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A New Ground-dwelling Frog of the Genus *Eleutherodactylus* (Anura: Leptodacylidae) from Eastern Cuba, and a Reconsideration of the *E. dimidiatus* Group

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ABSTRACT.—A new terrestrial frog of the genus *Eleutherodactylus* (subgenus *Euhyas*), is described from Sierra Maestra, eastern Cuba. The new species is morphologically related to *Eleutherodactylus dimidiatus*, *E. albipes*, and *E. emiliae*. The *E. dimidiatus* group is redefined, the advertisement calls of *Eleutherodactylus dimidiatus* are partially described, and the taxonomic status of *E. dimidiatus amelasma* is discussed.

KEYWORDS.—*Eleutherodactylus maestrensis, E. dimidiatus, E. intermedius*

INTRODUCTION

Cuba has one of the most diverse frog faunas of the genus *Eleutherodactylus* (49 species) in the West Indies. To determine systematic affinities among species of this genus, Dunn (1926) established species assemblages with Cuban taxa included in the following groups: *auriculatus*, *dimidiatus*, *varleyi*, and *ricordii*. Schwartz (1958 a, b) recognized basically the same species groups proposed by Dunn, but he adds the *symingtoni*, and places in them taxa described after Dunn's paper. Schwartz and Fowler (1973) considered the *emiliae* group, instead of the *dimidiatus,* and placed in it *E. albipes*, *E. emiliae*, and *E. intermedius*. Hedges (1989) proposed a new classification of the genus with five subgenera, of which *Euhyas* and *Eleutherodactylus* occur in Cuba. However, he made few changes to the scheme of Cuban species groups. In another contribution Estrada and Hedges (1996) and Estrada and Alonso (1997) proposed the *limbatus* group to include *E. limbatus*, *E. iberia*, *E. orientalis*, *E. jaumei*, and *E. cubanus*.

During recent expeditions to Sierra Maestra, the highest mountains of eastern Cuba, we found a new species of *Eleutherodactylus*, apparently related to *E. dimidiatus*. We herein describe the new taxon, and based on new morphological evidence re-evaluate the *E. dimidiatus* group. Additionally, we describe the advertisement calls of *E. dimidiatus*, report a new locality for that species, and propose a new taxonomic status for *E. dimidiatus amelasma*.

MATERIALS AND METHODS

The following abbreviations are used in descriptions: SVL, snout-vent length; HL, head length (taken from mandibular angle to snout tip); HW, head width; IO, interorbital distance (between the inner marginal midpoint of upper eyelids). Measurements were taken with calipers (0.05 mm accuracy) and an ocular micrometer (0.1 mm) under a dissecting microscope. Specimens were sexed by direct examination of gonads making a small ventral incision, through which also the stomach contents of some specimens were carefully removed.

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For osteological study frogs were cleared and double stained with Alizarin Red S and Alcian Blue; following the methodology of Dingerkus and Uhler (1977) for bones and cartilages. Species examined are listed in Appendix I. Besides the taxa listed herein, for evaluation of osteological characters used in the species group definition we additionally studied cleared and stained specimens of other 41 species of Cuban *Eleutherodactylus: acmonis*, *adelus*, *atkinsi*, *auriculatus*, *bartonsmithi*, *blairhedgesi*, *bresslerae*, *casparii*, *cubanus*, *cuneatus*, *eileenae*, *etheridgei*, *glamyrus*, *goini*, *guanahacabibes*, *greyi*, *guantanamera*, *gundlachi*, *iberia*, *ionthus*, *klinikowskii*, *leberi*, *limbatus*, *mariposa*, *melacara*, *orientalis*, *pezopetrus*, *pinarensis*, *planirostris*, *ricordi*, *riparius*, *rivularis*, *ronaldi*, *symingtoni*, *thomasi*, *toa*, *turquinensis*, *varians*, *varleyi*, *zeus* and *zugi*. Such specimens are deposited in the Museo Nacional de Historia Natural de Cuba. Line drawings were made with a camera lucida attached to a dissecting scope.

Calls of *Eleutherodactylus dimidiatus* were recorded at two localities: Meseta de Cajálbana (with a portable cassette recorder, and a microphone), and Sierra Maestra (with a professional cassette recorder, and a Sennheiser ME 66 microphone with an adapter system K6). Acoustic analyses were performed with the software BatSound 2.1 (Petterson Elektronic AB, © 1996-1999). Signals were digitized at 22050 Hz and sample size of 16 bits. Sonogram and power spectrum were generated with a FFT (Fast Fourier Transform) of 512 points, using Hanning window. Frequency modulation is expressed as the dominant frequency at end of call minus that at beginning of call divided by the call length (Cocroft and Ryan 1995). Call definition follows Duellman and Trueb (1986).

Museums and other zoological collection abbreviations used are: MNHNCu, Museo Nacional de Historia Natural de Cuba; LMD, field number series of Luis M. Díaz; CZACC, collection of the Instituto de Ecología y Sistemática (IES), Ciudad de La Habana, Cuba; MHNH, Museo de Historia Natural "Carlos de la Torre y Huerta" de Holguín, Cuba; BSC.H, Herpetological Collection of BIOECO, Museo Tomás Romay of Santiago de Cuba, Cuba; CARE, Private Collection of Alberto R. Estrada (collection unallocated, last reviewed by the senior author in 1995).

Eleutherodactylus maestrensis **new species**
Figures 1A, 2A, 3B.

Holotype.—MNHNCu 908, an adult female from "El Nueve" (20º03′18′′N, 76º36′13′′W), surroundings of Pico La Bayamesa (1 324 m), Municipio Buey Arriba, Granma Province, collected by Antonio Cádiz on June 18, 2003.

