

HERPETOLOGY.—*Another new species of Eleutherodactylus (Amphibia: Leptodactylidae) from western Cuba.* ALBERT SCHWARTZ, Albright College, Reading, Pa. (Communicated by Herbert Friedmann.)

Three papers (Schwartz, 1957, 1958a, 1958b) on collections of *Eleutherodactylus* from Pinar del Río Province, Cuba, have already been published. These, as well as the present description, are based upon collections made during the summer of 1957 under a National Science Foundation grant; collections were also made during the Christmas holiday seasons of 1956–57 and 1957–58. Much time has spent collecting amphibians and reptiles in the westernmost province of Pinar del Río; that this area has been but poorly worked previously is attested by the number of new forms which have been encountered there; to this increasingly large list of new species, another new small leptodactylid frog is herewith added.

On August 30 and 31, 1957, two visits were made to Soroa, Pinar del Río Province, in the company of Richard Thomas. Because of previously heavy precipitation, the area in general was very wet, and the Río Manantiales, which forms a scenic waterfall at Soroa, was at a high level. Collecting at night in the gorge along the river yielded a small series of frogs which I regarded as a new form at the time of collection. During the Christmas holiday season of 1957–58, opportunity was given to return to Soroa in the company of Edwin B. Erickson, Willard M. Stitzell, and George R. Zug. On this second visit, although the weather conditions were not so rainy as in August, we were able to secure another series of this small frog. I wish to thank these men who have helped me collect in the Soroa area; without their invaluable assistance such an adequate series of these little frogs would not have been obtained. I take great pleasure in naming this form after George R. Zug, whose interest, genial cooperation, and hearty assistance in the field have aided me immeasurably in my work, as—

Eleutherodactylus zugii, n. sp.

Type.—American Museum of Natural History (A.M.N.H.) no. 60938, from Soroa, Pinar del Río

Province, Cuba, one of a series taken by Edwin B. Erickson, Albert Schwartz, Willard M. Stitzell, and George R. Zug, on January 1, 1958. Original number 4903.

Paratypes.—A.M.N.H. nos. 60919–27, Soroa, Pinar del Río Province, A. Schwartz, R. Thomas, August 30, 1957; A.M.N.H. nos. 60928–35, Soroa, Pinar del Río Province, A. Schwartz, R. Thomas, August 31, 1957; A.M.N.H. nos. 60936–37, 60939–49, same data as type.

Distribution.—Known only from the gorge of the waterfall of the Río Manantiales at Soroa, Pinar del Río Province.

Diagnosis.—An *Eleutherodactylus* characterized by small size, warty dorsum, rosy suffusion on thighs, a single transverse brown band across center of thigh, long and straight vomerine series, and usually an orange or yellow striped dorsum.

Description of type.—An adult female, with the following measurements (all measurements in millimeters): snout-vent length, 18.9; head length (snout to posterior border of tympanum), 6.8; greatest width of head, 6.2; longitudinal diameter of eye, 2.2; longitudinal diameter of tympanum, 1.4; naris to anterior corner of eye, 2.0; femur, 7.8; tibia, 8.7; length of fourth toe, 6.9. Head slightly narrower than distance from snout to posterior border of tympanum; snout rather acute with nares relatively inconspicuous at anterior end of canthus rostralis; diameter of eye about equal to distance from naris to anterior corner of eye; interorbital space 2.3, about equal to diameter of eye; diameter of tympanum less than diameter of eye, distance from tympanum to eye about equal to diameter of tympanum. Digital discs present, poorly developed on digits 1 and 2, that on digit 3 the largest and equal to about one quarter size of tympanum. Fingers short, unwebbed, 3-4-2-1 in order of decreasing length; subarticular tubercles well developed. Toes short, unwebbed, 4-3-5-2-1 in order of decreasing length. Heels do not touch when legs are held with femora at right angles to body axis. Dorsum irregularly warty, with a raised median middorsal line from snout to above vent; upper eyelids somewhat warty, but not distinctly so. Throat and venter smooth; belly disc feebly developed. Posterior surface of thighs covered with smooth, flattened, pavementlike granules. Tongue

elongate oval, free behind, its greatest width about half that of floor of mouth. Vomerine teeth in two long, slightly bowed, series, extending from the level of the choanae, and almost meeting at the midline of the roof of the mouth.

