



Despite extensive herpetofaunal studies in the small Mesoamerican country of Costa Rica for well over a century, important discoveries still await. The recently described species of fringe-limbed treefrog, *Ecnomiohyla bailarina*, which was known only from the holotype collected in the Darién region of extreme eastern Panama, has been discovered at a second site approximately 750 terrestrial kilometers to the northwest in the southeastern Caribbean foothills of Costa Rica. 📷 © Brian Kubicki



Discovery of the Golden-eyed Fringe-limbed Treefrog, *Ecnomiohyla bailarina* (Anura: Hylidae), in the Caribbean foothills of southeastern Costa Rica

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ABSTRACT: We report on the discovery of three specimens of the recently described fringe-limbed treefrog, *Ecnomiohyla bailarina*, from the southeastern Caribbean foothills of Costa Rica; previously, this species was known only from the male holotype collected in the Darién region of extreme eastern Panama. The discovery of *E. bailarina* in Costa Rica represents a new country record and extends the species' known range approximately 750 terrestrial kilometers to the northwest. Additionally, we present a detailed morphological description of the three Costa Rican specimens, including unreported sexually dimorphic characters from a female specimen, describe the advertisement call, and shed more light on the natural history of this enigmatic species.

Key Words: Advertisement call, Limón Province, natural history, new country record, sexual dimorphism, Cordillera de Talamanca

RESUMEN: Reportamos el descubrimiento de tres especímenes del sureste de la vertiente caribeña de Costa Rica de la rana arborícola recientemente descrita *Ecnomiohyla bailarina*, la cual fue conocida solamente del holotipo colectado en Darién, región este de Panamá. El descubrimiento de *E. bailarina* en Costa Rica representa el primer registro en el país y una extensión del rango de la especie en unos 750 kms terrestres hacia el noroeste. Adicionalmente presentamos una detallada descripción morfológica de los tres especímenes de Costa Rica, incluyendo un reporte de las características de dimorfismo sexual del espécimen hembra, se describe el canto y más información sobre la historia natural de esta especie enigmática.

Palabras Claves: Canto, dimorfismo sexual, historia natural, nuevo registro del país, Provincia de Limón, Cordillera de Talamanca

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INTRODUCTION

The fringe-limbed treefrogs of the genus *Ecnomiohyla* are some of the most mysterious and elusive anurans in the Neotropics. These frogs typically inhabit the mid- to upper strata of mature humid forests, but at times individuals can be found in the lowest stratum of the forest. Relatively little information is available on the life history of most species, although in recent years some accounts have shed more light on the biology of these enigmatic frogs. The evidence suggests that members of this genus breed in water-filled cavities in standing trees, and that females provide parental care to the larvae (Duellman, 2001; McCranie and Wilson, 2002; Savage, 2002; Mendelson et al., 2008; Savage and Kubicki, 2010; Hoffmann and Kubicki, 2011).

Due to their apparent preference for inhabiting the canopy of mature humid forests, members of the genus *Ecnomiohyla* are observed infrequently and only rarely collected, resulting in the following species being described from a single type specimen: *Hypsiboas milarius* Cope, “1885” 1886; *Hyla phantasmagoria* Dunn, 1943; *Hyla fimbrimembra* Taylor, 1948; *Hyla valancifer* Firschein and Smith, 1956; *Hyla echinata* Duellman, 1961; *Hyla thysanota* Duellman, 1966; *Ecnomiohyla veraguensis* Batista et al., 2014; and *Ecnomiohyla bailarina* Batista et al., 2014. The genus *Ecnomiohyla* was proposed by Faivovich et al. (2005), and currently consists of 14 species with a collective distribution ranging from southern Mexico, through Central America, and into Colombia and Ecuador (Frost, 2015).

Herein we report the discovery of three additional specimens of *Ecnomiohyla bailarina*, from the Caribbean foothills of southeastern Costa Rica; previously this species was known from a single specimen, the male holotype, collected in the Darién region of extreme eastern Panama.

MATERIALS AND METHODS

We obtained three specimens of *Ecnomiohyla bailarina* during field explorations in a remote section of old-growth forest in the Caribbean foothills of the Cordillera de Talamanca in southeastern Costa Rica in October and November of 2013. The site lies within the Tropical Humid Forest life zone (Holdridge 1967), at an elevation of approximately 300 m a.s.l.

