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### Descriptions of Some Tadpoles From Thailand

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A collection of frog larvae was made over a ten month period from the Sakaerat Experimental Station and environs, located 250 km. northeast of Bangkok in Nakhon Ratchasima Province, Thailand. The purpose of making the collection was to establish the ecological patterns of frog larvae in a seasonal tropical situation. The following species are represented: BUFONIDAE—*Bufo melanostictus*; MICROHYLIDAE—*Calluella guttulata*, *Glyphoglossus molossus*, *Kaloula mediolineata*, *K. pulchra*, *Microhyla berdmorei*, *M. butleri*, *M. heymonsi*, *M. inornata*, *M. ornata*, *M. pulchra*; RANIDAE—*Ooeidozyga laevis*, *Ooeidozyga lima*, *Rana limnocharis*, *R. nigrovittata*; RHACOPHORIDAE—*Chirixalus nongkhorensis*, *C. vittatus*, *Polypedates leucomystax*, *Rhacophorus bimaculatus*. The purpose of this report is to describe and figure the larvae of the three species that have not been described adequately and figured previously: *Kaloula mediolineata*, *Microhyla inornata*, and *Chirixalus nongkhorensis*.

#### MATERIALS AND METHODS

Specimens were collected with a dip net, then preserved and stored in 10 per cent formalin. The bulk of the specimens are on deposit at Field Museum of Natural History. A synoptic collection will be deposited at the Applied Scientific Research Corporation of Thailand.

Specimens were examined under a dissecting microscope, measurements were taken with an ocular micrometer. Gosner's (1960) stages were used.

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## SPECIES ACCOUNTS

*Kaloula mediolineata*. Figure 1.

*Description*.—Head and body oval, flattened above and below, wider than high; snout broadly rounded; eyes lateral, visible from below; nostrils closed at stage 39, open at stage 43, distance between nostrils less than one half interorbital distance; mouth terminal, slightly dorsad, lips not expanded; spiracle median, opening three-fourths to four-fifths of distance from tip of snout to end of body; spiracle not developed into a tube; anal tube running obliquely along body and tail fin juncture, extending posteriorly along ventral fin for a short distance.

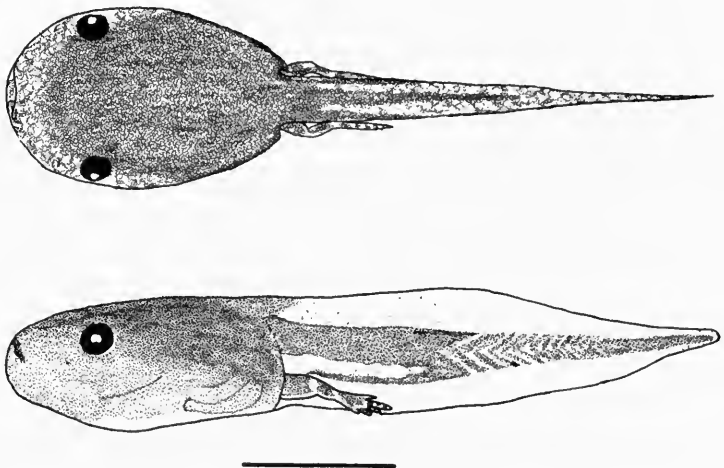


FIG. 1. Dorsal and lateral views of *Kaloula mediolineata*, stage 38. Line equals 5 mm.



