Helminth Parasites of Unisexual and Bisexual Whiptail Lizards (Teiidae) in North America. II. The New Mexico Whiptail (Cnemidophorus neomexicanus)

Author: Chris T. McAllister

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Helminth Parasites of Unisexual and Bisexual Whiptail Lizards (Teiidae) in North America. II. The New Mexico Whiptail (*Cnemidophorus neomexicanus*)

Chris T. McAllister, Renal-Metabolic Lab (151-G), Veterans Administration Medical Center, 4500 S. Lancaster Road, Dallas, Texas 75216, USA

ABSTRACT: Twelve of 61 (20%) unisexual New Mexico whiptails (*Cnemidophorus neomexicanus*) from three counties of central New Mexico (USA) and two counties of extreme southwestern Texas (USA) were found to be infected with one or more endoparasites. These included a linstowiid cestode (*Oochoristica bivitellobata*) in seven (11%), a larval spirurid nematode (*Physaloptera* sp.) in three (5%), an oxyurid nematode (*Pharyngodon warneri*) in two (3%) and an unidentified acanthocephalan cystacanth in a single (2%) lizard. This report constitutes the first record of helminths from *C. neomexicanus*.

Key words: Acanthocephala, Cestoidea, *Cnemidophorus neomexicanus*, Cyclophyllidea, cystacanth, helminths, lizards, *Oochoristica bivitellobata*, Oxyurida, *Pharyngodon warneri*, *Physaloptera* sp., Spirurida, survey.

The New Mexico whiptail (*Cnemidophorus neomexicanus*) is a diploid parthenogenetic teiid lizard that ranges from extreme southwestern Texas along the Rio Grande Valley northwestward to Sante Fe County, New Mexico (Wright, 1971). The species prefers disturbed areas with sandy to gravelly substrate in desert shrub and grasslands along riparian floodplains of the Rio Grande ranging in elevation from 600 to 1,900 m but also occurs at the edges of playas with sandy arroyos and washes (Axtell, 1966; Wright, 1971; Morafka, 1977). This clonal complex is thought to be derived from hybridization between the bisexual *C. tigris* (=*C. marmoratus* sensu of Hendricks and Dixon, 1986) and *C. inornatus* (Lowe and Wright, 1966; Parker and Selander, 1984). Wright (1971) provided summary information on the biology of *C. neomexicanus* in a species account. However, to my knowledge, nothing has been published previously on parasites of this whiptail lizard. This paper, the second in a series of reports on helminths of *Cnemidophorus* spp. (see McAllister, 1990), provides information on the identity, prevalence and intensities of helminths infecting this taxon in New Mexico and Texas.

Sixty-one juvenile and adult female *C. neomexicanus* with snout-vent lengths (SVL) ranging from 33 to 88 mm ($\bar{x} \pm$ SE $= 64.3 \pm 1.3$ mm) were examined for helminths. These specimens had been previously fixed in formalin, stored in 70% ethanol and borrowed from the Museum of Southwestern Biology of the University of New Mexico (UNM, Albuquerque, New Mexico 87131, USA), Laboratory for Environmental Biology of the University of Texas at El Paso (UTEP, El Paso, Texas 79968, USA) and Sul Ross State University Museum (SRSU, Alpine, Texas 79830, USA). Whiptails were collected during lizard activity seasons from 1969 to 1986 in Bernalillo (35°05'N, 106°39'W) ($n = 1$), Socorro (34°03'N, 106°53'W) ($n = 13$), and Valencia (34°48'N, 106°43'W) ($n = 3$) counties of central New Mexico and El Paso (31°47'N, 106°31'W to 31°55'N, 106°03'W) ($n = 39$) and Hudspeth (31°50'N, 105°50'W) ($n = 5$) counties of extreme southwestern Texas. Methods for processing lizards and staining and preparation of parasites have been previously described (McAllister, 1990). Representative helminth specimens are deposited in the United States National Museum Helminthological Collection (United States Department of Agriculture, Beltsville, Maryland 20705, USA; accession numbers are 80922 to 80923 for *Oochoristica bivitellobata*, 80926 for *Physaloptera* sp., 80925 for *Pharyngodon warneri* and 80924 for the acanthocephalan cystacanth).