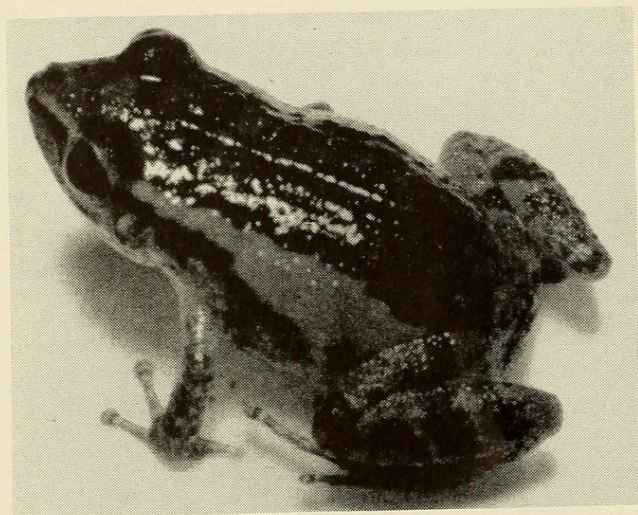


FIG. 1.—*Eleutherodactylus zugii*, n.sp., paratype, A.M.N.H. no. 60922, adult female, snout-vent length 18.0 mm. Photograph taken by William H. Gehrmann, Jr., in field.

Coloration of type.—Dorsum and sides chocolate brown; beginning on the snout, a pale orange line extends along the canthus rostralis, over the upper eyelid (where it is narrow but present), and along the dorsolateral area to end at the sides of the groin at the insertion of the hindlimbs; this pale orange line widens on the sides and meets the creamy white ventral coloration at the groin. The brown lateral color begins below the pale line on the snout, extends over the lores, tympanic region, and insertion of the forelimb, but is invaded by the ventral white color midway between fore- and hindlimbs, giving a mottled or blotched effect. Forelimbs brown, with the brachium pale orange. Thighs brown with a distinct and prominent rosy suffusion, especially prominent on their anterior faces, but present also on the dorsal surface. A truncate, brown triangle, its apex at the vent, extends ventrally over the posterior face of the thighs as far as the ventral color. A single brown transverse band across the center of the thigh and a small brown transverse band just above the knee; crus pinkish with a pair of transverse brown bands, the more distal of which is the wider, and which, when the legs are held in the flexed position, continues the transverse band of the thigh. Feet dull brown, irregularly blotched with darker. Venter pearly

white, with brown chromatophores scattered on all ventral surfaces except the median portion of the belly. The lower jaw is flecked with brown and white.

Variation.—The series of paratypes includes eleven males and nineteen females, of which all but one female appear to be mature. In adult males, the testes are jet black and prominent among the viscera; in fully adult females the oviducts are large and convoluted, and two are gravid. The means and observed ranges of the males are: snout-vent length, 15.0 (12.1–16.8); head length, 5.6 (4.6–6.4); greatest width of head, 5.2 (4.2–5.8); diameter of eye, 2.0 (1.7–2.2); diameter of tympanum, 1.3 (0.9–1.5); naris to eye, 1.6 (1.2–1.8); femur, 6.8 (6.0–7.5); tibia, 7.5 (6.2–8.4); length of fourth toe, 6.7 (5.4–7.7). The measurements of all females (type and paratypes) are: snout-vent length, 16.7 (12.7–19.2); head length, 6.1 (4.8–7.1); greatest width of head, 5.9 (4.5–6.8); diameter of eye, 2.1 (1.6–2.9); diameter of tympanum, 1.3 (0.9–1.8); naris to eye, 1.7 (1.2–2.5); femur, 7.3 (5.5–8.5); tibia, 7.6 (6.7–8.9); length of fourth toe, 7.2 (5.6–7.9). From these data it can be observed that females reach a larger size than males, but this difference is not so striking as may be noted in other species of Cuban *Eleutherodactylus*, as for example *cuneatus* (see Schwartz and Ogren, 1956, p. 96). When males and females of comparable size are studied, females are observed to have larger tympana than males.

