

## RESEARCH ON THE ENVIRONMENTAL QUALITY IN TELEORMAN RIVER BASED ON THE MACROZOOBENTHIC ANALYSIS

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### Abstract

The main purpose of the study was to determine the quality of Teleorman River. The present paper was based on the bibliographic material as well as the field research carried out during 2016-2017. The research objectives were the following: identification of the structure of benthic biocenoses in the monitoring points; establishing saprobity indices for each species identified and incorporation of the monitoring sections into the appropriate saprobity class; determining the quality of Teleorman River according to the Water Framework Directive 2000/60/EU, especially through analysis of Ephemeroptera fauna. The main benthic invertebrate groups in the Teleorman River were: Ephemeroptera, Plecoptera, Chironomidae, Trichoptera, and Gammaridae. In the structure of benthic zoocenosis, we have identified 14 species of Ephemeroptera, belonging to 6 families from 8 genera. Buzoiesti and Vulpești recorded a high quality ecological status, while Magura station had a good ecological status.

Keywords: environmental quality, ephemeroptera fauna, Teleorman River.

### 1. INTRODUCTION

Vedea River, a part of the Danube basin in the southern part of the country, which also includes Teleorman River is an important component of Argeș river basin (fig. 1). The hydrographic basin of Vedea River has an area of 5430 square km, north-south along 45°03'20" parallel and 43°42'13" north latitude, and on the west-east direction between the meridians 24°027'26" and 25°36'56" eastern longitude, being limited by Olt, Calmatui and Argeș basins.

The entire hydrographic system of Vedea and Calmatui basins enters an area with a very low density ranging from 0.4 km/square km at the top to 0.2-0.3 km/square km in the centre and 0.1 km/square km at the bottom. The hydrographic basin of Vedea River comprises 78 water courses totalling 2036 km, with an average density of 0.37 km/ square km. The average slope of the main river is 2 ‰, while the main tributaries are between 2 ‰ (Teleorman) and 5 ‰ (Vedita). There are 66 non-permanent courses. The sinuosity coefficient of Vedea is 1.39, while the tributaries vary between 1.14 (Vedita) and 1.88 (Cotmeana).

Asymmetry to the left is the main feature of Vedea basin, both in terms of tributaries and terraces. The tributaries on the right are reduced in number and have elongated basins. The tributaries on the left, including Teleorman, are stronger and have characteristics similar to the main collector. Vedea River has few surface resources and does not benefit from hydro-technical works, which makes the water supply to be made exclusively from underground sources. Teleorman River, with a length of

196 km and a basin area of 1427 square km springs from the southern part of Argeş County and crosses almost all the county until its flowing into Vedea.

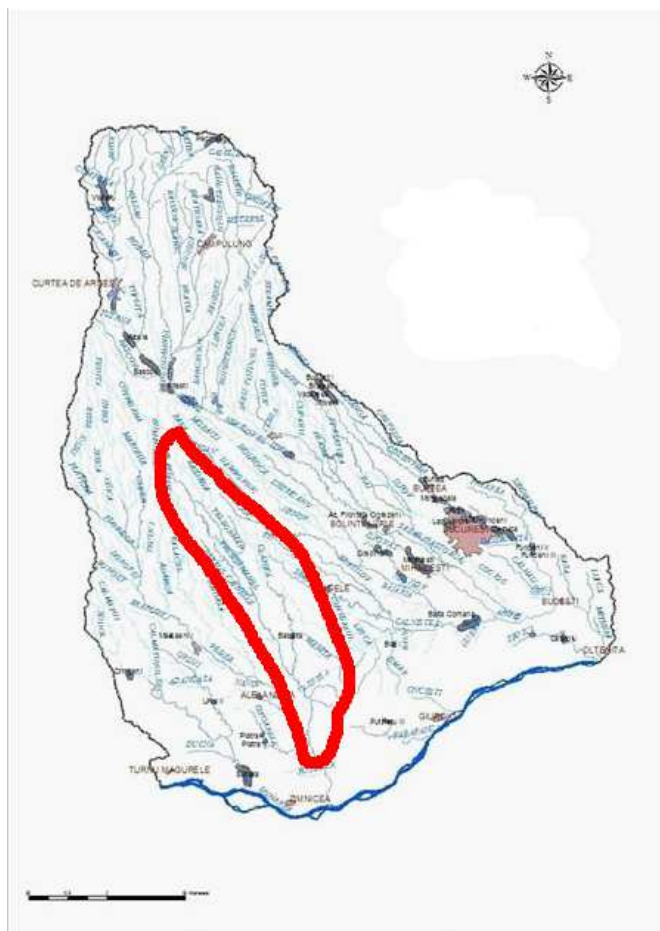


Figure 1. The river basin of Teleorman River - map of river basins (adaptation after PMBH Argeş – Vedea, 2012)

