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PARASITISM AMONG WHITE-TAILED DEER AND DOMESTIC SHEEP ON COMMON RANGE[1]

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Abstract: Parasitism was studied in white-tailed deer (*Odocoileus virginianus*) and domestic sheep (*Ovis aries*) which shared a common range in eastern West Virginia. Of 30 species of internal parasites, 11 were found in deer and 22 in sheep. Five parasites, *Sarcocystis* sp., *Cysticercus tenuicollis*, *Oesophagostomum venulosum*, *Cooperia punctata*, and *Gongylonema pulchrum*, occurred in both deer and sheep. An index of similarity of 17.2 suggests that the parasite faunas of these hosts are distinct, and that it is unlikely that white-tailed deer are reservoirs of common parasites of domestic sheep in the southern Appalachian region.

INTRODUCTION

According to a recent review, 79 genera containing 137 species of parasites have been reported from North American deer of the genus *Odocoileus*.[17] Of these, approximately 40% also have been reported from domestic livestock. Recent findings[10] have suggested that the helminth faunas of intermingling populations of white-tailed deer and cattle (*Bos taurus*) are distinct with little exchange occurring. These authors concluded that white-tailed deer are not important reservoirs of helminths of cattle. The parasite faunas of white-tailed deer and domestic sheep utilizing the same range, however, have not been described. This report presents findings on parasitism among intermingling populations of white-tailed deer and domestic sheep.

MATERIALS AND METHODS

Animals from Hardy County, West Virginia, were selected for study since white-tailed deer are abundant and sheep production is of major agricultural importance. This county is located in the mountainous eastern panhandle of West Virginia. Approximately 70% of the area is forested and lies 300 m or more above sea level.

The specific collection site for deer and sheep met the following criteria: 1. deer and sheep commonly were observed in the same pastures; 2. an abundance of deer was present; 3. access to area was relatively easy facilitating collection of deer; and 4. availability of adult sheep and lambs which had not received anthelmintic medication during the previous 6 months.

The collection site was typical of many small, family farms scattered throughout the Appalachian region of the Southeast. The farm was situated in a shallow, rocky valley having relatively poor soils. Forty-eight hectares of unimproved pasture of native grasses occurred in the bottoms and extended onto the hillsides, where a flock of 47 ewes and 70 lambs grazed. The ridges were heavily forested with an oak-hickory vegetative type. Supplemental grain was provided only for ewes during pregnancy. Hay was given sheep on pastures during the winter. An

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anthelmintic was administered to sheep during the previous spring. Unusual disease problems had not occurred.

During September, 1972, 5 (4 adults and 1 fawn) deer were collected at night by shooting. Deer were wrapped in plastic, surrounded by crushed ice and transported to a field laboratory for necropsy the following day. Concomitantly, 5 (3 adults and 2 lambs) sheep were purchased from the same farm where white-tailed deer were obtained. Sheep were necropsied immediately after euthanasia.

Postmortem procedures were similar for deer and sheep. After searching the skin and pelage for ectoparasites, the animals were skinned before further examination. General necropsy and parasitologic techniques have been presented elsewhere.[9-15] Fecal flotations using saturated sodium nitrate solution were done to detect coccidian oocysts. Sections of tongue, lung, liver, kidney, spleen, lymph node, cardiac muscle, and abomasum were preserved in buffered 10% formalin. Tissues were processed according to standard procedures, cut at 6 μm, and stained with Delafield's hematoxylin and eosin. An index of similarity[5] was used for comparing parasite faunas, and parasite profiles[16] were prepared for each host.

RESULTS

No ectoparasites were found on deer or sheep, but 30 species of internal parasites (Table 1) representing 18 genera were identified, viz., 2 protozoans, 2 cestodes, and 26 nematodes. White-tailed deer were parasitized by 11 species while 24 species were found in sheep. Five parasites, *Sarcocystis* sp., *Cysticercus tenuicollis, Oesophagostomum venulosum, Cooperia punctata,* and *Gongylonema pulchrum,* occurred in both deer and sheep. An index of similarity of 17.2 was calculated for the parasite faunas of these animals.