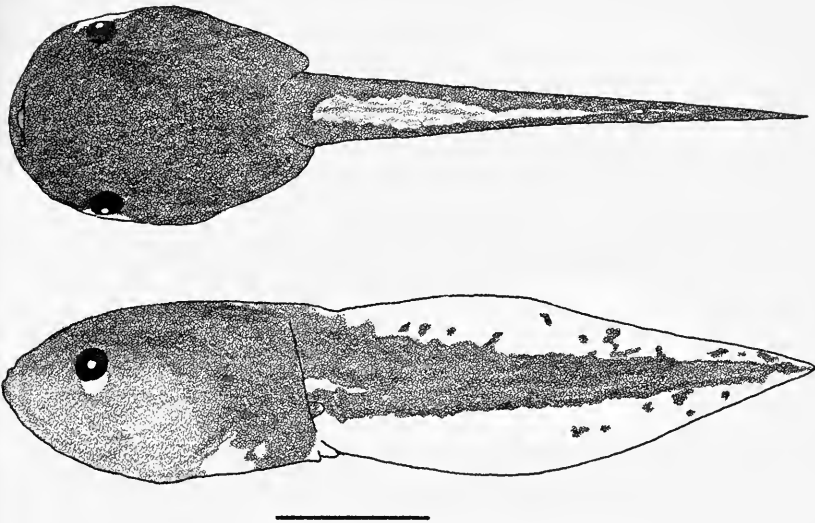


FIG. 2. Dorsal and lateral views of *Kaloula pulchra*, stage 27. Line equals 5 mm.

Tail elongately tapered, no terminal filament; dorsal fin beginning at end of body; greatest tail height just less than, just greater than, or equal to body height.

Color pattern in preservative uniformly dark above; anterior half of venter dark, no melanophores on posterior half; gut dark; caudal muscle dark with light stripe anteriorly; caudal fins basically transparent with a few scattered melanophores or a sparse melanophore network.

Eye moderately large, 11 to 13 per cent head-body length; width of oral apparatus 18 to 23 per cent head-body length; head-body 38 to 40 per cent of total length; maximum length recorded 27.8 mm. at stage 37; snout-vent length at metamorphosis 8.6 to 8.7 mm.

*Comparisons.*—*Kaloula pulchra* is the only sympatric *Kaloula* found over the entire geographic range of *K. mediolineata*. The most striking characteristic differentiating the larvae is that the spiracle of *K. pulchra* is produced into a tube which extends posteriorly past the body and empties next to or posterior to the anus. The spiracle of *K. mediolineata* is not produced into a tube and empties much anterior to the anus. The eye of *K. pulchra* is smaller (6 to 11 per cent head-body length), but the general coloration is similar to *K. mediolineata* (figs. 1, 2).

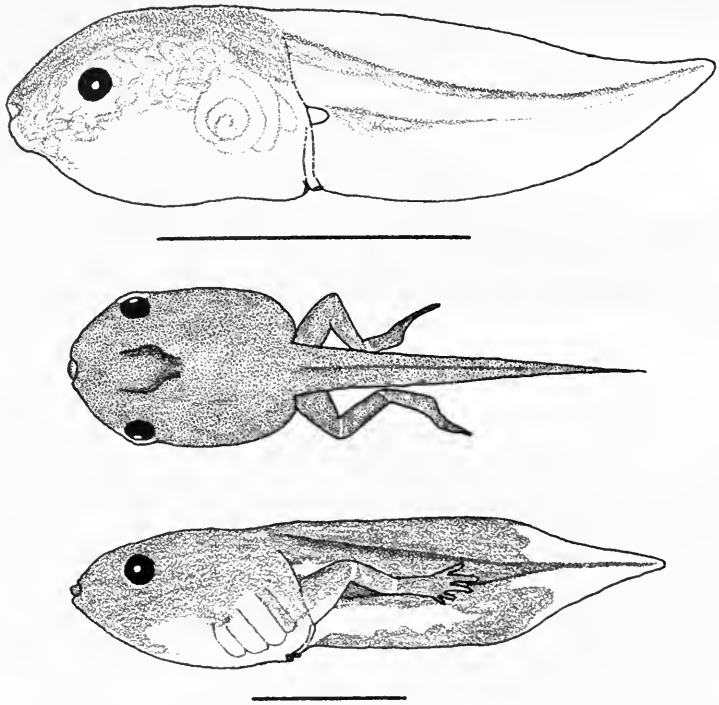


FIG. 3. The larva of *Microhylis inornata*. Upper figure lateral view at stage 27, lower figures dorsal and lateral views at stage 39. Lines equal 5 mm.

