

Original papers

Digenean trematodes from six species of birds (Passeriformes, Piciformes and Strigiformes) from north-western Poland

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ABSTRACT. Ten species of digeneans were found in a survey of six species of terrestrial birds associated with woodland and urban habitats of north-western Poland carried out in 2006–2009: *Leucochloridium paradoxum* Carus, 1835 (Leucochloridiidae) from the *Cyanistes caeruleus* (L.) and the *Parus major* L. (Paridae); *Leucochloridium perturbatum* Pojmańska, 1968 (Leucochloridiidae) from the *Turdus merula* L., (Turdidae) and the *Corvus monedula* L. (Corvidae); *Leucochloridium* sp. (Leucochloridiidae Poche, 1907) from the *Asio otus* (L.) (Strigidae) and *P. major*; *Strigea strigis* (Schränk, 1788) (Strigeidae) from the *A. otus*; *Morishitium elongatum* (Harrach, 1921) (Cyclocoelidae) and *Psilotornus confertus* Machalska, 1974 (Psilostomidae) and *Leyogonimus postgonoporus* (Neiland, 1951) and *Lutztrema attenuatum* (Dujardin, 1845) (Dicrocoeliidae) from the *T. merula*; *Plagiorchis maculosus* (Rudolphi, 1802) (Plagiorchiidae) from the *C. caeruleus*; *Prosthogonimus ovatus* (Rudolphi, 1803) (Prosthogonimidae) from the *Dendrocopos major* (Linnaeus) (Picidae); *Zonorchis petiolatus* (Railliet, 1900) (Dicrocoeliidae) from the *T. merula* and the *C. monedula*. Five species and one genus of digeneans: *L. paradoxum* from the *C. caeruleus* and the *P. major*; *Leucochloridium* sp. from the *A. otus* and *P. major*; *P. confertus* from the *T. merula*; *P. maculosus* from the *C. caeruleus*; *P. ovatus* from the *D. major* and *Z. petiolatus* from the *C. monedula* represent new Polish host records. *S. strigis* and *L. postgonoporus* represent new Polish locations.

Key words: Digenea, birds, terrestrial environments, north-western Poland

Introduction

Digenean trematodes occurring in Poland were listed by Sulgostowska and Czaplńska [1] and by Pojmańska et al. [2]. According to the lists, the Polish wild birds host 98 digenean species, i.e., about 30% of all the digenean species recorded in Poland. Additional information on digenean species new for Poland and occurring in birds as well as on new host-parasite relationships and new locations was provided by Kavetska et al. [3,4], Kalisińska et al. [5], Rząd et al. [6,7], and Okulewicz et al. [8]. Most of those publications deal with digeneans living in waterfowl. Okulewicz et al. [8] based their

publication on materials collected by Dr. Jerzy Okulewicz in 1974–2004 in Lower Silesia and revealed 11 avian digenean species new for Poland as well as new, hitherto unknown, digenean hosts. A group very well known in Poland are digeneans of thrushes, recorded during migrations [9–11]. Digeneans occurring in corvids have been fairly comprehensively investigated as well [12]. In contrast, the Tits *Parus major* and *Cyanistes caeruleus*, the Long-eared Owl (*Asio otus*), and also the Great Spotted Woodpecker (*Dendrocopos major*) have been seldom studied, for which reason their helminths are very poorly known. With regard to Central Europe, digeneans occurring in birds in

Table 1. Species, number and origin of birds

Species	Number of examined	Site
The Common or Eurasian Blackbird <i>Turdus merula</i> L.	60	BK, HL, S
The Jackdaw <i>Corvus monedula</i> L.	1	S
The Great Spotted Woodpecker <i>Dendrocopos major</i> (L.)	1	S
The Great Tit <i>Parus major</i> L.	30	BK, HL, S
The Blue Tit <i>Cyanistes caeruleus</i> (L.)	60	BK
The Long-eared Owl <i>Asio otus</i> (L.)	2	BK

Explanations: BK – Bukowo-Kopań Field Ringing Station (16°25'E; 54°28'N); HL – Hel Field Ringing Station, Kuźnica (18°28'E; 54°46'N); S – Szczecin (53°26'N, 14°32'E)

the Czech Republic and in Slovakia have been recently inventoried [13]. Similar lists of avian helminths, including those found in birds of Ukraine and other ex-USSR countries and from Germany, were published in 1962–1995 [14–16]. The knowledge on geographic distribution and developmental cycles of some digeneans, e.g., *Psilotornus confertus* (Psilostomidae) or *Leyogonimus postgonoporus* (Stomylotrematidae), is scant and requires more environmental and experimental studies. Owing to the trematode importance for avian health and condition as well as from the standpoint of digenean trematode diversity assessment, the presence of those helminths in the habitat should be monitored and the hosts identified to the maximum possible extent.

