

DESCRIPTIONS OF FIVE TADPOLES FROM SIAM.

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WITH TWO PLATES.

The following tadpoles have not been yet described.

That *Callula pulchra*, the common "bull-frog" of Bangkok and Singapore, should have remained so long unknown, is rather surprising, considering how plentiful and easily obtained it is.

Microhyla ornata is interesting, on account of the formation of its mouth, which is modified in a peculiar way for obtaining food from the surface of the water.

Rana nigrovittata and *Bufo parvus* were obtained this year in the mountain streams of Khao Sebab, Chantabun.

My thanks are due to Mr. C. L. Groundwater, for his very careful drawings illustrating this article.

Microhyla achatina.

Head and body ; length, $1\frac{3}{4}$ times to twice its breadth. Nostrils, rather far apart, midway between the eyes and the upper lip. Eyes, perfectly lateral, four times as far apart as the nostrils. Spiraculum, median, the transparent sheath opening below the centre of the coil of gut. Anal tube, median, long, curved, opening at the lower edge of the caudal membrane. Tail, twice as long as the head and body, about four times as long as deep, terminating in a fine point ; crests moderate, upper convex, at its greatest height nearly as deep as the lower, not extending on to the back ; lower crest nearly straight. Toes, almost fully webbed.

Mouth. I have left this until the last, as it presents unusual features, and is quite different from that of the other three species of *Microhyla* (*M. ornata*, *pulchra*, and *rubra*) at present known. As one would expect in this type of Batrachian, it has neither beak nor teeth. It consists of a horse-shoe shaped upper lip and a contractile lower one, the latter being furnished, in addition, with a large cutaneous expansion or flap, which can be erected or depressed at will. When the tadpole

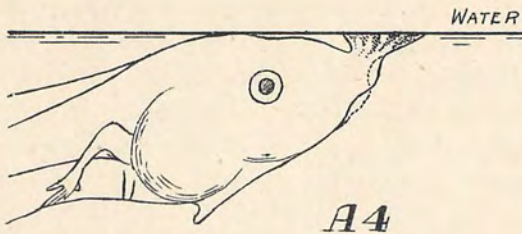
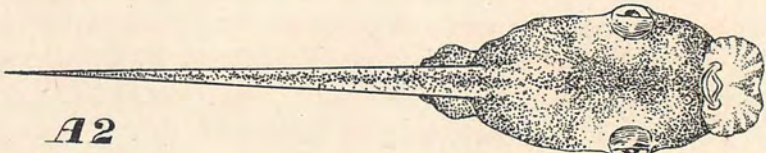
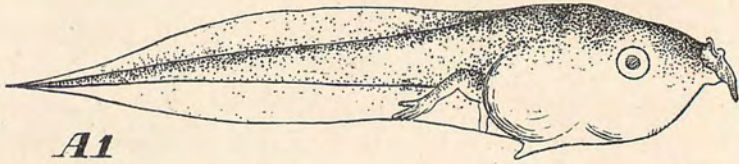
is at rest, and is below the surface of the water, this flap is lowered and is curved backwards upon itself (Fig. AI); but when feeding at the surface, it is raised and spread out, (Figs. 2 and 4), and then forms a very shallow, saucer-like arrangement, the purpose of which is to act as a funnel, and to furnish as large an area as possible for catching any minute particles floating upon the water, and which are drawn towards it by the strong sucking action of the creature. The lower jaw is constantly in action, as has been already described with the other tadpoles of this genus. Whether these tadpoles actually feed upon particles in the water, I could not find out, but that the main supply is drawn from the surface, is shown by the frequency with which they are to be seen feeding there, and by the readiness with which, on shaking the dust of decaying vegetable matter on to the water, they will at once rise up and devour it. Large particles, or those which are not suitable as food, are rejected and promptly spat out again, but it is surprising, when the tadpole is fully grown, what big pieces will be swallowed. With the protrusion of the fore legs, this expansion commences to be absorbed, but the tadpole still continues to feed, though less greedily; and it continues to do so almost up to the time of leaving the water.

