

THE SNAKES OF RARA AVIS, COSTA RICA II. PIT VIPERS (CROTALINAE)

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INTRODUCTION

In Rara Avis, at least 7 species of venomous snakes occur. Five of which belong to the sub-family of the pit vipers. The members of this family are characterized by their erectable, hollow fangs, and the presence of a loreal pit. This heat-sensitive organ is located between the nostril and the eye, on both sides of the head. With the aid of these extremely sensitive pits, the snake can discern temperature differences of 0.03°C. In this manner, pit vipers have the potential of infrared vision, which is extremely useful for night-time hunting. Members of the sub-family Crotalinae belong to the highest developed snakes. Because of their highly developed senses and extremely potent venom, pit vipers are highly efficient hunters. Mostly, they are 'sit-and-wait' predators that stay at the same location, sometimes for several days, waiting for passing prey. Since they are well camouflaged, they usually remain unseen until they strike and bite, at the final moment.

The majority of snakebite incidents in the Neotropics can be contributed to the Crotalinae. Only a fraction are caused by the coral snakes of the family Elapidae. The venom of pit vipers mainly contains hemotoxins, which cause destruction of bloodcells. However, the venom of some species also contains some neurotoxic elements. These chemicals obstruct the signal transduction in nerve cells, which can result in paralysis of the heart and respiratory muscles. Pit viper venom is usually injected in large quantities, but sometimes bites occur in which no venom is transferred.

Due to the large amount of venom injected, the length of the fangs and the chemical composition of the venom, a bite from a pit viper can always be regarded as very dangerous. A polyvalent 'anti-Crotalinae' serum, which is active against the venom of all Costa Rican pit vipers, is produced by Instituto Clodomiro Picado, Costa Rica.

The neotropical pit vipers are divided into 4 different genera: *Agkistrodon*, *Bothrops*, *Crotalus*, and *Lachesis*. Recently, the genus *Bothrops* has been subdivided into the following 5 genera:

Bothriechis: the palm pit vipers, mainly Central America

Bothriopsis: the forest pit vipers, mainly South America

Bothrops: the 'lanceheads'

Ophryacus: the Mexican horned pit viper, *Ophryacus undulatus* (only one species)

Porthidium: the hognosed and mountain pit viper

(after: Campbell and Lamar, 1989).

In most, mainly old, literature the old genus name is used, to avoid confusion the latter is therefore added between brackets.

■ *Bothriechis (Bothrops) Schlegelii* - Eyelash viper, Bocaraca, Oropele

The distribution of *Bothrops schlegelii* ranges from the southern part of Mexico, through Belize and northern Guatemala south to Ecuador and Venezuela. Mainly on low and moderate elevations on the Atlantic versant, but also in parts of Costa Rica, Panama and northwestern South America on the Pacific versant.

Bothrops schlegelii is a medium-sized pitviper. The maximum size is approximately 85 cm (34 in.), but most adult specimens attain a length of 50-60 cm (20-24 in.). It is a relatively slender built, arboreal snake with a prehensile tail.

The shape of the head is triangular, typical of the pitvipers. Characteristic of *Bothrops schlegelii* are the spinelike processes on the supraoculars, which give the impression of eyelashes (hence the common name).

The colouration is extremely variable, even within one population different color morphs occur. The ground colour is usually green, olive-green, brown or gray-brown with blotches, spots or crossbands in various colours. One distinct colour morph is recorded for Honduras, Nicaragua, Costa Rica and western Panama. These snakes exhibit a uniform bright golden dorsal and ventral colouration, and are locally known as 'Oropele' (Wilson and Meyer, 1985).

