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Protostrongylus macrotis (NEMATODA: METASTRONGYLOIDEA) IN PRONGHORN ANTELOPE FROM MONTANA AND WYOMING

ELLIS C. GREINER,[1] DAVID E. WORLEY,[2] and B. W. O'GARA[3]

Abstract: Lungworm prevalence and intensity in pronghorn antelope *(Antilocapra americana)* were studied from the National Bison Range (NBR) and Yellowstone National Park (YNP). Collections were made from August, 1965 to July, 1966. *Protostrongylus macrotis* was recovered from 97 of 99 (96.9%) YNP pronghorns, with a mean intensity of 22.1 (0 - 133) worms. *Protostrongylus macrotis* was found in pronghorns of all ages and was present during all months of the year. Lungworms were not recovered from 26 NBR pronghorns sampled during the same time period.

INTRODUCTION

Dikmans[4] first reported *Protostrongylus macrotis* from pronghorn antelope *(Antilocapra americana)* from Yellowstone National Park, Wyoming. He had originally described this helminth from the bronchi of mule deer *(Odocoileus hemionus)* from the same locality.[3] Boddicker and Hugghins[2] observed that pronghorns from South Dakota were infected with *P. macrotis*. This lungworm apparently has not been reported from the pronghorn elsewhere.

The present study was conducted to determine the distribution and frequency of *P. macrotis*, which is closely related to *P. stilesi* and *P. rushi* of bighorn sheep *(Ovis canadensis)*. The latter two species of helminths are associated with the lungworm-pneumonia complex which is thought to limit bighorn sheep populations.[6] The role of the lungworm in this complex may be as a means of microbe entry, but the importance of the pathogenicity of these lungworms has been challenged.[15] Comparisons between pronghorn and bighorn lungworm distributions and prevalences are reported herein.

MATERIALS AND METHODS

Pronghorns were collected monthly from August, 1965 to July, 1966 from Yellowstone National Park (YNP) in Park Counties, Wyoming and Montana, and the National Bison Range (NBR) near Moiese, Lake County, Montana. Lungs were frozen after collection and later thawed for recovery of lungworms. Thawed lungs were examined grossly after opening the trachea, bronchi, and bronchioles to expose the respiratory mucosa. Worms were fixed in 70% ETOH and stored in 70% ETOH and glycerin (95:5). They were cleared in glycerin and mounted in glycerin jelly for microscopic examination.

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RESULTS

Protostrongylus macrotis was recovered from 96.9% (97/99) of the pronghorn lungs from YNP, whereas it was not found in 26 sets of pronghorn lungs examined from the NBR. The intensity of infection ranged from 0 to 133 ($x = 22.1$). More than 100 worms were recovered from 3 pronghorns; over 50 worms from 9 lungs; and more than 22 (annual mean) from 31 lungs. The number of lungworms recovered from lungs collected during each month of the year is presented (Fig. 1). The mean worm burden is also compared with age of pronghorns examined (Fig. 2). The mean lungworm burden for male pronghorns was 30.4 and 19.6 lungworms per female. The female to male lungworm ratio was 4:3.

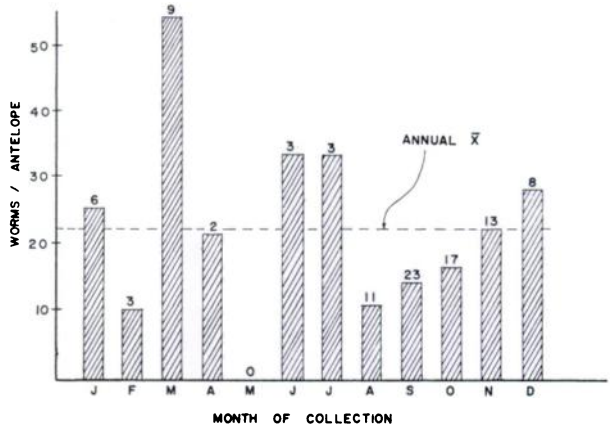

FIGURE 1. Comparison of the intensity of infection with the age of the host. Numbers above bars indicate number of hosts sampled.

