Helminths of the speckled rattlesnake, *Crotalus mitchellii* (Squamata: Viperidae)

Stephen R. Goldberg  
*Whittier College, Whittier, CA, sgoldberg@whittier.edu*

Charles R. Bursey  
*Pennsylvania State University, Sharon, PA, cxb13@psu.edu*

Xavier Glaudas  
*University of Nevada, Las Vegas, NV, xavier.glaudas@wits.ac.za*

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HELMINTHS OF THE SPECKLED RATTLE SNAKE, CROTALUS MITCHELLII (SQUAMATA: VIPERIDAE)

Stephen R. Goldberg¹, Charles R. Bursey², and Xavier Glaudas³,⁴

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 were found. Travassoastracris araujoi 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 America 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. Travassoastracris araujoi 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 rattle snake, Crotalus mitchelli (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. mitchelli is reviewed by McCrystal and McCoid (1986) and Ernst and Ernst (2012). To our knowledge, there are 2 previous reports of helminths in C. mitchelli: 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 helminth list of C. mitchelli.

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, cover-slipped, 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 (gravid adults of Abbreviata terrapenis, Physaloptera abjecta, Thubunaea cnemidophorus, and Travassoastracris araujoi and larvae of Physocephalus sp.). Travassoastracris araujoi 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.

¹Whittier College, Department of Biology, Box 634, Whittier, CA 90608. E-mail: sgoldberg@whittier.edu
²Pennsylvania State University, Shenango Campus, Department of Biology, Sharon, PA 16146.
³University of Nevada, Las Vegas, School of Life Sciences, 4505 Maryland Parkway, Las Vegas, NV 89154.
⁴Present address: University of the Witwatersrand, School of Animal, Plant, and Environmental Sciences, Johannesburg, P.O. Wits, 2050, South Africa.
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, Ophedrys vernalis, Pitvorthus 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).

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

Thubunacae 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).

We thank Jack Sites (BYU), Robert Drewes and Jens Vindum (CAS), David Kizirian and Jeff Seigel (LACM), Jim McGuire and David Wake (MVZ), George Bradley (UAZ), and Bradford Hollingsworth (SDMNH) for permission to examine specimens of C. mitchellii.

<table>
<thead>
<tr>
<th>Helminth</th>
<th>n</th>
<th>Prevalence</th>
<th>Mean intensity (SD)</th>
<th>Range</th>
<th>USNPC #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cestoda Mesocestoides sp.</td>
<td>3</td>
<td>1.7%</td>
<td>1</td>
<td></td>
<td>88616</td>
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<tr>
<td>Nematoda Abbreviata terrapenis</td>
<td>1</td>
<td>1.7%</td>
<td>1</td>
<td></td>
<td>101076</td>
</tr>
<tr>
<td>Physaloptera abjecta</td>
<td>2</td>
<td>3.5%</td>
<td>2</td>
<td></td>
<td>101075</td>
</tr>
<tr>
<td>Thubunacae cnemidophorus</td>
<td>1</td>
<td>1.7%</td>
<td>1</td>
<td></td>
<td>101077</td>
</tr>
<tr>
<td>Travassoscaris araujoi</td>
<td>70</td>
<td>25.0%</td>
<td>5.0 (3.8)</td>
<td>1–12</td>
<td>101078–101080</td>
</tr>
<tr>
<td>Physocephalus sp.</td>
<td>6</td>
<td>1.7%</td>
<td>6</td>
<td></td>
<td>101081</td>
</tr>
</tbody>
</table>

*New host record

We thank Jack Sites (BYU), Robert Drewes and Jens Vindum (CAS), David Kizirian and Jeff Seigel (LACM), Jim McGuire and David Wake (MVZ), George Bradley (UAZ), and Bradford Hollingsworth (SDMNH) for permission to examine specimens of C. mitchellii.

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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 Ari-
zona (UAZ).

<table>
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<th>Specimen numbers</th>
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<td>MVZ</td>
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<td>SDMNH</td>
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<tr>
<td>UAZ</td>
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