This study aimed at obtaining biological diversity of digenean trematodes occurring in wild terrestrial birds in north-western Poland.

Material and methods

In 2006–2009, 154 wild terrestrial birds from six species were examined for the presence of parasites (Table 1). The birds to be examined were obtained thanks to ornithologists who forwarded information about birds which perished due to various reasons, e.g., collisions with window panes and cars, predator attacks, weakened conditions, and inclement weather. The birds were obtained from the Baltic coastal region (Pomeranian Lakeland): Szczecin (53°26'N; 14°32'E), environs of Darłowo (Bukowo-Kopań Field Ringing Station; 16°25'E; 54°28'N) and from the Hel Peninsula (Hel Field Ringing Station, Kuźnica 18°28'E; 54°46'N). Trematodes were preserved in 75% ethanol and

mounted; the mounts were stained with carmine alum and embedded in Canada balsam.

Results

Ten species of digeneans were found in a survey of six species of birds (Table 2). The results extended the list of the Polish trematode hosts and revealed their new sites of occurrence. New Polish hosts were identified for the following trematode: *Leucochloridium paradoxum* (Carus, 1835) and *Leucochloridium* sp., *Psilotornus confertus* (Machalska, 1974), *Plagiorchis maculosus* (Rudolphi, 1802), *Prosthogonimus ovatus* (Rudolphi, 1803), and *Zonorchis petiolatus* (Railliet, 1900) (Table 2). *S. strigis* found in Bukowo-Kopań and *L. postgonoporus* found in Hel Peninsula were recorded in new Polish locations (Table 2).

Discussion

Knowledge about digenean of birds in Poland is incomplete. Digenean trematode of the Blue Tit, the Great Tit and the Great Spotted Woodpecker are not known in our country. Digenea of the Long-eared Owl are little known (only *Strigea strigis*). Digenean fauna of the Jackdaw is known well (seven species) and digenea of the Common or Eurasian Blackbird in its autumn and spring migration is very well known (13 species of Digenea) [2]. Two species of Digenea were found in the Blue Tit and the Long-eared Owl, including one identified as the genus. One by one species was found in the Great Tit and the Great Spotted Woodpecker (Table 2). These birds are new hosts of these parasites in Poland. Two species of Digenea

Table 2. Digenean trematodes of birds

Trematode species	Host (number of infected birds/ number of trematodes collected)	Site and date of collection	Location in host
Family: Leucochloridiidae			
<i>Leucochloridium paradoxum</i> Carus, 1835	<i>Cyanistes caeruleus</i> * (3/179) <i>Parus major</i> * (6/676)	BK, 22 Oct. 2007 BK, 19 Oct. 2008, 01 Nov. 2009; S, 21 Oct. 2009	Cloaca
<i>Leucochloridium perturbatum</i> Pojmańska, 1969	<i>Turdus merula</i> (1/2) <i>Corvus monedula</i> (1/103)	BK S	Cloaca
<i>Leucochloridium</i> sp.	<i>Parus major</i> * (1/6) <i>Asio otus</i> * (1/2)	HL, 31 Mar. 2009 BK, 22 Oct. 2007	Cloaca
Family: Cyclocoelidae			
<i>Morishiitum elongatum</i> (Harrach, 1921)	<i>Turdus merula</i> (1/5)	BK	Air sacks
Family: Strigeidae			
<i>Strigea strigis</i> (Schrank, 1788)	<i>Asio otus</i> (1/5)	BK	Intestine
Family: Psilostomidae			
<i>Psilotornus confertus</i> Machalska 1974	<i>Turdus merula</i> * (1/1)	HL, 07 Apr. 2009	Cloaca
Family: Plagiorchiidae			
<i>Plagiorchis maculosus</i> (Rudolphi, 1802)	<i>Cyanistes caeruleus</i> * (1/1)	BK, 10 Oct. 2009	Intestine
Family: Prosthogonimidae			
<i>Prosthogonimus ovatus</i> (Rudolphi, 1803)	<i>Dendrocopos major</i> * (1/1)	S, 10 Oct. 2007	Bursa Fabricii
Family: Stomylotrematidae			
<i>Leyogonimus postgonoporus</i> (Neiland, 1951)	<i>Turdus merula</i> (1/1)	HL	Intestine
Family: Dicrocoeliidae			
<i>Lutztrema attenuatum</i> (Dujardin, 1845)	<i>Turdus merula</i> (12/139)	BK, HL, S	
<i>Zonorchis petiolatus</i> (Railliet, 1900)	<i>Turdus merula</i> (3/5) <i>Corvus monedula</i> * (1/2)	BK, S S, 05 Mar. 2008	Gall bladder

