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## REDESCRIPTION OF *LEPTOPHIS CUPREUS* (COPE) (SERPENTES, COLUBRIDAE), A RARE SOUTH AMERICAN COLUBRINE SNAKE

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### ABSTRACT

*Leptophis cupreus* is redescribed on the basis of 18 specimens, including the holotype. The species is characterized by having a uniformly copper-colored dorsum, which distinguishes it from all other known species of *Leptophis*. We present photographs of the holotype and a living specimen of *L. cupreus*, describe and illustrate the everted hemipenis, and plot its known distribution.

KEYWORDS: *Leptophis cupreus*; holotype; Distribution; Hemipenis; Taxonomy.

### INTRODUCTION

*Leptophis cupreus* (Cope 1868) is a rare species of colubrid snake known from a few localities in north-western South America. For some unknown reason, Oliver (1942, 1948) did not include *cupreus* in his list of names available for species of the genus *Thalerophis* (= *Leptophis*), and he did not mention the species in any part of his revision. Subsequently, Peters & Orcés-V (1960) redescribed *Leptophis cupreus* based on five specimens collected in eastern Ecuador, and together with Peters (1960) reported that the holotype of *L. cupreus* (formerly USNM 6666) was presumably lost. Malnate (1971) however, referred to the holotype as ANSP 5202 in his list of types in the Academy of Natural Sciences of Philadelphia. Later, Dixon & Soini (1977) reported two specimens from the Iquitos region of Peru, and Pérez-Santos & Moreno (1988) mentioned a specimen (LACM 45444) from

the Chocó of western Colombia bringing the total of known specimens to nine.

Ancillary to a revision of *Leptophis* (Albuquerque, 2008, 2009) we examined 18 specimens of *L. cupreus*, including the holotype. Examination of these specimens allows us to counter Harding's (1995) suggestion that *L. cupreus* is a nomen dubium and makes possible a more detailed characterization of *L. cupreus* including within-species variation, distribution, and hemipenial morphology.

### MATERIAL AND METHODS

Institutional abbreviations of collections that provided access to specimens and/or photos are as follows: Academy of Natural Sciences of Philadelphia (ANSP), Instituto de Ciencias Naturales (ICN), Los Angeles County Museum of Natural History

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2. USGS Patuxent Wildlife Research Center, Smithsonian Institution, PO Box 37012, National Museum of Natural History, Room 378, MRC 111, Washington, DC 20013-7012, USA. E-mail: mcdiarmr@si.edu.

(LACM), Museum of Comparative Zoology (MCZ), Texas Cooperative Wildlife Collection (TCWC), and United States National Museum (USNM). The 18 specimens of *Leptophis cupreus* examined in this study are listed in the Appendix.

Ventral scales were counted according to Dowling (1951). All measurements were made to the nearest 0.1 mm using digital calipers, except for snout-vent (SVL) and tail length, which were taken with a flexible ruler to the nearest millimeter. Bilateral variation is reported as right/left. Where no hemipenis was everted, the sex of each specimen was determined by making a post-cloacal incision between the 10<sup>th</sup> and 12<sup>th</sup> subcaudals and checking for the presence of hemipenes. The hemipenial description is based on the manually-everted left organ of ICN 390 that was prepared following Pesantes (1994); the hemipenis is fully everted and almost maximally expanded (*sensu* Myers & Cadle, 2003; *see also* Zaher & Prudente, 2003). Terminology for hemipenial morphology followed Dowling & Savage (1960) and Zaher (1999). A distribution map was made using ArcView GIS 3.2 with some localities obtained from the online version of the Global Gazetteer 2.1 by Falling Rain Genomics ([www.fallingrain.com/world](http://www.fallingrain.com/world)).

## RESULTS

### Species account

#### *Leptophis cupreus* (Cope, 1868)

*Thrasops cupreus* Cope, 1868. Proceedings of the Academy of Natural Sciences of Philadelphia 20:96-140. Holotype: ANSP 5202, collected by James Orton in late 1867. Type-locality: "from the Napo and Maranon".

