THE HELMINTHS IN THE DIGESTIVE TRACT OF THE MALLARD AND PINTAIL IN SOUTHERN MANITOBA

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by

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ABSTRACT

This study was designed to identify the parasites of the mallard and pintail in southern Manitoba and to examine the role of these parasites in the regulation of the host populations.

The Delta marsh was the centre of the study during 1967-1968. One hundred and one mallards and 100 pintails were examined for helminths. The average helminth burden in the mallards was 243 per bird and 189 in the pintails. Mallards harboured an average difference of 56 helminths per bird more than pintails. The following kinds of helminths were recovered: Cestoda, five genera containing five species; Trematoda, seven genera with seven species; Nematoda, six genera with seven species; and Acanthocephala, two genera with two species. Both birds are host to a similar helminthfauna but the mallards have a greater intensity of infection than pintails. Similar foods were found in the crops of both species. The mallard may be more susceptible to parasitism than the pintail. The helminths in the host duck caused neither emaciation of the breast muscles nor a weight loss. The effects of the parasites in times of stress could be greater on mallards than pintails.

The parasite fauna of the canvasback was similar to that of mallards and pintails but the numbers were greater in the former.

The helminthfauna variability is just as great within each of these host species as between the two closely related hosts.

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INTRODUCTION

The decline in the number of mallard (Anas platyrhynchos platyrhynchos L.) and pintail (Anas acuta L.) ducks in Manitoba since 1957 has focused new attention on these once common species. This attention reveals a paucity of information on most aspects of their life history. Their parasitic fauna is relatively unknown and here may lie some factors that could contribute to the decline of these economically important birds.

Relatively little is known of the parasitic fauna of our wildlife and our knowledge is incomplete regarding the effects of almost all such parasites on wildlife. It is well known that few individual animals of any species are completely free from parasites. Some parasites produce abnormal conditions in the host animal though many others have not yet been linked with any diseased condition. Hosts in apparently good health usually have fewer parasites than those in a less healthy state. On the other hand, sick hosts may not support any helminths. A fundamental problem in parasitology is the accurate assessment of the physical condition of the bird. This is essential if any relationships are to be concluded concerning the effect of kinds and numbers of parasites on the health of the host.

The dabbling ducks, Anas platyrhynchos platyrhynchos and Anas acuta, occupy much the same habitat and have a number

of similar habits. The canvasback, Aythya valsineria L. is a diving duck and is found primarily in the pothole country of southern Manitoba, a habitat which differs considerably from the area in which the mallards and pintails were collected. Cornwell (1966) investigated the parasite fauna of the canvasback.

A comparison of the helminth fauna of these birds therefore permits one to examine two reciprocal aspects of a principle enunciated by a current school of Russian helminthologists; namely, that the habitat and food habits of any species determine its parasitic fauna. These three ducks belong to two different genera. Two prime differences relative to this program are (i) the area inhabited by the mallards and pintails collected in this study differs considerably from the areas where Cornwell collected his canvasbacks in Manitoba and (ii) the mode of feeding of the canvasback is quite different from that of mallards and pintails. Since A. platyrhynchos and A. acuta occupy similar niches, the hypothesis that they will have a similar parasite fauna can be examined. The differences in the canvasback's habitat and method of feeding enables one to examine the hypothesis that the canvasbacks will have a dissimilar helminthfauna. This fauna could differ in two possible ways, (i) the number and types of species and (ii) the total helminth burden.

The objectives of this study are four-fold:

(i) to determine what helminths are present in the digestive tract of the mallard and pintail in southern Manitoba.

(ii) to determine whether helminths are causing any emaciation of the pectoral muscles.

(iii) to determine whether the helminthfauna of dabbling ducks is significantly different from that of diving ducks.

(iv) to determine whether the helminthfauna is of greater variability within a host species than between two closely related host species.

