

First record of *Micrurus lemniscatus* (LINNAEUS, 1758) from western Venezuela with comments on coral snakes from the eastern Andean piedmont (Squamata: Serpentes: Elapidae)

Erstnachweis von *Micrurus lemniscatus* (LINNAEUS, 1758) aus dem westlichen Venezuela
mit Bemerkungen zu den Korallenschlangen der östlichen Vorgebirge der Anden
(Squamata: Serpentes: Elapidae)

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KURZFASSUNG

Wir berichten über den Erstnachweis von *Micrurus lemniscatus* LINNAEUS, 1758 aus der Umgebung von Barinitas im westlichen Venezuela. Die Belegexemplare werden mit den Unterarten von *M. lemniscatus* sowie mit ähnlichen Arten wie *M. filiformis* (GÜNTHER, 1859) und *M. isozonus* (COPE, 1860) in ihrer Beschuppung und Färbung verglichen. Die Region von Barinitas in den Andenvorbergen Westvenezuelas ist eines der artenreichsten Gebiete was die Gattung *Micrurus* betrifft. Weiters werden Angaben über wenig bekannte Korallenschlangen gemacht darunter eine neue Maximallänge für *M. isozonus* und eine minimale Fundorthöhe für *M. mipartitus anomalus* (BOULENGER, 1896).

ABSTRACT

We report the first voucher specimens of *Micrurus lemniscatus* LINNAEUS, 1758 from western Venezuela. The specimens are compared with different subspecies of *M. lemniscatus* meristically and by colour pattern, as well as with similar species like *M. filiformis* (GÜNTHER, 1859) and *M. isozonus* (COPE, 1860). The Barinitas region in the Andean piedmont of western Venezuela is one of the richest places known in terms of *Micrurus* species diversity. Comments on some little known coral snakes are provided, including a new maximum size record for *M. isozonus* and a low altitude record for *M. mipartitus anomalus* (BOULENGER, 1896).

KEY WORDS

Squamata: Serpentes: Elapidae: *Micrurus lemniscatus* complex, morphology, meristic data, venomous snakes, geographical distribution, range extension; *Micrurus isozonus* maximum size, *Micrurus mipartitus anomalus* lower altitude record, biogeography, Venezuela

INTRODUCTION

Micrurus lemniscatus (LINNAEUS, 1758) is a common coral snake found in a large portion of northern South America east of the Andes, from Bolivia to Trinidad (ROZE 1996). There are four described subspecies: *M. l. lemniscatus* from northern parts of Guyana, Suriname and French Guyana, reaching northern Pará and Maranhão in Brazil; *M. l. carvalhoi* ROZE, 1967 from south-eastern Brazil (states of Paraná, São Paulo, Minas Gerais and Mato Grosso, extending north along the Atlantic coast to Bahia and Rio Grande do Norte), *M. l. diutius* BURGER, 1955 from the central Amazon basin northward to eastern Venezuela, Trinidad, and the southern Guyanas; and *M.*

l. helleri SCHMIDT & SCHMIDT, 1925, which is found on the eastern slopes of the Andes on both sides of the Amazon river, from southern Venezuela through eastern Colombia, Ecuador and Peru to Bolivia, and in western Brazil, where its range is uncertain (ROZE 1996). Two subspecies of *M. lemniscatus* have thus been recorded from Venezuela: *M. l. helleri* from the south, and *M. l. diutius* from the east, whereas no records of this species exist for central, north-central or western Venezuela (CAMPBELL & LAMAR 1989; ROZE 1996).

For a long time, variation in the *Micrurus lemniscatus* complex has been poorly understood, and polyphyly in this com-

plex has been supported recently by molecular data by JORGE DA SILVA & SITES (2001).

From the Barinitas region (Barinas state, western Venezuela), one of us (DC) acquired three specimens of a coral snake species which turned out to be new to western Venezuela. The location is situated at 8°46' N, 70°24' W, at an altitude of about 600 m in evergreen rainforest environment of the Andean foothills. The specimens are housed in the Colección de Vertebrados, Universidad de los Andes, Mérida, Venezuela (CVULA). The abbreviations used in the text are: SVL: Snout-vent length; TL: Tail length. Comparisons were made with the

pertinent literature (DIXON & SOINI 1977; LANCINI 1979; CHIPPAUX 1986; CAMPBELL & LAMAR 1989; CUNHA & NASCIMENTO 1993; ROZE 1996).