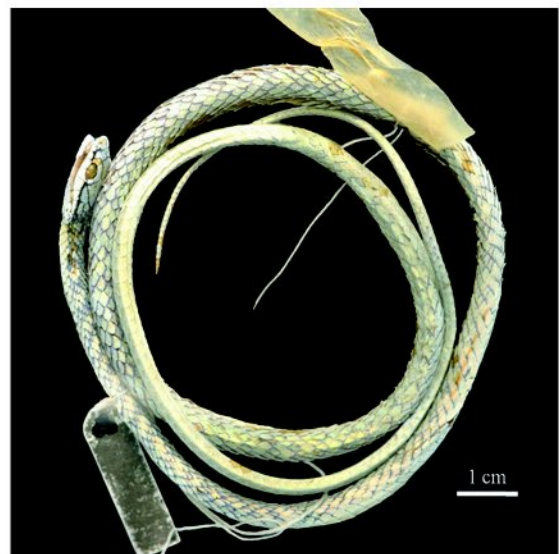
*Leptophis cupreus* – Boulenger, 1894:109; Werner, 1929:102-103; Peters, 1960:525; Peters & Orcés-V, 1960:139-141; Peters & Orejas-Miranda, 1970:164; Mertens, 1973:144-145; Dixon & Soini, 1977:20, 58; Duellman, 1978:249-250; Dixon & Soini, 1986:6, 75, 114; Pérez-Santos & Moreno, 1988:213-214; Pérez-Santos & Moreno, 1991:219-220; Carrillo de Espinoza & Icochea, 1995:16; Harding, 1995:225; Jorge da Silva & Sites, 1995:895.

#### Description of holotype (Figs. 1-2)

As noted by Malnate (1971), ANSP 5202 corresponds to the holotype of *L. cupreus* that was referred

to as "No. 6666" by Cope in the type description (1868:106). This specimen, originally cataloged as USNM 6666, was apparently recataloged as ANSP 5202 in the confusion over provenance of specimens in Cope's possession at the time of his death in 1897 (*see later discussion*).

The ventral and subcaudal counts for this specimen are identical to those reported by Cope (1868); other details of scutellation are the same, and the measurements are extremely similar. The coloration is different in several respects from that presented in Cope's description; however, the specimen has lost all of the *stratum corneum*, a condition that had begun when Cope described it, and as a result has not retained its original coloration. This specimen is a small female, possibly juvenile, SVL 313 mm, tail length 205 mm, with bands on the anterior and middle region of the body, similar to those found in juveniles of other species of *Leptophis* (*see* Oliver, 1948). Head elongate and distinctly broader than neck, narrower than diameter of midbody. Head length from the posterior tip of retroarticular process of the mandible 12.27 mm, 3.9% of SVL. Snout length from tip of snout to anterior margin of orbit 3.80 mm. Rostral wider than high, visible from above. Nasals undivided; right nasal separated from preocular by broad prefrontal contact with second and third supralabials; left nasal separated from preocular by loreal scale. Prefrontals not contacting orbits; prefrontals slightly larger than internasals. Frontal longer than wide, about twice as long as prefrontals.



**FIGURE 1:** Dorsal view of the holotype of *Leptophis cupreus* (ANSP 5202), a young female specimen (518 SVL) from the "Napo and Maranon".

Single anterior temporal on each side in contact with parietal, postoculars, and sixth, seventh and eight supralabials; two posterior temporal scales, upper reaching the end of parietal on each side. Eye large, horizontal diameter 2.64 mm, pupil round. Single preocular on each side, in contact with frontal. Two postoculars on each side, the upper about three times higher than lower. Two pairs of elongate chin shields separated by mental groove, with posterior pair distinctly more elongate. Mental not touching anterior chin shields. Anal plate divided; 152 ventrals; 137 paired subcaudals (tail complete); scales of vertebral and paravertebral rows slightly larger than those of adjacent rows; supralabials 8/8, 4-5/4-5 in contact with orbit; infralabials 10/10, 1-5 in contact with anterior chin shields; parietals longer than broad and in contact with upper postocular.

