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NEW FROGS FROM PANAMA AND COSTA RICA.<sup>1</sup>

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DURING the course of various excursions into Central America under the auspices of the Museum of Comparative Zoölogy, and of a tour of European museums under the auspices of the John Simon Guggenheim Memorial Fellowship, I have gradually become aware of certain frogs from that region as yet undescribed. I hereinafter offer descriptions of them, together with a few remarks as to their nearest relatives. The material is largely in my own collections, or in those of the Museum of Comparative Zoölogy (in the main collected by myself), or the United States National Museum. Any types now in my own collection will be deposited in the Museum of Comparative Zoölogy, as a return for the many favors I have enjoyed from the hands of its Director, Dr. Thomas Barbour.

*Eleutherodactylus talamancae*, sp. nov.

*Type*.—M. C. Z. no. 9879, collected by E. R. Dunn and Chester Duryea in 1923.

*Type locality*.—Almirante, Bocas del Toro, Panama.

*Range*.—Known from Monteverde, Zent, and Suretka, Costa Rica; Almirante and La Loma, western Panama.

*Diagnosis*.—An *Eleutherodactylus* of the *fitzingeri-longirostris* group, with smooth belly, webbed toes, slightly developed disks except on outer two fingers, very long snout, uniform thigh color, slight web on toes, large disks on outer fingers, no light throat stripe, very long legs, young with white upper lip and oblique lateral bars.

*Description*.—Type: head a pointed oval, flat above; snout flat and broad; eye about equal to its distance from nostril; upper eyelid less than interorbital width; distance from nostril to snout  $2\frac{1}{2}$  times in distance from nostril to eye; canthus rostralis well marked, rounded; loreal region sloping, concave; tympanum  $\frac{1}{2}$  eye; heel well beyond snout; very large disks on two outer fingers, other digital disks medium; toes webbed at base, web extending to

<sup>1</sup> Contributions from the Department of Biology, Haverford College no. 5.

inner phalangeal tubercle on all toes (less web than in *fitzingeri*, much less than in *longirostris*); first and second fingers equal; inner metatarsal tubercle well developed; a small outer one; skin finely granular above; a fold over tympanum; a slight dorso-lateral fold; smooth below; vomerine teeth in two transverse groups, well behind choanae and extending as far as their inner edges; brown, a darker brown dorsal marking, beginning as an interorbital bar (snout lighter) and extending to rump as an hourglass-shaped marking; faint barring on upper lip, and on anterior face of thigh and on tibia; belly white; under side of throat and limbs dusky; length 47 mm.

*Variation*.—Young specimens show a white line on upper lip and a black mark from snout through tympanum over arm to middle of side and on to the white of the belly.

*Remarks*.—This is close to *longirostris* but differs in longer snout, less web on toes, absence of light throat stripe, larger disks on outer fingers, and color of young. It occurs with *longirostris* at Suretka, Almirante, and La Loma. From *fitzingeri* with which it occurs at Suretka, Almirante, and Monteverde it differs in longer snout, less web on toes, longer legs, larger finger disks, absence of throat stripe, absence of light spotting on hind side of thighs, and color of young.

No other species can be confused with this one, which has a rather restricted range (*fitzingeri* and *longirostris* are widely-ranging forms).

It has previously been called by me *E. diastema* and specimens from collections have been distributed under that name to various museums. I have noted B. M. N. H. no. 1925-3-10-5, from Almirante; Berlin no. 28608 from Almirante, and U. S. N. M. no. 73222 from Suretka.

It has some similarity to *nubilus* (Escazu, Costa Rica; type, B. M. N. H. no. 1902-5-13-29) in color and shortness of webs, but *nubilus* is really much closer to *fitzingeri*, and, if anything, is merely a short-webbed race of that form from upper Costa Rica. Specimens from Escazu, La Palma, and Guapiles may represent it, although I should hesitate to give a final opinion. The type of *nubilus* agrees with *fitzingeri* in every character save shortness of webs, and dorsal color. The dorsal marking of *nubilus* is not that of *talamancae*. It has the throat mark, the wartiness, the spotting on the hind side of the thigh, the shorter legs, the shorter snout, the smaller finger disks, all *fitzingeri* characters.

The present series, kindly loaned me by Dr. Barbour, and all collected by myself, includes: M. C. Z. no. 7949, 7951-2 from Monteverde, M. C. Z. no. 8040 from Zent, M. C. Z. no. 9785-7 from Suretka, M. C. Z. no. 9879, 9882-4 from Almirante, and M. C. Z. no. 9971-5 from La Loma, in all 16 specimens, and the four distributed specimens from the original lot have been sent out in exchange, so that I have seen at least 22 of this quite distinct species.

I took the type with me to various European Museums so that it has been compared directly with the types of *nubilus*, *fitzingeri*, *longirostris*, *conspicillatus*, *raniformis*, etc., and it agrees with none of them.

