

LONGITUDINAL DISTRIBUTION OF THE MAYFLIES (EPHEMEROPTERA) COMMUNITIES IN BUZĂU RIVER

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Key words: mayflies, constance, dominance, Shanon-Wiener index, Simpson index, longitudinal distribution, saprobic valence

INTRODUCTION

According to Water Framework Directive 60/2000/EC, benthic macroinvertebrates become a priority in establishing of the surface water status. Among these, the mayflies (Ephemeroptera) have an important role in the evaluation of the physical, chemical and hydromorphological conditions of water flows. Mayfly taxa are widely accepted as bioindicators for water quality and ecological integrity (Bauernfeind & Moog, 2000).

In the course of their evolution, mayflies have adapted to certain hydromorphological conditions, therefore, knowing these conditions we can appreciate the population structure and vice versa, knowing the population structure we can appreciate their environmental conditions. That's why, the mayflies as all macroinvertebrates are the most used indicators for the determination of the water quality, because they respond to a great number of characteristics such as altitude, bottom, velocity and physical-chemical parameters.

The Buzău River represents one of the most important tributary of the Siret River, with a length of 302 km (Fig 1).

The surface of the Buzău river basin contains three kinds of relief: mountains, hills and field, from the peaks of Penteleu to the Bărăgan plain.

The prevailing geological structure is a siliceous one, followed by an organic and a reduced calcareous structure.

The distribution of the precipitations and the temperature follow the great forms of relief. Thus, the annual mean precipitations vary from 400 mm/year to 1200 mm/year and the annual mean temperature from -4°C in the mountain to 1°C in the plain.

MATERIAL AND METHOD

The longitudinal distribution of the mayflies' population in the Buzău River was established through seasonal samples in 2005 (April, July and September) from six monitoring sites: Vama Buzăului, Nehoiu, Măgura, Upstream Buzău, Banița, Racovița.

Quantitative samples were collected using Surber sampler (**STAS SR EN 28265/2001).

Physico-chemical conditions at each station were also monitored during each collection period.

Mayflies were identified up to genus and species levels and the individual density on square meter was calculated. Based on the mayflies population from every site, the longitudinal distribution of the species for each field sampling was established and the constance and dominance indices were calculated. The Shanon-Wiener and Simpson indices were used because they describe the ecosystem status base on the abundance level of the species (Stan Gh., 1995).

RESULTS AND DISCUSSIONS

The mayflies distribution is influenced not only by the relief, geology but also by the physico-chemical status of the water.

The physico-chemical characteristics of the Buzău river water quality – the global quality class – is given by the most unfavorable class, established for one the indicator groups. On the bases of the results obtained and after the processing of the physico-chemical monitoring data, it was made the appreciation of the surface water quality after five groups of indicators:

- oxygen regime: O_2 , CBO_5
- salinity: TDS, Ca, Mg, Na, chloride, sulphate
- nutrients regime: N-NO_3 , N-NO_2 , N-NH_4 , N total, P-PO_4 , P total
- metals: Zn, Cu

Analysing the values of the physico-chemical quality indicators, it is obvious that as we move away from the spring and we come near to that river mouth, their value is increasing because of the insufficient purified water contribution and also because of the natural degraded water of the Bălăneasa and Slănic tributaries. From total length of 302 km, 22% is of first class quality (high chemical status), 35% is of second class quality (good chemical status) and 43% is of third class quality (moderate chemical status).

A hydrological indicator which has influenced very much the structure and the distribution of mayflies from the Buzău River in 2005 is the debit. Due to special weather conditions significant increasing of the debit in 2005 in comparison with 2004 (Fig. 2, 3, 4) was noticed 10 species of Mayflies were identified from 5 genus and 3 families in April field sampling. The greatest density is registered in Vama Buzăului site of 140 individuals/ m^2 (Fig. 5).

