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A Small Amphibian Fauna from a Previously Unexplored Paramo of the Cordillera Occidental in Western Colombia

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ABSTRACT.—Four amphibian species were found on an isolated páramo (3300–3600 m) in the central part of the Cordillera Occidental of Colombia. The single salamander species is proposed as a new species of the *Bolitoglossa palmata* group, and the two *Eleutherodactylus* species are described as new. One of these appears to be a member of the *E. leptolophus* group. *Centrolene buckleyi*, a widespread species in the northern Andes, was also found.

RESUMEN.—Se encuentra cuatro especies de anfibios en un páramo asilado (3300–3600 m) en la parte central de la Cordillera Occidental de Colombia. La única especie de salamandra se nombra como una especie nueva de grupo de *Bolitoglossa palmata* y dos especies del género *Eleutherodactylus* se nominan como especies nuevas. Una de las cuales parece una especie del grupo *E. leptolophus*. *Centrolene buckleyi*, una especie de distribución muy amplia, también se encontró.

Although the frog fauna of the Cordillera Occidental is exceptionally rich (Lynch, 1998), few collections have been made at elevations above 2200–2400 m. Lynch (1995) described three species of *Eleutherodactylus* from isolated páramos in the northern half of the cordillera (Páramo de Frontino and Cerro Tatamá). The only other collections have come from Cerro Munchique (Depto. Cauca) on the southern part of the cordillera where one finds species otherwise distributed on the Cordillera Central (Lynch, 1981, 1998).

The Corporación Valle del Cauca (CVC) initiated an inventory of Cerro Calima in 1997, and I was invited to participate in a second visit in July 1998. The 1997 expedition obtained two species of *Eleutherodactylus* and one of *Bolitoglossa*, whereas the 1998 expedition obtained both species of *Eleutherodactylus* and one of *Centrolene*. Collections were made near the base camp (3450 m) situated in an apparently undisturbed (Fig. 1) páramo habitat (Páramo del Duende, 4°04'16"N, 76°30'56"W). Each visit was carried out during the "dry season" when helicopter flights were possible. At other times of the year, the peak of Cerro Calima is too cloud shrouded to allow prudent helicopter access. Aside from the interest of collecting one of the few páramo sites to be found on the Cordillera Occidental, this site is of particular interest in that it forms the upper part of a transect extending from sea level (Bahía Málaga, Municipio Buenaventura, Valle del Cauca) eastward along the Rio Calima (Lynch, 1998).

Fieldwork in July 1998 was difficult because temperatures fell below 0°C about 1900 h and

remained below freezing until 0730 or 0800. Frogs were calling during the day with peak vocalizations in midmorning and late afternoon, but attempts to approach calling frogs disturbed them. Nocturnal fieldwork was carried out with no success. Material was collected from dense stands of a bromeliad (*Guzmania*) although most specimens seen managed to escape in the 0.5-m deep stands of *Guzmania*. Searches of streams failed to reveal the presence of tadpoles. Nighttime lows ranged from –9°C to –13°C.

MATERIALS AND METHODS

For terminology, see Lynch and Duellman (1997). All measurements were made with dial calipers and a dissecting microscope. When sample sizes are adequate, means are reported as ± 1 SE of the mean. In the taxonomic accounts, the following abbreviations are used: E–N (eye to nostril distance), HW (greatest head width), IOD (interorbital distance), SL (standard length), SVL (snout–vent length).

RESULTS

Only four species were found. Perhaps not surprisingly, three of these represent species not found previously. The fourth species, *Centrolene buckleyi*, is widely distributed in the Andes of Colombia, Ecuador, and Venezuela (Lynch and Duellman, 1973; Duellman, 1979); and the Páramo del Duende record appears to represent the highest elevation reported.

Bolitoglossa hiemalis sp. nov.

