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ON *RANA FUSCIGULA* AND *R. ANGOLENSIS*.

By G. A. BOULENGER, LL.D., D.Sc., F.R.S.

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The frogs of the genus *Rana*, taken in the narrowest sense, are represented in South Africa by two closely allied, aquatic species, which may be regarded as the representatives of the Eurasian and North African *R. esculenta*, from which they differ principally in the cranial characters, the nasal bones never meeting on the median line, and a considerable portion of the upper part of the ethmoid remaining uncovered by the fronto-parietal bones, and also in the absence, in males, of external vocal vesicles. These two species have long been known under the names of *R. fuscigula*, D. & B., and *R. angolensis*, Bocage, or *delalandii*, D. & B.,\* and until lately they were regarded as perfectly distinct.

Within the last few years, however, doubts have been raised as to their status by Hewitt † and by Andersson,‡ who independently suggested an intergradation which, if confirmed, would reduce *R. angolensis* to subspecific rank. Mr. J. H. Power has also experienced difficulties in drawing a line between the two species, as they occur near Kimberley, and, at his suggestion, I have examined a portion of the material preserved in the Kimberley Museum, kindly sent to me for study by Miss Wilman, to whom I wish to express my best thanks.§

Adding to this the fine series in the British Museum, I have been able to examine about seventy specimens of *R. fuscigula* and about one hundred of

\* I believe two species have been confounded under this name by the authors of the 'Erpétologie Générale,' viz. *R. angolensis* and *R. oxyrhynchus*, as their description of the vomerine teeth applies to the latter and not to the former. However, M. Chabanaud informs me that only two type specimens are now preserved in the Paris Museum, and both agree with the definition of *R. angolensis*. The statement "Cette espèce est fort commune aux environs du Cap de Bonne Espérance" is erroneous, as neither of the two which they appear to have confounded occurs in the Cape Peninsula.

† 'Rec. Albany Mus.,' ii, 1911, p. 206.

‡ 'Svensk. Vet. Ak. Handl.,' xlvii, no. 6, 1911, p. 26.

§ All the specimens had been correctly identified by Mr. Power, but he writes to me that he has received, and actually caught, some which he has been unable to refer to either species, owing, I believe, to his having paid too much attention to the shape of the snout as a diagnostic character.

*R. angolensis*, and I may say I have had no difficulty in the discrimination of the two species, with the exception of the single specimen, from Natal, described years ago as *R. queketti*, on the specific distinctness of which I am in doubt. As I can also distinguish the two species in their larval condition, I see no reason for doubting their validity.

The uncertainty to which allusion has been made probably results from the imperfection of previous definitions, and I therefore now propose to give detailed descriptions of the two species, based exclusively on specimens from South Africa and Angola, and also diagnoses by means of which I trust the correct naming of specimens should offer no difficulties. I nevertheless agree with Mr. Hewitt in regarding the two species as the extreme forms of one common stock.

#### DIAGNOSES OF THE TWO SPECIES.

***Rana fuscigula*.**—Head usually a little broader than long, never longer than broad; interorbital space only a little narrower than the upper eyelid; tibio-tarsal articulation not reaching beyond the tip of the snout; heels not or but slightly overlapping; tibia twice in length from snout to vent, or slightly more or slightly less; toes entirely or nearly entirely webbed, never less than  $\frac{3}{4}$  webbed, rarely two phalanges of fourth free; glandular dorsal folds, if present, one only on each side, on the anterior third of the back. Tadpole with 5 or 6 upper and 4 lower series of labial horny teeth.

***Rana angolensis*.**—Head as long as broad or a little longer than broad, very rarely slightly broader than long; interorbital space much narrower than the upper eyelid; tibio-tarsal articulation reaching the tip of the snout or beyond; heels strongly overlapping; tibia  $1\frac{1}{2}$  to  $1\frac{2}{3}$  times in length from snout to vent; toes  $\frac{2}{3}$  to  $\frac{3}{4}$  webbed, two or three phalanges of fourth free; back, as far as the sacral region, usually with 6 or 8 more or less prominent, more or less interrupted glandular folds. Tadpole with 3 or 4 upper and 3 lower series of labial horny teeth.

