

EFFECT OF EYE FLUKES (Trematoda, Diplostomatidae) UPON ACTIVITY OF GUT DIGESTIVE ENZYMES IN BAIKAL OMUL (*Coregonus migratorius* Georgi, 1775)



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INTRODUCTION

The influence of different groups of parasites on digestion of vertebrates (including fish) is not well studied that primarily results from complicated sampling and selecting of an appropriate model for such investigations. However, some fresh water fish species show the influence of parasites on certain parameters of digestive system (activity and specter of digestive enzymes, content of protein and glycogen in alimentary canal and liver and etc.) (Izvekova et al., 2005; 2006). The influences of parasites localized in eyes can influence on activity of digestive enzymes in host's gut. It is very well known that eye flukes can decrease the ability of fish to find food and, thus, alter the feeding activity and behavior (Rusinek et al., 2007).

The goal of the present study is to determine the activity of main digestive enzymes in intestine of omul at different level of intensity of invasion by eye flukes.

SAMPLING AND AREA OF STUDY

The present study was focused on the fry fish (yearlings, 0+) *Coregonus migratorius* (Georgi, 1775) with a standard length of body (SL) as 40-50 mm (51 individuals) which were grown in Rezun'ka lake of Bolshaya Rechka fish farm before releasing into lake Baikal. The samples were collected in July, 2013. Fish were captured with a landing net (2 mm mesh size). The intensity and extensiveness of invasion of Diplostomatidae metacercaria in eyes of fry fish omul were determined on the binocular MBS 10 (Russia) via the compression method.

The extracting of digestive enzymes and determination of their activity (total activity of alkaline protease, trypsin, chymotrypsin, alpha amylase, lipase, N-aminopeptidase, maltase, alkaline phosphatase, leucine-alanine peptidase) were done following Gisbert et al. (2008). The concentration of the dissolved protein was determined by Bradford's method (Bradford, 1976).

For determination of relations between activity of digestive enzymes and intensity of invasion One Way ANOVA and parametric correlation analysis were applied.

Class: Pisces
Order: Salmoniformes
Family: Salmonidae
Genus: *Coregonus*
Species: *C. migratorius*



Class: Trematoda
Order: Strigeidida
Family: Diplostomatidae
Genus: *Diplostomum*
Species: *D. spathaceum*



RESULTS

The intensity of invasion of *D. spathaceum* in eyes of omul was 10.3 ± 0.8 at min and max of invasion – 0 and 25 individuals per fry consequently. The extensiveness was 93.7%.

The specific activity of studied enzymes is presented in Table 1. The activity of alpha-amylase is lower than activity of alkaline proteases. Then, the relation of A/P (amylase/proteases) for omul fry is < 1 and correspond to carnivorous fish.

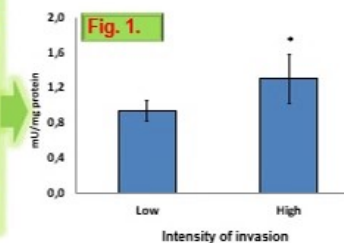


RESULTS

Enzyme	Mean	SE	(Unit)
Pancreatic	Amylase	1.08	0.14 mU
	Non specific lipase	5.1	0.46 mU
	Trypsin	27.04	2.92 mU
	Chymotrypsin	89.9	9.6 mU
	Total alkaline proteases	2.06	0.22 mU
Brush-border	Alkaline phosphatase	0.7	0.05 U
	Amino-peptidase	0.54	0.04 mU
	Maltase	7.5	0.5 mU

Indeed, the fry feed on the different type of small invertebrates as zooplankton, larvae of chironomids, oligacheta and etc. Also, the main alkaline protease is chymotrypsin because the level of activity is in three times higher than trypsin.

The differences in activity of studied enzymes between fry with low (less than 10 metacercaria per one fish) and high (more than 10 metacercaria per one fish) intensity of invasion were insignificant (One Way ANOVA at $p < 0.05$) for all enzymes except amylase. The activity of amylase was significantly (Levene test, $p=0.023$) higher for fry with high intensity of invasion (Fig. 1).



Enzymes	R Spearman
Alpha-amylase	0.03
Lipase	0.15
Trypsin	0.14
Chymotrypsin	0.15
Alkaline proteases	0.12
Alkaline phosphatase	-0.36
Maltase	-0.26
Amino-peptidase	-0.23

Correlation analysis revealed the significant negative correlation ($p < 0.05$) between maltase, alkaline phosphatase (brush border enzymes) and intensity of invasion whereas for all other enzymes the correlation was insignificant (Table 2).

DISCUSSION

Our data well correlate with the results obtained from studies of fry fish of the Baltic salmon when they suffer an acute form of parasite disease (diplostomosis). Those studies also demonstrate the change in the activity of digestive hydrolases (phosphatase activity) (Konradi-Kondrashov, Vismanis, 1979). Such a correlation between the parasite invasion intensity (that is not directly related to digestive tract disease of fish) and activity of digestive enzymes was earlier reported as well (Kurovskaya, 1984; Solov'ev et al., 2010).

The results obtained shed the light both on the influence of eye parasites on digestive processes of Baikal omul fry fish and features of functioning of host-parasite systems as a whole.