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METAGONIMUS YOKOGAWAI, A NEW PARASITIC TREMATODA SPECIES IN ICHTYOPARASITOFAUNA OF THE SERBIA

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During the study of fish parasites in the Serbian section of the Danube River in 2003, a new Trematoda species for ichthyofauna of Serbia has been detected. It is, at the same time, the first finding of larvae of Metagonimus yokogawai in Serbia, as adult forms have been observed from mallard Anas platyrhynchus (L.), previously. Metacercariae of M. yokogawai have been identified on the scales of chub Leuciscus cephalus (L.), barbel Barbus barbus (L.), bleak Alburnus alburnus (L.), pikeperch Sander lucioperca (L.) and rudd Scardinius erythrophthalmus (L.) in the Serbian part of Danube River. The particular risk, beside the possible negative influence of spreading on fish and other host populations (some aquatic snails, fish-eating birds and some mammals), is the potential spreading of the parasitic disease in humans – Metagonimosis.

Key words: Metagonimus yokogawai metacercaria, fish, Danube River, Serbia

INTRODUCTION

The fish parasites are often found in particular freshwater ecosystems which is their adaptation to intermediate and final hosts, as well as to environmental conditions in aquatic ecosystems (Kulakovskaya, 1973; Kakacheva-Avramova, 1983; Moravec *et al*., 1997; Moravec, 2001). The worldwide investigations of fish parasitofauna show that many individuals of the same parasite species can be found in very distinct geografic areas. One of these parasites is *Metagonimus yokogawai* trematoda. Distribution of this trematoda species have to be followed because humans are one of the hosts in its life cycle (Cho *et al*., 1983; Chai *et al*., 2000; Arsić-Arsenijević, 2003; Baltić *et al*., 2005).

The presence of the parasite was identified on chub *Leuciscus cephalus* (L.), barbel *Barbus barbus* (L.), bleak *Alburnus alburnus* (L.), pikeperch *Sander lucioperca* (L.) and rudd *Scardinius erythrhophthalmus* (L.)

The aim of this paper is to present records of Trematoda *Metagonimus yokogawai* (Katsurada, 1912) metacercariae from five fish species within the Serbian part of the Danube River. The frequency and abundance of this parasite

are discussed. The data on distribution and abundance of *M. yokogawai* are interesting due to the possible negative influence to fish and other host populations (some aquatic snails, fish eating birds and some mammals), as well as the potential risk of spreading of the parasitic disease metagonomiasis to humans (Cho *et al*., 1983; Chai *et al*., 2000; Arsić-Arsenijević, 2003; Baltić *et al.*, 2005).

MATERIAL AND METHODS

A total of 18 fish specimens was caught with fishing nets of different mesh size (32-50 mm).

Trematoda *M. yokogawai*, in the metacercaria stage, was removed from scales of collected fishes and identification of numerous metacercariae has been done using a stereomicroscope Olympus CO-01 (with amplification 10 x 10 and 10 x 40).

Metagonimus yokogawai metacercariae were measured by the micro-meter scale of the microscope ocular and snapped by digital camera Konica Minolta Dimage Z1.

Preserved parasites were identified according to the keys of Bauer (1987) and Byhovskaya-Pavlovskaya *et al*. (1962) as *M. yokogawai*.

The studied material has been stored in the collection of the Ichthyologic Section, Department for Hydrobiology, Institute for Biological Research, Belgrade - ref. number 98/2003 and 99/2003.

RESULTS

During the parasitological investigation of fishes collected from the Danube, downstream of the hydro-plant "Djerdap II", near Prahovo (Serbia, km 861 of the River) in October 2003, a trematode *M. yokogawai* was observed. Later, the parasite was found also on fishes collected from the Danube river, near Smederevo (river km 1116, October 2005). Sampling sites are presented in Table 1.

The numbers of examined and infected fishes, as well as basic fish morphometric features are presented in Table 1.

