

Gastrointestinal Helminths of Nine Species of *Sceloporus* Lizards (Phrynosomatidae) from Texas

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ABSTRACT: A total of 276 individuals of 9 species of sceloporine lizards from Texas were examined for gastrointestinal helminths. New host records include *Oochoristica* sp. in *Sceloporus merriami merriami* and *Sceloporus variabilis*; *Oochoristica scelopori* in *Sceloporus olivaceus*; *Atractis penneri* in *Sceloporus merriami merriami*, *Sceloporus olivaceus*, and *Sceloporus variabilis*; *Cosmocercoides variabilis* in *Sceloporus undulatus hyacinthinus*; *Physaloptera retusa* in *Sceloporus merriami merriami*, *Sceloporus olivaceus*, *Sceloporus serrifer*, and *Sceloporus variabilis*; *Physocephalus* sp. (larvae) in *Sceloporus magister bimaculosis*; *Spauligodon giganticus* in *Sceloporus merriami merriami* and *Sceloporus serrifer*; *Strongyluris similis* in *Sceloporus magister bimaculosis*, *Sceloporus merriami merriami*, *Sceloporus olivaceus*, *Sceloporus serrifer*, *Sceloporus undulatus hyacinthinus*, and *Sceloporus variabilis*; *Thubunaea iguanae* in *Sceloporus merriami longipunctatus*; and an acanthocephalan in *Sceloporus magister bimaculosis* and *Sceloporus merriami longipunctatus*. The highest prevalence in the study was recorded for *Spauligodon giganticus* in *Sceloporus poinsettii* (92%). The greatest mean intensity was recorded for *Atractis penneri* in *Sceloporus olivaceus* (206). Helminth species diversity varied from a high of 8 in *Sceloporus merriami* to 0 in *Sceloporus graciosus*.

KEY WORDS: Cestoda, *Mesocestoides* sp., *Oochoristica* sp., *Oochoristica scelopori*, Nematoda, *Atractis penneri*, *Cosmocercoides variabilis*, *Oswaldocruzia pipiens*, *Parathelandros texanus*, *Physaloptera retusa*, *Physocephalus* sp., *Skrjabinoptera phrynosoma*, *Spauligodon giganticus*, *Strongyluris similis*, *Thubunaea iguanae*, Acanthocephala, prevalence, intensity.

Nine species of lizards in the genus *Sceloporus* occur in Texas (Garrett and Barker, 1987). These include *Sceloporus graciosus arenicolous* Degenhardt and Jones, 1960; *Sceloporus grammicus microlepidoptus* Wiegmann, 1834; *Sceloporus magister bimaculosis* Phelan and Brattstrom, 1955; *Sceloporus merriami* Stejneger, 1904, represented by 3 subspecies, *S. m. annulatus* Smith, 1937, *S. m. longipunctatus* Olson, 1973, and *S. m. merriami* Stejneger, 1904; *Sceloporus olivaceus* Smith, 1934; *Sceloporus poinsettii* Baird and Girard, 1852; *Sceloporus serrifer* Cope, 1866; *Sceloporus undulatus* (Bosc and Daudin, 1801), represented by 3 subspecies, *S. u. consobrinus* Baird and Girard, 1853, *S. u. garmani* Boulenger, 1882, and *S. u. hyacinthinus* (Green, 1818); and *Sceloporus variabilis marmoratus* Hallowell, 1853. Geographic ranges are given in Garrett and Barker (1987).

