Transactions of the Illinois Academy of Science
(1987), Volume 80, 1 and 2, pp. 119-127

HELMINTHS OF *PEROMYSCUS LEUCOPUS, P. MANICULATUS,* AND *BLARINA CAROLINENSIS* FROM SOUTHERN ILLINOIS

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ABSTRACT

Helminths were recovered from 12 (12%) of 100 deer mice (*Peromyscus maniculatus*) and 26 (24%) of 109 white-footed mice (*P. leucopus*) collected in 16 counties of southern Illinois. Helminths from deer mice included *Choanotaenia peromysci* (7.0%), *Hymenolepis bennetti* (2.0%), *Postharmostomum helicis* (1.0%), *Physaloptera* sp. (1.0%), *Rictularia coloradensis* (1.0%) and *Moniliformis clarki* (1.0%). *Hymenolepis bennetti* (1.8%), *Physaloptera* sp. (4.6%), and *Rictularia coloradensis* (20.0%) occurred in white-footed mice. *C. peromysci* and *R. coloradensis* revealed a high degree of host-specificity and along with *Physaloptera* showed some degree of habitat dependence. Infection rates were highest during the summer. Thirteen (65%) of 20 southern short-tailed shrews (*Blarina carolinensis*) were infected with *Cryptocotylepis anthocephalus* (40.0%), *Brachylaima thompsoni* (20.0%), *Panopistus pricei* (15.0%), *Capillaria* sp. (15.0%), *Porrocaecum ensicaudatum* (10.0%) and *Porracaecum* sp. (10.0%).

INTRODUCTION

It is well known that the deer mouse, *Peromyscus maniculatus*, is host to a large number of parasites, many of which infect other rodents. Grundmann and Frandsen (1959, 1960) have shown that *P. maniculatus*, with its wide distribution and omnivorous diet, is responsible for distributing parasites to all habitats and localities. Where parasitic species are not host specific, deer mice maintain and spread them

to isolated and restricted populations of other rodent species. Geographic distribution records of the helminths of *P. maniculatus* in North America prior to 1953 have been summarized in four reports by Doran (1954a,b; 1955a,b) and continued thereafter up to 1967 by Dyer (1969).

Although the biology and habitat of *Peromyscus maniculatus* and the white-footed mouse, *P. leucopus* in southern Illinois have been investigated, information on their helminth fauna is lacking. It is of zoological interest to have a knowledge of the parasitic fauna of wild mammals in any region. A survey of the helminth parasites of these rodents may provide insight to parasitism in other rodent populations as well. Further, a comparison of the helminth fauna of these species with that of the southern short-tailed shrew, *Blarina carolinensis*, which is sympatric throughout most of the range of *Peromyscus* in southern Illinois, could add to our knowledge of parasitic distribution in this region. Finally, *Peromyscus* is known to harbor the larval stage of *Echinococcus multilocularis*, the etiological agent of hydatid disease in humans. An examination of these species for this tapeworm would contribute to our knowledge of the geographic distribution of this parasite in the contiguous United States.

MATERIALS AND METHODS

A total of 209 mice, including 100 *Peromyscus maniculatus* and 109 *P. leucopus*, trapped in 16 counties in southern Illinois, was examined for helminths (Figure 1). Sixty-one mice were collected from a reclaimed strip-mine site in St. Clair County during March and November, 1983, and March and April, 1984, while 148 mice were collected from old-field habitats from May through December, 1985 in counties south of and including Franklin, Gallatin, Hamilton, Perry, and Randolph. Accompanying the latter sample were 20 *Blarina carolinensis*. Species of *Peromyscus* were differentiated on the basis of body color, degree of bicoloration of the tail, length of tail relative to body size, and length and width of the hind foot.

Trematodes, cestodes, and acanthocephalans were fixed in alcohol-formalin-acetic acid solution (AFA) and stored in 70% ethanol until staining. Specimens were stained with either Grenacher's alcoholic borax carmine or Harris' hematoxylin, dehydrated, cleared in beechwood creosote and mounted in Canada balsam. Nematodes were fixed in steaming acetic alcohol, cleared in glycerine and studied in temporary mounts. Liver tissue was fixed in AFA, embedded in paraffin, sectioned on a microtome at 8 u, stained with hematoxylin-eosin, and examined for the presence of hydatid cysts.

