Baylisascaris procyonis prevalence and dynamics in a rodent population in Georgia

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Background

Zoonotic pathogens pose a significant public health risk and to understand risks of infection, their prevalence and distribution are needed. In addition, understanding the factors that modify zoonotic pathogen prevalence among wild populations or transmission to people can help prevent human infections.

Baylisascaris procyonis, the intestinal raccoon roundworm, is a significant pathogen of many avian and mammalian species, including humans. The parasite can cause visceral larval migrans that can result in ocular or neural larva migrans (NLM) if larvae migrate through the eyes or central nervous system, respectively. Previous work on *B. procyonis* in Indiana showed that increased habitat fragmentation increased the prevalence of infections among *Peromyscus leucopus* (Kellner et al. 2012). Although *B. procyonis* is widespread in raccoons in US, there are regional differences in prevalence with higher rates being found in the upper Midwest, Northeast, and Western states. Thus, raccoon infection rates in Indiana are much higher than in Georgia, where *B. procyonis* is emerging (Kellner et al. 2012, Blizzard et al. 2010). Because of the recent recognition and low prevalence of *B. procyonis* in Georgia, it is currently unknown if transmission is occurring among rodents or if it is restricted to raccoons. Additionally, relatively few studies have documented *B. procyonis* infections in rodents and none of these studies have been conducted outside of Indiana.

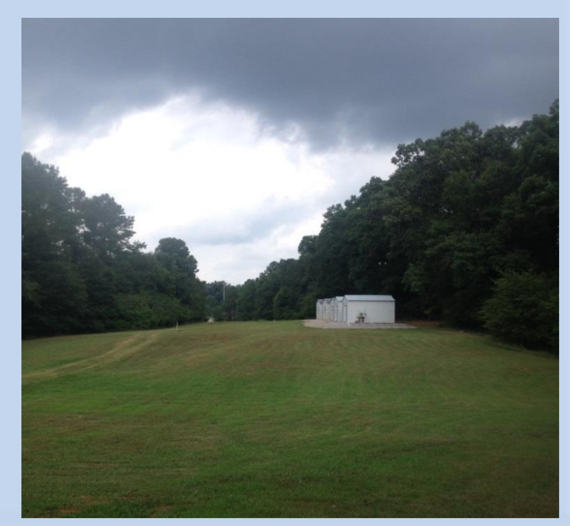
Objectives and Hypotheses

1. **Determine the prevalence of *B. procyonis* in rodents to better understand the ecology of this parasite in Georgia. We hypothesize that multiple rodent species will be infected and that prevalence rates will be lower than those reported from Indiana where the prevalence in raccoons is higher than in Georgia.**
2. **Determine if disturbance impacts *B. procyonis* infection rates. We hypothesize that increased disturbance will increase the prevalence of the parasite.**

