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MEĐUNARODNI VETERINARSKI
KONZORCIJUM ZA BIOSIGURNOST
AKVATIČNIH ORGANIZAMA
LUDVIG-MAKSIMILIJAN UNIVERZITET
MINHEN, NEMAČKA

VIII INTERNATIONAL
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VIII MEĐUNARODNA
KONFERENCIJA

WATER & FISH

CONFERENCE
PROCEEDINGS
June 13 - 15, 2018

ZBORNIK
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UNIVERSITY OF BELGRADE, FACULTY OF AGRICULTURE - SERBIA
AND INTERNATIONAL AQUATIC VETERINARY BIOSECURITY CONSORTIUM, LUDWIG-MAXIMILIANS-UNIVERSITY MUNICH, GERMANY

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8th INTERNATIONAL CONFERENCE "WATER & FISH"

CONFERENCE PROCEEDINGS

Faculty of Agriculture, Belgrade-Zemun, Serbia
June, 13 – 15. 2018.

PUBLISHER
University of Belgrade - Faculty of Agriculture

FOR THE PUBLISHER:
Prof. Dr. Milica Petrović

COMPUTER DESIGN
GRAPHIC, Novi Sad

TECHNICAL PREPARATION OF A COVER
Dr. Božidar Rašković

TECHNICAL TEXT PREPARATION
Dr. Ivana Živić

PRINTED BY
GRAPHIC, Novi Sad

NUMBER OF COPIES PRINTED
400 COPIES

ORGANIZATION OF THE CONFERENCE SUPPORTED BY:
Ministry of Education, Science and Technological Development Republic of Serbia

GENERAL DONOR
DTD RIBARSTVO, Bački Jarak

UNIVERZITET U BEOGRADU, POLJOPRIVREDNI FAKULTET - SRBIJA
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BIOSIGURNOST AKVATIČNIH ORGANIZAMA,
LUDVIG-MAKSIMILIJAN UNIVERZITETA U MINHENU, NEMAČKA

UZ PODRŠKU
EVROPSKOG DRUŠTVA ZA AKVAKULTURU - EAS
I
PAN-HELENSKOG DRUŠTVA TEHNOLOGA IHTIOLOGA - PASTI

VIII MEĐUNARODNA KONFERENCIJA ”VODA I RIBA”

ZBORNIK PREDAVANJA

Poljoprivredni fakultet, Beograd– Zemun, Srbija
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IZDAVAČ
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INTESTINAL PARASITES AND DIET OF COMMERCIALLY IMPORTANT FISH SPECIES IN THE BELGRADE STRETCH OF THE DANUBE RIVER (SERBIA)

ĐIKANOVIĆ VESNA[1], SKORIĆ STEFAN[2], NIKOLIĆ VERA[3], LENHARDT MIRJANA[1]

[1]*Institute for Biological Research «Siniša Stanković», University of Belgrade, Boulevard Despot Stefan 142, 11 060 Belgrade, Serbia*

[2]*Institute for Multidisciplinary Research, University of Belgrade, Kneza Višeslava 1a, 11 000 Belgrade, Serbia*

[3]*Faculty of biology, University of Belgrade, Studentski trg 16, 11000 Belgrade, Serbia*

CREVNI PARAZITI I ISHRANA KOMERCIJALNO ZNAČAJNIH VRSTA RIBA U BEOGRADSKOM SEKTORU DUNAVA

Apstrakt

U radu su prikazani rezultati istraživanja crevnih parazita i crevnog sadržaja (ishrane) komercijalno značajnih vrsta riba Dunava u beogradskom sektoru. U tom cilju je urađena identifikacija i prikazan je spisak crevnih parazita, kao i identifikacija organizama makrobeskičmenjaka iz crevnog sadržaja. Tokom istraživanja pregledeno je ukupno 39 jedinki sedam vrsta riba (*Silurus glanis, Sander lucioperca, Cyprinus carpio, Esox lucius, Lota lota, Zingel zingel, Hypophthalmichthys molitrix).* Pregledom crevnog trakta riba, utvrđeno je da je parazitima zaražena 21 jedinka, odnosno 53,85%. Paraziti nisu nađeni u jedinki šarana. U crevnom sadržaju sakupljenih jedinki riba identifikovani su predstavnici faune dna, pripadnici različitih grupa, u različitom broju i odnosu (Bivalvia, Gastropoda, Amphipoda, Gammarida, Oligochaeta, Insecta). Mnogi od predstavnika faune dna su prelazni domaćini u životnom ciklusu unutrašnjih parazita.

Ključne reči: *paraziti; ishrana, komercijalne vrste riba, Beograd, reka Dunav.*
Keywords: *parasitic species; feeding; commercially fish; Belgrade, River Danube.*

INTRODUCTION

Infection of fish with parasites depends on the way of fish life, physiological tolerance to individual parasites, the ability of the host to avoid them, the distribution of hosts, fish feeding habitats, etc. Generally speaking, the degree of infestation depends on the density of the population (directly proportional), and the diversity of parasites from the size of the host's body (directly proportional) (Simonović, 2010). The study of the parasite species and their abundance, intensity and prevalence of infection is of importance for the analysis of the fish population and also for ichthyofauna monitoring as a very important resource of aquatic ecosystems.

