SHORT COMMUNICATION

Tick Paralysis of a Snake Caused by *Amblyomma rotundatum* (Acari: Ixodidae)

BRITTA A. HANSON,[1] PHILIP A. FRANK,[2,3] JAMES W. MERTINS,[4,5] AND JOSEPH L. CORN[1]

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ABSTRACT A lethargic southern black racer, *Coluber constrictor priapus* Dunn and Wood, wild-caught in the Florida Keys, Monroe County, FL, was found to be paralyzed by the bite of a female ixodid tick, *Amblyomma rotundatum* Koch (Acari: Ixodidae). Removal of the tick restored the snake to normalcy within 18 h. Other, earlier reported cases of tick toxicosis in reptiles are reviewed and clarified. Evidently, the present incident is the only reported case of tick paralysis in a poikilotherm found in a natural setting.

KEY WORDS *Amblyomma rotundatum*, tick paralysis, *Coluber constrictor*

Tick paralysis is caused by a salivary neurotoxin secreted by one or more ticks during prolonged feeding on a host, and it can cause motor impairment and even death of the host (Masina and Broady 1999, Mans et al. 2004). Signs of paralysis usually improve within hours of tick removal and may completely reverse, depending on the duration of attachment and individual host response (Gothe 1984). Published reports of tick paralysis seem to be limited mostly to mammals and birds (Mans et al. 2004). Here, we report one of the few documented cases of tick paralysis in a poikilotherm.

On 20 April 2004, an adult southern black racer, *Coluber constrictor priapus* Dunn and Wood, was hand-caught by one of us (P.A.F.) on National Key Deer Refuge property on Cudjoe Key, Monroe County, FL (24° 40′ N, 81° 29′ W). The snake was extremely lethargic and made no attempt to escape or strike during handling. An engorged tick, later identified by J.W.M. as an adult female ixodid tick, *Amblyomma rotundatum* Koch (Acari: Ixodidae) (voucher retained in the parasitology reference collection of the National Veterinary Services Laboratories as accession no. 311885), was immediately removed from the mid-lateral surface of the snake. The snake was placed in a glass enclosure overnight for observation. Approximately 18 h later, the snake displayed normal levels of activity and struck at the handler several times before its release at the original site of capture.

Conventionally, tick species are incriminated as causing host paralysis by any of three measures (Mans et al. 2004): experimental demonstration, numerous clinical reports from various sources implicating the same tick species, or host recovery from clinical signs after location and removal of the tick. In hard ticks (Ixodidae), host paralysis frequently results from feeding actions of a single tick, and, at least experimentally, from rapidly engorging female ticks only (Mans et al. 2004).

The presenting signs and rapid recovery of our snake after removal of the tick strongly suggest tick paralysis as the cause of the loss of mobility. Although other factors, such as weather or injury, might have influenced the snake's behavior, evidence does not support these possibilities. The air temperature in nearby Key West, FL, was consistently 20.0°C overnight, with a daytime high of 25.6°C during 18–20 April. Although some cloud cover was present on 20 April, no precipitation was recorded, and it is unlikely that decreased sunlight contributed to the snake's lethargy, considering the animal's increased activity level in the glass enclosure, where it had no opportunity to bask. The snake looked to be in excellent physical condition upon release, but some unseen injury cannot be ruled out as a cause of the temporary paralysis.

Published reports of tick toxicosis and paralysis in reptiles are few and not entirely convincing. Aragão (1912) studied *A. rotundatum* (given as *A. agamum* Aragão) in the laboratory and reported the deaths of toads (*Bufo* sp.) and snakes (*Boa constrictor* L.) infested with 10 and 100 ticks, respectively. Aragão attributed the deaths to a toxic substance because insignificant blood volume was lost to the ticks, and no parasites were found in the blood of the affected animals. Unfortunately, neither clinical signs nor physiological recoveries of the toads or snakes after tick removal were reported, and a diagnosis of tick paral-

[1] Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, The University of Georgia, Athens, GA 30602.

[2] U.S. Fish and Wildlife Service, National Key Deer Refuge, Big Pine Key, FL 33043.

[3] Current address: 22978 Overseas Hwy., Cudjoe Key, FL 33042.

[4] U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, National Veterinary Services Laboratories, 1800 Dayton Ave., Ames, IA 50010.

