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Short Communication

Parasitic helminths in grey heron (*Ardea cinerea*) chicks

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Abstract: Parasitological studies were carried out on pulli ($n = 20$) collected on a breeding colony near the Włocławski Reservoir on the Vistula River (Central Poland). Larvae of the nematode *Contracaecum rudolphii* (mean intensity of infection 9.3) were detected in the stomachs of all chicks, with adult worms present in two chicks. Larvae of the nematode *Porrocaecum ardeae* (mean intensity 3.1), the tapeworm *Paradilepis scolecina* (58.5) and flukes of five genera: *Tylodelphys, Posthodiplostomum*, *Apharyngostrigea*, *Paryphostomum* and *Echinochasmus* (mean intensity in total 28.1) were found in the intestines of all chicks. The studies demonstrated that grey heron chicks are infected with parasites very early in life, which may adversely impact their health. The presence of adult *C. rudolphii* nematodes indicates a transfer of parasites from adult birds to chicks during feeding.

Key words: *Ardea cinerea;* pullus; Nematoda; Cestoda; Trematoda

Introduction

Grey heron (*Ardea cinerea* L., 1758) inhabits wide geographical areas in Europe, Asia and Africa. In Poland, this species was widespread until the mid-19th century, but after a long period of eradication its numbers dropped dramatically. Since being partially covered by conservation, its numbers have slowly increased; the size of the national breeding population of grey heron is now estimated at approximately 9,000–10,000 pairs (Wieloch 2004) with the largest heron grounds located in northern Poland. The breeding grounds are situated near water reservoirs, often together with, or close to, breeding colonies of the great cormorant, *Phalacrocorax carbo sinensis* (Blumenbach, 1798). Mixed colonies are predominantly found on islands. In northern Poland, of 16 colonies located on islands, 15 (94%) have mixed colonies of grey heron and great cormorant, whereas of the 60 colonies situated on land, only 4 (7%) were mixed (Żółkoś et al. 2010). In northern Poland, no on-ground colonies have been found and the majority of nests (75%) are located in pine-stands.

The majority of individuals nesting in Poland winter in the south of Europe, some fly to central Africa and a minor fraction stays for the winter in the west of the country together with birds from northern and eastern Europe. In March, birds are in breeding colonies and start their breeding season. After gaining the ability to fly, young individuals migrate to search for food in different directions, although mostly to the south-west. Migrations to wintering grounds last from the beginning of September till the end of October.

The breeding success of the grey heron depends on the number of eggs, age and experience of the parental pair, the abundance of food, the presence of predators and climatic conditions (Jakubas 2005, 2011). Within 20–30 days after hatching, chicks leave the nest onto surrounding branches and are able to fly after 50 days. The grey heron's diet is mainly composed of fish, but it also eats amphibians, small mammals and insects, earthworms, molluscs and crustaceans (Jakubas & Mioduszewska 2005). Such a varied diet makes it possible to become an intermediate or final host of parasites associated with both aquatic and terrestrial environments. Chicks are fed partially digested food by both parents, which may result in the transfer of parasites which thrive in the gastrointestinal tract of adult birds. Such an infectin level with nematodes of the *Contracaecum* genus has been described in very young cormorant chicks (Kuiken et al. 1999; Kanarek 2011) and (in the authors' opinion) may cause their high mortality. Wiese (1977) reported a high mortality in 2-to-4-week-old snowy egret, *Ergretta thula* (Molina, 1782), chicks on a pea patch in Delaware State caused by the infestation with the nematode *Eustrongylides ignotus*. In the available literature, there are few publications on parasites in grey heron. Of the gastrointestinal parasites found in adult birds, flukes are the most studied (Nogueserola et al. 2002; Sulgostowska 2007; Sitko 2012) with tapeworms and nematodes much less investigated (Korpaczewska 1963; Papazahariadou et al. 2008). However, there is a lack of research on gastrointestinal parasites in chicks.

The objective of the current study was to determine the infection level of gastrointestinal parasites in

