

**COMPARATIVE STUDY OF CESTODE
AND NEMATODE FAUNA
OF THE GASTROINTESTINAL TRACT
OF MALLARDS (*ANAS PLATYRHYNCHOS* L., 1758)
FROM THREE DIFFERENT POLISH ECOSYSTEMS**

Małgorzata Nowak¹, Katarzyna Kavetska¹, Katarzyna Królaczyk¹,
Agata Stapf¹, Sławomir Kornaś², Marek Wajdzik³, Marta Basiaga²

¹West Pomeranian University of Technology, Szczecin, Poland

²University of Agriculture, Faculty of Animal Sciences, Kraków, Poland

³University of Agriculture, Faculty of Forestry, Kraków, Poland

Abstract. The Mallard (*Anas platyrhynchos*) is the most acquired and, at the same time, the most common wetland game birds in Poland, occurring on the territory of almost the whole country. The habitat of this bird is constituted by most shallow water reservoirs, rivers, lakes and ponds situated in mid-fields. The aim of this study was to compare the composition of cestode and nematode fauna of the gastrointestinal tract of Mallards acquired from three different Polish ecosystems (Bzura Valley, the area of Warta Mouth National Park and reservoirs around Szczecin). The research material was constituted by tapeworms and nematodes found in gastrointestinal tracts of 211 Mallards. Fixed slides of tapeworms stained with acetocarmine were made, and nematodes were cleared in lactic acid. 30 species of parasites were determined – 23 tapeworms and 7 nematodes. Differences were indicated between helminth faunas of Mallards from the whereabouts of Borów, Słońsk and Szczecin. The most helminth species were noted in the gastrointestinal tract of Mallards acquired near Szczecin, and the least from Mallards from the whereabouts of Borów.

Key words: *Anas platyrhynchos*, helminths, Mallard, Poland

Corresponding author – Adres do korespondencji: dr hab. Katarzyna Kavetska prof. nadzw., West Pomeranian University of Technology, Department of Biology and Ecology of Parasites, Szczecin, Doktora Judyma 20, 71-466 Szczecin, Poland, e-mail: katarzyna.kavetska@zut.edu.pl

INTRODUCTION

The Mallard (*Anas platyrhynchos* L., 1758) is a breeding bird species common in Europe, North America and Asia, belonging to the surface-feeding ducks tribe (Anatini). The Mallard's winter habitats are usually the coasts of the North Sea and the Baltic Sea (except the years with harsh winters), although this bird can also reach the Mediterranean Sea and the Black Sea. In Poland, the Mallard is the most often acquired, and, at the same time, the most common wetland game bird occurring on the territory of almost the whole country [Tomiałojć and Stawarczyk 2003, Okarma and Tomek 2008]. The habitat of this bird is constituted by most shallow water reservoirs, rivers, lakes and ponds situated in mid-fields. Outside breeding season, the Mallard resides on sheltered banks of fresh water reservoirs. The species is increasingly more common in built-up areas [Tomiałojć and Stawarczyk 2003], and especially in large cities [Sikora et al. 2007]. The Mallard is an omnivorous species, although its diet is dominated by plants. It occasionally feeds on land and aquatic invertebrates [del Hoyo et al. 1992, Scott and Rose 1996].

Helminth fauna of the Mallard is relatively well known in Poland. The first complex research addressing the species' helminth fauna were conducted in south-eastern Poland in the fifties [Bezubik 1956] and concerned Mallards from Lubelskie and Białostockie provinces. In the sixties, research of helminth fauna of Mallards from different regions of Poland were conducted by Czaplinski [Czaplinski et al. 1992]. *A. platyrhynchos* endoparasite studies in north-western Poland were started by Kavetska in 1999.

The aim of this work, which is a continuation of the research started by Kavetska, was to compare the composition of cestode and nematode fauna in gastrointestinal tracts of Mallards from the West Pomeranian region (whereabouts of Szczecin and Słońsk) and the area of Bzura Valley (Borów).

MATERIAL AND METHODS

The research material was constituted by tapeworms and nematodes acquired from gastrointestinal tracts of 211 Mallards, originating from three different Polish ecosystems. The research was conducted in the years 2009–2011.

