A New Species of Columbid Snake (Synophis) from Western Colombia

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ABSTRACT.—Based on characters of external morphology, scutellation, and osteology, we describe a new species of Synophis from the Pacific versant of the Cordillera Occidental of Colombia. Assignment of this species to Synophis is tentative, pending a reassessment of nothopsin relationships. Some natural history notes are reported for the new species.

RESUMEN.—Con base en caracteres de morfología externa, escamación y vértebras, se describe una nueva especie de Synophis del bosque nublado de la vertiente pacífica de la Cordillera Occidental de Colombia. La referencia de esta especie a Synophis es provisoria y queda a la espera de una revisión de las relaciones de los nothópsinos. Se reportan algunos aspectos de la historia natural de la nueva especie.

In August 1994, personnel from the Laboratorio de Herpetología of the Universidad del Valle, in Colombia, began an intensive survey of the herpetofauna at Hacienda San Pedro on the Pacific slopes of the Cordillera Occidental of Colombia. Among the material collected at this site are two specimens representing an undescribed species referable to Synophis. In three years of work at Hacienda San Pedro, only two specimens of Synophis were collected. Herein, we describe this new species and discuss morphological variation and current problems encountered in studying the systematics of the genera Emmochilophis (E. fugleri and E. miops) and Synophis (S. bicolor, S. calaminus, and S. lasallei; sensu Hillis, 1990) and present natural history data for the new species. As indicated by Bogert (1964) and Hillis (1990), attempts to study the biology of these enigmatic snakes have been thwarted by a paucity of specimens, presumably because of low population densities and/or semifossorial habits.

MATERIALS AND METHODS

Because of the presumed sister relationship between the genera Synophis and Emmochilophis (sensu Hillis, 1990) and the similarity among their species, we compare and diagnose the new species with respect to members of Emmochilophis, Synophis, and Xenopholis (see the Appendix). To assess the validity of current phylogenetic hypotheses, we also examined a variety of other colubrid genera. Data from specimens unavailable for examination were compiled from Bogert (1964), Hillis (1990), Nicéforo-María (1950, 1970), Peracca (1896), and Werner (1923).

The sex of the female holotype was determined by visual examination of the relatively short tail length and small girth and was confirmed by the lack of radiodense hemipenial spines in radiographs (Card and Mehaffey, 1994). The sex of the male paratype was verified by presence of hemipenes and chin tubercles. Color descriptions are based on preserved specimens, field notes, and photographs of the paratype in life. Body measurements were made to the nearest 0.1 mm with a metal straight ruler and digital calipers. Illustrations were drawn with the aid of a Nikon SMZ-U dissecting microscope with a camera lucida attachment. The coordinates of the type locality were determined using a Magellan CPS satellite receiver. Vertebral characters were examined from radiographs (1.25-min exposure; 5 mV; 45 KV), dried skeletal material, and cleared-and-double-stained vertebrae. These materials were compared with descriptions by Bogert (1964), Fritts and Smith (1969), and Hillis (1990). Teeth were counted on the right side of the holotype only and were observed from the radiographs.

Synophis plectovertebralis sp. nov.
(Figure 1)

Holotype.—UVC 11858, a female collected on 31 March 1995 by Luciano Atoy Ortega at Hacienda San Pedro, about 6 km south El Queremal, Municipio Dagua, Departamento del Valle del Cauca, Colombia, 03°29'N, 76°42'W, at 1800 m on the Pacific versant of the Cordillera Occidental.
DESCRIPTION OF SYNOPSIS PLECTOVERTEBRALIS

Paratype.—UVC 11580, a juvenile male (below), collected by Taran Grant on 26 August 1994 at the type-locality.

