NOTES ON SOME TADPOLES, TOADS AND FROGS FROM JAVA

by

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Some years ago during a residence in Java, Dr. H. BOSCHMA collected a fairly large number of tadpoles and some adult frogs and toads, which he kindly left to me for examination. The result of the systematical part of this work is presented in this paper. As Dr. BOSCHMA reared the larvae of several species from the eggs and preserved them at successive stages of development, there is still a rich material left for embryological study.

Most of the animals being collected near Batavia, Buitenzorg and Tjibodas — all thoroughly investigated parts of the island — it can hardly be surprising that only three larvae were found, which had not hitherto been described, the species being known from adult specimens only. Besides for some species new localities could be recorded.

The collection was made from October 1920 till May 1921. Nearly all the material is excellently preserved in formaline 4%. As the larvae hardly (if at all) shrink in this fluid, formaline is much to be preferred to alcohol, in which the shrinking is considerable.

I have refrained from giving a complete list of the literature on the subject, as this can be found in VAN KAMPEN, Amphibia of the Indo-Australian Archipelago, 1923. Only the works that I actually used and the literature after 1923, have been cited under each species and in the bibliography at the conclusion of the paper.

I am indebted to Prof. Dr. P. N. VAN KAMPEN for valuable advice and criticism on this subject, which has been his special field of research for so many years.

Moreover Dr. K. W. DAMMERMAN, Director of the Zoological Museum at Buitenzorg, kindly furnished me with identified tadpoles from this Institution, which in some cases were useful to me for comparison.

PELOBATIDAE.

Megalophrys montana KUHL & v. HASSELT.

Megalophrys montana BOULENGER, 1882; WEBER, 1898; ANNANDALE, 1917; SMITH, 1917; VAN KAMPEN, 1923.

Localities: Tjibodas — many tadpoles.

Tjibeureum — many tadpoles and a few adults.

The larvae were found in December, January and April in running water, sometimes together with the tadpoles of *Bufo cruentatus, Megalophrys hasselti, Rana kuhli* and *Rhacophorus javanus.*

Megalophrys hasselti (S. MÜLLER).

Leptobrachium hasselti BOULENGER, 1890; VAN KAMPEN, 1907.

Megalophrys hasselti BOULENGER, 1908; VAN KAMPEN, 1909 and 1923; ANNANDALE, 1917; SMITH, 1925.

Localities: Tjibodas and environs (Tjiwalen, Tjibogo) — tadpoles.

Tjiapoes, on the slope of the mount Salak — tadpoles.

Many larvae of various sizes were caught in running water in December, January, April and July, together with those of *Meg. montana, Rana kuhli* and *Rana macrodon.* They are all of the uniformely coloured greyish brown type.

BUFONIDAE.

Bufo cruentatus TSCHUDI.

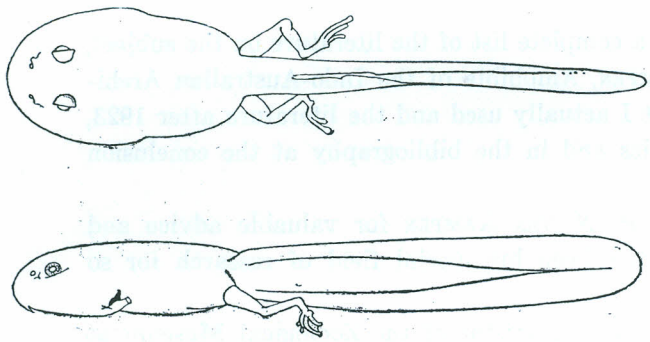
Bufo cruentatus HORST, 1883; VAN KAMPEN, 1923.

Bufo montanus WERNER, 1897.

Localities: Tjibeureum and environs; wood with many little waters.

Some adult frogs were captured and several tadpoles, which have not been described hitherto and which probably belong to this species, as will be discussed after the description of the larva.

Description of the tadpole (fig. 1).



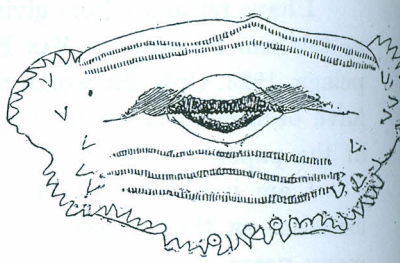


Fig. 1 & 2. Tadpole and mouth of the tadpole of *Bufo cruentatus.*

Body: regularly elliptical in outline, its length one and a half to twice its breadth.

Eyes: dorsal, nearer to the tip of the snout than to the spiraculum. Interorbital space one third to nearly half of the breadth of the body measured across the eyes.

Nostrils: somewhat nearer to the eyes than to the tip of the snout; rather wide apart the distance between them nearly equal to the interorbital space.

Spiraculum: not conspicuous, sinistral and nearly equally distant from the tip of the snout and from the vent.

Anus: medial at the end of a fairly wide tube, which generally is a little shifted to the right imitating a dextral situation of the vent. In somewhat older larvae with well developed hindlegs, however, the ventral crest does not fully extend to the root of the tail and the medial position of the anus is clearly visible.

Mouth: (fig. 2) ventral, somewhat wider than the interorbital space; one row of pointed papillae borders the upper lip along its sides and the lower lip all along without interruption; at the sides of the mouth a few stray papillae are often found within this row.

Series of teeth: $\frac{1^{1}1}{3}$. The interruption in the second row on the upper lip is very narrow and may be absent. The three rows on the lower lip are subequal in length. Jaws rather narrowly edged with black and finely serrate.

Tail: more than one and a half times as long as the body and three to three and a half times as long as deep, the depth remaining practically the same throughout the tail. Tip broadly rounded. Crests rather narrow and hardly convex. The dorsal crest does not extend to the root of the tail but ends at a little and variable distance from the body, the last part being a low, rather thick ridge. At about two thirds of its length the muscular portion of the tail suddenly narrows considerably and the crests broaden correspondingly.

In older tadpoles the toes are webbed to the slightly swollen tips; even along the fourth toe the web is continued as a shallow ridge. On the thighs and shins the limbs have some indistinct dark cross-bars.

Colour: back and sides of the body and muscular portion of the tail lighter or darker brown to nearly black with a velvety sheen especially in dark specimens. Belly and crests colourless, often with a very delicate powdering of brown on the lower parts of the dorsal crest and the caudal end of the ventral crest. The colourless skin is very transparent.

Dimensions: total length 21-27 mm.
length of body 8,5-10,5 mm.
breadth of body 4-6,5 mm.
length of tail 12-17 mm.
depth of tail 4-5 mm.

Unfortunately the young frogs just after their metamorphosis cannot be identified beyond doubt and when Dr. BOSCHMA tried to rear the tadpoles of *Bufo cruentatus* from the eggs, they all died at very young embryonic stages of development. So there is no conclusive evidence that this new tadpole belongs to *Bufo cruentatus,* but I think it highly probable for the following reasons.

Assuming that Tjibodas and its neighbourhood have been too thoroughly investigated for any new species to be found there, only *Nectophryne borbonica, Bufo cruentatus, Rana hascheana, Rana doriae* and the javanese species of *Philautus* and *Nyctixalus* need to be considered as their tadpoles are not yet

known [1]). *Philautus* and *Nyctixalus* can be dropped because their fingers and toes have conspicuous disks, which are lacking in fourlegged specimens of the new tadpole. Moreover the tadpole of *Philautus vittatus*, described by Mr. M. SMITH in 1924, is of a rather different type. Neither can the tadpole belong to *Rana hascheana* or *R. doriae* as both lack an outer metatarsal tubercle, which is distinct in older specimens of the new larva and the toes of the two species of *Rana* under discussion have distinct though small disks, whilst the toes of my tadpole are only slightly swollen. Consequently the only two possibilities left are that the tadpole belongs either to *Bufo cruentatus* or to *Nectophryne borbonica*. This agrees very well with the distinctly bufonid type of the tadpole, viz., the stout uniformely coloured body, the broad roundtipped tail and the medial position of the vent. In some respects, however, it differs from the known bufonid tadpoles:

1°. the lower lip is entirely bordered by papillae (not only at its sides).

