Arch. Biol. Sci., Belgrade, 60 (1), 103-107, 2008 DOI:10.2298/ABS0801103C

THE FAUNA OF ENDOPARASITES IN *ACIPENSER RUTHENUS* LINNAEUS, 1758 FROM THE SERBIAN PART OF THE DANUBE RIVER

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Abstract — Helminths of sterlet (*Acipenser ruthenus* L.) from the Danube River were studied as a part of ichthyoparasitological research in Serbia. The fish were collected during the period of 2002 – 2003 along the Danube's course through the Belgrade region. A total of 517 specimens of sterlet of different ages (0+ to 1+) were examined. Helminths were found in 342 or 66.15% of the collected specimens. The examined fish yielded a total of 13 helminth species: four species of Trematoda, one species of Cestoda, four species of Nematoda, and four species of Acanthocephala.

Key words: *Acipenser ruthenus*, endoparasites, Trematoda, Cestoda, Nematoda, Acanthocephala, Danube River, Belgrade region, Serbia

UDC 597.423(497.11Beograd)(282.243.7):616.99

INTRODUCTION

Acipenser ruthenus L. is a potamodromous freshwater species which prefers deep depressions in rivers with stony, gravely, and sandy beds. It originally inhabited Eurasian rivers, being widely distributed in ones flowing into the Caspian, Baltic, Black, and Arctic Seas, and the Sea of Azov. In the past, sterlets regularly occurred in the Danube River up to Vienna and even as far as Ulm. Recently, it has had a very limited distribution in the middle and upper Danube (Hensel and Holcik, 1997; Reinartz, 2002; Sokolov and Vasilev, 1989).

In Serbia, *A. ruthenus* occurs in the Danube and lower parts of its main tributaries, the Sava and Tisza Rivers (Janković, 1993). This fish is the smallest of all Danubian sturgeon species (Anonymous, 1997). Significant changes in sterlet populations were observed in the Serbian part of the Danube River after construction of the Iron Gate dams: I (943 km) and II (863 km) (Janković et al., 1994; Lenhardt et al., 2004). The gives species is the only sturgeon which is a still numerous in the Serbian part of the Danube.

In this study, we establish the species of endoparasites in the sterlet (*A. ruthenus* L.) during 2002 and 2003, and possible differences between the examined sites on the Danube River in the Belgrade region.

Study Area

The catchment area of the Danube River in the Belgrade region is part of the middle sector of the Danube basin – the largest sector of the river's watercourse from Bratislava to the Iron Gate dams (Serbia/Romania). With its main tributaries, the Danube represents the most significant Serbian water resource. The Danube this part flows through a densely populated area, and a permanent risk of pollution is present.

The sampling area covered five sites along 49 km of the Danube River (Fig. 1):

Site No. 1 – 1,173 km - Zemun, inside the narrow city area;

Site No. 2 – 1,169 km – Dorćol, downstream from the Sava's confluence;

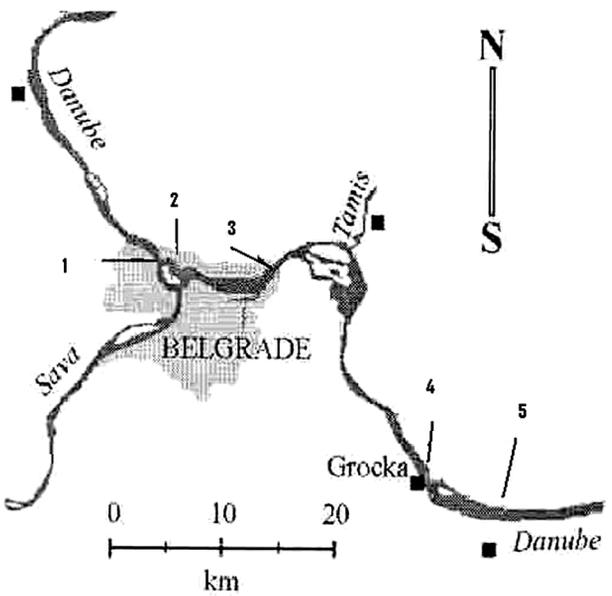

Fig. 1. Sampling sites along the Danube River in the Belgrade region.

Fig. 2. Specimen of *Skrjabinopsolus semiarmatus* found at sampling site 5 (a) and sampling site 1 (b).

Fig. 3. Specimen of *Amphilina foliacea*.

