

Jararaca!



Western subspecies of the Two-lined Forest Pitviper, *Bothrops bilineatus smaragdinus*

An Introduction to Brazilian Pitvipers of the genus *Bothrops*

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Among South American pitvipers, the genus *Bothrops* comprises some of the most notorious species, responsible for numerous human accidents and deaths every year. Species such as *B. atrox* and *B. jararaca* have acquired a ferocious reputation due to the terrible effects of their bites. There are a large

number of species of *Bothrops* (lanceheads) in South America; many remain poorly known outside their natural range since they are rarely seen in the pet trade. The South American country with the largest number of representatives is Brazil, where these snakes are called *jararaca*. This article introduces the

Brazilian representatives of the genus, illustrating the diversity of body forms and natural histories found among these snakes.

What is and what is not included in the genus *Bothrops*? For decades, this genus has been used as a "taxonomic trash can" for any Central or South American pitviper that was not obviously something else—i.e., a rattlesnake, Bushmaster, or member of the *Agkistrodon*. Over the last 10 years the arboreal and smaller terrestrial forms have been split off into a number of other genera, including *Bothriechis* (Central American arboreal species), *Porthidium* (hognosed pitvipers), *Bothriopsis* (South American arboreal pitvipers), and several smaller genera (Campbell & Lamar, 1989, 1992; Werman, 1992). The status of many of these genera remains uncertain, and a number of current studies are investigating these problems. In particular, there is considerable evidence suggesting that *Bothriopsis* should be synonymised with *Bothrops* (Cadle, 1992; Werman, 1992; Salomão et al., 1997), a course of action that will be followed here.

Under this new definition, *Bothrops* are almost entirely restricted to South America (*B. asper* extends north to Mexico, and *B. caribbaeus* and *B. lanceolatus* are found in the West Indies). According to the conventional classification, the genus comprises roughly 38 species (depending on taxo-

nomic interpretation), of which 20 occur in Brazil. However, as will be discussed below, the status of many forms is uncertain. Despite relatively low levels of genetic divergence (Salomão et al., 1997), *Bothrops* includes species with considerable morphological and ecological diversity, much of which can be found among Brazilian species.

BRAZILIAN BOTHROPS:

GROUP I: FOREST PITVIPERS

The first group consists of two species, *B. bilineatus* and *B. taeniatus*. The Two-

lined Forest Pitviper, *B. bilineatus*, is a small species which reaches up to 100 cm. The body is greenish, covered with fine black speckling and sometimes small, darker cross-bars on either side of the dorsal midline. The first dorsal scale row forms a cream-coloured light line on each side of the belly. This species is widespread in the rainforests of the Amazon basin and in the forests of the Atlantic coast of Brazil where, as with many other species, it is threatened due to rampant deforestation. This species is generally uncommon, but does cause a number of often serious bites in Amazonian Ecuador.

The Speckled Forest Pitviper, *B. taeniatus* (*B. castelnaudi* in older literature), has a similar range, except it is not found in Atlantic forests. This species has a spectacular pattern consisting of quadrangular dark spots outlined in white with numerous spots and speckles, giving a lichenous appearance to the body. The maximum length is at least 150 cm. Very little is known of its natural history, as it is rarely seen.

GROUP II: STOUT TERRESTRIALS

For convenience, Brazilian *Bothrops* can be subdivided into three basic morphological types:

1. slender arboreal forms (sometimes assigned to *Bothriopsis*, the "forest pitvipers")
2. small to medium-sized, stout-bodied terrestrial forms
3. medium to large, reasonably slender terrestrial forms