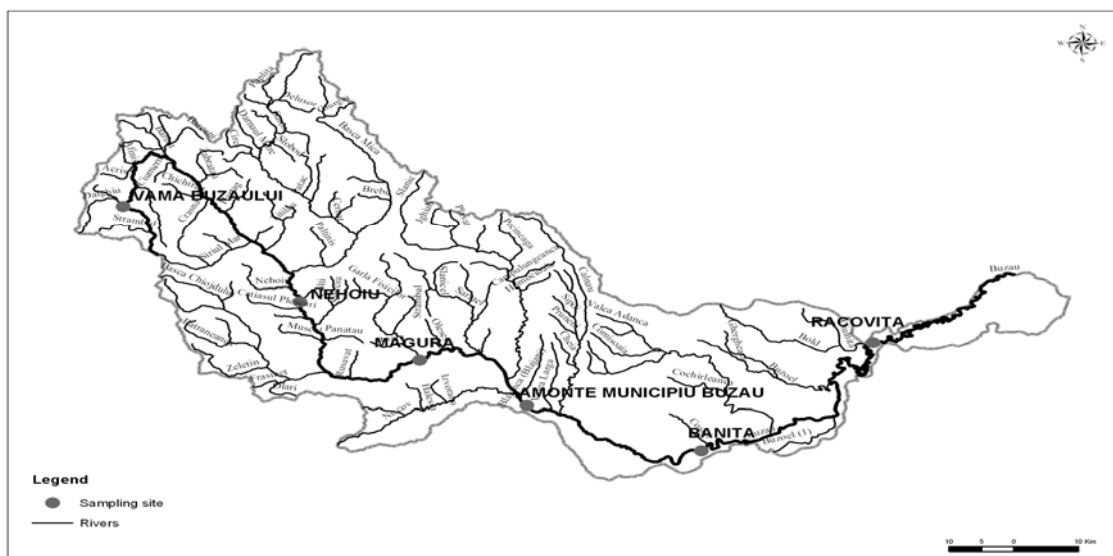


Fig.1. Buzău River sampling sites

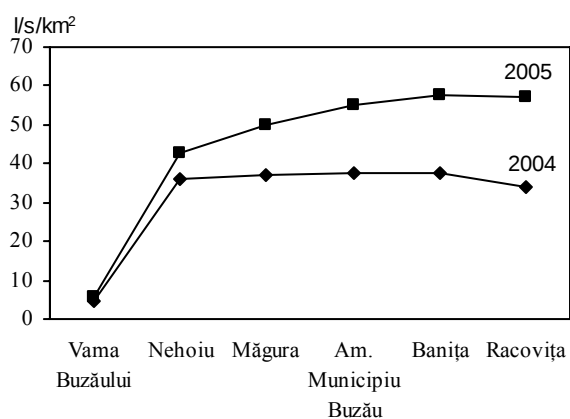


Fig. 2. Buzău River discharges in April 2004-2005

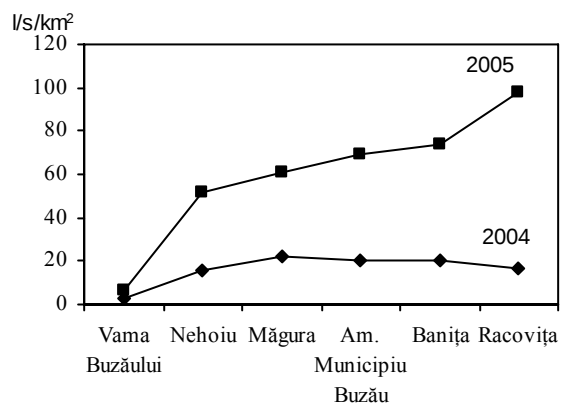


Fig. 3. Buzău River discharges in July 2004-2005

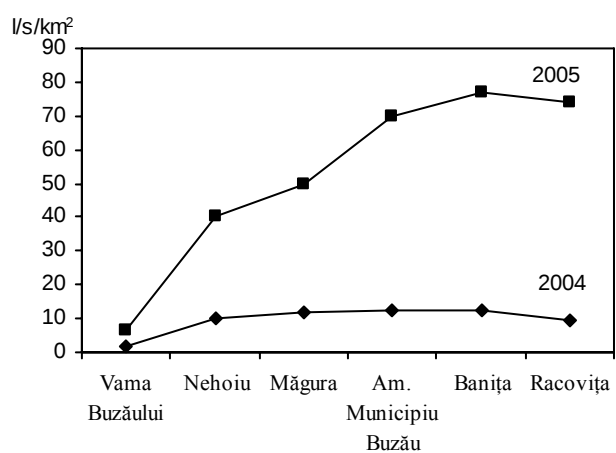


Fig. 4. Buzău River discharges in September 2004-2005

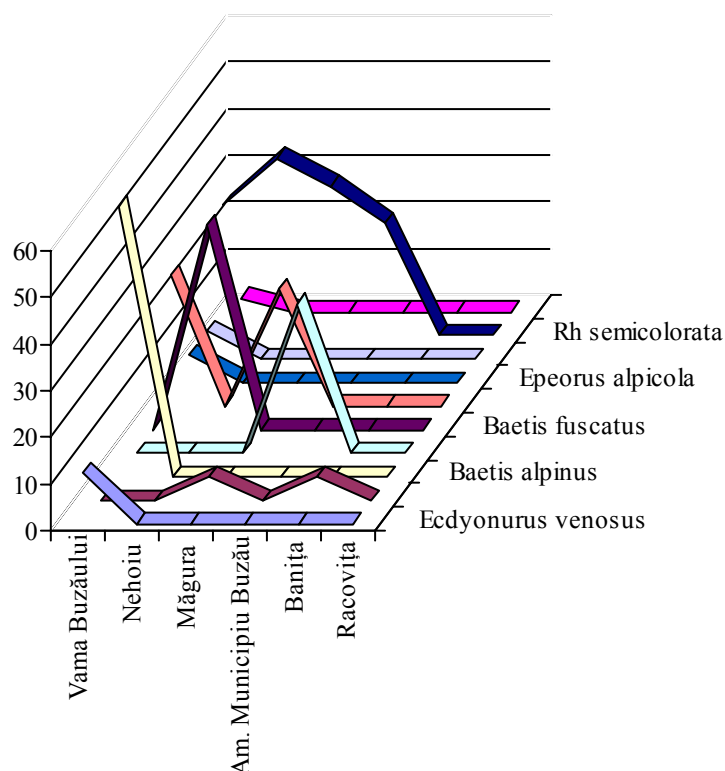


Fig. 5. Longitudinal distribution of the mayflies in April

The dominant species in this sampling site were: *Rhithrogena semicolorata*, *Baetis alpinus*, *B. rhodani*, *B. fuscatus*, and the constant species was *Rhithrogena semicolorata* (Fig. 6).

Baetis alpinus had the greatest density of 58 individuals/ m² in Vama Buzăului site (reference site). Another species of Baetides, *Baetis fuscatus* has a great density of 43 individuals/ m² in Nehoiu site. *Torleya major* has the smallest density of 3 individuals/ m² in Vama Buzăului site. The number of mayflies species from samples is decreasing till one species in Banița site and no species in sample in Racovița site (last sampling site).

16 species from 8 genus and 4 families were identified in July field sampling (Fig. 7). The greatest density of 202 individuals/ m², was registered in Nehoiu site, but the greatest number of species was found in Vama Buzău site.