**Lithodytes gaigei, sp. nov.**

*Type*.—M. C. Z. no. 10011.

*Type locality*.—Fort Randolph, Panama Canal Zone.

*Range*.—Known only from Fort Randolph and Barro Colorado Island, Panama Canal Zone, and from Talamanca Valley, Costa Rica.

*Diagnosis*.—Close to *Lithodytes lineatus* of South America, but differing in having head wider than body; no flash markings on thigh or in groin; vomerine teeth oblique rather than transverse.

*Description*.—M. C. Z. no. 10011: head a rather pointed oval; snout flat above, pointed; canthus rostralis angular; lores sloping steeply; upper eyelid less than interorbital diameter; eye equal to its distance from nostril; tympanum  $\frac{1}{2}$  eye; heel to between snout and eye; head wider than body; disks of fingers and toes equal, about half again diameter of digit, much smaller than tympanum; fingers and toes free; a large inner and small outer metatarsal tubercle; a tarsal fold; finger I about equal to finger II; toe III equal to toe IV; smooth below, uniformly and finely rugose above; vomerine teeth in two oblique groups, equally in and back from choanae, separated by diameter of choanae and distant from choanae by same distance; dark brown, lighter below; a light line from eye to sacrum, snout to vent 38 mm.

*Variation*.—A specimen from Barro Colorado Island, Univ. Michigan field no. 77, is much lighter below, and the dorso-lateral lines are hard to make out. Also the tarsal fold is invisible (the animal is soft); the first finger on one side is longer than the second and is shorter on the other; the third toe is longer than the fifth; snout to vent 39 mm. Two small specimens from Talamanca, M. C. Z. no. 9901, 9904, are 21 and 18 mm. in length. They are black above, slightly lighter below, and the dorso-lateral light lines begin on the snout where they meet. The vomerine teeth cannot be made out. In one the first and

second fingers are equal and the third toe is shorter than the fifth, in the other the first finger is the shorter and the third toe is equal to the fifth. The shagreening shows better in these two which are neither hard, like the type, nor soft like the Barro Colorado Island specimen.

*Remarks.*—A specimen of *lineatus* from Bolivia, kindly loaned me by Mrs. Gaige, shows transverse vomerine teeth; a narrower head, and a thicker body; flash markings in groin and on thigh; a protruding or overhanging snout; snout not so pointed; canthus not so marked; third toe longer than fifth.

The specimens had all been identified by me with *lineatus*, until Mrs. Gaige pointed out to me the differences between the Barro Colorado Island specimen and South American ones. These differences are more exaggerated in the Barro Colorado Island specimen than in the three others, but enough remains to show a distinguishable form, with which I take the liberty of associating her name.

As Ruthven remarked to Noble (Noble 1917, *Bull. Amer. Mus. Nat. Hist.* 37, p. 794) that a specimen he secured in British Guiana resembled a *Dendrobates* in life, so also the two which I took in Talamanca were so like *Phyllobates* that for some years they were identified as the very similarly colored *P. lugubris* with which they were associated in life.

I use *Lithodytes* advisedly. The shoulder girdle of both Fort Randolph and the Barro Colorado Island specimens is *Leptodactylus*-like, although the ossification of the sternum is not complete in the Barro Colorado Island specimen. The terminal phalanges are distinctly T-shaped in both. Noble (*loc. cit.*) on a series of five Guiana specimens ranging in length from 22.5 to 45.5 mm., has maintained that while young specimens have a T-shaped terminal phalanx, adults have a simple pointed phalanx and has referred the species to *Leptodactylus*. His figures are not convincing to me, and I have assured myself that M. C. Z. no. 6033 from Trinidad, 48 mm. long, has the terminal phalanx of toe IV extremely T-shaped. Neither *lineatus* nor *gaigei* is reminiscent in habit of any *Eleutherodactylus* or *Leptodactylus* known to me, and under the circumstances I prefer to recognize the genus *Lithodytes* Fitzinger, type *lineatus*, only other known species *gaigei*.

*Phyllobates flotator*, sp. nov.

*Type*.—Adult male, in my own collection, taken July, 1930.

*Type locality*.—Barro Colorado Island, Panama Canal Zone.

*Range*.—Costa Rica to Darien.

*Diagnosis*.—A *Phyllobates* with black and white coloration; a lateral streak starting from middle of black lateral band in groin and reaching eye; male with white throat; male with swollen third finger; tadpole with no labial teeth and much produced lower lip.

