

• Central American Coralsnake •

(*Micrurus nigrocinctus*)

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 caused documented bites



⚠ Moderate reliable: Confidence for this species is limited or almost non-existent for Colombian populations. Therefore, most of our knowledge comes from populations outside the national territory



⚠ Detail of: Head, body and tail.

1. Envenomation symptoms

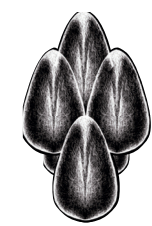


Micrurus envenomation produces local symptoms that can last several days. These symptoms are burning pain, redness of skin (erythema), imperceptible swelling (edema), intense pain radiating from the location of the bite outwards, encompassing the entire limb, and reduced muscle tone (flaccid paralysis) [1]. Systemic symptoms include blurry vision, double vision (diplopia), droopy eyelids (palpebral ptosis), paralysis or weakness of the eye muscles (ophthalmoplegia), eyes looking in different directions (divergent strabismus), facial expression with drooping eyelids and lips (myasthenic facies) and “broken neck” sign, muscle pain (myalgias), muscular twitches (fasciculations) in the face and extremities as well as peripheral paralysis that could lead to respiratory paralysis [1].

According to clinical manifestations, mild *Micrurus* envenomation exhibits fang marks, absence or mild edema, and slight local pain. Moderate envenomation presents slight edema and erythema, moderate pain that extends to the limbs with abnormal sensation (dysesthesia). Systemic symptoms include burning or prickling sensation (paresthesia) in cranial nerves with slight eyelid ptosis, slurred or slow speech (dysarthria) and distortion of the sense of taste (dysgeusia), but they don't progress into a respiratory paralysis in the first 12 hours [1]. Finally, severe envenomation shows presence of flaccid paralysis in the first 30 minutes, blurry vision, diplopia, eyelid ptosis or myasthenic facies, excessive salivation (sialorrhoea), dysarthria, “broken neck” sign, and build-up of carbon dioxide in the body due to altered breathing (respiratory/mixed acidosis) [1].

The envenoming caused by *Micrurus nigrocinctus* can provoke neurotoxic and myotoxic symptoms [2,3]. An envenomed case from Costa Rica reported severe intense pain that radiated from the location of the bite (index finger) to the end of the arm and to the chest; swelling, nausea, dizziness, and vomiting, before the patient lost consciousness. After treatment with antivenom and hospitalization for 6 days the patient recovered. During three months of convalescence this person experienced a numb hand that became hypersensitive to heat but eventually made a full recovery [4].

Another patient from the same country with severe envenomation had local pain that increased in intensity, local swelling, excessive salivation, glottis spasm, tongue paralysis, fasciculations of skeletal muscles, severe headache, and severe muscular pain, suggestive of myonecrosis (death of muscle tissue). The patient ended up suffering complete paralysis, and artificial respiration was needed to prevent asphyxia. However, administration of antivenom 8 hours after the bite and clinical care resulted in a full recovery [5]. The myonecrotic symptoms suggested by Bolaños [5] have been observed experimentally in mice during preclinical assays [3,6]. In Colombia there are no official reports of envenomation caused by *M. nigrocinctus*, but these could be expected for the Urabá region.



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2. Treatments and snakebite care



When facing snakebite caused by *M. nigrocinctus* it is important to avoid delaying medical treatment as this could carry life threatening consequences. The first aid actions should be limited to washing the wound with water and soap to prevent infections and immobilizing the site of the bite with a compression bandage before the immediate transfer of the patient to the hospital [2].

