

Meningeal Worm in Free-Ranging Deer in Nebraska

Authors: Oates, David W., Sterner, Mauritz C., and Steffen, David J.

Source: Journal of Wildlife Diseases, 35(1) : 101-104

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-35.1.101>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Meningeal Worm in Free-Ranging Deer in Nebraska

David W. Oates,¹ Mauritz C. Sterner,² and David J. Steffen,^{3,1} Genetics and Forensics Analysis Laboratory, Nebraska Game and Parks Commission, Lincoln, Nebraska 68503-0370 USA; ² Harold W. Manter Laboratory of Parasitology, 529-W Nebraska Hall, University of Nebraska, Lincoln, Nebraska 68588-0514 USA; ³ Veterinary Diagnostic Laboratory, University of Nebraska, Lincoln, Nebraska 68583-0907 USA

ABSTRACT: The meningeal worm (*Parelaphostrongylus tenuis*) was found in 22 (7%) of 300 white-tailed deer (*Odocoileus virginianus*) (257 adults, 43 fawns) examined from Nebraska (USA) during November 1996. None of 53 mule deer (*Odocoileus hemionus*) (47 adults and 6 fawns) examined were infected. Twenty-two white-tailed deer from 18 counties in eastern Nebraska were infected with *Parelaphostrongylus tenuis*. This is the first record of *P. tenuis* in white-tailed deer from this state.

Key words: Meningeal worm, mule deer, *Odocoileus hemionus*, *Odocoileus virginianus*, *Parelaphostrongylus tenuis*, survey, white-tailed deer.

The meningeal worm (*Parelaphostrongylus tenuis*), is a common and widely distributed parasite of the white-tailed deer (*Odocoileus virginianus*) in the eastern USA (Anderson and Prestwood, 1981; Comer et al., 1991). The white-tailed deer is the normal definitive host for this parasite and large numbers of *P. tenuis* have been reported from deer exhibiting no clinical signs (Samuel et al., 1992). Other wild ungulates such as caribou (*Rangifer tarandus*), moose (*Alces alces*), elk (*Cervus canadensis*), and mule deer (*Odocoileus hemionus*) may develop severe neurological disorders leading to death, from very low numbers of migrating *P. tenuis* (Anderson and Strelive, 1968; Anderson, 1972; Trainer, 1973; Samuel et al., 1992). The intermediate hosts for *P. tenuis* include several genera of terrestrial gastropods (snails and slugs); wild ungulates become infected while feeding when they accidentally ingest these infected gastropods (Anderson and Prestwood, 1981).

Populations of white-tailed deer and terrestrial gastropods suitable as intermediate hosts, exist in areas throughout North America (Lankester and Anderson, 1968). The reason that *P. tenuis* has not been established in the western North

America is unclear as no physical barriers exist. It has been suggested that an ecological barrier associated with a prairie habitat (Samuel and Holmes, 1974) may affect survival of first stage larvae (Shostak and Samuel, 1984).

With the increased translocation of wild ungulates to replenish animals in historic ranges and reduce populations of ungulates in national parks and urban areas (Lothian, 1981; Bryant and Maser, 1982; Jones and Witham, 1990), there is growing concern among wildlife biologists regarding the translocation of infected animals and the establishment of *P. tenuis* in the western states of the USA and provinces of Canada. In addition, with the increase of private game farms the danger of inadvertently transmitting the parasite to new areas has increased dramatically (Samuel, 1987; Samuel et al., 1992).

The Nebraska Game and Parks Commission (Lincoln, Nebraska, USA) became concerned about allowing the translocation of wild and domestic ungulates into the state. The presence of *P. tenuis* in bordering states and states west of the Missouri river (Table 1) has been documented and deer populations in Nebraska are at risk. This study was undertaken to determine if *P. tenuis* is present in deer in Nebraska. The authors conducted a preliminary survey with the cooperation of South Dakota Game, Fish, and Parks Department (Pierre, South Dakota, USA) to determine if *P. tenuis* existed in that state.