*Description*.—Type: adult male; snout slightly longer than orbit; loreal region vertical, slightly concave; interorbital space broader than upper eyelid; tympanum indistinct,  $\frac{1}{2}$  size of eye; disks well developed, smaller than tympanum; third finger swollen, as wide as disk; disk of toe I half size of toe II; disk of toe V half size of disk of toe IV; top of toe I misses penultimate phalanx of toe II; tip of toe II reaches antepenultimate phalanx of toe III; tip of toe III reaches antepenultimate phalanx of toe IV; toe IV  $2\frac{1}{2}$  phalanges beyond toe V; tip of toe V just past penultimate phalanx of toe III; two metatarsal tubercles; one tarsal tubercle; heel barely to eye; skin finely granular; gray above; white below; sides black; light line from groin to eye obliquely through black; upper lip white; dark line on anterior edge of thigh; dark line on dorsal surface of thigh running into another dark line on posterior edge of thigh at knee, 'anvil-shaped marking'; dark anal triangle; legs not barred; head to snout 17 mm.

*Variation*.—A female from the same locality is similar save for the third finger not being swollen. A specimen from Cana in Darien has slightly longer third and fifth toes.

*Remarks*.—The *Phyllobates* from Panama, Costa Rica, and Nicaragua that I have seen fall into three groups; typical *Phyllobates*, without specialized tadpoles, or modified male third finger (these apparently stem from *Hyloxalus*, which has webbed toes), *Phyllobates* which have specialized tadpoles and modified male third finger (*flotator* and *nubicola*); and *Phyllobates* which have markings black and yellow instead of black and white, and ventral light markings. (These are close to *Dendrobates*.)

There are still many problems in the group of three genera, even in the restricted region, but I feel reasonably sure about the species I have actually seen and these remarks must be taken as an arrangement of the material seen, and an attempt to allocate names based on unseen material.

I have myself added to the confusion, for what I called *talamancae* in 1921 was based on one specimen of *talamancae* and one of *latinasus*, and while I properly segregated *latinasus* in 1924, I included the present *flotator* under *talamancae*.

None of the three genera are known from north of Nicaragua.

*Key to the Phyllobates of lower Central America.*

- A. Markings white; no linear markings below.
- B. Tadpole with normal mouthparts; male with normal third finger; no complete light streak from groin to above eye.
- C. A light streak from groin to below eye; a dorso-lateral light streak from sacrum to above eye, above lateral black band; male with black throat; disk of toe I equals  $\frac{1}{2}$  disk of toe II; disk of toe V equals disk of toe IV; toe V reaching penultimate joint of toe IV.....*talamancae*.
- CC. No marked light streak from sacrum; at least a trace of a light streak from groin in lateral black band.
- D. Large (30 mm.); mottled below with gray in both sexes; a trace of groin streak; disk of toe I about equal to disk of toe II.  
*kingsburyi*.
- DD. Smaller (21 mm.); white below in both sexes; groin streak prominent to middle of side; disk of toe I equals  $\frac{1}{2}$  disk of toe II; disk of toe V about equal to disk of toe IV.....*latinus*.
- BB. Tadpole with umbrella mouthparts (much produced lower lip and reduced labial teeth); male with much swollen third finger; a light streak from groin to above eye, cutting diagonally across black lateral band; disk of toe I equals  $\frac{1}{2}$  disk of toe II, disk of toe V equals  $\frac{1}{2}$  disk of toe IV.
- C. Larger (21 mm.); black line on thigh; throat and chest of male dark; thigh red in life; toe V reaching penultimate phalanx of toe IV.....*nubicola*.
- CC. Smaller (17 mm.); hooked mark on thigh; thigh not red in life; male white below; toe V not reaching penultimate phalanx of toe IV.....*flotator*.
- AA. Markings yellow; linear markings below.
- B. Finger disks equals  $\frac{1}{2}$  diameter of tympanum and twice width of phalanx; finger I longer than finger II; light lateral streak to below eye; maxillary teeth definitely present.....*lugubris*.
- BB. Finger disks about equal to tympanum and three times the width of phalanx; finger I much shorter than finger II; light lateral streak to snout; toe I much reduced; no maxillary teeth.....*truncatus*.

NOTES ON THE *Phyllobates* OF LOWER CENTRAL AMERICA.*Phyllobates talamancae* (Cope).

1875, Jour. Acad. Nat. Sci. Philadelphia (2) 8, p. 102, pl. 23, fig. 6.

*Type*.—The type is from Old Harbour, Costa Rica (not in existence).

It has been seen from Gatun, Panama (Univ. Michigan no. 52932), Suretka, Costa Rica (M. C. Z. no. 9813-18, 20-21), and Santa Cecilia, Costa Rica (M. C. Z. no. 7858).

I feel quite sure about the arrangement of this form and the proper allocation of the name.

***Phyllobates kingsburyi* Boulenger.**

1918, Ann. Mag. Nat. Hist. (9), 2, p. 427.

*Type*.—B. M. N. H. no. 1912-11-1-46-49 from El Topo, Rio Pastaza, Eastern Ecuador, 4200 feet.

