

Field Guide to the Amphibians of Western India

PART 3

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(With two plates)

[Continued from Vol. 60(3): 702]

This part of the Field Guide has been long overdue but owing to other preoccupations, I was not able to compile my notes earlier. The first two sections namely Introduction and Families Caecilidae & Bufonidae as part 1, and Family Microhylidae as part 2 appeared in Vol. 60, pp. 415-438 and 690-702, (1963) of this *Journal*. This section describes a part of the Family Ranidae. The next and concluding section will describe the remaining ranid species and the tree frogs of the Family Rhacophoridae. The assistance given by Miss S. Isaac, Research Assistant at the Society is gratefully acknowledged.

Family RANIDAE: Frogs

The family Ranidae includes the "true frogs" and is after the family Bufonidae the most widely distributed of amphibian families, occurring in all the zoogeographical regions of the world except the Australian. Though the distribution of the family extends nearly to the arctic circle, the majority of the species are tropical in distribution. Aquatic and semiterrestrial forms predominate; a few are semi-arboreal. The skin is moist and frogs require a humid environment. The species of the family can be distinguished from all other Indian amphibia, except the tree frogs of the Family Rhacophoridae, by the presence of teeth on the upper jaw and the bifid tip of the tongue. One genus of Ranidae, the *Ooeidozyga*, is an exception in having the tongue entire and not bifid. This genus has not been reported from western India. The Rhacophorid tree frogs differ from the ranid frogs in having an additional cartilagenous phalange between the penultimate phalanges of their toes (*see* fig. 13 of Pt. 1 of this series, Vol. 60:426).

Four genera of the family Ranidae occur in western India. They can be distinguished by the following key.

KEY TO THE GENERA IN WESTERN INDIA OF THE FAMILY RANIDAE

- 1 Pupil horizontal or roundish-subtriangular 2
- 1 Pupil vertical 3
- 2 Vomerine teeth present (see fig. 9 in pt. 1, Vol. 60, p. 423) *Rana*
- 2 Vomerine teeth absent *Micrixalus*
- 3 Skin wrinkled, toes webbed *Nyctibatrachus*
- 3 Skin smooth, toes free *Nannobatrachus*

Nyctibatrachus and *Nannobatrachus* are endemic to the Western Ghats. The genus *Nyctibatrachus* occurs as far north as Matheran near Bombay. *Nannobatrachus* is rare and is so far known only from the Tirunelveli Hills in Tamil Nadu.

The majority of the species of the family are of the genus *Rana*. Four subgenera of the genus *Rana* occur in western India. These can be distinguished by the following key.

Genus *Rana* Linn. 1766

KEY TO THE SUBGENERA IN WESTERN INDIA OF THE GENUS *Rana*

- 1 Discs of toe tips if present without groove 2
- 1 Discs of toe tips with a crescentic or horse-shoe shaped circum-marginal groove (see fig. 14 in pt. 1, Vol. 60, p. 426) 3
- 2 Outer metatarsals separated by web up to base or at least in the distal half (see fig. 12a in Pt. 1, Vol. 60, p. 425) *Rana*
- 2 Outer metatarsals united completely or feebly separated at the distal end (see fig. 12b, in Pt. 1, Vol. 60, p. 425). Inner metatarsal tubercle enlarged usually shovel shaped or crescentic *Tomopterna*
- 3 Tongue with a long pitted papilla (see fig. 7b in Pt. 1, Vol. 60, p. 423) *Discodeles*
- 3 Tongue without a papilla; outer metatarsals usually separated by web to the base *Hylorana*

The following species of the four subgenera have been recorded from western India.

Subgenus <i>Rana</i>	<i>Rana</i> (<i>Tomopterna</i>) <i>dobsonii</i>
<i>Rana</i> (<i>Rana</i>) <i>hexadactyla</i>	Subgenus <i>Discodeles</i>
<i>Rana</i> (<i>Rana</i>) <i>cyanophlyctis</i>	<i>Rana</i> (<i>Discodeles</i>) <i>beddomii</i>
<i>Rana</i> (<i>Rana</i>) <i>tigerina</i>	<i>Rana</i> (<i>Discodeles</i>) <i>leithii</i>
<i>Rana</i> (<i>Rana</i>) <i>crassa</i>	<i>Rana</i> (<i>Discodeles</i>) <i>semipalmata</i>
<i>Rana</i> (<i>Rana</i>) <i>verrucosa</i>	<i>Rana</i> (<i>Discodeles</i>) <i>leptodactyla</i>
<i>Rana</i> (<i>Rana</i>) <i>limnocharis</i>	<i>Rana</i> (<i>Discodeles</i>) <i>diplosticta</i>
<i>Rana</i> (<i>Rana</i>) <i>brevipalmata</i>	<i>Rana</i> (<i>Discodeles</i>) <i>phrynoderma</i>
<i>Rana</i> (<i>Rana</i>) <i>malabarica</i>	Subgenus <i>Hylorana</i>
Subgenus <i>Tomopterna</i>	<i>Rana</i> (<i>Hylorana</i>) <i>curtipes</i>
<i>Rana</i> (<i>Tomopterna</i>) <i>rufescens</i>	<i>Rana</i> (<i>Hylorana</i>) <i>aurantiaca</i>
<i>Rana</i> (<i>Tomopterna</i>) <i>breviceps</i>	<i>Rana</i> (<i>Hylorana</i>) <i>temporalis</i>

