in the literature regarding the limits and affinities of these groups. Hence, it was considered advisable to outline briefly the conclusions which we reached.

The present paper is based upon the material preserved in the British and continental museums. Most of the figures included were made from type specimens and should be of considerable service in any future studies on this group. Our thanks are due to the custodians of the rare specimens reported upon here. We are indebted to Dr. Robert Mertens of the Senckenberg Museum, Dr. Ernst Ahl of the Berlin Museum, Dr. Otto Wettstein of the Vienna Museum, Dr. Jean Roux of the Basel Museum, and Dr. L. Roule and Mr. M. F. Angel of the Paris Museum.

The brevicipitid toads have probably been directly derived from the true frogs, Ranidæ. They differ from the latter principally in the more dilated sacrum. The more primitive genera approach closely to the Ranidæ and are to be distinguished only by their heavier build, expanded sacrum, large vomers, and ridged palate.² The more specialized forms have lost their teeth and all ventral elements of the shoulder girdle, except the coracoid. Their heads and feet may be variously modified for arboreal or fossorial life. Brevicipitids in the Asiatic, East Indian, and Malagasy regions seem to have independently run through a great series of structural changes, often parallel in the three regions.

In spite of the enormous differences exhibited by the adult skeletons of the various genera, it is remarkable that the tadpoles of all species of

¹The latter of the British Museum (Natural History).

²The so-called glandular ridges owe their character to folds, not to an accumulation of glands, except in *Breviceps*.

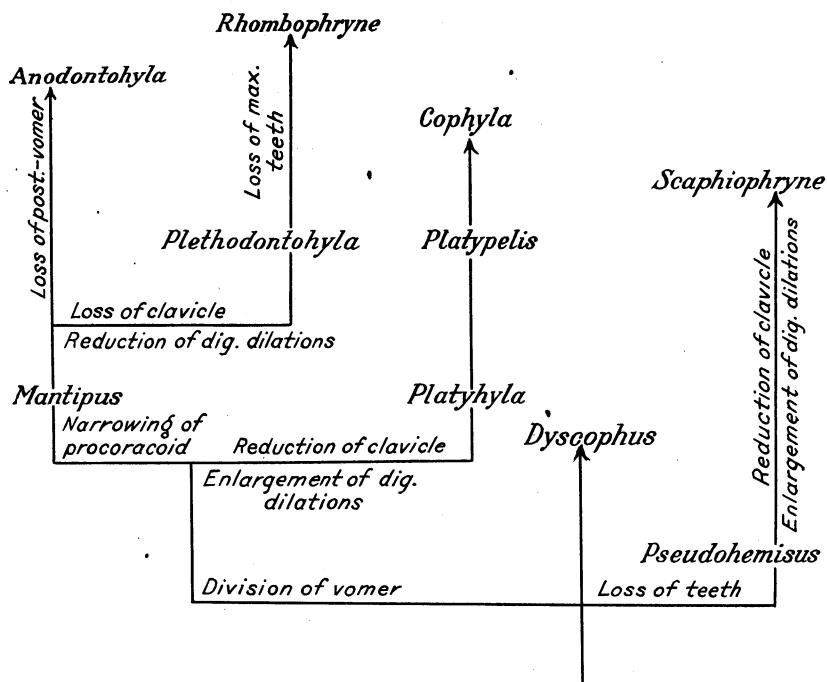
brevicipitids, so far as known, are of a single type, readily distinguishable from those of all other Salientia. Many brevicipitids, especially in the East Indian region, skip over the tadpole stages. This habit seems to have arisen independently in various families of frogs and does not always indicate relationship. It is, however, of considerable systematic value to find that the same distinctive type of tadpole is present in the Asiatic *Calluella*, with its complete dentition and pectoral girdle, as in the African *Phrynomerus*, with its toothless jaws, reduced girdle, and intercalary cartilages. It is regrettable that the life histories of the Malagasy brevicipitids are totally unknown.¹

The primitive brevicipitid stock is apparently represented in Madagascar by *Dyscophus*. All the other brevicipitid genera of this region, to judge from both the external and internal characters of the adult, seem to have been derived from this stock (Figs. 1 and 2). Fortunately, for an appreciation of their relationships, most of them have undergone one peculiar skeletal modification which is not found elsewhere among Salientia, and hence seems to stamp these forms as related. The vomer of each side is divided into an anterior and a posterior half. The posterior portion usually overlies the palatines and has been confused with these latter bones. Thus, Boulenger (1889, Ann. Mag. Nat. Hist., (6) IV, p. 247, footnote) states: "The so-called vomerine teeth are inserted on the palatine bones in the Dyscophidæ." As a matter of fact, true teeth are never found on the palatines in any Salientia. As shown in the following figures, the vomerine teeth are inserted on a part of the vomers. A division of the vomers, similar to that of the Malagasy brevicipitids, is found elsewhere among Amphibia only in the Plethodontidæ. Here it seems to define a natural group of genera. We have, therefore, in these divided vomers some evidence that most of the genera to be considered form a natural group.

Our conception of the interrelationships of the genera is shown in the accompanying diagram.

In constructing a key which would define the genera, an effort has been made to retain the groups of related genera as sections of the key. Sections I and II of the following key are such groups. The three genera in section III—namely, *Anodontohyla*, *Pseudohemisus*, and *Scaphio-phryne*, may or may not represent a natural assemblage. The single edentulous vomer which characterizes them may have arisen either

¹*Dyscophus antongilii*, a representative of the structurally most primitive genus, has large numbers of very small ovarian eggs, suggesting a long larval stage; *Anodontohyla boulengerii*, a specialized form, has large eggs suggesting a shortened life history.



directly, by loss of teeth from a primitively single vomer, or secondarily, by reduction and loss of the posterior dentigerous portion of a divided vomer. The evidence available (morphological only) suggests that both methods have been employed in the production of these three genera. *Pseudohemisus* and *Scaphiophryne* are very closely allied; in both, teeth are absent, not only from the vomer, but from the upper jaw. In both, the vomer has a posteriorly directed process which appears, from its position, to be homologous with the mesial part of the vomer in *Dyscophus* and a portion of the posterior part of the same bone. It seems most probable that these two genera have sprung from some primitive dyscophus-like form by a complete loss of teeth and reduction of the now functionless posterior portion of the vomer, accompanied in *Scaphiophryne* by a reduction of the clavicle and a specialization of the digits.

