# SOME HELMINTH PARASITES OF FRESHWATER BIRDS FROM THE SOUTH ISLAND, NEW ZEALAND, WITH PARTICULAR REFERENCE TO TREMATODES OF DUCKS

SHIRLEY RIND

Department of Zoology, University of Canterbury,
Christchurch, New Zealand

ABSTRACT

The major groups of helminth parasites found in eleven species of freshwater birds of New Zealand are summarised. Thirteen genera of trematodes are listed, none of which has been previously recorded from New Zealand. All genera are cosmopolitan. Families represented are Notocotylidae, Echinostomatidae, Strigeidae, Schistosomatidae, Microphallidae, Psilostomatidae, Cyclocoelidae and Opisthorchiidae. Acanthocephala are also recorded.

Pathogenicity and seasonal variation of trematode infections are discussed.

## INTRODUCTION

There is only passing mention (e.g. Stokell 1936) of the endoparasites of freshwater birds of New Zealand, and, apart from larval schistosomes described by Macfarlane (1949), there is no published account of the life history of a parasite of any indigenous or introduced birds inhabiting New Zealand fresh waters. Considering the subtropical to temperate climate of New Zealand and the existence of life forms capable of disseminating disease associated with helminths, there is a need for more detailed work in this area. This would have particular relevance in assessing threats to native water birds and to the establishment of domestic poultry farms in New Zealand.

During the course of life history studies of echinostomes, it has become obvious that most water fowl species (Table 1) are parasitised by some or all of the major groups of parasites. The following account is fragmentary, but it will serve as an introduction to this hitherto undocumented field.

## SOURCES OF MATERIAL

Birds were collected from sites ranging from Lake Rotoiti, Nelson, in the north to Kaitangata, Otago, in the south, and include the hydro lake, Lake Benmore, the Rakaia River system from Lake Coleridge to the sea, and Banks Peninsula with adjacent rivers and estuaries. Birds were examined post mortem in various conditions, from fresh to partially decomposed. Duck helminths came largely from gut samples and were collected during the shooting season.

Host species were identified (Falla *et al.* 1966) and names follow the nomenclature of the O.S.N.Z. Checklist of New Zealand Birds (1970). As mallards, greys and their hybrids could not be differentiated with certainty (Williams 1970), the term 'wild duck' is used to include all categories.

## METHODS

Where whole birds were collected, the following procedure was followed. To expose the viscera a longitudinal incision was made through the body wall from anus to mouth. The first cut was made medially, beginning in front of the anus and continuing ventrally to the posterior border of the keel. Cuts through the abdominal wall were then continued laterally, exposing abdominal viscera. In the thoracic region, the cut was continued through the ribs on the left side of the animal and the coracoid was severed with bone cutters. The skin was cut to expose organs in the neck. The entire ventral body wall could then be reflected, leaving the heart and related blood vessels *in situ* with air sacs, respiratory system, gut and related organs intact. All structures could then be examined (Giles 1969).

The state of preservation of specimens affected some of the included parasites, e.g. microphallids (0.5 - 1 mm long) were recovered only from birds examined within 24 hours of death. The parasites of birds cooled rapidly (to 10°C in refrigerator) are well preserved. In these conditions the parasites remain alive *in situ* for at least 3-4 days.

Gut contents were sieved (mesh 275 microns aperture was used, but a sieve of mesh 250 microns aperture was required to retain the smaller microphallids and immature forms of other parasites). The residue was diluted with tap water and examined in 90 mm petri dishes, where the parasites were separated and counted.

Cold Bouin's, 70% alcohol, cold Gilson's fluid or hot Gilson's (50-60°C) were used as fixatives. Delafield's haematoxylin was the most universally successful stain although Gower's aceto carmine gave some excellent results.

The following authors were consulted for the identification of parasites: Beverley Burton (1972), Cheng (1964), Dawes (1946, 1970), Dubois (1965, 1968), McDonald (1969), Petrochenko (1958), Skrjabin (1964), Yamaguti (1958) and Young (1938).

## RESULTS

It is noticeable that there is an overall higher rate of infection with cestodes than with any other group of parasite (Table 1). Individual birds often carry high numbers of cestodes (thousands) but trematode infections seldom exceed 50-100 per bird.

