

Lachesis muta (Bushmaster or Mapepire Zanana)

Family: Viperidae (Vipers and Pit Vipers)

Order: Squamata (Lizards and Snakes)

Class: Reptilia (Reptiles)



Fig. 1. South American bushmaster, *Lachesis muta*.

[<http://www.scientific-web.com/en/Biology/Animalia/Chordata/Reptilia/images/LachesisMutaMuta.jpg>,
downloaded 27 September 2011]

TRAITS. This terrestrial snake is the longest of all viperids. Adults are usually well over 250 cm and 3-5 kg with some of the longest approximately 350 cm. Prominent ridge of hard, sharp scales is present mid-dorsally along the anterior of the body. The top of the head is usually brown with irregularly scattered distinct dark spots. There are 28-35 dark brown or blackish dorsal diamond-shaped triangles arranged laterally along the vertebral line. The lateral corners of the triangles extend into vertical bars which extend a few scale rows down producing a banding pattern. These dark dorsal markings are amongst yellow-cream scales.

ECOLOGY. Tropical rainforests and lower montane wet forests that receive approximately 3000 mm rainfall per annum. *Lachesis muta* inhabits primary forests, often living near large buttressed trees or adjacent to fallen trees. Occasionally found in secondary forested areas recently cleared or adjacent to virgin forest. Most commonly found on high, well-drained ground with deep ravines.

SOCIAL ORGANIZATION. Little is known of the social organization of *Lachesis muta* because it is a very solitary snake and is also rarely seen in the wild, as a result there are very few recordings of bushmaster activity in the wild. The bushmaster has a commensal relationship with the large rodents that construct its underground refuge (Ripa, 2001). The bushmaster does not make its own home but scouts its environment for burrows made by large rodents such as agouti or armadillos and either steals the burrow for itself or shares it with the other animal.

There is no evidence that there is any care for neonates in bushmasters. In the Atlantic rainforest of Brazil's east coast, it was found that females are much more common than males among wild caught animals. The ratio is commonly 1 male : 5 females (Turner et al, 2008).

ACTIVITY. Bushmasters are usually very inactive during the day because of the scorching sun and high humidity found in its natural habitat. They spend most of the daylight period in their burrows resting until the sun goes down. In Trinidad, they frequently occupy the burrows of the "Lappe" (Rodentia: *Agouti paca*). Once it is cool, they emerge from their burrow and move to areas which have high olfactory indication of their prey being there. They are ambush predators and so lie in the dark waiting, hidden under leaves or in dense foliage until prospective prey comes within strike range. Hunting sites are usually at the base of *Welfia* palms because their seeds are eaten by their prey, rodents. Bushmasters are very cryptic, move infrequently and very slowly (Greene, Santana 1983). They use their infra-red receptors almost only for striking and rely greatly on vision in combat and courting.

Almost all reptiles, especially snakes, are seen basking in the sun after a meal to increase their core body temperature thus increasing their metabolic rate and speeding up digestion. Bushmasters do not like the sun at all and are never seen basking in the sun, hence they only feed on small mammals to make up for their slow digestion as small mammals are digested easily.

HUNTING BEHAVIOUR. Bushmasters hunt at night and are ambush predators. Like all pit vipers, bushmasters have one heat-sensing pit, on each side of their head midway between the nostril and eye. This is characteristic of all pit vipers which helps them locate warm-blooded prey at night since they rely on heat sensing and not light. It allows the bushmaster to differentiate between the cooler rocks and plants in the environment and a small mammal. If an endothermic (warm-blooded) animal is closer than 50 cm in any direction from the bushmaster, it can detect its heat signature and aim its strike precisely without any other sensory information. When they encounter a possible meal but it is not moving e.g a rodent paralyzed by fear, they may rapidly "bob" their heads attempting to thermally "see" the prey. This gives credibility to the theory that infra-red pits in Crotalines are more of an imaging device instead of a simple thermoreceptor: the potential prey (or the bushmaster) must "move" or it will not be able to be accurately distinguished (Ripa, 2001). The small rice rat, *Oryzomys* sp., is the bushmaster's favourite in the wild. They only eat warm-blooded prey; chemical cues are a significant part of hunting site location and determining the presence of prey but thermal indication is necessary to provoke a strike. Bushmasters are very particular when feeding and usually will not attempt to