Notations for deposited specimens of helminths are: USNM Helm. Coll. for the United States National Museum Helminthological Collection, United States Department of Agriculture, Beltsville, Maryland.

RESULTS AND DISCUSSION

Twelve (12%) of 100 *Peromyscus maniculatus* and 26 (24%) of 109 *P. leucopus* were infected with one or more species of helminths, including one species of trematode, two species of cestodes, two species of nematodes, and one species of acanthocephala. The prevalence, mean intensity, and range of each parasite recovered are listed in Table 1.

One of 7 *P. maniculatus* infected with *Choanotaenia peromysci* contained 20 tapeworms so tightly packed in the small intestine that mechanical blockage proba-

bly restricted normal activity of this organ. Hansen (1950) reported a similar situation involving an infection of a prairie vole, *Microtus ochrogaster*, with *Choanotaenia nebraskensis*. *C. peromysci* has previously been reported in *P. maniculatus* from Minnesota (Erickson, 1938), Nebraska (Hansen, 1950), Alberta (Lubinsky, 1957), and Colorado (Leiby, 1961). Its occurrence in *P. maniculatus* in southern Illinois constitutes a new locality record. Representative specimens have been deposited in USNM Helm. Coll., No. 79091. It was not detected in any of the 109 *P. leucopus* examined.

An analysis for host specificity revealed a significant difference ($\chi^2 = 7.88$, $P<0.01$) between hosts for *Choanotaenia peromysci* (Table 2). Of the two habitats investigated, reclaimed strip-mine and old field areas, *C. peromysci* was found only in deer mice from strip-mine areas (Table 3), indicating that perhaps strip-mines provide a more suitable environment for the intermediate host. Because the food habits of *P. maniculatus* and *P. leucopus* are similar, it appears probable that the latter would also be infected with this tapeworm had it also been collected from the same area. However, white-footed mice prefer more mature habitats and are rarely if ever taken on newly reclaimed areas. Perhaps experimental infection is needed to resolve the question of host specificity.

The other tapeworm detected in this study was *Hymenolepis bennetti* which occurred in low incidence in both *P. maniculatus* and *P. leucopus* (Table 1). Our specimens match the description of this tapeworm given by Freeman (1960) for specimens found in the woodland jumping mouse (*Napaeozapus insignis algonquinensis*) from Ontario. This parasite was detected in animals trapped from both strip-mine and old field areas (Table 3). Neither habitat nor host species appeared to have an effect on the prevalence of *H. bennetti*. Either the intermediate host (probably a beetle) has a wide geographic distribution, two or more intermediate hosts occur in different habitats, or both. Further, *H. bennetti* does not appear to be host specific to either species of *Peromyscus* (Table 2). This tapeworm in *Peromyscus* in southern Illinois constitutes a new locality record. Representative specimens have been deposited in USNM Helm. Coll., No. 79092.

Postharmostomum helicis was the only fluke detected. A single specimen was recovered in the caecum of one *P. maniculatus* (Table 1) trapped in an old-field area (Table 3). This trematode is infrequently reported from populations of *Peromyscus*. Southern Illinois constitutes a new locality record. The specimen has been deposited in USNM Helm. Coll., No. 79089.

Larvae of *Physaloptera* sp. were recovered from both species of *Peromyscus* (Table 1). Larvae of *Physaloptera* have previously been reported in deer mice from Colorado by Dyer and Olsen (1967). No significant difference in host specificity was detected (Table 2). Infections were found in only those mice trapped in old field habitats.

Rictularia coloradensis was recovered from the small intestines of both *P. maniculatus* and *P. leucopus*. It has previously been reported in *Peromyscus* sp. from North Carolina (Harkema, 1936), Maryland and Wisconsin (Tiner, 1948), Arizona (Kruidenier and Peebles, 1957), Utah (Grundmann and Frandsen, 1959, 1960; Frandsen and Grundmann, 1961), and Idaho (Leiby, 1962). Only mice collected from old field habitats were infected. *Rictularia coloradensis* appears to be both host-specific (Table 2) and habitat dependent (Table 3). Southern Illinois constitutes a new locality record. Representative specimens have been deposited in USNM Helm. Coll., No. 79094.

