BULLETIN
of the
MADRAS GOVERNMENT MUSEUM

Edited by the Director of Museums

THE SOUTH INDIAN AMPHIBIA
IN THE COLLECTION OF THE
MADRAS GOVERNMENT MUSEUM

by

S. THOMAS SATYAMURTI, M.A., D.Sc., F.Z.S.
Director of Museums, Government Museum, Madras

New Series - Natural History Section, Vol. VII, No.2
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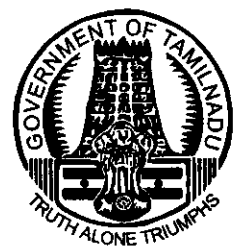

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FOREWORD

The South Indian Amphibia in the Collection of the Madras Government Museum was authored and edited by Dr. S. Thomas Satyamurti, the then Director of Museums, Government Museum, Madras. This book deals with the systematic account of various species of South Indian Amphibians, represented in the collection of the Government Museum, Chennai. They are described in their systematic order, grouped under their respective families and genera.

This publication has been prepared for the use of the students and other research scholars. This book has been a standard reference work on amphibians and has become out of print for several years. It has been felt that there is a need for a reprint and it is hoped that this reprint will stimulate detailed research on the Amphibians of South India.

Chennai - 600 008,
15-3-2005.

(M.A. SIDDIQUE)

THE SOUTH INDIAN AMPHIBIA

IN THE COLLECTION OF THE MADRAS GOVERNMENT MUSEUM

By S. THOMAS SATYAMURTI, M.A., D.SC., F.Z.S.

Director of Museums, Government Museum, Madras.

INTRODUCTION.

In the year 1888, Dr. Edgar Thurston, who was then the Superintendent of the Government Central Museum, Madras, published a concise handbook entitled " Catalogue of the Batrachia Salientia and Apoda (Frogs, Toads and Coecilians) of Southern India " as a Bulletin of the Madras Museum in the Old Series. It was illustrated by thirteen plates of black and white figures and was based on a study of the specimens in the collections of both the Madras Museum and the British Museum (Natural History), London. But that publication, useful and informative as it was, had become out of print and out of stock several years ago. Dr. Boulenger's monumental work on the Amphibia in the Fauna of British India volume on Reptiles and Amphibia, published in 1890, which has been a standard reference work on this group, has also become out of print, and the few copies that are still available in Libraries and Museums are very old and inaccessible and are often not in a condition fit to be handled freely for constant reference work. Students therefore experience a real difficulty in securing a suitable book that would enable them to easily identify the specimens of South Indian Amphibia they may happen to collect.

Since the publication of these early works on the Amphibians of India, however, a considerable amount of additional information has accumulated, especially on the habits, distribution, ecology and larval histories of the Indian species of Amphibians. Besides, a number of specimens not referred to in Thurston's Catalogue of the Batrachians of Southern India have since been added to the collections of the Madras Museum, and a few of these specimens belong to species not mentioned in the above Catalogue, such as, for instance, *Bujo fergusoni, Kaloula pulchra, Uraeotyphlus narayani and Uraeotyphlus menoni.*

Apart from the morphological and taxonmic information contained in the early works of Dr. Boulenger and Dr. Thurston on Indian Amphibians referred to above, the numerous volumes of the Records of the Indian Museum and the Journal of the Bombay Natural History Society contain a number of detailed papers on the habits, distribution, ecology, anatomy, and larval stages of the various Indian species of Amphibia, including a very detailed and comprehensive monograph on the genus *Rana* by Dr. Boulenger in the Records of the Indian Museum (Volume XX, 1920). Dr. Boulenger, Dr. N. Annandale, Mr. Narayan Rao, Dr. J. L. Bhaduri, Mr. J. C. Daniel and Mr. Mc Cann have all made many significant contributions towards the study of Indian Batrachians, and Van Kampen, in his monograph on the Amphibians of the Indo-Australian Archipelago has also dealt with many Indian species in a fairly detailed manner. Since the references to literature pertaining to Amphibia are widely scattered, many of them occurring in the Records of the Indian Museum and the Journal of the Bombay Natural History Society issued over a period

extending to nearly sixty years since the publication of Dr. Boulenger's Fauna of British India volume on Amphibia and Reptilia, the need for a convenient handbook on South Indian Amphibians embodying some of the more important findings contained in these later refrences especially for the use of students and field workers has been increasingly felt during recent years.

It is to fulfil this need, at least partially, that the present work was undertaken. In the case of several species, the range of distribution appears to be far more extensive than what has been originally indicated in Boulenger's volume on Amphibia in the Fauna of British India series, and several new locality records have since been established. Interesting observations have been made by several workers mentioned above and others on the habits larval histories and colour of the living animal. In preparing the present descriptive Catalogue I have therefore taken the opportunity to incorporate some of the additional information that has been gathered since the publication of the Fauna volume, and to mention all the more important and pertinent references relating to the species represented in the collection of the Madras Museum especially those appearing subsequent to the publication of the Fauna of British India volume on Amphibia so as to make the Catalogue sufficiently comprehensive and informative. An attempt has been made to give a clear pen and ink illustration of every species dealt with in the Catalogue so that it could prove helpful as a guide to the identification of most of the common South Indian species of Amphibians.

According to the present system of classification, the Vertebrata are divided into two main divisions of Superclasses, namely, the Pisces, including the fishes, and the Tetrapoda, including the rest of the vertebrates. The Tetrapoda include four classes, namely, Amphibia, Reptilia, Aves and Mammalia.

In several anatomical and behavioural characteristics the Amphibia resemble the fishes. Amphibians, like the fishes and reptiles, are all cold-blood (poikilothermic) animals, the temperature of their bodies being approximately the same as that of the surroundings. The majority of the Amphibians have a pair of lungs situated below the digestive tract, but they have a free-living larval stage during which they breathe by means of gills. The integument is, as a rule, naked though in the Coecilians there are thick, cutaneous rings and small scales are embedded in the skin. The skin is usually moist and serves as an important accessory respiratory organ. Horny, integumentary structures such as claws, scales and nails characteristic of reptiles, birds and mammals are lacking. Many skeletal features are peculiar to the Amphibians. Among these are the presence of one sacral and one cervical vertebrae. In most species of Amphibians the ova are impregnated and hatched outside the body and the larvae or tadpoles which are tailed and gilled undergo a series of changes before they metamorphose into the adult. Since excellent accounts of the general structure and life history of the Amphibians in general are available in standard text-books, it is needless to go into these details in the present account.

Living Amphibia are divided into three orders, namely, (1) Anura (frogs and toads); (2) Caudata (tailed Amphibians such as newts and salamanders) and (3) Apoda (Coecilians or worm-like Amphibians). Of these three Orders, only two, the Anura and the Apoda are represented in Southern India.

In the present descriptive Catalogue, the various species of South Indian Amphibians represented in the collection of the Madras Museum are described in their proper systematic order, grouped under their respective families and genera. The information pertaining to each species consists of a brief description of the animal followed by notes on its habits, wherever it is known, a list of the recorded localities and details of all the specimens of the species contained in the Museum collection (both among the exhibited series in the gallery and in the study collection), including the principal measurements of the larger specimens from each locality.

It should be noted that since the publication of Thurston's early monograph on South Indian Batrachia (1888) and Boulenger's Fauna of British India volume on the Reptilia and Batrachia, and other early works on Indian Amphibia, the nomenclature and classification of Amphibian genera and families have undergone certain radical changes, and it is the new nomenclature that has been adopted in the present Catalogue. The following are among the major changes :—

Some of the genera have been separated from the family Ranidae and included in a separate family, the Rhacophoridae which is a synonym for Polypedatidae. The generic name *Philautus* is used now, instead of the synonymous name *Ixalus*. The family Engystomatidae is now known by the name Microhylidae. Some of the species of *Kaloula* have been separated and included under a distinct genus *Ramanella*, created by Narayan Rao and Ramayana. The genus *Cacopus* is now correctly known by its synonymous name *Uperodon*.

I wish to express my gratitude to Mr. J. Cyril Daniel, Curator, Bombay Natural History Society, for having kindly permitted me to examine the Amphibian collections of the Bombay Natural History Society, and for having furnished me with much valuable information regarding the latest nomenclature and classification of Indian Amphibia. I would also like to express my grateful thanks to Dr. Richard G. Zweifel, Associate Curator of the Department of Herpetology, American Museum of Natural History, New York, for having very kindly furnished me with detailed information on the characters of the family Rhacophoridae (Polypedatidae), and finally I would like to thank Sri R. N. Meganathan, Artist-modeller of the Government Museum, Madras, for the care and skill with which he has prepared the illustrations for this paper.

SYSTEMATIC LIST OF SOUTH INDIAN AMPHIBIANS REPRESENTED IN THE COLLECTION OF THE MADRAS GOVERNMENT MUSEUM.

Class AMPHIBIA.

Order I. ANURA

Sub-order PHANEROGLOSSA.

Series A. FIRMISTERNIA.

Family RANIDAE.

Genus **Rana** Linnaeus.

1. *Rana hexadactyla* Lesson.
2. *Rana cyanophlyctis* Schneider.

Genus **Rana** Linnaeus.

3. ***Rana tigrina*** **Daudin.**
4. ***Rana verrucosa*** **Günther.**
5. *Rana limnocharis* Wiegmann.
6. *Rana malabarica* Dumeril & Bibron.
7. *Rana breviceps* Schneider.
8. ***Rana beddomii*** **(Günther).**
9. *Rana semipalmata* Boulenger.
10. *Rana leptodactyla* Boulenger.
11. *Rana curtipes* Jerdon.

Genus **Micrixalus** Boulenger.

12. *Micrixalus opisthorhodus* (Günther).
13. *Micrixalus silvaticus* (Boulenger).

Genus **Nyctibatrachus** (Boulenger).

14. *Nyctibatrachus major* Boulenger.

Family RHACOPHORIDAE (=POLYPEDATIDE).

Genus *Rhacophorus* Kuhl & v. Hass.

15. *Rhacophorus maculatus* Boulenger.
16. *Rhacophorus malabaricus* Jerdon.
17. *Rhacophorus pleurosticus* (Günther).

Genus **Philautus** Gistel (= **Ixalus** Dumeril & Bibron).

18. *Philautus leucorhinus* (Martens).
19. *Philautus variabilis* (Günther).

Family MICROPHYLIDAE (= ENGYSTOMATIDAE).

Genus **Microhyla** Tschudi.

20. *Microhyla rubra* (Jerdon).
21. *Microhyla ornata* (Dumeril & Bibron).

Genus **Kaloula** Gray (= **Callula** Gray).

22. *Kaloula pulchra taprobanica* Parker.

Genus **Ramanella** Narayan Rao & Ramanna.

23. *Ramanella montana* (Jerdon).
24. *Ramanella triangularis* (Günther).
25. ***Ramanella variegata*** **(Stoliczka).**

Genus **Uperodon** Dumeril & Bibron. (= **Cacopus** (Günther).

26. ***Uperodon systoma*** **(Schneider).**
27. *Uperodon globulosum* (Günther).

Series B. ARCIFERA.

Family BUFONIDAE.

Genus **Bufo**, Laurenti

28. *Bufo melanosticus* Schneider.
29. *Bufo microtympanum* Boulenger.
30. *Bufo hololius* Günther.
31. ***Bufo parietali*** **Boulenger.**
32. *Bufo fergusoni* Boulenger.

Order II. APODA (=GYMNOPHIONA).

Family CAECILIIDAE.

Genus **Ichthyophis** Fitzinger.

33 *Ichthyophis glutinosus* (Linnaeus).
34 *Ichthyophis monochrous* (Bleaker).

Genus **Uraeotyphlus** Peters.

35 *Uraeotyphlus menoni* Annandale.
36 *Uraeotyphlus narayani* Seshachar.

SYSTEMATIC ACCOUNT

Class AMPHIBIA.

Order ANURA.

This Order includes the frogs and toads. In the adult state they are gill-less and tail-less and possess four limbs. The caudal vertebrae are fused into one single elongated bony element called the urostyle. Like other Amphibians they pass through an aquatic larval stage—the tadpole. As the tadpode metamorphoses it develops anterior and posterior limbs, loses its gills and tail and the pharyngeal apertures get closed. The adult thereafter breathes by means of lungs, supplemented by the skin.

Sub-order PHANEROGLOSSA.

A tongue is present and the eustachian tubes are separated. All the Indian Anurans belong to this Sub-order.

Series A. FIRMISTERNIA.

The coracoids are firmly united by a single epicoracoid cartilage. The precoracoids, if present rest with their distal extremity upon the coracoids, or they are connected with the latter by the epicoracoid cartilage. The Firmisternia are supposed to have been derived from the next series, Arcifera, as evidenced by their ontogenetic development.

Family RANIDAE.

The upper jaw is toothed. The diapophysis of the sacral vertebrae are cylindrical or only very slightly dilated. The members of this family have their pectoral girdle constructed on the " Firmisternal " type. In most species of this family, the fingers are perfectly free, but the toes are more or less completely webbed. The feet of many of the

species of Ranidae are provided with one or more metatarsal tubercles which may be blunt, sharp or shovel-shaped and adapted for digging, as in the case of *Rana breviceps*. Some species of Ranidae, as for instance, *Rana semipalmata* and *Rana leptodactyla*, have well developed discs at the tips of their digits by means of which they are able to adhere firmly to smooth vertical surfaces such as walls and window panes.

Out of the six Indian genera, only four, namely, Rana, *Micrilxalus*, *Nyctibatrachus* and *Nannobatrachus* are represented in Southern India, and out of these, specimens of the first three genera only are contained in the Madras Museum collection of South Indian Amphibians.

It should be noted that the genera *Rhacophorus* and *Philautus* (synonym of *Ixalus*) have now been separated into a distinct family, the Rhacophoridae, although till recently they were included in the family Ranidae.

Genus **Rana** Linnaeus.

This genus includes moderate to large-sized frogs. The skin is smooth, or with cutaneous glandular folds, sometimes with flat tubercles. The tongue is large, oblong, extensively free and more or less deeply notched, and bifid behind. The toes are more or less strongly webbed, the web being generally broad. The fingers are quite free with simple dilated tips. The pupil is rounded, subtriangular or horizontal, or rhomboid and very contractile. The tympanum is generally distinct, but may sometimes be hidden. The vomerine teeth are normally present, arranged in two series or groups. The omosternum and sternum bear a bony style. The male bears two lateral vocal sacs.

This genus is cosmopolitan in distribution. Out of the forty-one known Indian species, about seventeen are South Indian, and out of these seventeen, only about ten are represented in the Museum collection.

Rana hexadactyla Lesson.

The Common Green Frog.

Plate I.

Rana hexadactyla Lesson, in Belanger, Voy. Ind. Or. Rep., 1834, p. 331.
Dactylethra bengalensis, Lesson, 111. Zool, 1834 (pl. xlvii).
Rana cutipora, Dum. & Bibr., Erp. Gen., VIII, 1841, p. 339.
Rana cutipora, Jerdon, Journ. Asiatic Soc. Bengal, 1853, p. 531.
Rana robusta, Blyth, Journ. Asiatic Soc. Bengal, 1854, p. 298.
Rana hexadactyla, Giinther, Catalogue Batrachia, 1858, p. 11.
Rana hexadactyla, Giinther, Rept. Brit. India, 1864, p. 405.
Rana hexadactyla, Giinther, Proc. Zool. Soc. London, 1875, p. 568.
Rana hexadactyla, Boulenger, Catalogue, Batrachia Salientia Ecaudata, Brit. Mus., 1882, p. 17.
Rana hexadactyla, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p.21, pl. iii.
Rana hexadactyla, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 441.
Rana hexadactyla, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 500.
Rana hexadactyla, Annandale, Rec. Ind. Mus., III., 1909, p. 284.
Rana hexadactyla, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 31 (tadpole).
Rana hexadactyla, Boulenger, Rec. Ind. Mus., XX, 1920, p 10.
Rana hexadactyla, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXVII, 1920, p. 120 (young specimen).
Rana hexadactyla, Narayan Rao, Journ Bomb. Nat. Hist. Soc., XXIX, 1923, p. 131 (larva).
Rana hexadactyla, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVII, 1934, p. 742.
Rana hexadactyla, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLII, 1940, p. 57.
Rana hexadactyla, Bhaduri, Journ. Bomb. Nat. Hist. Soc., XLIV, 1944, p. 484 (locality records and tadpole).
Rana hexadactyla, De Silva, Spolia Zeylanica, XXVII, 1953—55, p. 245.

This is one of the commonest species of South Indian frogs and is closely allied to the next species, *Rana cyanophlyctis*, but attains a much larger size. The skin is smooth, with more or less distinct rows of pores along the neck, sides and ventral surface of the body. The vomerine teeth are arranged in two oblique rows. The snout is somewhat obtusely pointed. The tympanum is large and distinct, almost as large as the eye. The fingers are slender and pointed, with the first one extending a little beyond the second. The toes are completely webbed right up to their tips. There is a distinct membranous fringe along the first and fifth toes. The metatarsus bears a small inner conical tubercle. The male bears two conspicuous external vocal sacs opening by two slits at the corners of the mouth.

Colour : The upper side is bright grass green in life, often with a central green or yellow pale vertebral stripe along the middle of the back. The underside is pale yellow or creamy white, but becomes dark green towards the posterior side and under surface of the thighs, this dark portion being profusely dotted with pale yellow or creamy white. But in young specimens the underside may be uniformly pale yellow or white throughout. The young are generally beautifully striped on the back. The colour of the specimens rapidly changes in spirit from bright green to a deep chocolate brown or almost blackish green.

Habits : This is the common tank frog of Southern India. It is almost exclusively aquatic and is very common in tanks and along the banks of rivers and lakes throughout South India. This is the species that is commonly dissected for anatomical and physiological studies in school and college laboratories. It is found abundantly in tanks and pools particularly during and after the monsoon when the dinning noise made by the males can be frequently heard almost throughout the night. These frogs are preyed upon by fresh-water fishes notably of the families Ophiocephalidae and Siluridae. The adult usually sits among weeds in the water, where its bright green colour harmonizes well with the green vegetation and conceals it to some extent. When disturbed, it dives through the weeds, but if they are too thick, it skips feebly two or three times.

Recorded localities : The distribution of this species ranges not only all over Southern India and Ceylon, but also extends to other localities in the North. In Southern India, it is said to be a very common species in the plains of Travancore where two distinct colour varieties are reported, namely (1) Dorsal surface brown with a median pale stripe and (2) Dorsal surface striped longitudinally with grey and white. It has also been specifically recorded from Ernakulam, Maddathorai, etc., in the Kerala State.

Prior to 1920 this species was known only from South India and Ceylon (Boulenger, *loc. cit.*., 1920). Bus Bhaduri (*loc. cit.*, 1944) states that it occurs in Bengal and probably also in the Punjab and in the Bombay State. Mc Cann (*loc. cit*, 1940) has recorded this species from Kaneri Caves, Salsette Islands in the Bombay State. This extends the range of its distribution considerably. It appears to be rare in these localities mainly due to its secretive nature, completely aquatic habits and concealing colouration. Ten large specimens of this species are reported to have been caught from a well in Sonarpur, near South Calcutta in 1942, and again, in 1943, several were collected from a pond at Konnagar, about nine miles from Calcutta and two specimens from a pond in Duilla in the Howrah

District, some eight miles south-west of Calcutta. A bright, leaf-green colour of the dorsum with the primrose yellow vertebral streak in the living frog was characteristics of all specimens collected from Bengal.

Specimens in the collection: Thurston (*loc. cit.*, 1886) states that the largest specimen available in the Madras Museum collection at that time measured from snout to vent, only 3-3/16 inches, and its hind limb measured 4 inches in length. But subsequently several much larger specimens have been collected and those collected from the tank in the museum compound in 1959 measure more than five inches in length from snout to vent. Günther (*loc. cit.*, 1864) records specimens attaining 5½ inches length from snout to vent, and with the hind limb measuring eight inches.

Most of the specimens of this species in the museum collection are from Madras. The largest specimens in the collection are from the tank in the museum compound. The measurements of one of these large, full grown specimens, a half grown specimen labelled " Madras ", another full grown specimen from Madras, exhibited in the gallery, and a very young specimen from Trichur, Kerala State, are furnished below :—

(1) Madras : Full grown specimen from the tank in the museum compound :

From snout to vent	112 mm.
Hind limb	152 mm.
Front limb	48 mm.

The vertebral pale stripe is very distinct. The specimens are blackish grey above and creamy white below in spirit. The skin of the back is not quite smooth. It is rather rough and granular. There appears to be some variation in the pattern of colouration among these tank specimens. Out of the four large specimens collected from the tank in the museum compound, only one bears the typical pale vertebral line on the back; two others are completely blackish above and the fourth specimen bears black blotches on a dark ground colour.

(2) Madras : One smaller, half grown specimen :

From snout to vent	84 mm.
Hind limb	104 mm.
Front limb	35 mm.

The colour of this specimen in spirit is dull purplish grey above with a white vertebral stripe and the lower surface is creamy white and profusely granular. On the underside of the thighs there is a slight brownish tinge.

(3) Madras : One large, full grown specimen, exhibited in the gallery :

From snout to vent	124 mm.
Hind limb	201 mm.
Front limb	68 mm.

This specimen is badly faded and is pale yellowish white throughout; it is very robust and the body is of an unusually stout build.

(4) Trichur, Kerala State: One very young specimen collected in September, 1914:

From snout to vent	15 mm.
Front limb	9 mm.
Hind limb	22 mm.

The colour of this specimen (in spirit) is uniformly pale brownish.

In addition to the above specimens, a large number of tadpoles and later developments stages of this species collected from a tank in Tambaram in 1949 are also contained in the collection.

Rana cyanophlyctis (Schneider).

The Water Skipper or the Skipper Frog.

Plate II, fig. 1.

Rana cyanophlyctis, Schneider, Hist. Amph. I, 1799, p. 137.
Rana bengalensis, Gray, III. Ind. Zool. I, 1834, pl. lxxxii, fig. 2.
Rana leschenaulti, Dum. & Bibr., Erp. Gen., VIII, 1841, p. 342.
Rana leschenaulti, Cantor, Journ. Asiatic Soc. Bengal, XVI, 1847, p. 1059.
Rana bengalensis, Kelaart, Prodr. Faun. Zeyl., 1852, p. 192.
Rana leschenaulti, Günther, Catalogue, Batrachia Salientia, 1858, p. 11.
Dicroglossus adolphi, Günther, Proc. Zool. Soc. London, 1860, p. 158, pl. 28, fig. B.
Rana cyanophlyctis, Peters, Mon. Berl. Acad., 1863, p. 78.
Rana cyanophlyctis, Günther, Rept. Brit. India, 1864, p. 406.
Dicroglossus adolphi, Günther, Rept. Brit. India, 1864, p. 402.
Rana cyanophlyctis, Stoliczka, Proc. Asiatic Soc. Bengal, 1872, p. 102.
Rana cyanophlyctis, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 17.
Rana cyanophlyctis, Murray, Zool. Sind., 1884, p. 398.
Rana cyanophlyctis, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 22. pl. iv, fig. 1.
Rana cyanophlyctis, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 442.
Rana cyanophlyctis, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 500 (larvæ).
Rana cyanophlyctis, Boulenger, Annandale & Tate Regan, Rec. Ind. Mus., I, 1907, p. 150.
Rana cyanophlyctis, Annandale, Rec. Ind. Mus., III, 1909, p. 285.
Rana cyanophlyctis, Annandale, Rec. Ind. Mus., VIII, 1912, p. 7.
Rana cyanophlyctis, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 30 (tadpoles).
Rana cyanophlyctis, Annandale, Rec. Ind. Mus., XVI, 1919, p. 122.
Rana cyanophlyctis, Boulenger, Rec. Ind. Mus., XX, 1920, p. 12.
Rana cyanophlyctis, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXIX, 1923, p. 131 (larvae).
Rana cyanophlyctis, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 155.
Rana cyanophlyctis, Mc Cann, Journ, Bomb. Nat. Hist. Soc., XLII, 1940, p. 58.
Rana cyanophlyctis, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLV, 1944–45, p. 436.
Rana cyanophlyctis, Acharji & Kirpalni, Rec. Ind. Mus., XLIX, 1951, p. 182.
Rana cyanophlyctis, De Silva, Spolia Zeylanica, XXVII, 1953—55, p. 245.

This species is closely allied to the common Green Frog, *Rana hexadactyla*, but it is much smaller in size, the maximum length from snout to vent being only about 2.5 inches. **It may be distinguished from *Rana hexadactyla* by its proportionately longer thigh. The skin on the upper side of the body bears small tubercles and warts and rows of pores. The** head is moderately large, with a blunt snout. The vomerine teeth are disposed in small, round or oblique groups, on a level with the posterior border of the choanae or just behind them. The tympanum is distinct, about two-thirds the diameter of the eye. The interorbital space is much narrower than the upper eyelid. The fingers are thin and pointed. The first finger does not extend beyond the second. The toes are more or less completely webbed and pointed at the tips. The fourth toe is very slightly longer than the third and

the fifth. The inner metatarsal tubercle is small, elongate and conical, somewhat resembling a rudimentary toe. The male bears two external vocal sacs.

Colour : The upper side is brownish, greyish or olive brown above, spotted or marbled with black or dark olive markings. A more or less distinct, dark, light-edged band is present along each flank, and on the front and back of the thighs, but often disappearing in the adult. Two blackish streaks on the hinder side of the thighs are almost always present The limbs bear dark spots which do not form complete cross bands. The under side is white or pale yellowish, speckled with blackish spots. There is considerable variation in the extent of the black speckling on the under surface in immature specimens. In most young specimens the under surface is completely white, without any trace of black markings, while in some, these black markings are present sometimes in the form of only a few scattered fine black spots. Sprit preserved specimens are mostly dark brown or brownish olive above.

Habits : This species is one of the commonest of South Indian frogs and is found at all seasons of the year, wherever there is sufficient water. It is almost entirely aquatic and is active both during day and night. It may be seen frequently on the banks of streams or ponds, and usually prefers still water on which it can float. It has the peculiar habit of skipping over the surface of water when alarmed. This accounts for its popular name " Water Skipper " or the " Skipper Frog ". After a series of leaps on the surface of the water, it frequently dives obliquely forwards to the bottom, where it burrows into the mud and partially buries itself, leaving only its two eyes above the mud. After a few minutes, it comes out of its temporary burrow and cautiously reappears on the surface. This species is an extremely active creature and appears to undertake long overland journeys during the night. During the period of aestivation, it is said to bury itself deep in the mud of tanks and ponds, and thus tides over adverse conditions. The call of this frog is characteristic and resembles a somewhat low-pitched rattle, produced by its ovoid vocal sacs which are inflated and deflated alternately. This frog is a voracious feeder, its food consisting of insects, little frogs, tadpoles and insect larvae. This is perhaps the only South Indian frog that habitually swims upstream. It is sometimes found in brackish water.

Recorded localities : This species is widely distributed, its distribution ranging from Arabia to Malay Peninsula and from the Himalayas to Ceylon. In South India it occurs extensively and has been recorded from Madras, Nilgiris, Yercaud, the Godavary Valley and the hills and forests of Malabar. In Trivandrum, Ferguson (*loc. cit.*, 1904) has recorded large numbers of this species at any time of the year on the borders of tanks and ponds, or floating on the surface of the water. Annandale (*loc. cit.*, 1919) has recorded it from streams in the Bombay State at Medha and Khandala and from Ernakulam in Kerala State, while Mc Cann (*loc. cit*, 1944–45) records it from Vizagapatam. Acharji and Kirpalni (*loc. cit*, 1951) have recorded it from the Kangra and Kulu valleys. In the Himalayas, it has been recorded from an altitude of 6,000 feet, while Annandale and Sewel collected one specimen from a small stream near Kotagiri in the Nilgiris, at an altitude of 5,700 feet.

Specimens in the collection :

(1) Dhoni Forest, South Malabar : Two full grown specimens. The measurements of the larger specimen are as follows :—

From snout to vent	62 mm.
Hind limb	98 mm.
Front limb	30 mm.

The black speckling on the upper side is very prominent. The warts on the dorsal side are rather more numerous and concentrated on the sides and towards the hind end. Above the cloacal opening, they are small and more or less in the form of small granulations.

(2) Madras : One half grown male specimen and two very young specimens. The measurements of the half grown specimen are as follows :—

From snout to vent	42 mm.
Hind limb	64 mm.
Front limb	22 mm.

The upper side is pale brown with dark markings. The skin on the dorsal side is covered only with small granulations especially on the hinder side of the body and on the thighs and legs. The under side is uniformly white without any trace of black specklings which appear to be present only in older and full grown specimens.

The two young specimens are about one-fourth adult size, rather faded, and dull greyish brown above.

(3) Atinakur, Kurnool District : One half grown specimen still retaining a vestige of an external gill on the left side and two tadpoles, one of which is larger, and has the hind limbs well developed in addition to the tail.

The mature specimen is only about half grown and the warts and tubercles on the dorsal side of this specimen are very well developed and conspicuous. The under side is uniformly pale yellowish brown (in spirit) and without any trace of black specklings.

Measurements of the mature specimen :

From snout to vent	38 mm.
Hind limb	53 mm.
Front limb	17 mm.

A small, sac-like vestige of an external gill is still persistent.

Measurements of the larger of the two specimens of tadpoles :

From snout to the tip of the tail	70 mm.
Hind limb	34 mm.
Maximum width of the body at the middle	18 mm.

The front limbs appear only as raised buds and have not yet developed in this specimen.

(4) Tittimatti, South Coorg : Three half grown specimens, one of which is of a very dark brown colour with blackish markings. The under side bears faint traces of brown spots in one of the specimens.

(5) Thomara, South Coorg : Six specimens, one full grown, another half grown and the remaining four very young specimens (about one-third the length of the full grown one). The first two specimens have their white under sides profusely speckled with brown spots while in the very young specimens these spots are either completely absent or only faintly indicated.

Measurements of the full grown specimen :

From snout to vent	60 mm.
Hind limb	85 mm.
Front limb	30 mm.

(6) Trichur, Cochin, Kerala State : Four specimens of which one is about half grown and the remaining three very young, about one-third the adult size None of these specimens bears any trace of the black markings on the under side. The warts and tubercles on the back are only prominent in the largest of these specimens (i.e., the half grown one).

Measurements of the half grown specimen :

From snout to vent	45 mm.
Hind limb	70 mm.
Front limb	26 mm.

(7) Horsleykonda, Chittoor District at elevation of 3,000—4,100 feet : Two specimens, one half grown, rather light brown specimen with darker brown markings in the study collection and another full grown, adult, mounted specimen exhibited in the gallery, but completely faded into almost white throughout.

Measurements of the half grown specimen in the study collection :

From snout to vent	38 mm.
Hind limb	60 mm.
Front limb	20 mm.

The under side in the above specimen is white with only a few, fine, scattered, blackish brown spots :

Measurements of the full grown specimen in the gallery :

From snout to vent	61 mm.
Hind limb	92 mm.
Front limb	38 mm.

(8) Ramanathapuram, South India : Three specimens (two half grown and one very young, about one-third adult size). All of them are faded and rather pale greyish brown above, with the markings and tubercles rather obscure. The under side is completely white in all the three specimens without any trace of the black speckling or spots.

(9) Netterikal Region, Kalakkad Forest (about 3,000–5,000 feet, Tirunelveli District : Two specimens.

(i) A half grown male specimen, dark brown, with blackish markings. The vocal sacs are very prominent. The under side is white, almost completely free from

spots, except at the extreme margins of the body and the thighs where there are a few faint markings.

Measurements :

From snout to vent	40 mm.
Hind limb	55 mm.
Front limb	22 mm.

(ii) A larger, female specimen, about three-fourths the full adult size. It is dark brown above with extensive blackish brown markings, but the skin is almost smooth, the warts and tubercles being inconspicuous and, at most, of the nature of fine granulation, especially at the sides and towards the hinder side. The under side is white, speckled with black markings which are heavier and more prominent on the under side of the throat.

Measurements :

From snout to vent	50 mm.
Hind limb	60 mm.
Front limb	20 mm.

