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THE AMPHIBIANS OF THE UNIVERSITY OF
MICHIGAN-WALKER EXPEDITION
TO BRITISH GUIANA

BY ALEXANDER G. RUTHVEN

The expedition¹ which was sent to British Guiana in the summer of 1914 secured a collection of amphibians which is of interest because of the new locality records, for the data on habits which accompanies it, and for the additional knowledge which it affords of the variability of several species. The party, consisting of F. M. Gaige, the writer, and native assistants, was in the field from July 14 to September 5, and most of the time was devoted to the study of the ants, amphibians, and reptiles.

The area covered by the field work comprised about sixteen square miles on the west bank of the Demerara River about Hyama Creek and the plantation known as Dunoon. The topography of the region consists of low detrital plains along the

¹ An account of this expedition is given in the Annual Report of the Director of the Museum of Zoology for the year 1914-1915.

river, in the rainy season but little above the high tide level, and of ridges of sand reaching a height of 100 feet. The vegetation apparently had been disturbed but little. From the river bank associations (elephant grass, mocca-moccas, and prickly shrubs and palms) to the foot of the sand reefs the lowland was covered with a dense forest among the conspicuous trees of which were the mora, trumpet-tree, tree-fern, and many palms. The clearings were small and widely separated and in many places had been allowed to revert partly or entirely to the forest. The slopes of the sand reefs were also heavily forested but with a more open association, the mora, greenheart and wallabas being the conspicuous trees. On the higher parts of the reefs the forest was composed of tall slender trees (the spar-bush of the natives), of stunted, scraggly trees and bushes about the open areas, or it was replaced by open areas of sand, locally known as mouries. The mouries were covered by a scanty growth of grasses, low bushes, plants with a heath-like growth habit, and xerophytic mosses and lichens, and supported thickets of stunted trees and shrubs (in which the clusias and figs were conspicuous) widely separated or so close together that the open areas formed narrow winding ways.

Unfortunately the breeding season of most of the species of amphibians was apparently over by July 14, but data on the breeding of some forms were obtained. The work was done intensively, an effort being made to obtain as many species as possible and series of specimens of each form with data on habitat distribution and coloration in life. The colors were obtained by comparison with Ridgway's "Color Standards and Color Nomenclature."

LIST OF SPECIES

Cæcilia gracilis Shaw.—Six specimens at Dunoon. The specimens were taken in the forest on the bank of the river; one under a board, the others emerged from the ground when the formalin tanks were emptied.

Pseudis paradoxa (Linnæus).—An excellent series of the species, collected in the summer of 1914, was obtained from Mr. James Rodway, Georgetown Museum. The specimens were taken from the ditches about Georgetown.

Leptodactylus hylædactylus Cope.—A single specimen taken in low woods at Dunoon, July 29, is referred to this species. It agrees with the descriptions of Cope² and Boulenger³, except that the writer can distinguish neither a dorso-lateral dermal fold nor a cross-band between the eyes.

Leptodactylus typhonius (Daudin).—An adult specimen taken at Georgetown by E. B. Williamson, January, 1912, and six specimens from Dunoon. The latter were all taken in the thickets on the mouries. All of the young specimens (25 mm. or less in length) have a narrow, light, dorsal line enlarging into a spot between the shoulders and otherwise differ in coloration from the adult. The colors in life of one young individual were as follows: Body above brownish olive with dark spots, a narrow capucine orange vertebral stripe enlarged into a spot of the same color between the shoulders, and a flame scarlet stripe on each side; muzzle above tawny olive; fore legs above light orange yellow nearly to feet; hind legs dark olive buff; a Sanfords brown patch on the buttocks. Another specimen was mineral gray above, with orange cinnamon lateral stripes, a cinnamon buff dorsal line, an olive buff spot, and deep olive buff snout.

² Proc. Acad. Nat. Sci. Phila., 1868, p. 115.

³ Cat. Batr. Sal., p. 240.

Leptodactylus caliginosus Girard.—A large series of specimens. The species was very common at Dunoon and was found only in the low forest, swamps, ditches, and clearings along the river and creeks. During the day it was found under logs, but at night it was active and could be collected in numbers with a light. The coloration is variable but a common type may be described as follows: Ground color above grayish olive with darker markings, the only constant ones being the blackish band from the end of snout to axilla and a large triangular olive brown, black-edged spot on the head; belly white with olive brown reticulations; posterior sides of thighs with an irregular pattern of black and old gold. In some of the specimens the darker markings are faint or wanting, the ground color above being russet with kaiser brown punctulations.