Anodontohyla differs from both *Pseudohemisus* and *Scaphiophryne* in the absence of any posterior process on the vomer and in the presence of teeth in the upper jaw. Though it is conceivable that this condition might be derived from some form with an undivided toothed vomer (as in *Dyscophus*) by complete loss of the vomerine teeth and posterior portion

of the vomer, a more probable explanation is suggested by the genera *Platypelis* and *Cophyla*. These have a divided vomer, retain teeth in the upper jaw, and show progressive reduction of the vomerine teeth. In *Cophyla* the reduction is very far advanced; the vomerine plate (which shows its double origin by a median anterior indentation) being loosely attached to the skull. One step farther along such a line of reduction would produce the condition of *Anodontohyla*. The much more primitive shoulder girdle of this genus, however, precludes any possibility of a direct derivation from *Cophyla* or *Platypelis*. For lack of other indications, it must be grouped with *Mantipus*, with which it most nearly agrees in pectoral girdle form.

The genera which fall into the second section of the key appear, from the constant presence of a divided dentigerous vomer, to be genetically related, but the absence of teeth in the upper jaw of *Rhombophryne* and the varying conditions of the shoulder girdle indicate different evolutionary lines. The broad procoracoid resting on the coracoid and the reduced clavicle suggest that *Platyhyla* and *Platypelis* are closely allied, the latter being derived from the former by reduction of the vomerine teeth. Further reduction of the teeth accompanied by a complete loss of the clavicle and a reduction of the procoracoid would result in a condition similar to that found in *Cophyla*. The greatly dilated finger tips and large Y-shaped terminal phalanges characteristic of these three genera further suggest their close affinity.

Mantipus, possessing a well-developed clavicle, appears to be the most primitive genus in this section. The backwardly directed process on the procoracoid suggests a backward extension of this cartilage to the coracoid, a condition characteristic of *Platyhyla* and *Platypelis*. Hence it is probable that these genera have been derived from a common stock. *Plethodontohyla* may have been derived directly from *Mantipus* by loss of the clavicle and reduction of the digital dilations. *Rhombophryne* seems to have been derived from a *Plethodontohyla*, such, for example, as *P. tuberatum*, by loss of the teeth in the upper jaw and a slight reduction of the procoracoid. These relationships will appear clearer if one compares the following figures with the diagram given above.

KEY TO THE GENERA¹

- I.—Vomerine bone in one piece, the posterior portion dentigerous and overlying the palatine. Teeth present on the upper jaw. Clavicle present; omosternum with an ossified style. Pupil vertically elliptic. *Dyscophus*.

¹Since this paper went to press it has been discovered that *Stumpffia* is not a ranid but a brevicipitid closely allied to *Anodontohyla*. *Mantella* is a toothless derivative of *Mantidactylus*.

II.—Vomerine bone in two pieces, the posterior dentigerous, omosternum, if present, never ossified. Pupil horizontal.

A.—Teeth present on the upper jaw; posterior vomer a broad transverse plate overlying the palatine.

(a) Clavicle well developed, reaching the scapula; omosternum present; procoracoid narrow, not resting on the coracoid. Vomerine teeth on whole width of posterior vomer. Tips of fingers and toes with small dilations. *Mantipus*.

(b) Clavicle reduced, not reaching the scapula; procoracoid broad, resting on the coracoid; omosternum present or absent. Tips of fingers and toes with very large dilations.

(a') Vomerine teeth on the whole or almost the whole width of the posterior vomer. *Platyhyla*.

(b') Vomerine teeth confined to mesial end of the posterior vomer. *Platypelis*.

(c) Clavicle absent; procoracoid a narrow slip not resting on the coracoid; omosternum present. Tips of fingers and toes slightly dilated or simple. Vomerine teeth on the whole width of the posterior vomer. *Plethodontohyla*.

B.—Teeth present on the upper jaw. Posterior vomer a small plate not overlying the palatine but fused with its fellow in the middle line. Clavicle absent; procoracoid reduced to a rudiment lying on the mesial anterior end of the coracoid; omosternum present. Tips of fingers and toes widely dilated. *Cophyla*.

C.—Teeth absent on upper jaw; posterior vomer a long plate overlying the palatine and bearing teeth across its whole width. Clavicle absent; procoracoid a narrow slip not resting on the coracoid; omosternum present. Tips of fingers and toes not dilated. *Rhombophryne*.

III.—Vomerine bone in one piece, not dentigerous. Pupil horizontal.

A.—Teeth present on the upper jaw. Vomer without any posterior process. Clavicle present, reaching scapula and mid-line of girdle; procoracoid narrow, not resting on the coracoid. *Anodontohyla*.

B.—Teeth absent on the upper jaw; vomer with a posteriorly directed process which partially overlies the palatine. Procoracoid narrow, not resting on the coracoid.

(a) Clavicle a narrow slip reaching scapula and mid-line of girdle. Tips of fingers and toes not dilated. *Pseudohemisus*.

(b) Clavicle reduced, not reaching mid-line of girdle. Tips of fingers and toes distinctly dilated. *Scaphiophryne*.

DYSCOPHUS Grandidier

Dyscophus GRANDIDIER, 1872, Ann. Sci. Nat. Zool., (5) XV, Art. 20, p. 10.

Pupil vertical. Clavicle present, well developed, reaching scapula and mid-line of girdle; procoracoid narrow; omosternum present, with an ossified style. Vomerine bone in one piece, the posterior portion overlying the palatine and bearing teeth on its whole width. Fingers free, toes webbed; no terminal dilations; terminal phalanges club-shaped.