We measured the three specimens of *E. bailarina* from southeastern Costa Rica (UCR 22287, UCR 22288, and CRARC 0094) with a ROHS NORM 2002/95/EC digital caliper, rounded to the nearest 0.1 mm, as follows: snout–vent length (SVL), internarial tip of the snout to the posterior edge of cloacal opening; head length (HL), posterior edge of the jaw articulation to the internarial tip of the snout; head width (HW), greatest width of head, at the posterior edge of the jaw articulation; length of crus (TI), outer edge of the flexed knee articulation to the opposing outer edge of the flexed tibiotarsal articulation; foot length (FL), proximal edge of the inner metatarsal tubercle to the tip of Toe IV; hand length (HaL), proximal edge of the prepollex to the tip of Finger III; interorbital distance (IOD), distance between the inner margins of the orbits; eye–naris distance (END), posterior margin of naris to the anterior margin of the orbit; width of disc on Finger III (DW); forearm length (FoL), proximal edge of the prepollex tubercle to the exterior margin of the flexed elbow articulation; tarsus length (TaL), proximal edge of the inner metatarsal tubercle to the exterior margin of the flexed tibiotarsal articulation; eye length (EL), the greatest horizontal length of the orbit between the anterior and posterior margins; and tympanic annulus diameter (TyD), greatest diameter between the anterior and posterior margins of the tympanic annulus. We indicated the following as a percentage of SVL: head length; head width; length of crus; length of foot; hand length; interorbital distance; eye–naris distance; forearm length; and tarsus length. We noted the following as a percentage of eye length: width of disc on Finger III; and tympanic annulus diameter.

Our webbing formulae follow those of Savage and Heyer (1967), as modified by Myers and Duellman (1982) and Savage and Heyer (1997). For descriptive purposes, we follow the webbing coverage on the hands and feet as in Mendelson et al. (2008) and Savage and Kubicki (2010): considerable = not extending to base of disc on one margin of any digit; substantial = extending to base of disc on one margin of one digit; extensive = extending to base of disc on one margin of two to four digits; and full = extending to base of disc on margins of all digits. The specimens are deposited in the Museo de Zoología, Escuela de Biología, Universidad de Costa Rica (UCR 22287 and UCR 22288), and the Costa Rica Amphibian Research Center (CRARC 0094). All photographs in the figures were taken by BK.

DIAGNOSIS AND SPECIMEN ANALYSIS

Ecnomiohyla bailarina Batista et al., 2014

(Costa Rican individuals, Figs. 1, 2)

Common Name: We propose the common name “Golden-eyed Fringe-limbed Treefrog” due to the bright yellow ground color of the iris in the four known specimens.

Diagnosis Based on Costa Rican Specimens and the Panamanian Holotype: A moderate-sized species of the genus *Ecnomiohyla*, adult males (n = 3) 58.6–68.1 mm SVL, only known female 57.8 mm SVL. This species differs from other members of the genus by a combination of the following characteristics: (1) extensive interdigital webbing on the hands (Fig. 3), with the webbing reaching the base of the disc on one margin of fingers II and IV; (2) feet extensively webbed (Fig. 3), with the webbing reaching the base of disc on one margin of toes I, II, III, and V; (3) skin on the dorsal surfaces of the head, body, and limbs highly tuberculate (Fig. 4); (4) skin on the venter lacking black keratinized tips on granulations (Fig. 4); (5) osteoderms present in the skin on the cranial and dorsal surfaces of the body (Fig. 5); (6) skin on top of the head not co-ossified; (7) prepollex with a bony prepollical projection, either bluntly rounded or forming a blunt point; (8) adult males with black keratinized spines present in two larger clusters, one at the dorsolateral tip of the prepollical projection and the other at the dorsolateral base of Finger I (Fig. 6A), females lack black keratinized spines on prepollex and base of Finger I (Fig. 7); (9) humerus lacking an enlarged *crista lateralis*; (10) fleshy fringe along the ventrolateral margin of the forearm and foot with widely spaced and pointed triangular projections; (11) fleshy tarsal fringe continuing onto the heel, becoming a cluster of several pointed fleshy tubercles (Fig. 6B); (12) vocal slits absent; and (13) dorsal surface mottled with green, red-brown, and darker markings, with individuals capable of undergoing considerable metachrosis.



Fig. 1. *Ecnomiohyla bailarina*, adult male (UCR 22287).



Fig. 2. *Ecnomiohyla bailarina*, adult female (UCR 22288).



Fig. 3. *Ecnomiohyla bailarina*, hand and foot of male (UCR 22287).



Fig. 4. Full body ventral and dorsal views (UCR 22287).



Fig. 5. Dorsal view showing osteoderms (UCR 22287).



Fig. 6. UCR 22287 (A) Detail of prepollex and Finger I; (B) detail of heel.



Fig. 7. *Ecnomiohyla bailarina*, hand detail of female (UCR 22288).