Leptodactylus rhodomystax Boulenger. — Two specimens obtained in the forest on the lower part of the sand reef correspond very closely to the original description of the species. The margin of the upper lip was terra cotta in life, the broad stripe under the eye and the spots at the angle of the mouth, white. The length of the two specimens is 18 mm. and 20 mm.

Lithodytes lineatus (Schneider).—A single specimen taken in a pile of chips in the forest on the sand reef at Dunoon.

Noble⁴ has concluded that this species is to be referred to the genus *Leptodactylus* for the reason that with age there is a change in the form of the distal digital phalange from an "Eleutherodactylus-like T-shaped type" to a "Leptodactylus-like simple type," and a similar change occurs in the ontogeny of a typical species of *Leptodactylus*, *L. melanonotus*. In the opinion of the writer Noble's argument fails to be convincing.

⁴ Bull. Amer. Museum Nat. Hist., XXXVII, pp. 793-797.

when his figures are examined. Drawings B, C, E, F, Figure 1, indicate a reduction in the extensions of the terminal phalanges of *lineatus* with age; but if the phalange reproduced in drawing A is, as stated in the legend, that of an adult specimen of this species the reduction with age cannot be without exceptions. Ignoring drawing A and granting a reduction with age Noble has not shown that the simple condition found in adult Leptodactylids is reached, the adult condition in *L. lineatus* being comparable to the immature condition in Leptodactylids as far as shown by his figures.

The writer has examined the phalanges in a series of specimens of *Leptodactylus albilabris* and finds a change in phalange form in this species of Leptodactylus such as Noble describes for *L. melanonotus*: the phalanges are T-shaped, the dilations being blunt in the young and only swollen on the end in the adults. Also in two specimens of *lineatus*, a partially grown individual and an adult, the phalanges are strikingly T-shaped in the young, the expansions being long and attenuated toward the ends, and short and blunt in the adult; in other words, the development is as represented by Noble's figures C and F. It is clear that if the adult form of the phalange in the specimens of *lineatus* now at hand is described as simple, that of the young of Leptodactylus species cannot be called T-shaped, for the change which takes place in the life-history of *lineatus* stops where the similar change in the ontogeny of the Leptodactylus species begins. Quite obviously this does not establish the generic identity of *lineatus* and the species hitherto referred to Leptodactylus, and it seems advisable to consider the former as generically distinct,—at least until it is shown that there are species which have the characters of Leptodactylus and an ontogenetic change in phalange form from a distinctly T-shaped to the simple type. If *lineatus* is re-

ferred to the genus *Leptodactylus* on the basis of our present knowledge, it must be by enlarging the conception of the genus to include both those forms which have simple phalanges in the adult form and those which have at least as T-shaped phalanges in the mature stages as the young of the species now referred to the genus.

The writer believes the conclusion of Peracca⁵, that the species represents a genus distinct from *Leptodactylus* and *Eleutherodactylus* and allied to *Plectromantis*, is more nearly correct. It differs from *Eleutherodactylus* in the shoulder girdle, from *Leptodactylus* in having T-shaped phalanges in the adult stage, and from *Plectromantis* in the absence of true pads. It is thus apparently closest to *Plectromantis*, and it is possible that a study of the phalanges of the latter may reveal that the genera are not to be separated. It is possible also that the species constituting the genus *Plectromantis* are to be referred to *Leptodactylus*, as Boulenger has suggested, and in this case it will be necessary to determine if the phalanges change to the same extent as in the species now referred to *Leptodactylus* or from the distinctly T-shaped, as in young *lineatus*, to the simple type, to decide whether or not *lineatus* goes with them.

The specimen obtained is immature, measuring 28.5 mm. in total length. The ground color of the back and sides, including the head, black; the numerous punctulations olive gray; the lateral stripes primuline yellow; an irregular spot of flame scarlet in the region of the groin extending on the thigh; fore limbs olive gray with black markings; the posterior limbs dark olive gray to the feet, the feet olive gray, the bands black; two large spots beneath the tibia and several on posterior face of femur flame scarlet; chin, throat and chest deep neutral

⁵ Bol. Musei Torino, XIX, No. 465, pp. 31-32.

gray with small white spots; abdomen and under surface of hind limbs neutral gray.

Bufo marinus (Linnæus).—This toad was very common in the region about Dunoon. It was found in numbers in the low forest along the river, less abundantly in the forest on the sand reef, and occasionally in the thickets on the mouries. Tadpoles were found in lowland pools in July and August, and some of them left the water on August 16 (Copeia, No. 31, pp. 43-44). The following description of the tadpole has been prepared by Helen Thompson Gaige.