Of the species usually referred to *Dyscophus*, only one has proved, upon dissection, to be referable to another genus. Mocquard (1901, Bull. Mus. Paris, p. 254) has described a frog under the name of *Dyscophus alluaudi*. The internal nares of this species were reported as small and well separated from the vomers, a condition which suggests a divided vomer. *Dyscophus* is characterized by an entire vomer, and its internal nares are in all other species of the genus large, elongate, and situated close to the transverse series of vomerine teeth. *D. alluaudi* agrees externally with the species of *Plethodontohyla*, for it has a truncate snout, distinct canthus rostralis, concave loreal region, and lacks the webbing between the toes (see Mocquard, 1902, Bull. Soc. Philom., Paris, (9) IV, Pl. II, fig. 3). Mr. M. F. Angel of the Paris Museum has very kindly dissected the type specimen of *D. alluaudi* and has sent us a sketch of the pectoral girdle. This agrees with that of most species of *Plethodontohyla*, differing only in the somewhat wider mesial end of the procoracoid. Therefore, *alluaudi* must be referred to the genus *Plethodontohyla*.

The type specimen of *Phrynocara quinquelineatum* Boettger (Boettger, 1913, in Voeltzkow, 'Reise in Ostafrika,' III, p. 283, Pl. XXIII), has been examined in the Senckenberg Museum by courtesy of Dr. Robert Mertens and proves to be a *Dyscophus* in its essential features. The pupil is probably vertical, clavicle present and well developed, omosternum with a bony style, and the vomer in one piece (Fig. 1). Though the shoulder girdle differs from that of *D. antongilii*, *guineti*, or *grandidieri* in having the clavicles but slightly bent and the procoracoid cartilage not resting on the coracoid, this species must apparently be referred to the genus *Dyscophus*.

The following species of *Dyscophus* appear to be valid.

***Dyscophus quinquelineatus* (Boettger)**

Figure 1

Phrynocara quinquelineatum BOETTGER, 1913, in Voeltzkow, 'Reise in Ostafrika,' III, p. 283, Pl. XXIII, figs. 11-17.

Type examined.

***Dyscophus grandidieri* Boulenger**

D. grandidieri BOULENGER, 1896, Ann. Mag. Nat. Hist., (6) XVII, p. 404.

Type examined.

***Dyscophus beloensis* Mocquard**

D. beloensis MOCQUARD, 1902, Bull. Soc. Philom., Paris, (9) IV, p. 22, Pl. II, fig. 4.

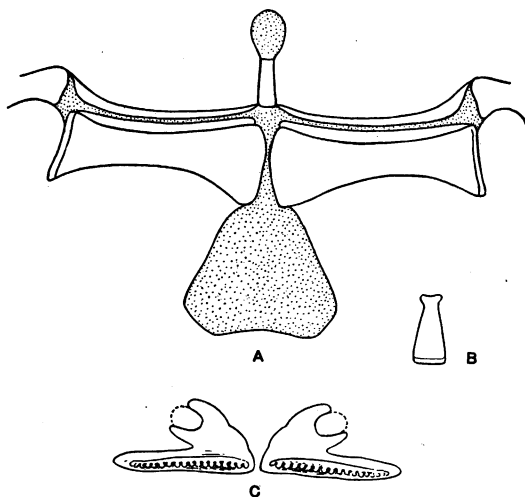


Fig. 1. *Dyscophus quinquelineatus* (Boettger), type.
(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) vomers.

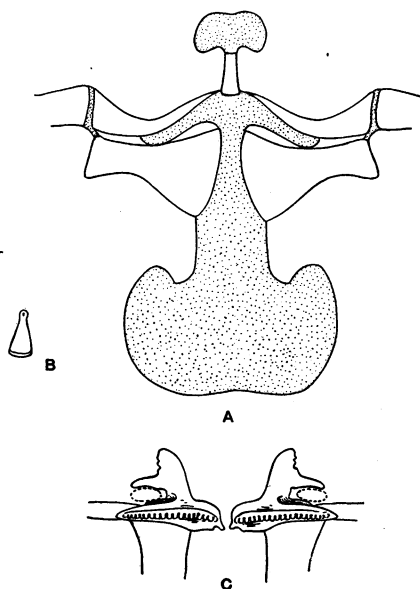


Fig. 2. *Dyscophus antongilii* Grandidier.
(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) vomers.

Dyscophus insularis Grandidier

D. insularis GRANDIDIER, 1872, Ann. Sci. Nat. Zool., (5) XV, Art. 20, p. 10.

Dyscophus antongilii Grandidier

Figure 2

D. insularis var. *antongilii* GRANDIDIER, 1877, Bull. Soc. Philom., Paris, (7) I, p. 41.

D. insularis var. *pallidus* GRANDIDIER, *tom. cit.*, p. 42.

D. sanguineus BOETTGER, 1880, Zool. Anz., p. 567.

D. antongilii BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 180.

D. antongilii MOCQUARD, 1895, Bull. Soc. Philom., Paris, (8) VII, p. 110.

D. antongilii var. *pallidus* MOCQUARD, *loc. cit.*

Specimens examined.

Dyscophus guineti (Grandidier)

Kaloula guineti GRANDIDIER, 1875, Ann. Sci. Nat. Zool., (6) II, Art. 6.

Discophus guineti STEINDACHNER, 1882, Sitz.ber. Ak. Wiss., Wien, LXXXV, p. 191, Pl. III.

Dyscophus guineti MOCQUARD, *tom. cit.*, p. 109.

Dyscophus insularis F. MÜLLER, 1885, Verh. Naturf. Ges., Basel, VII, p. 136 (*nec* Grandidier).

Specimens examined.

MANTIPUS Peters

Mantipus PETERS, 1883, Sitz.ber. Ak. Wiss., Berlin, p. 165.

Mantiphrys MOCQUARD, 1895, Bull. Soc. Philom., Paris, (8) VII, p. 134.

Mantiphrys MOCQUARD, 1909, N. Arch. Mus., Paris, (5) I, p. 72 (correction).

Plethodontohyla BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 473 (part).

Pupil horizontal. Clavicle present, well developed, reaching scapula and mid-line of girdle; procoracoid narrow; omosternum present, cartilaginous. Vomerine bone divided, the posterior portion bearing teeth over almost its whole width. Fingers and toes free, with slightly dilated tips; terminal phalanges Y- or T-shaped.