This has been seen from the types; Cana, Panama (U. S. N. M. no. 50197-200); and Rio Calobre, Panama (U. S. N. M. no. 53737-8). These specimens I have not seen recently. I am not wholly convinced that comparison of specimens would not show the Panamanian specimens to be different from the Ecuadorian.

***Phyllobates latinasus* Cope.**

1863, Proc. Acad. Nat. Sci. Philadelphia, p. 48.

*Type*.—This is from Truando River, Colombia; probably not in existence.

It has been seen from Rio Esnape, Panama (M. C. Z. no. 9207-9215); Cana, Panama (U. S. N. M. no. 54231, 63005, 66318); Cerro Azul, Panama (U. S. N. M. no. 54174-5); Almirante, Panama (M. C. Z. no. 9867-72); La Loma, Panama (M. C. Z. no. 10251-6); Santa Cecilia, Costa Rica (M. C. Z. no. 7859).

The specimens seen are all the same species, and different from any other seen, but close to *kingsburyi*. Whether they are Cope's species is perhaps questionable. *Latinasus* was described as 30 mm. long, which agrees with *kingsburyi*, but not with what I am calling *latinasus*, of which I have seen none over 21 mm. Otherwise the description agrees better with what I am calling *latinasus* than with what I am calling *kingsburyi*.

***Phyllobates nubicola* Dunn.**

1924, Occas. Papers Mus. Zool. Univ. Michigan 151, p. 7.

*Type*.—Univ. Michigan no. 58292 from above Boquete on trail to Chiriqui Grande, Panama, 4500 feet.

It has been seen from the type and others from the same trail on both sides of the divide. There is no doubt about this one.

*Phyllobates flotator* Dunn.

This has been seen from Suretka, Costa Rica (M. C. Z. no. 9819); La Loma, Panama (M. C. Z. no. 10257-62) Las Cascadas (M. C. Z. no. 9989), Rio Chenillo, Balboa, Empire, Barro Colorado Island (M. C. Z. no. 15289-92, 10728; Univ. Michigan no. 61620, 63587-93); Punta Bruja, Pacific side (M. C. Z. no. 16007); Cana, Panama (U. S. N. M. no. 50177). This is the common Barro Colorado species.

*Phyllobates lugubris* (Schmidt).

1858, Denkschr. Acad. Wien. **14**, 1. 250, pl. 2, fig. 14.

*Type*.—Krakau no. 1016 from cloud forest on Boquete trail, 5000-7000 feet.

It has been seen from Talamanca Valley, Costa Rica (M. C. Z. no. 9902-3); Zent, Costa Rica (M. C. Z. no. 8022, type of *Phyllobates beatriciae* Barbour and Dunn 1921, *Proc. Biol. Soc. Washington* **24**, p. 159); Almirante, Panama (M. C. Z. no. 9873-7).

The Krakau types, five in number, are completely faded, are 26 mm. long, and seem to have no maxillary teeth. They came, apparently, from much higher than any of the others. The largest of the recent specimens (and some were adult, tadpole-carrying males) was 20 mm. The description gives the coloration pretty exactly, except for an inverted horseshoe mark on the throat, which is not present in the recent specimens (but is present in recent specimens of the next form).

I am inclined to think *Dendrobates tinctorius vittatus* Cope 1893 (*Proc. Amer. Phil. Soc.*, p. 340) from Buenos Ayres, Costa Rica, the type of which is non-existent may come in here.

*Phyllobates truncatus* Cope.

1860, *Proc. Acad. Nat. Sci. Philadelphia*, p. 372.

*Type*.—The type, perhaps from New Grenada, is not in existence.

I have seen it from Barro Colorado Island, Panama, and from Nicuesa, San Blas, Panama. Both localities are represented in the Museum of Comparative Zoölogy.

The specimens seen differ as given in the key from *lugubris*. They are all tiny, about 14 mm. long. No maxillary teeth can



be made out. Cope says that the finger disks equals  $\frac{1}{4}$  the tympanum, and that finger I equals finger II. In my specimens the finger disks equals the tympanum, and finger I is much shorter than finger II. But the coloration of mine agrees very well with Cope's description, and nothing else from Panama does, and no other name at all fits them. I feel rather that I have seen only young specimens, and with both this and *lugubris* I am not certain as to their allocation in *Phyllobates*. The two are very much alike. Perhaps adults would have maxillary teeth, as my specimens of *beatriciae-lugubris* unquestionably do. Also, as I hope to make clear, they fit into no known *Dendrobates* species from the region. I am simply doing what I can with the material seen.

NOTE ON *Hyloxalus* AND *Dendrobates* FROM NICARAGUA AND PANAMA.