TABLE 1. Parasites of white-tailed deer and domestic sheep of West Virginia.

Parasite	Host
PROTOZOA	
Eimeria sp.	Sheep
Sarcocystis sp.	Deer, sheep
CESTODA	
Cysticercus tenuicollis	Deer, sheep
Moniezia expansa	Sheep
NEMATODA	
Threadworms	
Capillaria bovis	Deer
Whipworms	
Trichuris ovis	Sheep
Trichuris skrjabini	Sheep
Nodular worms	
Oesophagostomum columbianum	Sheep
Oesophagostomum venulosum	Deer, sheep
Bowel worms	
Chabertia ovina	Sheep

TABLE 1 (Continued)

Parasite	Host
NEMATODA (Continued)	
Trichostrongyles	
Cooperia curticei	Sheep
Cooperia mcmasteri	Sheep
Cooperi oncophora	Sheep
Cooperia punctata	Deer, sheep
Haemonchus contortus	Sheep
Ostertagia circumcinta	Sheep
Ostertagia dikmansi	Deer
Ostertagia mossi	Deer
Ostertagia trifurcata	Sheep
Skrjabinagia odocoilei	Deer
Trichostrongylus axei	Sheep
Trichostrongylus colubriformis	Sheep
Trichostrongylus vitrinus	Sheep
Nematodirus fillicollis	Sheep
Nematodirus spathiger	Sheep
Lungworms	
Dictyocaulus filaria	Sheep
Dictyocaulus viviparus	Deer
Müellerius capillaris	Sheep
Parelaphostrongylus tenuis	Deer
Spiruroids	
Gongylonema pulchrum	Deer, sheep

Parasite burdens of deer ranged from 243 to 4963 (av. 1475) helminths. Numbers of worms in sheep ranged from 1604 to 37,767 (av. 13,003). Parasite profiles for each host are presented in Figures 1 and 2.

Microscopic examination of tissues revealed *Sarcocystis* in the tongues of 2 deer and in tongue and cardiac muscle of 4 sheep. One to 4 sarcocysts were seen in histological sections. Pathologic alterations associated with eggs and larvae of *Parelaphostrongylus* were present in the lungs of 4 deer. Most lesions were mild and consisted of a granulomatous reaction with eosinophils, lymphocytes, histiocytes, and occasional foreign body giant cells. A cysticercus was found in the lungs of 1 deer; adjacent alveoli were compressed but inflammatory response was minimal. The lungs of 4 sheep contained lesions attributable to lungworm infection. Histologically, there were multifocal areas of granulomatous inflammation, peribronchial lymphoid hyperplasia, smooth muscle hypertrophy, and in 1 animal, multifocal areas of chronic bronchopneumonia. Reaction was mild to severe, and 1 animal was considered to have verminous pneumonia.

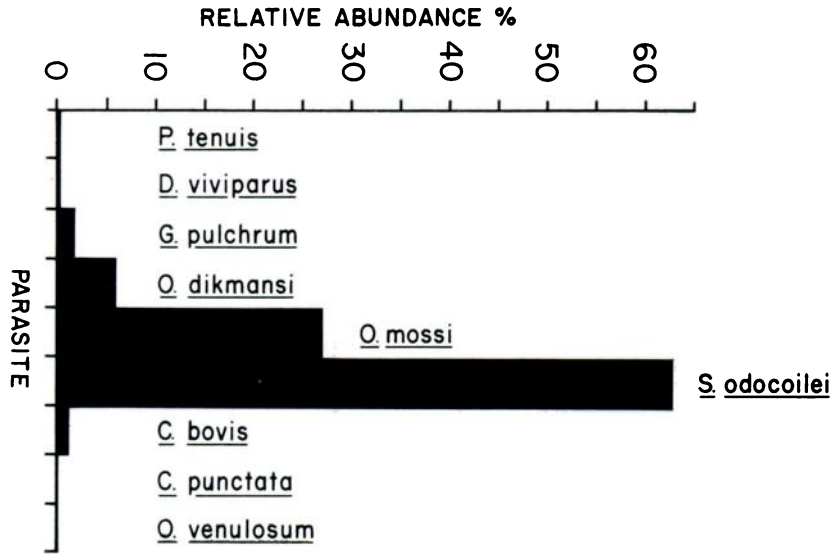

FIGURE 1. Parasite profile for white-tailed deer in eastern West Virginia.