2°. starting from the middle the spiral of the intestine is sinistral whereas in other bufonid tadpoles it is generally dextral.

The choice between *Nectophryne borbonica* and *Bufo cruentatus* is not easy because of the great resemblance between the adults of the species. However *Nectophryne* has not yet been recorded from Tjibeureum and the highest elevation from which it is known, is some 400 m lower than Tjibeureum's 1624 m. On the other hand *Bufo cruentatus* is abundant in the forests where these tadpoles were collected. So unless the contrary be proved I take them to belong to this species. They were found in stagnant or slow running water together with the larvae of *Megalophrys montana, Rana kuhli* and *Rhacophorus javanus* during the months December, January and April.

Bufo melanostictus SCHNEID. and **B. biporcatus** GRAVENHORST.

Bufo melanostictus & B. biporcatus FLOWER, 1896; VAN KAMPEN, 1909 and 1923.

Bufo melanostictus PARKER, 1925; OKADA, 1926; SMITH, 1925 a.

Bufo biporcatus SMITH, 1927.

Localities: Buitenzorg and environs (Tanah Sereal, Tjikeumeuh, Tjisadane, Tjitajam and Weltevreden — tadpoles.
Telok Djambe near Krawang — tadpoles.
Djolok and Tjipanas near Tjibodas — tadpoles.

As the tadpoles of *Bufo melanostictus* and *B. biporcatus* cannot be distinguished from each other and both species are very common round Buitenzorg, it is very likely that they were mixed when collected. Only the tadpoles from Tjipanas and Djolok near Tjibodas probably belong to *Bufo biporcatus* as *B. melanostictus* is not known to occur at so high an elevation, whereas *B. biporcatus* has already been recorded from Tjipanas and Tjibodas.

[1]) The tadpole of *Rana microdisca* is described in this paper.

The tadpoles were collected from October till May generally in sawahs and small pools, sometimes together with the larvae of *Microhyla achatina, Rana limnocharis, R. cancrivora, R. chalconota, R. erythraea, R. kuhli, Oœidozyga* (*Oxyglossus*) *lima* and *Rhacophorus leucomystax.*

Measurements of tadpoles of *Bufo cruentatus.*

	Total length	Length of body	Breadth of body	Length of tail	Depth of tail
	22 mm.	9 mm.	4 mm.	13,5 mm.	4 mm.
	22 „	9,5 „	6 „	13 „	4,5 „
	23,5 „	9,5 „	5 „	14 „	5 „
	25,5 „	10 „	5,5 „	16 „	4,5 „
	26 „	10 „	5,5 „	16 „	4 „
	27,5 „	10,5 „	5,5 „	17 „	5 „
fore legs showing through the skin	22 „	9,5 „	6 „	13,5 „	4,5 „
	23 „	9,5 „	6 „	14 „	5 „
	24,5 „	9,5 „	5 „	15 „	4 „
	26 „	10 „	5,5 „	16,5 „	5 „
tadpoles with *four* legs	23 „	9 „	4,5 „	14,5 „	4 „
	25 „	10 „	5 „	15 „	4,5 „
	26,5 „	10 „	5 „	16,5 „	5 „
beginning of reduction of tail	21 „	9 „	4 „	12,5 „	3,5 „
	20 „	8,5 „	3,5 „	12 „	2,5 „
	Young frogs		with	remains	of tail
	16,5 mm.	9 mm.	—	8,5 mm.	—
	12,5 „	9,5 „	—	3,5 „	—
	—	8,5 „	—	1,5 „	—

The colour of the larvae varies from light brown to dark velvety brown or black. In some cases Dr. BOSCHMA noted that they were black or dark brown at the moment of capture, whereas they are very much lighter after fixation. The transparency of the crests, contrasting sharply with the dark coloured muscular portion of the tail is very characteristic.

It is remarkable, that fourlegged tadpoles and young toads just after metamorphosis often have a dark crossbar on the thighs and shins though the adults of the species show no trace of them.

Bufo parvus BOULENGER.

Bufo parvus BOULENGER, 1887; SMITH, 1916; ANNANDALE, 1917; SMITH, 1922; VAN KAMPEN, 1923.

Localities: Tjibodas and neighbourhood (Gegerbintang, Djember, Rarahan, Goenoeng batoe and Tjadasgantoeng) — tadpoles.
Buitenzorg (Tanah Sereal) — tadpoles.

These tadpoles, which agree in every respect with SMITH's description (1916), were found in ponds and pools during the months December and January, sometimes accompanied by the larvae of *Rana chalconota* and *R. nicobariensis*.

The localities round Tjibodas are situated at an elevation of 1200-1400 m. Hitherto Badjoelmati in the residence of Besoeki was the only place on Java from which *B. parvus* has been recorded and Badjoelmati lies in the plain. But as *B. parvus* is known to occur at higher elevations, e.g. on Sumatra (Batak Mountains 900 m), its presence near Tjibodas need not be very surprising.

In his notes Dr. BOSCHMA describes the colour of the living tadpoles as dark brown or black with a reddish brown breast. Preserved in formaline 4% they are light brown with a still lighter coloured tail.

The tadpole of *B. parvus* resembles the larvae of *Bufo melanostictus* and *B. biporcatus* but can be distinguished from them by the following characteristics.

1°. In the tails of *B. melanostictus* and *B. biporcatus* the muscular portion is darkly pigmented and contrasts vividly with the very transparent crests. In *B. parvus* the colour of the muscular portion is much lighter especially near the tip of the tail, where it is hardly different from the crests, which are considerably less transparent than in *B. melanostictus* and *B. biporcatus*.

Moreover the tail of *B. parvus* generally is broader in proportion to its length (ANNANDALE 1917).

2°. The second row of teeth on the upper lip has a much wider interruption in *B. melanostictus* and *B. biporcatus* than in *B. parvus* (ANNANDALE 1917). In young larvae however this does not hold good or the difference is less obvious.

3°. In *B. melanostictus* and *B. biporcatus* the nostrils are often relatively wider than in *B. parvus*.

4°. Generally the tadpoles of *B. parvus* are larger and stouter than those of *B. melanostictus* and *B. biporcatus*.

BREVICIPITIDAE.

Microhyla palmipes BOULENGER.

Microhyla palmipes BOULENGER; VAN KAMPEN, 1923; PARKER, 1928.
Microhyla annectens p.p. VAN KAMPEN, 1923.

Localities: Neighbourhood of Buitenzorg — frogs.
Tjibodas — frogs and tadpoles.
Goenoeng poetri near Tjibodas — tadpoles.
Tjibeureum — frogs and tadpoles.

According to PARKER (1928) the only species of the genus *Microhyla* which inhabit Java are *M. achatina* and *M. palmipes* and all specimens recorded from Java as *M. annectens* should be referred to *M. palmipes*. As a matter of fact all adult specimens in this collection lack the median groove on the surface of the digital disks and have a small tubercle on the posterior half of the upper eyelid: they belong to *M. palmipes*.

Besides adult frogs the collection includes some new typically brevicipitid tadpoles, which probably belong to *Microhyla palmipes* BLGR. They cannot be the larvae of *Microhyla achatina* because they lack the typical lower lip, which characterizes this species. Neither can they belong to *Kaloula baleata* as a comparison with identified specimens from the Buitenzorg Museum showed beyond doubt. Moreover *Kaloula baleata* is only known from the lower parts of the country and these tadpoles were taken at elevations of 1410 m, 1483 m and 1624 m, where *Microhyla palmipes* is rather common.

Description: (fig. 3).