Paratypes (N= 29).—**Males**: MNHNCu 913-921, with the same data as holotype; MNHNCu 922, Cabezadas del Río 26, Surroundings of Pico la Bayamesa, Sierra Maestra, Municipio Buey Arriba, Granma Province; MNHNCu 922-925, Pico Maceo (20º02′42′′N, 76º37′38′′W), 1440 m, Sierra Maestra, Municipio Buey Arriba, Granma Province, collected by Luis M. Díaz on November 14, 2002; MHNH 21, Nuevo Mundo (900-1000 m), Base del Pico Maceo, Municipio Buey Arriba, Granma Province, collected by Luis M. Díaz on November 12, 2002; MNHNCu 926, El Cupeyal (20º03′50′′N, 76º29′03.4′′W), Sierra Maestra, Municipio Guisa, Granma Province, collected by Luis M. Díaz on November 23, 2002. **Females**: MNHNCu 910, Pico La Bayamesa (1 640 m), Buey Arriba, Granma, collected by Luis M. Díaz on November 16, 2002; MNHNCu 909, same data as holotype, but collected by Antonio Cádiz on June 19, 2003; MNHNCu 911-912, Pico Maceo (20º02′42′′N, 76º37′38′′W), 1 440 m, Sierra Maestra, Municipio Buey Arriba, Granma Province, collected by Luis M. Díaz on November 14, 2002; MNHNCu 1098, Barrio Nuevo, Municipio Buey Arriba, Granma Provice, collected by Luis M. Díaz on February 7, 2004. **Juveniles**: MNHNCu 927-931, same data as holotype; MNHNCu 932, Nuevo Mundo (900-1 000 m), Base del Pico Maceo, Municipio Buey Arriba, Granma Province, collected by Luis M. Díaz on November 12, 2002. BSC.H 2573, BSC.H 2574, BSC.H 2575, and BSC.H 2577, "El Nueve", 1.5 km NW of Pico La Bayamesa (20º03′16′′ N, 76º36′05′′ W), 1 372 m Municipio Guisa, Granma Province,

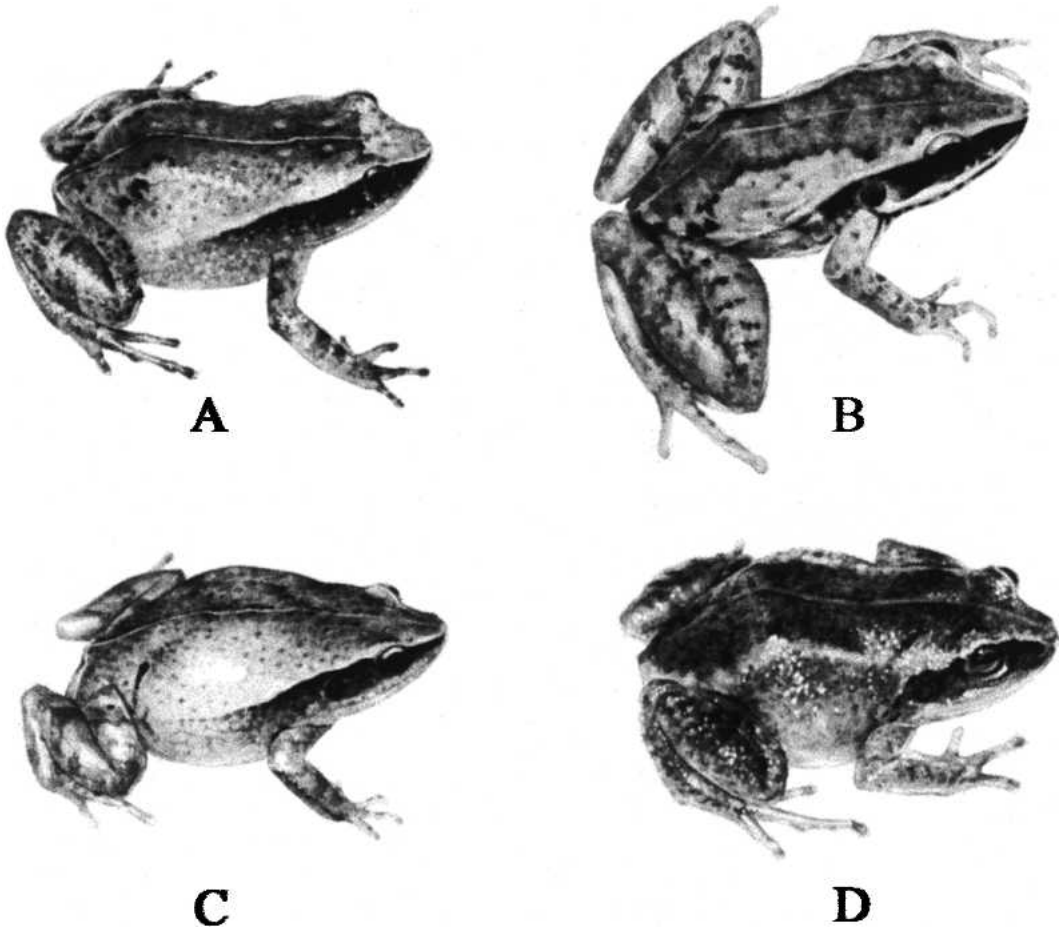

FIG. 1. Four similar species of ground-dwelling *Eleutherodactylus*: *E. maestrensis* n. sp., paratype MHNH 21 (A); *E. dimidiatus* (B), adult female from Minas del Frío, Sierra Maestra, no voucher specimen, drawing from a slide by Luis M. Díaz; *E. emiliae* (C), adult female from Topes de Collantes, Sancti Spiritus, no voucher specimen, drawing from a digital photograph by Nils Navarro; *E. albipes* (D), adult female from Pico La Bayamesa, no voucher specimen, drawing from a printed photograph by Luis M. Díaz. Drawings by Nils Navarro.

collected by Ansel Fong on June 18 and 21, 2003.