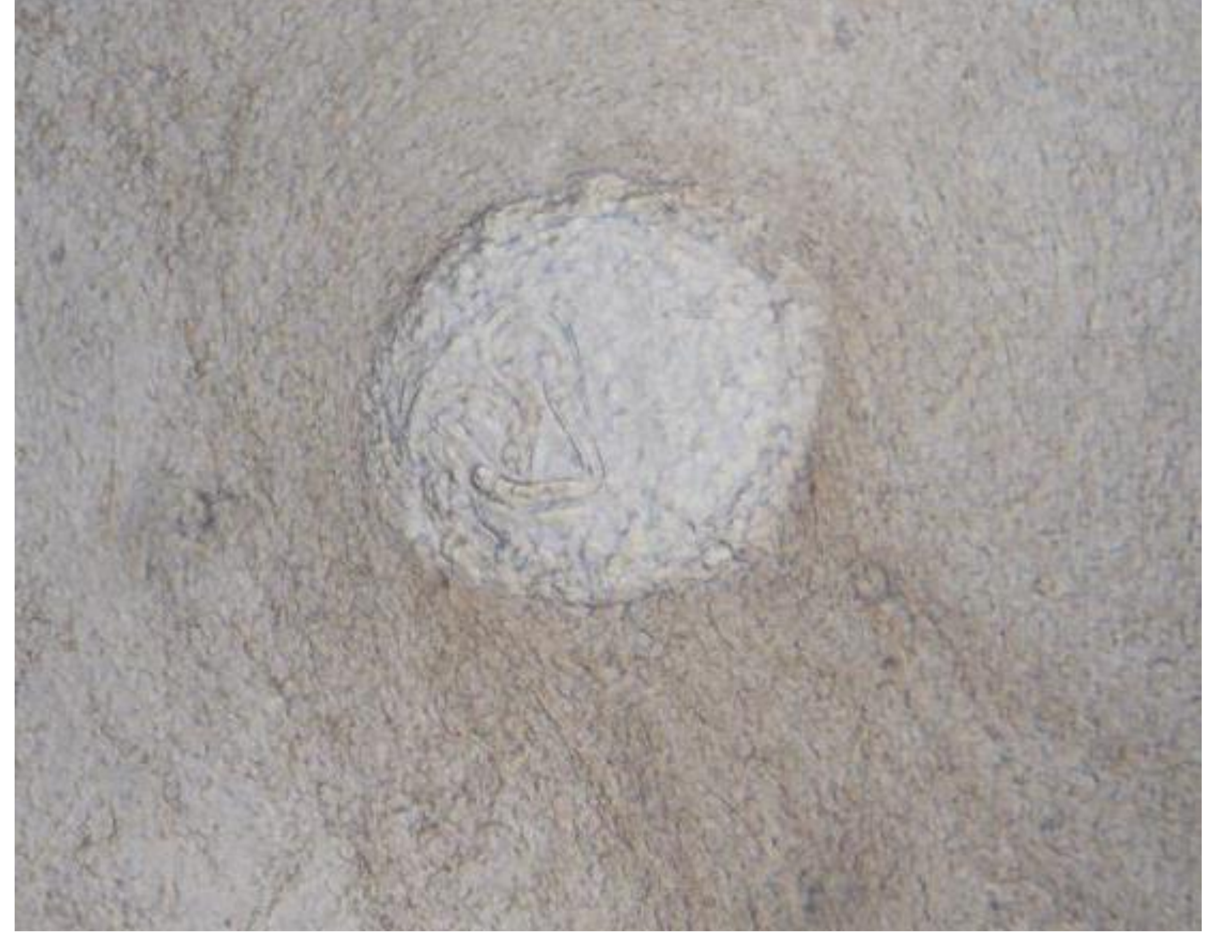
Methods

Rodents were trapped with Sherman traps baited with oatmeal and bird seed at five sites chosen to represent low and high disturbance habitats in Clarke, Oconee, and Jackson Counties in Georgia. Disturbance intensity was designated based on observed forest fragmentation.

Species, weight, and measurements were determined and recorded. Rodents were euthanized with isoflurane and exsanguinated via cardiac puncture followed by cervical dislocation. Plasma was separated for future serological testing for *B. procyonis*. Brains were isolated from each rodent and squashed between two glass plates for microscopic identification of larval *B. procyonis* (Page et al. 2008). Gastrointestinal tracts were opened, washed, and added into a blender with remainder of tissues from each skinned rodent. Bodies were blended and digested with 0.3% pepsin/1% HCl at 37°C with gentle stirring. Once digested, contents were microscopically analyzed for *B. procyonis*.



A *B. procyonis* larvae in brain of a white-footed mouse (*P. leucopus*) from Clarke County, Georgia.



Results

Rodents from two sites in Jackson and Clarke counties of Georgia were positive for *B. procyonis* (Table 1). Infections were only noted in *Peromyscus leucopus* which had a range of 1-12 larvae in their bodies and only one had one larvae in the brain (Table 2). No significant difference was noted between prevalence rates in rodents from high or low disturbance sites (p=1.00). Additionally, no significant differences (p=.588) existed between species of rodents.

Table 1: *Baylisascaris procyonis* infection rates in rodents from sites with high and low disturbance in Georgia.

County	Site	Disturbance level	Species	No. positive/No. sampled (%)
Clarke	River Storage	High	*Peromyscus leucopus*	5/37 (14)
			Tamias striatus	0/2
			Sigmodon hispidus	0/2
			P. polionotus	0/2
			Rattus norvegicus	0/1
Clarke	Whitehall	Low	*P. leucopus*	0/12
			S. hispidus	0/1
			P. polionotus	0/1
Clarke	Horticulture Farm	High, agriculture	*P. leucopus*	0/1
Jackson	Bear Creek	Low	*P. leucopus*	2/14 (14)
			*Rattus spp.**	0/3
Oconee	Rose Creek	High, agriculture	*P. leucopus*	0/8
			S. hispidus	0/7

*juveniles. Species will be confirmed by PCR and sequence analysis at a later date.

Table 2: Number of larvae per infected *Peromyscus leucopus*.

Site	No. of larvae in brain	No. of larvae in body
R. Storage	1	12
R. Storage	0	4
R. Storage	0	6
R. Storage	0	2
R. Storage	0	5
Bear Creek	0	1
Bear Creek	0	1

Conclusions

1. *B. procyonis* has only been recently reported in raccoons from Georgia and our study confirmed that infections are present in wild, clinically-normal *P. leucopus*. This is the first report of infected wild, clinically-normal rodents outside of Indiana.
2. Only *P. leucopus* were infected; however, low sample sizes for other rodent species limits the significance.
3. We documented *B. procyonis* in Jackson County for the first time.
4. No difference in prevalence between high and low levels of disturbance was observed, but additional study of this is warranted.
5. Because this parasite causes disease in numerous avian and mammalian hosts, wildlife with neurologic disease should be considered suspects for *B. procyonis* infection.

Discussion

Our study confirmed that rodents in Georgia are infected with *B. procyonis,* even though the prevalence of *B. procyonis* in raccoons is low (10-12%, Eberhard et al., 2003; Blizzard et al., 2010). The lower infection rate among rodents compared with previous studies in similar habitats in Indiana was expected because of the difference in prevalence among raccoons in Indiana compared with Georgia (Kellner et al., 2012; Beasley et al., 2013). However, rodents were infected which confirms that the parasite is not being maintained by raccoons alone and provides additional data on the role of wild, clinically -ormal rodents as intermediate hosts of this parasite.

Previous studies found that areas with high disturbance had higher rates of infection with *B. procyonis*. Although we found no differences in prevalence due to disturbance, we had a small sample size (n=14) for the low disturbance site due to poor trapping success. This study could be improved by replicating it at multiple sites with varying levels of disturbance.

Importantly, we detected infections in Jackson County which represents a new distribution report. Future studies could include testing raccoons at all of the sites to confirm the presence or absence of *B. procyonis*. Additionally, no work has been done to determine if there is variation in parasite prevalence in rodents based on season. Finally, infection of wild healthy rodents has only been reported for *P. leucopus,* but additional work is needed to evaluate if other rodent species can maintain asymptomatic infections with *B. procyonis*.

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