The majority of ducks (170 specimens) came from north-western Poland. These Mallards were shot by hunters, with respect for hunting seasons, in the floodlands of Warta Mouth National Park near Słońsk (Lubuskie province, sulęciński district) – 79 specimens, and in reservoirs in the whereabouts of Szczecin (Zachodniopomorskie province) – 91 specimens. The remaining ducks (n = 41)

were acquired in the area of central Poland in the middle part of Bzura Valley, the section between Sobota and Pęcławice (Borów, Łódzkie province, łowicki district).

Among the mentioned areas of bird acquisition, the most varied in terms of reservoirs is the area of the whereabouts of Szczecin (river Odra, Szczecin Lagoon, Dąbie Lake, mid-field post-glacial ponds). The most scarce reservoirs were found in the whereabouts of Borów (only Bzura River). The whereabouts of Słońsk encompassed Warta River with many floodlands, which was different from Bzura Valley.

Gastrointestinal tracts were dissected as a whole, and then divided into 9 anatomical sections (esophagus, proventriculus, gizzard, jejunum, ileum, rectum, cecum and cloaca with bursa of Fabricius). Helminths were acquired from each section, which were then cleaned of food remains and preserved in 70% ethanol. Fixed slides were made from tapeworms stained with acetocarmine, and nematodes were cleared in lactic acid. The specimens' species belonging was determined on the basis of available identification keys and original works.

RESULTS AND DISCUSSION

Presented research results indicated 30 species of parasitic helminthes: 23 species of tapeworms (Cestoda) and 7 species of nematodes (Nematoda).

Cestoda

Tapeworm fauna of the researched *A. platyrhynchos* was represented by 23 species belonging to two families: Dilepididae (one species) and Hymenolepididae (22 species) (Table 1).

Only one species from the Dilepididae family was found in the Mallard – *Platyscolex ciliata* (Fuhrmann, 1913). This species was present in Mallards from Słońsk and whereabouts of Szczecin. It was not found in Mallards from Borów. The intermediate host of *Platyscolex ciliata* can be, among others, a small crustacean – *Daphnia pulex* (Leydig, 1860), which lives in stagnant water reservoirs. There is a probability, that ducks acquired from the middle section of Bzura Valley (Borów) were not infected by *Platyscolex ciliata* because there was no potential intermediate host for the tapeworm in this area [Ryshikov et al. 1985].

The family Hymenolepididae in the researched ducks was represented by 22 species (Table 1). In the composition of cestode fauna of Mallards from the whereabouts of Szczecin, 19 species from this family were noted. 14 species were found in Mallards from Słońsk, and only 10 species from Hymenolepididae family were

found in ducks from Borów. These results show that significantly more species of tapeworms are found in Mallards acquired from aquatic ecosystems (stagnant and flowing water) in north-western Poland, than in Mallards acquired from flowing water ecosystems in central part of the country.

Table 1. Cestodes of the Mallard in Poland in own other studies

Tabela 1. Tasiemce krzyżówki w Polsce w badaniach własnych i innych autorów

Tapeworms Tasiemce	Pojmańska et al. 2007	Kavetska et al. 2008	Own research Badania własne 2011		
			Słońsk	okolice Szczecina	Borów
Dilphyllobothriidae					
<i>Schistocephalus solidus</i> (Muller, 1776)	+				
Dilepididae					
<i>Platyscolex ciliata</i> (Fufmann, 1913)	+	+	+	+	
Hymenolepididae					
<i>Aploparaksis furcigera</i> (Rudolphi, 1819)	+	+	+	+	+
<i>Cloacotaenia megalops</i> (Nitzsch in Creplin, 1829)	+	+	+	+	
<i>Dicranotaenia coronula</i> (Dujardin, 1845)	+	+	+	+	
<i>Diorchis diorchis</i> (Fuhrmann, 1913)	+				
<i>D. inflatus</i> (Rudolphi, 1819)	+				
<i>D. nyrocae</i> Yamaguti 1935	+				
<i>D. ransomi</i> Johri, 1939	+				
<i>D. stefanskii</i> Czapliński, 1956	+	+	+	+	
<i>Echinocotyle rosseteri</i> Blanchard, 1891		+		+	
<i>Fimbriaria fasciolaris</i> (Pallas, 1781)	+	+	+	+	+
<i>Fimbriarioides</i> Fuhrmann, 1932		+		+	+
<i>Gastrotaenia dogieli</i> (Gynezynskaja, 1944)		+	+		
<i>Microsomacanthus abortiva</i> (von Linstow, 1904)	+	+		+	
<i>M. baeri</i> Czapliński & Vaucher, 1977		+	+	+	+
<i>M. compressa</i> (Linton, 1892)	+	+		+	+
<i>M. pachycephala</i> (von Linstow, 1872)		+		+	
<i>M. paracompressa</i> (Czapliński, 1956)		+	+	+	+
<i>M. paramicrosoma</i> (Gasowska, 1931)	+	+	+		
<i>M. parvula</i> (Kowalewski, 1904)	+	+	+	+	
<i>M. spiralibursata</i> (Czapliński, 1956)	+	+	+	+	
<i>Monotestilepis tadornae</i> Gvozdev, Maksimova & Korniyushin, 1971		+		+	
<i>Retinometra giranensis</i> (Sugimoto, 1934)		+		+	+
<i>R. venusta</i> (Rosseter, 1897)	+	+	+	+	+
<i>Sobolevicanthus aculeostyleticus</i> Birova & Macko, 1991		+	+		+
<i>S. gracilis</i> (Zeder, 1803)	+	+		+	+
<i>S. krabellus</i> (Hughes, 1940)	+	+		+	
<i>S. octacanthus</i> (Krabbe, 1869)	+				