Diagnosis.—Males maximum SVL: 19.1 mm; females: 32.4 mm. *Eleutherodactylus maestrensis* is a member of the subgenus *Euhyas* (*sensu* Hedges 1989), morphologically related to *Eleutherodactylus dimidiatus*, *E. albipes*, and *E. emiliae*. From *E. dimidiatus* (Fig. 1B) the new species differs by having a more stocky body, wider head (head width/head length: 0.99-1.14 in *E. maestrensis*; 0.92-0.98 in *E. dimidiatus*, N= 10); smaller and less protuberant eyes (eye length/head length: 0.23-0.29 in *E. maestrensis*; 0.30-0.34 in *E. dimidiatus*); more rounded head in dorsal view (Fig. 2); shorter hindlimbs (shank length/SVL: 0.42-0.52 in *E. maestrensis* n. sp., 0.56-0.63 in *E. dimidiatus*); absence of supralabial light stripe (present in adults of *E. dimidiatus*), and an orange belly (pearl white or with a yellowish wash in *E. dimidiatus*). *Eleutherodactylus maestrensis* differs from *E. albipes* by having a less compact body; the dark head mask is extended up to the insertion of the forelimbs or beyond it, becoming gradually diffuse on flanks (the dark mask is limited to the area below supratympanic fold in *E. albipes*, being comparatively less contrast-

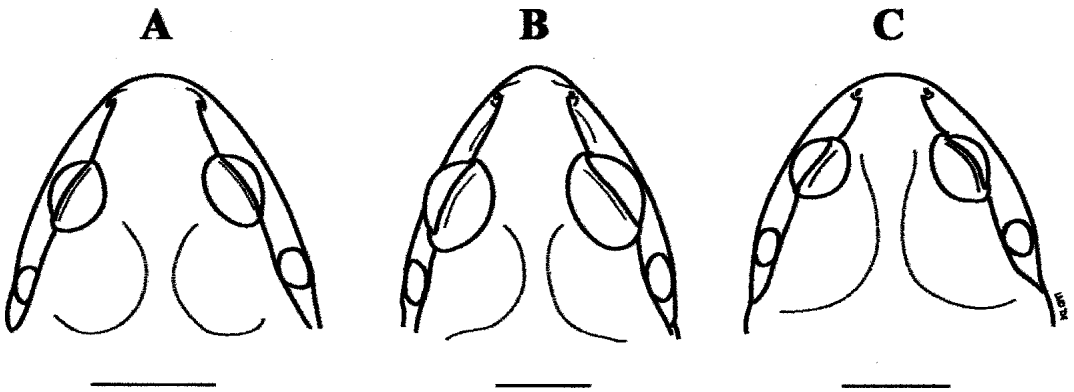

FIG. 2. Head shape of three morphologically related species of *Eleutherodactylus*: A, *E. maestrensis* n. sp. (Holotype); B, *E. dimidiatus* (LMD 503); and C, *E. albipes* (LMD 451). Scale bar: 5 mm. Drawings by LMD.

ing with respect to overall color); longer hindlimbs (shank length/SVL: 0.25-0.37 in *E. albipes*, N= 10); brown feet (orange colored in *E. albipes*); interorbital distance 30-41% of head width in *E. maestrensis*, and 25-29% in *E. albipes*; presence of distinct postfemoral glands that are not externally defined in *E. albipes*. Both *E. maestrensis* and *E. albipes* have orange bellies, but in most individuals of *E. maestrensis* there is a medial whitish hair line (complete or fragmented), crossed by another one at the level of the forelimbs, while in *E. albipes* such lines are absent and the ventral orange color is mixed with brown (not so in *E. maestrensis*). Regarding the dorsal pattern, *Eleutherodactylus maestrensis* is more similar to *E. dimidiatus* than to *E. albipes*, having a paler background color than the second species, and lacking dorsolateral pale stripes (*E. albipes* is usually dark coppery brown dorsally with two incomplete dorsolateral pale stripes). *Eleutherodactylus emiliae*, an endemic species from the mountains of central Cuba, is also a related taxon, and the only similarity with the new species is the overall pattern; it is a smaller, very stocky species with shorter hindlimbs (shank length/SVL: 0.39, N= 4).

Description.—Head wider than long and narrower than body, length 38.5% (37.6-42.2) of SVL in males, and 36.5% (36.1-38.7) in females; snout nearly rounded in dorsal view and subacuminate in profile, overlapping the lower jaw; snout length 41.8% (39.9-42.8) of head length in males, and

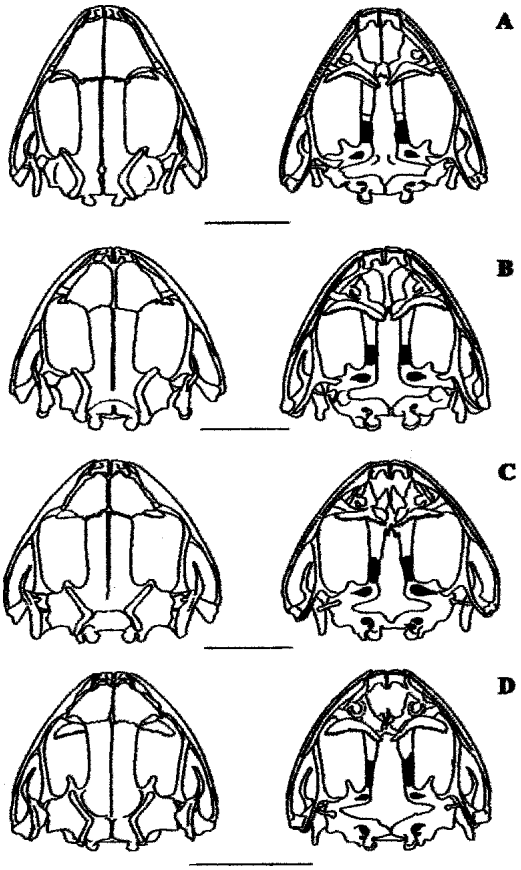

FIG. 3. Skull of some Cuban *Eleutherodactylus* (left: dorsal view; right: ventral view). A, *E. dimidiatus* (MNHNCu 888); B, *Eleutherodactylus maestrensis* n. sp. (MNHNCu 911); C, *E. emiliae* (MNHNCu 812); and D, *E. albipes* (LMD 291). Scale bars: 5 mm. Drawings by LMD.