Colour. Dark brown to black; sides of the head and body, between the eyes and the coil of gut, more or less transparent. A gold mark between the eyes (very conspicuous when young), and with or without gold or orange patches upon the sides of the body and tail. Caudal membrane colourless, or with minute black speckles.*

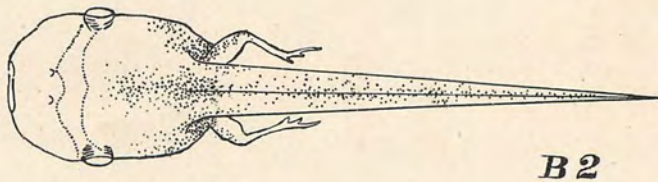
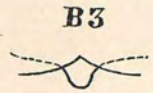
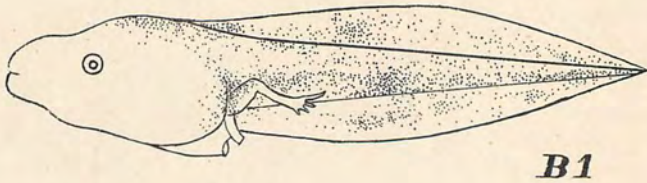
* Descriptions of the colouration of tadpoles must not be taken too strictly, as they are liable to variation. This variation appears to affect entire broods, rather than separate individuals. The original description of *M. achatina* was drawn up from specimens reared during 1914 and 1915. They were dark brown to black in colour, with a transparent patch on either side of the body between the eyes and the coil of gut, and a gold bar between the eyes. A brood taken this year had no transparent patch, and had, in addition to the gold bar on the forehead, a considerable amount of yellow along the flanks which later turned to orange. Another brood from near Paknampo, had a bright yellow spot at the base of the tail.

The "transparent" tadpole of *Microhyla ornata*, as described by Stanley Flower, is by no means always colourless, but can assume quite a respectable shade of grey-brown, whilst the peculiar arrangement of the pigmentation of the tail in Flower's unknown "transparent" tadpole, (P.Z.S. 1899, p. 903), may exist in both *M. ornata* and *M. achatina* and probably also does in others.

The tadpoles of *Callula pulchra* have considerable power of changing



MICROHYLA ACHATINA



x 2



CALLULA PULCHRA

Dimensions. Total length, 20 to 22 mm. Head and body, 7. Depth of tail, 4. Expansion of lip, fully extended, 2×3 . This structure may vary in size in different broods. The drawing (A 2) is from a large one and is by no means exaggerated,

The tadpole spends most of its time, almost motionless, a short distance below the surface of the water, rising at intervals to feed as described.

Microhyla achatina spawns throughout the rainy season in Bangkok. I have found the tadpoles in May, before the monsoon had properly broken, and I have found them again in June and July, and as late as October. The eggs are laid in masses and float on the surface of the water.

The young frog on leaving the water is of a light golden-brown colour above, with a broad dark wavy vertebral band (A 3). Many specimens at this stage are practically indistinguishable from the young of *M. ornata*. After two or three weeks they begin to assume the reddish tinge of adult life.

Microhyla pulchra.

Characters ; similar to *M. ornata*, but larger (*vide*, Flower, P.Z.S., 1899, p. 902).

Colour, the same ; if anything, more transparent. As I have

their colour, this change apparently being dependent upon their surroundings. I could induce it myself by changing the water in their tank. If it was muddy, they became olive, if clear, black, and the change would be effected in a few hours time. I once found a couple of specimens that were dirty pink in colour, so pale in fact that I thought I must have encountered some form of albinism. They were put aside by themselves, but on the following morning had resumed their usual dark brown colouration.

This power of changing colour is not necessarily carried into later life. The perfect form of *Callula pulchra* does not possess it, whilst exactly the converse obtains with *Rhacophorus leucomystax*, the common Tree-Frog of Bangkok. The perfect frog is probably as versatile and rapid a quick change artist as any frog known, and can vary from a pale yellow or almost pink to a dark grey or brown in an exceedingly short space of time, yet its tadpole is unable to vary in colour in the slightest degree.

The size of tadpoles at the time of completing their metamorphosis may vary considerably, and depends chiefly upon their food supply. The descriptions here given are of well grown specimens, with the hind-limbs fully developed, and before the protrusion of the fore-limbs,

already mentioned in the footnote to *M. achatina*, the colouration and degree of transparency of *M. ornata* is by no means constant.

Dimensions. Total length 28 mm., head and body 9.

