PREVALENCE OF SARCOCYSTIS IN WOLVES AND WHITE-TAILED DEER IN NORTHEASTERN MINNESOTA

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ABSTRACT: The prevalence of Sarcocystis (Protozoa: Sarcocystidae) in white-tailed deer (Odocoileus virginianus) from northeastern Minnesota was determined by histologic examination of tongue samples. Seventy-nine of 100 deer were infected; infection was higher in yearlings and adults than in fawns. Sporocysts of Sarcocystis were found in 3% of 72 wolf (Canis lupus) scats. Three of four captive wolves fed muscle from a white-tailed deer naturally infected with Sarcocystis shed sporocysts 12-14 days later.

INTRODUCTION

Sarcocystis in white-tailed deer has been documented throughout several regions of the United States and Canada (Karstad and Trainer, 1969; Pond and Speer, 1979; Mahrt and Colwell, 1980; Crum et al., 1981; Crum and Prestwood, 1982; Emnett and Huggins, 1982; Dubey and Lozier, 1983). The wolf is the primary predator of deer in northeastern Minnesota (Stenlund, 1955; Mech and Frenzel, 1971; Nelson and Mech, 1981), which suggests that this species may be a definitive host of the Sarcocystis in deer. The purposes of this study were to determine the prevalence of Sarcocystis in wolves and deer from northeastern Minnesota and to determine if the wolf can serve as a definitive host for Sarcocystis from deer.

MATERIALS AND METHODS

Tongues from 100 road-killed white-tailed deer were collected in Cook and Lake counties, Minnesota from November 1982 to April 1983. Most samples were obtained in or near the Jonvick wintering yard along Lake Superior. The tongues were frozen and later examined for tramuscular cysts according to method #2 described by Emnett and Huggins (1982). The prevalence of infection by Sarcocystis was determined and a chi-square test was used to detect any significant difference caused by host age or sex.

Wolf scats were collected from May 1982 to April 1983 from sites in central Superior National Forest (SNF) in northeastern Minnesota, and examined for sporocysts using a sugar flotation technique (Levine, 1973). Four captive wolves (three adult, one unknown) used as experimental hosts were part of a U.S. Fish and Wildlife Service colony located just north of St. Paul, Minnesota. All wolves were housed in separate kennels with concrete floors and fed dry-pelleted dog food supplemented with raw venison when available. Because no sporocysts were found in 50 fecal flotations from these wolves during pre-patency, the animals were considered to be Sarcocystis-free at the time of experimental feeding.

Tissue for feeding purposes was obtained from a road-killed white-tailed deer in Minnesota. Lean muscle was cut into fine pieces, weighed and placed in a 125-ml flask to which 10 times its weight in digestive fluid was added (Emnett and Huggins, 1982). The mixture was placed in an incubator at 36°C for 1 hr and stirred periodically. The fluid was then removed, strained through gauze, and the remaining tissue was squeezed to remove excess fluid. Ten ml of the filtrate was centrifuged for 10 min at 649 g, the supernatent discarded, and the sediment resuspended in 3 ml of 0.87% NaCl solution. An aliquot was removed with a pipette and one drop placed on a slide with a coverslip and examined for bradyzoites at 400×. Sarcocystis-infected muscle was divided into 454-g portions and one fed to each wolf. Scats were collected daily after the initial feeding of infected venison and examined for sporocysts employing the sugar flotation technique. Scats were examined periodically from post-infection day 25 up to day 41 when collection was terminated due to the absence of sporocysts.

RESULTS

Sarcocysts were found in 79 of 100 histologic sections of white-tailed deer (Table 1). A chi-square test revealed no sig-
TABLE 1. Prevalence and age-sex distribution of Sarcocystis in 100 white-tailed deer from northeastern Minnesota, 1982-1983.

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pos</td>
<td>Neg</td>
</tr>
<tr>
<td>Fawns</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Yearlings</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Adults</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>7</td>
</tr>
</tbody>
</table>

SIGNIFICANT difference in the prevalence of infection between sexes (1 df, 0.01) or between yearlings and adults (1 df, 0.01), but a significant difference (17.90) was found between fawns and the combined yearling-adult age groups (1 df, 0.01).

Two of 72 (3%) scats collected from wolves inhabiting SNF contained sporocysts of Sarcocystis. After ingesting Sarcocystis-infected venison, three of four experimental wolves shed sporocysts. Two wolves exhibited a pre-patent period of 12 days and a corresponding 4-consecutive-day patent period. The remaining wolf had pre-patent and consecutive-patent periods of 14 and 2 days, respectively. Only small numbers of sporocysts were shed during patency.

DISCUSSION

The 79% prevalence of sarcocysts was probably a low estimate because of the size and number of tissue sections examined. The estimate also was not considered to be truly representative of the entire northeastern Minnesota region because of different deer densities throughout the area. Deer numbers are lower in the interior of SNF than in the surrounding areas (Mech and Kars, 1977). Even though wolves inhabit the entire northeastern region (Mech, 1973), a greater prevalence of Sarcocystis likely would be found in areas of higher deer and wolf densities due to increased predator-prey interactions.

This is the first report of wolves as hosts of Sarcocystis in North America. However, the low prevalence of sporocysts found in wolf scats was surprising based upon the number of infected deer and their status as the primary prey of wolves in Minnesota. Due to the relative absence of sporocysts from these randomly collected scats, wolves of the Wood Lake Pack (Mech, pers. comm.) were tracked after killing a deer infected with Sarcocystis. Fecal samples were collected and examined from this pack on days 10-11, 15-16, and 30 after the kill. All scats were negative for Sarcocystis. The low intensity of infection in free-roaming wolves corresponds with the short patent period and few sporocysts shed by captive wolves, even though sporocysts were not seen from the Wood Lake Pack on day 15-16.

Assuming that the wolf is the primary definitive host in this life-cycle, one explanation for the low infectivity shown by captive wolves is that the deer tissue consumed contained very few sarcocysts. More likely however, is the possibility that the particular species of Sarcocystis parasitizing this deer was not one highly infective for the wolf. White-tailed deer harbor at least three species of Sarcocystis (Dubey and Lozier, 1983). These findings suggest that either wolves are poor hosts for deer Sarcocystis or that reshedding of sporocysts is limited by previous infections. If the patent period and low number of sporocysts shed by wolves during feeding trials are applicable to natural populations, then the high prevalence of Sarcocystis in deer might be accounted for by examining wolf populations and food habit studies. Assuming a wolf density in the study area of about one per 52 km² (Mech, pers. comm.) and an average consumption of 15 adult deer per yr (Mech, 1971), then approximately 12 parasitized deer per 52 km², or one per 4.3 km² are eaten by wolves each year and the resulting sporocysts passed into the environment.
Other predators besides wolves might be primary definitive hosts in the carnivore–deer cycle. Coyotes (Canis latrans) and dogs (Canis domesticus) shed numerous sporocysts after ingesting white-tailed deer tissue containing sarcocysts (Emnett and Huggins, 1982). However, dogs and coyotes are uncommon in the area surveyed (Mech, 1971), and their low numbers would not be sufficient to account for the high prevalence of Sarcocystis found in deer.

More experimental feeding studies are needed to better ascertain the role of the wolf in the Sarcocystis life-cycle involving white-tailed deer.

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LITERATURE CITED