One species of what might be called webbed-toed *Phyllobates* has been seen from the region (U. S. N. M. no. 50227, 66319-20 from Cána, Panama). Of the five species whose descriptions I know from Ecuador, Colombia, and Venezuela it agrees well enough with the very brief account of *Hyloxalus fuliginosus* Espada (1870, Jour. Soc. Lisboa 3, p. 59, San Jose de Moti, Ecuador). The five species have been described on a minimum of material, and I do not wish to add a name. In *Dendrobates* three forms are known to me from the region: a rather large species, black, spotted with green, usually called *tinctorius*, and quite widespread; a small red, black-spotted form, usually called *typographus*, from Nicaragua to western Panama; and a rather large, uniform red beast, from high altitudes in western Panama for which the name *speciosus* Schmidt 1858 (type, Krakau no. 1017) is applicable. The *typographus* form is Kesterstein 1867, and is definitely preoccupied by *pumilio* Schmidt 1858 (type Krakau no. 1018). True *tinctorius* has dorso-lateral light lines, and the Central American form had best be known as *Dendrobates auratus* Girard (1854, Proc. Acad. Nat. Sci. Philadelphia 7, p. 226; type not in existence, from Taboga Island, Panama).

To *auratus* belongs *maculatus* Peters (1873, MB Ak. Berlin, p. 617) from Chiriqui, and *amoenus* Werner (1901, Verh. Ges. Wien 51 from Costa Rica; type Vienna 1904, 3, p. 95). Possibly

*histrionica* Berthold (1846, *Nach. Göttingen*, p. 15, pl. 1, fig. 8) from Popayan, Colombia may preoccupy *auratus*.

To *pumilio* belongs *ignitus* Cope (1874, *Proc. Acad. Nat. Sci. Philadelphia*, p. 68) from Nicaragua the type of which is not in existence.

Much confusion exists concerning the Central American species or races of *Atelopus* (type *A. flavescens* from Cayenne). I have seen many or most of the types, and the original descriptions of all. I have also seen a good many modern specimens from the region, and am sure of at least one race as yet unnamed. I therefore proceed to name this race, and to give an analysis of the situation which will, I trust, clear up some of the confusion.

Stannius (1856, *Handb. Zool.* 2, p. 16) mentions an *Atelopus varius* seen in the Berlin Museum as exhibiting some vertebral fusion. The name is quite unidentifiable and is a *nomen nudum* pure and simple.

In the privately published and distributed *Nomenclator Rept. Amph. Mus. Berol.* of 1856, signed by Lichtenstein and compiled by Lichtenstein and Martens we find on page 40 *Phyrnidium*, gen. nov., type *varium* sp. nov. followed on page 40 by var. a *maculatum*, var. b *adpersum*, and var. c *crucigerum*. The specimens, 13 in number, were all from 'Veragoa.' One of the varieties is obviously a synonym of the typical form. Since *crucigerum* has been used otherwise, and since the description of *adpersum* conforms to what Keferstein in 1867 (*Nach. Göttingen*, p. 350) described as *Atelopus varius* from Costa Rica and which has always gone by that name, and since the types of *adpersum* (Berlin no. 3377-8 from Veragua) also agree with Costa Rican specimens, the name *adpersum* may be taken as a synonym of the typical form, as is *Hylaemorphus Pluto* Schmidt 1858 (*Denkschr. Ak. Wien*, p. 255) from Costa Rica.

True *Atelopus varius varius* is a small form (40 mm.), black (sometimes bluish gray) above, much marked with red and yellow above. I have taken numbers of them near San Jose, Costa Rica, and have seen many specimens from upper Costa Rica. There are no specimens from Panama except the types of *adpersum* and Berlin 3380. There were four in the original series of *adpersum*.

The type of *maculatum* is a larger form with fewer and larger

spots, and regularly barred legs. It is Berlin no. 3379 from Veragua and is two inches long. A specimen from Cameron, Chiriqui is Berlin no. 7743. These agree with specimens from the trail between the Chiriqui Lagoon and Boquete which I took myself, and with the types (Krakau no. 1014, four specimens, 53 mm. long), and the description of *Hylaemorphus Dumerilii* Schmidt (*loc. cit.*, p. 255, pl. 3, figs. 23-24) from the same region at 8000 feet, collected by von Warszewicz. It is highly probable that this gentleman collected both the Berlin type and the Krakau series.

The type of *crucigerum* (Berlin no. 3381) from Veragua has a yellow lateral band around snout and body. It is thus like the description and the type (Krakau no. 1015) of *Hylaemorphus Bibronii* Schmidt from 'near Panama 2000-3000 feet.' I have seen six modern (four in the Mus. Comp. Zoöl.) specimens from the Val de Anton (780 m.) in Coclé province which I feel sure are this form. The Krakau type is 36 mm. long. The description gives *crucigerum* as  $1\frac{1}{4}$  inches. The modern ones I have seen are all large. Two are immaculate yellow, two are slightly spotted with black, and one, 52 mm. long, has several black spots on the legs, and several on the body, including a very definite X-mark on the head. In all probability von Warszewicz collected the types of both. I believe the black pigment disappears as the animal grows older.