Twelve of 61 (20%) *C. neomexicanus*

TABLE 1. Helminths of *Cnemidophorus neomexicanus.*

Helminth species	Prevalence: Number infected/number examined	Prevalence: %	Intensity: $\bar{x} \pm$ SE	Intensity: Range
Cestoidea				
Oochoristica bivitellobata (d)[a]	7/61	11	6.7 ± 3.4	1–26
Nematoda				
Physaloptera sp. (s)	3/61	5	4.0 ± 3.0	1–10
Pharyngodon warneri (r)	2/61	3	6.5 ± 3.5	3–10
Acanthocephala				
Unidentified cystacanth (m)	1/61	2	1.0 ± —	1

[a] d, duodenum; s, stomach; r, rectum; m, muscle fascia.

(SVL 57 to 86 mm, 69.7 ± 2.5 mm) were infected with at least one of four helminths (Table 1). These included 10 (83%) infected lizards with a single helminth and 2 (17%) with two species. Prevalence was more than two-fold higher in northern populations of *C. neomexicanus* from New Mexico (6 of 17, 35%) when compared to southern populations from Texas (6 of 44, 14%); however, sample sizes were unequal.

Specimens of the linstowiid cestode, *Oochoristica bivitellobata* were found in seven whiptails, including one of 39 (3%) from El Paso County, Texas (68 mm SVL, UTEP accession number 6318) and three of 13 (23%) from Socorro (68 to 73 mm SVL, UNM 47032, 47034, 47882) and three of three from Valencia (73 to 86 mm SVL, UNM 39780 to 39782) counties, New Mexico. This suggests higher prevalence of the cestode in New Mexico populations of *C. neomexicanus* where, due to opportunistic feeding, the arthropod (insect?) intermediate host of *O. bivitellobata* may be more often available for ingestion by foraging lizards. Three distinct life cycle stages of *O. bivitellobata* occurred in two whiptails: a small prestrobilar form, an immature adult with distinct genital primordia, and a mature worm with gravid proglottids containing numerous eggs, each contained within uterine capsules in the parenchyma. Although some of the specimens were unrelaxed due to in situ fixation when the host was slowly killed, they did possess two distinct compact vitellaria, characteristic of *O. bivitellobata* (see Loewen, 1940; Brooks and Mayes, 1976).

There appears to be at least some host specificity for *O. bivitellobata* at the family level, as it has been reported previously in *Cnemidophorus* spp. from Arizona, California, Idaho, Nebraska, Nevada, South Dakota and Utah (Benes, 1985; McAllister et al., 1985; Lyon, 1986; Goldberg and Bursey, 1989, 1990). New Mexico and Texas represent new distributional records for the parasite.

Physaloptera sp. larvae were collected from three lizards, including two from El Paso County (59, 76 mm SVL, UTEP 1696, SRSU 4183) and a single whiptail from Valencia County (73 mm SVL, UNM 39782). These spirurids have been reported previously from various cnemidophorine taxa (Goldberg and Bursey, 1990; McAllister, 1990).

Only two *C. neomexicanus,* both from El Paso County (60, 67 mm SVL, SRSU 4177, UTEP 751), were infected with *Pharyngodon warneri.* This ubiquitous nematode has been reported from *C. sexlineatus* in South Dakota (Dyer, 1971) and Texas (Harwood, 1932), *C. tigris* in Utah (Grundmann, 1959) and *C. laredoensis* and *C. tesselatus* in Texas (McAllister et al., 1986; McAllister, 1990). In addition, *P. warneri* is known to infect a biparental ancestor of *C. neomexicanus,* the little striped whiptail (*C. inornatus*) in Brewster County, Texas (Specian and Ubelaker, 1974) and Cochise County, Arizona (Goldberg and Bursey, 1990).

