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HELMINTH FAUNA OF WATERFOWL IN CENTRAL OKLAHOMA[1]

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Abstract: Free-ranging waterfowl wintering in and migrating through central Oklahoma were collected and examined for intestinal helminths. Seventy-one ducks, including mallards *(Anas platyrhynchos),* American widgeons *(Anas americana),* blue-winged teal *(Anas discors),* and green-winged teal *(Anas crecca)* were examined; 64 (90.1%) harbored one or more species of metazoa. Six cestodes, 6 trematodes, 6 nematodes, and 1 acanthocephalan were identified. An experimental, non-flying population of ducks was established and monitored to determine the extent of helminth transmission in central Oklahoma. Seven species of helminths were acquired by the sentinel birds during the study. The significance of the parasites recovered and variations in prevalence and species composition of the infections are discussed as they relate to the life cycles of the parasites and the ecology of the hosts.

INTRODUCTION

Surveys of anatid helminths have been done in many parts of the world,[9,10] including several studies of helminths in migrating waterfowl in Europe and the U.S.S.R.[2,6] Most of the reports from North America have dealt with birds on the northern nesting grounds.[4,5,13] Information about the prevalence of helminths in migrating and wintering waterfowl is scarce[3,4,11,15] and none is available for Oklahoma. This paper reports on the helminths recovered in central Oklahoma from four species of free-ranging ducks as well as the implications of the helminth infections acquired by an experimental, non-flying population of ducks.

MATERIALS AND METHODS

Seventy-one free-ranging ducks were collected in Payne County, Oklahoma and examined for intestinal helminths. Ducks were trapped with a rocket net between March, 1976 and April, 1977. Freshly killed waterfowl were examined at necropsy; the alimentary tract was removed, separated into component parts, opened, and examined for parasites. Infections were recorded by prevalence (percentage of infected ducks) and intensity (average number of helminths per infected duck).

Cestodes, trematodes, and acanthocephalans were fixed in warm alcohol-formalin-acetic acid, stained with Semichon's acetocarmine, cleared in xylene, and mounted in Permount. Nematodes were fixed in hot 70% ethanol, cleared in lacto-phenol, and studied in temporary mounts. Nomenclature of the parasites follows McDonald.[9] Data were analyzed by the chi-square test or analysis of variance. Representative specimens have been

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deposited in the National Parasite Collection, Beltsville, Maryland and specimen numbers appear in Table 1.

An experimental population of pinioned ducks was established on a 100-ha impoundment to determine the extent of helminth transmission on winter habitat. Incubator-hatched, 1 day-old mallard ducklings, provided by Max McGraw Wildlife Foundation, were reared under laboratory conditions for 8 weeks. Prior to release, 12 randomly selected birds were examined at necropsy and were found to be free of helminth infections.

Ducks were released periodically onto the study area between June and September, 1976, and a stable population of approximately 60 birds was present throughout the study. The sentinel ducks were free to move about the lake and mix at will with free-ranging waterfowl. Ducks were examined periodically over a span of 6 months to determine if they became parasitized.

RESULTS AND DISCUSSION

Free-ranging Ducks

Nineteen species of helminths were recovered from the four species of ducks examined (Table 1). Helminths were present in 64 of the 71 ducks (90.1%). This value is comparable to the prevalence of infection in other species of dabbling ducks in other areas of North America.[4,11,13] The prevalence of infection for each host species varied: American widgeon *(Anas americana)*, 100%; mallard *(Anas platyrhynchos)*, 95.6%; green-winged teal *(Anas crecca)*, 84.2%; blue-winged teal *(Anas discors)*, 83.3%. However, the chi-square test revealed no significant difference in the prevalence of infection among the four host species ($x^2=3.36$, $P>0.05$).

Trematode infections occurred in 47.8% of the free-ranging ducks. Cestodes were recovered from 72.4% of the birds and were the most frequently encountered parasites. Acanthocephalans and nematodes were less prevalent, occurring in 20.3% and 26.1% of the ducks, respectively. Surveys from other locations have shown similar results.[3,4,8]

Infected birds harbored an average of 8.4 helminths, but there was considerable variation in the number of parasites recovered from individuals (range, 1-47). Variation was also apparent when the intensity of the infections was examined for each host species. American widgeons collected in the fall harbored infections of the greatest intensity (14), while infections of the lowest intensity occurred in blue and green-winged teal collected in the spring (6.5 and 3.2, respectively). Mallards collected from mid-October to mid-March harbored 11.7 helminths per bird. When mallards were separated into spring and fall collected birds, a small sample size resulted preventing seasonal comparison.