strike-hold any animal over 220 g (Turner et al, 2008). They usually strike-hold the shoulder of living prey, commonly small mammals and sometimes birds up to 120 g. The “true strike-hold” is shown in Figures 3 and 4: always into the shoulder, venom injected directly into the lungs and heart resulting in immediate death. Ripa (1999) reported that bushmasters only require heat and not chemical cues to induce strike-holds. They usually strike-release then perform chemosensory searching and trail-following if the prey weighs over 120 g (Boyer et al, 1995). Even if the prey gets away because of its size, the venom will usually kill it within minutes. This is however, according to Turner et al, (2008), “a difficult and often unproductive venture in flooded rainforests.”

Kilogram per kilogram, the world’s largest viper has the smallest prey swallowing capability of almost any snake. It is a frequent and highly active feeder on small prey (Ripa, 2001). *Lachesis muta* has a fairly quick strike but its strength lies in its venom which causes internal bleeding. Its venom, though relatively weak to closely related species, is produced in such large quantities (up to 400 mg) that the prey is dead within minutes. This is one of the largest volumes of venom produced by any species of snake. It also has very long fangs which sink deep into the body of its prey thus causing internal bleeding of the vital organs leading to a very quick death. The bushmaster’s hunting strategy as related by Greene and Santana (1983) is to find a good hideout and ambush prey, rarely feed on large animals and reduce detection by enemies.

SEXUAL BEHAVIOUR. Bushmaster females are oviparous (egg-laying) and are the only oviparous pit vipers in the Western Hemisphere. They are solitary snakes and only come into contact with other bushmasters when it is time to mate. Males locate receptive females by following the scent trails of females. When one finds a female, he flicks his tongue and rubs his head along the sides of her body to indicate his intentions. Once she is receptive, he turns upside down on top of her and rubs the ridge of his spine in a sawing motion against her to stimulate her. If she is coiled, he will hit her with his body to provoke her to loosen her coils, allowing him access. When she uncoils, they intertwine their bodies and copulate in that position (as seen in Figure 5), sometimes remaining coiled together for more than five hours.

When the female is ready to lay eggs, she will look for a den constructed by another animal and claim it as her own or will sometimes share the burrow with the animal that constructed it. She lays eight to twelve white eggs, a little larger than a chicken egg. After laying, she wraps her body around them and protects them until approximately 78 days later when they hatch. She does not leave her eggs for any reason during this period.

Drops in temperature and rising humidity levels are conditions that have been shown to signal hormonal responses in females. If they mate in these months, she will lay her eggs in the dry season when flooding is less frequent (Boyer et al, 1989). In the Atlantic rainforest, cold fronts occur July-December where a rise in humidity levels and sudden temperature drops trigger sexual behaviour of males such as unusually high rates of tongue-flicking (Turner et al, 2008). According to Souza (2007), in the wild, ‘breeding seasons’ are not an observed phenomenon; all cold fronts are potential breeding periods for bushmasters.

Sometimes more than one male is receptive to the scent trails of the same female and they may come into contact with each other and fight until one retreats or is killed. This is a rare occurrence in nature and has been observed more frequently in captivity where two males enter combat to mate with the female.

JUVENILE BEHAVIOUR. After hatching, bushmasters are approximately 50 cm long and pale coloured with yellow or bright orange tail tips which are gradually lost over time. This brightly coloured tail-tip may be to attract small insectivorous mammals to feed on. Young bushmasters develop their adult colouration when they are 1-2 years old. Sexual maturity is reached at about four years old. Observations on the feeding behaviour of bushmasters at different ages showed a characteristic swift strike, holding the prey until it stops moving then swallowing it afterward (Guitierrez et al. 1990).

