BARBEL (*BARBUS BARBUS* LINNAEUS, 1758) ENDOPARASITE FAUNA AND DIET IN THE BELGRADE SECTION OF THE DANUBE RIVER (SERBIA)

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ENDOPARAZITI I ISHRANA MRENE (*BARBUS BARBUS* LINNAEUS, 1758) U BEOGRADSKOM SEKTORU DUNAVA (SRBIJA)

Apstrakt

U radu su prikazani rezultati istraživanja crevnog sadržaja rečne mrene (*Barbus barbus* L. 1758). Tokom dvogodišnjeg perioda studije, 2007-2009, ukupno je prikupljeno 63 jedinki mrena u okviru beogradskog sektora reke Dunav. Cilj je bio da se dobije informacija o inficiranosti mrena crevnim parazitima (endoparaziti, helminti) i utvrdi prisustvo organizama makrozoobentosa u njihovom crevnom sadržaju (Gammaridae, Bivalvia, Gastropoda i Oligochaeta), kao posledica raspoloživosti hrane na području uzorkovanja. Nabrojani organizmi makrozoobentosa imaju veoma značajnu ulogu u ishrani mrena, s obzirom da je ona bentofagna vrsta, i da njena ishrana zavisi od sastava i strukture faune dna. Pojedini akvatični makrobeskičmenjaci (gamarusi, oligohete, školjke, puževi, i neke larve insekata), kojima se hrane mrene, predstavljaju i prelazne domaćine za nekoliko vrsta endoparazita. Pregledom crevnog sadržaja mrena ukupno je nađeno i identifikovano šest vrsta endoparazita (helminta) iz tri filuma (Platyhelminthes, Nematoda i Acanthocephala), sa prevalencom infekcije od 98.41%. Broj endoparazita po jedinki mrene varirao je u rasponu od 6 do 207. Najveća procentualna zastupljenost utvrđena je za parazita iz grupe Acanthocephala – *Pomphorhynchus laevis* (Müller, 1776), sa prevalencom inficiranosti od 7,73%. Takođe, udeo gamarusa u crevnom sadržaju mrena bio je u interval 31.43% do 46.73%, odnosno u zajednici makrozoobentosa od 1.4% do 16.22%. Ova činjenica ukazuje da su gamarusu bili omiljena hrana mreni i da je to doprinelo visokoj abundanci - parazita *Pomphorhynchus laevis* u crevnom sadržaju mrene. Uzimajući u obzir, raznovrsnost i bogatstvo faune parazita na području Srbije, neophodno je nastaviti istraživanja parazita što većeg broja slatkovodnih vrsta riba.

Ključne reči: mrena; endoparaziti; ishrana; makrozoobentosa; Dunav.
Keywords: barbel, endoparasite, diet, makrozoobenthos, Danube

INTRODUCTION

The barbel *Barbus barbus* L. 1758 (Cyprinidae) is a benthopelagic, rheophilic long-lived fish, feeds on benthic organisms, including crustaceans, insect larvae (mayfly and midge larvae), molluscs, crayfish and swan mussels, as well as on juveniles and eggs of other fish species (Vukovic and Ivanovic, 1971). Certain aquatic macroinvertebrates (gammarids, molluscs, oligochaetes and some insect larvae) consumed by barbels represent intermediate hosts for some endoparasites (Adámek and Obrdlík, 1977). Barbel endoparasite fauna composition is directly related to its feeding preferences and the macrozoobenthic fauna composition of its feeding habitat (Hine and Kenedy, 1974; Moravec et al., 1997).

The composition of the barbel helminth community in European surface waters is generally well-studied, especially in the Danube and Elbe river basins (Moravec and Scholz, 1991, 1995; Gelnar et al., 1996). The helminth parasites of the barbel were studied in the open waters of the Danube drainage system of the Balkan Peninsula and Serbia (Roman, 1955; Margaritov, 1966; Kakacheva-Avramova, 1977; Kiskaroly and Tafro, 1988; Djikanovic et al., 2010).

The aim of this study was to analyze the endoparasitic fauna of barbels in the Danube River (Belgrade city area) and to assess the relationship between the composition of the barbel's endoparasitic fauna, its diet and the macrozoobenthos community in this part of the river.

MATERIALS AND METHODS

A total of 63 barbels were collected at two locations: Zemun (1173 rkm) and Višnjica (1163 rkm), using bentic driftnets (dimension 30-50m x 2m, 32 – 50 mm mesh size), twice a month from November 2007 to November 2009. In laboratory, analysis of their intestines for food items and endoparasites was carried out. Parasites were identified using identification keys (Bykhovskaya-Pavlovskaya et al., 1962; Kakacheva–Avramova, 1983; Bauer, 1987; Moravec, 1994) to the lowest taxonomic level (species). Macrozoobenthic organisms recorded in the fish intestines were determined using the appropriate identification keys (Nilsson, 1997a,b; Glöer & Meier-Brook, 2003). Parasitic prevalence and intensity of infection were estimated as well as Fulton's body condition factor. Benthic fauna samples were taken during research conducted under the international project "Joint Danube Survey 1 and 2" (Paunovic et al., 2010).

