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SHANE P. MAHONEY AND WILLIAM THRELFALL

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Digenea, Nematoda, and Acanthocephala of two species of ducks from Ontario and eastern Canada

SHANE P. MAHONEY AND WILLIAM THRELFALL

Department of Biology, Memorial University, St. John's, Nfld., Canada A1B 3X9

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Sixty ducks (34 *Anas rubripes*, 26 *Bucephala clangula*), collected at three localities in Ontario and eastern Canada, were examined for helminth parasites. Twenty-three genera of parasites (17 of Digenea, 5 of Nematoda, 1 of Acanthocephala) were recovered. Eighteen of the recoveries represent new host records (11 digeneans, 5 nematodes, 2 acanthocephalans).

Eighty-eight percent of both host species were infected. The number of parasite species per infected bird ranged from 1–9 (mean 4) for *A. rubripes* and 1–7 (mean 2) for *B. clangula*. Preferred age and sex of host and site of infections for each parasite species was noted.

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Soixante canards (34 *Anas rubripes*, 26 *Bucephala clangula*) capturés en trois points de l'Ontario et dans l'Est du Canada ont été examinés. Vingt-trois genres de parasites (17 digéniens, 5 nématodes, 1 acanthocéphale) y ont été recueillis. Dix-huit des parasites constituent des cas nouveaux de parasitisme chez ces hôtes (11 digéniens, 5 nématodes, 2 acanthocéphales).

Le parasitisme atteint 88% des animaux examinés. Le nombre d'espèces de parasites va de 1–9 (moyenne 4) pour *A. rubripes* infecté et de 1–7 (moyenne 2) pour *B. clangula* infecté. Il a été tenu compte, pour chaque espèce de parasite, de la préférence d'âge et de sexe de l'hôte, de même que du site de l'infection.

[Traduit par le journal]

The black duck (*Anas rubripes* Brewster, 1902) and the common goldeneye (*Bucephala clangula* (Linnaeus, 1758)) are two widely hunted species of waterfowl in Ontario and eastern Canada (Cooch and Newell 1977). While a great deal is known about their general biology (Palmer 1976), little is known about their parasite fauna (Gower 1938; Lapage 1961; McDonald 1969*a*, 1969*b*). The present study was undertaken to obtain quantitative data on the helminthofauna of the above-mentioned species. It also presented the opportunity of comparing the parasites of a dabbling duck with those of a diver.

Materials and Methods

The viscera of 60 ducks were collected during the period August–October, 1973–1974 (34 *A. rubripes* Brewster, 1902 (32 from New Brunswick, 2 from insular Newfoundland); 26 *B. clangula* (22 from southern Ontario, 4 from insular Newfoundland)).

All species were aged and sexed by cloacal examination (Kortright 1962) and (or) characters of the plumage.[1] For the purposes of the present study two age classes were recognised: (1) IMM (HY), a bird which was collected in the same calendar year in which it was hatched; and (2) AHY, a bird which was in its second calendar year of life or older.

All material collected was frozen and examined when time permitted. Previously described necropsy techniques, methods of parasite recovery, and procedures employed in the preparation of parasites prior to identification were utilized (Andrews and Threlfall 1975; Turner and Threlfall 1975).

Infections are recorded as prevalence (i.e. percent of birds infected) and intensity (i.e. mean number of helminths per infected bird). Identification of the small numbers of cestodes recovered (88% of *A. rubripes*, 27% of *B. clangula* infected; difference between the two host species is significant ($P < 0.001$)) during the present work fell outside the parameters established for the study and are, therefore, omitted. The cestode fauna of *A. rubripes* in eastern Canada was investigated by McLaughlin and Burt (1973).

Results and Discussion

Thirty-three species of parasites were recovered from the birds examined. Among those collected were 21 species of Trematoda (17 genera), 10 of Nematoda (5 genera) and 2 of Acanthocephala (1 genus). Thirty (88%) of the *A. rubripes* were infected, with 25 helminth species being collected from this host (range 1–9; mean 4 per infected bird (Tables 1 and 2)). Twenty-three (88%) of the *B. clangula* were infected with representatives of 19 helminth species (range 1–7; mean 2 per infected bird (Tables 1 and 2)).