According to data presented in Table 1, the number of infected fish specimens is 12 (66.67%). Prevalence was high ranging from 25 to 100%. Maximum values were found for metacercariae taken from scales of *Leuciscus cephalus* and *Scardinius erythrophthalmus*.

The appearance of metacercaria is as described by Kakacheva-Avramova (1983) and Markevic (1951). The size range of the observed metacercariae was from 0.31 to 0.35 mm in lenght and from 0.1 to 0.13 mm in width (Figure 1, 2).

Table 1. *Metagonimus yokogawai* (Katsurada, 1912) on scales of examined fish specimens from the Serbian stretch of the River Danube – sites correspond to decription in the text

Site	Date	Examined specimens	No. of examined fish	Total length [cm]	Weight [g]	No. of infected fish	Prevalence (%)
Prahovo	October, 2003	*Leuciscus cephalus* (L.)	4	16 - 26	40 - 240	4	100
		Barbus barbus (L)	2	36 - 42	550 - 700	1	50
		Alburnus alburnus (L.)	4	5 - 5.5	2 - 2.5	1	25
		Stizostedion lucioperca (L.)	3	36 - 43	660 - 680	1	33.3
Smederevo	October, 2005	*Scardinius erythrophthalmus* (L)	5	29 - 40	400 - 600	5	100

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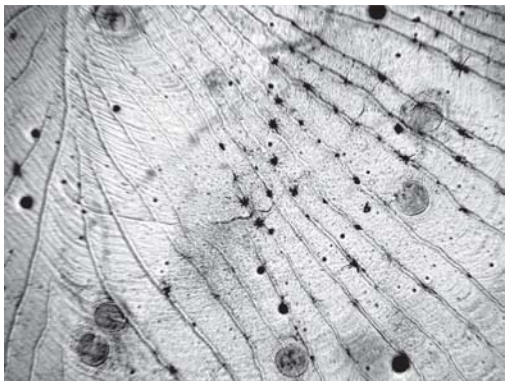

Figure 1. Digital camera picture: *Metagonimus yokogawai* metacercaria from scale of *Alburnus alburnus*

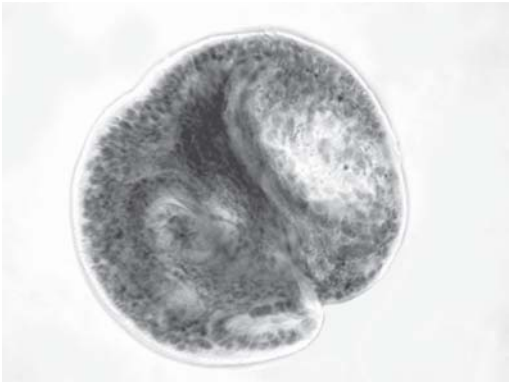

Figure 2. Digital camera picture: *Metagonimus yokogawai* metacercaria from *Rutilus rutilus* scale

DISCUSSION

The presented findings represent the first record of larval stages of *M. yokogawai* occurrence in Serbia. Kulišić (1989) reported the adult form of *M. yokogawai* found in the intestine of mallard *Anas platyrhynchus* (L.) captured in the region of Bara Reva (pond near Belgrade, Serbia), with a prevalence of about 3.13%.

The records of *M. yokogawai* indicate that the distribution area of the parasite is extended, as well as its possible negative influence on fish and other host populations (some aquatic snails, fish eating birds and some mammals).

According to Kulakovskaya and Koval (1973), Moravec *et al*. (1989, 1997) and Moravec (2001), *M*. *yokogawai* is widely distributed among fish species in the

Danube river, including Bulgaria and the Black Sea basin. It is reported in the Far East as well, particularly Japan, China, Korea, Philipines, Taiwan and the Amur region of Siberia, Mediterranean sea region, Balkan, Greece, Spain and ex USSR republics (Baltić and Teodorović, 1997). In Europe, *M. yokogawai* has been described by Pavlovski (1946), Markevic (1951), Skrjabin (1952), Bykhovskaya-Pavlovskaya *et al.* (1962), Kakacheva-Avramova (1983), Kocis *et al*. (1985) and Bauer (1987).

