

TWO NEW SPECIES OF *ELEUTHERODACTYLUS*
(AMPHIBIA: ANURA: LEPTODACTYLIDAE)
FROM BOLIVIA

John D. Lynch and Roy W. McDiarmid

Abstract.—*Eleutherodactylus fraudator*, new species, *E. mercedesae*, new species, and *E. rhabdolaemus* are reported from cloud forests in Departamento Cochabamba, Bolivia. *Eleutherodactylus pharangobates* Duellman is placed as a synonym of *E. rhabdolaemus* Duellman.

Although the genus *Eleutherodactylus* is extraordinarily speciose in many areas of northern South America and especially on the Andean slopes, it is poorly known in southern South America. Presently, the southern terminus of the genus is in northern Argentina (Lynch 1971, Cei 1980) where only a single species, *Eleutherodactylus dis-coidalis*, is recognized. Three species have been reported from Andean Bolivia in contrast to ten species recorded from adjacent areas in Peru. While such a gradient is consistent with the geographic pattern of diversity characteristic of many groups of tropical organisms, with frogs (especially *Eleutherodactylus*) this gradient is partially a reflection of collecting efforts. Thus, a series of small collections made by Mercedes S. Foster in 1979 as she travelled down the eastern versant of the Bolivian Andes along the road from Cochabamba to Villa Tunari (Cannatella [1980] presented a useful map of the area) are especially noteworthy for the frogs they contain. Her collections, when added to material collected in 1959 from the same area, provide us with some important additions to the Bolivian herpetofauna particularly within the genus *Eleutherodactylus*.

The three species previously reported from Bolivia are *E. cruralis* (Boulenger), *E. fenestratus* (Steindachner), and *E. pharangobates* Duellman. The cloud forests of adjacent Peru (Departamentos Ayacucho,

Cuzco, and Huánuco) harbor ten species: *E. cosnipatae* Duellman, *E. danae* Duellman, *E. granulatus* (Boulenger), *E. lindae* Duellman, *E. mendax* Duellman, *E. pharangobates* Duellman, *E. platydactylus* (Boulenger), *E. rhabdolaemus* Duellman, *E. salaputium* Duellman, and *E. scitulus* Duellman.

In addition to the two new species of *Eleutherodactylus* (described below) and *E. rhabdolaemus*, Foster obtained one specimen of *E. fenestratus* (USNM 257849, Miguelito, ca. 99 km from Cochabamba on Cochabamba to Villa Tunari road, Provincia Chapare, Departamento Cochabamba, 1770 m). This record is from the southern edge of the distribution of *E. fenestratus*, a wide-ranging species recorded from several localities in the southern Amazon Basin (Lynch 1980).

Our use of abbreviations and terminology follows Lynch (1980) and Lynch and Myers (1983).

Eleutherodactylus fraudator, new species
Figs. 1, 2A

Holotype.—USNM 257847, adult male, taken 73.5 km from Cochabamba on Cochabamba to Villa Tunari road, Provincia Chapare, Departamento Cochabamba, Bolivia, ca. 2690 m, on 23 Sep 1979, Mercedes S. Foster collector.

Paratopotype.—USNM 257846, adult male, taken with holotype.

Diagnosis.—A species of *Eleutherodactylus* distinguished from others by the following combination of characteristics: (1) skin of dorsum shagreened, that of venter smooth; low dorsolateral folds present; (2) tympanum prominent, round, $\frac{2}{3}$ eye length; (3) snout outline from dorsal view rounded to obtuse, round in lateral profile; canthus rostralis sharp in cross section; (4) upper eyelid broader than IOD; no cranial crests; (5) vomerine odontophores oval; (6) males with vocal slits; males with non-spinous nuptial pads; (7) first finger slightly longer than second; tips of two outer fingers truncate with expanded pads, those of inner fingers more rounded; (8) lateral fringes on fingers weakly defined or absent; (9) no ulnar tubercles; (10) no tubercles or folds on heel or tarsus; (11) inner metatarsal tubercle oval and elevated, outer low and indistinct; no supernumerary plantar tubercles; (12) toes with weak lateral keels; toe tips rounded to truncate; (13) brown with darker brown stripes; dark brown canthal-supratympanic and labial stripes; venter cream stippled with brown, heaviest on throat; (14) two adult males 28.1–28.3 mm SVL.

