

• Clark's coral snake •

(*Micrurus clarki*)

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



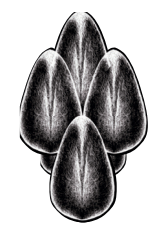
⚠ Detail of: Head, body and tail.

1. Envenomation symptoms



Venom of the species of the genus *Micrurus* are potentially dangerous to humans; its composition is predominantly neurotoxic, causing mild to absent local symptoms and significant systemic manifestations [1,2,3]. Currently, there is no published information about specific envenomation symptoms associated with bites of *Micrurus clarki*, however, such symptoms are probably similar to those recorded for other species of the genus *Micrurus*. Possibly the neurotoxins present in the venom of *M. clarki* belong to others already recognized in better studied species of coral snakes [2,4,5].

A person who has been bitten by a coral snake may experience symptoms as early as the first hour after the bite and they may increase in severity over the next 48 hours [4]. In mild cases, the symptoms experienced by the affected person will include loss of sensitivity and numbness or paraesthesia (tingling sensation) on the bitten area. In some cases, the bitten person exhibits no symptoms [6]. Systemic neurological symptoms appear in moderate and severe cases of envenomation depending on the amount of venom inoculated, and other factors specific to the affected person or the context of the bite [6]. In severe cases, neurological signs begin with double vision and drooping of the eyelids (palpebral ptosis) and difficulty controlling the muscles associated with the oral region and esophagus (dysarthria and dysphagia, respectively) [4]. The action of coral snake venoms produces musculoskeletal paralysis, affecting the muscles involved in breathing. In severe cases, medical treatment may include management with mechanical ventilation [4].



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2. Treatments and snakebite care



There is no specific treatment for *M. clarki* envenomation. However, envenomation caused by this species can be treated with commercially available antidotes, which can cross neutralize and act against *M. clarki* toxins. The bite of this species should be considered dangerous, because the risk of respiratory insufficiency in the envenomation by a coral snake is very high [4]. Therefore, the elapsed time for applying appropriate medical treatment plays an important role in the survival of the patient. Applying non-medical treatments such as punctures, sucking, tourniquets, herbal poultices, potions, or prayers performed by the community should be avoided [6]. The Sutherland method for elapid snakebite first-aid, suggests that the application of a firm crepe bandage with immobilization of the limb may reduce the dispersal of the venom [7], but in any case, it is important to go as soon as possible to a medical center.

The severity of an envenomation must be determined within the first 12 hours after the bite, into mild, moderate, or severe, according to symptoms exhibited by the bitten person [8]. The amount of antivenom to be administered will depend on the severity of the envenoming and the procedure should only be performed by physicians once the case has been confirmed [8].

Preclinical studies performed with the venom of *M. clarki* injected into mice have demonstrated that the SAC-ICP (antivenom produced by the Instituto Clodomiro Picado de Costa Rica; Spanish acronym) obtained by immunization with *Micrurus nigrocinctus nigrocinctus* venom, could efficiently neutralize the toxicity of *M. clarki* [9]. In fact, the SAC-ICP also has been effective for neutralizing the venom of *M. dumerilii* from Colombian populations [10]. It is important to note that a new study restricts *M. nigrocinctus* to the southern part of its distribution [11]; therefore, it is necessary to establish whether individuals used for immunization experiments mentioned above [9] are *M. n. nigrocinctus* or *M. mosquitensis* [11].

3. Snakebite capacity



Information about bites and venom of *M. clarki* is scarce [4,9,12]. In Colombia and Costa Rica, only two human fatalities have been recorded involving *M. clarki* envenoming [4]. In general, species of the genus *Micrurus* are considered dangerous and lethal to humans [2,3,11]. Coralsnakes have high diversity and are widely distributed, increasing the probability of a snakebite [4,9]. However, species of *Micrurus* are usually docile, and they tend to flee when they feel threatened [13,14]. Coralsnakes usually display deterrent behaviors, so bites are generally caused by direct and improper handling. In addition, their fangs are small (order of millimeters), and their buccal aperture is narrow (about an angle of 30°) making thicker clothes, split leather gloves and boots difficult to penetrate [12,15].

4. Recognition



M. clarki is a coralsnake of moderate body size, exhibiting a relatively thin to robust and cylindrical body, with a differentiated head from the neck. It can be distinguished by having a tricolored pattern of red, black, and yellow rings, with a black head cap extending from snout to the posterior tips of the parietal scales, followed by a white nuchal band that does not reach the parietal scales and a black ring encompassing three to six dorsal scales in length (shorter ventrally). The dorsal surfaces exhibit 13–20 black rings along the body, encompassing two to three scales in length (both dorsal and ventral). On the tail, there are five to nine black rings separated by yellow rings. The males and females of *M. clarki* differ in the number of black tail rings, which are six to nine in males and five to six in females [4,16].