Below we present diagnostic comparisons to other members of the genus *Ecnomiohyla*, with the contrasting characteristics for *E. bailarina* Batista et al., 2014 in parentheses. *Ecnomiohyla echinata* (Duellman, 1961) from Mexico differs substantially from the new form by the presence of a smooth dorsum (highly tuberculate dorsum), lacking cranial and dorsal osteoderms (cranial and dorsal osteoderms present), and with more reduced webbing on the hands and feet (extensive webbing found on both the hands and feet). *Ecnomiohyla valancifer* (Firschein and Smith, 1956) from Mexico lacks black keratinized spines on the prepollex and Finger I (black keratinized spines present on the prepollex and base of Finger I), and also lacks cranial and dorsal osteoderms (cranial and dorsal osteoderms present). *Ecnomiohyla fimbrimembra* (Taylor, 1948) from Costa Rica and Panama differs by the presence of co-ossified skin on the skull (skin not co-ossified on the skull), and lacking cranial and dorsal osteoderms (cranial and dorsal osteoderms present). In *E. miliaria* (Cope, “1885” 1886) from Honduras to Panama and *E. phantasmagoria* (Dunn, 1943) from Colombia and Ecuador, adult males have large recurved prepollical spines (blunt rounded to bluntly pointed prepollex), and lack clusters of small black keratinized spines on the prepollex of Finger I (clusters of black keratinized spines on the prepollex and base of Finger I). *Ecnomiohyla minera* (Wilson et al., 1985) from Guatemala differs by the presence of co-ossified skin on the skull (skin not co-ossified on the skull), reduced webbing on the hands (extensive webbing on hands that reach the disc on one margin of two fingers), and lacking osteoderms on the dorsal surfaces of the head and body (osteoderms present on the dorsal surfaces of the head and body). *Ecnomiohyla miotypanum* (Cope, 1863) from Mexico lacks extensive interdigital webbing on the hands (extensive interdigital webbing on the hands), a smoother dorsum that lacks large tubercles (highly tuberculate

dorsum). *Ecnomiohyla rabborum* Mendelson et al., 2008, from Panama have a large projecting *crista lateralis* on the humerus of adult males (lacking a humeral projection), smoother dorsal skin (highly tuberculate dorsal skin), and a smooth heel (a series of pointed fleshy tubercles on the heel). *Ecnomiohyla salvaje* (Wilson et al., 1985) from Guatemala and Honduras has a humeral projection in adult males (lacking a humeral projection in adult males), lacks osteoderms in the dorsal skin of the head and body (osteoderms present in the dorsal skin of the head and body), and co-ossified skin is present on the skull (skin not co-ossified on the skull). *Ecnomiohyla sukia* Savage and Kubicki, 2010, from Costa Rica lacks black keratinized spines on the prepollex and base of Finger I (black keratinized spines on the prepollex and base of Finger I), and scalloped fleshy fringes are present along the foot and forearm (dermal fringes of foot and forearm with widely spaced pointed triangular fleshy projections). *Ecnomiohyla thysanota* (Duellman, 1966) from Panama, known only from the female holotype, has a smooth dorsum (highly tuberculate dorsum), and lacks osteoderms in the dorsal skin of the head and body (osteoderms present in the dorsal skin of the head and body). *Ecnomiohyla tuberculosa* (Boulenger, 1882) from Brazil, Colombia, Ecuador, and Peru, according to Batista et al. (2014) lacks black keratinized spines on the prepollex (black keratinized spines on the prepollex and base of Finger I). *Ecnomiohyla veraguensis* Batista et al., 2014, can be distinguished from *E. bailarina* (according to Batista et al. 2014) by the presence of only a few large, widely spaced nuptial black keratinized spines dorsolaterally on the base of the pollex and none on the prepollex in adult males (thickly clustered smaller spines on prepollex and pollex), and a finely tuberculated dorsum (strongly tuberculated dorsum), with keratinized tubercles absent on the ventral side of the scalloped fringe on the heels (present in *E. bailarina*).

Morphological Measurements of Costa Rican *Ecnomiohyla bailarina*:

Male A (UCR 22287): SVL of 60.8 mm; HW 23.0 mm, 37.8 % of SVL; HL 21.3 mm, 35% of SVL; TI 33.1 mm, 54.4% of SVL; FL 25.0 mm, 41.4% of SVL; HaL 18.6 mm, 30.6% of SVL; IOD 6.6 mm, 10.9% of SVL; END 6.7 mm, 11.0% of SVL; FoL 11.5 mm, 18.9% of SVL; TaL 17.5 mm, 28.8% of SVL; EL 5.4 mm; DW 4.2 mm, 77.8% of EL; and TyD 4.6 mm, 85.2 % of EL.