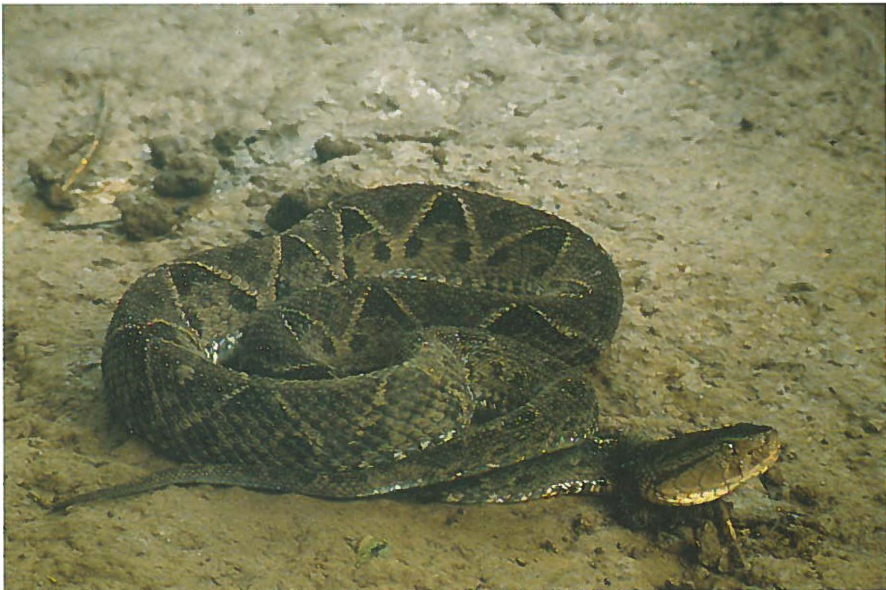


Foto 1: *Bothrops asper*. Volwassen vrouwtje, 185 cm lang.
Adult female, 185 cm total length.

Eyelash vipers are typical 'sit-and-wait' predators, they can be found on the same spot for several days, apparently without moving an inch. Their diet consist of frogs, birds and small mammals. Juveniles are known to eat lizards as well. These lizards (mostly anoles, genera *Anolis* and *Norops*) are attracted by the bright green or yellow tip of the snakes tail, that is wriggled in a worm-like fashion and in this way used as a lure. The brightly coloured tail tip disappears when the snake matures. Prey is killed by the relatively potent venom. The venom can cause severe effects in humans, and every year people die after being bitten by this snake, (Seifert, 1983). Plantation workers are often confronted with eyelash vipers. Due to the arboreal habits of these snakes, many bites occur in the upper parts of the body (head, chest) which makes it even more dangerous. *Bothrops schlegelii* is viviparous and produces litters of up to 20 young.

■ ***Bothrops asper*** - Lancehead, Fer-de-Lance, Terciopelo, Barba Amarilla

The Fer-de-Lance is one of the most feared animals in Latin America. In large parts of its range it is the most common venomous snake. Additionally, *Bothrops asper* inhabits many different habitats, including secondary growth areas e.g. plantations. Since this snake is often found in the immediate vicinity of human settlements it is responsible for a majority of the snakebite accidents in the neotropics. Over 50 % of the venomous snake bites in Costa Rica are caused by this species (Bolaños, 1984). Originally an inhabitant of tropical rain forest, the Fer-de-Lance has a preference for humid places e.g. streambeds. It is a primarily terrestrial animal, but juveniles are often encountered in low bushes (Scott, 1983).

Bothrops asper can be found from southern Mexico, throughout Central America up to the northern part of South America (northern Venezuela on the Atlantic and south Colombia on the Pacific versant).

Bothrops asper is a large species, with adults normally measuring between 130-170 cm, but specimens exceeding 2.5 m are also recorded. During daylight it is usually found coiled motionless under a fallen log or treestump. At night its activity commences, and this snake turns into a surprisingly agile hunter. Prey normally consists of mammals, but birds are also eaten. Juveniles prey on frogs and lizards that are lured with the brightly coloured tail tip, as in *Bothriechis schlegelii*.

If a lancehead feels threatened, this can be perceived by the vibrating tail tip that produces a clearly audible buzzing sound. When the source of the threat is not removed, the snake will not hesitate to defend itself. Fer-de-Lances are unpredictable creatures which have a lightning strike that is often elicited after only little provocation. The potent venom of *Bothrops asper* is highly hemotoxic and a bite needs to be regarded as extremely dangerous. Therefore these snakes should be treated with the most respect. Especially during the mating season (June-July) when they are more active and easily agitated.

The dorsal colouration of these snakes is brown or dark gray, with a pattern of dark triangular blotches that are fused mid-dorsally. These triangles are bordered by light, diagonal stripes that, seen from above, form a series of 'X'-shaped markings. The head is coloured dark brown dorsally, while the ventral surface and the labials are much lighter. Often the ventral side of the head is yellow, which explains the popular name 'Barba Amarilla' (=yellow beard). There is a dark stripe that connects the eye with the corner of the mouth. *Bothrops asper* is oviparous and extremely prolific, capable of producing litters of over 70 young. Usually litter size is between 40-50 young (Trutnau, 1990).