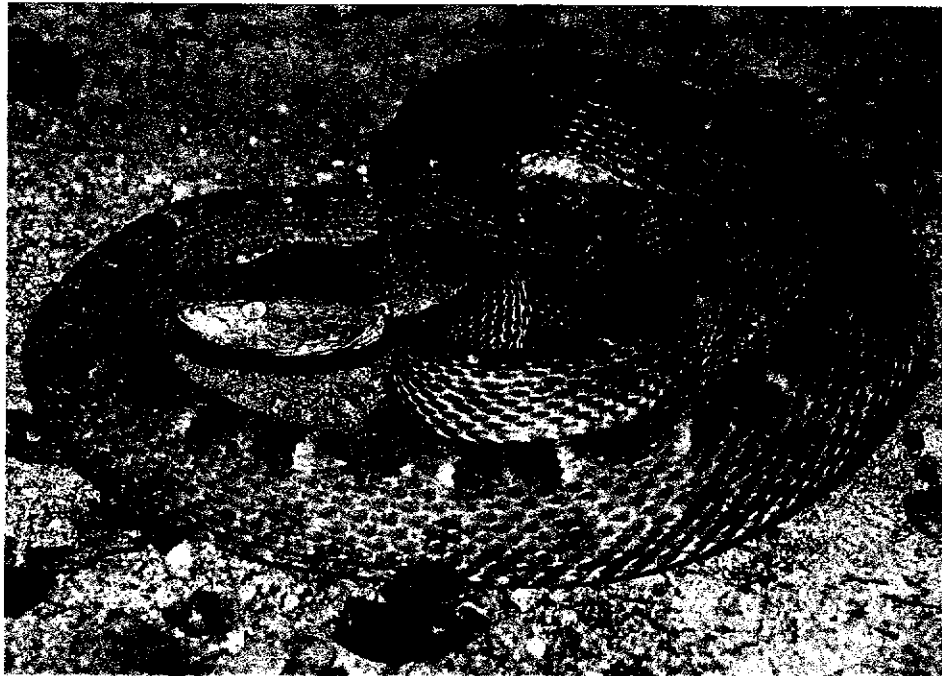
The second group of small to medium-sized, stout, terrestrial lanceheads includes seven species which occur in the southern and eastern parts of Brazil, outside the great Amazonian rainforests. The best known is the Urutu, *B. alternatus*. This handsome viper is the largest of the stout spe-

cies, exceptionally reaching 160 cm, although most specimens measure under 100 cm. Its intricate pattern consists of chocolate-coloured crescent- or telephone-shaped markings finely outlined in white. Most are irritable and strike with little provocation. Many hide their heads in their coils between strikes. This species is not uncommon in humid areas of southern and southeastern Brazil, as well as neighbouring Uruguay, Paraguay and Argentina; it causes many snakebite accidents.

Bothrops cotiara and *B. fonscolombii* are



Above - The Urutu, *Bothrops alternatus*, probably one of the most handsome members of the genus, and is similar in appearance to both *B. cotiara* and *B. fonsecar*.
 Below - *Bothrops neuwiedi bolivianus*, found in Bolivia and adjoining parts of Brazil.
 Right - The highly irascible *B. erythromelas* from southeastern Brazil's badlands