(10) Chalakudi, Cochin, Kerala State : Two half grown specimens, dull brown above with darker brown markings, the under side being completely white, without markings.

(11) Ernakulam, Cochin, Kerala State : One half grown specimen, somewhat pale brown above, with faint, darker markings. The under side is without any markings.

(12) Bangalore (?), Mysore State. There is one specimen from Bangalore collected and labelled by Dr. Gravely as *Rana cyanophlyctis*, but on scrutiny, this appears to have been based on incorrect identification as the specimen does not show the typical characteristics of *Rana cyanophlyctis*. It is dark brown above, smooth, except at the sides, where it is granular. On the under side, the skin in the region of the throat is granular. The under side, instead of being white with black spots, is white only in the anterior half, while the under side of the posterior half of the body and that of the thighs are dark brown, marbled with white markings—a pattern so characteristic of *Rana hexadactyla*. In all probability, it is a young specimen of *Rana hexadactyla*.

Rana tigrina Daudin.

The Indian Bull Frog.

Plate III.

Rana tigrina, Daudin, Hist. Rain. Gren Crap., 1803, p. 64, pl. xx & Hist. Rep. VIII, 1803, p. 125.
Rana brama, Lesson, in Belanger, Voy. Ind. Or. Rept., 1834, p. 329, pl. vi.
Rana vittigera. Wiegmann, Nova. Acta, Ac. Leop., 1835, p. 225, t. 21, fig. I.
Rana tigrina, Kelaart, Prodr. Faun. Zeyl. 1852, p. 192.
Rana malabarica, Kelaart, Prodr. Faun. Zeyl., 1852, p. 191.

Rana crassa, Jerdon, Journ. Asiatic Soc. Bengol, XXII, 1853, p. 531.
Rana tigrina, Günther, Catalogue, Batrachia Salientia, 1858, p. 9.
Rana tigrina, Peters, Mon. Berl. Acad. 1863, p. 77.
Rana tigrina, Günther, Rept. Brit. India, 1864, p. 407.
Hoplobatrachus ceylanicus, Günther Rept. Brit. India, 1864, p. 410.
Rana tigrina, Günther, Proc. Zool. Soc. London, 1875, p. 567.
Rana tigrina, Boulenger, Catalogue, Batrachia Salientia Ecaudata, Brit. Mus., London, 1882, p. 26.
Rana tigrina, Murray, Zool. Sind. 1884, p. 308.
Rana tigrina, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 21, pl. iii.
Rana tigrina, Boulenger, Fauna Brit, India, Reptilia and Batrachia, 1890, p. 449.
Rana tigrina, Aitken, Journ. Bomb. Nat. Hist. Soc., IX, 1895, p. 500.
Rana tigrina, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 501.
Rana tigrina, Boulenger, Annandale & Tate Regan, Rec. Ind. Mus., I, 1907, p. 151.
Rana tigrina, Annandale, Rec. Ind. Mus., III, 1909, p. 285.
Rana tigrina, Annandale, Rec. Ind. Mus., VIII, 1912, p. 8 (osteolgy).
Rana tigrina, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 34 (tadpoles).
Rana tigrina, Boulenger & Annandale, Rec. Ind. Mus., XV, 1918, pp. 51 and 59 (races of *Rana tigrina*).
Rana tigrina, Boulenger, Rec. Ind. Mus., XX, 1920, p. 17.
Rana tigrina, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXIX, 1923, p. 132.
Rana tigrina, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXVII, 1920, p. 120.
Rana tigrina, Mahendra, Journ. Bomb. Nat. Hist. Soc., XXXIII, 1929, p. 724.
Rana tigrina, Mc Cann Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 158.
Rana tigrina, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLII, 1940, p. 58.
Rana tigrina, Mc Cann. Journ. Bomb. Nat. Hist. Soc., XLV, 1944–45, p. 436 (larva).
Rana tigrina, Acharji & Kirpalni, Rec. Ind. Mus., XLIX, 1951, p. 183.
Rana tigrina, Gay, Journ. Bomb. Nat. Hist. Soc., LII, 1954–55, p. 212 (food).
Rana tigrina, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 245.

This is the largest of all Indian species of frogs, attaining a length of about six inches from snout to vent. The skin of the back is covered with longitudinal folds. In addition to the longitudinal folds, the skin bears small granular protuberences all over the back. A strong glandular fold is present, extending from the eye to the shoulder. The lower parts are smooth. The head is moderately large, about as long as broad, or broader than long, rather strongly depressed, and with a more or less pointed snout. The vomerine teeth are arranged in strong, oblique, straight or slightly curved series narrowly separated from each other, commencing from near the anterior border of the choanae. The tympanum is distinct, with a characteristic, strong fold of skin above it. It is about two-thirds the diameter of the eye. The nostrils are situated a little nearer to the end of the snout than to the eyes. The toes bear slightly swollen tips and are nearly entirely webbed. The fourth toe is the longest, being about one and a half times longer than the fifth. The web does not extend quite to the tip of the fourth toe. The inner metatarsal tubercle is compressed, elongated and shovel-shaped. The fingers are short the first being distinctly longer than the second. The subarticular tubercles are rather small and feebly developed. The male bears a white external vocal sac on each side of the throat, forming longitudinal folds. The forelimb is moderately thickened. A strong pad is present on the inner side of the first finger in the male, covered, during the breeding season, with a greyish brown, velvety, horny layer.

Colour : The colour of the Bull Frog is rather variable. Normally it is olive brown above (but it may also be yellowish, green or olive above), marked with characteristic, large irregularly shaped blackish spots which may be disposed in longitudinal series on the back, or form two or three cross bands. Towards the hinder side of the back, these spots become more numerous and crowded and tend to coalesce together, with pale interstices. A dark band extends forwards from the eye to the snout through the nostril. There is often a narrow light yellow vertebral stripe extending from the snout to the vent, but this is absent in some of the specimens in the collection. The males during the breeding season are pale greenish yellow above, with

dark spots. The under side is pale, with a series of broad, transverse black spots bordering the edge of the lower jaw. The young bear a yellowish lateral band, from behind the eye; this band may entirely disappear in the adult. The limbs bear dark cross bands which may be irregular or replaced by large spots. The hinder sides of the thighs are marbled with black and yellow. The lower parts are white, without spots, or with only a few spots on the throat. In the males, the colour changes according to the season. The under parts often bear a pinkish tinge on the lower portions of the thighs.

Habits : The Bull Frog is the largest of Indian species of frogs. It is mostly aquatic and is very common in tanks and ponds throughout India. Bull Frogs are sometimes preyed upon by otters. When frightened, it is said to jump over the surface of the water much in the same way as on land. Mc Cann (*loc. cit*, 1933) has given a vivid account of its breeding habits. The Bull Frog may be met with almost any time of the year in wells and tanks. Those living in dry situations bury themselves deep in the earth after the rains and reappear again at the onset of the next monsoon. During the period of aestivation they sometimes bury themselves as deep as twenty or thirty feet below the surface, and a number of them may be found in the same hole. When the monsoon breaks again large numbers may be seen all over the fields and around tanks and ponds. When they reappear from their burrows, most of the male Bull Frogs are a pale lemon yellow. The large external vocal sacs in the male are coloured a vivid cobalt blue, in the living condition. When they emerge at the break of the monsoon the male frogs croak loudly and incessantly, producing a deafening noise, and as the primary instinct at this time is that of mating, there is a considerable amount of fighting among the males for the possession of the females. The males distinguish the females mainly by their colour. Soon after mating, the male begins to lose its yellow colour and gradually assumes the usual brown and mottled colour pattern. The eggs are deposited singly in small puddles. Each egg is surrounded by a transparent, jelly-like substance. Eventually a number of eggs become agglutinated together to form a single mass. The tadpoles, when hatched out, get swept into larger pools where they undergo their metamorphosis. Cannibalism is widely prevalent among the tadpoles of the Bull Frog.

Much has been written about feeding habits of the Bull Frog. The food of the Bull Frog is extremely varied. Although insects constitute its principal diet, it feeds on small mammals, rarely small birds, snakes, lizards, other frogs, earthworms and in fact any creature which it is able to capture and overpower. A specimen which was caught in the act of swallowing a young Rat Snake was received from Travancore by Dr. Sundara Raj, and this specimen is still in the Museum collection, among the exhibited series of specimens in the Amphibian gallery. Once the Bull Frog has been observed to attack a Kingfisher (Aitken, *loc. cit.*, 1895; Gay, *loc. cit.*, 1954). This species is also said to be a regular cannibal and feeds readily on the young of its own species. On one occasion a specimen seven inches long was observed to eat another which was hardly less in size. In captivity, it will feed on raw meat. The Rat Snake, the Checkered Keelback or Water Snake and the Shikra (*Astur badius*) are among the chief enemies of the Bull Frog. Sometimes Bull Frogs are found infested with leaches.

Recorded localities : This species is widely distributed and is found throughout India and Ceylon, up to the base of the Himalayas. Its distribution also extends beyond India, from China to the Malay Peninsula and Archipelago. In India, it has been specifically recorded from Madras and Nilgiris; from Shenkottah, Vykkam and Shasthancottah in Travancore-Cochin (i.e., Kerala State); from Visakhapatnam (Mc Cann, *loc. cit.*, 1944–45); from Nepal at altitudes of 4,000—5,000 feet (Boulenger, Annandale and Tale Regan, *loc. cit.*, 1907); and from Kangra and Kulu valleys and the the Darjeeling District, in Eastern Himalayas (7,000 feet), (Acharji and Kirpalni, *loc. cit.*, 1951).

The forms occurring in Madras, Nilgiris, Malabar and Ceylon are referred to as variety *crassa* Jerdon (Annandale, *loc. cit.*, 1920, p. 20) which is distinguished from the typical form by its stouter and more toad-like form with very large, shovel-shaped, inner metatarsal tubercle. Thurston (*loc. cit.*, 1888) records specimens of this species from Madras and the Nilgiris (at an elevation of 7,000 feet) contained in the collection of the British Museum.

Specimens in the collection : Besides three large, full grown specimens, two from Madras and one from Travancore, measuring about 16 inches from snout to vent, exhibited in the gallery, there are several young and half grown specimens in the reserve collection. The measurements of the largest specimens in the collection are furnished below :—

(1) Travancore : One specimen, exhibited in the gallery. This specimen is reported to have been captured in the act of swallowing a young rat snake and is mounted with about three-fourths of the length of the rat snake actually shown swallowed by the frog.

Measurements :

From snout to vent	133 mm.
Hind limb	244 mm.
Front limb	85 mm.

The colour of this specimen is faded almost white, with faint indications of brownish cross bars on the limbs. The under side of the limbs is marked with brownhis markings. The belly is yellowish white. The longitudinal folds on the skin of the back are feebly developed in this specimen. It is said to have been received and added to the Museum collection by Dr. B. Sundara Raj.

(2) Madras : Two specimens, exhibited in the gallery. Of these, the larger and more recent specimen, with the colour markings fairly distinct, was collected in May 1957; it is the largest specimen contained in the collection.

Measurements :

From snout to vent	160 mm.
Hind limb	239 mm.
Front limb	85 mm.

The original colour and pattern of markings are still retained in this specimen to a large extent.

(3) Ernakulam : Two specimens, one half grown, and the other much smaller. The measurements of the larger, half-grown specimen are as follows :

From snout to vent	80 mm.
Hind limb	119 mm.
Front limb	35 mm.

(4) Trichur, Kerala State : Six specimens, all of them young and immature. Two of them are moderately small, measuring about 60 mm. from snout to vent. The other four are very young and small, ranging from 10 mm. to 35 mm. in length from snout to vent. The specimens are all faded into pale brown, with faint indications of slightly darker spots, owing to prolonged preservation in alcohol.

(5) Wallappa Rayadu Temple Tank, near Udayagiri, Nellore District: Four young specimens. Two of these are very young specimens, barely 10 mm. from snout to vent, but other two are larger.

The measurements of the largest of these young specimens are as follows :

From snout to vent	28 mm.
Front limb	12 mm.
Hind limb	48 mm.

The upper side is dark brown, marbled with dark markings, while the underside is paler brown.

Thurston (*loc. cit.*, 1888) states that the largest specimen in the Madras Museum measures six inches from the tip of the nose to the vent and nine inches from the vent to the tip of the longest toe. He is probably referring to the older full grown specimen from Madras, mentioned above, and exhibited in the gallery.

Rana verrucosa Günther.

Plate II, fig. 2.

Rana verrucosa, Günther, Proc. Zool. Soc. London, 1875, p. 567.
Rana verrucosa, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 29, pl. iv. fig. 1.
Rana verrucosa, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 25, pl. iv, fig. 2.
Rana verrucosa, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 448.
Rana verrucosa, Boetg., Ber. Offenb. Ver. Nat., 1892, p. 94.
Rana verrucosa, Ferguson, Journ, Bomb. Nat. His. Soc., XV, 1904, p. 501.
Rana verrucosa, Annandale, Rec. Ind. Mus. III, 1909, p. 285.
Rana verrucosa, Annandale, Rec. Ind. Mus. XV, 1918, p. 17, pl. i, fig. 1.
Rana verrucosa, Boulenger, Rec. Ind. Mus. XX, 1920, p. 26.

This species includes moderate-sized, more or less robustly built frogs. The dorsal surface bears numerous prominent warts and glandular folds. The lower parts are smooth but granulated under the thighs, near the vent. The head is moderately large, with an obtusely pointed snout, and is somewhat depressed and a little longer than broad. The snout projects slightly beyond the mouth. The loreal region is very oblique and concavely depressed. The vomerine teeth are disposed in strong, oblique rows touching the anterior borders of the choanae, or norrowly separated from them. The tympanum is very distinct and is slightly smaller than the width of the eye, being about three-fifths to two-thirds the diameter of the eye. The hind limb is rather long, and the toes are nearly completely webbed, but the web does not extend to the

extremity of the fourth toe. The toes are obtusely pointed and slightly swollen at the tips. The outer matatarsal tubercles are separated nearly to the base; the sub-articular tubercles on the toes are small, but prominent. The inner metatarsal tubercle is elliptical and rather compressed. The fingers are obtusely pointed, the first being longer than the second. The sub-articular tubercles on the fingers are large, and very prominently developed. The male bears internal vocal sacs and a rather feebly developed pad on the inner side of the first finger.

Colour: The upper side is greyish or brown, with darker spots and large markings of which the most constantly occurring ones are a V-shaped band between the eyes and transverse, bifurcated markings between the shoulders, and one or two cross bars on the posterior part of the body. The posterior portions of the thighs are black, marbled with whitish markings. A broad, pale, vertebral stripe is sometimes present, but when present, it is often interrupted by the dark markings. This stripe is, however, absent in the specimens contained in the Museum collection.

Habits : This frog appears to be essentially a hill species, being found usually at elevations of 4,000 to 7,000 feet in the hills of Southern India. This species is said to be very abundant in the Travancore Hills. It is less common in the Nilgiris. Unlike ***Rana limnocharis***, this species generally avoids small pools and puddles and is usually found at the edges of streams and large reservoids. Though both species occur in the Nilgiris, they are seldom found together in the same localities. *Rana verrucosa* is said to be common in the artificial lake at Ootacamund in the Nilgiris.

Recorded localities : Malabar hills; Nilgiris, up to an altitude of 7,000 feet; and in the Travancore Hills up to an altitude of about 4,000 feet. Ferguson (*loc, cit.*, 1904) has recorded this species from running water in streams at an elevation of 4,000 feet on the hills in Travancore. Annandale (*loc cit.*, 1909) has recorded this species from Tenmalai, Maddathorai and Kulattupuzha in Travancore, where it is said to be found along with *Rana leptodactyla*.

Specimens in the collection :

(1) Cochin, Kerala State : One adult, full grown specimen, mounted and exhibited in the gallery.

Measurements :

From snout to vent	42 mm.
Hind limb	69 mm.
Front limb	22 mm.

The specimen is almost completely faded into white, in spirit.

(2) Perambikulam Forest, Cochin, Kerala State : One adult, full grown specimen.

Measurements :

From snout to vent	43 mm.
Hind limb	55 mm.
Front limb	20 mm.

Six immature specimens are also contained in the collections, from the same locality.

Ernakulam, Kerala State: One adult, full grown specimen. The specimen is badly faded; it was originally exhibited in the gallery, but was subsequently removed to the reserve collections.

Measurements:

From snout to vent	50 mm.
Hind limb	70 mm.
Front limb	25 mm.

(4) Dhoni Forest, South Malabar : One half grown specimen, but the colour markings are fresher and clearer than in the preceding specimens. The broad, black, transverse markings on the upper aspect of the hind limb are particularly well marked. They are faded into deep brown in the specimen:

Measurements:

From snout to vent	34 mm.
Hind limb	46 mm.
Front limb	18 mm.

(5) Chalakudi, Kerala State: Two immature specimens, rather badly contracted. The measurements of the larger specimen are as follows:

From snout to vent	29 mm.
Hind limb	47 mm.
Front limb	17 mm.

Rana limnocharis Wiegmann.

The Streaked Frog.

Plate II, fig. 3.

Rana limnocharis (Boie) Wiegmann, N. Acta Acad. Leop., 1835, p. 255.
Rana gracilis, Wiegmann, *loc. cit.*, p. 257.
Rana agricola and *R. nilagirica*, Jerdon, Journ., Asiatic. Soc. Bengal, XXII, 1853, p. 532.
Rana gracilis, Günther, Rept. Brit. India, 1864, p. 409, and Proc. Zool., Soc. London, 1875, p. 567.
Rana gracilis vars. *andamanensis, nicobariensis, pulla*, Stoliczka, Journ. Asiatic Soc. Bengal, 1870, p. 142.
Rana brevipalmata, Peters, Mon Berl. Acad., 1871. p. 646.
Rana gracilis, Boulenger, Catalogue, Batrachia Salientia Ecaudata, Brit. Mus., 1882, p. 28.
Rana gracilis, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 24.
Rana limnocharis, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 450.
Rana limnocharis, Boulenger, Fasciculi Malayensis, Zool., pt. I, 1903, p. 134.
Rana limnocharis, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 501.
Rana limnocharis, Boulenger, Annandale and Tate Regan, Rec. Ind. Mus., I, 1907, p. 151.
Rana limnocharis, Annandale, Rec. Ind. Mus., III, 1909, p. 285.
Rana limnocharis, Boulenger, Vert. Fauna Malay Peninsula, Reptilia and Batrachia, London, 1912, p. 236.
Rana limnocharis, Annandale, Rec. Ind. Mus., VIII, 1912, p. 8.
Rana limnocharis, Annandale, Mem. Asiatic Soc. Bengal, VI, 1917, p. 132.
Rana limnocharis, Annandale, Rec. Ind. Mus., XIV, 1918, p. 68.
Rana limnocharis, Annandale and Narayan Rao. Rec. Ind. Mus., XV, 1918, p. 32 (Tadpole).
Rana limnocharis, Boulenger, Rec. Ind. Mus., XX, 1920, p. 28.
Rana limnocharis, Van Kampen, The Amphibia of the Indo-Australian Archipelago, 1923, p. 167, fig. 23.
Rana limnocharis, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXIX, 1923, p. 132 (larvae).
Rana limnocharis, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 166.
Rana limnocharis, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLV, 1944–45, p. 436.
Rana limnocharis, Acharji and Kirpalni, Rec. Ind. Mus., XLIX, 1951, p. 183.
Rana limnocharis, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 245.

This species is very closely related to *Rana tigrina*. It is, however, smaller and bears imperfectly webbed toes. There is usually a small outer metatarsal tubercle. There is a great deal of variation in the length and shape of the snout and in the relative length of the hind limbs. The skin of the back bears narrow, longitudinal

ridges. A fold of skin is present above the tympanum and another distinct transverse fold is present behind the eyes. The posterior surface of the thighs bears fine, close-set folds of the skin, but the lower side is smooth.

The vomerine teeth are arranged in two oblique series between the choanae, or extending a little beyond the level of their posterior borders. The head is as long as broad, and moderately depressed. The snout is either pointed or rounded, projecting more or less beyond the mouth, its shape being very variable. The loreal region is concave and markedly oblique. The nostrils are situated more or less midway between the eye and the tip of the snout, but rather nearer the end of the snout than the eye. The tympanum is distinct and is about half to two-thirds the width of the eye. The fingers and toes are rather bluntly pointed. The first finger extends beyond the second. The sub-articular tubercles are well developed and prominent. The hind limb is moderately long and the heel (i.e., the tibio-tarsal articulation) reaches the eye or even beyond, between the eye and the snout. In some specimens it may reach even beyond the snout. The toes are obtusely pointed and slightly swollen at the tips, and are only about half-webbed. A prominent, oblong inner matatarsal tubercle and a small, rounded, outer metatarsal subercle are present. The sub-articular tubercles are rather small, but prominent. The male bears two external vocal sacs, forming loose folds on the throat.

Colour: The upper side is greenish or greyish olive with large black spots on the back and on the limbs. The colour is sometimes suffused with bright carmine. Spirit-preserved specimens are all mostly dark brownish. A triangular transverse spot is present between the eyes, with the apex of the spot directed backwards, but this is absent in most of the specimens in the collection, examined. There is also a transverse band with forked edges, on the back between the forelimbs and a straight, V-shaped band across the sacral region. A yellowish vertebral line or broad band is often present. The sides of the thighs are marbled with black markings. Five broad, short, pale bands radiate outwards from the eye to the upper lip. The under side is uniformly whitish or pale yellowish white. The male bears a M-shaped black spot on the throat. A very characteristic feature of this species is the stripe or steak (from the presence of which the popular name " Streaked Frog " is derived) down the centre of the back. But this character is variable. The streak may very in width and colour, or may even be absent altogether. The lips bear dark vertical bars, and the limbs bear complete, or more often, incomplete cross bars.

Habits: Next to *Rana cyanophlyctis*, *Rana limnocharis* is the commonest and most widely distributed of the Indian frogs. They are found abundantly in the vicnity of tanks and streams, and generally frequent the edges of ponds and marshes. When disturbed, they leap into the water, but rapidly swim ashore again. They do not skip on the surface of the water as frogs of the species *R. cyanophlyctis* do. When alarmed, the frogs jump into the water and get submerged, but only for a while, for very soon they reappear, rising to the surface and swim ashore again, seeking shelter in the shore vegetation. They are extremely active in their habits. Normally they do not float on the surface of the water like *R. cyanophlyctis*, but only rest on the surface, with the legs hanging down below the surface. During the dry season, these frogs either collect under stones, etc., in damp places during the day, and come out at dusk, or they aestivate. Large numbers

of this species aestivate in crevices of rocks and under large stones, during the summer. During the monsoon, they wander far and wide in the grass and may be found both during the day and night.

At the onset of the monsoon, large numbers of these frogs collect on the banks of perennial streams and tanks to deposit their spawn. During this period, the males croak *incessantly*, commencing at dusk and stopping only with the break of dawn, but on cloudy or rainy days, they may be heard throughout the day. The vocal sacs in the male are blackish, and the voice is fairly strong and resembles a clattering sound produced in the distance. While the sound is being produced, the abdomen and the vocal sacs are alternately inflated and deflated.

This species is very common throughout the plains, especially in paddy fields and a variety, viz., *brevipalmatus*, is found on the hills. Captain Flower states that at Singapore, " it does not attempt to escape by jumping into the water, but even if touched, squats down close, so is easily caught ". But in other localities they appear to be quite active and agile.

In mountainous districts it is said to undergo prolonged hibernation, during which it conceals itself. Frogs which had fallen into wells and had been unable to escape have been observed to float on the surface in cold weather in a semitorpid condition in such localities (Boulenger, *loc. cit.*, 1920).

Recorded localities : This is a widely distributed species, its range extending from China throughout India, Burma and Ceylon, as far as Malay Peninsula and Archipelago, and eastwards to Philippines, Borneo and Lombok. In the Himalayas it occurs up to an altitude of 7,000 feet, especially in Sikkim, and in the Kangra and Kulu Valleys in Eastern Himalayas (Acharji and Kirpalni, *loc. cit.*, 1951). It has also been recorded from Nepal, Kumaon and Dharampur in the Simla Hills (Boulenger, Annandale and Tare Regan, *loc. cit.*, 1907). It has even been recorded from the Inle Lake on Burma (Annandale, *loc. cit.*, 1918). In South India, it has been recorded from the Nilgiris and the hills of Malabar, and from Trivandurm, Shencottah, Maddathorai, Karumadi and Vykkam in the Kerala State. This species is said to be common only in marshes in the Wynaad and the Nilgiris. It has also been observed to inhabit inundated paddy fields and meadows. In Travancore, it is said to be common in the open country and also in the jungle at the base of the hills. Mc. Cann (*loc. cit.*, 1944–45), has recorded it from the Visakhapatnam District.

Specimens in the collection : Several specimens are represented in the collection, but most of them are not full grown ones. The largest specimen in the collection measures only about 2 inches from snout to vent, while the recorded adult size for this species is 2.5 inches.

(1) Yercaud : Three specimens, of which only the largest appears to be an almost full grown adult. The measurements of this specimen are as follows :

From snout to vent	53 mm.
Hind limb	84 mm.
Front limb	26 mm.

(2) Trichur, Kerala State : Fourteen specimens, all of them young ones, some of them being very small. The largest of these measures only 25 mm. from snout to vent. The pale vertebral stripe in some of these specimens is very broad and prominent, but in others it is absent. Of these, thirteen specimens are in the reference collection and one is mounted and exhibited in the gallery. The measurements of the gallery specimen are as follows :—

From snout to vent	25 mm.
Hind limb	47 mm.
Front limb	17 mm.

(3) Chalakudi, Kerala State : Three very young specimens, rather faded. All of them are less than 10 mm. from snout to vent.

(4) Ernakulam, Kerala State : Two young specimens, pale brown in colour, measuring about 20 mm. from snout to vent (doubtfully referred to as *R. limnocharis*).

(5) Nallamalais, Kurnool District : Eight specimens, all of them very young ones, being less than half grown. The vertebral stripe is thin, narrow and inconspicuous in some, and broad and prominent in others. The black markings on the legs are distinct and take the form of broad cross bars. The hind limbs in all these specimens seem proportionately longer than in the specimens from the preceding localities. The skin of the back in some of these specimens is covered with granular or wart-like protuberences, rather than with longitudinal folds. The measurements of the largest specimen are as follows :—

From snout to vent	27 mm.
Hind limb	55 mm.
Front limb	20 mm.

(6) Madras : A single young specimen, with the vertebral stripe well marked. The skin of the back bears wart-like tubercles especially on the sides.

Measurements :

From snout to vent	24 mm.
Hind limb	36 mm.
Front limb	10 mm.

(7) Ootacamund, Nilgiris : One half grown specimen. The vertebral stripe is absent. The longitudinal folds on the back are conspicuous.

Measurements :

From snout to vent	30 mm.
Hind limb	45 mm.
Front limb	15 mm.

Rana malabarica Dum. and Bibr.

The Fungoid Frog.

Plate IV, figs. 1 and 2.

Rana malabarica (Bibr.), Tschudi, Class Batr., 1838, pp. 40 & 80.
Rana malabarica, Dum. & Bibr., Erp. Gen., VIII, 1841, p. 635, pl. lxxvi, fig. 1.
Hylorana malabarica, Günther, Rept. Brit. India, 1864, p. 426.
Hylorana malabarica, Stoliczka, Proc. Asiatic Soc. Bengal, 1872, p. 105.

Rana malabarica, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 60.
Rana malabarica, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 28.
Rana malabarica, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 456.
Rana malabarica, Boulenger, Rec. Ind. Mus., XX, 1920, p. 99.
Rana malabarica, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 168 (habits, colour, etc.)
Rana malabarica, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLII, 1940, p. 60.

This species includes moderate-sized frogs about two to three inches in length from snout to vent, but rarely exceeding about two and a half inches in length. The body and limbs in this species are proportionately more slender and elongated than in *Rana hexadactyla*. The skin is smooth or finely granulated above, with small warts on the sides, and bears a broad, ill defined, dorso-lateral glandular fold, extending from above the tympanum to the groin. The under parts are smooth, or granulate on the posterior part of the belly and under the thighs.

The head is rather depressed, with a broad, rather blunt snout. The snout is moderately projecting, and is as long as the eye or slightly longer. The loreal region is slightly oblique and concavely depressed. The tympanum is very distinct and is nearly as large as the eye or slightly smaller. The nostril is a little nearer the end of the snout than the eye. The vomerine teeth are disposed in oblique groups or short rows between the choanae. The fingers are moderate-sized, the first extending beyond the second. The tips of the fingers and toes are distinctly dilated. The sub-articular tubercles on the fingers are large and very prominently developed. The hind limb is rather variable, being either somewhat short or moderately long. The toes are comparatively short and rather imperfectly webbed. The sub-articular tubercles on the toes are rather large and very prominent. The inner metatarsal tubercle is blunt and oval, and very prominent. There is a fairly large, rounded tubercle, at the base of the fourth toe. The males bear rather feebly developed external vocal sacs, forming folds on the side of the throat, an ill defined flat gland on the front aspect of the arm, and a feebly developed pad on the inner side of the first finger, covered with a velvety, horny layer.

Colour : The colour of this species is bright crimson above, and blackish brown at the sides, but in spirit, the crimson of the back fades into a pale brown and the sides are dark brown. The crimson area on the back sometimes bears a few black spots. The sides of the head are also blackish brown. The upper sides of the limbs are blackish brown, marbled with pale brown and white. The under side of the body is white or yellow, either uniform or spotted or marbled with dark brown markings. The throat and breast may sometimes be dark brown. The tympanum is often reddish brown. A white streak is present on the upper lip, terminating in the glandular fold behind the mouth.

Mc. Cann. (*loc. cit.*, 1933) states that the colouring of this species is strikingly characteristic. The upper side may be brick red or orange-red, sometimes crimson and sometimes, especially in specimens in poor condition, yellowish. A sharp, narrow, white or yellowish line extends from the snout, passing from behind the eye to the vent. This line sharply demarcates the red dorsal surface from a broad, greyish black band along the flanks. The dark band merges with the mottled markings on the under surface. Both the hind and fore limbs are transversely, but irregularly, barred. The eyes are tinged with bright red and gold. Mc. Cann observes that when it is seated on a tree trunk, the characteristic red colour of its back gives it the appearance of a red bark fungus as the outline of its dark sides merges with the colour of the bark, and its limbs gathered well up under its body are also almost invisible. Hence its popular name, "Fungoid Frog".

Habits: This species is supposed to be a hill species, but it is by no means confined to hilly country, although it is most abundant at the base of the hill ranges. It does not ascend up to high elevations on the hills. It has been known to breed in running streams at the base of the Nilgiris. Mc Cann (*loc. cit.*, 1933) has given a good account of its habits and habitat. It generally frequents forested areas, but may be occasionally seen in open country. It is terrestrial or partly arboreal in habit and may be frequently seen adhering to the bark of trees or on the leaves of shrubs and bushes. It is probably a diurnal species, as it is seldom seen to be active at nights.

This frog is not a shy creature. It has been known to sit motionless and allow one to approach quite near, and may even allow itself to be touched. In the living state it so closely resembles the bark fungus that it must be regarded as a remarkable instance of protective colouration. The tips of the digits are sometimes dilated and capable of adhering to flat surfaces, but they are not so well developed, nor are they so strongly adhesive as in the case of *Rhacophorus maculatus*, the Chunam Frog. Mc Cann (*loc. cit.*, 1933) states, "when handled, the call of this frog is not unlike the mew of a kitten, plus a sort of high-pitched "*kut-kut*" repeated several times". When placed in water, this frog appears to be uncomfortable and attempts to come out of the water; it is therefore more or less completely terrestrial in its habits.

Recorded localities: This species is recorded in Western India, from Bombay to Malabar. It inhabits the hills and forested regions of Malabar and Bombay. Mc Cann (*loc. cit.*, 1933) has recorded it from the Salsette Jungles and at the north end of the Bombay Island. This species is said to be fairly common in the Island of Salsette and the northern part of Bombay Island.

