REPRESENTATIVES OF TAPEWORMS (CESTODA) OF FISHES IN BELGRADE SECTION OF THE DANUBE RIVER

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PREDSTAVNICI PANTLJIČARA (CESTODA) RIBA BEOGRADSKOG SEKTORA DUNAVA

Apstrakt

U radu su izneti rezultati dvogodišnjih istraživanja unutrašnjih parazita različitih vrsta riba Dunava u beogradskom sektoru, i u tom cilju je urađena identifikacija i prikazan je spisak crevnih parazita iz grupe pantljičare (Cestoda). Tokom istraživanja pregledene su ukupno 802 jedinke 22 vrste riba. Pregledom crevnog trakta riba, utvrđeno je da je parazitima zaraženo 140 jedinki 12 vrsta riba, odnosno 17.46%. U inficiranim jedinkama riba nađena su ukupno 13 crevna parazita koji pripadaju grupi Cestoda (pantljičare). Predstavljen je spisak vrsta faune crevnih panljičara, po vrsti ribe, međusobni odnos parazitskih vrsta, kao i njihova dinamika prisustva u jedinkama riba. Prikazane su vrednosti intenziteta (broj parazita po ribi) i ekstenziteta infekcije (% zaraženosti, broj zaraženih riba određenim parazitom).

Pantljičare su pljosnati, dorzo-ventralno spljošteni crvi, bez crevnog trakta. Telo im je podeljeno na članke (proglotise). Prednji kraj tela je skoleks i na njemu su smešteni organi za pričvršćivanje (pijavke, kukice). Iza njega je suženje (vratni region), a zatim sledi niz proglotisa. Razviće ovih parazita odvija se kroz smenu generacija (prelazni domaćin je oligoheta).

Tokom istraživanja, izdvojile su se određene parazitske vrste pantljičara ("*hit paraziti*"), koje inficiraju veliki broj vrsta riba. To su vrste *Proteocephalus torulosus* (7 vrsta riba), *Caryophyllaeides fennica* i *Caryophyllaeus laticeps* (6 vrsta riba). Vrsta ribe koja je inficirana sa najvećim brojem parazita je *Abramis brama* (12). U njenom crevu je identifikovana vrsta parazitske pantljičare sa najvišim intenzitetom infekcije - *Caryophyllaeus laticeps* (1-165).

Istraživana ihtiozajednica beogradskog sektora Dunava još uvek ima sastav koja se može okarakterisati autohtonom, uz napomenu da u toj fauni, nakon izgradnje HEPS

„Đerdap", nema više anadromnih jeseterskih vrsta (Acipenseridae). U zajednici se zapaža izrazita dominacija mirnih riba, pre svega krupatice (*Bllica bjoerkna*), bodorke (*Rutilus rutilus*) i deverike (*Abramis brama*). Većina konstantovanih vrsta riba mogu se smatrati predstavnicima zajednice gornjeg potamona, sa pojedinim elementima – vrstama riba zajednice donjeg ritrona.

Sprovedena studija je pokazala da je inficiranost riba Dunava u beogradskom regionu značajna, s obzirom na brojnost i raznovrsnost identifikovanih crevnih parazita grupe pantljičara. Podaci o konstatovanoj fauni crevnih pantljičara upotpunjuju i potvrđuju dosadašnja sporadična saznanja o njihovom rasprostranjenju u otvorenim vodama Srbije. Do sada je, u 75 godišnjim izučavanjima parazitofaune riba površinskih voda Srbije, nađeno ukupno 170 parazita (ekto- i endo-). Od toga, grupi pantljičara (Cestoda) pripada 19 taksona.

