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NEW VENEZUELAN FROGS OF THE GENUS *ELEUTHERODACTYLUS*

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WHILE engaged in ecological research in the coastal mountains of northern Venezuela, the junior author attempted to survey the amphibian fauna of the cloud forest in the vicinity of the Estación Biológica de Rancho Grande. The bulk of the material collected will be discussed elsewhere. The present paper deals with three undescribed species of *Eleutherodactylus* which were found.

The biological station lies at an altitude of 1090 m. in the lower edge of the cloud forest above Maracay. The region has been described and pictured by Beebe and Crane (1947), and a further analysis of some aspects of the regional conditions is in preparation by Test. Suffice it to say here that the cloud forest is preserved as a national park and, except along the road, is scarcely disturbed by human activity. Mostly on steep slopes, it shows a luxuriant growth and considerable variety of plants, of which tree ferns and palms are conspicuous elements. Dwarf palms and ferns are common on the forest floor, and an abundant epiphytic vegetation of leafy liverworts, ferns, orchids, bromeliads, *Philodendron,* and other plants is important to amphibians. Small streams with steep gradients form the only bodies of water this close to the divide.

The Venezuelan government kindly made available the facilities of the station, and a number of persons rendered assistance. Of these, special mention should be made of Dr. Tobias Lasser, director of the station; Dr. Ernst Schaefer, resident zoologist; Professor Alonso Gamero-Reyes; and Señor P. A. Dominguez. Dr. Avery R. Test rendered valuable assistance in the collecting. Dr. Juan A. Rivero kindly shared with us his knowledge of Venezuelan amphibians. To all of these we extend our hearty thanks.

Eleutherodactylus stenodiscus, new species

HOLOTYPE.—UMMZ 109866; Pico Periquito, Rancho Grande, Estado Aragua, Venezuela; Jan. 1, 1952; F. H. Test.

PARATOPOTYPES.—UMMZ 109867–71, 23 specimens, all from the slopes of Pico Periquito, 1090–1375 m.

RANGE.—Known only from the type locality.

DIAGNOSIS.—A dwarf *Eleutherodactylus* (adult ♀♀ 18–21 mm.) with a small, poorly differentiated tympanum, its diameter contained five to six times in that of orbit; distinct finger and toe disks, the larger of which are more or less pointed at tips; a dark spot above groin, or a dark dorsolateral stripe ending at this point; posterior surface of thighs with a triangular dark area below vent, or uniformly dark; one or several tubercles on eyelid; usually a small, conical tubercle on heel; heel of appressed leg reaching eye or a point slightly anterior to eye; venter finely granulate.

DESCRIPTION OF TYPE.—Adult female. Snout-vent length 21 mm. Head slightly longer than broad, about as wide as body; upper surface of head flat; canthus rostralis present, slightly incurved; loreal area slightly concave; nostrils prominent, lateral to canthus; snout somewhat prominent. Eye large, its diameter greater than distance from its anterior margin to nostril. In profile, upper surface of head nearly flat, sloping evenly from orbit to snout. Tympanum very small and indistinct, its diameter about one-sixth that of orbit. Interorbital distance slightly greater than width of eyelid. Eyelid tuberculate, an enlarged tubercle near middle of its margin. Vomerine teeth in short, closely approximated groups at level of hind margin of nares, the latter small, their diameter less than length of vomerine tooth rows. Tongue large, very slightly emarginate posteriorly, free for about half its length. Fingers and toes with well-marked disks, more or less pointed at tips; disks of third and fourth fingers much larger than those of first which is scarcely wider than the digit; subarticular tubercles rounded, no supernumerary tubercles; first finger shorter than second; a moderate tubercle at base of thumb; a V-shaped outer palmar tubercle. Leg of moderate length, heel of appressed leg reaching anterior margin of eye; toes with well-marked disks, about as large as those of fingers; third and fifth toes subequal in length; metatarsal tubercles well developed, the inner elongate, its tip reaching base of subarticular tubercle of first toe; outer metatarsal tubercle small, but quite distinct, projecting slightly; tarsal fold weak, extending forward from inner metarsal tubercle slightly more than half the length of tarsus; toes not webbed.

Skin of upper parts finely granulate, with scattered small tubercles; an enlarged tubercle on eyelid, a few posterior to angle of jaws; on sides tubercles tending to be arranged in two longitudinal rows; a group of tubercles at heel, one of which is enlarged and conical. Ventral surface finely granulate; a ventral disk present, completely but rather weakly delimited posteriorly.