There are only a few reports of helminths from sceloporine lizards in Texas: Harwood (1932) for *S. undulatus*; Specian and Ubelaker (1974a) for *S. merriami* and *S. undulatus*; McAllister (1988) for *S. olivaceus*; Goldberg et al. (1993) for *S. poinsettii*; and Goldberg et al. (1994a) for *S. serrifer*. In addition, there are reports of helminths

from populations of some of these lizards in other states and Mexico: *S. graciosus* in California (Stebbins and Robinson, 1946; Goldberg and Bursey, 1989a, b) and Utah (Woodbury, 1934; Pearce and Tanner, 1973); *S. magister* in Arizona (Walker and Matthias, 1973; Benes, 1985; Goldberg et al., 1994b); *S. undulatus* in Arizona (Goldberg et al., 1994b), New Mexico (Gambino and Heyneman, 1960), and Utah (Pearce and Tanner, 1973); and *S. grammicus* in Mexico (Prado Vera, 1971). There are apparently no published accounts of helminths from *S. variabilis*. The purpose of this report is to present data on helminths from 9 species of sceloporine lizards from Texas and to compare helminth infections among the various species of Texas lizards.

Materials and Methods

All specimens utilized in this study ($N = 276$) were borrowed from museums or collected and deposited in museums: *Sceloporus graciosus*, Department of Biology, Appalachian State University (APPSU), Texas Cooperative Wildlife Collection, Texas A&M University (TCWC), and the Museum, Texas Tech University (TTU); *S. grammicus*, Herpetology Collection, Texas A&I University (TAIC); *S. magister*, Herpetology Col-

Table 1. Helminths found in Texas lizards.

Host Helminth	Prevalence	\bar{x} intensity (range)	Site of infection	County	Reference
<i>Anolis carolinensis</i>					
<i>Oochoeristica anolis</i>	3% (1/30)	1	Small intestine	Harris	Harwood, 1932
<i>Pratocephalus</i> sp. (immature)	3% (1/30)	1	Small intestine	Harris	Harwood, 1932
<i>Cnemidophorus dixonii</i>					
<i>Mesocostoides</i> sp. (tetrathyridia)	5% (3/58)	Massive	Body cavity/viscera	Presidio	McAllister et al., 1991a
<i>Oochoeristica bivittellobata</i>	16% (9/58)	5 (1–13)	Small intestine	Presidio	McAllister et al., 1991b
<i>Oochoeristica</i> sp.	5% (3/58)	2 (1–5)	Small intestine	Presidio	McAllister et al., 1991b
<i>Parathelandros texanus</i>	5% (3/58)	1	Large intestine	Presidio	McAllister et al., 1991b
<i>Physaloptera</i> sp. (larvae)	19% (11/58)	3 (1–11)	Stomach	Presidio	McAllister et al., 1991b
<i>Acanthocephala</i> (juvenile)	21% (12/58)	2 (1–11)	Mesentery/muscle	Presidio	McAllister et al., 1991b
<i>Cnemidophorus exsanguis</i> *					
<i>Oochoeristica bivittellobata</i>	11% (4/37)	5 (1–9)	Small intestine	Brewster, Culberson, Hudspeth	McAllister, 1990c
<i>Pharyngodon warneri</i>	16% (6/37)	8 (1–15)	Large intestine	Culberson, El Paso, Hudspeth, Pecos, Presidio	McAllister, 1990c
<i>Physaloptera</i> sp. (larvae)	22% (8/37)	10 (1–45)	Stomach	Brewster, Jeff Davis, Presidio	McAllister, 1990c
<i>Cnemidophorus gularis</i> *					
<i>Oochoeristica bivittellobata</i>	1% (1/118)	4	Small intestine	Brewster	McAllister, 1990d
<i>Oochoeristica</i> sp.	6% (7/118)	4 (1–7)	Small intestine	Irion, Pecos, Taylor	McAllister, 1990d
<i>Parathelandros texanus</i>	1% (1/118)	1	Large intestine	Jeff Davis	McAllister, 1990d
<i>Pharyngodon kirbii</i>	2% (2/118)	6 (1–10)	Large intestine	Andrews, Brewster	McAllister, 1990d
<i>Pharyngodon warneri</i>	37% (44/118)	Massive	Large intestine	Not given	McAllister, 1990d
<i>Physaloptera</i> sp. (larvae)	19% (23/118)	3 (1–13)	Stomach	Hidalgo, Jeff Davis, Pecos	McAllister, 1990d
<i>Acanthocephala</i> (juvenile)	1% (1/118)	1	Body cavity/muscle	Starr, Tarrant	McAllister, 1990d
<i>Cnemidophorus inornatus heptagrammus</i>					
<i>Parathelandros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a
<i>Pharyngodon warneri</i>	Not given	Not given	Not given	Brewster	Specian and Ubelaker, 1974b
<i>Cnemidophorus tardoensis</i>					
<i>Pharyngodon warneri</i>	15% (5/34)	Massive	Large intestine	Webb	McAllister et al., 1986
<i>Physaloptera</i> sp. (larva)	3% (1/34)	1	Stomach	Webb	McAllister et al., 1986
<i>Cnemidophorus marmoratus</i>					
<i>Mesocostoides</i> sp. (tetrathyridia)	3% (1/35)	>200	Body cavity/liver	Presidio	McAllister et al., 1991a