REVIEW OF LITERATURE

A Review of Helminths Found in the Anatidae

General

The published works on the helminths of waterfowl are too extensive to summarize here. Therefore, this review will be concerned solely with the parasites of the better known members of the family Anatidae. McDonald (1965a) presented a useful bibliography and a list of anatid hosts and their parasites (1965b). Examination of the literature revealed an emphasis on morphological descriptions of parasites (eg. Cannon, 1938) with little attention to incidence and to pathology of helminth infections.

More ecological studies have been conducted in eastern Europe and the U.S.S.R. than in the western hemisphere, especially North America. Cornwell (1966) attempted to elucidate some factors involved in host-parasite relationships of anatid helminths in a study on the canvasback, Aythya valsineria L. in Manitoba.

Kinds of Surveys

Helminth surveys of waterfowl vary; some deal with one particular species in a number of hosts, while others discuss a particular class of helminth and its occurrence in one or several host species. Still others deal with all classes of helminths in one, two or many hosts.

I believe that the last type of survey is the most informative, and also fulfills the responsibility of a researcher to obtain the most information from the least number of birds, especially in view of dwindling waterfowl numbers.

Incidence of Helminth Infections

The occurrence of parasites in waterfowl is expressed usually in one of three ways: (i) as a ratio of infected to non-infected in terms of either a numerical or a percentage ratio; (ii) as the total number of parasites in either a single host or a number of hosts; (iii) as the mean number of parasites per host. This is usually an arithmetic mean. Unfortunately, some authors have not presented their data clearly and interpretation of these data is difficult (eg. Morgan, 1939).

The chief objection to the first method is that if nearly all of the ducks are parasitized, then comparisons of the ratios are not productive. This has resulted in authors using either method (ii) or (iii). Method (iii) would be more valuable if an error were given as this would give a concept of the parasite distribution. Method (ii) is commonly known as extensity and method (iii) as intensity.

Most of the North American and European data which were reviewed are summarized in Tables I and II. Several observations can be made. Sample sizes vary considerably but are

TABLE I

NORTH AMERICAN SURVEYS OF HELMINTHS IN THE ANATIDAE

Author	Location	Host Types	No. Examined	Percentage Infected or (Av./Bird)	Percentage Birds Infected or (Av./Bird) Cestoda	Trematoda	Nematoda	Acanthocephala	Comments
O'Roke (1928)	California	M*	134	40.3	-	-	-	-	Extremely low percentage infected
Gower (1938)	Michigan	M	104	80.5	-	-	-	-	Gives seasonal percentages for 11 genera
Morgan (1939)	Oregon	M	140	-	-	-	-	-	Data cannot be summarized
McNeil (1948)	Washington	M	62	80.6	62.9	45.2	0	17.7	
Warren (1956)	Idaho	S	25	-	-	-	-	-	Gives percent infected for each helminth species
Town (1960	Michigan	M	100	100	88	99	90	4	Gives percent infected with each helminth species
Hanson and Gilford (1961)	Illinois	M	639						Viscera of Canada Geese only
Buscher (1965a)	Manitoba	M	500	94 in August	91% in August	56% in Spring	33% in August	65% in August	Does not give overall percent infected for each helminth class-just when maximums occurred
Cornwell (1966)	Manitoba	S	7	(1322)	(1202)	(83)	(37)	(<1)	Marshes
Cornwell (1966)	Manitoba	S	23	(715)	(525)	(176)	(19)	(<1)	Potholes
Cornwell (1966)	Manitoba	S	6	(85)	(21)	(16)	(48)	(1)	Moulting lakes
Cornwell (1966)	Manitoba	S	3	(12)	(5)	(2)	(6)	(0)	Migrating birds with different food habits
Cornwell (1966)	Manitoba	S	180	Of the 250,817 helminths recovered, 78% were cestodes, 18.3% trematodes, 3% nematodes, and 0.1% acanthocephalans.					