Fig. 4. Anterior (a) and posterior (b) parts of *Contracaecum bidentatum*.

Site No. 3 – 1,163 km – Višnjica, on the periphery of Belgrade, situated below the downtown and downstream from the Sava River's inflow. Ten municipal sewage outlets are located on the right bank upstream from the site. Effluents from the nearby port and shipyard as well as from several upstream industrial facilities also affect the river at this site;

Site No. 4 – 1,132 km – the town of Grocka, where the river enters a region characterized by more intensive agricultural activities;

Site No. 5 – 1,124 km – the village Orešac, at the exit from the broader territory of Belgrade.

Fig. 5. Specimens of *Cystoopsis acipenseris*.

MATERIAL AND METHODS

We examined a total of 517 sterlet specimens, which were captured using nets with different mesh size (32 – 50 mm). The material was analyzed using standard parasitological procedure. The stomach and intestines were examined for determination of the helminth fauna. During the parasitological examination, the intestines were cut open and examined under a stereomicroscope. The parasites found were bleached, stained, prepared, and fixed for determination and collection.

For isolation, sorting, and identification of the parasite fauna of sterlet, we used "Olympus BO61" binoculars and an "Olympus CO-01" microscope.

Appropriate identification keys were used for determination of representatives of the parasite fauna to the lowest taxonomic level (Bauer, 1984, 1985, 1987; Bykhovskaya-Pavlovskaya et al., 1962; Lom and Dikova, 1989; Moravec, 1994).

We also analyzed the extensity and intensity of parasitic infestation of the fish specimens.

RESULTS AND DISCUSSION

The length of all captured sterlets ranged from 220 to 300 mm, their weight ranged from 13 to 30 g for juveniles; and from 300 to 380 mm and 351 to 370 g, respectively, for one-year-old specimens. Endohelminth parasites were found in 342 or 66.15% of all captured sturgeon specimens. Thirteen species of parasites belonging to four classes were registered in all. The highest percentages share of infected sturgeons were recorded at the Zemun and Dorćol sites: 87.13 and 64.21 %, respectively.

The species of endohelminths and intensity of parasitic infection per investigated sites are presented in Table 1.

The examined fish yielded the following 13 helminth species: four species of Trematoda - *Skrjabinopsolus semiarmatus* Molin, 1858 (Fig. 2), *Sanguinicola inermis* Plehn, 1905, *Posthodiplostomum cuticola* Nordmann, 1832, and *Azygia lucii* Müller, 1776; one species of Cestoda - *Amphilina foliacea* Rudolphi, 1819 (Fig. 3); four species of Nematoda - *Contracaecum bidentatum* Linstow, 1899 (Fig. 4), *Contracaecum sinipercae* Dogiel & Achmerov, 1959, *Cystoopsis acipenseris* Wagner, 1867 (Fig. 5), and *Capillospirura ovotrichuria* Skrjabin, 1924; and four species of Acanthocephala - *Acanthocephalus anguillae* Müller, 1780, *Acanthocephalus lucii* Müller, 1776, *Pomphorhynchus laevis* Müller, 1776 and *Pomphorhynchus bosniacus* Kistaroly & Cankovic, 1969.

All infected sterlet specimens from all sites contained *Skrjabinopsolus semiarmatus* (Trematoda), with infestation intensity of 1 – 337. These parasites comprised 81.87% of the total fauna of endohelminths (Table 1).

According to Moravec et al. (1989), three of the mentioned parasite species are specific for representatives of Acipenseridae - *Skrjabinopsolus semiarmatus, Contracaecum bidentatum*, and *Amphilina foliacea*. Kakacheva-Avramova (1983) cites the named species as well as the species *Cystoopsis acipenseris*. The other parasite species found in the examined sterlets have many other fish hosts.

There has been much relevant research on the fauna of fish parasites in Danubian waters. In this paper, we present the data of: Molnar (2006); Molnar et al. (2006); Moravec et al. (1999); Moravec (2001); Nedeva (2004); Ondrackova et al. (2005); and Thielen et al. (2004).

Papers treating the helminthofauna in fish from the Danube in Belgrade area [Cakić et al. (1989); Cakić et al. (2004)] contain little information about the endohelminths of sterlets, and a few data are cited here (Cakić, 1986a, 1986b). The cited author analyzed the parasites of sterlets in the Serbian part of the Danube River and reported the presence of three parasitic helminth species - *Skrjabinopsolus semiarmatus, Contracaecum bidentatum* and *Acanthocephalus anguillae.*

The catch of *A. ruthenus* in the Belgrade region of the Danube River nowdays is mostly composed of one- and two-year-old specimens, while three-year-olds are rare, a fact conformed by our results.