Male B (CRARC 0094): SVL of 58.6 mm; HW 22.3 mm, 38.1 % of SVL; HL 20.6 mm, 35.2 % of SVL; TI 33.2 mm, 56.7 % of SVL; FL 25.0 mm, 42.7% of SVL; HaL 18.9 mm, 32.3 % of SVL; IOD 5.5 mm, 9.4 % of SVL; END 6.3 mm, 10.8 % of SVL; FoL 12.5 mm, 21.3 % of SVL; TaL 16.9 mm, 28.8 % of SVL; EL 5.2 mm; DW 3.5 mm, 67.3 % of EL; and TyD 4.4 mm, 84.6 % of EL.

Female (UCR 22288): SVL of 57.8 mm; HW 22.8 mm, 39.4 % of SVL; HL 20.4 mm, 35.3 % of SVL; TI 33.7 mm, 58.3 % of SVL; FL 25.6 mm, 44.3 % of SVL; HaL 19.3 mm, 33.4 % of SVL; IOD 5.3 mm, 9.2 % of SVL; END 5.9 mm, 10.2 % of SVL; FoL 12.5 mm, 21.6 % of SVL; TaL 17.9 mm, 31 % of SVL; EL 4.9 mm; DW 3.8 mm, 77.6 % of EL; and TyD 4.1 mm, 83.7 % of EL.

Trait (mm)	UCR 22287	UCR 22288	CRARC 0094	Average	Range
SVL	60.8	57.8	58.6	59.1	57.8–60.8
HW	23.0	22.8	22.3	22.7	22.3–23.0
HL	21.3	20.4	20.6	20.8	20.4–21.3
TI	33.1	33.7	33.2	33.3	33.1–33.7
FL	25.0	25.6	25.0	25.2	25–25.6
HaL	18.6	19.3	18.9	18.9	18.6–19.3
IOD	6.6	5.3	5.5	5.8	5.3–6.6
END	6.7	5.9	6.3	6.3	5.9–6.7
FoL	11.5	12.5	12.5	12.2	11.5–12.5
TaL	17.5	17.9	16.9	17.4	16.9–17.9
EL	5.4	4.9	5.2	5.2	4.9–5.4
DW	4.2	3.8	3.5	3.8	3.5–4.2
TyD	4.6	4.1	4.4	4.4	4.1–4.6

Morphological Description Based on Costa Rican Specimens: Head slightly wider than body, with greatest width just posterior to the articulation of the jaws; upper lip rounded in dorsal outline; snout raised anterodorsally, truncate in dorsal outline and profile; snout short with nearly terminal protuberant nostrils directed laterally; and internarial area concave. Top of head flat; canthus rostralis distinct, arcuate, intercanthal area slightly concave, loreal region concave; and upper lip not flared. Skin on dorsal and lateral surfaces of head tuberculate; some darker tipped tubercles found scattered throughout the dorsal surfaces of the head, especially concentrated along the upper lip and tip of the snout; upper section of lower eyelid transparent; and supratympanic fold, tympanic membrane, and tympanic annulus distinct, with tympanic structure oriented dorsolaterally. Upper surfaces of the body and limbs tuberculate, with scattered larger tubercles; the larger tubercles are more pronounced and concentrated on the head and suprascapular region. Dorsal tubercles of head and body are formed by osteoderms. Slight axillary membrane present, extending from the posterior ventral surface of the upper arm to the ventrolateral surface of the body. Flanks tuberculate to strongly granular, especially along the anterior flank region; skin on the chin, chest, ventral surfaces of the body, arms, and thighs granulate; and skin of the groin and ventral surfaces of the lower legs smooth.

Arms short and upper arm hypertrophied; no distinct transverse dermal fold on wrist; a fleshy fringe extends from the elbow along the ventrolateral margin of forearm, metacarpus, and Finger IV to the base of the disc, including scattered irregular enlarged triangular fleshy projections, with the largest projections on the forearm and metacarpus; and fleshy fringe along the ventrolateral margin of the forearm, metacarpus, and Finger IV, noticeably reduced on one male (CRARC 0094). Hands are large; fingers moderately long and robust; relative lengths of the fingers $I < II < IV < III$; disc on Finger I much smaller than discs on fingers II–IV; discs on fingers II–IV subequal in size; subarticular tubercles on fingers I and II moderate to large, round to somewhat elliptical, distal subarticular tubercle of Finger III large, round, noticeably larger than proximal subarticular tubercle; distal subarticular tubercle on Finger IV large, bifid, noticeably larger than the smaller round proximal subarticular tubercle; accessory palmar tubercles numerous, low, small; thenar tubercle indistinct, prepollex enlarged, protuberant; bony prepollical projection flat blunt and rounded terminally; black keratinized spiny patches present on prepollex and base of Finger I on males, female lacking black keratinized spiny patches on prepollex and base of Finger I; and fingers extensively webbed, webbing formula: $I 2^- - 2^+ II \frac{4}{5} - 1\frac{1}{2} III 1^+ - 1^- IV$.