The species described by Boulenger (1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 473) as *Plethodontohyla inguinalis* proves, on examination, to be a *Mantipus* but differs slightly from the type species of the genus. The genus described by Mocquard as *Mantiphrys*, differing from *Mantipus* in having T-shaped, instead of Y-shaped, terminal phalanges, must be regarded as synonymous with *Mantipus*. In *M. inguinalis* the terminal phalanges of the fingers are distinctly Y-shaped while those of the toes are T-shaped, and in the type species they might be described either as broadly Y-shaped or T-shaped. The type specimen of *Plethodontohyla angulifera* Werner has been examined, but owing to its poor condition it

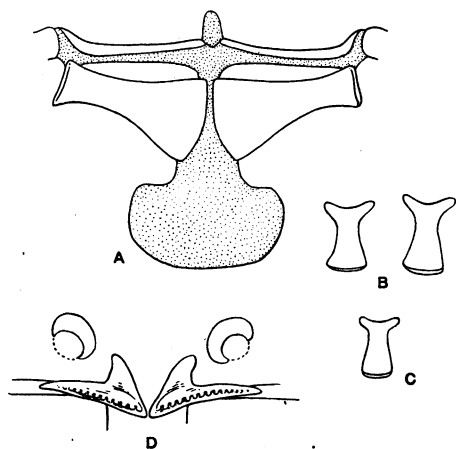


Fig. 3. *Mantipus hildebrandti* Peters, type.
 (A) Pectoral girdle, (B) terminal phalanges, fourth and third fingers, (C) terminal phalanx, fourth toe, (D) vomers.

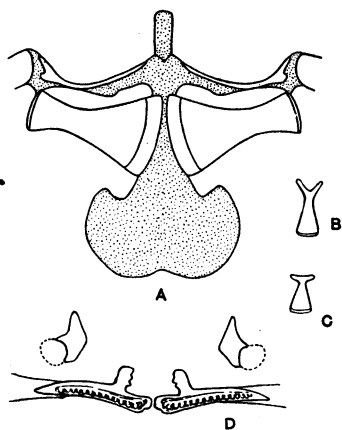


Fig. 4. *Mantipus inguinalis* (Boulenger), type.
 (A) Pectoral girdle, (B) terminal phalanx, fourth finger, (C) same, fourth toe, (D) vomers.

was found impossible to assign it definitely to any genus. There is present, however, a distinct, well-developed clavicle and the terminal phalanges are Y- or T-shaped. This, together with certain specific characters mentioned in the original description, *e. g.*, a pustulous snout, suggests that very probably it is a *Mantipus*. Certainly it cannot be a *Plethodontohyla*.

The species of *Mantipus* which appear to be valid are:

***Mantipus hildebrandti* Peters**

Figure 3

M. hildebrandti PETERS, *tom. cit.*, p. 166.

Mantiphrys lævipes MOCQUARD, 1895, Bull. Soc. Philom., Paris, (8) VII, p. 134.

Mantophrys lævipes MOCQUARD, 1909, N. Arch. Mus., Paris, (5) I, p. 72 (correction).

Type examined.

***Mantipus inguinalis* (Boulenger)**

Figure 4

Plethodontohyla inguinalis BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 473.

Type examined.

?*Mantipus anguliferus* (Werner)

Plethodontohyla angulifera WERNER, 1903, Zool. Anz., XXVI, No. 693, p. 251.

Type examined.

PLATYHYLA Boulenger

Platyhyla BOULENGER, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 247.

Pupil horizontal. Clavicle present, reduced, not reaching scapula or mid-line of girdle; procoracoid a broad plate resting on the coracoid; omosternum present or absent; when present small and cartilaginous. Vomer divided, the posterior portion bearing teeth across all, or almost all its width. Fingers and toes free with very large triangular discs; terminal phalanges Y-shaped.

Only two of the described species of *Platyhyla* are valid.

***Platyhyla grandis* Boulenger**

Figure 5

P. grandis BOULENGER, *loc. cit.*

P. verrucosa MOCQUARD, 1901, Bull. Mus. Paris, p. 254; 1902, Bull. Soc. Philom., Paris, (9) IV, p. 25, Pl. II, fig. 5.

P. voeltzkowi BOETTGER, 1913, in Voeltzkow, 'Reise in Ostafrika,' III, p. 282, Pl. XXIII, fig. 7.

Examination of a series of specimens, including the types of *grandis* and *voeltzkowi*, shows that this species is somewhat variable in the characters which have been used to define distinct species. The fingers and

toes are not webbed as stated in the original description, and the extent of the vomerine teeth and roughness of the skin vary. The skin is never quite smooth, the upper surface of the snout being always tubercular, and the tuberculation of the dorsal surface is usually more pronounced in juvenile and half-grown specimens. *P. verrucosa* Mocquard and *P. voeltzkowi* Boettger appear to fall within the limits of variation of *P. grandis*.

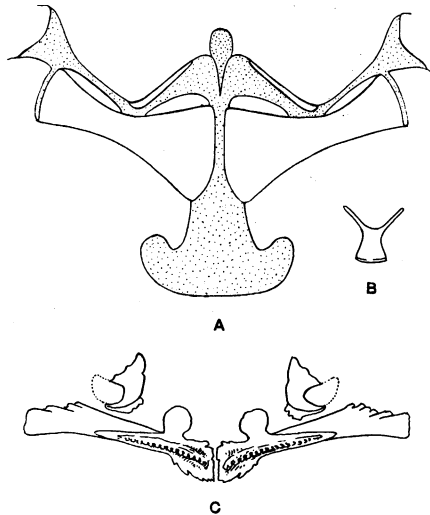


Fig. 5. *Platyhyla grandis* Boulenger, type.
(A) Pectoral girdle, (B) terminal phalanx, fourth finger, (C) vomers.

***Platyhyla tuberifera* (Methuen)**

Plethodontohyla tuberifera METHUEN, 1919, Proc. Zool. Soc. London, p. 354.

