

A new species of Costa Rican salamander, genus *Bolitoglossa*

by

David B. Wake* and Arden H. Brame, Jr.*

(Received for publication April 16, 1963)

Costa Rica has been the site of intensive herpetological collecting during the past century and although the fauna is relatively well known, a number of taxonomic problems remain. Recently a University of Michigan field party working in the Subtropical Wet Forest of the heavily collected Turrialba region obtained six representatives of an undescribed species of salamander, genus *Bolitoglossa*. The new species, a relatively small, slender form with extensively webbed hands and feet, is apparently related to the common species of higher elevations, *Bolitoglossa subpalmata*. In allusion to its habitus we name the species:

Bolitoglossa epimela sp. nov.

Figure 1

HOLOTYPE: UMMZ 119695, an adult female from a point on the Turrialba-Peralta road 6.2 miles northeast of the Río Reventazón bridge (approximately 7 miles east-northeast of Turrialba), at about 915 meters (3,000 feet) elevation, Provincia de Cartago, Costa Rica, collected by Priscilla and Andrew Starrett, July 29, 1957.

PARATYPES: UMMZ 123661 - 123664, same data as holotype; UMMZ 119696, same locality data as holotype, collected by Priscilla and Andrew Starrett, and Thomas M. Uzzell, Jr., August 3, 1957.

DIAGNOSIS: A small species (38.6 - 46.0 mm standard length) distinguished by its relatively slender body and long slender limbs, narrow head relative to standard length (Fig. 2), distinctive, extensively webbed hands and

* Department of Biology, University of Southern California, Los Angeles 7, California, U. S. A.

feet (Fig. 1), moderate numbers of maxillary teeth relative to standard length (32 - 43), and very dark dorsal coloration that is either solid or sparsely spotted with small, irregularly-shaped light areas. The closest relative appears to be *B. subpalmata* (including *pesrubra* and *torresi*), a larger species that has a wider head (Fig. 2), less webbing between the digits of the hands and feet, and averages more maxillary teeth in individuals of similar size. Among other Costa Rican members of the genus *B. alvaradoi*, *B. arborescendens*, *B. cerroensis*, *B. lignicolor*, and *B. robusta* are much larger. Webbing is more extensive in *B. alvaradoi*, *B. arborescendens*, *B. colonnea*, *B. lignicolor*, and *B. striatula*; less extensive in *B. cerroensis* and *B. robusta*. *Bolitoglossa alvaradoi*, *B. cerroensis*, *B. lignicolor*, and *B. striatula* all have extensive light pigmentation dorsally, or evidence of light dorsal banding. *Bolitoglossa colonnea*, a species of similar size, differs in having a distinctive and unique dermal interorbital ridge, and either lacks maxillary teeth or has but one or two. The small *B. nigrescens* has a wider head, fewer maxillary teeth, markedly shorter limbs, and similarly webbed but thicker and less flattened hands and feet with subcylindrical digits.

DESCRIPTION OF THE HOLOTYPE: Adult female, snout of moderate length, subtruncate; nostril small, labial protuberances of nasolabial groove very small; canthus rostralis indistinct, gently rounded. Standard length 6.6 times head width; standard length 4.6 times snout-gular fold length. Deep, distinct groove below eye extends full length of eye opening, does not communicate with lip. Eye of moderate size, not greatly protuberant. Poorly defined postorbital groove extends posteriorly from eye as shallow, relatively broad depression for 1.7 mm, proceeds sharply ventrally from posterior terminus and extends across gular area as well-marked groove parallel to and 3.5 mm anterior to gular fold. Vomerine teeth 11 - 8, in curved series that extend to center of internal nares. Maxillary teeth 21 - 22, extending posteriorly to point equal to three-fourths distance through eyeball. Four premaxillary teeth, none piercing lip. Body relatively slender, slightly desiccated by preservation. Very slender tail 1.1 times standard length; lateral compression moderate; slight basal constriction. Post-iliac glands small, poorly defined. Limbs moderately long, slender; when appressed to sides of trunk, two costal folds remain uncovered (limb interval 2); standard length 4.4 times right fore limb; standard length 3.9 times right hind limb. Digits of hands and feet easily distinguishable but extensively webbed; digital tips broadly rounded; borders of adjacent digits slope proximally and meet at level of articulation of penultimate and terminal phalanges. Area of webbed pad relatively large in relation to size of hands and feet, but digital tips remain free from web. Hands and feet flattened; digits flattened, not cylindrical. Subterminal pads distinct, moderate in size; partially obscured by flattening during preservation. Fingers in order of decreasing length: 3, 4, 2, 1; toes in order of decreasing length: 3, 4, 2, 5, 1.