A single whiptail collected in July 1986 from El Paso County (57 mm SVL, SRSU 4182) was infected with an unidentified acanthocephalan cystacanth. Cystacanths have been reported previously from other whiptail lizards, including a northern whiptail (*C. tigris septentrionalis*) and a desert grassland whiptail (*C. uniparens*) from Arizona (Benes, 1985; Goldberg and Bursey, 1990).

When compared to information provided on parasites of other whiptail lizards from widely separated geographic localities, there is a remarkable similarity in the helminth fauna among the species. All but the acanthocephalan are shared between *C. neomexicanus* and one of its biparental ancestors, *C. inornatus*, while almost one-half of the helminths are shared between *C. neomexicanus* and unisexual *C. laredoensis* and *C. tesselatus*. This is somewhat surprising because the ranges of *C. neomexicanus* and *C. laredoensis* in Texas are separated by approximately 750 km. However, *C. neomexicanus* is sympatric with *C. tesselatus* and its other biparental ancestor, *C. marmoratus* at the UTEP campus in El Paso (El Paso County, Texas) (C. S. Lieb, pers. comm.).

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BOOK REVIEW . . .

Systemic Pathology of Fish, A Text and Atlas of Comparative Tissue Responses in Diseases of Teleosts, Hugh W. Ferguson. Iowa State University Press, Ames, Iowa, USA. 1989. 276 pp. $54.95 U.S.

In this volume, the author and his contributing authors, Thomas W. Dukes, Michael Anthony Hayes, John Leatherland and Brian Wilcock, have reviewed an extensive literature and assembled an atlas describing comparative tissue responses in the diseases of teleosts. Taken from the perspective of the host, rather than the pathogen, the authors explore the fundamental "mechanisms of disease and pathophysiology in fish organs and tissues". Not intended to be exhaustive in its coverage of the etiologies of fish diseases, the text selectively explores the normal and abnormal in the context of our current knowledge of host histology, physiology and endocrinology. Its theme is comparative and directed at the interested student schooled in the fundamentals of mammalian pathology.

This primer to the systemic pathology of fishes is composed of thirteen well written, extremely readable chapters, each with an up-to-date reference list, and a substantial bibliography. The chapters include: (1) An Introduction to Postmortem Techniques and General Pathology of fish; (2) Gills and pseudobranchs; (3) Skin; (4) Kidney; (5) Spleen, Blood and Lymph, Thymus, and Reticuloendothelial System; (6) Cardiovascular System; (7) Gastrointestinal Tract, Pancreas, and Swimbladder; (8) Liver; (9) Nervous System; (10) The Eye (B. P. Wilcock and T. W. Dukes); (11) Endocrine and Reproductive Systems (J. F. Leatherland and H. W. Ferguson); (12) Musculoskeletal System; and (13) Neoplasia in Fish (M. A. Hayes and H. W. Ferguson). The two part bibliography is a valuable supplement to the text. Part one provides lists of books addressing general and veterinary pathology, fish and fish diseases, and water quality; while Part two lists articles pertaining to immunology, the reticuloendothelial system, stress, and inflammation. The latter articles are particularly germane considering the biology of disease under the high host population densities associated with intensive fish husbandry. The text is concise and well supported by many excellent photographs and photomicrographs clearly depiciting cellular morphology at gross, microscopic and ultrastructural levels.

As I think back to my graduate student days and my efforts to study lesions associated with a variety of fish parasites, I vividly remember the struggle and frustration associated with my attempts to interpret and understand cellular responses in fishes. Although the now standard volumes edited by Ribelin and Migaki and authored by Roberts were available and were a welcomed source of help, I can not help but think that had this book been available, I would not have experienced quite as many frustrations. This excellent volume is an important addition to the literature pretaining to fish diseases and has fulfilled the stated goal of the author by being an outstanding teaching aid and reference source for students and professionals. Moreover, I feel the scope of this pathophysiological presentation is such that it will function as a source of insight for future research into fish health and disease. I highly endorse its use by my colleagues.

Leslie S. Uhazy, Division of Mathematics and Science, Antelope Valley College, Lancaster, California 93536, USA.