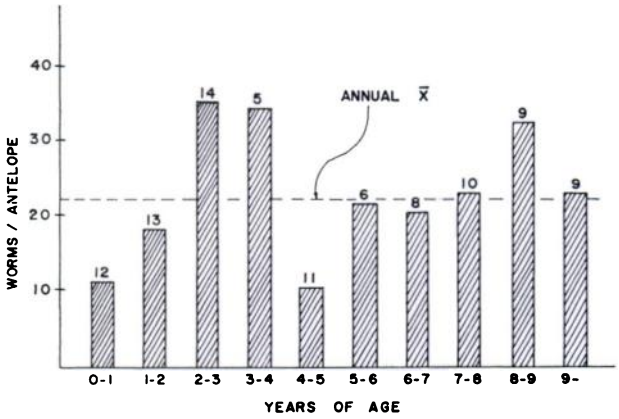

FIGURE 2. Comparison of the intensity of infection with time of year. Numbers above bars indicate number of hosts sampled.

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DISCUSSION

The biology and geographic distribution of *P. macrotis* are poorly known. It has been reported from pronghorns and elk *(Cervus canadensis)* in Wyoming[4] and mule deer in Montana[16] and Colorado.[11] Boddicker and Hugghins[2] reported 8% (5/60) of South Dakota hunter-killed pronghorns harbored this helminth, in contrast to 0 and 97% in the present two study areas.

Forrester and Senger[7] studied *P. stilesi* and *P. rushi* in several Montana bighorn sheep populations, including the herds of the NBR and the Gallatin region, which borders Yellowstone National Park. The NBR bighorns were least infected (no *P. rushi* recovered) and had the lowest intensity of infection. All of the Gallatin bighorns were infected with at least one lungworm species and were intermediate with regard to worm burden when compared to other herds. Becklund and Senger[1] did not record *Protostrongylus* from 12 bighorn sheep from the NBR. Marsh[9] did not find lungworms in NBR bighorns with pneumonia. Forrester[5] recovered potential gastropod intermediate hosts from 9 areas inhabited by bighorns, but did not find potential intermediate hosts for *Protostrongylus* on the NBR.

Pillmore[12,13] experimentally transmitted *P. macrotis* from mule deer with terrestrial gastropods. The duration of infection following exposure to this parasite was 12 to 15 months for two *Odocoileus hemionus*. Monson and Post[10] transmitted *P. stilesi* to mouflon-bighorn sheep hybrids *(Ovis musimon-O. canadensis)* using a terrestrial snail *(Vallonia pulchella)* as the intermediate host. Furthermore, the NBR bighorn herd originated from Banff National Park herd and 90% of the Banff bighorns harbor lungworms.[14] The possibility of the initial NBR bighorns seeding the range with lungworm larvae is evident. Therefore, the lack of appropriate terrestial gastropods on the NBR may be a critical limiting factor resulting in the absence of *P. macrotis* in pronghorns and the reduction of *Protostrongylus* in bighorn sheep on the NBR.

Differences in the prevalence of lungworms in the two pronghorn herds appear to reflect different ecological conditions in the two collecting areas. The NBR is a Palouse prairie area in northwestern Montana varying in elevation from 790 to 1490 m above sea level. Mean annual precipitation is about 30 cm. Range vegetation and terrain are ideal for pronghorns except during an occasional accumulation of deep snow. The Yellowstone pronghorn herd occupies grassland-foothills range along the northern boundary of YNP. Elevations vary from 1585 to approximately 1980 m. Precipitation in the sagebrush-grassland portions of the area averages only about 13 cm annually, although considerably more occurs in the higher areas used for summer range. However, environmental conditions in some parts of the Yellowstone range apparently were favorable for exposure of large numbers of pronghorns to the snail intermediate host of *P. macrotis*.

A correlation between mean lungworm burden and time of collection or host age was not determined (Fig. 1, 2). One 8 year-old pronghorn harbored a large number (115) of lungworms and this caused the high peak for the 8-9 year old group (Fig. 2). The worm burdens in excess of 50 worms found in 9 pronghorns were abnormally large. In their survey, Forrester and Senger[7] reported a mean burden of 10 *P. rushi* (1-162) and only 9 of 97 infected pronghorns harbored more than 50 worms. The duration of experimental *P. macrotis* infections in mule deer[12,13] suggests that this lungworm may overwinter in respiratory passages of pronghorns. This does not preclude the possibility of pronghorns accidentally ingesting infected gastropods during the winter months.

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