

Taxonomic structure of Digenea in wild ducks (Anatinae) from West Pomerania

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ABSTRACT. Parasitic fauna of birds connected with water environment, including digeneans, is relatively well researched in Poland. The exception, however, is West Pomerania, where those birds were not frequent objects of parasitological research until recently. The purpose of this work is to determine the taxonomic structure of the Digenea, parasitising wild ducks living in West Pomerania. The research material was 124 individuals of wild Anatinae (Anseriformes) belonging to 8 species: *Anas strepera*, *A. crecca*, *A. platyrhynchos*, *Aythya marila*, *A. fuligula*, *Melanitta nigra*, *M. fusca* and *Mergus merganser*. The ducks were obtained in the years 2001–2006 from small ponds near Szczecin, Lake Dąbie, the Szczecin Lagoon and the Baltic Sea. The research showed the presence of 29 species of digeneans from 11 families: *Paracoenogonimus ovatus* Katsurada, 1914; *Diplostomum mergi* Dubois, 1932; *D. parviventosum* Dubois, 1932; *D. phoxini* (Faust, 1918); *D. pusillum* (Dubois, 1928); *Ornithodiplostomum scardinii* (Shulman in Dubinin, 1952); *Echinochasmus spinulosus* (Rudolphi, 1808); *Echinoparyphium cinctum* (Rudolphi, 1802); *E. recurvatum* (Linstow, 1873); *Echinostoma miyagawai* Ischii, 1932; *E. revolutum* (Fröhlich, 1802); *Hypoderaeum conoideum* (Bloch, 1782); *Stephanoprora pseudoechinata* (Olsson, 1876); *Cryptocotyle concava* (Creplin, 1825); *C. lingua* (Creplin, 1825); *Leucochloridiomorpha lutea* (von Baer, 1826); *Catatropis verrucosa* (Fröhlich, 1789); *Notocotylus attenuatus* (Rudolphi, 1809); *Paramonostomum alveatum* (Mehlis, 1846); *Metorchis xanthostomus* (Creplin, 1846); *Prosthogonimus ovatus* (Rudolphi, 1803); *P. rarus* Braun, 1901; *Psilochasmus oxyurus* (Creplin, 1825); *Psilostomum brevicolle* (Creplin, 1829); *Psilotrema simillimum* (Mühling, 1898); *Bilharziella polonica* (Kowalewski, 1895); *Apatemon gracilis* (Rudolphi, 1819); *Australapatemon minor* (Yamaguti, 1933); *Cotylurus cornutus* (Rudolphi, 1808).

Key words: Anatinae, Digenea, helminths, northwestern Poland

Introduction

The research of parasitic fauna, including parasitic digeneans of wild ducks (Anatinae) has been conducted in Poland for a long time. Extensive information in the subject is presented both in original studies and cohesive publications [1, 2]. Despite the lack of continuity in the research, a series of works has appeared in the last years on ducks' parasites, concerning, e.g. the digeneans of the *Anas platyrhynchos* in northwestern Poland [3], digeneans of the digestive system of birds from the Masurian lakes [4], and overall studies concerning

parasitic fauna of birds in Poland [5, 6]. The results of those researches, as well as the fact of the existence of "grey areas" in Poland, suggested the necessity of faunistic research, mostly in northwestern Poland, since that area is geographically special (numerous reservoirs) and specific for its rich avifauna.

So, the purpose of this study, of exclusively qualitative character, is to determine the taxonomic structure of digeneans parasitising wild ducks in West Pomerania. The work is a comprehensive development of research results reported before [7, 8], and detailed descriptions of new species in the

fauna of Poland will be presented in separate studies.

Material and methods

The research material was digeneans isolated from 124 individuals of wild Anatinae (Anseriformes) belonging to three tribes: dabbling ducks (Anatini): *Anas strepera*, *A. crecca* and *A. platyrhynchos*; diving ducks (Aythyini): *Aythya marila* and *A. fuligula*; and sea ducks (Mergini): *Melanitta nigra*, *M. fusca* and *Mergus merganser*. The birds, collected in the years 2001–2006, came from various areas of West Pomerania: small ponds near Szczecin, Lake Dąbie, the Szczecin Lagoon and the Baltic Sea (Table 1).

