

## A New Diminutive Frog from Hispaniola (Leptodactylidae: *Eleutherodactylus*)

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*Eleutherodactylus thorectes* is described from the highest elevations of the Massif de la Hotte (Haiti) and placed in the *bakeri* series of the subgenus *Euhyas*. It is the smallest known species from Hispaniola and one of the smallest in the genus.

THE Massif de la Hotte lies at the end of the Haitian Tiburon Peninsula and harbors the most diverse assemblage of frogs in the West Indies. At least 26 species of *Eleutherodactylus* occur in the mountain range and 20 of those are known from the vicinity of Castillon, a village on the north slope (Schwartz, 1973; Hedges and Thomas, 1987; Hedges et al., 1987). Such diversity of *Eleutherodactylus* at a single locality rivals that of any comparable area in Central or South America.

In 1984 and 1985, C. A. Woods led a general biotic survey of the upper elevations of the Massif de la Hotte, in the vicinity of Morne Formon (2200 m) and Morne Macaya (2340 m), during which several undescribed species of *Eleutherodactylus* were collected. Among these is a very small and distinctive species found only in the highest elevations.

In the account below, the following abbreviations are used: E-N (distance between nostril and eye), EYE (horizontal diameter of eye), HW (greatest width of head), IOD (interorbital distance), MCZ (Museum of Comparative Zoology, Harvard University), SHL (shank length), THL (thigh length), and TYM (horizontal diameter of tympanum). Adults were sexed by gonadal examination. Institutional abbreviations are as listed in Leviton et al., 1985.

### *Eleutherodactylus thorectes* n. sp.

Fig. 1

*Holotype*.—UF-FSU 64545, an adult female from the crest and peak of Morne Macaya, Dépt. du Sud, Haiti (18°22'53"N, 74°01'29"W), 2200–2340 m, one of a series collected by R. Franz on 6–7 Feb. 1984.

*Paratypes* (46).—UF-FSU 64216, 64218–20, 64405–08, 64544, 64557, 64603–04, paratopotypes; MCZ 21564–66, 21568, La Hotte (=Morne Macaya?), 1515–2120 m; UF-FSU

61734–37, N facing slope of ravine on W end of Pic Macaya ridge, 2310–2320 m; UF-FSU 64209–10, basin N of west end of Morne Macaya ridge, 2270 m; UF-FSU 64365, S slope Riviere du Sud ravine (N slope Formon ridge), 1700 m; UF-FSU 64370–71, S slope Morne Formon ridge, 2100 m; UF-FSU 64393, 64571–72, ridge near campsite at Pic Formon, 2130–2270 m; UF-FSU 64403–04, N slope Morne Formon, 2100 m; UF-FSU 64425, saddle between Pic "2170" (2170 m) and Pic Formon (2200 m); UF-FSU 64542–43, saddle between Morne Formon and Morne Macaya, 1860–1900 m; UF-FSU 64546–48, 64550–51, 64556, USNM 266095–99, eastern Pic Macaya; UF-FSU 64567, 64570, ridge SE of Pic Formon, 2175 m; all localities in Dépt. du Sud, Haiti.

*Diagnosis*.—A very small species of *Eleutherodactylus* ( $\bar{x}$  adult SVL 12.2 mm [males], 14.5 mm [females]) with glandular areas (supraxillary, inguinal, and postfemoral), a short and stocky habitus, and relatively small digital tips; color pattern variable but nearly all specimens have a dark dorsal "X" and distinctive thoracic spot or marking.

*Description*.—Head as broad as body, longer than wide; snout subacuminate in dorsal view, rounded in profile, protuberant; nostrils weakly protuberant, directed dorsolaterally; canthus rostralis straight, rounded (in cross section), indistinct; loreal region flat; lips not flared; IOD greater than width of upper eyelid, no cranial crests; no supratympanic fold; tympanum superficial with non-tuberculate membrane, sexually dimorphic (larger in males; Table 1); one or two large tubercles usually present posterior to tympanum and angle of jaw; choanae round, moderate in size, not concealed by palatal shelf of maxillary arch; vomerine odontophores present in two small patches (five teeth per patch in holotype); tongue moderate in size, oval, not

