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FIRST NOTE ON FISH PARASITES IN POLISSKY NATURE RESERVE, NORTHERN UKRAINE

N. Yu. Rubtsova*[1], Yu. K. Kutsokon[2]

[1] *Institute of Parasitic Diseases (IPD), 11455 East Via Linda, #2-419, 85259, Scottsdale, Arizona, USA*
[2]*Schmalhausen Institute of Zoology, NAS of Ukraine,*
vul. B. Khmelnytskogo, 15, Kyiv, 01030 Ukraine
**Corresponding author*
E-mail: nyrubtsova@gmail.com

First Note on Fish Parasites in Polissky Nature Reserve, Northern Ukraine. Rubtsova, N. Yu., Kutsokon, Yu. K. — Nineteen species of parasites belonging to seven taxonomical groups were detected in nine species of fish (*Gobio gobio* (Linnaeus, 1758), *Cobitis taenia* Linnaeus, 1758, *Squalius cephalus* (Linnaeus, 1758), *Rutilus rutilus* (Linnaeus, 1758), *Misgurnus fossilis* (Linnaeus, 1758), *Sabanejewia baltica* Witkowski, 1994, *Barbatula barbatula* (Linnaeus, 1758), *Esox lucius* Linnaeus, 1758 and *Perca fluviatilis* Linnaeus, 1758) from two small rivers in Polissky Nature Reserve in the northern part of Ukraine. The highest species richness of parasites was registered for *G. gobio* (7 species). Four species of parasites were found in *S. cephalus.* Three parasite species were found in *E. lucius.* Two parasite species were detected in *R. rutilus* and *P. fluviatilis. C. taenia, M. fossilis*, and *S. baltica* harboured each one species of parasites. *Gyrodactylus* sp. from *S. baltica* was reported for the first time. All parasites represent new geographical finding for the north of Ukraine.
Key words: Polissky Nature Reserve, freshwater fish parasites, small rivers, Ukrainian inland waters.

Polissky Nature Reserve occupies about 20,104 hectares between the Ubort and Bolotnytsya Rivers in the northwestern part of Zhytomyr Region in the north of Ukraine. Small rivers of the reserve flow through clay, sandy loam, peat soils and marshes that occupy one fifth of the reserve (Zhyla, 2008). Fauna of lampreys and fish in small rivers of Polissky Nature Reserve is represented by 28 species, including five species that are under the special protection, and six species that are included to a Supplement 3 of the Bern Convention (Red Book..., 2009). The reserve lies between two rivers, the Ubort on the West and the Bolotnytsya on the East, which are very different in many respects. The Bolotnytsya River, which has a drainage system of water supply, has stagnant water, and fish population in this river is relatively poor, with a core of two or three species, mainly *Esox lucius* Linnaeus, 1758, *Perca fluviatilis* Linnaeus, 1758 *Gobio gobio* (Linnaeus, 1758) (Kutsokon, 2012). In the Ubort River, the flow is much faster and the water is transparent, but reddish due to organic substances of marsh origin (Polyshshiuk et al., 1978). The fish composition in this river is quite rich and consists of 20 species, including rare and red-listed ones. Dominant fish species in the Ubort River are *Rutilus rutilus* (Linnaeus, 1758), *Alburnoides rossicus* Berg, 1924, *Alburnus alburnus* Linnaeus, 1758, and *Gobio gobio* (Linnaeus, 1758). Recently, *Sabanejewia baltica* Witkowski, 1994 was recorded in the reserve for the first time in Ukrainian inland waters (Kutsokon, 2012, 2014).

In spite of the known importance of parasites as regulating factors in natural ecosystems (May & Anderson, 1978), no published data on fish parasites are known for water bodies of Polissky Nature Reserve. Zhytova (2011 a) studied larval stages of Digeneans from three species of mollusks from the Lake Grybove (vicinity of

the Reserve). She found cercariae of *Parafasciolopsis fasciolaemorpha* (Ejsmont, 1932), *Echinostoma spiniferum* (La Valette, 1855), *Echinopariphium aconiatum* Dietz, 1909, *Hypoderaeum conoideum* (Bloch, 1782), *Rubenstrema exasperatum*, *Plagiorchis mutationis* Panova, 1927, *Opisthioglyphe ranae* (Frölich, 1791) Looss, 1899 and metacercariae of two species, *Echinopariphium aconiatum* and *Echinostoma revolutum* (Frohl.). Parasitological research of 12 fish hosts from Belorussian part of Polissya, Braslavsky Lakes, which are 500 km north from Polissky Nature Reserve, revealed the presence of 27 species of parasites (Shendrik et al., 2015).