Structurally, the paratypes agree well with the type with the exception of the degree of wartiness on the dorsum and sides. In these characters, the type demonstrates a less warty condition than many of the paratypes; this is undoubtedly due to the method of preservation. In specimens which were less fully injected with formalin at the time of preservation, the dorsum, sides, and lateral portions of the belly are very warty, and the dorsal surface of the limbs are likewise studded with scattered tubercles, arranged at random. The vomerine teeth series are always relatively long and slightly arched; they may begin within the interior margin of choanae, or not extend quite so far medially as in the type.

The series of *E. zugii* shows three basic color patterns. The first pattern, of which the type is an example, shows a dark brown to tan mid-dorsal zone, bounded on each side by a broad yellow or orange dorsolateral stripe, ending on the sides just anterior to the hindlimb insertion (see

Fig. 1). To this category may be assigned 5 males and 10 females, as well as the type which is also a female. In some of these individuals, the mid-dorsal zone is mottled with yellowish or white, and one male (A.M.N.H. no. 60941) has the posterior portion of the dorsal band transversely striped in a condition reminiscent of that of *E. pinarensis* Dunn. In some of this lot, the snout is light tan, lighter than the dark brown dorsum, but only poorly delimited by a brownish to black interocular line, bar, or even elongate triangle, which extends posteriorly along the dorsal midline. In one individual (A.M.N.H. no. 60947) there is a pair of pink dots just posterior to the eye in the dorsal band. In frogs which have the dorsal band more lightly pigmented, the dorso-lateral bands are outlined above and below with black.

The second pattern involves the suppression of the broad dorsolateral orange bands, and the occurrence of a pair of dorsolateral stripes which end *dorsally*, rather than *laterally*, above the insertion of the hindlimbs. To this group belong five males and six females. That these dorso-lateral lines are different from the dorsolateral bands described for the preceding pattern is demonstrated by two specimens (A.M.N.H. nos. 60921, a male, and 60920, a female), both of which show vestiges of the lines posteriorly, but possess the broad dorsolateral bands in addition. All males and two females possessing the second dorsal pattern also demonstrate a fine pale mid-dorsal hairline from the sacral region to just above the vent, where it divides, sending a pale red branch along the concealed face of the thigh, where it becomes obscured in the pattern of that member. This feature is only barely indicated or absent in all frogs showing dorsal pattern one. Four females showing the second pattern have either one or two pairs of pink dots in the dorsal band, one pair behind the eyes and another in the scapular region.

The third scheme of dorsal coloration is that of a mottled dorsum with no indications of either dorsolateral bands or lines, the entire dorsum having a mottled or dotted appearance. To this group belong one male and three females. One female has two pairs of pink dots in the usual position. No specimen of this lot has a dorsal pale hairline or pale lines on the inner surface of the thighs. A gray or black interocular mark is present in all, although it may be not so obvious

(A.M.N.H. no. 60944) or may blend into the dorsal dark coloration (A.M.N.H. no. 60932).

The hindlimb markings remain remarkably constant in all individuals, despite the variation in dorsal pattern. These markings are those described for the type. The median transverse thigh band, and the more distal of the crural bands are always present; although the thigh band may be reduced or obsolescent, it is always present. In addition, many frogs show a brown transverse band on the pes, which, when the foot is flexed, continues the transverse marking from the thigh onto the crus and thence the pes. In some individuals, the more proximal of the crural bands noted in the type is completely absent. In all specimens, the rosy suffusion on the thighs and crus was well developed in life.