#### DESCRIPTIONS OF THE TWO SPECIES.

***Rana fuscigula*.**—Vomerine teeth in oval groups or very short transverse or oblique series between or just behind the level of the choanae.

Head usually a little broader than long, never longer than broad, much depressed; snout rounded, rarely obtusely pointed, feebly or scarcely projecting beyond the mouth, as long as the eye or a little longer (up to  $1\frac{1}{3}$  times); canthus rostralis obtuse; loreal region very oblique, feebly concave; nostril equidistant from the eye and the tip of the snout, or a little nearer the former; the distance between the nostrils not or but little greater than the interorbital width, which is a little less than that of the upper eyelid;

tympanum very distinct,  $\frac{5}{8}$  to nearly once the diameter of the eye and 2 to 4 times its distance from the latter.

Fingers obtusely pointed, first and second equal and as long as or slightly longer than the fourth, third as long as or a little longer than the snout; subarticular tubercles moderate or rather small, moderately prominent. Hind limb moderately long; the tibia-tarsal articulation reaching the eye, the tip of the snout, or between these two points when the limb is stretched forward; the heels meeting or narrowly separated, exceptionally slightly overlapping, when the limbs are folded at right angles to the body; tibia twice in length from snout to vent, or slightly more or slightly less, shorter than the fore limb, as long as the foot or slightly longer or shorter. Toes obtusely pointed, entirely webbed, or at least  $\frac{3}{4}$  webbed, in which case one or two phalanges of fourth and one of third and fifth are free; subarticular tubercles small and moderately or feebly prominent; a more or less distinct fold along the inner side of the tarsus; inner metatarsal tubercle elliptical, feebly prominent,  $\frac{1}{3}$  to  $\frac{1}{2}$  the length of the inner toe; no outer tubercle.

Upper parts with small tubercles and larger warts, some of which often form short, wavy longitudinal folds; sometimes a longer glandular fold on each side of the anterior third of the back, extending to the posterior border of the upper eyelid; a curved fold from the eye to the shoulder; lower parts smooth, thighs granular near the vent.

Brown, greyish-olive, or dark olive above, with dark brown or blackish spots which may form regular longitudinal series on the back and a cross-bar or a chevron between the eyes; a pale green vertebral streak often present; a more or less distinct dark canthal streak and dark and light marblings on the upper lip; a more or less distinct light streak often extends from below the eye to the shoulder; limbs with more or less regular dark cross-bars; hinder side of thighs usually with dark marblings. Lower parts white, spotted, marbled, or vermiculated with blackish; these markings may be restricted to the throat and breast.

Male with internal vocal sacs; the fore limb very strong; a thick pad on the inner side of the first finger, covered during the breeding season with a greyish-brown, velvet-like horny layer, of which a similar but smaller patch is also present on the upper surface of the second finger; small whitish, conical tubercles on the warts on the body.

Tadpole similar to that of *R. esculenta*, but tail often longer, 2 to  $2\frac{1}{2}$  times the length of the body, and horny labial teeth in more numerous series, viz. 5 or 6 upper and 4 lower, answering to the following formulae:

$$\begin{array}{cc} 1 & 2 \\ 5-5 & 3-3 \\ \frac{1-1}{3} & \frac{1-1}{3} \end{array}$$

The tadpoles referred to this species by Werner, 'Jen.

Denkschr,' xvi, 1910, p. 295, probably belong to *R. angolensis*.

MEASUREMENTS, IN MILLIMETRES.

