A New species of the *Eleutherodactylus conspicillatus* Group (Anura: Leptodactylidae) from Northeastern Peru

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Abstract: A new species of *Eleutherodactylus* belonging to the *Electherodactylus conspicillatus* group is described from the Río Huallaga drainage in the upper Amazon Basin near the base of the Andes in the Departamento de San Martín, Peru. *Eleutherodactylus citriogaster* is most similar to *E. condor* and *E. lymani*, allopatric species in southern Ecuador and northern Peru.

Key Words: Leptodactylidae, *Eleutherodactylus citriogaster*, Peru.

Resumen.- Nueva especie del grupo *Eleutherodactylus conspicillatus* (Anura: Leptodactylidae) del nordeste del Perú.- Se describe una especie nueva de *Eleutherodactylus* perteneciente al grupo *Eleutherodactylus conspicillatus*, encontrada en el drenaje del Río Hullaga en la parte superior de la cuenca amazónica, cerca de la base de los Andes en el Departamento de San Martín, Perú. *Eleutherodactylus citriogaster* es más similar a *E. condor* y *E. lymani*, especies alopátricas en el sur del Ecuador y el norte de Perú.

Palabras Clave: Leptodactylidae, *Eleutherodactylus citriogaster*, Perú.

INTRODUCTION

Terrestrial leptodactylid frogs of the genus *Eleutherodactylus* are highly speciose on the Amazonian slopes of the Andes and in the upper Amazon Basin. LYNCH (1980) reported 24 species in the upper Amazon Basin; 16 of these are known from Santa Cecilia in Amazonian Ecuador (DUELLMAN, 1978). Five of these Amazonian species were among the 45 species reported from the forested Amazonian slopes of the Andes in Ecuador by LYNCH and DUELLMAN (1980); two more species subsequently were named from the Andean slopes of northern Peru (DUELLMAN 1990b), were many additional unnamed species are known to occur.

In February 1989 a field party from the University of Kansas worked in the vicinity of Tarapoto in the Departamento de San Martín in northeastern Peru; it was joined by Rainer Schulte, a resident of Tarapoto. In addition to the new species of *Electherodactylus* named herein a new species of *Ischnocnema* (DUELLMAN, 1990a), the collections made in this region contain several new species of *Centrolene, Cochranella,* and *Colostethus*.

In the western part of the Departamento de San Martín, Peru, a series of complex ridges, reaching elevations of more than 1000 m, extend eastward and southward from the Cordillera Central of the Andes. These ridges support lower montane rainforest, whereas the intervening valleys contain remnants of dry tropical forest; most of the valleys are extensively cultivated. Major drainage systems flow eastward (e.g., Río Cainarachi) or southward (e.g., Río Mayo) into the Río Huallaga, which separates the Cordillera Central from the northern part of the Cordillera Oriental.

METHODS AND MATERIALS

Terminology, measurements and numbered characters in the diagnosis follow LYNCH and DUELLMAN (1980); snout-vent length is abbreviated SVL.

Museum abbreviations are: KU = Museum of

Natural History, The University of Kansas; MHNSM = Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru. In addition to the specimens of the new species listed in the descriptions, the following specimens of other species were examined: *E. condor*: KU 146991-147033; *E. lymani*: KU 119502-12, 141292,141962-65, 152009, 165539-40, 181265-67, 196465-69, 202416-17; MHNSM 4317, 11172.

Description of new species

Holotype.–KU 212277, an adult female, from the Cataratas Ahuashiyacu (06°30'S, 76°20'W, 730 m), 14 km (by road) northeast of Tarapoto, Provincia de San Martín, Departamento de San Martín, Peru, obtained on 8 February 1989 by William E. Duellman.

Paratypes.– All from Departamento de San Martín, Peru: KU 209483 from 18 km (by road) northeast of Tarapoto, collected on 30 November 1986 by Rainer Schulte; KU 212278-84, MHNSM 6080-82 from the type locality, collected on 8 February 1989 by William E. Duellman and John J. Wiens; KU 212287-88 from 15 km (by road) northeast of Tarapoto, 800 m, collected on 11 February 1989 by John J. Wiens; KU 212289-90 from 28 km (by road) northeast of Tarapoto, 600 m, collected by William E. Duellman and Rainer Schulte on 15 February 1989.