Holotype.—ICN (Amphibian collection, Instituto de Ciencias Naturales, Universidad Nacion-

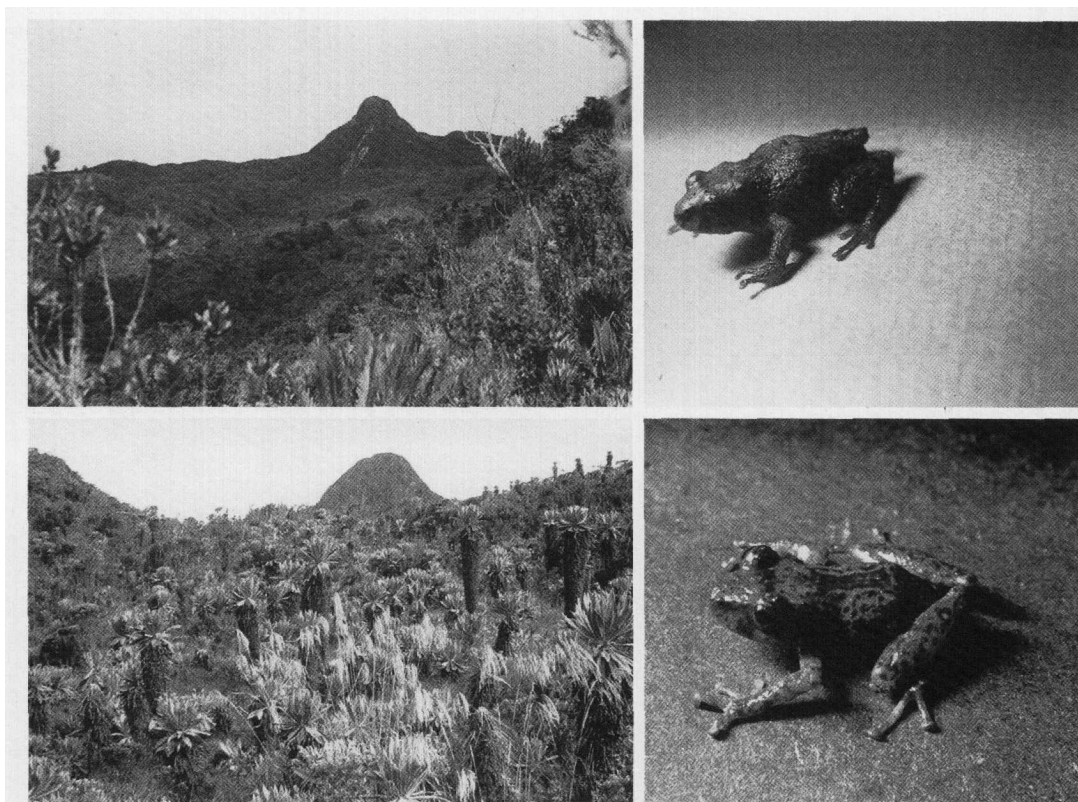


FIG. 1. Photographs of vegetation near base camp on Cerro Calima, showing undisturbed (neither burnt nor grazed) páramo. Upper right, *Eleutherodactylus xeniolum*, holotype; lower right, *Eleutherodactylus duende*, holotype.

al de Colombia) 43850, an adult female, one of a series collected in July and August 1997 by María Fernanda Hernández López (field number MFH 31) in the Páramo del Duende, Cerro Calima, Municipio de Río Frio, Departamento de Valle del Cauca, Colombia, between 3300 and 3600 m.

Paratypes.—Topotype males (ICN 43851-52), female (ICN 43853), and juvenile (ICN 43854), taken with the holotype.

Diagnosis.—A small *Bolitoglossa* (males 37.2–37.7 mm SL, females 44.6–48.9 mm SL) of the *palmata* group (snout short, blunt; digits flattened with round tips) differing from *B. orestes*

and *B. palmata* by having fewer maxillary (14–19) and vomerine (6–9) teeth and in coloration (flanks darker than dorsum, venter not darker than flanks); limb interval 4.0–5.5 costal folds.

Description of Holotype.—Adult female (ovigerous); snout broadly rounded in dorsal view, rounded in lateral profile; nostrils minute, at tip of snout (Fig. 2); labial protuberances small, bluntly rounded at lips; canthus rostralis short (1.6 mm), rounded, much shorter than eye length (2.1 mm); deep groove ventral and anteroventral to eye, not contacting lip; eye large, directed anterolaterally; interorbital distance 2.5 mm; postocular groove shallow, contacting post-trical (nuchal) fold; post-trical fold complete across throat; maxillary teeth 18–19, extending posteriorly to level of middle of eye; premaxillary teeth 3, embedded in tissue of lip; vomerine tooth series 8–9, weakly arched, extending laterally to lateral edges of choanae, separated from patch of “parasphenoid” teeth lying on roof of mouth between orbits; limbs short, five costal folds between adpressed limbs; webbing of digits nearly complete, tips free, rounded, flattened (Fig. 2); no subdigital pads; finger