Measurements in millimeters: head width 6.6; snout to gular fold (head length) 10.0; head depth at posterior angle of jaw 3.8; eyelid length 3.1; eyelid width 1.8; anterior rim of orbit to snout 2.8; horizontal orbital diameter 2.3; distance between vomerine teeth and parasphenoid tooth patch 0.8; snout

to fore limb 12.2; distance separating internal nares 2.0; distance separating external nares 2.3; snout projection beyond mandible 0.9; snout to posterior angle of vent (standard length) 46.0; snout to anterior angle of vent 42.5; axilla to groin 26.7; tail length 50.5; tail width at base 3.5; tail depth at base 3.8; fore limb length 10.5; hind limb length 11.8; width of right hand 4.0; width of right foot 5.1.

Coloration in life: chin and belly dark, flecked with light; underside of tail dark, marked with white. A few scattered pinkish blotches under and on side of tail.

Coloration in alcohol: ground color of dorsal surfaces of head, trunk, tail, and limbs very dark, almost black; ventral surfaces a little lighter, dark brown. Light, irregularly-shaped small spots very sparsely scattered over dorsal surfaces; one relatively large spot on head behind eyes; spots sparse on venter of trunk and throat, more numerous on tail. Tail and venter of hands and feet lightest portions of organism. Nasolabial grooves light, conspicuous.

VARIATION: Meristic data for the entire series are given in Table 1. The six specimens of *B. epimela* range in size from 38.6 to 46.0 mm standard length. Five females range in size from 38.6 to 46.0 mm standard length (mean 42.8). The ovaries of the three largest females contain greatly enlarged ova; the two smallest females contain very small ova. The single male is 42.8 mm standard length and is fully adult with bilobed testes.

TABLE I.

Data on Bolitoglossa epimela

	Snout-Vent Length	Axilla-Groin	Head Width	Hind Limb Length	Snout-Gular Fold	Limb Interval	Tail Length	Maxillary Teeth	Vomerine Teeth
UMMZ 123664	♂ 42.8	25.1	6.5	11.2	10.7	1	54.4	35	21
UMMZ 119695	♀ 46.0	26.7	6.6	11.8	10.0	2	50.5	43	19
UMMZ 123662	♀ 44.5	25.4	6.5	10.3	10.3	3	49.5	42	23
UMMZ 119696	♀ 44.4	25.9	6.3	10.9	10.7	2½	—	42	23
UMMZ 123661	♀ 40.6	22.3	5.9	10.1	9.4	2	46.8	37	24
UMMZ 123663	♀ 38.6	21.9	5.5	9.2	8.9	3	37.5	32	22

The entire series is slender and appears to be long-legged as a result of its slender limbs. Limb interval is from 2 to 3 in females, 1 in the single male.

Heads are relatively narrow in *B. epimela*, especially when compared with head width of its relative, *B. subpalmata* (Fig. 2). Standard length is

from 6.8 to 7.0 times head width in females, and 6.6 in the male. On the basis of our observations it appears that *B. epimela* has a narrower head than any other Costa Rican member of the genus. Certain South American species, including *B. orestes*, *B. altamazonica*, and *B. phalarosoma*, have heads that are as narrow or narrower than those of *B. epimela*.

Maxillary teeth range from 32 in the smallest individual to 43 in the largest (the holotype). Maxillary teeth apparently increase in number with increasing age in *B. epimela* as in most other members of the genus. No increase is seen in numbers of vomerine teeth, however, with the smallest individual having 22 teeth, the largest, 19. Vomerine teeth range from 19 to 24 in the series.