Specimens in the collection: Three specimens, of which one is half grown, from the Netterikkal Region of the Kalakkad Forest in the Tirunelveli district at an altitude of 3,000 to 5,000 feet, and two from Cochin, Kerala State, of which one is a half grown specimen mounted and exhibited in the gallery, and the other a very young specimen. The measurements of these three specimens are as follows:

(1) Netterikkal Region, Kalakkad Forest, Tirunelveli District (half grown specimen):

From snout to vent	33 mm.
Hind limb	45 mm.
Front limb	15 mm.

(2) Cochin, Kerala State: (Half grown specimen, mounted and exhibited in the gallery; faded white):

From snout to vent	34 mm.
Hind limb	57 mm.
Front limb	19 mm.

(3) Cochin, Kerala State: (very young specimen):

From snout to vent	22 mm.
Hind limb	25 mm.
Front limb	12 mm.

Rana breviceps (Schneider).

The Burrowing Frog.

Plate IV, fig. 3.

Rana breviceps, Schneider, Hist. Amph., I, 1799, p. 142.
Rana variegata, Gravenh, Delic. Mus. Vratisl., 1829, p. 33, pl. viii, fig. 1.
Pyxicephalus fodiens, Jerdon Journ. Asiatic Soc. Bengal, 1853, p. 534.
Pyxicephalus pluvialis, Jerdon, *loc. cit.*, p. 534.
Sphaerotheca strigata, Günther, Catalogue, Batrachia Salientia, 1858, p. 32, pl. ii, fig. A.
Tomopterna delalandii, Günther, *loc. cit.*, p. 129.
Tomopterna strigata, Günther, Proc. Zool. Soc. London, 1860, p. 165.
Pyxicephalus breviceps, Günther, Rept. Brit. India, 1864, p. 411.
Pyxicephalus breviceps, Theobald, Catalogue Rept., Asiatic Soc. Mus., 1868, p. 80.
Pyxicephalus breviceps, Anderson, Proc. Zool. Soc. London, 1871, p. 200.
Rana breviceps, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 32.
Pyxicephalus breviceps, Murray, Zool. Sind, 1884, p. 399.
Rana breviceps, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 25, pl. iv fig. 3.
Rana breviceps, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 451.
Rana breviceps, Ferguson, Journ, Bomb. Nat. Hist. Soc., XV, 1904, p. 502.
Rana breviceps, Narayan Rao, Rec. Ind. Mus., XI, 1915, p. 34 (larva).
Rana breviceps, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 32 (tadpoles).
Rana breviceps, Boulenger, Rec. Ind. Mus., XX, 1920, p. 103.
Rana breviceps, Mc. Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 167 (habits).
Rana breviceps, Mc. Cann, Journ. Bomb. Nat. Hist. Soc., XLV, 1944–45, p. 436.
Rana breviceps, Bhaduri & Kirpalni, Journ. Bomb. Nat. Hist. Soc., LII, 1954–55, p. 620.
Rana breviceps, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 245.

This species includes rather stoutly built, moderate-sized frogs, with a short head and rounded snout. The head is rather convex, and broader than long. The occipital region is rather convexly inflated. The vomerine teeth are set in strong, short, oblique series between the chonanae. The loreal region is oblique and slightly concavely depressed. The nostril is more or less equidistant from the eye and from the tip of the snout. The tympanum is distinct and about half to two-thirds the diameter of the eye. The skin of the upper side is smooth or granulate, with a few scattered tubercles especially towards the posterior side, or short, interrupted longitudinal folds may be present along the back. A particularly strong fold of the skin extends from the eye to the shoulder. The belly and under surfaces of the thighs are granulated.

The fingers are moderately thick and blunt, and rather short; the first finger extends much beyond the second and is nearly as long as the third. The sub-articular tubercles are large and very prominent, or sub-conical. The hind limb is very short, and the toes are also rather short and partially webbed. The sub-articular tubercles are fairly well developed. The inner metatarsal tubercle is very large, strongly compressed and shovel-shaped, with a sharp edge and is nearly as long as the second toe. It is inserted obliquely at the base of the first toe which it exceeds in length. The hind limbs are comparatively short and thick, with the tibio-tarsal articulation reaching as far in front as the tympanum.

Bhaduri and Kirpalni (*loc. cit.*, 1954–55), have described the presence of a small but distinct tubercle at the tibio-tarsal articulation in all the specimens collected from Trivandrum in Travancore and a few other localities. The fleshy, cutaneous tubercle is a very small, rounded structure, creamy yellow in colour, placed ventrally at the tibio-tarsal articulation and in a line with the shovel-shaped inner metatarsal tubercle. It is interesting to observe that this tubercle has been noticed only in specimens from Ceylon, Trivandrum, Bangalore, Cuddappah, Ratnagiri and in one of the specimens from Madras in the collection of the Zoological Survey of India and absent in specimens from other localities such as Malabar and Anamalai Hills and from localities in Northern India, Himalayas,

Assam, Nepal and Burma. Bhaduri and Kirpalni therefore suggest that the presence of the tubercle may form the basis for distinguishing a distinct geographical race. The tubercle is, however, absent in the specimens examined in the Madras Museum collection.

The male bears two well developed internal vocal sacs, forming folds on the sides of the throat, which are black, or blackish. In the males the toes are a little more slender than in the females.

The largest specimens measure about 2½ inches in length from snout to vent.

Colour : The upper side is light brown, olive or yellowish, marbled with dark brown markings. Usually there is a light vertebral band and sometimes also another pale yellowish longitudinal band one on each side just above the flank. The upper lip usually bears dark vertical bands. The throat of the male is blackish, while that of the female is usually spotted with brown. The limbs generally bear irregular dark cross bands, the groin and hinder side of the thighs being dark brown with yellow spots, or marbled with dark brown and yellow markings. The lower parts are white and the throat sometimes bears brown spots. There appears to be considerable colour variation in this species, some specimens being greenish, marbled with brown or dark brown markings. Formerly, they were distinguished as distinct species, namely, *Pyxicephalus fodiens* and *Pyxicephalus pluvialis* by Jerdon, but they are now considered to be synonymous with *Rana breviceps*.

Habits : This species is faily common in compounds in and around Madras during the monsoon from October to December. With the aid of its shovel-like metatarsal tubercle it burrows into the soft ground to a depth of about one and a half feet or more. It is a clumsy-looking species, thoroughly nocturnal in habits, even during the rains. Ms. Cann. (*loc. cit.*, 1963) reports that after dark this frog is quite common on the roads at Panchgani. If it happens to fall into water it appear very uncomfortable, but if disturbed or alarmed, it readily dives into water and soon reappears on the surface. Specimens kept in captivity have been observed to feed on insects. This species digs and burrows into the ground mostly during the day. At Khandala, Mr. Cann. (*loc. cit.*, 1963 reports that he found one which had dug itself about a foot below the surface of the ground.

Narayan Rao (*loc. cit.*, 1915) states that the adult of this species is thoroughly terrestrial and the burrowing habits have resulted in an appearance very similar to that of *Cacopus systoma*. It leads a solitary life and congregates only during the breeding season. A light vertebral line is present in most specimens, but this is not a constant character. Its call is characteristic and may be likened to the short syllables " Rut-Rut-Rut ", uttered in quick succession. It is entirely nocturnal in its habits, and young frogs are able to withstand captivity much better than adult specimens.

Recorded localities : This species is widely distributed, being recorded from Punjab and Sind in the North to Southern India and Ceylon. Its distribution also extends to upper Burma. In the Himalayas it is recorded up to about 7,000 feet. In Southern India it is mostly restricted to the plains and has been specifically recorded from Madras, Malabar, Tirunelveli and also from Trivandrum, Travancore, Anamalai Hills, Cuddapah in the Andhra State and Bangalore in the Mysore State. This species occurs in many parts of Northern India as well, though it may not be as common there as in Southern India. It has been specifically recorded by Mc. Cann. (*loc. cit.*, 1944–45) from the Visakhapatnam District.

Specimens in the collection:

(1) Madras: Three specimens, of which two are in the reference collection, and one mounted and exhibited in the gallery.

(*a*) Reference collection specimen, about three-fourths grown:—

Measurements:

From snout to vent	48 mm.
Hind limb	53 mm.
Front limb	29 mm.

The vertebral band and lateral bands are distinct.

(*b*) Reference collection specimen: slightly larger than the above specimen, but much more stoutly built, with very stout limbs:

Measurements:

From snout to vent	50 mm.
Hind limb	55 mm.
Front limb	30 mm.

The vertebral pale band is distinct and widens conspicuously in the inter-orbital area. The pale bands on the sides above the flanks are very broad. The marbled markings are more contracted towards the sides, posterior parts and over the limbs.

(*c*) Gallery specimen:

Measurements:

From snout to vent	54 mm.
Hind limb	73 mm.
Front limb	30 mm.

The colour of this specimen, in spirit, is pale brownish, with faint traces of the darker brown markings. It is badly faded.

(2) Red Hills, Chingleput District: Four half grown specimens, preserved in spirit, olive brown above, with dark brown markings and pale yellowish brown beneath. The vertebral stripes are present only in two of the specimens; the vertebral stripe in these two specimens does not widen in the inter-orbital space. The skin on the upper side bears scattered tubercles in all the specimens:

The measurements of the largest of these specimens are as follows:

Front limb	30 mm.
Hind limb	44 mm.
Front limb	15 mm.

(3) Trichur, Kerala State: One very young specimen, measuring less than 15 mm. in length, from snout to vent.

Rana beddomi (Günther).

Plate IV, fig. 4.

Polypedates beddomii, Günther, Proc. Zool. Soc. London, 1875, p. 571, pl. lxiii, fig. B.
Polypedatus brachytarsus, Günther, *loc. cit.*, p. 572.
Rana beddomii, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 55.
Rana beddomii, Thurston, Catalogue Batrachia Salientia and Apoda of Southern India, 1888, p. 26; pl. v, fig. 1, A,B.
Rana beddomii, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 453.
Rana beddomii, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 503.
Rana beddomii, Annandale, Rec. Ind. Mus. III, 1909, p. 285.
Rana beddomii, Annandale, Rec. Ind. Mus. XV, 1918, p. 18, pl. i, fig. 4.
Rana beddomii, Boulenger, Rec. Ind. Mus. XX, 1920, p. 114.
Rana beddomii, Abdulali & Daniel, Journ. Bomb. Nat. Hist. Soc., LII, 1954—55, p. 938.

This species includes moderate-sized frogs found inhabiting the forested regions of South India. The head is strongly depressed, as long as broad, or a little broader than

long. The snout is obtusely pointed, and feebly projecting beyond the mouth. The loreal region is oblique and concavely depressed. The nostril is equidistant from the eye and the tip of the snout. The interorbital space is equal to or less than the width of the upper eyelid. The vomerine teeth are disposed in short, transverse or feebly oblique series on a level with the posterior borders of the choanae. The tympanum is very distinct and is about half to two-thirds the diameter of the eye. The tongue bears a long, free, pointed papilla in the middle.

The fingers are moderately long, the first extending slinghtly beyond the second. The tips of the digits both in the fore and hind limbs are dilated into small discs. The sub-articular tubercles on the fingers are large and very prominent. The hind limb is long, with the tibio-tarsal articulation reaching the tip of the snout or belond. The toes are rather long, depressed and dilated at the tips, and are webbed up to two-thirds of their lengths. The sub-articular tubercles on the toes are moderate-sized or rather small, but prominent. There is no tarsal fold. There is a cmall, oval or elliptical inner metatarsal tubercle.

The skin is smooth or finely granulated on the upper side and bears small, elongate warts or short, glandular longitudinal folds. There is a particularly strong glandular fold extending from the eye to the shoulder. The under parts are smooth or feebly granulated on the posterior part of belly. A discoidal ventral fold is sometimes present.

The male does not bear any vocal sacs, but has an enlarged pad on the inner side of the first finger.

Colour : The upper side is brown (fading into pale brown in spirit-preserved specimens), with rather indistinct, darker brown spots. Rarely the colour is a uniform pinkish. A pale vertebral stripe is sometimes present. A more or less distinct dark cross band as present between the eyes. A dark brown or black temporal spot is also present. The tympanum is sometimes reddish. The upper sides of the limbs bear more or less distinct dark brown cross bars. The lower parts are uniformly white, the throat being rarely brown or marked with brown spots. But the colour appears to be variable.

It is reported (Abdulali & Daniel, *loc. cit.*, 1954–55) that specimens of this species found at Mahabaleshwar in Bombay State occurred in three strikingly different colour patterns :

(i) The commonest was dark above, very similar to *Rana leithii*.

(ii) A less frequent pattern was paler, with dark patches behind the eye (similar to breeding specimens from North Kanara).

(iii) A relatively rare colour pattern was dark brown, or almost black above, with a white vertebral streak, extending from the snout to the posterior end of the body. There was often a small white square blotch on the top of the head. These colour patterns were observed in both the sexes and all the frogs had verying shades of reddish orange on the under side. No specimens from these localities were larger than 40 mm. from snout to vent, while the specimens from South Indian localities contained in the Museum collection are much smaller.

Habits : This species usually inhabits forests in Southern India. Ferguson recording this species from Trivandrum (*loc. cit.*, 1904) states that this little frog is only found in forest and usually only on the hills, but on one occasion it was found at Bombayum about ten miles from Trivandrum in the low country. It is reported (Abdulali & Daniel, *loc. cit.*, 1954–55) that specimens of this species at Mahableshwar in Bombay State were frequently seen during the day, but were more abundant at night. This species feeds on insects and the stomach contents of these frogs collected from North Kanara and Mahableshwar included Gryllids, Reduvid bugs and Carabiid beetles.

Recorded localities : This species is recorded mostly from forests of Southern India, Malabar, Travancore, Sivagiri, Anamalais, North Kanara and Tirunelveli. Ferguson (*loc cit.*, 1904) has recorded it from Trivandrum and Bombayum about ten miles from Trivandrum in the plains. Annandale (*loc. cit.*, 1909) states that a single specimen of this species was taken with *Rana verrucosa* at the edge of a rocky stream at Tenmalai in the Western Ghats. The type specimens of this species are specifically recorded from the following localities :—

(i) Sivagiri Hills in the Tirunelveli District.
(ii) Anamalai Hills on the Madras-Cochin border; and
(iii) Malabar.

Specmens of this species have also been collected from North Kanara (Abdulali & Daniel, *loc. cit.*, 1954–66). These were taken from among dry leaves by the side of a stream in heavy forest. It is stated that in addition to the enlarged pad on the inner side of the first finger, mentioned by Boulenger (*Rec. Ind. Mus.*, XX, 1920) as a secondary sexual character, they had on the ventral side of each femur a granular, oval-shaped swelling occupying most of the area between the vent and the knee joint. Later, Mr. Abdulali found that these frogs were extremely common on and under the rocks in flowing streams at Mahableshwar in the Bombay State.

Specimens in the collection : Most of the specimens in the Museum collection are from the erstwhile Cochin State.

(1) Cochin, Kerala State : One, formerly exhibited in the gallery, but later withdrawn into the reference collection. It is half grown, and faded into a uniform, pale creamy brown colour :

Measurements :

From snout to vent	31 mm.
Hind limb	60 mm.
Front limb	18 mm.

(2) Cochin, Kerala State : One specimen, mounted and exhibited in the gallery, completely faded into white :

Measurements :

From snout to vent	31 mm.
Hind limb	49 mm.
Front limb	15 mm.

(3) Perambikulam, Cochin, Kerala State : Five, of which four are very young specimens and the remaining one nearly half grown. The measurements of the last specimen are as follows :—

From snout to vent	25 mm.
Hind limb	40 mm.
Front limb	15 mm.

(4) Kavalai, Cochin, Kerala State : Two, one of which is half grown and the other a young specimen. The measurements of the half grown specimen are as follows :—

From snout to vent	27 mm.
Hind limb	45 mm.
Front limb	15 mm.

The broad, elliptical dark brown transverse bars on the thighs and legs are very clearly marked in this specimen.

(5) Chalakudi, Cochin, Kerala State : One young specimen, somewhat dark brown above. The longitudinal folds on the back are very distinct.

Measurements :

From snout to vent	35 mm.
Hind limb	60 mm.
Front limb	20 mm.

(6) Netterikkal Region, Kalakkad Forest, Tirunelveli District; at an altitude of about 3,000—5,000 feet : One specimen. This is more than half grown, being larger than the preceding specimens. There is a fairly broad, pale, distinct, vertebral stripe along the back. The longitudinal folds on the back are prominent.

Measurements :

From snout to vent	35 mm.
Hind limb	60 mm.
Front limb	20 mm.

Rana semipalmata Boulenger.

Plate IV, fig. 5.

Rana semipalmata, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit, Mus., 1882, p. 56, pl. iv, fig. 3.
Rana semipalmata, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 27, p. v. fig. 2.
Rana semipalmata, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 454.
Rana semipalmata, Fischer, Journ. Bomb. Nat. Hist. Soc., XXIV, 1915 16, p. 194 (habits).
Rana semipalmata, Anandale, Rec. Ind. Mus. XV, 1918, p. 20, pl. i, fig. 3.
Rana semipalmata, Boulenger, Rec. Ind. Mus., XX, 1920, p. 117.

This is a moderately small-sized species of frog measuring about one and half inches in length from snout to vent. The head is depressed, about as long as broad, with an obtusely rounded snout and a mederately developed obtuse canthus rostralis. The loreal region is moderately oblique and concavely depressed. The nostril is placed a little nearer the end of the snout than the eye. The interorbital space is almost as wide as the upper eyelid The vomerine teeth are disposed in short oblique series just behind the level of the choanae. The tongue bears a long, pointed papilla in the middle. The tympanum is distinct, and is about as large as the eye. The fingers are moderately long, the first extending a little beyond the second. The tips of the figers are dilated into rather large

and conspicuous discs which are rather broader than long, and with a groove in front separating the upper from the lower surface. The sub-articular tubercles are moderately developed.

The hind limb is rather long, with the tibio-tarsal articulation reaching the tip of the snout or very near it. The toes are rather long, depressed and dilated at the tips as in the case of the fingers, and are half webbed. The sub-articular tubercles are moderately developed. There is no tarsal fold. A single, small, oval, inner metatarsal tubercle is present. It is about one-third the length of the inner toe.

The skin on the back bears short, longtitudinal glandular folds. The sides of the body are granulated, bearing small warts. A strong, glandular fold extends from the eye to the shoulder. The lower parts are smooth. The male has no vacal sacs and is devoid of any secondary sexual characters.

Colour : The upper side of the body is brown, and the sides of the body somewhat darker. The loreal and temporal regions are blackish. A dark cross-bar is present between the eyes. The limbs also bear dark cross-bars. The underside is white, but the throat and breast are mottled with brown.

This species is stated by Boulenger to be intermediate between *Rana beddomii* and *Rana leptodactyla*. It is distinguished from both by the much larger tympanum which is almost as large as the eye. It differs from the former in having the toes only half webbed, and from the latter in the first finger extending a little belond the second, and by the more well developed web between the toes.

Habits : C.E.C. Fischer (*loc. cit.*, 1916–16) has described the habits of this species in a note in the Journal of the Bombay Natural History Society. He observed its habits on the Anamalai Hills in 1915, and states that the sound produced by this frog is accompanied by an extraordinary expansion of the skin below the throat into a bladder nearly as large as the rest of the animal. The frog is aboreal in its habits. Its song is produced generally during the night, but may also be heard during the hours of daylight in the dense shade of the evergreen forest. Its song resembles the rapid drumming of the finger nails on a thin tin place (from eight to twenty or more strokes being heard), finally ending with one to four rather widely spaced strokes. This sound is repeated incessantly at short intervals, one frog answering the call of another. The bladder on the throat remains fully distended throughout.

Recorded localities : Malabar C. E. C. Fischer (*loc. cit.*, 1915–16) has recorded this species specifically from the Anamalai Hills.

Specimens in the collection :

(1) Dhoni Forest South Malabar : One specimen, collected by Prof. E. Barnes at an altitude of 1,500 to 4,000 feet.

Measurements :

From snout to vent	25 mm.
Hind limb	32 mm.
Front limb	12 mm.

The colour of this specimen (in spirit) is pale yellowish brown above, and almost whitish or creamy beneath. The dark cross bars on the limbs are also faded into brown, indistinct markings in the present specimen. The male type specimen cited by Boulenger (*loc. cit.*, 1920) measured only 27 mm. from snout to vent. The present specimen appears, therefore, to be an almost full grown specimen.

(2) Cochin, Kerala State: One specimen, mounted and exhibited in the gallery. The colour has completely faded into an almost uniform white.

Measurements:

From snout to vent	23 mm.
Hind limb	39 mm.
Front limb	14 mm.

Rana leptodactyla Boulenger.

Plate V, fig. 1.

Polypedatus brevipalmatus, Günther, Proc. Zool. Soc. London, 1875, p. 572.
Rana leptodactyla, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 57.
Rana leptodactyla, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 27.
Rana leptodactyla, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 454.
Rana leptodactyla, Boettg., Ber. Offenb. Ver. Nat. 1892, p. 95.
Rana leptodactyla, Annandale, Rec. Ind. Mus. III, 1909, p. 285.
Rana leptodactyla, Annandale, Rec. Ind. Mus., XV., 1918, p. 19, pl. i, fig. 2 (larva).
Rana leptodactyla, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXVII, 1920, p. 123 (egg., tadpoles, etc.).
Rana leptodactyla, Boulenger, Rec. Ind. Mus., XX, 1920, p. 118.

This is a species of rather small-sized frogs, with somewhat thin and attenuated limbs. The head is more or less strongly depressed, as long as broad or a little broader than long, with a rounded snout, slightly projecting beyond the mouth. The loreal region is oblique and concavely depressed. The nostril is equidistant from the eye and from the tip of the snout. The vomerine teeth are disposed in short, transverse or feebly oblique series on a level with the hinder edge of the choanae. The tongue bears a long, pointed papilla in the middle. The tympanum is very distinct, and is about half to three-fifths the diameter of the eye.

The fingers are moderately long, with their tips dilated into rather large discs which are slightly broader than long, and bear a groove in front, separating the upper from the lower surface. The first finger is shorter than the second. The sub-articular tubercles on the fingers are moderately large.

The hind limb is rather thin and long, with the tibiofarsal articulation reaching the tip of the snout or even beyond. The toes are rather long, depressed, dilated at the tips into large discs, and are only partially webbed. The sub-articular tubercles on the toes are rather small and inconspicuous. There is no tarsal fold and the inner metatarsal tubercle is elliptical.

The skin on the upper side bears short, longitudinal, glandular folds. The sides of the body are more or less granulate, with flattened warts. There is a strong glandular fold, extending form the eye to the shoulder. The underside is smooth, but the hinder part of the belly may sometimes be faintly granulated. The males do not bear any vocal sacs or other secondary sexual characters.

Colour : The upper side is brown or olive brown, mottled with darker brown markings. There is a more or less distinct sub-triangular dark spot between the eyes, often demarcated in front by a pale cross band. A black temporal spot is present. A pale vertebral band is also sometimes present. The limbs bear dark cross bars. The under side is white, uniform or sometimes spotted with brown, or sometimes brown with white dots.

Habits : This is essentially a species of the forests and in certain localities it has been found in association with *Rana verrucosa*. Very little has been recorded specifically about the habit of this species.

Recorded localities : This species is found in forests of Southern India. It has been specifically recorded from the forests of Malabar and the Anamalai Hills, and also from Devicolam, Travancore. Annandale (*loc. cit.*, 1909) states that it is common at Tenmalai, in Travancore along with *Rana verrucosa*.

Specimens in the collection :

(1) Perambikulam, Cochin, Kerala State : Six specimens, half grown. The measurements of the largest of these specimens are as follows :

From Snout to vent	12 mm.
Hind limb	43 mm.
Front limb	10 mm.

(2) Vellikulam Karai, Cochin, Kerala State : Three immature specimens.

(3) Trichur, Kerala State : Three specimens, half grown; they are, however, in a bad state of preservation. The measurements of the largest of these specimens are as follows :

From snout to vent	15 mm.
Hind limb	41 mm.
Front limb	12 mm.

(4) Coorg : One specimen, full grown, mounted and exhibited in the gallery. The specimen is in a rather poor state of preservation, with the skin partially disintegrated.

Measurements :

From snout to vent	33 mm.
Hind limb	57 mm.
Front limb	18 mm.

(5) Muthu Chulai Timber Forest, Cochin, Kerala State : Three nearly full grown specimens collected in 1911. The measurements of the largest specimen are as follows :

Front snout to vent	28 mm.
Front limb	13 mm.
Hnid limb	46 mm.

The colour of the specimen is dark brown above, paler brown below. The vertebral pale stripe along the back is conspicuous in these specimens.

Rana curtipes (Jerdon).

Plate V, fig. 2.

Rana curtipes, Jerdon, Journ. Asiatic Soc. Bengal, XXII, 1853, p. 532.
Pachybatrachus robustus, Mivart, Proc. Zool. Soc. London, 1868, p. 557.
Clinotarsus robustus, Mivart, Proc. Zool. Soc. London, 1869, p. 227.
Hylorana curtipes, Jerdon, Proc. Asiatic Soc. Bengal, 1870, p. 83.
Rana curtipes, Boulenger, Catalogue, Batrachia Salientia Ecaudata, 1882, p. 61.
Rana curtipes, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 28.
Rana curtipes, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 458.
Rana curtipes, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 503.
Rana curtipes, Narayan Rao, Rec. Ind. Mus., X, 1914, p. 265 (larva).
Rana curtipes, Boulenger, Rec. Ind. Mus., XX, 1920, p. 131.

This species is moderately large, attaining a length of about 3¼ inches from snout to vent. The head is large, strongly deprssed, with a short, rounded snout, which may sometimes be obtusely pointed. The loreal region is concavely depressed. The nostril is placed nearer the tip of the snout than the eye. The interorbital width is as broad as, or a little broader than, the upper eyelid. The vomerine teeth are poorly developed and disposed in oblique series or ill-defined groups on a level with the posterior borders of the choanae, and may sometimes be absent or indistinct. The tympanum is very distinct, about three-fourths, or even equal to, the diameter of the eye.

The fingers are rather slender, somewhat dilated at the tips, the first finger extending beyond the second. The sub-articular tubercles on the fingers are large and prominent.

The hind limb is rather short and thin, with the tibiotarsal articulation reaching the tympanum or the eye. The toes are somewhat short and are nearly completely webbed. The tips of the toes are dilated into very small discs which are longer than broad. The sub-articular tubercles on the toes are moderately large and very prominent. There is no tarsal fold. The inner metatarsal tubercle is small, oval and blunt. A rather large flat tubercle is present at the base of the fourth toe.

The skin is smooth and bears a narrow, but conspicuous glandular dorso-lateral fold extending from above the tympanum to the groin. There is also another oblique fold extending from behind the tympanum to the upper side of the forelimb.

The males bear internal vocal sacs and possess more robust fore limbs. A small, grey, velvety thickening is present on the inner metacarpal tubercle and on the inner side of the first finger.

Colour: The upper side is grey, pale brown or crimson, sometimes with scattered small black spots. The sides of the body are darker brown or black. A blackish oblique spot or band is present below the eye, and the upper lip bears a dark border. The lateral fold is paler, bordered with black. The limbs are dark puplish brown, without cross bands. The under side varies from light to dark brown, the throat being sometimes dark brown. In young specimens, the under parts are black.

Habits: This species is said to be found only in forest and is chiefly observed during the monsoon. It is distinguished by its peculiar, rather pleasing call. In the living condition, the head and back are said to be bright buff above, the sides deep maroon, the legs dark purple with a few white spots and the abdomen mottled with white. The young

ones possess a distinct parotoid gland on each side of the back, behind the tympanum, but this usually disappears with age. The young frog of this species is frequently said to attain a relatively large size, before losing the vestiges of its tail.

Recorded localities: North Canara; hills and forests of Malabar from Canara to Travancore. Specimens in the British Museum are said to be from North Canara and Malabar. Thurston (*loc. cit.*, 1888) states that there was a specimen of this species in the Madras Museum collection from Wynaad, but this is not now traceable in the collection, the specimen now represented in the collection having been collected from Bangalore. Ferguson, (*loc cit.*, 1904) records a single specimen of this species from Pirmerd at an elevation of 3,000 feet in Travancore.

Specimens in the collection: A single specimen from Bangalore, mounted and exhibited in the gallery. The head and front part of the body are broad, while the hind part of the body is comparatively slender and narrow:

Measurements:

From snout to vent	51 mm.
Hind limb	68 mm.
Front limb	35 mm.

The colour of this specimen is almost completely faded into uniform white.

Genus **Micrixalus** (Boulenger).

This genus is closely allied to the genus *Rana*. In fact, they appear to be dwarfed forms of *Rana*, in which the vomerine teeth are not developed. Thurston included species of *Micrixalus* in the genus *Ixalus*, which it closely resembles superficially.

The pupil is horizontal. The tongue is free and notched posteriority. Vomerine teeth are absent. The tympanum is indistinct or even concealed. The fingers are free, but the toes are webbed to a varying extent. The tips of the digits are dilated into well developed discs. The outer matatarsals are separated by the web. The distal phalanges of the digits are T-shaped. This genus is confined to South India and Ceylon.

Two species are represented in the Museum collection, namely, *M. opisthorhodus* and *M. silvaticus*. The former is distinguished by the presence of a free, pointed, median papilla on the tongue, while in the latter, there is no papilla on the tongue. Further, in the former, the toes are nearly webbed, while in the latter they are only partially webbed.

Micrixlus opisthorhodus (Günther).

Plate V, figs. 3 and 4.

? Limnodytes ? phyllophila, Jerdon, Journ. Asiatic Soc. Bengal, 1853, p. 95.
Ixalus opisthorhodus, Günther, Proc. Zool. Soc. London, 1868, p. 484, pl. xxxvii, fig. 3.
? Limnodytes ? phyllophila, Jerdon, Proc. Asiatic Soc. Bengal, 1870, p. 85.
Ixalus opisthorhodus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 95.
Ixalus opisthorhodus, Thurston, Batrachia Salientia and Apoda of Southern India, 1888, p. 34, pl. vi. fig. 2. A and B.
Micrixalus opisthorhodus, Boulenger, Fauna Brit, India, Reptilia and Batrachia, 1890, p. 465.
Micrixalus opisthorhodus, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 503.

This species includes rather small-sized frogs found in the forests and hills of South-western India. The skin is smooth above, with a few short, oblique folds. There is a strong, narrow, glandular lateral fold and another fold of skin extending from the eye to the shoulder. The lower surface is quite smooth. The snout is somewhat bluntly acuminate, prominent and about as long as the width of the orbit. The loreal region is flat and vertical. The nostril is almost equidistant from the eye and the tip of the snout. The interorbital space is wide and slightly broader than the upper eyelid. The tympanum is small and concealed. The tongue bears a free pointed papilla along the median line towards the front.

The fingers are free, but the toes are about three-fourths or almost entirely webbed. The discs at the tips of the digits are small, but moderately well developed. The sub-articular tubercles are small. A small inner metatarsal tubercle is present. The hind limb is fairly long, the tibio-tarsal articulation reaching between the eye and the tip of the snout. The male bears two internal vocal sacs, the openings of which are very small.

Colour : The colour and markings of the spirit preserved specimens are as follows : the upper side is brownish, with a few somewhat faintly marked darker markings. The regions between the eye and the nostril and the temporal area are dark brown. The upper side of the limbs bear dark cross bands. The lower side is uniform, or with brown spots on the throat and breast. The lower sides of the hind limbs and the thighs and sometimes the hind part of the belly are brightly rose-cloured in fresh specimens and this rose colour persists in most of the spirit-preserved specimens also. This feature accounts for the specific name *opisthorhodus* for this species.

In life, the colour of the upper side is dark brown, while the sides are lighter brown. The under side is yellowish with a series of dark, mottled markings, which are dense over the throat, rendering it dark coloured. The lower surface of the hind limbs is rose-coloured. The anal region is black. A very prominent black band is present on each side of the head under each eye and nostril. A few white tubercles are sometimes present on the sides. Two longitudinal folds are always present on th sides of the trunk and a few oblique folds and wrinkles on the head, back and hind limbs are also present. The limbs are prominently cross-barred.