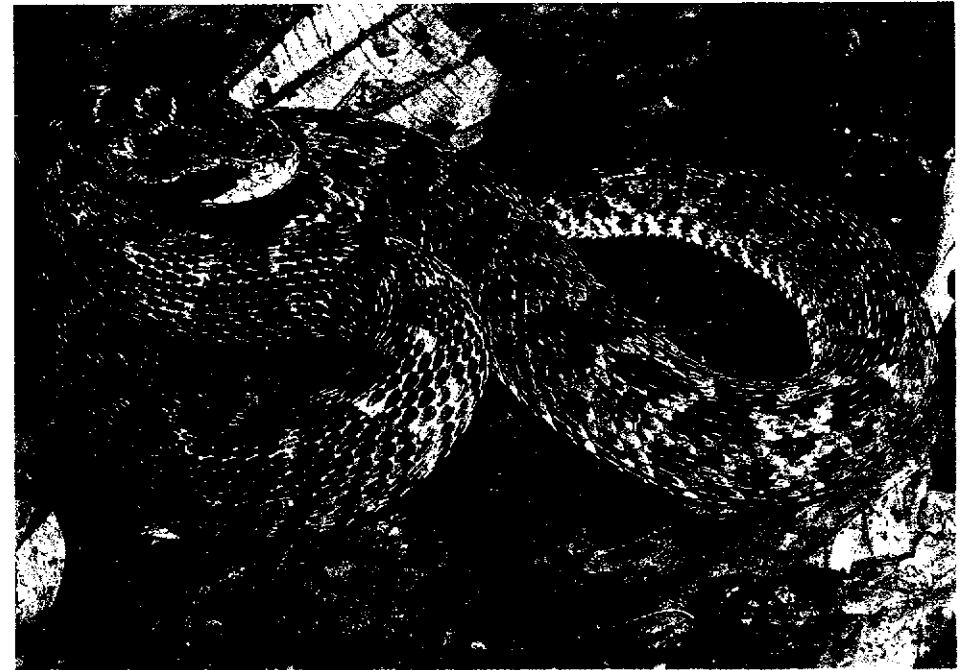


two similar species restricted to remnant Araucaria forests in southern and southeastern Brazil. Due to disappearance of habitat, they have become rare and localised in recent years. Both reach a maximum length of approximately 100 cm, and their pattern is similar to that of *B. alternatus*. These two species tend to be fairly placid and only strike after substantial provocation.

Bothrops neuwiedi, the *jararaca pintada*, is the most widespread of the stout pitvipers, occurring throughout the subtropical parts of South America south of the

cm), which is superficially similar to *B. neuwiedi*. Unlike most members of the genus, which are found principally in humid areas, *B. erythromelas* is restricted to the arid zones of northeastern Brazil. This form is particularly irascible, and captive specimens lose none of their tendency to strike with lightning speed at the slightest disturbance.

Bothrops itapetiningae is the smallest *Bothrops*, with adults reaching a length of only 50 cm. It is found over a wide area of central and southeastern Brazil, but it is rarely encountered and its natural history remains



Amazonian forest. It shows considerable variation in coloration, morphology, and ecology, which has led to the description of approximately 12 poorly-defined subspecies. It would not be surprising if it were eventually found to consist of several separate species. Maximum length is 110 cm, but most specimens measure only half this size. Like *B. alternatus*, most *B. neuwiedi* are irascible, striking wildly at any perceived threat and often hiding their heads between their coils.

The Caatinga Lancehead, *Bothrops erythromelas*, is a small species (up to 70

largely unknown. The least known pitviper in Brazil is *B. iglesiasi*; only a handful of specimens have been found in a small area of the northeastern Brazilian state of Piauí.

GROUP III:

SLENDER TERRESTRIALS

The third group consists of long, slender terrestrial species. Three are intermediate in physique between the previous group and the slender species. These are members of the *B. jararacussu* group, which has three representatives in Brazil (a fourth is being described). *Bothrops jararacussu* itself is one



