Rev. Biol. Trop., 36(1): 81-87, 1988

A new fish, *Brachyrhaphis roseni* (Poeciliidae) from Costa Rica and Panama*

William A. Bussing
Escuela de Biología & Centro de Investigación en Ciencias del Mar y Limnología (CIMAR), Universidad de Costa Rica

(Received: November 27, 1986)

Abstract: A new poeciliid fish is described from material collected in the Río Coto basin in southeastern Costa Rica and western Panama. *Brachyrhaphis roseni* is similar to *B. rhabdophora* in lacking several specialized characteristics which are found in some of the other seven known congeners. *B. rhabdophora* replaces the new form in adjacent drainages to the north and *B. episcopi*, likewise, replaces *B. roseni* in central Panama.

The known species of *Brachyrhaphis* are confined to Middle America with nine presently recognized species and at least one undescribed form from eastern Panama (cf. Bussing 1985, Fig. 3). *Brachyrhaphis roseni* was recognized as new to science by Robert R. Miller on the basis of numerous collections made by Horace G. Loftin in Panama between 1961 and 1963. Since then additional specimens have been collected in western Panama and across the border in the Río Coto drainage of Costa Rica. This increases the number of Costa Rican forms to five species.

B. roseni, as most members of the genus *Brachyrhaphis*, has a conspicuous black blotch on the anal fin or gonopodium. With the exception of *B. parismina* (including *B. cascajalensis*) the species of the genus also have a pattern of vertical black bars along the flanks as well as yellow or reddish coloration on the dorsal and anal fins. *Brachyrhaphis rhabdophora* inhabits the Pacific slope of Costa Rica and is replaced by the superficially similar *B. roseni* Southward into Panama. Both species exhibit considerable intraspecific variation between populations occurring at different altitudes and in different hydrographic basins.

MATERIAL AND METHODS

All body measurements relate to standard length (SL) in millimeters (mm), and were taken using the methodology of Rosen and Bailey (1959). The last two elements of both dorsal and anal fins are consistently well separated and recorded separately. Meristic counts and proportions expressed as thousandths of the standard length are presented in Table 1 for the holotype and 36 paratypes from throughout the geographic range (LACM 4821; UCR 104-13, 1675-1; USNM 246193, 246196, 246802).

Type material is deposited at the Academy of Natural Sciences of Philadelphia (ANSP), British Museum, Natural History (BMNH), Natural History Museum of Los Angeles County (LACM), Museo de Zoología, Universidad de Costa Rica (UCR) and the National Museum of Natural History, Smithsonian Institution (USNM).

Brachyrhaphis roseni, new species
(Figs. 1 and 2)

* Contribution No. 73, Museo de Zoología, Universidad de Costa Rica.