Dorsal scale rows 15-15-11; keels on dorsal scale rows 2-14 of trunk (reduced and often indistinct on scales of vertebral row), absent on first dorsal rows; dorsal scales of tail without keels. Single apical pit present on all dorsal scales of trunk, except those in first dorsal row. Narrow black ocular stripe along upper margins of second and third supralabials, covering lower postocular, lower edges of anterior and lower posterior temporals, and upper edges of last three supralabials; stripe disappears two scales posterior to last supralabial.

**Variation**

Additional specimens examined are similar in scutellation to the holotype (Table 1). The preoculars

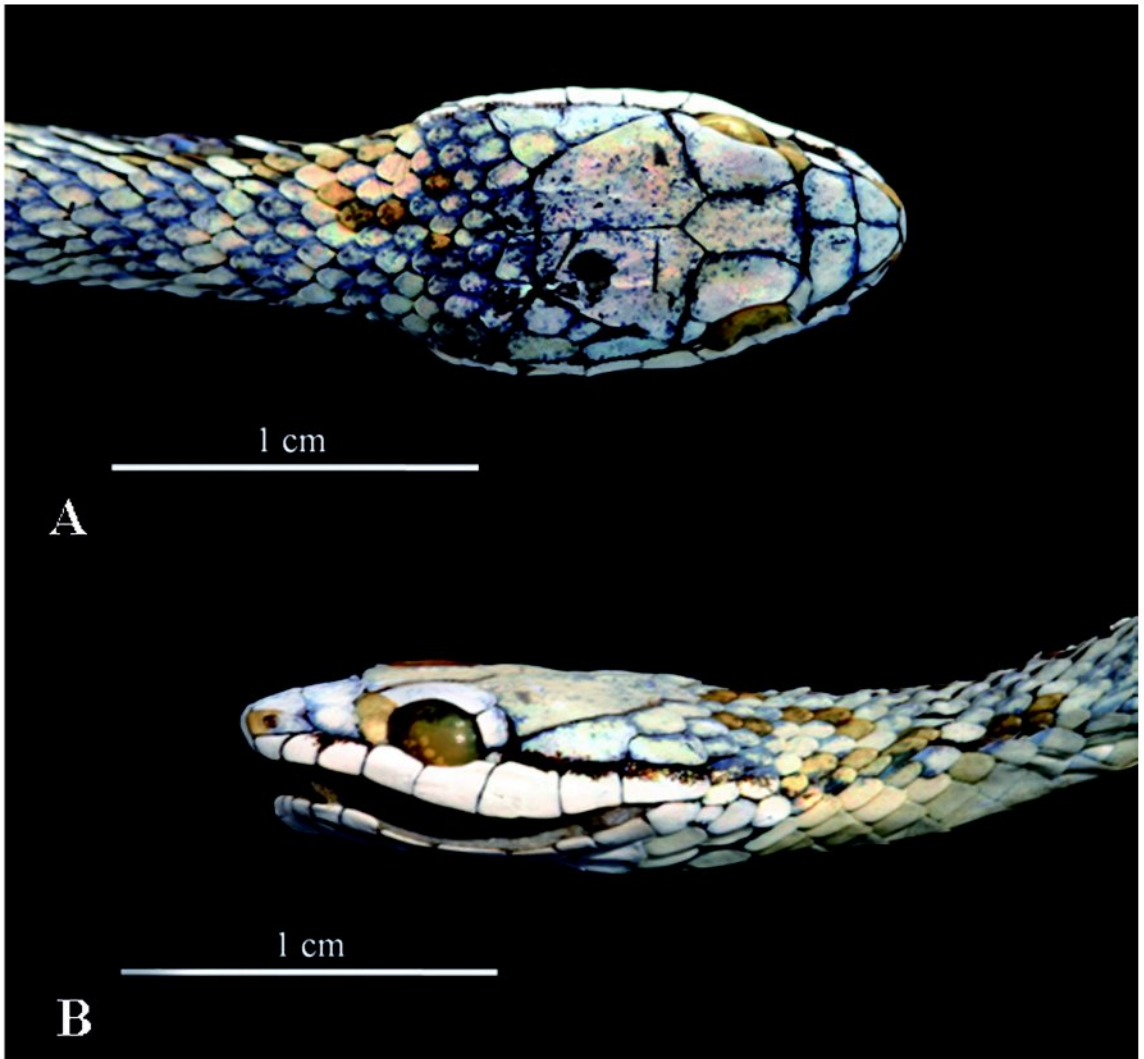


FIGURE 2: Dorsal (A) and lateral (B) view of head of the holotype of *Leptophis cupreus* (ANSP 5202).

**TABLE 1:** Morphometric and meristic variation in the specimens of *Leptophis cupreus* examined. Sl: Supralabials; SIO: Supralabials entering the orbit; Il: Infralabials; Ilg: Infralabials contacting the first genials; Pr/Pos: Preoculars/postoculars; Ta/Tp: Temporal anterior/temporal posterior; P + VE: number of pre-ventral and ventral scales; SC: Number of subcaudal scales; HL: head length; SL: snout length; SVL: Snout-vent length; TL: Tail length; m: male; f: female; juv: juvenile. All measurements are in mm.\*Holotype of *Leptophis cupreus*.

Specimens (sex)	Sl	SIO	Il	Ilg	Pr/Pos	Ta/Tp	P + VE	SC	HL	SL	SVL	TL
ANSP 5202P* (f)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	2+152	137	12.27	3.80	313	205