[5] Corresponding author, e-mail: james.w.mertins@aphis.usda.gov.

ysis cannot be unequivocally inferred. Again in the laboratory, Dunn (1918) studied the bionomics of the related ixodid tick *Amblyomma dissimile* Koch feeding on three species of Panamanian snakes, *B. constrictor*, *Epicrates cenchria* (L.), and *Oxybelis fulgidus* (Daudin). Several unspecified host animals died during the study, when large numbers of ticks attached to them in tight clusters. Other signs associated with host disease were not described, except for allusions to skin roughness, ulceration, abrasions, and dried scabs.

In a third laboratory investigation, Lehmann et al. (1969) studied the life cycle and host effects of ticks they called *A. testudinis* (Conil) on snakes, lizards, toads, finches, and mice. Subsequent references to this work in the literature of tick paralysis (Gothe 1984, 1999; Gothe and Neitz 1991; Mans et al. 2004) have quoted and accepted with little or no question the identity of the ticks as *A. testudinis.* The taxonomic and bionomic literature on ticks is justifiably more skeptical. As Lehmann et al. (1969) used it, Guglielmone et al. (2001, 2003) show that the name *A. testudinis* is a junior synonym for *Amblyomma argentinae* Neumann, a tortoise tick that occurs naturally only in the dry Chaco Region of Argentina. The discussions in Guglielmone et al. (2001, 2003) further call into question whether the ticks studied by Lehmann et al. (1969) were, in fact, even *A. argentinae.* The studied ticks originated from snakes caught wild in Peruvian rain forest (Lehmann et al. 1969). Guglielmone et al. (2001, 2003) and Camicas et al. (1998) show that several Neotropical *Amblyomma* reptile ticks, particularly *A. dissimile*, have frequently been confused with *A. argentinae.* Based upon this and other circumstantial evidence, we think it is highly probable that Lehmann et al. (1969) actually studied *A. dissimile.*

Among other things, Lehmann et al. (1969) found that poikilotherms, particularly snakes, were the best hosts for all stages of *A. dissimile*, although larvae and nymphs could feed to some extent on birds and mammals. In both toads (*Bufo* spp.) and snakes (*Natrix* spp.), the feeding activities of mated female ticks resulted in localized skin irritations and inflammations, but only in toads did the reactions proceed to actual tissue necroses that interfered with tick feeding. More significantly, all tick life stages were capable of causing an ascending flaccid paralysis of the host musculatures in both snakes and small toads. This paralysis progressed anteriorly from the caudal regions and eventually caused death from presumed paralysis of the respiratory muscles. Lehmann et al. (1969) observed 19 such cases, with the times from tick attachment to host death ranging from 11 to 51 d. The times to death, as measured from the first observed signs of paralysis, ranged from 8 to 18 d. Tick infestations per involved host were 1 to 5 females, 3 males, 3–20 nymphs, or 50–150 larvae. Lehmann et al. (1969) speculated that such intense laboratory infestations of immature ticks might not obtain in nature, but the numbers of adult ticks per host might be likely on wild hosts. They also observed that attachment of feeding adult female ticks on the host head or near the spinal column resulted in shorter survival times than when ticks attached in ventral somatic regions.

Degenhardt and Degenhardt (1965) found that the host-specific North American tick *Amblyomma elaphense* (Price) preferentially attaches to the tail of its host Trans-Pecos rat snake, *Bogertophis subocularis* (Brown). Prolonged and concentrated feeding by numerous ticks frequently causes local necrosis and eventual sloughing of the host's tail, but the mechanism of the disease is unclear. Mans et al. (2004) also reported a possible case of tick paralysis caused by *Hyalomma aegyptium* (L.) in an unspecified tortoise.

More than 70 tick species have been associated with tick paralysis, including at least seven *Amblyomma* spp. (Gothe and Neitz 1991, Mans et al. 2004). We consider this report as the first verifiable report of tick paralysis associated with *A. rotundatum* in a natural setting. All of the other reported cases of *Amblyomma* tick toxicoses in poikilotherms occurred in laboratory studies, were poorly characterized, were not confirmed as paralysis by removal of the tick(s) followed by subsequent host recovery, or a combination. *A. rotundatum* is native to Central and South America and was probably introduced to Florida with the giant toad, *Bufo marinus* (L.) (Oliver et al. 1993). It is one of only a few tick species that reproduce by parthenogenesis (Aragão 1912), and of all tick species, it is the one most likely to feed on amphibians.

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