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# A New Fat Little Frog (Leptodactylidae: *Eleutherodactylus*) from Lofty Andean Grasslands of Southern Ecuador

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*ABSTRACT* A new species in the *Eleutherodactylus unistrigatus* group is named from the Cordillera Occidental in southern Ecuador. The new species is terrestrial in páramo dominated by bunch grass.

*Key words:* Leptodactylidae; *Eleutherodactylus philipi* new species; Ecuador; Andes.

*RESUMEN* Se describe una especie nueva en el grupo *Eleutherodactylus unistrigatus* de la Cordillera Occidental en el sur del Ecuador. La especie nueva es terrestre en el páramo donde predominan racimos de pasto.

*Palabras claves:* Leptodactylidae; *Eleutherodactylus philipi* especie nueva; Ecuador; Los Andes.

More than a quarter century ago, Philip S. Humphrey assumed the directorship of the Natural History Museum at The University of Kansas and encouraged attention to the Neotropical fauna. When he arrived in Kansas, each of us was already interested in Neotropical frogs, and our research on these organisms has benefited from Phil's interests. The rich eleutherodactyline frog fauna of the Andes of southern Ecuador was described by one of us (Lynch, 1979) but novelties continue to be discovered.

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When Duellman collected in southern Ecuador in 1984 he found a number of distributional extensions for the taxa described by Lynch and among his collections were two small series of a small, fat frog from páramos northwest of Cuenca. We think it proper that Phil's interest in our work on Ecuadorian frogs be acknowledged by a presumably voiceless organism that watches over the high Andean fauna of southern Ecuador.

## MATERIALS AND METHODS

The characters, their definitions, and the numerical diagnosis follow the standard established by Lynch and Duellman (1980). The following abbreviations are used: EN = eye-nostril distance, HW = head width, IOD = interorbital distance, SVL = snout-vent length; AMNH = American Museum of Natural History, KU = Natural History Museum, The University of Kansas. Osteological observations were made on specimens that were cleared and stained with alizarin red and alcian blue.

## *Eleutherodactylus philipi* sp. nov.

**Holotype.**—KU 202592, an adult female, from 30.1 km (by road) NW Cuenca, 3580 m (02°47' S, 79°11' W), Provincia del Azuay, Ecuador, one of a series collected by Patricia A. Burrowes, William E. Duellman, and David M. Hillis on 13 March 1984.

**Paratypes.**—KU 202593–98, 202600–606 collected with the holotype; KU 202607–08, 202612, 202614 from 42.8 km (by road) NW Cuenca, 3820 m, Provincia del Azuay, Ecuador (same collectors and date).

**Referred specimens.**—Juveniles, KU 202599 from 30.1 km NW Cuenca, and KU 202609–11, 202613, and 202615 from 42.8 km NW Cuenca.

**Diagnosis.**—A member of the *Eleutherodactylus unistrigatus* group distinguished from other members of the group by the following combination of characters: (1) skin of dorsum bearing low tubercles, most prominent in males, that of venter coarsely areolate; dorsolateral folds absent; discoidal fold indistinct; (2) tympanic membrane and tympanic annulus absent; (3) snout short, ovoid in males and rounded in females in dorsal view, rounded in profile; (4) upper eyelid about equal in width to IOD, lacking enlarged tubercles; cranial crests absent; (5) vomerine odontophores low, oblique in largest female, indistinguishable in others; (6) males lacking vocal slits; glandular nuptial pads present; (7) first finger shorter than second; finger disks small, truncate; (8) fingers bearing lateral keels; (9) ulnar tubercles indistinct; (10) heel bearing small tubercle, outer edge of tarsus bearing indistinct tubercles, inner edge of tarsus bearing low tubercle; (11) inner metatarsal tubercle oval, 2×–3× round outer metatarsal tubercle; supernumerary plantar tubercles indistinct; (12) toes bearing

lateral keels; webbing absent; toe disks smaller than those on outer fingers; fifth toe longer than third; (13) dorsum of body and limbs, flanks, and posterior surfaces of thighs dark brown to black with or without grayish white longitudinal streaks on body, transverse bars on limbs, diagonal bars on flanks, and streaks and spots on posterior surfaces of thighs; venter tan with dark spots or uniform dark brown; (14) SVL in males 21.1–25.1 mm ($\bar{x}$ = 23.0 ± 0.4, $n$ = 10), in females 26.5–33.7 ($\bar{x}$ = 31.2 ± 1.1, $n$ = 6) mm.

