

The Influence of *Posthodiplostomum cuticola* (Digenea, Trematodes) Metacercariae Infestation on the Growth Rate of *Leuciscus cephalus* L. (Cyprinidae, PISCES)

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Abstract: The paper presents results of the analysis on the effect of the *P. cuticola* metacercariae infestation on the growth rate of chub (*Leuciscus cephalus* L.) in the Medjuvsrje Reservoir on the Zapadna Morava River (the Danube basin, Serbia). The fluke infestation induced a lower rate of growth primarily in length of the infested population.

Key words: *Posthodiplostomum cuticola*, *Leuciscus cephalus*, growth rate

Posthodiplostomum cuticola (von Nordmann 1832) is one of the most frequent parasites of the fluke class (Trematodes). The development cycle of the species includes two intermediate hosts. The first one is a mollusc (usually a snail of the *Planorbis* sp. or *Anisus* sp.) and the second one is a fish. The definite host is a bird, usually the representative of herons (*Ardea* sp.) Bauer *et al.* (1981).

The fluke larva (metacercaria), the agent of the black-spot disease, lives in the fish. The characteristic symptoms of the disease include dark stains on the body of the infested fish. A dark pigment (hemomelanin) produced by decomposition of blood hemoglobin and chromatophore accumulates around metacercaria, which is the host reaction to the parasite presence. The disease causes body deformation, bending of spine, skin and muscle fibers necrosis, kidney and liver dystrophy and other symptoms, even death of infected individuals (fish fry are the most susceptible to parasite infestation (Williams and Jones 1994).

The presence of *P. cuticola* metacercariae is registered primarily in cyprinid species (Bauer *et al.* 1981). This fluke is also observed in representatives of the

genus *Leuciscus*, including *L.idus* (Sobecka *et al.* 2004) *L. leuciscus* (Rolbiecki 2004) and *L.cephalus* (Cakic *et al.* 2004, Kirjusina and Vismanis 2007).

The study was conducted in the Medjuvrsje reservoir on the Zapadna Morava river (Danube basin, West Serbia) (43°53'15" - 43°55'15"N, 20°11'9" - 20°12'57" E). The Medjuvrsje reservoir (surface area of 1.5 km², length 9.3 km, width 272m and maximum depth of 12m), one of the oldest Serbian reservoirs, was created in 1953 (Markovic and Simovic 1997). The shores of the reservoir are steep, its bottom muddy. The biota (plankton communities, macrozoobenthos, macrophyte vegetation and ichthyofauna) of the reservoir is highly diversified. A total of 20 fish species belonging to 7 families are registered. The Cyprinidae family is the most abundant (14 species), the bleak (*Alburnus alburnus*) being the most predominant, whereas *L.cephalus* is a dominant predator species in the ichthyofauna (Markovic and Veljovic 2005). The ecosystem is characterised by enhanced sediment production (more than 70% of the original volume of the reservoir of 15.4 x 10⁶ m³ has been deposited) and eutrophication (Spasojevic *et al.* 2005.).

The conditions fostering the development cycle of the *P.cuticola* (Ondrackova *et al.* 2004) include the following: the abundance of macrophyte vegetation in the littoral zone of the lake, the presence of intermediate hosts and a numerous population of the definite host – the common heron (*Ardea cinerea*).

The objective of the present study was to evaluate the effect of *P.cuticola* meta-cercariae infestation on the growth rate of chub (*L.cephalus*), one of the most widespread cyprinid in various watercourses of Europe (Kottelat 1997) including the Serbian ones (Simonovic and Nikolic 1997).

The ichthyological investigation was conducted over 2000 – 2002 using standard fishing nets and hooks. In all the specimens examined, body length (in mm with accuracy of ± 1mm) and body weight (with accuracy of ± 0.1g) of live fish were measured. The presence of the *P. cuticola* metacercariae was detected by characteristic dark strains on the fish bodies (on the head, skin and fins) and in deeper tissues (after dissection).

The total of 147 specimens of *L.cephalus* aged 1+ to 9+ with the total length ranging from 89 – 430 mm (Table 1) and weight ranging from 7.0 to 1160.1 g (Table 2) were examined. A comparison was made between the growth rate of the chub infested by *P.cuticola* metacercariae and the rest of the population – non-infested or infested by other parasites (in Table 1 and 2 marked as non-infested).

The growth-in-length recorded in the part of the population infested by *P.cuticola* was lower than that in the non-infested population of any age. A statistically significant growth rate difference was observed between the specimens 3+ years of age (period of massive maturation) and those 5+ years of age (Table 1).

At all ages, except at the age of 1+, a more intensive body weight increase in non-infested specimens could be observed (differences were not statistically significant). Although the absolute weight increment showed the growth tendency in both parts of the sample, the greatest differences were recorded in the oldest specimens.

The obtained results suggested the negative effect of *P.cuticola* metacercariae on the growth rate of *L.cephalus*. The data, coupled with the analysis of the ichthyofauna structure and other hydrochemical and hydrobiological conditions, confirmed the deterioration of general environmental conditions in the ecosystem analysed.

Tab.1. Growth-in-length (in mm) of *L.cephalus* both infested by *P.cuticola* and non-infested (n = 147)

Age	Infested (n = 60)				Non-infested (n = 87)				t	df
	n	range	mean	s	n	range	mean	s		
1+	2	91 - 103	97	8.49	6	89 - 116	101	12.28	0.55	6
2+	7	118 - 157	136	18.52	12	131 - 162	146	11.72	1.41	17
3+	9	147 - 205	180	21.71	12	160 - 235	203	21.62	2.50*	19
4+	7	210 - 251	221	14.48	14	207 - 255	234	14.96	1.97	19
5+	20	237 - 280	264	15.15	16	237 - 303	267	17.64	0.68	34
6+	9	265 - 280	290	17.46	16	275 - 330	306	15.91	2.25*	23
7+	5	315 - 362	329	18.83	7	285 - 380	341	30.96	0.82	10
8+	1	375	375		4	362 - 413	393	21.82		3
9+					1	430	430			

s – standard deviation; t – Student's t-test; df – degrees of freedom; * p < 0.05

Tab.2. Growth-in-weight (in g) of *L.cephalus* both infested by *P.cuticola* and non-infested (n = 147)

Age	Infested (n = 60)				Non-infested (n = 87)				t	df
	N	range	mean	s	n	range	mean	s		
1+	2	8.1 - 10.1	9.0	1.48	6	7.0 - 11.6	8.5	12.28	0.37	6
2+	7	13.8 - 42.1	24.6	10.26	12	11.3 - 41.0	18.1	11.72	0.72	17
3+	9	28.5 - 100.0	60.7	24.64	12	36.2 - 120.0	73.5	21.62	0.65	19
4+	7	90.1 - 190.2	125.4	37.12	14	90.2 - 211.9	143.6	14.96	1.06	19
5+	20	140.1 - 230.0	179.4	33.91	16	146.1 - 285.1	215.0	17.64	1.78	34
6+	9	225.0 - 395.2	302.7	49.51	16	248.9 - 440.8	327.7	15.91	1.16	23
7+	5	321.9 - 480	398.5	72.06	7	360.8 - 701.0	474.1	30.96	1.39	10
8+	1	578.1	578.1		4	729.9 - 883.1	786.9	21.82		3
9+					1	1160.1	1160.1			

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