Legs relatively long and robust; tibiotarsal articulation in both males extending to about tip of snout when hind limb is adpressed, leg on female extending slightly beyond tip of snout; distinct fleshy fringe present on lower leg, originating on heel and extending along ventrolateral margin of tarsus, metatarsus, and outer margin of Toe V to base of disc, including several scattered large triangular shaped fleshy points; fleshy fringe of lower leg slightly reduced in one male (CRARC 0094) compared to other two specimens; several large pointed tubercles and a larger triangular flap present on heel; small tarsal fold present (see Remarks); discs on toes smaller than those on fingers, moderate-sized on toes II–V, distinctly smaller on Toe I; subarticular tubercles under the toes small to moderate-sized and round; inner metatarsal tubercle elongate, slightly raised, outer metatarsal tubercle small, round, and slightly raised (see Remarks); supernumerary and accessory tubercles very small to indistinct; toes nearly fully webbed, webbing extending to base of discs along one margin on four toes; web margin slightly concave between toes; and webbing formula: $I \frac{3}{4} - 1\frac{1}{3} II \frac{2}{3} - 1\frac{1}{3} III 1^- - 1\frac{1}{3} IV 1\frac{1}{2} - \frac{3}{4} V$. Cloacal opening directed posteriorly at mid-level of thighs, with a concentration of small raised and rounded white tubercles below vent. Large tongue broadly cordate; prevomerine teeth lying in two oblong and narrowly spaced transversal patches, positioned between and along the posterior margins of the moderately large ovoid choanae; and vocal slits absent.

Coloration in Life Based on Costa Rican Specimens: The dorsal coloration of *E. bailarina* is comprised of a mixture of irregular markings and tones that can be pale green, emerald green, yellowish-green, brown, tan, gray, and black; dark bands usually are present on dorsal surfaces of legs. The tympanic membrane in both males is partially- to nearly transparent, and the female is fully pigmented (Fig. 8). The throat, chest, abdomen, and ventral surfaces of the arms, legs, hands, and feet are pale yellow to cream, and lack contrasting spots or markings (Fig. 4). The iris is pale yellow to golden yellow, with a moderate to fine copper reticulation. The heels and area directly below the vent are white. Substantial metachrosis has been observed with this species, typically with the overall tone and color intensity of the dorsum and iris varying depending on the level of activity or substrate coloration.

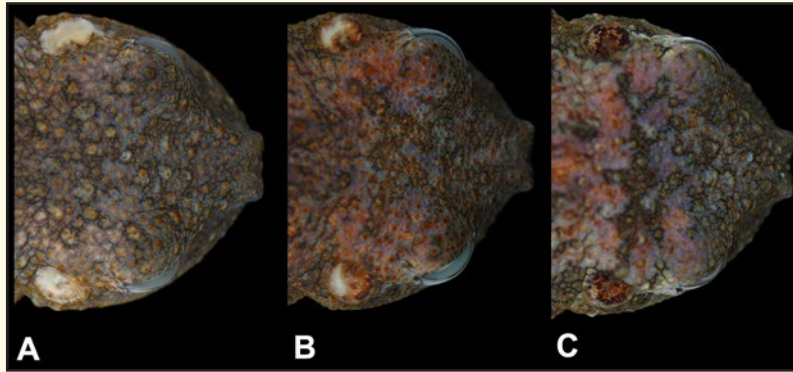


Fig. 8. Variation in the amount of pigmentation in the tympanic membrane of the three Costa Rican specimens of *Ecnomiohyla bailarina*. (A) = UCR 22287; (B) = CRARC 0094; and (C) = UCR 22288.

Coloration in Preservative Based on Costa Rican Specimens: The dorsal coloration is dull olive-gray, and the groin and posterior surface of the dorsal thigh is yellow. The throat, chest, abdomen, and ventral surfaces of the arms, legs, hands, and feet are pale cream.