Dorsal surface dull grayish brown; a broad blackish band from nostril to eye; a broad black crescentic bar curving around dorsal and posterior margins of tympanum; a small but sharply marked black spot above groin; dorsal pattern otherwise ill-defined, consisting of grayish bar between eyes, a light centered dusky blotch in scapular region, and a triangular blotch with apex directed forward in center of back; laterally a dusky band extending from shoulder to mid-side; upper surface of tibia and tarsus with narrow dusky crossbars; rear surface of thigh gray, with a few small scattered white spots; a triangular area below vent sharply black; underside of tarsus and foot black. Lip with a diagonal black bar extending forward from anteroventral margin of orbit; another black bar below orbit. Ventral surface gray with sparse white mottling, the throat and chest abruptly darker than the belly; rim of lower jaw darker, conspicuously white-spotted.

MEASUREMENTS.—Snout-vent length 21 mm; tibia 9.5; head length 8.5; head width 8.2; orbit 3.3; snout 3.8.

VARIATION.—The female holotype is the largest of the series. A male, snout-vent length 17 mm., tibia 8.3, head length 6.5, with small testes, not certainly mature, shows no external vocal sac and no internal vocal slits; agrees in all essential details of structure and pattern with the type. Among the 22 remaining paratypes the chief variations are those of pattern. The appressed heel reaches a point between the center of the eye and the nostril. Two of the series lack the enlarged conical tubercle on the heel. In some of the more lightly pigmented individuals an aggregation of glands is visible in the inguinal region.

In all of the paratypes the area below the vent is black; in the majority there is a triangular black patch sharply delimited laterally from the gray of the thighs; in a few the entire posterior surface of the thighs is blackish. The small, sharply marked black lumbar spot is present in 18 of 23; the remaining five have a more or less complete black dorsolateral stripe terminating above the groin. The black mark above and behind the tympanum is a constant feature throughout the series, as is also the diagonal dusky bar from shoulder to sides. This varies in intensity and in width, and in a few specimens is more or less continuous anteriorly with the post-tympanic bar so that the whole axillar area is

included. The dusky dorsal pattern is highly variable. Two separate dusky middorsal blotches are present in 12 of the series as in the type, in some forming chevrons directed anteriorly; six have these merged to form a single large, irregular blotch usually with a small light central spot just posterior to the scapulae; in four the dusky pigment is arranged in three broad longitudinal stripes, and in two there is a single rounded black spot near the middle of the back with no other dark pigment; a single paratype combines a dark dorsal blotch with light dorsolateral stripes continuous from eyelid to a point above the black lumbar spots. The amount of ventral pigment varies widely; all show at least some dark stippling and some are quite dark; the throat is appreciably darker than the belly, usually sharply and markedly so.

Color notes based on living or freshly preserved specimens indicate a wide range of ground color dorsally, varying from pale dull grayish brown to mahogany or blackish; the snout was usually lighter or more richly colored than the rest of the dorsum. No marked flash color was noted, although yellowish or orange-tan was recorded on the ventral leg surface in a few individuals.

REMARKS.—This species was found only on Pico Periquito above 1090 m., in places where there were considerable accumulations of leaf litter. It was always seen on the forest floor. In addition to those collected, at least 16 other individuals were handled alive in the field by the junior author.

In several respects *E. stenodiscus* resembles *E. parvus* of southeastern Brazil and may prove to be closely related to it. This species likewise has small, rather elongate toe disks which tend to be slightly pointed at the tips, a black area below the vent, black soles, and a similarly shaped head, especially as viewed in profile. To judge from the figure and description, *E. nigrovittatus* Andersson (1945) of eastern Ecuador is also a close relative. Neither of these, however, has as small a tympanum as has *stenodiscus,* nor finger disks as well developed. The Jamaican *E. andrewsi* Lynn (1937) agrees with *stenodiscus* in several features of pattern and in disk shape, but has a larger tympanum and much longer vomerine tooth rows.

Eleutherodactylus reticulatus, new species

HOLOTYPE.—UMMZ 109872; slope of Pico Periquito, ±1275 m., Rancho Grande, Estado Aragua, Venezuela; Jan. 10, 1952.

PARATOPOTYPES.—UMMZ 109873–74; Rancho Grande, ±1090 m.; Nov. 1, 1951 and Jan. 15, 1952.

RANGE.—Known only from the vicinity of Rancho Grande.

