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Abbreviata terrapenis (Nematoda: Physalopteridae): An Accidental Parasite of the Banded Rock Rattlesnake (*Crotalus lepidus klauberi*)

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ABSTRACT: The nematode, *Abbreviata terrapenis* (Physalopteridae) was found in 16 (6%) of 267 banded rock rattlesnakes (*Crotalus lepidus klauberi*) from Arizona and New Mexico. *Abbreviata terrapenis* in *C. lepidus* represents an accidental parasite in that "infection" was acquired by the ingestion of lizard prey. Feeding captive snakes on wild-caught lizards poses a risk of introducing nematodes to the snakes.

Key words: *Abbreviata terrapenis,* accidental parasite, banded rock rattlesnake, *Crotalus lepidus klauberi,* nematode.

During a study of diet, nematodes fitting the description of *Abbreviata terrapenis* were collected from the digestive tract of the banded rock rattlesnake (*Crotalus lepidus klauberi*) from Arizona and New Mexico. *Abbreviata terrapenis,* originally described from the ornate box tortoise (*Terrapene ornata*), infects painted turtle (*Chrysemys picta*), snapping turtle (*Chelydra serpentina*), Blanding's turtle (*Emydoidea blandingii*), Sonoran spotted whiptail (*Cnemidophorus sonorae*), western whiptail (*Cnemidophorus tigris*), and mountain spiny lizard (*Sceloporus jarrovii*) (Hill, 1941; Morgan, 1945; Goldberg et al., 1995, 1996, 1997). Because *A. terrapenis* is a heteroxenous helminth with an indirect life cycle involving an insect intermediate host (Anderson, 2000), its occurrence in insectivores, but not carnivores, might be expected.

The rock rattlesnake (*Crotalus lepidus*), a mountain rock dweller found on rocky ridges, hillsides, streambeds, and gorges in arid and semiarid habitats from 300–2,930 m, occurs from southeastern Arizona, southern New Mexico, and west Texas to Jalisco, Mexico (Stebbins, 1985). Four subspecies are recognized: both banded rock rattlesnake (*C. lepidus klauberi*) and mottled rock rattlesnake (*C. lepidus lepidus*) are found in the United States and Mexico; Durangan rock rattlesnake (*C. lepidus maculosus*) and Tamaulipan rock rattlesnake (*C. lepidus morulus*) are restricted to Mexico (Liner, 1994; Crother et al., 2000). Analysis of a large sample suggests that banded rock rattlesnake diet consists primarily of lizards and centipedes but small rodents, birds, and snakes are also consumed (Holycross, unpubl. data). Although McCrystal et al. (1996) reported captive neonatal snakes to eat crickets and Conant (1955) reported a grasshopper and caterpillars along with a lizard in the stomach of a wild-caught mottled rock rattlesnake, insects are not typical rattlesnake prey. Thus the occurrence of *A. terrapenis* was unexpected. The purpose of this paper is to record and discuss the presence of *A. terrapenis* in banded rock rattlesnakes from Arizona and New Mexico.

Two hundred sixty-seven banded rock rattlesnakes were borrowed from museums; 16 (6%) were found to harbor *A. terrapenis.* The body size (mean snout-vent length) of infected snakes was 474 ± 84 mm SD (range = 318–667 mm). These snakes were from the following museum collections: California Academy of Sciences (CAS 01814, 48022, 48024–48026, 48029, 48030, 48032, 84131); Museum of Southwestern Biology (MSB 4115, 32319, 49551); San Diego Society of Natural History (SDSNH 2160, 3123); University of Kansas (KU 6648); and University of Michigan (UMMZ 54019). Of the infected snakes, 14 were from Cochise County, Arizona and two were from Hidalgo County, New Mexico. The other snakes were from Arizona, New Mexico, and Chihuahua and Sonora, Mexico. The body cavity was opened by an incision along the ven-

TABLE 1. Number and location of *Abbreviata terrapenis* and prey found in banded rock rattlesnakes.