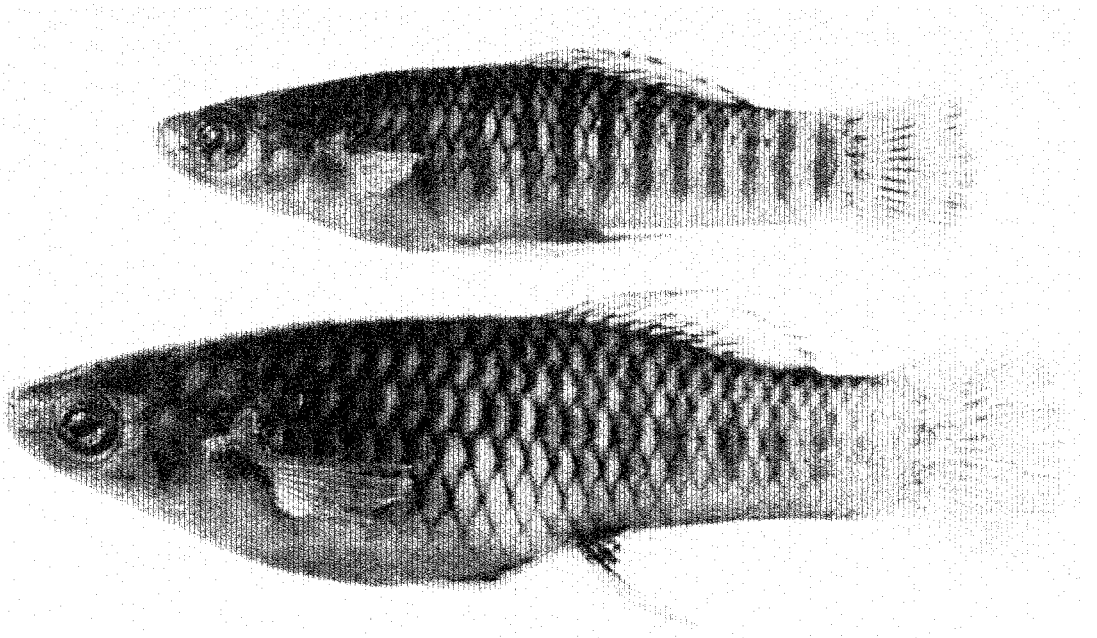

Fig. 1. *Brachyrhaphis roseni*, new species from Quebrada La Palma, a tributary of Río Coto, Costa Rica. Above: Male holotype, 30.5 mm SL (LACM 44220-1). Below: Female paratopotype, 39.2 mm SL (UCR 103-4).

Holotype: LACM 44220-1. An adult male 30.5 mm SL, collected in Quebrada La Palma (elevation 90 m) 3 km W of Paso Canoas (original number UCR 103-4) 3 Jan. 1967 by W. Bussing and O. Blanco B.

Paratypes: Abbreviations are spelled out when used for the first time. The elevation of each locality is given in meters and distances are expressed in kilometers. Collections are listed by principal drainage basins starting in Costa Rica and proceeding eastward into Chiriquí and Veraguas Provinces, Panama; following the collection date is the number of specimens in parentheses, and size range in millimeters standard length (SL).

COSTA RICA

Río Coto Basin: LACM 4888: Stream (20 m) on road to Golfito, 5 Jan. 1964 (108) 12.7-31.4 mm. LACM 4868: Quebrada Kilómetro 19 (20 m) 5 Jan. 1964 (52, including 2 cleared and stained specimens) 16.6-32.1 mm. LACM 4799: Stream (20 m) 12.6 km E of Golfito, 6 Jan. 1964 (126) 9.0-33.0 mm. LACM 4821; Quebrada San Antonio (20 m) 6 Jan. 1964 (81) 13.0-43.2 mm. LACM 4780; Río Caracol (20 m) 7 Jan. 1964 (5) 12.5-32.6 mm. LACM 4729; Río Nuevo (20 m) 24 Jul. 1963 (5) 15.0-24.6 mm. ANSP 140731: Río Claro near Golfito, 28 Feb. 1979 (3) 20.5-27.0 mm. UCR 103-4: Same data as holotype (17) 19.5-39.2 mm. UCR 104-13: Tributary of Río Corredores (40 m) 3 Jan. 1967 (135 plus 10 specimens donated to BMNH) 14.8-41.6 mm. UCR 107-9: Quebrada San Antonio (20 m) 4 Jan. 1967 (55) 13.8-29.6 mm. UCR 109-1: Quebrada Kilómetro 19 (20 m) 4 Jan. 1967 (74) 13.5-31.0 mm. UCR 110-6: Stream (20 m) on road to Golfito, 4 Jan. 1967 (32) 13.5-32.7 mm. UCR 1226-1: Stream (20 m) on road to Golfito, 27 Feb. 1979 (2) 25.7-31.6 mm.

PANAMA

Río Chiriquí Viejo Basin: ANSP: 104466: Stream 24 km W of Concepción, 2 Dec. 1961 (57) 11.7-30.7 mm. ANSP 151261: Stream on Canoas-Río Sereno road, 28 Jan. 1983 (107) 21.4-46.3 mm (10 specimens donated to Museo de Zoología, now UCR 1675-1). ANSP 146889: Pond 2 km E of Paso Canoas, 4 Mar. 1981 (18) 15.2-28.4 mm. ANSP 151272: Canal between Santa María and Progreso, 28 Jan. 1983 (20)

TABLE 1

Meristics and proportions in thousandths of standard length of the holotype (LACM 44220-1) and 36 paratypes of *Brachyrhaphis roseni*, new species.