Sixteen species of Digenea were collected from 28 (82%) of the *A. rubripes* examined (range 1–7; mean 4) and 11 from 14 (54%) of the *B. clangula* (range 1–4; mean 2). The range of numbers of Digenea for *A. rubripes* was 2–108 with a mean inten-

[1]Carney, A., and A. Geis. 1964. Preliminary keys, age and sex of duck wings. Unpublished report.

TABLE 1. Details of infections of (A) *Anas rubripes* and (B) *Bucephala clangula* with Digenea

Digenea	Number and percent* infected	Mean No. parasites per infected bird	Range of numbers per infected bird	Location†
Zygocotyle lunata (Diesing, 1836)	(A) 5 (15)	2	1–6	4
	(B) 1 (4)‡	1	1	3
Notocotylus attenuatus (Rudolphi, 1809)	(A) 10 (29)‡	9	1–27	2, 3
	(B) 1 (4)	1	1	2
Typhlocoelum cucumerinum (Rudolphi, 1809)	(A) 2 (6)	1	1–2	7
	(B) — (—)	—	—	—
Eucotyle sp. (*cohni* Skrjabin, 1924?)	(A) — (—)	—	—	—
	(B) 1 (4)	13	13	6
Leucochloridiomorpha constantiae (Mueller, 1935)	(A) 1 (3)	4	4	3
	(B) — (—)	—	—	—
Echinostoma revolutum (Froelich, 1802)	(A) 17 (50)	21	2–82	2, 3
	(B) 7 (27)	8	1–29	2, 3
Echinoparyphium elegans (Looss, 1899)	(A) 8 (24)	11	2–45	2
	(B) — (—)	—	—	—
Echinoparyphium recurvatum (Linstow, 1873)	(A) 8 (24)‡	10	7–21	2, 4
	(B) — (—)	—	—	—
Hypoderaeum conoideum (Bloch 1782)	(A) 5 (15)‡	3	1–10	2
	(B) — (—)	—	—	—
Stephanoprora mergi Cannon, 1938	(A) 2 (6)‡	14	4–24	2
	(B) — (—)	—	—	—
Echinostome sp.	(A) 12 (35)	6	1–14	2, 4
	(B) — (—)	—	—	—
Psilostomum sp.	(A) 4 (12)‡	3	1–7	3
	(B) — (—)	—	—	—
Pseudopsilostoma varium (Linton, 1928)	(A) — (—)	—	—	—
	(B) 4 (15)‡	5	1–6	1
Psilochasmus longicirratus Skrjabin, 1913	(A) 2 (6)	3	2–3	2*a*
	(B) — (—)	—	—	—
Prosthogonimus cuneatus (Rudolphi, 1809)	(A) 5 (15)‡	4	1–18	3, 7
	(B) 1 (4)	1	1	5
Microphallus sp. (*oblonga* Ching, 1960?)	(A) — (—)	—	—	—
	(B) 1 (4)	1	1	2*c*
Metorchis sp.	(A) — (—)	—	—	—
	(B) 2 (8)‡	7	5–8	8
Cotylurus cornutus (Rudolphi, 1808)	(A) 10 (30)‡	13	1–72	2*a*
	(B) 7 (27)	13	1–33	2*a*
Cotylurus erraticus (Rudolphi, 1809)	(A) — (—)	—	—	—
	(B) 1 (4)	15	15	2*a*
Cotylurus flabelliformis (Faust, 1917)	(A) 1 (3)	95	95	2 *a,b*
	(B) — (—)	—	—	—
Cotylurus platycephalus (Creplin, 1825)	(A) 1 (3)‡	1	1	5
	(B) — (—)	—	—	—
Apatemon gracilis (Rudolphi, 1819)	(A) 2 (6)	4	1–6	2
	(B) 4 (15)	12	1–29	2

*Percentage values are in parentheses.
†Number designations: 1, proventriculus; 2, small intestine (*a*, anterior; *b*, mid; *c*, posterior); 3, large intestine; 4, caeca; 5, bursa; 6, kidney; 7, miscellaneous (air sacs); 8, liver.
‡New host record.

sity of 30; *B. clangula* had a range of 1–55 with a mean intensity of 18 Digenea.

