Instituto Nacional de Salud

• Villavicencio Coralsnake •

(*Micrurus medemi*)

Bites, venoms, and venomous snakes of Colombia

G4

MEDICAL IMPORTANCE GROUP 4

Snakes that bite rarely, and have not caused significant envenoming or have not causes documented bites

Poorly Reliable: Confidence for this species is poor due to the lack of data and information on Colombian populations. Therefore, most of our knowledge comes from a few studies and populations outside the national territory.

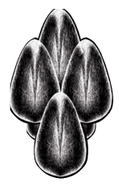
Detail of: Head, body and tail.

1. Envenomation symptoms

Envenomation caused by *Micrurus medemi* is expected to be characterized by its neurotoxicity, like other coralsnakes [1,2]. Currently, no reported cases of bites from this species are available in the literature, therefore, symptomatology is extrapolated from known snakebites by *Micrurus* species.

Local symptoms include mild pain, weak bleeding at the site of the bite marks, as well as reduced swelling (edema). In the following minutes after the bite, local tingling sensation (paresthesia) may appear, and less commonly burning or a sensation of heat. According to the amount of venom injected systemic symptoms appear between 30 minutes and two hours after the bite [1,2,3], beginning with blurry vision, double vision (diplopia), and drooping of the upper eyelid (palpebral ptosis). Subsequently, patients may exhibit generalized muscular weakness, dizziness, sleepiness, confusion, difficulty speaking, excessive salivation (sialorrhea), and finally, difficulty breathing [1].

In cases of severe envenomation, *M. medemi* venom leads to a flaccid paralysis of the skeletal muscles, including the intercostal respiratory muscles and the diaphragm. This is the main cause of death of the victims [1]. In contrast to envenoming by viperids, marked hemorrhage, blisters, and necrosis are absent, although myotoxic activity or toxins related to such activity have been reported for some coral snake venoms [4,5].



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Citation: Vásquez-Restrepo, J.D., Bocanumenth, D., Rincón-Aranguri, M.T. Snakes that bite rarely, and have not caused significant envenoming or have not causes documented bites: Villavicencio Coralsnake (*Micrurus medemi*). In the Book: *Bites, venoms, and venomous snakes of Colombia*; Angarita-Sierra T., Ruiz-Gómez, FJ, Eds.; Instituto Nacional de Salud: Bogotá D.C., Colombia, 2024.

DOI: 10.33610/230676ybescy

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2. Treatments and snakebite care

Given that the venom of *Micrurus medemi* is neurotoxic, medical attention must be received as soon as possible to reduce the risk of death by respiratory paralysis. Basic first aid includes extremity immobilization of the affected limb or other parts of the body, and cleaning with clear water and soap. The consumption of alcoholic drinks, oils, disinfectants, gasoline, or chemicals, as well as its topical use, must be avoided because it can complicate the treatment and generate additional complications [1]. Tourniquets, incisions, or mouth-suction are discouraged as well, since it can cause ischemia (reduced blood and oxygen flow), infections, or a secondary envenoming by ingestion [6]. When moving the patient, a neutral position (lying down or horizontal) must be sought. Full rest and continuous monitoring of respiratory performance are also important because respiratory assistance may be required.

Currently, antivenom therapy is the only effective treatment for a snakebite accident. Therefore, traditional practices are discouraged because they delay the time for receiving medical attention. Despite rumors about several plants that could contain potential therapeutic molecules, their usefulness has not been assessed in *Micrurus* envenomation [7,8,9]. Often, many healers lack true ethnobotanical knowledge, offering cures that do not have positive effects on the envenomation or are placebos (treatments with no therapeutic value) [10,11].

The application of antivenom must be carried out by qualified medical staff and in the hospital, in order to have control of possible side effects like anaphylaxis (extreme allergic reactions). Antivenom administration and dosage must follow the clinical picture of the envenoming, and the manufacturer's instructions according to the serum brand [1,2]. Currently, the technical sheet for the antivenoms produced in Colombia do not have explicit indications for their neutralizing capability for the *Micrurus medemi* venom. However, a recent study found that the INS antivenom for coral snakes has a good cross-neutralizing capability for several species, including *M. medemi* (0.68 mg/mL) [12]. Polyvalent antivenom from Probiol claims to work against *Micrurus*, although no specific data for species are provided in its technical sheet. In a general way it is recommended that each 10 ml neutralizes 1 mg of venom [13]. Despite this, either of both antivenoms is recommended, although dosage may vary for non-tested species. As a rule of thumb, *Micrurus* envenomation is considered severe when there are visible symptoms. Recommended dosage for INS antivenom varies from five vials for Andean coral snakes to 10 vials for Orinoquian and Amazonian species [14]. In the case of Probiol, dosages should be triplicated.