The research included an overall parasitological section, including the skin, eyes, knee joint capsule, body cavity, trachea, air sacs, liver, kidneys, intestine and cloaca with bursa of Fabricius. All found helminths were isolated and then preserved in 75% ethyl alcohol. From the isolated digeneans, permanent specimens were made dyed with borax carmine locked in Canadian balm.

Results and discussion

The research showed the presence 29 species of digeneans representing 22 genera from 11 families: Cyathocotylidae Mühling, 1898; Diplostomidae Poirier, 1886; Echinostomatidae Looss, 1899; Heterophyidae Odhner, 1914; Leucochloridiomorphidae Yamaguti, 1958; Notocotylidae Lühe, 1909; Opisthorchiidae Looss, 1899; Prosthogonimidae Lühe, 1909; Psilostomidae Looss, 1900; Schistosomidae

Stiles et Hassall, 1898 and Strigeidae Railliet, 1919.

Family Cyathocotylidae Mühling, 1898

Paracoenogonimus ovatus Katsurada, 1914 found in the intestine *Mergus merganser*. So far in Poland found still in *Circus aeruginosus*, *Buteo buteo*, *Gavia stellata*, *Haliaeetus albicilla* [1, 4, 9, 10].

Family Diplostomidae Poirier, 1886

Family Diplostomidae was represented by five species from two genera: *Diplostomum* von Nordmann, 1832 (*D. mergi* Dubois, 1932; *D. parviventosum* Dubois, 1932; *D. phoxini* (Faust, 1918); *D. pusillum* Dubois, 1928) and *Ornithodiplostomum* Dubois, 1936: *O. scardinii* (Shulman in Dubinin, 1952) which were found in the intestine of *Mergus merganser*. *D. pusillum* and *D. phoxini* were recorded in the Polish fauna for the first time. *D. pusillum* occurred in two individuals of *M. merganser* – from the Szczecin Lagoon and Lake Dąbie. The number of parasites amounted to 28 and 53 respectively. *D. phoxini* was found in two individuals of *M. merganser* from Lake Dąbie in the amount of one and 11. For the *D. mergi*, *D. parviventosum* and *O. scardinii*, *M. merganser* turned out to be a new host.

Diplostomum mergi is a widely distributed Holarctic parasite of piscivorous ducks, mainly from the species *Mergus* and *Somateria*. So far in Poland, an adult form has been found only in the intestine of the *Mergellus albellus* [1]. *Diplostomum parviventosum* is a parasite of the *M. merganser* with a Palaearctic range. *Diplostomum phoxini* is a species found in Poland for the first time. According to the Ukrainian data, the definitive hosts are Anatidae (but only experimentally) [11].

Table 1. Number of examined ducks and place of their origin

Duck species	Number of examined hosts	Place and year of collection
Anatini		
<i>Anas strepera</i>	1	Szczecin, 2005
<i>A. crecca</i>	1	Szczecin, 2002
<i>A. platyrhynchos</i>	4	Szczecin 2004, 2006
<i>A. platyrhynchos</i>	15	Lake Dąbie, 2006
Aythyini		
<i>Aythya marila</i>	8	Szczecin Lagoon, 2002
<i>A. fuligula</i>	15	Lake Dąbie, 2005
Mergini		
<i>Melanitta nigra</i>	10	Baltic, 2005
<i>M. fusca</i>	10	Baltic, 2005
<i>Mergus merganser</i>	54	Lake Dąbie, 2005
<i>M. merganser</i>	5	Szczecin Lagoon, 2001
<i>M. merganser</i>	1	Baltic, 2002

Diplostomum pusillum is a specific parasite of piscivorous birds and mammals in the Palaearctic region. It has not been recorded in Poland so far. *Ornithodiplostomum scardinii* is a species with a Palaearctic range found so far in Poland only in fish: the Rudd, Roach, White Bream, Carp Bream.

