

• Talla X, peloegato •

(*Bothrops asper*)

Bites, venoms, and venomous snakes of Colombia

G1

MEDICAL IMPORTANCE GROUP 1

Snakes that **bite frequently** associated with **serious and life-threatening envenoming**



⚠ High reliable: The information gathered on this species is robust and supported by multiple published scientific studies, including those on Colombian populations.



⚠ Detail of: Head, body and tail.

1. Envenomation symptoms

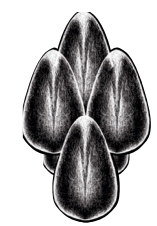


Envenomation caused by *Bothrops asper* can provoke local and systematic symptoms related to its grade of severity [1,2]. Mild envenomation is associated with local stinging such as a burning sensation and itching, ecchymosis (bruises), mild pain at the site of the bite, edema (swelling) involving one segment of the bitten limb (e.g., leg, forearm), increasing circumference of extremity less than 4 cm compared to the opposite limb. Bleeding at the site of the bite is absent and systemic signs such as hemodynamic alterations (changes in blood flow), hematuria (blood in the urine), renal failure, or hypotension (low blood pressure) are non-observed, however, in some cases, coagulation abnormalities may occur, but they are only detectable through laboratory tests. [1,3,4].

During moderate envenomation edema involving two segments of a bitten limb (e.g., foot and leg) increases by more than 4 cm compared to the opposite limb [1,5]. Hemorrhage or bleeding at the site of the bite occurs, as well as blistering in a few cases. Systemic signs arise such as incoagulable blood, hematuria, gingivorrhagia (bleeding gums), or bleeding into recent wounds. Nor hemodynamic alterations, renal failure, or hypotension are observed.

Finally, severe envenomation appears with edema that spreads beyond the bitten limb (e.g., from the hand to the trunk); bleeding is present at the site of the bite, as well as necrosis (damage of living tissue due to irreparable cell death) and increased pressure within a muscle compartment, known as compartment syndrome. Systemic signs such as incoagulable blood, hemodynamic alterations, hematuria, renal failure, or hypotension (low blood pressure) are present, as well as life-threatening signs such as cerebral hemorrhage or multi-systemic failure [1,3].

Clinical complications may occur from moderate and severe envenomation. Soft-tissue infection (e.g., cellulitis, abscess), fasciitis (inflammation of the connective tissue surrounding muscles, blood vessels, or viscera), acute renal failure, hypertension (high blood pressure), high potassium levels in the blood (hyperkalemia), and electrolyte disorders compromising the acid-base balance in the body (e.g., metabolic acidosis), have been reported. Some other complications are related to inflammatory and infectious processes in deep tissues such as joints and bones (e.g., arthritis, osteomyelitis). In some envenomations caused by *Bothrops asper* a severe systemic inflammatory response may occur, which can become complicated with sepsis, pulmonary inflammation, or meningitis. [1].



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2. Treatments and snakebite care



Envenomation caused by *Bothrops asper* becomes a race against time, and delays beginning medical treatment and antivenom therapy carry life-threatening consequences for the patient. In the case of snakebite caused by *B. asper*, first aid actions must calm the injured person down, wash the bite area with soap and water, immobilize the extremity and rapid transfer of the patient to the hospital. Traditional treatments performed by shamans and healers have been shown to be inadequate for combating the envenomation caused by this species [1,3,6]. We strongly recommend avoiding these practices because they delay timely and suitable treatment for the patient, as well as an antivenom therapy that will reduce the clinical complications and possible sequelae.

The antivenom therapy for combating envenomation inflicted by *B. asper* must follow the clinical manifestations of snakebites [1]. In cases of mild (2 vials of polyvalent antivenom from Instituto Nacional de Salud; 4 vials of polyvalent antivenom from Probiol or Bioclon), moderate (4 vials INS; 8 vials Probiol or Bioclon) and severe envenoming (6 vials INS; 12 vials Probiol or Bioclon) [7,8]. However, this dosage may vary at the discretion and criteria of the treating physician.

3. Snakebite capacity



In Colombia, *Bothrops asper* is one of most dangerous venomous snakes this species belongs to the genus that causes about 67% of the snakebite accidents in the country yearly [2,9]. The high danger of *B. asper* results from a combination of its high abundance in lowland ecosystems, great adaption to transformed habitats increasing human-snake encounters, the huge volume of venom possibly injected from its bite, its capacity to open its jaws up to 170° maximizing its grip during a bite, and efficient camouflage that results in people failing to detect the snake until it is disturbed, touched, or stepped on, provoking a bite as defensive behavior [10–12]. However, when the snake feels threatened, some snakes flee, others give a “warning” by wiggling their tail against the leaf litter, and some readily attack displaying dry bites (bite without venom injection) as deterrent behavior [13].