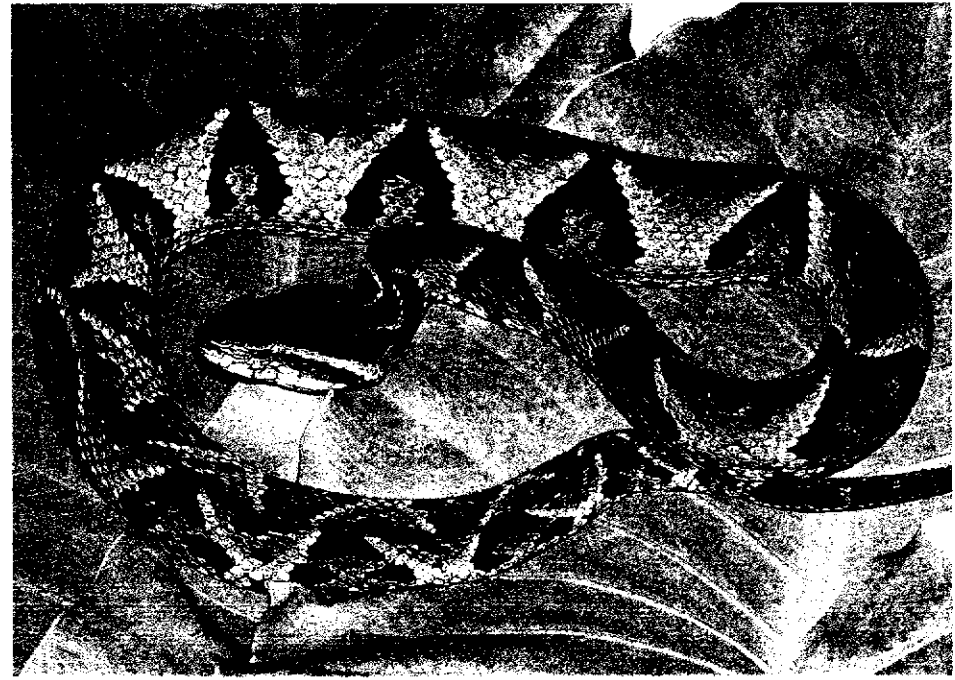
of the longest species of the genus, after *B. asper*, and perhaps the Caribbean species *B. lanceolatus* and *B. caribbaeus*; the record is approximately 220 cm, and large females often reach 150 cm. The robust stature of large specimens, together with their broad, large heads, make them ominously impressive creatures. The pattern is variable and changes considerably depending on the age of the snake. Large females have a particularly striking black and white or black and yellow pattern. The Jararacussu is found primarily in protected rainforest, and it has become rare in parts of its range as a result of deforestation. Large specimens produce prodigious quantities of venom, and a bite by such an individual is likely to be rapidly fatal unless treated with an effective antivenom.

Bothrops brazili is a slightly smaller species (maximum 160 cm) of similar stature, found throughout the Amazon Basin, where it inhabits virgin forests. Unlike *B. atrox*, it does not adapt to deforested areas or agriculture and is seldom encountered. Due to superficial similarities, it has been confused with *B. moojeni* and *B. atrox* in the past.

The third member of this "intermediate" group is *B. pirajai*, another rare species, of which only a handful of specimens are known. All come from cacao growing areas in the Atlantic forests of Bahia state. Large specimens reach at least 130 cm and resemble *B. jararacussu* in general appearance.

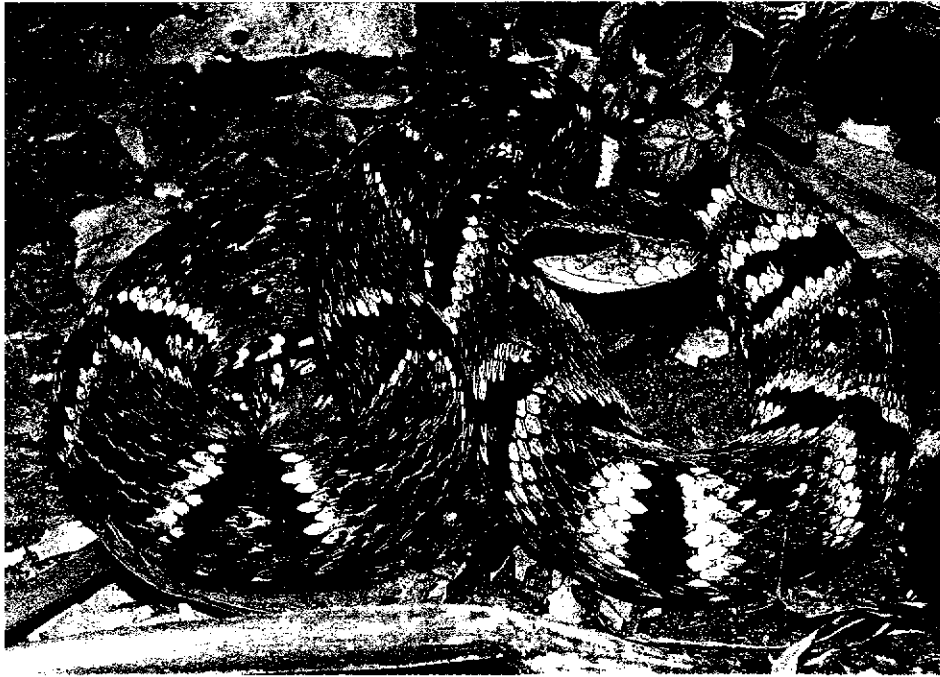
This group includes a number of long, slender, largely terrestrial species that are the principal cause of venomous snakebite throughout much of South America, largely due to the fact that most adapt well to highly modified regions, such as agricultural areas or secondary growth.