Six nematode species were collected from 20 (59%) of the *A. rubripes* (range 1–4; mean 2) and six from 9 (35%) of the *B. clangula* (range 1–4; mean 2). The nematode burden of the former species ranged from 1–29 parasites with a mean intensity of 8, while that of the latter was 1–6 with a mean intensity of 2 parasites.

The majority of the parasites found were species that are common in waterfowl. A few, however, deserve a little more consideration.

Stephanoprora mergi was described from *Mergus merganser* Linnaeus, 1758 in eastern Canada (Cannon 1938), its presence having been noted more recently in *Lophodytes cucullatus* (Linnaeus, 1758) from Ontario (Bain 1976). The present record increases its host range and it may well be that this species is a much commoner parasite than has been indicated in the past (McDonald 1969*b*).

TABLE 2. Details of infections of (A) *Anas rubripes* and (B) *Bucephala clangula* with nematodes and acanthocephala

Parasite species	Number and percent* infected	Mean No. parasites per infected bird	Range of numbers per infected bird	Location†
Capillaria anatis (Schrank, 1790)	(A) 4 (12)	8	2–16	3*c*, 4
	(B) 1 (4)	3	3	3*c*, 4
Capillaria mergi Madsen, 1945	(A) — (—)	—	—	—
	(B) 1 (4)	1	1	3*a*
Capillaria obsignata Madsen, 1945	(A) 1 (3)‡	3	3	4
	(B) — (—)	—	—	—
Capillaria spinulosa (Linstow, 1890)	(A) 8 (24)‡	7	1–20	4
	(B) — (—)	—	—	—
Capillaria sp.	(A) 4 (12)	2	1–5	3, 4
	(B) 1 (4)	1	1	4
Amidostomum acutum (Lundahl, 1848)	(A) 6 (18)‡	6	1–13	2
	(B) 3 (12)	2	1–3	2
Epomidiostomum uncinatum (Lundahl, 1848)	(A) 2 (6)	2	1–3	2
	(B) — (—)	—	—	—
Epomidiostomum crami Wetzel, 1931	(A) — (—)	—	—	—
	(B) 1 (4)‡	1	1	2
Streptocara formosensis Sugimoto, 1930	(A) — (—)	—	—	—
	(B) 2 (8)	1	1	2
Tetrameres fissispina (Diesing, 1861)	(A) 4 (12)	3	1–9	1
	(B) — (—)	—	—	—
Tetrameres ryjikovi Khuan Shen -i, 1961	(A) — (—)	—	—	—
	(B) 1. (4)‡	1	1	1
Tetrameres sp.	(A) 1 (3)	7	7	1
	(B) 3 (12)	1	1–2	1
Polymorphus cucullatus (van Cleave and Starrett, 1940)	(A) 3 (9)‡	2	1–4	3
	(B) 2 (8)‡	2	1–2	3
Polymorphus minutus (Goeze, 1782)	(A) — (—)	—	—	—
	(B) 3 (12)	3	1–7	3

*Percentage values are in parentheses.
†Number designations: 1, proventriculus; 2, gizzard; 3, small intestine (*a*, anterior; *b*, mid; *c*, posterior); 4, caeca.
‡New host record.

Pseudopsilostoma varium was described from *Gavia immer* (Brunnich, 1764), and was recently found in ring-necked ducks (*Aythya collaris* Donovan, 1809) from eastern Canada (Noseworthy and Threlfall 1978). This species, once again, is probably far more common in anatids than previously realized.