Comparisons.—*E. zugii* is a representative of the *ricordi* group as defined by Dunn (1926, p. 210). To this group 13 forms are now assigned. The present species does not require comparison with members of the *auriculatus*, *varleyi*, *dimidiatus*, and *symingtoni* groups because of its distinctive structural characters (for characteristics of these groups see Dunn, *op. cit.*, Schwartz, 1957 and 1958a). Of the members of the *ricordi* group, comparison with *ricordi* and its subspecies, *pinarensis*, *greyi*, *brevipalmatus*, *sierramaestrae*, *turquinensis*, *cuneatus*, and *etheridgei* is unnecessary; all these species are larger than *zugii* (although male *r. planirostris* and possibly *r. casparii* may be as small as adult female *zugii*, and male *etheridgei* are just slightly larger than male *zugii* and within the observed range of female *zugii*) and none possesses the rosy red suffusion on the hind legs nor has the single transverse brown band on the thigh and crus.

The only species of the *ricordi* group with which comparison is necessary are *E. gundlachi* Schmidt and *E. atkinsi* Dunn and its subspecies. The former species is known only from various localities in the Sierra Maestra and near Guantánamo, both in Oriente Province. *E. zugii* differs from *E. gundlachi* in smaller size; Alayo (1955, p. 8) gives a length of 22 mm. for *gundlachi* and I have examined a specimen (United States National Museum No. 118210) with a snout-vent length of 25.2 mm. Both *zugii* and *gundlachi* have red on the hindlimbs; the *gundlachi* hindlimb pattern involves a red anterior and posterior face to the thigh, with a distinct dorsal longitudinal brownish area from the groin to the outer face of the knee; in *zugii*, this dorsal longitudinal thigh

band is absent, the entire dorsal face of the thigh being pigmented and there being no definite, clearly defined area. *E. gundlachi*, just as *zugi*, possesses transverse thigh bands, regularly spaced; in *gundlachi* these number three, in *zugi*, only two with the much less prominent one at the knee. *E. gundlachi* likewise has two crural transverse bands, matching the two innermost thigh bands, in contrast to the one crural band in *zugi*. Structurally, *gundlachi* differs from *zugi* in the feeble development of digital discs (these are small but in harmony with the small size of the frog in *zugi*), much longer hindlimbs, and in having the dorsum extremely rugose with the warts arranged in longitudinal series (see Barbour and Ramsden, pl. 6, fig. 1, as *E. plicatus*), a condition not observed in the new species. It is possible that *zugi* is a western counterpart of the eastern *gundlachi*, but the differences are so pronounced, that I have no hesitancy in regarding *zugi* as a species distinct from *gundlachi*; the similarity between the two species rests almost solely on the red thighs of both forms.

E. atkinsi atkinsi Dunn and *E. atkinsi orientalis* Barbour and Shreve are members of the *ricordi* group, and also possess red in the groin and on the hindlimbs. Both these subspecies reach a much larger size than *zugi*; Dunn (1925, p. 166) gives lengths of 31 mm for the type, a male, and 39 mm for a female of *a. atkinsi*, and Barbour and Shreve (1937, p. 383) give maximum length measurements of *a. orientalis* as 43 mm. *E. atkinsi* lacks digital discs, whereas *zugi* possess them. In *atkinsi*, the red coloration occurs over the entire thigh, and there are no transverse dark bands on the thigh as in *zugi*. The nominate race in addition possesses a large and well defined black groin blotch which may extend onto the most proximal part of the thigh; this blotch is reduced or absent in the subspecies *orientalis*. Such blotching does not occur in any of the specimens of *zugi*. Dorsal warting is poorly developed in *atkinsi* except along the dorsolateral line; although *zugi* is warty dorsally, there is no increased development of these warts along the dorsolateral line. The scheme of coloration of both *atkinsi* and *zugi* (in the dorsally banded or lined phases) is superficially similar, but *atkinsi* regularly has a pale snout set off from the darker dorsal area by a discrete interocular bar or band, as well as a dusky scapular W and a sacral dusky marking. No *zugi* have a sharply differentiated pale snout