The relationship between the condition factor of particular fish and the number of identified parasites was assessed using basic statistics and correlation matrices of the Pearson correlation, and outliers were omitted from the correlation analysis.

RESULTS AND DISCUSSION

At the Zemun and Višnjica locations, 42 and 21 fish specimens were collected, respectively. A total of six endoparasitic species were found in the intestines of collected bar-

bel specimens, with a 98.41% infection prevalence. The total number of endoparasites per fish individual ranged from 6 to 207. The recorded helminth representatives belonged to 3 phylum - Nematoda (1 species), Acanthocephala (1 species) and Platyhelminthes with two classes – Cestoda (2 species), Trematoda/orderDigenea (2 species). The list of parasitic species, number of infected barbels, prevalence and intensity of infection per endoparasitic species are presented in Table 1.

All except one examined barbel were infected by the acanthocephalan species *Pomphorynchus laevis,* which is in accordance with previous investigations (Laimgruber et al., 2005; Djikanovic et al., 2010). The number of *P. laevis* specimens per individual ranged from 6 to 207. This acanthocephalan is often the dominant parasite species in barbel populations (Hine and Kenedy, 1974; Nedeva et al., 2003; Nachev and Sures, 2009). The prevalence and abundance of *P. laevis* in barbel have been attributed to the dynamics of the abundance of intermediate hosts (amphipods, gammarids) and their importance in the diet of the fish (Hine and Kenedy, 1974; Rumpus and Kennedy, 1974; Moravec and Scholz, 1991; Nachev and Sures, 2009). Moravec et al. (1997) described the barbel as specific in its choice of diet, suggesting that lower parasite diversity but higher abundance of one parasitic species can be a consequence of such food preferences. The presence of only one parasite species per individual could be explained by a high *P. laevis* intensity of infection, which results from the barbel's preferred diet that consists of amphipods, even though they represent a very small part of the bottom fauna.

Table 1. The barbel`s helminth fauna (*Barbus barbus* L.) in Belgrade region of Danube River 2007-2009.

SITES	**ZEMUN**	**VISNJICA**
PARASITIC SPECIES	**Cestoda** *Caryophyllaeus brachycollis* (Janiszewska, 1951) **Trematoda** *Allocreadium isoporum* (Looss, 1894) *Allocreadium dogieli* (Koval, 1950) **Nematoda** *Rhabdochona hellichi* (Šrámek, 1901) **Acanthocephala** *Pomphorhynchus laevis* (Müller, 1776)	**Cestoda** *Caryophyllaeus brachycollis* (Janiszewska, 1951) *Caryophyllaeus laticeps* (Pallas, 1781) **Trematoda** *Allocreadium isoporum* (Looss, 1894) **Nematoda** *Rhabdochona hellichi* (Šrámek, 1901) **Acanthocephala** *Pomphorhynchus laevis* (Müller, 1776)
NUMBER OF EXAMINED BARBELS	42	21
NUMBER OF INFECTED BARBELS	42	**20**
PREVALENCE (%)	**100**	**95.24**
NUMBER OF INFECTED BARBELS	*C. brachycollis* **3** *A. isoporum* **3** *A. dogieli* **1** *R. hellichi* **3** *P. laevis* **42**	*C. brachycollis* **1** *C. laticeps* **2** *A. isoporum* **2** *R. hellichi* **3** *P. laevis* **20**
INTENSITY OF INFECTION	*C. brachycollis* **5-9** *A. isoporum* **2-8** *A. dogieli* **11** *R. hellichi* **3-7** *P. laevis* **6-207**	*C. brachycollis* **3** *C. laticeps* **9-11** *A. isoporum* **5-8** *R. hellichi* **1-7** *P. laevis* **9-124**

The results of our study correspond well with the data of Laimgruber et al. (2005), Moravec et al. (1997) and Nachev and Sures (2009) who found the parasite *Rabdochona hellichi* (Nematoda) in barbel intestines. They also published finding *Caryophyllaeus barchycollis* and *Allocreadium isoporum*. The parasite list of *B. barbus* published by Margaritov (1966) and Kakacheva-Avramova (1977) for the Bulgarian section of the Danube River contained three cestode species (*Caryophyllaeus brachycollis, C. laticeps, C. fennica*), which supports our findings.