Eleutherodactylus fraudator tentatively is assigned to the *conspicillatus* group. However, the plesiomorphic nature of that group (Lynch 1986) prevents final determination of relationships at this time. *Eleutherodactylus fraudator* is readily distinguished from all others species in the group by having a continuous brown labial stripe instead of labial bars or spots. Additionally, the oval vomerine odontophores are distinctive.

Description.—Statements expressed in full in diagnosis are not repeated here. Head as wide as body, wider than long; HW 40.3–40.6% SVL; nostrils protuberant, directed laterally; snout obtuse, sloping abruptly anterior of nostrils, rounded below tip; canthus rostralis sharp, slightly concave to straight; loreal region concave, sloping abruptly to lips; lips not flared; E-N 75.0–82.0% eye length; low tubercles on upper eyelid; upper eyelid width 112.0–119.2%

IOD; relatively large frontoparietal fontanelle present, possibly indicating that these are young, albeit adult, males; supratympanic fold low, barely touching tympanum; tympanum low on head, length 40.0–46.2% of eye length, separated from eye by distance equal to its length; choanae ovoid, moderate-sized, about equal to tip of first finger, well separated from palatal shelf of maxillary arch; vomerine odontophores oval in outline, medial and posterior to choanae, separated by distance about equal to width of odontophore, bearing two to four teeth; tongue longer than wide, oval, posterior edge with shallow notch, posterior $\frac{1}{3}$ free from floor of mouth; vocal slits long, posterolateral to tongue; vocal sac subgular.

Skin of dorsum shagreened but with scattered low tubercles; dorsolateral folds extend from above tympanum to above groin; skin on flanks not areolate but with scattered tubercles; distinct glandular area in groin; no ventral discoidal folds; skin posteroventral to vent areolate; no anal sheath; palmar tubercle much larger than oval thetar, both low; subarticular tubercles low, longer than wide; fringes indistinct (presence at some points along margins of some fingers may be artifact of preservation); tips of fingers III–IV (Fig. 2) expanded, truncate, with enlarged pads, tips of II–IV with circumferential grooves; finger tip of III less than $\frac{1}{2}$ size of tympanum; finger lengths, shortest to longest, 2, 1, 4, 3; males with large (covers more than half length of digit), white and glandular nuptial pad on top of thumb; outer metatarsal tubercle low, $\frac{1}{2}$ to $\frac{1}{3}$ size of inner; subarticular tubercles longer than wide, sub-conical; toes lack fringes and webbing; lateral keels weakly developed; all toes bear pads on ventral surfaces; heels broadly overlap when flexed hind legs held at right angles to sagittal plane; shank 57.9–60.8% SVL.

The paratype, dissected to determine the condition of the *m. adductor mandibulae*, has the “S” condition (Lynch 1986).

Coloration in preservative.—Brown above



Fig. 1. *Eleutherodactylus fraudator*, left: holotype, USNM 257847; right: paratype, USNM 257846.

with darker brown interorbital triangle continuing posteriorly as a pair of stripes vaguely recalling scapular and sacral chevrons (Fig. 1); lateral margin of dorsolateral fold very dark brown delineating a brown flank band bordered ventrally by paler coloration; irregular dark brown marks forming broken stripe beginning above forelimbs and extending ventrally on anterior $\frac{1}{4}$ of flank; canthal stripe broad, dark brown, extending posteriorly above and below eye to join supratympanic stripe; supratympanic stripe expanded ventrally to form blotch, edged ventrally by cream line; tympanum dark, continuous with supratympanic stripe, annulus only slightly lighter; brown stripe on margin of upper lip; limbs irregularly barred (bars wider or narrower than interspaces, darkest marginally); top of thigh barred; posterior surface of thigh essentially dark brown with some traces of lighter mottling; groin pigmentless except in glandular area that is ochre in one specimen; ventral surfaces cream dusted with brown, heaviest on throat and chest.

Coloration in life.—Dorsally and laterally

mottled with tan, light and dark brown, pattern edged in black in some places; eye, lip, and lateral stripes dark brown to black; ventrally creamy gold, more or less iridescent, intermixed with brown; iris gold (from field notes of M. S. Foster).