The material examined consists of the cotype in the British Museum and four specimens from Antsihanaka, which are apparently referable to the same species. Careful examination shows that this is not a *Plethodontohyla* as stated by Methuen, but it closely approximates to *Platyhyla grandis*, differing only in the absence of an omosternum and the presence of teeth across the whole width of the posterior vomer. As the omosternum of the latter species is relatively very small and cartilaginous it does not appear desirable to separate the two generically, especially as *P. tuberifera* has the same very large, triangular digital discs, large, Y-shaped terminal phalanges and other characters of *Platyhyla*.

The specimens from Antsihanaka differ from the cotype in several features. The sacral "tubercles" are not developed as swellings but are

represented by white glandular spots; the snout is flatter and more rounded, and the skin of the belly and thighs quite smooth; the discs of the fingers are proportionately larger and there is constantly a white line from snout to vent. The largest specimen measures 40 mm. from snout to vent. These apparent differences (except the size) are probably due to differences in preservation, the cotype being hard and rather shrivelled.

PLATYPELIS Boulenger

Platypelis BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 474.

Pupil horizontal. Clavicle present, reduced, not reaching scapula or mid-line of girdle; procoracoid a broad plate resting on the coracoid; omosternum present or absent, when present small and cartilaginous. Vomer divided, the posterior portion bearing a small group of teeth near its inner end only. Fingers free or with a slight suggestion of web; toes webbed at the base; both fingers and toes dilated distally into large triangular discs; terminal phalanges Y-shaped.

The two species which belong to this genus are both very closely allied to *Platyhyla*, but appear to be generically distinct because of the greatly reduced vomerine teeth and the webbed toes. The shoulder girdle is almost exactly alike in the two genera, *P. cowanii* having an omosternum and *P. pollicaris* being without. The terminal phalanges also are alike in the two genera.

Platypelis cowanii Boulenger

Figure 6

P. cowanii BOULENGER, *loc. cit.*

Type examined.

Platypelis pollicaris Boulenger

P. pollicaris BOULENGER, 1888, Ann. Mag. Nat. Hist., (6) I, p. 106, Pl. VI, fig. 3.

Type examined.

PLETHODONTOHYLA Boulenger

Cophyla BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 182 and p. 473 (*nec* Boettger).

Plethodontohyla BOULENGER, *op. cit.*, p. 473.

Phrynocara PETERS, 1883, Sitz.ber. Ak. Wiss., Berlin, p. 166.

Pupil horizontal. Clavicle absent; procoracoid a thin slip, not resting on the coracoid; omosternum well developed, cartilaginous, not always distinct from the procoracoid. Vomer divided, the posterior portion bearing teeth across its whole width. Fingers and toes free, with or without terminal dilations; these, if present, quite small; terminal phalanges T-shaped or almost simple.

The genera described as *Plethodontohyla* and *Phrynocara* appear to be inseparable. The condition of the shoulder girdle and vomer is the same in each and a complete gradational series can be traced from straight

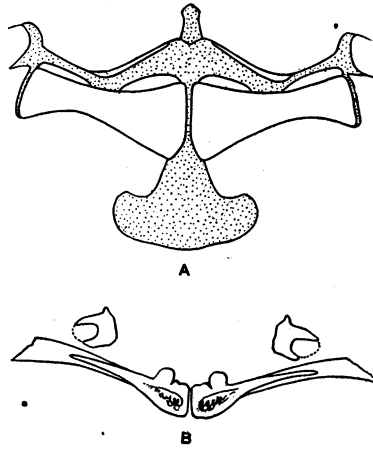


Fig. 6. *Platypelis cowanii* Boulenger, type.
(A) Pectoral girdle, (B) vomers.

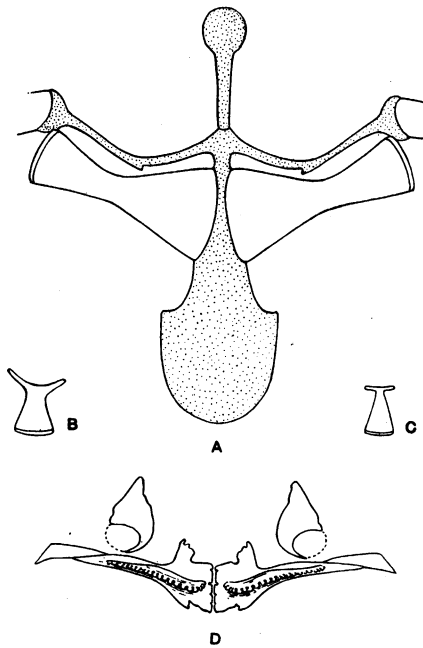


Fig. 7. *Plethodontohyla notosticta* Boulenger, type.
(A) Pectoral girdle, (B) terminal phalanx, fourth finger, (C) same, fourth toe, (D) vomers.

undilated digits and simple terminal phalanges to digits with discs and T-shaped phalanges through *P. tuberatum*, *P. læve*, *P. brevipes*, *P. ocellata*, and *P. notosticta*.

***P. notosticta* Boulenger**

Figure 7

Cophyla notosticta BOULENGER, *op. cit.*, p. 182.

P. notosticta BOULENGER, *op. cit.*, p. 473.

Type examined.

***P. brevipes* Boulenger**

P. brevipes BOULENGER, *op. cit.*, p. 474.

The vomerine teeth of this species do not form a continuous series as stated in the original description, but are distinctly interrupted in the mid-line.

Type examined.

***Plethodontohyla ocellata*, new species**

Type specimen a female from Antsihanaka, Madagascar. British Museum (Natural History), No. 1925.11.10.1.

Snout short, one and a quarter times the diameter of eye, viewed from the side vertically truncate, from above, obtusely pointed; canthus rostralis distinct, angular, bent; interorbital space much broader than the upper eyelid; tympanum slightly distinct, rather more than half the diameter of the eye; fingers and toes free, with very small discs; subarticular tubercles of fingers small, of toes indistinct; inner metacarpal tubercle well developed, oval; outer and median metacarpal tubercles present but flat and indistinct; first finger much shorter than the second; inner metatarsal tubercle flat, indistinct; outer absent. Tarso-metatarsal articulation reaches the tip of the snout. Skin smooth above and below; a glandular fold from eye to fore limb, connected anteriorly with its fellow by a transverse fold between the posterior borders of the upper eyelids; a more or less distinct fold across the chest. Habit stout.

