
Why Do Snakes Sleep On The Vegetation In Central Amazonia?

Snakes are prey for diverse predators, from invertebrates to mammals (see review in Greene 1988). However, many studies of vertebrate predation fail to consider carnivorous invertebrates (McCormick and Polis 1982). For instance, snakes may be preyed upon by scorpions, spiders, giant waterbugs, ants, and centipedes although literature references are rare (Greene 1988; McCormick and Polis 1982). In an extensive review of snake predators, Greene (1988) provided references for nearly 160 snake species, yet only 12 were by invertebrates.

Many diurnal snakes, even exclusively terrestrial species, are found at night sleeping on leaves and branches of low vegetation in Amazonian forests (Dixon and Soini 1986; Duellman 1978; pers. observ.). By sleeping above the ground, these snakes are less vulnerable to terrestrial predators. During a study on forest snakes in Central Amazonia, I found evidence that predation by ants may be a risk factor in sleeping on the ground for some snakes, here illustrated by the vine snake, *Oxybelis argenteus*, an arboreal colubrid.

Observations were made from July 1991 to October 1992 in a primary forest reserve (Reserva Florestal Adolpho Ducke, Instituto Nacional de Pesquisas da Amazonia) 25 km north of Manaus, Amazonas, Brasil. About 90 man-hrs of exclusive snake searching were conducted each month, during different times of the day. Visual searches were conducted by walking slowly along forest trails; the search effort extended to all visually-accessible microhabitats. Additional snake sightings were made during other activities. Each captured snake was measured (snout-vent length and tail length), weighed, marked by ventral scale clipping, and released at the site of capture.

A total of 356 individual snakes of 41 species were found (45 by day, 311 at night). Three species of diurnal, terrestrial snakes were found coiled asleep on the vegetation at night: four *Drymoluber dichrous* (0.7-1.6 m above ground), nine *Liophis reginae* (0.3-2.3 m), and three *Liophis typhlus* (0.3-0.7 m). Several arboreal or semiarboreal, diurnal and nocturnal snakes were also found coiled asleep or resting on the vegetation at night (e.g., diurnal species: *Chironius* spp., *Oxybelis* spp., and *Pseustes* spp.; nocturnal species: *Dipsas catesbyi*, *Leptodeira annulata*, and *Tripanurgos compressus*). No snake was found sleeping on the ground during this study.

Evidence of the risk of sleeping on the ground was observed in *Oxybelis argenteus*. Eighty-seven sightings were made. During the day, snakes (N = 10) were found active on low vegetation, searching for small frogs on the forest floor. At night (N = 77) they were found coiled asleep on thin branches of shrubs and small trees and on horizontal palm leaves, 8-400 cm (\bar{x} = 138.3, SD = 69.5) from the ground. All snakes found at night were at least 30 cm above ground, except one found 8 December 1991, that was only 8 cm above ground. This snake had approximately 200 mm of its tail resting on the leaf litter of the forest floor. This part of the tail showed several small bites clearly made by ants, probably a species of *Camponotus*. The proximal portion of the bitten tail had deep bites that went through the vertebrae. The snake had no apparent prey in the gut and behaved normally when manipulated, except that it could not move the bitten portion of the tail. On 14 January 1992 I again observed this marked individual on a shrub, 120 cm from the ground and 23 m from the site of the first observation. By then it had lost the bitten part of the tail and three vertebrae were exposed at the tail tip, with no evidence of regeneration. This individual was not seen again. (At a site 250 km north of Manaus, I observed bites similar to those described above made by *Camponotus* ants on the tail and body of several snakes that fell on pitfall traps raided by these ants).

At the study site, other terrestrial, diurnal animals were found on low vegetation at night (e.g., insects, spiders, frogs, and lizards). Strong predation pressure may have forced snakes and other animals to avoid sleeping on the ground. Although many terrestrial vertebrates that prey on snakes occur in Neotropical forests (e.g., Cunha and Nascimento 1978; Dixon and Soini 1986; Duellman 1978; Janzen 1983), invertebrate predators, including carnivorous ants and tarantulas, also may have contributed to this pressure (see McCormick and Polis 1982). Tarantulas (Theraphosidae) are able to eat small to medium-sized snakes in captivity (pers. obs.); these spiders and carnivorous ants both are very common throughout Amazonia. As proposed by McCormick and Polis (1982), group foraging by ants and the large size of tarantulas may facilitate predation on relatively large vertebrates.

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