The situation is complicated by three specimens in Berlin, Puerto Cabello, no. 3382, and Caracas, no. 3383-4, all labeled types of *crucigerum*. I was unable to convince myself in Berlin that they were the same species or race as the Veragua type, no. 3377. They reminded me then of the type of *certus* from Darien, and the figure of *cruciger* in Günther 1858 is now decidedly reminiscent of these Venezuela specimens. But the figure of *cruciger* in Günther certainly does not represent Panama material, being warty instead of smooth and having the toes half webbed instead of entirely webbed. Furthermore Lichtenstein and Martens mention 5 specimens of *crucigerum* from Veragua, and three smaller ones which they thought the same. Only one of these is now to be found.

I cannot completely solve this problem, but I think it clear that *Atelopus varius cruciger* must be used for Panama animals.

In the region east of the Canal Zone two or possibly three races are to be found. All are modern specimens. They come from Cerro Azul near the Canal Zone (U. S. N. M. no. 54183-4, 54186-96, all young); Rio Jappe, Darien (U. S. N. M. no. 53964-5, young); Pirri Range, Darien (U. S. N. M. no. 50230-48, all adult); Cana, Darien (U. S. N. M. no. 50168-75, 50226, 54230, and 66316. The last is very young); Porto Obaldia, Darien (U. S. N. M. no. 48594-5, adult); Mt. Sapo, Darien (M. C. Z. no. 8538, type of *Atelopus spurrelli certus* Barbour and many paratypes).

Of these, the specimens from Cerro Azul, Rio Jappe, Pirri Range, and Cana, if due regard be paid to age changes, are the same. The young have light bellies with a few small spots; dorsally they are brown with the legs barred with light and a couple of linear yellow marks or bands in the shape of inverted U's or V's. The adult has an immaculate light belly, and either a uniform brown dorsum, or with tiny light dots, circles or semi-circles.

For this race I propose the name *Atelopus varius glyphus*, the type of which is U. S. N. M. no. 50320 from Pirri Range, Darien.

The Porto Obaldia specimens have the same markings as the small young from Cana, but they are as large as Cana adults. Possibly they should be considered a separate race, but since only two specimens are known, I prefer to consider them *glyphus* for the time being.

The Mt. Sapo specimens, of which Barbour and Brooks took nearly fifty, were brick red in life, with considerable spotting below in males (females almost immaculate). Above the light color was reduced to fine lines which surround rounded black spots (larger in males than in females).

Barbour says they have 'no marked structural differences from *varius*' with which I agree entirely, having just carefully compared some San Jose *varius* with a paratype of *certus*, but he says 'it lacks the inherent quality of *varius*, which is variability.' I cannot agree that *varius* at San Jose, or even over a wide range in Costa Rica is any more variable than is *certus* on Mt. Sapo. I have seen true *varius* from some nineteen localities, and all were alike, save for the occasional bluish gray ground color, which seemed to crop up in several localities. Also, the specimens and figures of *maculatum* and *dumerilii* collected over

80 years ago can be matched spot for spot with recent specimens from the same trail.

We have then in Costa Rica and Panama the species *Atelopus varius*, smooth, with slim form, fully webbed toes. It is divided into the following races:

*Atelopus varius varius* (Lichtenstein and Martens) from upper Costa Rica and into Panama. It is small and heavily spotted above with irregular red and yellow marks.

*Atelopus varius maculatus* (Lichtenstein and Martens) from high western Panama. This is large and sparsely spotted with rounded yellow spots.

*Atelopus varius cruciger* (Lichtenstein and Martens) from mountains near Panama City to the west. This race is large with the black much reduced or entirely gone, or occasionally persisting as an X-mark on head.

*Atelopus varius glyphus* Dunn from the mountains of Darien. It is brown marked with lighter, the brown predominating, and sometimes uniform; a large race.

*Atelopus varius certus* Barbour from the mountains of Garachine peninsula. A small race with dark predominating in close-set, rounded spots. The light markings are red in life.

I might add that Noble (*Proc. Biol. Soc. Washington* 37, p. 66, 1924) has stated that the National Museum possesses *Atelopus varius* from Miraflores, but no such specimens are now in the collection, nor anything from Miraflores which could possibly be confused with *Atelopus*. Also there is no record in Washington of any such specimens having been there. Noble says they were collected by Goldman. Error has certainly crept in here.

I might also add that the types of Günther's *Phryniscus laevis* 1858 (*Cat. Batr. Grad. Brit. Mus.*, p. 43, pl. 3, fig. 1) were said to come from Panama (two), Quito, and Chile. I have seen no modern Panamanian specimens. I am inclined to think that *Phirix pachydermus* Schmidt 1858 (*loc. cit.*, p. 256, pl. 3, fig. 26) from near Bonaventura, 5,000 feet, is the same and antedates it.