Table 1. Continued.

Host Helminth	Prevalence	\bar{x} intensity (range)	Site of infection	County	Reference
<i>Chemidophorus neomexicanus</i> *					
<i>Oochoristica bivittellobata</i>	2% (1/44)	1	Small intestine	El Paso	McAllister, 1990b
<i>Pharyngodon warneri</i>	5% (2/44)	7 (3-10)	Large intestine	El Paso	McAllister, 1990b
<i>Physaloptera</i> sp. (larvae)	5% (2/44)	6 (1-10)	Stomach	El Paso	McAllister, 1990b
<i>Acanthocephala</i> (juvenile)	2% (1/44)	1	Muscle fascia	El Paso	McAllister, 1990b
<i>Chemidophorus septemvittatus</i> *					
<i>Mesocostoides</i> sp.	8% (7/83)	Massive	Coelom/viscera	Presidio	McAllister et al., 1995
<i>Oochoristica bivittellobata</i>	1% (1/83)	2	Small intestine	Presidio	McAllister et al., 1995
<i>Parathelandros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a
	5% (4/83)	2 (1-6)	Large intestine	Presidio	McAllister et al., 1995
<i>Pharyngodon kirbii</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974b
<i>Pharyngodon warneri</i>	2% (2/83)	10 (10)	Large intestine	Presidio	McAllister et al., 1995
<i>Physaloptera</i> sp. (larvae)	1% (1/83)	3	Stomach	Presidio	McAllister et al., 1995
<i>Acanthocephala</i> (juvenile)	6% (5/83)	2 (2-5)	Muscle fascia	Presidio	McAllister et al., 1995
<i>Chemidophorus sexlineatus</i>					
<i>Pharyngodon warneri</i>	50% (2/4)	Not given	Large intestine	Walker	Harwood, 1932
<i>Chemidophorus tessellatus</i>					
<i>Oochoristica bivittellobata</i>	11% (3/27)	2 (1-3)	Small intestine	Brewster, Presidio	McAllister, 1990a
<i>Parathelandros texanus</i>	11% (3/27)	7 (1-15)	Large intestine	Presidio	McAllister, 1990a
<i>Parapharyngodon warneri</i>	15% (4/27)	65 (1->200)	Large intestine	Brewster, Culberson, Presidio	McAllister, 1990a
<i>Physaloptera</i> sp. (larvae)	19% (5/27)	7 (1-25)	Stomach	Brewster, Presidio	McAllister, 1990a
<i>Chemidophorus tigris</i>					
<i>Parathelandros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a
<i>Pharyngodon cnemidophori</i>	Not given	Not given	Not given	Brewster	Specian and Ubelaker, 1974b
<i>Coleonyx brevis</i>					
<i>Pharyngodon mudgii</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974b
<i>Cophosaurus texanus scitulus</i>					
<i>Parathelandros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a
<i>Cophosaurus texanus texanus</i>	5% (1/21)	90	Body cavity	Johnson	McAllister, 1988
<i>Mesocostoides</i> sp. (tetrahyridia)					
<i>Crotaphytus collaris</i>	25% (1/4)	Not given	Large intestine	Terrill	Gambino and Heyneman, 1960
<i>Atractis penneri</i>					

Table 1. Continued.