Four genera of cestodes, fifteen genera of trematodes, three of nematodes and one acanthocephalan genus with two species were collected. A large number of helminth species were present, most of which are cosmopolitan. Many of the trematodes are of medical and veterinary importance (Keymer *et al.* 1962), and some

TABLE 1. HELMINTH PARASITES OF WATER FOWL FROM THE SOUTH ISLAND OF NEW ZEALAND. PERCENTAGES OF BIRDS INFECTED FROM ALL LOCALITIES 1968-1972

| Host species | Trematodes | Cestodes | Nematodes | Acanthocephala |
|---|---|---|---|---|
| *Mallard (*Anas p. platyrhynchos*), Grey (*Anas s. superciliosa*) and hybrids (292 birds) | 54.45 | 79.79 | 9.25 | 10.95 |
| Feral domestic goose (*Anser anser*) (1 bird, gut only) | Echinostomes and strigeids present | - | - | - |
| *Black swan (*Cygnus atratus*) (12 birds) | 41.72 | 100 | - | - |
| *Canada goose (*Branta canadensis*) (7 birds) | 42.86 | 42.86 | - | - |
| Shoveler (*Anas rhynchotis*) (5 birds) | 80.00 | 20.00 | 20.00 | - |
| Scaup (Black teal) (*Aythya novaeseelandiae*) (6 birds) | 66.66 | 83.33 | - | - |
| Grey teal (*Anas gibberifrons*) (5 birds) | 20.00 | 100 | 60.00 | - |
| Paradise duck (*Tadorna variegata*) (9 birds) | 44.44 | 55.55 | 11.11 | - |
| Bittern (*Botaurus stellaris poiciloptilus*) (1 bird) | Echinostome present | - | - | - |
| Pukeko (*Porphryio p. melanotus*) (21 birds) | Nothing found in intestine | | | |

*Introduced birds

of the wild bird population could act as reservoir hosts to parasites which may become a problem to newly established poultry farms, as is the case in eastern Europe (Bezubik 1956, Petrochenko 1958).

Of the digenetic trematodes, the families Notocotylidae, Echinostomatidae, Strigeidae, Schistosomatidae, Microphallidae, Psilostomatidae, Cyclocoelidae and Opisthorchiidae are represented (Table 2).

Of the cestodes the family Hymenolepididae is well represented. Nematodes of the families Ascaridae, Spiruridae and Trichuridae also occur in particular localities but otherwise were infrequently collected. Acanthocephala were mainly found in greys and mallards feeding in estuarine conditions (e.g. Avon-Heathcote Estuary, and Barry's Bay, Akaroa).

Regular sampling from any one area was not possible so little can be said concerning seasonal fluctuation. The incidence of helminths in wild ducks, however, varies from month to month (Table 3). The degree of infection with trematodes in columns 5, 6 and 7 (Table 3) indicates that in August (spring) and in March

TABLE 2. TREMATODES PRESENT IN WATER FOWL FROM THE SOUTH ISLAND OF NEW ZEALAND

| | |
|---|---|
| **Digenea** | |
| **Family Notocotylidae** | |
| *Uniserialis gippyensis* | Host: wild duck, paradise duck, domestic goose, shoveler<br>Location: Bursa Fabricius<br>Locality: Ashburton, Avon R., Banks Peninsula, L. Coleridge, Otago |
| *Catatropis* sp. | Host: wild duck, shoveler, paradise duck<br>Location: Caeca<br>Locality: Rakaia R., Ashburton, L. Coleridge, Avon R., Banks Peninsula, Otago |
| *Notocotylus* sp. | Host: wild duck<br>Location: Caeca, small intestine<br>Locality: Ashburton, South Waimakariri R. |
| **Family Echinostomatidae** | |
| **Echinoparyphium recurvatum* | Host: wild duck, Canada goose, scaup, paradise duck, black swan, domestic goose, bittern, shoveler<br>Location: Upper small intestine<br>Locality: Rakaia R., Ashburton, L. Coleridge, L. Ellesmere, Banks Peninsula, Waimakariri R., Hororata, Kaitangata |
| **Echinostoma revolutum* | Host: wild duck, Canada goose, paradise duck, domestic goose, shoveler<br>Location: Lower small intestine, caeca and rectum<br>Locality: Rakaia R., L. Coleridge, Ashburton, Banks Peninsula, Waimakariri R., Kaikoura, Kaitangata |
| **Family Strigeidae** | |
| *Cotylurus* sp.? | Host: wild duck, scaup, black swan<br>Location: Upper small intestine<br>Locality: L. Coleridge, Ashburton, Avon R., Kaitangata |
| **Family Schistosomatidae** | |
| **Dendritobilharzia pulverulenta* | Host: wild duck<br>Location: Portal veins, aorta<br>Locality: Banks Peninsula, Ashburton, Kaikoura, L. Coleridge |
| *Ornithobilharzia* sp. | Host: shoveler<br>Location: Liver<br>Locality: L. Ellesmere |

Family Microphallidae

*Levinseniella*? and *Spelotrema*?
Host: wild duck
Location: Small intestine
Locality: South Waimakariri R., Ashburton, Green I. (Otago)

Family Psilostomatidae

*Psilochasmus oxyuris*
Host: wild duck, scaup, black swan, shoveler
Location: Upper small intestine
Locality: L. Coleridge, Ashburton, Banks Peninsula, Waimakariri R.