Referred specimens.– All from Departamento de San Martín, Peru: KU 209384 from the Río Cainarachi, 33 km (by road) northeast of Tarapoto, 500 m, collected by Rainer Schulte on 27 August 1987; KU 212285 from the type locality, collected on 8 February 1989 by William E. Duellman; KU 217316, 217339-42 from the type locality, collected by Rainer Schulte and A. Wisnieski on 3 June 1989; KU 212286 from 8 km (by road) NE Tarapoto, 680 m, collected by Michael E. Morrison on 8 February 1989.

Diagnosis. A member of the *Eleutherodactylus conspicillatus* group, as defined by LYNCH (1976), characterized by: (1) skin on dorsum shagreened, lacking tubercles, with indistinct dorsolateral folds; skin on venter smooth; (2) tympanum distinct, round, its diameter about one third diameter of eye; (3) snout subacuminate in dorsal view, rounded in profile; canthus rostralis sharp; (4) upper eyelid slightly narrower than, or equal to, interorbital distance, not bearing pungent warts; cranial crests absent; (5) vomerine odontophores prominent, triangular in outine; (6) males with vocal slits; subgular vocal sac, and nonspinous nuptial pads on thumbs; (7) first finger longer than second; pads on Fingers III and IV much larger than those on Fingers I and II; discs much broader than long; (8) fingers lacking lateral fringes or keels; (9) ulnar tubercles present distally; (10) tubercles absent on heel and tarsus; (11) two metatarsal tubercles ; inner ovoid, three times size of outer tubercle; (12) toes barely webbed basally, lacking lateral fringes or keels; toepads nearly as large as those on Fingers III and IV; (13) dorsum grayish brown, with or without narrow brown chevrons and interorbital bar; pale canthal lines continuous with vertical rostral line; loreal region and supratympanic mark dark brown; labial bars cream; flanks tan with or without darker diagonal streaks; posterior surfaces of thighs mottled dark brown and cream; venter cream with brown flecks on throat and ventral surfaces of thighs; (14) adults large, nine males 31.6-41.3 mm SVL, four females 42.0-51.0 mm SVL.

Like *E. condor* and *E. lymani*, *E. citriogaster* is large, in contrast to other species in the *Eleutherodactylus conspicillatus* group in the upper Amazon Basin. Of these smaller species, *E. conspicillatus*, *E. malkini*, and *E. peruvianus* differ from *E. citriogaster* by having the posterior surfaces of the thighs dark brown with small cream to red spots. The other species (*E. fenestratus*, *lanthanites*, and *vilarisi*) have uniformly dark posterior surfaces of the thighs; furthermore, *E. lanthanites* has a median pale streak on the throat and prominent tubercle on the heel, and *E. vilarisi* differs by having a bifid palmar tubercle. Although *E. citriogaster* exhibits minor differences in proportions and structure from *E. condor* and *E. lymani*, the species are most easily distinguished by differences in coloration. The venter in *E. citriogaster* is bright yellow with brown or gray pigmentation on the throat, laterally on the belly, and on the ventral surfaces of the thighs. In *E. condor*, the venter is creamy white with dense gray pigmentation on the throat, belly, and ventral surfaces of the thighs, whereas *E. lymani* has dark bars on the margin of the lower lip, dark marks pos-