COLOR IN SPIRIT.—Above dark brownish gray with irregular, indistinct, wavy, chevron-shaped dark bands, the apices directed forwards; a dark streak from tip of snout to fore limb covering all the loreal region, below the eye and below the supra-tympanic fold which is lighter; two large, black, white-bordered ocellar inguinal spots; hind limbs white spotted, the spots transversely elongate on the femur to form short bars, round on the tibia; hinder side of thighs with a rather indefinite longitudinal white stripe; flanks with small white spots; under surface dirty white mottled with brown and profusely dotted with tiny white specks which are most numerous on the thighs.

NOTES ON THE PARATYPES.—Seven specimens are from Antsihanaka, two from Sahambendrana, and two from "Madagascar." None of these specimens differs appreciably from the type in bodily proportions. The skin, however, may be shagreened instead of smooth, and the coloration varies. In adult specimens, the upper surface may be almost uniformly dark brown or the dark bands may have spread until

the ground color is only represented by light spots uniformly scattered. The inguinal spot, dark streak through the eye, lighter supra-tympanic fold and indistinct white line on the hinder side of the thighs are uniformly present. The dorsal coloration of the young is striking; the whole dorsal surface is gray or magenta stippled with darker; the flanks have scattered tiny, white, black-bordered spots and dorso-laterally on each side there is a curved narrow, white, black-bordered line from above the tympanic region to the sacrum; under surface of foot and metatarsus black.

This species is very closely related to *P. brevipes* from which it appears to be distinguished by the following characters: tarso-metatarsal articulation reaching end of snout, digital discs distinct though small and the distinct color pattern. It should be recorded, however, that the type specimen of *P. brevipes* is a young female, badly faded in color, soft and rubbed, so that it is possible that eventually *P. ocellata* may prove to be the same.

***P. læve* (Boettger)**

Phrynocara læve BOETTGER, 1913, in Voeltzkow, 'Reise in Ostafrika,' III, p. 282, Pl. xxiii, fig. 10.

Type examined.

***P. tuberata* (Peters)**

Figure 8

Phrynocara tuberatum PETERS, 1883, Sitz.ber. Ak. Wiss., Berlin, p. 167.

Type examined.

***P. alluaudi* (Mocquard)**

Dyscophus alluaudi MOCQUARD, 1901, Bull. Mus. Paris, No. 6, p. 254; 1902, Bull. Soc. Philom., Paris, (9) IV, p. 22, Pl. II, fig. 3.

COPHYLA Boettger

Cophyla BOETTGER, 1880, Zool. Anz., p. 281.

Pupil horizontal. Clavicle absent; procoracoid reduced to a small plate lying on the coracoid mesially, not reaching the scapula; omosternum well developed, cartilaginous. Vomer divided, the posterior portions fused mesially and not overlying the palatine, but reduced to a small median plate lying in the center of the roof of the mouth between and slightly behind the ends of the palatines; the posterior vomers bearing a small group of teeth. Fingers free, toes webbed, both with broad triangular dilations; terminal phalanges Y-shaped.

***Cophyla phyllodactyla* Boettger**

Figure 9

C. phyllodactyla BOETTGER, loc. cit.

In the original description there is said to be a "longitudinal groove" dividing the upper surface of the discs. To prevent confusion, it should be pointed out that this groove does not divide the discs, as, for instance,

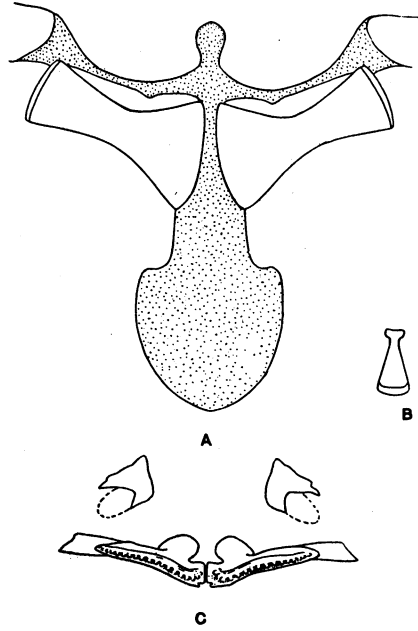


Fig. 8. *Plethodontohyla tuberata* (Peters), type.
(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) vomers.

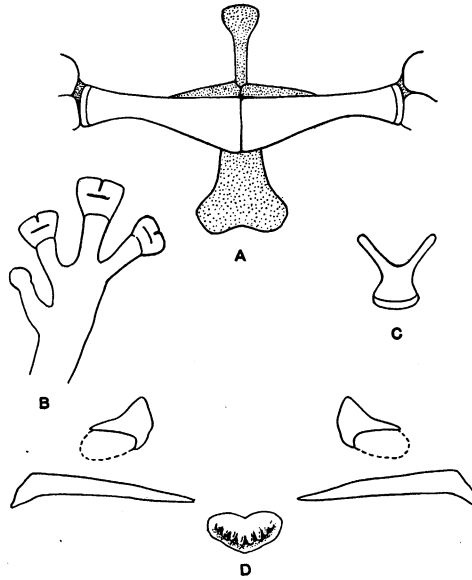


Fig. 9. *Cophyla phyllodactyla* Boettger, type.
(A) Pectoral girdle, (B) right hand, dorsal aspect, (C) terminal phalanx, third finger, (D) vomers.

in *Phyllobates*, but is a slight furrow more distinct distally between the arms of the terminal phalanx. There may also be a slight crease at right angles to this at its proximal end about the center of the upper surface of the disc.

Type examined.

RHOMBOPHRYNE Boettger

Rhombophryne BOETTGER, 1880, Zool. Anz., p. 567.

