

The cave habitat in which all specimens were collected was typically a small crevice (one to two meters deep) along a vertical wall of the deep reef, Oahu, Hawaii. Perhaps it is significant that these shallow pockets did not house holocentrids or priacanthids. Caves containing the latter were inspected for *Trimma taylori* but none were found. Sympatric cave inhabitants which were conspicuous included a prawn, *Stenopus* (an undescribed species) and the fishes *Pterois sphex* (Scorpaenidae), *Apogon maculiferus* (Apogonidae), *Gymnothorax* spp. (Muraenidae), an undescribed species of *Quisquilius* (Gobiidae), Scorpaenid sp., and *Pseudanthias* sp. (Serranidae-Anthiinae). Of these fishes, only *Pterois sphex*, *Gymnothorax* spp. and *Apogon maculiferus* seem likely potential predators of *T. taylori*.

Trimma taylori feeds on harpacticoid copepods. Eight specimens were examined for gut contents and three of these were empty.

KEY TO THE NOMINAL SPECIES OF TRIMMA

1. a. Predorsal scales on nape 2
b. No scales on nape 5
2. a. Dorsal fin with 8 rays 3
b. Dorsal fin with more than 8 rays 4
3. a. Gill raker on first arch 3+1+16 *T. caesiura*
b. Gill raker on first arch 3+1+13 or 14 *T. naudei*
4. a. Dorsal fin VI–II0, Pectoral 14 *T. taylori*
b. Dorsal fin VI–I9, Pectoral 13 *T. tevegae*
5. a. Pectoral fin with fewer than 19 rays 6
b. Pectoral fin with 19 rays *T. coralinus*
6. a. Pectoral fin with 17 rays 7
b. Pectoral fin with fewer than 17 rays 8
7. a. Body with eight dark bars or saddles *T. eviotops*
b. Body without bars or saddles *T. flammeus*
8. a. Pectoral with 15 rays, 11 scales transverse series *T. grammistes*
b. Pectoral with 16 rays, 9 scales transverse series *T. macrophthalma*

SUPPLEMENTARY KEY TO HAWAIIAN GOBIID FISHES

1. a. pelvic fins separate (no frenum) 2
b. pelvic fins united to form a cup See Gosline and Brock 1960, p. 266
2. a. each scale with a dark crescent shaped mark, no spines on the preopercle 3
b. no markings on scales, head compressed, 3 to 5 spines on the preopercle ..
..... *Asterropteryx semipunctatus*
3. a. no predorsal scales on nape *Eviota epiphanes*
b. predorsal scales on nape present *Trimma taylori*

TABLE 2
Comparison of the Nominal species of *Trimma*

Nominal Species	Author	Dorsal fin	Anal fin	Pectoral fin	Pelvic fin	Longitudinal scales
<i>T. caesiura</i> ¹	Jordan and Seale 1906	VI-I,8	I,8	15	I,5	23-25
<i>T. coralinus</i>	(Smith 1959)	VI-I,10	I,9	19	—	30
<i>T. eviotops</i>	Schultz 1943	VI-I,9-10	I,8-9	17	I,5	26-27
<i>T. flammeus</i>	(Smith 1959)	VI-I,9-10	I,8-10	17	—	26-36
<i>T. grammistes</i> ²	(Tomiyama 1936)	VI-I,10	I,9	15	I,5	30
<i>T. macrophthalma</i> ²	(Tomiyama 1936)	VI,I,9	I,9	16	I,5	23
<i>T. naudei</i>	Smith 1956	VI-I,8	I,8	16	—	24-25
<i>T. taylori</i>	n.sp.	VI-I,10	I,10	14	I,5	22-23
<i>T. tevegae</i>	Cohen and Davis 1969	VI-I,9	I,9	13	I,5	28

¹I examined 21 specimens for additional counts.

²Pectoral fin count from drawing with description.