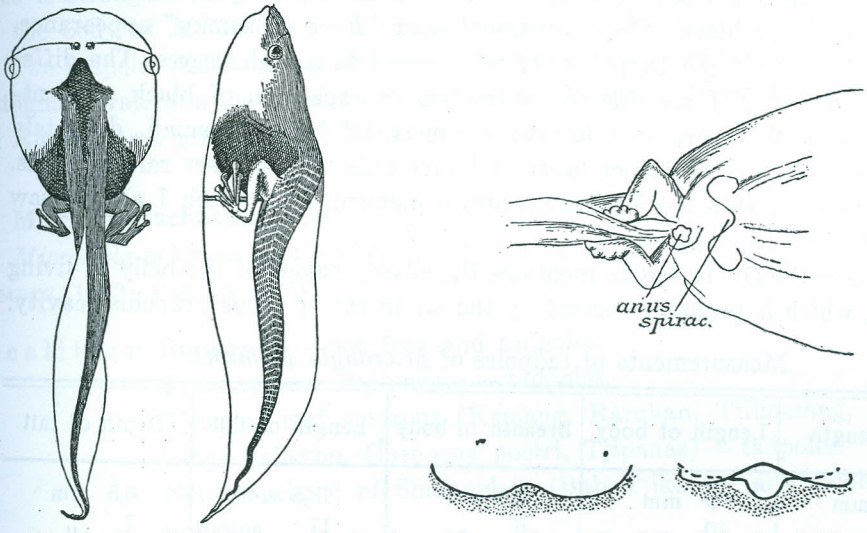


Fig. 3—5. Tadpole, anus and spiraculum, and mouth of the tadpole of *Microhyla palmipes*, shut and open.

Body: broadly oval; its length one and a half times its breadth. The greatest breadth lies near the anterior end between the eyes. Owing to the wide spiracular tube the body is much deeper at its posterior end than near the mouth.

Eyes: perfectly lateral.

Nostrils: rather nearer to the eyes than to the tip of the snout; closely together, the distance between them being only 1/6 to 1/5 of the interorbital space.

Mouth: (fig. 5) devoid of jaws or teeth; terminal and therefore hardly visible in dorsal view. Upperlip nearly straight, closing over the lower lip.

Spiraculum: (fig. 4) ventral and median at a little distance in front of the vent. Its form is very characteristic: a wide tube with a round emargination in the hinder edge and two small rounded lobules on either side of the emargination, (c.f. NARYAN's fig. of *Kaloula variegata*, 1918).

Anus: median at the end of a narrow, straight tube through the ventral crest.

Tail: One and a half to nearly two times the length of the body; its length two and a half to nearly three times its depth; terminating in a short flagellum

(which, however, has often been lost in preserved specimens). The muscular portion of the tail is attached to the body at an extremely dorsal level, it is even somewhat projecting, which gives the tadpoles a peculiar hunchbacked appearance. Owing to the dorsal attachment of the muscular portion the dorsal crest is practically obsolete at the root of the tail whilst the ventral crest has its greatest depth there. Halfway down the tail both crests are equally deep and both are slightly convex. The last narrow part of the muscular portion is not straight but undulating in the plane of the tail.

Hindlegs: webbed to the disks.

Colour: varying from very light with a black marking in the middle of the back to nearly black. The transitional shades have a "smoky" appearance. When light coloured the tadpoles are transparent to a high degree. The differences in colouring [1]) are due to contraction or expansion of black pigment-cells of which there are two layers: a superficial layer of small, delicately ramificated cells and a deeper layer of larger cells with coarser ramifications. Besides these the skin has very light brown pigment-cells, which I always saw expanded.

In his notes Dr. BOSCHMA mentions the silvery colour of the belly in living tadpoles, which is probably caused by the air in the spacious branchial cavity.

Measurements of tadpoles of *Microhyla palmipes*.

Total length	Length of body	Breadth of body	Length of tail	Depth of tail
27 mm	9 mm	6,5 mm	18,5 mm	6,5 mm
26 „	10 „	6 „	17 „	7 „
26 „	9 „	6 „	17,5 „	6 „
25 „	9,5 „	6,5 „	16 „	6,5 „
25 „	9 „	6,5 „	16,5 „	—
25 „	8,5 „	6 „	17 „	5,5 „
24 „	9 „	6 „	15 „	5,5 „
24 „	8 „	5,5 „	15,5 „	6,5 „
23,5 „	9 „	6,5 „	14,5 „	5 „
23 „	9 „	6 „	15 „	5,5 „
23 „	8 „	6 „	15,5 „	6 „
20,5 „	8 „	5,5 „	12,5 „	6 „
20 „	8,5 „	6 „	12,5 „	6 „
20 „	8 „	6 „	12 „	5 „
19 „	8 „	5 „	12 „	5 „

Dimensions: total length: 22-27 mm.
length of body: 8,5-10 mm.
breadth of body: 5-7 mm.
length of tail: 12-17 mm.
depth of tail: 5-7 mm.

[1]) DR. BOSCHMA mentions a case when darkly coloured tadpoles caught in broad daylight had turned very light after transport to the laboratory in darkness. This points to an influence of the light on the pigment-cells.

The resemblance between the tadpoles of *Microhyla palmipes* and *Kaloula baleata* is so close as to be almost deceptive, at least in dorsal view when the smaller eyes of *K. baleata* are the only difference. They can be distinguished from each other by characteristics of the tails and especially by the peculiar form of the spiraculum in *M. palmipes*. The spiraculum in *K. baleata* is narrower and lacks the typical emargination as well as the lateral lobules.

Judging after the description and figures of SMITH (1924) the likeness — also in dimensions — between the larvae of *Microhyla berdmorei* and *M. palmipes* is stronger still. The tails however furnish some distinctive characters and the body of *M. berdmorei* is broader in proportion to its length.

The tadpoles of *Microhyla palmipes* were caught in December and January in stagnant waters in the wood. In some cases the larvae of *Microhyla achatina* and *Rhacophorus javanus* were found in their company.

Microhyla achatina BOIE.

Microhyla achatina VAN KAMPEN, 1909; SMITH, 1916; ANNANDALE, 1917; VAN KAMPEN, 1923; PARKER, 1928.

Localities: Buitenzorg — one frog and tadpoles.
Tjiomas near Buitenzorg — tadpoles.
Tjibodas and environs (Kemang, Rarahan, Tjihoerang, Koebang, Babekon, Goenoeng poetri, Tjipanas) — tadpoles.
Neighbourhood of Sindanglaja (Bab Tjikalong and Djolok — tadpoles.
Krawang (Telok Djambe) — tadpoles.
Djember — tadpoles.

The highest elevation at which these tadpoles were collected being 1482 m (Goenoeng poetri), these localities once more confirm the statement that *M. achatina* does not occur above 1600 m. It was not found near Tjibeureum (1624 m). The tadpoles were found in stagnant water of sawahs, ponds and the like from the end of October till the end of April, sometimes together with the larvae of *Microhyla palmipes, Rana limnocharis, Rana kuhli, Rana chalconota, Rhacophorus leucomystax, Rhacophorus javanus* and *Bufo melanostictus* (or *B. biporcatus*).

Some of the tadpoles exceed the maximal sizes cited in literature, their dimensions being:

Total length	body length	Tail length
26,5 mm	8,5 mm	18 mm
27,5 „	9 „	19 „
28 „	9 „	19 „
28,5 „	10 „	19 „

RANIDAE.

Rana limnocharis BOIE.

Rana limnocharis VAN KAMPEN, 1909; SMITH, 1917; ANNANDALE, 1917; BOULENGER, 1920; VAN KAMPEN, 1923; PARKER, 1925; SMITH, 1925 a; OKADA, 1926.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiomas, Tjisadane, Tjiliwoeng) — frogs and tadpoles.
Tjibodas and environs (Djolok, Rarahan, Koebang, Babekon) — frogs and tadpoles.
Sindanglaja (Bab Tjikalong) — 2 frogs.
Soerabaja — 1 tadpole.