Thus, an absence of information on fish parasites as a necessary part of nature monitoring in Polissky Nature Reserve brought up our attention to the present research.

Material and methods

A parasitological survey of fish from two rivers of Polissky Nature Reserve was conducted during the first ten days of August 2015. Material was collected from five stations: two in vicinities of Selezivka village, on the Bolotnytsya River (51°32′25.8″ N, 28°06′15.5″ E; 51°32′10.8″ N, 28°06′10.7″ E) and three stations in vicinities of Maydan Kopyshanskyi village, on the Ubort River (51°31′35.3″ N, 27°51′56.3″ E; 51°31′46.2″ N, 27°51′58.4″ E; 51°32′20.1″ N, 27°52′01.8″ E). Fish were caught by fishing scoop-net outside the protected zone of the Reserve. Only the mass species that are not included in the Red Book of Ukraine (2009) were investigated, namely *G. gobio* (Linnaeus, 1758), *Cobitis taenia* Linnaeus, 1758, *Squalius cephalus* (Linnaeus, 1758), *R. rutilus*, *Misgurnus fossilis* (Linnaeus, 1758), *S. baltica, Barbatula barbatula* (Linnaeus, 1758), *E. lucius* Linnaeus, 1758 and *P. fluviatilis* Linnaeus, 1758, in total 68 specimens. Information on their number, standard lengths and place of collection is provided in table 1. Fish were identified, measured and studied for parasites on the day of capture using standard collection techniques (Bykhovskaya-Pavlovskaya, 1985). Parasite species identification was held at the Biological Faculty of Zaporizhzhya National University, Ukraine. Myxosporea and Monogenea were fixed on slides in a drop of glycerin-jelly and studied using phase-contrast and interference-contrast light microscopy (Iskov, 1989; Gusev, 1983; Rubtsova, 2011). Metacercariae of digeneans were processed according to Shigin´s technique (Shigin, 1976). Other helminthes were fixed in hot 4 % formaldehyde or 70 % ethanol and studied on wet mounts under the coverslip (Aspidogastrea, Cestoda, Digenea, Acanthocephala, Nematoda) or stained with acetocarmine and mounted in Canada balsam (Cestoda, Digenea) (Bykhovskaya-Pavlovskaya, 1985; Georgiev et al., 1986).

Results

List of parasites, their hosts, sites of infection, and parameters of infection are given in table 2. Prevalence is not given as percentage for most samples because of their small sizes (less than 15) (Bykhovskaya-Pavlovskaya, 1985), and intensity is not provided for Myxosporea.

Information on new findings of parasites for the Ukrainian fauna is provided in the current research, namely, three species of Myxosporea, seven monogenean species, one species of aspidogastrea, four species of digeneans, and by one species of cestodes, acanthocephalans and nematodes (see table 2). All found parasites are new geographical findings for the northern part of Ukraine. Two species of helminthes found more than in one host species: the acanthocephalan *A. lucii* and the nematode *R. acus*. Below we give remarks on the identified parasites concerning their previous findings from the territory of Ukraine.

Table 1. The number (N) and size of the studied fishes from the Bolotnytsya and Ubort Rivers

Species	N	Standard length (mm), mean (min–max) ± SD*
Bolotnytsya River		
G. gobio	7	96 (76–112) ± 15.9
C. taenia	15	73.5 (37–92) ± 14.6
M. fossilis	1	162
E. lucius	2	141 (108–174) ± 46.6
B. barbatula	1	93
Ubort River		
G. gobio	6	91.7 (69–112) ± 16.8
S. cephalus	10	97.8 (61–170) ± 35.5
R. rutilus	5	97.2 (65–114) ± 18.9
C. taenia	12	62.9 (29–93) ± 21.03
M. fossilis	1	164
S. baltica	2	55.5 (47–64) ± 12.02
E. lucius	2	117
P. fluviatilis	4	127.3 (97–145) ± 20.9

* SD — standard deviation.