In general the paratypes resemble the holotype in coloration. The general aspect is of a dark, almost solidly colored organism. One specimen (UMMZ 123664) has some orange coloration on the dorsum of the trunk and especially above the base of the tail. All individuals have irregularly shaped and placed small whitish spots sparsely scattered over the body. These spots are in general inconspicuous. Color notes taken in life and shortly after preservation indicate that the light spots are tan or pinkish. UMMZ 123664 was heavily mottled with red-brown on the body and at the base of the tail. Bronze to brassy coloration was found on the head and on the tip of the tail. The venter of the trunk was lavender black with pinkish blotches in life. The blotches were more numerous on the tail than on the belly. The femurs were cream-colored on the dorsal surface. Other members of the series were much more uniformly colored in life (and in alcohol) than the above-mentioned specimen.

Webbing of the hands and feet is similar in all of the individuals. There is a tendency for the longest digit of the hand and foot to have a slightly pointed tip; the tips of all other digits are bluntly rounded. The foot of one individual (UMMZ 123664) is abnormal.

RELATIONSHIPS: The relationships of *B. epimela* are not clear, but may be in one of three directions, either with *B. nigrescens*, *B. arborescendens*, or *B. subpalmata*.

Bolitoglossa nigrescens (type locality: Boquete Road Camp between Villa Mills and San Isidro del General, Provincia de San José, Costa Rica) is known only from the holotype, which we have examined. TAYLOR (2) reported that the single known individual was an adult female. The specimen measures 45.1 mm standard length and has a broader head (standard length 6.0 times head width) and fewer maxillary teeth (17) than any of the type series of *B. epimela*. The hind limbs are also shorter (9.3 mm) than in *B. epimela* of similar size. The two species have similar amounts of webbing, but the hands and feet of *B. nigrescens* are thicker with subcylindrical digits and larger subterminal pads. Both are similarly colored. Color, amount of webbing, and possibly size are the only characters relating *B. nigrescens* and *B. epimela*. It appears that a relationship exists between the two species, but that they are not closely allied.

Bolitoglossa arborescendens (type locality: Moravia de Chirripó, Provincia de Limón, Costa Rica) is another Costa Rican species that is known

only from the holotype (TAYLOR, 4). The color of the holotype in preservation is similar to *B. epimela*, but Taylor reported that it was a lively olive green with black dots in life. The two species are similar in habitus and general proportions, but *B. arborescandens* is considerably larger (62.3 mm standard length), has completely webbed hands and feet, and has many more maxillary teeth (71). *B. arborescandens* has a narrow head (standard length 6.8 times head width) and in this character resembles *B. epimela*. A relationship exists between *B. arborescandens* and *B. epimela* but they are probably not closely related.

Bolitoglossa subpalmata (type locality: La Palma, Provincia de San José, Costa Rica) may be the closest relative of *B. epimela*. The two can be distinguished by the larger adult size, less fully webbed hands and feet, and generally stockier habitus of *subpalmata*. *B. epimela* has, in general, fewer maxillary teeth and, as is evident from the accompanying graph (Fig. 2), a narrower head than *B. subpalmata* (only small *subpalmata* similar in size to adult *epimela* have been graphed). The differences between the two species are not marked, however, and most proportions are similar. *B. subpalmata* is highly variable in coloration and occasional individuals are found that resemble the color of *B. epimela*. Although the two species have limbs of similar length, the limbs of *B. subpalmata* are stockier than those of *B. epimela*. On the basis of these characters it seems that the two species are fairly closely related, but definitely distinct. *B. subpalmata* is found in the Turrialba region at high elevations on Volcán Turrialba, and to the best of our knowledge has never been taken near Peralta or at elevations as low as 1000 meters.

It is possible that *B. epimela* might be confused with *B. colonnea* due to similarity in size and habitus. Many characters separate the two, however, including presence of a dermal interorbital ridge, a broader head, shorter limbs, and no or very few maxillary teeth in *B. colonnea*. The snout of *B. colonnea* is more truncate and blunter and its hands and feet are more flattened and fully webbed than those of *B. epimela*. The two species are not closely allied.

