SOME ASPECTS OF BRANCHIAL PARASITISM IN *RUTILUS RUTILUS* (LINNAEUS, 1758) FROM MOARA DOMNEASCĂ LAKE

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The paper discusses some ecological aspects of the host-parasite relationship from a Romanian lentic ecosystem. The spatial distribution of the monogenean parasite genus *Paradiplozoon* on the roach (*Rutilus rutilus*) microhabitat level, the infestation parameters and also the link between the host size and the parasite intensity are analyzed.

Key words: infestation, microhabitat distribution, *Paradiplozoon* sp., *Rutilus rutilus*, Moara Domnească Lake.

INTRODUCTION

An environment intensively studied from many perspectives, through the efforts of an interdisciplinary team of biologists, ecologists, geneticists, chemists, pedologists, etc. is Moara Domnească agroecosystem. Located in the North-East of Bucharest, the Moara Domnească Lake is used for irrigation of the neighbouring agricultural areas and also for pisciculture (Stavrescu-Bedivan *et al.*, 2011). It is a lake with high trophic resources, considering the nutrient concentration in water (Bălan *et al*., 2010).

According to biodiversity research undertaken in the area of interest by a biologists team (Iorgu *et al*., 2009) from “Grigore Antipa” National Museum of Natural History (Bucharest), there is some information about the fish community structure in the Moara Domnească Lake. Thus, it is currently known that this lake contains dominant fish species like: rudd (*Scardinius erythrophthalmus*), roach (*Rutilus rutilus*), goldfish (*Carassius auratus gibelio*), chub (*Leuciscus cephalus*), pumpkinseed (*Lepomis gibbosus*), topmouth gudgeon (*Pseudorasbora parva*), etc. Also, the presence of some Asian species introduced in the Romanian fauna cannot be neglected: silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Aristichthys nobilis*) or grass carp (*Ctenopharyngodon idella*).

The aim of this work was to analyse the factors that could influence the spatial distribution of the monogenean *Paradiplozoon* sp. adult specimens found on the gills of *Rutilus rutilus* freshwater cyprinid host and the relationship established between the roach biometry and the parasite infection in Moara Domnească Lake.

MATERIAL AND METHODS

In July 2008, 63 *Rutilus rutilus* L., 1758 (Teleostei, Cyprinidae) specimens were sampled by electrofishing from the Moara Domnească Lake, with a Samus 720 MP device (Iorgu *et al.*, 2009).

Right away after sampling, the fish individuals were immersed into 5% formaldehyde and transported to the laboratory for parasitological analysis. Using a Krüss Optronic binocular microscope, branchial cavities, head, skin and fins of each fish individual were checked for parasites. The infestation parameters (prevalence, mean intensity, mean abundance) were calculated according to Bush *et al.* (1997).

Data regarding the parasite *Paradiplozoon* sp. (Monogenea, Diplozoidae) distribution on the fish host were recorded in special parasitic topography card. Each branchial arch has two hemibranches (external and internal); the branchial arches were numbered from 1 to 4, in an anteroposterior way and divided into three areas (dorsal, median and ventral). The conclusions about monogenean preference for a particular attachment site mentioned above were drawn using the statistic Student's t-test and a soft published online by Kirkman (1996).

The Bravais-Pearson correlation coefficient was used in order to estimate the relationship between the host body size and the corresponding parasite number; for each fish individual, the total length and the standard length were measured with a caliper to the nearest 0.1 mm.

The adult specimens of *Paradiplozoon* sp. were measured under a Novex Holland trinocular microscope (Stavrescu-Bedivan & Aioanei, 2009) and photographed with a Panasonic Lumix DMC-LS60 (6 Mpx, 3x optical zoom) digital camera.

RESULTS

A total of 25 *Paradiplozoon* sp. adult parasites have been collected from the gill filaments of *Rutilus rutilus* host specimens. The infestation parameters were calculated: prevalence (20.63%), mean intensity 1.92 (min. 1 – max. 7) and mean abundance (0.4).

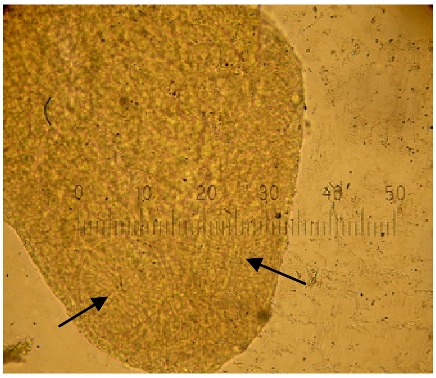
The general aspect of the body and also the attachment clamps (opisthaptor) are shown in Figs 1-3. Most of the individuals were fixed on the first branchial arch, median zone, external hemibranch (Table 1).

From the total *Paradiplozoon* sp. specimens, 14 were found in the left branchial cavity and 11 in the right branchial cavity. The unpaired Student's t test (used for comparing the mean number of parasites from both cavities) revealed there is an equal global parasite charge in the host branchial chambers ($p = 0.69$, at significance level $\alpha=0.05$) (Table 2).

In order to indicate a possible symmetry of *Paradiplozoon* sp. infection, a statistic Student's t test for paired data was used: the parasite number from the two types of hemibranches (external, internal) from both branchial cavities on each fish were compared. The null hypothesis (the means for the two data sets are not significantly different) was accepted, as comparison between variables series for each type of hemibranch showed a non-significant "p" (0.208 and 0.443) (α=0.05) in both cases (Table 3).

