

The Effects of *Baylisascaris procyonis* on Host Population Dynamics and Land Use and Prevalence of *B. procyonis* in Intermediate Host Populations

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Introduction

Baylisascaris procyonis, raccoon roundworm, is a frequent parasite of the raccoon (*Procyon lotor*). The adult worms live in the small intestine of the definitive host (raccoon). *B. procyonis* eggs shed in the raccoon feces are ingested by small mammals and birds who act as intermediate hosts (Kazacos 2001). Raccoon roundworm is the most common cause of clinical larva migrans in animals (Kazacos and Boyce, 1995). *B. procyonis* has recently been identified as an emerging zoonosis (Kazacos, 2002; Sorvillo et al., 2002). A high prevalence of *B. procyonis* infection in raccoons has been documented for many regions of the United States. In some places prevalence has been reported to be as high as 80% among adult raccoons and 90% among juvenile raccoons (Kazacos and Boyce, 1995; Kazacos, 2001).

The definitive host population dynamics, specifically age and gender, are not understood. In this study we examined the relationships between infection and host age and gender, season, and land use.

Prevalence of *B. procyonis* infection in intermediate hosts across landscapes has not been extensively examined. Higher prevalence in raccoons in rural landscapes has been documented (Page 2001b). Thus, a higher prevalence in intermediate hosts was expected.



Fig. 1. *Baylisascaris procyonis* transmission involves predation and scavenging, and requires that intermediate host to have contact with raccoon feces.

Materials and methods

Necropsy analysis: A total of 399 raccoon gastrointestinal tracts were obtained and dissected. The examination procedure included the longitudinal dissection of the stomach and intestine and examination of the lumen, mucous, and ingesta for presence of parasites. Each *B. procyonis* found was measured and sexed, and stored in 95% ethanol.



Fig. 2. *Baylisascaris procyonis* collected during necropsy.

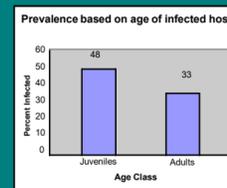
Data Analysis: Age of the raccoons was determined in the field. Yearlings were grouped with juveniles for data analysis. Chi-square analysis was performed to determine how host infection related to sex and age of host, season, and land use.

Intermediate host: Mouse species (*Peromyscus leucopus*, *P. maniculatus*) from six forest preserves in various landscapes were trapped and euthanized. Brains were smashed between glass plates and examined for larva. Full body digests were performed with acid-pepsin solution. Solutions were kept on a shaker-incubator. The number of larvae found in each individual was recorded and larva were stored in 95% ethanol.

Data Analysis: Chi-square analysis was used to relate prevalence of infection and land-use. ANOVA was performed to determine if worm burden differed as a function of land-use.

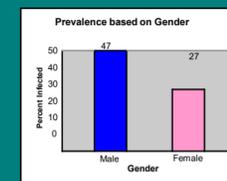
Results: Host Population Dynamics

Host Age
A total of 258 necropsies showed 101 infected individuals. The number of infected hosts differed significantly by host age ($\chi^2 = 5.507$, $p = 0.0189$, $df = 1$), with the frequency being higher in juveniles and yearlings.



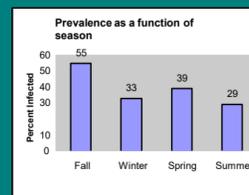
Host Gender

Prevalence in male raccoons (47%) was higher than in female raccoons (27%), exhibiting a significant difference between gender ($\chi^2 = 9.348$, $p = 0.0022$, $df = 1$).



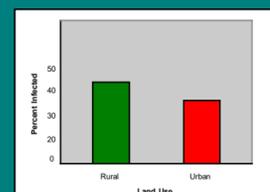
Season

Prevalence of infection differed as a function of season ($\chi^2 = 11.412$, $p = 0.0097$, $df = 3$), and was highest in fall, followed by winter, spring, and summer.



Land Use

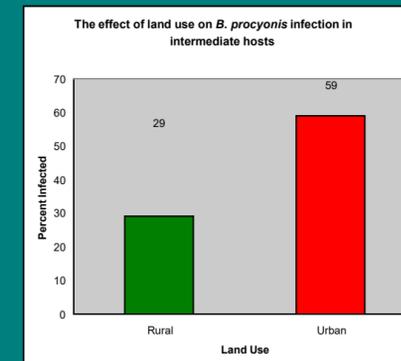
The prevalence in rural sites was not significantly different from urban sites ($\chi^2 = 1.416$, $p = 0.2340$, $df = 1$).



No significant differences were found in burden as a function of land use, season, or host age and gender.

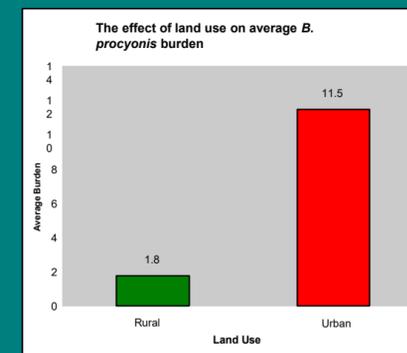
Results: Intermediate Hosts

Prevalence
In total, 121 *Peromyscus ssp.* were collected, showing 52 infected individuals. The number of infected intermediate hosts differed significantly by land use ($\chi^2 = p = 0.0010$, $df = 1$), with a higher prevalence in urban areas.



Burden

Larva burden in intermediate hosts differed significantly as a function of land use.



Conclusions

Because juvenile raccoons may acquire *B. procyonis* through egg ingestion as well as secondary host consumption, a higher prevalence in juvenile hosts was expected (??). Results confirmed this prediction. This suggests that direct infection of juveniles may be the most important means of maintaining presence of *B. procyonis* in a host population. Further study is necessary to explain the unexpectedly significant difference in prevalence between host gender. Host behavior may be a factor.

Kazacos (2001) reported that parasite loads of infected raccoons diminish in the winter and new infections are recruited during spring and early summer. Worms mature during the fall, resulting in the highest prevalence during the fall (Kazacos 2001). Our results confirm the higher autumnal prevalence, but do not support a significant change in burden as a function of season. Although previous studies have indicated a higher prevalence in rural landscapes (Page 2001b), our data did not confirm this difference. A GIS model is being created to better classify rural and urban landscapes.

The results of our study on *B. procyonis* infection in intermediate hosts suggest that prevalence is actually higher in urban areas, not in rural areas as we predicted. Previous research has suggested that prevalence in the definitive host (*P. lotor*) is higher in rural areas (Page 2001b). Increased prevalence in the intermediate host in urban areas may be due to factors such as greater raccoon population density. The GIS model of land use will be useful in more accurately classifying landscapes for further study.

Literature cited

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