ICN 0347 (f)	8/8	4/5-4/5	10/10	6/5	1/2-1/2	1/2-1/2	2+161	50+	17.13	5.44	491	142+
ICN 0390 (m)	9/9	5/6-5/6	10/10	5/5	1/2-1/2	1/1-1/1	1+160	146	25.46	8.08	831	495+
ICN 8379 (f)	9/9	5/6-5/6	11/11	6/6	1/2-1/2	1/2-1/2	2+171	148	22.94	7.14	739	480
ICN 8382 (f)	9/9	5/6-5/6	11/11	6/6	1/2-1/2	1/2-1/2	2+170	166	18.90	5.95	559	386
LACM 45444 (f)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	2+130	123	15.9	5.0	345	236
LACM 76811 (f)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	1+154	138	16.2	5.1	395	259
MCZ 166586 (m)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	3+144	131+	—	—	418	274+
MCZ 164915 (m)	8/7	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	1+147	121+	16.76	5.31	447	282+
TCWC 42808 (f)	8/8	4/5-4/5	—/10	5/5	1/2-1/2	1/1-1/1	1+153	161+	9.96	2.97	185	57+
USNM 197281 (juv)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	1+156	142	11.5	3.7	171	107
USNM 211036 (m)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/2	2+133	126	15.3	4.15	346	230
USNM 211037 (m)	8/8	4/5-4/5	10/10	6/6	1/3-1/3	1/2-1/2/2	2+150	143	14.15	3.65	315	206
USNM 211038 (f)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2/1/2	1+147	135	17.95	5.3	408	275
USNM 211039 (m)	8/8	4/5-4/5	10/10	5/5	1/2-1/2	1/2-1/1	1+155	135	14.9	4.7	374	230
USNM 211041 (m)	8/8	4/5-4/5	10/10	6/5	1/2-1/2	2/2-1/2	2+147	145	16.6	5.05	443	295
USNM 211042 (m)	8/8	4/5-4/5	—/—	—/—	1/2-1/2	1/2-1/2	1+157	137+	13.6	4.15	335	228+
USNM 562696 (f)	8/8	4/5-4/5	10/10	5/6	1/2-1/2	1/2-1/2	3+154	146	17.80	5.66	490	331