Habits : This species is said to be common in the densely wooded sholas near Kotagiri at elevations of about 6,000 feet. These frogs normally live in the margins of sheltered and shaded streams and take freely to water.

Thurston (*loc. cit.*, 1888) states that it is quite possible that this species is the same as Jerdon's *Lymnodytes phyllophila*, described as a small frog with the digital discs very slightly dilated and the toes not quite completely webbed. Its colour is described as reddish yellow, with the sides of the face dark purple. This species is reported to be found in all the western forests among decaying leaves and is most probably identical with *Micrixalus opisthorhodus*.

Recorded localities : This species has been recorded from the forests and hills of South-western India, Nilgiris and Malabar. Ferguson (*loc. cit.*, 1904) states that he obtained several specimens of this little frog at an elevation of 3,000 feet in a mountain

stream at Chimanji in South Travancore in May. Several tadpoles of this species in various stages of development were collected by him from the same pool.

Specimens in the collection:

(1) Kotagiri, Nilgiris, South India, at an altitude of 6,000 feet: five specimens. The measurements of the largest of these are as follows:

From snout to vent	30 mm.
Hind limb	44 mm.
Front limb	18 mm.

The rose colour is persistent on the under side of the thighs and limb in most of the spirit specimens.

(2) Coonoor, Nilgiris, South India, at an altitude of 5,700—6,000 feet: seven specimens, of which four are very young ones (one of them with the tail still persistent), and five tadpoles of varying lengths. They are all more or less of a uniform brown colour, with only faint indications of cross bars on the limbs and no trace of rose colour on the under surface of the thighs and the hind part of the belly. But the small wrinkles and folds on the back and the two lateral folds on the skin are clearly visible.

Measurements of the largest of the adult specimens:

From snout to vent	32 mm.
Hind limb	44 mm.
Front limb	19 mm.

Measurements of the largest specimen of tadpole:

Length from snout to tip of the tail	45 mm.
Maximum width of the body	11 mm.

It is possible that some of the small adult specimens and tadpoles belong to a different species of *Micrixalus*, but the identification cannot be confirmed in the absence of full grown specimens for purposes of camparison.

Micrixalus silvaticus (Boulenger).

Plate V, fig. 5.

Ixalus, silvaticus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 469.
Ixalus silvaticus, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 35.
Micrixalus silvaticus, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 466.

This species attains a slightly smaller size than the preceding one and hardly exceeds one inch from snout to vent. The skin is smooth both on the upper and lower sides. There is a narrow glandular lateral fold extending from a little behind the eye and a fold of the skin extends from the eye to the shoulder.

The snout is rounded or rather bluntly angular and subacuminate. The loreal region is flat and vertical. The nostril is situated midway between the eye and the tip of the snout. The interorbital space is fairly wide, being a little broader than the upper eyelid. The tympanum is small and indistinct. The tongue is devoid of a papilla. The

fingers are free, but the toes are about one-third to two-fifths webbed, the membrane extending as a narrow fringe along their sides. A small inner matatarsal tubercle is present. The hind limb is moderately long, the tibio-tarsal articulation reaching the posterior border of the eye. The discs at the tips of the digits are small. The male bears two internal vocal sacs.

Colour: The specimens are brown above with rather faint darker markings, including a broad, chevron-shaped mark between the eyes. The sides of the head are including brown. The limbs bear dark cross bars. The hinder side of the thighs is blackish brown. The front of the thighs and the region between the thighs at the vent are rose-coloured. The under side is brown, with the chest and throat spotted and the belly and the under side of the limbs marbled with whitish markings. The above desrription of colour applies only to spirit-preserved specimens. No authentic information is available regarding its colour during life.

Habits: This is essentially a forest species inhabiting hilly localities. Nothing specific has been recorded about its habits.

Recorded localities: This species had so far been recorded only from the forests of Malabar in Southern India. But the two specimens contained in the Museum collection are from Ootacamund. This species therefore has a wider range of distribution, occurring in the Nilgiris also, although it has not been previously recorded from the Nilgiris.

Specimens in the collection: Two specimens, from Ootacamund in the Nilgiris, at an altitude of 6,700 to 8,000 feet. They are dark brown in spirit, and the body is rather broad and stout, compared to its length. The skin on the ventral side is finely granular, while according to the original description of the species, the skin is smooth on the upper and lower surfaces.

Measurements of the larger specimen :

From snout to vent	25 mm.
Hind limb	35 mm.
Front limb	11 mm.

The specimens are extremely brittle and rather badly contracted. The discs at the tips of the digits are moderately well developed.

Genus **Nyctibatrachus** (Boulenger).

This genus is closely allied to *Rana*, but it is distinguished from it in the pupil being vertical. The tongue is free and deeply bifid behind. Vomerine teeth are present in two straight or oblique series. The tympanum is concealed. The fingers are free, but the toes are webbed and the tips of the toes are dilated into small discs. The distal phalanges are bifurcate as in *Rhacophorus*. The distribution of the genus is confined to South India.

Only a single species, *Nyctibatrachus major*, is represented in the collection.

Nyctibatrachus major (Boulenger).

Plate VI, fig. 1.

Nyctibatrachus major, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 114, pl. xii, fig. 2.
Nyctibatrachus major, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 39, pl. viii, fig. 2.
Nyctibatrachus major, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 468.
Nyctibatrachus major, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 503.

This species includes rather stoutly built, medium-sized frogs. On the upper side, the skin is covered with coarse granulations or close-set vermiculated folds. The upper eyelid bears well-developed tubercles and the throat, closs-set, fine, longitudinal folds.

The head is rather broad, with a very short and blunt snout. The vomerine teeth are disposed in two straight rows, behind the level of the choanae; in young specimens, the vomerine teeth occur in oblique rows. The eyes are large and prominent and directed obliquely upwards and forwards. The upper eyelid is very narrow and covered with coarse tuberc The interorbital space is rather wide, being twice as broad as the upper eyelid. The fingers are moderately slender and rather long, the first being shorter than the second. The toes are almost completely webbed. The tips of the fingers and toes are dilated into small discs. The inner metatarsal tubercle is small, elongate and not prominently developed. The sub-articular tubercles are also feebly developed. The hind limb is long, the tibio-tarsal articulation reaching the eye or even slightly further front. The male bears two internal vocal sacs.

Colour: The upper side is somewhat dark brown, marbled with darker brown or blackish indistinct markings. The under side is paler brown, more or less speckled with slightly darker brown markings, especially at the sides and on the under side of the thighs. The above description applies to spirit-preserved specimens but no authentic record of its colour in life is available.

Habits: This is essentially a forest species inhabiting hill forests at low elevations. Nothing specific has been recorded about its habits.

Recorded localities: Malabar and Wynaad, in Southern India. Ferguson (*loc. cit.*, 1904) has specifically recorded it from Pirmered in Travancore.

Specimens in the collection:

(1) Dhoni Forest, South Malabar, at an altitude of about 1,500 to 4,000 feet; two specimens, not full grown. The measurements of the two specimens are as follows:—

From snout to vent	43 mm.
Hind limb	70 mm.
Front limb	29 mm.

(2) Netterikkal Region, Kalakkad Forest, Tirunelveli District: One, half grown specimen, rather light brown above, with the darker markings very indistinct.

Measurements:

From snout to vent	36 mm.
Hind limb	55 mm.
Front limb	22 mm.

(3) Kavalai, Cochin, Kerala State : Two tadpoles.

Measurements :

(*a*) Older specimen : Maximum width : 14 mm. Length : 52 mm.

The hind limbs have developed in this specimen.

(*b*) Younger specimen : Maximum width : 12 mm. Length : 54 mm.

The hind limbs have not yet developed, but the tail is well developed in this specimen.

Family RHACOPHORIDAE (=POLYPEDATIDAE).

This family is closely related to the family Ranidae, and includes frogs with cylindricai sacral diapophysis and intercalary cartilages. They are distinguished from the Ranids only by the presence of the intercalary cartilage. Most species belonging to this family are tree frogs.

The family Rhacophoridae was not given a strictly formal description. It was first described as the Polypedatidae by Noble (*Ann. New York Acad. Sci.*, 1927, 30, pp. 31-128) who merely stated, " This family name, as used by me, embraces all the genera with intercalary cartilages, but otherwise of ranid organization " (page 105). The family status of the Rhacophoridae has been questioned. Laurent (*Rev. Zool. Bot. Afr.*, 1951, 45, pp. 116–122) feels that the group deserves only sub-family status under the Ranidae.

Genus **Rhacophorus** Kuhl. & v. Hass.

This genus comprises several common species, including the common Chunam Frog, *Rhacophorus maculatus* of Southern India. One of the main distinguishing features is that the tips of the fingers and toes are dilated into well developed discs. Vomerine teeth are present in two straight or oblique rows. The pupil is horizontal. The tongue is free and deeply bifurcated behind. The tympanum is distinctly visible and the fingers and toes are webbed to a varying extent. The outer metatarsals are separated by a web. The omosternum and sternum bear a bony style.

Only three species are represented in the Museum collection, although about twenty species are recorded from India and its neighbouring areas. These three species are the more common ones among the five species of the genus occurring in Southern India.

Rhacophorus maculatus (Boulenger).

The Chunam Frog or Tree Frog.

Plate VI, fig. 2 and 3.

Hyla leucomystax, Gravenh, Delic. Mus. Vratisl., 1829, p. 26.
Hyla maculata, Gray, Ill. Ind. Zool., I, 1834, pl. lxxxii, fig. 1.
Polypedates rugosus, Dum. & Bibr. Erp. Gen., VIII, 1841, p. 520.
Polypedates leucomystax, Kelaart, Prodr. Faun. Zeyl., 1852, p. 193.
Polypedates cruciger, Blyth, in Kelaart, Prodr. Faun. Zeyl., 1852, App., p. 48.
Polypedates leucomystax, Jerdon, Journ. Asiatic Soc. Bengal, 1853, p. 532.
Polypedates megacephalus, Hallow, Proc. Acad. Philadelphia, 1860, p. 48.
Polypedates maculatus, Günther, Rept. Brit. India, 1864, p. 428.

Polypedates maculatus, Blanford, Journ. Asiatic Soc. Bengal, 1870, p. 376.
Polypedates maculatus, Anderson, Proc. Zool. Soc. London, 1871, p. 307.
Polypedates biscutiger, Peters, Mon. Berl., Ac., 1871, p. 649.
Polypedates maculatus, Stoliczka, Proc. Asiatic Soc. Bengal, 1872, p. 106.
Rhacophorus maculatus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 83.
Rhacophorus maculatus, Thurston, Batrachia Salientia and Apoda of Southern India, 1888, p. 31.
Rhacophorus maculatus, Boulenger, Proc. Zool. Soc. London, 1889, p. 30.
Rhacophorus maculatus, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 475.
Rhacophorus maculatus, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 504.
Rhacophorus maculatus, Annandale, Rec. Ind. Mus., I, 1907, p. 398.
Rhacophorus maculatus, Annandale, Rec. Ind. Mus., III, 1909, p. 285.
Rhacophorus maculatus, Annandale, Rec. Ind. Mus., VIII, 1912, p. 14.
Rhacophorus maculatus, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 36 (tadpoles).
Rhacophorus maculatus, Allen, Journ. Bomb. Nat. Hist. Soc., XXVI, 1918–19, p. 681 (habits).
Rhacophorus maculatus, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 172.
Rhacophorus maculatus, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLII, 1940, p. 60.
Rhacophorus maculatus, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLV, 1944–45, p. 436.

The species includes moderate-sized frogs with partially webbed fingers. The head is generally bony and bears ridges above in adult specimens. The skin of the head is free. The snout is sub-triangular, obtusely pointed and about as long as the diameter of the orbit, and the loreal region concavely depressed. The nostril is much nearer the tip of the snout than the eye. The interorbital space is much wider than the upper eyelid. The vomerine teeth are present in two more or less oblique rows, commencing from the front edge of the choanae. The tympanum is more than half the diameter of the eye, usually nearly as large as the eye or three-fourths the diameter of the eye. The skin is smooth above, strongly granulated on the ventral surface of the body, on the belly, and on the under surface of the thighs. A narrow fold of skin extends from the eye to the shoulder above the tympanum.

The fingers are only slightly webbed. The toes are nearly completely webbed. The discs at the tips of the fingers and toes are well developed, being about half the diameter of the tympanum. The sub-articular tubercles are moderately developed. A single small, inner metatarsal tubercle is present. The hind limb is fairly long, the tibio-tarsal articulation reaching the tip of the snout.

The male bears internal vocal sacs.

Colour: The colour of the species is rather variable. The upper side is brownish, yellowish, greyish or whitish, with or without darker brownish spots or markings. These markings usually consist of cross bars on the limbs and small, round, white or whitish spots on the hinder side of the thigh, which are usually separated by a dark brown or pinkish network, and a more or less well developed white streak on the upper lip. This species possesses the power of changing its colour. The colour is capable of changing through various shades of grey, chocolate brown, and is sometimes tinged with rose or lilac and marked with more or less distinct black spots. There is usually a large hour glass shaped mark on the hinder part of the head and the front part of the back. Thurston (*loc, cit.*, 1888) records that the hind limbs of a specimen in the Madras Museum collection were perfectly white without markings. He is probably referring to the specimen from Ernakulam, mounted and exhibited in the gallery, in which the markings are completely absent.

Habits: This species is the familiar " Chunam Frog ", commonly found in Madras and its vicinity at night, adhering to vertical surfaces such as walls and glass panes of windows by means of the discs on its fingers and toes.

Mc. Cann. (*loc. cit.*, 1933) has given a good account of the habits and spawning of this species. He reports that this species is quite common in the Islands of Salsette at the north end of Bombay Island, and in the Ghats during the rains. It frequently enters houses where it commonly perches on the tops of windows and doors. This frog is capable of leaping considerably long distances through the air and appears as though it were parachuting towards the air when it leaps. Although it can swim well it never lives in water, and appears very uncomfortable when forced to remain in water. This species possesses remarkable powers of changing its colour according to the immediate environment; these colour changes are usually rapid and harmonize with the colour of the ground on which the frog rests. When placed on white cloth or glass, the frog is said to become almost white with apparently no visible markings. When resting all the four legs are well drawn up under the body, only the outline of the head and the body being seen. The rapid change in colour and the habit of resting motionless with the legs drawn up under the body are protective devices, rendering the frog almost invisible in its natural surroundings. It is sluggish in its habits and often sits for hours in the same place.

G.O. Allen (*loc. cit.*, 1918–1919) writing on the habits of this species states that this frog feeds on insects, but often sits motionless, even when the insects crawl all over its body. It is reported to feed on insects, when they are still alive. The tongue is covered with a gummy substance and is shot out through the huge gaping mouth with great rapidity to capture insects. It has been observed to feed on the " Geranium bug ", *Cydnus indicus*. The food of this species, like most other frogs, consists chiefly of insects, but certain insects are definitely avoided, such as Cantharids, garden bugs, water beetles, fireflies, and some Carabids.

Ferguson (*loc. cit.*, 1904) records that this species, the " Chunam Frog ", is very common in Trivandrum in the low country and often enters houses. It is frequently found sitting in the venetian shutters of doors and windows during the day and come out only at night to feed. The basin of the fountain in the public gardens at Trivandrum is reported to be a favourite breeding place for this species. Sometimes the egg mass is said to be allowed to float free and sometimes fastened to the sides of the basin or placed on the edges clear of the water. But in Madras, the Chunam Frog more frequently fastens its nest of eggs surrounded by a frothy mass, to leaves overhanging a pool of water as illustrated by a simple habitat group showing the breeding habits of this species, exhibited in the Amphibian Gallery of the Museum.

Mc Cann (*loc. cit.*, 1933) states that the spawn of this frog is in the form of a yellowish, globular, frothy mass about two to four inches in diameter. The outer surface of the mass dries into a crisp, membrane-like covering, and this helps to conserve the moisture within the mass, if it happens to get exposed to the sun. Mc Cann observes that if the mass is deposited in places where it is continuously moistened, the whole spawn generally slips down and floats on the surface of the water. The frothy masses are generally attached to branches of plants overhanging water and also on sloping surfaces of rocks in open places. The tadpoles undergo their embryonic development in the moist interiors of the spawn, until such time as they are able to swim about freely. When they are about to

leave the " nest ", a hole is formed at the bottom of the spawn by the wriggling of the tadpoles, and they drop into the water below. The tadpoles swim about actively as soon as they leave the spawn, and undergo rapid development into the adult frogs.

Recorded localities: India and Ceylon. In South India, this species has been specifically recorded from the lower slopes of the Nilgiris, Malabar, Salem and Madras, and from the Shevroy Hills (up to an altitude of about 5,000 feet). It has also been recorded from Trivandrum (Ferguson, *loc. cit.*, 1904). In Travancore, this species has been specifically recorded from Shasthancottah (Annandale, *loc. cit.*, 1909), and Mc Cann has recorded it from Salsette Islands at the north end of Bombay Island and in the Western Ghats (*loc. cit.*, 1933), and also from the Visakhapatnam District (*loc. cit.*, 1944-45). This species is very common in Madras and its vicinity. Thurston (*loc. cit.*, 1888) records a specimen of this species in the Madras Museum collection from Shevroy Hills, but this is not now traceable in the collection. Annandale (*loc. cit.*, 1907) has recorded it from an Island in the Chilka Lake in Orissa.

Specimens in the collection:

(1) Trichur, Kerala State: One half grown specimen:

Measurements:

From snout to vent	39 m.m.
Hind limb	66 mm.
Front limb	22 mm.

The upper side is more or less uniformly reddish brown in this specimen.

(2) Netterikkal Region, Kalakkad Forest, Tirunelveli District (altitude of 3,000–5,000 feet): One half grown specimen:

Measurements:

From snout to vent	39 mm.
Hind limb	58 mm.
Front limb	21 mm.

The deep chocolate brown markings on the thighs and extreme sides of the hinder side of the upper surface of the body are distinct. The whole of the upper surface is somewhat reddish brown.

(3) Kambakkam, Chingleput District: One, larger specimen, nearly three-fourths the full adult's size:

Measurements:

From snout to vent	61 mm.
Hind limb	97 mm.
Front limb	45 mm.

The upper side in this specimen is dull greyish brown with slightly darker brownish tinge over the snout and the eyelids. It is uniformly without markings, except over the

hinder sides of the thighs which are marked by large, rounded white or oval spots, separated by a purplish brown network. The granulation over the belly and the under side of the thighs is very conspicuous.

(4) Madras: One specimen, mounted and exhibited in the gallery slightly smaller than the preceding one.:

Measurements:

From snout to vent	53 mm.
Hind limb	98 mm.
Front limb	34 mm.

In addition to this, there are plaster casts of this species mounted in a habitat group illustrating the breeding habits of this species, also exhibited in the Amphibian Gallery.

(5) Wallapparayadu Temple Tank, near Udayagiri, Nellore District: The young specimens collected on 8th September 1913. The larger of the two specimens measures 19 mm. in length from snout to vent.

(6) Thomara, South Coorg: One half grown specimen, collected on 4th March 1914:

Measurements:

From snout to vent	30 mm.
Hind limb	62 mm.
Front limb	23 mm.

The colour of this specimen (in spirit) is pale brownish.

Rhacophorus malabaricus (Jerdon).

The Flying Frog.

Plate VI, fig. 4.

Rhacophorus reinwardtii, part, Dum. & Bibr., Erp. Gen., VIII, 1841, p. 532, pl. 89, fig. 1.
Rhacophorus malabaricus, Jerdon, Proc. Asiatic Soc. Bengal, 1870, p. 84.
Rhacophorus malabaricus, Boulenger, Catalogue, Batrachia, Salientia, Brit. Mus., 1882, p. 90.
Rhacophorus malabaricus, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 32.
Rhacophorus malabaricus, Boulenger, Fauna Brit. India, Reptilia and Amphibia, 1890, p. 473.
Rhacophorus malabaricus, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 503.
Rhacophorus malabaricus, Iyengar, M.O.P., Journ. Bomb. Nat. Hist. Soc., XI, 1915, p. 140.
Rhacophorus malabaricus, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 37 (tadpoles).

This species is considerably larger than the preceding one and is distinguished from it by the fingers being entirely webbed and by the heel being furnished with a dermal appendage. The head is broad, with a blunt, subacuminate snout. The loreal region is distinctly concave in the form of a shallow, oval depression. The interorbital space is wide. The nostril is a little nearer the tip of the snout than the eye. The vomerine teeth are placed in two straight or slightly oblique rows. The tympanum is distinct and is more than half the diameter of the eye.

The fingers and toes are almost completely webbed to the tips. The tips of the fingers and toes are dilated into large discs which are almost equal in diameter to the tympanum. The sub-articular tubercles are well developed. The outer margin of the forearm and the tarsus are fringed with a fold of the skin. The web in the hand extends only a little beyond half way between the first and the second finger in each hand, but right up to the disc between the other fingers.

The skin is finely granular on the upper side, and more coarsely granulated below. On the under side of the thighs, the granules are mixed with larger ones. The cutaneous flap above the vent is slightly developed. The skin is finely tuberculated, almost smooth, except at the sides of the upper jaw, which are slightly coarser in granulation.

Colour: M. O. P. Iyengar (*loc. cit.*, 1915) has given a good account of the colour of this species in life, and its habits. In life the upper portion of the body is bright grass green (changing into a dull steel blue in spirit), obscurely spotted all over with dark dots. The under side is golden yellow, granular a little from the armpits downwards. The webs are bright red, and two streaks of dull yellow are present at the sides, and are speckled all over with dark brown spots and tinged with red. The upper portion of the arms, the legs, and the last digits of the limbs are coloured green like the upper portion of the body. The under sides of the legs are yellow. The upper arms are yellowish but bear a red streak on the side towards the body. The under sides of the thighs are yellow and bear a reddish blotch which deepens in shade towards the knee joint. The reddish tinge also continues in a paler tone on the inner unexposed side of the leg towards the calf which is mainly yellow in colour. The web between the first and second finger is yellow and that between the second and third finger yellow towards the end only, but the remaining parts of the web are bright red. The web between the third and fourth finger is red throughout. The brilliancy of the colour of the species is most marked only during flight.

Habits: This is the familiar " Flying Frog " of Malabar. It is capable of making long gliding leaps by expanding the webs between its fingers and toes, the webs acting as parachutes. It possesses adhesive discs at the ends of its fingers and toes with which it can attach itself to any surface firmly. Being grass green in colour during life, it escapes being detected when it is among green leaves. When it flies, it produces a kind of whir which is distinctly audible. M. O. P. Iyengar (*loc. cit.*, 1915) states that this whirring sound and the sudden flash of colour as it darts from tree to tree resembles the habits of certain species of grasshoppers which make a sort of sound as they leap and make short flights and at the same time display their brilliantly coloured inner wings. The natural haunts of this species appear to be always among the tree tops. The specimen recorded by M. O. P. Iyengar is reported to be $3\frac{1}{4}$ inches in length from snout to vent, its front limb measuring 2 inches and its hind limb 5 inches in length.

Ferguson (*loc. cit.*, 1904) states that this is a common frog in the low country in Trivandrum where it sometimes enters houses. It is often found taking up its abode in a hanging fern basket or in an orchid pan. The breeding season of this species lasts from June to November and tadpoles may be found in all stages between these

months. The female constructs a nest usually in the vicinity of a pool of water. It is composed of a white frothy secretion and is attached to the leaves of a tree overhanging a pool. Within about twenty-four hours, the outside of the nest attains a parchment-like consistency and becomes brownish in colour. The tadpoles hatch out and drop into the water. They are carnivorous.

Recorded localities: Malabar Southern part of the Malabar Zone and forests of Mysore; Trivandrum.

Specimens in the collection:

(1) Ernakulam, Kerala State: The specimens, of which one is in the study collection, and the other mounted and exhibited in the gallery.

(*a*) Specimen in the study collection:

Measurements:

From snout to vent	78 mm.
Hind limb	128 mm.
Front limb	45 mm.

(*b*) Gallery specimen:

Measurements:

From Snout to vent	72 m.m.
Hind limb	126 mm.
Front limb	51 mm.

This specimen is faded and is completely whitish.

In addition to these, there is another, larger, full grown specimen of this species (also from Malabar) mounted and exhibited in the general Zoological Gallery along with specimens illustrating flight in animals, to show the incipient form of flight in this species.

Rhacophorus pleurosticus (Günther).

Plate VI, fig. 5.

Polypedates variabilis, Jerdon, Journ. Asiatic Soc. Bengal, 1853, p. 532.
Polypedates pleurosticus, Günther, Rept. Brit. India, 1864, p. 430, pl. xxvi, fig. 1.
Rhacophorus pleurosticus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 79.
Rhacophorus pleurosticus, Thurston, Batrachia Salientia and Apoda of Southern India, 1888, p. 30, pl. vi, fig. 1.
Rhacophorus pleurosticus, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 479.
Rhacophorus pleurosticus, Narayan Rao, Rec. Ind. Mus., XI, 1915, p. 349 (larvae).

This is much smaller than the preceding species and displays much greater variation in colour. The skin is smooth or finely granular on the upper side, while the lower surface of the thighs and the belly are more coarsely granular. There is a strong fold of skin from the eye to the shoulder.

The head is fairly broad, with a broadly rounded snout. As in the preceding species, the loreal region is concavely depressed. The interorbital space is wide, being as broad as, or even slightly broader than, the upper eyelid. The vomerine teeth are arranged in two small oblique series. The tympanum is small, indistinct, being about half to one-third of the diameter of the eye. ... ...

The fingers are webbed only at the base. The toes are almost entirely webbed. The discs at the tips of the fingers and toes are well developed, being about as large as the tympanum. The sub-articular tubercles are well developed. The males bear internal vocal sacs.

Colour : The specimens in the living condition are usually green or greenish above, with dark spots, edged with darker and lighter borders. The sides of the thighs are purplish brown, marked with yellow spots. The limbs are marked with darker cross bars. In spirit-preserved specimens, the colour tends to become very dark, almost blackish brown.

There is considerable variation in colour, in this species, some specimens being very dark and others very light in colour. In the dark specimens, the ground colour is yellow with large, chocolate brown bands and spots edged with black. There are also a few orange spots and smaller brownish spots between the larger markings. The limbs bear transverse, dark brown bars. The under side is greyish, with a few dark markings on the throat.

In the light specimen, the ground colour is light brown with the bands and spots of a slightly darker colour, bordered with black. The under side is white, with or without markings on the throat. The limbs are banded with brown transverse markings.

Jerdon (*loc. cit.*, 1853) has described this frog as the "Green Frog" of the Nilgiris, under the name *Polypedates variabilis*. He describes its colouration as being green, sometimes unspotted and sometimes with golden coloured or blackish spots. Sometimes the colour is said to be golden yellow with brown spots, or brown, with darker spots.

Habits : This species is common in the Nilgiris on the banks of streams and among shrubs and bushes. It is said to be the commonest species of Tree Frog at Kotagiri in the Nilgiris. It is frequently found in gardens and near tanks. Young specimens are yellowish green, and bear only a few dark markings. This species is closely related to *Rhacophorus microtympanum* which is confined to Ceylon, but is distinguished from the latter by the fingers being distinctly webbed at the base, while in *R. microtympanum* they are only very slightly and indistinctly webbed.

The larvae have been described by Narayan Rao (*loc. cit.*, 1915). The tadpoles occur in abundance in tanks in the vicinity of houses where fish are reared. Water snakes feed on these tadpoles in large numbers.

Recorded localities : Madras, Ootacamund, Nilgiris, Anamalai Hills and Malabar. In the Nilgiris, it has also been specifically recorded from Kotagiri. In the Nilgiris, this species occurs up to an altitude of about 6,000 feet.

Specimens in the collection: Two specimens from Palni Hills, Kodaikanal, South India (at an altitude of 6,500—7,500 feet). Both are rather shrunken. One of them (the larger specimen) is dark brown, while the other is much darker, almost blackish brown. The measurements of the larger specimen are as follows:—

From snout to vent	46 mm.
Hind limb	72 mm.
Front limb	31 mm.

The specimens are extremely stiff and brittle and the skin of the back in the larger specimen is badly wrinkled due to shrinkage in spirit. The body and the head of the larger specimen are proportionately much broader. The smaller specimen, which is only slightly smaller, measures 38 mm. in length from snout to vent, but its head and body are much narrower, the width at the base of the head being 12 mm. while the width at the base of the head in the larger specimen is 18 mm.

Genus **Philautus** Gistel.

(Syn. **Ixalus** Dum. and Bibr.).

This genus includes rather small-sized frogs, most species measuring only about one to one and a half inches from snout to vent. This genus is best represented in Southern India and Ceylon, as many as fourteen out of the twenty known species of this genus occurring in this region. The pupil is horizontal. The tongue is free and deeply bifurcated behind and is either with or without a conical pointed papilla in the middle. Vomerine teeth are absent. The tympanum is either distinct or indistinct and partly or completely concealed. The fingers are either free or webbed only at the base. The toes are either partly or entirely webbed and the tips of the fingers and toes are dilated into well developed discs. The sternum bears a bony style.

Only two species are represented in the Museum collection, namely, *P. leucorhinus* and *P. variabilis*. In the former, the tympanum is quite distinct, while in the latter, it is indistinct.

Philautus leucorhinus (Martens).

Plate VII, fig. 1.

Ixalus leucorhinus, Martens, Nomencl, Rept. Mus. Berol., 1856, p. 36.
Ixalus leucorhinus, Günther, Catalogue, Batrachia Salientia, 1858, p. 75.
Ixalus temporalis, Günther, Rept. Brit. India, 1864, p. 434, pl. xxvi, fig. E.
Ixalus punctatus, (?) Anders, Journ. Asiatic Soc. Bengal, xl, 1871, p. 27.

Ixalus leucorhinus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 98.
Ixalus leucorhinus, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, P. 35, pl. vi, fig. 3.
Ixalus leucorhinus, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 483.
Ixalus leucorhinus, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 505.
Philautus leucorhinus, Narayan Rao, Proc. Ind. Acad. Sciences, VI, Sec. B., 1938, p. 421 (tadpoles).
Philautus leucorhinus, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 248.

This species includes rather small-sized frogs. The skin is smooth on the upper side and granular on the under side, on the belly, and on the lower surface of the thighs. A fold of skin extends from the eye to the shoulder.

The snout is rather sharply pointed, a little longer than the diameter of the orbit. The loreal region is slightly depressed. The nostril is nearer to the tip of the snout than the eye. The interorbital space is wider, broader than the upper eye-lid. The tympanum is distinct, but rather small, being only half the diameter of the eye.

The fingers are only very slightly webbed, but the toes are nearly half webbed. The discs at the tips of the digits and the sub-articular tubercles are moderately developed. A small inner metatarsal tubercle is present. The hind limb is fairly long, the tibio-torsal articulation reaching between the eye and the tip of the snout. The male bears can internal vocal sac.

Colour: In spirit-preserved specimens. the colour is yellowish brown or olive brown above, with a dark band below the canthus rostralis and the temporal region. Sometimes there is a large hexagonal or triangular pale spot on the snout and usually a dark band between the eyes, and another curved spot one on each side of the back. Sometimes there is also a pale vertebral band or stripe which, in some specimens is continued along the hind limbs. On the under side, the throat is usually spotted with brown, or sometimes almost completely brown, with a median white line. No accurate records of the colour of this species in the living condition are available.

Habits: This species inhabits mostly hilly areas, at moderate elevations. Nothing specific has been recorded about its habits.

Recorded localities: Ceylon, Malabar and North Kanara. It has been recorded mostly from the hills of the Malabar Coast as far north as North Kanara. Thurston (*loc. cit.*, 1888) records specimens of this species in the British Museum collection from Malabar and North Kanara. Ferguson (*loc. cit.*, 1904) records this species from Pirmerd in Travancore.

Specimens in the collection: One Specimen, not fully grown, from Dhoni Forest, South Malabar, at an altitude of between 1,500 and 4,000 feet. It is dark rufous brown, without any pale vertebral stripe or triangular spot on the snout. The skin on the under surface is finely granular.

Measurements: From snout to vent: 22 mm.