Host Helminth	Prevalence	\bar{x} intensity (range)	Site of infection	County	Reference
<i>Eumeces fasciatus</i>					
<i>Mesocoleium monax</i>	11% (1/9)	1	Small intestine	Harris	Harwood, 1932
<i>Mesocostoides</i> sp. (Tetrathyridia)†	11% (1/9)	1	Body cavity/mesentery	Harris	Harwood, 1932
<i>Oochoristica eumecis</i>	11% (1/9)	1	Small intestine	Harris	Harwood, 1932
<i>Cosmoecroides dukae</i>	44% (4/9)	Not given	Large intestine	not given	Harwood, 1932
<i>Oswaldoeruzia pipiens</i>	22% (2/9)	Not given	Digestive tract	Walker	Harwood, 1932
<i>Hemidactylus turcicus</i>					
<i>Ascarys</i> sp. (larvae)	9% (9/98)	Not determined	Viscera	Harris	McAllister et al., 1993
<i>Raillettiella frenatus</i>	44% (210/480)	14 (1-72)	Lungs	Hidalgo	Pence and Selcer, 1988
<i>Raillettiella teaguei</i> †	20% (17/86)	Not given	Lungs	Harris	Riley et al., 1988
<i>Ophisaurus ventralis</i>					
<i>Cosmoecroides variabilis</i>	25% (1/4)	Not given	Large intestine	Harris	Harwood, 1930
<i>Phrynosoma cornutum</i>					
<i>Dioclethos phrynosomatis</i>	57% (4/7)	Not given	Small intestine	Grimes, Harris	Harwood, 1932
<i>Skryabinoptera phrynosoma</i>	43% (3/7)	Not given	Stomach	Grimes, Harris	Harwood, 1932
<i>Sceloporus grammicus microlepidotus</i>					
<i>Strongylurus similis</i> ‡	9% (1/11)	1	Large intestine	Refugio	This study
<i>Sceloporus magister bimaculosis</i>					
<i>Oochoristica scelopori</i>	6% (1/17)	1	Small intestine	Brewster	This study
<i>Atractis penneri</i>	6% (1/17)	709	Large intestine	El Paso	This study
<i>Physaloptera reitusa</i>	6% (1/17)	1	Stomach	El Paso	This study
<i>Physicocephalus</i> sp. (larvae)‡	12% (2/17)	>100	Viscera	Brewster, Presidio	This study
<i>Thubunaea iguanae</i>	12% (2/17)	2 (1-2)	Stomach	Brewster, Presidio	This study
<i>Acanthocephala</i> (juvenile)‡	6% (1/17)	5	Muscle	Presidio	This study
<i>Sceloporus merriami annulatus</i>					
<i>Paratelandros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a
<i>Sceloporus merriami longipunctatus</i>					
<i>Paratelandros texanus</i>	33% (13/39)	17 (1-42)	Large intestine	Presidio	This study
<i>Thubunaea iguanae</i> ‡	8% (3/39)	3 (1-7)	Stomach	Presidio	This study
<i>Acanthocephala</i> (juvenile)‡	3% (1/39)	1	Small intestine	Presidio	This study
<i>Sceloporus merriami merriami</i>					
<i>Oochoristica</i> sp. ‡	9% (2/23)	2 (1-2)	Small intestine	Brewster, Val Verde	This study
<i>Atractis penneri</i> ‡	17% (4/23)	174 (47-329)	Large intestine	Val Verde	This study
<i>Paratelandros texanus</i>	13% (3/23)	7 (4-12)	Large intestine	Val Verde	This study

Table 1. Continued.