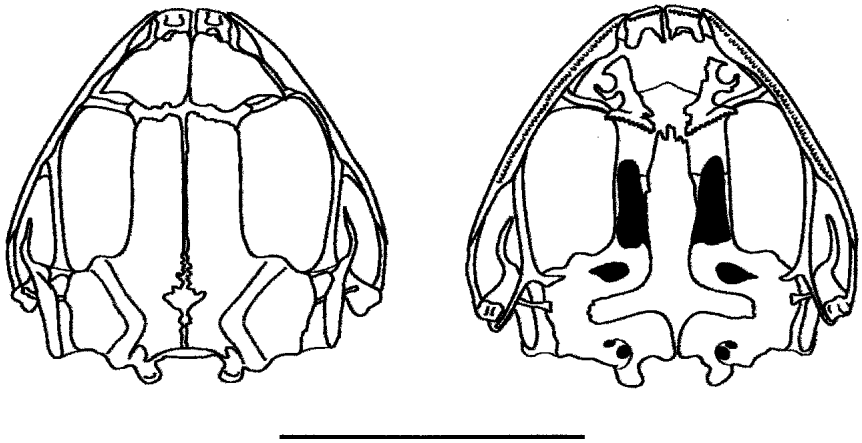

FIG. 4. Skull of *Eleutherodactylus intermedius* (left: dorsal view; right: ventral view). Scale bar: 5 mm. Drawings by LMD.

44.6% (38.8-51.5) in females; nostrils not protuberant, directed laterally, and separated by a distance equivalent to 28.8% (22.7-34.1) of head width in males, and 26.2% (23.8-28.9) in females; canthus rostralis straight in dorsal view; loreal region slightly concave; lips not distinctly flared; interorbital distance 2-3 times the upper eyelid width, without tubercles; there are no tubercles on upper eyelids and in the loreal area; tympanum superficial, round, with distinct annulus, 76.8% (53.5-100.0) of eye length in males and 60.7% (54.2-64.1) in females, separated from eye by a distance equivalent to 32.7% (17.1-50.0) of its own diameter in males, 62.7% (50.0-71.7) in females; supratympanic fold distinct, hiding upper edge of tympanum, extending posteroventrally toward the arm insertion; tiny postrictal tubercles; choanae small, about 66% of third finger disc diameter, round to oval, not concealed by palatal shelf of maxillary arch; vomerine odontophores large, arched, narrowly separated, and extended beyond the external margins of choanae; tongue suboval, not notched behind, posterior ½ – ¾ not adherent to floor of mouth; external vocal sac apparently absent; males with sublingual slits.

Skin mostly smooth on dorsum and belly, slightly areolated on flanks; a shallow glandular area is evident behind supratympanic fold and over forelimbs; enlarged postfemoral glands with a distinct tonality; suprainguinal glands present, but unconspicuous; a barely evident lateral fold behind the shallow supraxilar glandular area; discoidal folds defined; anal opening not extended in sheath; palmar tubercle oval or bifid, low, smooth, 1.3 times longer than thenar tubercle; supernumerary palmar tubercle absent or if present rounded and very low; subarticular tubercles of fingers rounded and low; fingers length order: III > IV > II > I; digital discs small (1.2-1.3 times more expanded that finger), rounded to subtriangular in shape; hands 19.3% (17.5-21.4) of SVL in males, and 20.3% (19.1-21.3) in females; heels without tubercles; inner metatarsal tubercle 2-2.3 times larger than the outer metatarsal tubercle, oval and smooth; supernumerary tubercles absent or inconspicuous; subarticular tubercles rounded and low, only slightly projected anteriorly in profile; toes without a defined lateral ridge; circumferential groove bordering the distal half of toe pad; heels do not overlap when flexed legs are held at right angles to sagittal plane; toes length order: IV > III > V > II > I. Measurements are summarized in Table 1 together with those of related species.

Color in live specimens: dorsal color brown, grayish brown or yellowish tan, generally darker along its middle part; some specimens with more contrasting dorsolateral zones lighter than middle dorsum; a middorsal pale hair line divided at

TABLE 1. Variation of some measurements (in mm) of *Eleutherodactylus maestrensis* and related species (only females included). Values are the mean ± SD.