Comparison of helminth diversity from ducks collected in this study and those collected in other areas suggested that seasonal variations in helminth populations exist. Blue-winged teal and green-winged teal collected in the summer in Eastern Canada harbored 21 and 23 species of helminths, respectively.[13] Similarly, blue-winged teal collected in the summer at Delta, Manitoba were parasitized by 20 species of helminths.[5] Blue-winged teal and green-winged teal collected in the spring during this study yielded 5 and 7 species of helminths, respectively. Data from cinnamon teal *(Anas cyanoptera)* and shovelers *(Anas clypeata)* collected in the spring and fall in southwest Texas also suggested seasonal differences among species of parasites, prevalence, and intensity.[3,15] Buscher reported that the magnitude and diversity of helminth infections in the gadwall *(Anas strepera)*, pintail *(Anas acuta)*, and shoveler was greatest on the nesting ground, reached a peak in August and an annual low in winter and early spring.[4]

TABLE 1. Helminths recovered from free-ranging ducks in central Oklahoma.

Helminths (USNM No.)	Mallard	American widgeon	Green-winged teal	Blue-winged teal	Total % infected
Trematoda					
Echinostoma revolutum (74948)	*9/23(39.1)	2/11(18.2)	—	5/18(27.8)	22.5
Zygocotyle lunata (74949)	6/23(21.6)	4/11(36.3)	4/19(21.0)	—	19.7
Tracheophilus cymbius (74950)	3/23(13.0)	—	4/19(21.0)	—	9.8
Apatemon gracilis (74946)	2/23(8.7)	—	2/19(10.5)	—	5.6
Hypoderaeum conoideum (74947)	1/23(4.3)	—	—	—	1.4
Psilochasmus oxyuris	—	1/11(9.1)	—	—	1.4
Cestoda					
Cloacotaenia megalops (74945)	17/23(73.9)	4/11(36.3)	11/19(57.9)	13/18(72.2)	63.4
Fimbriaria fasciolaris (74944)	3/23(13.0)	—	2/19(10.5)	—	7.0
Hymenolepis sp.	2/23(8.7)	3/11(27.3)	—	—	7.0
Diorchis longiovum (74941)	1/23(4.3)	—	—	—	1.4
Microsomacanthus compressa (74943)	1/23(4.3)	—	—	—	1.4
Dicranotaenia coronula (74942)	1/23(4.3)	—	—	—	1.4
Acanthocephala					
Corynosoma constrictum (74940)	2/23(8.7)	5/11(45.4)	3/19(15.8)	4/18(22.2)	19.7
Nematoda					
Tetrameres crami (74939)	7/23(30.4)	1/11(9.1)	4/19(21.0)	2/18(11.1)	19.7
Echinuria uncinata (74937)	3/23(13.0)	3/11(27.3)	—	—	8.4
Epomidiostomum uncinatum (74938)	—	3/11(27.3)	—	2/18(11.1)	7.0
Amidostomum sp. (74936)	—	1/11(9.1)	—	—	1.4
Heterakis dispar	—	1/11(9.1)	—	—	1.4
Microfilariae	**6/280(2.1)	—	1/49(2.0)	—	1.2

*Birds infected/birds examined (%).
**Blood films from 280 mallards and 49 green-winged teal were examined for microfilariae in an associated study.

Seasonal variation in parasite prevalence and diversity can be correlated with changing food habits of the migratory host as well as the longevity of the adult parasites. Mallards, pintails and American widgeons depend on native aquatic vegetation during the summer, but rely heavily on waste grain and cultivated crops during fall migration and on the wintering ground.[1] This change in diet may result in the natural loss of some helminths, as well as affecting the possibility of acquiring new infections.

Helminth Transmission in Oklahoma

Fourteen sentinel mallards were collected from late October to mid-March. Twelve (85.7%) were infected with one or more helminths, comprising seven species (Table 2). Six of the seven species also were found frequently in the free-ranging waterfowl. *Diorchis bulbodes* was the only parasite recovered from the sentinel birds and not from the wild ducks.