Family Echinostomatidae Looss, 1899

In the studied material this family was represented by 7 species, out of which four formed a parasite-host system for the first time in Poland. So far, the matter of diagnosing and final establishment of the number of species of the genus *Echinostoma* has not been explicitly solved, thus two species have been distinguished basing almost solely on morphological differences in helminthofauna of the examined ducks: *E. revolutum* (Fröhlich, 1802) and *E. miyagawai* Ischii, 1932. A cosmopolitan species *E. revolutum* was found in the intestine of *A. platyrhynchos*, *A. fuligula*, *A. marila* and *M. merganser*. The occurrence of this trematoda in *M. merganser* and *A. marila* was recorded for the first time in Poland, so they are new parasite-host system for Poland. *E. revolutum* has been found in a lot of bird species so far in Poland [1, 2], whereas the next species of this genus, *E. miyagawai*, has been found only in the *Anas platyrhynchos*. This species had already been recorded before in that host in West Pomerania by Betlejewska and Korol [3]. *Echinoparyphium recurvatum* (von Linstow, 1873) in the examined ducks was noted in the *A. platyrhynchos*, *A. crecca*, *A. fuligula* and *A. marila*. That species had already been found before in Poland in those hosts and also in other bird species [1, 3, 12]. One specimen of *Echinoparyphium cinctum* (Rudolphi, 1802) was found in *A. fuligula* from Lake Dąbie. This is a new finding of this species in Poland. Despite the fact that the Internet service Fauna Europaea lists our country as a place of this parasite's occurrence, the authors of this study have not reached the source of this information. Species *E. cinctum* is in Europe mainly a parasite of the Anseriformes and Charadriiformes. *Echinochasmus spinulosus* (Rudolphi, 1809) and *Stephanoprora pseudoechinata* (Olsson, 1876) were found in the *Mergus merganser* and this is the first finding of those parasites in *M. merganser* in Poland. *E. spinulosus* is a species unique to grebes and divers.

S. pseudoechinata, however, is a parasite of gulls and terns, also found in grebes and ducks [1]. The occurrence of a cosmopolitan species of the Anseriformes, *Hypoderaeum conoideum* (Bloch, 1782) was recorded in the intestine of the *Anas crec-*

ca. The species has been found in Poland so far in 8 bird species [1, 3, 13].

Family Heterophyidae Odhner, 1914

The family Heterophyidae was represented by two species in the helminthofauna of the examined birds. *Cryptocotyle concava* (Creplin, 1825) was found in *Melanitta nigra* and *M. fusca*, and for the first time in Poland in *Mergus merganser*. The species *C. concava* parasitises mainly piscivorous birds: Anatidae and Laridae. Moreover, also for the first time in Poland, the presence of the trematod *Cryptocotyle lingua* (Creplin, 1825) was recorded in the intestines of the *M. merganser*. Three specimens of *C. lingua* were found in one *M. merganser* from Lake Dąbie. Similarly to the case of *E. cinctum*, a note can be found in the Internet service Fauna Europaea about the occurrence of *C. lingua* in the territory of Poland, but there is no information on literature confirming this fact. *C. lingua* is a parasite of piscivorous birds and mammals with a Palaearctic range.

Family Leucochloridiomorphidae Yamaguti, 1958

The species *Leucochloridiomorpha lutea* (von Baer, 1827) was recorded only in the *Anas platyrhynchos*. As the sources say, this is a relatively rare parasite of ducks. In Poland, an adult parasite has been so far found in *Anas querquedula* and *Aythya fuligula* [1, 12] and experimentally in ducklings and chickens during a research of the development cycle of this parasite [1].