TABLE 2

Comparison of the Nominal species of *Trimma*

Scale Transverse	Gillrakers on first arch	Vertebrae	Locality	Live Coloration
6-7	3-1-16	25	Samoa	Plain bright red with grey spots on back of tail and grey spots on many scales of back and head. Fins all bright red.
10-11	3+1+10	—	Seychelles	Body red with two silvery areas on back below first, and three below second dorsal fin. Orange spots on head and peduncle. Rays red with pink membrane.
8-9	3+1+11-12	25	Phoenix & Samoan Islands	Pale with eight vertical bars, saddles on head and body.
8-9	3+1+11-12	—	Australia & S. Africa	Light orange with darker spots; edge of soft dorsal and caudal, dusky.
11	—	—	Japan	Longitudinal dark bands.
9	—	—	Japan	(not described)
8	3+1+13-14	—	Seychelles	Body and fins brilliant orange-scarlet, irregularly mottled with iridescent light areas; dorsal fin with two light pink bars between the orange.
7	3+1+12-14	25	Hawaii	All straw yellow with orange-red and dark pigment spots on head.
7	—	25	New Britain	(Live body color not described) Dark reddish spot at end of caudal peduncle.

NOTE: *Asterropteryx semipunctatus* and *Eviota epiphanes* were placed in the Eleotridae by Gosline and Brock (1960). However, the only eleotrid in Hawaii is *Eleotris sandvicensis*, which is restricted to freshwater. It can be easily distinguished from the gobies. *E. sandvicensis* possesses about 75 scales in longitudinal series whereas gobies generally have less than 30 longitudinal scales. In addition, eleotrids are primarily freshwater and have six branchiostegal rays; gobies are mostly marine and have five branchiostegal rays. There are 21 other gobies presently known in the Hawaiian Islands.

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**TWO NEW SPECIES OF *ELEUTHERODACTYLUS*
(AMPHIBIA: LEPTODACTYLIDAE)
FROM THE LOWLANDS AND
LOWER CLOUD FORESTS OF
WESTERN ECUADOR**

JOHN D. LYNCH¹ AND KENNETH MIYATA²

ABSTRACT: *Eleutherodactylus muricatus* sp. nov., an ally of the large, flare-snouted frogs of the *rubicundus* assembly, is named from lowland and lower cloud forest localities in Provincia Pichincha, Ecuador. The new species is smaller than its sympatric allies *E. crenunguis* and *E. latidiscus*. *Eleutherodactylus tenebrionis* sp. nov., is also found in primary lowland and lower cloud forests in west-central Ecuador. It is allied to a species found in the high cloud forests in western Ecuador but differs in color pattern and lacks a calcar and ulnar tubercles.

INTRODUCTION

Approximately 15 species of *Eleutherodactylus* inhabit the Pacific lowlands of Ecuador (Lynch, in press) and perhaps another 40 species are found in the cloud forests of the Pacific versant in the Ecuadorian Andes. Most of these frogs are small organisms (less than 35 mm SVL) but two members of the *rubicundus* assembly [*Eleutherodactylus crenunguis* Lynch and *E. latidiscus* (Boulenger)] are much larger species having long, slender limbs and digits and large emarginate (or notched) digital pads.

Our field work in western Ecuador over the past several years has revealed that *crenunguis* is a frog of the lower cloud forests (800–1500 m) and is not an altitudinal replacement for *latidiscus* (20–1500 m). In the course of this field work two additional species having notched or indented digital pads were found in sympatry

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with both of the larger species. In spite of sharing the notched pads, only one of these species seems allied to the *rubicundus* assembly as defined by Lynch (1979). The other species appears to be most closely allied to a species found in the high cloud forests of western Ecuador (Lynch and Trueb, in press).

The format of the descriptions follows Lynch's long-used style. Abbreviations employed below include the following: SVL — snout-vent length; HW — head width; IOD — interorbital distance; E-N — eye to nostril distance.

Eleutherodactylus muricatus sp. nov.

Holotype: MCZ 94469, an adult male collected at the Río Faisanes where it is crossed by Ecuador Highway 28 (the road from La Palma to Quito via Chiriboga), 14.4 km from the junction with Highway 30 (the Aloag to Santo Domingo de los Colorados road) at La Palma, Provincia Pichincha, Ecuador, 1380 m, on 12 November 1977 by Ken Miyata.

