Reprinted from

Canadian Journal of Zoology

Helminths from the digestive tracts of mallards and pintails in the Delta Marsh, Manitoba

V. F. J. CRICHTON AND H. E. WELCH

Volume 50 • Number 5 • 1972

Pages 633–637

Published by The National Research Council of Canada

Helminths from the digestive tracts of mallards and pintails in the Delta Marsh, Manitoba

V. F. J. CRICHTON[1] AND H. E. WELCH
Department of Zoology, University of Manitoba, Winnipeg, Manitoba
Received October 4, 1971

CRICHTON, V. F. J., and H. E. WELCH. 1972. Helminths from the digestive tracts of mallards and pintails in the Delta Marsh, Manitoba. Can. J. Zool. **50**: 633–637.

At least five species of cestodes, seven of trematodes, seven of nematodes, and two of acanthocephalans were found in *Anas platyrhynchos platyrhynchos* (L.) and *Anas acuta* (L.). Male and female adult and juvenile mallards harbored greater numbers of worms than did pintails. Adult females of both species had greater numbers of helminths per bird than did males. In addition, juvenile birds harbored greater numbers of parasites than did adults. The parasitic faunas of the two surface-feeding ducks, mallard and pintail, differed quantitatively despite their common habits. These differences were not a reflection of different diets but the suspicion is that mallards are more susceptible to parasitism than pintails. No serious cases of helminthiasis were found in the 101 mallards and 101 pintails examined in 1967 and 1968.

CRICHTON, V. F. J., et H. E. WELCH. 1972. Helminths from the digestive tracts of mallards and pintails in the Delta Marsh, Manitoba. Can. J. Zool. **50**: 633–637.

L'examen de canards *Anas platyrhynchos platyrhynchos* (L.) et *Anas acuta* (L.) a révélé la présence de plusieurs parasites: au moins cinq espèces de cestodes, sept de trématodes, sept de nématodes et deux d'acanthocéphales. Les adultes, mâles et femelles, et les jeunes de mallards abritent plus de parasites que les canards pilets. Chez les deux espèces, les femelles adultes contiennent plus d'helminthes, en moyenne, que les mâles. Par ailleurs, les jeunes contiennent plus de parasites que les adultes. Les deux espèces de canards, mallard et pilet, se nourrissent en surface, mais en dépit de ces habitudes communes, les faunes qui les parasitent diffèrent quantitativement. Ces différences ne sont pas dues à des diètes différentes, mais semblent indiquer que les mallards sont plus susceptibles au parasitisme que les canards pilets. De 101 canards mallards et 101 canards pilets examinés en 1967 et 1968, aucun ne présentait de cas grave d'helminthiase.

Introduction

The decline in numbers of mallards (*Anas platyrhynchos platyrhynchos* (L.)) and pintails (*Anas acuta* (L.)) in Manitoba since 1957 has focused attention on these once common species. Their parasites are relatively unknown and may be a factor in their decline. Both birds are among the most common waterfowl nesting in the Delta Marsh along the southern shore of Lake Manitoba (Hochbaum 1944). They share many habits and are frequently together in spring migrating flights, loafing sites, and stubble flights (Sowls 1955). Kortright (1943) recorded instances of interbreeding. Animals occupying similar niches and closely related phylogenetically should have similar parasitic faunas. The occurrence of both ducks in the Delta Marsh permitted an examination of this question, and of the role of parasites in duck populations.

Materials and Methods

Ducks were shot, aged, sexed, weighed, and examined externally and internally for abnormalities, parasites, and gross parasitic lesions. The keel–sternum (K. S.) ratio (emaciation index of Cornwell 1966) was measured as an indicator of the birds' physical condition. The depth of the pectoral muscle was measured in millimeters at a point 2.5 cm from the anterior and 1.0 cm to the right of the keel. This was divided by the height of the ventral edge of the keel above the sternum at the same point. The K. S. ratio varied from 0.4 to 1.1.