*Remarks:* The known range of *Kaloula mediolineata* is restricted to western and peninsular Thailand. A small series of larvae were collected from a small temporary pond in the deciduous dipterocarp forest at Sakaerat. I never heard the adults call even though special efforts were made to record the mating calls of the frogs encountered. Local village people, who were adept natural historians, related that *Kaloula mediolineata* use the same ponds as *Glyphoglossus molossus* to deposit eggs after a heavy rain. The *K. mediolineata* call after the *Glyphoglossus* call on the same night, the *mediolineata* beginning about midnight. One reason the people are so intimate with the breeding habits of *K. mediolineata* is that they consider *mediolineata* a much better tasting frog than either *K. pulchra* or *G. molossus*.

Most of the specimens were raised in the laboratory from samples collected in the field. One of the metamorphosing larvae had the light median dorsal stripe characteristic of the adults, but this was lost in preservation.

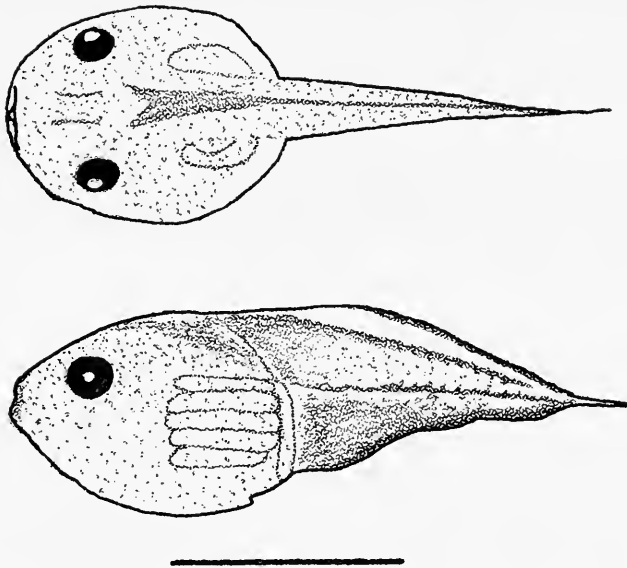


FIG. 4. Dorsal and lateral views of *Microhyla ornata*, stage 25. Line equals 5 mm.

### *Microhyla inornata*. Figure 3.

*Description*.—Head and body oval, flattened above, spheroidal ventrally, wider than high; snout broadly rounded; eyes lateral, visible from below; nostrils closed at stage 39, distance between nostrils about one-fourth interorbital distance; mouth terminal, slightly dorsad, lips not expanded; spiracle median, opening nine-tenths of distance from tip of snout to end of body to located at the end of the body; spiracle produced into, at most, a very short tube; openings of spiracle and anus next to each other; anal tube running between body and lower caudal fin, not branched posteriorly.

Tail elongately tapered, pattern of tail tip visually producing a filament; dorsal fin beginning at end of body; greatest tail height about equal to body height.

Color pattern in preservative uniformly dark above or with uniformly scattered numerous melanophores; anterior third of venter dark with no melanophores on belly or only a few melanophores under the mouth region; tail of larvae up to stage 27 with melanophores on upper half of musculature and on lower margin of musculature, fins transparent; tail of late stage larvae (38-39) dark except for light streaks on musculature and ventral fin anteriorly

and tip of tail with transparent fins producing a filamentous appearance of the tail tip musculature.

Eye moderately large, 8 to 13 per cent head-body length; width of oral apparatus 17 to 22 per cent head-body length; head-body 38 to 41 per cent total length; maximum total length recorded 19.1 mm. at stage 39.

*Comparisons.*—The larvae of this species are the same size and general habitus of *Microhyla ornata*. Smith (1924) commented that some of the larvae that he presumed erroneously all to be *Microhyla ornata* metamorphosed into *Microhyla inornata*. He could not distinguish the species as larvae with his laboratory samples. In natural settings, the two species are easily differentiated by relative darkness, however. *Microhyla inornata* is a dark brown tadpole in the water, *Microhyla ornata* is almost transparent. The best differentiating characteristic of preserved larvae is that the caudal fins of *M. ornata* are often dark outlined (fig. 4) while the fins of *M. inornata* are either entirely dark except for the tip or transparent. In preservative, larval *M. inornata* resemble larval *Kaloula pulchra*. These two species are of different size (19.1 mm. vs. 31 mm. total length) and the spiracle is never produced into as pronounced a tube in *M. inornata* as in *Kaloula pulchra*.