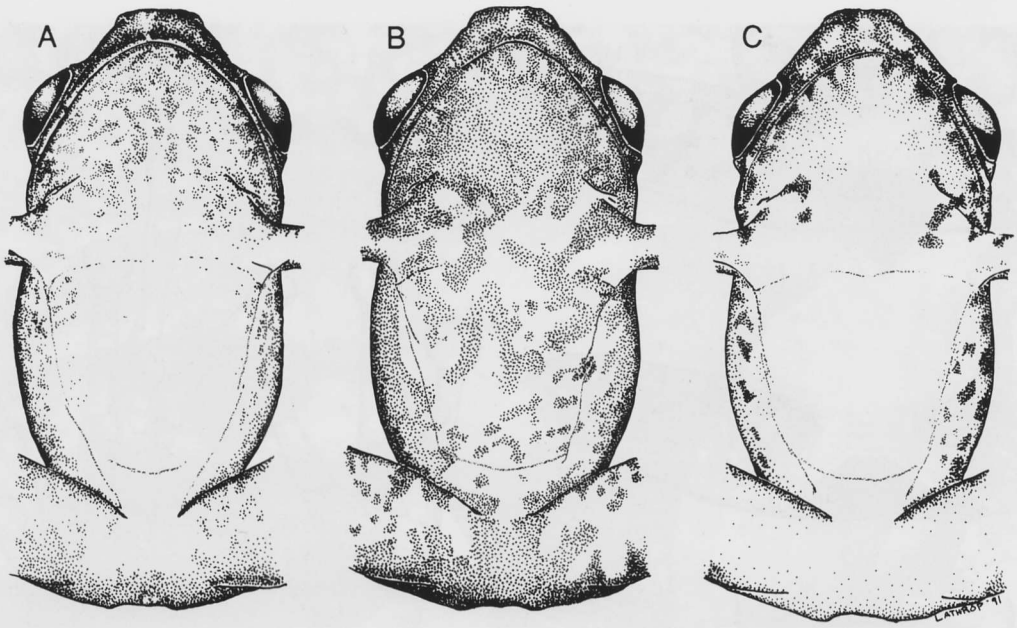

Figure 1. Ventral color patterns of *Eleutherodactylus*: A: *E. citriogaster*, KU 212287; B: *E. condor*, KU 147020; C: *E. lymani*, KU 181265.
Figura 1. Patrón de coloración ventral de *Eleutherodactylus*: A: *E.citriogaster*, KU 212287; B: *E. condor*, KU 147020; C: *E. lymani*, KU 181265.

terolaterally on the throat, and essentially unpigmented belly and ventral surfaces of the thighs (Fig, 1). Moreover, the three species differ in the color pattern on the posterior surfaces of the thighs–mottled dark brown and creamy tan in *E. citriogaster*, dark brown with small pale spots in *E. condor*, and black with bold cream mottling in *E. lymani* (Fig. 2).

Description. Nine adult males, four adult females (two gravid and two with convulated oviducts). Head as wide as body, slightly longer than wide; head width 36.6-41.5% ($\bar{x}$ = 39.3) of SVL in males, 40.4-47.1% ($\bar{x}$ = 43.0) in females; head length 39.8-43.7% ($\bar{x}$ = 42.1) of SVL in males, 41.2-45.9 ($\bar{x}$ = 44.3) in females; snout moderately long, protruding beyond margin of lip, subacuminate in dorsal view, rounded in profile; eye-nostril distance slightly less than length of eye; eye-nostril distance 23.4-32.5% ($\bar{x}$ = 28.2) of head length in males, 29.7-31.0% ($\bar{x}$ = 30.3) in females; eye large, prominent, its length 31.7-36.7% ($\bar{x}$ = 34.0) of head length in males, 30.2-33.9% ($\bar{x}$ = 31.9) in females; upper eyelid lacking tubercles, its width 85.3-97.6% ($\bar{x}$ = 91.7) of interorbital distance in males, 82.4-100.0% ($\bar{x}$ = 90.2) in females. Top of head flat; cranial crests absent; canthus rostralis straight, sharp; loreal region concave; lip slightly flared anterior to orbit; internarial area not depressed; nostril elliptical; slightly protruding laterally at point above anterior margin of lower jaw. Supratympanic fold distinct, curving posteroventrally from posterior corner of orbit, barely obscuring dorsal part of tympanic annulus; tympanum round, separated from eye by distance equal to diameter of tympanum, which is 34.0-43.4% ($\bar{x}$ = 38.2) of diameter of eye in males, 35.5-46.9% ($\bar{x}$ = 39.1) in females. Choanae ovoid, widely separated, not obscured by palatal shelf of maxillary arch; vomerine odontophores prominent, triangular, posteromedial to choanae, widely separated medially, each bearing 4-7 ($\bar{x}$ = 6.0) teeth in males, 5-7 ($\bar{x}$ = 6.5) teeth in females. Tongue narrowly cordiform, shallowly notched posteriorly, free behind for about one third of its length; vocal slit elongate, extending from midlateral base of tongue toward angle of jaws; vocal sac single, median, subgular, restricted to throat.