DIAGNOSIS.—A small species of *Eleutherodactylus* (♀♀ to 35 mm. in snout-vent length; ♂ 25 mm.) with small tympanum, its diameter contained three or four times in that of orbit; distinct disks on fingers and toes, those of outer fingers broader than long, truncate or feebly emarginate at tips, that of fourth finger somewhat larger than tympanum; heel of appressed leg reaching nostril or tip of snout; sides with enlarged flat tubercles; head and upper parts with scattered tubercles; venter granulate, with a reticulate pattern of blackish and white; concealed surface of thighs blackish, spotted with white.

DESCRIPTION OF HOLOTYPE.—An adult female 33 mm. in snout-vent length. Head wider than body, about as long as broad; canthus rostralis distinct, slightly curved; loreal region concave, sloping out to rim of jaw; snout prominent, slightly truncate. Eye large, its diameter slightly more than distance from its anterior margin to nostril; interorbital distance slightly greater than width of eyelid. Tympanum small but distinct, its diameter contained slightly more than three times in that of orbit. Vomerine teeth in straight rows, closely approximated in mid-line, slightly posterior to nares, the latter small with diameter less than the length of a vomerine row. Tongue large, rounded, feebly emarginate posteriorly, free for nearly half its length.

Fingers and toes with distinct disks, progressively larger from inner to outer digits, those of outer fingers much broader than long, truncate terminally; disk of fourth finger slightly larger than tympanum. Fingers moderately long and slender, 3–4–2–1 in order of decreasing length. Subarticular tubercles large, rounded not projecting; no supernumerary tubercles on digits; outer palmar tubercle rather small, V-shaped; inner palmar tubercle elongate, projecting slightly. Leg rather long, heel of appressed leg reaching nostril. Toe disks well developed, slightly smaller than those of fingers; toes 4–5–3–2–1 in order of decreasing length, fifth toe exceeding third by slightly more than the length of its disk, its tip reaching beyond the penultimate subarticular tubercle of fourth toe. An elongate inner metatarsal tubercle; a small, rounded outer metatarsal tubercle; no tarsal fold; toes free.

Skin of upper parts tuberculate, many of the tubercles elongate; a pair of short, crescentic glandular folds in scapular region; a weakly developed glandular fold over each tympanum; eyelids tuberculate, an enlarged projecting conical tubercle somewhat posterior to center of each eyelid; two enlarged rounded tubercles back of angle of jaws; sides thickly studded with low rounded tubercles, many of which are elongate and tend to be arranged in longitudinal rows; a group of small tubercles

at heel. Venter rather inconspicuously granulate, with a weakly delimited ventral disk.

Dull grayish brown above, mottled and spotted with blackish; an ill-defined dorsal pattern consisting of an interorbital bar, a V-shaped figure in scapular area, and a chevron-like mark above the sacrum; upper jaw with four dark bars below and anterior to eye, separated by whitish spots; a narrow dark line over tympanum; upper surface of legs with narrow, dusky crossbars, ill-defined on femora, well marked on tibia, tarsus, and foot. Ventral surface, including legs, with a contrasting, rather finely reticulate pattern of blackish on a light background, the pattern of nearly uniform intensity on throat and belly; front and rear surfaces of thighs and concealed surface of shanks, dark brown or blackish, with numerous small, round, white spots; lower lip with alternating white and blackish areas.

MEASUREMENTS.—Snout-vent 33 mm.; tibia 18; head length 13; head width 12.5; orbit 5.5; snout 6.

VARIATION.—Of the two paratypes one is an adult female 35 mm. in length. It differs from the type in having less conspicuous tubercles on the dorsum, and in having a paler, less contrasting ventral pattern; the heel of the appressed leg reaches the snout. The smaller paratype, a male 25 mm. in length, not certainly mature, has no trace of a vocal sac externally, and no slits can be made out within the mouth; the heel reaches the snout; otherwise in color and proportions it agrees closely with the type.

The type, in life, was described as "clay brown, with blackish markings on face, back, and legs; venter purplish-black and white." One of the paratypes, UMMZ 109874, was "dusky gray with black and blackish marks."

REMARKS.—Very little is known about the habits of *E. reticulatus*. The type and one of the paratypes were flushed in the daytime from accumulations of damp leaf litter on the forest floor. The other paratype was taken at night, in heavy fog, from the leaf of a plant, where it was active about four feet above the ground.