Of this species a very numerous material including tadpoles of several different sizes has been collected from October till April. Most of them were found in sawahs, others in ponds, pools or solokans; always in stagnant or nearly stagnant water. Often they were accompanied by the larvae of *Rana cancrivora*, in other cases by those of *Rana chalconota, Rana macrodon, Microhyla achatina, Rhacophorus leucomystax, Rhacophorus reinwardti, Oœidozyga lima* and *Bufo melanostictus* (or *B. biporcatus*).

Rana cancrivora GRAVENHORST.

Rana tigrina and *R. tigrina* var. *angustopalmata* VAN KAMPEN, 1907.
Rana tigrina VAN KAMPEN, 1909.
Rana tigrina var. *cancrivora* and *R. cancrivora*, ANNANDALE and BOULENGER, 1920.
Rana cancrivora ANNANDALE, 1917; BOULENGER, 1920; VAN KAMPEN, 1923; SMITH, 1927.

Localities: Buitenzorg and environs (Tanah Sereal, Tjisadane, Tjiliwoeng) — frogs and tadpoles.
Babekon near Tjibodas — frogs and tadpoles.

These tadpoles were found from October till January in sawahs and nearly always together with the larvae of *Rana limnocharis*, in one case with these of *Oœidozyga lima*. The tadpoles of *R. cancrivora* are deceptively like those of *R. limnocharis*. All the same it is possible to draw up some distinctive characters, which, though not conclusive each apart, may furnish sufficient evidence when occurring in combination, especially when tadpoles of both species taken at the same place and time can be compared as was the case with this material. Nevertheless there are always cases where a conclusion is practically impossible and greatly a matter of personal appreciation.

These distinctive characters were derived from older tadpoles, which judging from their hindlegs belong without doubt to *R. cancrivora*.

Afterwards they were applied to younger specimens and apparently they hold good. They can be drawn up as follows:

1°. The tadpoles of *R. cancrivora* are nearly always bigger than those of *R. limnocharis*. If one compares tadpoles with equally long hindlegs, those of *R. cancrivora* have the bigger bodies. On the other hand: if tadpoles of the same body-length are compared, those of *R. limnocharis* have further developed hindlegs.

The 1st table draws a comparison between the sizes of tadpoles of both species collected at the same time and place, divided into 6 categories:

a. young frogs with remains of the tail,
b. tadpoles with four legs and unreduced tail,
c. tadpoles with the forelegs showing clearly through the skin,
d. tadpoles with hindlegs longer than 10 mm,
e. tadpoles with hindlegs from 10-4 mm,
f. tadpoles with hindlegs up to 4 mm.

a. In young frogs with remains of the tail the body-length varies as follows:
Tanah Sereal: *Rana limnocharis* 12-13 mm, average 12,6 mm.
Rana cancrivora 13,5-16 mm, average 14,3 mm.
Tjisadane: *Rana limnocharis* 10,5-12 mm, average 11,4 mm.
Rana cancrivora 13 mm, average 13 mm.

Calculated from the entire material the average body-length is:

Rana limnocharis 12,83 mm.
Rana cancrivora 14,15 mm.

b. Unfortunately only very few tadpoles with four legs and unreduced tail were available. Therefore only the average body-length for the entire material was calculated:

R. limnocharis: 11,5-14 mm, average 12,92 mm.
R. cancrivora: 13-17 mm, average 15,25 mm.

c. Of both species tadpoles with forelegs clearly showing through the skin were taken at Tanah Sereal, Buitenzorg. The variability of their body-length is:

R. limnocharis: 13-15 mm, average 13,96 mm.
R. cancrivora: 15,5-18 mm, average 16,78 mm.

Average body-length calculated from the entire material:

Rana limnocharis 13,85 mm.
Rana cancrivora 16,41 mm.

At this stage the tadpoles attain their largest size.

d. Of *R. cancrivora* only very few tadpoles with hindlegs longer than 10 mm were found at different localities. Their body-lengths vary from:
13,5 mm — 15,5 mm, average 14,71 mm.

TABLE I.

A. Measurements of young frogs with remains of tail.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail.	Total length	Length of body	Length of tail.
Tanah Sereal	— mm	14 mm	8 to 9 mm	18 mm	13 mm	5 mm
Buitenzorg	— „	14 „	± 8 „	— „	13 „	9,5 „
	17,5 „	13,5 „	4 „	16,5 „	12 „	4,5 „
	15 „	13,5 „	1,5 „	18 „	13 „	5 „
	15 „	14,5 „	0,5 „	16,5 „	13 „	3,5 „
	15,5 „	15 „	0,5 „	16 „	12 „	4,5 „
	—	13,5 „	visible but	14,5 „	12 „	2,5 „
	—	14 „	to short	15,5 „	12,5 „	3 „
	—	15 „	to be	15 „	12,5 „	2,5 „
	—	16 „	measured.	13,5 „	13 „	0,5 „
				13 „	12 „	1 „
				13 „	12 „	1 „
				—	12 „	— tip broken
				—	13 „	— visible but too short to be measured
				—	12,5 „	—
				—	13 „	—
				—	13 „	—
				—	13 „	—
				—	13 „	—
				—	13 „	—
				—	12 „	—
Tjisadane	14,5 „	13 „	1,5 „	16 „	11,5 „	5 „
Buitenzorg	20,5 „	13 „	7 „	14 „	11,5 „	3 „
				12 „	11,5 „	0,5 „
				12,5 „	12 „	1 „
				11,5 „	10,5 „	1 „
				—	15,5 „	9 „
Babekon	17,5 „	16 „	1,5 „	18 „	15 „	3,5 „
near				17 „	14,5 „	2,5 „
Tjibodas				17 „	16 „	1,5 „
Tanah Sereal				17 „	12,5 „	4,5 „ too short to be measured.
Tjihoerang				19,5 „	14,5 „	5,5 „
				13 „	12 „	1 „
				14 „	13,5 „	1 „
				—	14 „	too short to be measured.

TABLE Ia.

B. Measurements of tadpoles with four legs.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail.	Total length	Length of body	Length of tail.
Tjisadane	34 mm	13 mm	21 mm	29,5 mm	11,5 mm	18 mm
	35 „	14 „	21 „			
Tanah Sereal	43,5 „	17 „	27 „	33 „	13,5 „	20 „
Babekon	40 „	17 „	23 „			
Tjisadane				33 „	14 „	19 „
Tjihoerang				28 „	13 „	15,5 „
				—	12 „	18 „
Tjisadane				31 „	12,5 „	18,5 „
Tanah Sereal				34,5 „	14 „	21 „

C. Measurements of tadpoles with forelegs showing through the skin.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail.	Total length	Length of body	Length of tail.
Tjisadane	40,5 mm	15,5 mm	25 mm	36 mm	14 mm	22,5 mm
				35,5 „	13,5 „	22 „
				37 „	14 „	23 „
				37 „	14 „	23 „
				38,5 „	14 „	24,5 „
				36 „	13 „	23 „
				37,5 „	14 „	23,5 „
				36 „	13,5 „	21,5 „
				33 „	13 „	20 „
				35,5 „	14 „	22 „
				36 „	14 „	22 „
Tjisadane	42,5 „	16 „	26,5 „	34,5 „	13,5 „	21 „
				36 „	13,5 „	23 „
				36,5 „	13,5 „	23 „
				34 „	13,5 „	21 „
				36 „	13 „	23 „
Tanah Sereal	39,5 „	15,5 „	24 „	36 „	14 „	22 „
Tjisadane	41,5 „	16,5 „	25 „	35,5 „	14,5 „	21,5 „
				33 „	15 „	18,5 „
Tanah Sereal	47,5 „	17,5 „	30,5 „	37 „	14 „	23 „
	43 „	17 „	26,5 „	36,5 „	14 „	23 „
	49 „	18 „	31,5 „	36,5 „	14 „	22 „
	41,5 „	17,5 „	24,5 „	38,5 „	15 „	23,5 „
	39,5 „	15,5 „	24 „	39 „	15 „	24 „
	34,5 „	16 „	19 „	38 „	15 „	23 „
	39,5 „	16 „	24 „	38 „	14 „	24,5 „
				36 „	13,5 „	22,5 „
				33,5 „	13,5 „	20 „
				34,5 „	13 „	21,5 „
				36 „	14,5 „	22 „
				33 „	13 „	20 „
				35,5 „	13,5 „	22 „
				35 „	14 „	21,5 „
				36,5 „	14 „	22,5 „
				34 „	13,5 „	21 „
Tjisadane	38 „	15 „	23 „	37 „	13,5 „	24 „
				26,5 „	12,5 „	14 „

TABLE Id.