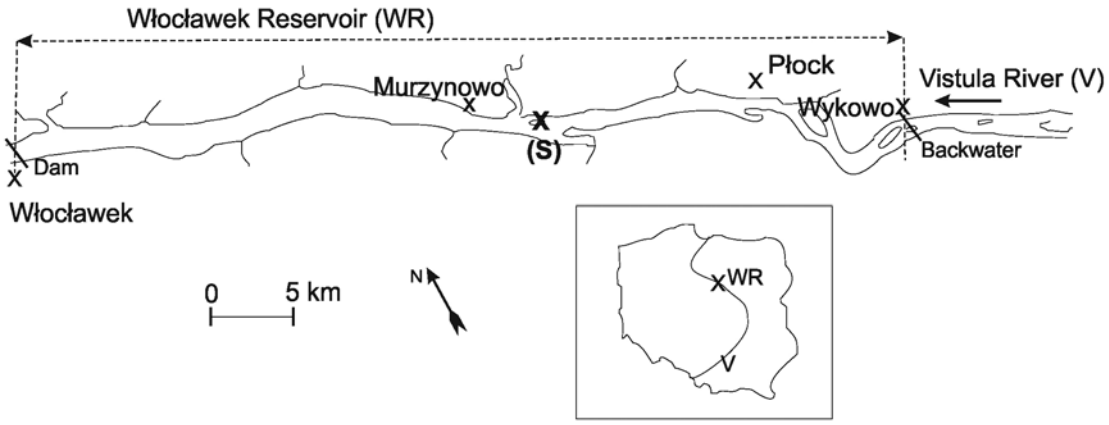

Fig. 1. Sampling site (S) of grey heron chicks in the area of the Włocławek Reservoir (WR). Inset map of Poland indicates course of the Vistula River (V) and location of the Reservoir (WR).

Table 1. The infection of grey heron chicks with Nematoda (N), Cestoda (C) and Trematoda (including all species).

	Subsequent sections of the gastrointestinal tract											
	Oesophagus				Stomach				Intestine			
Parasite	Larvae		Adult		Larvae		Adult		Larvae		Adult	
	P	I	P	I	P	I	P	I	P	I	P	I
Contracaecum rudolphii (N)	0	0	0	0	100	9.3 ±5.00	10	0.8 ±1.70	0	0	0	0
Porrocaecum ardeae (N)	0	0	0	0	0	0	0	0	100	3.1 ±1.97	0	0
Paradilepis scolecina (C)	0	0	0	0	0	0	0	0	0	0	100	58.5 ± 44.75
Trematoda	0	0	0	0	0	0	10	0.2 ± 0.41	0	0	100	28.1 ± 17.72

Explanations: P(%)– the prevalence, I – mean intensity of infection (±SD).

dead grey heron chicks found in a breeding colony in Central Poland.

Material and methods

Parasitological studies of intestinal parasites were carried out on 20 grey heron pulli collected from a breeding colony situated on the island near the right bank of the Włocławski Reservoir (the lower Vistula River), close to locality Murzynowo (52°34′20.3″ N, 19°32′36.0″ E) (Fig. 1). The gastrointestinal tract was divided into subsequent segments (oesophagus, stomach, intestine), placed in separate crystallizers and the organs were then dissected longitudinally and decanted with saline (0.9% NaCl). Parasites were determined directly after decantation or after fixation in 70% ethanol with glycerol (5%) or after the preparation of fixed specimens. Parasites were identified and classified into species following the guidelines of Baruš et al. (1978), Ryzhikov et al. (1985), Sulgostowska & Czaplińska (1987).

Results and discusion

No parasites were found in the oesophagus of the examined chicks. Larvae were detected in the stomachs of all chicks and adult specimens of *Contracaecum rudolphii* Hartwich, 1964 (Nematoda) were present in two birds. The mean intensity of infection was 9.3 (Table 1). In the stomachs of two chicks, single flukes of the *Echinochasmus* genus were found. In all examined chicks, larvae of *Porrocaecum ardeae* (Frölich, 1812) nematode, *Paradilepis scolecina* (Rudolphi, 1819) tapeworm and flukes of *Tylodelphys* Diesing, 1850, *Posthodiplostomum* Dubois, 1936, *Apharyngostrigea* Ciurea, 1927, *Paryphostomum* Dietz, 1909 and the *Echinochasmus* Dietz, 1909 genera were identified in the intestines. The mean intensity of infection with *P. ardeae* and *P. scolecina* was 3.1 and 58.5, respectively, the mean intensity with flukes in total was 28.1 (Table 1).

In the gastrointestinal tract of the examined chicks, parasites associated by life cycle with hydrobionts predominated due to the location of the colony near a large water reservoir. Jakubas & Mioduszewska (2005) investigated the diet of grey heron from colonies located at Gdańska Bay, Lake Drużno and in Kąty Rybackie and found that it was 95% composed of different fish species.

Larvae and adults of *C. rudolphii* were found in all examined chicks; this nematode is cosmopolitan and is associated in its life cycle with crustaceans, aquatic insect larvae and fish. Nematodes of the *Contracaecum* Raillet et Henry, 1912 genus are found in the gastrointestinal tracts of many fish-eating bird species (Pyrovetsi & Papazahariadou 1995; Nogueserola et al. 2002; Papazahariadou et al. 2008) although they have been most often isolated in cormorants (Torres et al. 2000; Abollo et al. 2001; Dziekońska-Rynko & Rokicki 2008; Biedunkiewicz et al. 2012). Kuiken et al. (1999) demonstrated that the prevalence in one-week-old chicks

at the Dore Lake cormorant colony (Saskatchewan, Canada) was 50%, in two-week-old chicks it was 71% and it increased to 83% in three-week-old birds. The authors found mature *C. rudolphii* specimens in two-week-old chicks which may indicate that this nematode is passed from parents to chicks with food. Similar observations on cormorant chicks from colonies in north-eastern Poland were reported by Kanarek (2011). The prevalence in one-week-old chicks was 17.9%, although it reached 91.5% in two-week-olds. The L_3 and L_4 larvae were most commonly found in cormorant chicks, with adult parasites being identified less frequently.