Monoliformis clarki was the only acanthocephalan detected. A single specimen was found in the small intestine of one *P. maniculatus*. This species has previously been reported in *P. maniculatus* from Utah (Grundmann and Frandsen, 1959, 1960; Frandsen and Grundmann, 1961) and Colorado (Leiby, 1961).

The number of mice infected with each helminth per season (Table 4) and the percent of mice infected during spring, summer, and winter (Figure 2) shows a certain degree of seasonal variation, with infection rates being highest in the summer. Food items available to *Peromyscus* vary from season to season. Those that serve as intermediate hosts for the helminths (i.e., beetles, roaches, snails) are more available in the summer and early fall. Hence, the prevalence of infections should be highest during this period.

Helminths recovered from 20 *Blarina carolinensis*, their prevalences, mean intensities, and ranges are given in Table 5. One species of cestode, two species of trematodes, and three species of nematodes were detected. Thirteen (65%) of the 20 *B. carolinensis* were infected with at least one species of helminth, all of which constitute new locality records for southern Illinois.

Cryptocotylepis anthocephalus was found in 8 shrews. It has previously been reported from the northern short-tailed shrew (*Blarina brevicauda*) in Ohio (Oswald, 1958), North Carolina (Miller et al., 1974), Iowa (Wittrock and Hendrickson, 1979), Connecticut (Huffman and Penner, 1981), and Pennsylvania (Barker and McNair, 1984). Representative specimens have been deposited in USNM Helm. Coll., No. 79090.

Brachylaima thompsoni was found in four shrews. Representative specimens have been deposited in USNM Helm. Coll., No. 79087. The other species of fluke detected was *Panopistus pricei* which included 18 individuals in a single shrew. Representative specimens have been deposited in USNM Helm. Coll., No. 79088. Both species have been reported in *Blarina brevicauda* from Ohio (Oswald, 1958), North Carolina (Miller et al. 1974), Iowa (Wittrock and Hendrickson, 1979), Connnecticut (Huffman and Penner, 1981), and Pennsylvania (Barker and McNair, 1984).

Capillaria sp. was detected in the urinary bladder of 3 shrews. Because of the poor condition of the specimens, the specific epithet could not be ascertained. *Capillaria* sp. has been reported from *Blarina brevicauda* in Ohio (Oswald, 1958), North Carolina (Miller et al., 1974), Iowa (Wittrock and Hendrickson, 1979), and Connecticut (Huffman and Penner, 1981).

Third stage larvae of *Porrocaecum ensicaudatum* were found in the intestines of 2 shrews, while in 2 others, *Porrocaecum* sp. third stage larvae were found encysted in the mesenteries. *Porrocaecum* sp. has been reported from *Blarina brevicauda* in Ohio (Oswald, 1958), North Carolina (Miller et al., 1974), Connecticut (Huffman and Penner, 1981), and Pennsylvania (Barker and McNair, 1984). Representative specimens of *P. ensicaudatum* have been deposited in USNM Helm. Coll., No. 79093.

Results of this investigation suggest that the two species of *Peromyscus* and *Blarina carolinensis* possess different helminth faunas. Low sample size for the shrew precluded meaningful comparisons, however.

Larvae of *Echinococcus multilocularis* were not detected in this study, possibly because of low sample size. This parasite has been reported in mammals from northern Illinois by Ballard and Vande Vusse (1983).

ACKNOWLEDGMENTS

We thank Charles Paine, Todd Fink and Bob Massey for help in collecting specimens. Most specimens were collected in conjunction with a study of golden mouse distribution funded by the Illinois Department of Conservation.