Here we present our observations on these western Venezuelan specimens, and discuss them in the context of unresolved taxonomic issues in the *M. lemniscatus* complex. Furthermore, we present new data on little known coral snakes from the Andean piedmont, including a new maximum size record for *M. isozonus* (COPE, 1860) and the lowest altitude recorded for *M. mipartitus anomalus* (BOULENGER, 1896).

RESULTS AND DISCUSSION

One specimen (CVULA 6497) is an adult female (820 + 80 mm, SVL + TL) having 243 ventrals, 37 subcaudals and 12+1½ triads. The others are two unsexed juveniles: CVULA 6498 (200 + 20 mm) has 245 ventrals, 39 subcaudals, and 10 + 1 triads, and CVULA 6499 (235 + 25 mm) has 249 ventrals, 38 subcaudals, and 11 + 1½ triads.

Table 1 shows selected data of the four subspecies of *M. lemniscatus*. There are published photos of all subspecies: *M. l. lemniscatus*, page 172, fig. 79 in CUNHA & NASCIMENTO (1993); of *M. l. carvalhoi*, page 235, fig. 67 in CAMPBELL & LAMAR (1989); and page 256, fig. 38 in ROZE (1996); of *M. l. diutius*, page 235, figs. 68 and 69, in CAMPBELL & LAMAR (1989); page 191, fig. 58 in ROZE (1996); and of *M. l. helleri*, page 235, figs. 70 and 71 in CAMPBELL & LAMAR (1989).

DIXON & SOINI (1977) examined eight animals from the Iquitos region, Perú, and determined them as *M. l. helleri* with the following diagnostic characters: 225 - 258 ventrals, 31 - 40 subcaudals (including both sexes), 9 - 11 body triads, 1 - 2 triads on the tail, and 10 - 12 red rings.

CUNHA & NASCIMENTO (1993) examined 87 specimens from Amapá and Carajás, Brazil, and described a range of 217 - 268 ventrals, 38 - 42 subcaudals, and 9 - 14 triads for *M. l. lemniscatus*. They defend the view that *M. l. helleri* is a synonym of *M. l. lemniscatus* because all characters fell with-

in the range of variation of the nominal subspecies.

CHIPPAUX (1986) stated that *M. l. lemniscatus* in French Guyana has more than 226 ventrals and is a rainforest dweller, while *M. l. diutius* has less than 226 ventrals and is restricted to savanna. This interpretation must be considered as highly questionable, as CUNHA & NASCIMENTO (1993) recorded many specimens from Pará (Brazil) having fewer than 226 ventrals (as few as 217) and they are clearly not *M. l. diutius*. They also stated that *M. l. lemniscatus* inhabits both primary and secondary forests and savanna.

MURPHY's (1997) account on *M. l. diutius* from Trinidad (based apparently on nine specimens) indicated a range of 216 - 236 ventrals, 25 - 35 subcaudals, and 7 - 13 triads. There, *M. l. diutius* inhabits both forest and savanna. CAMPBELL & LAMAR (1989) describe the habitat of *M. l. diutius* as lowland rain forest and lower montane forest, as well as savanna and gallery forest, secondary growth and floodplains.

One of us (CBA) observed two individuals of *M. l. diutius* in primary rainforest in Serranía de Supamo, 350 m a.s.l., Bolívar state, Venezuela, foraging at the same place in two successive nights.

Our specimens from western Venezuela conform to the description of *M. l. helleri* as well as that of *M. l. lemniscatus*, and represent an extension of about 1000 km from the closest known records of *M. l. lem-*

Table 1: Selected data describing *Micrurus lemniscatus* subspecies taken from CAMPBELL & LAMAR (1989), CHIPPAUX (1986), CUNHA & NASCIMENTO (1993), DIXON & SOINI (1977), MURPHY (1997) and ROZE (1966, 1996). M – male, F – female.

Tab. 1: Ausgewählte Daten zur Charakterisierung der Unterarten von *Micrurus lemniscatus* nach CAMPBELL & LAMAR (1989), CHIPPAUX (1986), CUNHA & NASCIMENTO (1993), DIXON & SOINI (1977), MURPHY (1997) and ROZE (1966, 1996). M – Männchen, F – Weibchen.