Diagnosis.—Ferrarelli (1994) listed the following characters shared by members of the tribe Nothopsini: (1) dentition ginglyphous; (2) posterior hypapophyses present; (3) neural spine expanded and grooved or sulcate on dorsal surface; (4) zygapophyses expanded; (5) prefrontal scale single; and (6) anal plate single. Of these, 1, 2, 4, 5, and 6 are present in *S. plectovertbralis*. We consider *S. plectovertbralis* to be a member of *Synopsis* on the basis of (1) presence of a loreal scale; (2) more than 144 ventral scales; (3) internasals not separated medially (i.e., scales in contact); and (4) scale row reduction. *Synopsis plectovertbralis* can be distinguished from other species of *Synopsis* and *Emnochlophys* as follows; dorsal scale rows 19-19-17; nuchal collar present and incomplete; lower five or six dorsal scale rows not keeled, all others weakly keeled; infralabials 7–9; anterior three or four infralabials in contact with anterior chin shields; Infralabial IV in contact with posterior chin shields; ventrals 144–147; subcaudals 79–91 (likely reflecting intersexual variation); superior and inferior quarter of posterior supralabials gray; and loreal present.

*Emnochlophys fugleri* has 19-19-19 dorsal scale rows, 140 ventrals, and 97 subcaudals in males. *Synopsis calaminus* has 21-19-17 dorsal scale rows and 163–166 ventral scales; *S. lasallei* has 21–23 anterior, 21–23 midbody, and 19–21 posterior dorsal scales and 144–158 ventrals, and *S. bicolor* has 156–166 ventrals [180 reported for the holotype and 184 in a specimen in northwestern Colombia (Bogert, 1964)], 100–106 subcaudals in females, and 118 subcaudals in males (136 in unsexed holotype and 127 in a male in northwestern Colombia).

Description of the Holotype.—Female, presumably juvenile (see Discussion); snout–vent length (SVL) 195.5 mm; tail length (TL) 76.5 mm (= 28.13% of total length); eye diameter (ED) 1.4 mm; pupil round; greatest head width (HW) 6.2 mm at level of supralabials 7 and 8; and head length (HL) 10.1 mm from snout to posterior margin of jaw; width at midbody 6.0 mm (= 97% HW); head distinct from neck (Fig. 1).

Parietals large, paired, longer than wide; prefrontals fused, two times wider than long; frontal single, heptagonal, width equal to length; loreal present, rectangular, two times longer than high; preocular single, bordering anterior one-fourth margin of orbit; supraocular single, bordering dorsal one-fourth margin of orbit; temporals 1 + 2; anterior temporals two times longer than high; posterior temporals two times longer than high, one-half length of anterior temporals; internasals not separated by rostral and prefrontal, distinctly wider than long; nasals not in contact, bearing pattern of irregular shallow creases; rostral concave, two times wider than high, bordered by first supralabials, nasals, and internasals; rostral visible from above; mental triangular, bordered by first pair infralabials; infralabials 7; supralabials 7/8 (fourth and fifth entering orbit on left side, third and fourth on right); anterior genials bordered laterally by infralabials 1–3 on right side, 1–4 on left side, three times longer than wide; posterior genials bordered laterally by infralabial 4, four times longer than wide, anterior halves in contact medially, posterior halves divergent, separated posteriorly by single pair of gulars. Dorsal scale rows 19-19-17; rows 1–5 or 6 smooth, others weakly keeled. Anal entire; 147 ventrals; 79 paired subcaudals.

Vertebrae (Fig. 2) procoelous; postzygapophyses expanded laterally and projecting anteriorly, fused synostotically with prezygapophyses, demarking a zygapophyseal foramen on either side of the axis of the vertebrae (all but first 25 caudal vertebrae). Anterior margin of fused zygapophysis articulating posteroventrally with postzygapophysis of preceding verte-
Fig. 2. Dorsal and lateral views (A and B) of trunk vertebrae of *Synophis plectovertbralalis* and dorsal view (C) of *Synophis bicolor* showing similarities between the two species. Note that the postzygapophyses curve anteriorly and fuse with the prezygapophyses in both species; the zygaphysseal foramen is present in both species as well; however, the degree of ossification in *S. plectovertbralalis* is less extreme than that of *S. bicolor*. Black indicates foramina or spaces between vertebral elements.