(Museum of Zoology, No. 48285, collected August 4, 1914, by A. G. Ruthven.) Length of body once and a half its width and three-fourths the length of the tail. Nostrils a little nearer eyes than end of snout, distance between them less than interocular space and equal to diameter of eye. Eyes nearer end of snout than spiraculum, distance between them equals width of mouth. Spiraculum sinistral, visible from above and below, equidistant between nostril and insertion of hind leg. Anal opening median, larger than opening to spiraculum. Hind legs well developed, their total length equal to the body width. Tail three times as long as deep, ending in a rounded point; crests narrow, extending halfway to level of spiraculum; depth of the muscular part at the base half the greatest total depth.

Color (in alcohol) grayish black above, brownish black beneath. Muscular portion of tail colored like back above, edged with yellow beneath. Crests grayish translucent.

Mouth bordered by papillae on the sides only. Beak black. Series of labial teeth $\frac{2}{3}$, second upper series interrupted in middle by a space one-third of the entire length of the row. Lower rows straight, the outer forming the margin of the lip.

Measurements of six specimens: length of body, 9 mm.;

length of tail, 11, 11, 12, 12, 13, 13 mm., average 12 mm.; width of body, 6 mm.; greatest depth of tail, 4, 4.5, 3.5, 4, 4, 4 mm., average 4 mm.; depth muscular portion tail at base, 2, 2.5, 1.5, 2, 2, 2 mm., average 2 mm.

Bufo typhoni (Linnæus).—A very common species about Dunoon. It was found in all habitats from the thickets on the mouries to the low forest along the river, but it seemed to be most common in the forest on the lower parts and at the foot of the sand reef. There is apparently a considerable sexual dimorphism in size (Plate III) as the largest female measures 79 mm., the largest male, 32 mm. in length. The great variations in coloration are indicated in the following general description made from the living animals. Ground color above usually some shade of brown, sometimes grayish olive or ecru olive, occasionally prussian red; the dark markings (bister, carob brown, warm sepia or black) when fully developed consisting of a preocular band, an interocular band, a shoulder band, a sacral band, and a pelvic band, all interrupted on the vertebral line, some usually wanting or reduced to spots, the sacral and interocular bands most persistent, upper surface sometimes immaculate, occasionally the entire upper surface of head the color of the interocular band; sometimes a vertebral stripe of greenish buff, deep olive buff, cartridge buff or tea green. Sides of body cream buff, deep olive buff or some dark shade of brown (chestnut, carob brown, walnut brown), black, or reddish (orange cinnamon or terra cotta), immaculate or marked with cream buff, ivory yellow or fawn-color. The belly may be immaculate ivory yellow, honey yellow, pale orange yellow, cream buff or cartridge buff, the region of the chest ochre red, burnt sienna, orange cinnamon, ferruginous, Hay's russet, or coral pink; or the under surface may be spotted or washed with cream buff, cartridge buff, deep olive buff,

Mikado brown, buffy brown or chestnut drab or black, sometimes to such an extent on the chin and throat that the lighter ground color is reduced to a median line and a transverse line in the pectoral region, and in these specimens the lighter color on the posterior part of the abdomen may be dusky dull violet blue, pale lilac or deep lavender. In our series the females tend to be duller colored than the males, but many of the former had the red ventral colors described above while some of the males did not. It is only in the male specimens, however, that the dorsal band is wide and of a contrasting color.

Hyla maxima (Laurenti).—A large specimen taken in a cocoanut tree at Dunoon on September 5.

Hyla taurina (Fitzinger).—Apparently common in the forest along the river; most frequently observed in the moccas; a single specimen taken in a bromelia in a thicket on a mourie (Plates II and III). The color pattern is variable as the darker markings may occur as stripes, spots, or reticulations and be more or less distinct, but in most of the specimens they take the form of more or less definite stripes from the eyes, and an interocular band is present. The colors of one specimen were as follows: Above dark greenish olive, light spots clove brown, ground color of head ecru olive, light spots above ear and a few on the sides old gold; femur Saccardo umber with bister bands, hind limbs otherwise buffy olive with brownish olive bands; fore limbs olive with faint dusky bands; belly and under surface of legs immaculate white, chin sea foam yellow with sepia spots; iris strontian yellow. Another specimen was snuff brown above except on the head behind the eyes, where it was avellaneous brown; the thighs were Roods brown, the tibia and feet drab; under surface white; iris cream buff. A third was

buffy brown on the back and fore limbs, deep olive on the head, and dark olive buff on the hind limbs, with olive brown and clove brown markings; the belly whitish, the ventral spots drab.