	E. maestrensis					
Characters	Males (N = 10)	Females (N = 5)	Holotype	*E. albipes* N = 5	*E. dimidiatus* N = 9	*E. emiliae* N = 3
Snout-vent length	17.06 ± 1.08	28.17 ± 3.42	29.3	28.28 ± 3.18	35.27 ± 3.57	22.46 ± 1.67
Head width	6.95 ± 0.34	11.27 ± 1.23	11.75	11.63 ± 1.55	13.76 ± 1.27	8.62 ± 1.0
Head length	6.69 ± 0.31	10.30 ± 1.24	11.35	9.53 ± 1.10	14.84 ± 0.67	8.78 ± 0.40
Snout length	2.95 ± 0.35	4.31 ± 0.49	4.7	3.99 ± 0.39	6.32 ± 0.52	3.28 ± 0.41
Upper eyelid width	1.09 ± 0.10	1.33 ± 0.31	1.4	1.14 ± 0.19	2.22 ± 0.51	1.2 ± 0.21
Interocular distance	2.35 ± 0.28	3.75 ± 0.37	4.07	3.17 ± 0.38	4.08 ± 0.55	2.83 ± 0.30
Tympanum width	1.41 ± 0.24	1.62 ± 0.28	1.6	1.74 ± 0.32	2.89 ± 0.67	1.55 ± 0.26
Tympanum height	1.27 ± 0.22	1.65 ± 0.23	1.6	2.09 ± 0.30	2.48 ± 0.30	1.43 ± 0.15
Internarial distance	1.97 ± 0.21	2.95 ± 0.31	3.1	2.72 ± 0.36	3.67 ± 0.48	2.13 ± 0.15
Thigh length	7.85 ± 0.55	12.73 ± 1.35	13.25	11.78 ± 1.18	19.19 ± 1.68	9.18 ± 0.66
Shank length	8.00 ± 0.27	12.69 ± 1.19	13.45	9.88 ± 1.76	20.84 ± 2.41	9.08 ± 0.58
Tarsal length	5.10 ± 0.37	7.71 ± 0.95	9.1	7.28 ± 0.54	11.98 ± 1.45	5.91 ± 0.38
Foot length	7.66 ± 0.44	12.1 ± 1.57	12.9	11.37 ± 0.82	20.39 ± 2.24	8.86 ± 0.71
Hand length	3.28 ± 0.24	5.7 ± 0.63	5.85	5.69 ± 0.40	8.34 ± 1.07	4.28 ± 0.37
Eye-tympanum distance	0.61 ± 0.22	1.65 ± 0.16	1.8	1.55 ± 0.31	1.78 ± 0.47	1.38 ± 0.33
Eye diameter	1.85 ± 0.13	2.66 ± 0.35	2.6	2.82 ± 0.23	4.26 ± 0.38	2.68 ± 0.59
Eye-naris distance	1.66 ± 0.35	1.87 ± 0.19	2.06	2.43 ± 0.54	3.94 ± 0.49	1.91 ± 0.24
Fingertip (III) width	0.36 ± 0.04	0.66 ± 0.11 (N = 4)	0.73	0.74 ± 0.05	0.96 ± 0.08	0.47 ± 0.06
Toe tip (IV) width	0.51 ± 0.06	0.80 ± 0.14 (N = 4)	0.86	0.87 ± 0.08	1.14 ± 0.02	0.49 ± 0.01

the level of vent to reach the inner surface of thighs; some individuals with dispersed black spots on dorsum; other specimens with suprascapular pale ocelli (generally four) symmetrically arranged; dorsal surface of head, from middle eyelids to snout tip, slightly paler than dorsum; interocular dark bar not defined; a distinctive black mask covering the sides of head, posteriorly delineated by the supratympanic fold, and barely extended beyond the insertion of forelimbs, becoming diffuse on flanks; mandibular margins dark with some small whitish dots; suprainguinal blotches present, at times connected from one body side to the other by a barely evident grayish bridge or by a series of black dots; vent surrounded by a dark area faded toward inner part of thighs; extremities with the same basic background color than dorsum but with more or less evident bands (variable in the series); belly and ventral surface of thighs orange, but individually more or less intense, with a mid pale hairline (absent in a single individual), crossed transversally by another one at the level of forelimbs; some white dots are dispersed on belly, throat, and lower surface of flanks; iris dark coppery brown or with the upper half golden coopery. Juveniles are very similar to adults but flanks are darker, being a continuation of the head black mask; in some cases, the throat is brown reticulated.

Color in alcohol: Preserved specimens become light gray or grayish brown. The overall pattern remains, but the orange color, creamy or yellowish tonalities disappear, becomes more difficult to observe the pale ventral hairline in most specimens.

Osteology (Fig. 5): Description is based on female specimens MNHNCu 911 and 912. Skull wider than long; maxillae very slightly overlapping premaxillae by a brief toothless flange; pars facialis of the maxillae moderately high; pars palatina slightly broader anteriorly; palatal process of the premaxillae indented, pars dorsalis almost vertical; nasals large and in wide contact, articulated with frontoparietals; frontoparietals straight and well ossified, fused with prootics; anterior margin of epiotic eminences with large, blunt projections; prootics well ossified; cristae paroticae with relatively narrowly projected platforms; zygomatic ramus of squamosal arched and

FIG. 5. Inguinal amplexus in *Eleutherodactylus maestrensis* n. sp. Female: Holotype (MNHNCu 908); male: paratype MNHNCu 921. Photograph by LMD.

pointed, ¾ of the otic ramus; otic ramus without an expanded plate; vomers well developed, partially enclosing the choanae, with long dentigerous process; palatines moderately broad; cultriform process of parasphenoid slightly wide, not overlaping the level of palatines; parasphenoid alae deflected posteriorly; medial ramus of the pterygoids never in contact with the parasphenoid alae; falangeal formula 3,3,4,4 in hands, 3,3,4,5,4 in feet; terminal phalanges T-shaped, not overlapped by the subterminal phalanges. Transverse process of the vertebrae unequal in length, as follows: III > IV > V > VI ≈ VII ≈ VIII > II (atlas without diapophyses); sacral diapophyses barely dilated; the sacrococcygeal articulation is bicondylar. Alary process of the hyoid plate anteriorly oblique respecting sagital plane; posterolateral process sharpened and directed below.

Etymology.—The species name alludes to Sierra Maestra, the highest mountain range of Cuba.