NATURAL HISTORY OBSERVATIONS BASED ON COSTA RICAN INDIVIDUALS

Ecnomiohyla bailarina is a nocturnal frog that has been observed to inhabit only mature humid forest. During eight visits to the site, SS heard five individuals calling from the mid- to upper strata of the forest, 10–20 meters above the ground. He climbed into the canopy (a height of 17 m) to collect one of these individuals (UCR 22287), but discovered two others in close proximity in the lower stratum of the forest, at a height of 2–3 meters above the ground; these two individuals perhaps were engaged in pre-breeding activity, because one is a female (UCR 22288) and the other a male (CRARC 0094). We determined the sex of these individuals due to the presence or absence of keratinized spiny structures on the prepollex and base of Finger I, which is assumed to be a sexually dimorphic character in this taxon. The general area where all the individuals have been heard and/or seen is approximately one hectare in size, and surrounds a large light gap where several trees fell during a windstorm approximately two years prior to the above-mentioned observations. *Ecnomiohyla bailarina* and *E. sukia* have been observed in sympatry at this site.

Ecnomiohyla bailarina has been heard producing advertisement calls during the afternoon twilight and evening hours, but only sporadically. One individual produced nine different advertisement calls within a 9.5-hour period of observation (SS), between 1730 and 0300 hrs. The advertisement call for *E. bailarina* consists of a series of quickly repeated notes of pulsed intensity. SS attempted to record the advertisement call of *E. bailarina* for analysis, but due to the height of the calling individuals within the forest canopy the recordings were weak, requiring amplification (2–4 ×) in Raven Lite ver. 1.0. Because of the difficulty in discerning what might represent artifact produced during the amplification and what could truly be the beginning and end of each note in the advertisement calls, the data we provide here are based on our best estimation and interpretation of spectrograms produced in Raven Lite ver. 1.0; three different advertisement calls were analyzed and measured. Advertisement call 1 (Fig. 9) had a total duration of 2.2 seconds, and consisted of a seven individual notes; the average dominant frequency of the notes is 1.1 kHz. Advertisement call 2 had a total duration of 1.9 seconds, and consisted of a six individual notes; the average dominant frequency of the notes is 1.15 kHz. Advertisement call 3 had a total duration of 2.2 seconds, and consisted of a seven individual notes; the average dominant frequency of the notes is 1.1 kHz. The pauses between individual notes in the advertisements calls ranged from 0.1 to 0.2 seconds in duration. In addition to the advertisement call, SS also heard several weaker two note vocalizations (0.3–0.4 sec in total duration) being produced by the male that was found in close proximity to the female; this weaker two note vocalization possibly is an interaction call emitted in response to the detection of another individual in relatively close proximity.

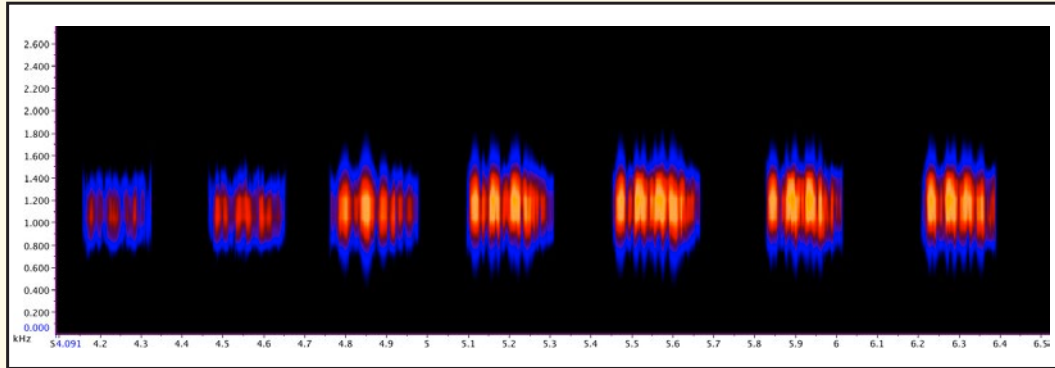


Fig. 9. Audiospectrogram of an advertisement call by *Ecnomiohyla bailarina*.

DISTRIBUTION

Ecnomiohyla bailarina is known to inhabit only two sites, the type locality on the north slope of the Jingurudó mountain range, about 14.6 km S from Pavarandó village (N 7.70903°, W 78.04882°, 750 m a.s.l.), Sambú, Comarca Emberá-Wounaan N°2, Darién, Panamá (Batista et al., 2014), and a single site near Río Peje in the foothills of the Cordillera de Talamanca in southeastern Costa Rica (Cantón de Matina, Distrito de Matina), within the Tropical Humid Forest life zone (Holdridge, 1967), at an elevation of approximately 300 m a.s.l. (Fig. 10). The straight-line distance between the two known sites for *E. bailarina* is approximately 600 kilometers, but if measured in terrestrial distance, it is roughly 750 kilometers.

Ecnomiohyla bailarina likely inhabits the remaining sections of old-growth humid forest between the two known sites in extreme eastern Panamá and southeastern Costa Rica, but presently no observations or specimens are available from intermediate sites.