*M - many hosts
S - single host

TABLE II

EUROPEAN AND U.S.S.R. SURVEYS OF HELMINTHS IN THE ANATIDAE

Author	Location	Host Types	No. Examined	Percentage Infected Or (Av./Bird)	Percentage Birds Infected Or (Av./Bird) Cestoda	Trematoda	Nematoda	Acanthocephala	Comments
Bezubik (1956a)	Poland	M*	278	73	58	23	9.0	33.0	
Ryzhikov(1956a)	U.S.S.R.	M	44	100	90.7	83.7	79.1	7.0	Breeding Grounds
Ryzhikov(1956b)	U.S.S.R.	M	26	100	84.6	69.3	92.3	11.5	Wintering Grounds
Okorokov(1957)	U.S.S.R.	M	173	90.7	84.0	24.0	17.0	35.0	
Wiśniewski(1958)	Poland	M	277	<100	Most Characteristic Of Area	Second Most Characteristic Of Area			

*M - many hosts

usually more than 100 per species except in specialized studies. Where parasitism by helminth classes is given, most records reveal the presence of four classes: Cestoda, Trematoda, Nematoda and Acanthocephala. Approximately 80% of all birds harbour cestodes and 60% trematodes. Nematode infection rates vary, with some authors reporting low percents and others high ones. Generally, the acanthocephalans are found in approximately 30% of the anatids from North America and about 20% of those from Europe and Russia.

Extensity of Parasitism

Extensity is the percent of individuals infected with a particular helminth class or species (Buscher 1965b). It is often used to show differences in seasonal parasitism or in parasitism of various hosts. For example, Gower (1938), used extensity of infection to study the seasonal abundance of 11 genera of helminths from wild ducks (Table III) in Michigan.

TABLE III

SEASONAL AND TOTAL PERCENTAGES OF INFECTION
(Gower, 1938)

Genus	Spring	Summer	Fall	Winter	Total
Amphimerus	11.7	11.6	2.0	30.0	8.6
Cotylurus	5.9	27.0	41.0	10.0	28.0
Echinostoma	35.0	27.0	39.0	50.0	42.0
Maritrema	5.9	0	2.0	30.0	4.8
Prosthogonimus	17.5	0	27.0	20.0	18.3
Typhlocoelum	17.5	3.8	12.0	0	9.6
Zygocotyle	17.5	23.0	4.0	10.0	11.0
Fimbriaria	5.9	65.0	21.0	40.0	31.0
Hymenolepis	47.0	57.0	61.0	60.0	57.0
Tetrameres	11.7	31.0	4.0	10.0	12.5
Filicollis	5.9	3.8	12.0	0	7.7

As mentioned above extensity data are used to show differences in parasitism of various hosts. O'Roke (1928) examined 10 species of waterfowl from California and found only 40.3% parasitized (Table I). This low percentage does not agree with other studies. In one instance, he reported 42 of 43 ducks from one area to be free of helminths. This suggests either a nonrepresentative sample of hosts and/or inadequate necropsy procedures.

Another use is to show different rates of parasitism for different hosts. Table IV gives Town's (1960) extensity data for diving ducks on the Detroit River. No single parasite species was found in all the ducks. With the exception of a single bird which harboured only one species of parasite, several species were found in the hosts. Town's data as seen in Table I are unusual in that the extensity for cestodes ranked third after trematodes and nematodes.

Table V summarizes the extensity of helminth infections from Druzno Lake in Poland found by Wiśniewski (1958). This example shows little difference between host species.

Cornwell (1966) discussed the incidence of helminths in various organs of canvasbacks. His tabulated data show the percent infection and the mean difference in male and female birds: males harbour fewer parasite than females.

An obvious conclusion is that seasonal variations in extensity occur for both classes and species of parasites. Some species attain maximums in the spring, others in summer and

TABLE IV

PERCENTAGE AND NUMBER OF DIVING DUCKS
INFECTED WITH HELMINTHS FROM THE DETROIT RIVER
(TOWN, 1960)

(% Infected (No.))