	British Museum.												Kimberley Museum.															
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.
	♂	♂	♀	♂	♂	♂	♂	♀	♀	♀	♀	♂	♀	♀	♀	♂	♂	♀	♂	♂	♂	♀	♀	♂	♂	♂	♂	♀
From snout to vent	61	85	110	73	72	68	49	84	83	79	75	57	70	62	65	94	89	108	66	65	63	95	87	70	61	60	58	68
Head	21	29	38	27	24	23	18	28	26	28	26	20	24	21	20	31	30	34	21	22	22	31	28	23	20	20	19	22
Width of head	22	30	44	28	26	25	19	34	31	34	27	20	26	22	23	34	32	38	22	23	23	36	32	23	22	20	19	25
Snout	8	11	15	10	9	9	7	11	10	11	10	7	9	8	9	11	11	13	8	9	8	13	10	9	8	8	7	8
Eye	7	9	11	9	8	8	6	10	10	10	9	6	7	7	7	10	9	10	7	8	8	11	10	9	7	7	7	8
Inter-orbital width	3	3	5	3	3	3	2	3.5	3	3.5	3	2.5	3	2.5	3	4	3.5	4	2.5	3	2.5	5	4	4	3	3	2	3
Tympanum	5	7	8	7	6	6	4	7	7	8	6	4	5	4	4.5	8	7	9	5	5	5.5	8	7	6	5	5	5	5
Fore limb	36	48	62	46	42	43	30	48	46	47	40	30	39	35	37	51	51	63	37	36	38	50	47	36	34	36	33	39
Hind limb	93	120	160	119	110	109	78	125	119	123	105	85	103	91	109	149	150	182	98	104	103	126	120	100	99	93	86	106
Tibia	28	40	49	37	34	32	23	38	36	38	33	28	33	30	33	47	45	57	32	33	33	42	39	34	32	29	27	34
Foot	30	40	50	40	35	35	25	40	37	39	33	28	34	30	36	48	45	56	32	33	33	39	39	34	32	32	27	35

1. Klipfontein, L. Namaqualand. 2. Cape Town. 3. Cape of Good Hope. 4-11. Deelfontein, Cape Province. 12-14. Schoombie, Middelburg, C.F. 15. Port Elizabeth. 16-18. Vredefort Road, Orange Free State. 19-25. Schoombie. 26-28. Kalk Bay, Cape Peninsula.

*Habitat*.—Namaqualand, Cape Province, Orange Free State, Western Transvaal.

A smaller race inhabits Nyassaland and Massailand.

The record of this species from Sierra Leone (Günther, Cat., p. 132; Boulenger, Cat., p. 50) is the result of a misunderstanding. The two specimens in the British Museum labelled as from that part of Africa belong to two distinct species—*R. fuscigula* and *R. occipitalis*. I had overlooked or misread a MS. label on the jar containing these frogs; it bears the following indication, which explains everything: "*Rana fuscigula*, Cape. Ditto, Sierra Leone." The latter locality evidently applies to the *R. occipitalis*, the other specimen being from the Cape of Good Hope.

***Rana angolensis***.—Vomerine teeth in short or moderately long transverse or oblique series between the choanae, rarely extending a little beyond the level of the posterior borders of the latter.

Head as long as broad or a little longer than broad, very rarely slightly broader than long, rather less depressed than in the preceding species; snout usually obtusely acuminate and projecting beyond the mouth, longer than the eye, rarely not longer; canthus rostralis obtuse; loreal region less oblique than in the preceding, feebly concave; nostril equidistant from the eye and the tip of the snout, or nearer the former; the distance between the nostrils greater than the interorbital width, which is much less than that of the upper eyelid; tympanum very distinct,  $\frac{1}{2}$  to  $\frac{3}{4}$  the diameter of the eye and  $1\frac{1}{2}$  to 3 times its distance from the latter.

Fingers obtusely pointed, first and second equal or, very rarely, first slightly longer than second, third as long as or a little longer or a little shorter than the snout; subarticular tubercles rather small and feebly prominent.