	Holotype	Paratypes	
		18 males	18 females
Dorsal fin rays	12	9-12(10.6)	
Anal fin rays		18	
Pectoral fin rays	14	13-14(13.8)	
Pelvic fin rays		6	
Caudal fin rays	16	15-17(15.8)	
Longitudinal scales	29	27-29(27.7)	
Caudal peduncle scales	16	16	
Predorsal scales	12	11-13(12.5)	
Total gill rakers	14	12-17(14.2)	
SL	30.5 mm	19.5-34.5 mm	28.4-44.2 mm
Head length	308	298-319	288-304
Head width	184	179-219	190-223
Snout length	95	85-104	85-103
Orbit length	98	89-108	80-96
Interorbital width	125	122-148	130-151
Greatest body depth	266	257-313	284-335
Depth caudal peduncle	177	172-198	155-183
Length caudal peduncle	413	373-416	313-339
D origin to C base	511	465-515	416-462
A origin to C base	508	492-513	411-432
Length dorsal fin base	246	195-246	174-211
Predorsal distance	511	514-565	566-611
Preanal distance	538	527-570	593-649
Length dorsal fin	400	348-413	296-346
Length anal fin	292	293-338	91-109
Length pectoral fin	210	202-243	192-230
Length pelvic fin	164	152-189	137-156
Length caudal fin	246	247-283	220-270

10.5-25.7 mm. USNM: 246195: Stream (135 m) 1.5 km E of Chiriquí Viejo bridge, 7 Oct. 1961 (27) 13.3-35.1 mm.

Río Chico Basin: ANSP 104345: Stream (150 m) 3 km W of Concepción, 2 Dec. 1961 (16) 17.2-36.4 mm. ANSP 146887: Río La Pita, 4 Mar. 1981 (12) 20.3-30.7 mm. USNM 246188: Stream (215 m) 6.5 km W of Concepción, 2 Dec. 1961 (100) 15.0-39.3 mm. USNM 246802: Stream (135 m) 19 km W of David, 2 Dec. 1961 (58) 11.6-34.7 mm. USNM 246818: Stream (75 m) 16 km W of David, 2 Dec. 1961 (2) 34.5-39.0 mm. USNM 246197: Stream (30 m) 8 km W of David, 2 Dec. 1961 (27) 18.4-35.1 mm. UCR 450-9: Stream (160 m) 1.5 km W of Concepción, 25 Jan. 1971 (26, including 1 cleared and stained specimen) 18.6-43.0 mm.

Río Chiriquí Basin: ANSP 104467: Stream (180 m) on David-Boquete road, 16 Dec. 1961 (7) 18.0-38.8 mm. ANSP 146894: Quebrada Brazo de Gómez, 2 Mar. 1981 (3) 22.4-26.1 mm. ANSP 146882: Stream on road to Gualaca, 2 Mar. 1981 (3) 17.1-23.5 mm. ANSP 147050: Stream 2 km from Gualaca, 2 Marz. 1981 (1) 17.9 mm. ANSP 151271: Stream 2.2 km WNW of Gualaca, 29 Jan. 1983 (5) 12.0-26.3 mm. USNM 246804: Stream (230 m) on David-Boquete road, 16 Dec. 1961 (1) 30.8 mm. USNM 246198: Ditch (120 m) at Gualaca, 16 Dec. 1961 (6) 16.0-23.8 mm.

Coastal drainages between Río Chorcha and Río San Félix: ANSP 104322: Río San Félix (40 m) 18 Nov. 1961 (1) 17.1 mm. USNM 246194: Río Chorcha (30 m) 1 Dec. 1961 (9)