Parasites and any gross lesions caused by them were located by an examination of the digestive tract using a dissecting microscope. Cestodes, trematodes, and acanthocephalans were killed in 2% magnesium chloride and fixed in F. A. A. (formaldehyde – acetic acid – alcohol) under pressure. Cestodes and trematodes were stained in Ehrlich's acid alum haematoxylin and mounted in permount. Nematodes were killed and relaxed in 0.5% acetic acid, fixed in T. A. F. (triethanolamine – formalin – distilled water), processed by Baker's rapid method (Goodey 1963) and mounted in glycerin. Samples of each helminth species were mounted for identification. Hymenolepids were not identified beyond genus with the exception of *Hymenolepis megalops* (Nitzsch in Creplin, 1829) Parona, 1899. Some identifications were checked against the collection of Dr. M. McDonald, Bear River Research Station, Utah.

Observations and Discussion

Sixty-eight adult male and 19 adult female mallards plus seven juvenile males and seven

[1]Present address: Department of Zoology, University of Guelph, Guelph, Ontario.

juvenile females were examined. The corresponding figures for the pintails were 56, 24, 7, and 13, respectively. Mean and standard error of the weights in grams for adult male mallards were 1244 ± 17 and 1099 ± 26 for females, and for adult male pintails 924 ± 9 and 836 ± 18 for females. The mean K. S. ratio of male mallards was 0.90 ± 0.01 and of females 0.93 ± 0.03, and that of male pintails was 0.86 ± 0.02 and of females 0.89 ± 0.02.

TABLE 1

Helminths recovered from mallards and pintails and the prevalence of each species, Delta Marsh, 1967 and 1968

	Mallards				Pintails			
	Adults		Juveniles		Adults		Juveniles	
	♂	♀	♂	♀	♂	♀	♂	♀
Sample size	68	19	7	7	56	24	7	13
Helminth species								
Cestoda								
Hymenolepis spp.	60	17	7	7	47	19	7	13
H. megalops (Creplin, 1829)	34	7	4	2	31	14	5	7
Diorchis nyrocae Yamaguti, 1935	44	11	6	5	5	5	6	12
Gastrotaenia cygni Wolffhügel, 1938	39	8	1	1	33	13	2	5
Fimbriaria fasciolaris (Pallas, 1781) Wolffhügel, 1899	29	9	6	3	18	9	3	6
Ligula intestinalis Linnaeus, 1758	1	0	0	0	0	0	0	0
Trematoda								
Echinostoma revolutum (Froelich, 1802)	16	4	3	5	11	8	0	2
Echinoparyphium sp.	26	12	3	4	6	6	4	7
Zygocotyle lunata (Dies., 1836) Stunkard, 1916	25	10	5	3	15	6	1	1
Cotylurus flabelliformis (Faust, 1917) van Haitsma, 1931	9	4	3	2	9	0	3	4
Notocotylus attenuatus (Rud., 1809) Kossack, 1911	12	4	1	5	16	12	7	8
Hypoderaeum conoideum (Bloch, 1782) Dietz, 1908	9	4	1	1	3	4	2	3
Nematoda								
Echinuria uncinata (Rud., 1819) Soloviev, 1912	2	1	4	4	1	0	0	2
Capillaria contorta (Crepl., 1839) Travassos, 1915	13	2	0	1	9	6	0	0
Capillaria sp.	15	5	5	3	6	4	3	10
Amidostomum anseris (Zeder, 1800) Railliet and Henry, 1909	48	17	7	7	15	5	2	5
Epomidiostomum uncinatum (Lundahl, 1848) Seurat, 1918	24	7	5	5	14	2	0	0
Streptocara crassicauda (Creplin, 1829) Skrjabin, 1916	6	3	1	0	0	1	0	0
Tetrameres crami Swales, 1933	29	12	5	3	30	17	4	9
Acanthocephala								
Corynosoma constrictum (Van Cleave, 1918)	18	>0	>0	>0	19	>0	>0	>0
Polymorphus sp.	20	>0	>0	>0	14	>0	>0	>0

Kinds of Helminths Recovered

A minimum of 21 helminth species were recovered from mallards and 20 from pintails (Table 1). Most of the hymenolepid cestodes were not identified to species. In addition, Table 1 indicates which helminth species were found in each group of ducks and the proportion of the group infected with the various species.

This study adds three nematode species, *Streptocara crassicauda*, *Capillaria contorta*, and *Tetrameres crami*, and one cestode species, *Gastrotaenia cygni* to the list of helminths recovered from Manitoba's mallard and pintail populations by Neufeld (1954) and Buscher (1965).