REMARKS: The holotype and UMMZ 123661 - 4 were collected at night and they were active at that time. One was collected on a log by the edge of a stream; the others were found on leaves of plants growing from rock faces along the stream. The rock cliff was moistened by seepage from above the swift stream. The region was apparently heavily forested and wet. One specimen either fell or was placed in the stream. It struggled violently but could swim to the surface and crawl out onto land. Those found on leaves were able to walk upside down using their hands and feet alone; the tail seemed somewhat prehensile but was not used in walking.

A single specimen of *Oedipina poelzi* was obtained by the same collectors at the type locality of *B. epimela*.

There is a degree of correlation in *Bolitoglossa* between the amount of webbing of hands and feet, and the extent to which the species is arboreal. The slightly webbed members of the genus, such as *B. robusta*, tend to be terrestrial; the fully webbed species, such as *B. colonnea*, are highly arboreal. *B. epimela*

has hands and feet that are greatly flattened, especially at the digital tips, but are incompletely webbed. Yet the species is well-adapted for an arboreal existence as indicated by the field notes. *B. epimela* is another of the species that bridges the gap between the incompletely webbed, largely terrestrial species (the *Magnadigita* of TAYLOR, 1 and 3), and the completely webbed, largely arboreal species (the *Bolitoglossa* of Taylor). Discovery of this species strengthens our contention that the genus *Magnadigita* is un-natural and cannot be recognized (see WAKE and BRAME, 5).

ACKNOWLEDGEMENTS

Dr. Charles F. Walker of the University of Michigan Museum of Zoology (UMMZ) loaned the material on which the above description is based, and provided the field notes. Dr. Jay M. Savage read the manuscript and offered valuable criticism. We thank both for their assistance.

SUMMARY

A new species of salamander, *Bolitoglossa epimela*, is described from material collected between Turrialba and Peralta, Provincia de Cartago, Costa Rica. *B. epimela* is apparently most closely related to *Bolitoglossa subpalmata*, from which it differs in being smaller and slenderer with a narrower head, and having more fully webbed hands and feet. *B. epimela* apparently occurs at lower elevations than *B. subpalmata*.

RESUMEN

Se describe una nueva especie de salamandra, *Bolitoglossa epimela*, de ejemplares capturados entre Turrialba y Peralta, Provincia de Cartago, Costa Rica. Parece que *B. epimela* tiene un parentesco muy cercano con *B. subpalmata*. Se diferencia *B. epimela* de *B. subpalmata* en el tamaño más pequeño y forma del cuerpo y cabeza más angosta, además de tener mayor desarrollo de las membranas interdigitales. *B. epimela* aparentemente habita alturas más bajas que las de *B. subpalmata*.

LITERATURE CITED

- 1 TAYLOR, E. H.
1944. The genera of plethodont salamanders in Mexico, Pt. I. *Univ. Kansas Sci. Bull.*, 30(12): 189-232, figs. 1-2, pls. 12-15.
- 2 TAYLOR, E. H.
1949. New salamanders from Costa Rica. *Univ. Kansas Sci. Bull.*, 33(6): 279-288.

3. TAYLOR, E. H.

1952. The salamanders and caecilians of Costa Rica. *Univ. Kansas Sci. Bull.*, 34(12): 695-791, figs. 1-14, pls. 76-88.

4. TAYLOR, E. H.

1954. Additions to the known herpetological fauna of Costa Rica with comments on other species. No. 1. *Univ. Kansas Sci. Bull.*, 36(9): 597-639, figs. 1-12.

5. WAKE, D. B., & A. H. BRAME, JR.

1936. The status of the plethodontid salamander genera *Bolitoglossa* and *Magnadigitata*. *Copeia*, 1963 (2): In Press.

Fig. 1: *Bolitoglossa epimela*. Holotype. UMMZ 119695, adult female.



Fig. 2: Relationship of head width to standard length. E = *Bolitoglossa epimela*; S = *Bolitoglossa subpalmata*.