Specific treatment must be administered only to patients with signs of envenoming and by medical personnel, who should be attentive for signs of respiratory paralysis and anaphylactic shock. It consists in using monovalent/polyvalent antivenom according to clinical manifestations, ideally in the first 4 hours, although effectiveness has been found even after 24 hours [7]. Some experts recommend handling all accidents resulting from *Micrurus* snakebites as if they were severe with the usage of 5-10 vials of antivenom for treatment [7], while others base their treatment on the degree of envenoming. For mild envenomation between 0 and 2 vials, for moderate envenomation between 3-9 vials of antivenom will be necessary and for severe envenomation more than 6-10 vials [1,8]. In Colombia the only antivenom that neutralizes *M. nigrocinctus* venom is polyvalent IPC (Instituto Clodomiro Picado, Universidad de Costa Rica, San José, Costa Rica), one vial of 10 ml neutralizes 3 mg of venom [1]. If there are signs of respiratory paralysis, treatment will include orotracheal intubation and artificial respiration as well as prophylaxis for pulmonary thromboembolism with heparin. If there are signs of hemolysis, treatment with hemodialysis should be applied [1].

3. Snakebite capacity



During the 2010-2020 period, there were 605 snakebites caused by coral snakes (genus *Micrurus*) in Colombia, with an average of 60 bites per year. Of these only 3 cases resulted in mortality (0.5%). This represents less than 1.3% of the total snakebite reports for the country. However, the National Surveillance System of Public Health (SIVIGILA, Spanish acronym) database doesn't discriminate snakebite accidents at species level. Thus, currently it is not possible to know which of these reports might belong to *M. nigrocinctus*. However, due its narrow buccal opening angle (~30°), low encounter rate, and non-aggressive behavior snakebites caused by *M. nigrocinctus* or other coral snakes are infrequent.

4. Recognition



Micrurus nigrocinctus is a small to medium-sized snake that can reach 115 cm, although most individuals range between 60-75 cm [4,9]. There is sexual dimorphism (size difference by sex) where females tend to be larger than males (♀ 60.6 ± 8.6 cm; ♂ 53 ± 5.4 cm) [10]. It is a robust snake with a tricolored monads body pattern composed of black, red and yellow rings (yellow may vary to white or cream). The head is not easily distinguishable from the body. It has a black snout that generally extends to the posterior part of the eye, followed by a pale band (yellow or cream, but may be red in some individuals) and a black nape ring [11]. The full rings follow the sequence red-yellow-black-yellow, where red rings tend to be 2-4 times longer than black rings and yellow rings are very short (2 scales long) or they may be absent and are often incomplete ventrally. Individuals can have between 10-24 black body rings and 3-8 black tail rings [11].

In Colombia, *M. nigrocinctus* can be confused with *M. dissoleucus* and *M. ancoralis*; however, the black rings of these two species form triads (three black rings between two red rings) while *M. nigrocinctus* rings form monads (one black ring between two red rings). *Micrurus dumerilii* is another similar species that can have black rings arranged in monads or triads, but it can be distinguished from *M. nigrocinctus* by its black head cap that extends posteriorly to include all or most of the parietals [11].

5. Distribution



Micrurus nigrocinctus is distributed from Mexico through Central America to the Pacific region of northwestern Colombia [9], from sea level to 2000 meters above sea level [12]. In Colombia, it has been registered in Chocó and Antioquia (Urabá region) departments below 350 meters of elevation [13]. (Figure 1).

