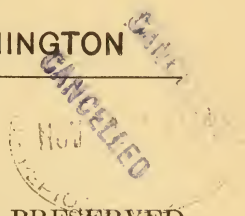
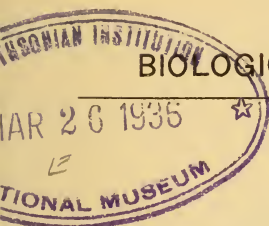


PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON



SOME NEOTROPICAL BATRACHIANS PRESERVED  
IN THE UNITED STATES NATIONAL MUSEUM  
WITH A NOTE ON THE SECONDARY SEXUAL CHAR-  
ACTERS OF THESE AND OTHER AMPHIBIANS.

BY G. K. NOBLE.

Among the neotropical Amphibia contained in the collections of the U. S. National Museum, and kindly loaned to me for study by Doctor L. Stejneger, there are included two new species and several other rare or interesting forms. The greater number of these specimens come from Panama. As several of the species were not hitherto recorded from that country, I have included below a list of the rarer forms, together with the localities from which they were obtained. The abbreviations given below refer to the names of the collectors.

- (B) August Busck.
- (C) E. D. Christopherson.
- (G) E. A. Goldman.
- (H) S. F. Hildebrand.
- (M & H) S. E. Meek and S. F. Hildebrand.
- (N) G. W. Nelson.
- (P) C. H. Van Patten.

PANAMA.

*Eleutherodactylus longirostris* (Boulenger).

Rio Mamoni (M & H), Pedro Miguel (M & H), Miraflores (M & H), Arrijam (M & H), Caña (G), Rio Chilibrillo (G).

*Eleutherodactylus brocchi* (Brocchi).

Cerro Brujo (G).

*Eleutherodactylus goldmani*, new species.

Cerro Brujo (G).

**Leptodactylus bolivianus** (Boulenger).

Caña (G), Miraflores (M & H), Rio Morte Arnade (M & H), Rio Mamoni (M & H), Rio Chorrera (M & H).

**Centrolene prosoblepon** (Boettger).

Cabima (B).

**Centrolenella fleischmanni** (Boettger).

Canal Zone (B).

**Eupemphix pustulosus** (Cope).

Porto Bello (B), Upper Trinidad River (M & H), Panama (N), Canal Zone (C), Tobago Island (B), Rio Mamoni (M & H).

**Hyla gabbii** Cope.

Rio Calobre (M & H), Caña (M & H).

**Hyla rosenbergi** Boulenger.

Rio Bayano (M & H), Arrijam (G).

**Hyla chica** Noble.

Rio Calobre (H).

**Agalychnis spurrelli** Boulenger.

Cabima (B).

**Agalychnis moreletii** (Dumeril).

Panama (P).

**Atelopus varius** Stannius.

Caña (G), Miraflores (G), Rio Jappe, Darien (M & H).

**Phyllobates latinasus** (Cope).

Caña (G).

**Bufo granulosus** Spix.

Rio Calobre (M & H).

**Bufo valliceps** Wiegmann.

Porto Bello (B).

SOUTH AMERICA.

**Leptodactylus bolivianus** Boulenger.

La Guaira, Venezuela; Lyon and Robinson.

**Borborocoetes stejneri**, new species.

Organ Mts.; J. N. Rose.

**Centrolenella fleischmanni** (Boettger).

Quevedo, Ecuador; J. B. Rorer.

The Panama collections include two specimens, one adult and one juvenile, of an apparently undescribed *Eleutherodactylus*. I would hesitate very much adding one more species to the long list of forms already included in this difficult genus were it not for the fact that the present species is strikingly different from any form previously recorded from Panama. It may be known as

**Eleutherodactylus goldmani**, new species.

*Diagnostic characters*.—Allied to *E. sallaei* and *E. rhodopis*; agreeing with them in the pointed snout and dark face stripe; differing from these species in the dense, spiny granulations of the back. Loreal region concave, a pronounced supratympanic fold, continued posteriorly about half the length of the body as a dorsolateral fold; tympanum nearly as large as the eye; interorbital space  $1\frac{1}{2}$  times as broad as the upper eyelid. Uniform brown above, a black streak on each side of the head extending from the tip of the snout to the tympanum and curving ventrally to follow the dorsolateral fold.

