

Microhyla karunaratnei (Anura: Microhylidae), a new species of frog endemic to Sri Lanka

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Abstract

Microhyla karunaratnei, a new species of frog (Microhylidae) is described from Morningside Estate (Sinharaja World heritage Site), Sri Lanka. This species is distinguished from all other Sri Lankan *Microhyla* by the presence of a median cleft on the dorsum of the digital discs and by its distinctive black and white ventral colouration.

Key words: Amphibia, Microhylidae, *Microhyla*, Sri Lanka.

Introduction

Three species of *Microhyla* are recognised as being valid in Sri Lanka by Kirtisinghe (1957) and Dutta (1985): *M. ornata* (Duméril & Bibron, 1842); *M. rubra* (Jerdon, 1854) and *M. zeylanica* Parker & Hill, 1949. The present species was discovered in 1992 in the course of an amphibian research project in the Sinharaja World Heritage Site, Sri Lanka.

S.K. Dutta, P.B. Karunaratne and others (pers. comms.) have drawn attention to the fact that the Sri Lankan amphibia are far from well known, and that the number of valid species significantly exceeds the 48 recognised by Dutta (1985). This description of *Microhyla karunaratnei* is the second in a series of descriptions of new Sri Lankan amphibian species.

Materials and methods

Methods for making measurements are those described in Fernando et al. (1994). Description of interdigital membranes follows Parker (1934).

Tadpoles were reared in 20 l glass aquaria at 28°-30° C in water of pH 7. They were fed by adding a few drops of raw chicken egg yolk to the water every other day. Tadpole growth was staged according to Gosner (1960).

Abbreviations. Snout-vent length, SV; Australian Museum, Sydney, AMS; National Museum of Sri Lanka, Colombo, NMSL; standard deviation, s.d.

Microhyla karunaratnei, new species Figures 6-8

Holotype. AMS R 148277, 16.5 mm male, Sri Lanka, Morningside Estate, Sinharaja World Heritage Site: 1 km from research station at the edge of a shallow pond (6°24'N, 80°37'E), P. Fernando, 10 September 1995.

Paratypes. AMS R 148278 - R 148283 (6 ex.), 15.8 mm SV male, March 1992; 17.0 mm SV male and 19.1 mm SV female, August 1993; 19.1 mm SV male,

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1994; 16.3 and 16.8 mm SV males, October 1995; NMSL, 1 ex., 15.6 mm SV; all from around shallow ponds in the vicinity of the research station on Morningside Estate, Sinharaja World Heritage Site (06°24'N, 80°38'E), collected by P. Fernando.

Diagnosis

Microhyla karunaratnei is distinguished from all other *Microhyla* species known from Sri Lanka, western and southern India (Daniel, 1963; Dutta, 1985) and the Andaman Islands (Pillai, 1977) by the combination of the following characters: median cleft on dorsal side of digits (vs. digits entire); venter marbled in black and white in living specimens and grey-brown and white in alcohol-preserved specimens (vs. venter uniformly coloured).

Description

The following description relates to the holotype and five paratypes (see also Table 1 for morphometric data). Clavicles absent. Pupil circular. Upper jaw edentate; tongue entire. Snout blunt, broader than long (snout length 0.56 of snout length, s.d. = 0.04), almost equal in length to horizontal diameter of eye (snout length 0.94 of eye diameter, s.d. = 0.12). Nostrils positioned dorsolaterally. Canthus rostralis rounded. Loreal region oblique. Interorbital width 1.7 times width of upper eye lid (s.d. = 0.25). Tympanum hidden. Skin smooth. A glandular fold extends from the posterior angle of eye to forelimb.

Tips of digits dilated into discs. Subarticular tubercles prominent. Fingers free, their relative lengths $1 < 2 < 4 < 3$. Discs on fingers poorly developed, with a median notch on the dorsal surface (Fig. 1). Two well-developed metacarpal tubercles, the outer completely divided (Fig. 2). Toe discs more developed than those on fingers, each with a distinct median groove on its dorsal surface (Fig. 3). Toes webbed, the webbing between the fourth and fifth toes and third and fourth toes to between antepenultimate and proximal subarticular tubercles of the fourth toe. Webbing between second and third toes to between distal and proximal subarticular tubercles of second toe. Webbing between first and second toes to between proximal and distal subarticular tubercles of first toe. Toes with lateral fringes. Two small metatarsal tubercles, the outer one circular and the inner one oblong (Fig. 4). The heels meet when the hind limbs

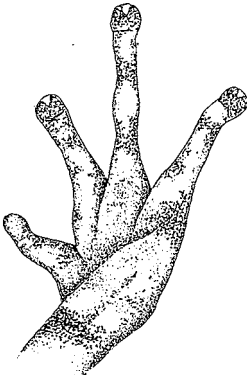


Figure 1. Dorsal surface of right hand of *Microhyla karunaratnei*, 16.5 mm SV AMS paratype, showing notched digital discs.