*Eleutherodactylus philipi* is most similar to (and apparently most closely related to) *E. riveti,* but is easily distinguished from that species because it lacks a tympanic membrane and tympanic annulus (present in *riveti*). In southern Andean Ecuador, *E. baryecuus* and *E. ruidus* lack tympanic membranes and annuli, but each species has cranial crests and larger digital disks. *Eleutherodactylus cryophilius* is superficially similar (small disks, short limbs) but has heavy cranial crests.

**Description.**—$n$ = 10 males, 8 females. Head narrower than body, wider than long; HW/SVL 37.0–39.6% ($\bar{x}$ = 38.0 ± 0.3) in males, 37.7–39.3% ($\bar{x}$ = 38.6 ± 0.2) in females; snout short, rounded in dorsal view and in profile in females, ovoid in dorsal view and rounded in profile in males; EN 67.7–83.3% ($\bar{x}$ = 73.4 ± 1.5) length of eye in males, 69.0–83.3% ($\bar{x}$ = 75.9 ± 2.0) in females; nostrils protuberant, directed anterodorsolaterally; canthus rostralis evident, weakly concave; loreal region concave, sloping abruptly to lips; lips not flared; upper eyelids lacking enlarge tubercle; eyelid 84.0–123.8% ($\bar{x}$ = 102.5 ± 4.0) IOD in males, 81.5–113.8% ($\bar{x}$ = 96.6 ± 4.0) in females; supratympanic fold evident, obscured by large flattened tubercles; postrictal tubercles not distinct from skin texture; choanae small, round, not concealed by palatal shelf of maxillary arch; vomerine odontophores low or absent, each smaller than a choana, each bearing clump of 0–3 teeth, separated from one another on midline by distance equal to width of odontophore; tongue longer than wide, posterior two fifths not adherent to floor of mouth, posterior border notched slightly; vocal slits and sac absent in males.

Dorsum lacking folds, bearing low flat warts (more pungent in males and small females); skin of flanks and venter areolate; discoidal fold indistinct, just anterior to groin; cloacal sheath short; cloacal opening directed ventrally at midlevel of thighs; ulnar tubercles low, antebrachial largest; palmar tubercle weakly bifid, slightly larger than oval thenar tubercle; supernumerary palmar tubercles indistinct; subarticular tubercles round, prominent, nonconical; fingers bearing lateral keels; all fingers bearing ventral digital pads at tips; disks scarcely wider than digits immediately proximal to disk; tips of digits round or weakly truncate; first finger slightly shorter than second; large white, glandular nuptial pad on thumb of adult males.

Heel bearing small tubercle; similar, less obvious, tubercles along outer

Fig. 1. Holotype of *Eleutherodactylus philipi*, KU 202592, ♀, SVL 33.1 mm. KU Color transparency No. 7241. Photo by W. E. Duellman.

edge of tarsus (most distinct in smaller individuals); small elongate tubercle on inner margin of tarsus; inner metatarsal tubercle twice as long as wide, about 3× round outer metatarsal tubercle; subarticular tubercles round, prominent, nonconical; supernumerary plantar tubercles low, those at bases of toes most distinct; toes bearing lateral keels; digital disks of toes slightly smaller than those of fingers but more obvious and more truncate; tip of disc of Toe V extending to distal edge of distal subarticular tubercle on Toe IV; tip of disc on Toe III extending to distal edge of penultimate subarticular tubercle on Toe IV; heels of flexed hind limbs held at right angles to sagittal plane not touching; shank 36.2–41.2% ($\bar{x}$ = 38.4 ± 0.5) SVL in males, 34.7–41.8% ($\bar{x}$ = 38.4 ± 1.0) in females.

In preservative, dorsum and flanks dark brown to black with ($n$ = 9) or without ($n$ = 9) pale grayish white longitudinal streaks on dorsum and diagonal bars or large spots on flanks; grayish white upper lip with two dark labial bars and narrow grayish white interorbital bar ($n$ = 3); narrow, irregular, pale bars on limbs ($n$ = 5) and tan elbows ($n$ = 2); posterior surfaces of thighs black with ($n$ = 5) or without ($n$ = 13) pale streaks dorsally and row of pale spots ventrally; white triangular mark below vent ($n$ = 2); venter creamy tan to pale brown with rows of prominent dark brown spots ventrolaterally and spots along midline coalesced to form irregular line ($n$ = 6), uniform dark brown ($n$ = 11), or dark brown with small white spots ($n$ = 1).