Warren (1956) carried out a similar study on mallards from Idaho and recovered 17 species of helminths. The Delta material had two more cestode species, *G. cygni* and *Fimbriaria fasciolaris*; three more nematode species, *Amidostomum anseris*, *Echinuria uncinatum*, and *S. crassicauda*; but four fewer trematode species than the Idaho ducks. Different flyways may explain this difference. Schiller (1951) found nine and six cestode species in mallards and pintails, respectively, from Ohio, Michigan, and Wisconsin, but his identification of 11 species of *Hymenolepis* is the chief reason for the difference.

Number of Helminths Recovered

The parasite fauna of each duck comprised several species. In mallards and pintails the minimum number of helminth species found was 2 and 1, respectively, while the maximum was 12. Table 2 indicates the total number of helminths recovered from each host. A minimum of 1 and a maximum of 4223 helminths were found in the necropsy of individual birds. A significant difference was observed with a *t*-test in parasite burden between juvenile mallards and juvenile pintails, between adult males of both species, and between adult females of both species. Mallards had significantly more worms than did pintails. In both species, female ducks harbored approximately 140 more helminths per bird than did males. The sample size of juveniles was not large enough to draw a concrete conclusion concerning the correlation of parasite burden to the sex of juvenile birds.

Prevalence, Seasonal Occurrence, and Host Migration

The prevalence of helminth infections is high (Table 2) and is higher than that reported from a variety of waterfowl from North America (McNeill 1948; Town 1960; and Buscher 1965), the U.S.S.R. (Ryzhikov 1956*a*, *b*; Okorokov 1957), and Poland (Bezubik 1956; and Wiśniewski 1958).

Our observations on seasonal variation confirmed the findings of Johnson (1920), Gower (1938), Bezubik (1956), and Buscher (1965). Cestodes reached maximum numbers in adult mallards in August and in adult pintails in July. Trematodes occurred in nearly equal numbers in mallards during June, July, and August while the peak in pintails occurred in July. Nematodes reached maximum numbers in both hosts during May and acanthocephalans during July in mallards and August in pintails.

TABLE 2

Total number of helminths recovered and prevalence of infection in mallards and pintails, Delta Marsh, 1967 and 1968

	Sample size	Cestoda		Trematoda		Nematoda		Acanthocephala		Total No.
		No.	Pre. %	No.	Pre. %	No.	Pre. %	No.	Pre. %	
Mallards										
Adult	68	9543	99	800	77	424	91	266	40	11 033
	19	4601	100	593	95	158	100	207	37	5 559
Juvenile	7	2611	100	234	100	617	100	22	86	3 484
	7	4056	100	230	86	195	100	10	29	4 491
Pintails										
Adult	56	1523	96	383	71	206	75	199	45	2 311
	24	3147	96	703	88	107	92	158	46	4 115
Juvenile	7	6093	100	312	100	26	72	319	100	6 750
	13	5902	100	350	85	118	93	15	31	6 385

NOTE: Pre. % = prevalence of infection in percent.

In July 1967 the range of numbers of helminth species in the samples was 3–12 in mallards, and 2–8 in pintails. In August, adult and juvenile mallards and pintails showed a range of parasite species per host of 4–12. In September the number of species in adult and juvenile mallards ranged from 4–12 while for pintails it was 4–10. In spring 1968, newly arrived male mallards had 2–11 parasitic species and pintails 1–6, but by May the ranges for each bird were closer, namely, 3–11 and 3–9, respectively. No conclusion can be drawn, for samples were small, two years of migration were involved, and no other hosts were examined.

Comparison of Helminth Faunas of Mallards and Pintails

One would expect that *A. platyrhynchos* and *A. acuta*, so closely related phylogenetically (Delacour and Mayr 1945) and ecologically, would have a similar helminth fauna. The species of parasites are similar in both hosts, but are greater in number in mallards than pintails, throughout the spring, summer, and autumn. Mallards also appear to enter the Marsh with more parasites than do pintails. This difference is true no matter which sex is considered. Juvenile mallards had a heavier burden than juvenile pintails. In general, juvenile birds had more helminths than did adults.