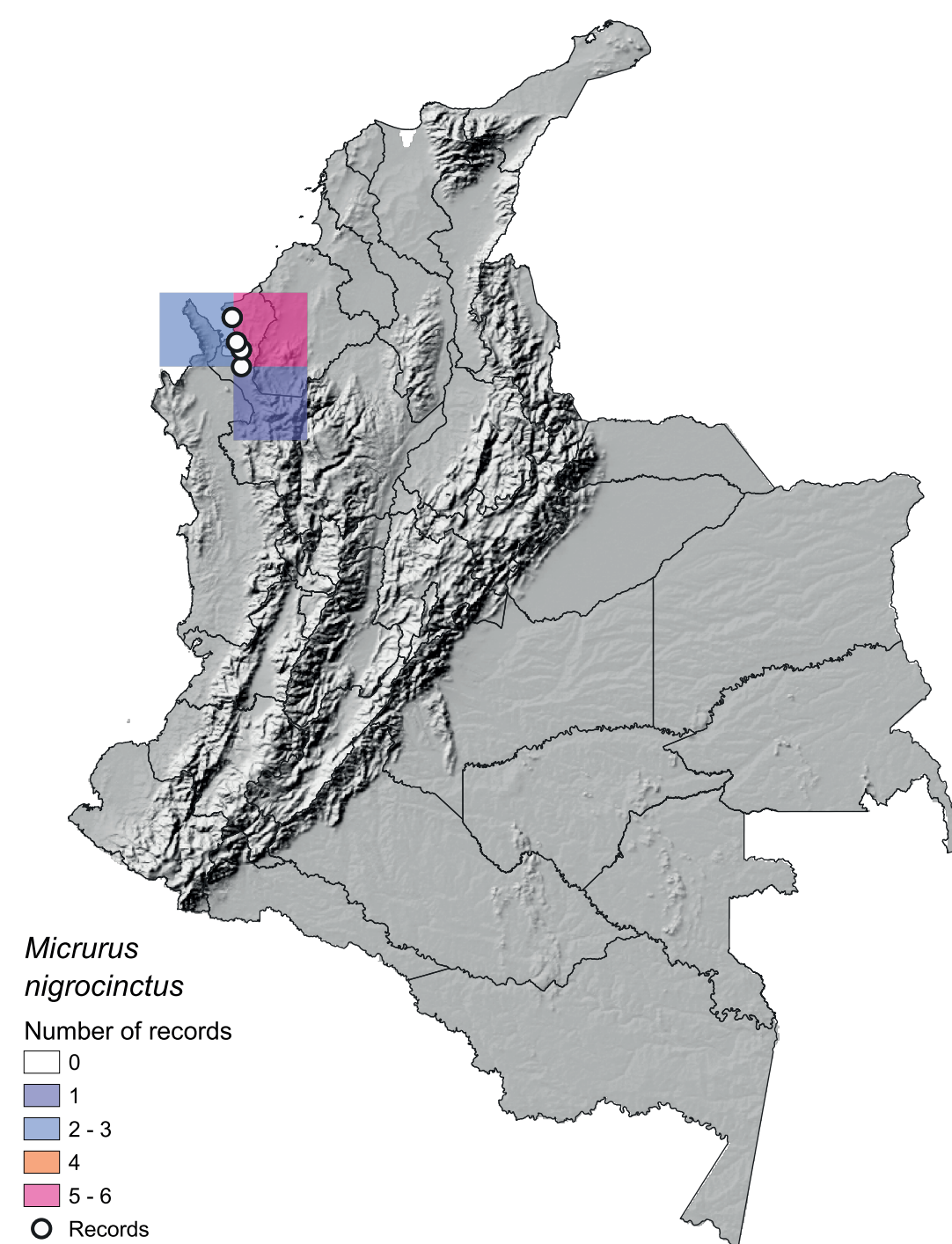
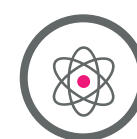


Figure 1. Geographic distribution of *Micrurus nigrocinctus* in Colombia and its habitat suitability model. Based on bioclimatic variables, the habitat suitability model predicts the species' potential distribution in Colombia, identifying zones with suitable or unsuitable environmental conditions for 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. Information on the natural history of Colombian populations is scarce. However, activity patterns, reproduction, diet and ecological interactions of this species have been studied from Central American populations. It inhabits lowland rainforest, lowland dry forest, thorn forest, lower montane wet, cloud forest, as well as transformed habitats [9,14]. The diet, like in other *Micrurus*, is constituted largely by snakes, it also includes caecilians, many types of lizards and their eggs as well as eels [4,15–19]. Its predators are birds like the laughing falcon (*Herpetotheres cachinnans*), mammals such as armadillos (*Dasypus novemcinctus*) and opossum (*Philander opossum*) as well as cannibals of the same species of snake [17,20–22].