Twenty-eight locker plants (Fig. 1) east of Grand Island (Nebraska) contacted by the Nebraska Game and Parks Commission (Lincoln, Nebraska) agreed to save heads of deer brought to them for processing by hunters during the 1996 rifle deer season. The deer were tagged for

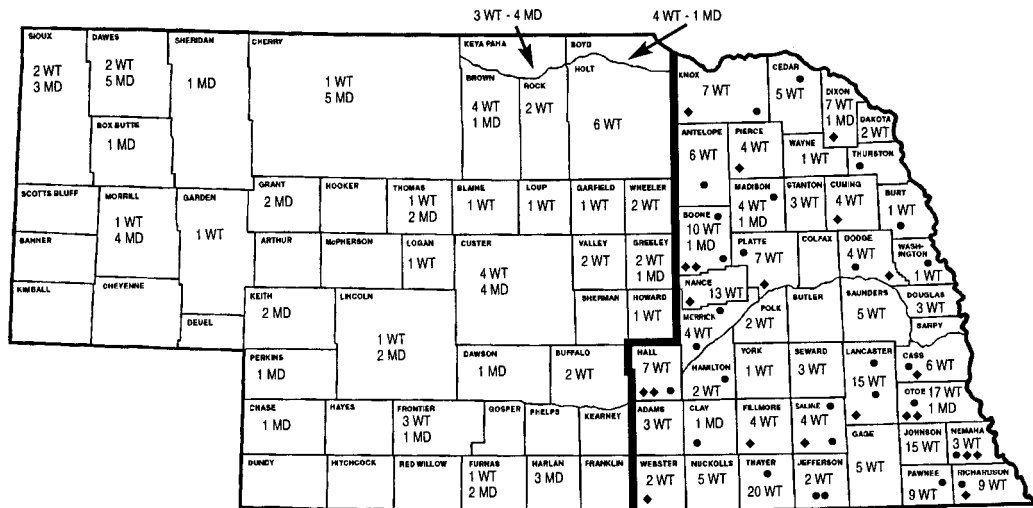


TABLE 1. Prevalence of *Parelaphostrongylus tenuis* infection in deer from the central USA.

State	Prevalence (%)	Positive/examined	References
Iowa	45	19/42 ^a	(Jarvinen and Hedberg, 1993)
Missouri	15	13/85 ^a	(Garrison et al., 1986)
North Dakota	8	40/519 ^a	(Wasel, 1995)
Oklahoma	52	40/79 ^a	(Carpenter et al., 1972)
	39	75/190 ^a	(Kocan et al., 1982)
Nebraska	0	0/53 ^b	Present study
	7	22/300 ^a	
South Dakota	0	0/21 ^b	Present study
	7	10/142 ^a	

^a White-tailed deer.^b Mule deer.

fects (Table 1). In conjunction with this study the authors conducted a preliminary examination of deer from the adjoining state of South Dakota. One hundred sixty three deer were examined (142 white-tailed deer, 21 mule deer). Only 10 of 142 (7%) white-tailed deer were infected with *P. tenuis*. No mule deer were infected.

The number of adult *P. tenuis* found in brain cavity ranged from one to four, but most infections consisted of only one nematode; several had two nematodes and only one had four individuals. Most adult nematodes were embedded in the dura mater of the parietal regions of the brain. The ages of infected deer ranged from a fawn to a 3.5-yr-old doe. Of the 22 infected deer, 12 were males and 10 were females. Abnormal coloration and thickening of the dura mater as well as exudate was noticed in several deer infected with *P. tenuis*.

Our results indicate that the meningeal worm is well established in eastern Nebraska. Most infected deer were located along major waterways or their tributaries. Deer collected in six of the 13 counties along the Missouri River were infected with *P. tenuis*. Four deer with *P. tenuis* were collected in 12 counties east of Grand Island along the Platte River. In addition, six deer in six counties adjacent to the Blue, Loup, Nemaha, and Elkhorn Rivers were infected. This accounts for 16 of the 18 counties with infected deer and 19 of 22 deer infected. Three deer from

two counties were not adjacent to major waterways. This distribution suggests that infected deer occur most frequently along major river systems.

The intermediate hosts (land snails and slugs) and the final host (white-tailed deer) for *P. tenuis* are found throughout the state. All the deer examined in this study from the western two thirds of the state (40) were not infected with *P. tenuis* suggesting that at this time, *P. tenuis* may be confined to the eastern one-third of Nebraska. There was limited sampling of deer in the western part of the state and further studies are needed to better define the extent of the westward range of this parasite.

The presence of *P. tenuis* in Nebraska warrants closer monitoring of the mule deer population in areas where mule deer and white-tailed deer coexist. Any translocation of wild ungulates within or outside the state of Nebraska, private or otherwise, should be regulated to reduce the risk of infected animals from eastern North America and eastern Nebraska spreading the parasite to the west.

We thank P. Oates for aiding in sample collection; E. Oates and M. Oates for handling samples in Lincoln; E. Boyd, S. O'Hare and K. Hams for data entry and manipulation; A. Doster, J. Erickson, and C. Kamphaus for aiding in sectioning skulls and laboratory clean-up; and K. Church and S. Gardner for editing. This is a contribution of Federal Aid in Wildlife

Restoration, Project W-85-R and contribution number 12312 Nebraska Agricultural Research Division, University of Nebraska.