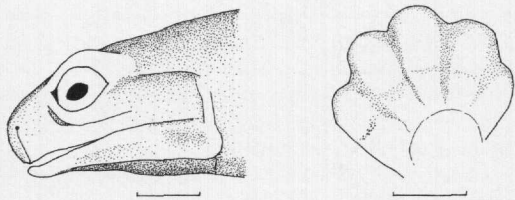


FIG. 2. *Bolitoglossa hiemalis* (ICN 43850). Side of head and top of left hind foot. Scales equal 2 mm.

lengths, longest to shortest, 3-2-4-1; toe lengths, longest to shortest, 3-4-2-5-1; postiliac glands inconspicuous; tail deeper than wide with obvious basal constriction.

Color in Alcohol.—Dorsum brown with cream dashes dorsolaterally; cream blotches at base of tail; flanks darker than dorsum, nearly black; venter brown with cream flecks.

Color in Life.—Dorsum copper-brown to bright olive-brown, usually with small, white flecks; top of tail washed with orange; venter dark brown with white spots; flanks dark brown; iris gold.

Measurements, in Millimeters, of Holotype.—SL 48.9; head width 6.4; head length (snout to gular fold) 9.0; front limb length 7.7; hind-limb length 8.5; axilla to groin 28.6; width hind foot 4.4.

Data for the four paratypes (ICN 43851-54, two males, an ovigerous female, and a juvenile of undetermined sex) are as follows: SL 37.7, 37.2, 44.9, 27.0; tail length 33.0, 34.0, 36.5, 20.5; head length 8.1, 7.7, 9.6, 6.0; head width 4.8, 4.8, 5.9, 4.1; width of hind foot 3.4, 2.9 (not measurable), 2.2; axilla to groin 19.6, 19.5, 25.2, 14.2; limb interval 4.50, 4.25, 4.00, 4.00; maxillary teeth 14-15, 14-16, 16-16, 11-11; vomerine teeth 6-6, 6-6, 7-7, 6-6. The mental glands of the two males are swollen and the three premaxillary teeth pierce the skin of the lip.

Etymology.—Latin, *hiemalis*, meaning of winter, in reference to the climate in which this small tropical salamander lives.

Remarks.—The discovery of a third species of Brame and Wake's (1962) *Bolitoglossa palmata* group is hardly surprising, although its location on the westernmost mountain range in Colombia was unexpected. One might have expected a second páramo species from the northern Cordillera Occidental to be allied to *B. hypacra*, but such an association is contrary to the limited morphological data available at present (in *B. hypacra* the toes are nearly free of web and the limbs are long, separated by only two costal folds). The two other species of the *palmata* group have a peri-Amazonian distribution, but the discovery of this species suggests that the group has a northern Andean distribution like most endemic groups of amphibians associated with the northern Andes (Lynch et al., 1997).

Until a thorough evaluation of the salamanders of South America is undertaken, my placement of this species in the phenetic *palmata* group must be viewed as tentative, and only limited biogeographic conclusions should be drawn from its assignment.

Centrolene buckleyi (Boulenger)

Only two individuals (ICN 43889-90) were found at approximately 3450 m, one in a stand of *Guzmania* and the other in another bromeliad

species on a tree 4 m above ground, both approximately 50 m from the nearest stream.

Eleutherodactylus duende sp. nov.

Holotype.—ICN 43892, a male obtained 23 July 1998 by John D. Lynch (field number JDL 21659) in the Páramo del Duende, Cerro Calima, Municipio de Río Frio, Depto. Valle del Cauca, Colombia, 3450 m.

Paratopotypes.—ICN 43893-98, collected with holotype 23-25 July 1998.

Paratypes.—ICN 43855-61 (females), 43862-72, UVC (Natural History Museum, Universidad del Valle, Cali) 13762-63 (males), collected in the Páramo del Duende (3300-3600 m) in July-August 1997.

Referred Material (Juveniles and Poorly Preserved Adults).—ICN 43873-76, 43878-88, collected in the Páramo del Duende (3300-3600 m) in July-August 1997.