1–5 with dark gray superior margins; anterior half of infralabial 6 so marked; infralabials 1–5 and 7 with gray inferior margins; mental gray laterally; cream medially; genials cream with irregular gray mottling; gulars cream with irregular and diffuse gray mottling; rostral gray inferiorly, cream superiorly; Supralabial 1 gray; Supralabials 2–6/7 with fine gray inferior margin; Supralabials 2–8/7 gray superiorly, color pattern becoming progressively wider posteriorly, producing a cream band extending from Supralabial 2, passing beyond ultimate supralabial and joining ventral scales; nasals irregularly mottled cream and gray; internasals cream, becoming gray posteromedially; right loreal solid gray, left loreal cream anteriorly, gray posteriorly; prefrontal gray with cream mottling at margins abutting preocular scales; preocular gray along margin of orbit, cream adjacent to prefrontal scales; supraocular gray posteriorly and along margin of orbit, otherwise cream; postocular gray inferiorly and along margin of orbit, cream otherwise. Frontal gray; parietals gray, each bearing one irregular cream blotch; anterior temporals gray with small cream blotch adjacent to upper posterior temporals; upper posterior temporals cream rostrally and gray posteriorly; lower posterior temporals gray. Bilateral cream nuchal blotches present with distinct, irregular gray mottling; nuchal blotches separated anteriorly along midline by gray coloration. Iris and sclera black. In life, dorsum black; venter white; nuchal collar and markings on head creamy yellow.

*Variation*. In *Paratype*.—Subadult male SVL 212.0 mm; TL 100.0 mm (= 32.1% total length); HW 5.8 mm; HL 11.0 mm; ED 1.3 mm. Right inverted hemipenis extends in situ to level of seventh subcaudal; slips of retractor muscles merge at level of subcaudal 10; M. retractor penis longus originates at level of Subcaudal 28. Ventral 144; subcaudals 91. Infralabials 8/9; Infralabials 1–4/5 contacting anterior genials; Infralabials 5 and 6 border posterior genials; prefrontal exhibits weak mediang groove. Supralabials 8; Supralabials 4 and 5 enter the orbit. Weak chin tubercles scattered on mental, infralabials, and genials. Temporals 1 + 3. *Paratype* agrees with holotype except for the following aspects: Supralabials 2–6 with fine gray inferior margin, and 2 and 3 otherwise entirely cream. Supralabial 4 with posterodorsal margin gray. Rostral cream, gray superiorly; internasals gray; right loreal solid gray, left loreal cream along inferior margin, gray superiorly; prefrontal gray with irregular cream mottling laterally; right preocular gray; left preocular gray with cream blotches; supra- and postauricular gray with dark cream blotches; frontal gray with brownish tinge laterally; parietals gray with brownish
tinge and large, irregular cream blotches on left parietal; anterior temporals gray; posterior temporals gray with irregular cream blotches. Anterior ventrals cream. In addition to black dorsals, white ventrals, and creamy yellow nuchal collar and facial markings, two yellow longitudinal lines were observed on the dorsal surface of the tongue.

Etymology.—The specific epithet is a combination of the Latin adjectives plecto- meaning braided or woven, and -vertebralis in reference to the vertebrae. The name refers to the braided appearance of the peculiar vertebrae in dorsal view.

Natural History.—Synophis plectovertebralis occurs in forest, on the Pacific slope of the Cordillera Occidental of Colombia at 1800 m. The holotype was reported to have been collected in a small pile of vegetation debris in a cow pasture, whereas the paratype was collected while active at night in moist leaf litter approximately 5 m from a stream (“La Seca”) in a remnant patch of forest.

No defensive behavior was noted upon capture of the paratype; however, the following day, the snake was observed to become rigid while being manipulated for photography. Rigidity increased to the point of forming a zig-zag pattern along the axis of the vertebral column, at which time the specimen did not respond to stimuli. Body compression (dorsalventral flattening), as is common in many xenodontines (Meyers, 1986), was not associated with this behavior.

The stomach of the holotype contains the mostly digested remains of a gymnophthalmid lizard referable either to Ptychoglossus or Arthrosoaura by the presence of parallel margins on the ventral scales (Harris, 1994). Species of Arthrosoaura are confined to the Amazon regions, whereas Ptychoglossus stenolepis is common at the type-locality; therefore, it is likely that the prey item represents P. stenolepis.