In details of structure and in body proportions *reticulatus* is rather generalized, presenting no noteworthy features which might give a clue to relationships. The striking characters are those of pattern. The sharply contrasting, delicate, black and white reticulum of the ventral surface seems to be unique, although approached by a few individuals of *E. megalops* Ruthven (1917*b*), a stouter frog, with a longer snout, and with the largest finger disk distinctly smaller than the tympanum. The pattern of the posterior thigh surface, blackish with small white spots,

recalls that of a number of Middle American species, such as *rugulosus* and *fitzingeri,* which differ widely from *reticulatus* in the possession of well-webbed toes and in other features. A similarly spotted thigh pattern occurs also in *E. insignitus* Ruthven (1917*a*) of the Santa Marta Mountains in Colombia, but this is a much more stoutly built frog, with smaller disks and a smooth dorsum.

Eleutherodactylus anotis, new species

HOLOTYPE.—UMMZ 109876; from a small stream at Rancho Grande, 1090 m., Estado Aragua, Venezuela; Dec. 8, 1951.

PARATOPOTYPES.—UMMZ 109877; 4 specimens; Dec. 28, 1951; Rancho Grande.

RANGE.—Known only from three streams within 1 km. of the type locality and from a stream beside the Maracay-Choroni road at 1300 m. on the south side of the divide.

DIAGNOSIS.—A medium-sized species of *Eleutherodactylus* (♀♀ to 47 mm. in snout-vent length) lacking a tympanum; nostril much nearer to tip of snout than to eye; disks of fingers and toes rather large, truncate or faintly emarginate at tips; heel of appressed leg reaching a point between eye and snout; a narrow, incomplete dorsolateral fold usually present from above forearm to mid-side; scattered, small tubercles on dorsum, most numerous in scapular region and along sides; venter mottled gray and white; concealed surface of thighs dark reddish brown, uniform or with a few small white flecks; in life posterior part of belly and undersurface of legs washed with red.

DESCRIPTION OF TYPE.—Adult female, snout-vent length 40 mm. Head width equal to length (angle of jaws to snout), and rather greater than width of body; surface of head between orbits slightly concave; canthus rostralis marked, nearly straight, but with a slight incurved area immediately posterior to nostril; nostrils distinctly lateral to canthus; tip of snout prominent, somewhat truncate. Eye large; length of orbit equal to distance from its anterior margin to nostril. Interorbital distance very slightly greater than width of an eyelid. No tympanum, the area behind eye with numerous tubercles. An enlarged tubercle near margin of eyelid; other smaller tubercles most numerous posteriorly. Vomerine teeth in short but prominent rows posterior to nares, rather narrowly separated in mid-line. Nares of moderate size, their greatest diameter slightly less than length of a vomerine tooth row. Tongue large, rounded, its posterior margin entire, free for about one-third its length.

Fingers and toes with well-developed disks, those of outer fingers squarish or slightly emarginate terminally, narrow at base; disk of first finger much smaller, only slightly wider than the digit. Fingers long and slender, 3–4–2–1 in order of decreasing length. Subarticular tubercles of fingers and toes rounded; no supernumerary tubercles; outer palmar tubercle low, rounded, broadly V-shaped; inner tubercle elongate. Leg of moderate length, heel of appressed leg reaching midway between anterior margin of eye and nostril. Toes 4–5–3–2–1 in order of decreasing length, with disks about equal to those of fingers; an elongate inner metatarsal tubercle, its tip falling short of subarticular tubercle of first toe; a very small rounded outer metatarsal tubercle; no tarsal fold; a trace of webbing basally between toes.

Skin of dorsal surface granulate, with a few scattered small tubercles; sides with more numerous and larger tubercles which tend to be elongate; a few very small tubercles in loreal area; larger tubercles in postorbital area; two or three enlarged tubercles back of angle of jaws. A curved glandular fold extending back from eye toward shoulder; a narrow fold in a dorsolateral position, beginning above shoulder and extending posteriorly nearly halfway to groin. A group of small tubercles at heel, one of which is very slightly enlarged. Venter granulate; a weakly delimited ventral disk.

Dorsal surface dull grayish, brighter on snout; a blackish interorbital bar, sharply delimited anteriorly, fading to a dull grayish posteriorly and merging with the mottling of the back; a dorsal pattern, much obscured by mottling, consisting of a W-shaped figure in the scapular region, followed by an irregular, roughly triangular blotch in center of back; sides with ground color rather more olive than that of back, mottled and spotted with dusky; upper surface of legs with narrow dusky crossbars, not sharply outlined; dorsal surface of thigh with an ill-defined ocellus-like mark at base, consisting of a pale gray oval with an elongate dark center; posterior surface of thighs uniform dark reddish brown; soles of feet and undersides of tarsus grayish brown; venter mottled with dark grayish brown and white, darker on the throat, gradually lighter posteriorly; head with a narrow and ill-defined dark stripe from snout to eye, another on postorbital fold; two broad blackish bars from orbit to rim of upper jaw.