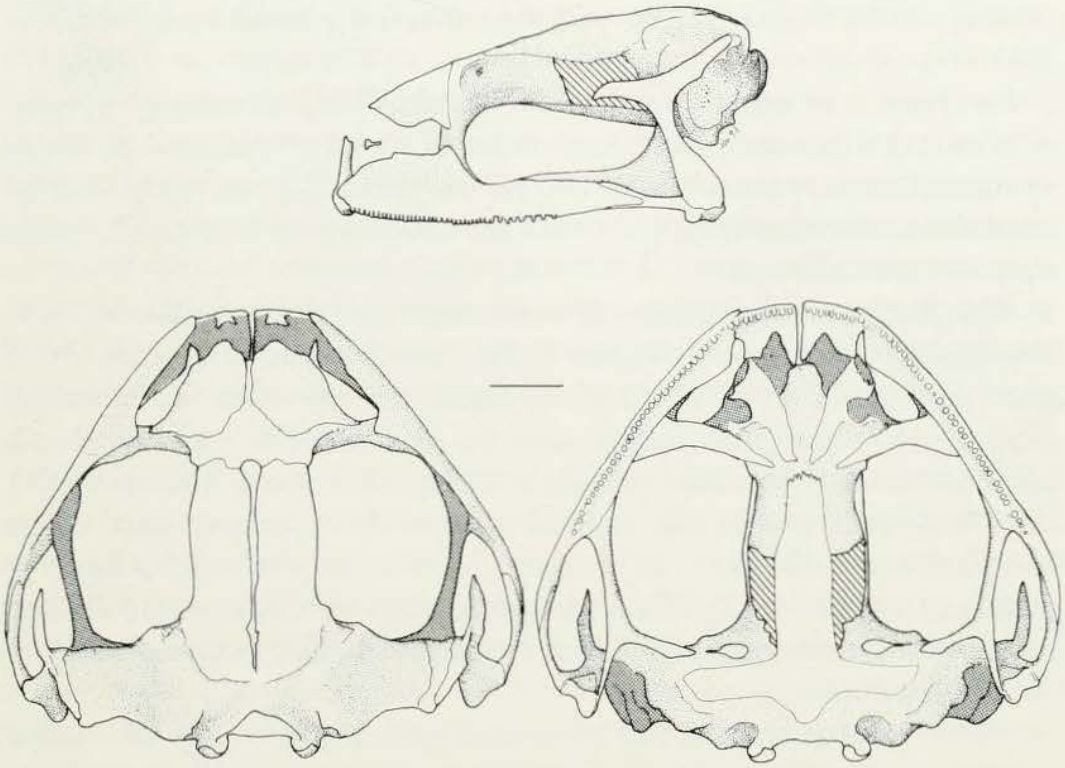

Fig. 2. Dorsal, ventral, and lateral views of the skull of *Eleutherodactylus philipi*, KU 202595, ♀, SVL 33.7 mm. Line = 2 mm. Drawing by J. D. Lynch.

In life, the dorsum varied from dark brown (with orange tint in some individuals) to black, with or without yellow to silvery gray markings; the venter was silvery gray mottled with black in some individuals to orange-brown or dull gray with no noticeable markings in others. The iris was grayish bronze with fine black reticulations (Fig. 1).

Measurements of holotype (in mm): SVL 33.1, shank 11.9, HW 13.0, head length 10.6, chord of head length 11.5, upper eyelid width 2.8, IOD 3.2, eye length 4.2, EN 2.9

**Cranial osteology.**—KU 202595, ♀, SVL 33.7 mm. Skull slightly broader than long, deep; nasals small, narrowly separated from one another but broadly separated from frontoparietals; sphenethmoid large, extending well anteriad beneath nasals; frontoparietals narrowly separated medially, lacking lateral development of crests; narrow shelf defining limits of roof of frontoparietals posteriorly; frontoparietals fused to prootics but parts of sutures visible anteriorly; cristae paroticae relatively slender (anteriorly-posteriorly); epiotic eminences relatively shallow; alary processes of premaxillae directed dorsally; palatal shelf broad, deeply dissected; vomers elongate, well separated, lacking odontophores; neopalatines extending medially almost to dentigerous processes of vomers; cultriform process of parasphenoid narrowing slightly anteriorly, not in contact with neopalatines or vomers; alary processes of parasphenoid perpendicular to cultriform

process, not tapering laterally, well separated from median rami of pterygoids (Fig. 2).