Subgenus *Rana*

Aquatic and semi-terrestrial species Many are widely distributed and occur different habitats. All commercially exploited species of

Indian amphibia belong to this subgenus. The species occurring in western India can be separated by the following key.

KEY TO THE SPECIES OF *Rana* (*Rana*) OCCURRING IN WESTERN INDIA

- | | | |
|---|--|----------------------|
| 1 | Toes completely webbed (<i>see</i> fig. 12a in pt. 1, Vol. 60, p. 425) | 2 |
| 1 | Toes incompletely webbed | 5 |
| 2 | Skin of back with longitudinal folds (<i>see</i> fig. 4 in pt. 1, Vol. 60, p. 422) | 3 |
| 2 | Skin of back smooth or with tubercles and warts | 4 |
| 3 | Inner metatarsal tubercle strongly compressed, crescentic (<i>see</i> fig. 12f in pt. 1, Vol. 60, p. 425); Heels do not overlap when legs are folded at right angles to the body (<i>see</i> fig. 11b in pt. 1, Vol. 60, p. 424) | <i>crassa</i> |
| 3 | Inner metatarsal tubercle comparatively smaller, blunt; heels overlap when the legs are folded at right angles to the body | <i>tigerina</i> |
| 4 | Size large; skin of back smooth, 2 rows of porous warts on flanks (<i>see</i> fig. 5 in pt. 1, Vol. 60, p. 422); snout flat, obtusely pointed | <i>hexadactyla</i> |
| 4 | Size smaller up to 60 mm; skin warty; a single row of porous warts on flanks; snout rounded; inner metatarsal tubercle fingerlike ... | <i>cyanophlyctis</i> |
| 5 | A distinct dorso-lateral glandular fold from above tympanum to vent (<i>see</i> fig. 2 in pt. 1, Vol. 60, p. 422); back between the glandular folds, bright orange or yellowish red or red crimson | <i>malabarica</i> |
| 5 | Dorso-lateral glandular fold absent; no distinctive colour pattern | 6 |
| 6 | Toes 3/4th webbed, 2 phalanges of 4th toe free; outer metatarsals separated by web nearly to base. Tibiotarsal articulation reaches nostril or tip of snout (<i>see</i> fig. 10, in pt. 1, Vol. 60, p. 424) | <i>verrucosa</i> |
| 6 | Toes 1/2 webbed, 3 phalanges of 4th toe free; outer metatarsals united in the basal half; Tibiotarsal articulation reaches nostril | <i>limnocharis</i> |
| 6 | Toes feebly webbed, web not reaching 2nd phalange of toes; outer metatarsals separated by web nearly to base. Tibiotarsal articulation reaches tip of snout or beyond .. | <i>brevipalmata</i> |

***Rana hexadactyla* Lesson 1834: Indian Pond Frog**

Diagnosis. Size large. Females reach 130 mm in snout to vent length. The flattish snout with indistinct canthus rostralis, the absence of longitudinal folds on the back and the web of the toes reaching the tip of toes distinguishes it from *Rana tigerina* and *Rana crassa* of equivalent size. Tympanum distinct, equal to or slightly less than diameter of eye. First finger longer than or equal to second. Toes fully webbed. A strong dermal fringe on the outer toes. Outer metatarsals separated nearly up to base by web. Tibio-tarsal articulation reaches tympanum or eye when the leg is held along the body. A small but prominent inner metatarsal tubercle.

Skin smooth above, warty on the flanks, anal area, and throat. Pustular on thighs. Two curved series of closely arranged porous warts from behind the shoulder to the groin and from the axilla to the groin distinct during the breeding season. A U-shaped line of warts above the anus and occasionally extending up the flanks. A glandular fold from behind the eye to the shoulder.

Colour. Bright grass green or olive green above, with or without a pale yellow vertebral line from snout to vent. A black streak along the eye to the shoulder fold. Behind the thighs patterned in black and white or yellow. Ventrally and on flanks white or yellowish white. Throat occasionally stippled with brown.