Skin on dorsum shagreened with indistinct

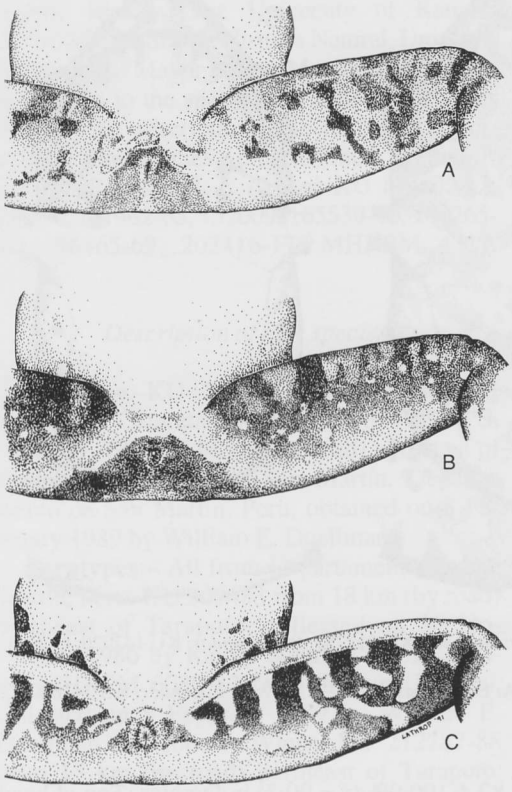

Figure 2. Color patterns on posterior surfaces of thighs of *Eleutherodactylus*: A: *E. citriogaster*, KU 212287; B: *E. condor*, KU 147020; C: *E. lymani*.
Figura 2. Patrón de coloración de la superficie posterior de los muslos de *Eleutherodactylus*: A: *E. citriogaster*, KU 212287; B: *E. condor*, KU 147020; C: *E. lymani*.

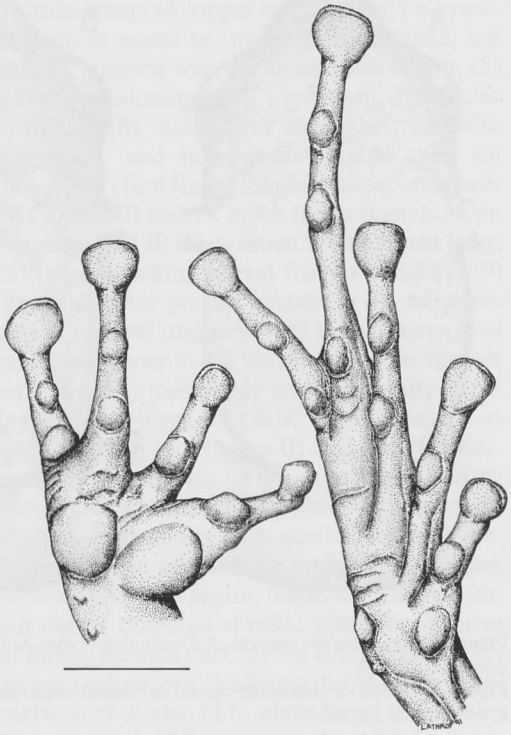

Figure 3. Hand and foot of *Eleutherodactylus citriogaster*, KU 212287. Line = 5 mm.
Figura 3. Mano y pie de *Eleutherodactylus citriogaster*, KU 212287. Linea = 5 mm.

lateral fold extending from occiput to point between midlength of body and groin; flanks granular; a few large granules below supratympanic fold posterior to tympanum; two or three low tubercles distally on ventrolateral surface of forearm; tubercles absent on heel and tarsus; all ventral surfaces smooth; discoidal fold evident. Anal opening unmodified, directed posteriorly at upper level of thighs, bordered below by pair of tubercles.

Forearms moderately robust; fingers long, slender, bearing broadly elliptical discs, widest on Fingers III and IV; relative lengths of fingers I > II < IV < III; subarticular tubercles round, elevated; supernumerary tubercles absent; palmar tubercle large, broadly ovoid, emarginate or slightly bifid distally; thenar tubercle broadly ovoid, slightly larger than palmar tubercle (Fig. 3); males with elliptical, nonspinous, unpigmented nuptial excrescence on inner edge of thumb. Hind limbs moderately robust, long; heels broadly overlapping when hind limbs flexed at right angles to axis of body; tibia length 56.4-63.5% ($\bar{x}$ = 61.2) of SVL in males, 64.0-67.5% ($\bar{x}$ = 64.9) in females; foot length 47.2-56.5% ($\bar{x}$ = 51.6) of SVL in males, 53.3-56.9% ($\bar{x}$ = 55.4) in females. Inner tarsal fold present on distal one third of tarsus; inner metatarsal tubercle broadly elliptical, about three times size of subconical outer metatarsal tubercle; toes long, slender, bearing subtruncate discs nearly as large as those on Fingers III and IV, lacking lateral fringes, barely webbed basally; relative lengths of toes I < II < III < V < IV; subarticular tubercles round, subconical; supernumerary tubercles absent (Fig. 3).