The relationship between the macrozoobenthos community composition and structure and fish intestine contents is presented in Table 2. The dominant invertebrate hosts in the diet of the barbel were Gammaridae represented in fish gut contents with 31.4% and 46.7%, in the two studied locations respectively. Our results indicate that the fish gut content resulted from selective feeding behaviour, since Gammaridae were represented by a higher ratio in the fish's diet than in the benthic fauna composition (1.4% to 16.22%). A major characteristic of the principal invertebrate fauna of the Danube River in Serbia is the high abundance of gammarids (*Dikerogammarus villosus* being the most frequent), except in the Belgrade are, where gammarids represent a small part of bottom fauna (Paunovic et al., 2010). Representatives of Oligochaeta, Molluscs and Ephemeroptera, identified in barbel gut contents, are intermediate hosts for recorded endoparasitic species (*Caryophyllaeus brachycollis*, *C. laticeps, Allocreadium isoporum, A. dogieli)* (Kakacheva-Avramova, 1983; Bauer, 1987; Moravec et al., 1997). According to Moravec and Scholz (1995) trichopteran larvae (*Hydropsyche*) serve as intermediate hosts for the transmission of Nematoda *Rhabdochona hellichi* (Moravec, 1995; Moravec et al., 1997; Laimgruber et al*.,* 2005). The recorded Trematoda parasites have complex life cycle, which includes two intermediate hosts; the first is a mollusc (*Sphaerium* sp, *Bythinia tentaculata*), and the second is some type of insect larva (i.e. Ephemeroptera) (Bauer, 1987).

Table 2. Bottom fauna and intestine content of examined barbels in Belgrade section of the Danube River, Zemun and Visnjica locality

Group of bottom fauna/ locality	ZEMUN		VISNJICA	
	Bottom fauna (%)	Intestine content (%)	Bottom fauna (%)	Intestine content (%)
Gammaridae	1.4	31.43	16.22	46.73
Gastropoda	11.46	6.08	8.7	4.20
Bivalvia	27.54	2.08	4.18	5.40
Oligochaeta	60.8	6.45	71.45	3.60
Others (Insects, Crustacea)		53.96		40.07

There was a negative correlation between the Fulton condition factor (CF) and the number of parasites per barbel specimen (r =0.3568; **Fig 1**).

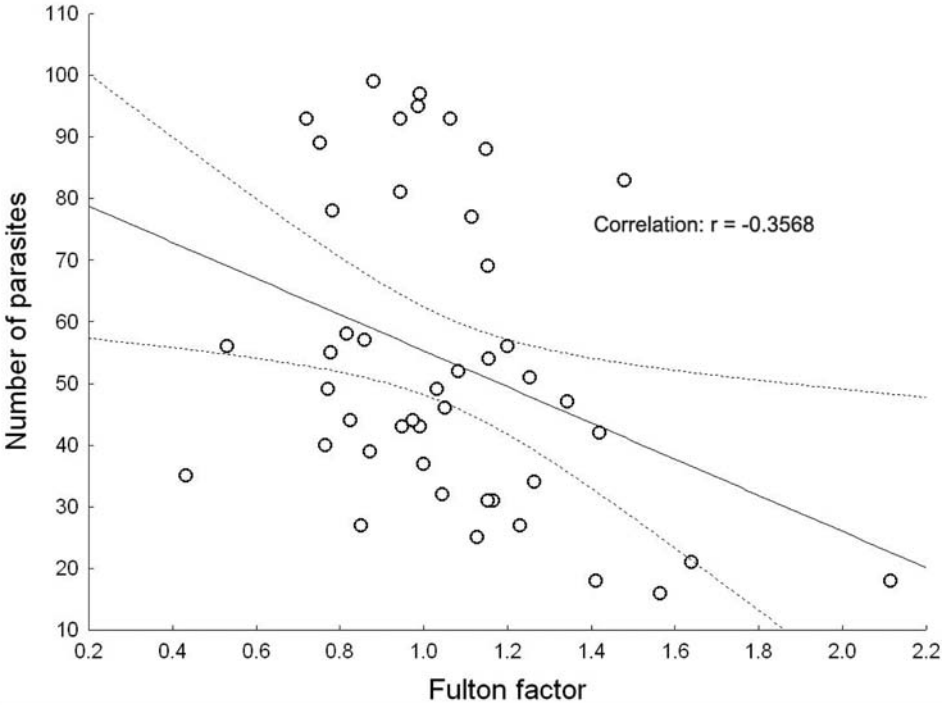

Figure 1. Correlation between Fulton condition factor and number of parasites

CONCLUSION

The feeding habits of the barbel and its diet are influenced by the available local invertebrate fauna, which is, in turn, determined by water quality and habitat composition.

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