Pupil horizontal. Clavicle absent; procoracoid a very thin slip, not resting on the coracoid; omosternum present but small, cartilaginous and not distinct from the procoracoid. No maxillary or premaxillary teeth. Vomer divided, the posterior portion bearing teeth across its whole width. Fingers and toes free, very short, the toes with very slight dilations; terminal phalanges T-shaped or almost simple.

Rhombophryne testudo Boettger

Figure 10

R. testudo BOETTGER, *tom. cit.*, p. 568.

Type examined.

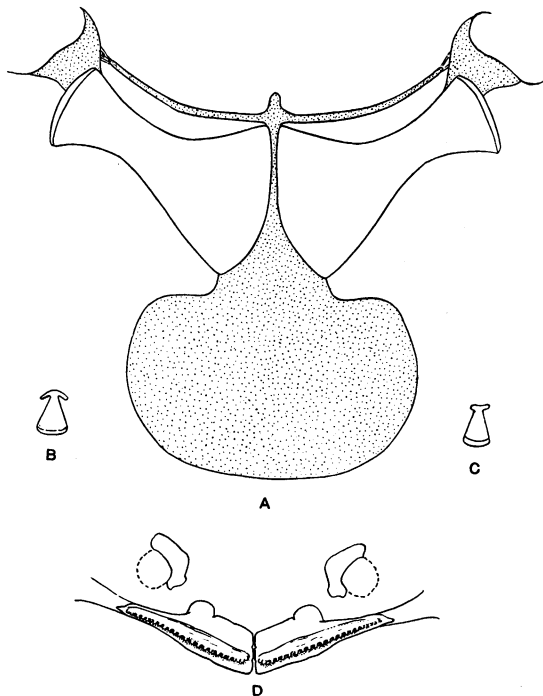


Fig. 10. *Rhombophryne testudo* Boettger.

(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) same, fourth finger, (D) vomers.

ANODONTOHYLA¹ F. Müller

Anodonthyla MÜLLER, 1892, Verh. Nat. Ges. Basel, X, p. 198.

Pupil horizontal. Clavicle present, well developed; procoracoid a thin slip not resting on the coracoid; omosternum present, cartilaginous, not distinct from the procoracoid. Maxilla and premaxilla toothed; vomer in one piece, toothless, without posterior process. Fingers and toes free; former distinctly, latter indistinctly dilated distally; terminal phalanges broadly Y- or T-shaped. Inner finger very short.

***Anodonthyla boulengerii* F. Müller**

Figure 11

A. boulengerii F. MÜLLER, *loc. cit.*

Mantiella pollicaris BOETTGER, 1913, in Voeltzkow, 'Reise in Ostafrika,' III, p. 280, Pl. XXIII, fig. 8.

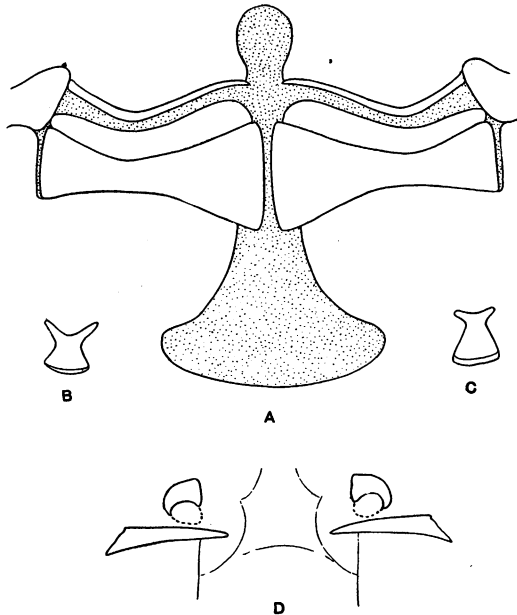


Fig. 11. *Anodonthyla boulengerii* F. Müller, type.

(A) Pectoral girdle, (B) terminal phalanx, fourth finger, (C) same, fourth toe, (D) vomers.

Type specimens of both species examined. A characteristic of this species is the very large egg. In a female 21 mm. long from snout to vent, the eggs were 2 mm. in diameter.

***Anodonthyla montana* Angel**

A. montana ANGEL, 1925, Bull. Mus. Paris, No. 1, p. 62, figs. 1-4.

Type examined.

¹This name was originally spelled *Anodonthyla*. We use the emended form adopted by later writers.

PSEUDOHEMISUS Mocquard

Hemissus GRANDIDIER, 1872, Ann. Sci. Nat. Zool., (5) XV, Art. 20, p. 11 (*nec* Gunther).

Calophrynus BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 472; 1896, Ann. Mag. Nat. Hist., (6) XVII, p. 403 (*nec* Tschudi). MOCQUARD, 1895, Bull. Soc. Philom., Paris, (8) VII, p. 108.

Pseudohemissus MOCQUARD, *loc. cit.*

Pupil horizontal. Clavicle well developed, straight, reaching the scapula and the mid-line of the girdle; procoracoid a very thin slip, not resting on the coracoid; omosternum well developed, cartilaginous, or with the style partially ossified. Maxilla, premaxilla, and vomer edentulous; vomer in one piece with a posteriorly directed process which partly overlies (in one species nearly meets) the palatine; fingers free, toes webbed; neither dilated distally; terminal phalanges simple, either pointed or club-shaped.

A comparison of the skeletons of *Kalophrynus madagascariensis* Boulenger and *K. pleurostigma* Tschudi shows that these species differ in several characters. In the Madagascar species palatine bones are present, the vomers are large with a backwardly directed process which partially overlies the palatines, the nasals are widely separated from the frontoparietals and the omosternum is large. These characters indicate that the Madagascar species of *Kalophrynus* ought to be referred to a separate genus. By courtesy of M. Angel at the Paris Museum, the type specimens of *Pseudohemissus obscurus* have been examined and this species is undoubtedly referable to the same genus as the Madagascar species of *Kalophrynus*. The name of the genus thus becomes *Pseudohemissus* Mocquard. There are four species in the genus.

Pseudohemissus obscurus (Grandidier)

Figure 12

Hemissus obscurus GRANDIDIER, 1872, Ann. Sci. Nat. Zool., (5) XV, Art. 20, p. 11.