Discussion

The paucity of specimens and lack of equivalent semaphorants for most species contribute to much of the difficulty in studying snakes of the tribe Nothopsini (Diaphorolepis, Emmochliophis, Nythopsis, Synophis, and Xenophilus). Among the species of Diaphorolepis, Emmochliophis, and Synophis, adult and juvenile males and females have been examined only for Diaphorolepis wagneri (pers. obs., mostly at UVC), S. bicolor (Bogert, 1964; but see below), and S. lasallei (Bogert, 1964). The only known specimen of E. miiops is a female (Boulenger, 1898; Sheil, 1998) of unknown maturity, the sole specimen of E. fugleri is a male (Fritts and Smith, 1969) of unknown maturity, and the sex of the sole specimen of D. laevis is not reported (Werner, 1923). Synophis calamitus is known only from a female and an unsexed specimen, both juveniles (Hillis, 1990), and S. plectovertebralis is known only from single, immature male and female specimens (described herein). Because of this lack of specimens, it is impossible to assess accurately characters that vary ontogenetically or sexually (for which equivalent semaphorants must be compared; Henning, 1966) or are polymorphic.

Among colubrid snakes, protuberances or tubercles on the chin are known to be confined to males (e.g., Fritts and Smith, 1969; Savitzky, 1974), and it seems that their appearance coincides with the onset of sexual maturity. In a series of Diaphorolepis wagneri, chin tubercles are absent in all neonates, females, and a relatively small male (UVC 5255; 325 mm SVL); they are weak in a larger, subadult male (UVC 12187; 333 mm SVL), and are strongly expressed in an even larger, adult male (UVC 5254; 348 mm SVL). Because only a single male Synophis plectovertebralis is known, we do not know whether its indistinct protuberances represent the maximum expression in this species. However, the tubercles of the paratype are similar to those of a subadult D. wagneri (UVC 12187), and therefore we postulate that it is a subadult specimen. Because female colubrids generally attain greater relative snout-vent lengths than males (Shine, 1978; Fitch, 1981; Shine, 1993), we assume that the female (whose SVL is 16 mm less than that of the male paratype) is a juvenile.

The systematics of Synophis and Emmochliophis was studied recently by Hillis (1990), who proposed a hypothesis of relationships among their species and established their current generic taxonomy. However, Hillis’ (1990) incorrect coding of several outgroup character states (his Characters “B” = number of ventrals, “K” = shape of rostral scales, “L” = keels on first row of dorsals, and “M” = keels on remaining dorsals), treatment of intraspecifically variable characters (e.g., expansion of neural spines, number of infralabials, presence of pale nuchal collar, and eye size relative to head depth), and incorrect identification of Diaphorolepis wagneri (KU 75682) as D. laevis make his conclusions arguable. Also, it should be noted that the monophyly of Emmochliophis + Synophis has not been tested rigorously because Hillis (1990) assumed their monophyly and included only a single outgroup taxon (Diaphorolepis). In Hillis’ (1990) cladogram, the only characters that separate Emmochliophis and Synophis from Diaphorolepis are expanded postzygapophyses (A1 on his cladogram), which also occurs in Xenophilus, and the presence of fewer than 160 ventrals (B1 on his cladogram), which also occurs in D. laevis as well. Similarly, the absence of scale row reduction is a putative synapomorphy for E. fugleri +
E. miops, but this character state is also seen in Xenophilus. As currently defined, Emmochliophis and Synophis differ in the occurrence of a loreal (absent in Emmochliophis; present in Synophis) and scale row reduction (not reduced in Emmochliophis; reduced in Synophis), and it is based on these differences that we assign the new species to Synophis. We emphasize that a phylogenetic interpretation of these differences awaits a rigorous cladistic analysis based on appropriate characters and outgroups (Diaphorolepis, Notophis, and Xenophilus; Ferrarezz, 1994).