The intestines of the sterlets from the Danube River in the Belgrade region contained numerous and diverse representatives of helminths, which can be a consequence of pollution and poor water quality. The saprobic status of the Danube in the Belgrade area can be judged from the fact that the bottom fauna corresponds to β- meso- to α-mesosaprobic conditions, according to WQMP.

The main purpose of our research was to study the helminth fauna of *Acipenser ruthenus* L. along the Serbian stretch of the Danube River in the Belgrade region. In our opinion, it is necessary to continue these examinations in order to determine the role of helminths in regulating the population density of sterlet.

Our investigation showed that the degree of sterlet parasite infestation is very high and that further examinations are needed to determine the role of helminth parasites in regulating the population density of sterlet.

Acknowledgments — This work was supported by Grant 143023 from the Ministry of Science of the Republic of Serbia. We acknowledge the help and support we got from professional fisherman Vasilije Ranković from Smederevo in gathering the material needed for this study.

REFERENCES

Anonzmous (1997). Document Doc. 10.89; Prop. 10.65, Appendix II. *Proposal Submitted by Germany and the United States of America to List All Acipenseriformes.*

Bauer, O. N. (1984). *Guide for identification of parasites of the freshwater Fish Fauna of the USSR*, Vol 1. Zoological Institute, Academy of Sciences of the USSR, Leningrad.

Bauer, O. N. (1985). *Guide for identification of parasites of the freshwater Fish Fauna of the USSR*, Vol 2. Zoological Institute, Academy of Sciences of the USSR, Leningrad.

Bauer, O. N. (1987). *Guide for identification of parasites of the freshwater Fish Fauna of the USSR*, Vol 3. Zoological Institute, Academy of Sciences of the USSR, Leningrad.

Bykhovskaya-Pavlovskaya, I. E., Gusev, A. V., Dubinina, M. N., Izyumovan, A., Smirnova, T. C., Sokolskaya, I. L., Shtein, G. A., Shulman, S. S., and *V. M. Epstajn* (1962). Guide for Determination of Parasites of Freshwater Fish of the USSR. Zoological Institute, Academy of Sciences of the USSR, Leningrad.

Cakić, P. (1986a). *Prilog poznavanju ekto- i endoparazita riba voda kanala Pančevačkog rita.* University of Belgrade, Belgrade.

Cakić, P. (1986b). Kečiga (*Acipenser ruthenus* L.) - novi domaćin za parazitsku trematodu *Azygia lucii* (Müller, 1776) Luhe, 1909. *Arch. Biol. Sci. (Belgrade),* **38** (1-4), 7P-8P.

Cakić, P., Lenhardt, M., Kolarević, J., Nedeva, I., Radev, V., Karaivanova, E., and *G. Atanassov* (2004). The first data on chub (*Leuciscus cephalus* L.) parasites in the Serbian part of the Danube River. In: *Proceedings of the 35th Conference of IAD,* 49-55.

Cakić, P., Savin, Z., and *D. Kataranovski* (1989). Beitrag zur Kenntnis der Ekto- und Endoichtyoprasiten in der Kanalgewasser der Pancevacki Rit (Jugoslawien). *Arch. Biol. Sci. (Belgrade)* **41** (3-4), 189-194.

Hensel, K., and *J. Holcik* (1997). Past and current status of sturgeons in the upper and middle Danube River. *Environ. Biol. Fish,* 48, 185-200.

Janković, D. (1993). Populations of Acipenseridae prior and after construction of the HEPS Djerdap I and II. *Ichthyologia* **25** (1), 29-34.

Janković, D., Krpo, J., Lenhardt, M., and *A. Hegediš* (1994). Ecological characteristics of the Danubian fish species. – In: *The Danube in Yugoslavia* (Eds. D. Janković and M. Jovičić), 159-173. Institute for Biological Research, Belgrade.

Kakacheva–Avramova, D. (1983). *Helminths of Freshwater Fishes in Bulgaria*, 261 pp. Bulgarian Academy of Sciences, Sofia.