The specimens examined were obtained at Nong Pling, near Paknampo, in June.

I could find no reliable character except that of size, upon which to rely for a diagnosis between these two species. With half a dozen well grown living specimens of each in a dish together, it was not difficult to separate them, chiefly on account of the difference in size. Apart from this the snout of *M. pulchra* was shorter, the body less regularly oval in shape, and there was a particular green tint about the tadpole which made it easy to distinguish it from *M. ornata*. On none of these points however, could one rely, and in a preserved specimen they would disappear entirely.

The young on leaving the water have the handsome markings upon the back which are so characteristic of the adult.

Callula pulchra.

Head and body ; length about $1\frac{1}{2}$ times its breadth ; much flattened above ; snout very broad. Nostrils close together, much nearer the eyes than the tip of the snout. Eyes perfectly lateral, six times as far apart as the nostrils. Spiraculum median, large, the transparent sheath opening below the hinder end of the body. Anal tube long, median, curved downwards and backwards, projecting below the edge of the caudal membrane. Tail twice as long as the head and body, bluntly pointed ; crests full convex, about equal in depth.

Mouth simple (without horny beak or teeth), very small, placed at the extremity of the head, and consisting of a straight (viewed from above) upper lip, and a contractile lower one. Toes not webbed.

Colour. Dark olive-brown to black, with or without fine golden speckles. Below often speckled with white. Sometimes a pale curved bar across the snout, and light markings on the sides. Caudal membranes colourless, or with small dark patches.

Dimensions. Total length, 40 mm. Head and body, 14. Breadth of body, 9. Depth of tail, 7.5.

It will be seen from the above description that this tadpole

bears no resemblance whatever to the "transparent" tadpole of Stanley Flower (P. Z. S. 1899, p. 903), and which he believed to belong to this species.

A good account of the spawning habits of this frog has already been given by Mr. Ferguson (Journ. Bombay Nat. Hist. Soc., Vol. XV, p. 391, 1904), and there is no need here to repeat his remarks. I can, however, confirm them all.

Callula pulchra spawns in Bangkok at least twice during the rainy season. The first eggs are deposited some time during April. May or June, as soon in fact as a heavy fall of rain will provide them with a sufficient supply of water. As the exact time of deposition can never be foretold, the female is enabled to carry the eggs in her body for a considerable period, ready for expulsion as soon as the proper time arrives. I have found them stuffed with apparently ripe spawn as early as February. Shallow water is invariably chosen for breeding purposes. Deep puddles, such as form after an hour or two of heavy rain, or road-side drains are selected, whilst the deeper and more permanent water of ponds, even though close at hand and equally accessible, is avoided. The instinct of the preservation of species would here appear to be at fault, but this is overcome by the immense numbers of young which are produced. For the majority of these shallow puddles, unless more rain falls within a few days, dry rapidly up, and the inhabitants perish. Millions must die every season from this cause alone, but as Mr. Ferguson has remarked, "considering the vocal powers of the adults, this infant mortality can be contemplated without sadness."

The tadpoles of *Callula pulchra* are every active, constantly moving about from place to place in search of food. They are unable, by their own powers, to remain below the surface of the water, and unless tucked away beneath some leaf or stone or other matter, rise involuntarily to the surface, where they remain floating. They will devour both animal and vegetable matter, and the more putrid it is, the more they seem to like it. To watch them tackling a piece of meat or fruit, one would imagine them to be tadpoles of the Ranid type with horny beak and teeth, rather than to belong to the toothless Engystomatid group. The lower jaw is in constant movement.

The young on leaving the water vary from black to bronze brown, with light brown or golden patches on the limbs. The light flank mark may or may not be present.

They are very active, much more so than their parents, and given plenty of food grow rapidly. One I kept measured after two months 28 mm. from snout to vent.

Rana nigrovittata.

Head and body; length a little more than $1\frac{1}{2}$ times the breadth; snout rounded. Nostrils nearer the tip of the snout than the eyes. Eyes towards the upper part of the head, looking outwards and upwards, not twice as far apart as the nostrils. Spiraculum sinistral, directed backwards and upwards, nearer the eye than the vent, prominent in life. Anal tube pointing straight backwards and downwards, opening on the right hand side of the caudal membrane. Mouth subterminal; sides with a single row of papillae, below a double row. Beak broadly edged with black, finely serrated; upper lip with a long continuous row of teeth, followed by a second row broadly interrupted by the beak; lower lip with three long continuous rows, or the upper very narrowly interrupted. Tail, about twice as long as the head and body, four times as long as deep; tip bluntly pointed; crests fairly full, upper equal to or a little deeper than lower, not extending on to the back; both slightly convex. Dorso-lateral fold defined. Toes nearly fully webbed.