Measurements of holotype (and paratype) in mm.—SVL 28.3 (28.1), shank 16.3 (17.1), HW 11.4 (11.4), head length 10.3 (10.1), chord of head length 11.4 (11.1), upper eyelid width 3.1 (2.8), IOD 2.6 (2.5), tympanum 1.8 (1.6), eye 3.9 (4.0), E-N 3.2 (3.0), hind leg (vent to tip of fourth toe) 53.8 (53.8).

Etymology.—Latin, meaning cheat or deceiver; used because these frogs look very much like *Gastrotheca marsupiata*.

Referred specimen.—In addition to the types, we are aware of one additional specimen of *E. fraudator*. USNM 146568, a juvenile female 14.3 mm SVL, was taken at Incachaca, Provincia Chapare, Departamento Cochabamba, 2100 m, on 27 Oct 1959, R. B. Cumming. We prefer not to include it in the type series because of its juvenile nature.

Remarks.—These frogs were calling from

a road-cut in the late afternoon from under rocks or in heavy "moss." The road-cut, a sheer face, was very rocky and covered with vegetation 3 to 5 cm tall interspersed with many bare areas. Males, completely hidden, gave single note, high pitched calls.

We considered the possibility that this species might be identical with that named *Leptodactylus* (*Plectromantis*) *andicola* by Boettger (1891) from Sorata, Bolivia, a locality east of Lago Titicaca at about 2650 m on the eastern Andean slopes of Departamento La Paz. Heyer (1978:33) reported that the type had been destroyed but placed the species in the genus *Eleutherodactylus*. Our comparison of the published description also indicates that several features are in agreement with *Eleutherodactylus*, and *E. fraudator*. However, the description is somewhat general and the following points are at variance (states for *fraudator* in parentheses): snout almost $1\frac{1}{2}$ times as long as eye (about equal); IOD as wide as upper eyelid (narrower); first finger as long as second (longer); narrow fringes on fingers and toes (indistinct or absent); fold on distal $\frac{1}{3}$ of tarsus (no tarsal fold); upper lip blotched (brown labial stripe); limbs indistinctly banded (bands prominent). Additionally, Boettger (1891) made no mention of dorsolateral folds; given that such folds are important in the taxonomy of *Leptodactylus*, the omission suggests that the type of *andicola* lacked such folds. We conclude that if *andicola* is an *Eleutherodactylus*, it is distinct from *E. fraudator*.

In reading the description of *L. andicola* we were struck by its agreement with that of *Gastrotheca marsupiata*. Although Heyer (1978:33) placed *andicola* in *Eleutherodactylus*, we think it equally likely that it might be a *Gastrotheca marsupiata*. Although the type is reported to be 48 mm SVL, somewhat large for a *G. marsupiata* (Duellman and Fritts 1972:17), Sorata is within the range of *G. marsupiata*. Also many other traits, as described by Boettger (1891) for

andicola, are similar to those found in *Gastrotheca*.

Eleutherodactylus mercedesae, new species
Figs. 2B, C, 3

Holotype.—USNM 257848, adult male, ca. 3.3 km N of Cochabamba to Villa Tunari road on road to San Onofre, at a point 97.5 km from Cochabamba on Cochabamba to Villa Tunari road, Provincia Chapare, Departamento Cochabamba, Bolivia, ca. 1690 m, taken 29 Oct 1979, Mercedes S. Foster collector.

Paratype.—USNM 165753, Limbo, Provincia Chapare, Departamento Cochabamba, Bolivia, 1950 m, probably collected 25 Oct 1959, Robert B. Cumming.

Diagnosis.—A species of *Eleutherodactylus* distinguished from others by the following combination of characters: (1) skin of dorsum finely granular, that of venter areolate; irregular, indistinct dorsolateral folds; (2) tympanum prominent, superficial, $\frac{1}{3}$ eye length; (3) snout subacuminate in dorsal view, round in lateral profile; canthus rostralis sharp; (4) IOD about equal to width of upper eyelid; no cranial crests; (5) vomerine dentigerous processes large, nearly triangular, just medial and posterior to choanae; (6) males with vocal slits; males lack nuptial pads; (7) first finger slightly shorter than second; fingers long, tips truncate, pads large; (8) lateral fringes on fingers; (9) no ulnar tubercles; (10) fold along distal $\frac{1}{3}$ of inner edge of tarsus; no heel or tarsal tubercles; (11) two metatarsal tubercles, inner large, oval, about four times size of low outer; three small supernumerary plantar tubercles; (12) toes with narrow lateral fringes, basal webbing; toe tips truncate with broad pads; (13) dorsum brown with lichenose pattern of cream (green in life); throat streaked and mottled with cream and brown; posterior surfaces of thighs brown with many cream flecks and mottling; (14) adults large, two males 40.1–49.5 mm SVL.