Explanations: *new Polish host; BK, HL, S – see: Table 1.

were found in the Jackdaw. The Jackdaw is a new hosts in Poland for one (Table 2). Six species of Digenea were found in the Common Blackbird. For one the Common Blackbird is a new Polish host. The results of investigations show new Polish hosts for trematodes: *Leucochloridium paradoxum*,

Leucochloridium sp., *Psilotornus confertus*, *Plagiorchis maculosus*, *Prosthogonimus ovatus* and *Zonorchis petiolatus* (Table 2).

New in Poland hosts of *L. paradoxum* are the Blue Tit and the Great Tit. So far known in Poland, the natural definitive hosts of the species are *Turdus*

merula and *T. philomelos* in which *L. paradoxum* was found for the first time in Poland [9]. In addition to eight other avian species examined in the Czech Republic, *L. paradoxum* was found in *C. caeruleus* and *P. major* [13]. In its geographic distribution known from records of the larval forms, *L. paradoxum* occurs most probably throughout Europe [1,17]. The list of *L. paradoxum* hosts in Europe is still being increased, the trematode in question was found for the first time in Italy in *Philomachus pugnax* in the last years [18]. Trematodes from the genus *Leucochloridium* were found in the Long-eared Owl for the first time in Poland (Table 2). The Long-eared Owl was most probably accidentally infected with adult *Leucochloridium* sp. by consuming the infected small birds. The examined owl stomachs showed undigested remains of small birds (most probably *Parus* sp.).

The Common Blackbird is a new host in Poland for *P. confertus*. This species is a very rare trematode, no data being available on its life cycle. In Poland, *P. confertus* was found exclusively in *Turdus iliacus* and *T. philomelos*, and was described by Machalska as a new species [19]. Outside of Poland, *P. confertus* was found in the Common Blackbird in the Czech Republic [13] and has been reported from the Eurasian Water Shrew (*Neomys fodiens* Pennant, 1771) in the Oriental Pyrenean Mountains [20]. The parasite scant albeit important records notwithstanding, the literature contains hardly any information on the trematode's occurrence.

The Blue Tit is a new in Poland host for *P. maculosus*. It is a frequent parasite of birds representing different orders; in Poland, it has been recorded in the Passeriformes. The presence of the parasite in the Baltic coastal region was reported from birds living on the Lake Drużno [21]. The Polish list of definitive hosts consists of four species so far, which – compared to the list of hosts in the Czech Republic (15 species) – is a small fraction of all the known hosts.

The Great Spotted Woodpecker is a new host for *P. ovatus* in Poland. The trematode is a cosmopolitan parasite of wide host specificity, occurring in juvenile birds both on wetlands and in terrestrial habitats. In Poland, the parasite invades hosts representing different orders, including the Anseriformes, Charadriiformes, Passeriformes, a total of 19 host species being identified [2]. For comparison, a total of 16 definitive host species, including wetland and terrestrial birds. The parasite was reported from *Dendrocopos major* in Ukraine [16]. The trematode

in question is widely distributed in various regions of Poland. In the Pomeranian Lakeland, it was found in ducks dwelling in Lake Dąbie and the Szczecin Lagoon [3,22]. The list of *P. ovatus* hosts worldwide has been recently expanded to include avian species from Brazil: The Neotropical Cormorants (*Phalacrocorax brasilianus*) and The Rosy-billed Pochards (*Netta peposaca*) [26].

