THE RESPONSE OF THE SPECIES OF *EPHEMEROPTERA* AND *PLECOPTERA* OF THE SASAR RIVER BASIN TO THE ANTHROPOGENIC ALTERATIONS

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ABSTRACT. The species of Ephemeroptera as well as Plecoptera can be used as a bioindicator group in the evolution of the flowing water quality, du to their increased sensitivity to the anthropic pressure. In most cases, the zoobenthic communities respond to the action of disturbances by re-adjusting their specific composition and numerical abundance, respectively by changing the spatial distribution of the most taxons (Relyea and colab, 2000; Tudorancea & Tudorancea, 2002; Tudorancea, 2004). The diversity of the fauna of ephemeroptera and plecoptera undergoes important changes for the stations located especially downriver from the industrial centers within the Baia Mare industrial surroundings, thus the most affected stations, in the decreasing order of the intensity of the impact, are Valea Firiza, downriver of Baia Mare, upriver of Baia Mare, and downriver of Baia Sprie.

Keywords: Ephemeroptera, Plecoptera, Saprobe Index, EPT Index, anthropic pressure

INTRODUCTION

Ephemeroptera can be used as a bioindicator group in the evolution of the flowing water quality, as it presents a series of ecologic and behavioral specializations, which allow them to colonize a large spectrum of aquatic biotypes.

According to Hilsenhoff (1987), the pollution tolerance of Ephemeroptera is variable relative to the family. Thus, the most tolerable are the Caenidae and Siphlonuridae families, followed – in descending order according to their tolerance – by the Baetidae, Ephemeridae, Heptageniidae, Pothamanthiidae families, a low tolerance being recorded for the Leptophlebiidae, Oligoneuriidae, Polymitarcidae families, the highest sensitivity being presented by the Ephemeridae family.

Plecoptera were used in the formulas of some quantitative and qualitative indices, due to their quality of bioindicators of the rivers water quality.

Regarding the tolerance to pollution of Plecoptera, on a scale of 1 to 10, the Nemouridae, Perlodidae, Taenopterygidae families have a slowly higher tolerance, the Capniidae, Chloroperlidae and Perlidae families have a tolerance equal to 1, the Leuctridae family has a very reduced tolerance to pollution, that it is 0 (Hilsenhoff, 1987; Jhonson and colab. 1997).

In most cases, the zoobenthic communities respond to the action of disturbances, by re-adjusting their specific composition and numerical abundance, respectively by changing the spatial distribution of the most taxons (Relyea and colab, 2000; Tudorancea & Tudorancea, 2002; Tudorancea, 2004).

Description of the sampling stations

For the Sasar River, the stations were located upriver and downriver of the urbane centers of Baia Sprie and Baia Mare, which determine a massive anthropical pollution (the station upriver of Baia Sprie (2), the station downriver of Baia Sprie (4), the station upriver of Baia Mare (9) and the station downriver of Baia Mare (10)).

The most important tributaries of the Sasar River: Valea Limpedea (3), Valea Morii (5), Valea Gordanului (6), Valea Firiza (7) were assessed from a biologic viewpoint. The target was to establish the ecologic condition, taking into account the location within the areas affected by pollution or exposed to incidental pollution. Two witness, unpolluted stations were identified, thus the stations: Valea Mariutii (1) and upriver of Blidari (8).

Ten stations were totally explored, and their location is shown in Fig.1.

MATERIALS AND METHODS

This work sums up the results of the sampling campaigns, which had extended for a period of 4 years (2003-2006).

The collected samples were preserved on the terrain in formaldehyde 4%. In the laboratory, the sorting of the organisms was made under stereomicroscope.

The Saprobe Index (S) was computed and the Normalized Global Biologic Index (NGBI) was determined, in order to set the impurity degree of the Sasar River and the studied tributaries. Additionally, the EPT Index was computed.

The Saprobe Index (S) was computed for the

macrozoobenthos according to the Pantle-Buck method (Malacea, 1969).