Snake identification	*Abbreviata terrapenis*	Helminth site	Prey	Prey site
CAS 01814	3 female	stomach	*Sceloporus jarrovii*	stomach
CAS 48022	1 female	stomach	*Sceloporus* sp.	intestine
CAS 48024	4 (2 male, 2 female)	stomach and intestine	none	—
CAS 48025	1 male	stomach	*Sceloporus jarrovii*	intestine
CAS 48026	6 (3 male, 3 female)	stomach	*Sceloporus jarrovii*	intestine
CAS 48029	2 female	stomach	none	—
CAS 48030	4 female	stomach	*Sceloporus jarrovii*	stomach
CAS 48032	10 (3 male, 7 female)	stomach	none	—
CAS 48131	1 male	stomach	*Sceloporus jarrovii*	stomach
KU 6648	1 male	colon	*Sceloporus* sp.	intestine
MSB 4115	39 (15 male, 24 female)	stomach	*Sceloporus* sp.	intestine
MSB 32319	4 3rd stage encapuslated	peritoneum	none	—
MSB 49551	24 (10 male, 14 female)	stomach	none	—
SDSNH 2160	4 4th stage larvae	stomach	none	—
SDSNH 3123	4 female	stomach	none	—
UMMZ 54019	2 (1 male, 1 female)	stomach	*Sceloporus jarrovii*	stomach
7F7B10752C	2 female	feces	*Cnemidophorus* sp.	feces
7F7B177600	1 female	feces	*Cnemidophorus* sp.	feces
7F7B180432	1 female	feces	*Sceloporus jarrovii*	feces

tral surface and the contents of the stomach and distal 3 cm of the intestine were examined. All prey remains and parasites were removed. In addition, three fecal samples palpated from live banded rock rattlesnakes (catch and release, Peloncillo Mountains [31°31′N, 109°03′W] Hidalgo County, New Mexico, A.T.H. field numbers 7F7B10752C, 7F7B177600, 7F7B180432) contained *A. terrapenis* (Table 1). Prey and parasites were initially identified using a dissecting microscope. Nematodes were cleared in a drop of glycerol and identified using a compound microscope.

There was evidence of lizard consumption in 12 (5%) banded rock rattlesnakes (*Cnemidophorus* in two snakes; *Sceloporus* in 10 snakes) (Table 1). With some variation, the morphology of mature specimens from banded rock rattlesnakes agreed with the description of *A. terrapenis* as presented by Hill (1941). The nematodes possessed symmetrical lips, each supporting a single median external tooth, a single median internal tooth, and two doubled teeth located toward the angles of the mouth. Total length of females ranged from 27–38 mm. The vulva was situated 6–8 mm from the anterior end. The vagina was long, slender, and ran anteriad for a short distance, then posteriad to an enlargement which narrowed before dividing dichotomously into four uteri. Males were shorter and ranged from 20–26 mm in length. Spicules were very unequal in size and shape with the left spicule about eight times the length of the right. There were four pairs of para-anal pedunculated papillae, a median sessile papilla, one pair of preanal papillae, and five pairs of post anal sessile papillae. Selected nematodes were deposited in the United States National Parasite Collection, (USNPC), Beltsville, Maryland as USNPC 91254.

Babero and Emmerson (1974) reported *Thubunaea cnemidophorus,* normally a parasite of teiid lizards (Goldberg et al., 1997), from three rattlesnake species collected in Nevada: sidewinder (*Crotalus cerastes*), speckled rattlesnake (*C. mitchellii*), and Mojave rattlesnake (*C. scutulatus*). Sidewinders, speckled rattlesnakes, and young Mojave rattlesnakes also feed on lizards (Lowe et al., 1986). *Abbreviata terrapenis* has been previously found in both lizard genera, *Cnemidophorus* and *Scelo-*

porus (Goldberg et al., 1995, 1996, 1997) on which banded rock rattlesnakes feed. Thus, the presence of *A. terrapenis* in banded rock rattlesnakes would appear to be the fourth example of accidental parasitism in North American rattlesnakes. Babero and Emmerson (1974) reported the sidewinder, the speckled rattlesnake, and the Mojave rattlesnake as new host records, a status we believe must be slightly modified.

We have chosen the term "accidental" for this occurrence because of the textbook definitions of parasitism, the term most accurately describes our observations (see Roberts and Janovy, 2000): *A. terrapenis* has entered a host different from its normal, definitive host. We base this supposition on the fact that in snake MSB 32319, four third stage larvae were found encapsulated in the peritoneum. Jones (1995) has reported encapsulated larvae of species of *Abbreviata* in gastric tissues of small snakes and lizards preyed upon by large Australian lizards which in turn serve as definitive hosts of *Abbreviata.* Because third stage larvae of *Abbreviata* had become encapsulated in a rattlesnake, we believe the snake would not be a definitive host, but rather, a potential paratenic host. Fourth stage and mature nematodes were found in the lumen of the digestive tract in a posture similar to that seen in lizard stomachs. How long gravid female nematodes might survive and whether growth and maturity of immature nematodes would occur remains an open question. Because mature nematodes enter with lizard prey, we consider rattlesnakes to be accidental hosts. We would apply the same terminology to the nematodes in the report of Babero and Emmerson (1974).

These observations suggest that feeding captive snakes wild-caught lizards presents an opportunity for transmission of nematodes to the snakes. In addition, when reporting the presence of nematodes in snakes, one must consider the possibility that the nematode entered in a prey item.

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