The intriguing question is why two birds so closely related and collected in the same area differ so much quantitatively in their parasite burden. This difference is pronounced when the mean number of helminths from males of both species is examined. The mean burden of 68 male mallards was 162 ± 39 while that of the 56 male pintails was 41 ± 6. This difference is even harder to explain when the food of these birds was examined. Examination of mallard and of pintail crops revealed that they had consumed similar types and amounts of invertebrate material (Seymour and Welch 1972).[2] The minor differences in the diet cannot explain the difference that was observed in parasite numbers. It seems likely that mallards are more susceptible to parasitism than are pintails; Dr. M. McDonald (personal communication) believes that the mallard is more susceptible to parasitism than the pintail, and our data support this statement. Interestingly, mallards have the longer list of recorded parasites (McDonald 1969*a*, *b*).

In order to determine if other ducks of different basic habits would have similar or dissimilar parasite faunas, a comparison was made of the faunas of mallards and pintails (surface-feeding ducks) with that of canvasbacks, *Aythya valisineria* (Wilson), a diving duck. Cornwell's survey (1966) of the canvasback from the Delta Marsh was of a similar size and type to our survey and was used for comparison.

Mallards and pintails had almost the same intestinal helminths as the canvasbacks. The latter had, in addition, small numbers of *Tetrameres spinosus* (Maplestone, 1931) Wehr, 1933; *Amidostomum skrjabini* Boulenger, 1926; *Ribeiroria* sp.; and *Sphaeridiotrema globulus* (Rud., 1814) Odhner, 1913. The prevalence of helminths in 121 canvasbacks, 101 mallards, and 99 pintails was, respectively: cestodes 78.6, 84.3, and 80.4; trematodes, 18.3, 7.6, and 11.8; nematodes, 3.0, 2.0, and 4.7; and acanthocephalans, 0.1, 6.1, and 3.1.

The most noticeable difference between the three hosts is in the parasitic burden. Adult canvasbacks from the marshes had a mean helminth burden of 1322 ± 1017 per bird whereas mallards and pintails had 191 ± 34 and 80 ± 20, respectively. Canvasbacks have larger and more variable burdens than mallards and pintails. It was also possible to conclude that in the Delta Marsh all three species of hosts show similar patterns of seasonal abundance, females carry greater helminth numbers than males, and that juveniles of all species harbor more helminths than do adults.

Pathogenicity of Parasites

The most common macroscopic effects of the helminths were tissue lesions and partial or complete blockage of the intestinal lumen. *Echinuria uncinata* caused the formation of large nodules in the zone between the proventriculus and gizzard. In some cases these nodules almost perforated the gut wall. Cornwell (1963) reported several uniform symptoms and lesions caused by *E. uncinata*. The prominent keel, poor feather condition, behavioral patterns, and atrophy of the visceral organs reported by Cornwell were not obvious in our specimens. *Amidostomum anseris*, *E. uncinatum*,

[2]Seymour, N., and H. H. Welch. 1972. Stomach analysis of mallards and pintails. Manuscript in preparation.

and *G. cygni* often caused erosion and inflammation of the gizzard wall. The nodules occasionally found on the external surface of the intestine were caused by the embedded probosces of acanthocephalans and in some cases the probosces penetrated into the abdominal cavity. Occasionally, acanthocephalans and (or) cestodes were present in such large numbers that passage through the digestive tract was probably restricted at anatomically susceptible sites.

Attempts were made to determine whether the parasites exerted any chronic effects on their hosts by correlating the K. S. ratio with the number of helminths present. The results of this correlation indicated that the K. S. ratio was independent of the number of helminths present.

Atrophy of breast muscles appears early in the onset of most common avian diseases (Cornwell 1966). Our data did not support this statement with respect to either intestinal helminthic infection or sarcosporidiosis of mallards and pintails. In the case of lead poisoning Crichton (1969) found atrophy of the muscles in birds that were afflicted.

Town (1960) used a Spearman Rank Correlation coefficient test to show that a positive correlation existed between cestode numbers and the weights of ducks, but the r_s value was too small to say that the correlation was conclusive. No correlation was found in the Delta data.

Despite the high numbers of parasites, no serious debilitation was found in the mallard and pintail populations during 1967 and 1968. We agree with Gower (1938) who concluded that only a few helminths are pathogenic to waterfowl and that other helminths may become pathogenic under certain adverse environmental conditions.