ANTIPREDATOR BEHAVIOUR. Due to the large size of bushmaster adults, they have virtually no natural predators but have been seen in captivity to rise up to four feet before attempting to strike at handlers. There are however, many predators of *L. muta* eggs, so the mother stays with her eggs from the time they are laid until the approximate 78 days after when they hatch. She stays coiled around them, never leaving them even to feed. Once they do hatch, they are on their own as bushmasters show no form of neonatal care however it was noted by Switak (1969) that *Lachesis muta* neonates and early juveniles exhibit “aggressive behaviour and/or tail vibrations” to any large animals that come too close.

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Fig. 2. Bushmaster hatchling showing lighter scale pigmentation.
[http://www.kostich.com/bushmaster_egg001.jpg, downloaded 30 September 2011]



Fig. 3. True strike-hold: Fangs in the heart and lungs and the prey is lifted above the ground.
[Turner et al, 2008]

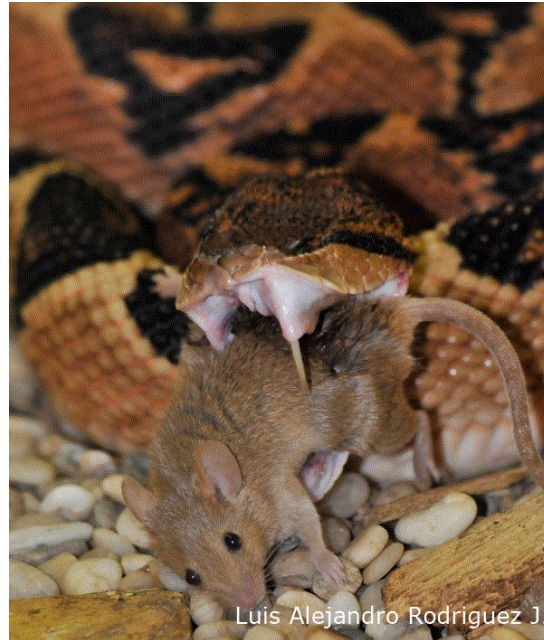


Fig. 4. *Lachesis muta* feeding showing fangs extended into abdomen of prey.
[<http://gallery.photo.net/photo/8975954-1g.jpg>, downloaded 19 September 2011]

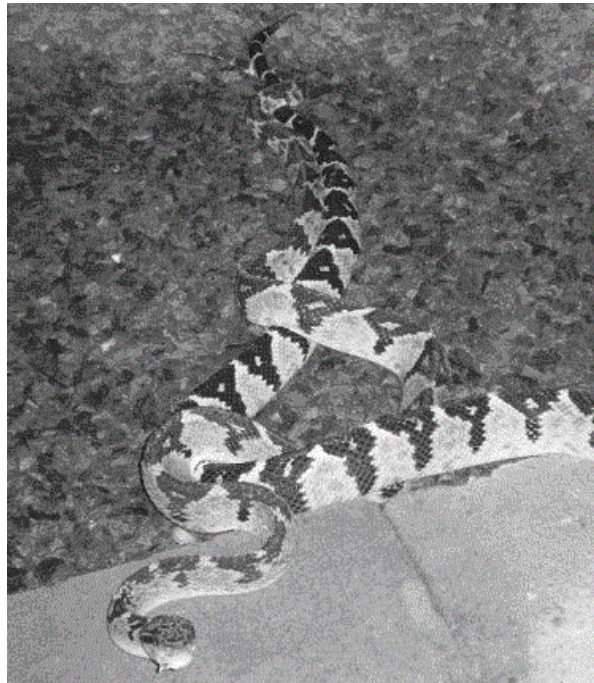


Fig . 5. First known image of an actual mating of Atlantic Bushmasters taken in the semi-extensive indoor system at Sierra Grande in 2007. [Turner et al, 2008]

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