Color in preservative: Dorsum of head and body grayish brown–unicolor (2 individuals),

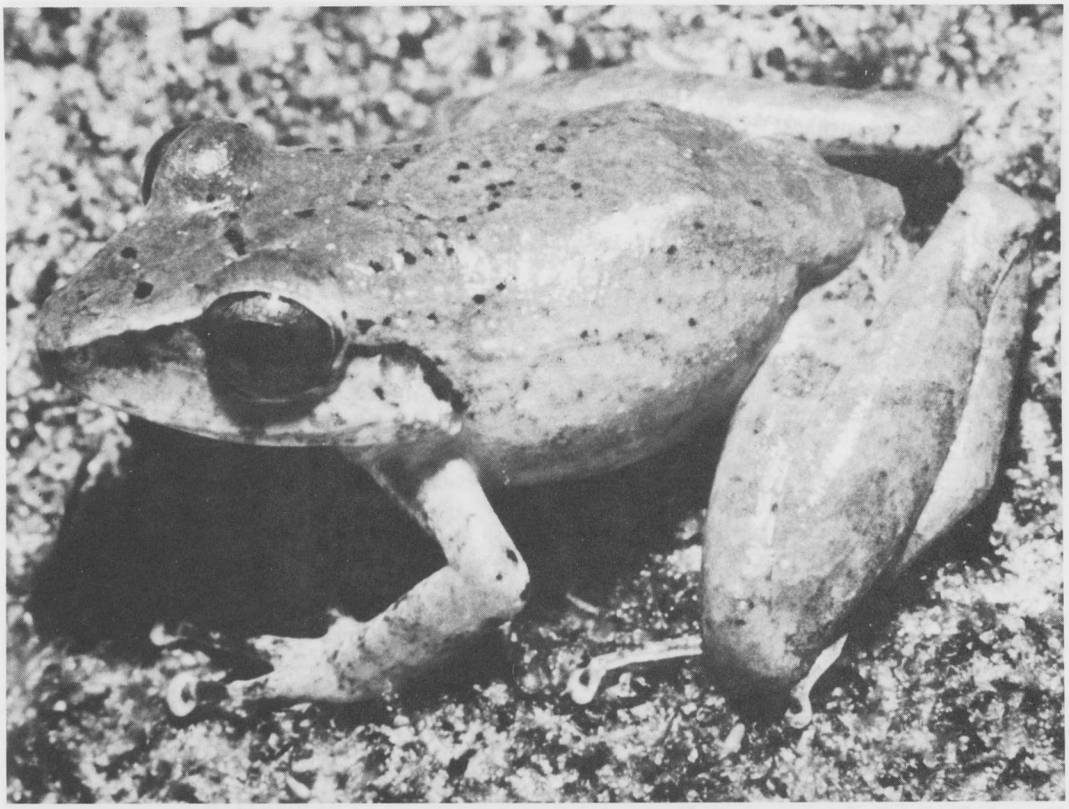

Figure 4. Holotype of *Eleutherodactylus citriogaster*, KU 212277, female, 42.0 mm SVL.
Figura 4. Holotipo de *Eleutherodactylus citriogaster*, KU 212277, hembra, 42.0 mm SVL.

with scattered dark flecks (6), with two dark chevrons on dorsum of body (5); narrow dark interorbital bar (9); pale cream line on anterior part of canthus continuous with vertical rostral line; loreal region dark brown; upper lip ventral and posterior to orbit with 3 or 4 cream bars; lower edge of supratynmpanic fold dark brown; tympanum brown. Flanks creamy tan, unicolor (5), with 3 or 4 irregular, diagonal grayish tan streaks (8). Dorsal surfaces of limbs brown with darker brown cross bars (diagonal on shanks)–2 or 3 on forearms, 3-5 on thighs, 3-5 on shanks, 3 or 4 on tarsi; anterior surfaces of thighs tan with cream suffusion ventrally; posterior surfaces of thighs mottled dark brown and cream (Fig. 2A). Venter creamy white with diffuse brown flecks on throat, laterally on belly, and on thighs and shanks (Fig. 1A); dark brown on distal posteroventral surfaces of thighs; plantar and palmar surfaces dark brown.