The taxonomic position of this species is still insecure. Especially regarding its relationship with the closely related *Bothrops atrox* which remains to be confirmed. Because both species have a vast distributional range and are also highly variable in appearance, separate species



Foto 2: *Porthidium nasutum*. Volwassen vrouwtje, 579 mm lang.
Adult female, 579 mm total length.



Foto 3: *Porthidium nasutum*. Zelfde dier als op foto 2 maar van bovenaf.
Let op zeer dunne, afwijkend gekleurde staart. Same animal as on photo 2,
from above. Note the very slender, abberant coloured tail.

have only recently been acknowledged. Even within Costa Rica this intraspecific variation is obvious: animals from the central and Pacific parts of the country differ substantially in size and colouration from animals from the Atlantic versant (both populations are separated by mountain ranges) (Jiménez-Porras, 1964). Also the composition of the venom of both populations differs, as is shown in research on the activity and electrophoretic patterns (see table 1).

■ *Porthidium (Bothrops) nasutum* - Hognosed viper, Tamagá

This species is frequently found in Rara Avis, mostly sunbathing on the trails and 'light-gaps'. It is an inhabitant of lowland rain forests on the Atlantic versant of Central America, south from Chiapas, Mexico, to northern Venezuela. Its altitudinal range is 0-900 meters.

Porthidium nasutum is a relatively small pit viper that reaches a maximum size of approximately 65 cm in females, males are considerably smaller. The body is stout with a very thin tail. It was striking that several specimens collected had a part or their entire tail missing. Possibly the tail-luring in this species sometimes gets out of control.

The head is clearly triangular, but more elongate than in other pit viper species, and with a characteristically upturned rostral scale, which is typical for this species. Its dorsal ground colouration is light brown with a pattern of light and dark transverse blotches. Melanistic specimens have also been found. Often a brown or reddish brown mid-dorsal stripe is present. From the corner of the mouth, a light brown stripe extends towards the eye. Supra- and sublabial scales exhibit a pattern of light bordered, brown spots that disappear when the animal ages.

The hognosed viper feeds on lizards and small mammals. Prey is seized with a fast strike and held in the mouth until the venom functions. In general, hognosed vipers behave very calmly and do not try to bite when caught. However, some specimens are very temperamental and strike at everything that comes within their range. *Porthidium nasutum* is ovoviparous and produces up to 27 young per litter (Trutnau, 1990).

■ *Porthidium (Bothrops) picadoi* - Picados pit viper, Mano de Piedra

This species is only known from a few locations in the central Costa Rican mountain ranges (Cordillera de Tilarán, Cordillera Central, and Cordillera de Talamanca), where it lives between 500 and 2000 meters altitude. Additionally there are some records from extreme northern Panama (Campbell & Lamar, 1989). *Porthidium picadoi* is not a common species. It is also easily mistaken for closely related *Porthidium nummifer*, or for the bushmaster (*Lachesis muta*). Therefore, only few reliable data on the exact distribution of this species exist. Picados pitviper appears to have a preference for dark, humid areas in rain or cloud forests.

Porthidium picado is a medium sized snake with a maximum size of 1.25 m. Due to their large girth, even smaller specimens appear very impressive.

Ground colour is light brown to chestnut-brown with dark brown to black diamond shaped blotches, dorsally. These blotches are sometimes fused mid-dorsally and form a zig-zag band. The dorsal side of the head is often a little darker than the rest of the body, and is separated from the light coloured supralabials by a black post-orbital stripe. Below the eye there is usually a dark spot. The strongly keeled dorsal scales give this snake a coarse appearance.



Foto 4: *Bothriechis schlegelii*. Jong exemplaar, ongeveer 17 cm lang. Let op de opvallend gele staartpunt. Juvenile, about 17 cm total length. Note the strikingly yellow tailtip.



Foto 5: *Bothriechis schlegelii*. Jong exemplaar, merk op hoe kleur en tekening van deze soort kan variëren op lokale schaal. Juvenile, note the variation in colour and pattern of this species on a local scale.

Porthidium picadoi possesses an extremely potent venom that has the strongest hemotoxic action of all Costa Rican crotalids (see table 1) (almost 4 times as active as the venom of the Bushmaster, *Lachesis muta*). However, because of its rarity and its preference for remote areas, this snake hardly poses any danger for humans.

This viper is named after a famous Costa Rican herpetologist, Clodomiro Picado, who started describing the native herpetofauna, at the beginning of the century, and who was an expert on Central American venomous snakes.