contact the frontal in eight (ICN 8382, MCZ 164915, USNM 197281, 211036-38, 211041-42) of 18 specimens examined. The dark postocular stripe extends nine scales posteriorly from the last supralabial as a diffuse black stripe in ICN 8382; in other specimens it is shorter and more diffuse (e.g., LACM 45444, 76811) (Fig. 3). ICN 390, LACM 45444, MCZ 164915 and USNM 562696 have keels on all dorsal scales of the trunk, except on the first; in some specimens the keels are reduced on scales of the second and fourteenth rows anterior to the reduction from 15 to 11 scale rows and on scales of the vertebral row; dorsal scales on the tail are keeled posterior to the point of reduction. Keels are more prominent in males than females and juveniles, and not visible in a



**FIGURE 3:** *Leptophis cupreus* (LACM 45444). Lateral view of head showing the short and diffuse postocular stripe.

few long preserved specimens. The *stratum corneum* has been lost in ICN 8379; a pale stripe appears at vertebral scale 4 (33 mm from the tip of the snout), borders paravertebral rows at vertebral 18 (78 mm from the tip of the snout), and becomes indistinct at vertebral 27 (110 mm from the tip of the snout). In life, the dorsal color of the Venezuelan specimen (USNM 562696) was coppery tan; the chin and first 15 ventral scales were white and the remainder of the ventrals tan.

#### Hemipenis (Fig. 4)

Left retracted organ extends for length of 7 subcaudals. Everted hemipenis single, noncapitate; *sulcus spermaticus* undivided, intrasulcar surface smooth. Basal region bearing numerous spines, distributed in five rows; first row with six spines; spines on first row larger than those in other rows; two spines adjacent to *sulcus* largest. Spines arranged irregularly rather than in transverse rows. Few spinules present, occurring in area adjacent to *sulcus*. Small number of papillate calyces with fringing papillae occurs above fifth row of basal spines; papillae decrease in length and number distally and become stouter, as calyces increase in size. Seven papillae occur on calyces in middle of organ, 6-5 between middle of organ and proximal region of lobe, and 4 in proximal region. Lobe is completely

calyculate. Proximal region of lobe has few, irregularly distributed, papillate calyces. Sulcate side is similar to asulcate side.

**Dentition**

ICN 390 has 25/25 recurved maxillary teeth without a diastema, 15/14 palatine teeth, 26/25 pterygoid teeth, and 29/30 dentary teeth. Maxillary teeth increase in size posteriorly. Last three maxillary teeth are ungrooved and enlarged. One specimen from the Iquitos region has 21 maxillary teeth (Dixon & Soini, 1977).

**Ecology**

Little is known about the ecology of *L. cupreus*. Dixon & Soini (1977) collected two specimens in the leaf litter of primary forest at Yanamomo, Peru. USNM 562696 was collected at 1880 m elevation on Cerro de la Neblina, substantially higher than other records of the genus. It was first seen as it searched among the leaf rosettes of *Neblinaria celiæ*, a bizarre plant restricted to the higher elevations of Cerro de le Neblina (Givnish *et al.*, 1986); presumably the snake was hunting frogs that frequently hide in the leafy rosettes that can hold up to 100 ml of rainwater. According to notes accompanying one