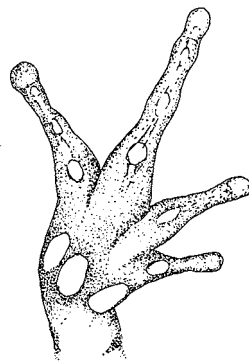


Figure 2. Ventral surface of right hand of *Microhyla karunaratnei*, 19.1 mm SV AMS paratype, showing distribution of tubercles.

Table 1. Measurements of holotype and the five AMS paratypes of *Microhyla karunaratnei*, SV 16.3-19.1 mm, expressed as percentages of SV.

	Mean	s.d.	Range
Snout length	10.2	1.7	7.9 - 11.8
Snout width	18.2	1.9	15.7 - 20.6
Eye diameter	10.8	1.1	8.9 - 12.1
Interorbital space	11.7	0.6	11.0 - 12.5
Upper eyelid width	7.0	1.0	5.2 - 8.0
Length of thigh	43.1	2.2	39.3 - 45.6
Vent to tibiotarsal articulation	84.3	4.9	78.6 - 93.2
Upper arm length	15.7	0.8	14.7 - 16.5
Fore arm length	18.6	1.4	17.1 - 20.9
Head length	23.8	3.5	19.4 - 26.8
Head width	31.1	1.1	29.8 - 32.4
Internarial width	7.6	0.5	7.1 - 8.4

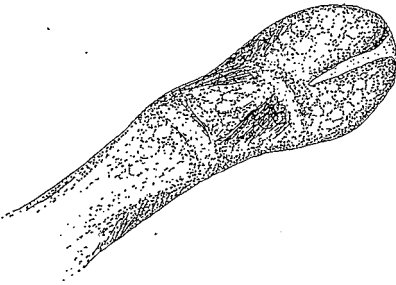


Figure 3. Dorsal surface of fourth toe disc of *Microhyla karunaratnei*, 19.1 mm SV paratype, showing median cleft.



Figure 4. Ventral surface of right foot of *Microhyla karunaratnei*, 19.1 mm SV paratype, showing distribution of tubercles.

are addressed (thigh length 1.1 times fore-leg length, s.d.=0.1). Tibiotarsal articulation reaches eye (SV 1.2 times distance from tibiotarsal articulation to vent, s.d. = 0.1).

Colour. In life (Figs. 5-7), pinkish grey-brown with a blackish lateral stripe extending from the eye to the groin, not interrupted above the shoulder; the dorsal margin of this strip is distinct, but ventrally it breaks up and becomes indistinguishable from the ventral pattern. There is a dark brown mid-dorsal marking that commences between the eyes (connecting the upper eyelids), narrowing behind the occiput, broadening between the shoulders, narrowing and broadening again, giving rise to two posteriorly-directed bands of variable length. In some specimens the marking continues on narrowing and broadening again, and in others it is interrupted between the broad patches (Figs. 5 and 7). Among the other dorsal colour pattern variations observed were the absence of the retrorse markings and an indistinct pattern with the whole of the dorsum in a reddish-brown tint. There are a few indistinct, narrow, wavy bands parallel with the edges of the dorsal marking.