*Type*.—U. S. N. M 54033, adult ♂; Cerro Brujo, June 7, 1911, E. A. Goldman, collector.

*Description of Type*.—Head much longer than broad, broader than body; distance between nostril and eye equal to the interorbital width, greater than the diameter of the eye; distance between nostril and tip of snout contained just twice into the distance between nostril and eye; snout pointed, the internostril width two-thirds the interorbital width; portion of snout anterior to nostrils rounded, nearly truncate; canthus rostralis very sharp, the loreal region concave and very abrupt; tympanum pronounced, nearly as large as the eye, separated from the eye by a space equal to one-half its diameter. Tibio-tarsal joints of either side strongly overlap when the legs are folded at right angles to the body; tibio-tarsal articulation reaches well beyond the snout; digital dilations well defined, pointed, only a seventh as large as the tympanum; digits free except for the barest indication of a web between the outer toes; two well defined metatarsal tubercles, the inner very pronounced, a tarsal fold present. Vomerine teeth in two small transverse series well behind the choanae; the groups separated from one another by a space equal to the greatest length of either; tongue large, truncate but not emarginate behind. Skin of the whole dorsal surface and of the sides of the body between the lateral folds shagreened or covered with dense, spiny warts of a small size; side of the head and body below fold, as well as the entire ventral surface, smooth; no granulations on the belly; posterior surfaces of the thighs granular.

Color (in alcohol) dark purplish brown above, whitish below; a black streak on each side from the tip of the snout, through the eye and tympanum to the middle of the body; a black spot on the humerus, an irregular dark blotch at the distal end of the femur, some indication of three cross bars on the femur, and five on the tibia; ventral surfaces of the hind limbs suffused with purplish brown.

*Measurements.*

|   |        |
|---|--------|
| Tip of snout to vent . . . . .                          | 42 mm. |
| Tip of snout to posterior border of tympanum . . . . .  | 18 mm. |
| Greatest breadth of head . . . . .                      | 15 mm. |
| Distance from axilla to tip of longest finger . . . . . | 27 mm. |
| Distance from vent to tip of longest toe . . . . .      | 83 mm. |
| Tibia . . . . .   | 28 mm. |

Among the batrachians included in the South American collections there is a single specimen of a species collected by Doctor J. N. Rose in the Organ Mts. of Brazil. On preliminary examination I thought it an aberrant species of *Zachaenus*. But the tongue of this species is not fully adherent behind, and I am forced to refer it to the genus *Borborocoetes*. No specimens of *Zachaenus* are available for study. From the descriptions it would appear that the only character separating *Zachaenus* from *Borborocoetes* is the adherent tongue. This is certainly a feature of little consequence. The tongues of the various species of *Telmatobius* differ enormously in their degree of adherence. The recognition of a monotypic genus upon such a feature is not consistent with present-day custom. On the other hand, *Z. parvulus*, *B. miliaris* and the species described below do not seem very closely related. Until the structure of *Zachaenus* is better known, it is perhaps most conservative to consider the genus as valid. Nevertheless, it should be pointed out that the species described below stands intermediate between *Zachaenus* and such a typical form of *Borborocoetes* as *B. quixensis*. The species may be known as

***Borborocoetes stejnegeri*, new species.**

*Diagnostic characters.*—Head short, sharply pointed, the eyes directed forward; no tympanum; vomerine teeth in two slightly oblique series in contact with each other and behind the choanae; tibio tarsal articulation reaching only to the angle of the jaw; skin granular above, smooth below; uniform reddish brown above, whitish below, throat pale brown spotted with white.