Diagnosis.—(1) Skin of dorsum smooth to shagreen with or without scattered warts, venter areolate; no dorsolateral folds; (2) tympanum prominent, round, larger in adult females than in adult males, 29-53% eye length; (3) snout subacuminate in dorsal view, rounded in lateral profile, long; canthus rostralis prominent; (4) IOD broader than upper eyelid; upper eyelid bearing low tubercles; cranial crests absent; (5) vomerine odontophores low, oblique; (6) males with vocal slits, lacking nuptial pads; (7) first finger shorter than second; disks small, expanded; (7) fingers bearing lateral fringes; (8) ulnar tubercles small; (10) small tubercles on heel, outer edge of tarsus, none on inner edge of tarsus; (11) two metatarsal tubercles, inner oval, 5-6 times size of outer; supernumerary tubercles at bases of toes; (12) disks of toes smaller than those of fingers; webbing absent; fifth toe very long; (13) venter dark brown with cream spots; large cream spot in groin; posterior surfaces of thighs brown with cream spots; (14) adults small, males 16.0-20.0 ($\bar{x} = 18.6 \pm 0.2$, $N = 24$) mm SVL, females 23.8-29.7 ($\bar{x} = 25.7 \pm 0.6$, $N = 9$) mm SVL.

Eleutherodactylus duende is most similar to *E. lasalleorum* but may be readily distinguished from the latter by the absence of dorsolateral folds; presence of vomerine odontophores; less prominent tubercles on the eyelids, forearm, and heel; and coloration (pale spots on posterior surfaces of thighs in *E. duende*). In addition, *E. duende* is larger and has longer legs than *E. lasalleorum* (one male 15.6 mm SVL, three females 18.4-21.0 mm SVL; shank 36.5% SVL in one male, 46.2-48.4% in females).

Description.—Head as broad as body (or slightly broader); HW 36.8-40.1% ($\bar{x} = 39.1 \pm 0.2$) SVL in 19 males, 39.4-43.4% ($\bar{x} = 41.0 \pm 0.5$) in seven females; snout subacuminate in

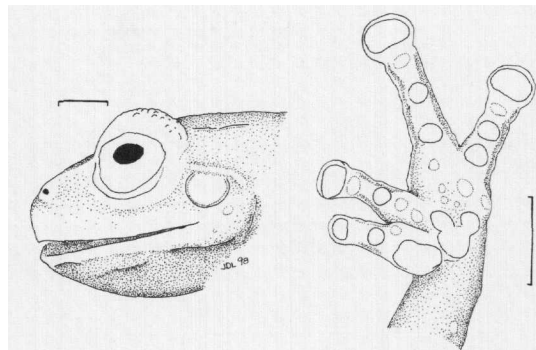


FIG. 3. *Eleutherodactylus duende*, side of head (ICN 43895) and palmar view of hand (ICN 43893). Scales equal 2 mm.

dorsal view, rounded in lateral profile (Fig. 3); E-N 72.4–100.0% ($\bar{x} = 80.0 \pm 2.0$) eye length in 18 males, 86.2–100.0% ($\bar{x} = 95.5 \pm 2.1$) in six females; nostrils slightly protuberant, directed laterally; canthus rostralis straight, with edge obvious but not sharp; loreal region concave, sloping abruptly to lips; lips not flared except slightly posteriorly in larger females; in juvenile females, HW/SVL values are like those of males; upper eyelid bearing numerous low tubercles, usually one subconical; upper eyelid width 72.0–104.5% ($\bar{x} = 88.2 \pm 2.0$) IOD in 17 males, 69.7–96.2% ($\bar{x} = 81.2 \pm 4.1$) in six females; IOD flat, lacking cranial crests; supratympanic fold present, not prominent; tympanum round, separated from eye by distance equal to diameter of eye; tympanum diameter 28.6–44.4% ($\bar{x} = 37.3 \pm 1.0$) eye length in 18 males, 40.0–53.3% ($\bar{x} = 46.4 \pm 2.1$) in six females (juvenile females have smaller tympani, values similar to those of males); poststrictal tubercle(s) subconical; choanae round, well median to palatal shelf of maxillary arch; vomerine odontophores median and posterior to choanae, oblique, low, bearing 2–3 teeth in slanted row, separated medially by distance greater than odontophore width; tongue round or slightly longer than wide, its posterior border not notched, posterior one-sixth not adherent to floor of mouth.