The NGBI integrates, in its appraisal, the taxonomic abundance and the indicator faunistic group, which attribute to some taxons a sensitivity level to perturbations (Beisel and colab., 1998).

The EPT index is based on the abundance of the most sensitive groups of benthic macroinvertebrates: ephemeroptera, plecoptera, and trichoptera. It is computed relative to the abundance of the other macroinvertebrates (Winquist and colab., 2005).

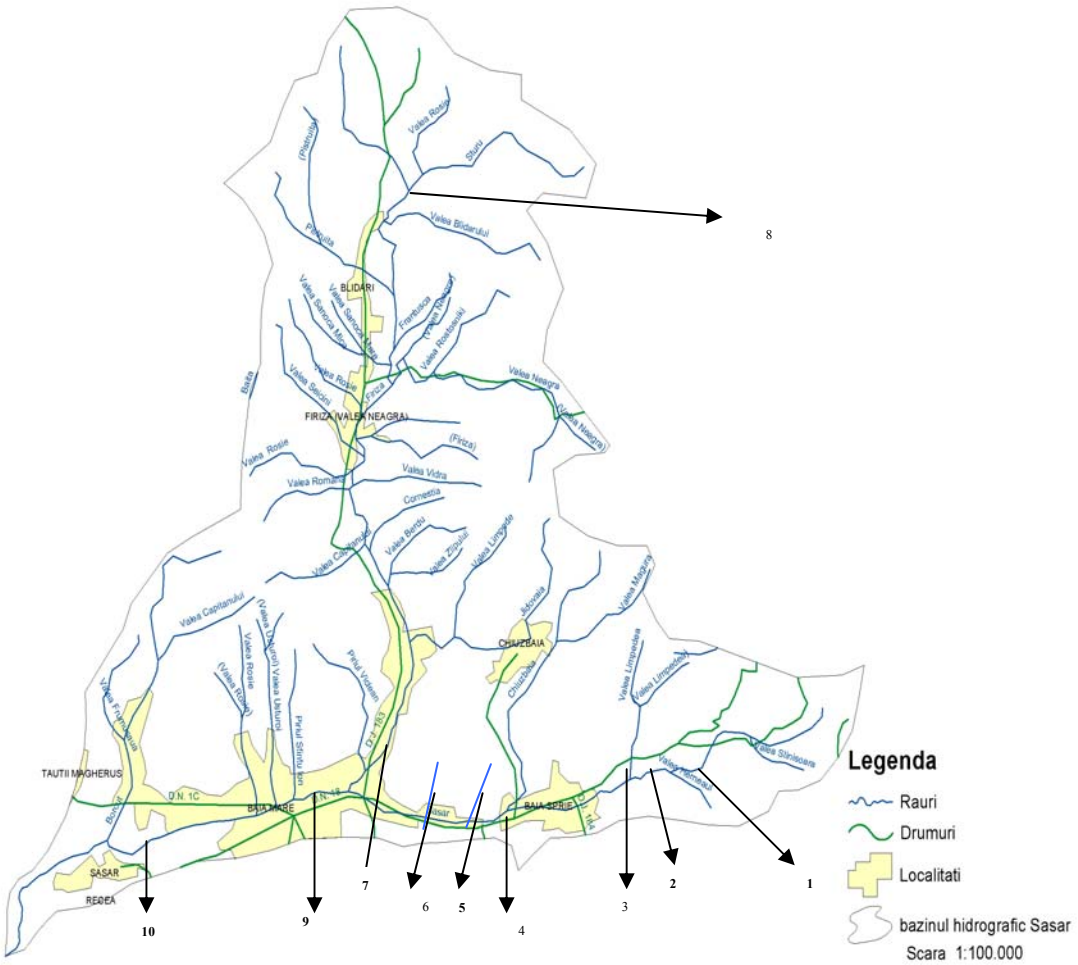

Chart 1. The location of the sampling stations within the hydrographic basin of the Sasar River

RESULTS AND DISCUSSIONS

In order to determine the fauna of ephemeroptera and plecoptera, seven sampling campaigns had been made in the research stations during the period 2003-2006, and the following list presented in the Table 1 resulted from their analyses:

A number of 20 species of ephemeroptera and 9 species of plecoptera were found and identified for the Sasar River, following the systematic study, carried out during the period 2003-2006.