F. Measurements of tadpoles with hindlegs up to 4 mm.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail	Total length	Length of body	Length of tail
Tjisadane	31 mm	13 mm	18 mm	29,5 mm	12 mm	18 mm
	29,5 „	12,5 „	17 „	29,5 „	11,5 „	18 „
	27 „	12 „	17,5 „	27 „	10,5 „	17 „
Tjisadane	29 „	12,5 „	16,5 „	27,5 „	10,5 „	17 „
				25 „	10 „	15 „
				24 „	9 „	15 „
Tanah Sereal	32 „	13 „	19,5 „	30,5 „	11,5 „	19 „
	30 „	11,5 „	18,5 „	27 „	10,5 „	17 „
	28 „	11 „	17,5 „	25,5 „	10 „	15,5 „
	23,5 „	10,5 „	13 „	26 „	10 „	16 „
	25 „	10 „	15 „			
Tjihoerang Buitenzorg				29,5 „	11,5 „	18,5 „
				26 „	10 „	16,5 „
				25,5 „	9,5 „	16 „
				24 „	9,5 „	15 „
Tanah Sereal				25 „	9,5 „	16 „
				23,5 „	9 „	15 „
Tjisadane				27,5 „	10 „	17,5 „
				26 „	9,5 „	16,5 „
				27 „	10 „	17 „
				23 „	9 „	14 „
				23,5 „	9 „	14,5 „
				22,5 „	8,5 „	14,5 „
Tanah Sereal	33 „	13 „	20 „			
	30,5 „	12,5 „	18 „			
	33 „	12 „	21 „			
	30,5 „	11,5 „	19 „			
	30,5 „	12 „	19 „			
	29,5 „	11,5 „	18 „			
	20,5 „	11 „	18,5 „			

At this stage *R. limnocharis* (material from several localities) has a body-length of 12-15,5 mm, average 13,35 mm. When the tadpoles of each locality are treated separately the following values for the body-length of *R. limnocharis* are found:

Tjisadane: 12-13 mm, average 12,6 mm,
„ : 14-15,5 mm, average 14,62 mm,
Tanah Sereal: 12,5,-13,5 mm, average 13 mm,
„ : 12,6-13,5 mm, average 13,15 mm.

In every case *R. limnocharis* is smaller than *R. cancrivora.*

e. Tadpoles with hindlegs from 10-4 mm.
Body-length of:

	Rana limnocharis.	*Rana cancrivora.*
Tanah Sereal	11-14 mm, average 11,88 mm.	12,5-13,5 mm, average 13,1 mm.
Tjisadane	11-12,5 mm, average 11,68 mm.	13,5-15 mm, average 14,16 mm.

When calculated from the tadpoles from all localities the average body-lengths are:

Rana limnocharis 11,78 mm.
Rana cancrivora 13,77 mm.

f. Tadpoles with hindlegs up to 4 mm.
Body-length of:

	Rana limnocharis.	*Rana cancrivora.*
Tanah Sereal	10-11,5 mm, average 10,5 mm.	10-13 mm, average 11,2 mm.
Tjisadane	10,5-12 mm, average 11,33 mm.	12-13 mm, average 12,5 mm.

Average calculated from the body-length of all the tadpoles from different localities together:

Rana limnocharis 10,02 mm,
Rana cancrivora 11,84 mm.

In groups d. and e. the difference is not very striking. Probably this is due to the scantiness of the material of these stages and perhaps the limits of the classes are taken somewhat wide.

2°. A second distinctive character can be found in the relative length of the series of teeth on the lower lip. ANNANDALE (1918) states that the third row of teeth on the lower lip is longer in *R. cancrivora* than in *R. limnocharis.* The 2nd table shows for a number of tadpoles of both species, which percentage has the third series of teeth longer than, equal to or shorter than half the length of the second row.

TABLE II.

Locality	*Rana cancrivora.*				*Rana limnocharis.*			
	Total number	Number of tadpoles where the 3rd series of teeth compared to 1/2 of the 2nd row is:			Total number	Number of tadpoles where the 3rd series compared to 1/2 of the 2nd series is:		
		shorter	equal	longer		shorter	equal	longer
Tanah Sereal	17	1	—	16	40	18	14	8
Tjisadane	3	—	—	3	60	28	19	13
Tjisadane	7	2	—	5	18	6	3	9
Tjisadane	7	—	1	6	19	8	6	5
Tjisadane	4	—	—	4	10	5	4	1
Tjisadane	2	—	—	2	13	8	2	3
Tjihoerang	2	—	—	2	6	2	3	1
Tanah Sereal	1	—	1	—	9	4	2	3
Tanah Sereal	10	—	1	9				
Babekon	6	5	1	—				
	59	8	4	47	175	79	53	43

The result is that *R. limnocharis* is much more variable in this respects than *R. cancrivora*. Generally nearly half of the number of tadpoles of this species has the third series shorter than half the length of the second row; often a nearly equal number has the third series equal to half of the second row and there are always some with a dentition of the *cancrivora*-type.

Rana cancrivora generally has the third row of teeth longer than half the length of the second series. In total out of 59 tadpoles of *R. cancrivora* 47 had the long third row of teeth, which consequently can be considered as giving at least some indication as to the identity of the tadpole under consideration.

3°. As a rule the tadpoles of *R. cancrivora* are less strongly pigmented and more uniformely coloured than those of *R. limnocharis*, especially in the distal half of the tail. Moreover *R. limnocharis* has a series of dark spots along the dorsal margin of the muscular portion of the tail, which is hardly discernible or entirely absent in *R. cancrivora*.

ANNANDALE (1918) mentions the shorter and blunter tail of *R. cancrivora* as a difference with *R. limnocharis*. As a matter of fact at first sight the tail seems shorter indeed, but the measurements in the table do not confirm this. In larvae of the same total length, the tail-length varies within the same limits round the same average. Perhaps the tail of *R. cancrivora* is a trifle deeper.

The blunter tip of the tail is a character that as often as not holds good.

Rana macrodon KUHL.

Rana macrodon FLOWER, 1899; BOULENGER, 1912; BOULENGER, 1920 and 1920 a; SMITH, 1922; VAN KAMPEN, 1923; PARKER, 1925; SMITH, 1925 a; SMITH, 1926.

Localities: Djolok near Tjibodas — one tadpole.
Tjiapoes on the Salak — one tadpole.

Habitat: a pond (Djolok).

Time: January and July.

Occasional companions: larvae of *Rana limnocharis* and *R. chalconota, Megalophrys hasselti* and *Rhacophorus reinwardti.*

The identification of these tadpoles is not beyond doubt. FLOWER's original description (1899) tallies fairly well with their outward appearance, but still there are some differences. As FLOWER's description, which is cited again and again in literature, seems to be the only available information (I at least have not been able to find further data) and as I have no identified specimens to compare these tadpoles with, it is impossible to decide, whether these differences are specific or whether they can be explained by variability. The tadpoles differ from FLOWER's description in the following points:

1°. the upper lip has only one series of teeth; FLOWER mentions a second broadly interrupted row.

2°. beak rather narrowly edged with black, not broadly.