Pars facialis of maxilla deep, not in contact with posterolateral process of nasal; maxilla and quadratojugal in broad contact; zygomatic ramus of squamosal slightly shorter than otic ramus, extending anteriorly without being directed toward maxilla; otic ramus of squamosal bearing slight otic plate; columella absent.

**Distribution and ecology.**—*Eleutherodactylus philipi* is known from two localities, one from the higher slopes on either side of the crest (4000 m) of the Cordillera Occidental of the Andes. Both localities are in páramo dominated by bunch grass and are along the road from Cuenca to Molleturo, which in March 1984 terminated about 75 km NW Cuenca. The site at 30.1 km NW Cuenca is at an elevation of 3580 m on the eastern slope of the cordillera above the Hoya de Cuenca, whereas the site at 42.8 km NW Cuenca (7.8 km below the crest) is at an elevation of 3820 m on the western slope of the Cordillera. At that point, the road is in the uppermost valley of the Río Chilcoplaya.

All individuals were found beneath stones in páramo by day. Other anurans found under stones in the páramo at these localities include one *Eleutherodactylus cryophilius* at 30.1 km NW of Cuenca, and one *Atelopus ignescens*, two *Gastrotheca litonedis*, and one *Eleutherodactylus vidua* at 42.8 km NW of Cuenca.

**Etymology.**—The specific epithet is a Latinized noun in the genitive case and is a patronym for Philip S. Humphrey, who, as Director of the Natural History Museum, The University of Kansas, has provided collegial and stimulating leadership.

**Remarks.**—We define the *Eleutherodactylus unistrigatus* group as those members of the genus having the mandibular ramus of the trigeminal nerve passing lateral to the *m. adductor mandibulae externus superficialis* ("S" condition of Lynch, 1986) and Toe V extending to the distal margin of the distal subarticular tubercle of Toe IV; thus Toe V is much longer than Toe III. Approximately 190 species presently are recognized in this group.

Color pattern variation is not uncommon in *Eleutherodactylus*. None of the six juveniles has a visible dorsal pattern in preservative, but one has a pattern of dark spots on a tan venter, and another has small white spots on the venter; the only other individual with white spots on the venter is an adult male. Of the four largest adult females, two have dorsal and ventral patterns and two are uniform dark brown or black; some adult males have patterns dorsally and ventrally, whereas others lack a pattern. One adult male that has a pattern dorsally is uniformly dark ventrally, and a juvenile that lacks a dorsal pattern has dark spots on a tan venter. Therefore, with the exception of the apparent absence of a dorsal pattern in juveniles, pattern polymorphism is not correlated with sex or size.

The skull of *Eleutherodactylus riveti* (based on KU 119857, 120080–81) closely resembles that of *E. philipi* except the frontoparietals are not fused to the prootics (but the fusion in *E. philipi* apparently is ontogenetic, unlike the fusion in the subgenera *Euhyas* and *Syrrhophus*). In *E. riveti*, the zygomatic ramus of the squamosal is shorter and less deep than that of *E. philipi*. The most obvious differences between the two are the presence of a columella and of vomerine odontophores in *E. riveti*. In *Eleutherodactylus ruidus* (based on AMNH 17592), the most obvious differences evident in the skull are the low cranial crests (evident on posterior part of frontoparietals only), the frontoparietals are not fused to the prootics, and the vomers have odontophores.

Lynch (1979) viewed *Eleutherodactylus balionotus, riveti,* and *ruidus* as near relatives in the sense of species replacing one another geographically. His hypothesis was based on phenetic resemblances rather than explicit synapomorphies. With the discovery of *E. philipi* and the availability of skeletal material of three of the four taxa, we remain as imprecise as before, because we still lack the synapomorphies that would allow corroboration or testing of Lynch's hypothesis. The similarities in cranial morphology between *E. philipi* and *E. riveti* are consistent with them being closely related. However, in the absence of osteological material of *E. balionotus* and several other species from southern Ecuador and Peru, we are unable to provide a more explicit or inclusive hypothesis of relationships among these four species of the *Eleutherodactylus unistrigatus* species group.

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