The eudominant species in this field sampling were *Oligoneuriella rhenana*, *Ephemerella ignita*, and euconstant *Oligoneuriella rhenana*, *Baetis vernus* and constantes *Ephemerella ignita*, *Rhithrogena beskidensis* (Fig. 8).

Oligoneuriella rhenana has registered in this field sampling, the greatest density of 93 individuals/ m² in Nehoiu site, but also in the other 4 sites where it was present, the density exceeds 40 individuals/ m². Not even in this sample from Racovița site were any mayflies present. 16 species from 7 genus and 4 families were identified in the September sampling sites. (Fig. 9). The greatest density of 371 individuals/ m² was registered in Vama Buzău site.

The eudominant species in this site sampling were *Baetis melanonyx*, *Oligoneuriella rhenana*, *Ephemerella ignita*, *Rhithrogena semicolorata*, and

euconstant *Ephemerella ignita*, *Caenis pseudovivulorum*, *Baetis vernus* (Fig. 10).

Baetis melanonyx has registered the greatest density of 97 individuals/ m² in this field sampling, although it was present only in the sample from Vama Buzău site.

There were no mayflies in macroinvertebrates sample from the Racovița site, but in exchange, in the Banița site, the number of species has increased, *Ephemerella ignita*, *Baetis vernus* and *Caenis pseudovivulorum* being present.