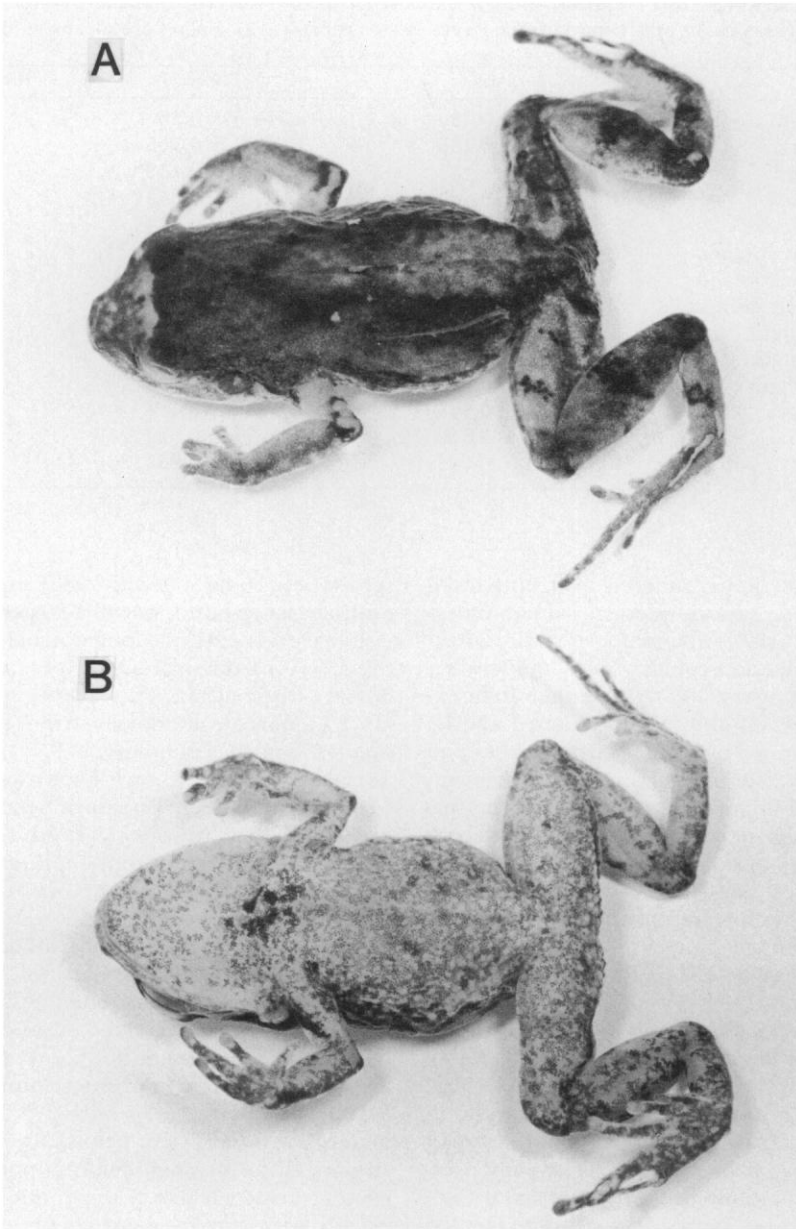


Fig. 1. *Eleutherodactylus thorectes* (UF-FSM 64545), holotype. (A) dorsum, (B) venter.

notched behind, posterior two-thirds not adherent to floor of mouth; no vocal slits (and presumably no vocal sac); liver large with a long and pointed left lobe.

Skin of dorsum relatively smooth middorsally (often one or two pairs of tubercles present) grading to tuberculate and rugose dorsolat-

erally and ventrally (venter nearly smooth in some individuals), no dorsolateral or discoidal folds; skin below vent slightly to coarsely tuberculate; anal opening not extended in sheath; supraxillary, inguinal, and postfemoral glands usually present (present in holotype); ulnar tubercles present and form a low ridge; palmar

TABLE 1. VARIATION IN SOME MEASUREMENTS OF *Eleutherodactylus thorectes* (16 MALES, 25 FEMALES [INCLUDING THE HOLOTYPE]; SAMPLE SIZE INDICATED IN PARENTHESES IF SMALLER). Values are means  $\pm$  SE (in mm).