Composition of fish fauna in the Belgrade stretch of the Danube River still has autochthonous character. The construction of a hydro-energetic system „Djerdap" caused changes in ichthyocoenosis and exstinction of anadromous sturgeon fish species (Acipenseridae) in this river section (Lenhardt et al., 2006). In the Danube near Belgrade, based on the analysis of commercial catch fish of K1 category (*Silurus glanis*, *Sander lucioperca)* constitute 16.7% per abundance and 35.7% by mass, while K2 fish (*Esox lucius*, *Cyprinus carpio, Lota lota, Hypophthalmichthys nobilis, Zingel zingel*) are not registered in catches (Hegediš et al., 2013).

The aim of this study is establishment of intestinal parasitic species in economically significant fish species from Belgrade catchment of the Danube River, as well as analyses of their intestinal content and identification of found macrozoobentic individuals.

MATERIAL AND METHODS

This study comprehends the data derived from two-year long investigations (2007-2009) within the Danube River in Belgrade section, on localities Zemun (1.173 rkm) and Višnjica (1.162 rkm). The work covers the investigations on endoparasites and the diet of commercially freshwater fishes. Fish specimens have been sampled by multimesh nets (32 – 50 mm). Fish were transported to the laboratory, where the analyses of their intestines for endoparasites and diet were conducted. The material was analyzed using standard parasitological procedure. Appropriate identification keys were used for determination of parasite fauna representatives to the lowest taxonomic level (Bykhovskaya-Pavlovskaya et al., 1962; Bauer 1987; Moravec, 1994). Determination of the macrozoobenthic organisms recorded in the fish intestines was conducted to the lowest taxonomic level using the appropriate identification keys.

RESULTS AND DISCUSSION

A total of 39 individulas of seven economically significant fish species (*Silurus glanis*, *Sander lucioperca*, *Esox lucius*, *Cyprinus carpio, Lota lota, Zingel zingel, Hypothalmihthis molitrix*) have been collected and examined during this study. . By examination of their intestinum, parasitic species have been identified in 21 fish specimens (Table 1).

Table 1. List of collected and examined fish species and prevalence of infection (number of infected fish and % of infestation)

Fish species	Number of examined fish specimens	Number of infected fish specimens	Percentage of infection (%)
Esox lucius (Linnaeus, 1758)	3	1	33.33
Sander lucioperca (Linnaeus, 1758)	5	2	40.00
Lota lota (Linnaeus, 1758)	4	4	100.00
Silurus glanis (Linnaeus, 1758)	1	1	100.00
Cyprinus carpio (Linnaeus, 1758)	1	0	0
Zingel zingel (Linnaeus, 1758)	11	10	90.91
*Hypophthalmichthys molitrix** (Valenciennes 1844)	14	3	21.43
Σ	**39**	**21**	**53.85**

*allochthonous fish species

Results of examination of fish intestine for identification of endoparasites and diet are presented in the Table 2. The presented findings of intestinal parasites in commercially important fish species of the Belgrade part of the Danube are significant from the aspect of consumption of selected fish species. None of the identified endoparasites has caused damage to the abdominal cavity, nor is the cause of zoonosis in humans. No parasites were found in the carp, while in the previous studies, a total of 17 were identified (Babić, 1935; Andrić, 1984, Cakić and Hristić, 1987; Kiškarolj and Tafro, 1988**;** Cakić, 1992). **O**nly one single pike, out of the three examined, was infected with acanthocephalus, while in previous years there were representatives among Cestoda (5), Trematoda (3), Nematoda (4) and Acanthocephala (5) (Babić, 1935; Andrić, 1984; Cakić, 1992; Cakić and Fišter, 1997). Two individuals of pike perch were infected, and in 2013 was the first observations of *Eustrongylides* larvae (Nematoda) (Bjelić-Čabrilo et al., 2013).

Table 2. The results of determined intestinal parasites and diet of seven commercially fish species

Fish species	**Intestinal parasite**				**Diet**
	Cestoda	Trematoda	Nematoda	Acanthocephala	
Esox lucius				*Pomphorhynchus laevis*	Bivalvia (*Sphaerium* sp.) Insecta.
Sander lucioperca	*Proteocephalus* sp.	*Rhipidocotyle campanula*	*Camallanus lacustris, Philometra rischta*		Annelida (fragmented, impossible to determine to a lower level), Bivalvia (*Dreissena polymorpha*), some small fish specimens.
Lota lota			*Contracaecum siniperca, Contracaecum* sp., *Camallanus truncates, Hysterothylacium bidentatum*	*Pomphorhynchus laevis, Metechinorchynch us truttae, Acanthocephalus anguillae,*	Crustacea (*Asellus* sp., Gammaridae), Bivalvia, Gastropoda (*Lithoglyphus naticoides*), Oligochaeta, some fish specimens
Silurus glanis			*Camallanus lacustris Camallanus* sp.		none
Cyprinus carpio					Bivalvia
Zingel zingel		*Bucephalus polymoprhus, Bunodera luciperca, Nicolla skrjabini, Bucephalus polymorphus*	*Hysterothylacium bidentatum,*	*Pomphorhynchus laevis Acanthocephalus lucii, Acanthocephalus* sp.	Crustacea (*Asellus* sp., Gammaridae), Gastropoda (*Lithoglyphus naticoides*), Oligochaeta, Insecta, specimens of small fish.
Hypophthalmichth ys molitrix		*Allocreadium* sp.	*Camallanus* sp.		Oligochaeta algae