## 2. MATERIALS AND METHODS

During September 2016 and May 2017, we had three field work trips in September 2016, February and April 2017. Following the analysis of the geographical, hydromorphological and anthropogenic characteristics, we set up four sampling stations for qualitative and quantitative samples: Vulpeşti, Buzoieşti, Tătăraşti and Măgura (fig. 2). For the quantitative analysis we took three samplings per station, with a Sorber-Sampler benthic mesh having a sampling surface of 0.16 square metres and mesh size 200 µm. We sorted and processed the samples in the Hydrobiology Laboratory of the University of Piteşti. We calculated a number of ecological indices for Ephemeroptera Order, representative of the structure of Teleorman River: ecological spectrum, frequency, species constancy, relative abundance, index of ecological significance (W). We determined the ecological status in accordance with the methodology required by the Water Framework Directive 60/2000 /EC

## 3. RESULTS AND DISCUSSIONS

The results following the data processing are shown in Figures 3, 4, 5. The analysis of the samples shows that the maximum density of **Diptera varia** was recorded at Buzoieşti station – 1.891

ind./square m, and the minimum at Măgura station. **Gammaridae** were few in number at Buzoiești. **Trichoptera** had the maximum value at Vulpești station, but low values at Tătăraști. **Ephemeroptera** had the maximum value at Buzoiești (1.310 ind./square m), and a low numerical density in Măgura (486 ind /square m).