Species	L	G	C	E	D	Total(%)
No. Examined	52	15	22	8	3	100
Echinostomidae	100(52)	86(13)	95(21)	75(6)	66(2)	94
Zygocotyle lunatum (Dies.,1836) Stunkard 1917	86(45)	100(15)	68(15)	0(0)	0(0)	75
Cotylurus flabelliformis (Faust 1917) Van Haitsma, 1931	40(21)	40(6)	63(14)	37(3)	0(0)	44
Schistosomidae	40(21)	40(6)	63(14)	37(3)	0(0)	44
Typhocoelum cymbium (Dies.,1850)	44(23)	33(5)	50(11)	50(4)	0(0)	43
Eucotyle wehri Price,1930	21(11)	40(6)	36(8)	12(1)	0(0)	26
Notocotylus imbricatus (Looss,1893) Szidat,1935	11(6)	6(1)	8(2)	50(4)	0(0)	13
Amphimerus elongatus Gower,1938	13(7)	0(0)	4(1)	25(2)	0(0)	10
Ribeiroia ondatrae (Price,1931)	2(1)	0(0)	0(0)	62(5)	66(2)	5
Tetrameres crami Swales,1933	0(0)	0(0)	0(0)	37(3)	66(2)	5
Amidostomum sp.	78(41)	67(10)	63(14)	50(4)	33(1)	70
Capillaria sp.	57(30)	67(10)	86(19)	75(6)	33(1)	66
Hymenolepididae	73(38)	60(9)	27(6)	12(1)	33(1)	55
Hymenolepis sp.	94(49)	73(11)	91(20)	12(1)	66(2)	83
Fimbriaria sp.	6(3)	13(2)	27(6)	25(2)	0(0)	13
	17(9)	0(0)	4(1)	0(0)	0(0)	10

L-lesser scaup, G-greater scaup, C-canvasback, E-common goldeneye, D-common merganser

TABLE V

EXTENSITY OF HELMINTH INFECTIONS IN ANATIDAE FROM POLAND (Wiśniewski, 1958)

Species	No. Examined	Percent Infected
Anas platyrhynchos	61	93
Aythya nyroca	23	100
Anas querquedula	14	100
Anas strepera	4	100
Aythya fuligula	1	100
Aythya ferina	6	100

autumn and some in the winter.

Intensity of Parasitism

Intensity is the number of helminths present in or the average number of helminths per individual (Buscher,1965b).

Cornwell (1966) discussed the intensity of helminth infections in the canvasback. He concluded that female canvasbacks carry greater helminth burdens than males. This is interesting in view of the fact that adult sex ratios among North American ducks usually favors the drake (Bellrose et al, 1961).

Table VI summarizes McNeil's (1948) work in Eastern Washington with regards to intensity. As most nematodes in waterfowl are tissue dwellers, McNeil's record of no nematodes suggests inadequate necropsy procedures. If mallards are excluded concrete conclusions are difficult because of the small sample sizes for the other species. In mallards, the

higher cestode burden compared to other helminth classes agrees with the literature. McNeil found a maximum of 206 helminths in a given host.

TABLE VI

INTENSITY OF HELMINTH INFECTIONS IN ANATIDS FROM WASHINGTON (McNEIL,1948)

Host Species	No. Examined	Mean Trematodes per Bird	Mean Cestodes per Bird	Mean Acanths. per Bird
Mallard	38	8	11	1
Pintail	3	0	67	1
Redhead	3	9	13	0
Green Winged Teal	3	0	1	0
Baldpate	1	0	0	0
Gadwall	1	0	0	0
Canvasback	1	18	0	0
Teal*	2	38	22	14
Coot	4	1	0	4
Canada Goose	5	1	1	0

*immature male, either blue winged or cinamon teal

Wiśniewski (1958) found in Poland that approximately four times as many cestodes were recovered as trematodes. Table VII summarizes the intensity of infection of each helminth class from Wiśniewski's work. The relative frequencies of infection with all helminth classes agree with the literature.

From the literature discussed in this section it is apparent that the intensity of infection with cestodes generally exceeds that of any other helminth class.