Natural History.—*Eleutherodactylus maestrensis* is a terrestrial species that inhabits mountain rain forests and pine patches. Most specimens were found under leaf litter. A single frog was caught under a small stone close to the margins of the river that crosses Nuevo Mundo, at the base of Pico Maceo. Stomach contents of three individuals reveal several large prey items: cockroaches (a female of *Epilampra hamiltoni*, and a nymph of *Epilampra* sp., in two different frogs, respectively), pillbugs (Crustacea: Isopoda), and a fire-fly larva (Coleoptera: Lampyridae). Holotype female and male MNHNCu 921 (SVL= 16.5 mm) were found in amplexus within a plastic vial (Fig. 5). Amplexus was inguinal instead of the widespread axilar modality of the ge-

nus. Other amphibian species collected or heard by us in areas on which the new species occur were: *E. albipes*, *E. atkinsi*, *E. auriculatus*, *E. cubanus*, *E. cuneatus*, *E. dimidiatus*, *E. glamyrus*, *E. gundlachi*, *E. intermedius*, *E. ionthus*, *E. melacara* and *E. turquinensis*.

Distribution.—Eleutherodactylus maestrensis was collected at six localities in the Sierra Maestra (Fig. 6): Barrio Nuevo, Pico Maceo, Nuevo Mundo, Pico La Bayamesa, "El Nueve" (1.5 km NW of Pico La Bayamesa), and El Cupeyal, which covers an aerial distance of about 25 km, in the municipalities of Buey Arriba and Guisa, Granma Province, at elevations between 900 and 1 640 m.

The Eleutherodactylus dimidiatus *species group*

In Dunn's (1926) classification, the *dimidiatus* group contained *E. dimidiatus* and *E. emiliae*, both with small digital discs, smooth skin above and below, large series of vomerine odontophores, a dark mask, and gray or tan color. Schwartz and Fowler (1973) proposed the *emiliae* group (*E. albipes*, *E. emiliae*, and *E. intermedius*), excluded *E. dimidiatus* for considering it related to Jamaican species. Hedges (1989) included the same taxa within that group. Based on new morphological evidences, we recognize the *dimidiatus* group and include: *E. albipes*, *E. dimidiatus*, *E. emiliae*, and *E. maestrensis*, but *E. intermedius* and *E. tetajulia* are excluded for reasons discussed below.

The *E. dimidiatus* group may be redefined by the following combination of characters [see Fig. 3 for skull comparisons; also Lynch (1996): 151, for skull of *E. dimidiatus*]: Skin mostly smooth on dorsum and ventral surface; digital discs poorly developed; skull longer than wider (*E. dimidiatus*) or wider than long (*E. albipes*, *E. emiliae*, and *E. maestrensis*); epiotic eminences of skull anteriorly with large, blunt projections; nasals large, in broad contact, also contacting frontoparietals; vomers developed and separated medially, bearing very large vomerine odontophores with enlarged and pointed teeth; squamosal with a moderately curved, blade-like zygomatic ramus

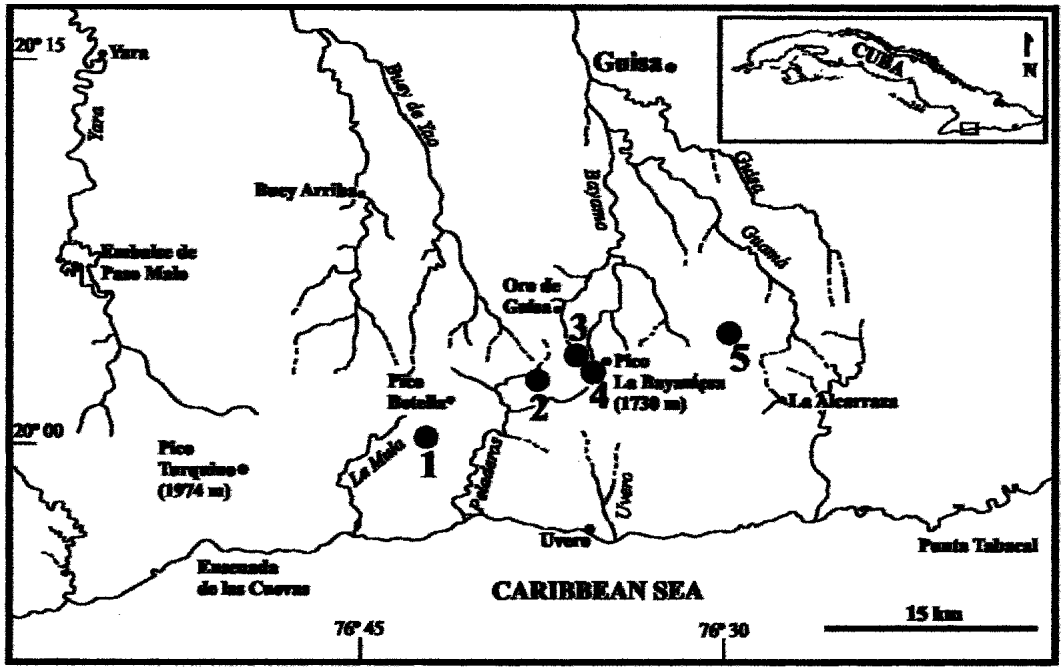

FIG. 6. Distribution of *Eleutherodactylus maestrensis* n. sp. in Sierra Maestra, eastern Cuba. Numbered localities: Barrio Nuevo (1), Pico Maceo (2), Pico La Bayamesa (3), El Nueve (4), and El Cupeyal (5).