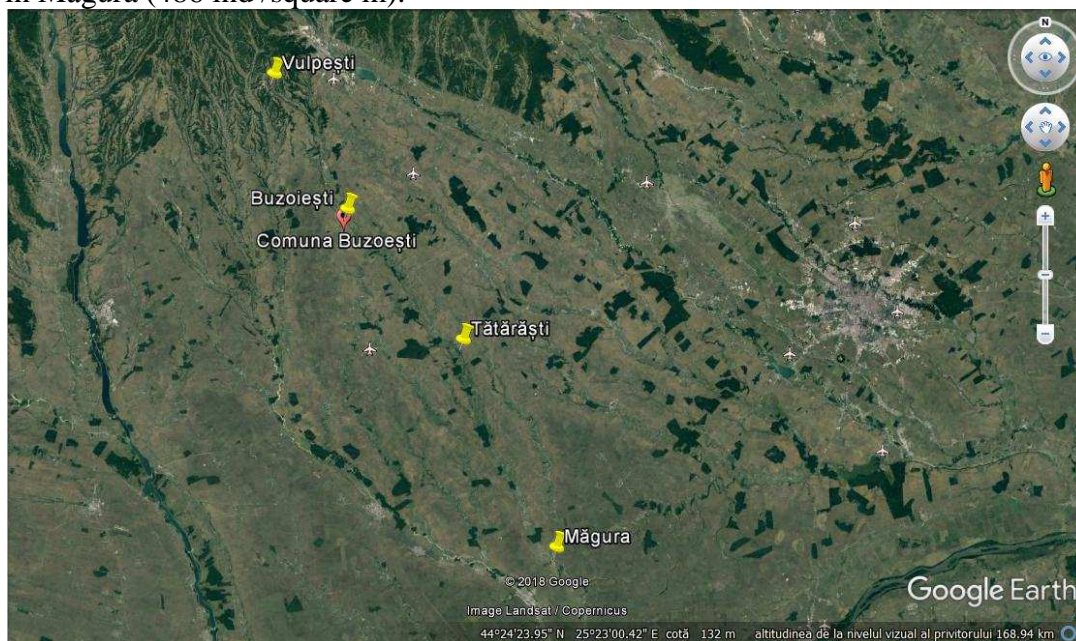


Figure 2. Location of sampling stations on Teleorman River

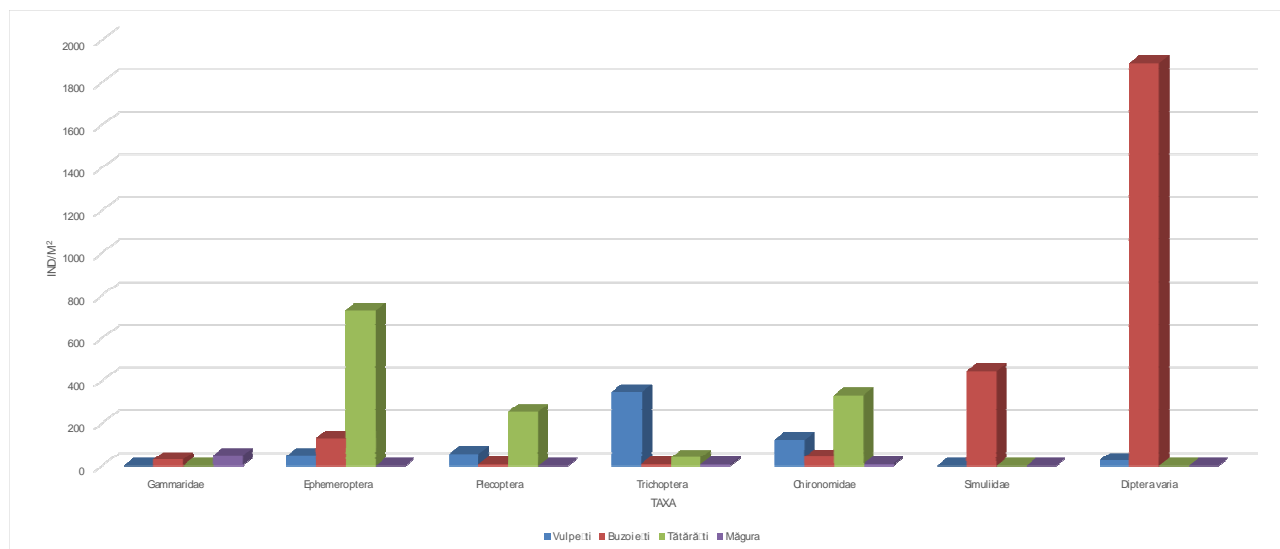


Figure 3. Benthic zoocenosis structure of Teleorman River in September 2016

**Chironomidae** maintained high values at Tătăraști and Vulpești stations; **Simuliidae** reached maximum abundance at Tătăraști station (1.462 ind./square m). The abundance of **plecoptera** decreased progressively upstream downstream, reaching the maximum value at Buzoiești and the minimum at Vulpești station on a par with Tătăraști station. The dominant groups were **simuliidae** and **trichoptera** with a similar downstream upstream distribution, both of them having the

maximum values at Tătăraști and Buzoiești stations (1.462 or 1.270 ind./square m), and the minimum values in **gammaridae** at Măgura station (24 ind./ square m).