A complementary treatment of tetanic toxoids, antibiotics, or diuretics may be required [15], and a paraclinical test for arterial gases, total CK (creatinine kinase), transaminases and LDH (lactate dehydrogenase) could be necessary in order to monitor the patient´s progress [16].

3. Snakebite capacity

According to preclinical assays, the venom of *Micrurus medemi* shows high lethality, that is, it requires less venom to kill compared to other coralsnakes like *M. spixii*, *M. lemniscatus*, *M. dumerilii*, *M. surinamensis*, and *M. mipartitus* [12].

However, this is an uncommon species with a restricted distribution making a snakebite caused by this species unlikely. Coralsnakes usually display deterrent antipredator behaviors like head hiding, erratic movements, tail coiled or scape [17], so bites are commonly derived from direct and careless handling. In addition, coralsnake fangs are small (order of millimeters), which is the reason why thicker clothes, gloves and boots are not easily penetrated. Although in Colombia there is an average of 4468 snakebites per year, historically only about 1.3% are caused by coral snakes (see Chapter 1), disaggregated data for *M. medemi* are not reported in the National Health Surveillance System (SIVIGILA, Spanish acronym).

4. Recognition

Micrurus medemi is a tricolored patterned coralsnake, with black rings arranged in monads and separated by red rings arranged in the middle of two short whitish/reddish/yellowish rings (black-white-red-white-black) [17,18,20]. However, the red rings are often melanistic (darkened) varying from dark red and purple to almost black, giving the impression of a bicolored coralsnake with only long dark rings separated by short paler rings [17,18,20,21,22]. A black cephalic cap covers the head to the parietal region, followed by a whitish/reddish/yellowish diadem and a black collar that consists of 7–9 dorsal scales in length [17,18]. The whitish/reddish/yellowish body rings are 1–1.5 scales long at the dorsum, lengthening to 2 at the sides of the body (trapezoid-shaped), while the black rings are 7–10 scales long. Males have 15–22 and females 22-25 black body rings.

Micrurus medemi differs from other sympatric or nearby distributed species by its color pattern. For example, *M. mipartitus* is a black-white bicolored species that can resemble heavily melanistic *M. medemi*, differing by having red rings on the tail and a red and white cephalic ring from behind the eyes to the parietal region. In contrast, *M. helleri* and *M. hemprichii* are black-triad patterned, that is, they have three black rings between the red ones. *Micrurus ornatissimus* and *M. tikuna* differ by the absence of a clear nuchal diadem followed by a wide black ring. And in *M. remotus* the red body rings are longer than the black ones. In addition, these species do not show extreme melanistic red rings, and the last four species are distributed farther south or southeast (Amazon ecoregion), the reason why they do not occur in the same place as *M. medemi*.

5. Distribution

Micrurus medemi is an endemic Colombian species, distributed in the lowlands of the eastern slope of the Cordillera Oriental in the Meta and Cundinamarca departments, found in the urban and peri-urban area of Villavicencio and Restrepo (Meta), Guayabetal (Cundinamarca) municipalitie and surroundings, and an additional record from vereda Portachuelo, Manzanares, municipality of Acacías (Meta) [17,18,19]. Their altitudinal range goes from 250–1577 meters above sea level [18,19]. (Figure 1).