Pseudohemissus obscurus MOCQUARD, *loc. cit.*

Types examined.

Pseudohemissus madagascariensis (Boulenger)

Figure 13

Calophrynus madagascariensis BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 472.

Type examined.

Pseudohemissus calcaratus (Mocquard)

Calophrynus calcaratus MOCQUARD, *loc. cit.*

Pseudohemissus brevis (Boulenger)

Calophrynus brevis BOULENGER, 1896, Ann. Mag. Nat. Hist., (6) XVII, p. 403.

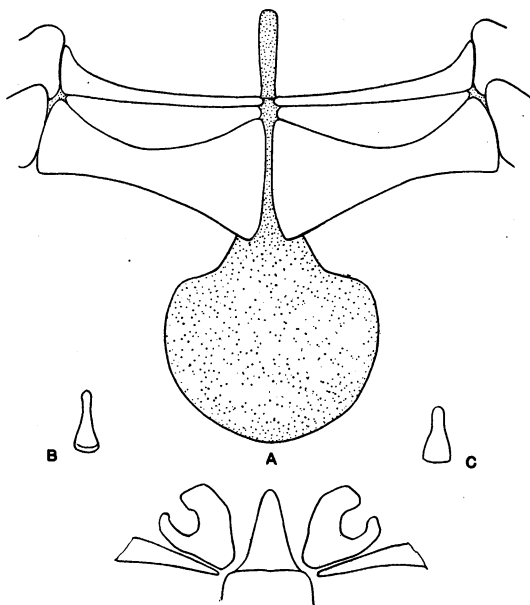


Fig. 12. *Pseudohemismus obscurus* (Grandidier), type.

(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) same, third finger, (D) vomers.

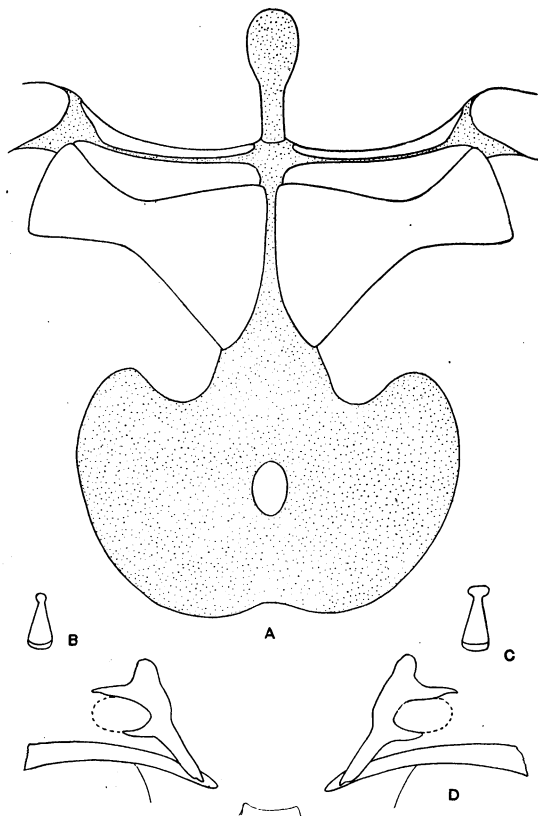


Fig. 13. *Pseudohemismus madagascariensis* (Boulenger), type.

(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) terminal phalanx, fourth finger, (D) vomers.

SCAPHIOPHRYNE Boulenger

Scaphiophryne BOULENGER, 1882, 'Cat. Batr. Sal. Brit. Mus.,' p. 472.

Pupil horizontal. Clavicle present, reduced, not reaching mid-line of girdle; procoracoid a thin slip, not resting on the coracoid; omosternum well developed, cartilaginous. Maxilla, premaxilla, and vomer edentulous; vomer in one piece with a posteriorly directed process which partly overlies the palatine. Fingers free, toes webbed at base; former with large triangular terminal dilations, latter not, or but indistinctly dilated; terminal phalanges of fingers broadly Y- or T-shaped, of toes similar but with the arms much shorter.

This genus is certainly very closely allied to the preceding and may not prove to be distinct. The chief distinctive character, i. e., the Y-shaped terminal phalanges, is not of generic value in other genera (e g., *Plethodontohyla*) but as there is also a difference in the degree of development of the clavicle, it has been deemed advisable to regard them as distinct, at any rate, for the present.

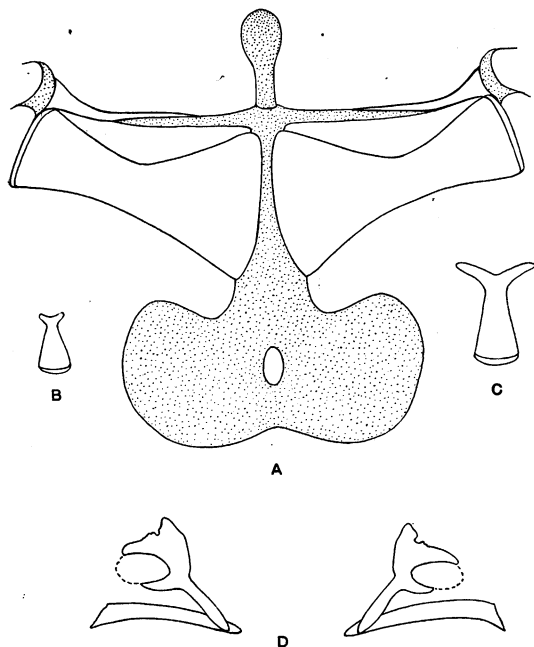


Fig. 14. *Scaphiophryne marmorata* Boulenger.

(A) Pectoral girdle, (B) terminal phalanx, fourth toe, (C) same, fourth finger, (D) vomers.

***Scaphiophryne marmorata* Boulenger**

Figure 14

S. marmorata BOULENGER, *loc. cit.*

S. spinosa STEINDACHNER, 1882, Sitz.ber. Ak. Wiss., Wien, LXXXV, p. 189,

Pl. II.

Type examined.