Family Notocotylidae Lühe, 1909

Catatropis verrucosa (Fröhlich, 1789), a cosmopolitan trematod of birds connected with water environment, was found in the intestine of the *Mergus merganser* and this is the first finding of the parasite in this host species in Poland, since in our country it had been recorded only in the *Aythya ferina* and the *Cygnus olor* [1, 2, 13]. The next species, *Notocotylus attenuatus* (Rudolphi, 1809), was found in five host species: *Anas platyrhynchos*, *Aythya fuligula*, *A. marila*, *Mergus merganser* and *Melanitta fusca*; in *M. merganser* for the first time in Poland. This trematod is a cosmopolitan, commonly occurring parasite of the intestine in the Anseriformes and also occurs in birds of other orders [1–3]. In the examined material, the species *Paramonostomum alveatum* (Mehlis, 1846) was found in *Aythya marila* and *Melanitta nigra*. This fluke, unique for the Anseriformes had only been recorded in *M. fusca* and *Somateria mollissima* [1, 5], so the *Aythya marila* and *Melanitta nigra* are

hosts recorded for the first time in Poland for this fluke.

Family Opisthorchiidae Looss, 1899

One individual of *Metorchis xanthostomus* (Creplin, 1846) was found in the *Anas platyrhynchos*. In Poland, the parasite had been noted in some host species, including the *A. platyrhynchos* [1, 2].

Family Prosthogonimidae Lühe, 1909

Two species from the family Prosthogonimidae were found in the Mallard's bursa Fabricii: *Prosthogonimus ovatus* (Rudolphi, 1803) and *Prosthogonimus rarus* (Braun, 1901). The species *P. ovatus* in a cosmopolitan parasite, mainly of the Passeriformes and Anseriformes [1]. *P. rarus*, in turn, occurs mainly in the Anseriformes and only sporadically in birds of other orders. In Poland, an adult form has been recorded in six host species [1, 3, 12].

Family Psilostomidae Looss, 1900

Isolated individuals of *Psilochasmus oxyurus* (Creplin, 1825) and *Psilotrema simillimum* (Mühling, 1898) were found in the *Anas platyrhynchos*. *P. oxyurus* commonly occurs in the Anseriformes. In Poland, this species has been recorded in four host species, including *A. platyrhynchos* [1], and *P. simillimum* has been so far recorded in four bird species [1, 3, 12]. *Psilostomum brevicolle* (Creplin, 1829), in turn, was found in *Melanitta fusca* and *Anas platyrhynchos* (one individual here). This is a parasite of the Anseriformes and some species of gulls. In Poland, it has been recorded so far in *Melanitta fusca* and *Somateria mollissima* [1].

Family Schistosomatidae Stiles et Hassall, 1898

Bilharziella polonica (Kowalewski, 1895) was found in two host species: *Anas platyrhynchos* and *Mergus merganser*. This parasite commonly occurs in birds of water and mud environment belonging to several orders, most often the Anseriformes. It is the first instance of this parasite in the *M. merganser* [1, 3]. *B. polonica* situates itself in the blood vessels of the intestine and liver, mainly in the vessels of the mesentery, and also of the kidneys and stomach. During a post-mortem it "falls out" of blood vessels inside the intestine or goes there right after a host's death.

Family Strigeidae Railliet, 1919

The species *Apatemon gracilis* (Rudolphi, 1819) was found only in the intestine of the *Mergus merganser*. In Poland it has been recorded so far in five host species [1, 4], but not in the *M. merganser*.

Australapatemon minor (Yamaguti, 1933), a typical parasite of Anatinae, was found in the *Anas platyrhynchos* and *Aythya fuligula*. Despite the fact that until recently its presence in Poland was connected only with the *Melanitta fusca* [1], the latest study by Sulgostowska, based on the material from the years 1954–1970 from the Masurian lakes, prove that this is a typical parasite of *Anas platyrhynchos*, *A. strepera*, *A. crecca*, *Aythya ferina*, *A. nyroca*, *A. fuligula* and *A. marila* [4]. A cosmopolitan species *Cotylurus cornutus* (Rudolphi, 1808) was found in the examined material only in *Anas strepera* and *Aythya fuligula*, for the first time in *A. strepera*. *C. cornutus* is found in numerous bird species, mainly in Anseriformes and Charadriiformes.