Ključne reči: *slatkovodne ribe, crevni paraziti, Cestoda, infekcija, beogradsko područje Dunava*

Keywords: freshwater fish, intestine parszite, Cestoda, infection, Belgrade section of the Danube River

INTRODUCTION

The catchments area of the Danube River in the Belgrade region is a part of the middle sector of the Danube River Basin – the largest sector of the river's watercourse from Bratislava to the Iron Gate dams (Serbia/Romania) (Babic-Mladenovic et al., 2010). With its main tributaries, the Danube represents the most significant Serbian water resource. Ichthyofauna of the Serbian section of the Danube River consists of 68 fish species from 50 ordos and 16 families (Simonovic and Nikolic, 1996). In the meantime, in this river section, have been found three more allochthonous, invasive gobid species (family Goobidae), introduced fish species *Syngnathus abaster* (family Syngnathidae) and species *Perccotus glenii* (family Odontobutidae). Composition of fish fauna in the Belgrade section of the Danube River still have autochtonous character. It can be seen the dominance of still water fishes, like white bream (*Blicca bjoerkna*), roach (*Rutilus rutilus*) and bream (*Abramis brama*). The construction of a hydro-energetic system „Djerdap" caused changes in ichthyocenosis and exstinction of anadromous sturgeon fish species (Acipenseridae) in this river section (Lenhardt et al., 2006).

Parasitic species of freshwater fishes represent a large group of organisms comprising either adults or larval stages. During last 75 years, systematic parasitofauna investigations have been carried out and a total of 170 parasites of fish species in Serbian open waters (Danube River Basin) have been reported (Djikanovic et al., 2011).

Cestoda (tapeworms) are long, extremely dorso-ventraly flattened hermaphroditic parasites, without intestines. These typeworms as adults are found in the intestine of vertebrates. Larvae are not segmented with scolex, usually encysted; adults are segmented, with flattened body with scolex (attachment organ). These parasites generally have larval forms encysted in an intermediate host (Oligochaeta).

In this work, the aim is to present results of freshwater fish intestine parasites (Cestoda) investigation in the Belgrade section of the Danube River. Checklist of identified endoparasites per fish are presented, relation of identified parasitic species, as well as their presence in specimens of different fish species.

MATERIAL AND METHODS

Ichthyoparasitological samples were collected during period November 2007 to November 2009 along the course of the Danube River through the Belgrade Region, by nets of different size of mesh (32 – 50 mm), from two sampling sites, Zemun (1.173 rkm) and Visnjica (1.162 rkm). Fish were transported to the laboratory, where the analysis of their intestines for endoparasites was conducted. The intestines were examined under an Olympus binocular microscope and Olympus stereomicroscope. Parasitic species found were fixed first with hot 4% formaldehyde and after two weeks put into 70 % alcohol for determination and collection. Identification was carried out to the species level, except in case of juvenile individuals. Parasites were identified using identification keys (Bykhovskaya-Pavlovskaya et al., 1962; Kakacheva – Avramova, 1983; Bauer, 1987) to the lowest taxonomic level (species, ordo). The level of parasitic infestation was studied by analyzing of number of parasites per fish specimen. It has been analyzed prevalence (number of fish infected by certain parasite, % of infestation,) and intensity (number of parasites per fish) of infection.

RESULTS AND DISCUSSION

During the ichthyoparazitological study 22 freshwater fish species from families Cyprinidae (14), Esocidae (1), Percidae (4), Centratchidae (1), Siluridae (1) and Gadidae (1) have been collected and examined. 802 fish specimens have been examined and 17.46% were infected. In intestine of 12 fish species 13 species/taxa of Cestoda (*Caryophyllaeides fennica* (Schneider, 1902), *Khawia sinensis* (Hsü, 1935), *Caryophyllaeus brachycollis* (Janiszewska, 1951), *Caryophyllaeus laticeps* (Pallas, 1781), *Caryophyllaeus fimbriceps* (Annenkova-Khlopina, 1919), *Caryophyllaeus* sp. juvenile (Gmelin, 1790), *Triaenophorus nodulosus* (Pallas, 1781), *Triaenophorus* sp. juvenile (Rudolphi, 1793), *Proteocephalus torulosus* (Batsch, 1786), *Proteocephalus sp.* juvenile (Weinland, 1858), *Ligula intestinalis* (Linnaeus, 1758), *Diphyllobothrium* sp. (Cobbold, 1858) and Cestoda-cysts) have been found. During the investigation, few parasitic species have been dissociated ("*heat parasites*"), infested a large number of fish species. These parasitic species are: *Proteocephalus torulosus* (7 fish specimens), *Caryophyllaeides fennica* and *Caryophyllaeus laticeps* (6 fish specimens). Fish species with the greatest number of intestine parasitic species was *Abramis brama* (12). In its intestine parasite with the highest intensity of infection - *Caryophyllaeus laticeps* (1-165) have been identified. Fish species that had been infected by a great number of cestodes were *Abramis sapa* (8), as well as *Abramis ballerus* and *Vimba vimba* (5), while others were infected with two or three tapeworms. In intestine of *Rutilus rutilus* and *Sander lucioperca* only one parasitic species was found. Number of infected fish species, prevalence and intensity of infection per each cestode are presented in Table 1.