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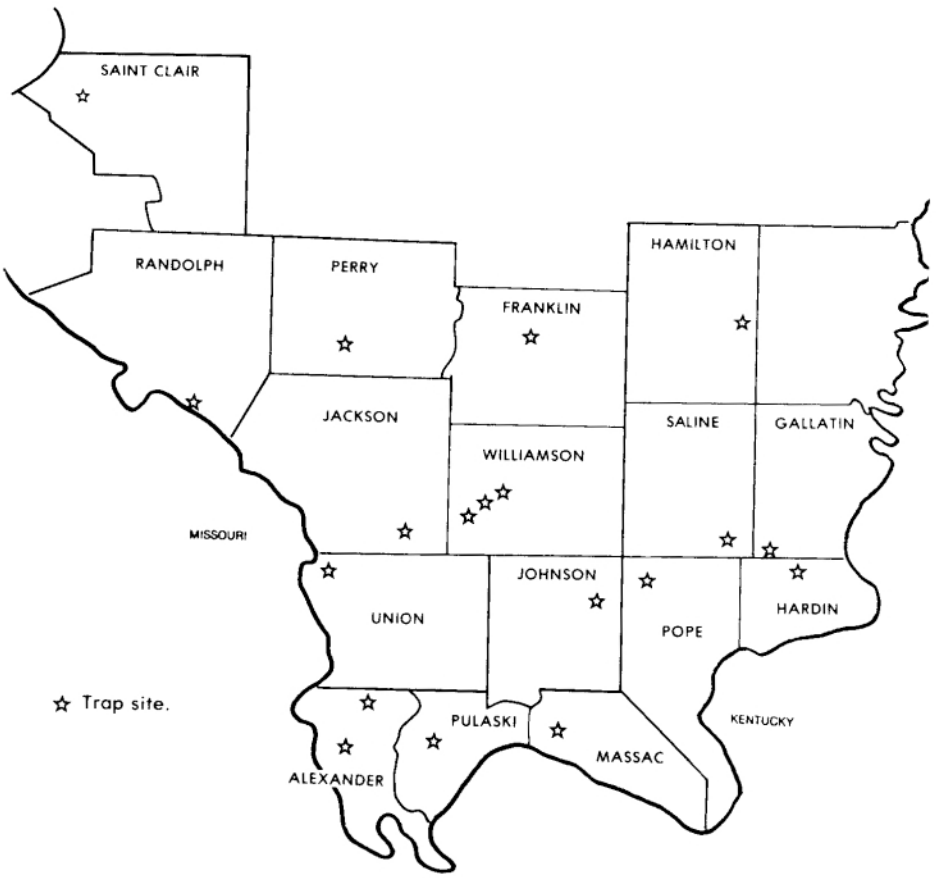

Fig. 1. Trap site locations for *Peromyscus leucopus* and *P. maniculatus* collected in southern Illinois from 1983 through 1985.