Dorsum smooth in most individuals but some (mostly males) have low tubercles over dorsal surfaces; no dorsolateral folds except in individuals having lineate patterns; venter areolate, discoidal folds well anterior to groin; anal sheath and enlarged perianal tubercles absent; series of very small ulnar tubercles present, antibrachial largest; palmar tubercle bifid, twice size of oval thenar tubercle; supernumerary palmar tubercles numerous; subarticular tubercles round, nonpungent; fingers bearing lateral fringes; disks round, width about 1.5 times width of

digit below disk; disks bear broad ventral pads (Fig. 3); disk of thumb least expanded; first finger shorter than second; nuptial pads on males absent.

Nonconical tubercle present on heel; series of smaller tubercles along outer edge of tarsus; folds or tubercles on inner edge of tarsus absent; inner metatarsal tubercle twice as long as wide, about four times size of round outer metatarsal tubercle; supernumerary plantar tubercles at bases of toes I–IV; subarticular tubercles round, nonconical; toes bearing prominent lateral fringes, webbing absent; disks twice as wide as digit below disk, round distally with broad ventral pads; tip of toe V reaches distal edge of distal subarticular tubercle of toe IV, that of toe III reaches midway between penultimate and distal subarticular tubercle of toe IV; hind limbs long, heels overlapping when flexed hind limbs held perpendicular to sagittal plane; shank 47.5–54.3% ($\bar{x} = 50.6 \pm 0.4$) SVL in 19 males, 48.8–55.6% ($\bar{x} = 53.1 \pm 0.7$) in nine females.

Color in Alcohol.—Brown above with pale blotches, usually in form of thin, cream lines outlining blotches; flanks brown with cream spots, including large irregular shaped blotch in groin and on lower flanks; venter dark brown with cream spots; throat brown with cream flecks; undersides of legs brown with cream spots; posterior surfaces of thighs brown with cream spots; anal triangle absent; shanks usually lacking bars, when present, bars slightly oblique and as wide as interspaces.

Color in Life.—Dorsum olive, pale brown, or reddish-brown with dark olive-brown markings; venter dark gray, dark brown, or black with dull cream or dull yellow spots; dull yellow spots on flanks and concealed surfaces of limbs; iris chocolate brown with some orange highlights to dull yellow with brown reticulation and brown horizontal stripe.

Measurements, in Millimeters, of Holotype.—SVL 18.9, shank 10.1, HW 7.3, upper eyelid width 1.8, IOD 2.2, tympanum length 1.0, eye length 2.7, E–N 2.1.

Etymology.—The trivial name is used as a noun in apposition and is the name given this páramo by the biologists of the CVC. A *duende* is a troll, fancifully, one that guards wild places. In the Páramo del Duende, the call of this small frog was the only vertebrate sound other than the calls of several bird species.

Remarks.—Although the association of *E. duende* and *E. lasalleorum* is phenetic, such an association is biogeographically consistent with the *E. curtipes* group (Lynch, 1995) and suggests that other species of the *E. leptolophus* group will be found on Cerro Tatamá and the Farallones de Citará. Diego Garcés showed me photographs of at least one other species of *Eleutherodactylus*

(no vouchers available) from the Farallones de Cali at about 4000 m.

In the original description of *E. lasalleorum* (Lynch, 1995), I spelled the name *lasallorum* twice and *lasalleorum* eight times. Such a *lapsus* is unfortunate, but my intent was that the latter spelling be the correct spelling for the name of the taxon, and, accordingly, I here revise the spelling.

Eleutherodactylus xeniolum sp. nov.

Holotype.—ICN 43891, a gravid female obtained 28 July 1998 by John D. Lynch in the Páramo del Duende, Cerro Calima, Municipio de Rio Frio, Valle del Cauca, Colombia, 3450 m (original field number JDL 21667).

Paratype.—ICN 43877, a male obtained in the Páramo del Duende (3300–3600 m) in July–August 1997.

Diagnosis.—(1) Skin of dorsum shagreen, that of venter areolate; dorsolateral folds absent; (2) tympanum obscure, round; (3) snout round in dorsal and lateral profiles, short; (4) upper eyelid bearing tubercle, narrower than IOD; cranial crests absent; (5) vomerine odontophores and teeth absent; (6) vocal slits and nuptial pads absent in males; (7) first finger shorter than second; disks not expanded; (8) ulnar tubercles present; (9) fingers bearing lateral fringes; (10) tubercles on heel and outer edge of tarsus; (11) two metatarsal tubercles, inner oval, 3 times size of outer; supernumerary tubercles numerous; (12) disks of toes slightly larger than those of fingers; toes bearing lateral fringes; fifth toe long; (13) pale brown above with brown markings; posterior surfaces of thighs cream with brown reticulum; venter cream mottled with brown; groin with large cream blotch; (14) adults minute, one male 12.6 mm SVL, one adult female 17.6 mm SVL.