Table 1. Number of infected fish species, prevalence and intensity of infection per each identified cestode

Parasitic species/taxa / Fish species	***Abramis brama***			***Abramis ballerus***			***Abramis sapa***		
	Extensity of infection		Inten. of infec.	Extensity of infection		Inten. of infec.	Extensity of infection		Inten. of infec.
	Number of infected	Prev (%)		Number of infected	Prev (%)		Number of infected	Prev (%)	
Caryophyllaeides fennica (Schneider, 1902)	16	2.00	1-9	6	0.75	1-19	12	1.50	1-11
Khawia sinensis (Hsü, 1935)									
Caryophyllaeus brachycollis (Janiszewska, 1951)	5	0.62	1-9						
Caryophyllaeus laticeps (Pallas, 1781)	17	2.12	1-165	7	0.87	1-10	12	1.50	1-9
Caryophyllaeus fimbriceps (Annenkova-Khlopina, 1919)	7	0.87	1-13						
Caryophyllaeus sp. juvenile (Gmelin, 1790)	15	1.87	1-17				1	0.12	0-4
Triaenophorus nodulosus (Pallas, 1781)	1	0.12	0-3				1	0.12	0-27
Triaenophorus sp. juvenile (Rudolphi, 1793)	4	0.50	1-2						
Proteocephalus torulosus (Batsch, 1786)	2	0.25	2-18	3	0.37	1-2	5	0.62	1-2
Proteocephalus sp. juvenile (Weinland, 1858)	4	0.50	1-8	2	0.25	1-15	1	0.12	0-2
Ligula intestinalis (Linnaeus, 1758)	3	0.37	1-10				1	0.12	0-1
Diphyllobothrium sp. (Cobbold, 1858)	3	0.37	1-9						
Cestoda-ciste	6	0.75	1-5	2	0.25	0-1	3	0.37	0-6
Parasitic species/taxa / Fish species	***Bllica bjoerkna***			***Aspius aspius***			***Barbus barbus***		
	Extensity of infection		Inten. of infec.	Extensity of infection		Inten. of infec.	Extensity of infection		Inten. of infec.
	Number of infected	Prev (%)		Number of infected	Prev (%)		Number of infected	Prev (%)	
Caryophyllaeides fennica (Schneider, 1902)	3	0.37	1-4						
Khawia sinensis (Hsü, 1935)									
Caryophyllaeus brachycollis (Janiszewska, 1951)							4	0.50	3-9
Caryophyllaeus laticeps (Pallas, 1781)	1	0.12	0-4	1	0.12	0-9			
Caryophyllaeus fimbriceps (Annenkova-Khlopina, 1919)									
Caryophyllaeus sp. juvenile (Gmelin, 1790)	2	0.25	1-2				2	0.25	9-11