On a final taxonomic note, when considering the assignment of generic names, workers should be aware of a problem regarding Synophis bicolor, the type species of Synophis. The holotype of S. bicolor has not been examined in over a century, and all comparisons have been based on Peracca’s (1896) brief description. The vagueness of the type locality (“’America meridionale’” (Peracca, 1896)) further confuses matters. Bogart (1964) assumed that he was dealing with a single Ecuadorian species and consequently interpreted the extreme divergence in number of ventrals and subcaudals between his material and the holotype as intraspecific variation. However, Nicéforo-Maria (1970) described a male (MLS 2072) from near Medellin in the Cordillera Central de Colombia as having 184 ventrals and 127 subcaudals, thus resembling the unsexed holotype (with 180 ventrals and 136 subcaudals) more closely than any of the Ecuadorian material examined by Bogart (1964) or Hillis (1990; maximum number of 166 ventrals and 118 subcaudals; N = 8). This suggests that, as currently defined, S. bicolor may consist of two relatively invariable, allopatric species.

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Literature Cited


DESCRIPTION OF SYNOPSIS PLECTOVERTEBRALIS

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APPENDIX
SPECIMENS EXAMINED

**Synopsiss plectovertebralis**

**COLOMBIA: Valle del Cauca:** 6 km south El Queremal, Municipio Dagua 03°29'N, 76°42'W, 1800 m on the Pacific versant of the Cordillera Occidental, UVC 11858 (holotype), UVC 11580 (paratype).

**Synopsiss lasallei**

**ECUADOR: Napo:** 2 km south-southwest Rio Reventador, 1490 m, KU 164221.

**Synopsiss bicolor**

**ECUADOR: Pastaza:** Mera, 1140 m, KU 121341.

**Synopsiss calamitus**

**ECUADOR: Pichincha:** 4 km southeast Tandayapa, 1890 m, KU 197107 (holotype); 9 km southeast Tandayapa, 2150 m, KU 164208 (paratype).

**Xenopholis scalaris**

**ECUADOR: Napo:** Puerto Libre, Rio Aguarico, 570 m, KU 121929. **Napo:** Santa Cecilia, 340 m KU 121930; Lago Agrio, 330 m, KU 126055.

**Emmachloris fugleri**

**ECUADOR: Pichincha:** 24 km south Santo Domingo de los Colorados, 4 km east Rio Baba Bridge, 600 m, UIMNH 78795 (holotype).

**Emmachloris miops**

**ECUADOR: Imbabura:** Parambas, 00°48'18"N, 78°21'03"W, 780 m, BMNH 1946.1.12.30 (holotype).

**Diaphorolepis wagneri**

**COLOMBIA: Valle del Cauca:** Municipio Cali, Pichindé, Farallones de Cali, UVC 5254; Pance, Camino a Corea, Ponce, Farallones de Cali, UVC 5255. **Chocó:** Municipio San José del Palmar, 13 km east San José del Palmar, 1800 m, UVC 12187.

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Egg-Laying Activities and Reproductive Traits in Females of *Oplurus cuvieri cuvieri*

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**Abstract.**—We studied the egg-laying activities and the relationships between basic reproductive traits of *Oplurus cuvieri cuvieri* in a deciduous dry forest area of Madagascar. Oviposition was observed after the first heavy rain of the rainy season. Females migrated to the trails from their shelter trees in the forest and moved around along the trail, presumably making nest site selections. The egg-laying activities were divided into four phases: digging, laying eggs, filling, and covering. Females left the nests with a rapid bipedal locomotion after oviposition. Mean body temperature of the oviposited females was 42°C. Extensive predation on the eggs by snakes was confirmed. Clutch size was variable (2–5) and depended on maternal SVL. With female body size held constant, egg mass and egg length exhibited negative correlations with clutch size. Mean relative clutch mass was 20.4%. Behavioral elements such as migrations to egg-laying site should be evaluated as the female reproductive investment as well as relative clutch mass.

The Opluridae is a lizard family that was formerly included as a subfamily of the Iguanidae (Frost and Etheridge, 1989). Oplurid lizards are grouped into two genera, *Chalarodon* and *Oplurus*. *Chalarodon* is a monotypic genus, and *Oplurus* consists of six species. All members of Opluridae except one subspecies of *O. cuvieri*, which occurs on Grand Comoro, are endemic to Madagascar (Blanc, 1977; Meirte, 1992). The ecology and behavior of the Opluridae is poorly known, and even basic information on the life history of this unique taxon is largely lacking.

Information on female reproductive investment such as clutch size, egg size, and hatching size is vital for understanding life-history evo-