Ventrally white with black (grey-brown in alcohol-preserved specimens) marbling (Fig. 6). The pattern varies from one individual to another, but the

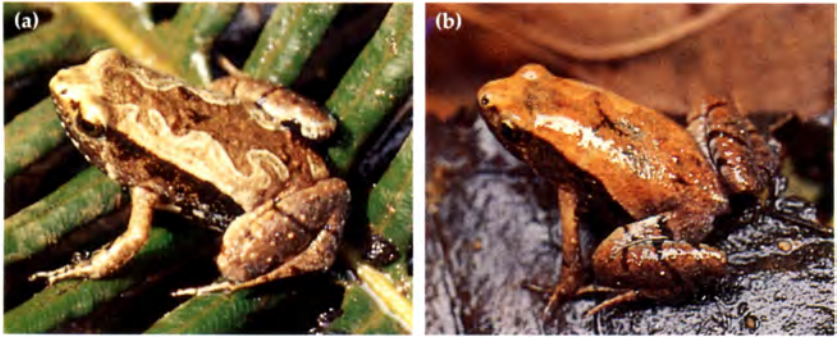


Figure 5. Dorsal colour pattern of *Microhyla karunaratnei* in life, (a) 16.3 mm SV AMS paratype; (b) 16.8 mm SV AMS paratype. Photographs: Vimukthi U. Weeratunga.

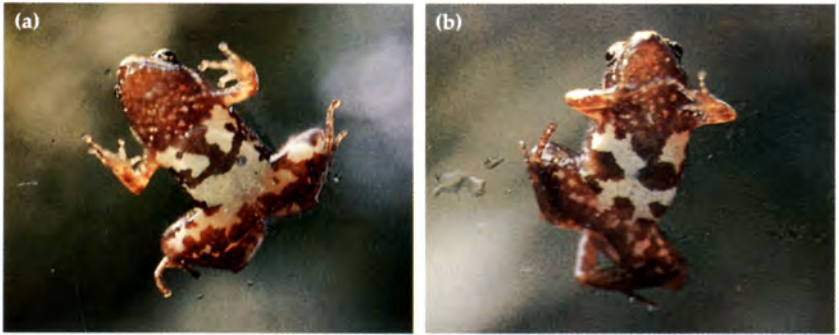


Figure 6. Ventral colour pattern of *Microhyla karunaratnei* in life, (a) 16.5 mm SV holotype (AMS R 148277); (b) 16.8 mm SV AMS paratype. Photographs: Vimukthi U. Weeratunga.



Figure 7. *Microhyla karunaratnei* in life, 16.5 mm SV holotype, AMS R 148277. Photograph: Vimukthi U. Weeratunga.

Table 2. Measurements of 4 tadpoles of *Microhyla karunaratnei*, AMS R 148284, Gosner Stages 31, 35, 36 and 37, as percentages of head & body length.

	Mean	s.d.	Range
Maximum head & body width	62.9	7.1	53.6 - 68.9
Maximum head & body depth	55.8	5.6	50.0 - 61.2
Tail length	167.1	25.6	140.2 - 196.1
Internarial distance	10.8	0.8	10.0 - 12.0
Interorbital width	64.6	6.4	56.3 - 69.9
Maximum depth of tail	24.8	3.1	21.5 - 27.6
Maximum depth of lower tail crest	10.5	1.8	8.2 - 12.5
Maximum depth of upper tail crest	6.1	1.4	4.4 - 7.9

marbling was observed in all specimens. Gular region blackish (grey-brown in alcohol-preserved specimens) with fine, white stippling. A black mark on the anterior side of the thigh, and an incomplete bar on its dorsal side. Vent enclosed in a black patch. Limbs with dark cross-bars.

Tadpole stage. Morphological type—Orton's type II (Duellman & Trueb, 1986); plane of orientation of larvae, horizontal. Total length of a tadpole (stage 37), 32.0 mm (Fig. 8). Morphometric measurements of four tadpoles are given in Table 2. Head and body length 1.6 times width (s.d. = 0.2); head rhomboid in dorsal view. Tail length 1.7 times that of body (s.d. = 0.3). Tail length 4.1 times tail width (s.d. = 0.5). Lower crest depth 1.7 times that of upper (s.d. = 0.1). Body depth 1.4 times tail depth (s.d. = 0.2). Head and body length 0.4 of total length (s.d. = 0.04). Interorbital distance 6.0 times internarial distance (s.d. = 0.6). Mouth supraterminal; no papillae on lower lip. Eyes lateral. A faint naso-orbital groove present in large tadpoles. Spiraculum opening above notched flap on mid-line on underside of belly.

The tadpoles are transparent, with a little pigmentation around the nostrils and a median, diamond-shaped mark dorsally. In tadpoles with well-developed hind limbs the toes are completely webbed and the notches on the discs can be observed clearly.

Etymology

The species name is a patronym honouring P.B. Karunaratne, the Sri Lankan naturalist.