Hind limb variable in length, but usually very long; the tibio-tarsal articulation reaching the tip of the snout or beyond, the heels strongly overlapping; tibia  $1\frac{1}{2}$  to  $1\frac{7}{8}$  times in length from snout to vent, usually as long as or a little longer than the fore limb, rarely a little shorter, usually as long as or a little longer than the foot. Toes obtusely pointed, about  $\frac{2}{3}$  webbed, rarely  $\frac{3}{4}$ , 2 or 3 phalanges of fourth free; subarticular tubercles small and feebly prominent: a more or less distinct fold along the inner side of the tarsus; inner metatarsal tubercle oval or elliptical,  $\frac{1}{3}$  to  $\frac{2}{5}$  the length of the inner toe; no outer tubercle.

Upper parts smooth or with small tubercles, usually with more or less prominent, interrupted, glandular, longitudinal folds on the back, 6 or 8 in number, of which a pair beginning from the upper eyelids may be more developed than the others; a curved fold from the eye to the shoulder. Lower parts smooth, thighs granular near the vent.

Coloration very variable. Brown or olive above, usually with dark olive or black spots, which may be large or small, disposed irregularly on the back

or forming regular longitudinal or transverse series; these spots sometimes light-edged; a yellowish or pale green vertebral streak or broad band sometimes present; a dark canthal streak and a dark temporal spot; a light streak from the loreal region to the shoulder usually present, above the upper lip, which is usually brown or blackish spotted with whitish; flanks and hinder side of thighs more or less marbled with blackish, or dark brown, or blackish with white spots; upper surface of limbs with dark cross-bands. Lower parts white, uniform, or with the throat and breast spotted, marbled, or vermiculated with black; in specimens from Angola the throat and breast are usually dark brown or blackish, with the white ground appearing as round spots.

Male with internal vocal sacs, sometimes indicated externally by folds on the sides of the throat; fore limb very strong; a thick pad on the inner side of the first finger, covered during the breeding season with a greyish-brown, velvet-like, horny layer, of which a similar but narrow patch is also present on the upper surface of the second finger; small whitish, conical, or spinose tubercles on the head and body.

The tadpole is distinguished from that of the preceding species by fewer series of horny labial teeth, viz. 3 or 4 upper and 3 lower, answering to the

following formulae:  $\begin{array}{c} 1 \\ 3-3 \\ 1-1 \\ 2 \end{array}$ , or  $\begin{array}{c} 1 \\ 2-2 \\ 1-1 \\ 2 \end{array}$ , or  $\begin{array}{c} 1 \\ 2-2 \\ 3 \end{array}$ . The tail is often largely blotched

with blackish.

*Habitat*.— Eastern parts of the Cape Province, Natal, Zululand, Transvaal, Bechuanaland, Rhodesia, Angola, Portuguese East Africa, Nyassaland.

Mr. Power informs me that *R. angolensis* is plentiful at the Vaal River, 16 miles north of Kimberley, and at the Modder River, 24 miles south of Kimberley, and that *R. fuscigula* occupies the intermediate area. He has however, taken specimens of both species in the same pool at the junction of the Modder and Riet Rivers, and there are other parts of the country where their range overlaps.

*Rana theileri*, Macquard, 'Bull. Mus. Paris,' 1906, p. 252, from the Transvaal, is certainly a synonym of *R. angolensis*.

I am now inclined to regard, provisionally, *R. queketti*, Bouleng., 'Proc. Zool. Soc.,' 1894, p. 643, Pl. XXXIX, fig. 1, founded on a single specimen from Pietermaritzburg, as an abnormal *R. angolensis*. It agrees with this species in the shape of the head, in the very narrow interorbital space, and in the toes, which are only about  $\frac{2}{3}$  webbed. But the hind limb is shorter, as in *R. fuscigula*, the tibio-tarsal articulation reaching between the eye and the nostril, and the tibia measuring a little less than  $\frac{1}{2}$  the length from snout to vent.

