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DISTRIBUTION OF *PARELAPHOSTRONGYLUS TENUIS* (NEMATODA: METASTRONGYLOIDEA) IN WHITE-TAILED DEER FROM OKLAHOMA[1]

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Abstract: The meningeal worm *(Parelaphostrongylus tenuis)* was found in 75 of 190 (39%) white-tailed deer *(Odocoileus virginianus)* examined in Oklahoma from 1977-81. Infections were found in deer from southeastern mixed forest, oak-hickory forest, oak-bluestem parkland and oak-hickory parkland, and not in deer from western bluestem prairie, bluestem-grama prairie and grama-buffalo grass ecoregions. Factors which may influence the distribution of meningeal worm in Oklahoma include distribution and densities of suitable snail hosts and deer feeding habits.

INTRODUCTION

Considerable information has accumulated on the ecology and distribution of the meningeal worm *(Parelaphostrongylus tenuis)* of white-tailed deer (Anderson and Prestwood, 1981). The parasite appears to be restricted to eastern North America and may, more specifically, be restricted in distribution by the specific physiographic regions in which deer herds exist. For example, in the southeastern United States, the meningeal worm has been reported only from deer occupying oak-hickory pine and mixed-mesophytic vegetative regions, but not from animals from flood plain areas and southern mixed vegetative areas (Prestwood and Smith, 1969).

Due to restocking efforts and a change in management programs, the population of white-tailed deer in Oklahoma, which numbered fewer than 500 in 1916, is presently estimated at over 100,000 animals. Deer which were used to restock unoccupied range were obtained from five areas, one of which is now known to be a region enzootic for *P. tenuis*.

Due to the increase in number of deer which occurred in Oklahoma and the variation in geographic areas within the state, Oklahoma offers a unique opportunity for evaluating the ecological relationship between the presence of meningeal worm parasites and the ecoregion in which the deer host exists. This report presents results of a 5-yr study on the distribution of the meningeal worm among white-tailed deer in Oklahoma.

MATERIALS AND METHODS

From 1977-81, meninges and braincases from 190 white-tailed deer were examined for *P. tenuis*. Animals were collected from 23 counties in Oklahoma. Collections were made between the months of July and February and consisted mainly of adult females. All heads were examined within 12 hr of collection.

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Procedures for examination followed Prestwood and Smith (1969). Representative specimens were deposited in the National Parasite Collection, Beltsville, Maryland, USNM Helm. Coll. No. 77200.

RESULTS

Parelaphostrongylus tenuis was found in 75 of 190 deer (39%) (Table 1). Positive deer were from southeastern mixed forest ecoregions (50%), oak-hickory forest types (76%), oak-hickory parkland (25%), and oak-bluestem parkland (15%). Deer from bluestem prairie, bluestem-grama prairie and western prairie ecoregions were not infected (Fig. 1). Only three collection sites outside of the southeastern mixed forest and oak-hickory forest ecoregions had infected deer. These sites were, however, adjacent to counties which comprised the oak-hickory forest and southeastern mixed forest ecoregions (Fig. 1).

DISCUSSION

The meningeal worm appears to be widely distributed throughout the range of the white-tailed deer with reports occurring from Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Kentucky, Louisiana, Maine, southern Manitoba, Maryland, Michigan, Minnesota, Mississippi, New Brunswick, New Hampshire, New Jersey, New York, North Carolina, Nova Scotia, Oklahoma, Ontario, Pennsylvania, Quebec, Tennessee, Texas, Virginia, West Virginia and Wisconsin (Anderson and Prestwood, 1981). In most instances, the parasite is found in oak-pine subclimax and climax deciduous forests as well as in Appalachian oak and pocosin vegetative types. It has not been found in areas with sandy soil or areas with predominantly pine forests. These findings are apparently independent of herd densities.

The transmission and subsequent distribution of *P. tenuis* has been reported to

TABLE 1. Distribution of *Parelaphostrongylus tenuis* by ecoregion for white-tailed deer from Oklahoma.

