

DESCRIPTION OF TWO NEW SPECIES OF THE
ELEUTHERODACTYLUS MILESI GROUP
(AMPHIBIA: ANURA: LEPTODACTYLIDAE)
FROM NORTHERN HONDURAS

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Abstract.—Two new species of the *Eleutherodactylus milesi* group (*E. chrysozetetes* and *E. cruzi*) are described from the Cordillera de Nombre de Dios of northern Honduras. *Eleutherodactylus milesi* is shown to have a wide range in Honduras on scattered montane ridges and is reported from Guatemala for the first time.

The systematics of *Eleutherodactylus matudai* and *E. milesi* were reviewed by Savage (1975), who included them in the *E. rugulosus* group. These species subsequently were removed from the *rugulosus* group (Miyamoto 1983, Savage 1987) and placed as a separate infrageneric lineage, the *E. milesi* group (Savage 1987). Members of this stock differ in karyology ($2N = 22$; $NF = 44$) and jaw musculature (DFSQAT + e) from those of the *rugulosus* group ($2N = 20, 22$; $NF = 36$; jaw muscle formula: dfsq; dfsqat + e). Externally, frogs of the *milesi* group are distinct (features for the *rugulosus* group in parentheses) in: lacking tarsal folds (a well-developed inner tarsal fold), having a strongly tuberculate dorsum (dorsum smooth to rugose), and having a pair of paranal light bars (never with such markings). In addition *E. matudai* has an indistinct tympanum in females and *E. milesi* has the tympanum indistinct or hidden (distinct, nearly transparent tympanum).

Recent fieldwork in Guatemala and Honduras substantially increases the known range for *Eleutherodactylus milesi* and this information and data on variation are presented here. Among other newly collected material from the Cordillera de Nombre de Dios of northern Honduras are two forms, clearly allied to *E. matudai* and *E. milesi*, but trenchantly different from them and

from one another. These distinctive frogs are regarded as representing previously unknown species and are described below following the style and terminology of Savage (1975); a few features not mentioned in that paper follow the definitions of Savage (1987).

Eleutherodactylus chrysozetetes,
new species
Fig. 1

Holotype.—KU 209035, adult male, from Quebrada de Oro ($15^{\circ}38'N$, $86^{\circ}47'W$), elevation 880 m, tributary of Río Viejo, south slope of Cerro Búfalo, Cordillera de Nombre de Dios, Departamento de Atlántida, Honduras, 17 Aug 1984, James R. McCranie, Kenneth L. Williams, and Larry David Wilson. Original number LDW 6529.

Diagnosis.—*Eleutherodactylus chrysozetetes* is a moderately large frog and is distinguished from the two previously described members of the *milesi* group, *E. matudai* and *E. milesi* (characteristics for these species in parentheses), in having extensive toe webbing with about three phalanges free of the web on toe IV (basal to moderate webbing, with four to four and one-half phalanges free of web); strongly expanded finger and toe disks, about twice width of digit (finger disks definite, less than twice width of digit; toe disks weak, barely expanded);



Fig. 1. Holotype, KU 209035. *Eleutherodactylus chrysozetetes*.

tympanum hidden in adult males and presumably females (tympanum evident in adult males). *Eleutherodactylus chrysozetetes* is further distinguished from *E. matudai* (states for *matudai* in parentheses) by having: paired vocal slits in adult males (no vocal slits); groin with a light spot on the dark uniform flank color (groin mottled). In addition, *E. chrysozetetes* can be distinguished from *E. milesi* (states of *milesi* in parentheses) by having: a well-developed fleshy fringe along margins of toes (a very narrow ridge); adult males to 41.3 mm in standard length (20–34 mm). *E. chrysozetetes* is compared to the second new species described in this paper in the diagnosis for the latter form.

Summary of characteristics. —Dorsum tuberculate; canthus rounded; tympanum hidden in adult males; first finger equal to or shorter than second; finger disks strongly

expanded, at least twice width of digit just proximal to disks on fingers III–IV; inner tarsal fold absent; toe disks strongly developed, about twice width of digit; a well-developed fleshy fringe along margins of toes; toes extensively webbed, webbing formula: I 1+–2, II 1+–2 1/2, III 2–3 1/4, IV 3+–2 V; paired vocal slits in adult males; nuptial pads in adult males; throat and venter heavily suffused with pale purple; dorsum dark olive brown, blotched with pale olive brown; groin light spotted on a uniform dark flank; posterior surface of thigh uniform purplish-brown with a light para-anal bar; underside of tibial segment suffused with pale purple.