The head is usually more olivaceous than the back, and the dark spots on the hind limbs frequently have paler (citric drab in one) centers.

Hyla helenae, new species^o

Diagnosis: Habit of *Hyla alboguttata*. Tongue subcircular, nicked and free behind; vomerine teeth between the choanae which are large and in two oblique series forming together a chevron the point of which is directed forward. Tympanum distinct, one-half the diameter of the eye. Fingers with rudiment of web, the disks nearly as large as the tympanum, no projecting rudiment of pollex; toes webbed to penultimate phalange of fourth toe, disks smaller than those of fingers. Head as broad as long; interorbital space broader than upper eyelid; snout shorter than diameter of orbit. Skin smooth above, granular below.

Habitat: Valley of the Demerara River, British Guiana.

Type Specimen: Cat. No. 52681, Museum of Zoology, University of Michigan; Dunoos, British Guiana; August 14, 1914; A. G. Ruthven, collector.

Description of Type Specimen: (Plate I.) Head as broad as long, a little more than one-third of total length. Tongue subcircular, indistinctly nicked and free behind; vomerine teeth in the form of a very open chevron. Head large, depressed, as long as broad; snout rounded, shorter than diameter of eye; canthus

^o Named for Helen Thompson Gaige to whom I am indebted for much assistance in the study of this collection and for the descriptions of the larvae.

rostralis distinct, loreal region concave; interorbital space much wider than upper eyelid. Tympanum distinct, half the diameter of the eye. Fingers with rudiment of web, no projecting rudiment of pollex, disks nearly as large as tympanum; toes webbed to penultimate phalange of fourth toe, disks smaller than those of the fingers, a single metatarsal tubercle, sub-articular tubercles well developed. Length of hind leg to tibio-tarsal articulation equal to length of body forward to the eye. Skin smooth above, granular beneath.

Total length 19.5 mm.; head length 7.25 mm.

The colors in life were as follows: Above deep green with numerous well-defined brown spots; thighs, hind feet and inner side of tarsus orange buff, tibiæ javel green; fore limbs, except elbows and inner side of feet, asphodel green, elbows viridine yellow, inner side of fore feet orange buff; both fore limbs and hind limbs with light brown cross-bars; upper lip viridine yellow with vertical brown bars; belly white, immaculate.

In alcohol the green has faded to a brownish olive, the light markings to dull white.

Description of Tadpole: Cat. No. 52517, Museum of Zoology, University of Michigan; collected by A. G. Ruthven. Length of body twice its width and seven-tenths the length of the tail. Nostrils much nearer eyes than snout, distance between them two-thirds interocular space and equal in diameter of eye. Eyes equidistant between end of snout and spiraculum, distance between them equal to width of mouth. Spiraculum sinistral, protruding, visible from above and below, equidistant between posterior border of eye and insertion of leg. Anal opening inconspicuous, dextral in the caudal crest. Hind legs small, their total length equal to the greatest depth of the muscular part of the tail, tips round. Tail almost three times as

long as deep, ending in an acute point; crest not wide, not extending on back much beyond the level of the anal opening; depth of the muscular part at base more than half the greatest total depth.

Color (in alcohol) dark brown above with darker iridescent streak down vertebral region, between eyes and on either side. This darker color, spotted with white, encroaches on the sides of the throat. Belly yellowish white, iridescent. Muscular part of tail yellowish with four well-defined square dark spots, becoming progressively smaller posteriorly, on the median line above. Crests gray spotted with black, the spots larger and more numerous on the posterior third of the crest. The square spots may persist until the tadpole is nearly ready to transform; however, one specimen of approximately the same stage of development as 52517 has them only faintly indicated and the crests are immaculate.

Mouth three-fourths bordered by papillae. Beak with wide margin of black. Series of labial teeth $\frac{3}{3}$, the second upper series very short, the first widely interrupted in the middle. The first lower series very narrowly interrupted in the middle. Another specimen has only a trace of the second upper series, while a third has only one long, curving, upper series, widely interrupted.

Length of body 14 mm.; length of tail 20 mm.; width of body 7 mm.; greatest depth of tail 7 mm.; depth of muscular portion of tail at base 4 mm.