The values of Simson and Shanon-Wiener diversity indeces have registered a slight decrease with altitude and because of the polluted waters. However, the values of diversity indices indicate a better quality of water. The taxons number index and density has the same decrease tendency (Fig. 11).

Finally, we emphasized the distribution of mayflies species in each site where they were present and we noticed the correlation between saprobic valency value of each species and the organic load (Fig. 12).

According to Kokwitz and Marsson Saprobic System, each species has a saprobic value depending on the tolerance to organic pollution.

It is obvious that species with small saprobic value prevail in the first site (reference site) Vama Buzăului and they don't exceed the first class quality limits (standard concerning the reference objectives for the classification of the surface water quality 1146/2002) and as we come near the river mouth, species with a saprobic value which exceed 1,8 value, specific to beta-mesosaprobic zone prevail.

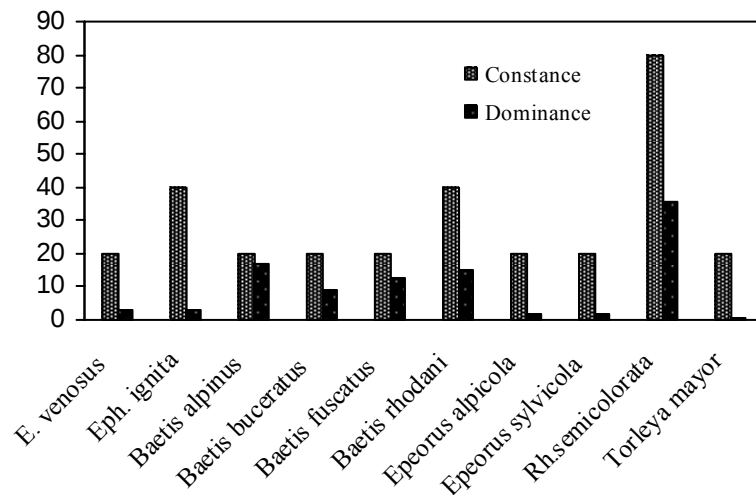


Fig. 6. Constance and dominance index in April