1

2



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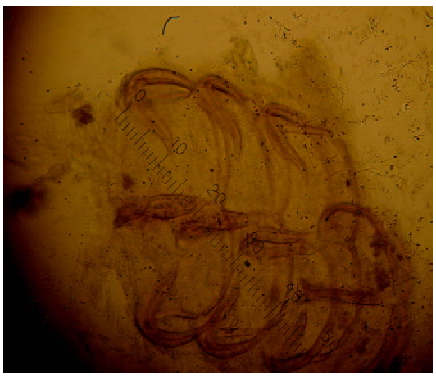

Figs 1–3. *Paradiplozoon* sp.: 1. general aspect of the body (4x, one division = 36 μ); 2. the buccal suckers (arrows) (40x, one division = 3.6 μ); 3. the opisthaptor clamps (40x, one division = 3.6 μ).

Table 1

Spatial distribution for real effectives of *Paradiplozoon* sp. on *Rutilus rutilus* microhabitat level (I. H. – internal hemibranch; E. H. – external hemibranch; Z1, Z2, Z3 – dorsal, median and ventral zones of branchial arch; A1-A4 – branchial arches)

	A1			A2			A3			A4			Total
	Z1	Z2	**Z3**	Z1	Z2	Z3	Z1	Z2	Z3	Z1	Z2	Z3	
I. H.	2	6	1	2	1	0	1	0	0	1	0	0	12
E. H.	1	2	2	0	1	1	0	0	3	0	1	0	13
Total	3	8	3	2	2	1	1	0	3	1	1	0	25

Table 2

Comparison between the mean number of *Paradiplozoon* sp. parasites from both branchial cavities of the host *Rutilus rutilus*

Habitat	Mean	Confidence interval (C. I.) for the mean = 95%	Standard deviation (S. D.)	t value	Degrees of freedom (d. f.)	p (probability)
Left branchial cavity	0.222	(5.7713E-02 – 0.3867)	0.659	-0.405	124	0.69
Right branchial cavity	0.175	(1.0094E-02 – 0.3391)	0.661			

Table 3

Difference between the mean number of *Paradiplozoon* sp. from both hemibranches (I. H. – internal hemibranch; E. H. – external hemibranch) of the host *Rutilus rutilus*

Habitat	Mean	Confidence interval (C. I.) for the mean = 95%	Standard deviation (S. D.)	t value	Degrees of freedom (d .f.)	p (probability)
I. H.	-6.349E-02	(-0.1633– 3.6360E-02)	0.396	-1.27	62	0.208
E. H.	4.762E-02	(-7.5666E-02 – 0.1709)	0.490	0.772	62	0.443

The 63 roach specimens captured in July 2008 from Moara Domnească Lake recorded an average total body length of 94.48 mm (min. 52 – max. 155) and an average standard body length of 76.25 mm (min. 43 – max. 121). Infestation intensity with *Paradiplozoon* sp. positively correlated both with total body length (r = 0.183) and standard body length (r = 0.184) of the hosts. The null hypothesis (there is no significant relationship between the two variables) was accepted as the correlation coefficient was lower than the tabular value (α = 0.05; N-2 f. d).

DISCUSSION

The fixing preferences for *Paradiplozoon* sp. specimens were followed on the microhabitat level of the fish host (*Rutilus rutilus*). No preference between the right and the left branchial arches was noticed. In the literature, many parasitologists agreed upon this statement in cyprinid species (Dzika, 1999; Chapman *et al.*, 2000; Özer & Öztürk, 2005; Turgut *et al.*, 2006; Rubio-Godoy & Tinsley, 2008; Stavrescu-

Bedivan & Aioanei, 2008; Nack *et al.*, 2010; Soylu *et al.*, 2010). It seems that this symmetry was due to the equal chances for infection of both branchial cavities with the parasite eggs in aquatic environment (Aioanei, 1999).

The most *Paradiplozoon* sp. adult specimens were attached on median zone of the branchial arches. Probably the diporpa and juvenile stages, along their maturation, leave the dorsal and ventral zones, migrating in the median area of the hemibranches. According to Wooten (1974), it is perfectly justified the monogenean attachment on median zones, as the most powerful current of water passes over the middle of branchial arches, thereby engaging convenient conditions for parasites establishment.

The data provided by this research are similar with those recorded in various studies regarding the monogenean preference for the first branchial arch (Fuentes & Nasir, 1990; Dzika, 1999; Hendrix, 2004; Tombi *et. al*, 2010). Choosing that particular site can be seen as a consequence of the favoured position of the first branchial arch, in the direction of the water flow that bears a great amount of parasite eggs looking for an attachment site.

It was also recorded that the most *Paradiplozoon* sp. specimens were fixed on the external hemibranches of the *Rutilus rutilus* fish from Moara Domnească Lake; in previous surveys, we noticed that the parasite charge for the internal hemibranch was higher than the external hemibranch charge (Stavrescu-Bedivan & Aionei, 2008; Aioanei & Stavrescu-Bedivan, 2009). Comparing our data to other parasitological investigations, we can assume that the "type of hemibranch" does not influence, in a significant manner, the parasite fixing preferences. Researchers like Geets *et al.* (1997) or Aioanei (1999) considered that both hemibranches conventionally delimit the branchial microhabitat.

In order to identify a possible relationship between the fish size and the parasites number, there is no unanimity of opinion in the main stream publications; the present paper recorded a positive, but not significant correlation in the case of roach specimens infested with monogenean *Paradiplozoon* sp.

CONCLUSIONS

As expected, no significant difference between the left and right branchial cavities of cyprinid host was noticed for parasite fixing preference; there is no significant relationship between the fish biometry and the parasite infection; the most *Paradiplozoon* sp. individuals preferred the first branchial arch and the median zone of the *Rutilus rutilus* hemibranches. A range from 1 to 7 monogenean specimens per infested roach was recorded in Moara Domnească Lake in July 2008.

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