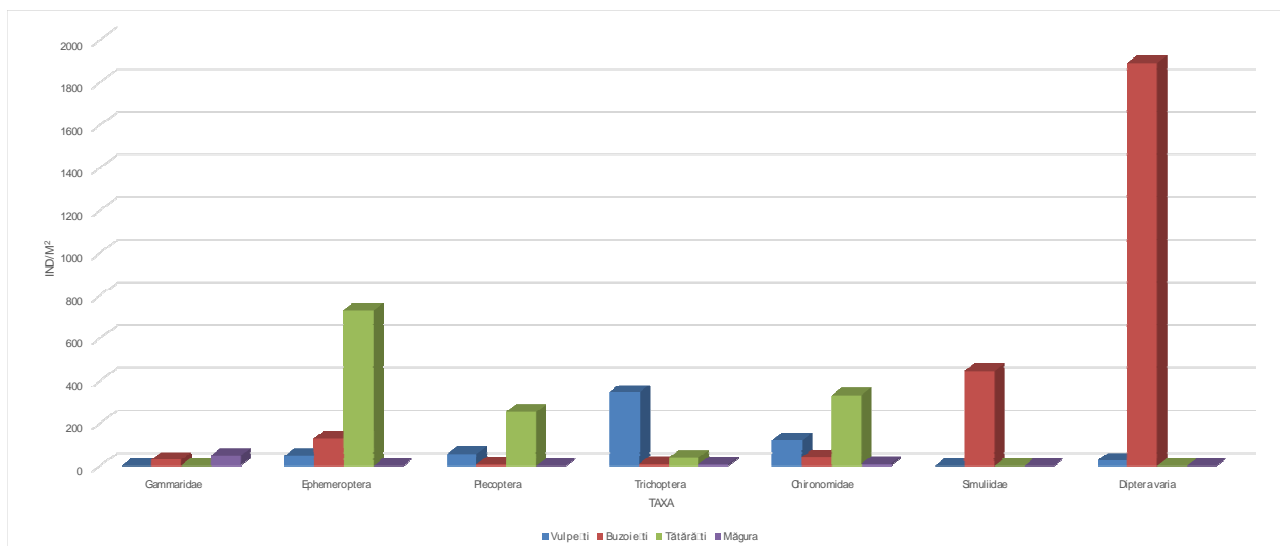


Figure 4. Benthic zoocenosis structure of Teleorman River in February 2017

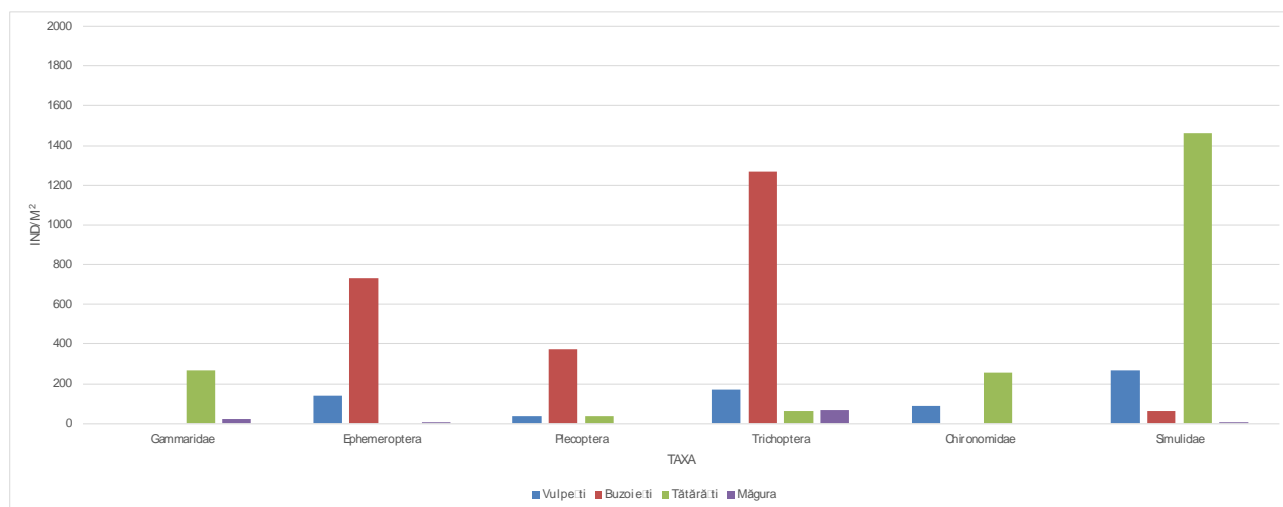


Figure 5. Benthic zoocenosis structure of Teleorman River in May 2017

### ECOLOGICAL CHARACTERIZATION OF BIOCECENOSIS ON TELEORMAN RIVER IN TERMS OF EPHEMEROPTERA FAUNA

Following the analysis of ephemeroptera fauna in the samples from the four stations along Teleorman River there were identified 14 species of 7 genres belonging to 6 families from all three suborders (Table 1).

As regards the main ecological parameters, the processed data are listed in Tables 2 - 5 where one can see the frequency of species in each sampling station, abundance, constancy and category of each species. *Baëtis alpinus* prevails over the upstream stations and is a first class quality indicator,

while *Baëtis rhodani* prevails downstream, as a quality indicator for 2nd and 3rd classes, similar to *Ecdyonurus venosus* and most species of *Epeorus sp.* genre. *Rhithrogena semicolorata* (litoreophilic species) is characteristic for all stations, which shows that the underlayer is rocky, cloddish and the flow speed is quite high.