The juvenile has bars or spots of dark green and black on the back. Thighs with horizontal bars of black and white which may extend up to the abdomen. The largest specimen with this distinctive coloration in the *BNHS* collection measures 52 mm from snout to vent.

Distribution. South and east India up to Calcutta, along the east coast. In the Peninsula its northern limits are not definite. McCann (1934, 1940)^{1&2} records this species from Bombay. The specimens are not in the *BNHS* collections. While it is likely that the species occurs in the Bombay area, it has not been since collected in and around Bombay. There is a record from Punjab. Along the west coast, the *BNHS* collection has specimens from as far north as Goa.

Breeding. The male has external vocal sacs and acquires nuptial pads on the outer aspect of the first and second fingers at breeding time. Call unknown.

The season commences with the monsoon and perhaps even during the premonsoon showers spawning might happen as suggested by juveniles in the *BNHS* collection obtained from Palghat, Kerala from March to June. In areas which receive both the southwest and northeast monsoons, two broods occur. At Trivandrum, Kerala, Ferguson (1904)³ records the breeding season as lasting from July to September, while I have collected gravid females in October and just metamorphosed juveniles in January from the same area. The breeding habits are not fully known. Ferguson (op. cit.) states that the eggs are laid in paddy fields. Juveniles were collected by me from decaying vegetation in a drying pond. Gravid females contain 2,000+ eggs of less than a millimetre. Bhaduri (1944)⁴ describes the tadpoles collected in the environs of Calcutta as olive green above with darker blotches and whitish below, the anterior portion being transparent. Teeth rows in mouth disc five but usually two are lost. Metamorphosed young with a rudiment of the tail range from 17 to 27 mm in snout to vent length but within

¹ McCANN, C. (1934): Occurrence of the Si-toed Frog (*Rana hexadactyla* Lesson) in the Bombay Presidency. *J. Bombay nat. Hist. Soc.* 37:742.

² ——— (1940): A reptile and amphibian miscellany. *ibid.* 42:57.

³ FERGUSON, H. S. (1904): A list of Travancore batrachians. *ibid.* 15:499-509.

⁴ BHADURI, J. L. (1944): Further locality records of *Rana hexadactyla* Lesson in Bengal with brief notes on its tadpoles. *ibid.* 44:484.

this size range specimens with completely absorbed tail have also been collected.

Habits. The preferred habitat of this frog, perhaps the most aquatic of Indian amphibia, is ponds with dense aquatic vegetation where, while resting on the surface, its colour merges with the green of the plants. I have also seen the frog resting among brown drying weeds where its colour stood out in startling contrast! The frog keeps clear of open water. The preference for vegetation is probably related to the protection it may receive from aerial and aquatic predators. A wild caught specimen contained dragonfly larvae and snails. In captivity they take insects and smaller frogs. The species is common in the ponds and weed grown stretches of water along the east coast of the peninsula in Tamil Nadu. It is probably more widespread than its recorded distribution suggests and is possibly often confused with the Indian Bull Frog *Rana tigrina*. It is reported to be eaten in the Madras area (Annandale in Boulenger 1920)⁵ and would form a part of the commercial catches from Tamil Nadu and other areas in the south.

***Rana cyanophlyctis* Schneider 1799: Skipper Frog**

Diagnosis. Medium sized frogs. Large females rarely exceeding 60 mm in snout to vent length. Male much smaller. Distinguished from *Rana hexadactyla* by its smaller size, colour, and by the following characters: Snout rounded, first and second fingers more or less equal in length. Tibio-tarsal articulation reaches up to either between the nostril and eye or the eye or the tympanum when held against the side of the body. Toe tips swollen and rounded. A single line of porous warts on flanks, from behind the shoulder to the groin. Inner metatarsal tubercle finger-like.

Skin dorsally warty. A strong fold from behind the eye to the shoulder. An U-shaped line of warts above the anus as in *Rana hexadactyla*. Ventrally smooth.

Colour. Grey, olive, brown or blackish above with darker spots or marblings dorsally. A dark-edged white band on the back of the thighs. Ventrally white, often spotted, vermiculated or marbled with black. The black on the belly is commoner and more widespread in the larger females.

Distribution. Throughout the Indian Peninsula from the Himalayas southwards, Iran, South Arabia, Sri Lanka, Nepal and Thailand.

⁵ ANNADALE, N. In BOULENGER (1920): Monograph of the South Asian, Papuan, Melanasian and Australian frogs of the Genus *Rana*. *Rec. Indian Mus.* 20:1-223.

Breeding. While calling the vocal sacs of the males project through slits on the floor of the mouth. The inflated sacs are bluish white in colour hence the name *cyanophlyctis* for the species. The call is distinctive and easily recognised. McCann (1932)⁶ compares it to the low pitched rattle of castnets. The call, though more often heard during the rainy season, is heard at other times of the year also and I believe is the only frog call heard near permanent water throughout the year.