	Males	Females	Holotype (female)
Snout-vent length	12.2 $\pm$ 0.28	14.5 $\pm$ 0.36	15.1
Head length	4.90 $\pm$ 0.135	5.82 $\pm$ 0.165	6.0
Head width	4.49 $\pm$ 0.111	5.34 $\pm$ 0.152	5.7
Tympanum	1.29 $\pm$ 0.067	1.16 $\pm$ 0.044	1.1
Eye diameter	1.90 $\pm$ 0.052	2.13 $\pm$ 0.044	2.0
Eye-naris distance	1.12 $\pm$ 0.040	1.30 $\pm$ 0.036	1.2
Internarial distance	1.46 $\pm$ 0.035	1.64 $\pm$ 0.036	1.6
Interocular distance	1.68 $\pm$ 0.056	1.93 $\pm$ 0.044	2.1
Thigh length	5.58 $\pm$ 0.146	6.56 $\pm$ 0.175	6.6
Shank length	5.65 $\pm$ 0.139 (15)	6.50 $\pm$ 0.149	6.8
Tarsal length	3.91 $\pm$ 0.128 (14)	4.52 $\pm$ 0.106	4.8
Foot length	5.25 $\pm$ 0.163 (14)	6.12 $\pm$ 0.171	6.6
Fingertip (III) width	0.43 $\pm$ 0.019 (12)	0.56 $\pm$ 0.022 (21)	0.6
Toetip (IV) width	0.44 $\pm$ 0.024 (9)	0.53 $\pm$ 0.020 (20)	0.6

tubercle single, thenar tubercle oval, both moderately distinct; supernumerary palmar tubercles distinct, variably abundant; subarticular tubercle round, non-conical, but moderately elevated; all fingers slightly to moderately expanded at tips, III and IV more than I and II; fingertips rounded or pointed; semicircular pad (specialized area of epithelium) present on ventral surface of fingertip; "u-shaped" circumferential groove bordering distal two-thirds of pad, interrupted at distal end if fingertip pointed; width of largest pad (III)  $\frac{1}{3}$ - $\frac{1}{2}$  TYM, smallest (I)  $\frac{1}{4}$ - $\frac{1}{3}$  TYM; fingers with indistinct lateral ridges; first finger shorter than second when adpressed; fingers III-IV-II-I in order of decreasing length.

Small tubercles sometimes present on heel or outer edge of tarsus (not present in holotype); outer metatarsal tubercle conical and elevated, higher than oval-shaped inner metatarsal tubercle, the latter twice as large; numerous small supernumerary plantar tubercles usually present; toes not webbed or with slight basal webbing, with lateral keels and slightly expanded tips; toetip rounded or slightly pointed; semicircular toepads with "u-shaped" circumferential groove bordering distal two-thirds; heels do not touch (or just touch) when flexed legs are held at right angles to sagittal plane.

In alcohol, dorsal ground color is tan, brown, or dark brown; dorsal body markings variable, usually with poorly-defined dark brown mottling or blotches and nearly all specimens show traces of a dark scapular "X" (e.g., Fig. 1); pat-

tern types (Hedges et al., 1987) superimposed on that background, out of 33 specimens with visible pattern, include long dorsolateral stripes (39.3%), long dorsolateral stripes/narrow middorsal stripe (21.2%), reverse parentheses (15.2%), narrow middorsal stripe (9.1%), scapular "X" only, as in holotype (9.1%), wide middorsal stripe (6.1%); dark brown or black eye stripe usually present on side of head, consisting of a canthal bar (just below canthus and sometimes poorly defined) and supratympanic bar (extending from behind the eye to just above insertion of arm); upper and lower lips with or without dark brown spots or other markings; dorsal surface of head (snout) pale or light brown and usually lighter than body although often with brown markings; dark interocular bar or triangle usually present but poorly defined, the apex of the triangle (if present) joining with the anterior half of the scapular "X"; tympanic membrane usually clear below but with variable amounts of brown pigment on upper edge and center; dorsal surface of upper and lower arms usually with brown markings or mottling but rarely forming distinct bands; anterior dorsal surface of upper arm usually with dark brown or black blotch which forms a continuation of the eye stripe; dorsal surface of thighs usually with one or more indistinct brown transverse bars; dorsal surface of shank and foot usually with a single indistinct dark brown transverse bar each; ventral ground color variable (yellow, gray, brown, or dark brown) with variable amounts of brown spotting or mottling; nearly

all specimens with a distinctive thoracic spot or marking, dark-edged, light in the center, of variable shape and irregular in outline, visible as a dark thoracic spot or spots in individuals with light venters, or a light thoracic spot (or midgular line) in individuals with dark venters; ventral surface of limbs variable but patterned similarly to belly; glandular areas (if present) usually orange or yellow; testicular peritoneum dark brown or black. No information available on color in life.

Measurements of all known specimens (except UF-FSU 64405 and 64408 which are desiccated, and MCZ 21564–66, 21568, which are poorly preserved) are summarized in Table 1 along with the individual measurements of the holotype.

*Etymology*.—From the Greek; *thorektes*, warrior armed with a breastplate; in allusion to the distinctive thoracic spot present on most individuals of this species.