This small species may be distinguished from all other *Eleutherodactylus* by the combination of very small adult size, digital disks not expanded, and because its fifth toe is markedly longer than the third. Superficially, it resembles *E. myersi* and *E. repens* but differs from each in having a longer fifth toe.

Description.—Head narrower than body; snout round in dorsal and lateral profiles; nostrils very slightly protuberant, directed dorsolaterally; canthus rostralis sharp, concave (Fig. 4); loreal region concave, sloping abruptly to upper lip; lips not flared; interorbital space broad, lacking cranial crests; upper eyelid bearing low, prominent tubercle on posterior quarter; supratympanic fold not evident; tympanum round, ill-defined, separated from eye by distance equal to half diameter of tympanum; postriatal tubercle subconical; choanae round to elongately oval, well median of maxillary arch; odon-

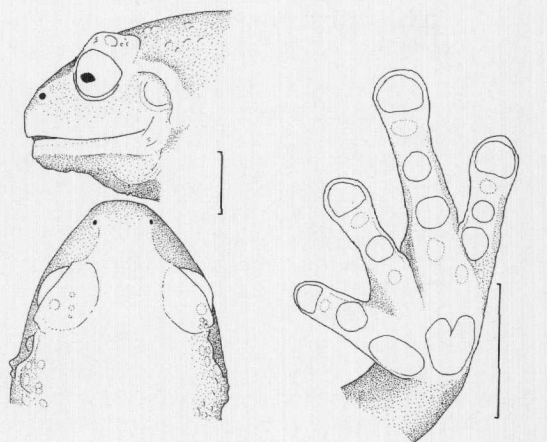


FIG. 4. *Eleutherodactylus xeniolum* (ICN 43891). Top and side views of head; palmar view of hand. Scales equal 2 mm.

tophores and vomerine teeth absent; tongue broader than long, posterior two-fifths not adherent to floor of mouth, posterior edge not notched.

Skin of dorsum shagreen, lacking folds; skin of venter areolate, discoidal folds well anterior to groin; anal sheath and enlarged perianal warts absent; ulnar tubercles scarcely distinct from skin texture; palmar tubercle bifid, slightly larger than oval thenar tubercle; supernumerary tubercles numerous; subarticular tubercles round, nonconical; fingers bearing obvious lateral fringes; disks scarcely wider than digits (Fig. 4), disks longer than wide, round distally; ventral pads as long as wide; disk of thumb not expanded; first finger shorter than second.

Tubercle on heel, relatively large, nonconical; series of tubercles present along outer edge of tarsus, equal in size; tubercles and folds on inner edge of tarsus absent; inner metatarsal tubercle two and one-half times as long as wide, about three times size of round outer metatarsal tubercle; small supernumerary tubercles over entire plantar surface with larger ones at bases of digits; subarticular tubercles round, nonconical; toes with well-developed lateral fringes, webbing absent; disks of toes slightly wider than digits, disks longer than wide, round distally, with ventral pads longer than wide; tip of Toe V reaching base of distal subarticular tubercle of Toe IV, that of Toe III shorter, tip reaching about two-thirds of way between penultimate and distal subarticular tubercle of Toe IV; hind limbs short, heels not overlapping when flexed hind legs held perpendicular to sagittal plane.

Color in Alcohol.—Pale brown above with brown interorbital triangle and elongate blotch

above vertebral column; upper flanks dark brown; limbs brown with brown blotches; anal triangle brown; canthal-supratympanic stripe and labial bars brown; chin cream with brown flecks; venter cream, heavily mottled with brown; large cream blotch in groin and over anterior surface of thigh; posterior surface of thigh cream with thin brown reticulum; underside of shank cream with brown flecks.

Color in Life.—Dorsum and venter pale brown; dorsum marked with reddish-brown blotches and bands; groin and posterior surfaces of thighs dull orange; iris brownish-bronze with brown flecking.

Measurements, in Millimeters, of Holotype and Paratype, Respectively.—SVL 17.6, 12.6; shank 6.9, 6.3; HW 6.0, 4.6; head length 6.3, 4.8; chord of head length 6.5, 5.2; upper eyelid width 1.5, 1.0; IOD 2.0, 1.6; tympanum length 1.0, 0.5; eye length 1.8, 1.4; E-N 1.5, 1.3.