Hosts and their parasites

Anatini. Isolated individuals of *Cotylurus cornutus* (Strigeidae) were found in the intestine in one examined *Anas strepera*. This is a new parasite-host system in Polish fauna, since the research of this host species so far had shown the occurrence of 9 species of Digenea, but *C. cornutus* had not been among them [1, 12]. In the *Anas platyrhynchos* as many as 13 species of digeneans were found belonging to 8 families: Echinostomatidae, Leucochloridiomorphidae, Notocotylidae, Opisthorchiidae, Prosthogonimidae, Psilostomidae, Schistosomatidae and Strigeidae. However, earlier research of *Anas platyrhynchos* from the area of Szczecin [3] and the research of other authors in Poland indicate the presence of at least 20 species of Digenea in the Mallards fauna [1, 3, 12]. In one examined *Anas crecca* the occurrence of two trematod species from the family Echinostomatidae was found; so far at least 8 species have been known in Poland [1, 4, 12].

Aythiini. Six trematod species were found in the *Aythya fuligula*, belonging to 3 families: Echinostomatidae, Notocotylidae and Strigeidae, but the research of other authors indicate that the *A. fuligula* can be a host of at least 13 fluke species [1]. In the *Aythya marila* from northwestern Poland, four parasite species were found, belonging to 2 families: Echinostomatidae and Notocotylidae, while the results of other researches show the possibility of the occurrence of as many as 6 species of Digenea [1, 4].

Mergini. As many as 15 fluke species from 7 families (Cyathocotylidae, Diplostomidae, Echinostomatidae, Heterophyidae, Notocotylidae, Schistosomatidae and Strigeidae) were found in the

Mergus merganser. The reason of that may be the fact that this is the first so extensive study of this host species in Poland (60 individuals). The number of fluke species found by other authors so far is very small because it only includes two species: *Prosthogonimus ovatus* (Rudolphi, 1803) and *Tylodelphys excavata* (Rudolphi, 1803) [1]. In the *Melanitta fusca*, the occurrence of 3 fluke species belonging to 3 families have been determined: Heterophyidae, Notocotylidae and Psilostomidae. Those species had been already recorded in Poland in the *M. fusca* and other birds [1, 2, 4]. In two out of 10 parasitologically examined *Melanitta nigra*, two species of Digenea from two families were found: Heterophyidae and Notocotylidae. So far in Poland, the occurrence of three species of Digenea has been determined in the *Melanitta nigra*, including also *Cryptocotyle concava*.

Summary and conclusions

The carried out study showed the existence of four, not previously recorded in Polish fauna, digenean species representing three families: Diplostomidae (*Diplostomum phoxini* and *D. pusillum*), Echinostomatidae (*Echinoparyphium cinctum*) and Heterophyidae (*Cryptocotyle lingua*). The existence of 21 not previously recorded parasite-host systems was demonstrated for the following hosts:

- *Anas strepera* (with *Cotylurus cornutus*);
- *Anas platyrhynchos* (with *Psilostomum brevicolle*, *Leucochloridiomorpha lutea*);
- *Aythya marila* (with *Echinostoma revolutum*, *Paramonostomum alveatum*);
- *Aythya fuligula* (with *Echinoparyphium cinctum*);
- *Melanitta nigra* (with *Paramonostomum alveatum*);
- *Mergus merganser* (with: *Echinostoma revolutum*, *Echinochasmus spinulosus*, *Stephanoprora pseudoechinata*, *Cryptocotyle concava*, *Cryptocotyle lingua*, *Diplostomum parviventosum* *D. phoxini*, *D. mergi*, *D. pusillum*, *Ornithodiplostomum scardinii*, *Bilharziella polonica*, *Apatemon gracilis*, *Notocotylus attenuatus*, *Catatropis verucosa*).

The fluke *Ornithodiplostomum scardinii* from the family Diplostomidae is a species so far found in Poland only in intermediate hosts (the Rudd, Roach, White Bream and Bream). It should be assumed, then that the life cycle of this parasite closes in the territory of Poland.

The richness of grouping of flukes from the

genus *Diplostomum* in the piscivorous *Mergus merganser* is worth noting. This the first such a piece of information in Poland, which suggests the necessity of continuing the research of helminthofauna of this host species.

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