(as long as the otic ramus or twice its size); otic ramus nor expanded or with a distinct otic plate overlapping the cristae paroticae in dorsal view; cristae paroticae slightly projected as relatively narrow platforms; cultriform process of the parasphenoid broad to slender, reaching or not the level of palatines; parasphenoid alae at right angle respecting the cultriform process or slightly deflected posteriorly; pterygoids do not contact the parasphenoid alae. All species have a dark mask extending toward the forelimbs insertion or beyond it. There are two morphological trends within the *dimidiatus* group: *E. albipes* and *E. emiliae*, with very stocky bodies and shorter hindlimbs, and *E. dimidiatus* and *E. maestrensis*, with more stylized bodies and longer hindlimbs (although the new species has an intermediate habitus). Both morphologies are in correspondence with different locomotor patterns: *E. albipes* and *E. emiliae* are slow moving frogs ("walking ground frogs"), while *E. dimidiatus* and *E. maestrensis* (especially the former) are more able to jump longer distances.

Differing from species herein considered within the *E. dimidiatus* group are *E. intermedius* and *E. tetajulia* which have a shallowly areolate venter; generally two dorsolateral rows of small to moderate sized tubercles, which are more accentuated in the posterior half of body; anterior border of epiotic eminences very small and rounded (Fig. 4); shorter vomerine odontophores; cristae paroticae broad and short; parasphenoid alae more conspicuously deflected with respect to the cultriform process, with truncate distal border. Both species have a stocky habitus; the supratympanic fold is usually black colored and the area beneath it (which includes the postrictal tubercles) is light in most *E. intermedius*, but less so in *E. tetajulia*. *E. varleyi* have some osteological and external similarities with *E. intermedius* and *E. tetajulia*, but differs basically from those species by having a more stylized body, more conspicuously granulated and plicated skin, short vomerine odontophores, and a vocal sac (absent in *E. intermedius* and probably so in *E. tetajulia*). *E. intermedius* and *E. tetajulia* share many of the dorsal color patterns of *E. varleyi* (Díaz et al. 2003), however parallel polimorphism among not closely related species is not uncommon within the genus (Lynch 1966; Schwartz and Fowler 1973). Based on their strong morphological divergence, as defined above, we exclude *E. intermedius* and *E. tetajulia* from the *E. dimidiatus* group, but at this point we do not propose a hypothesis on their relationships with other species.

Eleutherodactylus dimidiatus, *E. albipes*, and *E. maestrensis*, were found at Pico La Bayamesa; however *E. albipes* was collected only in the cloud forest of this peak (1 720-1 730 m), never syntopically with *E. maestrensis*. Small juveniles of *Eleutherodactylus maestrensis* are essentially similar to adults, but with darker flanks. In *E. albipes*, young frogs (less than 1 cm) have dark bellies, and wide light dorsolateral areas, that remain as pale, sometimes inconspicuous, dorsolateral narrow stripes in the most common adult pattern illustrated in Figure 1D.

Vocalizations

Vocalizations of frogs in the *E. dimidiatus* group have never been described. We only know the advertisement calls of *Eleutherodactylus dimidiatus* (Fig. 7) which are soft, mostly single-noted "chips" given sporadically; most calls have descendant frequency modulation, but some describe an inverted "U-shaped" pattern (frequency modulation: –51.1 to –116.8 kHz/second). Ten calls of a single specimen from Meseta de Cajálbana (Pinar del Río) have a dominant frequency of 2.4-3.6 kHz (x= 2.8), a call duration of 9-14 milliseconds (x=12.0), and a repetition rate of 5.9 calls per minute; four calls from one specimen from "El Nueve" (surroundings of Pico La Bayamesa, Sierra Maestra) have a dominant frequency of 2.2-2.8 kHz (x= 2.5), a call duration of 10-17 milliseconds (x= 13.7), and a repetition rate of 3.6 calls per minute. External vocal sac is absent in *E. dimidiatus*, and calling males exhibit only a minute and flatten pouch on throat during their acoustic emissions. In this species, males call from the ground, but two specimens were observed calling during the night from vegetation: one at about 1.2 m height in a branch bifurcation