Ecoregion	No. positive/no. examined	% positive
Southeastern mixed forest	29/58	50
Oak-hickory forest	28/37	76
Oak-hickory parkland	2/8	25
Oak-bluestem parkland	6/40	15
Bluestem prairie	0/10	0
Bluestem-grama prairie	0/32	0
Grama-buffalo grass	0/5	0
Total	75/190	39

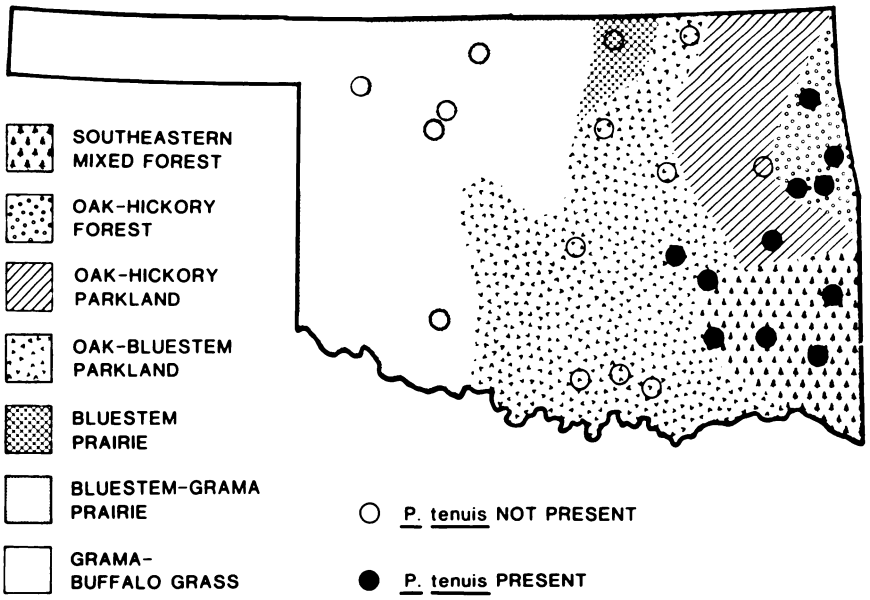

FIGURE 1. Distribution of *Parelaphostrongylus tenuis* in white-tailed deer from Oklahoma by ecoregion.

be dependent on the availability and distribution of suitable molluscan intermediate hosts (Anderson, 1972; Lankester and Anderson, 1968). Field and laboratory studies have implicated numerous slugs and terrestrial snails as intermediate hosts for this parasite. Although it was not the intent of the present study to identify molluscan intermediate hosts in Oklahoma, published information shows that three terrestrial snails *(Zonitoides arboreus, Z. nitidus* and *Triodopsis albolabris)* and one slug *(Deroceras laeve)*, which are documented hosts for *P. tenuis*, are present in Oklahoma (Branson, 1961; Branson, 1973). Based on the reports of the distribution of these molluscs, however, only *Triodopsis*, a terrestrial snail that prefers damp rocky areas with an abundance of small fungi, appears to be limited to the oak-hickory and oak-pine ecoregions of Oklahoma. These ecoregions are found from the northern to the southern border to eastern Oklahoma and exist in areas with an average rainfall of 1 m or greater (Gray and Gallowat, 1959).

In the eastern portion of the state, the higher moisture conditions may contribute to a more randomly distributed population of snails, and an increased chance of their being ingested when their distribution coincides with deer feeding habitat. In the western and central portions of the state, lower annual rainfall may result in desiccation of larval stages as well as limiting suitable snail habitat to areas along riverbeds, creeks, and drainage areas, so that while the actual numbers of snails may be no different than other parts of the state, the local distribution of snails and/or larvae may be restricted.

Factors which could be equally as important as snail density and distribution may include deer density, deer feeding activities and habits, and possible movement of infected animals into

areas with susceptible intermediate hosts. Oklahoma may be a good example of this last possibility since deer restocking efforts were common between 1946 and 1972. These restocking efforts moved 8,956 deer from five locations. Included in these were 3,199 deer moved from Pittsburg County many of which were placed in counties from which *P. tenuis* has not been reported. Although restocked deer were not examined for *P. tenuis*, a 1972 report (Carpenter, et al., 1972) showed that 53% of the deer from Pittsburg county were infected with this parasite and the present study shows 80% of the deer from this area are harboring patent *P. tenuis* infections. It appears that many of the deer that were translocated from this area did harbor this parasite and they were placed into counties which have potentially susceptible molluscan hosts. To date, however, we have not been able to identify infected deer outside of the eastern-most ecoregions of Oklahoma.

It appears that, at least in Oklahoma, the geographic distribution of suitable intermediate hosts is not the only limiting factor in the distribution of *P. tenuis*. The exact relationship between the factors discussed here and *P. tenuis* distribution will however, remain obscure until definitive studies on the population dynamics of molluscan hosts as they relate to deer behavior are investigated.

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