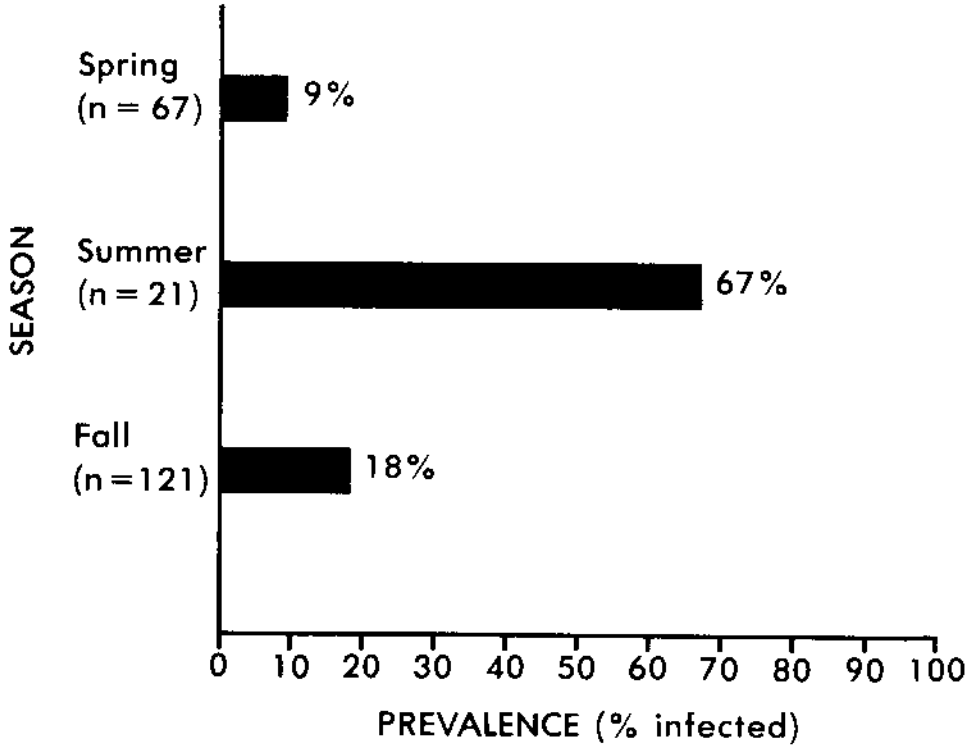

Fig. 2. Seasonal prevalences of helminths of *Peromyscus leucopus* and *P. maniculatus* collected in southern Illinois from 1983 through 1985.

Table 1. Helminths recovered from 100 *Peromyscus maniculatus* and 109 *Peromyscus leucopus* collected between 1983 and 1985 from southern Illinois.

	% infected		$\bar{X}$ intensity		range	
	P.M.	*P.L.*	*P.M.*	*P.L.*	*P.M.*	*P.L.*
CESTODA						
Choanotaenia peromysci	7.0	0.0	0.35	0.00	0-20	0
Hymenolepis bennetti	2.0	1.8	0.05	0.03	0-3	0-2
TREMATODA						
Postharmostomum helicis	1.0	0.0	0.01	0.00	0-1	0
NEMATODA						
Physaloptera sp.	1.0	4.6	0.01	0.65	0-1	0-35
Rictularia coloradensis	1.0	20.0	0.01	0.48	0-1	0-7
ANCANTHOCEPHALA						
Moniliformis clarki	1.0	0.0	0.01	0.00	0-1	0

Table 2. Host specificity for helminths found in *Peromyscus maniculatus* and *Peromyscus leucopus* collected between 1983 and 1985 from southern Illinois.

	χ^2
CESTODA	
Choanotaenia peromysci	7.88*
Hymenolepis bennetti	0.01
NEMATODA	
Physaloptera sp.	2.40
Rictularia coloradensis	19.59*

*significant at $p<0.01$

Table 3. Habitat effect on occurrence of helminths found in *Peromyscus maniculatus* and *Peromyscus leucopus* from southern Illinois collected between 1983 and 1985.

	Reclaimed strip-mine	Old-field	
	P.M. (n = 61)	*P.M.* (n = 39)	*P.L.* (n = 109)
CESTODA			
Choanotaenia peromysci	+*	−**	−
Hymenolepis bennetti	+	+	+
TREMATODA			
Postharmostomum helicis	−	+	−
NEMATODA			
Physaloptera sp.	−	+	+
Rictularia coloradensis	−	+	+
ACANTHOCEPHALA			
Moniliformis clarki	+	−	−

* (+) = parasite found
** (−) = parasite not found

Table 4. Seasonal variation in occurrence of helminths from *Peromyscus maniculatus* and *Peromyscus leucopus* collected in southern Illinois between 1983 and 1985.

	Spring (n = 67)*	Summer (n = 21)	Fall (n = 121)
CESTODA			
Choanotaenia peromysci	3	0	4
Hymenolepis bennetti	2	1	1
TREMATODA			
Postharmostomum helicis	0	0	1
NEMATODA			
Physaloptera sp.	0	4	2
Rictularia coloradensis	0	9	14
ACANTHOCEPHALA			
Moniliformis clarki	1	0	0

*n = number of *Peromyscus* collected per season

Table 5. Helminths detected in 20 *Blarina carolinensis* collected from southern Illinois during 1985.

	% infected	X intensity	range
CESTODA			
Cryptocotylepis anthocephalus	40.0	1.6	0-15
TREMATODA			
Brachylaima thompsoni	20.0	0.6	0-5
Panopistus pricei	15.0	1.1	0-18
NEMATODA			
Capillaria sp.	15.0	0.3	0-2
Porrocaecum ensicaudatum	10.0	0.6	0-10
Porrocaecum sp.	10.0	3.3	0-62