### **Chirixalus nongkhorensis.** Figure 5.

*Description.*—Head and body oval; snout rounded; eyes dorsal; distance between nostrils slightly less than interorbital distance; mouth subterminal; oral disk emarginate laterally, single row of papillae interrupted anteriorly and posteriorly; denticle formula

1        1  
2-2    3-3

— or —, in the latter case, the last denticle row of the upper labi-

1-1    1-1  
2       2

um consisting of only 5-6 denticles; beak well developed, serrate; spiracle sinistral, midway between tip of snout and base of tail, low on side of body; anus dextral.

Tail with a filamentous tip; dorsal fin beginning at end of body; greatest tail height about equal to body height.

Color pattern in preservative blotched gray above, clear below; tail strongly or weakly blotched gray.

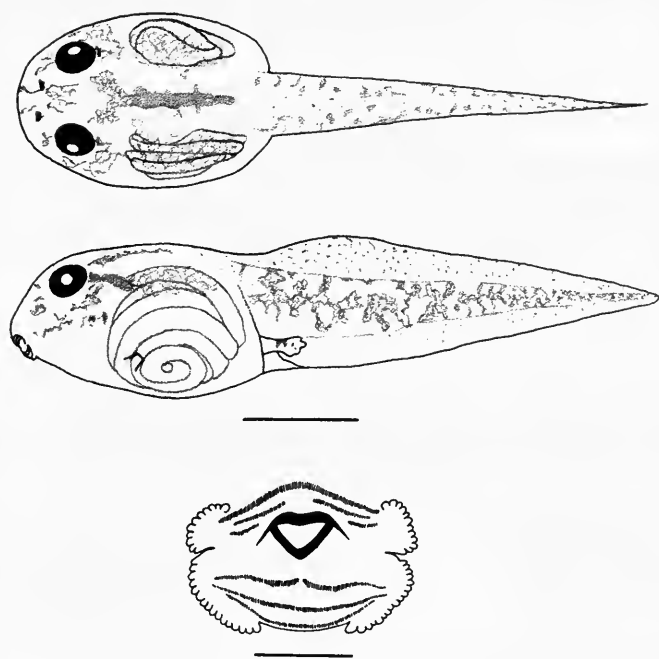


FIG. 5. The larva of *Chirixalus nongkhorensis* at stage 35. Upper figures dorsal and lateral views; line equals 5 mm. Lower figure of mouthparts; line equals 1 mm.

Eye large, 13 to 15 per cent head-body length; width of oral apparatus 17 to 22 per cent head-body length; head-body 34 to 46 per cent total length; maximum total length recorded 39.6 mm. at stage 37.

*Comparisons.*—The larva of *Chirixalus nongkhorensis* is quite distinct from *Chirixalus vittatus*, the only other species of the genus which was collected. Larval *C. nongkhorensis* are drab in life, losing no brightness of color in preservative. Larval *C. vittatus* have brightly contrasting yellow and black tails in life, the contrast in pigment extending into preservative (fig. 6). The denticle rows of

*C. vittatus* are better developed, having the formulae  $\frac{1}{3-3}$ ,  $\frac{1}{3-3}$ , or  $\frac{1}{4-4}$ .  
 $\frac{1-1}{2}$     3    3

*Remarks.*—There is confusion in the literature concerning the identity of larval *C. vittatus*. At Sakaerat, only two species of