Figure 8. *Microhyla karunaratnei*, 32.0 mm tadpole (AMS R 148284), stage 37, in life.



Figure 9. Type locality of *Microhyla karunaratnei*, Morningside Estate, Sinharaja World Heritage Site.

Distribution

Microhyla karunaratnei is known only from the type locality (Fig. 9), the eastern edge of the Sinharaja World Heritage Site, at an elevation of around 1100 m. The vegetation in the area is regenerated submontane scrub (the area having earlier been planted with tea (*Camellia*)).

The type locality of *M. karunaratnei* (Rakwana Hill Range) is well separated from that of *M. zeylanica* (central massif). *Microhyla ornata* and *M. rubra* occur at lower elevations.

Microhyla karunaratnei has been observed only in and around the margins of disused "gem pits," now filled with water. These pits are scattered throughout the Morningside Plain, covered with a dense growth of grass, *Hedyotis* sp. (Rubiaceae) and the fern *Gleichenia linearis* (Gleichenaceae). Adults were usually found in the tangled roots and stems of grass surrounding small pools of water.

Ecology

Microhyla karunaratnei has been observed breeding in the clear water of disused gem pits, ranging in depth from about 0.5 to 2 m. These pits are usually from 1-10 m across (Fig. 9). Both calling males and tadpoles in all stages of development were observed during visits to the site from 1992-95 in the months of February, March, August, October and December. It appears therefore that breeding is not seasonal and probably occurs throughout the year. Tadpoles of *Euphlyctis cyanophlyctis* (Ranidae) were observed to be sympatric with those of *M. karunaratnei* in some of the pools. It was also noted that tadpoles of *M. karunaratnei* were not present in pools with marginal shade from shrubs more than a few metres tall, although larval *Polypedates longinasus* (Rhacophoridae) were observed in these, while being absent from the exposed pools inhabited