The eggs are laid in a frothy mass in standing water though I have collected tadpoles from a fairly large stream, these were possibly a secondary introduction. Tadpoles brown in colour with darker blotches on the tail. Mouth disc with three rows of teeth, one on the upper and two on the lower lip. Beak heavy, black. A black palatine plate inside the mouth. Tadpoles vary considerably in size. McCann's (op. cit.) largest specimen with fully developed hind limbs measured 44 mm, whereas I have collected specimens in the same developmental stage measuring 74 mm in length. Tadpoles from Arabia are larger exceeding 100 mm in length (Anderson 1895).⁷ The tadpoles are larvivorous (McCann, op. cit.). Juveniles at metamorphosis measure 17 to 19 mm and resemble the adult in colour and pattern.

Habits. The commonest and most easily seen of Indian frogs, inhabiting all biotopes of the country. It prefers still waters where it can float placidly on the surface. Most ponds, rain puddles and other stretches of water usually have one or two floating on the surface and several squatting along the edges. The ability of this species to skip over the surface of the water like a ricocheting stone was first remarked upon by Emperor Babar in the 16th century. In association with this habit this frog, unlike other species, does not let the hind legs dangle but has them parallel to the surface of the water permitting the quick flurry of strokes necessary for the skipping get away. After skipping for some distance the animal may remain on the surface, or make a short dive and return to the surface or dive and scramble into the mud at the bottom depending on the extent of its alarm. The distance covered in the skipping alarm flight depends on whether the frog had taken off from land or water. The skipper is both diurnal and nocturnal and during the rainy season wanders considerably on land at night. Where permanent water is available it is seen throughout the year. In other areas it aestivates. Annandale (*in* Boulenger 1920) records seeing them at Quetta (Pakistan) floating sluggishly on the surface of a well whose sides were frozen. It is fairly tolerant of brackish water as well as water

⁶ McCANN, C. (1932): Notes on Indian Batrachians. *J. Bombay nat. Hist. Soc.* 32:152-180.

⁷ ANDERSON, J. (1895): Reptiles and Batrachians from Aden. *Proc. Zool. Soc. London.* p. 600.

polluted by industrial effluents. The food consists of insects and small vertebrates.

***Rana tigerina* (Daud.): Indian Bull Frog**

Diagnosis. Size large; adult females occasionally exceeding 160 mm in snout to vent length. Males smaller. Snout obtusely pointed, projecting beyond the mouth. Tympanum distinct, equal to or slightly smaller than the diameter of the eye. First finger longer than second. Toes fully webbed but the web does not reach the tip of the third toe. Fifth toe with an outer fringe of web. Outer metatarsals separated by web nearly to the base. An obtuse inner metatarsal tubercle. Tibio-tarsal articulation reaches the eye or between the eye and the nostril. Heels overlap when folded at right angles to the body.

Skin smooth or granulate above with distinct longitudinal glandular folds. A fold from behind the eye to the shoulder. Ventral skin, smooth.

Colour. Olive green or brown above with darker markings. A light coloured vertebral streak from snout to vent often present. Limbs barred or spotted.

The juvenile is dark green above with dark brown markings and a black line along the side of the head.

Secondary Sex Characters: Male with external vocal sacs which are bright blue during breeding season. Forelimbs thick. The inner side of the first finger with a horny pad, velvety in texture, and greyish brown in colour. Males at breeding congregations in the Bombay area are bright yellow. This colour which is evident at breeding congregations changes to a sober brown if the animal is removed elsewhere.

Distribution. Throughout the Indian Subregion; Sri Lanka; Burma to Indo-China; South China; Formosa.

Breeding. As in the majority of Indian amphibia, the season coincides with the arrival of the monsoon rains. A detailed account of the breeding habits of the species in the Bombay area has been given by McCann (1932) and is summarised below. The first heavy showers of the monsoon bring frogs out of their aestivation retreats. The males in their lemon yellow livery congregate in rain water pools and ditches. Croaking loudly they alertly await the females which are fought over, the nearest male usually succeeds in holding on to the female and fending off competitors by kicking strongly with the hind legs. The spawn is laid in rain water pools and other transitory water. The eggs which float when laid, later sink to the bottom where they hatch. The tadpole is omnivorous and is usually a bottom feeder, only occasionally coming to the surface. According to McCann they are larvivorous.



Above: *Rana tigerina*; Below: *Rana cyanophlyctis*.
(Photos: R. Whitaker)



Above: *Rana breviceps*; Middle: *Rana malabarica* (Photos: R. Whitaker);
Below: *Rana limnocharis* (Photo: S. R. Nayak) Male, Calling at night.