Coloration. —In life the holotype was dark olive brown, blotched with pale olive brown; upper surfaces of limbs same as dorsum; posterior surface of thigh uniform purplish-brown with a light para-anal bar; venter and

throat pale purple; soles of hands and feet purple; underside of tibial segment suffused with pale purple; iris steel gray with rust-red horizontal band.

Measurements. — Standard length in millimeters, other measurements as percentages of standard length: standard length 41.3; head length 41.9; head width 42.1; orbit 13.3; snout length 17.2; loreal length 9.2; hindleg length 166.1; tibia length 53.0.

Etymology. — The specific epithet is from the Greek *chrysos* (=gold) and *zētētēs* (=searcher), with reference to the occurrence of this form along the Quebrada de Oro (stream of gold).

Natural history notes. — The holotype and a juvenile specimen were collected during the morning in the forest alongside the Quebrada de Oro. The vegetation at the type locality is in the Subtropical Wet Forest formation (Holdridge 1967) and will be described in more detail in a subsequent paper. The known elevational range is 880–1110 meters.

Referred specimen. — KU 209036, a juvenile from Quebrada de Oro, taken between 920–1110 m.

Eleutherodactylus cruzi, new species

Fig. 2

Holotype. — KU 209037, adult male, from south slope of Cerro Búfalo (15°38'N, 86°47'W), elevation 1520 m, Cordillera de Nombre de Dios, Departamento de Atlántida, Honduras, 4 Jun 1980, Gustavo A. Cruz Díaz, James R. McCranie, and Larry David Wilson. Original number LDW 5606.

Paratopotype. — KU 209038, adult male.

Diagnosis. — A medium sized *Eleutherodactylus* (males to 32.6 mm in standard length, females presumably 8 to 10 mm longer) differing from all other members of the *milesi* group in having the following combination of characteristics: moderate toe webbing, with about four phalanges free of web on toe IV; definite finger disks, almost twice width of digit; toe disks weak, barely

expanded; a distinct ridge along toes, basally; tympanum hidden in adult males (and presumably females); and a unique coloration with a narrow, median dorsal light stripe, the venter cream and lightly punctate and the throat punctate. *Eleutherodactylus cruzi* most closely resembles the larger *E. matudai* (adult males to 50 mm in standard length) in disk size, toe webbing and fringing. The latter form has the tympanum distinct in males and indistinct in females (hidden in male and almost certainly in female *E. cruzi*), the venter uniform gray with silver or white spots, throat heavily pigmented, dorsum without a median dorsal light stripe and groin mottled (venter cream and lightly punctate, throat punctate, a median dorsal light stripe and a distinct white spot in groin in *cruzi*). *E. cruzi* has more toe webbing, somewhat broader finger disks and somewhat better developed toe ridges than *E. milesi* but is most obviously distinct in having the tympanum hidden in males and in coloration (the latter species has the tympanum evident but indistinct in males, the venter and throat heavily marked and/or suffused with dark pigment and the dorsum never with a narrow median light stripe). The newly described *E. chrysozetetes* cannot be confused with *E. cruzi* (features for the latter in parentheses) since the former has strongly expanded finger and toe disks, about twice as wide as digits (definite finger disks, less than twice as wide as digits; barely expanded toe disks), extensive toe webbing with only about three phalanges on toe IV free of web (about four phalanges free of web), distinct toe fringes (toes ridged) and a larger size to 41.3 mm in adult males (to 32.6 mm). Coloration also will separate these forms as *E. chrysozetetes* resembles *E. matudai* and *E. milesi* in having the throat and venter heavily marked with dark pigment and lacks a mid-dorsal light stripe.

Summary of characteristics. — Dorsum tuberculate; canthus rounded; tympanum hidden in adult males; first finger equal to or shorter than second; finger disks definite,



Fig. 2. Holotype, KU 209037. *Eleutherodactylus cruzi*.

almost twice width of digit just proximal to disks on fingers III–IV; inner tarsal fold absent; toe disks weakly expanded; ridge along margins of toes basally; toes moderately webbed, modal webbing formula: I 2–2 1/2, II 2–3 1/2, III 3–4, IV 4–2 1/2 V; paired vocal slits in adult males; nuptial pads in adult males; venter cream, lightly punctate; throat punctate; dorsum uniform brown except for a narrow mid-dorsal light stripe; groin with a light spot; posterior surface of thigh uniform brown with a distinct light para-anal bar; underside of tibial segment banded; adult males 26.9–32.6 mm in standard length.

