

## A New Species of *Leptolalax* (Anura: Megophryidae) from Pulau Tioman, West Malaysia

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**Abstract.** - A new species of *Leptolalax* is described from a cave at the top of Gunung Kajang, Pulau Tioman, Pahang, West Malaysia. It differs from all other Malaysian species of *Leptolalax* in several aspects of coloration and in having smooth as opposed to rough or pebbled skin on the dorsum.

**Key words.** - *Leptolalax*, Anura, Tioman, Malaysia.

### Introduction

There are at least eight species of *Leptolalax* found throughout West Malaysia and Borneo (Berry, 1975; Inger et al., 1995; Inger et al., 1997; Matsui, 1997) but only one of these, *L. gracilis*, is known from both regions. In an unpublished document, Day (1990) reported *Leptobranchium* sp. from Pulau Tioman, Pahang, West Malaysia based on five larvae collected in the Tengku Air Cave (Gua) at 1000 m elevation on Gunung Kajang. Lim and Lim (1999) referred these larvae to *Leptolalax gracilis* based on three additional larvae they collected at a lower elevation (ca. 400 m) on Gunung Kajang. More recently, Grismer et al. (2004) reported two adults from Gua Tengku Air. Examination of those adults indicates that they belong to the genus *Leptolalax* not *Leptobranchium* (but they are not *L. gracilis*). We therefore, refer these specimens and the larvae of Lim and Lim (1999) to the new species described herein.

### Materials and Methods

The following measurements were made with sliding calipers to the nearest 0.1 mm: adults; snout-vent length (SVL), tibial length (TL), head width (HW), head length (HL), and diameter of tympanum (TYM). Tadpoles (Table 1); interorbital distance (IOD), internarial distance (IND), tail length (TL), and tail height (TH). Tadpoles were preserved in 10% formalin and transferred to 70% ethanol. Due to shrinking and wrinkling, head-body width (HBW), head-body height (HBH), and tail height (TH) are likely to be underestimated. Observations on external morphology were made with the use of a dissecting microscope. Specimens were compared to material listed in Appendix I and descriptions in Berry (1975), Inger (1985), Inger et al. (1997), Inger et al. (1995), Inger and Stuebing (1997), Malkmus (1992), and Matsui (1997).

### *Leptolalax kajangensis*, new species (Figs. 1-2)

**Holotype.** - ZRC 1.7714; adult male, 34.0 mm SVL; found inside Gua Tengku Air, Gunung Kajang, Pulau Tioman, Pahang, West Malaysia at 1000 m in elevation. Collected by Jesse L. Grismer and Timothy M. Youmans on 21 July, 2001.

**Paratype.** - ZRC 1.7715; adult male, 35.0 mm SVL. Same data as holotype.

**Diagnosis.** - *Leptolalax kajangensis* differs from all other Malaysian species of *Leptolalax* in lacking distinct dark crossbands on the limbs and having a generally dark, unicolor to weakly patterned dorsum. It differs further from *L. arayai*, *L. dringi*, *L. gracilis*, *L. hamidi*, and *L. maurus*, in having smooth, as opposed to rough, warty skin. It differs further from *L. dringi*, *L. gracilis*, and *L. heteropus* in lacking dark spots on the ventrum. It differs further from *L. gracilis* and *L. hamidi* in lacking a dark inguinal blotch and from *L. gracilis* in lacking a distinctly bicolored forelimb and dark markings on the ventral surface of the foreleg.

**Description of holotype.** - Habitus moderately slender, head longer than wide; snout rounded in dorsal profile, weakly projecting beyond lower jaw; nostrils raised, directed dorsolaterally, and situated on canthi, near tip of snout; canthi rounded; lores slightly oblique; eye large, diameter slightly longer than length of snout; internarial distance less than interorbital distance; interorbital width slightly greater than length of snout; tympanum visible, less than one-half diameter of eye, separated from eye by width of tympanum; vomerine teeth absent; tongue notched, without papillae.

Forelimbs slender; fingers slender, unwebbed, tips rounded; first finger equal in length to second; no subarticular tubercles or elongate cornified pads visible beneath fingers; large inner palmar tubercle present and



Figure 1. Photograph of *Leptotalax kajangensis*, new species, on forest leaf litter.

much smaller outer palmar tubercle at base of fourth digit.

