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HELMINTHS OF THE SPECKLED RATTLESNAKE, *CROTALUS MITCHELLII* (SQUAMATA: VIPERIDAE)

Stephen R. Goldberg¹, Charles R. Bursey^{2,4}, and Xavier Glaudas^{3,4}

ABSTRACT.—Fifty-six speckled rattlesnakes, *Crotalus mitchellii*, from western North America were examined for helminths. One species of Cestoda (tetrathyridia of *Mesocestoides* sp.) and 5 species of Nematoda (gravid adults of *Abbreviata terrapenis*, *Physaloptera abjecta*, *Thubunaea cnemidophorus*, and *Travassoascaris araujo* and larvae of *Physocephalus* sp.) were found. *Travassoascaris araujo* had the highest prevalence and greatest mean intensity of helminths infecting *C. mitchellii*. Three new host records for *C. mitchellii* are reported. As has been reported for other North American rattlesnakes, *C. mitchellii* is parasitized by “generalist” helminths.

RESUMEN.—Cincuenta y seis Viboras de Cascabel (Cascabeles Pintitas, *Crotalus mitchellii*) del oeste de América del Norte fueron examinadas para determinar la presencia de helmintos. Se encontró una especie de Cestoda (larvas de *Mesocestoides* sp.) y cinco especies de Nematoda (adultos grávidos de *Abbreviata terrapenis*, *Physaloptera abjecta*, *Thubunaea cnemidophorus* y *Travassoascaris araujo* y larvas de *Physocephalus* sp.). *Travassoascaris araujo* tuvo la prevalencia más alta y la intensidad promedio mayor de helmintos que infectan a *C. mitchellii*. Se documentan tres nuevos records de *C. mitchellii*. Como ha sido reportado para otras Viboras de Cascabel de América del Norte, *C. mitchellii* es infectada por parásitos helmintos “generalistas.”

The speckled rattlesnake, *Crotalus mitchellii* (Cope, 1861), ranges from southwestern Utah, southern Nevada, western Arizona, and southern California into northwest Sonora and northeast Baja California and prefers rocky terrain from sea level to 2440 m elevation (Stebbins 2003). The biology of *C. mitchellii* is reviewed by McCrystal and McCoid (1986) and Ernst and Ernst (2012). To our knowledge, there are 2 previous reports of helminths in *C. mitchellii*: the nematode *Thubunaea cnemidophorus*, reported by Babero and Emerson (1974), and *Mesocestoides* sp. (tetrathyridia) and unidentified oligacanthorhynchid acanthocephalan cystacanths, reported by Goldberg and Bursey (2000). The purpose of this note is to add to the helminthlist of *C. mitchellii*.

Fifty-six specimens of *C. mitchellii* (mean snout–vent length = 664.4 mm, SD = 161.9, range 244–952 mm) collected from Arizona, California, Nevada, Baja California, and Baja California Sur during the years 1930 to 2000 were borrowed from various museums (Appendix) and examined for helminths. The body cavity of each specimen was opened by a midventral incision, and the digestive tract

contents were examined under a dissecting microscope. Nematodes were cleared in a drop of lactophenol on a microscope slide, coverslipped, and studied under a compound microscope. Cestodes were dehydrated in an ascending series of ethanols, regressively stained in hematoxylin, cleared in xylene, mounted in balsam, and studied using a dissecting microscope. Parasite terminology is in accordance with Bush et al. (1997).

Found were one species of Cestoda (tetrathyridia of *Mesocestoides* sp.) and 5 species of Nematoda (*Abbreviata terrapenis* [Hill, 1941]; *Physaloptera abjecta* Leidy, 1856; *Thubunaea cnemidophorus* Babero and Matthias, 1967; and *Travassoascaris araujo* Sprent, 1978; and larvae of *Physocephalus* sp.) Voucher helminths were deposited in the United States National Parasite Collection, Beltsville, Maryland, USA (Table 1).

Tetrathyridia are large, solid-bodied cysticercoids known only from the cyclophylidean genus *Mesocestoides* and are typically encountered embedded in the livers or coelomic mesenteries of their paratenic hosts. The genus has worldwide distribution and is known from a great variety of amphibians and

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TABLE 1. Number of helminths, mean intensity, prevalence (%), and USNPC voucher numbers for helminths recovered from 56 *Crotalus mitchellii*.

