

TWO ADDITIONAL NEW SPECIES OF *ELEUTHERODACTYLUS* (LEPTODACTYLIDAE) FROM SOUTHWESTERN COLOMBIA

por

John D. Lynch & Ángela M. Suárez-Mayorga¹

Resumen

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Se describen dos especies del género *Eleutherodactylus* y del grupo *unistrigatus* de la zona andina en el sur de Colombia. Una se halla de 1500 a 2600 m en el occidente del Caquetá y en el Huila adyacente—esta especie está más relacionada con *E. chloronotus* y *E. vicarius*. La otra es conocida en dos localidades muy cercanas en el departamento del Cauca y parece ser la especie hermana de *E. spinosus* de los flancos orientales de los Andes en el sur del Ecuador.

Palabras clave: Andes, *Eleutherodactylus*, sistemática, taxonomía.

Abstract

Two new species of the *unistrigatus* group of *Eleutherodactylus* are described from the Andes in southern Colombia. One is known from 1500 to 2600 m in western Caquetá and adjacent Huila—this species is related to *E. chloronotus* and *E. vicarius*. The other is known from two localities in northern Depto. de Cauca and appears to be the sister species of *E. spinosus*, known from the eastern flanks of the Andes in southern Ecuador.

Key words: Andes, *Eleutherodactylus*, systematics, taxonomy.

Introduction

The two species described herein have few commonalities—each is a member of the subgenus *Eleutherodactylus* and each was first collected in the 1980s when

fieldwork was still safe in southwestern Colombia. One has been mentioned previously in the literature (Suárez, 2000) but the other has resided quietly in the Amphibian collection of the National University for over 20 years. Our interest in these two species derives from a desire to

¹ Laboratorio de Anfibios, Instituto de Ciencias Naturales, Universidad Nacional de Colombia.

complete the amphibian inventory but also because we think we can place each phylogenetically.

Materials and methods

Terminology follows **Lynch & Duellman** (1997). In the species accounts, the following abbreviations are used: E-N, eye to nostril distance, HW, greatest head width, IOD, interorbital distance, SVL, snout-vent length. When samples merit, means are reported as \pm one standard error of the mean.

Eleutherodactylus corniger sp. nov.

E. (leutherodactylus) sp. 2: **Suárez**, 2000: 400.

Holotype: ICN 22867, an adult female, one of a series collected 1 July 1989 by J. D. Lynch, J. H. Restrepo, and P. M. Ruiz (field number JDL 17308).

Paratopotypes: ICN 22868, 22871-72, 22875, 22879-80.

Paratypes: COLOMBIA, Caquetá, Mpio. Florencia, 3.1 km E Alto de Gabinete, 2260-2270 m (ICN 22886-87, 22890, 22893-94, 22896-98, 22903, 22910-11, 22916, 22918, 24201), 5.0 km E Alto de Gabinete, 2100 m (ICN 24207), 5.8 km E Alto de Gabinete, 2070 m (ICN 24211-14, 24216, 24219-21, 24227), 8.6 km E Alto de Gabinete, 2040 m (ICN 22924-27, 22932, 22934, 22939), Mpio. San Vicente de Caguán, Insp. Policía Guayabal, entre vereda la Esperanza y San Jorge, 1500 m (ICN 42850). Huila, Mpio. Gigante, Reserva Forestal Ventana, 2500-2600 m (ICN 42858-59), Mpio. Palestina, Parque N. N. Los Guacheros (ICN 47900).

Type-locality: COLOMBIA, Departamento de Caquetá, Municipio de Florencia, vereda Gabinete, 0.7 km E límite Huila—Caquetá, 2340-2370 m.s.n.m.

Referred Specimens (juveniles): COLOMBIA, Caquetá, Mpio. Florencia, 0-7-1.1 km E Alto de Gabinete, 2300-2380 m (ICN 22869-70, 22873-74, 22876-78, 22881-85, 24200), 3.1 km E Alto de Gabinete, 2260-2270 m (ICN 22888-89, 22891-92, 22895, 22899-902, 22904-09, 22912-15, 22917, 22919, 24202-06), 5.0 km E Alto de Gabinete, 2100 m (ICN 24207-08), 5.8 km E Alto de Gabinete, 2070 m (ICN 24210, 24215, 24217-18, 24222-26), 8.6 km E Alto de Gabinete, 2040 m (ICN 22921-23, 22928-31, 22933, 22935-38, 22940-45).

Etymology: Latin, meaning bearing horns, in reference to the conical tubercles on the upper eyelids.