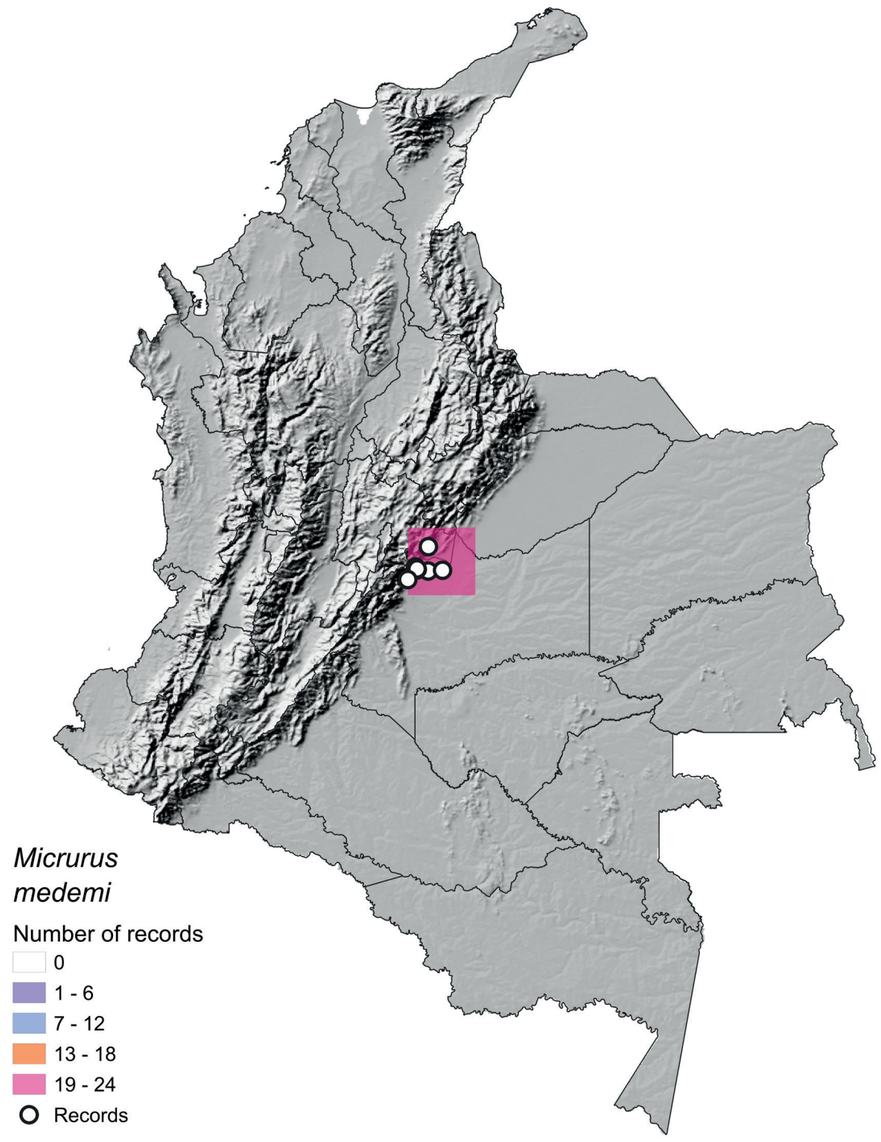

Figure 1. Geographic distribution of *Micrurus medemi* in Colombia and its habitat suitability model. Based on bioclimatic variables, the habitat suitability model predicts the species' potential distribution in Colombia, identifying zones with suitable or unsuitable environmental conditions for its occurrence across the country. Values close to 1 indicate optimal environmental conditions (high probability of presence), while values close to 0 indicate unsuitable conditions (absence likely).

6. Natural history

Uncommon. Currently, few data about the natural history, biology, and ecology of *Micrurus medemi* are available in the literature. This is an uncommon terrestrial and semifossorial snake (adapted to digging), inhabiting lower montane rainforest, including forest edges [18,20], and gallery forest (authors pers. comm). The only record for their diet is a small non-venomous snake (Ninia atrata) [17], although it is likely that just as with many other *Micrurus*, this snake has an ophiophagous diet or it is based on snake-like animals (i.e., legless) like amphisbaenians and caecilians [17]. When threatened, *Micrurus medemi* exhibits similar behavior as other coralsnakes, coiling its body, hiding the head, and waving the tail in a loop as a lure [24].

7. See it in the wild, rural or peri-urban areas

Micrurus medemi inhabits both forests and forest edges, and despite it being a very uncommon species, it can be found occasionally in anthropic ecosystems in rural and peri-urban areas, like roads [25] and human settlements (authors pers. comm.).