*Type.*—U. S. N. M. 52608, adult ♂, Organ Mts., Brazil, 1500 meters, August 15, 1915, J. N. Rose, collector.

*Description of type.*—Head a trifle broader than long, sub-triangular; about as broad as the body; eyes directed forward; internasal space two-thirds the interorbital space, distance between nostril and eye equal to the greatest diameter of the eye; canthus rostralis rounded; loreal region sloping gradually; no tympanum, but a fold present in the position of a supratympanic fold; tibio tarsal joints of either side in contact when the legs are folded at right angles to the body; tibio tarsal articulations reach

the angle of the jaw. First finger not extending beyond second, no digital dilations; no web between the toes; subarticular tubercles pronounced, no tarsal fold, two metatarsal tubercles, the inner about three times as long as the outer. Vomerine teeth in two slightly oblique series, behind the choanae and in contact with each other; tongue ovate, entire, scarcely free behind, the posterior edge finely crenated (possibly abnormally so). Skin finely granular above; a curved fold from the eye to the shoulder; a suggestion of one or two other folds in the shoulder region.

Ground tone dull reddish brown above, spotted or marbled on the sides; ventral surface white, throat brownish spotted with white, limbs brownish spotted with whitish, the spots varying in size, nearly absent from the ventral surface of the femurs.

*Measurements.*

|   |      |     |
|---|------|-----|
| Tip of snout to vent . . . . .                          | 42   | mm. |
| Tip of snout to angle of jaw . . . . .                  | 20   | mm. |
| Greatest breadth of head . . . . .                      | 21   | mm. |
| Distance from axilla to tip of longest finger . . . . . | 24   | mm. |
| Distance from vent to tip of longest toe . . . . .      | 59   | mm. |
| Tibia . . . . .   | 17.5 | mm. |

It will be noted from the above list that the collections under discussion include representatives of the two rare bufonid (leptodactylid) genera *Centrolene* and *Centrolenella*. Some time ago when I was describing the latter genus, I suggested that *Hyla prosoblepon* Boettger would probably be found referable to *Centrolene*, and certain species of "*Hylella*" to *Centrolenella*. Both of these prophesies are now substantiated. The two specimens of *Hylella fleischmanni* Boettger in the collections possess the T-shaped terminal phalanges, reduced pectoral girdle and other distinctive features of *Centrolenella*. (See Noble 1920 Bull. Amer. Mus. Nat. Hist. 42, p. 441.) *H. fleischmanni* must be referred to that genus. The National Museum collections include a single specimen of *H. prosoblepon*. This specimen and two additional ones in the American Museum from Bocas del Toro, Panama, substantiate my other guess that the species should be referred to *Centrolene*. A well developed humeral spine is present in both sexes (although better developed in the male). In other internal structures the specimens agree fully with *Centrolene*. In the paper referred to above, I was at a loss to attribute any functional significance to the humeral spine of the female. It seemed remarkable that a secondary sexual character apparently functioning in only the male sex to insure amplexus should be present in both sexes. I suggested in my earlier paper that the spine might conceivably assist the female in retaining its position on a tree. In an earlier paper (Noble 1920 Copeia No. 79, p. 16) I had the occasion of discussing another secondary sexual character well developed in both sexes. This is an enlarged prepollex found in the "Dagger Frog," *Babina*. Unfortunately, Procter (1920 Proc. Zool. Soc. London, pp. 421-422) has misunderstood my use of the word "dagger." As I pointed out in the paper mentioned, it is a matter of little consequence whether or not the terminal phalanx of the prepollex actually

perforates the skin. Hence, I chose to use the name "dagger"—a word I put in quotation marks—for the whole structure both dermal covering and bony core. The fact that a female frog should possess an enlarged prepollex (with dermal covering) seemed to me of considerable interest.