Habits. The largest of the Indian amphibia, the Bull Frog is widely distributed from the fringes of the deserts to c 2000 m elevation in the hills. Though not as aquatic as *Rana hexadactyla*, every spread of permanent or semi-permanent water has its complement of members of this species hiding in the grass or hollows at the very edge of the water, ready to dive in at the least sign of danger. Usually they blend so well with their habitat that it is difficult to locate them. In the non-breeding season they are silent but at the beginning of the rainy season their call, a deep toned, *oong awang* can be heard throughout the night, each new shower being welcomed with a fresh uproar. Another sound heard only when the frog is caught by a predator is an almost human scream. The frog sometimes gives out a chukle-like *kut kut kut* when caught by hand.

In the absence of permanent water in areas where there is a definite and prolonged dry season, the frog aestivates, singly or several together. In sandy areas they follow the falling water table; instances are on record of specimens being collected at depths of 6 to 9 metres. It is, however, a hardy species able to withstand considerable dessication.

The diet is catholic and anything in movement which can be swallowed is swallowed, the hands being used to thrust in the unwieldy sections of the prey. In addition to the normal diet of insects which varies with seasonal abundance of the prey species and is not selective, the Bull Frog is reported to have taken mice, shrews, birds up to the size of the Pitta (*Pitta brachyura*), snakes upto a metre in length, Spiny tailed Lizard (*Uromastyx*), toads, other frogs including smaller sized frogs of its own kind, land crabs etc. It is in turn fed on by waterfowl aquatic animals from fishes to crocodiles and various land animals. There is now heavy commercial exploitation of this species, the legs being exported. The rate of exploitation with selective collection of the larger forms is a serious drain on the breeding population and will affect the status of the species as well as its commercial importance unless reasonable safeguards are legislated. One of the adverse effects of removal of the frog now noticed in agricultural areas, is the increase in the number of land crabs and the consequent damage to wet land crops.

***Rana crassa* Jerdon 1853: Jerdon's Bull Frog**

Diagnosis. Very closely resembles *Rana tigerina* but can be distinguished by its shorter leg; the tibio-tarsal articulation reaches only to the tympanum or the eye. The heels do not overlap when the legs are folded at right angles to the body. The inner metatarsal tubercle is distinctive being crescentic and nearly one to one and a half times the length of the inner toe.

Colour. Grey, brown, or green with darker markings. White below, occasionally with black spots on the throat.

Breeding. This species has been confused with *tigerina* and information on its larval stages are not reliable. The breeding habits need to be studied particularly with regard to the characters responsible for reproductive isolation from the closely allied *Rana tigerina*.

Distribution. Peninsular India and the Gangetic Plain. In the west coast upto Malabar. In the east up to Calcutta. Sri Lanka.

Habits. Apart from the fact that it is an excellent burrower unlike *tigerina* no separate records are available of its habits from those of *tigerina*, with which species it has been confused till recently. The young like those of *Rana tigerina* are seen in temporary rain water pools. I have collected adults near tanks in Tamil Nadu. The ecology and behaviour of the sympatric *Rana crassa* and *Rana tigerina* are excellent problems for investigation.

***Rana verrucosa* Gunther 1875**

Diagnosis. Medium sized frogs (up to 61 mm in snout to vent length). Snout obtuse, tympanum distinct nearly the size of the eye. First finger longer than second. Tibio-tarsal articulation reaches nostril or tip of snout; heels strongly overlap when folded at right angles to the body. Toes fully webbed except the fourth which has two phalanges free. A dermal fringe to the fifth toe. Outer meta-tarsals separated nearly to the base. Two meta-tarsal tubercles, the inner larger. A short tarsal fold.

The skin of the back is extremely warty hence the name *verrucosa*. A fold from eye to shoulder. Ventrally smooth.

Colour. Dark grey or brown above with darker markings. A light vertebral streak if present interrupted by the markings on the back. Limbs and lips barred. Sides of the thigh patterned in black and yellow. Ventrally white.

Secondary sexual characters. Male with internal vocal sacs. Pads on the inner aspects of the first finger well developed and base of thighs granular in the male.

Breeding. Call not recorded. Breeding habits unknown. The tadpoles collected from a forest pool in Kerala in September has been described by Annandale (1915).⁸ The mouth disc has five rows of teeth, a marginal row followed by an interrupted row in the upper and three

⁸ ANNANDALE, N. A. (1915): Some undescribed tadpoles from the hills of southern India. *Rec. Indian Mus.* 15:17-23.

unbroken rows in the lower lip. A gravid female was collected in south Kerala in November suggesting that there may be two breeding seasons in some areas.

Distribution. Hill forests of Kerala and Tamil Nadu up to 2000 metres.