Diagnosis: (1) Skin of dorsum smooth with low tubercles on upper flanks and lower back, that of venter

areolate; low dorsolateral and postocular folds; (2) tympanum prominent, round, small, 1/3 eye length; (3) snout long, subacuminate in dorsal view, round in lateral profile; canthus rostralis evident, edge rounded, strongly concave; lips not flared; (4) IOD broader than upper eyelid, no cranial crests; conical tubercle on upper eyelid; (5) vomerine odontophores prominent, subtriangular in outline in females, oval in males, narrowly separated; males with vocal slits, nuptial pads; (7) first finger shorter than second, round, broad disks on fingers 2-4; (8) fingers lack lateral fringes; (9) 2-3 low ulnar tubercles; (10) conical tubercle on heel, series of subconical tubercles along outer edge of tarsus, one tubercle on inner edge of tarsus; (11) two metatarsal tubercles, inner elongate, outer conical, 1/5 to 1/6 size of inner; few supernumerary plantar tubercles; toes bearing low lateral fringes, no webbing; toe disks smaller than those of fingers, Toe V long, nearly reaching distal subarticular tubercle of Toe IV; (13) dorsum lacking pattern (green or brown in life) or consisting of interorbital bar, occipital W and sacral chevron; flanks and thighs boldly barred with black; venter cream with brown spotting/reticulum; (14) adults moderate-sized, males 22.1-28.1 (mean 25.2 ± 0.4 , $N = 16$) mm SVL, females 29.4-38.1 (mean 34.4 ± 0.4 , $N = 25$) mm SVL.

Eleutherodactylus corniger is most similar to, and presumably related to, *E. chloronotus* and *E. vicarius* but differs from each in having conical tubercles on the upper eyelid and heel, subconical tubercles along the outer edge of the tarsus, and dorsolateral folds (Figures 1A-B). The prominent black bars on the thighs and flanks readily distinguish *E. corniger* from the other two species. It is like *E. vicarius* in having a strongly concave canthus rostralis.

Description (proportions are based on 16 males and 16 females): Head as broad as body, broader than long; HW 34.7-39.5 (mean 37.3 ± 0.3) % SVL in males, 35.6-40.1 (mean 38.0 ± 0.3) % in females; snout subacuminate in dorsal view, rounded in lateral profile, bearing feeble point at tip; E-N 76.3-91.9 (mean 84.4 ± 1.2) % eye length in males, 68.8-93.3 (mean 83.8 ± 1.6) % in females; nostrils directed dorsolaterally, weakly protuberant; canthus rostralis sharply concave, edge sharp to rounded; loreal region concave, sloping abruptly to lips; lips not flared; conical tubercle on posterolateral surface of upper eyelid; interorbital region flat, no cranial crests; upper eyelid width 76.9-100.0 (mean 88.2 ± 1.7) % IOD in males, 78.4-100.0 (mean 89.9 ± 1.7) % in females; postocular folds prominent, bearing 1-2 subconical tubercles; tympanum round, its length 25.0-33.3 (mean 28.8 ± 0.8) % eye length in males, 26.5-38.1 (mean 30.4 ± 0.9) % in females, separated from eye by $1 \frac{1}{2}$ tympanum diameters; supratympanic fold thick,



Figure 1. *Eleutherodactylus* from the Andes of southern Colombia. **A.** *E. corniger*, ICN 22867; **B.** *E. corniger*, ICN 22868; **C.** *E. epacrus*, ICN 24113; **D.** *E. taciturnus*, ICN 11688. Photos A-C by JDL, D by Pedro M. Ruiz-C.

bearing 1-2 subconical tubercles; 1-2 subconical postrictal tubercles; ventrolateral edge of lower lip bearing small tubercles, most evident posteriorly; choanae round, not concealed by palatal shelf of maxillary arch; vomerine odontophores median and posterior to choanae, separated medially by distance equal $\frac{1}{2}$ width of an odontophore, each larger than a choanae, oval in males, subtriangular in outline in females, bearing up to 6 teeth in a slanted row; tongue oval, posterior $\frac{1}{3}$ not adherent to floor of mouth, posterior edge not notched; long vocal slits lateral to tongue, vocal sac subgular.