Table 1. List of ephemeroptera species identified in Teleorman River

ORD. EPHEMEROPTERA			
SUBORDIN	FAMILIE	SPECII	
EPHEMEROIDEA	EPHEMERIDAE	<i>Ephemera danica</i>	
BAËTOIDEA	LEPTOPHLEBIIIDAE	<i>Paraleptophlebia submarginata</i>	
	EPHEMERELLIIDAE	<i>Ephemerella ignita</i>	
	CAËNIDAE	<i>Caenis macrura</i>	
	BAËTIDAE		<i>Baëtis alpinus</i>
			<i>Baëtis lutheri</i>
			<i>Baëtis muticus</i>
			<i>Baëtis rhodani</i>
	<i>Baëtis vernus</i>		
HEPTAGENOIDEA	ECDYONURIIDAE	<i>Ecdyonurus dispar</i>	
		<i>Ecdyonurus torrentis</i>	
		<i>Ecdyonurus venosus</i>	
		<i>Epeorus sp.</i>	
		<i>Rhithrogena semicolorata</i>	

Table 2. Ecological characterization of the biocenosis in Teleorman River in terms of Ephemeroptera Fauna – Vulpești Station

Taxa	September	February	May	F%	Constancy of the species	n	A	W	W <sub>x</sub>	Category of species
<i>Baëtis alpinus</i>	465	523	485	100	EUCONSTANT	1473	55.85	55.85	W5	CHARACTERISTIC
<i>Baëtis lutheri</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis muticus</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis rhodani</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis vernus</i>	-	25	22	66	CONSTANT	41	1.55	1.02	W3	ACCESORY
<i>Rhithrogena semicolorata</i>	265	232	190	100	EUCONSTANT	690	26.16	26.16	W5	CHARACTERISTIC
<i>Ecdyonurus dispar</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL

<i>Ecdyonurus torrentis</i>	55	10	33	100	EUCONSTANT	97	3.67	3.67	W3	ACCESSORY
<i>Ecdyonurus venosus</i>	19	30	-	66	CONSTANT	49	1.85	1.22	W3	ACCESSORY
<i>Epeorus sp.</i>	45	123	9	100	EUCONSTANT	175	6.63	6.63	W4	CHARACTERISTIC
<i>Paraleptophlebia submarginata</i>	32	29	30	100	EUCONSTANT	91	3.45	3.45	W3	ACCESSORY
<i>Ephemera danica</i>	-	-	21	33	ACCESSORY	21	0.79	0.26	W2	ACCESSORY
<i>Ephemerella ignita</i>	56	15	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Caenis macrura</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<b>TOTAL</b>	<b>937</b>	<b>987</b>	<b>790</b>			<b>2637</b>				

**Table 3. Ecological characterization of the biocenosis in Teleorman River in terms of Ephemeroptera Fauna – Buzoiești Station**

Taxa	September	February	May	F%	Constancy of the species	n	A	W	WX	Category of species
<i>Baëtis alpinus</i>	221	456	333	100	EUCONSTANTĂ	1087	48.44	48.44	W5	CHARACTERISTIC
<i>Baëtis lutheri</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis muticus</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis rhodani</i>	110	66	35	100	EUCONSTANTĂ	211	9.40	9.40	W4	CHARACTERISTIC
<i>Baëtis vernus</i>	10	-	-	66	CONSTANTĂ	53	2.36	1.55	W3	ACCESSORY
<i>Rhithrogena semicolorata</i>	230	232	167	100	EUCONSTANTĂ	633	28.20	28.20	W5	CHARACTERISTIC
<i>Ecdyonurus dispar</i>	12	84	-	66	CONSTANTĂ	96	4.27	2.81	W3	ACCESSORY
<i>Ecdyonurus torrentis</i>	29	20	6	100	CONSTANTĂ	67	2.98	2.98	W3	ACCESSORY
<i>Ecdyonurus venosus</i>	20	42	13	100	EUCONSTANTĂ	75	3.34	3.34	W3	ACCESSORY
<i>Epeorus sp.</i>	-	-	10	33		23	1.02	0.33	W2	ACCESSORY
<i>Paraleptophlebia submarginata</i>	34	-	-	0	EUCONSTANTĂ	0	0.00	0.00	W1	ACCIDENTAL
<i>Ephemera danica</i>	-	25	-	66	ACCESSORY	35	1.55	1.02	W3	ACCESSORY