REMARKS

In the description of *Ecnomiohyla bailarina*, Batista et al. (2014) stated that the species lacks a tarsal fold and an outer metatarsal tubercle, but a close examination of the ventral surface of the foot of this species in this publication (fig. 4, plate H) illustrates a small tarsal fold, although it is slightly obscured by a piece of light colored debris; additionally, in the same image, although the lighting is not optimal to note skin topography, a small round outer metatarsal tubercle appears present, and agrees with the location of a small outer metatarsal tubercle on all three Costa Rica specimens. We note that a small tarsal fold and a small round outer metatarsal tubercle (Fig. 11) indeed are present in *E. bailarina*.

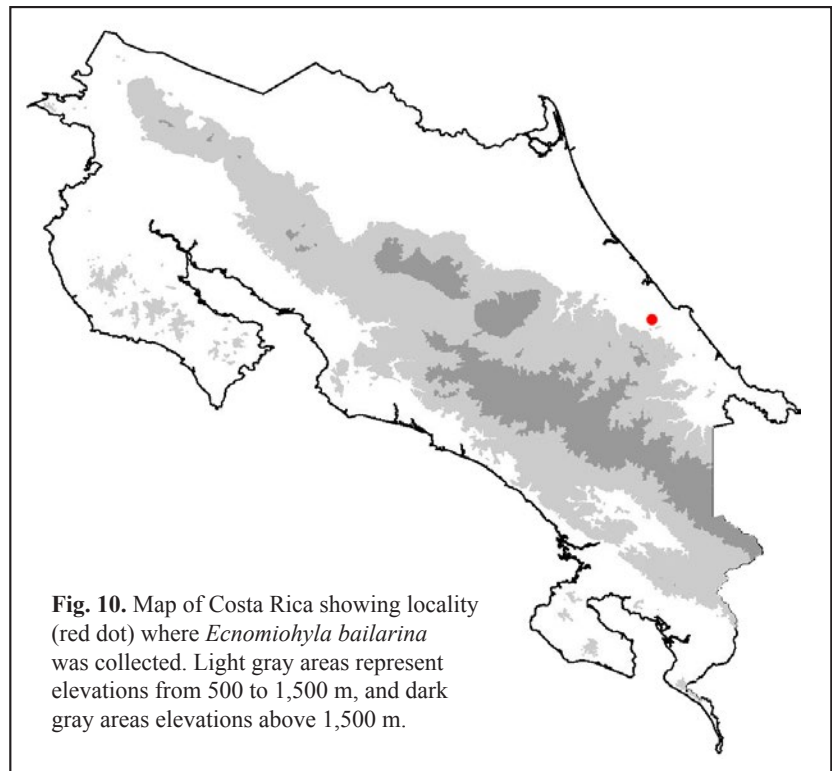


Fig. 10. Map of Costa Rica showing locality (red dot) where *Ecnomiohyla bailarina* was collected. Light gray areas represent elevations from 500 to 1,500 m, and dark gray areas elevations above 1,500 m.

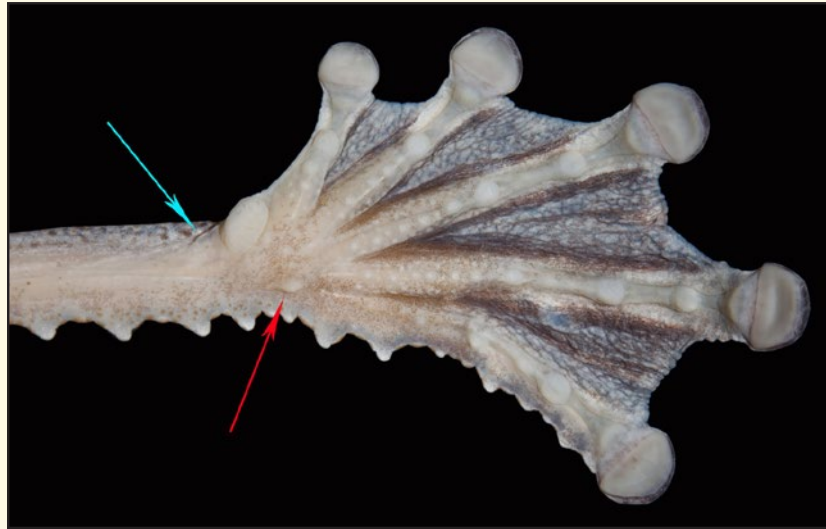


Fig. 11. Ventral view of the foot of a Costa Rican specimen of *Ecnomiohyla bailarina*. Red arrow points to the small, slightly raised, round outer metatarsal tubercle; blue arrow shows the small tarsal fold structure.