Micrurus multiscutatus, *M. multifasciatus* and *M. mipartitus* inhabit the natural geographic range of *M. clarki*, but they are easily distinguishable by presenting a bicolor ring pattern. *M. clarki* is different from *M. oligoanellatus*, because this coralsnake has no black ring on the neck [17]. In Panamá and Colombia, *M. clarki* is sympatric with *M. dumerilii* [4]. *M. dumerilii* has a triadal or monadal pattern (according its geographic distribution) of red, black, and white rings on the body and a bicolor pattern of black and white rings on the tail; while *M. clarki*, as mentioned above, has a monadal pattern on the body and bicolor pattern on tail, with yellow color rings instead of white rings [17, 18]. In general, adult individuals of *M. clarki* are larger in body size than sympatric species of the same genus [4]. *M. nigrocinctus* is another species of coralsnake that could be confused with *M. clarki*; however, *M. nigrocinctus* has a black cap that barely reaches the parietals, while in *M. clarki* the black cap completely covers the parietals [4].

5. Distribution



Micrurus clarki is distributed in Central Pacific Costa Rica, in the lowlands of Western Panamá to Pacific Darién, and in the western and Atlantic region of Colombia [4,12]. In Colombia, records of this species are from the municipalities of Istmina (Andagoya), Río Sucio (Urabá) and the municipality of Condoto, Chocó department [1,4,19]. In addition, it has been registered in the municipality of Guapi in the department of Cauca and in the municipality of Dagua in the department of Valle del Cauca between 0–900 m asl.

Analyses of the potential distribution of *M. clarki* proposed that the distribution of this species in Colombia covers an area of approximately 188.102 km², ranging from North of Santander (7°57'40"N, 72°41'0"W) to Nariño (77°21'28"W) [19]. However, the presence of *M. clarki* in some of the localities proposed in this study must be confirmed, because suitable habitat suggested by niche modeling does not mean that the species is present there. For example, we are not aware of confirmed records of *M. clarki* in northern Santander (Figure 1).



Figure 1. Geographic distribution of *Micrurus clarki* 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. *M. clarki* is considered an uncommon species [4]. This coral snake is primarily nocturnal and terrestrial, inhabiting tropical rainforests; but it is also found in tropical dry forests and in moist riparian forests [1,4,12]. This snake feeds on the marbled swamp eel (*Synbranchus marmoratus*), however, its diet is poorly known and dietary items only have been recorded for individuals from populations in Costa Rica [9,20]. *Micrurus clarki* is an oviparous snake [17], but clutch size is unknown. To date, there are no records on of the natural history of Colombian populations.

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



M. clarki is a nocturnal species, but it can be active during the day on the floor of dense and well-preserved forests. Therefore, encounters between humans and this snake are uncommon [1,4,12].

8. Conservation



Least Concern. According to the IUCN, *M. clarki* is under the category of Least Concern, because it has a wide geographical distribution including pristine and disturbed habitats, and there are no known threats to its conservation [21]. However, there is insufficient knowledge regarding their threats and population status that in the future could be reflected in changes in their threat category. It is not registered with CITES [21], nor in the Resolution 1912 of 2017 of the Colombian Environmental Ministry [22].

9. Scientific name and common names



The name *Micrurus* comes from the Greek word *mikros* that refers to “small”, and the specific epithet *clarki*, was assigned in honor of doctor H.C. Clark, who is considered a pioneer in tropical medicine and who collected the holotype specimen [9]. *Micrurus clarki* is commonly known as Clark’s coral snake (serpiente coral de Clark, in Spanish) and Clarks Korallenotter. In addition, it is usually called *coral*, *coralilla*, *coral macho*, *gargantilla* [4].

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



TOXICITY AND BIOLOGICAL ACTIVITY	VENOM ACTIVITY PROFILE	GENERAL BIOLOGICAL TRAITS
LD₅₀ (µg/mice): 15,3(7.1-23.5 µg)*	Proteolytic: Unknown	Total Length (cm): ♂ ♀ 50 (38-92)
MCD (µg/mL): Unknown	Neurotoxic: Yes	Weight (g): Unknown
MDD (µg/mice): Unknown	Myotoxic: Yes	Reproduction: oviparous
MED (µg/mice): Unknown	Hemotoxic: Unknown	Diet: Snakes, caecilians, eels (<i>Synbranchus marmoratus</i>)
MHD (µg/mice): Unknown	-	Distribution: Pacific mainland

PROTEOME

PLA₂: 36,5%	SVSP: 1,0%	SVMP: 1.6%	NGF: No
CRISP: No	CTL: No	DIS: No	KUN: 0,9%
BPPs: No	VEFG: No	3FTx: 48.2%	
Crotoxin: No	Crotamine: No	LAAO: No	

MAIN ENVENOMATION SYMPTOMS		RISK	GRADE OF ENVENOMATION
Hemorrhage: No	Ecchymosis: Yes	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: No	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; VEEFG: vascular endothelial growth factor; 3FTx: three-finger toxins; LAAO: L-amino acid oxidases.

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