Coloration.—In preservative the holotype (KU 209037) is uniform brown with a narrow mid-dorsal light stripe; dorsal surfaces of limbs brown with dark brown bands; venter cream, lightly punctated with brown;

throat cream, punctated with brown; groin brown with a cream colored light spot; posterior surface of thigh brown with light brown para-anal bar; underside of tibial surface cream, banded with brown. The paratopotype (KU 209038) is similar to the holotype except that the overall appearance of the dorsal surfaces is a slightly lighter shade of brown.

Measurements.—Standard lengths in millimeters, other measurements as percentages of standard length (holotype followed by paratopotype). Standard length in adult males 32.6, 26.9; head length 42.6, 45.0; head width 42.6, 44.2; orbit 16.3, 14.9; snout length 17.5, 18.6; loreal length 10.4, 11.2; hind leg length 184.0, 201.4; tibia length 58.0, 64.7.

Etymology.—The species is named in honor of Gustavo A. Cruz Díaz, in recog-

dition of the many years of friendship McCranie and Wilson have enjoyed with this exemplary Honduran biologist and the invaluable assistance he has proffered to them.

Natural history notes.—Both specimens of this species were collected during the morning at 1520 m alongside a trickle at the beginning of a small stream in the Lower Montane Wet Forest formation (Holdridge 1967).

The *Eleutherodactylus milesi* Population System

Recently collected material of frogs resembling *Eleutherodactylus milesi* from the Caribbean versant of Guatemala and Honduras provide significant extensions in the known geographic and elevational ranges for the species group and exhibit substantial variation in features previously used (Savage 1975) to diagnose the species. *E. milesi* was described from the mountains (Sierra de Omoa) west of San Pedro Sula, Departamento de Cortés, Honduras. Additional localities for the species were the Montañas de Yoro, Departamento de Yoro and the Cordillera de Nombre de Dios, Departamento de Atlántida of north-central Honduras.

These samples shared the following distinctive features: 1) dorsum tuberculate; 2) canthus rounded; 3) tympanum indistinct in males, hidden in females; 4) finger disks definite; 5) no tarsal fold; 6) toe disks barely expanded, hardly wider than digit just proximal to disk; 7) a very narrow ridge along margins of toe; 8) toes with no or at most basal webbing; 9) paired vocal slits in adult males; 10) nuptial pads in adult males; 11) venter heavily suffused with light brown to chestnut pigment; 12) throat heavily pigmented to almost uniform dark brown; 13) dorsum brown, spotted to occasionally blotched, rarely with a broad mid-dorsal light stripe; 14) groin with a single light spot

on dark uniform flank color; 15) posterior surface of thigh uniform reddish brown with a distinct light para-anal bar; 16) underside of tibial segment boldly marked with brown spotting or mottling, rarely suffused with chestnut pigment; 17) adult males 20–27 in standard length, females to 34 mm. The maximum size of adult males recorded as 22 mm in Savage (1975) was a typographical error. The newly acquired specimens from east and west of previously known localities for the species all agree with the above description in characteristics 1, 2, 4–6, 8–16. Variation in other features is briefly described below by general locality from east to west (populations numbered as on Fig. 3).

Samples 1–6 are very similar to one another and to previously collected material except that adult males attain lengths (in mm) of 28 (sample 3) and 34 (sample 6) and a female reaches 39 (sample 3).

Samples 7–10 have the tympanum indistinct in males and most females (no males present in sample 8, one female in sample 9 with the tympanum hidden on the right side); adult males reach to 28 (in mm) (sample 7) and 30 (sample 9) and females 41 (sample 9).