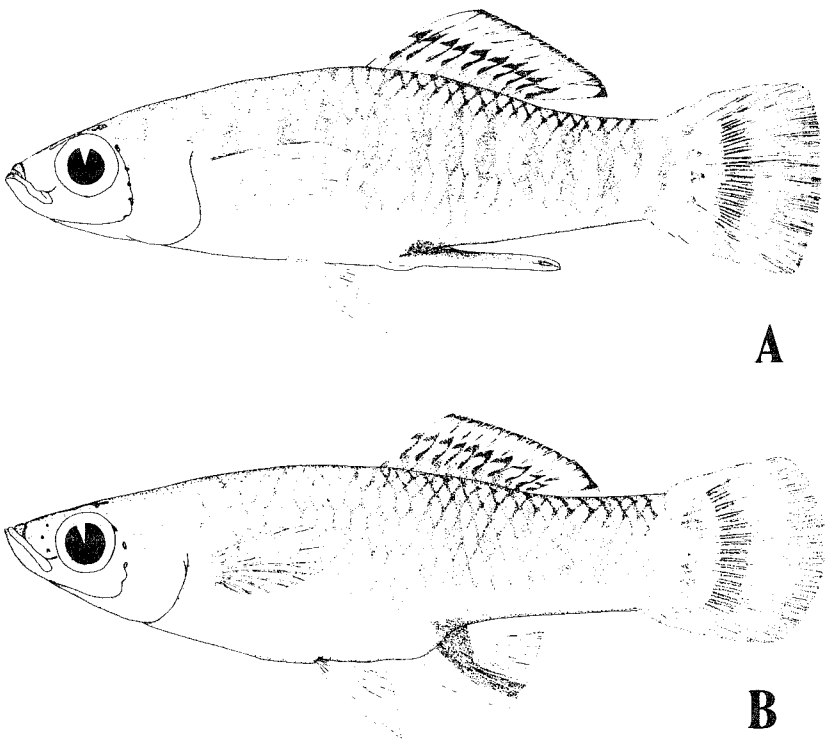

Fig. 2. *Brachyrhaphis roseni,* new species from a tributary of Río Coto, near Golfito, Costa Rica (UCR 1226-1). A. Male paratype, 25.7 mm SL. B. Female paratype, 31.6 mm SL.

29.5-40.8 mm. USNM 246820: Río Jacaque (< 30 m) 9 Dec. 1961 (2) 23.2-24.5 mm.

Río Tabasará Basin: ANSP 104240: Stream (135 m) on Soná-Remedios road, 29 Oct. 1961 (9) 23.8-38.5 mm.

Río San Pablo Basin: ANSP 104394: Stream (150 m) on road to Remedios, 29 Oct. 1961 (108) 15.2-37.1 mm. ANSP 104229: Stream (60 m) on road to Remedios, 27 Oct. 1961 (1) 28.4 mm. ANSP 104332: Stream (60 m) near Santiago-Soná road, 28 Jan. 1962 (23) 21.2-36.6 mm. ANSP 104352: Río Santa Clara (120 m) 4 Jan. 1962 (3) 20.0-33.5 mm. ANSP 104373: Stream (90 m) 3 km W of Río San Pablo bridge, 4 Jan. 1962 (29) 15.4-33.7 mm. USNM 246193: Stream (215 m) 31 km W of Soná, road to Remedios, 29 Oct. 1961 (50) 15.6-44.1 mm. USNM 246816: Stream (60 m) near Santiago-Soná road, 28 Oct. 1961 (5) 21.4-30.2 mm. UCR 452-6: Río Santa Clara (130 m) 27 Jan. 1971 (19) 18.2-32.0 mm.

Río San Pedro Basin: ANSP 104365: Stream (45 m) on road to Soná, 28 Oct. 1961(2) 17.7-25.2 mm. ANSP 104370: Stream (30 m) on road to Soná, 28 Oct. 1961(4) 17.9-23.0 mm. ANSP 104315: Stream (30 m) 3 km N of Montijo, 14 Jan. 1962(2) 20.0-29.0 mm. ANSP 104473: Río San Martín Grande (30 m) 14 Jan. 1962(7) 15.0-29.3 mm. ANSP 104235: Stream (200 m) on La Mesa road, 4 Jan. 1962 (11) 18.2-30.8 mm. ANSP 104335: Stream (75 m) 5 km W of Pena, 4 Jan. 1962(8) 15.8-23.2 mm. USNM 246825: Stream (105 m) on road to Soná, 4 Jan. 1962(55) 14.9-82.2 mm. USNM 246823: Stream (75 m) on Soná road, 28 Oct. 1961(2) 20.9-28.2 mm. USNM 246199: River (105 m) on Soná road, 28 Jan. 1962(2) 19.0-20.3 mm USNM 246817: Río San Martín Chiquito (30 m) 14 Jan. 1962(4) 19.6-28.3 mm.