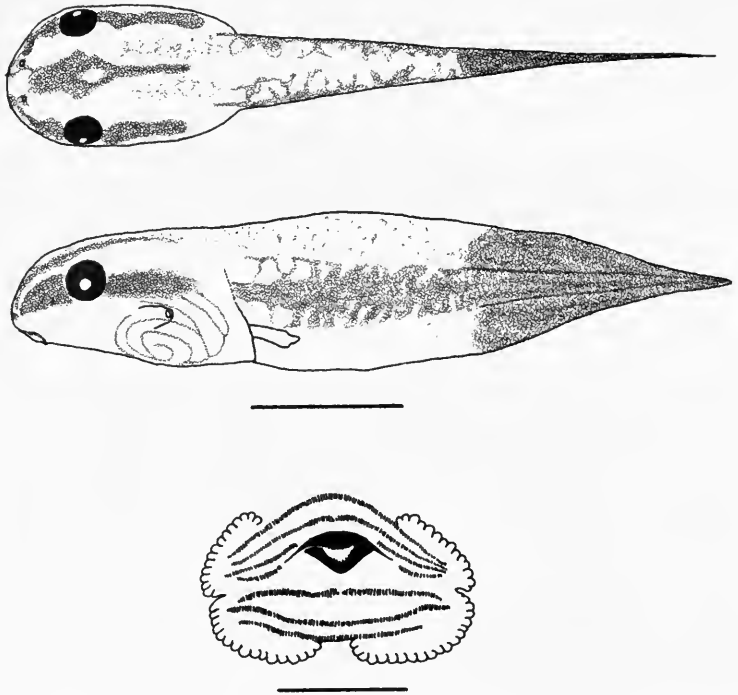


FIG. 6. The larva of *Chirixalus vittatus* at stage 33. Upper figures dorsal and lateral views; line equals 5 mm. Lower figure of mouthparts; line equals 1 mm.

*Chirixalus* were encountered both as adults and larvae: *C. nongkhorensis* and *C. vittatus*. By matching metamorphosing individuals with juveniles of each species, I have determined the larval identities as illustrated in Figures 5 and 6. Pope (1931) figured the larvae of two *Chirixalus* species from China: *C. doriae* and *C. vittatus*. His description of *C. doriae* matches the specimens I have identified as *C. vittatus*. The only point of difference is that the Chinese larvae were greenish brown in life, the Sakaerat specimens were yellow. The pattern of dark lateral stripes passing through the eye, the contrasting black tip of the tail, and a denticle formula of 1 of the Chinese specimens

$$\begin{array}{r} 4-4 \\ \hline 1-1 \\ 2 \end{array}$$

of "*C. doriae*" match point for point with the Sakaerat specimens of *C. vittatus*. As each locality had but two species of *Chirixalus*, sharing one in common, it is reasonable to assume that the similar appearing larvae should represent the same species: *C. vittatus*. Therefore,

Pope's description of *C. doriae* is actually that of *C. vittatus*, *vice versa*. Pope noted that his description of *C. vittatus* (actually *C. doriae*) differed from the description of *C. vittatus* by Smith (1924). Smith's description of *C. vittatus* gave a denticle row formula of

$$\begin{array}{c} 2 \qquad 2 \\ \hline 2-2 \text{ or } 3-3. \\ \hline 1-1 \qquad 3 \\ 2 \end{array}$$

The denticle row formulae given by Smith agree with

Sakaerat specimens of *C. vittatus* (allowing for differences of interpretation of whether a denticle row is composed of two abutting halves or single) and Pope's description of *C. doriae* (actually *C. vittatus*), and differs from Pope's description of *C. vittatus* (actually *doriae*)

$$\begin{array}{c} 1 \qquad 1 \\ \hline 2-2 \text{ or } 3-3. \\ \hline 1-1 \qquad 1-1 \\ 2 \qquad 2 \end{array}$$

given as

states:

"Light brown, thickly speckled with dark brown and gold, below whitish; membranes almost colorless.

Another form has a dark band along each side of the head and body and continued along the muscular part of the tail, the posterior part of which is black."

Smith pictured the first form, which bears no resemblance to the *C. vittatus* from Sakaerat. The color description of the second matches the Sakaerat specimens of *C. vittatus*. Apparently Smith's two forms actually represent two species. I have no idea what species the first form represents.

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