LITERATURE CITED

- ANDERSON, R. C. 1972. The ecological relationships of meningeal worm and native cervids in North America. *Journal of Wildlife Disease* 8: 304–310.
- , AND A. K. PRESTWOOD. 1981. Lungworms. In *Diseases and parasites of white-tailed deer*. Miscellaneous Publications No. 7, W. R. Davidson, F. A. Hayes, V. F. Nettles, and F. E. Kellogg, (eds.). Tall Timbers Research Station, Tallahassee, Florida, pp. 266–317.
- , AND U. R. STRELIVE. 1968. The experimental transmission of *Pneumoststrongylus tenuis* to caribou (*Rangifer tarandus terraenovae*). *Canadian Journal of Zoology* 46: 503–510.
- BRYANT, L. D., AND C. MASER. 1982. Classification and distribution. In *Elk of North America: Ecology and management*, J. W. Thomas and D. E. Toweill, (eds.). Stackpole Books, Harrisburg, Pennsylvania, pp. 1–59.
- CARPENTER, S. W., H. E. JORDAN, AND J. A. MORRISON. 1972. Meningeal worm *Parelaphostrongylus tenuis* infection in white-tailed deer in Oklahoma. *Journal of Wildlife Diseases* 8: 381–383.
- COMER, J. A., W. R. DAVIDSON, A. K. PRESTWOOD, AND V. F. NETTLES. 1991. An update on the distribution of *Parelaphostrongylus tenuis* in the southeastern United States. *Journal of Wildlife Diseases* 27: 348–354.
- GARRISON R. C., D. J. ROBBINS, AND D. C. ASHLEY. 1986. A report on the prevalence of the parasite *Parelaphostrongylus tenuis* in white-tailed deer (*Odocoileus virginianus*) in northwestern Missouri. *Transactions Missouri Academy Science* 20: 104.
- JARVINEN, J. A., AND W. A. HEDBERG. 1993. *Parelaphostrongylus tenuis* (Nematoda) in White-tailed deer (*Odocoileus virginianus*). *The Journal of Parasitology* 79: 116–119.
- JONES, J. M., AND J. H. WITHAM. 1990. Post-translocation survival and movements of metropolitan white-tailed deer. *Wildlife Society Bulletin* 18: 434–441.
- KOCAN, A. A., M. G. SHAW, K. A. WALDRUP, AND G. J. KUBAT. 1982. Distribution of *Parelaphostrongylus tenuis* (Nematoda: *Metastrongyloidea*) in white-tailed deer from Oklahoma. *Journal of Wildlife Disease* 18: 457–460.
- LANKESTER, M. W., AND R. C. ANDERSON. 1968. Gastropods as intermediate hosts of *Pneumoststrongylus tenuis* (Dougherty) of white-tailed deer. *Canadian Journal of Zoology* 46: 373–383.
- LOTHIAN, W. F. 1981. A history of Canada national parks. Volume IV. Ministry of Environment, Parks of Canada, Ottawa, Ontario, Canada, 155 pp.
- SAMUEL, W. M. 1987. Moving the zoo or the potential introduction of a dangerous parasite into Alberta with its translocated host. In *Focus on a new industry*, L. A. Renecker, (ed.). Proceedings of the Alberta Game Growers' Association Conference. Alberta Game Growers' Association, Red Deer, Alberta, pp. 85–92.
- , AND J. C. HOLMES. 1974. Search for elaphostrongyline parasites in cervids from Alberta. *Canadian Journal of Zoology* 52: 401–403.
- , M. J. PYBUS, D. A. WELCH, AND C. J. WILKE. 1992. Elk as potential host for meningeal worm: Implications for transmission. *The Journal of Wildlife Management* 56: 629–639.
- SHOSTAK, A. W., AND W. M. SAMUEL. 1984. Moisture and temperature effects on survival and infectivity of first-stage larvae of *Parelaphostrongylus odocoilei* and *P. tenuis* (Nematoda: *Metastrongyloidea*). *The Journal of Parasitology* 70: 261–269.
- TRAINER, D. O. 1973. Caribou mortality due to the meningeal worm (*Parelaphostrongylus tenuis*). *Journal of Wildlife Diseases* 9: 376–379.
- WASEL, S. W. 1995. Meningeal worm, *Parelaphostrongylus tenuis* (nematode), in Manitoba, Saskatchewan and North Dakota: Distribution and ecological correlates. M.S. Thesis, University of Alberta, Edmonton, Alberta, 100 pp.

Received for publication 13 May 1998.