Río Negro Basin: ANSP 76413: Jacinto, at head of Río Negro, Azuero Peninsula, 1940(38) 13.0-34.1 mm.

Río Santa María Basin: USNM 246196: Stream (300 m) near Santa Fe, 9 Feb. 1962(24) 12.8-37.7 mm.

Diagnosis: *Brachyrhaphis roseni* is distinguished from its congeners by the following combination of characteristics: presence of dusky bars on the flanks; 9-12 (usually 10 or 11) dorsal fin rays; dorsal-fin origin over 11th. vertebra; tip of gonopodium straight or slightly curved dorsally (without fleshy thickenings); 4-7 (usually 5 or 6) serrae on gonopodial ray r p; three well developed gonopophyses, first two with uncini, third with no or incipient uncini. In addition, the species has no fleshy bean-shaped pad at tip of first pelvic ray, nor bony knob on premaxillary symphysis of males.

Description: Body of females robust, males slender. Body depth of both sexes greatest at pelvic-fin origin; greatest body depth in SL 3.2-3.9 times in males and 3.0-3.5 times in females. Dorsal profile gently rounded in both sexes. Ventral profile rounded anteriorly; postanal profile straight or slightly concave. Caudal peduncle depth in SL 5.1-5.8 times in males, 5.5-6.5 times in females.

Head length 3.1-3.5 times in SL; head width 4.5-5.3 times in SL. Eyes slightly below dorsal head profile; horizontal orbit diameter 2.9-3.3 times in head length of males and 3.2-3.6 times in females. Least width of bony interorbital 2.0-2.5 times in head length. Snout length approximately that of orbit diameter, 2.9-3.6 times in head length.

Mouth opening located dorsally. Three irregular rows of recurved sharp-pointed conical teeth on each jaw. Teeth of outer series enlarged and widely spaced. Teeth of inner series shorter and more closely spaced.

Dorsal fin arising posterior to midpoint of body, above or slightly in advance of anal-fin origin in both sexes. Dorsal-fin origin to snout tip (predorsal distance) in SL 1.8-2.0 times in males and 1.6-1.8 times in females. Distance from dorsal-fin origin to caudal-fin base in SL 1.9-2.2 times in males and 2.2-2.4 times in females. Length of dorsal-fin base in SL 4.1-5.1 times in males and 4.7-5.7 times in females. Depressed length of dorsal fin in SL 2.4-2.9 times in males and 2.9-3.4 times in females. Dorsalfin rays 9(1), 10(13), 11(21), 12(2), mean 10.6 (frequency in parentheses).

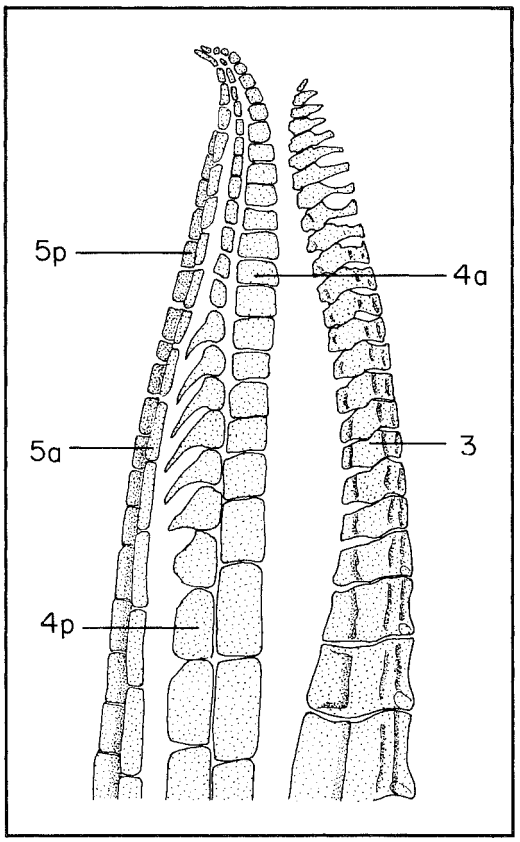

Fig. 3. Distal tip of gonopodium of *Brachyrhaphis roseni*, new species (LACM 4868) a male paratype, 28.8 mm SL.