Lenhardt, M., Cakić, P., Kolarević, J., Mićković, B., and *M. Nikčević* (2004). Changes in sterlet (*Acipenser ruthenus* L.) catch and length frequency distribution in the Serbian part of the Danube River during the twentieth century. *Ecohydr. Hydrobiol.* **4** (2), 193-197.

Lom, J., and *I. Dykova* (1989) Protozoa Parasites of Economically

Important Fish Species, *Fisheries Society of the Czech Republic,* 102 pp. Prague.

Molnar, K. (2006) Some remarks on parasitic infections on the invasive *Neogobius* spp. (Pisces) in the Hungarian reaches of the Danube River, with description of *Goussia szekelyi* sp. n. (Apicomplexa: Eimeriidae). *J. Appl. Ichthyol.* **22**, 395-400.

Molnar, K., Marton, S., Eszterbauer, E., and *C. Szekely* (2006). Comparative morphological and molecular studies on *Myxobolus* spp. infecting chub from the River Danube, Hungary and description of *Myxobolus muellericus* sp. n. *Diseases Aquat. Organisms* **68**, 209-218.

*Moravec, F. (*1994). Parasitic Nematodes of Freshwater Fishes of Europe, 172-173, 195-198, 377-380, and 396-399. Kluwer.

Moravec, F. (2001). Checklist of the Metazoan Parasites of Fishes of the Czech Republic and the Slovak Republic (1873-2000), 168 pp. Academia, Prague.

Moravec, F., Holcik, J., and *J. Meszaros* (1989). Notes on the helminth fauna of the sterlet (*Acipenser ruthenus* L.) in Slovakia. *Biologia (Bratislava),* **44**, 2, 151-155.

Moravec, F., Konecny, R., Baska, F., Rydlo, M., Scholz, T., Molnar, K., and *F. Schiemer* (1997). Endohelminth fauna of barbel, *Barbus barbus* (L.), under ecological conditions of the Danube basin in Central Europe. Studie AVCR 3/1997, 96 pp. Academia, Prague.

Nedeva, I. (2004). Studies on the ecological state of the Danube (Serbian and Bulgarian parts). *Bulg. Acad. Sci.* News No. **3** (3) 2.

Ondrackova, M., Davidova, M., Pecinkova, M., Blazek, R., Gelnar, M., Valova, Z., Cerny, J., and *P. Jurajda* (2005). Metazoan parasites *Neogobius* fishes in the Slovak section of the River Danube. *J. Appl. Ichthyol.* **21**, 4, 345-349.

Reinartz, R. (2002). *Sturgeons in the Danube River. Biology, Status, and Conservation*. 150 pp. Landesfischereiverband Bayern e.V. & Bezirk Oberpfalz.

Sokolov, L. I., and *V. P. Vasilev* (1989). *Acipenser ruthenus* Linnaeus, 1758. In: *The Freshwater Fishes of Europe. Vol. 1.* (Ed. J. Holcik), 227-262.

Thielen, F., Zimmermann, S., Baska, F., Taraschewski, H., and *B. Sures* (2004). The intestinal parasite *Pomphorhynchus laevis* (Acantocephala) from barbel as a bioindicator for metal pollution in the Danube River near Budapest, Hungary. *Environ. Pollut.* **129** (3), 421-429.

WQMP (Water Quality Monitoring Program) 1984-2005, *Annual Reports of the Public Health Institute, Belgrade* [in Serbian].

ПРИСУСТВО ФАУНЕ ЕНДОПАРАЗИТА КОД КЕЧИГЕ (*ACIPENSER RUTHENUS* L. 1758)У СРПСКОМ ДЕЛУ ДУНАВА

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Током ихтиопаразитолошких истраживања проучени су хелминти кечиге (*Acipenser ruthenus* L., 1758) у српском делу реке Дунав. Анализиран материјал прикупљен је током 2002. і 2003. године на пет профила дуж тока Дунава кроз београдски регион (1.124 – 1.173 km). Прегледано је укупно 517 примерака риба старости од 0^+ do 1^+, а паразити су нађени код 342 примерака, што износи 66.15% од укупног броја уловљених риба. Прегледане јединке заражене су хелминтима који припадају групама Trematoda (4 врсте), Nematoda (4 врсте), Acanthocephala (4 врсте) і Cestoda (1 врста).

Наша истраживања показују да је веома висок степен инфицираности кечига Дунава на подручју Београда хелминтима и да су неопходна даља истраживања у циљу дефинисања улоге ових паразита у регулисању густине популације ове врсте.