Paratypes. MCZ 92091, 92095, 92100-01, 94848, 97528-31, USNM 211172-74, topotypes; MCZ 97592, Centinela, 14.1 km SE Patricia Pilar by road, Provincia Pichincha, 570 m; MCZ 90337, 94456, 94460, Centro Científico Rio Palenque, 47 km S Santo Domingo de los Colorados, Provincia Pichincha, 220 m.

Diagnosis. 1) skin of dorsum smooth with numerous conical tubercles, that of venter feebly areolate; no dorsolateral folds; no anal sheath; 2) tympanum moderately distinct, its length $\frac{1}{4}$ eye length; 3) snout subacuminate in dorsal view, rounded in lateral profile; canthus rostralis moderately distinct; 4) upper eyelid much wider than IOD, bearing many conical warts; no cranial crests; 5) vomerine odontophores large, triangular in outline, narrowly separated; 6) males with vocal slits, subgular vocal sac; no nuptial pads; 7) first finger shorter than second; all digits bearing broad discs, pads on fingers II-IV, those of III and IV notched; 8) fingers bearing lateral keels; 9) 1-2 small ulnar tubercles; 10) one large conical tubercle on heel; low tubercles along outer edge of tarsus; short inner tarsal fold; 11) two metatarsal tubercles, inner elongate, 10 times size of round, subconical outer; supernumerary plantar tubercles at base of toes; 12) toes bearing lateral fringes, not webbed; toe