The Jackdaw is a new in Poland host for *Z. petiolatus* (Table 2). In previous investigation of the Jackdaw in Poland, Rutkowska found *Zonorchis* sp. in the environs of Warsaw and Żmigród [12]. *Z. petiolatus* was noted in the Common Blackbird in Poland as synonym for *Lyperostomum petiolatum* Railliet, 1900 [1]. In the literature there are some synonyms of *Z. petiolatus*, including *L. petiolatum*, *L. turdia* and others [24]. Except the Common Blackbird, *Z. petiolatus* was noted in Poland in *T. philomelos*, *T. iliacus*, *T. pilaris* [1,2,9] and *Pica pica* [12]. *Z. petiolatus* parasitizes mainly crows and thrushes in the Palaearctic Region. The parasite occurs less commonly in representatives of other avian orders, e.g., in the White Ibis (*Eudocimus albus*) in USA [25].

Remaining species of trematodes: *L. perturbatum*, *M. elongatum*, *S. strigis*, *L. postgonoporus*, *L. attenuatum* are known in Poland and were noted in the same hosts earlier (Table 2). According to the present knowledge *L. perturbatum* is a common species, particularly in the Passeriformes. It is likely to occur throughout Europe [1]. In Poland, it has been so far reported from more than 10 species of various avian orders: Charadriiformes, Passeriformes, Gruiformes [1,2]. The parasite was recorded in, i.a., *Turdus viscivorus*, *T. philomelos*, *T. iliacus*, and *T. merula* during their spring and autumn migrations [9]. The environs of Darłowo (BK) and Szczecin are new localities on the Baltic coast and adjacent areas; so far, the Baltic coast region has featured the parasite in its eastern part, i.e., in the Vistula Lagoon, Lake Drużno, and on the Hel Peninsula [2,9]. *M. elongatum* is a Holarctic digenean occurring in passerines and woodpeckers [13]. In Poland it has been reported from *Turdus merula* and *T. philomelos* (synonym *Cyclocoelum polonicum* Machalska, 1980) [2,9]. So far, the trematode has been encountered only during spring and autumn migrations of the hosts, with the maximum of 124 individuals in one *T. philomelos* [9]. In this study the date of trematode finding also coincided with the blackbird spring migration. Environs of Darłowo are a new locality of the trematode on the Baltic co-

ast; the parasite had earlier been reported in the region only from the Hel Peninsula [9]. *Strigea strigis* is a typical owl parasite occurring in the Palaearctic and in Africa. In Poland, the parasite was found in four owl species, including *A. otus* [1,2] in Warsaw [1] and in the environs of Lublin [1,26]. During the last decade, *S. strigis* was reported from *A. otus* and some other owl species in the Czech Republic [13,27] and in the Netherlands [28]; it was also reported from the White-tailed Eagle, considered to be a paratenic host [29]. *Leyogonimus postgonoporus* is a rare Holarctic trematode of thrushes and starlings, in Poland found by Okulewicz and Wesółowska [11] in the Lower Silesia as a parasite of *Scolopax rusticola* and *Turdus merula*. The occurrence of *L. postgonoporus* worldwide was described by Neiland [30] and Groschaft [31]. Recent records have been supplied by studies on avian trematode fauna in the Czech Republic where the species was found in *Turdus merula*, *T. philomelos*, *Dendrocopos major*, and *Parus major* [13]. *L. attenuatum* (synonyms: *Brachylecithum attenuatum* (Dujardin, 1845); *Lutztrema monenteron* (Price et McIntosh, 1935) is a frequent and common parasite of the Passeriformes, occurring in the Holarctic and South America. In Poland, it has been reported from a number of avian species, including *Turdus merula* [2]. *L. monenteron* was found on the Baltic coast, in the Vistula Lagoon and on the Hel Peninsula, during spring and autumn migrations of thrushes [9,32].

It has to be borne in mind that the distribution of adult digeneans shown in this paper reflects the parasites' occurrence in the sampling localities rather than the true distribution. The detected localities, and hence distribution, are related to the avian behaviour, whereby birds are capable of transporting digeneans, often over long distances. Trematode distribution is closely associated with the occurrence of larval parasite hosts. Studies on birds during migrations may reveal the presence of introduced trematodes which do not belong to the fauna of Poland [33].

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