	<i>M. l. carvalhoi</i>		<i>M. l. diutius</i>		<i>M. l. helleri</i>		<i>M. l. lemniscatus</i>	
	M	F	M	F	M	F	M	F
Ventralia	228-254	250-263	212-225	225-242	225-248	240-260	235-246	242-264
Subcaudalia	29-36	27-34	31-38	31-37	31-41	34-43	36-40	31-39
Triads / Triaden	10-15	9-16	7-11	8-11	9-11	8-12	12-15	9-14
Length of white bands / Länge der weißen Bänder	1½ Dorsalia		>2 Dorsalia, 2-5 Ventralia		2-3 Dorsalia, 3-4 Ventralia		1½ - 2 Dorsalia, 2-3 Ventralia	

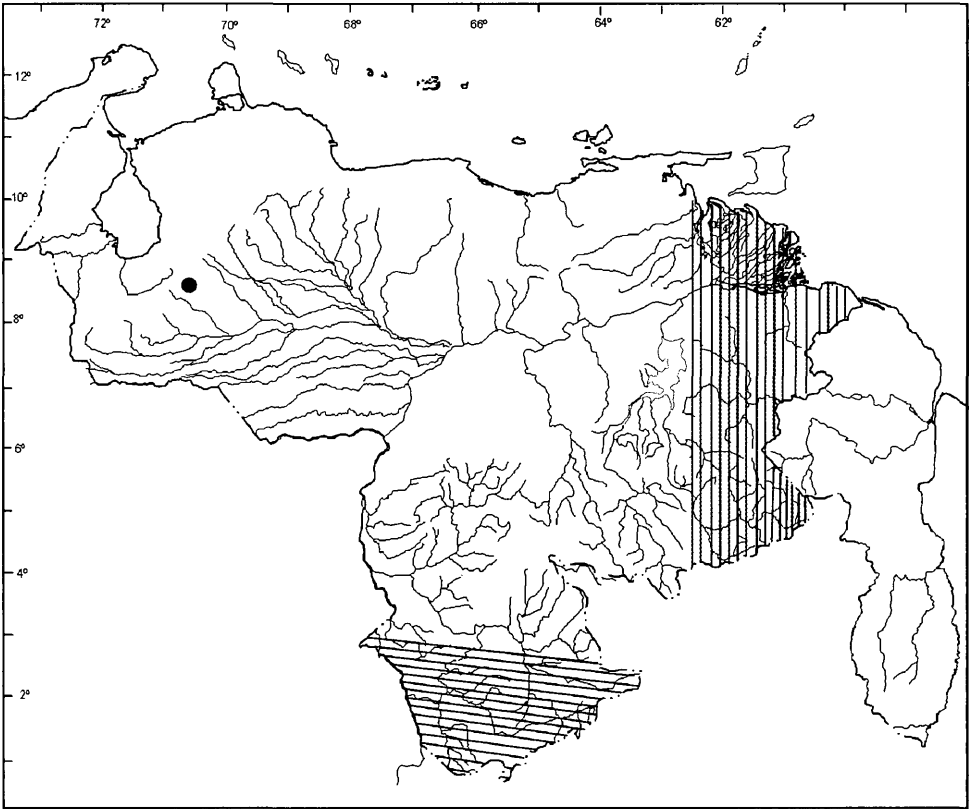


Fig. 1: Distribution of *Micrurus lemniscatus* in Venezuela (dot: locality referred herein) including the reported distribution of *M. l. helleri* (horizontal lines) and *M. l. diutius* (vertical lines) according to ROZE (1996).
Abb. 1: Verbreitung von *Micrurus lemniscatus* in Venezuela (Punkt: in diesem Artikel behandelter neuer Fundort) und das bekannte Verbreitungsgebiet von *M. l. helleri* (horizontal gestreift) und *M. l. diutius* (vertikal gestreift) nach ROZE (1996).



Fig. 2: *Micrurus lemniscatus* (CVULA 6499).

Unsexed juvenile (SVL + TL 235 + 25 mm) from Barinitas, Venezuela.