Anal-fin rays 10(18 female paratypes). Anal-fin origin to caudal base (preanal distance) in SL 1.8-1.9 times in males and 1.5-1.7 times in females. Distance from anal-fin origin to caudal-fin base in SL 2.0 times in males and 2.3-2.4 times in females. Length of gonopodium in SL 3.0-3.4 times. Length of anal-fin base in SL 9.2-11.0 times in females.

Pectoral-fin rays 13(8), 14(29), mean 13.8. Tip of fins extending posteriorly to origin of pelvic fins of females and to midpoint of pelvics of males. Length of pectoral fin in SL 4.1-4.9 times in males and 4.3-5.2 times in females.

Pelvic-fin rays 6(37). Tip of fins extending posteriorly to vent of females and to about sixth anal-fin ray of males. Length of pelvic fin in SL 5.3-6.6 times in males and 6.4-7.3 times in females. Caudal-fin rays 15(14), 16(17), 17 (5), mean 15.8. Length of caudal fin in SL 3.5-4.1 times in males and 3.7-4.5 times in females.

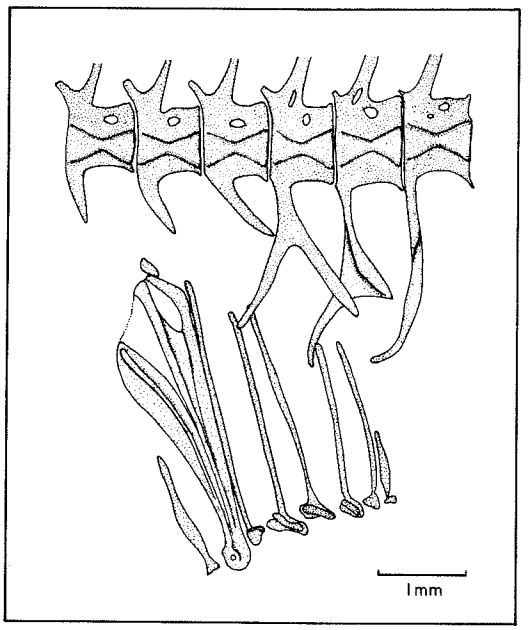

Fig. 4 Gonopodial suspensorium of *Brachyrhaphis roseni*, new species (LACM 4868) a male paratype, 28.8 mm SL.

Total number of gill rakers on first arch 12 (1), 13(7), 14(17), 15(9), 16(2), 17(1), mean 14.2. Scales in lateral series 27(11), 28(24), 29 (2), mean 27.7. Scale rows around caudal peduncle 16(37). Predorsal scales 11(1), 12(18), 13(18), mean 12.5. Vertebrae 12 + 17 on three cleared and stained paratypes.

Gonopodium bilaterally symmetrical. Ray 3 terminating short of other rays, terminal segments rapidly decreasing in size, also with spines ventrally (Fig. 3). Subdistal serrae on ray 4p: 4(5), 5(35), 6(39), 7(6), mean 5.5; holotype with 5 serrae. Unspecialized small distal segments of rays 4 and 5 forming tip of gonopodium and continuing nearly straight or slightly decurved (Fig. 3).

Gonopodial suspensorium with three well-developed gonapophyses curved anteriorly (Fig. 4). Gonapophysis I curved anteroventrally, tip lying above gonactinosts 6 and 7 or between 5 and 6; a pair of long, slender uncini arising slightly nearer base than center of gonapophysis and directed posteroventrally. Gonapophysis II projecting anteroventrally between preceding uncini and bearing a pair of short, stout uncini directed posterioventrally from midpoint of gonapophysis. Gonapophysis III oriented vertically, but distal half curving anteroventrally; uncini, if present, short, wide-based and arising nearer tip than base of gonapophysis. Ligastyle minute.