The group of ephemeroptera is largely spread on the Sasar basin, having an average tolerance to pollution. This is the distribution of ephemeroptera for every station:

10 species for Valea Mariutii, 9 species for upriver of Baia Sprie, 8 species for Valea Limpedea, 3 species for downriver of Baia Sprie.

The group of plecoptera has a limited dispersion for the Sasar River basin, instead, being extremely sensitive to the anthropogenic influence.

Thus the distribution of plecoptera for every station is as follows: 5 species for Valea Mariutii, 3 species for upriver of Baia Sprie, 4 species for Valea Limpedea, 1 species for Valea Morii, 6 species for the station which is upriver of Blidari.

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Table 1

THE NUMERICAL ABUNDANCE OF EPHEMEROPTERA AND PLECOPTERA IDENTIFIED DURING THE PERIOD 2003-2006

Taxon	STAŢII									
	V. Măr.	Am.BS	V. Limp	Av. BS	V.Mor	V.Gordan.	.Firiz.	Am. BM	Av. BM	Am. Blid
EPHEMEROPTERA Order										
Leptophlebiidae										
Paraleptophlebia sp	-	-	4	-	-	-	-	-	-	3
Habroleptoides sp.	-	-	-	-	-	-	-	-	-	1
Leptophlebia sp.	-	-	-	-	-	-	-	-	-	1
Ephemeridae										
Ephemera danica Muller	9	4	2	-	3	-	-	-	-	-
Ephemerelllidae										
Ephemerella ignita Poda	-	8	12	-	-	-	-	-	-	2
Ephemerella sp.	-	-	-	5	-	-	-	-	-	-
Caenidae										
Caenis sp	-	-	-	-	-	4	-	-	-	-
Heptageniidae										
Ecdyonurus dispar Curtis	2	-	-	-	6	4	-	-	-	-
Ecdyonurus insignis Eaton	-	-	-	-	1	-	-	-	-	1
Ecdyonurus venosus Fabricius	2	-	6	-	1	-	-	-	-	-
Ecdyonurus sp	2	4	2	-	-	2	-	-	-	-
Epeorus sylvicola Pictet	3	-	4	-	-	-	-	-	-	2
Rhithrogena semicolorata Curtis	2	6	-	-	1	2	-	-	-	-
Rhithrogena sp.	1	1	-	-	-	-	-	-	-	2
Heptagenia suphurea Muller	9	4	-	-	-	10	-	-	-	-
Heptagenia sp.	-	-	-	-	-	-	-	-	-	1
Electrogenalateralis Zurwerra&Tomka	-	-	-	-	-	-	-	-	-	1
Bäetidae										
Bäetis alpinus Pictet	6	2	2	-	-	-	-	-	-	4
Bäetis rhodani Pictet	17	55	14	36	4	9	2	26	4	-
Bäetis vernus Curtis	-	4	-	4	-	-	-	-	-	-
PLECOPTERA Order										
Taeniopterygidae										
Brachyptera seticornis Klapalek	2	4	-	-	-	-	-	-	-	-
Brachyptera sp.	2	-		-	-	-	-	-	-	-
Leuctridae										
Leuctra sp	-	-	1	-	-	-	-	-	-	2
Nemouridae										
Nemoura cinerea Reitzus	3	-	-	-	-	-	-	-	-	-
Protonemura intricata Ris	8	3	6	-	-	-	-	-	-	1
Familia Perlidae										
Perla marginata Panzer	23	1	11	-	15	-	-	-	-	6
Perla sp.	-	-	-	-	-	-	-	-	-	2
Perlodidae										
Perlodes intricatus Pictet	-	-	-	-	-	-	-	-	-	4
Chloroperlidae										
Chloroperla tripunctata Scopoli	-	-	1	-	-	-	-	-	-	1

A step by step disappearance of the sensitive and highly sensitive forms to the pollution phenomenon, prevailing over the tolerant taxons, is observed within the stations which are subject to an intense anthropic pressure (the station upriver of Baia Sprie, the station downriver of Baia Sprie, the station upriver of Baia Mare, the station downriver of Baia Mare).