Habits. Little known. I have collected this species from the side small fast flowing hill streams overhung with vegetation in the hill forests of south Kerala. Ferguson (op. cit.) reported them from similar situations. Annandale (op. cit.) records that "It is very abundant in the Travancore Hills" and that the species avoids small springs and pools and is usually found at the edge of streams and reservoirs. The coloration is to a certain extent cryptic.

Rana limnocharis Boie in Wiegmann, 1835: Indian Cricket Frog

Diagnosis. Small sized frogs, the majority of specimens seen hardly exceeding 35 mm in snout to vent length. Maximum size recorded, ♂ 51 mm, ♀ 64 mm. Breeding commences at a much smaller size, 20 mm ♂ and 23 mm ♀. Distinguished from other ranids by the smaller size and the brief webbing of the toes, usually half webbed with three phalanges of the fourth toe free. The tibio-tarsal articulation reaches the nostril when the leg is held along the body. Outer metatarsals united in the basal half or third. An inner and an outer metatarsal tubercles present. First finger longer than the second.

Skin warty above often with longitudinal glandular folds, short and interrupted. A strong fold from eye to above shoulder. Smooth below.

Male with a median subgular external vocal sac. The vocal sac area becomes black in the breeding season. A strong pad appears on the inner aspect of the first finger of the breeding male.

Colour. Usually grey or brown with darker markings. Lips and legs often with darker bars. A vertebral band of varying width often present. Ventrally white.

Distribution. East Asia from Pakistan to Japan. Apart from the typical form, three races have been named from India, namely *nilagrica* from the Nilgiri Hills in Tamil Nadu; *syhadrensis* from the western ghats near Bombay; and *andamanensis* from the Andaman group. The races are not readily distinguishable.

Breeding. Specimens in a ready to breed condition have been collected from March to August and October to January. The breeding season coincides with the monsoon rains and in areas like Trivandrum which receive both monsoons there are two distinct breeding seasons. However the occurrence of frogs in breeding condition in March and again in October-December at Mahableshwar in Satara Dt., Maharashtra,

which receives only the SW Monsoon cannot be easily explained. The species apparently does not have a fixed breeding season if conditions suitable for breeding are continuously available.

I have located and collected males calling from under the soil during the breeding season. McCann (1932) compares the call to the loud clatter of castanets and according to Minton (1966)⁹ the call is "a series of loud staccato notes often delivered in bursts suggesting telegraphy". I would compare the call to that of the cricket.

***Rana brevipalmata* Peters 1871**

Diagnosis. Medium sized frogs (snout to vent length 47 mm) closely resembling *Rana limnocharis* but can be separated by the longer hind limbs and shorter web between the toes. Snout pointed, tympanum distinct, first finger longer than second, hind limbs long the tibiotarsal articulation reaching the tip of the snout or beyond; heels strongly overlapping when the legs are folded at right angles to the body. Toes slender, feebly webbed, web not reaching to second phalange of toe. Outer metatarsals separated nearly to the base by web. Inner metatarsal tubercle prominent, half or more the length of the inner toe. A small outer metatarsal tubercle. Skin warty above, smooth below.

Colour. Greyish above with darker markings. White below.

Distribution. Malabar (Kerala); Nilgiris (Tamil Nadu).

Breeding. Male with a pair of vocal sacs and a strong pad on the side of the first finger. Breeding habits and tadpole unknown.

Habits. Unknown.

***Rana malabarica* (Bibr.) 1838: Fungoid Frog**

Diagnosis. Medium sized frogs, the largest in the BNHS collection has a snout to vent length of 81 mm. Adults easily recognised by their distinctive coloration. Snout obtuse, projecting slightly beyond the mouth. Tympanum very distinct, slightly less or equal to the diameter of the eye. Tips of fingers and toes swollen. First finger longer than second. Tibio-tarsal articulation reaches the tympanum or the eye when the leg is held along the body. Heels overlap feebly when the legs are folded at right angles to the body. Toes feebly webbed, two or three phalanges of the fourth toe free. Subarticular tubercles on fingers and toes and inner and outer meta-tarsal tubercles large and prominent.

Skin smooth or granular above with a distinct dorso-lateral glan-

⁹ MINTON JR., SHERMAN, A. (1966): A contribution to the herpetology of West Pakistan. *Bull. American Mus. nat. Hist.* 134:55.

dular fold from above the tympanum to the groin. A shorter fold terminating in a large gland below the tympanum or is continued as a line of glands along the flanks. Ventrally granulate on belly and the under-side of the thighs.