*Centrolene valerioi*, sp. nov.

*Type*.—M. C. Z. no. 16003.

*Type locality*.—La Palma, Costa Rica, 4,500 feet.

*Range*.—Known only from type locality.

*Diagnosis.*—Centrolene without humeral hooks, no vomerine teeth; tympanum almost aborted; nostrils raised, prominently; bones white; color in life white with a dorsal green network.

*Description.*—Tongue circular; head broader than long, semicircular as seen from above save for projection made by nostrils; eyes directed forward, their diameter greater than their distance from tip of snout; canthus rostralis rounded but distinct; lores concave; nostrils protuberant, causing snout to overhang; interorbital space twice as wide as upper eyelid; tympanum barely visible, directed upward,  $\frac{1}{6}$  the diameter of eye; fingers with disks wider than tympanum, truncate; first finger longer than second; web on about  $\frac{1}{2}$  of outer fingers, to penultimate phalanx of 3 and 4; inner fingers webbed at base; toes webbed to just short of disks of 3 and 5, not quite to penultimate phalanx of 4; a single weak inner metatarsal tubercle; heel reaches to beyond snout; smooth above, belly and thighs rugose; in life white, a narrow green dorsal stripe, green vermiculations on dorsal surface and on shin, thigh unpigmented, white beneath, iris golden; in preservative white, a few faint dark chromatophores where green was in life; length 21 mm., width of head 8; arm 13, leg 39 mm.

*Variation.*—A paratype (M. C. Z. no. 16004) from the same locality is practically identical.

*Remarks.*—Manuel Valerio and I collected these two specimens the nights of Jan. 15–16, 1929.

Its relationships may best be shown by a key to the species of this group known to me from Panama and Costa Rica, four in all, all of which I have seen in the field.

A. Tympanum completely absent; no vomerine teeth; snout very flat; bones white; uniform green in life with white spots above; gular sac white; upper eyelid golden; iris silver with dark lines; no humeral hook; in preservative, white with sparse chromatophores black.

*fleischmanni.*

AA. Tympanum tiny; no vomerine teeth; nostrils raised, prominent; bones white; green dorsal stripe and chain markings in life above; gular sac white; iris golden; no humeral hook, in preservative white with few dark chromatophores in vermiculations. . . . *valerioi.*

AAA. Tympanum distinct; vomerine teeth present in 6 out of 13; snout normal; bones green; green above in life; gular sac green; a rudimentary humeral hook, not projecting; in preservative uniform purple above; fingers more webbed. . . . . *pulveratum.*

AAAA. Tympanum distinct; vomerine teeth present in 32 out of 34; snout normal; bones green; green above in life with black dots; a white line around upper jaw; gular sac green; iris black with gold lines; a well developed humeral hook in males, and in some females; in preservative purple above usually (36 out of 41) with black dots; fingers less webbed. . . . . *prosolepon.*

In view of the resemblances between *prosolepon* and *pulveratum* as against *fleischmanni* and *valerioi*, and of the uncertain

nature of the vomerine teeth as even a specific character, and as I have seen only one female of *prosolepon* with a humeral hook, I cannot accept the genus *Centrolenella* (Noble 1920, *Bull. Amer. Mus. Nat. Hist.* 52, p. 441, type *C. antioquiensis*) as distinct from *Centrolene* (based on absence of hook and of vomerine teeth.)

I have seen the following in the field: two *valerioi* from La Palma; ten *prosolepon* from La Palma; two *pulveratum* from Barro Colorado Island; one *fleischmanni* from Suretka, four from San Jose, and six were taken and more seen on Barro Colorado Island. I say this because I might otherwise seem to be dealing harshly with the species of a supposedly rare and little-known group. Besides the 25 of my own collecting I have seen 60 more of these forms in various museums, so my remarks are based on 85 specimens, 78 of which are from Panama and Costa Rica. The results of observations on these specimens are the following ranges and synonymies:

*Centrolene fleischmanni*. San Jose, La Palma, Turrialba, Surubres, Suretka, Costa Rica; Ft. Davis, Barro Colorado Island, Rio Esnapé, Cahah Cr., Rio Sucubti, Panama; Salidero, Ecuador 29 specimens. (*Hylella fleischmanni* Boettger, Ber. Senckenberg, Ges. 1893, p. 251, San Jose, Costa Rica, Type, Senck. Mus. no. 1419a; *Hylella chrysops* Cope 1894, Proc. Acad. Nat. Sci. Philadelphia, p. 196, San Jose and Alajuela, Costa Rica; *Centrolenella parambae* Noble 1925, Amer. Mus. Nov. 165 p. 13).