Trematodes were the most abundant helminths found, with 78.6% of the ducks harboring one or more species. *Zygocotyle lunata* and *Echinostoma revolutum* comprised the majority of the infections.

Diarchis bulbodes was found in one of the experimental birds. The nematodes and acanthocephalans were each represented by a single species. *Tetrameres crami* infected 7 of 14 birds while *Corynosoma constrictum* occurred in one duck.

Two birds harbored infections with *Cloacotaenia megalops*. McDonald[9] recorded *Cypris pubera* as the only intermediate host of this common tapeworm, and indicated that this ostracod is active only during the spring months. The two birds were released onto the lake in July, 1976 and were examined in early February, 1977. These circumstances indicate that this intermediate host may be active in late summer or fall as well as spring, or that *C. megalops* is capable of utilizing another intermediate host. In view of the frequency with which this parasite is found in wild birds, the latter seems more likely.

Possible periods of infection were difficult to determine due to the difficulty of capturing the sentinels at regular intervals. However, 103 birds were released in September and four were captured before spring. All four were parasitized and five species of helminths were recovered. *D. bulbodes, Z. lunata, E. revolutum,* and *T. crami* were present in two birds released in mid-September and collected in late October, while *Z. lunata, T. crami,* and *C. constrictum* were recovered from two birds released in late September and collected in mid-March.

TABLE 2. Prevalence and intensity of helminth parasites recovered from 14 non-flying sentinel mallards.

Helminths	# ducks infected	%	Mean intensity	Range
Trematoda				
Zygocotyle lunata	10	71.4	2.0	1-3
Echinostoma revolutum	2	14.3	1.5	1-2
Apatemon gracilis	1	7.1	1.0	1
Cestoda				
Cloacotaenia megalops	2	14.3	1.0	1
Diorchis bulbodes	1	7.1	13.0	13
Acanthocephala				
Corynosoma constrictum	1	7.1	1.0	1
Nematoda				
Tetrameres crami	7	50.0	1.8	1-5

The mean intensity for all helminths recovered from the sentinel ducks was lower than that from free-ranging waterfowl (3.8 vs. 8.4). Several factors could account for the lower intensity of infection observed in the sentinel birds, including the seasonal constraints of the study and the fact that the birds were restricted to one locale.

Several helminths recovered from the sentinel ducks are known or hypothesized to utilize a variety of copepod and amphipod crustaceans as intermediate hosts,[9,14] and some of these crustaceans are able to serve as intermediate hosts for more than one species of helminth. Twelve species of helminths were recovered from *Gammarus lacustris* from one location in Canada.[7] At least 13 species of helminths are known to utilize *G. pulex* as an intermediate host, and a number of helminths are able to use several species of *Gammarus*.[7] Gammarids are common inhabitants of aquatic vegetation and population densities reach 10,000/m^2 in certain places.[12] In Oklahoma, half of the sentinel ducks collected were infected with *Tetrameres*, which relies upon *Gammarus fasciatus* for transmission. The presence of this amphipod indicates that transmission of other helminth species may be possible in Oklahoma, particularly when other helminths using *Gammarus* were recovered from wild ducks using the area.

Significance of Parasitic Infections in Waterfowl in Oklahoma

The manifestations of parasitic infection are most often seen on the nesting ground where competition for nest sites and increased reproductive activity place the greatest demands on the birds. The key to maintaining healthy, productive waterfowl populations may, however, be on the wintering areas. Recent management practices have enhanced the potential for transmission of parasites on the wintering ground by altering wintering areas for many species of ducks. Most refuges along the migration route provide waterfowl foods and habitat that are attracting increasing numbers of ducks and geese. Populations that previously dispersed over a wide geographic range now concentrate in localized areas, and remain for longer periods of time.

Even though the intensity of the infections in migrating and wintering waterfowl observed in this study and other similar studies was low, this study has shown that helminth acquisition on wintering areas is possible. Management decisions designed to hold and concentrate wintering waterfowl, with attendant overcrowding, may seriously contaminate wintering habitat and directly influence the health of subsequent waterfowl populations.

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