SUSCEPTIBILITY OF CATTLE TO AN ISOLATE OF Dictyocaulus viviparus FROM BLACK-TAILED DEER *

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SUSCEPTIBILITY OF CATTLE TO AN ISOLATE OF *Dictyocaulus viviparus* FROM BLACK-TAILED DEER*

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Abstract: Patent infections did not develop in calves after inoculation with *Dictyocaulus viviparus* infective larvae isolated from black-tailed deer *(Odocoileus hemionus columbianus).* One calf died of bacterial pneumonia on postinoculation day 21. Two calves coughed and had elevated respiratory rates and dyspnea between days 14 and 21. Respiration was normal for these calves on day 25.

A calf and a susceptible black-tailed deer were placed on contaminated grass pasture with eight deer infected naturally with *D. viviparus.* Patent infection did not develop in the calf but larvae of *D. viviparus* were recovered in feces from the deer on post-exposure day 30.

INTRODUCTION

The importance of wild ruminants as reservoirs for *D. viviparus* infection in livestock has been suggested. Samuel[9] considered that evidence for cross-transmission of *D. viviparus* between white-tailed deer *(Odocoileus virginianus)* and cattle was inconclusive. Experimental infection studies have indicated that patent infections do not develop in Holstein calves after inoculation with *D. viviparus* isolates from elk[7] and moose.[4] Longhurst and Douglas[5] found that several gastrointestinal nematode species from black-tailed deer matured in domestic sheep, but *D. viviparus* did not.

An outbreak of dictyocauliasis among a captive herd of black-tailed deer[6] gave an opportunity to test infectivity of this isolate in bovine calves by experimental inoculation and by natural exposure on contaminated pasture.

MATERIALS AND METHODS

Inoculum

Freshly dropped feces were collected from eight black-tailed deer infected naturally with *D. viviparus.* First-stage larvae (L_1) were recovered from feces by the Baermann technique and cultured to infective stage (L_3) by the method of Rubin and Lucker.[8] The number of viable L_3 was determined by dilution count; the inoculum was administered orally with a 50 ml syringe and 15 cm plastic catheter.

Experimental animals

A Jersey calf (1), 5 months old, and three Holstein calves (2, 3, and 4), approximately 4 months old, were obtained from the Oregon State University dairy. The calves, raised in stalls with concrete floors, were not exposed previously to lungworm larvae.

A male black-tailed deer fawn, 9 months old, was used also. It was a hand-reared orphan that was housed indoors after it was 4 months old. Lungworm larvae were not recovered in feces from this fawn before the experiment began.

Inoculations

On February 26, 1971 (day 0), calves 1, 2, and 3 were each inoculated *per os* with 25,000 deer strain *D. viviparus* L_3. The calves were observed daily for

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changes in respiration; fecal samples were collected at periodic intervals after post-inoculation (PI) day 23.

Natural exposure

Eight infected black-tailed deer fawns were confined on grass pasture on March 28, 1971 to ensure that the area was contaminated heavily with lungworm larvae. Calf 4 was taken from the Oregon State University dairy and transported to the deer enclosure on April 8 (day 0). The noninfected fawn was tranquilized, moved to the enclosure, and released in the pen with calf 4 and the infected deer the following day. These animals were observed daily for changes in respiration and general condition. Freshly dropped feces were collected from calf 4 and the fawn periodically after post-exposure day 20.

RESULTS

Experimental inoculations with deer strain D. viviparus L_3

Coughing, dyspnea, and nasal discharge were observed initially in the three calves on PI day 16. Elevated respiratory rates of 46/min (calf 2) and 80/min (calf 3) were recorded. Calf 1 stood with legs spread and head lowered on day 19; respiration was 76/min. The rectal temperature was 41.7C on day 20. Antibiotics were administered to calf 1, but it died the next morning. Postmortem examination revealed a severe pneumonia, enlarged pleural lymph nodes from which a nonhemolytic *Streptococcus* was isolated, and a few immature *D. viviparus* in air passages of the lung. Additional worms were not recovered in lung tissue from one diaphragmatic lobe that was cut up and placed in warm tap water for 8 hours.

Respiration of calves 2 and 3 returned to normal by PI day 25. Larvae of *D. viviparus* were not recovered in feces collected from either calf between PI days 23 and 70.

Natural exposure to deer strain D. viviparus L_3

The calf began grazing within 6 days after placement in the enclosure with the deer and was kept on contaminated pasture for 50 days. Although coughing was observed occasionally, *D.viviparus* L_1 were not recovered in feces from calf 4 collected 12 times between post-exposure days 23 and 48. After removal from the enclosure, the calf did not cough and general condition was excellent.

The fawn began grazing in the enclosure on the first day (April 9). A marked loss in body weight was observed and the fawn was removed from the contaminated pasture on post-exposure day 15. The fawn was observed coughing on post-exposure day 23 and dyspnea was noted on day 28. Larvae of *D. viviparus* were recovered in feces from the fawn on day 30; output was 0.4 larvae per gram (LPG) of feces. Output of larvae increased to 122 LPG on post-exposure day 40. The deer coughed occasionally and lungworm larvae were passed in feces until the time of treatment (post-exposure day 60). Cambendazole[2] was given as a drench at the dose rate of 50 mg/kg of body weight. Lungworm larvae were not recovered in feces from this deer on post-treatment day 6. Output was 25 LPG in feces collected 29 days after treatment. The count was 5 LPG on post-treatment day 59 and larvae were not recovered in feces collected on day 87.

DISCUSSION

Calves responded clinically to inoculation or ingestion of deer strain *D. viviparus* L_3. Elevated respiratory rates, dyspnea, and coughing were observed between PI days 16 and 24. Migration of lungworm larvae in calf 1 probably enabled bacteria to become established in the lungs. This isolate of *D. viviparus* did not mature in these calves. Similar results have been reported when *D. viviparus* isolates from elk[7] and moose[4] were tested experimentally in Holstein calves.

[2] Supplied by Merck & Company, Rahway, N.J.

The fawn placed on contaminated pasture with calf 4 responded clinically to the exposure and a patent infection developed. The 30-day prepatent period is 5 days longer than that reported previously for cattle strain *D. viviparus* in cattle.[8] Treatment with cambendazole probably removed only mature lungworms in air passages. Recovery of larvae in feces in less than 30 days after treatment suggests that immature worms in lung tissue matured after the population of mature worms was removed. This observation agrees with data obtained when the eight infected deer were treated.[6]

When Dikmans[1] synonymized the wild ruminant lungworm, *Dictyocaulus hadweni,* with the cattle lungworm, *D. viviparus,* he indicated that controlled experiments would be necessary to determine whether these isolates from wild ruminants could infect cattle. Recent experiments with *D. viviparus* isolates from elk,[7] moose,[4] and black-tailed deer (the present experiment), indicate that these strains do not mature in cattle. A long association of *D. viviparus* with wild ruminant species has probably resulted in evolution of distinct physiologic strains of this nematode, well adapted to their natural host and incapable of maturation in cattle at the present time. The host-parasite relationship between *D. viviparus* and cattle is poorly adapted. Reciprocal cross - transmission experiments indicate that cattle strain *D. viviparus* matures in elk,[7] red, fallow and roe deer,[2] and also in mouflon, chamois, camels, and antelopes.[3]

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