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LITERATURE CITED

- BATISTA, A., HERTZ, K., MERBERT, G., KÖHLER, S., LOTZKAT, M., PONCE, AND M. VESELY. 2014. Two new fringe-limbed frogs of the genus *Ecnomiohyla* (Anura: Hylidae) from Panama. *Zootaxa* 3,826: 449–474.
- BOULENGER, G. A. 1882. Catalogue of the Batrachia Salientia s. Ecaudata in the Collection of the British Museum. 2nd ed., Taylor and Francis, London, United Kingdom.
- COPE, E. D. 1863. On *Trachycephalus*, *Scaphiopus* and other Batrachia. Proceedings of the Academy of Natural Sciences of Philadelphia 15: 43–54.
- COPE, E. D. “1885” (1886). Thirteenth contribution to the herpetology of tropical America. Proceedings of the American Philosophical Society 23, 271–287.
- DUELLMAN, W. E. 1961. A new species of fringe-limbed tree frog from Mexico. Studies of American hylid frogs VIII. Transactions of the Kansas Academy of Science 64: 349–352.
- DUELLMAN, W. E. 1966. A new species of fringe-limbed tree frog, genus *Hyla*, from Darién, Panamá. University of Kansas Publications, Museum of Natural History 17: 257–262.
- DUELLMAN, W. E. 2001. The Hylid Frogs of Middle America. 2 Volumes. Contributions to Herpetology, Volume 18, Society for the Study of Amphibians and Reptiles, Ithaca, New York.
- DUNN, E. R. 1943. An extraordinary new *Hyla* from Colombia. *Caldasia* 2: 309–310.
- FAIVOVICH, J., C. F. B. HADDAD, C. A. GARCIA, D. R. FROST, J. A. CAMPBELL, AND W. C. WHEELER. 2005. Systematic review of the frog family Hylidae, with special reference to Hylinae: phylogenetic analysis and taxonomic revision. *Bulletin of the American Museum of Natural History* 294: 1–240.
- FIRSCHER, I. L., AND H. M. SMITH. 1956. A new fringe-limbed *Hyla* (Amphibia: Anura). *Herpetologica* 12: 17–21.
- FROST, D. R. 2015. Amphibian Species of the World: An Online Reference. Version 6.0. Electronic Database accessible at www.research.amnh.org/herpetology/amphibia/index.html (accessed 20 February 2015), American Museum of Natural History, New York, United States.
- HOFFMANN, H., AND B. KUBICKI. 2011. The tadpole of *Ecnomiohyla sukia* Savage and Kubicki 2010 (Amphibia: Hylidae). *Zootaxa* 2,793: 63–66.
- HOLDRIDGE, L. R. 1967. Life Zone Ecology. Tropical Science Center, San José, Costa Rica.
- MCCRANIE, J. R., AND L. D. WILSON. 2002. The Amphibians of Honduras. Contributions to Herpetology, Volume 19, Society for the Study of Amphibians and Reptiles, Ithaca, New York.
- MENDELSON III, J. R., J. M. SAVAGE, E. GRIFFITH, H. ROSS, B. KUBICKI, AND R. GAGLIARDO. 2008. Spectacular new gliding species of *Ecnomiohyla* (Anura: Hylidae) from central Panama. *Journal of Herpetology* 42: 750–759.

- MYERS, C. W., AND W. E. DUELLMAN. 1982. A new species of *Hyla* from Cerro Colorado, and other tree frog records and geographical notes from western Panama. *American Museum Novitates* 2,752: 1–32.
- SAVAGE, J. M. 2002. The Amphibians and Reptiles of Costa Rica: A Herpetofauna between Two Continents, between Two Seas. The University of Chicago Press, Chicago, Illinois, United States.
- SAVAGE, J. M., AND W. R. HEYER. 1967. Variation and distribution in the tree-frog genus *Phyllomedusa* in Costa Rica, Central America. *Beitrage zur Neotropischen Fauna* 5: 111–131.
- SAVAGE, J. M., AND W. R. HEYER. 1997. Digital webbing formulae for anurans: a refinement. *Herpetological Review* 28: 131.
- SAVAGE, J. M., AND B. KUBICKI. 2010. A new species of fringe-limb frog, genus *Ecnomiohyla* (Anura: Hylidae), from the Atlantic slope of Costa Rica, Central America. *Zootaxa* 2,719: 21–34.
- TAYLOR, E. H. 1948. Two new hylid frogs from Costa Rica. *Copeia* 1948: 233–238.
- WILSON, L. D., MCCRANIE, J. R., & WILLIAMS, K. L. 1985. Two new species of fringe-limbed frogs from Nuclear Middle America. *Herpetologica* 41: 141–150.



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