*Comparisons*.—Except for *E. limbatus*, placed in the genus *Sminthillus* until recently (Bogart, 1981; Hedges, 1988), and possibly *E. cubanus*, *E. thorectes* is the smallest known *Eleutherodactylus* (ca. 450 species). The males of two Jamaican species, *E. griphus* and *E. sisypodemus* (Crombie, 1977, 1986) are nearly as small, although the females are considerably larger than females of *E. thorectes*. In Hispaniola, the next largest species are *E. glanduliferoides* and *E. haitianus*.

The South Island (Hispaniola south of the Cul de Sac/Valle de Neiba) species, *E. glanduliferoides* ( $\bar{x}$  SVL = 15 mm [males], 16 mm [females]), inhabits the Massif de la Selle and has a more pointed snout than *E. thorectes*. Also, it has a relatively smooth venter and a unique dorsal pattern (present in all known individuals) of a narrow light middorsal stripe on a wide tan middorsal band, the latter bordered by two long dark brown dorsolateral stripes. The North Island species, *E. haitianus* ( $\bar{x}$  SVL = 14 mm [males], 15 mm [females]), most closely resembles *E. thorectes* in habitus (short, stocky), and ventral skin texture (tuberculate) but differs in having an external vocal sac and lacking glandular areas.

In the Massif de la Hotte, species that might be confused with *E. thorectes* are young individuals of *E. amadeus*, *E. audanti*, *E. breviostris*, and *E. ventrilineatus*. All four are high elevation species with small or slightly enlarged digital

tips, and have been collected with *E. thorectes* or nearby. *Eleutherodactylus amadeus* ( $\bar{x}$  SVL = 19 mm [males], 23 mm [females]) can be distinguished by its relatively smooth dorsal and ventral skin texture, generally lighter ventral coloration, and absence of a scapular "X." *Eleutherodactylus audanti* ( $\bar{x}$  SVL = 18 mm [males], 23 mm [females]) is surprisingly uncommon in the Massif de la Hotte in contrast to its abundance throughout the La Selle range. Nonetheless, it is known from Formon Ridge (1650 m) very near an *E. thorectes* locality and thus the two species may overlap. Both *E. thorectes* and *E. audanti* have a scapular "X," although the latter species can be distinguished by its pattern of flank bars, lack of glandular areas, and presence of an external vocal sac in males. *Eleutherodactylus breviostris* ( $\bar{x}$  SVL = 24 mm [males], 27 mm [females]) is a very dark and rugose species with a short snout and usually with a series of dorsal tubercles (and corresponding pattern) that form a "W." *Eleutherodactylus ventrilineatus* ( $\bar{x}$  SVL = 28 mm [males], 32 mm [females]) can be distinguished by its very small digital tips (none are expanded) and dark coloration above and below, occasionally with a light midventral line. Distinguishing characteristics of other La Hotte species less likely to be confused with *E. thorectes* are given in Schwartz (1973), Hedges and Thomas (1987), and Hedges et al. (1987). As mentioned above, *E. thorectes* can also be distinguished from all La Hotte species by its very small size and thoracic spot.

*Natural history*.—*Eleutherodactylus thorectes* appears to be restricted to the highest elevations of the Massif de la Hotte, with most specimens collected on the peaks of Morne Formon (2200 m) and Morne Macaya (2340 m). All localities are above 1700 m. This region is characterized by pine (*Pinus occidentalis*), woody shrubs, tree ferns, bromeliads, and in disturbed areas, climbing bamboo (R. Franz and D. Cordier, unpubl.). Specimens were found in rotten logs, in sphagnum, under pine needles, and under decaying leaves on the ground. Although information associated with two specimens (UF-FSU 64542–43) states that they were collected "in bromeliads and along trail," other collecting data associated with that locality indicates that the reference to bromeliads was for a single individual of another species. Thus, it appears from collecting notes that *E. thorectes* is terrestrial, which agrees with its short and stocky habitus, and

digital tips which are only slightly to moderately enlarged.

*Reproduction.*—All but three of 30 females have enlarged follicles, enlarged and convoluted oviducts, and/or were gravid. Gravid females are present in collections from all 4 mo sampled (Jan., Feb., June, and Sept.) indicating that reproduction in this species is probably continuous. Of two females dissected, one (UF-FSU 64550) had three large (2.0–2.1 mm) ovarian follicles and the other (UF-FSU 64548) had two large follicles and one oviducal egg (2.1 mm). Clutch size in this species (3) is thus one of the smallest of any oviparous amphibian, not surprising considering its very small body size. The slightly smaller Cuban species, *E. limbatus*, has a clutch size of one (Noble, 1931). No information is available on vocalization in *E. thorectes*.