The limbs in this specimen are far too brittle for making accurate measurements satisfactorily.

Philautus variabilis (Günther).

The Tinkling Frog.

Plate VII, fig. 2.

Phyllomedusa wynaadensis, (?) Jerdon, Asiatic Soc. Bengal, XXII, 1853, p. 533.
Ixalus variabilis, Günther, Catalogue, Batrachia Salientia, 1858, p. 74, pl. iv, figs. A and B.
Ixalus variabilis, Günther, Rept. Brit. India, 1864, p. 433.

Ixalus variabilis, Günther, Proc. Zool. Soc. London, 1875, p. 573.
Ixalus variabilis, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 102.
Ixalus variabilis, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888 p. 36, pl. vii fig. 2.
Ixalus variabilis, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 487.
Ixalus variabilis, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 505.
Ixalus variabilis, Annandale, Rec. Ind. Mus., IX, 1913, p. 309.
Ixalus variabilis, Annandale, Rec. Ind. Mus. XVI, 1919, P. 303 (tadpoles).
Philautus variabilis, Narayan Rao, Proc. Ind. Acad. Sciences VI, Sec. B, 1938, P. 424 (tadpotes).
Philautus variabilies, DeSilva, Spolia Zeylanica XXVII, 1953–55, P. 429.

This species attains a slightly larger size than the preceding species. The skin is smooth above, sometimes with small, scattered tubercles. A fold of skin extends from the eye to the shoulder. On the under side the skin is finely granular.

The snout is comparatively broader and more rounded than in the preceding species. The loreal region is slightly concavely depressed. The interorbital space is wide, being slightly broader than the upper eye-lid. The nostril is placed nearer the tip of the snout than the eye. The tongue is without a papilla. The tympanum is indistinct, and is about half the diameter of the eye.

The fingers are either entirely free, or only very slightly webbed. The toes are about half to two-thirds webbed. The discs at the tips of the digits are moderately large. The sub-articular tubercles are also moderately well developed. A small inner metatarsal tubercle is present. The hind limb is fairly long, the tibio-tarsal articulation reaching usually between the eye and the tip of the snout. The male bears an internal vocal sac.

Colour: The Colour and colour pattern of this species are very variable. In spirit-preserved specimens, the upper side is generally bluish, greenish, brownish, greyish or blackish, and may be either uniformly coloured or variously spotted and marbled with darker or lighter markings. Thurston (*loc. cit.*, 1888) records that a specimen in the Madras Museum collection, collected at Ootacamund, in the Niligiris, was grass green during life.

Annandale (*loc. cit.*, 1913) states that the colouration appears to have literally no significance in this species. In one of the specimens he examined, the whole of the dorsal surface was pale bluish grey with a bold, irregular reticulation of black lines; in another specimen, it was of an almost uniform deep brown, except that the limbs were obscurely barred, and there was a very conspicuous lozenge-shaped mark on the snout; a third specimen had a distinct M-shaped dark mark on the back and a dark cross bar between the eyes. The colouration of other specimens reported by Annandale was of a less striking character but different in each case.

Habits: This is the familar "Tinkling Frog" of the Nilgiris. It had been described by Jerdon as being found in grass and among bushes on the Nilgiris. It emits a peculiar, loud, clear, metallic call, which accounts for its popular name, "Tinkling Frog". It is very abundant at Ootacamund in the Nilgiris, where it is frequently heard during the monsoon, although it is difficult to see and capture them. The peculiar tinkling call is often misleading as it appears to proceed from a direction entirely different from the actual location of the frog. The moment one begins hunting for them they are said to stop tinkling and hide themselves.

Recorded localities: Ceylon; hills near the Malabar Coast; Sivagiri Pycara; hills of South India, generally; Ootacamund, Nilgiris, Wynaad and Kotagiri (altitude 6,000 feet). At Pattipola, in the Central Provinces of Ceylon, it has been recorded at an altitude of about 6,000 feet. It has also been recorded from Golconda, Anamalai Hills, Tirunelveli and Malabar. Ferguson (*loc. cit.*, 1904) reports that he has taken this species in a swamp at Chimanji in Travancore at an elevation of 3,000 feet. Thurston, (*loc. cit.*, 1888) records that a specimen in the Madras Museum collection from Ootacamund was found inside the flower of an Arum.

Specimens in the collection:

(1) Shevroy Hills, South India: One adult specimen, mounted and exhibited in the gallery:

Measurements:

From snout to vent	28 mm.
Hind limb	43 mm.
Front limb	17 mm.

(2) Palni Hills, Kodaikanal, at an altitude of from 6,000 to 6,800 feet:

Measurements:

From snout to vent	31 mm.
Hind limb	43 mm.
Front limb	18 mm.

This specimen is considerably faded in spirit, and is pale creamy, or whitish brown above, without any markings.

(3) Coonoor, Nilgiris; at an altitude of from 5,700 to 6,000 feet: Six tadpoles in various stages of development. The largest specimen measures 41 mm. in length and 12 mm. in maximum width. Two of the tadpoles are in an advanced stage of development, with the hind legs also well developed.

(4) Ootacamund, Nilgiris; at an altitude of 6,700 to 8,000 feet: Four fairly full grown specimens collected in May 1921.

Measurements (of the largest specimen):

From snout to vent	32 mm.
Hind limb	42 mm.
Front limb	16 mm.

Of these, three specimens are dark brown, but one (a young specimen, smaller than the others) is much paler, almost pale sandy brown above, and pale yellowish brown below. A similar pale, creamy brown specimen from Kodaikanal, Nilgiris, probably of the same species, is also represented in the collection. The dilatations at the tips of the digits in all these specimens are well marked.

Family MICROHYLIDAE (= ENGYSTOMATIDAE).

This family includes burrowing as well as terrestrial and aquatic forms. The maxillary teeth are absent. The diapophysis of the sacral vertebrae are dilated. This is a large family including about twenty-two genera, of which only five are represented

in India. Of these five, specimens belonging to four genera, namely, *Microhyla*, *Kaloula*, *Ramanella* and *Uperodon* are contained in the Museum collection. The frogs of this family are easily distinguished by their proportionately small head and narrow mouth and by the absence of teeth in the upper jaw.

These four genera may be distinguished as follows:

1. Pupil vertical; tongue elliptical; tympanum concealed and toes more or less webbed—*Microhyla*.

2. Pupil vertical; tongue oblong; palatine bones forming an acute ridge; tympanum concealed; the tips of both fingers and toes more or less dilated—*Kaloula*.

3. Pupil vertical; tongue oblong, notched behind; palatine bones forming only a slight ridge; tympanum concealed; tips of fingers dilated; those of toes blunt—*Ramanella*.

4. Pupil vertical; tongue oval; two small protuberences present between the choanae; the toes are webbed only at the base—*Uperodon*.

Genus **Microhyla** Tschudi.

This genus includes frogs of rather small size and slender build. The pupil is vertical and circular. The tongue is rather narrow and elliptical, free behind and not notched. The palate is toothless, with a more or less distinct dermal ridge across the palate and another similar ridge in front of the pharynx. The tympanum is concealed. The fingers are free, but the toes are webbed to a greater or less extent, sometimes very slightly. The tips of the digits are usually more or less dilated. The outer metatarsals are united. The sternum is cartilaginous. The terminal phalanges are T-shaped.

Two species, *Microhyla rubra* and *Microhyla ornata* are known from India, and both of them are represented in the Museum collection. The former is distinguished from the latter by the metatarsal tubercles being strongly developed and compressed.

Microhyla rubra (Jerdon).

Plate VII, Fig. 3.

Engystoma rubrum, Jerdon, Journ. Asiatic Soc. Bengal, 1853, p. 534.
Diplopalma rubra, part, Günther, Catalogue, Batrachia Salientia, 1858, p. 50.
Microhyla rubra, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 164.
Microhyla rubra, Thurston, Batrachia Salientia and Apoda of Southern India, 1888, p. 40.
Microhyla rubra, Boulenger, Fauna Brit. India. Reptilia and Batrachia, 1890, p. 491.
Microhyla rubra, Ferguson, Journ, Bomb. Nat. Hist. Soc., XV, 1904, p. 506.
Microhyla rubra, Annandale, Rec. Ind. Mus., III, 1909, p. 286.
Microhyla rubra, Narayan Rao, Rec. Ind. Mus., XI, 1915, p. 31 (larvae).
Microhyla rubra, Annandale and Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 42 (tadpoles).
Microhyla rubra, Parker, A. Monograph of the Frogs of the Family Microhylidae, Brit, Mus., London, 1934, p. 142.
Microhyla rubra, De Silva, Spolia, Zeylanica, XXVII 1953–55, p. 250.
Microhyla rubra, Daniel, Journ. Bomb. Nat Hist. Soc. Lx (3), 1963, p. 695.

This is a rather sturdily built frog with a somewhat broad and rounded snout. The snout is a little shorter than the diameter of the orbit. The interorbital space is fairly wide, being broader than the upper eye-lid. The pupil is erect and the tongue elliptical. The tympanum is concealed. The fingers are moderately developed, the first being much shorter than the second. The toes are moderately long, and are webbed at the base up to about one-third of their length. The tips of the digits are not dilated. The sub-articular tubercles are distinct and well developed. Two large, oval, compressed, metataral tubercles are prominently developed, the outer tubercle being somewhat larger than the inner. The hind limb is moderately long, the tibio-tarsal articulation reaching only slightly beyond the shoulder. The skin is smooth, without any granulation. The male bears a subgular vocal sac.

Colour: In spirit-preserved specimens, the colour is reddish brown on the upper side, but the sides are darker. A dark brown line extends from the tip of the snout through the eye along the sides of the back to the vent. The limbs bear more or less well defined cross bars. The thighs bear dark brown marks. Sometimes a dark X-shaped mark is present on the front of the back, extending from between the eyes. The under surface is white, either without markings or with a few brown dots on the throat. In the male the throat is black.

Ferguson (*loc. cit.*, 1904) has described briefly the colour of this species in life. He states that during life, the body is almost transparent, the upper side being reddish pink, marked with very fine dark brown spots, visible only under the lens. These are said to form dark marks over the eyes and nostrils, and they also form a more or less diamond-shaped figure on the back; probably this diamond-shaped mark is the same as the X-shaped marked found on spirit specimens. Both the crests are densely spotted towards the end.

Habits: This species is said to be found in the rivers and sandy banks in South India and is very common in Madras during the monsoon. The specimens are rather small-sized, reaching a length of about one inch only from snout to vent. This species is strictly nocturnal. The breeding season lasts from June to November. The eggs float in flat, transparent masses. Ferguson (*loc. cit.*, 1904), referring to the habits of this species in Travancore, states that this little frog is fairly common in the low country in Travancore, but not easy to find as it is almost entirely nocturnal in its habits. Ferguson (*loc. cit.*, 1904) has also given an account of the tadpoles of this species. Annandale (*loc. cit.*, 1909) says that this species is apparently abundant in open country in the Kerala State (i.e., Travancore–Cochin). Tadopoles are said to be common in November, in little pools of rain water in the sand near Trivandrum.

Recorded localities: This is a widely distributed species, found in Assam, South India and Ceylon. It has been specifically recorded from Nellore, Madras, Nilgiris (at an altitude of 6,000 feet) and Tirunelveli District in the Madras State. Thurston (*loc. cit.*, 1888) has recorded it as having been found in the water tub in the Museum compound in Madras. Ferguson (*loc. cit.*, 1904) and Annandale (*loc. cit.*, 1909) have recorded this species specifically from the plains of Travancore in Kerala State.

Specimens in the collection:

(1) Madras : Twelve specimens, some of which are not full grown. In almost all the specimens, the dark, chocolate brown marks on the thighs and the dark brown stripe along the sides of the body are well marked. In many of the specimens, these marks are dilated anteriorly and narrowed posteriorly, where they curve outwards. The largest specimen is about 1-2 inches in length from snout to vene—the maximum recorded size for this species. The measurements of this specimen are as follows :—

From snout to vent	26 mm.
Hind limb	32 mm.
Front limb	12 mm.

The maximum width of the body in this species is only about half inch or 12 mm.

(2) Bangalore : at an altitude of about 3,000 feet. Ten adult specimens, although many of them are very small, being imperfectly grown ones, and four immature specimens with vestiges of the tail still persistent. The measurements of the largest of these specimens, which is about full grown, are as follows :

From snout to vent	25 mm.
Hind limb	30 mm.
Front limb	11 mm.

(3) Red Hills, Chingleput District : One specimen, about three-fourths grown. The dark markings on the thighs are only very faintly marked.

Measurements :

From snout to vent	20 mm.
Hind limb	26 mm.
Front limb	9 mm.

(4) Udayagiri, Nellore District : One specimen, mounted and exhibited in the gallery. It is faded almost completely into a uniform white.

Measurements :

From snout to vent	21 mm.
Hind limb	34 mm.
Front limb	12 mm.

Microhyla ornata (Dum. & Bibr.)

The Black-throated Frog.

Plate VII, fig. 4.

Engystoma ornatum, Dum. and Brbr., Erp. Gen., VIII, 1841, p. 745.
Engystoma carnaticum, Jerdon, Journ. Asiatic Soc. Bengal, XXII, 1853, p. 534.
Engystoma malabaricum(?), Jerdon, *loc. cit.*
Diplopelma ornatum, part, Günther, Catalogue, Batrachia Salientia, 1858, p. 50.
Diplopelma ornatum, Günther, Rept. Brit. India, 1864, p. 417.
Diplopelma carnaticum, Stoliczka, Journ. Asiatic Soc. Bengal, 1870, p. 154, pl. ix, fig. 5.
Microhyla ornata, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 165.
Microhyla ornata, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 41.
Microhyla ornata, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 491.
Microhyla ornata, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 506.
Microhyla ornata, Annandale and Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 42 (tadpoles).
Microhyla ornata, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 176.
Microhyla ornata, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLII, 1940, p. 62.

Microhyla ornata, Acharji and Kirpalni, Rec. Ind. Mus., XLIX, 1951, p. 184.
Microhyla ornata, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 250.
Microhyla ornata, Parker, A Monograph of the Frogs of the Family Microhylidae, Brit. Mus., London, 1934, p. 139.
Microhyla ornata, Daniel, Journ. Bomb. Nat. Hist. Soc., LX(3), 1963, p. 693.

In this species the body is comparatively more slender than in the preceding species and is distinguished from the latter by the metatarsal tubercles being very small. The skin is smooth. The snout is obtuse and broadly rounded. The pupil is erect and the tongue elliptical. The interorbital space is fairly wide, being broader than the upper eyelid. The tympanum is concealed. The fingers and toes are rather slender, with their tips dilated into very small discs. The fingers are fee, the first being shorter than the second. The toes are only very slightly webbed, the web being only rudimentary. The sub-articular tubercles are quite distinct. Two very small metatarsal tubercles are present, slightly unequal in size. The hind limb is moderately long, the tibio-tarsal articulation reaching between the shoulder and the eye. The male bears a subgular vocal sac.

Colour: In spirit-preserved specimens, the colour is reddish or greyish olive or greyish brown above, with a large, dark marking on the back extending from between the eyes backwards and widening posteriorly. Sometimes there are wavy, somewhat dusky longitudinal lines on each side of this marking. A dark band is also present along the side of the head and body. The limbs are conspicuously marked with dark cross bars. On the underside, the throat and chest are normally greyish or brownish with white spots. The rest of the lower surface is uniformly coloured, without spots. No authentic record of its colour during life is available.

Habits: This species is said to be common in South India during the monsoon. Like the preceding species, it is nocturnal, and during the day, it may be found hidden under leaves and stones. This species feeds on insects, especially on small Coleoptera and small ants. Tadpoles may be found in June and July. The eggs are laid in flat, transparent masses. They are irregularly shaped and considerably smaller than those of *Microhyla rubra*, reaching a diameter of only 2 mm. The toes are completely webbed in the young specimens (Ferguson, *loc. cit.*, 1904).

Mc Cann (*loc. cit.*, 1933) states that this species was found by him to be very common at Panchgani (4,400 feet), living under stones. This frog is reported by him to be completely nocturnal, as they have never been seen moving about during the day, even on the dullest days, during the monsoon. The eggs are laid singly, each being surrounded by a globular, mucilaginous substance. The tadpoles develop within this enveloping membrane and may be seen moving about in it. In about four to five days they break through and move about freely. It has been found very difficult to rear the tadpoles of this species from the egg stage under artificial conditions. This species is said to be very rare in Western India, but is found in abundance, throughout the rains, where it occurs.

Recorded localities: This species is also a widely distributed one being found in Kashmir, all over India, Assam, Burma, Ceylon, Southern China and Indo-China. In South India, it has been specifically recorded from Walaghat in the Nilgiris and from Tirunelveli District. Ferguson (*loc. cit.*, 1904) records this species from Travancore and states that it is fairly common in Trivandrum. Mc Cann (*loc. cit.* 1940) has recorded it from Andheri in Bombay. Acharji and Kirppalni (*loc. cit.*, 1951) have recorded this species from

Kangra and Kulu valleys and in the Eastern Himalayas, it has been recorded by them from Sukhna in the Darjeeling District. Boulenger has mentioned about a specimen collected from Kashmir. Thurston (*loc. cit.*, 1888) and Boulenger (*loc. cit.*, 1882) have recorded this species from Madras and Assam.

Specimens in the collection: Six specimens from Bangalore at an altitude of about 3,000 feet, of which one is mounted as an exhibit in the gallery, and the remaining five are stored in the study collection. Of these latter, some are very young, half grown specimens.

The measurements of the largest specimen in the study collection (which is about three-fourths grown) are as follows:

From snout to vent	18 mm.
Hind limb	22 mm.
Front limb	9 mm.

The colour and markings are rather faded in these spirit-preserved specimens.

The measurements of the specimen mounted and exhibited in the gallery (from Bangalore) are as follows:

From snout to vent	18 mm.
Hind limb	26 mm.
Front limb	9 mm.

The colour of this specimen, preserved in spirit, is dark brown.

Besides the above, there are a large number of tadpoles of this species from Bangalore in the study collection. They are divided into two lots and preserved in two separate tubes. One of these lots consists of very young tadpoles which are very dark, almost black in colour. The other lot consists of older and larger tadpoles which are brownish in colour. Both belong to the same species, *Microhyla ornata*, but as the pigmentation is deeper in young tadpoles, they appear black than the older ones.

Genus **Kaloula** Gray.

(Syn. **Callula** Gray).

This genus is closely allied to the preceding one, from which it is distinguished by the palatine bones forming an acute ridge. It includes rather stoutly built frogs of small size, but one of the Indian species at least reaches a length of three inches from snout to vent.

The pupil is vertical and circular. The tongue is oblong and free behind and on the sides, and is either entire or feebly notched. Each palatine bone forms a sharp and prominent ridge across the palate. The ridge is sometimes toothed. In addition to this, there are two dermal ridges across the palate, in front of the pharynx; the anterior one is smooth and the posterior denticulated. The tympanum is concealed. The fingers are free and the toes are either free or more or less webbed. The tips of the digits are more or less dilated. The outer metatarsals are united. The sternum is cartilaginous. The omosternum and the praecoracoids are absent. The terminal phalanges are triangular or T-shaped.

Formerly, this genus was more extensive and comprised as many as eight known species, of which four had been recorded in India, all these four species occurring in South India and represented in the Museum collection, namely, *Kaloula pulchra*, *K. obscura*, *K. triangularis* and *K. variegata* (= *K. olivacea*).

Of these four species, however, *Kaloula pulchra* alone is at present retained in the genus *Kaloula*, and the sub-species of this species found in India and represented in the Museum collection is *Kaloula pulchra taprobanica* Parker.

The remaining three species have now been separated and included in the genus *Ramanella*, *Kaloula obscura* being now known as *Ramanella montana* with which it is synonymous, and *Kaloula triangularis* and *Kaloula vriegata* being now correctly regarded as *Ramanella triangularis* and *Ramanella variegata* respectively. The genus *Ramanella* was established by Narayan Rao and Ramanna in 1925 (*Proceedings of the Zoological Society of London*, 1925, p 587). Of these species, however, *Kaloula pulchra* attains the largest size, reaching a length of three inches from snout to vent, while the species of *Ramanella* referred to above are only slightly over an inch in length from snout to vent. In spite of their dilated digits, these frogs are not arboral in habit. *Kolaula pulchra* is said to be burrowing in habit.

Kaloula pulchra Gray.

Kaloula pulchra, Gray, The Zoological Miscellany, No. 1, London, 1831, p. 38.
Callula pulchra, Günther, Rept. Brit. India, 1841, p. 437.
Hylaedactylus bivittatus, Cantor, Journ. Asiatic Soc. Bengal, XVI, 1847, p. 1064.
Callula pulchra, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 170 (with figures of hand and foot).
Callula pulchra, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 494.
Callula pulchra, Flower, Proc. Zool. Soc. London, 1896, p. 908, and 1899, p. 906.
Callula pulchra, Butler, Journ, Bomb. Nat. Hist. Soc., XV, 1904, p. 390.
Kaloula pulchra, Barbour, Proc. Acad. Nat. Sciences Philadelphia, 1909, pl. xviii, fg. 7 (terminal phalanx).
Callula pulchra, Boulenger, Vert. Fauna Malay Peninsula, Reptilia and Batrachia, London, 1912, p. 264, fig. 73.
Kaloula pulchra, Barbour, Mus. Comp. Zool. Harvard Coll, XLIV, 1, 1912, p. 71, pl. vii, fig. 29.
Callula puchra, Smith, Journ. Nat. Hist. Soc., Siam, II, 1917, p. 40, figs. B1-B3 (tadpole.)
Kaloula pulchra, Annandale, Mem. Asiatic Soc. Bengal, VI, 1917, p. 152, fig. 9 ; pl. vi, figs. 7—7b (tadpole).
Kaloula pulchra, Annandale and Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 43 (tadpoles).
Kaloula pulchra, Van Kampen, Amphibia of the Indo-Malayan Archipelago, 1923, p. 150.
Kaloula pulchra, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 249.

The Indian form of this species, which is the one that is represented in the Museum collection, belongs to the sub-species *Koloula pulchra taprobanica* Parker and the following description pertains essentially to this typical Indian sub-species. The distribution of this sub-species ranges over Ceylon and India, south of the Ganges.

Kaloula pulchra taprobanica Parker.

Plate VII, fig 5.

Kaloula pulchra taprobanica, Parker, A Monograph of the Frogs of the Family Microhylidae, Brit, Mus., London, 1934. p. 86–87.
Kaloula pulchra taprobanica, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 249.
Kaloula pulchra taprobanica, Daniel, Journ. Bomb. Nat. Hist. Soc., LX(3) 1963, p. 699.

This species is closely related to the Indian species of *Ramanella* described in the present account, but specimens grow to a much larger size, often attaining a length of three inches from suout to vent.

The skin of the back is excessively slimy, and it is either smooth or bears flat, smooth tubercles. A fold of skin extends from the eye to the shoulder, and another more or less distinct fold is present across the head behind the eyes. The skin of the underside is smooth.

The head is much broader than long. The snout is short and rounded, and is about as long as, or shorter than, the diameter of the orbit. The loreal region is oblique. The nostril is a little nearer to the tip of the snout than to the eye. The inter-orbital space is broader than the upper eyelid. The fingers are rather slender and their tips bear well developed triangular discs which are less than half the diameter of the eye. The first finger is shorter than the second. The toes are moderately well developed and slightly webbed at the base. The third toe is much larger than the fifth. The tips of the toes are only feebly dilated. The subarticular tubercles are well developed. There are two metatarsal tubercles, the inner one of which is oval, large, compressed and bears a sharp dge, while the outer one is smaller. The hind limb is moderately long, the tibio-tarsal articulation reaching the shoulder or slightly beyond. The male bears an external, subgular vocal sac.

Colour : The specimens are yellowish, light brown or pinkish above, usually with a large, dark brown spot covering almost the entire back and a dark band on the sides. Sometimes there are irregular, yellowish spots which coalesce with each other. A narrow, dark, vertebral line may be present. The under side is whitish or dirty buff coloured, without spots, or marbled with brown markings. The chin and throat are black in the male. The tadpoles of this species are dark olive brown to black in colour, with or without fine golden speckles.

Habits : These frogs are nocturnal in habit. The croak of these frogs is very loud. The males croak while floating on the surface of the water, the mouth, head and inflated sides of the body being held just above the surface of the water and with the vocal sac under the mouth inflated like a globe. Although they are mostly aquatic in habit, they can hop very well on land. They are good swimmers. The eggs are connected in the form of strings. The development of the tadpole is very rapid. The tadpoles are omnivorous, feeding both on animal and vegetable matter; they are incapable of remaining submerged below the surface of water.

Describing the habits of this species in the Malay Peninsula, Butler (*loc. cit.*, 1904) states that in dry weather these frogs are seldom seen or heard but they became active soon after a shower of rain and croak noisily. The males may be found floating in large numbers on the surface of every pool, their bodies being inflated until they resemble rather " flattened tennis balls " in shape. They keep repeating their extraordinarily loud and strident cry of " ah-wauk " throughout the day and night. It is said to be the noisiest frog known, its noise being deafening at close quarters. At a distance of about half a mile their sound resembles that of a gurgling waterfall. Males have a single large vocal sac under the throat, the sac becoming globular when inflated and their skin is profusely covered with a sticky, slimy secretion. The females are not slimy. Specimens kept in captivity become easily tamed.

Recorded localities.—This species is widely distributed and is recorded from Peninsular India, Ceylon, Burma, Southern China and Malay Peninsula. It has also been recorded from Sumatra, Borneo, Flores and Celebes and from the regions extending from India and South China to the Malay Peninsula. Boulenger (*loc. cit.*, 1882) has recorded this species from China, Moulmein in Burma, Siam, Penang, Ceylon and Cauvery in South India. It should be noted, however, that the forms occurring in Burma, Malaya, Penang, etc., belong to the typical subspecies, *Kalouta pulchra pulchra*, while those occurring in Ceylon and India belong to the subspecies *Kaloula pulchra taprobanica*. In India, this subspecies occurs only south of the Ganges.

Specimens in the collection.—Two specimens from Madras.(They are brownish above, with paler brown markings, coalescing together. The fold of skin across the head behind the eyes is very strongly developed. The underside is uniformly pale yellowish brown. The measurements of the larger specimen are as follows :—

From snout to vent	30 mm.
Hind limb	32 mm.
Front limb	16 m.m.

Genus **Ramanella** Narayan Rao and Ramanna.

The pupil is vertical and the tongue oblong and notched behind. The palatine bones form a straight ridge, only occasionally denticulate, across the palate in front of the oesophagus. No other folds are present on the roof of the buccal cavity. The tympanum is concealed. The fingers and toes are free. The tips of the fingers are dilated, but the tips of the toes are blunt, not dilated. The outer metatarsals are united. Pre-coracoid and omosternum are absent. The diapophysis of sacral vertebra are broadly dilated. The terminal phalanges are triangular.

Of the three genera of the family Engystomatidae (i.e., Microhylidae), recorded from South India, *Kaloula* approaches this genus more closely as is evidenced by the anatomical and osteological characters.

Three syecies of *Ramanella*, all of them commonly occurring in South India, are represented in the Museum collection, namely, *Ramanella montana* (formerly designated as *Kaloula obscura*), *Ramanella triangularis* and *Ramanella variegata*.

In *R. triangularis* the toes are perfectly free, while in *R. variegata*, the toes are webbed at the base, i.e., they bear a rudimentary web, and in *R. montana* the toes are one-third to half webbed. In *R. variegata*, the metatarsal tubercles are small and inconspicuous and in *R. monana* the tips of the digits are dilated into web developed discs and the outer metatarsal tubercles are minute. All these three species are rather small, the specimens reaching a length of only slightly over an inch from snout to vent.

Ramanella montana (Jerdon).

Plate VII, Fig. 6.

Hylaedactylus montanus (?) Jerdon, Journ. Asiatic Soc. Bengal, XXII, 1853, p. 533.
Callula obscura, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 169, pl. xiii, fig. 3.
Callula obscura, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 42, pl. viii, fig. 3.

Callula obscura, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, P. 493.
Callula obscura, Ferguson, Journ. Bomb. Nat. Hist. Soc. 1904, p. 506.

Kaloula obscura, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 43 (tadpoles).
Ramanella montana, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1932–33, p. 178.
Ramanella montana, Parker, A monograph of the Frogs of the family Microhylidae, Brit. Mus., London, 1934, p. 91.
Ramanella obscura, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 250.
Ramanella montana, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLVI, 1946, p. 404–5.
Ramanella montana, Daniel, Journ. Bomb Nat. Hist. Soc., LX (3), 1963, p. 701.

This is a rather small-sized species, with a fairly stoutly built body. The skin is smooth, or with small, flat tubercles on the head and back. A cutaneous fold extends from the eye to the shoulder. The snout is somewhat broad and short and well rounded. The interorbital space is wide, being broader than the upper eyelid. The fingers are free and moderate-sized and the toes are about one-third to half-webbed. The tips of the fingers are dilated into well developed truncated discs. The tips of the toes are slightly swollen. The sub-articular tubercles are distinct. Two small metatrasal tubercules are present, the inner being oval and blunt and the outer minute and rounded. The hind limb is fairly long, the tibio-tarsal articulation reaching the eye or even beyond, to the tip of the snout. The male bears subgular vocal sac.

Colour : The colour and markings of spirit-preserved specimens are as follows : The upper side is brownish or greyish, with blackish, rather pointed, angular markings; sometimes the skin is uniformly blackish brown. The underside is blackish brown, spotted with white. The colour of the tadpoles of this species in life is described by Ferguson (*loc. cit.* 1904). He states that the body of the tadpole is greenish above, during life, mottled with dark brown. The sides and under parts are paler, without markings. The tail is pinkish, spotted with brown and the crests are transparent, spotted with minute brown specks. The colour of the adult frog in life appears to be brownish black. The ankles are tinged with orange and the whole under side and the limbs are dotted with pale blue spots. A median dark spot is present on the back, commencing on the upper eyelids broadening between the shoulders, narrowing again and finally broadening in the sacral region.

Habits : This species is nocturnal in habit. Ferguson (*loc. cit.* 1904) states that he had not found it on the hills in Travancore. He found one specimen in the tin pot of a putting hole on the Resdency links in Travancore. Tadpoles of this species were obtained by him in the month of July. In other localities on the Malabar coast and elsewhere in South India, this species appears to be essentially a hill form. These frogs appear to aestivate after the rains. Mc. Cann (*loc. cit.*, 1946) has recorded a male and female in torpid state in the hollow of a tree.

Recorded localities : Ceylon, Southern India. Hills of the Malabar Coast. In South India, it has been specifically recorded from Travancore, Malabar and Anamalais. Ferguson (*loc. cit.*, 1904) records this species from Travancore, but he had found the specimens only in the plains in Travancore.

Specimens in the collection : Two specimens from Thomara, South Coorg, collected in 1914 rather doubtfully labelled as "*Callula obscura?*" A note accompanying the

specimen reads as follows :—" From under a log of wood; colour; brownish black. Ankle orange. The whole under surface and the limbs dotted with pale blue; Thomara. South Coorg, 4—3—1914 ".

Measurements of the larger specimen :

From snout to vent : 29 mm.

As the specimens were too rigid and contracted, it was not possible to determine the length of the limbs accurately.

These spirit-preserved specimens are dark brownish, almost blackish brown above, and pale brown below. The spots on the under side are not clear in these specimens.

Ramanella triangularis (Günther).

Plate VII, fig. 1.

Callula triangularis, Günther, Proc. Zool. Soc. London, 1875, p. 576.
Callula triangularis, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 171, pl. xi fig. 4.
Callula triangularis, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 42, pl. viii, fig. 5.
Callula triangularis, Boulenger, Fauna Brit. India, Reptillia and Batrachia, 1890, p. 495.
Callula triangularis, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 507.
Kaloula triangularis, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. (tadpoles).
Ramanella triangularis, Parker, A Monograph of the Frogs of the Family Microhylidae, Brit. Mus., London, 1934, p. 94.
Ramanella triangularis (and var. *rufeventris*), Narayan Rao, Proc. Ind. Acad. Sciences, VI, Sec. B, 1938, p. 418.
Ramanella triangularis, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (3), 1963, p. 701.