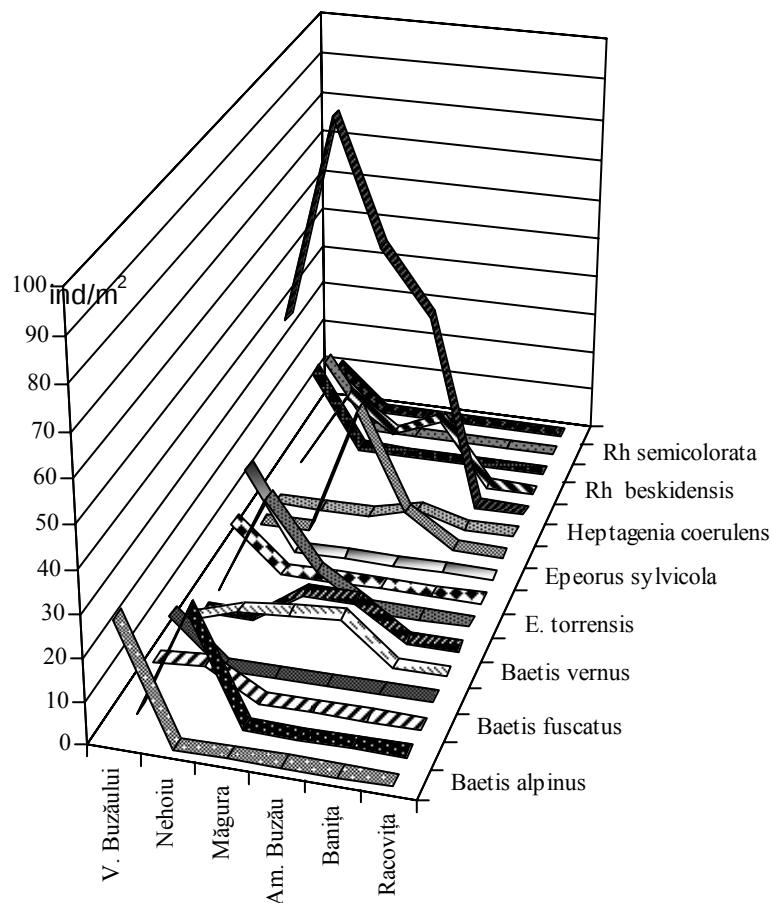


Fig. 7. Longitudinal distribution of the mayflies in July

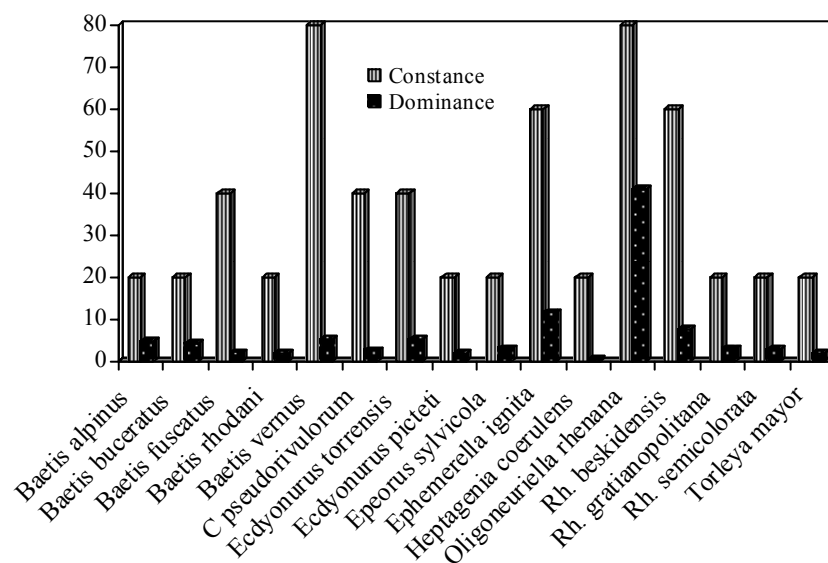


Fig. 8. Constance and dominance index in July

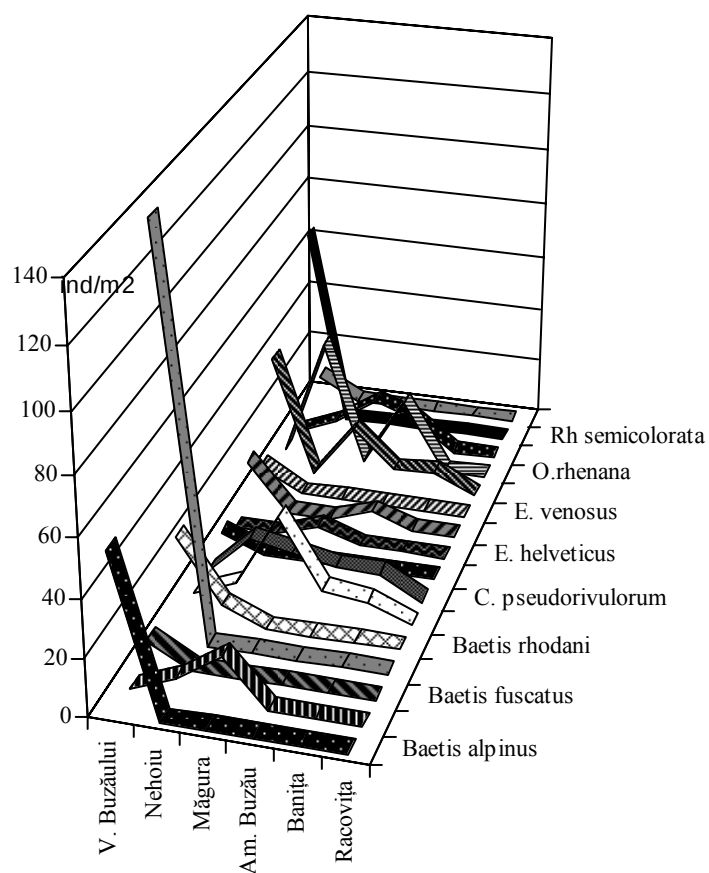


Fig. 9. Longitudinal distribution of the mayflies in September

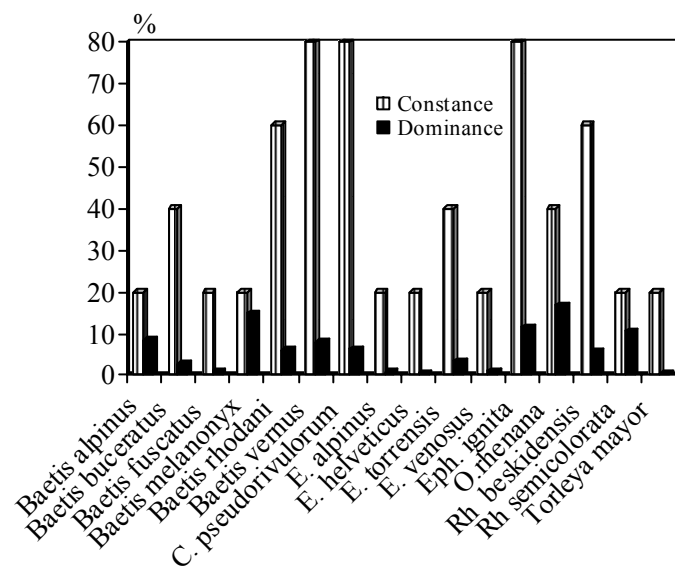


Fig. 10. Constance and dominance index in September

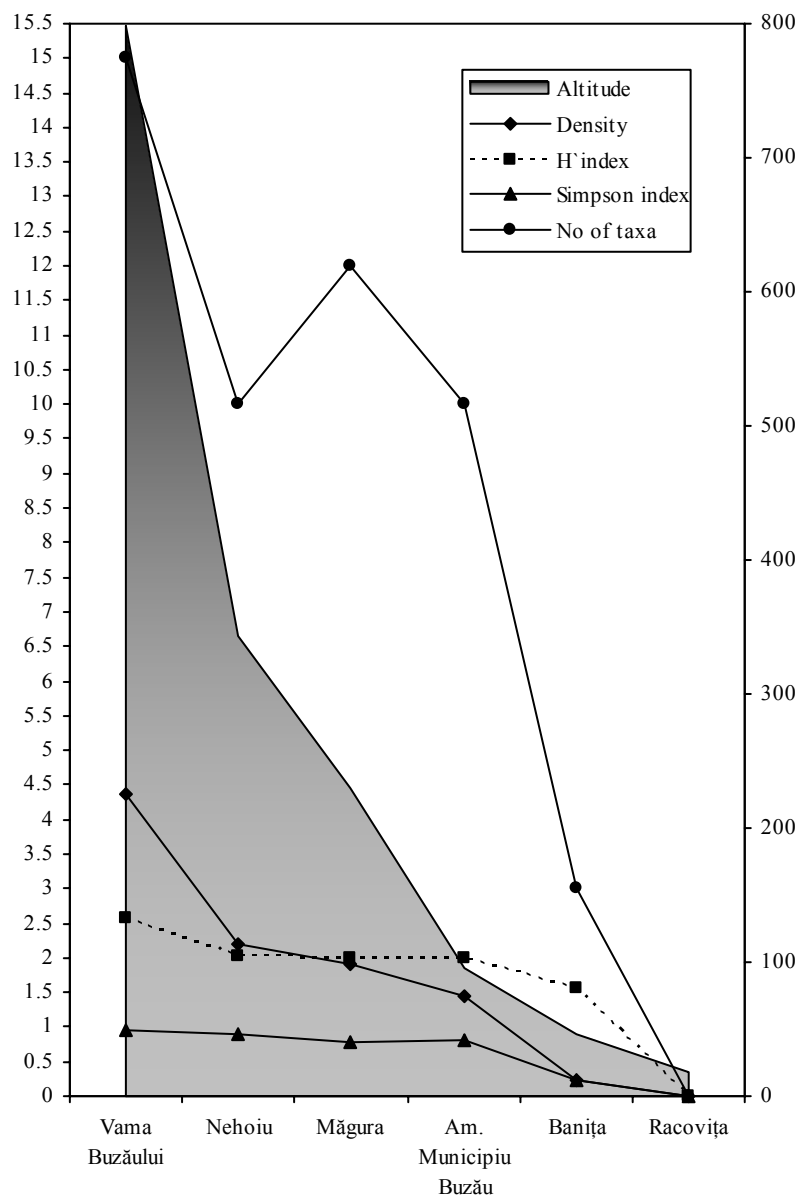


Fig.11. Evolution of diversity index, density and number of taxa with the altitudinal variation