MEASUREMENTS.—Snout-vent 40 mm.; tibia 21.5; head width 16; orbit 6.7; snout 7.2.

VARIATION.—The largest of the four paratypes is a female with a snout-vent length of 46.5 mm. The series shows little variation in structural features. In one the heel of the appressed leg reaches the

snout; in the others, a point between eye and nostril. The narrow, incomplete dorsolateral fold varies in length; in one paratype it is represented only by a series of elongate tubercles above the forearm. In the larger individuals the head is markedly wider than the body. In two of the paratypes there is a poorly-defined light stripe in a dorsolateral position, curving laterally above the forelimb; this is barely discernible in the type, and in the two remaining paratypes is represented only anteriorly by elongate light spots. The dark dorsal pattern varies in intensity. The median dark dorsal spot is greatly reduced in one paratype, and in another forms an inverted V-shaped figure. In none of the paratypes is the ocellus at the base of the thigh as distinctly marked as in the type. There is little variation in the pigmentation of the rear surface of the thighs; in all, this area is reddish brown, contrasting with the grayer tone of the dorsal surface.

In life the dorsal surface of three of these frogs was more or less greenish, ranging from a dusky olive through a distinct greenish olive to a yellowish olive; in one the olive appeared to be overlaid with reddish cinnamon. The posterior part of the belly and the undersurfaces of the shanks and thighs were reddish in all of the type series, coral-red in the type, and brownish salmon in the paratypes. A few scattered, irregular pale gray flecks on the dorsum were rather prominent in the living frogs, but are scarcely apparent after preservation.

A series of seven additional specimens was collected from a stream beside the Maracay-Choroni road on the south side of the divide at about 1300 m. Unfortunately, these died and were somewhat desiccated before preservation. Although they are scarcely in comparable condition, they agree with the type series in all structural features; the ground color, however, is much paler and the dorsal pattern more pronounced. Of four small immature specimens from Rancho Grande, one is notable in having a broad, light, middorsal stripe, a variation unrepresented in any of the adults at hand.

REMARKS.—In addition to the preserved specimens of *E. anotis,* another adult and several young thought to be of this species were handled alive in the field. Although apparently not aquatic in habit, all individuals were found in close association with small, rushing mountain streams. In the daytime they hid in rocky crevices, and at night they were encountered on the exposed surfaces of boulders in the water and on rock outcrops at the stream edge.

Among the species of *Eleutherodactylus* which occur at Rancho Grande, *E. anotis* may readily be recognized by the complete absence of a tympanum. In one specimen in which the skin of the tympanic area

has been reflected there is no trace of cavum tympani, annulus, nor plectrum; the entire area between the posterior process of the squamosal and the maxillary arch is occupied by muscle. Other South American species lacking a visible tympanum are known; some or conceivably all of these may be closely related to *anotis*. These differ from the latter as follows: *E. surdus* (Boulenger) has the nostrils equidistant between eye and tip of snout, and white spots on hind surface of thighs; *E. whymperi* (Boulenger) has a tuberculate dorsum and shorter legs, the appressed heel reaching only to angle of the jaw; *E. roseus* (Boulenger) has three subconical tubercles on the eyelids, a white stripe on the canthus, and dark diagonal spots on the sides (Boulenger, 1918); *E. ventrivittatus* Andersson (1945) has large black ventral markings contrasting sharply with a white ground color, and broad black bars on the femora; *E. carvalhoi* Lutz and Kloss (1952) has a conspicuous, large light spot on each flank, and a vertical loreal region.

Of these, we have seen only *ventrivittatus* (UMMZ 92127–28, 92130–33, from the Oriente of Ecuador). Despite several obvious differences, there is sufficient resemblance to *anotis* in size and shape of disks and in relative length of toes to suggest that there may be a close relationship. *E. ventrimarmoratus* (Boulenger), from Peru and Ecuador, with the tympanum poorly differentiated, but with similar foot structure (Boulenger, 1912), is quite conceivably related, as is also *E. carmelitae* Ruthven of the Santa Marta Mountains, still another species with a reduced tympanum (Ruthven, 1922).

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