In southern and southeastern Brazil, *B. jararaca* is by far the most common venomous snake and has maintained itself even within many cities. It is also the best known, as a result of numerous studies carried out on its biology and venom at various institutes in Brazil (e.g., Sazima, 1992). Interest in this species has always been stimulated by the fact that it is responsible for the vast majority of bites in densely populated parts of Brazil. Its pattern consists of a series of carat-shaped marks (C), with distinctly serrated edges. These



On this page, two rare rainforest forms — *Bothrops pirajai* (above) from the Atlantic rainforest of Brazil, and *Bothrops brazili* (below), which is closely related to *Bothrops jararacussu* (left), the largest and bulkiest of the Brazilian Bothrops





Bothrops jararaca, the commonest pitviper in densely populated southeastern Brazil

marks become somewhat scrambled towards the tail. The coloration and shape of the markings is variable. Adults eat mostly rodents, whereas juveniles eat mostly frogs, as well as other small vertebrates. Centipedes have also been found in their diet. This slender species reaches about 150 cm, rarely more. Despite their fearsome reputation, most are relatively calm snakes, at least in comparison to other members of the genus.

The closest relative of *B. jararaca* is the Golden Pitviper, *B. insularis*. This is in many ways one of the most interesting lanceheads: its range is confined to the tiny (0.4 km²) island of Queimada Grande, off the coast of São Paulo state in southeastern Brazil. The venom of this species is about five times as toxic as that of mainland *B. jararaca*; this is interpreted as an adaptation for feeding on birds; rodents, the normal prey for large adult *Bothrops*, are absent from the island. Whereas a mainland *B. jararaca* can bite its prey and then release it to follow its scent trail later on, *B. insularis* needs to hold on to its avian prey to avoid losing it. There would thus be some

selective advantage in a venom that kills its prey as rapidly as possible.

Another peculiarity of the species is the high percentage of specimens with sexual abnormalities: most are genetically female, but with male sexual organs. Many are infertile, and the population may be undergoing natural extinction; nevertheless, it is still possible to observe large numbers of specimens in a single day. Most are likely to be found coiled in low bushes, as this species is semi-arboreal even when adult, unlike most other representatives of the genus.

The final group in the genus is the *B. atrox* species complex, which occurs throughout Brazil, with the exception of some southern and southeastern regions. Traditionally a number of species were recognised within this complex. Whereas *B. atrox* itself was regarded as restricted to the Amazonian lowlands, other populations were recognised as *B. taeniurus* (northeastern coast of Brazil), *B. marajoensis* (Marajó Island), *B. moojeni* (Central Brazil) and *B. pradoi* (eastern coast). However, recent studies (Wüster et al., 1997)

suggest that these species are largely fictitious entities, and that the variation in pattern or scalation probably simply represents adaptations to local ecology rather than an indication of separate phylogenetic ancestry. This problem is still under study.

All populations of this complex attain medium to large sizes: large females generally attain 120-150 cm, and occasional specimens may measure nearly 200 cm. Males remain 20%-30% shorter than females. All are relatively slender and can move with alarming speed. These lanceheads will not go out of their way to attack mankind, but they will defend themselves with great vigour when threatened. Their considerable size, agility, and their rapid and far-reaching strikes make them dangerous opponents. A peculiarity of this group is the display of localised skin twitching when the snake is alarmed.

Members of the *B. atrox* complex occupy a wide variety of habitats, from open dry forests to rainforests and mangroves, as well as plantations and secondary growth. They thrive in agricultural areas and are thus responsible for most of the snakebites in their range. They can be extremely common in some habitats, and experienced snake hunters can find up to 30 snakes in a day in some regions. Juveniles eat just about any small animal that they can overpower, whereas adults eat mostly small mammals as well as some lizards. A juvenile *B. atrox* holds the world record for the relatively largest prey item recorded in a snake: it contained a *Cnemidophorus* lizard weighing nearly 1.6 times as much as itself.