Colour. Back bright orange red, yellowish red, or crimson, from the tip of the snout to vent, distinctly separated from the black of the flanks along the canthus rostralis, upper eyelid, and the dorso-lateral fold. Upper lip white and the colour may extend along the line of glands on one sides. Ventrally white, uniform or spotted or marbled with black. Throat and chest often wholly brownish black or black. Legs brown or black barred or marbled with yellowish white. The barring in some of the young specimens (19 mm snout to vent length) resemble stripes.

Juvenile collected in May were greyish or yellowish white above instead of red (snout to vent length 14 mm).

Distribution. The Western Ghats and the lowlands west of the Ghats from Kasara Ghat in Nasik Dist., Maharashtra to Edanad, Chenganur Dist., Kerala. It is possible that the range extends further south but I have not seen it in the Trivandrum area nor has Ferguson (op. cit.) included it in his list of Travancore batrachia. The species is known from the Nilgiris and has been reported from Jagdalpur, Bastar, M.P. (J. C. Daniel & Selukar 1964).¹⁰ It is possible that it may occur in suitable biotopes in other areas of the Eastern Ghats and perhaps in other areas of Peninsular India.

Breeding. Male with feebly developed external vocal sacs and a velvety pad on the inner aspect of the first finger at the breeding season and a glandular area on the anterior portion of the arm.

The breeding season commences with the onset of the monsoon and the northward extension of the rains along the range of the species. Females collected in Edanad, Kerala in March had enlarged ovaries with granular developing ova while the ovaries of specimens collected at Kanheri Caves, Bombay in the same month were dormant. In May females from Talewadi, N. Kanara were spent and just metamorphosed young were noticed. Females from the Bombay area collected in May and early June were gravid. McCann (1940) records a female with eggs in July and Chari (1962)¹¹ collected tadpoles of different stages

¹⁰ DANIEL, J. C. & SELUKAR, T. G. (1964): Occurrence of the fungoid frog *Rana malabarica* (Bibr.) at Jagdalpur, Bastar District, M.P. *J. Bombay nat. Hist. Soc.* 60:743-744.

¹¹ CHARI, V. K. (1962): A description of the hitherto undescribed tadpoles of, and some field notes on the Fungoid Frog, *Rana malabarica* Bibron. *J. Bombay nat. Hist. Soc.* 59:71-76.

in August and the first week of September which supports McCann's observation that the species is a late breeder in the Bombay area. However it is possible that the species has an extended breeding season. The difference in size between the sexes is not very apparent but the largest specimen collected was a female.

The species breeds in still water, preferring shallow pools holding weeds or grass in forest or open country. The call which is given out by the male with sitting at the edge of such pools has been syllabilised by Abdulali (*in* Chari, *op. cit.*) as *wack, wack, wack*. My own observations support a treble version of this syllabilisation. However, McCann (1940) compares the call to the noise made by a tin rattle.

Chari (*op. cit.*) has shown that Boulenger's (*op. cit.*) description of the tadpole was based on misidentification. The tadpole according to Chari is straw yellow in colour and has the head and body blotched with brownish black and tail speckled with black. Mouth disc has one row of teeth on the upper lip and two, the inner interrupted, on the lower lip. Occasionally a short third row. Largest tadpole was 48 mm in total length. Metamorphosis was completed in two months and 18 days after collection of tadpoles. The period is perhaps less in nature.

Habits. This species prefers forested land though it has been recorded in open country particularly in the breeding season. McCann (1936) notes that it is semi-arboreal and may often be seen at considerable heights on trees. When on trees the red coloration of the back is said to resemble red bark fungus and the oblitative pattern of the rest of the body breaks the outline of the body merging the animal into the background; hence the trivial name "Fungoid Frog". McCann (1964) records that a powerful fungoid odour was given out under excitement by a specimen he caught at Tansa Lake near Bombay in May. Abdulali (*op. cit.*) records the odour of a specimen he collected in the same area as resembling burnt rubber. The frog is not as agile as other species and is easily caught and perhaps the coloration is apsmatic. I have seen them mainly at night though McCann (1932) states that they are diurnal. Later (1940) he noted that several specimens that lived in his house were nocturnal. In summer months a large number may gather in moist areas. Such congregations have been observed in the moist cisterns of Kanheri Caves at Bombay and P. B. Shekar (*Per. Communication*) who collected the species at Edanad in Kerala reports that he saw over 30 frogs inside a well in March sitting on the sides above the water. As noted by Abdulali (*op. cit.*) the species does not breed in such areas but in rain water pools. A land frog it is reluctant to enter water and avoids doing so except for breeding.

Subgenus *Tomopterna*: Burrowing Frogs

The species of this subgenus are usually seen only during the breeding season when they surface to breed. In appearance they resemble the burrowing microhylids but have a much larger head. The inner metatarsal tubercle is much enlarged, crescentic in shape and in most species exceeds the inner toe in length. It is the main burrowing tool. The food is ants and other subterranean insects. Three species occur in Western India.