The prevalence of *C. rudolphii* in grey heron chicks in the current study is consistent with the results reported by the above-cited authors (Kuiken et al. 1999; Kanarek 2011). The prevalence in the examined sample of chicks was 100% and the mean intensity reached 9.3. Larvae (L_3 and L_4) predominated in the stomach and, additionally, adult nematodes were found in two chicks, which confirms the potential to transfer adult parasites to chicks with food. Although this nematode is less pathogenic, when the gastrointestinal tract is not filled with food, it may digest the mucosa of a host – causing damage that leads to digestive disturbances (Huizinga 1971; Rokicki et al. 2011). Such damage, together with other stress factors (bacteria, xenobiotics), may be fatal (Pyrovetsi & Papazahariadou 1995).

The *Porrocaecum ardeae* nematode, the *Paradilepis scolecina* tapeworm and flukes representing five genera were found in the intestines of the examined chicks. Nematodes of the *Porrocaecum* genus are found in many bird species linked to both aquatic and terrestrial environments (Vicente 1995; Ferrer et al. 2004; Papazahariadou et al. 2008; Yoshino et al. 2009; Fanke et al. 2011). These parasites have a complex life cycle that includes animals associated with both aquatic and terrestrial habitats (oligochaetes, crustaceans, fish and small mammals). In Poland, this nematode was first identified by Bezubik in 1954 in an adult grey heron and purple heron, *Ardea purpurea* (L., 1766). Fanke et al. (2011) detected *P. ardeae* in cranes (Gruiformes) in Germany. The prevalence in the examined birds (n = 101) was over 60%. In three birds, the infestation was fatal due to an intestinal perforation. Nematodes of *Porrocaecum* genus were also found in owls (Strigiformes) in Spain (Ferrer et al. 2004). The prevalence in the small owl, *Athene noctua* (Scopoli, 1769) was 3.3% and in barn owl, *Tyto alba* (Scopoli, 1769) it reached 6.7%.

Paradilepis scolecina tapeworm is a cosmopolitan parasite in fish-eating birds, mainly cormorants, although it may sporadically infect other species (Korpaczewska 1963; Ryzhikov et al. 1985; Dziekońska-Rynko & Dzika 2011; Biedunkiewicz et al. 2012). Its life cycle is linked to the aquatic environment. The crustacean *Eudiaptomus graciloides* (G.O. Sars, 1863) (Copepoda) is the first intermediate host, with fish being the second. According to Karstad et al. (1982), a large number of tapeworms may cause extensive damage to the host intestine. Pathological effects observed by the authors in cormorants were associated with the deep penetration of scolexes into the intestinal wall. Infiltrations with macrophages, eosinophils and lymphocytes around the cuticle of tapeworms were found in increased numbers.

Flukes detected in the intestine of the examined chicks are linked to the aquatic environment. Sulgutowska (2007) investigated the prevalence of flukes in many bird species from the Masurian lakes and found six different fluke species in the intestines in grey heron. The prevalence of *Codonocephalus urniger* (Rudolphi, 1819) and *Posthodiplostomum brevicaudatum* (Nordmann, 1832) was 100% in both, with *Apharyngostrigea cornu* (Zeder, 1800) – 80% and with *Posthodiplostomum cuticola* (Nordmann, 1832) it was 40%. Sitko (2012) detected 29 different flukes in herons in the Czech Republic. He identified 21 Digenea species in different segments of the gastrointestinal tract. Flukes representing *Tylodelphys, Posthodiplostomum*, *Apharyngostrigea*, *Paryphostomum* and *Echinochasmus* genera were detected by the above-mentioned authors in adult birds as well as in chicks. In the available literature, there is a lack of data on the pathogenicity of flukes inhabiting the gastrointestinal tract of birds. It appears that they are not neutral to the function of the digestive system (digestion, absorption), especially with a high infestation intensity.

The conducted studies demonstrated that grey heron chicks are infected very early with parasitic helminths. Some parasites are transferred during feeding, which is confirmed with adult nematodes of *C. rudolphii* being found in chicks. The presence of dead chicks on heron grounds may result from a lower bird health caused by early acquisition of parasites. Severely-infected chicks may be thrown out of nests during fights with stronger (non-infected) individuals, which is fatal to weaker birds. The list of factors determining the breeding success of grey heron, namely, the number of eggs, age and experience of the parental pair, abundance of food and the presence of predators and climatic factors can be supplemented with an additional parameter, i.e. the infection with parasites.

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