*Centrolene valerioi*. La Palma, Costa Rica. 2 specimens.

*Centrolene pulveratum*. Turrialba, Bebedero, Costa Rica; Chiriqui, Barro Colorado Island, Panama; Pueblo Rico, Choco, Colombia (?); Paramba, Salidero, Rio Durango, Rio Japayo, Ecuador. 13 specimens. (*Hyla pulverata* Peters, M. B. Ak. Berlin, 1873, p. 614, Chiriqui, type Berlin no. 7842; *Hylella parambae* Boulenger 1898, Proc. Zool. Soc. London, p. 125, pl. 17, fig. 2 (*parambae* in original desc. but obvious typ. error.) Paramba, Ec. Type, B. M. N. H. no. 98—4—28—163).

*Centrolene prosolepon*. La Palma, Bebedero, Limon, La Junta, San Isidro, Costa Rica; Bocas del Toro, Bugaba, Progreso, Boquete, Cabima, Las Cascadas, Barro Colorado Island, Panama. 41 specimens. (*Hyla prosolepon* Boettger, Kat. Batr. Mus. Senckenberg, 1892, p. 45, La Junta, Costa Rica, type, Senck. Mus. no. 1400, 1a; *Hylella puncticrus* Boulenger, Ann. Mag. Nat. Hist., 1896, 18, p. 341, La Palma, Costa Rica, type, B. M. N. H. no. 96—10—8—70—71).

Several species of this group have been described from South America, and I have not seen the types, but save for *valerioi*, which is obviously distinct, the Central American names antedate all others, and are certainly applicable.

*Hyla colymba*, sp. nov.

*Hyla albomarginata* Dunn 1924, Occas. Papers Univ. Michigan Mus. Zoöl. 151, p. 3.

*Type*.—M. C. Z. no. 10234, collected by Chester Duryea and E. R. Dunn, 1923.

*Type locality*.—La Loma (or Buenavista) on trail from Chiriqui Lagoon to Boquete, about 1500 feet altitude.

*Diagnosis*.—A small *Hyla* of the *albomarginata* group; differing in smaller size; smaller tympanum; no pollicial spur; less web; smaller disks; and in the presence of a fringe on last phalanx of fingers and toes, which is beyond the web, and wider than the disks.

*Description*.—Tongue circular; head a pointed oval; snout blunt; vomerine teeth in two arcuate groups between the nares; canthus rostralis rounded; lores sloping; interorbital space much wider than upper eyelid; eye less than its distance from snout, greater than its distance from the nostril; tympanum  $\frac{1}{3}$  eye, half covered by supratympanic fold which reaches elbow; smooth above, belly and underside of thigh granular; a gular vocal sac; no chest fold; no heel flap; palms granular; fingers III–IV  $\frac{1}{2}$  webbed, III–II the web reaches  $\frac{1}{3}$  on III and  $\frac{1}{2}$  on II, II–I rudimentary; toes a phalanx of IV and disk free, not to disks of III and V, II–III a phalanx and disk free; II–I rudimentary; disks smaller than width of digits, the same size as tympanum; fingers and toes with a fringe wider than disks on last phalanx; heel to snout; heels meeting when appressed; color in life brownish green; in preservative pale, with more or less expanded chromatophores and whitish points; length 32 mm.

*Variation*.—Another adult varies only in degree of expansion of the chromatophores; a young specimen (22 mm.) has a rudimentary tail and less web. It was, in life, bright green with tiny dark dots, and a white line from the eye over the tympanum. M. C. Z. no. 10232–3, 10235–43, frogs and tadpoles, are paratypes.

*Remarks*.—There is no doubt that this form is distinct from either Barro Colorado Island or Brazilian *albomarginata*, with both of which I have compared it. The differences are not obvious at first sight, and my recognition of this form as distinct has arisen from the striking color differences observed in Barro Colorado specimens (webs red, red on concealed surfaces of thigh); on the differences in the calls of the two (a metallic ‘cheep’ in the new form, an explosive ‘bop’ in Barro Colorado Island); a note from Dr. Adolpho Lutz, suggesting that the Brazilian *albomarginata* has very different tadpoles from the La Loma form as described by me in 1924.

The differences mentioned in the diagnosis hold for both



Barro Colorado specimens and for Brazilian ones. I am not sure that the *albomarginata* from Central America do not deserve racial recognition. The glandular dorso-lateral fold is much less developed in the northern specimens (seen from Barro Colorado Island, Trinidad River, Panama; San Carlos, Costa Rica; Machuco, Maselina Cr., Nicaragua). Nor do I know whether the Brazilian specimens have the red on webs and thighs.

At any rate, the general type is represented in Central America by a beast differing but slightly from the Brazilian, and by a smaller beast, which has gone into the mountain brook habitat and has very specialized tadpoles, as described by me in 1924.