The specimens of the *Psilostomum* sp. which were recovered resemble those found recently in *L. cucullatus* (Bain 1976) and appear most similar to *Psilostomum cygnei* Southwell and Kirschner, 1937. However, because of the inadequacy of Southwell and Kirshner's (1937) original description it was not possible to state with certainty that the specimens were *P. cygnei*. Specific identification must await comparative study with the type specimens.

The lone microphallid from *B. clangula* resembles most closely *Microphallus oblonga* (Ching, 1960) from which it differs slightly in the size of its genital papilla.

Fewer nematodes were found than Digenea, with Acanthocephala being the least prevalent group.

The numbers of parasite species found in the two hosts examined during this study closely approximate those found by various other workers (Bishop and Threlfall 1974; Turner and Threlfall 1975).

While the percentage of *A. rubripes* and *B. clangula* infected was the same (88%), the former species had a higher prevalence of infection for 8 of the 9 helminth species common to both hosts. An index of similarity (Holmes and Podesta 1968) revealed that the helminth populations of the two duck species are indeed very similar (index of similarity 76% for all shared species, 72% for digeneans, 86% for nematodes). Figure 1 shows a comparison of profiles of shared helminth species. It reveals that the dominant helminth species in *A. rubripes* is *Echinostoma revolutum*, whereas in *B. clangula* three species (*E. revolutum*, *Cotylurus cornutus*, *Apatemon gracilis*) are almost equally common. Possible reasons for these differences in host parasite burdens are numerous and include such factors as age distribution of the population samples examined and differences in the areas from which the host specimens were obtained.

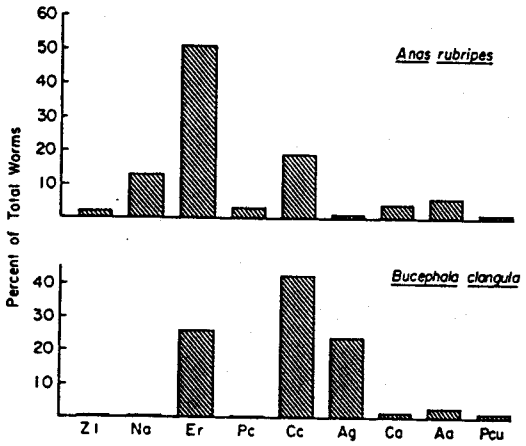

FIG. 1. Comparison of helminth profiles of *Anas rubripes* and *Bucephala clangula*. Zl, *Zygocotyle lunata*; Na, *Notocotylus attenuatus*; Er, *Echinostoma revolutum*; Pc, *Prosthogonimus cuneatus*; Cc, *Cotylurus cornutus*; Ag, *Apatemon gracilis*; Ca, *Capillaria anatis*; Aa, *Amidostomum acutum*; Pcu, *Polymorphus cucullatus*.

In artificial impoundments, as compared with natural areas, there may well be an increased population of intermediate hosts (Whitman 1974). This factor, together with the concentration of definitive hosts, could explain the higher level of parasitism in the *A. rubripes*, 94% of which were collected from the Tintamarre National Wildlife Area. As well, 19 (56%) of the *A. rubripes* were immature birds compared with only 6 (23%) of the *B. clangula*. Immature birds are most frequently infected and have a higher intensity of infection than adults. It has been suggested that this is probably because the young birds have not developed an age immunity to parasite infections (Buscher 1965). Furthermore, it is possible that feeding habits may differ between the age classes, as has been shown for wild ducklings of different species (Collias and Collias 1963) and for different ages of *A. rubripes* (Mendall 1949). The present data suggest immature birds are more frequently infected and have a higher intensity of infection than adults.

The need for an understanding of the parasite fauna of wild anatids is essential in light of man's increased efforts to artificially create wetland areas for the perpetuation and management of waterfowl species. Studies such as the foregoing are important in determining the 'normal' parasite burden of a given host species, and thus allowing us to assess the impact of these organisms on the host, should their numbers increase significantly.

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