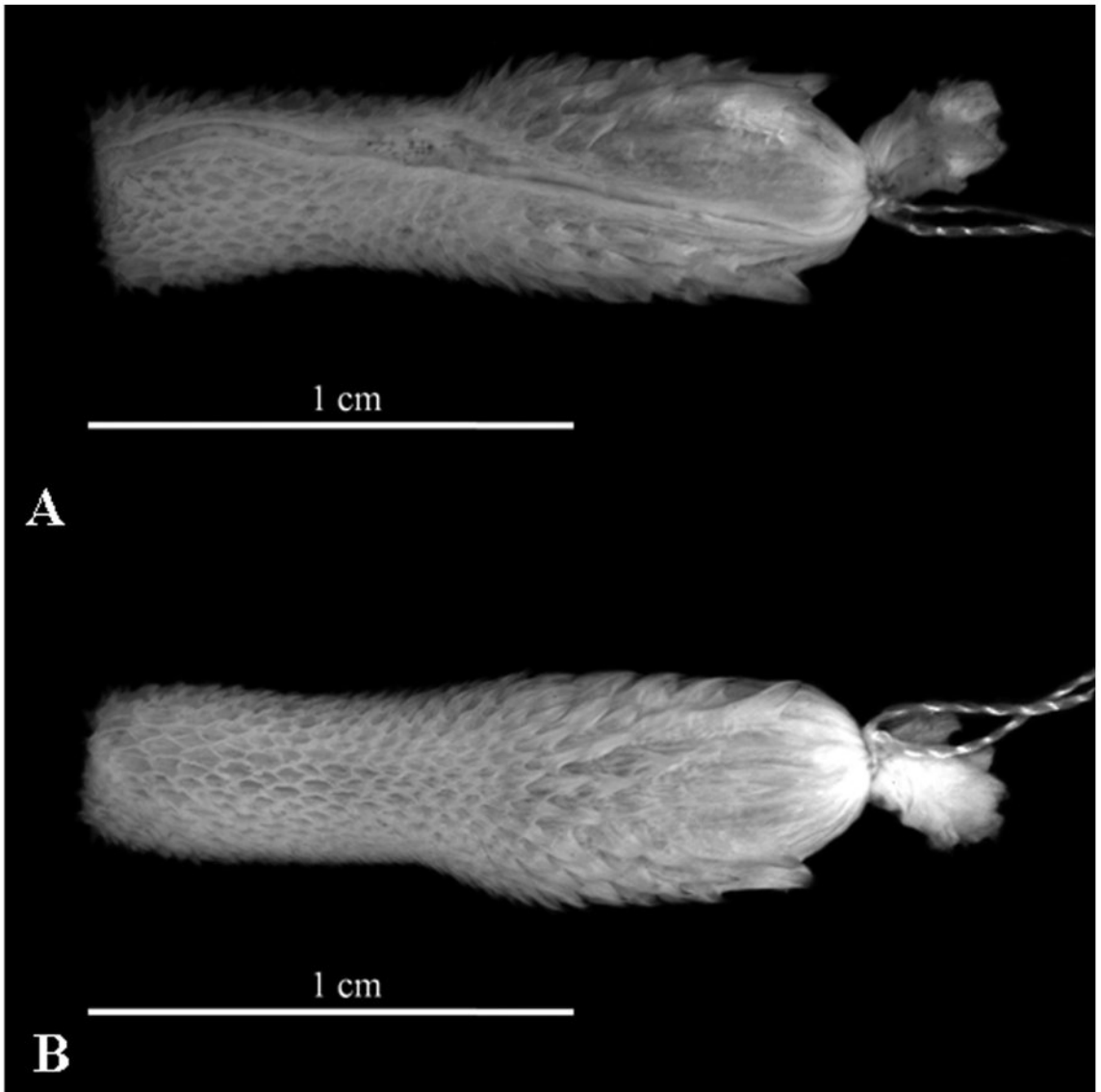


FIGURE 4: *Leptophis cupreus*. Left hemipenis of ICN 390: (A) sulcate and (B) asulcate sides.

specimen (USNM 211042), a frog of the genus *Eleutherodactylus* (= *Pristimantis*) was removed from its stomach. Another specimen (USNM 211038) collected in March, 1956 contained two large ova in the oviduct.

### Distribution

Though apparently rare, or at least rarely encountered, *L. cupreus* appears to be widely distributed. It is known from the southwestern Guayana Highlands of Venezuela and adjacent Colombia (Sierra de La Macarena), the Amazonian lowlands of Ecuador, Colombia and Peru, and from two localities on the Pacific versant of the Andes in Colombia and Ecuador (Fig. 5).