Special Parasite Surveys

The types of parasite surveys conducted on waterfowl were

TABLE VII

INTENSITY OF HELMINTH INFECTIONS IN ANATIDS
FROM POLAND
(Wiśniewski, 1958)

Host Species	No. Examined	Cestoda av./bird	Trematoda av./bird	Nematoda av./bird	Acanthocephala av./bird
Anas platyrhynchos	61	406	19	0	5
Aythya nyroca	23	410	88	0	<1
Anas querquedula	14	79	1	0	0
Anas strepera	4	7	22	0	0
Aythya fuligula	1	888	10	0	6
Aythya ferina	6	90	15	0	1

discussed earlier. This section briefly reviews some of the more important studies on particular classes of parasites.

Cestoda: Table VIII summarizes some of the known data. In cestode surveys of waterfowl one would expect at least 50% of the birds examined to harbour cestodes. Members of the family Hymenolepididae are the most common cestodes. Within this family, the genus Hymenolepis is the most frequent one encountered.

Schiller (1951) examined 184 specimens (18 species) of Anseriformes collected in the North Central States for cestodes. Schiller's finding that over a thousand tapeworms in a single host was not unusual is significant as his observations were based on 18 host species. As many as six species of a genus occurred simultaneously in a given individual host.

Korpaczewska (1963) published one of the few papers giving extensity and intensity data for each tapeworm species encountered in waterfowl from three Polish lakes.

Town (1960) found that members of the family Hymenolepididae were predominant. The intensity of infection ranged from one to 38,000 with a mean of 6,431 for the Hymenolepididae excluding Hymenolepis megalops (Creplin, 1829). Twelve percent of eight common goldeneyes were infected with cestodes; much lower than the usual 66% of the other ducks.

Buscher's work (1965a) showed an extensity of 50% or greater in bluewinged teal, shovellers and pintails at three collecting sites (Table VIII). Juvenile birds were more heavily infected than adult birds. This agrees with the literature.

Cornwell (1966) found that 78.6% of all the helminths recovered from 180 canvasbacks were cestodes. Three quarters of these were found in the small intestine. Cornwell's data on location of parasites in the digestive tract are difficult to summarize, but cestodes comprised well over 50% of the total helminths found in the gizzard, duodenum and small intestine and approximately 50% of those in the cloaca.

Schiller's data (1953) on Aleutian teal (Anas crecca L.) in Alaska showed cestode infections to be relatively light ranging from one to 25 per bird. His work on four species of eiders (1955) showed that the percent infection ranged from 58.4 to 86.6.

TABLE VIII

CESTODE SURVEYS OF THE ANATIDAE AS SUMMARIZED FROM THE LITERATURE

Author	Location	Host Types	No. Examined	Percent Parasitized with Cestodes	No. of Genera	Cestodes Species	Maximum No. of Parasites Per Host	Mean No. of Parasites Per Host	Range	Comments
Schiller (1951)	North Central States	M	184	63	5	34	1,680	-	-	Up to six species of same genus in one host
Korpaczewska (1963)	Poland	M	128	90	15	25	1,414	-	1-1,414	Gives extensive tables for intensity and extensity
Town (1960)	Michigan	M	100	88	2	Many	38,000	6,431 for Hymenolepididae	1-38,000	
Buscher (1965a)	Manitoba	M	278	91 (August)			-	294	-	
	Gulf Coast		82	50 (Winter)	16	27	-	4	-	
Cornwell (1966)	Manitoba	S	180	-						Percentages given for each area of host
	Michigan				4	?	-	-	-	
Neufeld (1954)	Manitoba	M	7 species	-	4	16	-	-	-	
Schiller (1953)	Alaska	S	20	80	3	4	-	-	1-25	Aleutian Teal
Schiller (1955a)	Alaska	S	116	59	3	5	-	-	-	Old Squaw Duck
Schiller (1955b)	Alaska	1 Genus 4 Species	93	68	6	13	-	-	-	Eider Ducks
Heck* (1958)	Washington	M	232	56	1	1	27	-	-	Interested in only one Cestode

*Study of Gastrotaenia cygni
M - many hosts
S - single host