This fact can be justified by different types of habitats of these ducks. The area of north-western Poland, from which the Mallards with richer cestode fauna were acquired, is more abundant with water reservoirs like Dąbie Lake, Szczecin Lagoon, Odra Valley, mid-field post-glacial ponds, floodlands of Warta Mouth

National Park near Słońsk, than the area of łowicki district, Łódzkie province (river ecosystem), from which the birds with less diverse tapeworm species composition were acquired. Depending on the habitat type, the ducks' diet may differ, which fact can affect their contact with potential intermediate parasite hosts, and can therefore lead to differences in tapeworm species composition. This situation indicates high significance of the encounter and compatibility filters in the host-parasite relationship [Combes 1999]. As it has been indicated, the cause of this situation is probably a different set of habitat conditions in the three geographical regions of Poland analyzed here.

Five species of tapeworms: *Aploparaksis furcigera* (Rudolphi, 1819), *Fimbriaria fasciolaris* (Pallas, 1781), *Microsomacanthus baeri* (Czapliński & Vaucher, 1977), *M. paracompressa* (Czapliński, 1956) and *Retinometra venusta* (Rosseter, 1897) were noted in Mallards from Zachodniopomorskie, Lubuskie and Łódzkie provinces. *Gastrotaenia dogieli* (Gynezynskaja, 1944) and *Microsomacanthus paramicrosoma* (Gasowska, 1931) were found only in Mallards from Słońsk, and 8 species of tapeworms were found only in ducks from the whereabouts of Szczecin, and not those from Słońsk and Borów (Table 1).

According to Pojmańska et al. [2007] 20 species of tapeworms were indicated in *A. platyrhynchos* in Poland until 2007, belonging to three families: Diphylobothriidae, Dilepididae and Hymenolepididae. In the research conducted on the area of north-western Poland [Kavetska et al. 2008] 23 species of tapeworms were found in Mallards, belonging to two families: Dilepididae and Hymenolepididae (Table 1). From among the species found in Mallards in different parts of Poland [Pojmańska et al. 2007], we have found 6 in our research: *Schistocephalus solidus* (Muller, 1776), *Diorchis diorchis* (Fuhrmann, 1913), *D. inflatus* (Rudolphi, 1819), *D. ransomi* (Johri, 1939) and *Sobolevicathus octacanthus* (Krabbe, 1869).

Nematoda

Nematodes in the Mallard's helminth fauna were represented by 7 species belonging to 6 families: Amidostomatidae, Ascarididae, Tetrameridae, Acuariidae, Dioctophymatidae, Capillariidae and one taxon of genus rank, *Epomidiostomum* sp. (Table 2). 7 species of nematodes were found in Mallards from Słońsk. 5 species and one indeterminate specimen of *Epomidiostomum* sp. were found in Mallards from the whereabouts of Szczecin. Similarly to tapeworms, the least species (4) were noted in Mallard specimens from Borów (Table 2).