<i>Ephemerella ignita</i>	15	19	-	33	ACCESORY	19	0.84	0.55	W2	ACCESORY
<i>Caenis macrura</i>	-	7	-	33	ACCESORY	5	0.22	0.07	W1	ACCIDENTAL
<b>TOTAL</b>	<b>681</b>	<b>951</b>	<b>564</b>			<b>2304</b>				

**Table 4. Ecological characterization of the biocenosis in Teleorman River in terms of Ephemeroptera Fauna – Tătăraști Station**

Taxa	September	February	May	F%	Constancy of the species	n	A	W	WX	Category of species
<i>Baëtis alpinus</i>	43	342	85	100	EUCONSTANT	470	23.03	23.03	W5	CHARACTERISTIC
<i>Baëtis lutheri</i>	7	-	-	33	ACCESORY	7	0.34	1.12	W3	ACCESORY
<i>Baëtis muticus</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis rhodani</i>	150	-	292	66	CONSTANT	472	23.13	15.26	W5	CHARACTERISTIC
<i>Baëtis vernus</i>	45	23	-	100	EUCONSTANT	118	5.78	5.78	W4	CHARACTERISTIC
<i>Rhithrogena semicolorata</i>	100	256	270	100	EUCONSTANT	688	33.72	33.72	W5	CHARACTERISTIC
<i>Ecdyonurus dispar</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Ecdyonurus torrentis</i>	-	12	-	33	CONSTANT	8	0.39	0.12	W2	ACCESORY
<i>Ecdyonurus venosus</i>	31	43	40	100	EUCONSTANT	114	5.58	5.58	W3	ACCESORY
<i>Epeorus sp.</i>	5	-	7	100		90	4.41	4.41	W3	ACCESORY
<i>Paraleptophlebia submarginata</i>	22	30	22	100	EUCONSTANT	74	3.62	3.62	W3	ACCESORY
<i>Ephemera danica</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Ephemerella ignita</i>	3	-	6	66	CONSTANT	6	0.29	0.19	W2	ACCESORY
<i>Caenis macrura</i>	-	-	-	0	ACCESORY	0	0.00	0.00	W1	ACCIDENTAL
<b>TOTAL</b>	<b>406</b>	<b>688</b>	<b>722</b>			<b>2047</b>				

**Table 5. Ecological characterization of the biocenosis in Teleorman River in terms of Ephemeroptera Fauna – Măgura Station**

Taxa	September	February	May	F%	Constancy of the species	n	A	W	WX	Category of species
<i>Baëtis alpinus</i>	460	540	450	100	EUCONSTANT	1473	55.85	55.85	W5	CHARACTERISTIC
<i>Baëtis lutheri</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis muticus</i>	265	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis rhodani</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Baëtis vernus</i>	-	19	22	66	CONSTANT	41	1.55	1.02	W3	ACCESORY
<i>Rhithrogena semicolorata</i>	-	232	200	100	EUCONSTANT	690	26.16	26.16	W5	CHARACTERISTIC
<i>Ecdyonurus dispar</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Ecdyonurus torrentis</i>	54	-	33	100	EUCONSTANT	97	3.67	3.67	W3	ACCESORY
<i>Ecdyonurus venosus</i>	-	30	-	66	CONSTANT	49	1.85	1.22	W3	ACCESORY
<i>Epeorus sp.</i>	45	100	9	100	EUCONSTANT	175	6.63	6.63	W4	CHARACTERISTIC
<i>Paraleptophlebia submarginata</i>	32	29	-	100	EUCONSTANT	91	3.45	3.45	W3	ACCESORY
<i>Ephemera danica</i>	-	-	21	33	ACCESORY	21	0.79	0.26	W2	ACCESORY
<i>Ephemerella ignita</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<i>Caenis macrura</i>	-	-	-	0		0	0.00	0.00	W1	ACCIDENTAL
<b>TOTAL</b>	<b>856</b>	<b>950</b>	<b>735</b>			<b>2637</b>				

As regards the ecological spectrum (Figure 6) it can be noticed that in the upstream stations of Vulpești, Buzoiești and Măgura, the best represented is *Ecdyonuriidae* family, with a share of 87% at Vulpești and Magura stations, 44% at Tătăraști station, decreasing gradually to 39% at Buzoiești station. *Baetidae* are best represented at Buzoiești and Tătăraști stations, 50-60%, but the percentage decreases to 3% at Vulpești and Măgura. *Ephemeridae*, *Leptophlebiidae*, *Ephemereliidae* and *Caenidae* have a share of less than 10% in all stations.