Metagonimus yokogawai has a complex life cycle which includes two intermediate and a final host. The first intermediate hosts are freshwater snails from genera *Melania* (*M. libertina*, *M. ebenina*), *Blanfordia* (*B. nosophora*), *Piradus* (*P. cingulatus*), *Fagotia* (*F. acicularis*) and *Semisulcospira* spp. (Cho *et al*., 1983; Kakacheva-Avramova, 1983).

The parasite subsequently infects freshwater fishes, from families Salmonidae, Cyprinidae, Percidae and Siluridae as the second intermediate host, (Markevic, 1951; Bykhovskaya-Pavlovskaya *et al*., 1962; Hristovski *et al*., 1998). *Metagonimus yokogawai* (most common heterophyid fluke in areas of the Far East and Mediterranean basin) encysted under the scales or in the skin of various fish species.

The final hosts are found to be cats, dogs, pigs, foxes and other fish eating mammals, as well as fish eating birds. The mature trematodes can be found in the upper parts of the final host intestine (Baltić *et al*., 2005).

If first intermediate hosts are considered, only snails belonging to genus *Fagotia* (*F. esperi*, *F. acicularis*) are present in the investigated stretch of the Danube; both species have been reported frequently and with high population density (Arambašić, 1994; Berneth *et al*., 2002; Csanyi *et al*., 2005; Paunović *et al*., 2005). The investigation on infections of snails should be performed in order to determine other possible first intermediate hosts and establish the level of infections.

Other hosts are frequent in the area, so their presence does not represent a limiting factor for the spreading of *M. yokogawai.*

Metagonimus yokogawai causes a disease known as metagonomosis. Serious consideration should be given to the potential consequences of this infection to humans in the region. Baltić *et al*. (2005) stressed that there is a potential risk of spreading of metagonomiasis to humans in the region. According to Arsić-Arsenijević (2003), eggs produced by adult worms in the final host penetrate the lymphatic and blood circulation and subsequently, attack the heart, lungs, nervous system and other organs where they form granulomas. Metacercariae infect humans after ingestion of raw or undercooked fish. In heavily infected patients the infection can cause severe gastrointestinal disorders and easy fatiguability (Chai *et al*., 2000).

The infection of humans by *M. yokogawai* was not reported in Serbia, likely due to the fact that there is no habit to eat fresh, thermally untreated fish. The change of nutritional habits in the region could contribute to human infection. Further, uncooked fresh commercially not important fish is often used as an additional food source for pigs in extensive farming. Taking into account that pork

represents an important food resource for the population in the region, the risk of infection is obvious.

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METAGONIMUS YOKOGAWAI NOVA PARAZITSKA TREMATODA ZA IHTIOPARAZITOFAUNU SRBIJE

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SADRŽAJ

Tokom istraživanja parazita riba srpskog dela Dunava (2003) nađena je nova vrsta Trematoda za ihtioparazitofaunu Srbije. Ovaj nalaz je istovremeno i prvi nalaz larvi (metacerkarija) metilja *Metagonimus yokogawai* (Katsurada, 1912) s obzirom da su odrasle jedinke ovog parazita nađene prethodno kod divljih pataka *Anas platyrhynchus* (L). Metacerkarije *M. yokogawai* pronađene su na krljuštima klena *Leuciscus cephalus* (L.), mrene *Barbus barbus* (L.) uklije *Alburnus alburnus* (L.), smuđa *Sander lucioperca* (L.) i crvenoperke *Scardinius erythrophthalmus* (L). Posebna opasnost, pored širenja infekcije metiljem *M. yokogawai* i negativnog uticaja na populaciju riba i ostalih prelaznih domaćina (neki vodeni puževi, ribojedne vrste ptica i neki sisari), jeste i pojava metagonimioze kod ribojednih sisara, među kojima je i čovek.