Triaenophorus nodulosus (Pallas, 1781)									
Triaenophorus sp. juvenile (Rudolphi, 1793)									
Proteocephalus torulosus (Batsch, 1786)									
Proteocephalus sp. juvenile (Weinland, 1858)									
Ligula intestinalis (Linnaeus, 1758)									
Diphyllobothrium sp. (Cobbold, 1858)									
Cestoda-ciste				1	0.12	0-4			
Parasitic species/taxa / Fish species	***Chondrostoma nasus***			***Leuciscus idus***			***Gymnocephalus schraetzer***		
	Extensity of infection		Inten. of infec.	Extensity of infection		Inten. of infec.	Extensity of infection		
	Number of infected	Prev (%)		Number of infected	Prev (%)		Number of infected	Prev (%)	Inten. of infec.
Caryophyllaeides fennica (Schneider, 1902)				1	0.12	0-2			
Khawia sinensis (Hsü, 1935)									
Caryophyllaeus brachycollis (Janiszewska, 1951)				8	1.00	1-6			
Caryophyllaeus laticeps (Pallas, 1781)									
Caryophyllaeus fimbriceps (Annenkova-Khlopina, 1919)									
Caryophyllaeus sp. juvenile (Gmelin, 1790)									
Triaenophorus nodulosus (Pallas, 1781)									
Triaenophorus sp. juvenile (Rudolphi, 1793)									
Proteocephalus torulosus (Batsch, 1786)	1	0.12	0-9	2	0.25	2-12	2	0.25	1-1
Proteocephalus sp. juvenile (Weinland, 1858)							1	0.12	0-1
Ligula intestinalis (Linnaeus, 1758)									
Diphyllobothrium sp. (Cobbold, 1858)									
Cestoda-ciste	3	0.37	0-11				1	0.12	0-1
Parasitic species/taxa / Fish species	***Sander lucioperca***			***Rutilus rutilus***			***Vimba vimba***		
	Extensity of infection		Inten. of infec.	Extensity of infection		Inten. of infec.	Extensity of infection		
	Number of infected	Prev (%)		Number of infected	Prev (%)		Number of infected	Prev (%)	Inten. of infec.
Caryophyllaeides fennica (Schneider, 1902)							5	0.62	1-2

Khawia sinensis (Hsü, 1935)				1	0.12	0-2			
Caryophyllaeus brachycollis (Janiszewska, 1951)									
Caryophyllaeus laticeps (Pallas, 1781)							3	0.37	1-18
Caryophyllaeus fimbriceps (Annenkova-Khlopina, 1919)									
Caryophyllaeus sp. juvenile (Gmelin, 1790)							1	0.12	0-2
Triaenophorus nodulosus (Pallas, 1781)									
Triaenophorus sp. juvenile (Rudolphi, 1793)									
Proteocephalus torulosus (Batsch, 1786)							1	0.12	0-1
Proteocephalus sp. juvenile (Weinland, 1858)	1	0.12	0-12						
Ligula intestinalis (Linnaeus, 1758)									
Diphyllobothrium sp. (Cobbold, 1858)									
Cestoda-ciste							2	0.25	2-7

In previous ichthyoparasitological studies in Serbian open waters, representatives of tapeworms were identified. Babic (1935) determined tapeworms from the Danube and Sava River fishes. Seasonal dynamic appearance of Cestoda *Ligula intestinalis* metacercariae in schneider (*Alburnoides bipunctatus* Bloch, 1782), in the Borsko Lake (eastern Serbia) were examined by Petrovic et al. (1975). Andric (1984) provided detail data on fish parasites from the Obedska Bara swamp and reported five cestodes from 7 fish species. Cakic and Hristic (1987) reported *Triaenophorus nodulosus* of white grasscarp, bream and carp in Pancevacki Rit channels. Kiskaroly and Tafro (1988) examined fishes in the Danube River and DTD channel and recorded *Amphilina foliacea, Caryphyllaeides fennica, Caryophyllaeus laticeps, C. branchicollis, Proteocaphalus torulosus, Silurotaenia siluri* and *Ligula intestinlis.* Fish parasite studies in highland rivers and lakes of Sjenicko-Pesterska plateau (Uvac River Basin) (Cakic, 1992) determined nine Cestoda species. . Examination of sterlet specimens in Serbian part of the Danube River identified one representative from Cestoda (*Amphilina foliacea*) (Cakic et al., 2008). Composition of identified tapeworm community was similar to results of our study.

CONCLUSION

Results obtained in this ichtyoparasitological study will contribute considerably to complete data on fish helminths composition and their distribution in Serbian open waters, which is of benefit for scientific (academic) public and economic fisheries and its development. In addition the data on intestine fish parasites are important for evaluation of conditions and general effect of the level of parasitism on the community structure.

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