Myxobolus muelleri was found in the present study on the gills of *P. fluviatilis* known as a common parasite of Cypriniformes, Siluriformes, Gadiformes, Perciformes, Mugiliformes and earlier was registered in many other Ukrainian locations, such as the Dnipro, Dnister, Danube, Tisza, Siversky Donets, Southern Bug, Stryi Rivers, Shatsky Lakes, Crimea waters, as well as the

Table 2. Fish parasites, their hosts and parameters of infection in the Bolotnytsya and Ubort Rivers

Parasite	Host(s)	Site of infection	Geogra-phical location	Prevalence	Intensity, number of specimens mean (min–max)
Phylum Cnidaria Class Myxosporea					
Myxobolus muelleri	*P. fluviatilis*	gills	Ubort	one of four	–
M. dispar	*C. taenia*	gills	Ubort	6 %	–
M. cyprini	*G. gobio*	gills, body cavity	Ubort	one of nine	–
Phylum Platyhelminthes Class Monogenea					
Tetraonchus monenteron	*E. lucius*	gills	Bolotnytsya	one of two	3
T. monenteron	*E. lucius*	gills	Ubort	two of three	4 (3–5)
Gyrodactylus cobitis	*M. fossilis*	gills	Bolotnytsya	one of one	2
Gyrodactylus sp.	*S. baltica*	gills	Ubort	one of five	1
Dactylogyrus cryptomeres	*G. gobio*	gills	Ubort	one of nine	2
D. fallax	*R. rutilus*	gills	Ubort	one of five	2
D. rutili	*R. rutilus*	gills	Ubort	one of five	1
Paradiplozoon zeller	*G. gobio*	gills	Ubort	12 %	2
Class Cestoda					
Ligula intestinalis	*G. gobio*	body cavity	Ubort	one of nine	2
Class Trematoda Subclass Aspidogastrea					
Aspidogaster limacoides	*S. cephalus*	intestine	Ubort	one of ten	3
Subclass Digenea					
Allocreadium transversale	*G. gobio*	intestine	Ubort	one of nine	4 (3–6)
Palaeorchis incognitis	*S. cephalus*	intestine	Ubort	one of ten	6
Diplostomum sp. mtc*	*G. gobio*	eye lens	Ubort	one of nine	3
Rhipidocotyle campanula mtc	*S. cephalus*	fins	Ubort	one of ten	5
Phylum Acanthocephala Class Palaeacanthocephala					
Acanthocephalus lucii	*E. lucius*	intestine	Ubort	one of three	2
A. lucii	*P. fluviatilis*	intestine	Ubort	three of four	3 (2–4)
A. lucii	*G. gobio*	intestine	Ubort	one of nine	1
A. lucii	*S. cephalus*	intestine	Ubort	one of ten	2 (1–3)
Phylum Nematoda Class Chromadorea					
Raphidascaris acus	*E. lucius*	intestine	Ubort	one of two	2
R. acus	*M. fossilis*	intestine	Ubort	one of two	1

* mtc — metacercariae.

Black and Azov Seas (Iskov, 1989). *Myxobolus dispar* found on the gills of *C. taenia,* is known as a common parasite of cyprinid fish and was reported from the following Ukrainian locations: the Dnipro, Dnister, Danube, Uzh, Stryi, Tisza, Prut, Southern and Western Bug, Siversky Donets Rivers, Shatsky Lakes, Crimean waters, as well as from brackish parts of the Black and Azov Seas (Iskov, 1989). *Myxobolus cyprini* found on the gills and in the body cavity of *G. gobio* is known as a parasite of cyprinid fish and was previously reported from the rivers Dnipro, Dnister, Siversky Donets, Danube, Prut, Southern Bug, inner waters of Crimea, as well as fish farms of Ukraine (Iskov, 1989). All species of Myxosporea are new geographical findings in the north of Ukraine.