### Diagnosis and comparison with similar species

*Leptophis cupreus* is distinguished from its congeners by adults having a uniformly copper dorsum (Fig. 6) (vs. dorsum uniformly green, dorsum green with each dorsal scale edged with black, or middorsal area green or bronze contrasting in colour with the posterior area of trunk). The posterior venter is also coppery but slightly darker than the dorsum, and has dark brown and white streaks. Further, *L. cupreus* differs from the occasionally sympatric *L. abaeuilla abaeuilla*, *L. a. nigromarginatus*, *L. a. urostictus*, and *L. riveti* (see Oliver, 1948; Albuquerque, 2008, 2009) by the absence of black spots in the center of each parietal scale (vs. present in *L. a. nigromarginatus*); scales on dorsal surface of head not edged with black

(vs. edged in *L. a. nigromarginatus* and *L. a. urostictus*); dorsum unstriped in adults (vs. two dorsolateral stripes separated from each other by a pale vertebral stripe in *L. a. abaeuilla*), adult color pattern without dark oblique bands (vs. with dark bands in *L. riveti*); and keels absent on the first dorsal scale rows (vs. keels present on all dorsal scales of trunk in *L. riveti*).

### DISCUSSION AND CONCLUSION

Peters & Orcés-V (1960) knew that the holotype of *Thrasops cupreus*, USNM 6666 (simply listed as "No. 6666" in Cope's (1868:106) original description) was not in the United States National Museum when they prepared their paper; accordingly, they reported it as lost. In addition, the holotype was not reported in Cochran's (1961) type list because she only included specimens that physically were in the USNM at the time. Finally, an annotation in the original USNM catalog ledger (Volume 2) reads "6601-7000 assigned to Mr. Cope in Phila. March 1867." We interpret this statement to indicate clearly that these numbers were intended to be used by Cope for USNM specimens. In the introductory paragraph, Cope (1868:96) stated that the expedition was undertaken under the auspices of the Smithsonian Institution for the purposes of scientific exploration. All other specimens listed by number in Cope's (1868) paper also refer to USNM catalog records. We are left to conclude that in the confusion following Cope's death, some of the specimens on 'loan' to Cope were returned to the Smithsonian Institution and others were inadvertently cataloged at the Academy of Natural Sciences in Philadelphia.

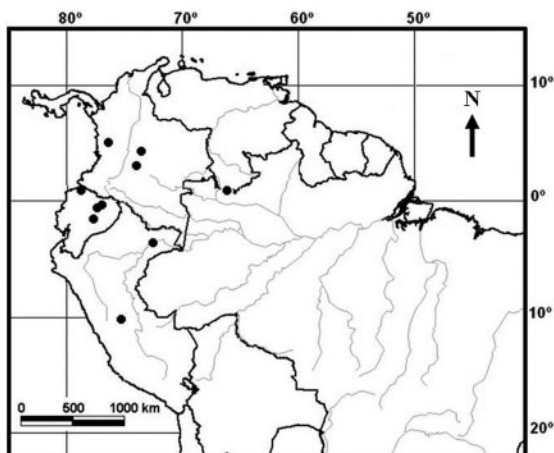


FIGURE 5: Map of northern South America showing the distribution of *Leptophis cupreus*.



FIGURE 6: *Leptophis cupreus*. A specimen without locality data photographed at the Valencia Aquarium, Valencia, Venezuela. Courtesy of Marco Natera Mumaw.