■ *Lachesis muta* - Bushmaster, Cascabel muda, Matabuey

There are not many snakes in the world who possess such an impressive reputation as the bushmaster. Although this huge viper does appeal to the imagination, most stories about this infamous 'jungle monster' are greatly exaggerated.

The bushmaster is the largest member of the Viperidae, and the second largest venomous snake in the world, only the king cobra (*Ophiophagus hannah*) exceeds this snake in size. A total length of over 2 metres is not uncommon and lengths of up to 3.5 m are reported fairly frequently. The largest size ever measured for a bushmaster was 4265 mm, although the evidence has disappeared.

The Spanish name 'Cascabel muda', which literally translates into 'silent rattlesnake', indicates that the bushmaster is closely related to the rattlesnakes. Although *Lachesis* does not have a rattle, the hard tip of the tail can produce a clearly audible humming sound, when vibrated against leaves. This tail vibrating is part of the impressive defensive behavior of the bushmaster. According to people who are familiar with this species, it usually has a rather mild character, and especially during daytime, there is no sign of aggressiveness. At night, however, this snake immediately employs its defensive posture when threatened, with its head erected, and neck inflated it strikes at the imposer. During the breeding season, this aggressive behavior does not appear to be restricted to night time.

Bushmasters differ from all other neotropical Crotalidae in that they lay eggs instead of being ovoviviparous. Additionally, this species seems to guard its nest and rigorously defend it against intruders.

Lachesis muta melanocephalus, the black headed bushmaster, a subspecies that occurs on the Osa peninsula in southwestern Costa Rica, differs in having an atypically aggressive disposition, at any time. Normally, however, bushmasters are shy, secretive creatures.

Lachesis muta is an inhabitant of the relatively cool rain- and cloud forest floors, in Central America and northern South America. Bushmasters mostly avoid exposure to light, and can therefore be found in holes and under fallen trees etc. during the daylight hours. It is at night that they become active and start their hunt for prey, primarily mammals.

The subspecies that occurs in Rara Avis and most of Costa Rica is *Lachesis muta stenophrys*. These animals are characterized by their relatively large size, the presence of a mid-dorsal ridge, and the heavily keeled, almost pyramid-like, dorsal scales. Their ground colour may vary from grey-brown to yellow-brown or even reddish-brown, with black, diamond shaped markings, mid-dorsally. When viewed laterally, these markings appear as triangles, often centered with a blotch coloured in the ground colour. The black triangles often extend laterally towards the ventral scales. The head is similarly coloured to the rest of the body, and has a dark postorbital stripe which extends to the corner of the mouth, and sometimes even beyond. In the subspecies *Lachesis muta melanocephala*, the postorbital stripes are fused with the black head cap.

Research on the chemical composition of the venom of *Lachesis muta stenophrys* showed that the venom of freshly hatched bushmasters has no toxic activity. As the animal

ages, the toxicity increases. However, the venom of the hatchlings did show a strong coagulating effect on human plasma (Gutierrez et al., 1990).

species	MHD (in micrograms (µg))*	Relative activity (in %)**
<i>Bothrops asper</i> (Atlantic)	1,5	17
<i>Bothrops asper</i> (Pacific)	2,5	10
<i>Bothriechis schlegelii</i>	1,7	15
<i>Porthidium picadoi</i>	0,25	100
<i>Porthidium nasutum</i>	5,6	5
<i>Lachesis muta</i>	0,9	28

Table 1: Hemotoxic effects of the venom of some Costa Rican pit vipers. (after: Gutiérrez & Chaves, 1980)
*Minimal Hemotoxic Dosis (MHD): The amount of venom that produces an area of haemorrhage with a 10 mm diameter. **Compared to *Porthidium picadoi* venom (= 100 %)

Species	Amount of venom per extraction	Frequency of bite accidents*	Mortality (in %)
<i>Bothrops asper</i>	187.5 mg	46.12	5-10
<i>Bothriechis schlegelii</i>	11.9 mg	18.90	0-1
<i>Porthidium nasutum</i>	16.9 mg	10.48	0-1
<i>Porthidium picadoi</i>	?	0	?
<i>Lachesis muta</i>	tot 333 mg	0.42	75

Table 2: Some data on the amounts of venom injected per bite, frequency of bite accidents, and mortality for some pit vipers that occur in Rara Avis (after: Bolaños, 1982; 1984). *Percentage of bite accidents per species, calculated over a total of 477 bites, recorded in Costa Rica in 1979.

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