Abb. 2: *Micrurus lemniscatus* (CVULA 6499). Jungtier unbekannten Geschlechts (Kopf-Rumpflänge + Schwanzlänge 235 + 25 mm) aus Barinitas, Venezuela.

niscatus from Guyana (ROZE 1996), and about 800 km W of the closest known population of *M. l. diutius* in eastern Venezuela, and about 700 km NW of the apparent known range of *M. l. helleri* in extreme southern Venezuela (Amazonas state; see fig. 1). In Colombia, *M. l. helleri* reaches the Andean piedmont NE of Villavicencio to just SW of the boundary with Venezuela (CAMPBELL & LAMAR 1989), at about 300 km SW from Barinitas.

We can assume some inconsistencies on the taxonomic arrangement of at least one subspecies. All counts of *M. lemniscatus helleri* really fall into the range described for *M. l. lemniscatus*, as CUNHA & NASCIMENTO (1993) pointed out. ROZE (1996) did not follow the suggestion of these authors to include *M. l. helleri* in the synonymy of *M. l. lemniscatus*. Unless a better sample illustrates more clearly the different counts of these two subspecies, we cannot agree in considering *M. l. helleri* a valid form, and thus, conclude that our specimens fall into the range of the meristic data given for *M. l. lemniscatus*. The only features ROZE (1996) gives as differentiating both subspecies are confusing in our sample. According to ROZE (1996), *M. l. lemniscatus* have a dark outline

on all or several scales in the red and white bands, while *M. l. helleri* have not [but see color plate 40 on page 256 in ROZE (1996) for a specimen of *M. l. helleri* from Peru with red and white bands completely outlined by black!; see also fig. 79 on page 172 in CUNHA & NASCIMENTO (1993) to see a specimen of *M. l. lemniscatus* from Pará, Brazil, with red and white bands also outlined by black!]. In our sample, the three specimens have red and white bands without black outlining (or a few markings; see fig. 2). On the other hand, *M. l. lemniscatus* has 9 to 15 triads while *M. l. helleri* has 8 to 12 triads. As shown before, CVULA 6497 has 12 triads (falling into the ranges of both *M. l. lemniscatus* and *M. l. helleri*).

Two other coral snakes resemble *M. lemniscatus* in appearance. *Micrurus isozonus* (COPE, 1860) is the most common coral snake in the Llanos and the Barinitas area, and is also quite similar to *M. lemniscatus* in general appearance [see photos 71 and 72 in LANCINI (1979); fig. 63 on page 264 in CAMPBELL & LAMAR (1989), photo 35 on page 255 in ROZE (1996)]. Meristically, *M. isozonus* is characterized by a range of 199 - 225 ventrals, 25 - 33 subcaudals, and 10 to 14 triads. Another similar species

Table 2: Meristic comparisons (sexes combined) between five species of *Micrurus* occurring in the Barinitas region, Venezuela. Data from CAMPBELL & LAMAR (1989), ROZE (1966, 1996), and personal observations. Measurements in mm. (S) – for the species, (SS) – for the subspecies.

Tab. 2: Vergleichsangaben (Geschlechter nicht getrennt) zu fünf Arten der Gattung *Micrurus*, die in der Barinitas-Region in Venezuela vorkommen. Nach CAMPBELL & LAMAR (1989), ROZE (1966, 1996) und eigenen Beobachtungen. Maße in mm. (S) – für die Art, (SS) – für die Unterart.

	<i>M. lemniscatus</i>	<i>M. mipartitus anomalus</i>	<i>M. dumerilii venezuelensis</i>	<i>M. isozonus</i>	<i>M. d. dissolucus</i>
Total length (SVL + TL) / Gesamtlänge (Kopf-Rumpf- und Schwanzlänge)	up to / bis zu 1390 (S)	up to / bis zu 1005 (S)	up to / bis zu 922 (S)	up to / bis zu 885	up to / bis zu 602 (SS)
Ventralia	212-264	223-271	177-199	199-225	171-208
Subcaudalia	27-43	27-33	33-51	26-33	20-28
Black rings (body + tail)	30-36 + 5	34-80	17-26 + 6-11	30-33 + 3-4	22-31 + 3-5
Schwarze Ringe (Rumpf + Schwanz)					
White rings (body + tail)	20-24 + 3-5	no data / keine Angaben	34-52 + 7-12	20-22 + 2	14-20 + 2-3
Weißer Ringe (Rumpf + Schwanz)					
Red rings (body + tail)	10-12 + 4-7	3-6 on tail / auf dem Schwanz	18-24	9-10 + 2	6-9 + 1-2
Red rings (body + tail)					
Triads (body + tail)	8-12 + 1½-2	no triads / keine Triaden	no triads / keine Triaden	9-14 + 1-1½	1½ 7-½ 10 + 1-1½
Triads (body + tail)					
Triads (Rumpf + Schwanz)					