A step by step decrease of the ephemeroptera and plecoptera communities, relative to the antropogene impact intensity, is observed for the stations: Valea Limpedea, Valea Morii, Valea Gordanului and Valea Firiza. Thus, whereupon the species of average tolerance to pollution dominate at the Valea Limpedea, Valea Morii and Valea Gordanului stations, achieving high numeric abundance, as only 2 individuals of Baetis rhodani (Ephemeroptera) were identified at the Valea Firiza station.

In the case of the witness stations: Valea Mariutii and upriver of Blidari, the ephemeroptera and plecoptera communities are in good shape, the anthropogenic influence being minimal.

Due to the urbanization, industrialization, and less due to the farming, for the Sasar River basin, a more or less brutal simplification of the ephemeroptera and

plecoptera communities is observed, relative to the intensity of the disturbances. Of course, cannot be ignored, either, the consequences generated by the natural background of the area, which deal with high polymetallic accumulations. Arscott and his collaborators (2002), Haybach (2003) and Hughes (2006) show that the water pollution represents a highly important role in the distribution of the benthic communities. Thus, the decreasing of the dissolved oxygen and the toxic impact of anorganic nature in the industry, determines the decline of all the taxons belonging especially to the ephemeroptera and plecoptera communities.

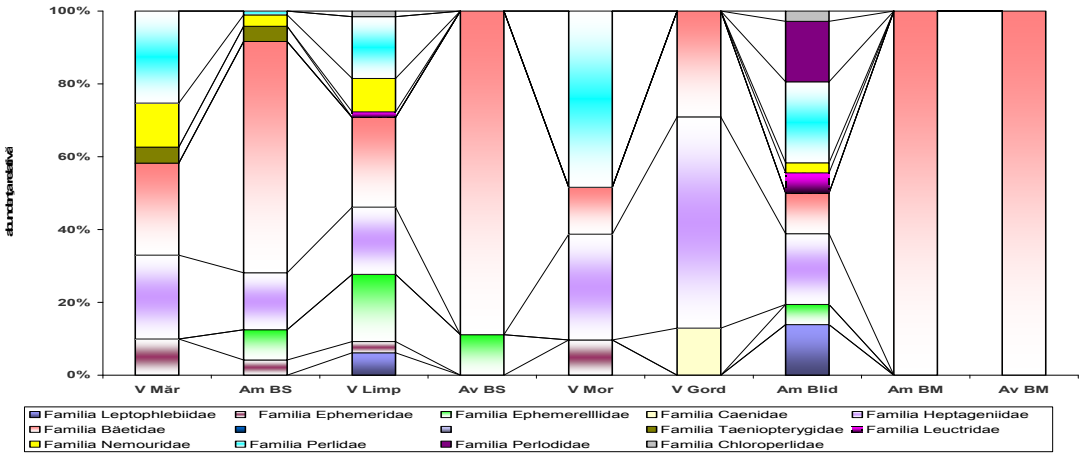

Chart 2. The taxonomic spectrum of Ephemeroptera and Plecoptera within the Sasar River basin

The diversity of the ephemeroptera and plecoptera communities undergoes important changes for the stations located especially downriver from the industrial centers within the Baia Mare industrial surroundings, thus the most affected stations, in the decreasing order of the intensity of the impact, are Valea Firiza, (NGBI=2), downriver of Baia Mare (NGBI=3), upriver of Baia Mare (NGBI=3), and downriver of Baia Sprie (NGBI=4).