This is a moderate-sized species, readily distinguished from the other species of *Ramanella* recorded in the present Catalogue by the presence of a large, triangular blackish mark on the back. The skin is smooth, or with some flat tubercles on the back. The snout is short, blunt and broadly rounded and about as long as the diameter of the orbit. The interorbital space is wide, being broader than the upper eyeiled. The fingers are moderately long, with their tips dilated into small truncated discs. The toes are moderately developed, and are entirely free, without any trace of the web. The tips of the toes are simple, not dilated. The sub-articular tubercules are well developed. Two small metatarsal tubercles are present, the inner one being larger; it is also blunt and oval in shape. The hind limb is moderately long, the tibio tarsal articulation reaching the shoulder or a little beyond it. The male bears a subgular vocal sac.

Colour : The specimens (in spirit) are light olive, or olive brown above, with a large, triangular blackish blotch or marking extending nearly the entire length of the back In the only specimen which shows the colour markings well in the Museum collection, this large triangular patch is dark brown with a dark, blackish brown edge and a few scattered blackish spots. The sides are lower surface are blackish brown. The under side is spotted with whitish dots. The limbs are blackish brown, with large, pale, olive brown patches or spots.

Habits : In South India, this species is more common on the hills, but it is also frequently met with in the plains under a heap of dried leaves or other suitable cover in close proximity to pools of rain water. Ferguson (*loc cit.*, 1940) has observed this species

under stones and logs of wood at low elevations in hills of Travancore. Little is known about the habits of the adult. The tadpoles are said to be transparent at first, but become brownish later.

Recorded localities : Nilgiris and Malabar in South India. Thurston (*loc. cit.*, 1888) has recorded that there was a specimen in the Madras Museum collection from Ootacamund (7,000 feet altitude) and cites its measurements as : " length of body : 31 mm. and hind leg : 40 mm." But this specimen is not now traceable in the Museum collection. Instead, there are specimens from Wynaad and from Pattani, South Siam. This species therefore, seems to be more widely distributed than it was supposed to be by Boulenger, Thurston and other early authors, as its distribution appears to extend eastwards to Siam. Ferguson (*loc. cit.*, 1904) records this species from Chimanji, Travancore, at an elevation of 3,000 feet on the hills, under stones and logs.

Specimens in the collection : (1) Pattani, Pattani District, South Siam : One specimen, collected by Prof. E. Barnes in 1929, and formerly in the study collection, but now mounted and exhibited in the gallery.

The specimen is fairly large and exceeds the maximum recorded size cited by Boulenger in the Fauna of British India volume (*loc. cit.*, 1890) for this species, namely, 1.6 inches. The colour and colour makings in this specimen are also surprisingly fresh and distinct, although it had been preserved in spirit for years. The large triangular patch on the back is particularly well marked and is darker brown, edged with a very dark, blackish brown border, and marked with a few scattered, blackish brown spots. There are also a number of tubercles on the skin on the upper side.

Measurements :

From snout to vent	41 m.m.
Hind limb	42 mm.
Front limb	28 mm.

(2) Wynaad, South India : One specimen, formerly mounted as an exhibit in the gallery, but now stored in the study collection. It has faded completely into a uniform, creamy white, with only a faint indication of the triangular patch on the back—

Measurements :

From snout to vent	32 mm.
Hind limb	44 m.m.
Front limb	24 mm.

Ramanella variegata (Stoliczka).

Plate VIII, fig. 2.

Callula variegata, Stoliczka, Proc. Asiatic Soc. Bengal, 1872, p. 111.
Callula olivacea, Günther, Proc. Zool. Soc. London, 1875, p. 576, pl. lxiv, fig. B.
Callula variegata, Blanford, Journ. Asiatic Soc. Bengal, XLVIII, 1879, p. 116.
Callula olivacea, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 42, pl. viii, fig. 4.
Callula variegata, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 494.
Kaloula variegata, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 43 (tadpoles).
Ramanella variegata, Parker, A Monograph of the Frogs of the Family, Microhylidae, Brit. Mus., London, 1934, p. 63.
Ramanella variegata, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 250.
Ramanella variegata, Daniel , Journ. Bomb. Nat. Hist. Soc., LX (3), 1963, p. 700.

This species includes moderately small-sized frogs attaining a length of about one and a half inches. The body is rather elongate. The skin is almost smooth and bears a fold from eye to the shoulder. The snout is short and obtuse, about as long as the diameter of the orbit. The interorbital space is wide, being broader than the upper eyelid. The fingers are moderately slender, with their tips dilated and truncated. The toes are moderately long, and are not dilated at their tips. They are very slightly webbed, the web being almost rudimentary. The sub-articular tubercles are only slightly developed. The two metatarsal tubercles are small and inconspicuous, the inner being elongate. The hind limb is fairly long, the tarso-metatarsal articulation reaching about the level of the posterior border of the eye or even behind it. The male bears a subgular cocal sac.

Colour : The colour of the spirit-preserved specimens is olive brown on the upper side, marbled with dark brown markings. The under side is uniformly whitish without spots. No record of its colour in life is available, but the predominating colour of this species, even during life, appears to be dark olive; hence the specific name *olivacea* which is a synonym for *variegata*.

Habits : This species has been recorded from the Madras Museum compound where Dr. J. R. Henderson has reported finding them living in white ants' (termites') nests, (Thurston, *loc cit*. 1888). Dr. Thurston has also recorded having observed a single specimen in his own garden in Madras feeding on white ants (termites) underneath a flower pot and another specimen in the overflow pipe in the bathroom of his bungalow. This is a very common frog in South India, the presence of which after a heavy shower is detected by the peculiar cry, represented by the syllables " Qhuay, Qhuay, Qhuay ". It has been taken in termites' nests, in company with the black scorpion (*Palamnaeus*).

Recorded localities : Peninsular India as far north as the Godavari and Ceyon. There are specimens in the British Museum collection, collected from the Yellagherri Hills and the Godavary Valley. It has also been specifially reocrded from Madras and Godavari, near Bhadrachalam.

Specimens in the collection : A single specimen from Madras. It is mounted and exhibited in the gallery. The specimen is more or less faded badly into uniform, pale creamy brown colour.

Measurements:

From snout to vent	22 mm.
Hind limb	28 mm.
Front limb	12 mm.

Genus **Uperodon** Duméril & Bibron.

Syn. **Cacopus** (Gunther).

This genus is distinguished from the preceding one by the presence of two small bony protuberenes, close together, between the choanae. The pupil is vartical, and the tongue oval and free behind, withouf any notch. The choanae are very large, with

a movable integumentary flap which can close the nostril. The tympanum is concealed or indistinct There are two toothed dermal ridges, a narrow one across the parasphenodial region and another, broader one in front of the oesophogus. The fingers are free and the toes are webbed at the base. The tips of the digits are not dilated. The outer metatarsals are united. The sternum is large, plate-like and cartilaginous. The diapophyses of the sacral vertebrae are prominently dilated.

This genus inclues stoutly built frogs burrowing in habit and freeing chiefly on ants.

Only two Indian species are recorded, and both these are represented in the Museum collection, namely, *Uperodon systoma* and *U. globulosum*. In the former which is much more common, the snout is moderately short, being scarcely longer than the width of the orbit, while in the latter, the snout is longer, being nearly twice the diameter of the orbit.

Uperodon systoma (Schneider).

The Funny looking Frog.

Plate VIII, fig. 3.

Rana systoma, Schneider, Hist. Amph., I, 1799, p. 144.
Systoma leschenaulti, Tschudi, Class. Batrachia, 1838, p. 86.
Uperodon marmoratum, Dum. & Bibr., Erp. Gen., VII, 1841, p. 749.
Uperodon marmoratum, Günther, Catalogue, Batrachia Salientia, 1858, p. 49.
Rana systoma, Peters, Mon. Berl. Acad., 1863, p. 82.
Cacopus systoma, Günther, Rept. Brit. India, 1864, p. 415.
Pachybatrachus Petersii, Keferst. Arch. f. Naturg., 1868, p. 274, pl. 6, figs. 8 — 10.
Cacopus systoma, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit., Mus., 1882, p. 174.
Cacopus systoma, Thurston, Proc. Zool. Soc. London, 1887, p. 189.
Cacopus systoma, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 43, pl. ix, fig. 1.
Cacopus systoma, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, pl. 496.
Cacopus systoma, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 507.
Cacopus systoma, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 45 (tadpoles).
Uperodon systoma, Parker, A Monograph of the Frogs of the Family Microhylidae, Brit. Mus., London, 1934, p. 75.
Uperodon systoma, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 250.
Uperodon systoma, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (3), 1963, p. 698.

This is a robust, stoutly built frog, attaining a moderate size (about 2.5 inches in length from snout to vent. The skin is smooth, but the upper surface is sometimes beset with tubercles. Compared to the size and bulk of the body, the head is small. The mouth is also small, with a rather bluntly rounded, obtuse snout. The canthus rostralis is absent. The interorbital space is wide, being nearly twice the width of the upper eyelid. The fingers are moderately long, the first being slightly shorter than the second. The toes are comparatively short and imperfectly webbed. The subarticular tubercles are usually not very distinct. Two strong, compressed, shovel-shaped metatarsal tubercles are present, the inner one being very large, and as long as the second toe. The hind limb is comparatively short. The male bears a subgular vocal sac.

Colour: The specimens (in spirit) are olive or pinkish brown above, marbled with dark or blackish brown reticulated markings. The under side is uniformly whitish, without spots. In living speimens, the colour of the upper side is black or blackish brown, marbled with delicate primrose undulating markings.

Habits: This is the familiar species commonly known as the "Funny-looking Frog" on account of its amusingly stout build. This frog is often found in large numbers at nights in compounds in and around Madras during the monsoon, producing a characteristic sound. The male bears an enormous subgular vocal sac which produces the sound. Thurston (*loc. cit.*, 1888) records a specimen which he had found in a torpid state, buried in a hole, which it had excavated for itself, underneath flower pots in his garden. It is burrowing in habit, the shovel-shaped metatarsal tubercles being well adapted for burrowing in soft ground. Not much is known about the breeding habits of this species. Ferguson (*loc. cit.*, 1904) records that in Trivandrum, this burrowing frog is fairly common in low country, but not much in evidence, as it is entirely nocturnal. The eggs are globular and are placed in large, irregular masses, which may be found floating in the paddy fields.

Recorded localities: Throughout India; Madras, Nilgiris, Biligiriranga Hills, Mysore. Ferguson (*loc. cit.*, 1904) has recorded it specifically from Travancore. It is a common species occurring also in the plains of India.

Specimens in the collection: Six adult more or less full grown specimens (of which one is mounted as a gallery exhibit and the rest stored in the study collection, one young specimen, less than half grown, and a number of eggs and tadpoles, all from Madras.

The measurements of the largest specimen in the study collection are as follows:—

From snout to vent	52 mm.*
Hind limb	56 mm.
Front limb	30 mm.

(* This is slightly less than the maximum recorded size for this species.)

Unfortunately, this specimen is badly faded and is almost uniformly yellowish or creamy brown above, with faint indications of dark brownish, indistinct, marbled markings. The under side is uniformly yellowish white.

The other smaller specimens in the study collection are darker brown, with the blackish brown marbled markings more distinct.

The tadpoles in the collection are rather translucent, with the internal organs showing through as a black opaque mass :

Measurements of the specimen exhibited in the gallery :

Front limb	39 mm.
Hind limb	78 mm.
Front limb	39 mm.

The colour of this specimen is faded into a uniform, pale yellowish white. No trace of the marbled markings is seen.

Uperodon globulosum (Günther).

Plate VIII, figs. 4 and 5.

Cacopus globulosus, Günther, Rept. Brit. India, 1867, p. 416, pl. xxvi, fig. K.
Systoma globulosum, Cope, Journ. Acad. Philadelphia (2), VI, 1867, p. 194.
Cacopus globulosus, Anderson, Proc. Zool. Soc. London, 1871, p. 201.

Cacopus globulosus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 175.
Cacopus globulosus, Thurston, Proc. Zool. Soc. London, 1887, p. 189.
Cacopus globulosus, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 43, pl. x, fig. 1.
Cacopus globulosus, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 497.
Uperodon globulosum, Parker, A Monograph of the Frogs of the Family, Microhylidae, Brit. Mus., London, 1934, p. 76.
Uperodon globulosum, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (3), 1963, p. 697.

This species is closely allied to the preceding species, but may be distinguished from it by its stouter and more strongly globular shape and by its longer snout. The canthus rostralis is distinct, but obtuse. The interorbital space is very wide, being three times the width of the upper eyelid. The metatarsal tubercles are well developed, and as in the preceding species, they are compressed and shovel-shaped. The inner metatarsal tubercle is large, being longer than the second toe. The skin is smooth, or slightly tuberculated above. The male bears a prominent, subgular vocal sac. This species attains a larger size than the preceding one, and a maximum size of three inches (from snout to vent) has been recorded.

Colour : The spirit-preserved specimens are uniformly brown above, or spotted with darker brown. No record of its colour during life is available.

Habits : The habits of this species are more or less similar to those of the preceding species. They are said to feed largely on white ants (termites). The globular shape of most of the specimens is due either to the distension of the abdominal cavity by fluid or by the enormous development of the ovaries in the females. Thurston (*loc. cit.*, 1888) mentions a specimen in which the stomach was distended by fluid in such an extraordinary manner that the body assumed the shape of a ball from which the head and limbs projected.

Recorded localities : This species is somewhat restricted in its distribution. It has been recorded from Russelkonda, Ganjam District, in Orissa, and Calcutta.

Specimens in the collection : One specimen from Russelkonda, Ganjam District, Orissa. It has its stomach enormously distended by a mass of winged termites (white ants). The specimen is uniformly dull olive brown. Thurston (*loc. cit.*, 1888) also refers to this specimen in the Madras Museum collection. This specimen is of the maximum size (three inches in length from snout to vent) recorded for this species.

Measurements :

From snout to vent	78 mm.
Hind limb	56 mm.
Front limb	31 mm.

SERIES B. ARCIFERA.

The coracoids and precoracoids are divergent in this group, connected by an arched cartilage (the epicoracoid). The epicoracoid cartilage is free from the corresponding cartilage of the opposite side and overlaps it. Only one family of this series, namely, Bufondiae, is represented in South India, and this is also the sole family of this series represented in the Museum collection.

Family BUFONIDAE.

The jaws are toothless. The diapophysis of the sacral vertebrae are dilated. This family includes the true toads and is world-wide in distribution. Three genera of this family are recorded in India, of which species belonging to only one genus, *Bufo*, are represented in the Museum collection.

Genus **Bufo** Laurenti.

The pupil is horizontal. The tongue is elliptical, entire and free behind. Vomerine teeth are absent. The nostrils are lateral. The fingers are free, but the toes are webbed to a greater or less extent. The tips of the digits are either simple or dilated into small discs. The outer metatarsals are united. The omosternum is usually absent. The sternum is cartilaginous and plate-like, sometimes more or less calcified along middle line. The diapophysis of the sacral vertebrae are moderately dilated. The terminal phalanges are obtuse or triangular.

Some species of *Bufo* bear bony ridges on the upper surface of the head, namely the canthal, supraorbital, preorbital, postorbital, parietal and supra-tympanic ridges.

This genus is more or less cosmopolitan in distribution, being found all over the world, except New Guinea, Polynesia, Australia, Madagascar and Pacific Islands. This genus includes the true Toads, of which about eighty-five species are known. But only about fifteen species are recorded from the Indian Region, of which only five, all of them found in South India, are represented in the Museum collection.

Of these five species, *Bufo melanosticus*, *B. parietalis* and *B. microtympanum* possess bony ridges on the head, while the remaining two species (*B. hololius* and *B. fergusonii*) are devoid of them.

Bufo melanosticus Schneider.

The Common Indian Toad.

Plate IX, Fig. 1.

Bufo melanosticus, Schenider, Hist. Amph., I, Jena, 1799, p. 216.
Bufo bengalensis, Daudin, Hist. Rain. Gren Crap., 1803, p. 94, pl. xxxiv, fig. 1, and Hist. Rept., VIII, 1803 p. 197.
Bufo bengalensis, Lesson, in Belanger, Voy. Ind. Or. Rept., 1834, p. 334.
Bufo isos, Lesson, *loc. cit.*, p. 333.
Bufo scaber (Daudin) Schlegel, Abbild. neuer oder unvolst., bek. Amph., Dusseldorf, 1837–44., p. 64, pl. xx, fig. 2.
Bufo melanosticus, Günther, Catalogue, Batrachia Salientia, 1858, p. 61.
Phrynoides melanosticus, Cope, Proc. Acad. Philadelphia, 1863, p. 357.
Bufo melanosticus, Günther, Rept. Brit. India, 1864, p. 422.
Bufo melanosticus, Stoliczka, Proc. Asiatic Soc. Bengal, 1870, p. 155.
Bufo melanosticus, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, p. 306.
Bufo melanosticus, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 46, pl. xii, fig. 1.
Bufo melanosticus, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 505.
Bufo melanosticus, Flower, Proc. Zool. Soc. London, 1896, p. 911, pl. xliv, fig. 3 (tadpole).
Bufo melanosticus, Ferguson Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 508.
Bufo melanosticus, Stejneger, Bull. U.S. Nat., Mus., VIII, 1907, p. 72, figs. 58 – 61.
Bufo melanosticus, Boulenger, Annandale & Tate Regan, Rec. Ind. Mus., I, 1907, p. 149.
Bufo melanosticus, Annandale, Rec. Ind. Mus., III, 1909, p. 286.
Bufo melanosticus; Boulenger, Vert. Fauna, Malay Peninsula, Reptilia and Batrachia, London, 1912, p 272 with figure.
Bufo melanosticus, Annandale, Rec. Ind. Mus., VIII, 1912, p. 19.
Bufo melanosticus, Annandale, Rec. Ind. Mus., XIV, 1918, p. 69.
Bufo melanosticus, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 38 (tadpoles).

Bufo melanosticus, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXIX, 1923, p. 135.
Bufo melanosticus, Van Kampen, The Amphibia of the Indo-Australian Archipelago, 1923, p. 80.
Bufo melanosticus, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXVI, 1933, p. 178.
Bufo melanosticus, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 244.
Bufo melanosticus, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 435.

This is a large and stoutly built species of toad, attaining a length of about six to six and half inches in length from snout to vent. The head is broader than long, and bears a few raised bony ridges. The snout is short and blunt, being shorter than the upper eyelid. The interorbital space is much broader than the upper eyelid. The loreal region is almost flat and only slightly oblique. The nostril is nearer the tip of the snout than the eye. The tympanum is very distinct, about two-thirds the diameter of the eye, and is situated very close to the eye. The tips of the fingers and toes are blunt. The first finger usually extends beyond the second, which is shorter than the fourth. The toes are about half-webbed and bear very small, single sub-articular tubercles. A moderate-sized elliptical inner, and a smaller outer, metatarsal tubercles are present. A tarsal fold is absent. The hind limb is fairly long, the tarso-metatarsal articulation reaching the tympanum or the eye.

The upper surface of the body bears more or less prominent warts which are often spiny. These warts are varied in size. The parotoids are very prominent, more or less elongated and elliptical or bean-shaped. The under side is granular. The upper side of the head is nearly smooth. The male bears a subgular vocal sac and black nuptial excrescences on the two inner fingers during the breeding season.

Colour : The colour of the upper parts (in spirit-presented specimens) is brown or yellowish brown, sometimes with carmine-colour spots, the spines of the warts and the ridges on the head being usually black. The under side is yellowish, without spots, or more or less spotted with brown. Thurston (*loc. cit.*, 1888) records that some of the Nilgiri specimens had, during life, bright red markings, or a reddish diffuse tinge on the upper surface, while the colour of other specimens was uniformly pale yellow.

In the males, during the breeding season, the throat is tinged with brick-red or orange-yellow, which is only distinct when the gular sac is inflated (Mc Cann, *loc. cit.*, 1933).

Habits : This is the commonest species of toad found in India. It is also the commonest toad occurring in South India. It makes a characteristic chirping sound and sometimes emits a shrill whistle. The length of the adult specimens is subject to considerable variation. This species is very abundant in damp places, and the banks of the streams in the Nilgiris, especially in the vicinity of Kotagiri and Coonoor. The hill specimens are as a rule much larger than those found on the plains. Toads of this species usually remain hiding in holes during the day and come out in the evenings hunting for insects in and around human dwellings. The eggs are laid in stagnant and often muddy water in which the tadpoles undergo their development. The tadpoles are blackish brown above and greyish beneath.

Mc Cann (*loc. cit.*, 1933) has given a fairly detailed account of its habits. He states that although this toad is such a common creature, like the rest of the family, little appears to be known about its habits. This species is entirely nocturnal, beginning to be active soon after sunset. It spends the day hiding in holes at the base of tree trunks and in walls, under stones or any other suitable places which will afford it a hiding place,

during the hours of daylight If the hole is large enough to accommodate several, they will live together. They also sometimes bury themselves in cotton or coir, whenever this is available. In the districts, these toads frequently enter houses, and, if not disturbed, they will remain motionless in a corner.

During the greater part of the year, these toads are, as a rule, silent, but where there is plenty of rainfall, they may be heard throughout the year. During the period when they are silent, they only utter a feeble note, if handled. But after the onset of the monsoon, especially in dry districts, they become very boisterous. The monsoon is the breeding season, when the males burst into continuous croaking. During this season the throat is tinged with brick-red or orange-yellow, which is only distinct when the gular sac is inflated. The males are smaller than the females and far exceed the females in number and consequently there is a keen competition among the males for the possession of the females and there is often considerable fighting.

Mc Cann (*loc. cit.*, 1933) has also given an account of the breeding habits of this species. The eggs are generally laid in running water, but they are also sometimes laid in pools and tanks. The ova are discharged in the form of long " strings " composed of a gelatinous substance. These strings get entangled in the vegetation and are thus prevented from being washed away by the currents. Two strings are produced at a time. As the larvae appear, the gelationous substance of which the strings are composed swells and the larvae remain within it for a time before they emerge. When the tadpoles emerge, they adhere to the outside of the strings for some time before they become free-swimming, by means of the suckers.

The breeding season is usually restricted to the beginning of the rainy season, but under favourable conditions, these toads may breed throughout the year in the certain localities. About a week after the onset of the rains and after the mating has taken place, the incessant croaking of the male toads ceases and very few toads can be seen during the day. They now turn their activities towards procuring food. Though they are nocturnal in habit, during the breeding season, these toads may be seen to be active both during day and night. The period of development is comparatively short. Young toads are gregarious and may be seen in large numbers soon after the monsoon, and sometimes even as early as August.

Recorded localities : This species occurs throughout India, Burma and Ceylon. In Southern India, it is found both in the plains and on the hills. It has been recorded from the Nilgiris up to an altitude of about 7,000 feet. In the Himalayas, it has been found up to an elevation of 9,000 to 10,000 feet. Annandale (*loc. cit.*, 1909) states that it is common all over the plains in Travancore. Some specimens taken at Ernakulam are said to be unusually dark, the ventral surface being marked with white. Boulenger, Annandale and Tate Regan (*loc. cit.*, 1907) have specifically recorded this species from Nepal and Kumaon. Beyond Indian limits, its distribution extends to China, Malaya, Archipelago and the Philippine Islands. Ferguson (*loc. cit.*, 1904) states that it is a very common toad both on the hills and in the low country in Travancore.

Specimens in the collection : Thurston (*loc. cit.*, 1888), records that a typical specimen of the Madras Museum collection measured only 4-5/8 inches in length from the tip of the snout to the tip of the longest toe, and a specimen from Cochin also said

to have been in the Madras Museum collection is reported to have measured 5-3/4 inches between the same points. He also records that a full grown male specimen in the Madras Museum had the forelimb swollen for breeding purposes. But these specimens are not now traceable in the Madras Museum collection.

The specimens now represented in the collection are as follows :—

(1) Coimbatore District : One specimen, mounted and exhibited in the gallery. It is faded into a pale yellowish white. The tubercles on the skin of the back are very strongly developed.

Measurements :

From snout to vent	147 mm.
Hind limb	110 mm.
Front limb	71 mm.

(2) Horsleykonda, Chittoor District : One fairly large adult specimen collected at an altitude of 3,000–4,000 feet. The upper side is dark brownish and the lower yellowish brown. The spines on the warts on the back are black. The under surface is coarsely tuberculated throughout. The ridges behind the eyes on the head are very strongly developed and black, with the intervening space deeply concave. The tympanum is distinct, and close to the eye, but separated from the latter by a distinct ridge.

Measurements :

From snout to vent	120 mm.
Hind limb	142 mm.
Front limb	63 mm.

(3) Madras : Two specimens, not full grown. One of the specimens, which is slightly larger than the other (about three inches in length from snout to vent) is dark smoky brown above, and paler brown below. The other specimen is lighter brown above and pale yellowish brown below, with prominent, large, dark brown spots on the chest in the region between the bases of the front limbs :

Measurements :—

Larger specimen :

From snout to vent	84 mm.
Hind limb	102 mm.
Front limb	50 mm.

Smaller specimen :

From snout to vent	55 mm.
Hind limb	66 mm.
Front limb	30 mm.

(4) Kunnavaram, East Godavary District : One small, specimen, dark brown above, with the warts on upper surface prominently developed, but the spines on the warts are not developed. The under side is paler brown and finely granulated.

Measurements :

From snout to vent	47 mm.
Hind limb	55 mm.
Front limb	21 mm.

Bufo microtympanum Boulenger.

Plate IX, fig. 2.

Bufo microtympanum, Boulenger, Catalogue, Batrachia, Salientia, Ecaudata, Brit. Mus., 1882, p. 307; pl. xxii, fig. 1.
Bufo microtympanum, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 47, pl. x, iii fig. 1.
Bufo microtympanum, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 505.
Bufo microtympanum, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 39 (tadpoles).
Bufo microtympanum, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 438.

This species attains a smaller size than the preceding one and is confined to the hills of Southern India at fairly high altitudes. The skin on the upper side bears irregular, distinctly porous warty prominences. The parotoids are conspicuous, elliptical and elongated, being two and half times as long as broad.

The head bears prominent bony ridges. It is broad, with a short, blunt snout. The interorbital space is moderately wide, being broader than the upper eyelid. As the specific name suggests, the tympanum is very small, and generally indistinct, being less than half the width of the eye. The fingers are moderately slender ,the first extending beyond the second. The toes are about half webbed. The tips of the digits are simple and not dilated into discs. Each of the toes bears a simple, subarticular tubercle. Two moderately well developed metatarsal tubercles are present. A tarsal fold is absent. The hind limb is fairly long, the tarso-metatarsal articulation reaching the eye or even beyond. The male bears a subgular vocal sac. Full grown, adult specimens of this species attain a length of about three inches from snout to vent.

Colour : Fresh specimens are brownish above, and yellowish beneath, marbled with brown markings but the spirit-preserved specimens in the collection are more or less uniformly rusty brown.

Habits : This is essentially a hill species and is found at moderate to fairly high elevations on the hills. Not much has been recorded about its habits.

Recorded localities : Malabar, Kodaikanal and Pluney Hills at an altitude of 7,000 feet. Thurston (*loc. cit.*, 1888) records this species from the Nilgiris and states that he has observed specimens of this species in a hole in a decayed wood in a forest near Coonoor.

Specimens in the collection :

(1) Wynaad, Malabar District :—Two specimens, almost equal in size. They are only about half the maximum recorded size for the species. The measurements of the larger specimen are as follows :

From snout to vent	39 mm
Hind limb	49 mm.
Front limb	20 mm.

(2) Dhoni Forest, South Malabar (altitude between 1,500 and 4,000 feet) : One specimen much paler brown than the preceding ones and the warts on the back are more numerous and prominent. The ventral surface is pale creamy brown :

Measurements :

From snout to vent	35 mm.
Hind limb	42 mm.
Front limb	22 mm.

(3) Netterikkal Region, Kalakkad Forest, Tirunelveli District (altitude about 3,000 to 5,000 feet) :

Measurements :

From snout to vent	37 mm.
Hind limb	44 mm.
Front limb	23 mm.

(4) Madras : Five young specimens, much less than half grown, the largest of these measuring only 26 mm. in length from snout to vent.

(5) Horsleykonda, Chittoor District (altitude about 3,000 to 4,000 feet). Three young specimens. The upper side is very much darker brown than in the preceding young specimens from Madras. The ventral surface is pale yellowish brown, with the marbled darker brown markings more distinct than in the preceding specimens. The largest of these young immature specimens measures only 23 mm. in length from snout to vent.

Bufo hololius Günther.

Plate IX, fig. 3.

Bufo hololius, Günther, Proc. Zool. Soc. London, 1875, p. 569, pl. lxiv, fig. A.
Bufo hololius, Boulenger, Catalogue, Batrachia Salientia, Ecaudata, Brit. Mus., 1882, P. 289.
Bufo hololius, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 45, pl. xi, fig. 3.
Bufo hololius, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 502.
Bufo hololius, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 423.

This species is much smaller than the preceding one, the measurements of the only recorded specimen from Malabar in the British Museum being cited as 1.4 inches from snout to vent, by Boulenger (*loc, cit.*, 1890). The skin is smooth and the upper surface bears flat, smooth, porous glandular patches. Many of these patches are of a darker colour (very dark brown) than the ground colour. The parotoids are smooth, flattened and reniform. The top of the head is smooth, without any bony ridges. The skin on the under side is smooth for the most part, but is finely granulated in the region of the chest in between the bases of the fore limbs. The snout is short and prominent. The interorbital space is fairly wide, being as broad as the upper eyelid. The tympanum is distinct and very large, being nearly as large as the eye and is situated very close to the eye. The fingers are short, the first finger extending a little beyond the second. The toes are also short and webbed only at their bases. Two small matatarsal tubercles are present. The sub-articular tubercles are single and not pronounced. There is no tarsal fold. The hind limb is moderately long, the tarso-metatarsal articulation reaching the eye.

Colour : The colour of the specimens (in spirit) is olive brown above, marbled with darker brown markings. The under side is yellowish brown in the single specimen examined. The under side in this species is said to be whitish, without spots. No record of the colour of this species in life is available.

Habits : No information is available on the habits of this species.

Recorded localities : This species has so far been recorded only from Malabar [both by Boulenger (*loc. cit.*, 1882 and 1889) and by Thurston (*loc. cit.*, 1888)], but in the Madras Museum collection there is one specimen from Horsleykonda, Chittoor District

and another slightly smaller one from Nellore District in Andhra Pradesh. These new locality records thus extend the range of this species considerably beyond its original limits.

Specimens in the collection:

(1) Horsleykonda, Chittoor District: One specimen: Colour: above, brownish, marbled with darker brown and with some of the glandular patches especially towards the sides, appearing darker brown. The under side is yellowish brown, somewhat darker brown over the chest and abdomen.

Measurements:

From snout to vent	51 mm.
Hind limb	54 mm.
Front limb	25 mm.

This specimen is larger (being two inches from snout to vent) than the single recorded specimen of this species from Malabar which is stated to measure only 1.4 inches in length from snout to vent (Boulenger, *loc. cit.*, 1890).

The present specimen from Horsleykonda has since been mounted and exhibited in the gallery.

(2) Nellore District, Andhra Pradesh: Two specimens:

(i) Colour, above, pale brownish, marbled with darker brown markings. The under parts are yellowish brown.

Measurements:

From snout to vent	46 mm.
Hind limb	51 mm.
Front limb	23 mm.

(ii) Colour faded completely into white:

Measurements:

From snout to vent	52 mm.
Hind limb	64 mm.
Front limb	29 mm.

This specimen was originally mounted and exhibited in the Amphibian gallery, but has since been removed and kept in study collection.

The specimens in the Museum collection, from Horsleykonda, Chittoor District and Nellore District in Andhra Pradesh are from localities which are hitherto unrecorded for the present species.

Bufo parietalis Boulenger.

Plate IX, fig. 4.