Skin of dorsum smooth except for low tubercles on lower back and somewhat more prominent tubercles on flanks; discoidal folds low, well anterior to groin; no anal sheath; pair of small subanal tubercles; 2-3 ulnar tubercles, more prominent distally; palmar tubercle bifid, much larger than oval thenar tubercle; supernumerary palmar tubercles

low, flat, smaller than subarticular tubercles; subarticular tubercles round, nonconical; indistinct lateral keels on fingers; disks on fingers 2-4 round, nearly three times as wide as digit below disk, that on thumb twice as wide as digit; low tubercles borne on low fold on distal $\frac{1}{3}$ of inner edge of tarsus; 2-3 more pungent tubercles along outer edge of tarsus; conical tubercle on heel; inner metatarsal tubercle three times as long as wide, 6-8 times size of conical outer metatarsal tubercle; supernumerary plantar tubercles barely evident at bases of toes; subarticular tubercles longer than wide, nonconical; thin lateral fringes on toes, also along outer edge of toe V with small tubercles along outer edge of sole; basal web only between toes IV and V; Toe V reaches or almost reaches distal subarticular tubercle of Toe IV; hindlegs long, heels overlapping when flexed hindlimbs held perpendicular to sagittal plane, shank 46.3-57.3 (mean 53.1 ± 0.8) % SVL in males, 48.9-59.0 (mean 53.1 ± 0.7) % in females.

Coloration in alcohol: Dorsal surfaces cream to brown, sometimes devoid of dark markings but usually with reddish brown to dark brown markings; maximally, pattern consists of interorbital bar, occipital W, and sacral and inguinal chevrons as well as slightly oblique limb bars; canthal stripe, supratympanic fold, and two labial bars reddish brown to brown; dark brown to black slanting bars on lower flanks, separating cream spots, similar pattern on anterior surfaces of thighs; posterior surfaces of thighs (and tops of thighs) bearing black bands, separated by cream areas; anal triangle prominent; ventral surfaces cream with faint brown mottling to heavily mottled and reticulated with brown; underside of shank dark brown with cream spots.

Coloration in life: Bright lime-green to brown, with or without dark brown dorsal markings; groin and concealed limbs white with black cross bars; dorsolateral folds often with pale orange cast; venter usually white with black markings, other ventral surfaces pale brown or with brown/black spots; in some, venter is cream to nearly yellow with few brown flecks; upper iris nearly white, reddish brown horizontal streak, lower iris gray-brown (JDL fieldnotes, 1 July 1989).

Measurements of holotype in mm.: SVL 34.0, shank 17.9, HW 12.8, head length 12.0, chord of head length 13.0, upper eyelid width 3.0, IOD 3.3, tympanum length 1.3, eye length 4.3, E-N 3.5.

Natural history: In the vicinity of the type-locality, *E. corniger* was the most abundant frog found. Individuals were found in the forest along streams as well as on vegetation alongside the road. A few individuals were found by day, beneath rocks—all others were active on vegetation. No reproductive activity was observed. Nevertheless, males are adult and reproductively active (enlarged testes, nuptial pads) and adult females were found at most localities. Females smaller than 28.3 mm SVL are juveniles (straight, non dilated oviducts, minute eggs).

Distribution: In the vicinity of the type-locality, *E. corniger* occurs only above 2000 m (2040-2380 m). The record from the Parque N. N. Los Guacheros (Huila) lacks altitudinal data but probably falls in this range as well. The record from Municipio Gigante (Huila) is from yet higher elevations (2500-2600 m) on the western flank of the Cordillera Oriental. ICN 42850 was collected in Caquetá (San Vicente de Caguán) at lower elevations (1500 m) on the eastern flank of the cordillera. The fieldwork along the Guadalupe (Huila)—Flores (Caquetá) transect was intensive between 700 and 2400 m on the eastern flank of the cordillera and *E. corniger* was not observed or collected at the several localities below 2000 m.

Remarks: Like many other species of *Eleutherodactylus*, *E. corniger* is pattern polymorphic. The most common pattern consists of dark dorsal markings (73 specimens). Six other specimens are peculiar in that they have no dark markings dorsally except the interorbital bar. This may not be a discrete polymorph but is here separated. Six specimens (one of which lacks dark markings, the others have these) exhibit a pale snout (back as far as the eyes) and lack canthal stripes (6%). The combinations evident here (dark markings, none) support the notion that each of these represents a discrete polymorphism. The fourth polymorph is what JDL has termed the *dorsoconcolor* morph for nearly forty years. This morph is seen in ten specimens (10%).