By virtue of its color pattern, *E. merce-*

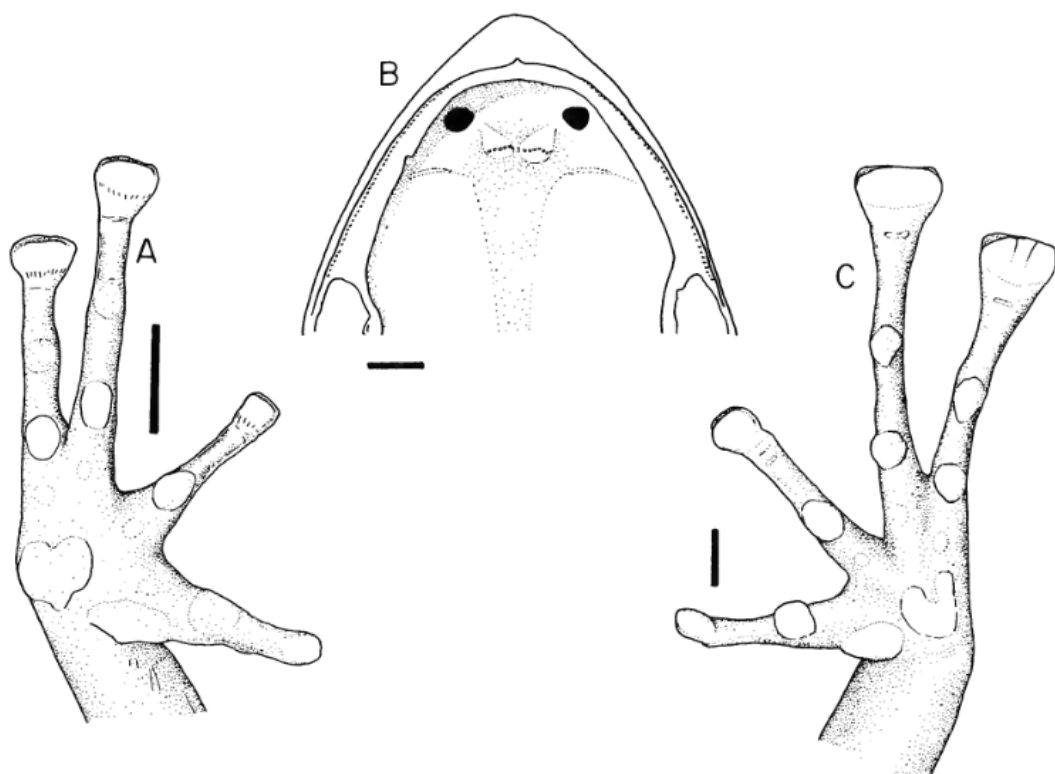


Fig. 2. (A) Hand of *Eleutherodactylus fraudulentus* (USNM 257847), (B) palate and (C) hand of *E. mercedesae* (USNM 257848). (A) is a composite of the left and right hands of the holotype to remove distortions caused by encysted parasites. Scales equal 2 mm.

desae is distinguished from every other species in the genus. Although it has characteristics of Lynch's (1976) *unistrigatus* group, we are unable to suggest any relatives at this time.