Hindlimbs relatively short; heels overlap when limbs flexed; tibiotarsal articulation of adpressed limb reaches tip of snout; tips of toes rounded; third and fifth toe equal in length; slight webbing between first and second and second and third toes only; oval inner metatarsal tubercle present; subarticular tubercles absent.

Skin on back smooth to faintly pebbled; flanks faintly pebbled; limbs smooth to faintly pebbled; prominent supratympanic fold extending from eyelid to shoulder; ventral surfaces smooth.

**Coloration.** - In life and ethanol, dorsal surfaces almost black with no visible pattern except for minute, faint, light-colored spots; limbs slightly lighter with faint dark mottling; faint dark mottling on flanks blending to grayish dusty ventral surfaces punctuated by minute gray spots. Supratympanic fold darker than dorsum. Iris metallic gold in life.

**Measurements of holotype.** - SVL 34.0 mm; TL 14.2 mm; HW 18.5 mm; HL 10.0 mm; TYM 1.6 mm.

**Variation.** - The paratype closely approximates the holotype in all aspects of coloration and morphology. It differs in the following measurements: SVL 35.0 mm; TL 14.6 mm; HW 19.4 mm; HL 9.4 mm TYM 1.8 mm.

**Etymology.** - This species is named after the type locality of Gunung Kajang, Pulau Tioman, West Malaysia

**Tadpoles.** - Table 1 lists measurements, growth stages, and tooth row formulae of tadpoles. Based on specimens (ZRC 1.3339-41); stages 30, 36, and 37 (Gosner, 1960) from a small stream at 333 m below Gua Tengku Air on G. Kajang and specimens (0051-54 uncatalogued specimens in the British Museum reported by Day, 1990) stage 30 (Gosner, 1960) from Gua Tengku Air. Head and body relatively large and round; nostrils dorsally located, closer to tip of snout than eye; eyes dorsolateral, not visible from below; spiracle sinistral, nearer to eye than vent; vent dextral, opening at margin of ventral fin; dorsal fin slightly deeper than ventral fin, not extending onto head-body; fins not deeper than caudal musculature; oral apparatus not emarginate; mouth subterminal; bordered by a single row of conical papillae; large submarginal papillae without denticles; jaw sheaths black, robust, strongly arched, and finely serrated; upper jaw lacking medial notch; denticles small; rows A1 and P5 markedly shorter than adjacent rows. Tadpoles (ZRC.1.3339-41) from stream dusky brown above with faint darker mottling; venter cream colored, nearly immaculate; faint dark stippling on caudal fins, edges clear and immaculate; lateral line hash marks distinct. Tadpoles from Gua Tengku Air (uncatalogued BM specimens) lack pigment and are white to transparent in life.

**Comparisons with other species.** - *Leptotalax kajangensis* differs from all other Malaysian species of *Leptotalax* on the basis of skin surface texture and coloration. *Leptotalax arayai*, *L. dringi*, *L. gracilis*, *L. hamaidi*, *L. maurus*, and *L. pelodytoides* all have coarsely textured skin ranging from distinctive corrugations in

Table 1. Selected measurements (mm), growth stage (GS), and labial tooth row formulae (LTRF) of *Leptotalax kajangensis*. Abbreviations follow Materials and Methods. \* = Specimen damaged.

Cat. no.	HBW	HBL	HBH	IOD	IND	TL	TH	GS	LTRF
0051	13.5	23.3	8.4	4.8	3.2	39.9	10.0	30	6(2-6)/5(1-4)
0052	15.2	23.8	9.3	6.6	4.9	49.9	13.7	38	6(2-6)/5(1-4)
0053	13.5	23.5	10.0	5.0	4.3	*	*	30	6(2-6)/5(1-4)
0054	14.5	25.5	10.0	5.4	3.9	45.5	11.0	30	6(2-6)/5(1-4)
0055	14.1	25.9	10.0	6.7	4.8	43.5	12.0	38	6(2-6)/5(1-4)
ZRC.1.3339	11.2	23.5	8.2	6.0	2.6	41.4	*	30	6(2-5)/5(2-4)
ZRC.1.3340	19.6	30.8	14.5	7.3	4.5	56.4	*	35	6(2-6)/1(1-3)
ZRC.1.3341	18.0	31.9	14.2	7.8	4.6	51.9	*	36	5(4)/4(1-3)



Figure 2. Tadpole of *Leptotalax kajangensis* at type locality.

