THE TADPOLE OF *TYLOTOTRITON VERRUCOSUS* ANDERSON.

By MALCOLM A. SMITH, *F.Z.S.*

(Plate XX.)

I am indebted to Dr. Annandale for the privilege of examining a fine series of adult and larval specimens of *Tylototriton verrucosus* obtained in the neighbourhood of Darjiling and Kurseong, in which district they are, he records, very abundant.[1] Last November whilst on Chieng Dao, N. Siam, my native collector also met with this newt at between 5,000 and 6,000 feet and obtained a number of larvae, but unfortunately no adults. Siam is a considerable extension southwards of the range of *T verrucosus* hitherto recorded from the Eastern Himalayas, Yunnan and Upper Burma. For the following information about its breeding habits I am indebted to Dr. Annandale, who has also kindly supplied the drawings which accompany this article :—

" *T verrucosus* is common at certain places in the Darjiling District at altitudes between 4,000 and 6,000 feet, but it is very local and I have been unable to obtain any evidence of its occurrence west of the Tista watershed.

" The life-history is interesting and the metamorphosis apparently prolonged. The adults enter the water as soon as the first spring showers fall in March or April and the females begin to lay their eggs shortly afterwards. The eggs are lightly attached, singly, to weeds, etc., and apparently hatch rapidly. The breeding season probably continues throughout the rainy season but the adults have left the water by the beginning of October. The growth of the larva is very slow in the first year, but the four legs are usually, if not always, developed before winter, in which growth probably ceases. I am not sure whether the young leave the water in the following year or whether there is a further larval period of one or more years, but I think that the metamorphosis is completed by the beginning of the second winter at any rate in most individuals. There may, however, even be a kind of " axolotl " stage in suitable conditions. The larva may, at any rate, attain about half the size of the adult before its gills begin to shrivel up and it leaves the water. This it does in October before the gills have completely disappeared."

The eggs of this newt are large although somewhat variable in size, measuring, when the gelatinous envelope is fully distended by the developing embryo, between 6 and 10 mm. in diameter. The young one on emerging is about 11 mm. long, and is provided with well developed external gills, with a pair of elongated " balancers " originating from a point behind and below the eye and in a line with the continuation of the mouth backwards, with a crested tail and budding fore-limbs.

[1] Annandale, *Rec. Ind. Mus.* vi, p. 215 (1911).

These latter develop rapidly and all four legs, with their digits, are complete at quite an early stage in life. The " balancers " apparently soon disappear, although a trace of them often persists in the form of a small tubercle at their point of origin.

The following description applies to a fully grown tadpole in which absorption of the external gills has not yet commenced :—

Head a little longer than broad, broader than, and about half the length of, the body ; eyes almost entirely lateral, the distance between them greater than the distance between the nostrils which are close to the tip of the snout. Tail as long as, or a little shorter than, the head and body, its tip obtusely pointed ; upper crest full, from one and a half to twice the depth of the lower crest, not reaching as far forwards as the head. The skin may be finely or coarsely granular ; the prominent ridges upon the sides of the head, which are so characteristic of the adult, are just apparent, while the knob-like projections upon the flanks are visible as elongated vertical folds of skin. The opercular folds are well developed and extend backwards on either side of the neck leaving a deep notch in the mid line ; these lateral prolongations are absorbed when the creature leaves the water, and in the adult are represented by a transverse fold of skin. The external gills are usually three in number on either side. Dr. Annandale has figured an example with two only, but this appears to be unusual and may be accidental. The colour of the tadpole is olive brownish, thickly speckled with darker markings. His statement about the size attained by it before leaving the water is borne out by a specimen [1] in his collection (90 mm. in total length), but not by my series (about 40 examples) from Siam. Possibly his individual is an example of partial neoteny and no doubt the actual stage in growth at which the tadpole leaves the water is variable and dependent partly upon the available water supply of the stream or pool it inhabits. My series were all caught in one place, in a shallow marshy spot upon the hill-side, and several of them, in which the gills have almost entirely disappeared, are only 52 mm. in total length. Others with the gills still persisting are larger, the biggest measuring 75 mm. in length.

Some of these larvae were kept in captivity for several weeks, but none evinced any desire to continue their aquatic existence ; one by one they clambered out of the water and hid themselves in some damp weeds provided for them close by.

The absorption of the crests occurs before the absorption of the gills, the latter process apparently not taking place until after the creature has left the water.

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[1] This specimen was taken at the edge of a small lake on the Sitong Ridge, Darjiling district.