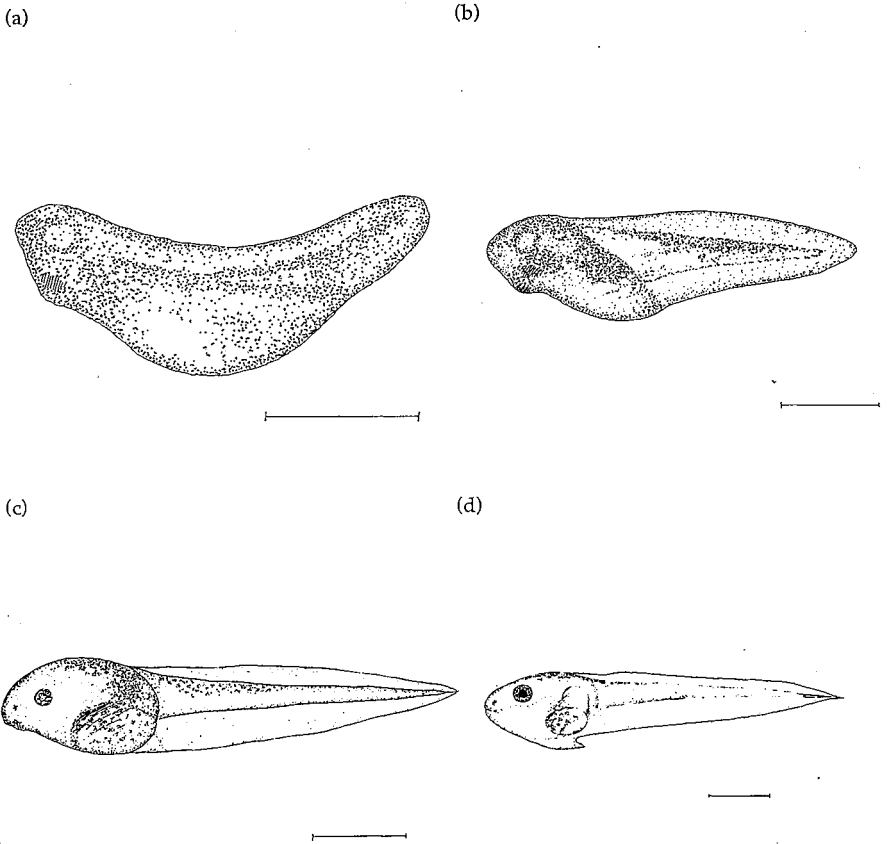


Figure 10. Larvae of *Microhyla karunaratnei* (a) 30 hrs after laying, embryo in stage 18, strongly arched, no heart beat visible, fins and cornea opaque, muscular response positive; (b) 55 hrs after laying, head & body length 1.7 mm, tail length 2.5 mm, stage 19, heart beat visible, cornea opaque, no tail fin circulation, adhesive organ present; (c) 78 hrs after laying, head & body length 1.9 mm, tail length 3.2 mm, stage 22, cornea and tail fin transparent; (d) 96 hours after laying, head & body length 2 mm, tail length 3.9 mm, stage 25, mid-ventral spiraculum present; limb buds appeared after the 23rd day (stage 26). Scale bars = 1 mm.

by *M. karunaratnei* larvae. The larvae of *M. karunaratnei* were observed to go down to mid-depth of the pool when disturbed, and remain stationary while rapidly beating the terminal filaments of their tails.

A pair of *M. karunaratnei* in axillary amplexus were collected at around 1700 hrs on 15 August 1993 from the margin of a 0.5 m deep pool of diameter 3 m, the bottom of which contained a dense growth of grass. The pair was placed in a glass container with wet grass in about 2 cm of water and kept darkened until eggs were laid the same day. The tadpoles were reared (see Materials & methods) to maturity (metamorphosis took 8 weeks) and some of their developmental stages are illustrated in Fig. 10 (a-d) (note that the laboratory conditions for tadpole rearing varied considerably from the natural situation).

Discussion

Two species of *Microhyla* are common to Sri Lanka and India: *M. rubra* and *M. ornata*, both of which lack digital discs (Dutta, 1985; pers. obs.). *Microhyla zeylanica*, which is endemic to Sri Lanka, has digital discs but these are entire and not cleft (Parker & Hill, 1948; pers. obs.). *Microhyla chakrapanii* Pillai, 1977, has toe-discs, but these lack a median cleft (Pillai, op. cit.). *Microhyletta inornata* (Boulenger, 1890), which has a range that extends from the Andaman Islands to Malaysia (but excludes mainland India), also lacks digital discs (Parker, 1934).

The tadpole of *M. karunaratnei* is most easily distinguished from *M. zeylanica* by the absence of papillae on the lower lip; and from *M. rubra* and *M. ornata* by the depth of the body being greater than that of the tail (this is exaggerated in life as the flap on the underside of the belly hangs open, but collapses when preserved). The tail is deeper than the body in *M. rubra* and about equal in *M. ornata* (Kirtisinghe, 1957).

It is interesting to note that *M. karunaratnei* has taken advantage of habitat modification caused by humans, viz. the creation of pools of water by illegal gem mining. Since every pit had large numbers of tadpoles of this species, it is possible that the population of the species has benefited from the additional availability of breeding habitat.

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Literature cited

- Boulenger, G.A. 1890. The fauna of British India, including Ceylon and Burma. Reptilia and Batrachia. Taylor & Francis, London. xvii+541 pp.
- Daniel, J.C. 1963. Field guide to the amphibians of western India, Part 1. J. Bombay nat. Hist. Soc., 60: 415-438.
- Duellman, W.E. & L. Trueb. 1986. Biology of amphibians. McGraw-Hill, New York. xvii + 670 pp.
- Dutta, S.K. 1985. Amphibians of India and Sri Lanka. Unpubl. Ph.D. thesis, Univ. Kansas.
- Fernando, P., Dayawansa, N. & M. Siriwardhane [check spl.]. 1994. *Bufo kotagamai*, a new toad (Bufonidae) from Sri Lanka. J. South Asian nat. Hist., 1: 119-124.
- Gosner, K.L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. Herpetologica, 6: 183-190.
- Kirtisinghe, P. 1957. The Amphibia of Ceylon. Publ. By the author, Colombo. xiii + 112 pp.
- Parker, H.W. 1934. A monograph of the frogs of the family Microhylidae. British Mus., London. viii+208 pp., 67 figs.
- Parker, H.W. & W.C.O. Hill. 1948. Frogs of the genus *Microhyla* from Ceylon. Ann. Mag. Nat. Hist., (12) 1(10): 759-764.
- Pillai, R.S. 1977. On the frogs of the family Microhylidae from Andamans including a new species. Proc. Indian Acad. Sci., 86B(2):135-138.