Description.—Statements expressed in full in diagnosis not repeated here. Head equal to or wider than body, wider than long; HW 36.4–39.7% SVL; snout deep and lacking tubercles at tip; nostrils moderately protuberant, directed laterally, much nearer tip of snout than to eye; canthus rostralis straight or weakly sinuous; E–N 90.4–93.5% eye length; loreal region concave, especially anteriorly, sloping abruptly to lip; small tubercle in center of loreal region; lips not flared; upper eyelids with few small tubercles; upper eyelid width 118.2–120.0% IOD;

supratympanic fold distinct, contacting upper edge of tympanum, extending posteroventrally to above arm insertion; tympanum round, its length 36.5–37.1% eye length, separated from eye by distance equal to or slightly more than its diameter; two, low to moderate postictal tubercles posteroventral to tympanum; scattered tubercles on head (three or four on upper eyelid, one between eyes, two preinterocular, one on loreal surface, two behind eyes on a line between tympana), but none on margin of lower jaw; choanae relatively large, about equal to subarticular tubercle width, ovoid, not concealed by palatal shelf of maxillary arch; vomerine odontophores between and slightly posterior to choanae (Fig. 2B), narrowly separated, slightly larger than choana,

approximately triangular in outline, much elevated, bearing slanted row of six or seven teeth; tongue longer than wide, somewhat cordate, posterior border with shallow notch, posterior $\frac{1}{4}$ free from floor of mouth; moderately long vocal slits lateral to posterior half of tongue, slit covered posteriorly by distinct labial flap.

Skin of dorsum finely granular, bearing some enlarged warts (more distinct in paratype); a series in the area where dorsolateral folds might occur, a pair in scapular region, a series forming a fold high on flanks; skin of flanks coarsely granular with few enlarged warts; throat smooth; ventral discoidal folds prominent; no anal sheath. In USNM 165753, several strigiid parasites have encysted beneath the skin just above the anus and three more below and to the right. The resulting structures (not on the holotype) superficially resemble specialized anal warts. A single strigiid cyst occurs on the underside of the left shank near the heel, and another on the left heel.

Skin of arm smooth except for some rugosity on outer surface of forearm; palmar tubercle distinctly bifid (Fig. 2C), larger than thenar; thenar tubercle oval, distinctly elevated; supernumerary palmar tubercles present, subconical; subarticular tubercles raised, round to oval, basal on III subconical, others non-conical; fringes along edges of fingers, least developed along outside of IV, palm, and I; fingers very long and slender (Fig. 2C); toe tip on I scarcely expanded, on II expanded but smaller than tympanum, on III and IV expanded, larger than tympanum, weakly emarginate; circumferential grooves present on all fingers (least evident on thumb).

Upper surface of thigh smooth (lower and posterior proximal surfaces areolate); outer surface of shanks feebly granular; one or two minute outer tarsal tubercles; inner metatarsal tubercle 2.5 times as long as wide; supernumerary plantar tubercles low, at bases of toes II–IV; subarticular tubercles

moderate-sized, mostly subconical, longer than wide; toe tips truncate, smaller than those of outer fingers, weakly emarginate; heels of flexed hind legs broadly overlap ($\frac{1}{2}$ length of leg) when limbs held at right angles to sagittal plane; heel of adpressed hind leg reaching well beyond snout; shank 69.3–70.1% SVL.

The paratype was dissected to record the condition of the *m. adductor mandibulae* ("S"). A moderate-sized frontoparietal fontanelle, slightly larger than that illustrated by Lynch (1971:147) for *E. palmeri* (= *E. nyctophylax*), is found in adult males of *E. mercedesae*.

Coloration in preservative.—Brown above with cream blotches in complex lichenose pattern; light areas include a \perp -shaped mark on snout (bordered posteriorly by dark interocular bar that forms anterior edge of brown interocular triangle, irregular in shape), two irregular paired blotches on anterior half of trunk, more diffuse cream blotches posteriorly (Fig. 3); canthal stripe dark brown; two or three dark brown subocular spots; dark brown supratympanic fold, separated from eye; tympanum dark brown, annulus cream except dorsally where dark color of tympanum is continuous with that of supratympanic fold; pair of dark brown spots on each side in scapular region; lips incompletely barred (three bars consisting of dark half-moons); flanks pale brown, reticulated with cream; limbs cream with brown bars, bars about equal to interspaces, transverse on shank; lower lip with two or three irregular shaped, light brown marks; center of throat with cream, \clubsuit -shaped mark edged in brown, posterior sides longer than anterior ones (Fig. 3); throat darker than belly, belly cream with brown reticulation; undersides of limbs cream with brown spots; posterior surfaces of thighs dark brown with many irregular, small cream spots and lines; anal triangle diffuse.