Host Helminth	Prevalence	\bar{x} intensity (range)	Site of infection	County	Reference
<i>Physaloptera retusa</i> †	4% (1/23)	1	Stomach	Val Verde	This study
<i>Spauligodon giganticus</i> ‡	4% (1/23)	1	Large intestine	Val Verde	This study
<i>Strongyluris similis</i> ‡	9% (2/23)	6 (5-7)	Intestine	Val Verde	This study
<i>Sceloporus olivaceus</i>					
<i>Mesocestoides</i> sp. (tetrathyridia)	14% (1/7)	> 200	Body cavity	Johnson	McAllister, 1988
<i>Oochoristica scelopori</i> ‡	3% (2/61)	1	Small intestine	Johnson	This study
<i>Atractis peneri</i> ‡	2% (1/61)	206	Large intestine	Hidalgo	This study
<i>Physaloptera retusa</i> ‡	48% (29/61)	20 (1-78)	Stomach	Johnson, Tom Green, Travis	This study
<i>Strongyluris similis</i> ‡	20% (12/61)	11 (1-31)	Large intestine	Blanco, Hood, Johnson, Travis	This study
<i>Sceloporus poinsetti</i>					
<i>Oochoristica scelopori</i>	30% (3/10)	7 (3-15)	Small intestine	El Paso	Goldberg et al., 1993
<i>Physaloptera retusa</i>	54% (7/13)	66 (1-229)	Stomach	Blanco, Jeff Davis, Llano, Pecos	This study
<i>Spaligodon giganticus</i>	92% (12/13)	30 (2-103)	Large intestine	Blanco, Jeff Davis, Llano, Pecos, Sutton	This study
<i>Skrjabinoptera phrynosoma</i>	80% (8/10)	27 (4-68)	Stomach	El Paso	Goldberg et al., 1993
<i>Thubunaea iguanae</i>	20% (2/10)	1	Stomach	El Paso	Goldberg et al., 1993
<i>Sceloporus serrifer</i>					
<i>Physaloptera retusa</i> ‡	60% (15/25)	5 (1-36)	Stomach	Starr, Webb, Zapata	This study
<i>Physocephalus</i> sp. (larvae)	29% (7/24)	> 50	Stomach wall	Webb, Zapata	Goldberg et al., 1994a
<i>Spauligodon giganticus</i> ‡	88% (22/25)	11 (1-76)	Large intestine	McMullen, Starr, Webb, Zapata	This study
<i>Strongyluris similis</i> ‡	36% (9/25)	7 (1-25)	Digestive tract	McMullen, Starr, Webb	This study
<i>Sceloporus undulatus consobrinus</i>					
<i>Physaloptera retusa</i>	20% (2/10)	54 (3-104)	Stomach	Hudspeth, Val Verde	This study

Table 1. Continued.