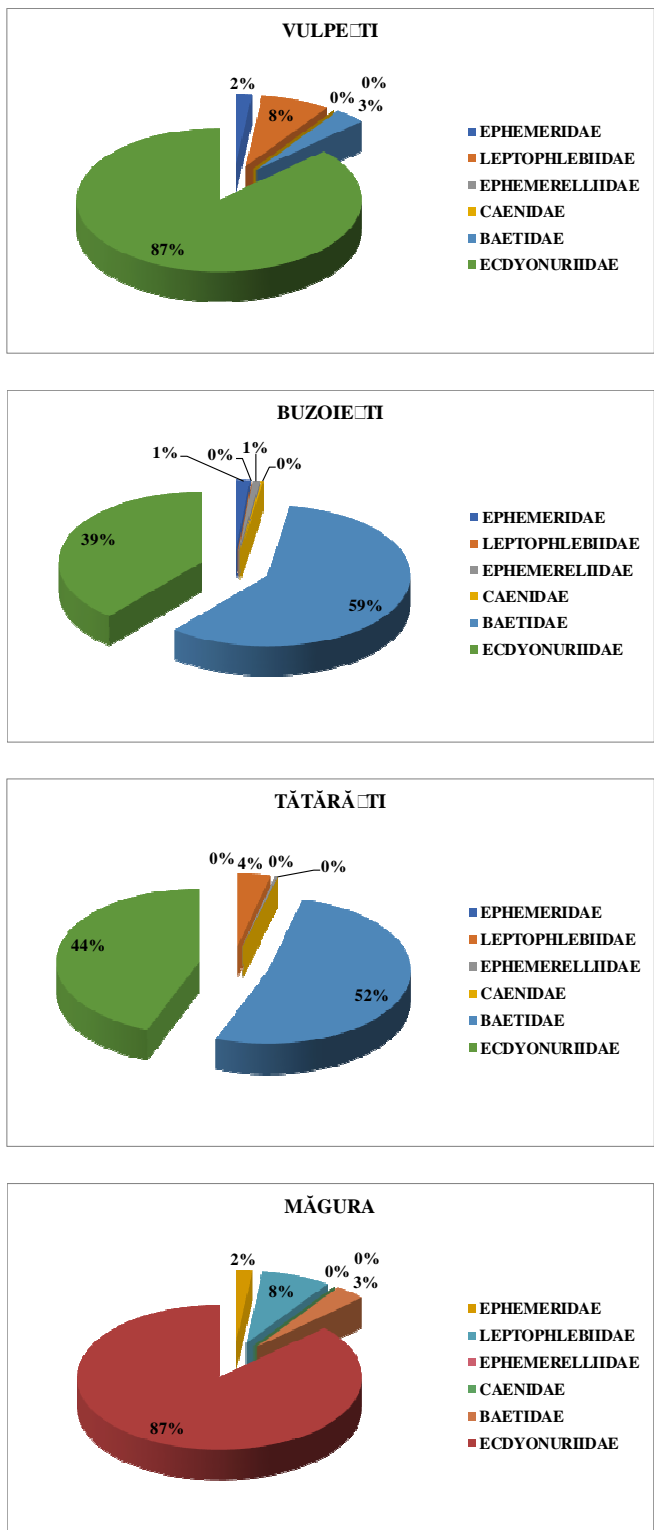


Figure 6. Ecological spectrum of Ephemeroptera Fauna in Teleorman River

4. CONCLUSIONS

After studying the data, the following conclusions can be drawn:

- The main benthic invertebrate groups in Teleorman River are Ephemeroptera, Plecoptera, Chironomidae, Trichoptera and Gammaridae.
- Ephemeroptera and Plecoptera, oxyphilic and reophilic groups are well represented at Buzoiești and Tătăraști stations (the anthropic impact is low, water is unpolluted, with high flow speed and low discharge).
- The number of gammaridae and trichoptera is approximately constant and kept at low levels.
- Depending on the season, the values are comparable at the same station, in different months, without high variations.
- The identified ephemeroptera species, as well as their distribution and ecological characteristics on stations show that they are characteristic of the rhithron area in which the studied water course is included. The 1<sup>st</sup> and 2<sup>nd</sup> quality classes are the same as those resulting from the physical and chemical analyses.

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