Coloration in life.—Medium brown dor-



Fig. 3. *Eleutherodactylus mercedesae*, holotype, USNM 257848.

sally with irregular, light green splotches (spots look like moss) and few black marks; black eyestripe (canthal plus supratympanic stripe) and lip marks; limbs iridescent coppery with green marks; thighs and sides of body speckled cream, green, and brownish black; ventrally pearly yellow, mottled brown; iris gold (from field notes of M. S. Foster).

Measurements of holotype (and paratype) in mm.—SVL 40.1 (49.5), shank 28.1 (34.3), HW 15.9 (18.0), head length 13.5 (17.1), chord of head length 16.5 (19.7), upper eyelid width 3.9 (4.8), IOD 3.3 (4.0), tympanum 1.9 (2.3), eye 5.2 (6.2), E-N 4.7 (5.8).

Etymology.—This strikingly beautiful frog is named for Mercedes S. Foster whose herpetological collecting efforts in Latin America have added significantly to our knowledge of the fauna of that region.

Remarks.—The type locality is in forest adjacent to the road to San Onofre. The holotype was found active on the forest floor during the day.

The throat pattern in *E. mercedesae* is somewhat similar to that in *E. rhabdolaemus* (see below and Fig. 4). However, we

do not believe that this feature is a synapomorphy. Several species of *Eleutherodactylus* in the Andes of Colombia and Ecuador have similar throat markings.

Eleutherodactylus rhabdolaemus Duellman

Eleutherodactylus rhabdolaemus Duellman, 1978a:65 (holotype, LSUMZ 26150, Huanhuachayocc, on trail from Tambo to Valle del Apurimac, Departamento Ayacucho, Peru, 1650 m).

Eleutherodactylus pharangobates Duellman, 1978b:426 (Holotype, KU 173236, Buenos Aires, Departamento Cuzco, Peru, 2400 m). NEW SYNONYMY.

Although Duellman (1978a) compared *rhabdolaemus* with *pharangobates* (as "*E. sp.* [Buenos Aires]"), he (1978b) did not compare *pharangobates* with *rhabdolaemus* (but did compare it with *E. cosnipatae*, *E. danae*, and *E. granulatus*, three other species from the vicinity of the type locality). The two species are purported to differ in several respects (Table 1).

One of us (JDL) has examined all known specimens of the two taxa. The following

Table 1.—Purported differences between two nominal species of *Eleutherodactylus* (from Duellman 1978a, b). Cited differences marked with asterisk.

	<i>rhabdolaemus</i>	<i>pharangobates</i>
Scapular tubercles	Present	Not mentioned
Snout shape	Narrowly rounded	Acuminate
Vomerine odontophores	Present, both sexes	Absent in males*
Digital pads	Rounded	Truncate*
Heel, tarsal tubercles	Small	Absent*
Throat coloration	Longitudinal stripes	Brown with cream flecks*
Labial stripe	Absent	Present*

point-by-point analyses are based on direct comparisons of the type series (KU 173236–54) of *E. pharangobates* with the KU paratypes of *rhabdolaemus* (138877, 175082–84), the USNM Bolivian series, and notes on the holotype (LSUMZ 26150). The skin of the dorsum is finely shagreened in all specimens of each species; all specimens we examined have a pair of scapular warts. Although not mentioned in the description of *E. pharangobates*, scapular warts are obvious in the photograph (Duellman 1978b, Fig. 2e) of the paratype (KU 173237). These warts (indistinct in some specimens), often bordered with darker pigment to form scapular marks, are more prominent in paler individuals because the dark scapular marks show up better against the ground color. Duellman (1978a, b) described the snout shapes in the diagnoses of the two species as distinct but direct comparison belies these differences (which were not cited in the comparison of *E. rhabdolaemus* to *pharangobates* by Duellman [1978a] as distinguishing characteristics). Both species have long snouts with sharp canthi rostrali and subelliptical to somewhat pointed snouts (in contrast to all other forms except *E. scitulus* in the cloud forests of adjacent Bolivia and Peru). Duellman (1978b) reported that male *E. pharangobates* lack vomerine odontophores. In both sexes of both nominate species, including type material, low vomerine odontophores are evident. We find no difference in position, size, shape, or tooth number. Duellman (1978a) distinguished