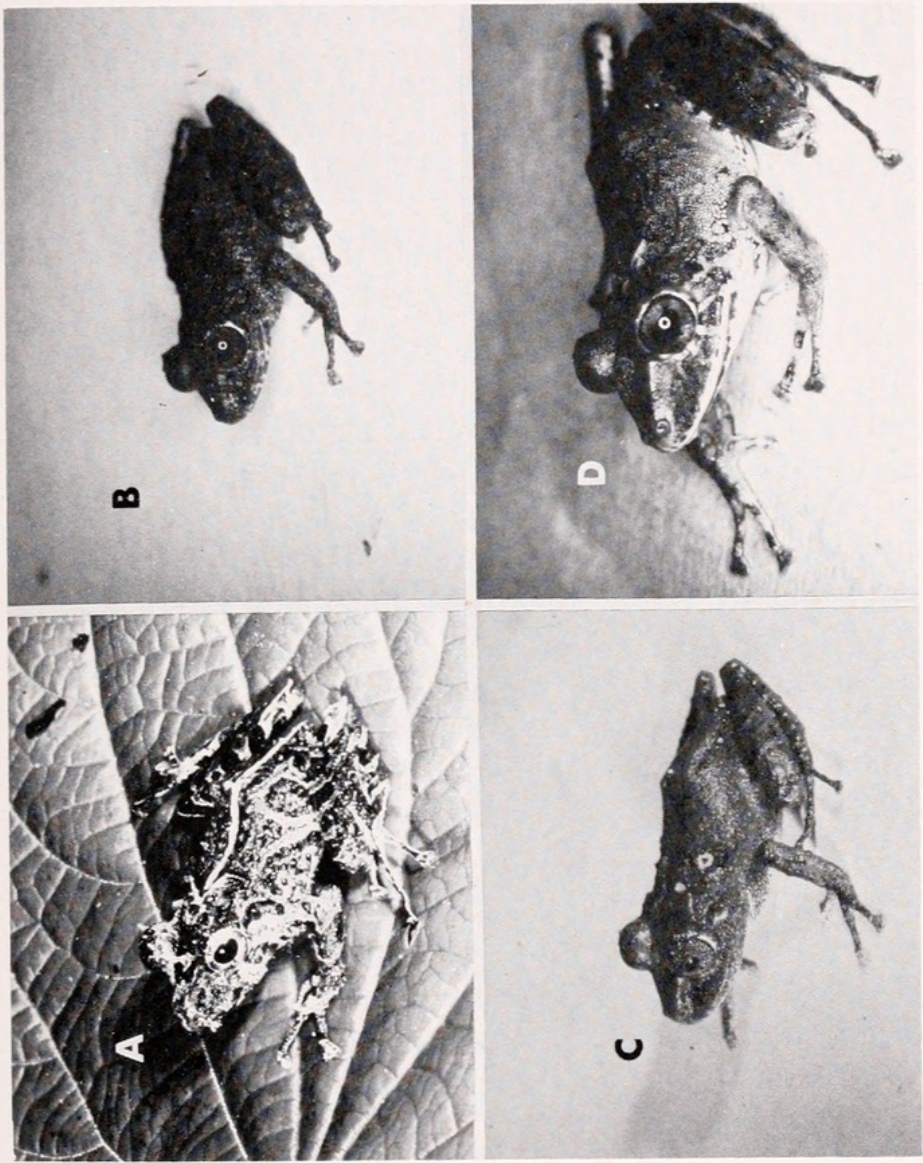


Figure 1. (A) *Eleutherodactylus muricatus*, MCZ 94456, 33.8 mm SVL; (B) *E. tenebrionis*, KU 146171, 36.9 mm SVL; (C) *E. tenebrionis*, KU 179224, 30.6 mm SVL; (D) *E. latidiscus*, KU 131612, 45.1 mm SVL.

pads notched, smaller than those of outer fingers; 13) dorsum brown with black spots; ventral surfaces brown with cream flecks; slightly darker brown chevrons on throat; posterior surfaces of thighs brown; 14) adults from type-locality moderate-sized, males 31.8–40.7 (\bar{x} = 36.0, n = 4) mm SVL, one female 46.3 mm SVL; two gravid females from the lowlands (Centinela and Rio Palenque) are only 33.8–36.0 mm SVL.

Eleutherodactylus muricatus is most similar to *E. crenunguis* but differs in coloration (no orange patch on the breast) and in having fewer, larger tubercles on the dorsum (Fig. 1). It is also smaller than *E. crenunguis* (Lynch 1976).

Description. Head as wide as or wider than body, wider than long: HW 37.1–39.9 (\bar{x} = 38.4, n = 7) per cent SVL; snout subacuminate in dorsal view, rounded in lateral profile; nostrils weakly protuberant, directed dorsolaterally; canthus rostralis relatively sharp (swollen), straight or weakly convex; loreal region concave, sloping gradually to lips; lips flared; E–N 80.7–100.0 per cent (\bar{x} = 89.4, n = 7) eye length; upper eyelid 100.0–132.3 per cent (\bar{x} = 119.7, n = 7) IOD, bearing many pungent tubercles; no cranial crests; supratympanic fold moderately distinct, obscuring upper edge of tympanum; tympanum not prominent, round, separated from eye by distance equal twice tympanum length; tympanum length 22.0–27.9 (\bar{x} = 25.1, n = 6) per cent eye length except in MCZ 94456 (small female from Rio Palenque has ratio of 37.5 per cent); postriotal tubercles present, not prominent; choanae round, not concealed by palatal shelf of maxillary arch; vomerine odontophores median and posterior to choanae, large, triangular in outline, separated on midline by distance less than $1/3$ an odontophore width, each larger than a choana, bearing 5–12 teeth in a transverse row; tongue longer than wide, its posterior edge notched; posterior $1/3$ not adherent to floor of mouth; males with vocal slits posterolateral to tongue, median subgular vocal sac.

Skin of dorsum smooth but bearing many warts, most numerous on lower back (where skin is tuberculate); many elongate, subconical warts on flanks; no dorsolateral folds; no anal sheath; skin posterior and posterolateral to anus areolate but also bearing conical warts; skin of throat areolate, that on other ventral surfaces smooth with very feeble areolations; discoidal folds well anterior to groin; one or two small ulnar tubercles; palmar tubercle bifid, larger

than oval thenar tubercle; several prominent supernumerary palmar tubercles; subarticular tubercles round, pungent; fingers bear lateral keels; all digits with pads, that of thumb scarcely wider than digit below pad, on II twice as wide, on III–IV three times as wide (wider than tympanum); pads of fingers III–IV notched apically; discs on all pads broader than long; fingers long, first slightly shorter than second; thumb of male lacking nuptial pad or swelling.