3°. upper crest of the tail somewhat less convex; tip of the tail less acutely pointed (but perhaps it has been damaged).

4°. spiraculum equally distant from the end of the snout and from the anus; according to FLOWER it is nearer to the vent, but it seems to me that FLOWER's figure of the tadpole in this respect tallies better with my specimens than with his own description.

Rana kuhli SCHLEG.

Rana conspicillata GÜNTHER, 1872.

Rana kuhli SMITH, 1917; BOULENGER, 1920 and 1920 a; VAN KAMPEN, 1923; SMITH, 1925 and 1925 a; OKADA, 1926.

Localities: Buitenzorg (Botan. Garden) — tadpoles.
Tjibodas and environs (Kemang, Tjihoerang, Rarahan, Goenoeng batoe) — frogs and tadpoles.
Tjibeureum — frogs and tadpoles.

These tadpoles were caught in December and January, April and May in slowly running water or the quieter parts of faster streamlets, occasionally also in ponds. Tadpoles of *Megalophrys hasselti* and *Meg. montana, Bufo cruentatus* and *B. melanostictus* (or *B. biporcatus*), *Microhyla achatina, Rana chalconota, R. nicobariensis* and *Rhacophorus javanus* were sometimes found in their company. The outward appearance of these tadpoles tallies nearly completely with SMITH's description and figures (1917), only the mouth shows some slight differences, viz.:

1°. the second series of teeth on the upper lip is continuous (SMITH: broadly interrupted).

2°. on the lower lip the second series is much shorter than the first and

the third attains only one-third of the length of the second row (SMITH: "the lowest row about half the length of the first or second, which are subequal").

As regards the coloration young tadpoles often have darker and more definitely outlined spots or cross bars on the tail than older larvae.

Rana microdisca BOETTGER.

Rana microdisca BOETTGER, 1892; BOULENGER, 1920; VAN KAMPEN, 1923.

Locality: Tjibodas — one frog and some tadpoles.

In April a young frog was collected, which belongs without doubt to *Rana microdisca*. As its hindlegs agree in every detail (disks, web and coloration) with those of a fullgrown fourlegged tadpole, this and some similar but younger larvae consequently belong to *Rana microdisca*. The tadpoles were collected in December.

Description: (fig. 6).

Body: its length about one a half times its breadth; regularly oval in younger tadpoles, in older ones the hinder part rather broader than the front.

Eyes: superior, looking obliquely in front and upward; nearer to the tip of the snout than to the spiraculum. Interorbital space more than one and a half times to nearly twice the distance between the nostrils.

Nostrils: equally distant from the eyes and the tip of the snout, rather wide apart (± 2 mm).

Spiraculum: sinistral, somewhat nearer to the end of the snout than to the vent.

Anus: dextral, close to the lower border of the ventral crest at the end of a rather long and wide tube.

Mouth: (fig. 7) ventral, narrower than the interorbital space; papillae in a single series along the sides and the lower lip (in young larvae sometimes with a narrow interruption in the middle).

Teeth: $\frac{1^1 1}{1_2 1}$. The second series on the upper lip is broadly interrupted. On the lower lip the uppermost series is the longest and has a narrow gap in the middle. The lowest row is about half as long as the second series.

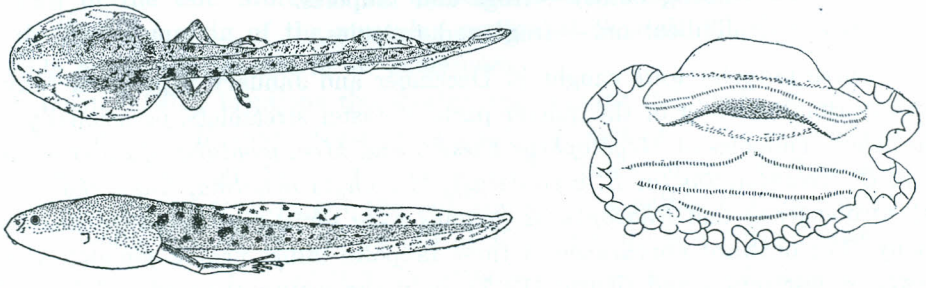


Fig. 6 & 7. Tadpole and mouth of the tadpole of *Rana microdisca*.

Jaws: edged with black and finely serrate.

Tail: nearly two and a half times the length of the body and four to five times as long as broad; tip blunt but not broadly rounded; crests narrow, the

ventral nearly straight, the dorsal convex and somewhat deeper but at a little distance from the body suddenly decreasing to a low ridge.

Colour: back and sides of the body and muscular portion of the tail light brown with dark brown spots and speckles, which are largest near the root of the tail and very small on the body. Dorsal crest and distal third part of the ventral crest also spotted; belly and proximal part of the ventral crest colourless.

Dimensions: total length: 33-37,5 mm.
length of body: 10,5-13 mm.
breadth of body: 6-8,5 mm.
length of tail: 22-26,5 mm.
depth of tail: 4-5 mm.

The actual measurements were:

Total length	Length of body	Breadth of body	Length of tail	Depth of tail
37 mm	11,5 mm	8,5 mm	26,5 mm	5 mm
37 „	11,5 „	8,5 „	26 „	5 „
34 „	11,5 „	7 „	23 „	4,5 „
34,5 „	10,5 „	7 „	24 „	4 „
33 „	12 „	7 „	22 „	5 „
37,5 „	13 „	6 „	24,5 „	5 „

The last is a tadpole with four well developed legs.

The larva of *Rana microdisca* resembles that of *R. kuhli* in general type, but differs from it by the characteristical spots on the skin and the sudden decrement of the dorsal crest, which in *R. kuhli* retains its full depth up to the root of the tail.

Rana jerboa (GTHR.).

"Unbestimmbare Froschlarve" WEBER, 1898.

Rana jerboa VAN KAMPEN, 1907 and 1909; BOULENGER, 1920 and 1920 a; VAN KAMPEN, 1923; SMITH, 1925 a.

Localities: Tjibeureum — frogs.
Tjibodas — tadpoles.
Java — tadpoles collected by Mr. P. A. OUWENS.

The frogs were caught in December and January in woods, where *Megalophrys montana, Microhyla palmipes* and *Philautus aurifasciatus* likewise occured; the tadpoles in December in swiftly running water together with the larvae of *Megalophrys montana.*

The skin of the tadpoles shows several white dots, which in microscopical sections appear to be glands like those composing the granular patches on the skin of the tadpoles of *Rana chalconota* (ANNANDALE 1917). The largest group of these glands is found at some distance from the eye, surrounding it on its caudal and ventral sides and the foremost scattered dots of the right and left groups nearly meet each other on the tip of the snout. Another small group of three or four glands lies dorsally just in front of the eye and yet another

fairly large group is found on the sides of the body in front of the root of the tail. Finally on the ventral surface three or four glands lie on either side in front of the hindlegs.

On the tail a series of similar glands occurs at the base of both crests on the border of the muscular portion. Here each white gland is bordered with black or darkbrown pigment. The distal third part of the tail is free from them.

Rana chalconota (SCHLEG.).

Rana labialis [1]) BOULENGER, 1887; FLOWER, 1896; ANNANDALE, 1917.

Rana chalconota VAN KAMPEN, 1907 and 1909; BOULENGER, 1920; SMITH, 1922; SMITH, 1925 a and 1926.

Rana chalconota and *R. labialis* VAN KAMPEN, 1923.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiomas and Tjitajam) — 3 frogs and many tadpoles.
Tjibodas and neighbourhood (Kemang, Rarahan, Goenoeng poetri, Goenoeng batoe, Tjihoerang, Djember, Tjisaroea, Telaga Warna, Gegerbintang and Gadog near Tjipanas) — tadpoles.
Tjiapoes on the slope of Mt. Salak — tadpoles.