The type locality of *L. cupreus* is from the Napo and Marañón, a rather vague locality for many of the species described from the Orton collections (Cope, 1868). The locality encompasses what is now part of eastern Ecuador and northeastern Peru, along Orton's known route from the upper reaches of the Río Napo to the Río Marañón, then east to the Brazilian border (Orton, 1870). Until the present study, *L. cupreus* was generally thought to have a cis-Andean distribution. However, one of the specimens (USNM 211036) presumably available to Peters & Orcés-V (1960), but not mentioned in their paper, and the specimen (LACM 45444) mentioned as questionable by Pérez-Santos & Moreno (1988) are trans-Andean. USNM 211036 was collected by Gustavo Orcés-V in San Lorenzo, a small city in northwestern Ecuador, and LACM 45444 (Fig. 7) was collected by Phil Silverstone in the Chocó region of Colombia, and we have no reason to doubt the accuracy of these locality records. Perhaps *L. cupreus* is like a few other snake species (e.g., *Corallus caninus*) that are known to occur on both sides of the Andes. *Leptophis cupreus*, *L. ahaetulla ahaetulla*, *L. a. nigromarginatus*, *L. a. urostictus*, and *L. riveti* have overlapping distributions, although

the latter two taxa have a strictly trans-Andean distribution (Oliver, 1948, Albuquerque, 2008).

The apparent rarity of *L. cupreus* in collections might be due to various factors including low population density, specialized microhabitat, or a failure to differentiate specimens of *L. cupreus* from other sympatric *Leptophis*; perhaps we simply do not know where or how to find it. If *L. cupreus* were relatively common, a lack of collecting seems unlikely considering its large geographic range and the extensive series of other snakes collected from this general region, for example, the collections made by Harvey Bassler in the vicinity of Iquitos, Peru in the 1920s and 1930s (Oliver, 1948; Myers, 2000). The microhabitat preferences of the snakes of the genus *Leptophis* are semi-arboreal (e.g., Oliver, 1948; Albuquerque *et al.*, 2007; Savage, 2002) or arboreal (e.g., Henderson, 1982; Martins & Oliveira, 1998), but two of the specimens examined were collected among leaf litter of the forest floor (Dixon & Soini, 1977). Based on our review of specimens and the literature, it seems highly desirable to conduct further fieldwork in the range of this species to understand better its distribution and the factors that contribute to its apparent rarity.



FIGURE 7: *Leptophis cupreus* (LACM 45444). A female specimen collected in the Chocó region of Colombia.

## RESUMO

*Leptophis cupreus* é redescrita com base em 18 espécimes, incluindo o holótipo. A espécie é caracterizada por ter o dorso uniformemente cobre, o que a distingue de todas as outras espécies conhecidas de *Leptophis*. Nós apresentamos fotografias do holótipo e de um espécime vivo de *L. cupreus*, descrevemos e ilustramos o hemipênis evertido, e plotamos a sua distribuição conhecida.

PALAVRAS-CHAVE: *Leptophis cupreus*; holótipo; distribuição; hemipênis; taxonomia.

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## APPENDIX

### Specimens Examined

*Leptophis cupreus*: VENEZUELA: AMAZONAS: Rio Negro: Cerro de la Neblina, 0.5 km East of Pico Charles, Camp I, 1820-1880 m., USNM 562696. COLOMBIA: CHOCÓ: divide between Atrato and San Juan drainages near Tado; trail between right bank of San Juan, opposite Tado and I. Bordo in Atrato drainage, LACM 45444; META: ICN 390; La Macarena, ICN 347; VillaVicencio, ICN 8379, ICN 8382. ECUADOR: "Napo and Maranon", ANSP 5202 (Holotype of *Leptophis cupreus*); ESMERALDAS: San Lorenzo, USNM 211036; NAPO: Coca, MCZ 164915, MCZ 166586; Loreto, USNM 211037; PASTAZA: Alto Rio Curaray, USNM 211038, USNM 211039; Canelos, Upper Rio Bobonaza, USNM 211041; Canelos, USNM 211042. PERU: LORETO: Yanamono, north bank of Amazon River, just above mouth of Napo River (Iquitos region), TCWC 42808; USNM 197281; PASCO: Iscozazin Valley, Pan de Azucar, LACM 76811.

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