Remarks: It is with considerable hesitancy that the writer has described this form because the metamorphosed specimens are probably immature. The three adults are, however, very similar in structure and color and are apparently not to be referred to any of the described species. Dr. George A. Boul-

enger has kindly examined a specimen and has expressed the opinion that the form is allied to *H. alboguttata* Boulenger. The writer has not been able to examine a specimen of *H. alboguttata*, but the specimens here described certainly have many of the characters of that form as given in the original description⁷: the obvious differences are in the width of the interorbital space, the relative length of the snout, and coloration.

Habits: The adults were all taken in the lowland forest along the river. They were on the leaves of ravenalias and cacao. The tadpoles were found in a pool in the same habitat.

Hyla boans Daudin.—Five specimens. The species was found in the forest on the bank of the river. The ground color of the back in a typical specimen was vinaceous russet, the cross bands ecru olive, the head washed above with olive ochre, the region of the groin pale bluish lavender, the lateral dark stripe on head and body blackish brown (3), the anterior face of the tibia blackish brown (3), a line above anus and one on foot ivory white, ventral surface white. In others the ground color was buffy brown on the back and fore legs, the hind legs dark olive buff, the head deep olive, and the dark markings olive brown and clove brown.

Hyla acuminata Cope.—This little tree frog was not rare in low woods at the base of the sand reef near Dunoon, but it was not found elsewhere.

Hyla rubra Daudin.—Numerous specimens from the clearings and forest on the banks of the river at Dunoon. The species was common in this habitat. The color pattern is rather constant, consisting principally of an interocular band, two

⁷ Catalogue of the Batrachia Salientia in the British Museum, p. 356.

dorsal bands, a lateral dark band from the eye to the middle of the side, a canthal streak, and pale spots or reticulations on the anterior and posterior sides of the thighs. In life the ground color of the back was lime green, vetiver green, buffy olive or olive brown, the stripes olivaceous black or fuscous; the light spots on the thighs ochraceous buff or primuline yellow; the belly straw yellow, and the chin and throat amber yellow. Some of the specimens had pallid methyl blue, others citron yellow, spots on the groin; one was vetiver green above with olive buff stripes, sea foam green belly, and ochraceous buff spots on the thighs; and one was glaucous above with faint streaks of army brown and a lateral head stripe of seal brown.

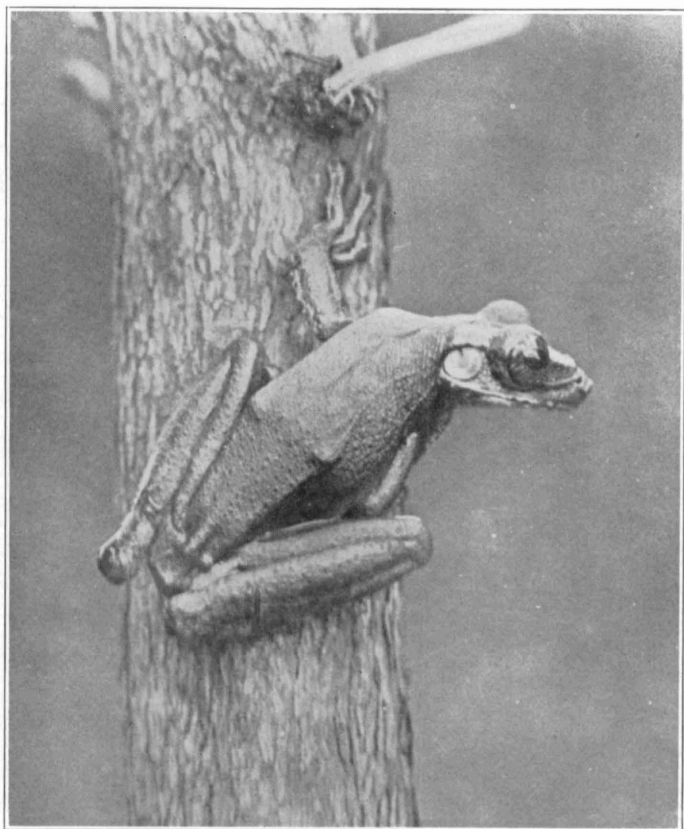
Phyllomedusa hypochondrialis (Daudin).—A single specimen was taken in the forest on the north side of the river at Dunoon.

Pipa americana (Linnæus).—There is a specimen in the Museum which was taken at Tumatumari Falls, British Guiana, February, 1912, by E. B. Williamson.



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E. N. FISCHER, *del.*



HYLA TAURINA
BUFO TYPHONIUS

PLATE III