Host Helminth	Prevalence	\bar{x} intensity (range)	Site of infection	County	Reference
<i>Sceloporus undulatus hyacinthinus</i>					
<i>Cosmoceroides variabilis</i> †	4% (1/23)	2	Large intestine	San Jacinto	This study
<i>Oswaldocruzia pipiens</i>	33% (1/3)	Not given	Digestive tract	Walker	Harwood, 1932
	13% (3/23)	1	Digestive tract	Nacogdoches, San Jacinto	This study
<i>Parahelantros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a
<i>Physaloptera reusa</i>	17% (4/23)	3 (1-6)	Stomach	Colorado, Harris, Travis	This study
<i>Strongylurus similis</i> †	4% (1/23)	1	Large intestine	Colorado	This study
<i>Sceloporus variabilis</i>					
<i>Oochoristica</i> sp.‡	2% (1/42)	1	Small intestine	Nueces	This study
<i>Atractis penneti</i> †	10% (4/42)	96 (1-230)	Large intestine	Cameron	This study
<i>Physaloptera reusa</i> †	26% (11/42)	29 (1-249)	Stomach	Live Oak, Nueces, Uvalde	This study
<i>Strongylurus similis</i> †	2% (1/42)	1	Large intestine	Uvalde	This study
<i>Scincella lateralis</i>					
<i>Brachycoelium dawiesi</i>	23% (26/111)	Not given	Small intestine	Walker, Harris	Harwood, 1932
<i>Mesocoelium monas</i>	5% (5/111)	Not given	Small intestine	Harris	Harwood, 1932
<i>Cylindrotaenia americana</i>	37% (41/111)	Not given	Digestive tract	Not given	Harwood, 1932
<i>Mesocostoides</i> sp. (tetrahyridia)†	2% (2/111)	1	Body cavity/mesentery	Not given	Harwood, 1932
<i>Cosmoceroides variabilis</i>	4% (4/111)	Not given	Large intestine	Harris	Harwood, 1930
<i>Oswaldocruzia pipiens</i>	5% (6/111)	Not given	Digestive tract	Walker	Walker, 1932
<i>Physaloptera squamatae</i>	4% (4/111)	Not given	Stomach	Harris	Harwood, 1932
<i>Thubunaea leiopismae</i>	20% (22/111)	Not given	Stomach	Harris	Harwood, 1932
<i>Urosaurus ornatus</i>					
<i>Parahelantros texanus</i>	Not given	Not given	Large intestine	Brewster	Specian and Ubelaker, 1974a

* Mean intensity data for *Chemidophorus* was recalculated from McAllister (1990b, c, d) and McAllister et al. (1994).

† Possibly *Mesocostoides* sp. originally given as *Cysticercus* (larva).

‡ New host record.

lection at Dallas Museum of Natural History (DMNH), Natural History Museum of Los Angeles County (LACM), TCWC, and Department of Zoology, University of Arkansas (UADZ); *S. merriami*, APPSU, Herpetology Collection, Sul Ross State University (SRSU), and Herpetology Collection, University of Texas at Austin (TNHC); *S. olivaceus*, Arkansas State University Museum of Zoology (ASUMZ), LACM, TNHC, and DMNH; *S. poinsettii*, LACM and ASUMZ; *S. serrifer*, Museum of Natural Science, Louisiana State University (LSUMZ), SRSU, and TNHC; *S. undulatus*, LACM and ASUMZ; and *S. variabilis*, TAIC and TCWC.

The body cavity was opened by a longitudinal incision from vent to throat, and the gastrointestinal tract was excised by cutting across the anterior esophagus and rectum. The esophagus, stomach, and small and large intestines were slit longitudinally and examined under a dissecting microscope. Each helminth was examined and identified using the standard glycerol wet mount. Cestodes were stained with Semichon's acetocarmine or hematoxylin and mounted in balsam. Representative specimens were deposited in the U.S. National Parasite Collection, Beltsville, Maryland 20705. Accession numbers are given in the Appendix.

Results and Discussion

The known helminth fauna for Texas lizards including prevalences and mean intensities (sensu Margolis et al., 1982), infection sites, and localities (county) are presented in Table 1. For sceloporine lizards, known helminths consist of 3 cestode species, *Mesocestoides* sp. represented as tetrathyridia, *Oochoristica scelopori* Voge and Fox, 1950, and an unidentified (perhaps undescribed) species of *Oochoristica*; 10 nematode species, *Atractis penneri* (Gambino, 1957) Baker, 1987, *Cosmocercoides variabilis* (Harwood, 1930) Travassos, 1931, *Oswaldocruzia pipiens* Walton, 1929, *Parathelandros texanus* Specian and Uebelaker, 1974, *Physaloptera retusa* Rudolphi, 1819, *Physocephalus* sp. (encysted larvae), *Skrjabinoptera phrynosoma* (Ortlepp, 1922) Schulz, 1927, *Spauligodon giganticus* (Read and Amrein, 1953) Skrjabin, Schikhobalova, and Lagodovskaja, 1960, *Strongyluris similis* Caballero, 1938, and *Thubunaea iguanae* Telford, 1965; and 1 species from the phylum Acanthocephala, an unidentified cystacanth.