KEY TO THE SPECIES OF *Rana* (*Tomopterna*) IN WESTERN INDIA

- 1 An outer metatarsal tubercle present; Tibiotarsal articulation reaches tympanum or posterior border of eye *rufescens*
- 1 Outer metatarsal tubercle absent; tibiotarsal articulation does not reach beyond shoulder 2
- 2 Snout shorter than eye in length; toes 1/4 to 1/2 webbed *breviceps*
- 2 Snout as long as eye; web toes rudimentary *dobsoni*

***Rana rufescens* (Jerdon) 1854: Rufescent Burrowing Frog**

Diagnosis. Medium sized frogs, the largest specimen in the *BNHS* collection has a snout to vent length of 43 mm. Head broader than long with rounded snout and distinct tympanum about half or slightly over half the diameter of the eye. First finger much longer than the second, third equal to or slightly longer than the first. Tibio-tarsal articulation reaches tympanum or posterior border of the eye. Heels slightly overlapping when legs are folded at right angles to the body. Toes feebly webbed. One phalange of 1st and 2nd toes free; 2 phalanges of 3rd and 5th toes and 3 phalanges of 4th toe free. Sub-articular tubercles of fingers and toes prominent. Inner meta-tarsal tubercle large, nearly one-third the length of the inner toe and is compressed and crescentic in shape. A small outer meta-tarsal tubercle.

In the field it can be easily confused with *Rana limnocharis* but can be distinguished by the size and shape of the meta-tarsal tubercle and the much more rounded snout.

Skin with numerous warts above and two glandular ridges forming an inverted open V between the shoulders. A glandular fold from the eye to the shoulder. Ventrally smooth except on the back of the thighs where it is granular.

Colour. Brown above with darker spots and marblings. Occasionally a crossbar between eyes. Lips and limbs barred. Most specimens have patches of varying shades of red on them and in some almost the whole dorsal surface may be brick red.

Distribution. Salsette Island, Bombay, southwards along the Western Ghats to Malabar.

Breeding. The male has external vocal sacs appearing as blackish folds on the sides of the throat in the breeding season. A strong pad on the first finger. Call not recorded. Females collected in June at Kanheri Caves, Salsette Island, Bombay and at Gersoppa, North Kanara were gravid. Gravid and spent females have been collected in the Koyna area in July. Abdulali (1962)¹² records a pair in copula in June at Kanheri Caves. The tadpole has not been described so far.

Habits. Little known. It is an uncommon frog. A burrower, it is mainly seen during the early monsoon months, when juveniles and adults have been collected near water and in grass. Adults have been seen at other times of the year in forests under logs and stones.

***Rana breviceps* Schneider 1799: Indian Burrowing Frog**

Diagnosis. Medium sized frogs. Adults in the BNHS collection average 56 mm (range 43 to 65 mm) females and 48 mm (range 41 to 56 mm) males in snout to vent length. Snout short, less than the diameter of eye in length, rounded. Tympanum distinct, approximately three-fifth the diameter of the eye. First finger considerably longer than second, equal to or a little shorter than the third. Tibio-tarsal articulation reaches the shoulder. Heels do not meet when the legs are folded at right angles to the body. Web on toes does not reach the last phalange of the first to third and the fifth toes. Two phalanges of the 4th free. Outer metatarsals bound together. Sub-articular tubercles prominent. Inner metatarsal tubercle, large, compressed, crescentic and more than the inner toe in length. No outer tubercle.

A small circular tubercle occurs on the tarso-metatarsal joint in some specimens from south India. The presence of this tubercle was first noticed in specimens collected at Trivandrum in Kerala (Bhaduri & Kirpalani 1954)¹³ and the occurrence of this tubercle was recorded in specimens from Sri Lanka and India south of c. 17°. Specimens from the range of the species north of 17° latitude lack the tubercle. However specimens without tubercle also occur south of latitude 17°. While collecting at Trivandrum the specimens studied by Bhaduri & Kripalani, I was struck by their remarkable resemblance to species of the Microhylid genus *Uperodon* rather than the *Rana breviceps*. I was familiar with in the Bombay area. The colour too was markedly different being greyish with darker markings instead of the uniform brown of the back in specimens from the Bombay area. It is possible that the southern

¹² ABDULALI, H. (1962): An account of a trip to the Barapede Cave, Talewadi, Belgaum District, Karnataka State, with some notes on Reptiles and Amphibians. *J. Bombay nat. Hist. Soc.* 59:228-237.

¹³ BHADURI, J. L. & KIRPALANI, MIRA, (1954): Notes on the frog *Rana breviceps* Schneider. *J. Bombay nat. Hist. Soc.* 52:620-623.



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