

NUMBER II.

NOVEMBER 1, 1915.

OCCASIONAL PAPERS OF THE MUSEUM OF
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN.

PUBLISHED BY THE UNIVERSITY.

THE BREEDING HABITS OF *HYLODES CRUENTUS*
PETERS.

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The large collection of amphibians from the Sierra Nevada de Santa Marta, Colombia, in the Museum, contains a series of specimens of *Hylodes cruentus* Peters¹ which illustrates rather fully the life-history of the species. A part of this material was gathered by the writer, who had an opportunity to study the form in its environment while a member of the Bryant Walker Expedition sent to the region by the Museum in 1913, and a part was collected by M. A. Carriker on April 24, 1914.

The specimens obtained are from two localities, San Lorenzo and the heights east of San Miguel, the former collected by the writer, the latter by Carriker. On San Lorenzo

¹For the identification of the specimens the writer is indebted to Dr. George A. Boulenger, of the British Museum.

the species was found from an altitude of about 5,000 feet to the summit (about 8,300 feet), the San Miguel specimens were obtained at altitudes of 6,000 to 7,000 feet. The principal habitat of this frog is evidently a large species of Bromeliaceæ. At 5,000 feet these epiphytes occur almost exclusively on the trees and mostly above a height of five feet, but at altitudes above 6,500 feet, generally speaking, they descend and above 7,500 feet occur on the bases of the tree trunks, on logs and occasionally on the ground. The mountain top is devoid of trees and the Bromeliaceæ, here of large size and of course growing on the ground, become the dominant plants. At 5,000 feet all of the specimens of this frog were obtained in the epiphytes growing from 5 to 20 feet from the ground,² and none were found elsewhere. At higher elevations they were found in the plants growing on the ground and on the bases of the trees, and on the mountain top they were discovered in the plants on the ground and in the litter about them. It will be noted that on the summit, and there only, were individuals found outside of the plants, but it is probable that the frogs also occur to some extent on the ground in the higher parts of the forest where the epiphytes are growing low down on the trees.

The breeding habits of *H. cruentus* are evidently similar to those of *H. martinicensis* Peters in that the eggs are deposited on the leaves of plants and the metamorphosis takes place in the egg, the young emerging in the adult form (see plate). The acts of fertilization and egg-laying were not seen, but the eggs were found in some numbers. They were all attached to the inside surface of the leaves, and mostly but not always, near the center of the plant. All of the sets were well above the water held by the plant. The eggs were found in

² Plants higher than 20 feet on the trees were not examined.

sets of from four to eight and the number of sets found in a single plant varied from one to four. They were often attacked by a fungus which destroyed them, but when this had occurred sufficient gelatinous matter remained to show that the eggs which survived were not the complete set.

In 1913 the eggs were first observed between July 19 and 23, but it was evident that at this time most of them had hatched, and a number of recently hatched young were found in the plants. In the San Miguel collection there are eggs collected on April 24, 1914, which have small embryos.

The eggs are large and transparent and the developing embryo floats freely in a fluid. The smallest eggs (five millimeters in diameter), those from San Miguel, contain the youngest embryos. The latter are about four and three-fourths millimeters in length (exclusive of tail) and have the head, tail and limb buds, but not the body, folded off. Eggs with slightly older embryos, from San Lorenzo, have a diameter of six to six and a half millimeters, and those which have nearly or quite reached the time of hatching are eight or nine millimeters in diameter and the young are six to eight millimeters in length exclusive of the tail.

Metamorphosis is completed in the egg except that the tail is apparently not usually entirely absorbed before hatching. The limbs begin to appear very early, in fact before the body has been folded off. The yolk is large in amount and still distends the body of the frog at the time of hatching. The tail is very large, thin and vascular and in the early stages is closely applied to the yolk (Fig. 2). Previous to the time that the young frog leaves the egg the tail decreases in size (Fig. 3), but in the cases observed it still persisted until after the frogs had hatched, either in its embryonic form or as a filamentous appendage or as a small rudiment. It must entirely disappear

shortly after hatching as no trace of it can be seen in the young frogs, presumably of the year, found in the plants.

As soon as the legs are sufficiently developed and the yolk reduced the frogs struggle about in the egg, and it is evidently by means of this struggle that the egg envelope is finally broken. Many sets of eggs found between July 19 and July 23, 1913, were near the time of hatching, and the eggs in several sets were observed to hatch between July 22 and July 25. The eggs were all at about the same stage of development, and the eggs in the same set hatched within a few hours.

There was no evidence of any kind of brooding habit. Adult frogs were occasionally found in plants containing egg masses, but by no means as a rule, and in no case in proximity to the eggs.

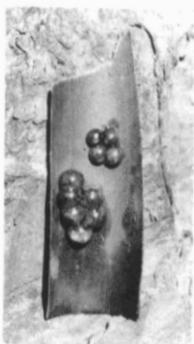
PLATE

PLATE I.

Figure 1. Eggs of *Hylodes cruentus* Peters on the leaf of a species of Bromeliaceæ.

Figure 2. Large embryo within the egg, showing the large vascular tail and the position of the limbs.

Figure 3. Embryo removed from the egg. This embryo was within a few days of the time of hatching. The limbs are in the characteristic position and the tail has been partly absorbed.



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