Numerous tubercles on heel, one large conical tubercle (not a calcar); low tubercles along outer edge of tarsus; short fold at base of inner metatarsal tubercle which is three times as long as wide, 10 times size of round, subconical outer metatarsal tubercle; supernumerary plantar tubercles at bases of each toe; subarticular tubercles longer than wide, pungent; toes bearing distinct lateral fringes, broad discs, expanded pads; pads notched apically, smaller than those of outer fingers; heels of flexed hind limbs broadly overlap; shank 54.7–62.2 per cent (\bar{x} = 58.4, n = 7) SVL.

Brown above with black spots enclosing tubercles; bars evident on thighs but remainder of pattern (limbs, labial bars, canthal-supratympanic stripe, dorsal chevrons, etc.) only suggested by black spots; venter brown with cream flecks and small spots; inverted brown chevrons on chin and throat; undersides of limbs and groin brown with cream flecks; anterior and posterior surfaces of thighs brown with cream flecks. In small individuals, ground color gray and with evident shank bars (narrow and oblique), labial bars, and canthal-supratympanic stripe.

In life, *E. muricatus* from the type locality are pale to dark brown with black rings around large tubercles; flanks paler brown with yellowish wash; venter dark purplish-brown with yellow-brown mottling; iris gold flecked with black. Lowland specimens lack the black rings around the tubercles; the venter is a muddy yellow mottled with dark brown; the lower flanks, groin, and underside of the limbs have a purplish-brown wash; the iris is copper. The above color descriptions apply to daytime patterns; at night all individuals are much paler in dorsal coloration, ranging from pale buff to olive brown, but the various markings remain intact.

Measurements of holotype (in mm). SVL 32.3; shank 20.1; HW 12.5; head length 11.6; upper eyelid 2.9; IOD 2.9; tympanum length 1.0; eye length 4.3; E-N 3.9.

Etymology. The specific epithet is derived from the Latin, meaning spiny, in reference to the pungent tubercles on the dorsum and upper eyelid.

Variation. The two adult females from low elevations (MCZ 94456 from Río Palenque, 220 m, and MCZ 97592 from Centinela, 570 m) are much smaller than the only adult female from the type-locality. They are also peculiar (Fig. 1) in having prominent vertebral stripes which are yellow-cream to buffy orange in life. All of the material from the lower elevations has venters more pale than the topotypic material; in life the ventral surfaces of the topotypic population are predominantly brown with some yellowish mottling while those of the low elevation populations are predominantly yellowish with brown mottling. The lowland populations also have more prominent tubercles on the eyelids and dorsum. All of these differences are rather minor and probably represent slight geographical or altitudinal variation. We are taking a conservative approach in assigning all of these specimens to the same taxon; further work may well prove we have confused two species.

Remarks. Adults of *E. crenunguis* and *E. latidiscus* are seldom encountered. No adult females of *E. crenunguis* have been found, although juvenile females to 41.3 mm have been examined, and adult males range in size from 35.0 to 49.2 mm SVL. Very few adults of *E. latidiscus* are available even though juveniles are often quite common. Three males with vocal slits are 43.9–50.0 mm SVL and four females having convoluted oviducts are 49.7–64.5 mm SVL. Both of these frogs are considerably larger than the sympatric *E. muricatus*.

Natural History. *Eleutherodactylus muricatus* from the type-locality have been collected on streamside vegetation within 1.5 m of the water surface. Several specimens were taken on logs just above water level, but the majority were perched on large leaves adjacent to the stream. For a description of the type-locality see Miyata (in press). Individuals are found in low density on most nights at this locality.

The lowland specimens have all been taken from primary forest or, in the case of the Centinela specimen, from very recently eut primary forest. The Río Palenque specimens were taken from low vegetation in forest with a dense canopy on rainless nights.



Lynch, John D. and Miyata, Kenneth. 1980. "Two new species of Eleutherodactylus (Amphibia: Leptodactylidae) from the lowlands and lower cloud forests of western Ecuador." *Breviora* 457, 1–12.

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