Family Cyclocoelidae

*e.g. *Typhlocoelum cucumerinum*
Host: wild duck, shoveler
Location: Air sacs, lungs, trachea
Locality: Banks Peninsula, Ashburton

Family Opisthorchiidae

*Metorchis* sp.
Host: wild duck
Location: Gall bladder, liver
Locality: Avon-Heathcote Estuary

*Pathogenic forms

(autumn), higher percentages of ducks examined are infected with trematodes than in any other month.

In Great Britain (Beverley-Burton 1972) and eastern Europe (Bezubik 1956) the situation differs in that only a late summer peak is recorded. Climatic differences may account for this. New Zealand winters in lowland areas are comparatively mild so that there is access to waterways containing invertebrates throughout the year. In Canterbury the spring increase coincides both with the onset of the breeding season of the ducks and with the rapid increase in numbers of aquatic invertebrates which serve as intermediate hosts.

In the months following the breeding season, juvenile water birds, more vulnerable than adults, are infected and reinfected. By late summer the ducks examined have been well exposed to sources of infection and include large numbers of juvenile birds. These birds are included in samples examined from December through to March. During the summer, too, the water recedes, leaving ponds and reduced dabbling grounds with a consequent higher concentration of animals likely to carry infective stages of trematodes. This results in a late summer peak which parallels the condition recorded in Great Britain. It is more difficult to assess the situation in the period April-June (Table 3). In May with an overall low percentage of ducks parasitised, it appears there has been a sudden fall in infection. The April sample was small and the May sample while large, contained only gut helminths so these figures cannot be compared. During the shooting season (May-June) abnormal conditions prevail and ducks

TABLE 3. INCIDENCE OF HELMINTHS IN WILD DUCKS EXAMINED BETWEEN JANUARY 1972 AND DECEMBER 1973

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Month | No. of ducks | % infected with Cestodes | % infected with Nematodes | % infected with Acanthocephala | % infected with Trematodes | % infected with 2 or more spp. Trematodes | % of Trematode infected ducks infected with 2 or more spp. of Trematode |
| July | 15 | 86.6 | 11.11 | 0 | 46.6 | 33.3 | 62.5 |
| Aug. | 11 | 100 | 18.0 | 0 | 81.8 | 54.5 | 66.6 |
| Sept. | 15 | 86.6 | 5.3 | 5.3 | 66.6 | 33.3 | 50.0 |
| Oct. | 4 | 100 | 20.0 | 20.0 | 75.0 | 25.0 | 33.3 |
| Nov. | 20 | 85.0 | 19.0 | 4.8 | 75.0 | 40.0 | 46.6 |
| Dec. | 12 | 83.0 | 16.7 | 41.7 | 100 | 58.3 | 58.3 |
| Jan. | 12 | 100 | 0 | 9.1 | 58.3 | 25.0 | 42.8 |
| Feb. | 25 | 100 | 20.1 | 4.2 | 80.0 | 32.0 | 40.0 |
| Mar. | 17 | 76.5 | 23.1 | 6.3 | 76.5 | 53.0 | 64.3 |
| Apr. | 5 | 100 | 20.0 | 0 | 60.0 | 60.0 | 100 |
| May | 78 | 74.4 | 5.3 | 15.8 | 57.0 | 23.0 | 40.0 |
| June | 21 | 83.3 | 13.3 | 20.0 | 71.4 | 38.9 | 46.6 |

are noticeably disturbed. In addition some were hand fed prior to the shooting season and others had been on fields of autumn grain crops, resulting in lowered rates of infection.

The high "mortality" rate at this time must also influence the nature of any recorded fluctuation of infection with endoparasites. In considering the effect of shooting on game birds, it is estimated (Balham and Miers 1959) that 28% of ducks banded in January are shot in the first season, this percentage dropping to 3-4% the following year. In relation to the survival of the grey duck as a species, it has been estimated that up to 90% of greys banded die from shooting alone. On Lake Ellesmere observations on fluctuating numbers of birds (Tunnicliffe 1973) suggest an instability in this group of water fowl, the grey duck in particular becoming reduced in numbers in this area.

No host specificity has been shown by parasites common in Anatidae, so that known pathogenic parasites could endanger any species (Table 2). In general, mature birds shot have a low parasite load, with all common species occurring at all times of the year but none in high numbers. This indicates a state of host-parasite equilibrium, but without being able to estimate the numbers that succumb to parasitic infections, the question arises as to how important parasites may be to the survival of endemic water birds. Taking into account variation in physical conditions and behavioural characteristics (as in grey v. mallard) the balance may at any time be upset and forms such as the paradise

duck, grey and brown teal, the blue duck, the scaup, and bittern may follow other birds to eventual extinction.

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