Bufo parietalis, Boulenger, Catalogue, Batrachia Salientia, Ecaudata,, Brit. Mus., 1882, p. 312, pl. xxi, fig. 2.
Bufo parietalis, Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 47 pl.x iii fig. 2.

Bufo parietalis, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 507.
Bufo parietalis, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 508.
Bufo parietalis, Narayan Rao, Journ. Bomb. Nat. Hist. Soc., XXVII, part 1, 1920, p. 126.
Bufo parietalis, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 434.

This is a medium-sized species of toad, measuring about three inches from snout to vent. The skin on the upper side is covered with numerous warts of irregular size. Some of the warts along the middle of the back are large. The parotoids are moderately large, elongate and elliptic, and are very prominently developed. The snout is short and blunt and the head broad and triangular in outline. The crown bears very prominent ridges; of these, the parietal ridges are obliquely directed inwards. The interobital space is broad, concavely depressed and wider than the upper eyelid. The tympanum is distinct, but smaller than in the preceding species, being about two-thirds the diameter of the eye. The first finger extends beyond the second. The toes are only half webbed, with simple, sub-articular tubercles. Two moderately developed metatasal tubercles are present. There is no tarsal fold. The hind limb is long, the tarso-metatarsal articulation reaching between the eye and the tip of the snout. The male bears a subgular vocal sac.

In a single specimen examined by Narayan Rao (*loc. cit.*, 1920), the following peculiar characteristics were noted: (1) The bony ridges on the crown were by no means prominent; (2) There was a distinct occipital and a prefrontal ridge; and (3) The toes were considerably less than half webbed and the subarticular tubercles were absent. The specimen belonged to the collection of the Indian Museum.

Colour: The colour in preserved specimens is uniformly brown above, and the lower surface is marbled with brown. Its colour during life is not recorded.

Habits: Very little is recorded about the habits of this species, but it appears to be essentially a hill species. Ferguson (*loc. cit.*, 1904), recording this species from Travancore, states that this species is confined to the hills, where it may be met with up to an altitude of 3,000 feet.

Recorded localities: The species has been so far recorded only from Malabar and Travancore, but in the Madras Museum collection, there are specimens of this species from Cochin and the Nilgiris in South India. It appears therefore to be more widely distributed in Southern India than was originally supposed.

Specimens in the collection:

(1) Cochin, Kerala State (Timber forests): One specimen, slightly more than half grown. The colour is uniformly brownish and the warts along the middle of the back disposed in two longitudinal rows are particularly large and prominent. The under side is more or less finely granulated. The ridges behind the eyes are especially prominent.

Measurements:

From snout to vent	50 mm.
Hind limb	73 mm.
Front limb	37 mm.

(2) The Kundans, Nilgiris: One young specimen, much smaller than the preceding one, and somewhat darker brown in colour, collected by Prof. Barnes. The parotoids are very prominent, elongated and elliptical. The warts on the upper side are numerous and of irregular size, those along the middle of the back being proportionately larger;

Measurements:

From snout to vent	...	...	...	...	...	...	24 mm.
Hind limb ..	...	...	...	...	...	...	33 mm.
Front limb ...	...	...	...	...	...	...	15 mm.

These two specimens are the first specific records of this species from Cochin and the Nilgiris, as this species had so far been recorded only from Malabar.

There are also a few specimens of tadoples from Ootacamund, Nilgiris, in the Museum collection, preserved along with the above specimens, but it is not certain whether they belong to the present species. They have been collected at an altitude of about 6,700 to 8,000 feet.

A very young specimen from Nagari Hills, Chittoor District, collected by Prof. Barnes and measuring 14 mm. in length from snout to vent, is also represented in the Museum collection and seems referable to the present species, although the skin is relatively smooth. It is dark brown above, and paler, yellowish brown below.

Bufo fergusonii Boulenger.

Plate IX, fig. 5.

Bufo fergusonii, Boulenger, Journ. Bomb. Nat. Hist. Soc., VII, 1892, p. 317.
Bufo fergusonii, Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 509.
Bufo fergusonii, Narayan Rao, Rec. Ind. Mus., XI, 1915, p. 37 (habits and distribution).
Bufo fergusonii, Annandale & Narayan Rao, Rec. Ind. Mus., XV, 1918, p. 38, pl. ii, figs. 4, 4a (tadpoles).
Bufo fergusonii, De Silva, Spolia Zeylanica XXVII, 1953–55, p. 244 and p. 251.
Bufo fergusonii, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 434.

This is a moderate-sized species of toad, reaching a length of about 1-3/4 to 2 inches from snout to vent. The body is more or less robust, and slightly broader behind. The skin on the upper side is covered fully with rough, close-set, spinose tubercles, and on the under side, the skin is uniformly covered with smaller and finer granules. The crown bears weak bony ridges, namely, the canthal, preorbital, supraorbital, postorbital, supratympanic and parietal. The parietal ridges are directed obliquely onwards. The snout is short and blunt, rather obtuse. The interorbial space is depressed, and is broader than the upper eyelid. The tympanum is rather small, but distinct, and situated close to the eye, and is less than half its diameter in width. The parotoids are rather inconspicuous, rounded, and about as long as broad. The first finger does not extend beyond the second and the toes are imperfectly webbed. Enlarged subarticular tubercles are absent and the metatarsal tubercles are feebly developed. The tarsal fold is absent.

This species resembles closely *Bufo beddomii* in general appearance, and in the nature and disposition of the warts in the upper surface. In fact, the specimen contained in the Museum collection closely approximates the figures of *B. beddomii* reproduced in Thurston's Catalogue (*Batrachia alientia and Apoda of Southern India*, 1888, p. 46; pl. xi. fig. 4).

***Colour*:** The colour (of spirit-preserved specimens) is pale olive brown above, with a few irregular darker blotches, but these markings are not traceable in the only specimen represented in the collection. The under side is uniformly paler brown. No authentic record of its colour in life is available.

***Habits*:** The type specimen of this species was a gravid female, measuring 46 mm. in length from snout to vent and was found by Mr. Ferguson at Trivandrum in 1891 (Ferguson, *loc. cit.*, 1904). A favourite haunt for this species is stated to be the white ants nest's. They are very slow in their movements and more often run on the ground than hop. In capativity they appear to become very tame.

Narayan Rao (*loc. cit.*, 1915) has described in some detail the habits of this species. He observes that it is entirely nocturnal and does not appear to occur in any large numbers and considers this to be certainly one of the rare species of toads met with in South India. In loose earth, it burrows with great ease. It feeds almost exclusively on termites. Curiously enough, it does not feed on black ants, beetles and earthworms which appear to be the staple food of bigger species of toads like *Bufo melanosticus*. It generally walks on the ground and can also run, especially when its prey is sighted and is within easy reach. When the toad walks, the body is lifted from the ground and its movements then resemble somewhat those of the common garden lizard (*Calotes*). In attempting to take a wider range of view of its environment, the body is lifted up and supported on all the four limbs somewhat after the manner of a mammal and the toad may move in that posture. While running it keeps its head low. When held in the hand, it does not attempt to escape, but remains calm and will even feed on white-ants from off one's hands. It appears very uncomfortable when thrown into the water and darts excitedly in an attempt to jump off from the surface of the water.

Recorded localities : This species had originally been recorded only from Trivandrum. But Narayan Rao states (*loc. cit.*, 1915) that this species enjoys a much wider distribution. In 1903, two specimens were taken in the compound of the then residence of Dr. William Miller in Nungambakkam in Madras, one of which was sent to Dr. G. A. Boulenger, who, in acknowledging receipt of the toad, mentions that it is also known from Ceylon. Since then specimens have been obtained from Malabar and the outlying districts of Mysore. It is possible that this little toad may be found in North India also. This toad is replaced in Northern India by *B. stomaticus* Lutken, but its occurrence in North India has not yet been definitely reported. De Silva has recorded it from Ceylon (*loc. cit.*, 1953-55).

There are also two specimens of this species in the Madras Museum collection from other localities, not previously recorded. One of these, in the study collection, is from Ernakulam, Kerala State, and the other, exhibited in the gallery, is from Udayagiri, Nellore District. The range of this species therefore appears to be much more extensive than was originally supposed.

Specimens in the collection :—

(1) Ernakulam, Kerala State : One, almost full grown specimen. The colour is dark brown above, paler brown below. The warts on the back are very rough, numerous and close-set, somewhat irregular in size and are spinose. There are no indications of the black blotches on the back, in the present spirit preserved specimen.

Measurements :

From snout to vent	42 mm.
Hind limb	54 mm.
Front limb	22 mm.

(2) Udayagiri, Nellore District : One specimen mounted and exhibited in the gallery. It is faded into a dull uniform yellowish white colour. The tubercles on the back are small.

Measurements :

From snout to vent	34 mm.
Hind limb	39 mm.
Front limb	20 mm.

Order APODA. (= GYMNOPHIONA).

This Order includes worm-shaped burrowing Amphibians, without limbs. The tail is rudimentary or absent. Small, bony scales are usually present, embedded in the skin. The eyes are rudimentary, sometimes covered by cranial bones. A retractile tentacle is present between the eye and the nostril. A tympanum is absent. The male bears an unpaired, intromittent copulatory organ. They are all terrestrial and burrowing in habit, and are either oviparous or viviparus, with or without an aquatic larval stage.

This Order comprises a single family, the Caecilidae, including the limbless Amphibians popularly known as the Caecilians.

Family CAECILIIDAE.

With the characters of the Order. The distribution of this family ranges over tropical parts of America, Africa and Asia. Three genera are recorded in the Indian Region, of which only two are represented in the Museum collection, namely, *Ichthyophis* and *Uraeotyphlus*. In the former, the tentacle is situated between the nostril and the eye, near the lip, while in the latter, the tentacle is placed below the nostril.

Genus **Ichthyophis** Fitzinger.

Cycloid scales are present embedded in the skin. The eyes are externally distinguishable. The tentacle is conical, near the lip, situated between the eye and the nostril. It is extensile, and is surrounded by a ring-shaped groove. Two series of teeth are present in the upper jaw, and usually also in the lower jaw. A short, pointed tail is present. The squamosal bones are in contact with the parietals.

The forms included in the genus *Ichthyophis* are not typical burrowers. They do not dig by means of the head to lead a subterranean life, but live under rotten vegetation where there is sufficient moisture. This has been described as a " surface cryptic life ".

Two species are recorded in India, and both are represented in the Museum collection. They are *Ichthyophis glutinosus* and *Ichthyophis monochrous*. In the former, the snout

is as long as the distance between the eyes, and a yellow lateral band is present. In the latter, the snout is shorter than the distance between the eyes, and there is no lateral band.

But the forms hitherto grouped under these two species, namely, *Ichihyophis, glutinosus* and *Ichthyophis monochrous* have very recently been split up and described as seven different species, based largely on their geographical range of distribution, as follows : (vide Daniel, *Journ. Bombay Natural History Society*, LX(2), 1963, P. 429) :—

1. *Ichthyophis sikkimensis.*—Eastern Himalayas.
2. *Ichthyophis bombayensis.*—Surat Dangs (Waghi).
3. *Ichthyophis subterrestris.*—Alibag, Kolaba District (across the Harbour from Bombay City), Anamalai Hills, Nilgiris, Kottayam, Kerala.
4. *Ichthyophis beddomii.*—Gersoppa, North Kanara, Nilgiris, Kerala.
5. *Ichthyophis peninsularis.*—Malabar, Kerala.
6. *Ichthyophis tricolor.*—Nilgiris, Peermade, Kerala (I.T. Maddathorai).
7. *Ichthyophis malabaricus.*—Maduvangard, Kerala.

The forms hitherto grouped under *Ichthyophis glutinousus* would appear to correspond to *Ichthyophis sikkimensis, I. beddomii. I. subterrestris* (part), and *I. tricolor.* The last species (*tricolor*) was treated as a distinct variety of *I. glutinosus* in the earlier classification.

The specimens hitherto referred to as *Ichthyophis monochrous* would seem to ompriss the newly created species, *Ichthyophis bombayensis, I peninsularis, I. malabaricus* and *I subterrestris* (part).

In the collection of this Museum, therefore, the specimens formerly labelled as *Ichthyophis glutinosus* will have to be strictly referred to the following species in the new classification, based mainly on their geographical distribution and locality records :—

(1) Specimens from Kasturi Pass, South Coorg, Kanara—*Ichthyophis beddomii.*
(2) Specimens from Kavalai, Cochin, Kerala State—*Ichthyophis tricolor.*

(This was hitherto described only as a distinct variety of *I. glutinosus*).

Similarly, the specimens in the Museum (both from the Nilgiris and Kambakkam) formerly referred to as *Ichthyophis monochrous,* will probably have to be strictly designated as *Ichthyophis subterrestris,* since among the other species into which the original *Ichthyophis monochrous* has been split, *Ichthyophis bombayensis* occurs only in Surat Dangs (Waghi), and the other two species, namely, *I. peninsularis* and *I. malabaricus* are confined to Kerala.

In the present account, however, the two original species have been described only under their earlier and better known names (*Ichthyophis glutinosus* and *I. monochrous*) retaining the older nomenclature for the sake of convenience in referring to the earlier literature cited. The equivalent new specific names, however, are indicated within brackets against the corresponding groups of specimens under the heading, " Specimens in the collection "

Ichthyophis glutinosus (Linnaeus).

Plate X, figs. 1 to 4.

Caecilia glutinosa, Linné, Syst. Nat. Ed., 10, 1758, p. 229.
Caecilia hypocyanea, (v. Hasselt) Schlegel, Abbild. Neuer oder unvolbst. beck, Amph., Dusseldorf, 1837—44, p. 119, pl. xxxix, fig. 1 (larva).
Epicrium glutinosum, Günther, Rept. Brit. India, 1864, p. 441.
Ichthyophis glutinosus. Boulenger, Catalogue, Batrachia Gradientia, Brit. Mus., 1882, p. 89, pl. iv, figs. 2,2a—c.
Ichthyophis glutinosus, Sarasin, Erg. naturw., Forschungen auf Ceylon, II, 1887—90, pls. i—xxiv.
Ichthyophis glutinosus. Thurston, Catalogue, Batrachia Salientia and Apoda of Southern India, 1888, p. 48.
Ichthyophis glutinosus. Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 515.
Ichthyophis glutinosus. Ferguson, Journ. Bomb. Nat. Hist. Soc., XV, 1904, p. 509.
Ichthyophis glutinosa, Annandale, Rec. Ind. Mus., III, 1909, p. 286.
Ichthyophis glutinosus, Boulenger, Vert. Fauna, Malay Peninsula, Reptilia and Batrachia, London, 1912, p. 285, fig. 79 (after Sarasin).
Ichthyophis glutinosus, Nieden, . Gymnophiona, in "Das Tierreich", Berlin, pt. 37, 1913, p. 6, figs. 12 and 13.
Ichthyophis glutinosus, Van Kampen, The Amphibia of the Indo- Australian Archipelago, 1923, p. 2, fig. 1.
Ichthyophis glutinosus, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XLII, 1940, p. 63.
Ichthyophis glutinosus, Humayun Abdulali, Journ. Bomb. Nat. Hist. Soc., LII, 1954—55, p. 639 (distribution and habits).
Ichthyophis glutinosus, De Silva, Spolia Zeylanica, XXVII, 1953–55, p. 243.
Ichthyophis glutinosus, Daniel. Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 429.

The body is cylindrical, somewhat depressed and worm-like, with very numerous (about 240—400) distinct circular folds, some of these bifurcating. The snout is rounded, and is as long as the distance between the eyes, which are easily distinguishable. The tentacle is small, in front of and below the eye, close to the lip, and usually much nearer the eye than the nostril. Both series of mandibular teeth are well developed. The tail is very short, but distinct and pointed. The total length of an average adult is about 15 inches (380 mm.), and the maximum diameter of the body is about 14 mm.

Colour : The colour of the body is dark brown or bluish black, with a lemon yellow, sharply defined band extending along each side of the body, from the head to the tail. The band varies much in width. The tentacles are white and the eyes black, with a very narrow, pale brown ring round them. In life, the colour of the adult animal is said to be bright metallic brown, with a bright yellow stripe along the sides.

Habits : The animal lives in moist places usually in the mud near the water. Its food consists of earthworms and small burrowing snakes. The eggs are very large (about 9 mm. by 6 mm.) and are provided with yellow yolk and connected by a gelatinous string. They are deposited in a burrow near the water and the female protects them by coiling herself round the mass of eggs. The embryo has three pairs of external grills. The young are provided with an opening on each side—the spiraculum—and lead an aquatic life. In the larvae, the head is fish-like or newt-like in appearance and provided with well developed labial lobes. They have large eyes and laterally compressed tail, with an upper and a lower dermal fold, and are aquatic. The tail bears a fin above and below. The circular folds are very indistinct in the youngest specimens, but become gradually more distinct as the animal grows. The movements of the animal resemble those of an earthworm.

Recorded localities : Hills of Ceylon, Southern India, especially Malabar, Eastern Himalayas to the Malay Peninsula, Khasi Hills, Assam, Burma, Siam, Sumatra, Borneo and Java, East Indies. There are specimens in the British Museum from Wynaad and the Nilgiris. Humayun Abdulali (*loc. cit.*, 1954–55) has recorded it from the Kanara side of the Gersoppa Falls in South Bombay State. In the collections of the Bombay

Natural History Society, there are specimens from Anamalai Hills and Ootacamund in South India and from Garo Hills in Assam. One specimen has been recorded from Panchgani at an elevation of 4,300 feet in the Satara District of Bombay. Ferguson (*loc. cit.*, 1904) states that this species is fairly common on the hills is Trivandrum. Annandale (*loc. cit.*, 1909) records a specimen taken from a hollow tree in Maddathorai in Travancore. Mc. Cann (*loc. cit.*, 1940), has recorded this species from the Billigirirangan Hills in Mysore.

Specimens in the collection :

(1) Kasturi Pass, South Coorg : Four rather young, half grown specimens, identified by Dr. G. S. Myers of the University of California, U.S.A. All the specimens are faded into a uniform dull brownish colour and are rather depressed and sub-cylindrical. The largest one measures about 170 mm. in length and 9 mm. in maximum diameter. The tail is short, distinctly finned above and below and pointed. The circular folds on the body are only faintly marked. (*Ichthyophis beddomii*).

(2) Kavalai, Cochin, Kerala State : Two adult specimens of *Ichthyophis glutinosus* var. *tricolor* Annandale. Of these, one is mounted and exhibited in the gallery and the other stored in the study collection. The colour of the specimens is faded into a uniform, dull greyish white. (*Ichthyophis tricolor*).

Measurements :

(i) Specimen in the study collection :
Length : 230 mm.
Maximum diameter : 14 mm.

This specimen is much stouter than the half grown ones from South Coorg referred to above.

(ii) Specimen exhibited in the gallery :
Length : 228 mm.
Maximum diameter : 13 mm.

Ichthyophis glutionsus var. tricolor was described as a new variety of this species from Travancore, by Dr. Annandale in the Records of the Indian Museum (*loc. cit.*, 1909, p. 286). It has the whole of the ventral surface pure white, and therefore differs in appearance from the typical form.

Coorg and Cochin may be added to the list of localities from which this species has been specifically recorded.

(3) In addition to the above, one embryo and two larvae of *Ichthyophis glutionsus* s. str. are also mounted as exhibits in the Amphibian Gallery. These specimens were collected in 1941.

Measurements of the large specimen of the larva :
Length : 129 mm.
Width at the middle of the body : 6 mm.

The embryo mounted along with these larvae bears external gills.

Ichthyophis monochrous (Bleaker).

Plate XI, figs. 1 to 6.

Ichthyophis glutinosus, var., Cantor, Journ. Asiatic Soc. Bengal, XVI, 1847, p. 1058.
Epicrium monochrous Bleaker, Nat. Tijdschr. Ned-India, XVI, 1858/59, p. 188.
Epicrium monochrous, Günther, Rept. British India, 1864, p. 443.
Ichthyophis monochrous, Peters, Mon. Berl. Acad., 1879, p. 932.
Ichthyophis monochrous, Boulenger, Catalogue, Batrachia Gradientia, British Museum, 1882, p. 91; pl. iv. figs. 1–1c (larva).
Ichthyophis monochrous, Thurston, Catalogue Batrachia Salientia and Apoda of Southern India, 1888, p. 49.
Ichthyophis monochrous, Boulenger, Fauna Brit. India, Reptilia and Batrachia, 1890, p. 517.
Ichthyophis monochrous, Boulenger, Vert. Fauna Malay Peninsula, Reptilia and Batrachia, London, 1912, p. 286.
Ichthyophis monochrous, Nieden, Gymnophiona in "Das Tierreich", Berlin, pt. 37, 1913, p. 7.
Ichthyophis monochrous, Van Kampen, The Amphibia of the Indo-Australian Archipelago, 1923, p. 3.
Ichthyophis monochrous, Mc Cann, Journ. Bomb. Nat. Hist. Soc., XXXI, p. 1039.
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Ichthyophis monochrous, De Silva, Spolia Zeylanica, XXVII, 1955–56, p. 243.
Ichthyophis monochrous, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 429.

This species is closely allied to the preceding one which it resembles in many respects. But it differs from *I. glutinosus* in the head being shorter and the snout being shorter than the distance between the eyes; and in the inner series of teeth in the lower jaw being indistinct and composed of a few teeth only. The body is encircled by about 235 to 360 circular folds. This species is said to attain a larger size than the preceding species, reaching a maximum length of about 500 mm. The greatest diameter of the body is about 13 mm.

Colour : The colour of the animal is a uniform purplish black or ranging from blackish brown to lead colour, and there is no yellow lateral band as in the preceding species. The tentacles are white. The anal region and the tip of the tail are pale pinkish.

Habits : The habits of this species are more or less the same as those of the preceding species. Mc Cann, who records this species from Khandala (Bombay State), has observed that "it lives under stones, during the rains, in burrows, much after the fashion of the earthworm, which it resembles in its movements. At first it might well be mistaken for one of these creatures as its body is also coated with slime. On removal of the stone under which it lives, the animal soon begins to descend into its burrow, away from light."

Recorded localities : Java, Borneo, Sumarata, India to Malay Peninsula and Singapore; Philippines. In India, this species has been recorded from the Western Ghats, Malabar, Waghai in Surat, and Khandala in Bombay State. There are specimens of this species from Malabar in the British Museum collection. In the Madras Museum collection, specimens from the Nilgiris and Kambakkam Hills near Madras, in the Chingleput District are represented.

Specimens in the collection :

(1) Kambakkam Hill (near Madras), Chingleput District; Three specimens, of which two are exhibited in the gallery and one is preserved in the study collection. The specimen in the study collection is more or less uniformly dark brownish and somewhat shrunken. It measures 215 mm. in length and 12 mm. in maximum diameter about the middle of the body. The tail is pointed and the numerous, fine, close-set circular folds on the body are distinct. This specimen has been indentified by Dr. G. S. Myers of the University of California, U.S.A. (*Ichthyophis subterrestris*?)

(2) Ootacamund, Nilgiris, South India : One specimen, mounted and exhibited in the gallery : (*Ichthyophis subterrestris*?)

Measurements : Length : 222 mm. Maximum width at the middle of the body: 12 mm.

(3) From a marsh at Kambakkam (near Madras), Chingleput District : Two young specimens, exhibited in the gallery :

Measurements (of the larger specimen) :

Length : 123 mm. Maximum width at the middle of the body : 7 mm.

The other specimen is only slightly smaller.

Genus **Uraeotyphlus** Peters.

The members of this genus closely resemble those of the preceding one in external appearance, but differ from them in certain osteological characters. The squamosals are free from the parietals. The teeth are small and numerous and are present both in the jaws and on the palate. Two series of teeth are present in the lower jaw. Eyes are distinctly visible. Tentacles are extensile and placed below the nostril. Cycloid scales are present, embedded in the skin.

Two species, *Uraeotyphlus menoni* and *U. narayani*, are represented in the Museum collection.

Uraeotyphlus menoni Annandale.

Plate XII, figs. 1 to 4.

Uraeotyphlus menoni, Annandale, Records of the Indian Museum, IX, 1913, p. 301.
Uraeotyphlus menoni, Seshachar, Proc. Ind. Acad. Sciences, Bangalore, IX, Section B, 1939, p. 227.
Uraeotyphlus menoni, Ramaswamy, Records of the Indian Museum, XLIII, 1941, p. 144.
Uraeotyphlus menoni, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 428.

This species is closely related to *Uraeotyphlus oxyurus*, but may be distinguished from the latter by its shorter head, less numerous rings on its body and in the relatively more anterior position of its nostril. There is also a difference in the colouration.

The head is short, triangular, with a blunt and rounded snout. The snout is about as long as the distance between the eyes, but it is rather short and inconspicuous. The tentacle is situated below and slightly in advance of the nostril. The teeth are moderate-sized, and both rows on the lower jaw are well developed. The eyes are distinct. The body is cylindrical, slender, with about 170 close-set circular folds which are interrupted on the mid-ventral line by a narrow gap in the anterior part of the body. Seshachar (*loc. cit.*, 1939), however, states that he found 197 folds on the body of the type specimen and 195 folds on that of the co-type specimen. In the posterior part, the interruptions are more irregular, the longer ones alternating with the shorter ones. The tail is short and pointed, and bears ten complete rings. But Seshachar (*loc. cit.*, 1939), states that in the type and co-type specimens he had examined, there were only three and four rings on the tail respectively.

Colour: The dorsal surface is slaty grey; the throat and lips are paler and the ventral surface of the body white, blotched with slaty grey, becoming darker posteriorly. The white ground colour extends for some distance up each fold on the side. The tail is uniformly slaty grey. A pale spot is present round the vent.

Habits: The habits, in general, resemble those of the species of *Ichthyophis*, but nothing specific has been recorded.

Recorded localities: Coastal districts of the southern part of the Malabar Zone. This species has been specifically recorded from Trichur (from where the type specimen was obtained) and from Kondatti in the South Malabar District.

Specimens in the collection: (1) Kondatti, South Malabar District, Kerala State: One specimen, identified by Dr. G. S. Myers of the University of California, U S.A. It is pale, almost whitish brown, resembling an earthworm in external appearance. It measures 142 mm. in length and 8 mm. in maximum diameter about the middle of the body. The specimen is badly faded and bleached almost into a creamy white colour.

(2) Western Ghats: One specimen, much larger and fresher in appearance, dark brownish and with the circular folds on the body much better marked than in the preceding specimen. It measures 210 mm. in length and 11 mm. in maximum diameter about the middle of the body.

Uraeotyphlus narayani Seshachar.

Plate XIII, figs. 1 to 4.

Uraeotyphlus narayani, Seshachar, Proc. Ind. Acad. Sciences, Bangalore, XI, Section B, 1939, p. 224.
Uraeotyphlus narayani. Ramaswamy, Records of the Indian Museum, XLIII, 1941, p. 144.
Uraeotyphlus narayani, Daniel, Journ. Bomb. Nat. Hist. Soc., LX (2), 1963, p. 428.

This species was described comparatively recently as a new species by Professor B. R. Seshachar (*loc. cit.*, 1939). The type specimens were from Kottayam, a small town in Kerala State. The body is cylindrical and smooth, with about 150-180 circular folds dorsally. The head is elongated, rounded anteriorly and slightly flattened dorso-ventrally. The snout is longer than the distance between the eyes. The eyes are distinct and the tentacles are placed below or slightly in front of the nostrils. In spirit-preserved specimens they are usually contracted and inconspicuous. The teeth are moderate-sized; both rows of teeth in the lower jaw are well developed. The teeth in the front row are larger than those of the hind row. The tail is short and pointed, with three or four complete circular folds. The vent is in the form of a short, longitudinal ventral slit.

Colour: In fresh specimens, the dorsal side is steel grey and the ventral surface pale flesh-coloured, except on the throat, and also posteriorly, where it is dark. A pale spot surrounds the vent.

Habits: The habits, in general, resemble those of the species of *Ichthyophis*, but nothing specific has been recorded.

Recorded localities: Kannam, sixteen miles from Kottayam, Travancore, Kerala State, at an elevation of about 300–500 feet above sea level.

Specimens in the collection: A single specimen from Kottayam, Kerala State, collected in 1941, is represented in the collection (mounted and exhibited in the gallery). The specimen is somewhat faded, due to prolonged preservation in spirit. The upper surface is brownish (darker along the middle of the back than towards the sides), with the circular folds clearly visible as yellowish transverse streaks. The head and the entire ventral surface of the body are very pale yellowish, almost whitish. The eyes are distinctly visible as minute black specks on the head near the snout. The tail is short and blunt. The specimen measures 205 mm. in length and 13 mm. in maximum diameter (somewhat behind the middle of the body, where it is widest).

REFERENCES TO LITERATURE ON AMPHIBIA

NOTE.—The following list includes most of the better known standard works on Amphibia as well as the more important papers published in scientific journals, such as the Records of the Indian Museum and the Journal of the Bombay Natural History Society, especially those dealing with South Indian species. For further literature, reference may be made to the list of references furnished for each species in the text of this paper.

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INDEX

INDEX—*cont.*

EXPLANATIONS TO PLATES.

NOTE.—All figures are drawn natural size, except where otherwise stated. Where figures are drawn enlarged or reduced, the extent of magnification or reduction is indicated by the number or fraction mentioned within brackets against the name of each species in the explanations.

PLATE I.

Rana hexadactyla Lesson ($\times \frac{3}{4}$).

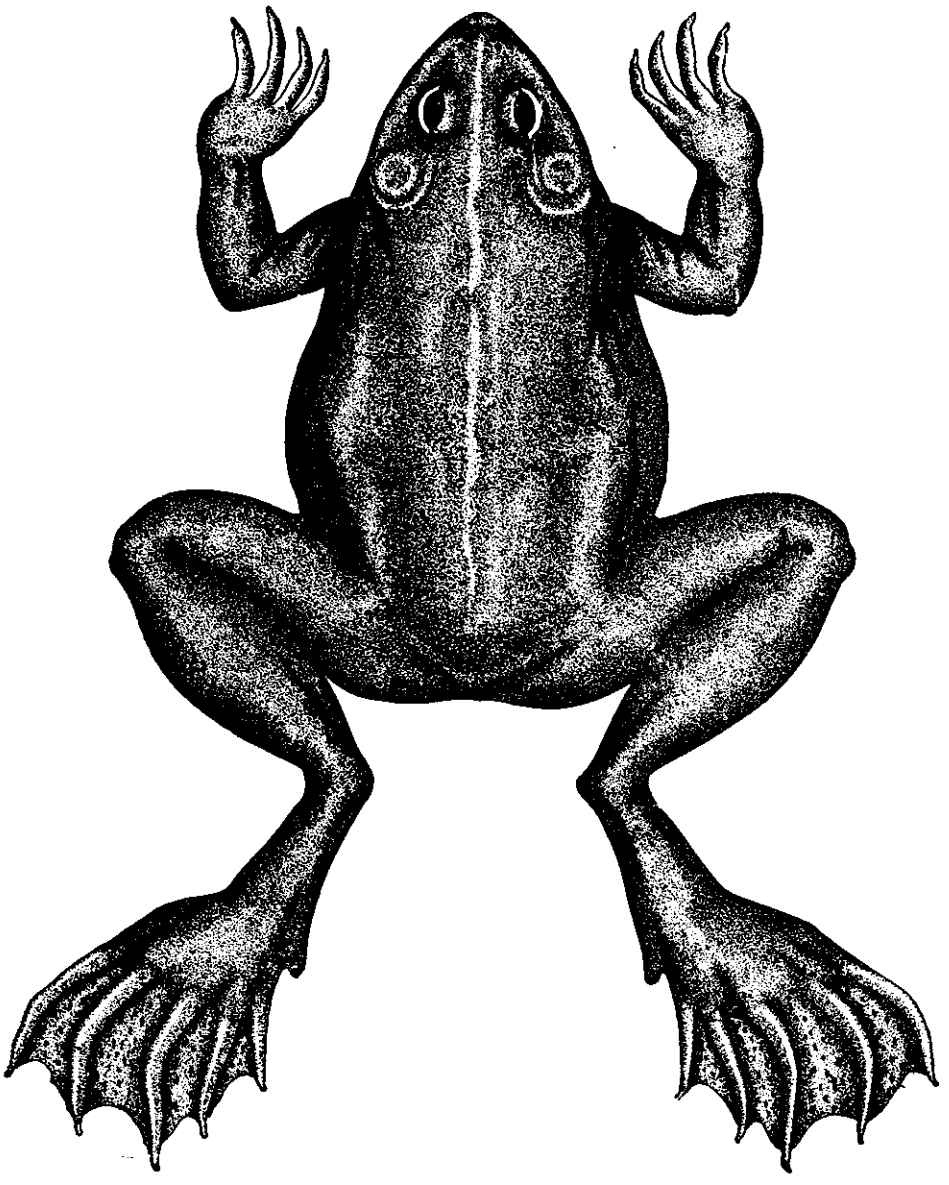

PLATE II.