is *M. filiformis* (GÜNTHER, 1859) [see photo 22 on page 252 in ROZE (1996), which is easily distinguished from *M. lemniscatus* by meristic data. This species has a high number of ventrals (270 - 333), 30 - 45 subcaudals, and 13 to 20 + 1?2 triads. Therefore, the ventral and subcaudal counts for both *M. filiformis* and *M. isozonus* fall outside of the range of the western Venezuelan specimens we assign here to *M. lemniscatus*.

The Barinas Andean piedmont is a crucial corridor between four major bio-regions in north-western South America: Amazonia, the Andes, the Llanos and the Cordillera de la Costa (BARRIO-AMORÓS 1998). With five species of *Micrurus* this area may harbour one of the most diverse elapid snake communities of Venezuela. Apart from *M. lemniscatus* which we first record in this paper, the following coral snake species have been found: *M. d. dissolucus* COPE, 1859, from northern Venezuela and Colombia; *M. dumerilii venezuelensis* ROZE, 1989, a subspecies from the north-eastern range of the species; *M. isozonus*, a typical savanna inhabitant; and *M. mipartitus anomalus* (BOULENGER, 1896), a typical montane (Andean) species (see selected comparisons between these species in table 2). In Venezuela we are only aware of one more site where five *Micrurus* species co-occur, the Cerro de la Neblina region (ROZE 1987), with *M. remotus* ROZE, 1987, *M. surinamensis nattereri* SCHMIDT, 1952, *M. hemprichii ortonii* SCHMIDT, 1953, *M. spixii obscurus* (JAN, 1872), and *M. lemniscatus*. Unfortunately, the last two species were just reported from the region, and ROZE (1987) neither designated voucher specimens nor did he provide data for the specimens he called *M. l. helleri*. There are two sites with the same number of *Micrurus* species outside Venezuela: the Manaus region of Brazil (MARTINS & OLIVEIRA 1998) and Santa Cecilia in Amazonian Ecuador (DUELLMAN 1978), and we only found one locality surpassing Barinitas in coral snake diversity, the Iquitos region of Peru, with eight species (DIXON & SOINI 1977).

We add here further notes on coral snakes from the Andean piedmont of Venezuela: *Micrurus mipartitus anomalus* has a reported altitudinal range from 500 - 2000 m a.s.l. (ROZE 1996); we are aware of three

specimens (CVULA 6346-6348) from CBX 13 Island, Borde Seco Dam (07°44' 30" N, 71°32'50" W), estado Mérida, collected at 250 m a.s.l., in microsympatry (buried all together, about 5 cm deep between the roots of a tree) with *M. dumerilii venezuelensis* (CVULA 6428). The smallest *M. mipartitus* (CVULA 6348, 177 + 17 mm SVL + TL), and the specimen of *M. d. venezuelensis* (486 + 80 mm), have scales of unidentified snakes in their digestive tracts. The longest *M. m. anomalus* (CVULA 6546, 430 + 27 mm), bears three eggs.

ROZE (1996) specifies 885 mm (total length) to be the maximum size reported for *M. isozonus*, and considers the species to be a medium sized coral snake. Based on our experience in the Venezuelan field we can

say with certainty that *M. isozonus* is a large coral snake, and certainly the largest in the Andean piedmont, as far as we know. Two female specimens from the Barinitas region have total (SVL+TL) lengths of 1000+75 mm (CVULA 6554) and 1025+70 mm (CVULA 6553), the latter representing the maximum size record for the species. However, we are aware of an even longer specimen from Central Venezuela, which has not been deposited yet to any official collection. Both animals were kept alive for a while in the "Serpentario Los Llanos" and fed with live snakes, as *Helicops angulatus* (LINNAEUS, 1758), *Mastigodryas pleei* (DUMÉRIL, BIBRON & DUMÉRIL, 1854), *Leptodeira annulata ashmeadi* (HALLOWELL, 1845), abundant species of the surroundings.

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