Helminth	<i>n</i>	Prevalence	Mean intensity (SD)	Range	USNPC #
Cestoda					
<i>Mesocestoides</i> sp.	3	1.7%	1		88616
Nematoda					
<i>Abbreviata terrapenis</i>	1	1.7%	1		101076
<i>Physaloptera abjecta</i> ^a	2	3.5%	2		101075
<i>Thubunaea cnemidophorus</i>	1	1.7%	1		101077
<i>Travassoascaris araujo</i> ^a	70	25.0%	5.0 (3.8)	1–12	101078–101080
<i>Physocephalus</i> sp. ^a	6	1.7%	6		101081

^aNew host record

reptiles; hosts are listed in Burse et al. (2012). The life cycle of species of *Mesocestoides* is believed to require 3 hosts: a vertebrate definitive host, a vertebrate second intermediate host, and an arthropod first intermediate host (Rausch 1994).

Abbreviata terrapenis was described from the tortoise *Terrapene ornata* collected in Oklahoma by Hill (1941) and has also been found both in lizards (Goldberg et al. 1995, 1996, 1997) and rattlesnakes, including *C. mitchellii* (Babero and Emmerson 1974) and *C. lepidus* (Goldberg et al. 2002), although it is likely that rattlesnakes acquire *A. terrapenis* by feeding on infected lizards.

Physaloptera abjecta is a common nematode in North American snakes: *Arizona elegans*, *Coluber constrictor*, *Heterodon platirhinos*, *Lampropeltis getula*, *Masticophis flagellum*, *Ophiodrys vernalis*, *Pituophis melanoleucus*, *Thamnophis sirtalis* (Ernst and Ernst 2006). *Crotalus mitchellii* represents a new host record for *Physaloptera abjecta*. Members of the Physalopteridae utilize insects as intermediate hosts (Anderson 2000).

Travassoascaris araujo is a common nematode in *Crotalus durissus terrificus* in Brazil and Central America (Baker 1987). Larvae of *T. araujo* encyst in the liver of mice where they are infective to snakes (Araujo 1971, 1972). Of the helminths infecting *C. mitchellii* (Table 1), *Travassoascaris araujo* had the highest prevalence and greatest mean intensity of infection. *Crotalus mitchellii* represents a new host record and the second host to harbor *T. araujo*. North America is a new locality record.

Thubunaea cnemidophorus was described from the teiid lizard *Aspidoscelis tigris* from Nevada by Babero and Matthias (1967). It also has been reported in Nevada rattlesnakes

Crotalus cerastes, *C. mitchellii*, and *C. scutulatus* by Babero and Emmerson (1974). It is likely that rattlesnakes became infected by ingesting lizards containing *T. cnemidophorus* (their normal hosts).

Physocephalus sexalatus is mainly a nematode of wild and domestic pigs (Anderson 2000). Infective larvae have been found in many species of dung beetles, and encapsulated larvae of *Physocephalus* sp. commonly occur in tissues of amphibians, reptiles, birds, and mammals (Anderson 2000). *Crotalus mitchellii* likely becomes infected by ingesting lizards infected by *Physocephalus* sp. *Crotalus mitchellii* represents a new host record for larvae of *Physocephalus* sp.

Rather than having a unique group of helminths, *C. mitchellii* is infected with generalist helminths that are often found in other rattlesnakes (see summary of parasites in rattlesnakes by Ernst and Ernst 2006).

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APPENDIX. Specimens of *Crotalus mitchellii* examined for helminths, listed by museum. California Academy of Sciences (CAS), Monte L. Bean Life Science Museum (BYU), San Diego Natural History Museum (SDSNH), Natural History Museum of Los Angeles County (LACM), Museum of Vertebrate Zoology (MVZ, Berkeley, CA), University of Arizona (UAZ).

Museum	Specimen numbers
BYU	18774, 34960
CAS	52547, 85698, 90182
LACM	2998, 23236, 28018, 63974, 104874, 104887, 104890, 104893, 104908, 104911, 104912, 104917, 104920, 104929, 104930, 104938, 104951, 104958, 104962, 134443
MVZ	970, 7457, 26004, 26663, 28572, 38416, 52012, 52014, 71694, 72419, 128329, 176153, 176154, 176155, 176156, 193438, 193446, 200857, 228673, 228681, 228685, 228749
SDMNH	2606, 28647, 35146, 46834, 59424, 62291, 63918
UAZ	35996, 54634