Fig. 1. *Rana cyanophlyctis* Schneider.
„ 2. *Rana verrucosa* Günther.
„ 3. *Rana limnocharis* Wiegmann (×2).

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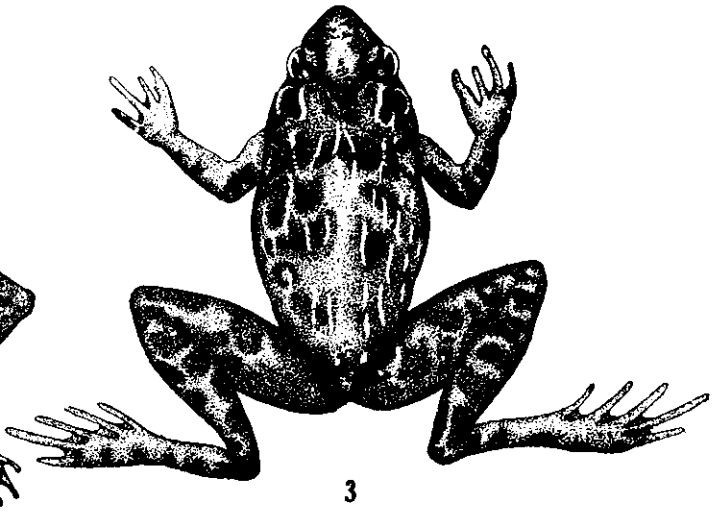

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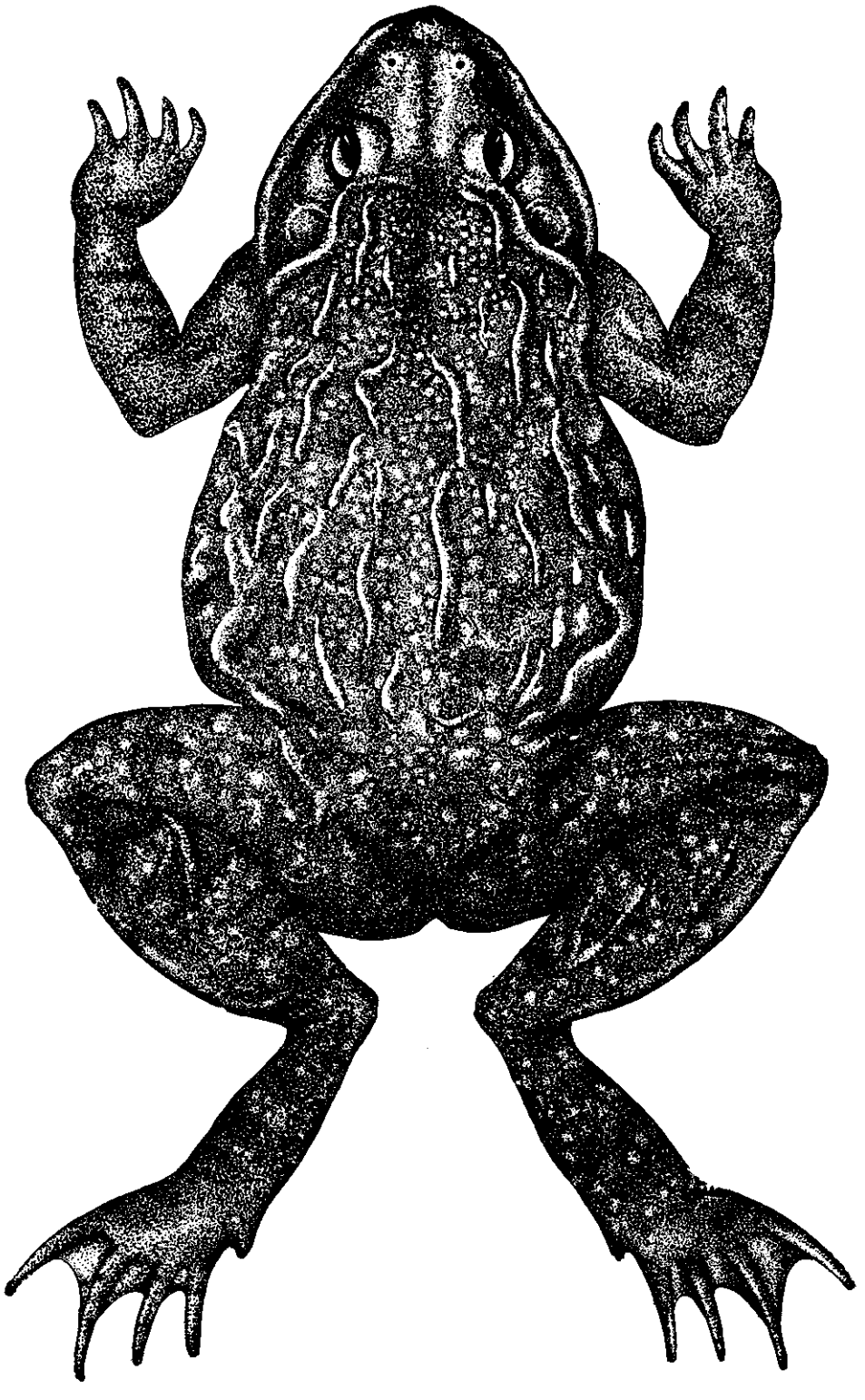
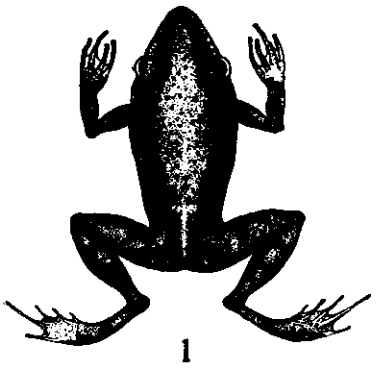


PLATE IV.

Fig. 1. *Rana malabarica* Dumeril & Bibron (dorsal view).
„ 2 Do. Do. (lateral view).
„ 3. *Rana breviceps* Schneider.
„ 4. *Rana beddomii* (Günther) (×2).
„ 5. *Rana semipalmata* Boulenger (×2).



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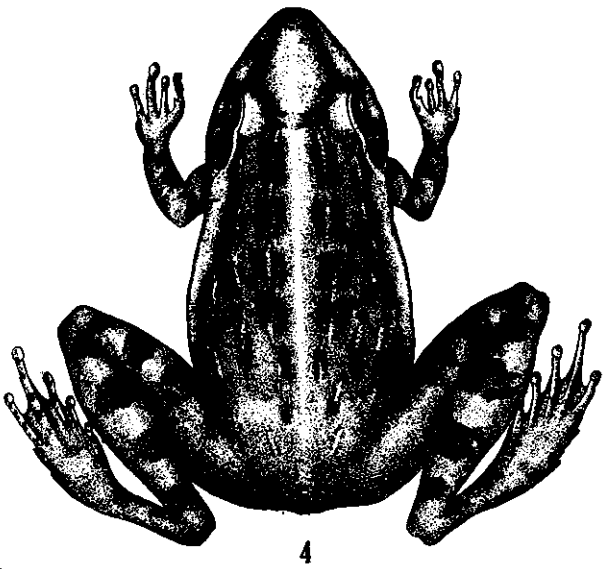

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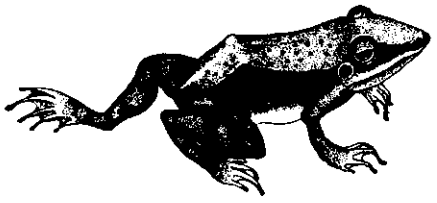

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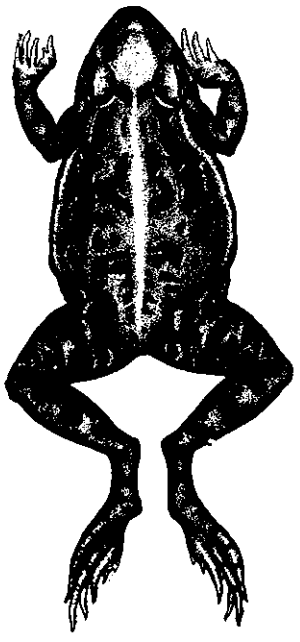

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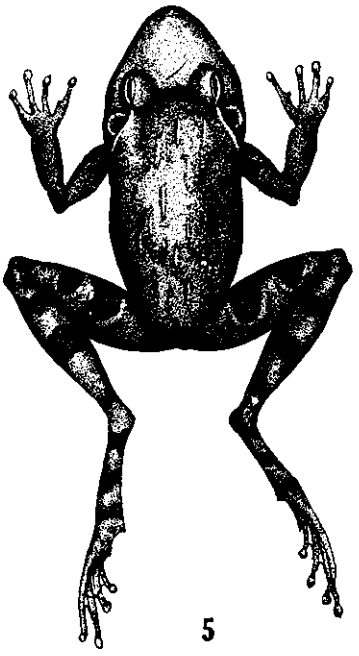

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PLATE V.

Fig. 1. *Rana leptodactyla* Boulenger ($\times 1\frac{1}{2}$).
,, 2. *Rana curtipes* Jerdon.
,, 3. *Micrixalus opisthorhodus* (Günther) (dorsal view, $\times 1\frac{1}{2}$).
,, 4. Do. Do. (ventral view, $\times 1\frac{1}{2}$).
,, 5. *Micrixalus silvaticus* (Boulenger) ($\times 1\frac{1}{2}$).

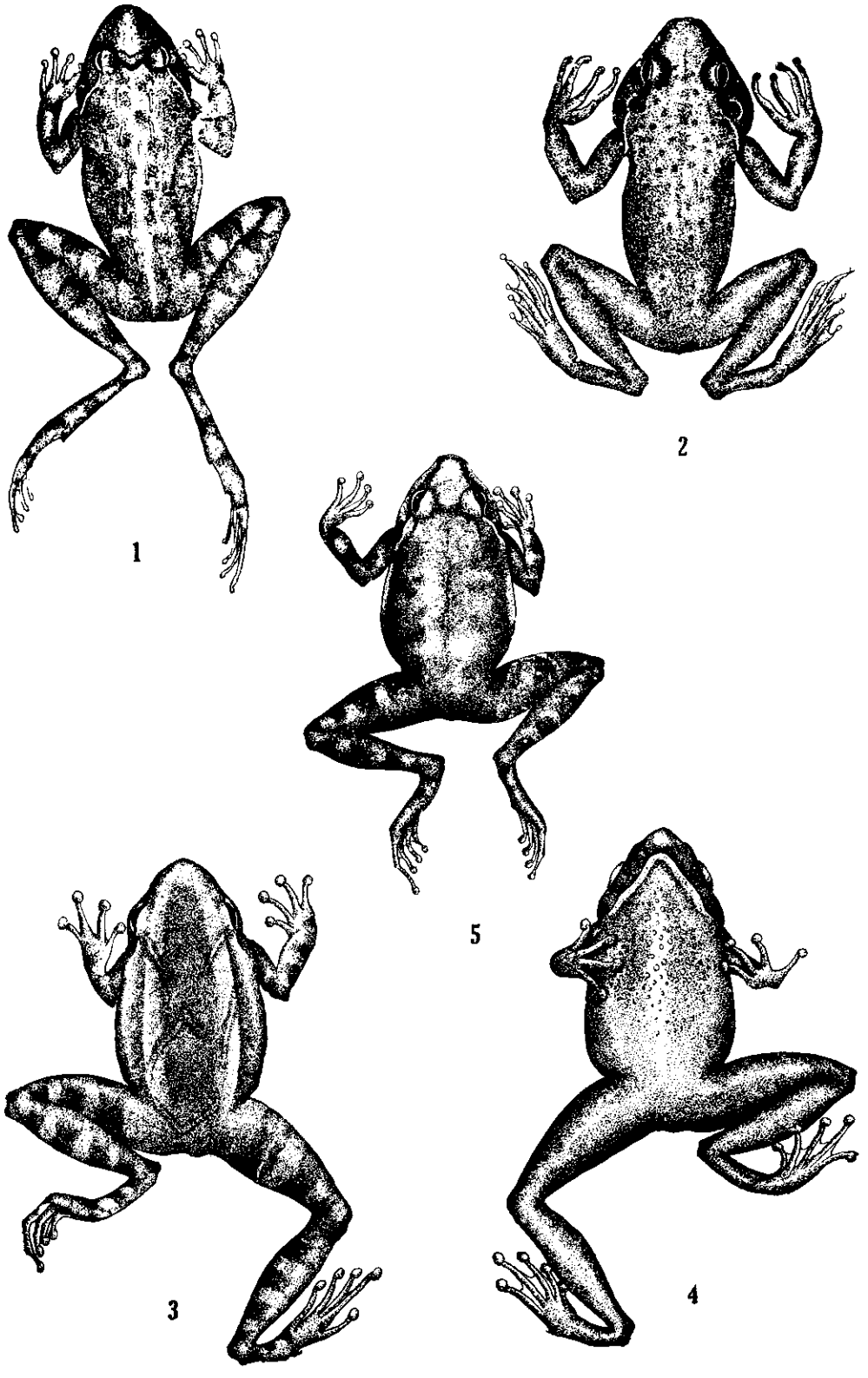
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PLATE VI.

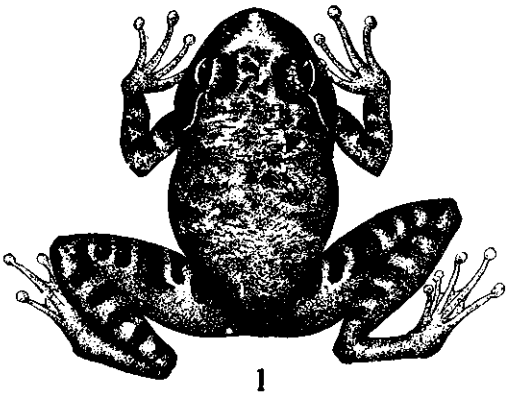
Fig. 1. *Nyctibatrachus major* Boulenger.

,, 2. *Rhacophorus maculatus* Boulenger (dorsal view).

,, 3. Do. Do. (lateral view).

,, 4. *Rhacophorus malabaricus* Jerdon ($\times \frac{3}{4}$).

,, 5. *Rhacophorus pleurosticus* (Günther) ($\times 1\frac{1}{2}$).



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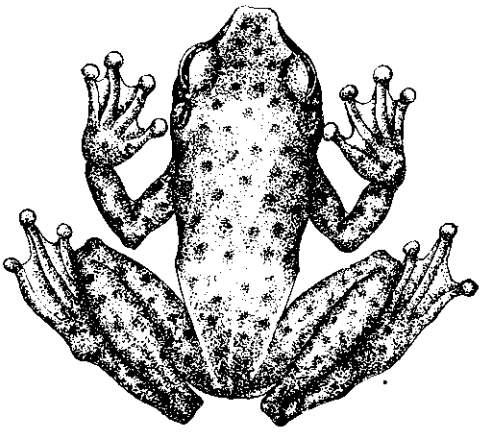

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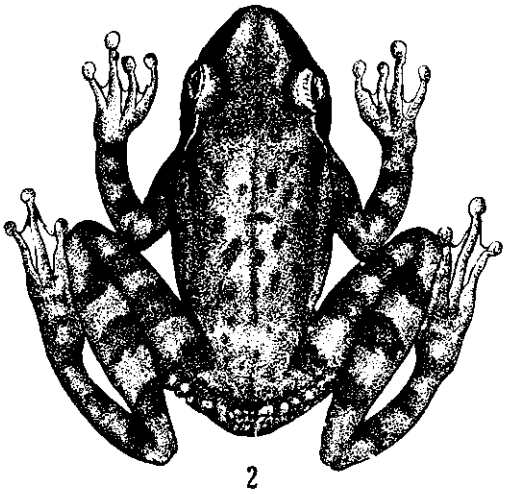

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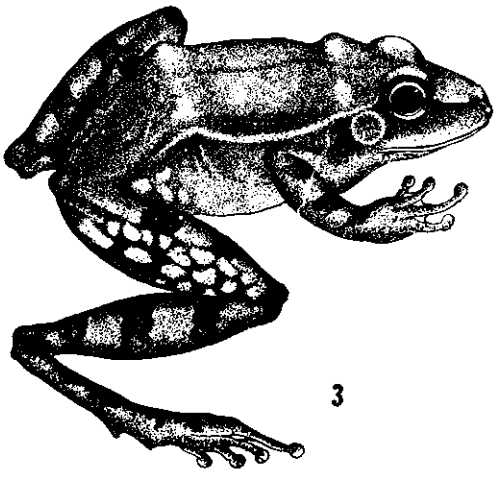
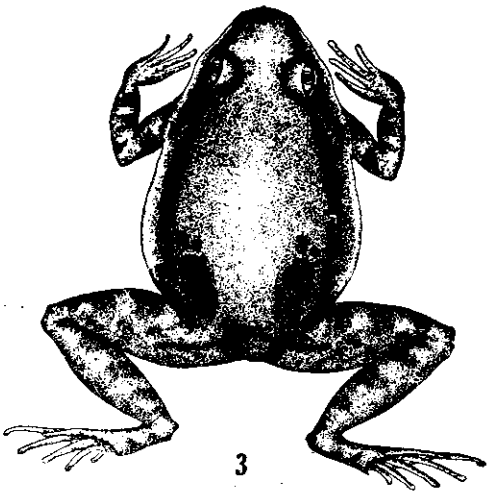


3

PLATE VII.

Fig. 1. *Philautus leucorhinus* (Martens) (×2).
„ 2. *Philautus variabilis* (Günther) (×1½).
„ 3. *Microhyla rubra* (Jerdon) (×2).
„ 4. *Microhyla ornata* (Duméril & Bibron) (×2).
„ 5. *Kaloula pulchra taprobanica* Parker (×1½).
„ 6. *Ramanella montana* (Jerdon) (×1½).

1



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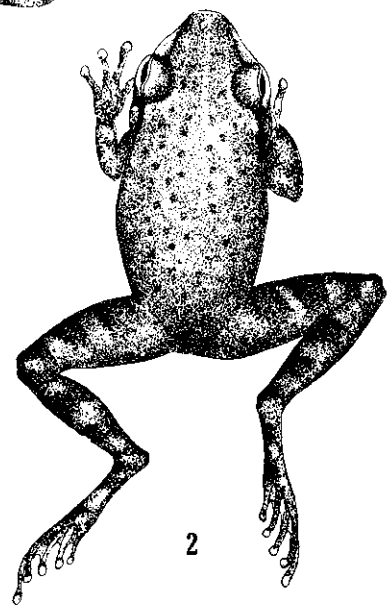

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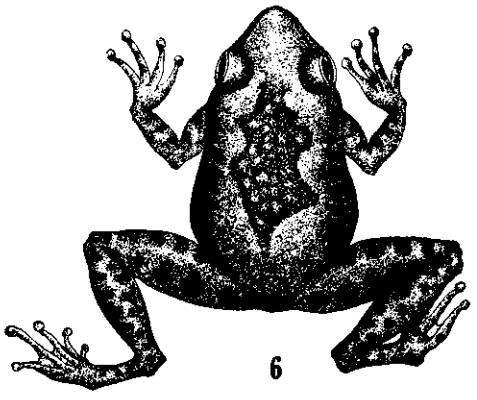

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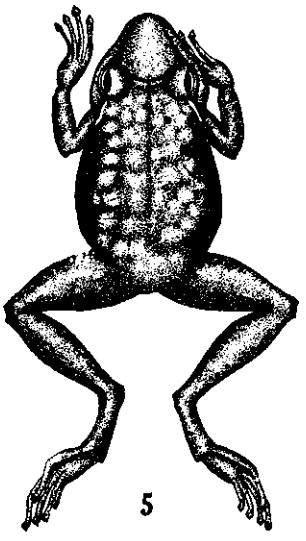

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PLATE VIII.

Fig. 1. *Ramanella triangularis* (Günther).
„ 2. *Ramanella variegata* (Stoliczka) (×2).
„ 3. *Uperodon systoma* (Schneider).
„ 4. *Uperodon globulosum* (Günther) (dorsal view, ×¾).
„ 5. Do. Do. (lateral view, ×¾).

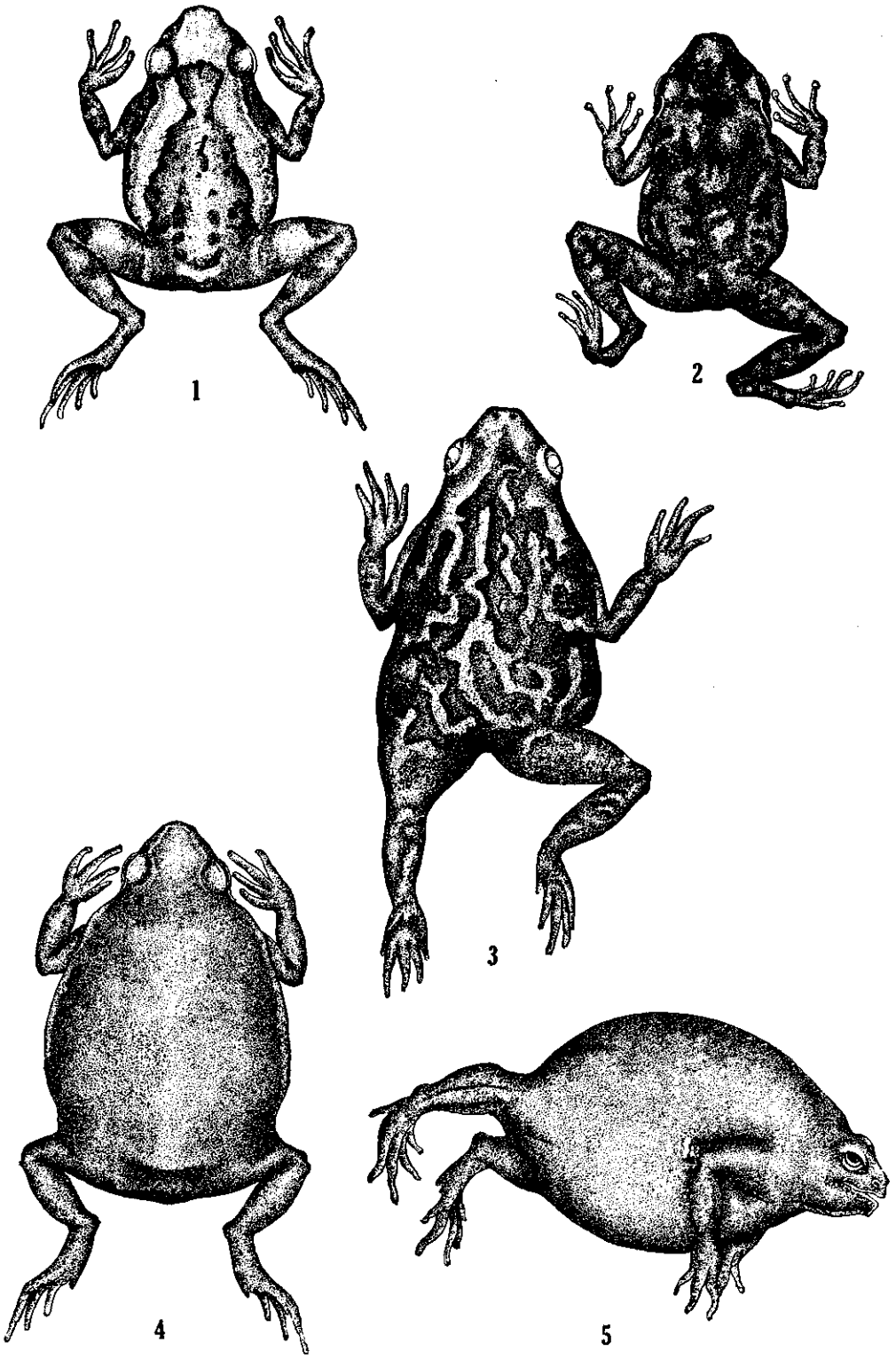
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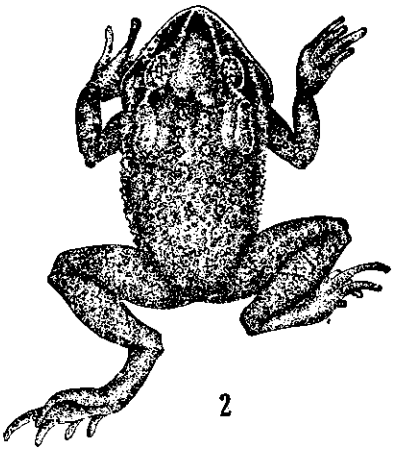
PLATE IX

Fig. 1. *Bufo melanosticus* Schneider ($\times\frac{3}{4}$).
„ 2. *Bufo microtympanum* Boulenger.
„ 3. *Bufo hololius* Günther.
„ 4. *Bufo parietalis* Boulenger.
„ 5. *Bufo fergusonii* Boulenger.

1



2

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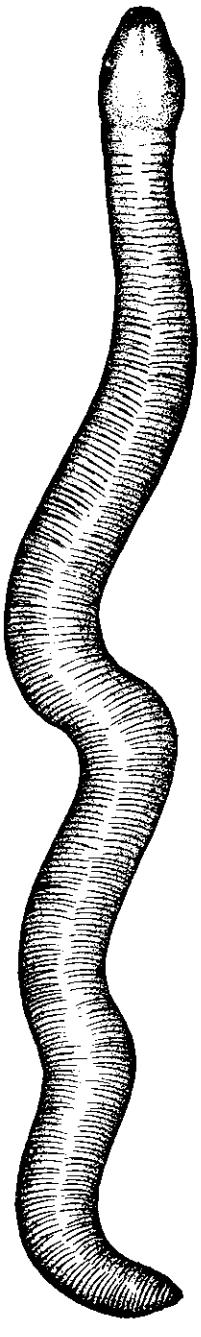
PLATE X.

Fig. 1. *Ichthyophis glutinosus* (Linnaeus) (adult).
„ 2. Do. Do. (young).
„ 3. Do. Do. (side view of the head region, ×2).
„ 4. Do. Do. (tail region, ×2).



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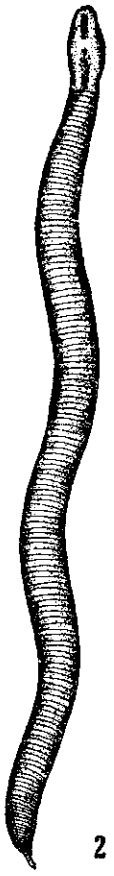

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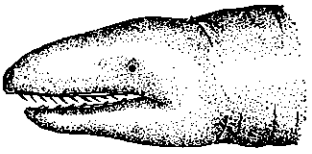

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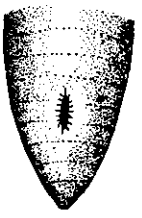

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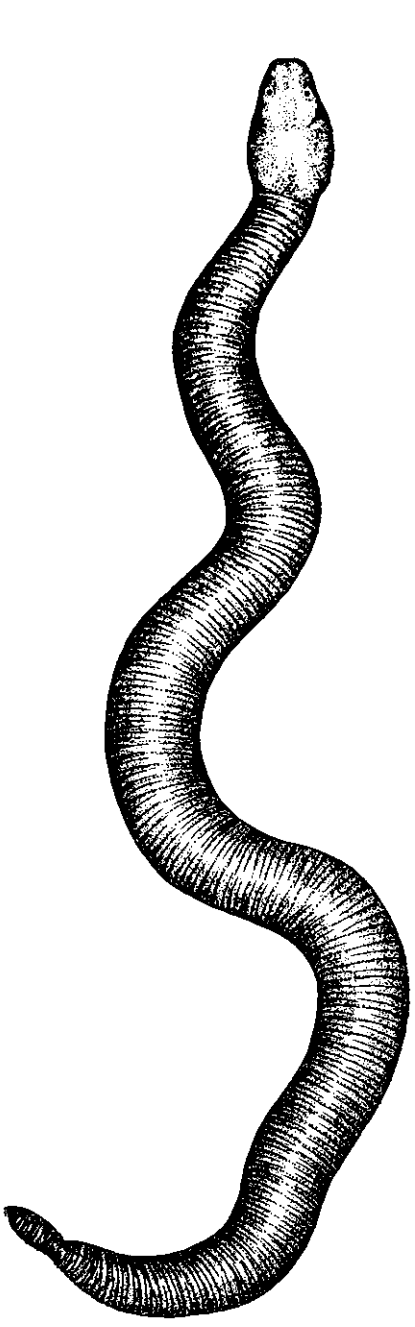
PLATE XI.

Fig. 1. *Ichthyophis monochrous* (Bleaker) (adult).
,, 2. Do. Do. (side view of head region, ×2).
,, 3. Do. Do. (tail region, ×2).
,, 4. Do. Do. (young).
,, 5. Do. Do. (ventral view of head region of young one, ×2).
,, 6. Do. Do. (tail region of young one, ×2).



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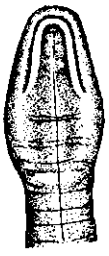

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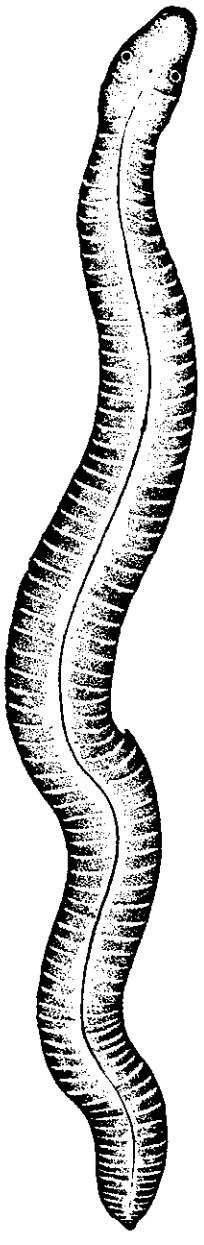
PLATE XII.

Fig. 1. *Uraeotyphlus menoni* Annandale (adult).
„ 2. Do. Do. (ventral view of head region, ×2).
„ 3. Do. Do. (side view of head region, ×2).
„ 4. Do. Do. (tail region, ×2).



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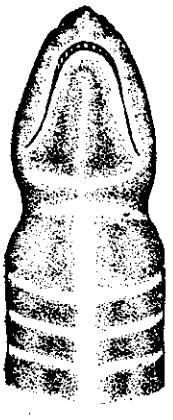

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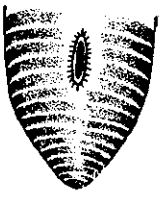

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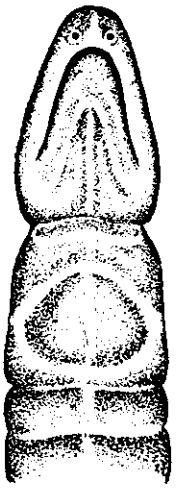
PLATE XIII.

Fig. 1. *Uraeotyphlus narayani* Seshachar (adult).
„ 2. Do. Do. (ventral view of head region, × 2).
„ 3. Do. Do. (side view of head region, × 2).
„ 4. Do. Do. (tail region, × 2).

1



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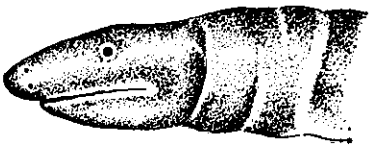

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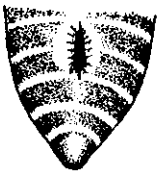

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