Reproductive patterns differ between populations of the Atlantic and Pacific slopes of Costa Rica according to local climatic regimes [23]. Mating occurs at the end of the rainy season (November) on the Pacific slopes and snakes in the Atlantic population presumably from January to March coincide with the months of the lowest precipitation. Oviposition takes place during the dry season, February to March, (Pacific) and during the rainy and dry season, June and March, (Atlantic), suggesting continuous reproduction [10,23]. Clutch size varies from 3-14 eggs and incubation lasts between 47-81 days [10,23].

The venom of *Micrurus nigrocinctus* is composed mainly of the snake toxin families phospholipases A2 (PLA2), three-finger toxins (3FTx), metalloproteinases (SVMP), ohanin (OH), L-amino acid oxidases (LAO), C-type lectin/lectin-like proteins (CTL), serine proteinases (SVSP), and nucleotidase (NU). This profile was obtained from specimens from Costa Rica [24,25] (see Chapter 2). Given geographical differences in venom profiles for other species [26,27], further studies are necessary to know the venom profiles of Colombian populations and their ontogenetic changes (See Chapters 2 and 5).

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



This species can be found active during twilight in the lowland and premontane forested areas, as well as in perturbed areas such as pastures, coffee crops, banana plantations, and gardens around urban areas [14,15].

8. Conservation



Least Concern. The species wide distribution throughout Central America and northwestern Colombia, as well as its tolerance to transformed areas are factors that cause this species to be evaluated as not facing immediate extinction threats [14]. Nevertheless, habitat loss, and deliberate killing by humans and unintentional road-killing, illegal wildlife trafficking and, to a lesser extent, collection for scientific affect *M. nigrocinctus* populations [28].

This species is not included in the Resolución 1912 de 2017 del Ministerio de Ambiente y Desarrollo Sostenible for threatened wildlife species in Colombia [29], but it is present in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) list under appendix III for populations of Honduras [30].

9. Scientific name and common names



The name of this genus is derived from the Greek “mikros” (μικρός), meaning “little or short” and “oura” (οὐρά), meaning “tail”, in reference to the relatively short tail found in members of this group. The species epithet is derived from the Latin “nigrum”, meaning black and “cinctum”, meaning “belt”, in reference to the black rings present in its color pattern [9]. The English vernacular name for this species is Central American Coralsnake and in Spanish, for Colombia the most common are: *coral* and *coralillo*.

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



TOXICITY AND BIOLOGICAL ACTIVITY	VENOM ACTIVITY PROFILE	GENERAL BIOLOGICAL TRAITS
LD₅₀ (µg/mice): 2.3 (1.8-2.8)	Proteolytic: No	Total Length (cm): ♂ (53 ± 5.4) ♀ (60.6 ± 8.6)
MCD (µg/mL): Unknown	Neurotoxic: Yes	Weight (g): ♂ ♀ Unknown
MDD (µg/mice): Unknown	Myotoxic: Yes	Reproduction: oviparous
MED (µg/mice): Unknown	Hemotoxic: No	Diet: snakes, lizards, lizard's eggs, eels
MHD (µg/mice): Unknown	-	Distribution: Central America and northwestern Colombia from sea level to 350 m elevation.

PROTEOME

PLA₂: 48%	SVSP: 0.7%	SVMP: 4.3%	NGF: 0%
CRISP: 0%	CTL: 2.2%	DIS: 0%	KUN: 0%
BPPs: 0%	VEFG: 0%	3FTx: 38%	
Crotoxin: No	Crotamine: No	LAAO: 2.3%	

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

★★ Moderate reliable: Confidence for this species is limited or almost non-existent for Colombian populations. Therefore, most of our knowledge comes from populations outside the national territory LD₅₀: median lethal dose; MCD: minimum coagulant dose; MDD: minimum defibrinating dose; DEM: minimum edema-forming dose; DHM: minimum hemolytic dose; PLA₂: phospholipases A₂; 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; VEGF: vascular endothelial growth factor; 3FTx: three-finger toxins; LAAO: L-amino acid oxidases.

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