Four species of nematodes: *Amidostomum acutum* (Lundahl, 1848), *Tetrameres fissispina* (Diesing, 1861), *Echinuria uncinata* (Rudolphi, 1819) and *Eucoleus contortus* (Creplin, 1839) were noted in Mallards from Warta Mouth National Park near Słońsk, Mallards from the whereabouts of Szczecin and the ducks

from Borów. Two species of nematodes: *Porrocaecum crassum* (Deslongchamps, 1824) and *Hystrichis tricolor* (Dujardin, 1845) were found in one Mallard specimen from the whereabouts of Słońsk. In the life cycle of these two species of nematodes there are intermediate hosts, which belong to the Oligochaeta subclass, including *Criodrilus lacuum*, which inhabits muddy bottoms of fresh water reservoirs [Baruš et al. 1978]. The whereabouts of Słońsk are one of the most important wetlands in Europe, stretching over a few thousand hectares, which are a sanctuary for thousands of water and wetland birds. A statement that only in this region of Poland proper environmental conditions existed to open the so-called encounter and compatibility filters, leading to infection of the Mallards with *P. crassum* and *H. tricolor* nematode species, seems fully justified.

The distribution of nematode fauna in the researched ducks was probably influenced by: their diet, habitat type and geographical region. These factors were discussed in detail in the tapeworm fauna distribution section.

Table 2. Nematodes of the Mallard in Poland in own and other studies

Tabela 2. Nicienie krzyżówki z Polsce w badaniach własnych i innych autorów

Nematodes Nicienie	Pojmańska et al. 2007	Kavetska et al. 2008	Own research Badania własne 2011		
			Słońsk	okolice Szczecina	Borów
Amidostomatidae					
<i>Amidostomum acutum</i> (Lundahl, 1848)	+	+	+	+	+
<i>A. anseris</i> (Zeder, 1800)	+				
<i>Epomidiostomum</i> sp.				+	+
<i>E. uncinatum</i> (Lundahl, 1848)	+				
Syngamidae					
<i>Cyathostoma variegatum</i> (Creplin, 1849)	+				
Trichostrongylidae					
<i>Trichostrongylus tenuis</i> (Mehlis, 1846)	+				
Ascarididae					
<i>Porrocaecum crassum</i> (Deslongchamps, 1824)	+	+	+		
<i>Ascaridia gali</i> (Schrank, 1788)	+				
<i>Heterakis gallinarum</i> (Schrank, 1788)	+				
Tetrameridae					
<i>Tetrameres fissispina</i> (Diesing, 1861)	+	+	+	+	+
Acuariidae					
<i>Echimuria uncinata</i> (Rudolphi, 1819)	+	+	+	+	+
<i>Streptocara crassicauda</i> (Creplin, 1829)	+		+	+	
Dioctophymatidae					
<i>Hystrichis tricolor</i> Dujardin, 1845	+	+	+		
Capillariidae					
<i>Eucoleus contortus</i> (Creplin, 1839)	+	+	+	+	+
<i>Capillaria anatis</i> (Schrank, 1790)	+	+			
<i>Baruss capillaria mergi</i> (Madsen, 1945)	+				
<i>Pseudocapillaria mergi</i> (Madsen, 1945)		+			

According to the information provided by Pojmańska et al. [2007], until 2007 the nematode fauna of Mallards in Poland was composed of 15 species belonging to 8 families. Subsequent studies of nematode fauna conducted by Kavetska [2008] indicated the presence of 8 species from 6 families in Mallards from north-western Poland. In the material studied by us, we did not discover the presence of Syngamidae and Trichostrongylidae families representatives (Table 2), which were noted earlier in Poland, and a typical host for which is fowl (hens, turkeys).

CONCLUSIONS

1. Comparative studies of the Mallard's gastrointestinal tract helminth fauna, with specimens from three different Polish ecosystems, have shown the presence of 30 parasitic species of helminthes: 23 species of tapeworms and 7 species of nematodes.
2. The most parasitic helminth species were noted in the gastrointestinal tracts of Mallards acquired from the whereabouts of Szczecin (an area with numerous stagnant, as well as flowing water reservoirs), and the least were noted in Mallards from the middle section of Bzura Valley (flowing water).
3. The differences in helminth fauna composition between the studied ducks from the researched ecosystems were probably influenced by the nourishment they were getting, their habitat, and their migrations.