Tetraonchus monenteron from *E. lucius* is known from the rivers Western Bug, Danube, Tisza, Latoritsa, Tereblya, Prut, Dnister, Southern Bug, Dnipro and its reservoirs (Kyiv, Kaniv, Kremenchuk, Zaporizhzha), as well as from the Dnipro Estuary, the Sea of Azov and Nothern Azov Estuary (Lisitsyna & Miroshnichenko, 2008). It has been reported as a

common parasite of pikes in the Kakhovka reservoir during our long-term research in this water body (Rubtsova, 2015). *Gyrodactylus cobitis* found in *M. fossilis* in the present study is also known from the Danube, Tisza, Seret, Prut, Dnipro, and Siversky Donets Rivers, and in the Kaniv reservoir (Lisitsyna & Miroshnichenko, 2008). There is no published information on parasites of *S. baltica*, so we consider *Gyrodactylus* sp. from this host a new faunistic record for this host as well as a new geographical record for Ukraine.

Dactylogyrus fallax found presently on *R. rutilus* is well known as a common parasite of *R. rutilus* both from fresh waters: the rivers Tisza, Southern Bug, Dnipro and its reservoirs (Kyiv, Kaniv and Zaporizhzha), and brackish waters of the Azov and Black Seas of Ukraine (Lisitsyna & Miroshnichenko, 2008). *D. fallax* was recordered by us during 2002–2015 studies of *R. rutilus* in Kakhovka reservoir (Rubtsova, 2015). *Dactylogyrus rutili* also found by us on *R rutilus,* was previously reported from the same host from the rivers Tisza and Dnipro (Zaporizhzha reservoir) (Lisitsyna & Miroshnichenko, 2008). *Dactylogyrus cryptomeres* and *Paradiplozoon zeller* were found by us on the gills of *G. gobio*. *D. cryptomeres* was previously recorded in the rivers Tisza, Cheremosh, Prut, Tereblya, Dnister, Dnipro and its reservoirs (Kyivske and Kanivske), Siversky Donets; *P. zeller* earlier was reported only from the Tisza River from four hosts including *G. gobio* (Lisitsyna & Miroshnichenko, 2008). All species of monogeneans are new geographical findings for the fauna of parasites of northern Ukraine.

We found *Aspidogaster limacoides* in the intestine of *S. cephalus.* On the territory of Ukraine, it was previously recorded only in the rivers of the Azov and Black Seas basins (Bykhovskaya-Pavlovskaya, 1987) and from the Kakhovka reservoir (Rubtsova, 2015). Our finding is a new geographical record of aspidogastrids for the north of Ukraine.

In the present study, *Palaeorchis incognitis* was found in the intestine of *S. cephalus.* This digenean was registered previously in five species of cyprinid fish, including *S. cephalus* from the rivers of the Black, Azov and Baltic Seas basins of (Bykhovskaya-Pavlovskaya & Kulakova, 1987). We found *Allocreadium transversale* in the intestine of *G. gobio*; previously it was registered in the rivers of the Carpathians and the rivers of the Black Sea basin in various species of fish, including cyprinids (Bykhovskaya-Pavlovskaya & Kulakova, 1987). Metacercariae of *Rhipidocotyle campanula*, presently found in the fins of *S. cephalus*, are known from various parts of the former Soviet Union from a number of cyprinids (Bykhovskaya-Pavlovskaya & Kulakova, 1987). Metacercariae of *Diplostomum* sp. found in the eye lens of *G. gobio* are well-known and common parasites of many fish species, including cyprinids (Bykhovskaya-Pavlovskaya & Kulakova, 1987). All digeneans are new geographic findings in fish of the northern Ukraine.

A plerocercoid of *Ligula intestinalis* was found in the body cavity of *G. gobio.* This parasite is common in many species of cyprinids and has a wide geographical distribution in Ukraine (Dubinina, 1987); nevertheless, for the studied region this is the first finding.

We identified an acanthocephalan *Acanthocephalus lucii* from three hosts: *E. lucius, G. gobio*, and *P. fluviatilis.* This parasite was previously registered from the same hosts, and 26 more species of fish from other parts of Ukraine, namely, the Western Bug, Tisza and its inflows, Dnister, Stryj, Southern Bug, Dnipro and its inflows, Siversky Donets Rivers, small rivers of Southern Azov and brackish waters of the Black Sea estuaries (Lisitsyna & Miroshnichenko, 2008). Considering the fact that acanthocephalan life cycle includes invertebrate intermediate hosts, the presence of *A. lucii* also indicates the presence of isopods or/and amphipods in studied rivers. Information on species composition of aquatic invertebrates has never been published for the studied rivers of the Reserve.