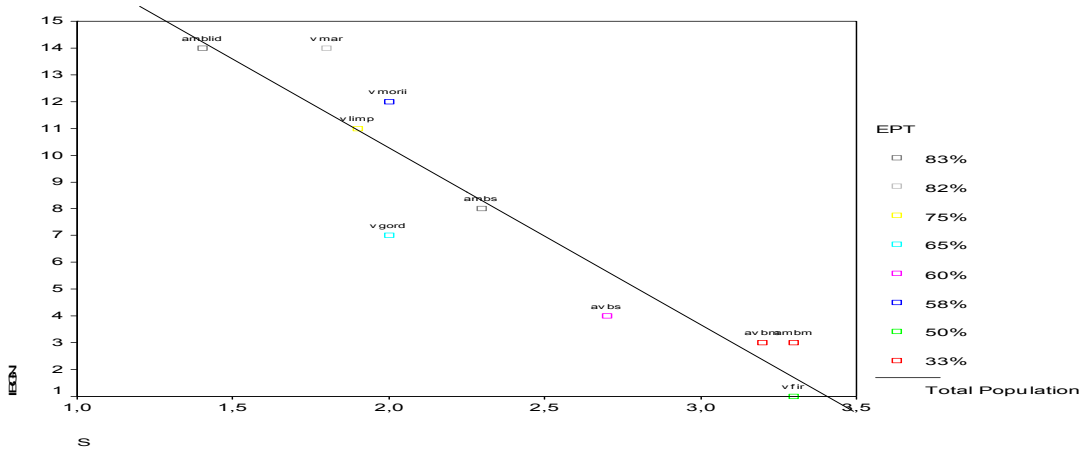

Chart 3. The distribution per stations of the saprobe index values S, NGBI and EPT index in the Sasar River basin

Observing the data from Fig.3, we could assume that, for the Sasar River basin, from the point of view of the structuring mode of the most sensitive groups of insects (Ephemeroptera, Plecoptera, and Trichoptera), the most stable stations are: the station upriver of Blidari (EPT=83%), the station upriver of Baia Sprie (EPT=83%), the Valea Mariutii station (EPT=82%), and the Valea Limpedea station (EPT=75%).

Important biological unbalances were recorded in the stations: downriver of Baia Sprie (EPT=60%), Valea Firiza (EPT=50%), downriver of Baia Mare (EPT=33%), and upriver of Baia Mare (EPT=33%).

The pollution of the Sasar River and of the Friza River is mostly determined by the mining activities belonging to the Baia Mare Mining Section, mainly because the mine waters purging stations are not exploited within the designed parameters and in a lesser extent by the city's drain waters.

CONCLUSIONS

Following the systematic study performed during the period 2003-2006, a figure of 20 species of Ephemeroptera and 9 species of Plecoptera were found and identified, for the Sasar River basin.

The quality categories of the waters of the Sasar River and of its main tributaries, are:

-excellent ecologic quality, with a high degree of stability and a low or absent impurity level for the

stations upriver of Blidari (S=1.4; NGBI=14), Valea Mariutii (S=1.8; NGBI=14);

-good ecologic quality, with existing (but minimal) anthropic stress for the stations: Valea Limpedea (S=1.9; NGBI=12), Valea Morii (S=2; NGBI=12), Valea Gordanului (S=2; NGBI=9);

-mediocre ecologic quality, with evident anthropic impact on the benthic communities for the station: upriver of Baia Sprie (S=2.3; NGBI=8);

-poor ecologic quality, with a high impurity level, for the station: downriver of Baia Sprie (S=2.7; NGBI=4);

-unsatisfactory ecologic quality, with an extremely high impurity level, for the stations: Valea Firiza (S=3.3; NGBI=1), downriver of Baia Mare (S=3.2; NGBI=3).

-good ecologic quality, with existing (but minimal) anthropic stress for the stations: Valea Limpedea (S=1.9; NGBI=12), Valea Morii (S=2; NGBI=12), Valea Gordanului (S=2; NGBI=9);

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-unsatisfactory ecologic quality, with an extremely high impurity level, for the stations: Valea Firiza (S=3.3; NGBI=1), downriver of Baia Mare (S=3.2; NGBI=3).

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