REFERENCES

- Baruš V., Sergeeva T.P., Sonin M.D., Ryzhikov K.M., 1978. Helminths of Fish-Eating Birds of the Palearctic Region I. Nematoda. Czech. Acad. Sci., Moscow/Prague.
- Bezubik B., 1956. Helminthofauna dzikich kaczek (podrodziny Anatinae) [The helminth fauna of wild ducks (subfam. Anatinae)]. Acta Parasitol. Pol. 4, 407–510 [in Polish].
- Combes C., 1999. Ekologia i ewolucja pasożytnictwa. Długotrwałe wzajemne oddziaływanie [Ecology and evolution of parasitism. Long-term interactions]. PWN, Warszawa [in Polish].
- Czapliński B., Sulgostowska T., Czaplińska D., 1992. Katalog fauny pasożytniczej Polski. Część IV. Pasożyty ptaków. Zeszyt 2A. Tasiemce – Cestoda [Catalogue of parasitic fauna of Poland, Part IV. Parasites of birds, Tapeworms – Cestoda]. Pol. Tow. Parazytol., Warszawa [in Polish].
- del Hoyo J., del Eilliot A., Sargatal J., 1992. Handbook of the birds of the world. Lynx Editions, Barcelona.
- Kavetska K., Rząd I., Korniyushin V., Korol E., Sitko J., Królaczyk K., 2008. Helminthofauna przewodu pokarmowego krzyżówki *Anas platyrhynchos* L., 1758 północno-zachodniej Polski [Enteric helminths of the Mallard *Anas platyrhynchos* L., 1758 in the north-western part of Poland] Wiad. Parazytol. 54, 23–29 [in Polish].

- Okarma H., Tomek A., 2008. Łowiectwo [Hunting]. Wydaw. Edukacyjno-Narodowe H₂O, Kraków [in Polish].
- Pojmańska T., Niewiadomska K., Okulewicz A., 2007. Pasożytnicze helminty Polski. Gatunki, żywicieli, białe plamy [Parasitic helminths in Poland. Species, hosts, Terra Incognita]. Pol. Tow. Parazytol., Warszawa [in Polish].
- Ryzhikov K.M., Ryšavý B., Khokhlova I.G., Tolkatcheva L.M., Kornychin V.V., 1985. Helminths of Fish-Eating Birds of the Palearctic Region II. Cestoda and Acanthocephales. Czech., Acad. Sci., Moscow/Prague.
- Scott Derek A., Rose Paul. M., 1996. Atlas of Anatidae Populations in Africa and Western Eurasia. Wetlands Int. Public., United Kingdom.
- Sikora A., Rohde Z., Gromadzki M., Neubauer G., Chylarecki P., 2007. Atlas rozmieszczenia ptaków lęgowych Polski 1985–2004 [The Atlas of breedingbirds in Poland 1985–2004]. Bogucki Wydaw. Nauk., Poznań [in Polish].
- Tomiałojć L., Stawarczyk T., 2003. Awifauna Polski. Rozmieszczenie, liczebność i zmiany [Avifauna of Poland. Distribution, abundance and changes]. Pro Natura, Wrocław [in Polish].

PORÓWNAWCZE BADANIA FAUNY TASIEMCÓW I NICIENI PRZEWODU POKARMOWEGO KRZYŻÓWKI (*ANAS PLATYRHYNCHOS* L., 1758) Z TRZECH ODMIENNYCH EKOSYSTEMÓW POLSKI

Streszczenie. Krzyżówka (*Anas platyrhynchos*) jest najczęściej pozyskiwanym i zarazem najpospolitszym wodno-błotnym ptakiem łownym w Polsce, występującym na terenie niemal całego kraju. Środowiskiem życia tego ptaka jest większość płytkich zbiorników wodnych, rzek, jezior oraz śródpolnych oczek wodnych. Celem pracy było porównanie składu cestodofauny i nematofauny przewodu pokarmowego krzyżówki pozyskanej z trzech odmiennych ekosystemów Polski (Dolina Bzury, obszar Parku Narodowego „Ujście Warty” i akwenu wodne okolic Szczecina). Materiał do badań stanowiły tasiecmce i nicienie pozyskane z przewodów pokarmowych 211 krzyżówek. Wykonano preparaty stałe z tasiemców barwionych acetokarminem, a nicienie prześwietlono w kwasie mlekowym. Oznaczono 30 gatunków pasożytów – 23 gatunki tasiemców i 7 gatunków nicieni. Wykazano różnice w helmintofaunie krzyżówki pozyskanej z okolic Borowa, Słońska i Szczecina. Najwięcej gatunków pasożytniczych helmintów zanotowano w przewodzie pokarmowym krzyżówki pozyskanej z okolic Szczecina, a najmniej u krzyżówki z okolic Borowa.

Słowa kluczowe: *Anas platyrhynchos*, helminty, krzyżówka, Polska

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