A great many tadpoles of several different sizes were collected from the end of October till the end of January, in March, April and July in stagnant waters (sawahs, ponds and pools and a crater-lake near Gegerbintang) sometimes together with the larvae of *Bufo parvus* and *B. biporcatus, Microhyla achatina, Rana limnocharis, R. macrodon, R. kuhli, R. erythraea* and *R. nicobariensis, Rhacophorus leucomystax* and *Rhac. reinwardti.*

Rana erythraea (SCHLEG.).

Rana erythraea FLOWER, 1896; VAN KAMPEN, 1907 and 1909; BOULENGER, 1920; VAN KAMPEN 1923; PARKER, 1925; SMITH, 1925 a.

Localities: Buitenzorg, Botan. Garden — frogs.
Buitenzorg — tadpoles.
Tjitajam near Buitenzorg — tadpoles.

These tadpoles were collected in November in stagnant water (sawahs and a pond) once in company with the larvae of *Rana chalconota* and on another occasion with those of *Bufo melanostictus* (or *B. biporcatus*).

Rana nicobariensis (STOL.).

Rana javanica VAN KAMPEN, 1907 and 1909.

Rana nicobariensis BOULENGER, 1920 [2]) and 1920 a; VAN KAMPEN, 1923; SMITH, 1925 a.

Localities: Tjibodas and environs (Babekon, Goenoeng batoe, Gegerbintang, Djember and Tjadasgantoeng) — tadpoles.

[1]) With BOULENGER and SMITH I consider *R. labialis* as a variety of *Rana chalconota.*

[2]) Not the tadpole.

Time: December and January.
Habitat: ponds, pools and sawahs.
Occasional companions: larvae of *Rana cancrivora, R. kuhli, R. chalconota* and *Bufo parvus.*

If there remained some slight doubt, whether the tadpoles described by VAN KAMPEN (1909) really belong to *R. nicobariensis,* this identity is now confirmed by a young frog (taken among the tadpoles) which agrees perfectly with the description of the species.

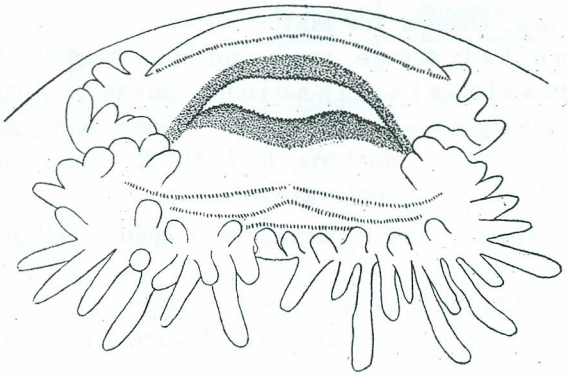


Fig. 8. Mouth of the tadpole of *Rana nicobariensis.*

Some of the tadpoles have a short third series of teeth on the lower lip in addition to the two rows mentioned in the original description. Out of fifty tadpoles thirty-five had three and fifteen two series of teeth on the lower lip (fig. 8).

Oœidozyga lima (KUHL) [1]).

Oxyglossus lima BOULENGER, 1882; VAN KAMPEN, 1907 and 1909; BOULENGER, 1912; VAN KAMPEN, 1923.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiliwoeng and Tjisadane) — frogs and tadpoles.
Time: October and December.
Habitat: sawahs.

Occasional companions: larvae of *Bufo melanostictus* (or *B. biporcatus*), *Rana limnocharis, R. cancrivora* and *Rhacophorus leucomystax.*

Contrary to BOULENGER's statement (1882 and 1912) some half grown frogs on examination of their shoulder-girdles appeared to have bony sterna (BOULENGER: "sternum a cartilaginous plate") [2]).

Rhacophorus leucomystax (KUHL).

Rhacophorus leucomystax FLOWER, 1896 and 1899; VAN KAMPEN, 1907; ANNANDALE, 1912; BOULENGER, 1920 a; SMITH, 1922, 1925 a; VAN KAMPEN, 1923; PARKER, 1925; OKADA, 1926.

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[1]) According to SMITH (1927) the generic name of *Oxyglossus* should be changed into *Oœidozyga.*

[2]) Further details have been published in the following paper: K. SCHIJFSMA, 1930. Das Brustbein von *Oœidozyga* (*Oxyglossus*). Tijdschr. Ned. Dierk. Ver. Ser. III, Dl. II.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiomas, Tjisadane and Tjitajam) — frogs and tadpoles.
Tjibodas and neighbourhood (Rarahan, Babekon, Koebang, foot of the Tjadasgantoeng) — frogs and tadpoles.
Telok Djambe near Krawang — tadpoles.

Time: October till May.
Habitat: sawahs, ponds and other stagnant waters.
Occasional companions: larvae of *Megalophrys montana, Bufo melanostictus* (or *B. biporcatus*), *Microhyla achatina, Rana limnocharis, R. kuhli, R. chalconota, Oœidozyga lima* and *Rhacophorus reinwardti.*

The very numerous material includes all stages of development.

Rhacophorus javanus BOETTGER.
Rhacophorus javanus VAN KAMPEN, 1907 and 1909, 1923.

Localities: Buitenzorg, Tjibodas, Tjibeureum, Goeha lalaj (a grotto near Tjibeureum) — tadpoles.

Time: November, December, January and April.
Habitat: ditches and swamps, often with a rich vegetation; Goeha lalaj: deep dark water in a grotto.

TABLE III.

Rhacophorus javanus: proportional length of body and tail in:

Spotted tadpoles			Spotless tadpoles		
Tot. length	Body-length	Tail-length	Tot. length	Body-length	Tail-length
17 –18 mm	5 – 6 mm	12–13 mm			
19 „	5,5– 6 „	13–13,5 „	20 –21 mm		
20 –21 „	7 – 7,5 „	13 14 „	21,5–23 „	7 mm	13.5–14,5 mm
21,5 – 23 „	8 – 9 „	14–15 „	23,5–24,5 „	7–8 „	14,5–16,5 „
23,5 – 24,5 „	8,5– 9,5 „	15–15,5 „	25 –25,5 „	8–8,5 „	16 „
25 –25,5 „	9 – 9,5 „	16 16,5 „	27,5 „	8–8,5 „	16,5–17,5 „
26 –27,5 „	10 „	17–17,5 „	28 „		
28 –29 „	11 –12 „	17–18,5 „		10 „	18 „

Occasional companions: larvae of *Megalophrys montana, Bufo cruentatus, Microhyla palmipes, Microhyla achatina* and *Rana kuhli.*

Among the spotted tadpoles, which agree in every particular with the original description, there are always some uniformely coloured greyish brown or brown individuals. As in older tadpoles the absence of spots is the only dif-

TABLE IV.

Rhacophorus javanus: development of papillae along the lower lip in:

Spotted tadpoles			Spotless tadpoles		
Tot. length	Body-length	Papillae	Tot. length	Body-length	Papillae
17—18 mm	5 6 mm	1 row			
20—21 „	7,5—8 „	nearly 2 rows to two rows compl.	19 —22 mm 21,5—24 „	6—7,5 mm 7—8 „	1 row 1 row; beginning
22—23,5 „	8 —9 „	2 -2½ rows to 3 rows compl.			of 2nd row to 2nd row nearly complete.
24—25,5 „	9 —9,5 „	2—2½ rows 3 rows ± compl. 3—3½ rows	24 —25,5 „	8—8,5 „	1 row; beginning of 2nd row,
27—29 „	10 —12 „	nearly 3 rows 3 rows compl. 3 to nearly 4 rows	28 „	10 „	two rows ± complete, beginning of 3rd row.

ference with the normal larvae, and as there is in some cases a perfectly gradual transition from spotted to uniformely coloured tadpoles, both types can be considered as belonging to *Rhacophorus javanus.*

At an earlier age the spotless tadpoles differ in some respects from the spotted individuals, viz., their tails are somewhat longer in proportion to the length of the body and have a slightly different form. In spotless larvae the lower margin of the tail is straight and consequently the tip is turned downward; whereas in spotted tadpoles, both crests being slightly convex, the tip points backward. When the tadpoles have attained a length of ± 30 mm the differences have all but disappeared.