Although our hypothesis is not supported by synapomorphies, we are convinced that *E. chloronotus*, *E. corniger*, and *E. vicarius* form a clade. Each is distributed allopatrically and the combined distributions are very nearly contiguous. *Eleutherodactylus vicarius* is distributed between 2960 and 3300 m on the spine of the Cordillera Central along the border between Cauca and Huila. *Eleutherodactylus chloronotus* occurs between 2285 and 3350 m in southern Colombia (Nariño and Putumayo) and adjacent Ecuador (Napó and Sucumbios). Although **Lynch & Ruiz** (1983) suggested that specimens from southern Colombia were *E. vicarius*, here we reject that notion based upon study of fresh material. Lastly, *E. corniger* occurs between 1500 and 2600 m along the southern part of the spine of the Cordillera Oriental. If the sharply concave canthus rostralis is a synapomorphy, *E. corniger* and *E. vicarius* are sister species. Assuming that our supposition of relationships is correct, this small group of species provides additional evidence of ecological shifts congruent with speciation events (**Lynch**, 1999).

Eleutherodactylus taciturnus sp. nov.

Holotype: ICN 11688, an adult female obtained by Pablo Bernal 24 March 1982.

Paratypes: ICN 6523 (Municipio Paéz, Km 34 carretera Belalcazar—Tacueyó, 2400 m, collected by P. M. Ruiz in early 1980). ICN 11689-91, 11693 (topotypes collected 25 March 1982). ICN 11696 (Km 67, 2640 m, obtained 26-27 March 1982). ICN 11697 (Km 64 where road crosses Río Sucio, 2590-2610 m). ICN 11698-702 (Km 70, 2640 m, collected 28 March 1982).

Type-locality: COLOMBIA, Departamento de Cauca: Municipio de Inzá, vereda Río Sucio, Km 66-67 (near where the road crosses the Río Sucio) carretera Popayán—Inzá, 2660-70 m.s.n.m.

Referred specimens: ICN 11692, 11694-95 (topotypic juvenile females).

Etymology: Latin, meaning not talkative, in reference to our suspicion that the frog does not call.

Diagnosis: (1) Skin of dorsum and flanks covered with small round tubercles, that of venter areolate; no dorsolateral folds; (2) tympanum, *cavum tympanicum*, and columella absent; (3) snout short, subacuminate in dorsal view, rounded in profile; canthus rostralis concave; (4) upper eyelid slightly narrower than IOD, bearing one conical tubercle; no cranial crests; (5) vomerine odontophores oval, median and posterior to choanae, narrowly separated, each smaller than a choanae; (6) males lacking vocal slits but with nuptial pads; (7) first finger shorter than second, large disks on outer fingers; (8) fingers bearing fleshy fringes; (9) ulnar tubercles present, small; (10) round tubercles on heel and outer edge of tarsus; short, low inner tarsal fold; (11) two metatarsal tubercles, inner oval, 3 times size of subconical outer; (12) fifth toe long, not reaching distal subarticular tubercle of Toe IV; toes with lateral fringes, no webbing; few supernumerary plantar tubercles; (13) dorsum brown with small black spots; chin with brown V-shaped markings; axilla and groin black, pale spots on posterior flanks; venter cream with brown spots; posterior surfaces of thighs cream with black spots; (14) adults relatively small, three males 17.6-20.9 (mean 19.4) mm SVL, ten females 24.2-31.7 (mean 27.6 ± 0.6) mm SVL.

Eleutherodactylus taciturnus most closely resembles, and is probably related to, *E. spinosus* from the eastern slopes of the Andes in southern Ecuador. The two share a peculiar feature (presence of small round tubercles over the skin of the dorsum—Figure 1D), which we postulate as a synapomorphy. The two species are readily distinguished in that *E. spinosus* has a visible tympanum and lacks the inverted chevrons on the throat.

Description: Head as wide as body, wider than long, HW 35.4-39.2 (mean 37.0) % SVL in males, 36.5-41.7 (mean 38.4 ± 0.5) % in females; snout subacuminate in dorsal view, angularly rounded in lateral profile; nostrils weakly protuberant, directed dorsolaterally; canthus rostralis concave, prominent but edge not sharp; E-N 66.7-73.3 (mean 69.6) & eye length in males, 75.0-88.2 (mean 82.8 ± 1.6) % in females; loreal region concave, sloping abruptly to lips; lips not flared; upper eyelid with conical tubercle in posterolateral part, bearing smaller tubercles scattered over surface; interorbital region flat (no cranial crests); upper eyelid width 80.0-81.8 (mean 80.9) % IOD in males, 72.4-100.0 (mean 84.8 ± 3.0) % IOD in females;

supratympanic fold thick, poorly defined, bearing subconical tubercles; tympanum absent, skin in area bearing rounded tubercles; one subconical postrictal tubercle; choanae small, round, not concealed by palatal shelf of maxillary arch; vomerine odontophores median and posterior to choanae, slanted or oval in outline, separated by distance about one-half width of an odontophore, each smaller than a choanae, bearing 4-7 teeth in a slanted row or clump; tongue longer than wide, posterior 2/5 not adherent to floor of mouth, posterior edge not notched; males lack vocal slits.