8. Conservation

Critically Endangered. In the national assessment, *Micrurus medemi* is categorized as Endangered [20], while on a global scale it is considered in the Critically Endangered category [26]. In both cases, this is due to its small extent of occurrence (< 100 km2 or < 5000 km2, respectively), low number of localities (1 to 5, respectively), and the reduction in its area of occurrence, habitat quality, and low number of individuals. This species is listed in Resolution 1912/2017 from the Colombian Environmental Ministry and is not considered in CITES. Like all the snakes in Colombia, the main threats are killing by humans because of fear and habitat loss [27], especially considering that this is a true venomous snake. Currently, there are no specific population studies on this species nor data of illegal trade.

9. Scientific name and common names

The scientific name of *Micrurus medemi* is composed of two elements, the first one is the genus and the second is the specific epithet. *Micrurus* is derived from the Greek words *mikros*, meaning small, and *oura*, meaning tail, in reference to their short tail [18]. The name *medemi* is a patronym after Federico Medem (Friedrich Johann Graf von Medem, 1912–1984), a Latvian-Colombian herpetologist who extensively contributed to our knowledge of the Colombian herpetofauna [21].

Given that this species is mainly known from the Meta department in Colombia, and its type locality is in Villavicencio, *Micrurus medemi* is commonly known as the Villavicencio Coralsnake (coral de Villavicencio). Another common name reported in the literature is culebra de corbata (necktie snake) [18].

Table 1. Summary of important biological, venomic, epidemiological and medical traits.

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TOXICITY AND BIOLOGICAL ACTIVITY	VENOM ACTIVITY PROFILE	GENERAL BIOLOGICAL TRAITS
LD_{50} (µg/mice): 8.79 (7.16–10.80µg)	**Proteolytic:** Yes	**Total Length (cm):** ♂ 25.6–92.3 ♀ 55.3–90.5
MCD (µg/mL): Unknown	**Neurotoxic:** Yes	**Weight (g):** ♂ 3.9–53.0 ♀ 22.6–88.3
MDD (µg/mice): Unknown	**Myotoxic:** Yes	**Reproduction:** oviparous
MED (µg/mice): Unknown	**Hemotoxic:** No	**Dieta:** snakes and lizards
MHD (µg/mice): Unknown	-	**Distributión:** Orinoquía

PROTEOME			
PLA_2: 43.14 %	**SVSP:** 0.39%	**SVMP:** 9.63%	**NGF:** 3.39%
CRISP: 0	**CTL:** 7.83%	**DIS:** Unknown	**KUN:** 5.35%
BPPs: Unknown	**VEFG:** Unknown	**3FTx:** 17.63%	
Crotoxin: No	**Crotamine:** No	**LAAO:** 7.48%	

MAIN ENVENOMATION SYMPTOMS		RISK	GRADE OF ENVENOMATION
Hemorrhage: No	**Ecchymosis:** Unknown	**Bites per year:** Unknown	**Mild:** Unknown
Nausea: Unknown	**Hematemesis:** No		
Hypotension: No data	**Blisters:** No	**Bites per 1,000 people yearly:** Unknown	**Moderate:** Unknown
Edema: Yes	**Vomiting:** No		
Coagulopathy: No	**Diarrhea:** No	**Sequalae caused per year:** Unknown	**Severe:** Unknown
Sialorrhea: Yes	**Local Pain:** Yes		
Hematuria: No	**Necrosis:** No	**Deaths caused per year:** Unknown	
Renal failure: No			

★ Poorly Reliable: Confidence for this species is poor due to the lack of data and information on Colombian populations. Therefore, most of our knowledge comes from a few studies and populations outside the national territory. LD_{50}: median lethal dose; MCD: minimum coagulant dose; MDD: minimum defibrinating dose; DEM: minimum edema-forming dose; DHM: minimum hemolytic dose; PLA_2: phospholipases A_2; SVSP: serine proteases, SVMP: metalloproteinases; NGF: nerve growth factor; CRISP: cysteine-rich secretory protein; CTL: C-type lectin/lectin-like, DIS: disintegrins, KUN: Kunitz peptides; BPPs: bradykinin-potentiating peptides; VEFG: vascular endothelial growth factor; 3FTx: three-finger toxins; LAAO: L-amino acid oxidases.

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