Samples 7 and 8 from the sierra along the border between Guatemala and Honduras and sample 9 from the Sierra de las Minas, Departamento de Baja Verapaz, Guatemala are slightly different from other series of the *milesi* complex in the condition of the tympanum in females (usually indistinct, not hidden). However, we are reluctant to place undue emphasis on this feature or the slight variations in webbing, toe disk width and fringing and adult size among samples 1–9 and conclude that they represent a single morphospecies, *Eleutherodactylus milesi*. This species seems to be comprised of isolated populations generally occurring on widely separated ridges between 500–1720 m elevation in Caribbean versant Guatemala and Honduras. The single known female (BM 1985/1452) from extreme eastern Honduras (sample 1) probably was taken

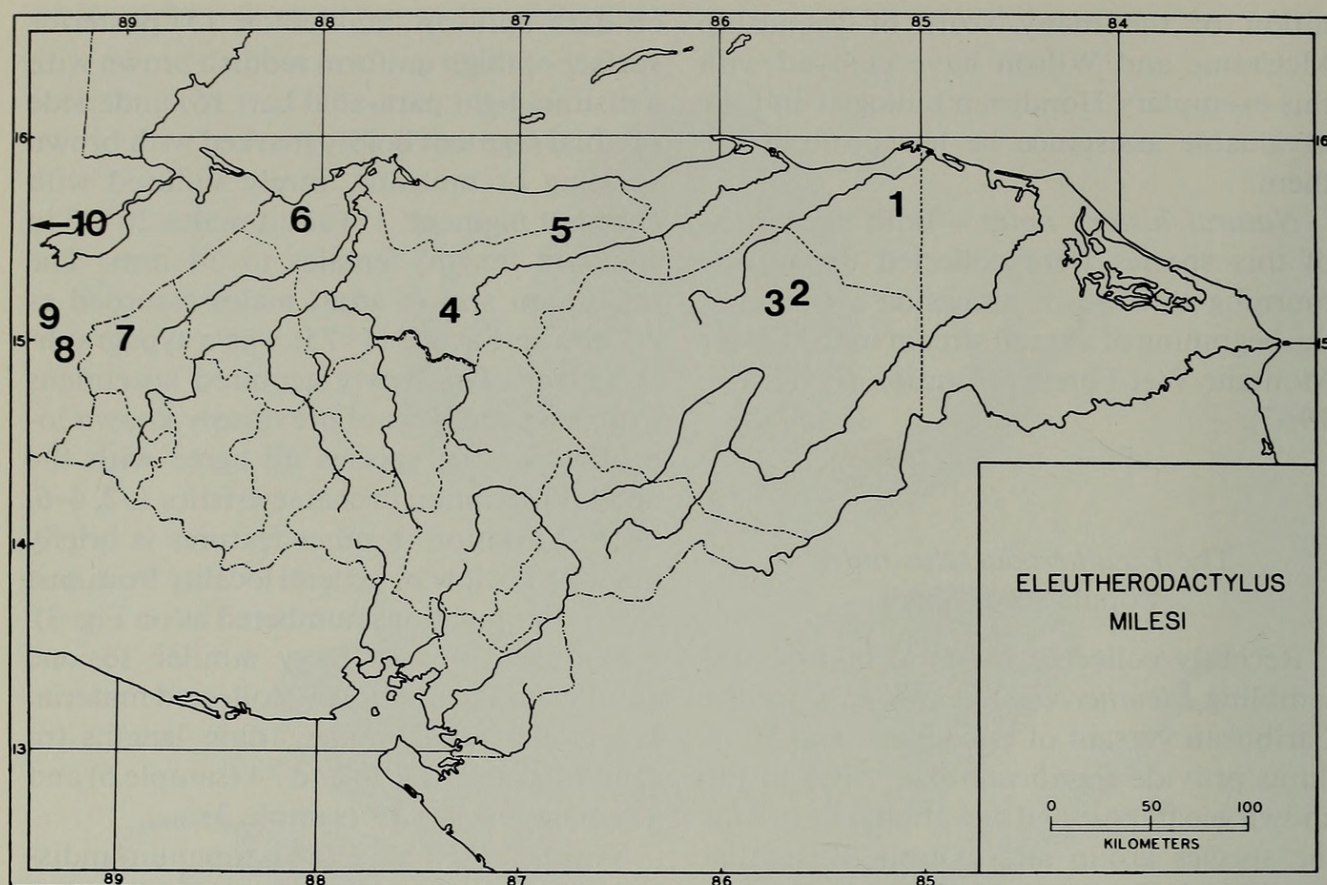


Fig. 3. Distribution of the *Eleutherodactylus milesi* group in Honduras and Guatemala. Numbers refer to samples discussed in text. *E. milesi* and both new species, *E. chrysozetetes* and *E. cruzi* described here occur at locality 5.

below 500 m elevation and this population needs further study to establish its status conclusively.