pharangobates from *rhabdolaemus* in having truncate digital discs. Inspection of specimens under magnification fails to confirm a shape difference. Casual inspection (without magnification or direct comparison) does give the impression of truncate finger tips in the type series of *E. pharangobates*. However, in those specimens having had the fingers laid out in a fixing pan, one gets the impression of truncateness whereas in those preserved by Richard Thomas (collector of most of Duellman's [1978a] specimens of *rhabdolaemus*), the hands were not laid flat in a fixing tray and the tips appear less truncate (more rounded). We consider the tips of the outer fingers of all specimens to be weakly truncate owing to slight emargination of the ungual flap. The two species were reported (Duellman 1978a) to differ in tuberculation of the heel and tarsus. Both have a low inner tarsal fold which usually has a tubercle on it. Both have small, nonconical tubercles on the heels and each has smaller tubercles along the outer edge of the tarsus.

Duellman (1978a) contrasted *rhabdolaemus* and *pharangobates* in two aspects of coloration: throat pattern and labial stripe. The type series of *E. pharangobates* includes a single female and 12 males. The males have semi-inflated vocal sacs and the throat pattern is obscure. In the female, the throat pattern is identical to that of paratypes of *E. rhabdolaemus* (Fig. 4) except that it is paler. The pattern of a dark central streak with narrower lateral streaks is evident in all specimens from the type series



Fig. 4. Ventrals of *Eleutherodactylus rhabdolaemus*. Intensity of throat patterns declines to right. Paratype of *E. rhabdolaemus*, KU 175083; female paratype of *E. pharangobates*, KU 173246; and male paratype of *E. pharangobates*, KU 173250.

examined. The same general throat patterns are repeated in several of the Bolivian specimens except that a streaked throat is obvious in several males as well.

Darker specimens have dark faces. The labial stripe recorded by Duellman (1978a, b) for *pharangobates* is produced by a paler face edged by the dark canthal stripe and the partial labial bars; the clear area evident between these dark markings was termed a labial stripe (see Duellman 1978b, fig. 2e). The pattern evident in dark specimens is identical to that seen in pale specimens. The difference in intensity is consistent in the type series of *pharangobates* but is bridged within the series of paratypes of *rhabdolaemus*. This difference appears to be the result of metachrosis. This interpretation is supported by Foster's observation (unpublished field notes) that a specimen of *E. rhabdolaemus* (USNM 257854) varied from "very dark to light brown—changes color."

In the absence of sustained differences, we combine the two taxa. *Eleutherodactylus pharangobates* was described on 29 August 1978, slightly more than two months after the description of *E. rhabdolaemus* appeared (27 June 1978). Duellman (1978a, b) reported specimens from the Peruvian

Departamentos Ayacucho, Cuzco, and Huánuco from localities between 1020 and 2650 m. He also reported one specimen (USNM 146587, as *pharangobates*) from Departamento Cochabamba, Bolivia. We have seen the following material of *E. rhabdolaemus* from Bolivia (all Provincia Chapare, Departamento Cochabamba): Limbo, on mule trail to "Mino Porro," 1950 m, USNM 146592–93; 10 km N Limbo, 1800 m, USNM 146587–91; Miguelito, ca. 99 km from Cochabamba on Cochabamba to Villa Tunari road, 1770 m, USNM 257850–51; Paracti, 83 km from Cochabamba on Cochabamba to Villa Tunari road, 2040 m, USNM 257856–57; road to San Onofre, ca. 3.3 km N of Cochabamba to Villa Tunari road at point 97 km from Cochabamba, 1695 m, USNM 257855.

Acknowledgments

We would like to thank the curators of the following museum collections for loan of pertinent material: KU—Museum of Natural History, University of Kansas; LSUMZ—Louisiana State University, Museum of Zoology; USNM—National Museum of Natural History. In addition, JDL

thanks W. E. Duellman for providing space. R. I. Crombie and R. P. Reynolds read a draft of the manuscript and made several worthwhile comments.

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(JDL) School of Biological Sciences, University of Nebraska, Lincoln, Nebraska 68588; (RWM) U.S. Fish & Wildlife Service, National Museum of Natural History, Washington, D.C. 20560.