MEASUREMENTS, IN MILLIMETRES.

	British Museum.																Kimberley Museum.																									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.
From snout to vent	♂	♂	♀	♀	♀	♀	♀	♀	♀	♀	♀	♂	♂	♀	♀	♀	♀	♂	♀	♀	♀	♀	♂	♂	♀	♀	♂	♂	♀	♀	♂	♂	♀	♀	♂	♂	♀	♀	♂	♂	♀	♀
Head	53	46	73	59	61	64	64	77	55	64	53	53	51	77	77	71	60	53	68	45	80	88	52	63	75	69	67	75	65	92	80	46	58	49	45	63	62	40	48	73	71	72
Head	19	17	25	19	21	23	22	26	21	24	20	20	18	24	25	24	21	19	22	16	26	31	18	25	26	23	22	25	22	29	27	17	21	19	17	23	23	18	18	26	25	24
Width of head	19	16	25	19	20	21	22	26	18	24	18	18	18	24	23	23	21	19	22	16	26	32	17	24	29	20	20	23	22	27	26	16	20	19	17	22	22	17	17	24	23	24
Snout	7.5	7	11	8	8	10	9	12	9	9	8	7	11	10	9	9	7.5	9	7	10	14	7.5	11	9	9	11	10	13	12	6	8	7	6.5	10	9	7	7.5	10	10	10	10	
Eye	7	6	8	6	8	8	8	7	7	7	7	6	8	8	8	7	6.5	8	6	9	11	6	8	8	8	8	8	8	8	8	7	7	6.5	8	8	7	7	7	7	9	9	
Interorbital width	2	2.5	2	2.5	2	2.5	2	3.2	5	2.5	2.5	2.5	2.5	3.2	5	3	2	2.5	2.5	4.5	2	3	3	3.2	5.2	5	3	3.2	5.2	3	3.5	3.5	2.2	5	2	2.2	5.5	2	2	3	3	3
Tympanum	4	4	6	4	5	5	5	6.5	5	5	4	4.5	5	5	5	4	5	4	5	4	6	7	4	6	5	6	5	5	5	5	6.5	6.5	4	5	4	4	5	5	4	4	6	6
Fore limb	35	30	42	33	34	35	35	47	34	36	37	36	31	41	37	40	31	35	28	26	44	52	29	45	44	42	40	40	39	48	44	25	33	32	28	35	35	28	27	30	30	30
Hind limb	105	82	127	100	105	108	108	152	110	105	108	107	90	135	129	137	101	108	127	88	133	100	90	130	140	123	122	125	117	158	139	79	104	94	85	115	117	93	87	123	128	120
Tibia	33	27	42	32	35	37	35	51	37	35	35	36	20	45	42	44	32	33	42	28	46	54	29	40	45	39	38	40	37	51	46	25	34	30	26	38	30	29	43	44	40	
Foot	30	27	39	32	34	35	34	45	34	35	34	34	30	42	40	41	30	33	39	27	41	50	30	40	45	40	38	40	37	51	44	24	34	30	26	35	37	29	28	40	40	37

1-4. Port Elizabeth. 5. Riverton, near Kimberley. 6-7. Watersmeet, Vryburg, Brit. Bechuanaland. 8. Durban. 9. Pietermaritzburg.  
10. Ross's Kloof, Natal. 11-16. Sibundeit, Zululand. 17. Freeburg. 18-20. Walkersroom, Transvaal. 21. Turloop, Transvaal.  
22. Matsi, Gazaland. 23. Guanyaya R., N. of Bulawayo. 24-25. Angola. 26-27. Cacadu, Angola. 28-31. Fungo Andongo, Angola. 32. Riverton, near Kimberley. 33-36. Moider R., Kimberley. 37. Watersmeet, Vryburg, Brit. Bechuanaland. 38-39. Tainings, Brit. Bechuanaland. 40-41. Potcheilsroom, Transvaal. 42. Marandellas, S. Rhodesia.