Skin of head smooth, of body bearing numerous small, round, elevated tubercles (a few larger tubercles on lower back), extending onto flanks; no dorsolateral folds present but postocular folds present; skin of upper surfaces of limbs nearly smooth but some rounded tubercles in limb bars; skin of venter areolate; discoidal folds well anterior to groin; no anal sheath; a pair of subanal tubercles; three ulnar tubercles, antebrachial largest; palmar tubercle bifid, much larger than oval thenar tubercle; several supernumerary palmar tubercles; subarticular tubercles round, nonconical; disks of fingers 2-4 large (twice width of digit below disk), round distally disks bearing broad ventral pads, that of thumb scarcely expanded; fingers bearing fleshy fringes; first finger shorter than second; nuptial pad present but difficult to see (due to cream color of inner digits).

Two round tubercles on knee, one on heel, 3-4 along outer edge of tarsus; inner edge of tarsus bearing low, short fold on distal 1/5; length of inner metatarsal tubercle 2 ½ times width, three times size of subconical outer metatarsal tubercle; supernumerary plantar tubercles immediately basal to toes; subarticular tubercles longer than wide, nonconical; toes bearing lateral fringes, no webbing, and large disks (smaller than those of outer fingers); tip of Toe V reaches about ½ way between penultimate and distal subarticular tubercles of Toe IV, that of III to middle of penultimate subarticular tubercle of Toe IV; hindlegs long, when flexed hindlimbs held perpendicular to sagittal plane, heels overlapping; shank 48.8-58.5 (mean 52.8) % SVL in males, 49.2-60.3 (mean 56.9 ± 1.0) % SVL in females.

Coloration in alcohol: Dorsum brown with scattered dark brown or black spots; postocular stripe edged medially with white; white patch on nape; side of head paler brown with dark brown blotch between nostril and eye (remnant of canthal stripe?), 2-3 labial bars, and supratympanic stripe; limbs brown with narrow, oblique darker brown (nearly black) bands; inner digits cream; axilla and groin black with black extensions along lowermost flank and slanted



Figure 2. Throat of *Eleutherodactylus taciturnus*, ICN 11690.

bars on posterior flanks defining cream or yellow spots; anterior surface of thigh black; posterior surfaces of thighs dirty cream with black spots or bars; underside of shank black with large cream spots; ventral surfaces pale brown to dirty cream, dark brown inverted chevrons on chin (Fig. 2), venter and undersides of thighs spotted with dark brown.

Coloration in life: Dorsal surfaces olive brown to dark olive green with dark brown to black markings; suprascapular line red; pale spots on lower flanks white to cream; flanks pale brown with black markings; limb bars black; ventral surfaces cream to rusty gray with dark brown to black markings; subarticular tubercles red; iris copper (reticulated or flecked with black) to red with a brown to black horizontal stripe (P. M. Ruiz fieldnotes, 24-28 March 1982).

Measurements of holotype in mm.: SVL 24.7, shank 14.3, HW 10.3, head length 9.0, chord of head length 9.8, upper eyelid width 1.9, IOD 2.7, eye length 3.0, E-N 2.6.

Natural history: Specimens were found at night perched on vegetation along streams. Juvenile females (22.2-22.7 mm SVL) were collected with the type-series.

This species occupies relative high Andean forest (2400-2670 m).

Remarks: We are much impressed by the similarities between *E. spinosus* and *E. taciturnus* in terms of size, proportions, sizes and distribution of tubercles, and coloration (compare this description with that of *E. spinosus* in Lynch, 1979). Except for the absence of a tympanum and the longer hindlegs in *E. taciturnus* we might have been persuaded that it is the same species as *E. spinosus*, in spite of the great distance (about 600 kms) separating localities of the two. The peculiar texture of the skin of the dorsum is here proposed as a synapomorphy linking the two.

Discussion

Some additional species found on the Caquetá transect (Suárez, 2000) remain to be described but the amount of material is limited. Some of the species reported by Suárez (2000) were found subsequently in collections from the Parque Nacional Los Picachos but are not known to occur farther north in the Cordillera Oriental. For others (*E. cornutus*, *E. dolops*, *E. petersorum*, and *E. pugnax*), known as well from Ecuador (Lynch & Duellman, 1980), the Caquetá transect is the northernmost locality.

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