*L. dringi* to isolated tubercles of varying sizes in *L. gracilis* (Inger and Stuebing, 1997; Inger et al. 1997; Matsui, 1997). *Leptotalax kajangensis* resembles *L. pictus* and *L. pelodytoides* in having smooth to weakly pebbled skin on the dorsum (Inger et al. 1995) but differs from *L. pictus* in lacking small tubercles on its sides (Malkmus, 1992). *Leptotalax kajangensis* falls within the size range (SVL 34.0-35.0 mm) of *L. dringi* (SVL 30.0-38.8 mm), *L. gracilis* (SVL 31.0-48.0 mm), *L. heteropus* (SVL 33.0-35.0 mm), *L. pelodytoides* (SVL 30.0-42.0 mm), and *L. pictus* (SVL 31.0-47.0 mm) but is larger than *L. arayai* (SVL 29.9) and *L. marus* (SVL 26.0-32.0). *Leptotalax kajangensis* differs most notably from other species in coloration. Its generally unicolor black dorsal pattern contrasts sharply with the various mottled body patterns of *L. dringi*, *L. hamidi*, *L. heteropus*, *L. pelodytoides*, and *L. pictus*. It does resemble *L. maurus* to some extent in that *L. maurus* has a black unicolor dorsum but differs in that the latter also has lighter colored limbs with darker crossbars and light colored spots on the flanks, patterns which are absent in *L. kajangensis*. *Leptotalax gracilis* also has a generally dark dorsal coloration with varying degrees of dark mottling but is distinctive in having a light colored brachium. The single specimen of *L. arayai* has a light ground color with darker crossbands on the limbs.

**Natural history.** - Both specimens of *Leptotalax kajangensis* were found in a cave (Gua Tengku Air) near the summit of Gunung Kajang at approximately 1000 m in elevation. This subterranean, obliquely oriented cavern is formed from the overhang of large boulders piled on top of one another. It contains a small pond (3 m x 4 m) drained by a small subterranean stream (1-3 m in width by 2-4 cm in depth) running for 3-4 m along the cave floor. Both specimens of *L. kajangensis* were observed in the afternoon sitting on top of large rocks adjacent to the stream approximately 10 m from the entrance to the cave and approximately 10 m below the outside ground level. It was from the subterranean pond that Day (1990) collected "large tadpoles" he referred to as *Leptobrachium* sp. We observed additional tadpoles and

assume these to be larvae of *Leptotalax kajangensis* based on the fact that the type material were collected from the same stream and adults were observed calling from the edge of the pond.

Three additional larvae examined here (ZRC.1.3339-41) were collected from a lower stream on Gunung Kajang at approximately 400 m on 26 June 1996 (Lim and Lim, 1999). We tentatively assign these to *Leptotalax kajangensis* because they match the larvae from Tengku Air in morphology (Table 1). However, the Tengku Air specimens lack pigment and are white to transparent in life (Fig. 2). ZRC.1.3339-41 are countershaded with dark pigment above and have minute dark flecks on a light venter. This indicates that either *L. kajangensis* is not confined to only the upper most elevations of Gunung Kajang or that there may be an additional species of *Leptotalax* found lower down on the mountain.

**Biogeography.** - Pulau Tioman had a land positive connection with Peninsular Malaysia as late as the Pleistocene (Voris, 2000). The presence of amphibian species on Pulau Tioman such as *Leptotalax kajangensis*, *Megophrys nasuta*, *Rana hosii*, *R. picturata* and others that require streams with moderate to strong currents for reproduction suggests these species are unlikely candidates for long distance dispersal over flat, low-lying landscape (Inger and Voris, 2001). Pulau Tioman was part of a large granitic arc of mountains extending from what is currently peninsular Malaysia through the Kepulauan Anambas and Natunas across the Greater Sunda Shelf which provided a dispersal corridor for montane species (Inger and Voris, 2001) across the flat, low-lying exposed Sunda Shelf. Thus, the presence of stream-breeding species requiring moderate to fast flowing water on Pulau Tioman is most likely a result of vicariance.

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