We identified a nematode *Raphidascaris acus* from two hosts: *E. lucius* and *M. fossilis.* This nematode is widely distributed on the territory of the former Soviet Union, including Ukraine (Vismanis et al., 1987). Our finding is a new geographic record of this parasite for the studied area.

Discussion

Diversity of parasites differed drastically in two studied parts of the reserve. In the Bolotnytsya River, only two species of Monogenea were found in 26 fish specimens of five species, while in the Ubort River, 15 parasite species of eight taxa were registered in 24 fish specimens of eight species (table 2). Such a difference in the species diversity of parasites may be caused by several reasons. The sample of the hosts from the Bolotnytsya River was half that of the Ubort. The Bolotnytsya is known for poorer species composition of fish compared to the Ubort (Kutsokon, 2012). Hydrological conditions in two rivers are different: in the Bolotnytsya, the water flow is slower and its depth and width are 2–3 times smaller compared to those in the Ubort (Zhyla, 2008; our unpublished data). All this influences on the temperature and oxygenation of water and creates different conditions for survival and transmission of fish parasites. Indirectly such different conditions can affect the number of possible intermediate invertebrate hosts. Monogeneans have a direct life cycle, they are easily transferred from one host to another in the young age of fish or during spawning, and thus they survive in the conditions of the Bolotnytsya River. The absence of Myxosporea in the Bolotnytsya, other parasites with a direct life cycle, could be explained by both the insufficient sample size of hosts and the unfavorable conditions for the transmission of these parasites, for example, the rarefaction of the host population. The absence or scarcity of intermediate hosts of majority of other parasites found in the present study in the Ubort River (cestodes, aspidogastrids, trematodes, acanthocephalans and nematodes) could be the reason of their absence in the Bolotnytsya. This assumption is supported by the list of cercariae and metacercariae revealed by Zhytova (2011 a) from mollusks in Grybove Lake, a pond of the Bolotnytsya River about 2 miles away from our sampling site, that shows no trematodes infecting fish as definitive hosts. Zhytova, in her other work performed about 100 km far to the south of Zhytomyr Region, found sporocysts of *Diplosthomum* sp. in the mollusk *Lernaea stagnalis* (Zhytova, 2011 b). We found metacercariae the same genus in the eye lens of *G. gobio* in the Ubort River, where conditions, obviously, are favorable for parasites with complex life cycles. The closest studied site for fish parasites from Polissya is in north of Belarus, Braslavsky Lakes (Shendrik et al., 2015). Among the fish species sampled in the present research, only *E. lucius* and *P. fluviatilis* were studied by Shendrik et al. (2015). It was only an acanthocephalan *A. lucii* that appeared to be common parasite of these fish species in northern Belorussian and northern Ukrainian parts of Polissya. It is noteworthy that in our samples, *A. lucii* was also harbored by *S. cephalus* and *G. gobio,* while the results published by Shendrik et al. (2015) showed the presence of *A. lucii* also in *Sander lucioperca* (Linnaeus, 1758). This indicates modern state of population boundaries and a wide range of definitive hosts of this acanthocephalan in the mentioned areas. The authors also recorded metacercariae of *Diplostomum* sp. in nine of 12 fish species in Braslavsky Lakes (Shendrik et al., 2015).

In Polissky Reserve, there is a large number of plants and animals, which are aboriginal to the area and even relict species entered in the red book (Zhyla, 2008). This suggests that the fauna of parasites, revealed in the present study is close to the aboriginal condition, not changed by the introduction of invasive species that has become common in the water bodies worldwide (Havel et al., 2015). The most prevalent fish species collected in the present study, *G. gobio*, was infected by the largest number of parasites. None of the parasites showed high parameters of infection in the Ubort and Bolotnytsya Rivers that is common and typical for natural ecological systems, where parameters of infection may be even lower (Miroshnichenko, 1977). Thus, this study shed some light on the issue of fish parasite situation in Polissky Nature Reserve. Future collections may reveal larger diversity of parasite species in small rivers in this part of Ukraine.

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