Another point in which spotted and spotless tadpoles are different from each other, is the development of the papillae along the lower lip. In very young tadpoles the papillae of the first series appear all practically at the same time, often leaving a narrow gap in the middle. Then the second row is formed, the papillae appearing one after the other from the corners of the mouth to the middle until the whole series is doubled.

Often the third series begins its development before the second row is completed and a fourth before the third is finished.

Now, if spotted and spotless tadpoles of the same total length are compared in this respect (table IV), it appears that in spotted larvae the development of the series of papillae has more advanced than in spotless tadpoles. Spotted larvae of 20 to 21 mm are equal in this respect to spotless tadpoles of 22-24 mm, about half of the second row being developed by that time.

On comparing tadpoles of the same body-length the difference is less striking but still sufficiently apparent. Spotless larvae with a body-length of 7 to 7,5

mm have only one series of papillae, sometimes near the corners of the mouth some papillae of the second row begin to develop. Spotted tadpoles of the same body-length have the second series complete or all but accomplished. In larvae with a body-length of 8 mm the second row is not yet complete when they belong to the spotless types, whereas in spotted larvae of that size the third row is already developing.

The result in both cases is the same, fullgrown tadpoles of either type having a thick at least quadruple series of papillae along the lower lip.

The tadpoles of *Rh. javanus* closely resemble those of *Rh. reinwardti;* in fact the only distinctive character is furnished by the spots on the muscular portion of the tail. Consequently the uniformely coloured individuals of *Rh. javanus* are all but indistinguishable from *Rh. reinwardti.* Yet there are some very slight differences, which are visible but not easily formulated.

1°. The papillae along the lower lip are placed in three to four thick-set rows in *Rh. javanus.* In *Rh. reinwardti* there at most three rows, often in the middle only two. To my eye the papillae in *Rh. reinwardti* seem shorter and more regularly placed than those of *Rh. javanus.*

As for the development of the papillae *Rh. reinwardti* is intermediate between the spotted and the spotless larvae: tadpoles measuring 21-24 mm with a body-length of 8-9 mm have the second series of papillae nearly complete.

2°. The form of the body is regularly elliptical in *Rh. javanus,* whereas in *Rh. reinwardti* it is a rectangle with rounded angles.

3°. The tail of *Rh. reinwardti* is slightly shorter than that of spotless tadpoles of *Rh. javanus;* the proportions of tail- and body-length are the same as in the spotted larvae.

4°. The skin in *Rh. reinwardti* is transparent and of a light greyish yellow colour whereas in *Rh. javanus* it is brown or greyish brown and hardly transparent.

Rhacophorus reinwardti (BOIE).

Rhacophorus reinwardti VAN KAMPEN, 1909 and 1923.

Localities: Buitenzorg (Botan. Garden) — a frog and tadpoles.
Tjiomas near Buitenzorg — tadpoles.
Tjiapoes on the slope of the Mt. Salak — tadpoles.
Tjibodas — a young frog.

Time: December and January, March, April and the end of July.

Habitat: ponds and other stagnant water.

Occasional companions: larvae of *Microhyla achatina, Rana limnocharis, Rana chalconota* and *Rhacophorus leucomystax.*

Philautus aurifasciatus (SCHLEG.).

Ixalus aurifasciatus BOULENGER, 1882; VAN KAMPEN, 1907; ANNANDALE, 1917 a.

Philautus aurifasciatus VAN KAMPEN, 1923.

Localities: Buitenzorg, Tjibodas, Tjibeureum — frogs.
Time: December, January and March.
Habitat: woods.

Occasional companions: *Megalophrys montana, Microhyla palmipes* and *Rana jerboa* (metamorphosed).

GENERAL CONCLUSIONS.

This collection includes twenty-two out of the thirty-seven species of Anura known from Java (as mentioned by VAN KAMPEN, 1923), [1]) most of them as tadpoles. The tadpoles of *Bufo cruentatus, Microhyla palmipes* and *Rana microdisca* are described for the first time in this paper. As the three principal localities where the material was collected are situated at rather different elevations, which has a marked effect on the distribution of the species, it seems useful to arrange them in a table after the places, where they were found.

Buitenzorg and environs.	Tjibodas and neighbourhood 1247—1483 m.	Tjibeureum 1624 m.
	Megalophrys montana.	Megalophrys montana.
	Megalophrys hasselti.	
		Bufo cruentatus.
Bufo parvus.	Bufo parvus.	
Bufo melanostictus and B. biporcatus.	Bufo biporcatus.	
Microhyla achatina.	Microhyla achatina.	
Microhyla palmipes.	Microhyla palmipes.	Microhyla palmipes.
Rana limnocharis.	Rana limnocharis.	
Rana cancrivora.	Rana cancrivora.	
Rana kuhli.	Rana kuhli.	Rana kuhli.
	Rana macrodon.	
	Rana microdisca.	
	Rana jerboa.	Rana jerboa.
Rana chalconota.	Rana chalconota.	
Rana erythraea.		
	Rana nicobariensis.	
Oœidozyga lima.		
Rhacophorus leucomystax.	Rhacoporus leucomystax.	
Rhacophorus javanus.	Rhacophorus javanus.	Rhacophorus javanus.
Rhacophorus reinwardti.	Rhacophorus reinwardti.	
Philautus aurifasciatus.	Philautus aurifasciatus.	Philautus aurifasciatus.

The table shows, that only four species were found at all three localities, viz., *Microhyla palmipes, Rhacophorus javanus, Rana kuhli* and *Philautus aurifasciatus*. Three other species, *Bufo melanostictus, Rana erythraea* and *Oœidozyga lima* occurred at Buitenzorg (the lowest elevation) only and neither does literature record them from Tjibodas or Tjibeureum.

[1]) As I do not dispose of sufficient data to value AHL's records of species of *Hyla* and *Rhacophorus* from Java (1927 and 1929), I have not taken them into account.

The greatest number of species (17) was collected at Tjibodas, but many of them were also found at Buitenzorg, others at Tjibeureum. *Rana macrodon, Rana nicobariensis, Rana microdisca* and *Megalophrys hasselti* occured at Tjibodas only. In literature however *Rana nicobariensis* has been recorded from Batavia, which is situated slightly above sea-level. *Rana macrodon* was known to occur at Buitenzorg; Tjibodas and Tjiapoes on the slope of the Mt. Salak are new as javanese localities for this species.

APPENDIX.

Hylophorbus ocellatus (V. MÉHELY).

Metopostira ocellata V. MÉHELY, 1901; VAN KAMPEN, 1909 and 1914.

Hylophorbus ocellatus VAN KAMPEN, 1923.

Besides the javanese material the collection includes two frogs, which Mr. W. C. VAN HEURN found hidden under a stone on the island Ambon (Soja di Atas). I identified them as *Hylophorbus ocellatus,* because the original description tallies almost perfectly with their outward appearance and even the colour is the same as in MÉHELY's specimens (which had been preserved in the same fluid: formaline 4%). In the lumbar region the typical eyespot is still faintly discernible.

The few details in which these frogs differ from the original description can be explained by their youthful condition. They measure 22,5 and 24,5 mm from snout to vent, whereas MÉHELY mentions 33-42 mm as the length of his specimens. The differences are:

1°. the hindlegs are shorter; they reach only to the axil or to the tympanum.

2°. the tympanum is hidden. MÉHELY himself mentions this as a peculiarity of young frogs of this species.

3°. the skin is perfectly smooth.

Hitherto *Hylophorbus ocellatus* was known only from New Guinea, and Ambon is a new locality even for the genus, which includes only inhabitants of Australia, New Guinea and the Philippines, excepting *H. dubius,* which occurs on Halmahera. The two frogs under discussion certainly do not belong to *H. dubius.*

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