Etymology.—Latin, neuter, meaning a small gift to a guest. The name is a noun in apposition and is used in allusion to my finding the frog within minutes of the arrival of the helicopter to extract us from the páramo.

Remarks.—Unfortunately only two specimens were taken which limits my ability to place the species in any systematic context. The holotype was found walking in the short grass at 0800 hrs. No ecological data exist for the male.

DISCUSSION

Of the 77 species of *Eleutherodactylus* previously known from the Cordillera Occidental (Lynch, 1998; Lynch and Ardila-Robayo, 1999), only four were recorded from páramos (or sub-páramos)—*E. buckleyi* on Cerro Munchique (3050 m), *E. lasalleorum* (3700–3850 m) and *E. satagiuis* (3300–3850 m) from the Páramo de Frontino, and *E. xestus* from Cerro Tatamá (4050 m), a markedly depauperate fauna in contrast with that from the Cordillera Central (Ruiz-Carranza et al., 1996). Páramos of the Cordillera Occidental exist as a series of mostly very small islands (in contrast to those of the Cordillera Central) and as befits an island arc, beta diversity is notable (even in the present level of ignorance). The discovery of *E. duende* and *E. xeniolium* assures that additional diversity will be found when other peaks (Farallones de Cali and Citará) are visited and inventoried. The absence

of a species of the *E. curtipes* group (Lynch, 1995) from Cerro Calima was unexpected by me and perhaps is a consequence of species extinction on very small habitat islands (assuming our collecting effort was adequate to detect all species present).

Acknowledgments.—The Corporación Valle del Cauca invited me to participate in the second visit to the Páramo del Duende. For this courtesy, I thank N. Gómez, W. Vargas, and E. Velasquez.

LITERATURE CITED

- BRAME, A., AND D. B. WAKE. 1962. A new plethodontid salamander (genus *Bolitoglossa*) from Venezuela with the redescription of the Ecuadorian *B. palmata* (Werner). *Copeia* 1962:170–177.
- DUELLMAN, W. E. (ed.). 1979. The South American herpetofauna: its origin, evolution, and dispersal. *Univ. Kans. Mus. Nat. Hist. Monogr.* 7:1–485.
- LYNCH, J. D. 1981. Leptodactylid frogs of the genus *Eleutherodactylus* in the Andes of northern Ecuador and adjacent Colombia. *Misc. Publ. Mus. Nat. Hist., Univ. Kans.* 72:1–46.
- . 1995. Three new species of *Eleutherodactylus* (Amphibia: Leptodactylidae) from paramos of the Cordillera Occidental of Colombia. *J. Herpetol.* 29: 513–521.
- . 1998. New species of *Eleutherodactylus* from the Cordillera Occidental of western Colombia with a synopsis of the distributions of species in western Colombia. *Rev. Acad. Colomb. Cienc. Ex. Fis. Nat.* 22:117–148.
- LYNCH, J. D., AND M. C. ARDILA-ROBAYO. 1999. The *Eleutherodactylus* of the *taeniatus* complex in trans-Andean Colombia: taxonomy and distribution. *Rev. Acad. Colomb. Cienc. Ex. Fis. Nat.* 23:615–624.
- LYNCH, J. D., AND W. E. DUELLMAN. 1973. A review of centrolenid frogs of Ecuador, with descriptions of new species. *Occ. Pap. Mus. Nat. Hist. Univ. Kans.* 16:1–66.
- . 1997. Frogs of the genus *Eleutherodactylus* (Leptodactylidae) in western Ecuador: systematics, ecology, and biogeography. *Nat. Hist. Mus., Univ. Kans. Spec. Publ.* 23:1–236.
- LYNCH, J. D., P. M. RUIZ-CARRANZA, AND M. C. ARDILA-ROBAYO. 1997. Biogeographic patterns of Colombian frogs and toads. *Rev. Acad. Colomb. Cienc. Ex. Fis. Nat.* 21:237–248.
- RUIZ-CARRANZA, P. M., M. C. ARDILA-ROBAYO, AND J. D. LYNCH. 1996. Lista actualizada de la fauna de Amphibia de Colombia. *Rev. Acad. Colomb. Cienc. Ex. Fis. Nat.* 20:365–415.

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