The enlarged prepollex of *Babina* and the humeral spine of *Centrolene* may be called pseudo-secondary sexual characters, since they are well developed in both sexes (although larger in the male). The structures may be compared with the horns of the White Goat (*Mazama*) or even the horns of some cattle. They are obviously not dependent for their formation upon the secretion from the gonads—as in the case of the horns of the deer. It is important to bring out this comparison. In no vertebrates below Amphibia do we find secondary sexual characters, at least male structures primarily concerned in insuring fertilization, well developed in the female where they can have no such significance. The ultimate analysis of the nature of all secondary sexual characters may be determined only by experiment. Recent work on cock and hen feathering of fowl has shown how complicated the analysis may become. In the absence of experiment, it seems to me important to draw a sharp distinction between nuptial asperities or the fluctuating structures of the breeding season and copulatory organs present in both sexes and apparently not dependent for their formation upon any endocrine system. The humeral spine of *Centrolene* and the prepollex of *Babina* seem to be examples of elaborate somatic characters carried along from generation to generation but functional only in one sex, and then during only a limited period.

I may add in passing that recent field work prevents me from believing that the "dagger" of *Babina* can have any functional significance outside of the breeding season. The recently discovered *Hyla heilprini* Noble, although equipped with an exposed prepollex in the male, does not use this structure to inflict wounds as the breeding *Babina* is capable of doing. Although the "dagger" of *H. heilprini* is not as large as in *Babina*, it is an example of a pseudo-secondary sexual character since it is present in both sexes, although to be sure, smaller and covered by the integument in the female. The prepollex is a vestigial structure in most Salientia and its enlargement is a secondary specialization. This has been pointed out elsewhere. (Gregory, Miner and Noble, 1923 Bull. Amer. Mus. Nat. Hist. XLVIII, pp. 279-288).

Lastly, a word may be said in regard to the nature of the humeral spine of *Centrolene*. I have not had the opportunity of examining a male *C. gekoideum*, but a breeding pair of *C. prosoblepon* are now in the collections of the American Museum of Natural History. The spine is covered in both sexes by the integument of the shoulder. On dissection the spine is found to be an elongate, distally directed process of the *crista ventralis*. The *portio epicoracoidea* and the *portio abdominalis* of the *pectoralis* insert on the base of this spine. In the male *C. prosoblepon*, having a head and body length of 26.5 mm., the spine projects free from any muscular attachment for a distance of 2.2 mm. In a female of 29.5 mm., head and body length, 1.5 mm. of the spine is exposed. The spine is broader in the male than in the female.

It should be pointed out that in no other vertebrates, fossil or recent (excepting only another species of tree frog described from New Guinea, Boulenger 1912, Zool. Jahrb., Suppl. 15, 1, p. 211), is the humerus modified in this extraordinary fashion. The *crista ventralis* serves for the attachment of an extensive musculature in all frogs. Further, in most frogs (*Hyla*, *Leptodactylus*, etc.), this crest is entirely covered by the *deltoides*. It is, in fact, the last part of the appendicular system that one would imagine could be modified in correlation with factors other than muscular stresses. The pectoral musculature of *C. prosoblepon* agrees closely with that of *Hyla*. There is the same division of the *pectoralis*, *portio epicoracoidea* found in that genus. It is difficult to understand how this modification of the humerus could have been brought about. Whether or not the remarkable humeral spine of *Centrolene* arose suddenly in the phylogeny of the genus, it seems likely that it disappeared in this way. I have already suggested (Noble 1920 Bull. Amer. Mus. Nat. Hist. 42, p. 441) that *Centrolenella* has been derived from *Centrolene*. Zoogeographic considerations allow us to infer that this change probably took place recently. Nevertheless, there is no indication of a humeral spine in *Centrolenella*. The question of the origin of the spine can not be answered definitely. It would be interesting to know more of the exact stock from which *Centrolene* has evolved.

