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Accumulation of Some Heavy Metals in *Raphidascaris acus* (Bloch, 1779) and Its Host *(Esox lucius* L., 1758*)*

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SUMMARY: Concentrations of some heavy metals (Fe, Zn, Cu, Mn and Cr) in liver of pike (*Esox lucius* L., 1758) and its endoparasite [*Raphidascaris acus* (Bloch, 1779)] inhabiting Işıklı Lake (Turkey) were analyzed using atomic absorption spectrophotometry. Only Fe and Zn were detected in R. acus and liver of fish, while levels of Cu, Mn and Cr were below detection limit (<0.028). The Fe and Zn level in R. acus were 68.4 and 86.9 times higher than in the liver. Nematodes could provide reliable information about the heavy metal pollution of the lakes.

Key words: *Raphidascaris acus*, Pike, Heavy Metal, Pollution, Işıklı Lake

Raphidascaris Acus (Bloch, 1779)'ta ve Konağında (*Esox lucius* L., 1758) Bazı Ağır Metallerin Birikimi

ÖZET: Işıklı Gölü'nde yaşayan turna balığı (*Esox lucius* L., 1758)'nın karaciğerinde ve endoparazitindeki [*Raphidascaris acus* (Bloch, 1779)] bazı ağır metallerin (Fe, Zn, Cu, Mn ve Cr) konsantrasyonları Atomik Absorbsiyon Spektrofotometre kullanılarak analiz edilmiştir. Cu, Mn ve Cr analiz limitinin altında çıkarken (<0.028), karaciğer ve parazitte sadece Fe ve Zn tespit edilmiştir. R. acus'taki Fe ve Zn düzeyleri karaciğere göre 68.4 ve 86.9 kere daha fazladır. Nematodlar göllerdeki ağır metal kirliliği hakkında güvenilir bilgiler verebilir.

Anahtar kelimeler: *Raphidascaris acus*, Turna Balığı, Ağır Metal, Kirlilik, Işıklı Gölü

INTRODUCTION

Pollution in aquatic biotopes is, due to anthropogenic influence, still a subject of many researchers. To assess levels of biologically available pollutants bioindicators are useful tools in addition to chemical water analyses which primarily describe the total concentration of a particular pollutant (3).

Knowledge of fish parasites is of particular interest in relation not only to fish health but also to understand ecological problems. Although the majority of parasitological papers have dealt with parasites as threat for the health of fish (14,15), several hundred papers have been published since 1990 about the relationship between pollution and parasitism in the aquatic environment (1, 8-10, 12, 13, 16, 17, 19-23).

Different studies show higher concentrations of heavy metals in some intestinal fish parasites compared to those found in the tissues of their final hosts. For example, Galli et al., (5) examined the contents of Pb and Cr in one host-parasite system (*Leuciscus cephalus-Acanthocephalus anguillae*) and demonstrate higher concentrations of these metals in acanthocephalans than in its host. Gabrashanska and Nedeva (4) examined the contents of Cu, Cr and Zn in two host parasite system (*Vimba vimba melanops-Caryophillaeus brachycollis* and *Alburnus alburnus-Ligula intestinalis*) and demonstrate higher concentrations of these metals in cestodes than their hosts. Additionally, Tenora et al. (21) investigated Pb, Cr and Cd levels in the *Philometra ovata* and three of its hosts. Mean concentrations of Pb, Cr and Cd in *Philometra ovata* from hosts (*Abramis brama, Rutilus rutilus, blicca bjoerkna*) were 160, 43 and 119 times higher than in the muscle of the hosts.

This aspect in addition to their capacity to accumulate heavy metals suggests that parasites may serve as useful indicators for biologically available metals in aquatic ecosystems that current methods of water and sediment analysis can not accurately measures (5).

In order to provide data supporting the usefulness of these parasites as indicators of heavy metal pollution, we examined Cu, Fe, Zn, Mn and Cr concentrations in *Raphidascaris acus* and the liver of host fish.

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MATERIAL AND METHODS

Sampling: During the period of December 2002 and November 2003, 20 pike were caught by fisherman in Işıklı Lake. The fish body weights were between 165-356 g and lenghts were 235-376 mm.

The samples were brought to the laboratory on the same day. The fish were killed by a blow on the head. The nematodes were removed separately each intestine from different fish. The entire liver from each sample were dissected, washed and distilled water, dried with filter paper, weighed, packed in polyethylene bags and kept at –30 °C until analysis.

Analytical procedures: The wet samples (liver and nematoda) that were weighed (1 g) before, 5 ml nitric acid (65%) and 1 ml hydrogen peroxide were placed into the digestion bombs and digested in a microwave digestion system. The advantages of microwave digestion against the classical method are the shorter time and keeping volatile compounds in the solution (6). After digestion, the samples were cooled to room temperature. The resulting solutions were made up to exactly 25 ml with high-quality deionized water and analyzed for Fe, Zn, Cu, Mn and Cr using a Perkin Elmer Atomic Absorpsion Spectrometer Analyst 800.

RESULTS

The concentrations of heavy metals in fish liver and *R. acus* are given in Table 1. As shown Table 1, only Fe and Zn were detected in *R. acus* and liver of fish samples, while levels of Cu, Mn and Cr were below detection limit (<0.028).

Table 1. Heavy metal concentrations in *R. acus* and host liver (mg/kg)

	Fe	Zn	Cu	Mn	Cr
R. acus	17.1±0.3	11.13±0.4	BDL*	BDL	BDL
Pike liver	0.25±0.2	0.13±0.3	BDL	BDL	BDL

*Below detection limit

The average mean concentrations of Fe are significantly different between two organisms: 0,25 (Liver host) and 17,1 mg/kg wet weight (Parasite). The iron level in *R. acus* was 68.4 times higher than in the liver of the pike. The average mean concentrations of Zn are significantly different between the two organisms: 0,13 (Liver host) and 11,13 mg/kg wet weight (Parasite). The zinc level in *R. acus* was 86.9 times higher than in the liver.

DISCUSSION

In this study, we measured the accumulation of Fe, Zn, Cu, Mn and Cr in *R. acus* and liver of host (*Esox lucius*). Only Zn and Fe were detected in liver and parasite of fish samples, while Cu, Mn and Cr were undetectable levels (<0.028) in parasites and host liver.

The concentrations of iron in *R. acus* was 68.4 times higher than that in the liver of pike. . Fe occurs in proteins like hemoglobin or myoglobin and is also bound in proteins such as ferritin which play important physiological roles and are found in high concentrations in the fish liver (7).

Concerning essential elements, a relatively higher concentration of zinc has often been detected without any poisonous effect on the health of the organism. Morever, zinc in interaction with particular toxic elements (eg., Cd and Pb) may even reduce their toxicity. On the other hand, the higher concentrations of copper is usually toxic (11). As Miller and Mackay (11) and Bireš et al., (2) demonstrated, zinc can inhibit the accumulation of copper in animal tissues and hence, it affords certain protection against toxic effects of Cu. In this study, Cu was below detection limit in liver and *R. acus*, while the zinc concentrations in *R. acus* was 89.6 times higher than in the liver.

The mean Cr value of 22 mg/g in *Pomphorhynchus laevis* (Acanthocephala) is ~60 times higher than that of the chub liver (18). Although this, we couldn't determine Cr in parasite and host liver. This finding outlines that several geochemical and biologically factors differently affect the bioavailability of the studied metals. In this study, levels of Cr, Pb and Cd were below the detection limit. This may be related to their location in the body cavity of the host but other factors are probably also involved.

It can be concluded that the results add further evidence to the possibility of using parasite as indicator of the metal pollution.

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