NATURAL HISTORY

As is the case in many groups of tropical snakes, there is little hard information about the natural histories of most *Bothrops*. However, a few, especially *B. jararaca* (Sazima, 1992), have been studied in detail and some generalizations are possible.

Bothrops appear to be primarily ambush hunters: they remain coiled, immobile, and wait for prey to pass within reach. The effectiveness of their markings as camouflage has to be seen to be believed: even an

exceptionally large specimen is almost impossible to spot when lying fully exposed on the leaf litter of the forest floor. In *B. jararaca*, and presumably most other species, the snake bites its prey and lets go. After a few minutes it follows the scent trail to recover the prey, which by then will have died a short distance from the snake. Active foraging also takes place. In flooded areas, *B. atrox* can be seen crawling along road edges at night.

In many species, diet changes during growth. Juveniles eat a wide variety of small vertebrates, particularly frogs, whereas adults eat primarily small mammals. Centipedes are also eaten by juveniles of several species. Some juveniles (e.g., *B. jararaca* and *B. jararacussu*) use their brightly-coloured tail tips to lure prey within range. In other species, the bright tail tip is present but luring has not been observed.

As far as is known, all *Bothrops* are viviparous and give birth to live young. Litter sizes are variable, typically five to 20 in some of the larger species, such as *B. jararaca* and *B. atrox*. In Central America, litters of over 30 have been recorded in *B. asper*. Smaller litters are more typical in the arboreal species *B. bilineatus*, *B. insularis*, and *B. taeniurus*.

VENOM & BITES

The various species of *Bothrops*, in particular those of the *B. atrox* group, are responsible for between 80% and 90% of venomous snakebites in South America. Most bites are the result of overlooking the well camouflaged snakes and stepping on them.

The consequences of a bite by any *Bothrops* can be terrible. *Bothrops* venoms, as with all snake venoms, contain many different components with a variety of activities. The effects of a bite can include local symptoms (pain, swelling, ecchymosis, blistering, sometimes necrosis and other effects), and various disturbances of the blood circulation (non-clotting blood, haemorrhaging, shock). Kidney failure can occur as a further complication. Deaths are rare if treatment with specific antivenom is initiated soon after a bite, but local tissue damage can nevertheless be severe. Amputations of ne-

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cretic limbs are not exceptional if treatment is delayed. Even workers in Brazilian research institutes who received antivenom within minutes of a bite have suffered permanent limb or digit dysfunction. Interestingly, the symptoms in at least some species (*B. jararaca* and *B. moojeni*) vary depending on the age of the animals: bites by small specimens are more likely to lead to non-clotting blood, and less likely to lead to local tissue damage, than bites by adult specimens.

The venoms of several *Bothrops* species have been used extensively in medical research. Probably the most important outcome has been the development of ACE-inhibitors for combating high blood pressure; the research that led to the development of these important drugs was based on studies of the action of *B. jararaca* venom on blood pressure. These medicines have saved millions of lives, many times more than have ever been ended by these snakes.

CAPTIVE HUSBANDRY

Most *Bothrops* make hardy captives without special requirements, feeding readily on mice. Several species have been bred over generations in research institutes in Brazil and elsewhere. This, and the beautifully intricate pattern of some species, might make them attractive for herpetoculturists.

However, the captive husbandry of any venomous snake requires extensive experience and a high degree of responsibility. This applies to *Bothrops* more than to most other venomous snakes. Most members of this genus are irascible and often strike with lightning speed, and without appreciable warning. The slender species in particular are agile and fast-moving. Anyone who thinks of a *Bothrops atrox* as essentially a rattlesnake is in for a shock: thinking of it as a *Dendroaspis* with three-quarter-inch fangs would be closer to the mark. These species are therefore not recommended as captives to any but the most experienced herpetoculturists. It should go without saying that a specific antivenom should always be kept on the premises if husbandry of these snakes is to be attempted. ☛

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