Acknowledgments

We express our thanks to Dr. H. A. Hochbaum, Director of the Delta Waterfowl Research Station, for giving freely of his knowledge of waterfowl and for the use of facilities at the Station. Appreciation is extended to the National Research Council of Canada, Grant No. A 2914, the North American Wildlife Foundation, and the Canadian Wildlife Service for financial support.

BEZUBIK, B. 1956. The helminth fauna of wild ducks (subfam. Anatinae). (Summary in English.) Acta Parasitol. Pol. **4**: 407–510.

BUSCHER, H. N. 1965. Dynamics of the intestinal helminth fauna in three species of ducks. J. Wildl. Manage. **29**: 772–781.

CORNWELL, G. W. 1963. Observations on waterfowl mortality in Southern Manitoba caused by *Echinuria uncinata* (Nematoda, Acuariidae). Can. J. Zool. **41**: 699–703.

——— 1966. An ecological reconnaissance of helminth populations in the canvasback (*Aythya valisineria*). Ph.D. Thesis, University of Michigan, Ann Arbor, Michigan.

CRICHTON, V. F. J. 1969. The helminths in the digestive tract of the mallard and pintail in southern Manitoba. M.Sc. Thesis, University of Manitoba, Winnipeg, Manitoba.

DELACOUR, J., and E. MAYR. 1945. The family Anatidae. Wilson Bull. **57**: 3–55.

GOODEY, J. B. 1963. Laboratory methods for work with plant and soil nematodes. Ministry Agric. Fish. Food. Tech. Bull. No. 2.

GOWER, W. C. 1938. Seasonal abundance of some parasites of wild ducks. J. Wildl. Manage. **2**: 223–232.

HOCHBAUM, H. A. 1944. The canvasback on a prairie marsh. Stackpole Co., Harrisburg.

JOHNSON, J. C. 1920. The life cycle of *Echinostoma revolutum* (Froelich). Univ. Calif. Publ. Zool. **19**: 335–388.

KORTRIGHT, F. M. 1943. The ducks, geese, and swans of North America. The American Wildlife Institute, Washington, D.C.

McDONALD, M. E. 1969*a*. Annotated bibliography of helminths of waterfowl (Anatidae). Wildl. Dis. **45**: 1–177. Bur. Sport Fish. Wildl. U.S. Dep. Interior. Fish Wildl. Serv. Special Sci. Rep. Wildl. No. 125. Washington, D.C.

——— 1969*b*. Catalogue of helminths of waterfowl (Anatidae). Bur. Sport Fish. Wildl. U.S. Dep. Interior. Fish Wildl. Serv. Special Sci. Rep. Wildl. No. 126. Washington, D.C.

McNEILL, C. W. 1948. A preliminary survey of parasites of eastern Washington waterfowl. Murrelet, **29**: 2–4.

NEUFELD, N. 1954. A survey of cestodes in birds of Manitoba. M.Sc. Thesis, University of Manitoba, Winnipeg, Manitoba.

OKOROKOV, V. I. 1957. Helminthfauna of wild waterfowl of the Cheylyabinsk district and the seasonal dynamics of the most prevalent diseases caused by them. (In Russian.) Uch. Zap. Chelyabinsk. Gos. Pedagog. Inst. **3**: 177–185.

RYZHIKOV, K. M. 1956*a*. The helminthfauna of anatid birds in the Rybinsk reservoir. (In Russian.) Tr. Gel'minthol. Lab. S.S.S.R. **8**: 112–130.

——— 1965*b*. The helminthfauna of anatid birds in their wintering places. (In Russian.) Tr. Gel'minthol. Lab. S.S.S.R. **8**: 131–139.

SCHILLER, E. L. 1951. The Cestoda of Anseriformes of the North Central States. Am. Midl. Nat. **46**: 444–461.

SOWLS, L. K. 1955. Prairie ducks. Stackpole Co., Harrisburg.

TOWN, R. H. 1960. A survey of helminth parasites in diving ducks found dead on the lower Detroit River. M.Sc. Thesis, University of Michigan, Ann Arbor, Michigan.

WARREN, A. J. 1956. Arthropod and helminth parasites of the mallard duck, *Anas platyrhynchos platyrhynchos* (L.) in northern Idaho. M.Sc. Thesis, University of Idaho, Moscow, Idaho.

WIŚNIEWSKI, L. W. 1958. Characterization of the parasitofauna of an eutrophic lake. Acta Parasitol. Pol. **6**: 1–64.