(although as noted above, the snout may be poorly delimited in some specimens), nor do they have a scapular W or a sacral marking of any sort. Certainly no difficulty will result in distinguishing adult *atkinsi* from adult *zugi*; young *atkinsi* within the size range of adult *zugi* can be distinguished by the presence of a black groin spot and absence of any transverse thigh banding. Remarkably, at Soroa, of hundreds of *Eleutherodactylus* collected, no *E. a. atkinsi* (the subspecies known to occur in Pinar del Río Province) have been taken, despite excellent weather conditions and suitable habitat.

One other Cuban species of *Eleutherodactylus* is known to have red in the groin; this species is *E. emiliae* Dunn. No confusion between *emiliae* and *zugi* should occur; the former is known only from the Sierra de Trinidad in Las Villas Province, is a member of the *dimidiatus* group having a black cheek patch, feebly developed discs, and smooth skin, and is larger. *E. emiliae* is also microhylid in appearance, and thus is quite different from *zugi*.

Remarks.—The series of *E. zugi* was taken as the result of three visits to Soroa. Soroa lies in the Sierra del Rosario subregion (see Marrero, 1951, pp. 416 *et seq.*), an area of great relief owing to the montane mass of the Sierra del Rosario; the highest peak in this mountain range is Pan de Guajaibón, with an elevation of 728 meters; the elevation at Soroa is much less than this, probably no more than 300 meters. This subregion receives more than 150 cm of rainfall annually, and is exceeded in Cuba only by the more western but adjoining Sierra de los Organos. Both areas appear to be especially rich in amphibians. At the time of our first visit to Soroa in August, 1957, the area was very wet, and the Río Manantiales was in flood with much water coming over the falls in the gorge. The spray from the falls had moistened the ground, rocks, and vegetation in the immediate vicinity, and the specimens of *E. zugi* were taken on the exposed leaves of shrubs between 2 inches and 4 feet above the ground. These leaves were very wet with droplets of water from the spray of the waterfall.

At the time of our second visit in January, 1958, conditions were less wet, and the river was not in flood. Specimens of *E. zugi* were taken during the day under palm trash and other debris on the narrow flood plain in the gorge, no farther back from the river than 30 feet. Con-

ditions under the trash were not especially wet. At night, these frogs were taken on moist rocks as much as four feet above the ground surface, and none was captured on leaves as in August. Despite a moderate but continued rain beginning in the early afternoon of January 1, the dense forest canopy prevented the drenching of the understory of shrubs and herbs upon which we had collected *zugui* in August. It appears that *E. zugui* utilizes ground cover such as debris and trash during the day, and at night ventures forth to forage from low plants (if weather conditions are wet) or from rocks (if weather conditions are drier). No specimens of *E. zugui* have been collected outside of the gorge of the Río Manantiales; it may be that the gorge presents the optimum conditions of humidity which this frog requires, and that it is unable to persist in the deciduous forest above the gorge. In the gorge also we have taken *E. eileenae*, *E. cuneatus*, *E. d. amelasma*, and *E. r. planirostris*. Above the gorge in the deciduous forest these four species also occur, although *eileenae* is distinctly less abundant and *ricordi* more abundant than in the gorge.

Despite much collecting in other parts of Pinar del Río, *E. zugui* has not been taken elsewhere. It should be looked for along any of the streams cutting through the montane masses of the Sierra de los Organos and the Sierra del Rosario. Its complete distribution will become

known only by searching for it in the most humid habitats in the mountainous areas.

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Language is not an abstract construction of the learned, or of dictionary-makers, but is something arising out of the work, needs, ties, joys, affections, tastes, of long generations of humanity, and has its bases broad and low, close to the ground.—WALT WHITMAN.



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