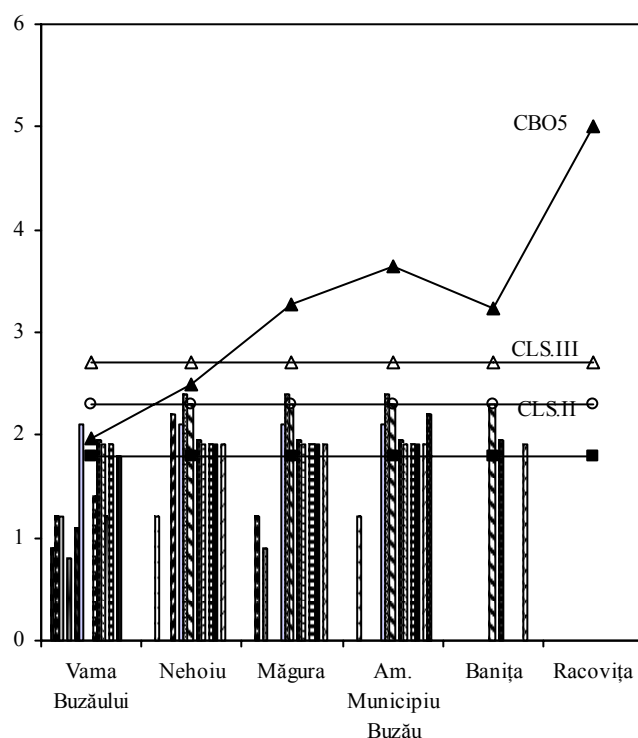


Fig. 12. Evolution of the saprobic valency with the CBO5 variation

CONCLUSIONS

After analyzing the samples from 2005, there were identified 21 species from 9 genus and 4 families. Also, there was no mayflies individual in the samples from Racovița site, because of the great flows registered in 2005. Analysing the samples from those 3 fields sampling, we noticed that *Ephemerella ignita* and *Baetis vernus* are constante species being present in almost all samples and eudominants as individual number/m² are *Oligoneuriella rhenana*, *Rhitrogena semicolorata*.

REZUMAT

Conform Directivei 60/2000 EEC macronevertebratele bentonice devin prioritare în stabilirea "stării" apelor de suprafață. Dintre acestea efemeroptrele (Ephemeroptera) dețin un rol important în evaluarea condițiilor fizico-chimice și hidromorfologice ale cursurilor de apă. Prin dependența lor față de anumite condiții ale mediului, diferite specii de efemeroptere pot servi ca indicatori ai tipurilor de apă sau ai calității acestora. Acestea sunt influențate, în distribuția lor longitudinală de la izvor la vărsare, de schimbările caracteristicilor biotopului.

Structura comunităților și distribuția longitudinală a efemeropterelor din râul Buzău a fost stabilită prin analiza probelor sezoniere (martie, iulie, septembrie) prelevate din 6 secțiuni de monitorizare.

Bazinul hidrografic al râului Buzău reprezintă bazinul unuiu din afluenții cei mai importanți ai râului Siret, principala arteră hidrografică ce strabate bazinul și care dirijează aproape întregul regim hidrologic fiind râul Buzău, cu o lungime de 306 km. Suprafața bazinului hidrografic Buzău se desfășoară pe cele trei mari trepte de relief, iar geologia predominantă este cea silicioasă, urmată de cea organică și foarte puțin calcaroasă.

Au fost identificate 21 de specii aparținând la 5 familii, prezente în 5 secțiuni de monitorizare. S-a constatat absența efemeropterelor în ultima secțiune de monitorizare, Racovița aflată 40 km de confluența Buzăului cu Siretul, datorită condițiilor hidrologice deosebite din acest an. Speciile constante prezente în aproape toate probele au fost *Ephemerella ignita*, *Baetis vernus*, *Oligoneuriella rhenana*, *Baetis rhodani*, *Rhitrogena semicolorata* iar cele eudominante ca număr de indivizi în probă au fost *Oligoneuriella rhenana*, *Rhitrogena semicolorata* și *Ephemerella ignita*. De asemenea s-a constatat o scădere a indicilor de diversitate Simpson și Shanon-Wiener odată cu altitudinea și datorită impactului surselor de poluare prezente aval de secțiunea Nehoi.

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