Helminth diversity ranged from 0 helminth species in *Sceloporus graciosus arenicolous* to 8 in *Sceloporus merriami*. Of the 51 species of lizards in Texas (Garrett and Barker, 1987), 30 (59%) are now reported to harbor helminths. *Parathelandros texanus* infects the greatest number of lizard species (10) but is apparently limited in range to west Texas. *Physaloptera retusa* has been

recorded in more Texas counties (18) than any other lizard helminth.

None of the 14 species of helminths infecting sceloporine lizards from Texas are unique to the genus *Sceloporus*; all are shared with other amphibian or reptilian host species. Eight are heteroxenous helminths requiring an arthropod intermediate host: *Mesocestoides* sp., *Oochoristica* sp., *Oochoristica scelopori*, *Physaloptera retusa*, *Physocephalus* sp., *Skrjabinoptera phrynosoma*, *Thubunaea iguanae*, and an acanthocephalan. Six are monoxenous with skin penetration, egg ingestion, or autoinfective routes of infection: *Atractis penneri*, *Cosmocercoides variabilis*, *Oswaldocruzia pipiens*, *Parathelandros texanus*, *Spauligodon giganticus*, and *Strongyluris similis*.

In Texas, *Sceloporus merriami* harbored 8 species of helminths, *S. magister* 6, *S. olivaceus*, *S. poinsettii*, and *S. undulatus* 5 each, *S. serrifer* and *S. variabilis* 4, *S. grammicus* 1, and *S. graciosus* 0. The failure to find any helminths in *S. graciosus* may be due to the small sample size ($N = 12$); however, Burkholder and Tanner (1974) reported very low helminth prevalences in large sample sizes (> 300) of *S. graciosus* from Salt Lake and Wasatch counties, Utah.

In conclusion, our investigations along with previous studies have indicated 14 species of helminths in sceloporine lizards from Texas. Six are monoxenous species; lizard density may be most important in determining the intensity of infection by these helminth species. The remaining 8 species are heteroxenous; intermediate host distribution and lizard diet may be most important in determining infection intensities for these species.

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Appendix: USNM Helminthological Collection Numbers

- S. grammicus*: *Strongyluris similis*, 84169.
- S. magister*: *Oochoristica scelopori*, 84170; *Atractis penneri*, 84171; *Physaloptera retusa*, 84172; *Physocephalus* sp. 83420; *Thubunaea iguanae*, 84173; *Acanthocephala* 83419.
- S. merriami*: *Oochoristica* sp., 84233; *Atractis penneri*, 84174; *Parathelandros texanus*, 84175; *Physaloptera retusa*, 84232; *Spauligodon giganticus*, 84176; *Strongyluris similis*, 84177; *Thubunaea iguanae*, 84178; *Acanthocephala*, 84179.
- S. olivaceus*: *Oochoristica scelopori*, 84234; *Atractis penneri*, 84180; *Physaloptera retusa*, 84181; *Strongyluris similis*, 84182.
- S. poinsettii*: *Physaloptera retusa*, 84183; *Spauligodon giganticus* (female and alate male) 84184, (analate male) 84185.
- S. serrifer*: *Physaloptera retusa*, 84186; *Spauligodon giganticus* (female and alate male) 84187, (analate male) 84188; *Strongyluris similis*, 84189.
- S. undulatus*: *Cosmocercoides variabilis*, 84190; *Oswaldocruzia pipiens*, 84191; *Physaloptera retusa*, 84192; *Strongyluris similis*, 84193.
- S. variabilis*: *Oochoristica* sp., 84235; *Atractis penneri*, 84194; *Physaloptera retusa*, 84195; *Strongyluris similis*, 84196.