Color in life: Dorsum pale tan olive-brown with brown markings; belly bright yellow; ventral surfaces of limbs darker yellow; chin creamy yellow with or without gray flecks; posterior surfaces of thighs dull yellow and brown; upper lip pale creamy yellow with brown bars; iris bronze with median, horizontal, red streak (Fig. 4).

Measurements: (in mm; female holotype followed by ranges with means in parentheses of nine male paratypes and three female paratypes, respectively): SVL 42.0, 31.6-41.3 (37.0), 42.5-51.0 (45.2); tibia length 26.9, 19.9-23.7 (22.6), 27.4-34.4 (30.8); foot length 23.4, 16.5-20.0 (19.1), 23.6-29.0 (26.0); head width 17.0, 12.0-16.2 (14.5), 18.2-22.4 (20.0); head length 19.2, 13.8-17.2 (15.6), 18.9-23.4 (20.7); interorbital distance 3.9, 3.2-4.2 (3.9), 4.7-6.0 (5.3); eyelid width 3.9, 2.9-4.2 (3.6), 4.0-5.6 (4.6); eye-nostril distance 5.7, 3.6-5.0 (4.4), 5.8-7.0

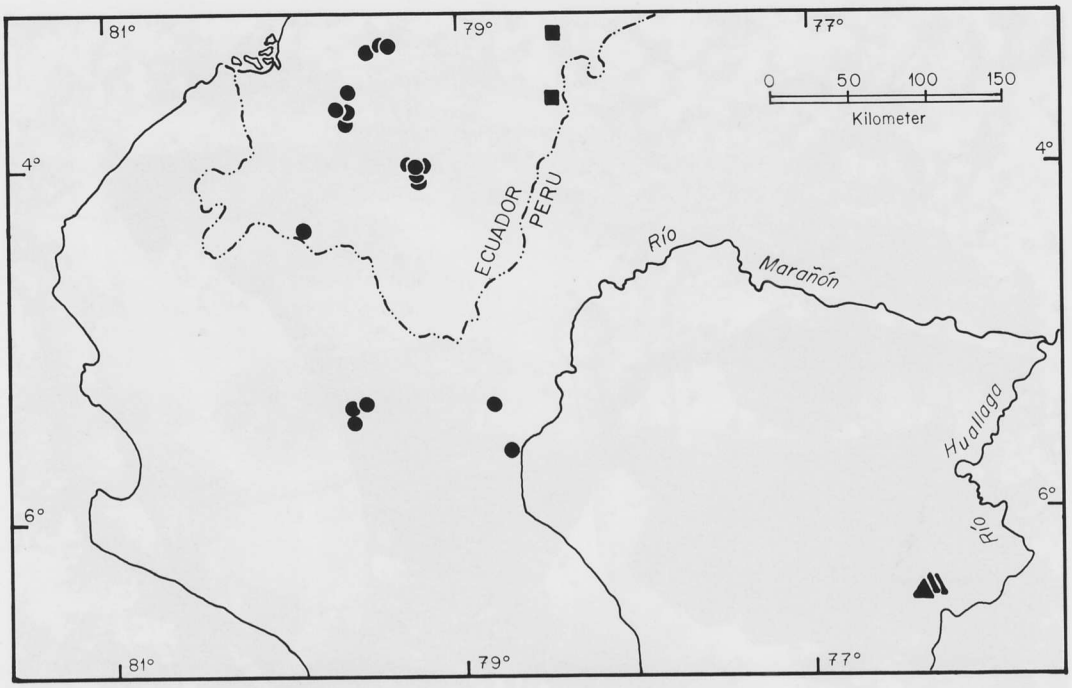

Figure 5. Distribution of three species of *Eleutherodactylus*.
Triangles = *E. citriogaster*; squares = *E. condor*; circles = *E. lymani*.
Localities are those of specimens examined, plus those for *E. lymani* given by LYNCH (1979) and those for *E. condor* given by LYNCH and DUELLMAN (1980) and DUELLMAN and LYNCH (1988).
Figura 5. Distribución de tres especies de *Eleutherodactylus*.
Triángulos = *E. citriogaster*; cuadrados = *E. condor*; círculos = *E. lymani*. Las localidades son las examinadas para los ejemplares objeto de estudio, las citadas en LYNCH (1979) para *E. lymani* y las citadas en LYNCH y DUELLMAN (1980) y DUELLMAN y LYNCH (1988) para *E. condor*.