4. Recognition



This snake can be easily recognized from its lanceolate or triangular-shaped head without protruding snout (snout non-prognathous), heat-sensing pits between the nostrils and eyes, a marked dark postocular stripe that extends from behind the eye to the angle of the mouth slightly encroaching on the posteriormost 1–2 supralabial scales, and moderately keeled dorsal scales [14].

Despite the high variability of the body coloration, *B. asper* can be identified by having a dorsal pattern of 14–28 pale X-shaped markings on a tan, brownish, grey, olive, or pale-yellow dorsum [13,14]. In Colombia, the most similar species sharing similar habitat and distribution are *B. punctatus*, and *Bothrocophias colombianus*. However, these species can be distinguished from *B. asper* by having a dorsal surface of the head with spots, stripes, or blotches on a tan or pale-yellow background in *B. punctatus* dark brown trapezoidal blotches or spots arranged in such a way that they form squares, and a prehensile tail in *B. punctatus* [15], or strong keeled dorsal scales (tuberculate) in *B. colombianus*.

5. Distribution



In Colombia, *B. asper* is widely distributed across the trans-Andean region, inhabiting the Pacific coastal region (Gorgona Island and the mainland) and the Caribbean ecoregions and the Cauca-Magdalena inter-Andean valleys, as well as the Andean ecoregion up to 1800 m of elevation (Figure 1). This snake has records in at least 15 of the 16 departments of the trans-Andean region. It is a common species of herpetofauna communities in the Colombian lowlands [14,16]. The potential area of the distribution of *B. asper* in Colombia is 494,085 km² (Figure 1).