Gonactinost 1 free. Primary gonactinostal complex (gonactinosts 2, 3 and 4) long, slender; openings distally between gonactinosts 2 and 3, and 3 and 4; narrow lateral flange on gonactinost 4. Gonactinosts 5 to 10 free; gonactinost 5 lying against primary gonactinostal complex; gonactinost 6 with tip expanded laterally into inverted triangle; other gonactinosts simple.

Sensory canals of supraorbital series consisting of an open groove. Preopercular canal closed, with 7 pores. Mandibular canal typically closed, with 5 pores, occasionally represented by open groove; holotype with 5 pores. Preorbital canal closed, with 4 pores or with 2 pores dorsally, an open groove below; holotype with 4 pores.

Coloration: Orange and yellow pigments lost in preservative, otherwise preserved and live specimens with same coloration. Ground color yellow-gray; scale pockets edged in black or dark brown creating a reticular pattern on body that fades out on belly. A series of 11 or 12 dusky vertical bars along sides, most prominent on males and on urosome of both sexes (Figs. 1 and 2).

Dorsal fin dusky along base with a row of black blotches on interradial membranes at midlength; distal half of fin orange with a thin black margin. Anal fin and gonopodium orange or yellowish with black blotch at base extending onto body and along fourth and fifth anal rays. Border of caudal fin on males yellow or orange with sub marginal duskiness; dark streaks on interradial membranes forming a wide intermittant vertical bar at midlength of caudal fin of both sexes.

Etymology: This species is named in memory of Donn E. Rosen in recognition of his outstanding contributions to biosystematics and biogeography, many dealing with fishes of the Middle American region.

Ecology: *Brachyrhaphis roseni* inhabits streams of low to moderate current velocity. Specimens were collected between 20 and 300 m above sea level at temperatures of 22-30 °C. The species is principally insectivorous.

Geographic distribution: The species is restricted to the Río Coto basin in Costa Rica, but extends eastward into Panama to the headwaters of the Río Santa María drainage in Veraguas Province, Panama. To the north it is replaced by *B. rhabdophora* (Regan) and to the east by *B. episcopi* (Steindachner). *Brachyrhaphis terrabensis* (Regan) is sympatric with *B. roseni* in the Chiriquí and Chiriquí Viejo basins, but occurs at higher altitudes.

REMARKS

Brachyrhaphis roseni and *B. rhabdophora* differ from their congeners in lacking a number of seemingly specialized characteristics (*eg.* fleshy thickenings at gonopodial tip, fleshy pad on pelvic ray, modified premaxillary process, etc.). The lack of trenchant differences between these two species also suggests a close relationship.

In the process of analyzing the new species and specimens collected throughout the range of *B. rhabdophora,* additional differences were also observed between *rhabdophora* occurring in northern Costa Rica and those found in the south. It is quite possible that, pending further study, these two populations will merit specific recognition and that the species name *Brachyrhaphis olomina* (Meek) can be revived for the northern population.

ACKNOWLEDGMENTS

I am grateful to the following persons who assited in the loan of specimens or use of their facilities: W. Smith-Vaniz, B. Chernoff (ANSP), R. Lavenberg, J. Seigel (LACM) and A. Wheeler (BMNH). Others are gratefully acknowledged for their collaboration in making field collections: O. Blanco, D. & P. Fromm, H. Loftin, J. Savage and N. Scott. The work was carried out in the facilities of the Academy of Natural Sciences of Philadelphia, Natural History Museum of Los Angeles County, Smithsonian Institution and the Museo de Zoología, Universidad de Costa Rica.

RESUMEN

Se describe una olomina nueva de material recolectado en la cuenca del río Coto en el sureste de Costa Rica y en Panamá occidental. La especie nueva es similar a *B. rhabdophora* por carecer ambas de varias características especializadas presentes en los otros siete miembros del género *Brachyrhaphis*. *Brachyrhaphis rhabdophora* reemplaza a *B. roseni* en las cuencas hidrográficas adyacentes en el norte y de igual manera, *B. episcopi* lo reemplaza en Panamá central.

REFERENCE

Bussing, W.A. 1985. Patterns of distribution of the Central American ichthyofauna, p. 453-473. *In* F.G. Stehli & S.D. Webb (eds.). The great American biotic interchange. Plenum Pub. Corp.