Sample 10, a single female (MVZ 159934), is from the somewhat isolated Sierra Xucaneb, Departamento de Alta Verapaz, Guatemala. It differs from all other examples of the *Eleutherodactylus milesi* population system in having well-developed toe fringes, in this one feature it resembles *Eleutherodactylus matudai* of northwestern Pacific slope Guatemala and *Eleutherodactylus chrysozetetes* (described in this paper from northcentral Honduras). This specimen may represent a distinct species within the complex, but we are reluctant to recognize it as new without seeing adult males.

Specimens examined.—Honduras: Colon; Sample 1, Río Guaraska, north slope Montañas de Río Platano, (BMNH 1985/1452). Olancho; Sample 2, Montaña de Ma-

lacate, 760 m (KU 209059). Sample 3, Sierra de Agalta, 1450 m (ROM 18099–107), 1060 m (ROM 18113), 1050 m (ROM 18109–111), 1000 m (ROM 18108, 18112). Yoro; Sample 4, Montañas de Yoro, Portillo Grande, 1460 m (MCZ 21290; FMNH 21862–64), Santa Marta, 1460 m (MCZ 21291). Atlántida; Sample 5, Cordillera de Nombre de Dios, above La Ceiba (MCZ 21293–294), Cerro Búfalo, Quebrada de Oro, 1110 m (KU 209058), 940 m (KU 209083–091), 880 m (KU 209080–082, 209096, 209098–104, 209142–143, LACM 137306–311), 810 m (KU 209105–106), 780 m (KU 209092–095). Cortés; Sample 6, Sierra de Omoa, west of San Pedro Sula (FMNH 4699–4711, 142147, 21820, 21829), MCZ 21295–99, UMMZ 120388, USNM 118202), Cerro Cusuco, 1650–1720 m (LACM 137298–305), 1690 m (KU 209067–070, 209107), 1580 m (KU

209040–051), 1570 m (KU 209060), 1560–1570 m (KU 209065–066), 1550 m (KU 209052–055, 209061–064), 1540–1550 m (KU 209071–075), 1530 m (KU 209056–057, 209141). Copan; Sample 7, Sierra Espíritu Santo, Montaña Cerro Azul, 1050 m (KU 209077), 1100 m (KU 209076), 1300 m (KU 209078–079), 1350 m (KU 209097). Guatemala: Zacapa; Sample 8, Sierra Espíritu Santo, La Unión, 850 m (CM 57743–44), Baja Verapaz; Sample 9, Sierra de las Minas, Aldea Vista Hermosa, 500–650 m (KU 189797–99, 189801–04). Alta Verapaz; Sample 10, Sierra de Xucaneb, Finca Volcán, 875 m (MVZ 159934).

Distribution.—Premontane and lower montane forests on the Atlantic versant of northern Honduras and adjacent eastern Guatemala (500–1720 m) (Fig. 3).

Co-occurrence and Relationships

The species *Eleutherodactylus matudai* (northwestern Guatemala), the various populations of *Eleutherodactylus milesi* (Caribbean slope Guatemala and Honduras) and the montane form *Eleutherodactylus cruzi* from above 1500 m in north-central Honduras are allopatric, although the latter ultimately may prove to be sympatric with *E. milesi*. *Eleutherodactylus chrysozetetes* is sympatric with *E. milesi* between 880–1110 m elevation on Cerro Búfalo. That three distinctive species of this group occur on Cerro Búfalo, and possibly elsewhere in the Cordillera Nombre de Dios, is almost inexplicable but perhaps reflects the stochastic influence of the orogenic factor in tropical frog evolution.

In terms of relationships the Caribbean versant species seem to form a derived cluster, as compared to *Eleutherodactylus matudai*, and have the characteristic white groin spot and reduction in distinctiveness of the tympanum. *E. matudai* lacks vocal slits which are found in adult males of Caribbean versant populations. Other features (toe webbing, fringing, and finger disk development) combine in a mosaic in the three

recognizable Caribbean slope forms. Of the three, *Eleutherodactylus chrysozetetes* is most similar to *E. matudai* in hand and foot structure but most different from it in the modification of the tympanum. Thus, while *E. matudai* seems to be the primitive sister-group (in which vocal slits have been lost) to the eastern forms, it is not possible on the basis of current data to explicate the relationships of the Caribbean versant species among themselves.

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