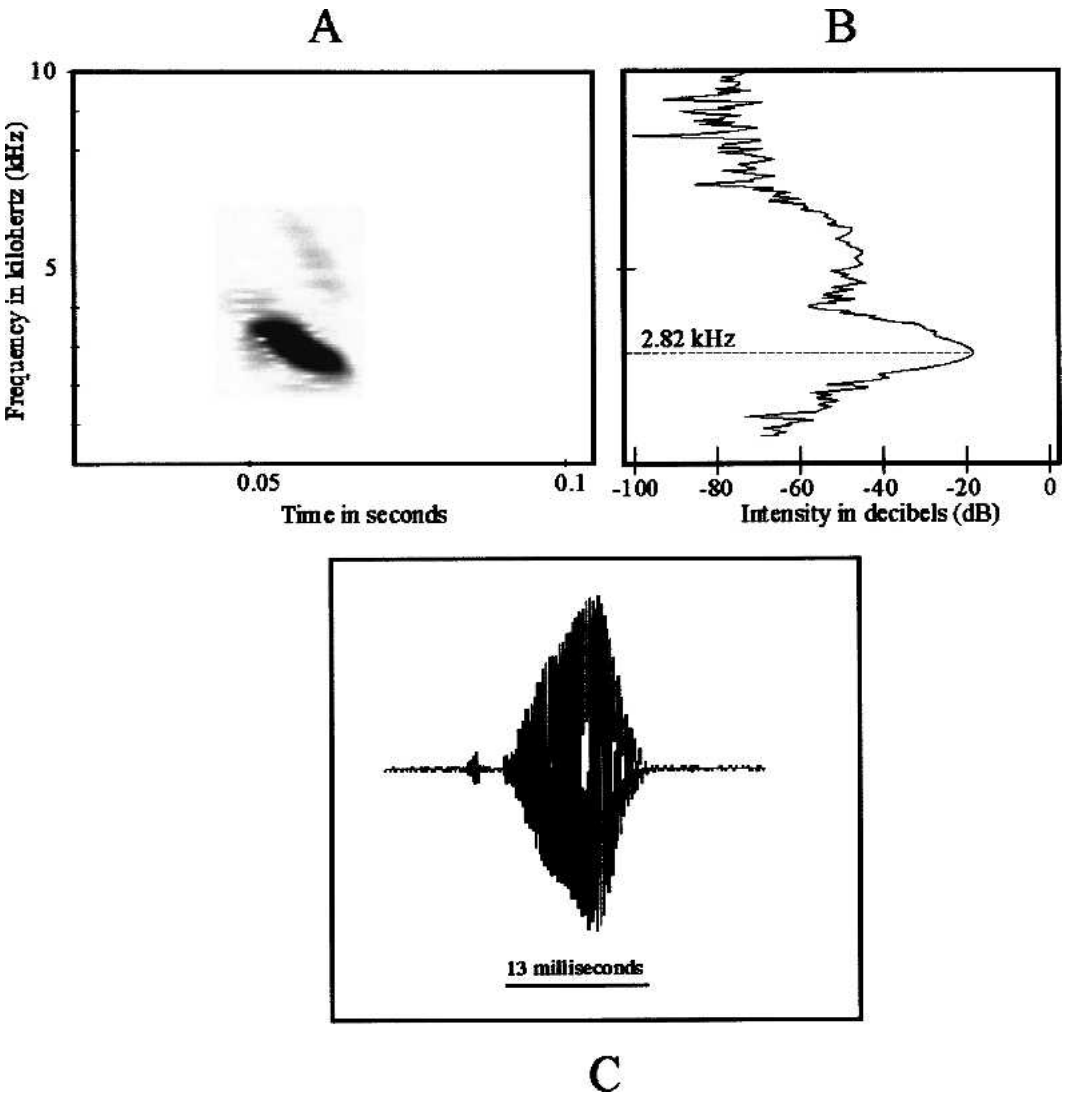

FIG. 7. Sonogram (A), power spectrum (B), and waveform (C) of an advertisement call of *Eleutherodactylus dimidiatus* from Meseta de Cajálbana, Pinar del Río (voucher specimen MNHNCu 969; air temperature: 23-24ºC).

of a small and dense bush; the other on a leaf at 1.5 m, both at Meseta de Cajálbana, Pinar del Río Province.

Additional notes on Eleutherodactylus dimidiatus

Eleutherodactylus dimidiatus is the widespread member of the group in Cuba; however, it had never been reported from Isla de la Juventud. One specimen was collected by the senior author under leaf litter in a gallery forest at Los Indios (referred in Appendix I): the species also inhabits this island. Schwartz (1958) described *E. dimidiatus amelasma* based on a single specimen from Pinar del Río, "differing from the nominate race in the bold, cream color, labial line extending from just anterior to the naris to the insertion of the forelimb, the almost complete absence of a black blotch or spots in the groin, absence of distinct barring of the hind limbs, more slender build, and more pointed snout". Morpho-

logical and acoustical comparisons of *E. dimidiatus* from Pinar del Río and Sierra Maestra, do not reveal differences to support the subspecific status of the western population. Characters used to define *E. d. amelasma* are within the range of variation of the species, and for this reason it would be better to consider *E. dimidiatus* as a monotypic species.

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APPENDIX I

Specimens examined for comparisons

Eleutherodactylus albipes (N= 11).— LMD 284, Aguada de Joaquín, Sierra Maestra,

Granma; LMD 285, few meters from the top of Pico Turquino, Sierra Maestra, Santiago de Cuba; LMD 451, 460-461, and 497, Pico La Bayamesa, Sierra Maestra, Guisa, Granma; MNHNCu 26, 280-81, Pico Turquino, Santiago de Cuba. Cleared and stained specimens: LMD 291 y MNHNCu 903, Aguada de Joaquín, Sierra Maestra, B. Masó, Granma.

Eleutherodactylus dimidiatus (N= 16).—LMD 30-33, Piedra La Vela, Ojito de Agua, Parque Nacional Alejandro de Humboldt, Guantánamo; LMD 64, gallery forest at Los Indios, Isla de la Juventud; MNHNCu 888, Loma del Taburete, Reserva de la Biosfera Sierra del Rosario (cleared and stained); MNHNCu 968, Meseta de Cajálbana, Pinar del Río; LMD 498-501, El Cupeyal, Sierra Maestra, Guisa, Granma; LMD 503, Pico La Bayamesa, Sierra Maestra, Municipio Guisa, Granma; LMD 504, Pico Maceo, Sierra Maestra, Municipio Guisa, Granma; MNHNCu 341, Yunque de Baracoa, Baracoa, Guantánamo; MNHNCu 42, Pico Turquino, Sierra Maestra, Granma; MNHNCu 348, La Isabelica, Sierra de la Gran Piedra, Santiago de Cuba.

Eleutherodactylus emiliae (N= 5).—CARE 886, 896 and 897, Topes de Collantes (Arboretum), Sancti Spiritus; CARE 133, Topes de Collantes (surroundings of Hotel Los Pinos); CARE 886, Cleared and stained specimen: MNHNCu 812 (female), Topes de Collantes (surroundings of Hotel Los Pinos), Sancti Spiritus.

Eleutherodactylus intermedius (N= 8).—LMD 463, and LMD 475-478, Pico La Bayamesa, Sierra Maestra; LMD 496, El Cupeyal, Sierra Maestra, Guisa, Granma. Cleared and stained specimens: MNHNCu 243, La Isabelica, Gran Piedra, Santiago de Cuba; LMD 293, Aguada de Joaquín, Granma, Sierra Maestra.

Eleutherodactylus tetajulia (N= 3).—LMD 413, Meseta de El Toldo, Parque Nacional Alejandro de Humboldt, Holguín Province. Cleared and stained specimens: LMD 398 and MNHNCu 898, same locality.