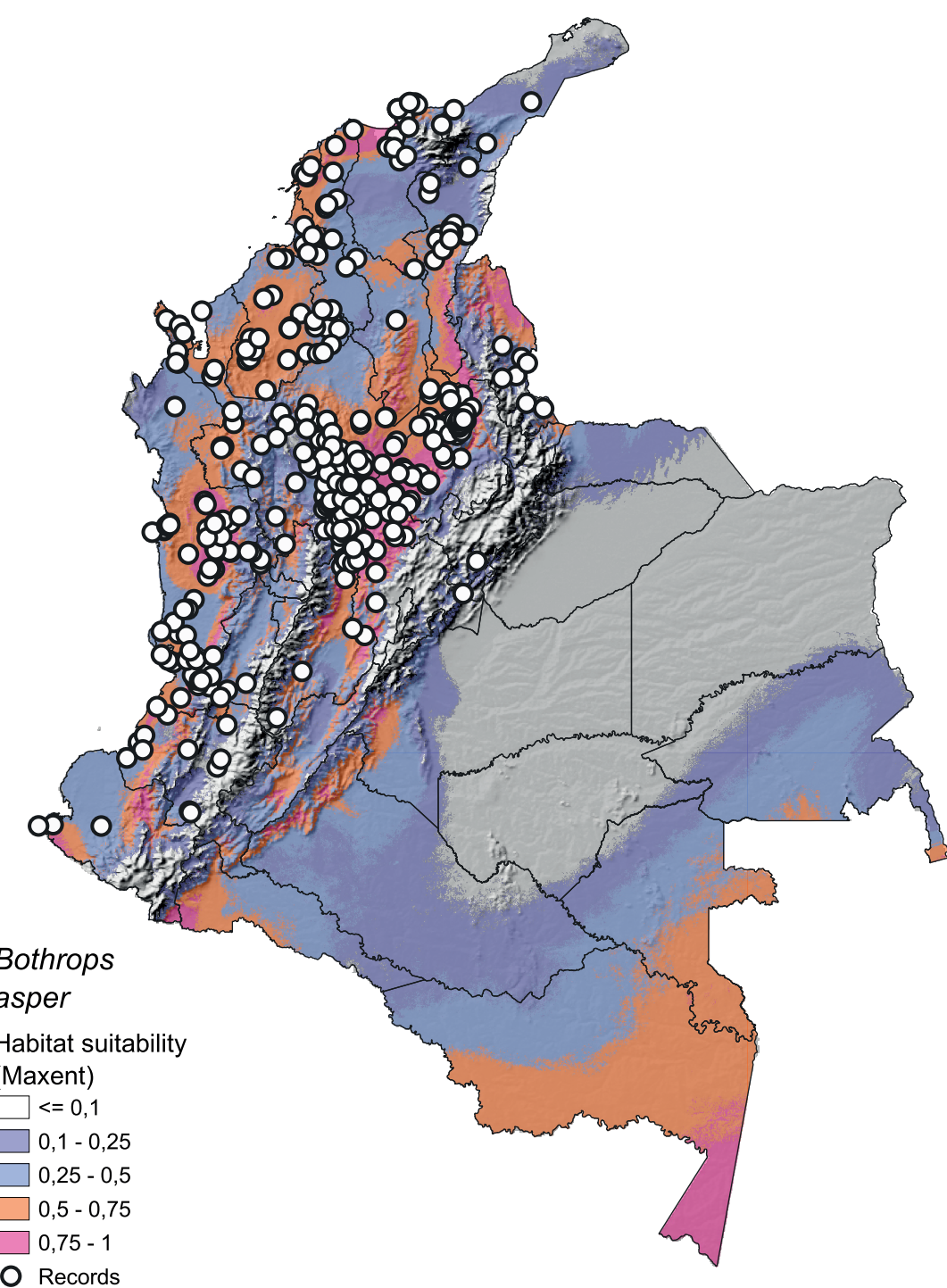


Figure 1. Geographic distribution of *Bothrops asper* in Colombia and its habitat suitability model. Based on bioclimatic variables, the habitat suitability model predicts the species' potential distribution in Colombia, identifying zones with suitable or unsuitable environmental conditions for its occurrence 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



Frequent or Common. This snake is abundant in both transformed and conserved areas of the Colombian lowlands of the Chocó and Caribbean and inter-Andean valleys of the Cauca and Magdalena Rivers. It is particularly found in areas where prey is abundant, such as surrounding mammal burrows, creeks, and streams, swamps, oil palm plantations, or piles of waste in the backyards of houses [13,17,18]. However, its abundance decreases across the Andean elevational gradient and is less frequent in cold and pristine Andean forests [11,13,14]. Mostly, this species can be considered terrestrial, however, juvenile and newborns can be found on branches up to 2–3.5 m [16] (Table 1).

Bothrops asper inhabits broad habitat from the Chocoan rainforests and evergreen forest of the main Andean rivers to xerophytic forests on the Caribbean coast. Especially, this snake has preferences for habitats with elevated moisture (>75% humidity relative) [11]. However, populations from xerophytic forests are associated with riparian forests, artificial ponds, or road edges with secondary vegetation [16,19]. Also, transformed habitats through human activities in both dry and humid ecosystems provide good microhabitats that are frequently used by *B. asper*, such as fallen objects in pastures, piles of palm leaves or thatch or pruned trees, piles of waste, and voids between the ground and houses, etc. [18,20]

The activity period of *B. asper* is mainly crepuscular or nocturnal, according to environmental thermal conditions or the season of the year (dry or rainy seasons) [11,21]. During daytime, this snake rests near their preys' refuges or at nocturnal ambush sites, spending days to weeks inactive or immobile [21]. So, *B. asper* uses sit-and-wait tactics to hunt its prey. However, when it is moving the snake spends an average of 37 minutes moving, although it moves less during cold nights [21]. Currently, for Colombian populations there are no spatial, feeding or reproduction biological studies; thus, most of the natural history data of this species reported here were retrieved from Costa Rican and Ecuadorian populations. Therefore, a comprehensive study of these traits, as well as the ecology of the species, is urgently needed.

The diet of *B. asper* is wide and includes a great diversity of dietary items associated with prey shifts across its development. Rodents, birds, and anurans compose the main dietary items for adults; lizards, snakes, and frogs are important for juveniles; arthropods, small lizards [e.g., lizards (*Anolis*) and geckos (*Gonatodes*)] and frogs are consumed by newborns [11,14,20]. The venom toxicity of the snake is correlated with ontogenetic prey shift, showing higher lethal, hemorrhagic and coagulant activities in newborns and juveniles than adults [12]. Scavenging or necrophagous behaviors have been reported as occasional feeding strategy in some Costa Rican specimens. The main predators of *B. asper* include mammals (e.g., peccaries, skunks, coatis, and raccoons), birds (e.g., falcons, hawks, chickens), snakes [e.g., mussurana (*Clelia clelia*) and blacktail cribo or arroyera (*Drymarchon corais* and *D. melanurus*)], and arthropods (e.g., crabs, spider, and centipedes), the latter mainly feeds juvenile and newborns of *B. asper*.