(6.4); eye diameter 5.8, 4.5-6.1 (5.3), 5.4-7.4 (6.3); tympanum diameter 2.2, 1.6-2.4 (2.0), 2.3-3.0 (2.6).

Distribution and Ecology: *Eleutherodactylus citriogaster* is known from six streams at elevations of 600-800 meters on the northern and southern slopes of a northwest-southeast ridge northeast of Tarapoto (Fig. 5). All individuals were found at night in the immediate vicinities of cascading streams. Adults were on rocks in, and at the edge of, streams; juveniles were on rocks, except for the two smallest ones (17.6 and 17.8 mm SVL) that were low herbs.

Etymology: The specific name is derived from the Greek *kitrinos* meaning citron yellow and the Greek *gaster* meaning belly; the name refers to the bright citron yellow color of the venter in life.

Discussion

On the basis of the "S" condition of the *m. adductor mandibulae* and the pathway of the mandibular ramus of the trigeminal nerve, together with smooth skin on the venter, *Eleutherodactylus citriogaster* is a member of the *Eleutherodactylus conspicillatus* group as defined by LYNCH (1986). By its large size, little webbing on the toes, large discs on fingers and toes, and coloration, *E. citriogaster* seems to be allied with *E. condor* Lynch and Duellman, 1980, and *E. lymani* Barbour and Noble, 1920. The latter has a broad distribution on the Pacific slopes of the Andes in southern Ecuador and northern Peru (Fig. 5). In these regions it inhabits semi-arids areas at elevations of 600-2500 m (LYNCH, 1979; pers. obs.). *Eleutherodactylus condor* occurs in cloud forests on two extra-

Andean mountain ranges–Cordillera del Cóndor and Cordillera de Cutucú (LYNCH and DUELLMAN, 1980; DUELLMAN and LYNCH, 1988). Both of these species are separated geographically from *E. citriogaster*, which occurs in seasonal lower montane rainforest on an outlying ridge of the Andes in northern Peru. Ecologically, the three species are alike in that they usually are found in the immediate vicinity of montane streams.

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REFERENCES

DUELLMAN, W.E. (1978): The biology of an equatorial herpetofauna in Amazonian Ecuador. *Misc. Publ. Mus. Nat. Hist. Univ. Kansas* 65: 1-352.

DUELLMAN, W.E. (1990a): A new species of leptodactylid frog, genus *Ischnocnema*, from Peru. *Occas. Pap. Mus. Nat. Hist. Univ. Kansas* 138: 1-7.

DUELLMAN, W.E. (1990b): A new species of *Eleutherodactylus* from the Andes of northern Peru (Anura: Leptodactylidae). *J. Herpetol.* 24: 348-350.

DUELLMAN, W.E. and LYNCH. J. D. (1988): Anuran amphibians from the Cordillera de Cutucú, Ecuador. *Proc. Acad. Nat. Sci. Philadelphia* 140: 125-142.

LYNCH, J. D. (1979): The frogs of the genus *Eleutherodactylus* in the Andes of southern Ecuador. *Misc. Publ. Mus. Nat. Hist. Univ. Kansas* 66: 1-62.

LYNCH, J. D. (1980): A taxonomic and distributional synopsis of the Amazonian frogs of the genus *Eleutherodactylus*. *Amer. Mus. Novitat.* 2696; 1-24.

LYNCH, J. D. (1986): The definition of the Middle American clade of *Eleutherodactylus* based on jaw musculature (Amphibia: Leptodactylidae). *Herpetologica* 42: 248-258.

LYNCH, J. D. and DUELLMAN W. E. (1980): The *Eleutherodactylus* of the Amazonian slopes of the Ecuatorian Andes (Anura: Leptodactylidae). *Misc. Publ. Mus. Nat. Hist. Univ. Kansas* 69: 1-86.

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