Colour. Light olive to light brown, finely speckled with darker. A dark band passing through the nostril and eye on to the flank. Tail spotted with black. Below pale grey.

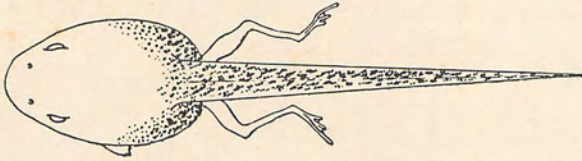
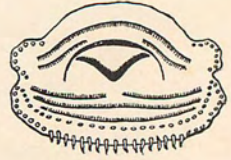
Dimensions. Total length, 37 mm. Head and body, 13. Breadth of body, 8. Depth of tail, 6.

The young on leaving the water resemble their parents.

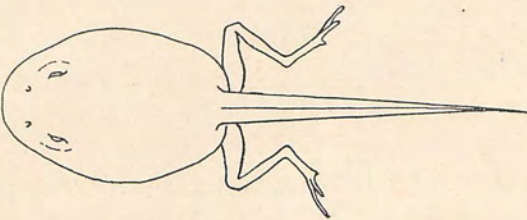
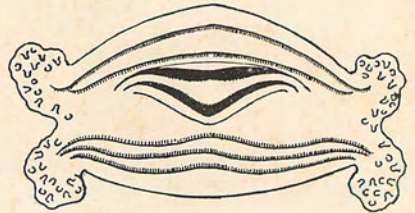
Large numbers of these tadpoles were found at the end of March, in the small mountain streams of Khao Sebab, Chantabun. They were found at all elevations up to 1,500 feet, inhabiting the quiet pools and backwaters branching off from the main current.

Bufo parvus.

Head and body; length $1\frac{1}{3}$ to $1\frac{1}{2}$ times its breadth; snout rounded. Nostrils nearer the eyes than the tip of the snout. Eyes towards the upper surface of the head, looking outwards and slightly upwards,



RANA NIGROVITTATA



BUFO PARVUS

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twice as far apart as the nostrils. Spiraculum sinistral, directed backwards and upwards, a little nearer the eye than the vent. Anal tube short, median, directed backwards and downwards. Mouth subterminal; beak broadly edged with black, finely serrated; papillæ short, at the sides of the mouth only; upper lip with two long series of teeth, the lower narrowly interrupted; lower lip with three long series of uninterrupted teeth. Tail short, one and a half times as long as the head and body, about three times as long as deep, tip rounded; crest full, convex, upper equal to or a little deeper than lower, not extending on to the back. Toes webbed at the base.

Colour. Head and body blackish; muscular portion of tail pale brown; membranes almost colourless.

Dimensions. Total length, 25 mm Head and body, 10; depth of tail, 4.5.

The young on emerging from the water are bronze-brown in colour, usually with a pinkish patch across the snout, and others upon the body, these patches increasing in size and number as the little creature grows. The parietal ridges are not apparent at first, but begin to appear in about five weeks time.

The tadpoles were found on Khao Sebab, and were taken at the same time and in similar situations as the preceding species.

In company with another species of frog with a remarkable dermal flap on the top of its head, and which I believe to be new to Science, *Rana nigrovittata* and *Bufo parvus*, were the only Batrachians met with upon this hill at any elevation. I was unfortunately just too late to procure the tadpole of this unknown frog, but found plenty of the young ones just leaving and having left the water.

Whether these hill dwellers breed at any other time, I do not know, but one is led to infer that it is an instinct of preservation which leads them to spawn at this particular season, the dryest time of the whole year, and the very opposite to that chosen by those species which inhabit the plains. For at no other time could such suitable conditions be found. Every stream on this steep hill during the wet monsoon, must become a small torrent, washing down all before it, and obliterating those quiet pools and backwaters which are so necessary for the development of these tadpoles.