Bothrops asper is a viviparous snake, having an average of 5 to 86 hatchlings (Costa Rican populations) [11]. In Colombian populations, litter sizes range from 5 to 42 hatchlings. These reports came from female snakes in captivity, that after being captured in the wild gave birth to hatchlings in the serpentarium (see Chapter 8). Reproductive cycles in *B. asper* have shown a wide variation according to climatic conditions in which maturity, fat storage, gonad development, mating and births in the Costa Rican populations (Pacific versus Caribbean regions) [22]. Given the broad distribution of *B. asper* across the trans-Andean region and its great ecosystem diversity, variability in the reproductive cycles is expected in Colombian populations [23]. During courtships of *B. asper* combat behaviors between males have not been reported; however, it is not unusual to find females with several males during the mating season [11].

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



Bothrops asper can be found during nocturnal hours along trails, side roads, and forest edges. During the day, this snake hides under fallen objects located in the backyards of houses, fallen rocks or logs in the forests and pastures, as well as in piles of leaves and wastes.

8. Conservation



Least Concern. The wide distribution of *B. asper* across the trans-Andean region in Colombia and the Neotropical lowlands from Mexico and North-western Peru, as well as its high abundance in both transformed and conserved habitats within its distribution range means this snake can be considered not to be facing major immediate extinction threats [16,18]. Nevertheless, deliberate snake killing, and habitat loss are the main extinction threats facing by *B. asper* populations [18,24]. This species is not listed into de resolution 1912 of 2017 of the Colombian Environmental Ministry [25].

9. Scientific name and common names



Its scientific name is derived from the Greek root *Bothros* (pit) and *ops* (face) referring to the heat-sensing organ located between nostrils and eyes, and the Latin root *asper* (rough or harsh) likely referring to the coarse texture of the dorsal skin [14,26]. Since *B. asper* is one of the most important snakes from a public health standpoint, as well as an important element of the indigenous and rural human community folklore, this species has numerous common names. The most frequent common names in Colombia are “talla equis”, “cuatro narices”, “equis”, “pelogato”, “boquidorada”, “mapaná”, “veinticauro”, “cabeza de candado” [4,14,16].

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



TOXICITY AND BIOLOGICAL ACTIVITY	VENOM ACTIVITY PROFILE	GENERAL BIOLOGICAL TRAITS
LD₅₀ (µg/mice): 76.9 (42.9–133.1 µg)	Proteolytic: Yes	Total Length (cm): ♂ 66.2 (16–192) ♀ 66.2 (11–169)
MCD (µg/mL): 0.88 (0.011–5.40 µg)	Neurotoxic: No	Weight (g): ♂ 144 (3–2052.8) ♀ 208.6 (11–2200)
MDD (µg/mice): 4.98 (0.48–25.31 µg)	Myotoxic: Yes	Reproduction: Viviparous
MED (µg/mice): 0.89 (0.23–2.30 µg)	Hemotoxic: Yes	Diet: insects, frogs, lizards, rodents
MHD (µg/mice): 3.33 (0.30–6.89 µg)	-	Distribution: Pacific, Caribbean, Cauca-Magdalena inter-Andean River valleys up to 1800 m elevation, as well as Gorgona Island.

PROTEOME

PLA₂: 31.29%	SVSP: 3.89%	SVMP: 33.17%	NGF: Unknown
CRISP: 1.45%	CTL: 8.54%	DIS: 3.27%	KUN: Unknown
BPPs: 5.5%	VEFG: Unknown	3FTx: Unknown	
Crotoxin: No	Crotamine: No	LAAO: 3.0%	

MAIN ENVENOMATION SYMPTOMS		RISK	GRADE OF ENVENOMATION
Hemorrhage: Yes	Ecchymosis: Yes	Bites per year: 2,317	Mild: Unknown
Nausea: Yes	Hematemesis: Yes		
Hypotension: Yes	Blisters: Yes	Bites per 1,000 people yearly: Unknown	Moderate: Unknown
Edema: Yes	Vomiting: No		
Coagulopathy: Yes	Diarrhea: No	Sequelae caused per year: Unknown	Severe: Unknown
Sialorrhea: No	Local Pain: Yes		
Hematuria: Yes	Necrosis: Yes	Deaths caused per year: Unknown	
Renal failure: Yes			

★★★★ High reliable: The information gathered on this species is robust and supported by multiple published scientific studies, including those on Colombian populations. 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.

10. Referencias

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