The individuals of common zingel, in previous years, were not subject to ihtioparasitological research. In our study, it is the fish with the highest percentage of infection (90.91%). All collected burbot specimens were infected with parasites, the presence of which was confirmed by previous studies (Babić, 1935; Kiškarolj and Tafro, 1988; Cakić, 1992). One caught wels catfish individual was infected with nematodes, while a much larger number of parasites were identified in the previous studies by Babić (1935); Andrić (1984) and Kiskarolj and Tafro (1988). With introduction of non-native fish species *Hypophthalmichthys molitrix* spreading of parasites to native taxa have been reported , supplemented by fish parasite fauna: *Trichodina nobilis (*Chen 1963)*, Lernaea cyprinacea* (Linnaeus 1758) and *Sinergasilus polycolpus* (Markevich 1940) (Cakić and Hristić, 1987; Cakić et al., 1996; Nikolić and Simonović 1998).

In the intestinal contents of the sampled individuals of commercial fish species representatives of the bottom fauna were identified (Bivalvia, Gastropoda, Amphipoda, Gammarida, Oligochaeta, Insecta). *Dreissena polymorpha* and *Sphaerium* sp. were identified within Bivalvia group ., while within Gastropod *Lithoglyphus naticoides*. Many of the benthic organisms are intermediate hosts for larval stages of certain groups of parasites. The feeding habits of fish and its diet are influenced by the available local invertebrate fauna, which is, in turn, determined by water quality and habitat composition.

Table 3. The review of fish intestinal parasites from the Belgrade strech of the Danube River

Intestinal parasites	**Class**
Proteocephalus sp. (Weinland, 1858)	Cestoda (1)
Bunodera lucioperca (O.F. Müller, 1776) *Bucephalus polymorphus* (von Baer, 1827) *Nicolla skrjabini* (Ivanitzky, 1928) *Allocreadium* sp. (Looss, 1900) *Rhipidocotyle campanula* (Dujardin, 1845) Trematoda-ciste Trematoda gr.spp.	Trematoda / Digenea (7)
Hysterothylacium bidentatum (Linstow, 1899) *Contracaecum siniperca* (Dogiel & Achmerov, 1946) *Contracaecum* sp. (Railliet & Henry, 1912) *Camallanus lacustris* (Zoega, 1776) *Camallanus truncatus* (Rudolphi, 1814) *Camallanus* sp. (Railliet & Henry, 1915) *Philometra rischta* (Skrjabin, 1923)	Nematoda (7)
Acanthocephalus anguillae (Müller, 1780) *Acanthocephalus lucii* (Müller, 1776) *Acanthocephalus* sp. (**Koelreuter, 1771)** *Pomphorhynchus laevis* (Müller, 1776) *Pomphorhynchus* sp. (Monticelli, 1905) *Metechinorhynchus truttae* (Schrank, 1788)	Acanthocephala (6)

Catch statistics in the period 1969-2010 indicates an increasing presence of Abramidae fish and allochthon species in total fish catch (Jarić et al., 2016). It was noticed that the most numerous species are bream, barbus and prussian carp (40–70% in catch), silver and bighead carp (4%), while economically valued species are less represented: sterlet (8–10%), pike perch (3–5%), and even more rarely, wels catfish, northern pike and common carp (each with a 1–2%) (Smederevac-Lalić, 2013).

ACKNOWLEDGEMENTS

This research was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Project No. 173045 and 37009.

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CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

639.2/.3(082)

INTERNATIONAL Conference "Water & Fish" (8 ; 2018 ; Beograd)
Conference Proceedings / 8th International Conference "Water & Fish", Faculty of Agriculture, Belgrade-Zemun, Serbia, June, 13-15. 2018. ; [editors in chief Vesna Poleksić, Božidar Rašković and Zoran Marković]. - Belgrade : University, Faculty of Agriculture, 2018 (Novi Sad : Graphic). - XII, 544 str. : ilustr. ; 23 cm

Tekst na engl. i srp. jeziku. - Na spor. nasl. str.: Zbornik predavanja. - Tiraž 400. - Bibliografija uz svaki rad. - Apstrakti ; Abstracts.

ISBN 978-86-7834-308-7

a) Рибарство - Зборници
COBISS.SR-ID 264387852

ISBN 978-86-7834-308-7