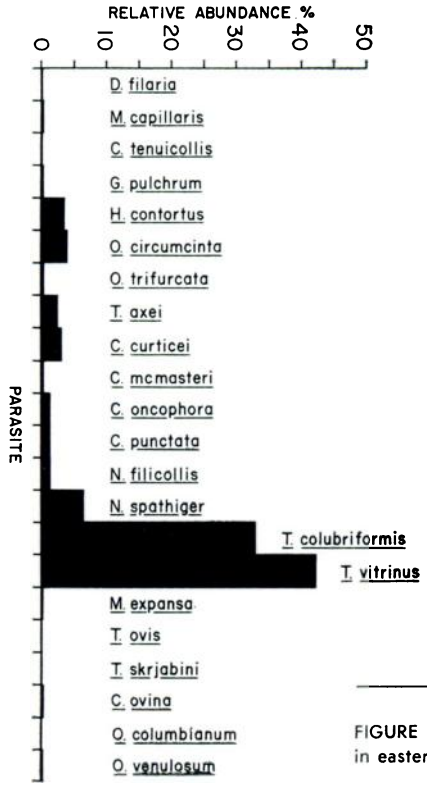

FIGURE 2. Parasite profile for domestic sheep in eastern West Virginia.

DISCUSSION

Much of the sheep production in the southeastern United States traditionally has been located in mountainous terrain where farming operations are primarily confined to valleys and gentle slopes. Steeper slopes and ridges in this region usually are forested, and the edge effect provided by the meeting of two distinct types is conducive to production of an abundance of wildlife including white-tailed deer as evidenced by legal harvest of over 2000 deer in this county during 1972. Due to the distribution of farming operations along the slopes and valleys, frequent contact between deer and sheep is afforded. Of the 11 parasites found in the deer examined, 5 (45.4%) also were found in sheep. These findings are similar to those reported previously;[17] however, the low index of similarity (17.2) strongly suggests that the parasite faunas of deer and sheep are quite distinct. Only on one occasion was a "shared" parasite, viz., *Gongylonema pulchrum*, more prevalent in white-tailed deer. Based on

this study, white-tailed deer cannot be considered important reservoirs for common parasites of the lung and gastrointestinal tract of sheep in the southern Appalachians.

Although experimentally infected sheep[2] were considered relatively resistant to neurologic disease caused by *Parelaphostrongylus tenuis,* neurologic disorders caused by meningeal worm have been reported in sheep of New York,[18] Connecticut,[7] and West Virginia.[1] White-tailed deer are usual hosts for this helminth, where only occasionally does it produce neurologic signs.[3,8] The prevalence of meningeal worm in deer of this study was comparable to that previously reported in eastern West Virginia.[13] Neurologic disease, however, had not occurred in sheep on this or adjacent farms at the time of this study. In view of this and of results of experimental infections,[2] it is likely that unusual ecologic conditions which promote contact between sheep and infected intermediate hosts are necessary to precipitate sporadic outbreaks of neurologic disease among sheep.

The intensity of infection with helminths among white-tailed deer was considered low to moderate when compared with deer from other areas of the Southeast. Lungworms (*Dictyocaulus viviparus* and *P. tenuis*) potentially were the most pathogenic parasites present in deer. Microscopic lung lesions were similar to those described previously for *P. tenuis*[4] and for *Parelaphostrongylus andersoni.*[5]

Among sheep, only 1 animal was considered heavily parasitized, and lungworm pneumonia caused by *D. filaria* and *Müellerius capillaris* was diagnosed histologically. This animal also harbored the greatest number of gastrointestinal helminths. The sum effect of all helminths undoubtedly contributed to the overall poor physical condition of this adult ewe.

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