*Remarks.*—Most endemic South Island species of the genus *Eleutherodactylus* have been placed in the subgenus *Euhyas*, a western Caribbean clade of 78 species (Hedges, 1988). In addition to electrophoretic similarities, species in this large assemblage of primarily terrestrial frogs typically have livers with a long left lobe, long vomerine tooth rows, glandular areas (supraxillary, inguinal, and/or postfemoral), small digital tips, and lack a median, subgular, external vocal sac. None of the above traits alone is found in all species of this group and thus a combination of characters is usually necessary to allocate species. Although *E. thorectes* does not have long vomerine tooth rows, it does possess the other four traits associating it with the subgenus *Euhyas* (no tissue or blood samples are available from *E. thorectes* for biochemical comparisons).

A group of species within the subgenus *Euhyas*, the *bakeri* series, have similar pattern polymorphisms (Hedges et al., 1987) and occur primarily in the La Hotte range. They are: *E. amadeus*, *E. bakeri*, *E. eunaster*, *E. glanduliferoides*, *E. glaphycompus*, *E. heminota*, *E. semipalmatus*, and several undescribed species. The pattern types present in *E. thorectes* are found in species of the *bakeri* series and several species in that series have short vomerine tooth rows (like *E. thorectes*). *Eleutherodactylus thorectes* is therefore placed in the *bakeri* series of the subgenus *Euhyas*.

Some species of West Indian *Eleutherodactylus* appear to have converged on similar morphologies and ecologies (Hedges, 1988). Among the

different convergent types, *E. thorectes* can be placed in the small terrestrial montane ecomorph (Hedges, 1988 [*E. thorectes* = sp. nov. "T"]). Other members of this ecomorph are *E. haitianus* (Hispaniola—North Island), and probably *E. alticola* (Jamaica). All three are small, high-altitude species with a short and stocky habitus, moderately to coarsely rugose and tuberculate skin, small digital tips, and terrestrial habits.

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## The Genus *Heptapterus* (Teleostei, Pimelodidae) in Southern Brazil and Uruguay, with the Description of a New Species

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The species of the genus *Heptapterus* Bleeker (1858) in Uruguay and in the Brazilian states of Rio Grande do Sul and Santa Catarina are reviewed. Characters previously considered diagnostic for the genus are discussed. The monotypic genus *Phreatobius* Goeldi (1905) is a junior synonym of *Heptapterus*. *Heptapterus sympterygium* n. sp. is described from the coastal plains of Rio Grande do Sul. This species has the anal and caudal fins connected, a feature shared only with *H. cisternarum* (Goeldi, 1905). *Heptapterus eigenmanni* Steindachner (1907) is a junior synonym of *H. mustelinus* (Valenciennes, 1835). Four other unidentified species are recorded from drainages between Rio Grande do Sul and Santa Catarina.

A ocorrência de espécies do gênero *Heptapterus* Bleeker (1858) no Uruguai e nos estados brasileiros do Rio Grande do Sul e Santa Catarina é revisada. Discutem-se os caracteres anteriormente considerados diagnósticos do gênero. O gênero monotípico *Phreatobius* Goeldi (1905) é um sinônimo júnior de *Heptapterus*. *Heptapterus sympterygium* sp. n. é descrita para a planície costeira do Rio Grande do Sul. Esta espécie possui as nadadeiras anal e caudal interconectadas, característica esta ocorrente apenas em *H. cisternarum* (Goeldi, 1905). *Heptapterus eigenmanni* Steindachner (1907) é considerada sinônimo de *H. mustelinus* (Valenciennes, 1835). Registra-se a ocorrência nas bacias hidrográficas situadas na região entre o Rio Grande do Sul e Santa Catarina de quatro outras espécies ainda não identificadas.

**D**URING a study of the pimelodid genus *Heptapterus* Bleeker (1858) an undescribed species was found in the eastern drainages of Rio Grande do Sul, Brazil. It has the anal and caudal fins connected, an unusual feature for the family. This new species is described below, and characters previously considered diagnostic for *Heptapterus* are discussed in connection with the generic position of the new species, as well as of *Phreatobius cisternarum* Goeldi, 1905, the only other pimelodid with united anal and caudal fins.

For the present study it was also necessary to verify the accuracy of the original description of the nominal *H. eigenmanni* Steindachner (1907), which has the number of anal-fin rays within the range of the new species. Examination of the type material and a collecting expedition to the type locality showed that *H. eigenmanni* is a junior synonym of *H. mustelinus* (Valenciennes, 1835). New data on geographical variation of *H. mustelinus* are further discussed below. In addition, four other undescribed species of *Heptapterus* were found