MICROBIOLOGICAL CHARACTERISTICS OF AQUATIC ECOSYSTEMS FROM THE MIDDLE SIRET RIVER DURING 2004-2006

Dumitra Răducanu, Octăvița Ailiesei

***Keywords**: bacterioplankton, aquatic ecosystem, aerobic and anaerobic microflora,amonifing microflora, proteolytic microflora, water pollution*

INTRODUCTION

Researches on biological productivity of aquatic ecosystems could not be complete if the role of bacterioplankton in the matter and energy flow is ignored.

In Siret river, especially at surface of water, existing a specific (autochtonous) microbiota, wich develops function of nutritive supplies, especially organic biodegradable substances.

In case of appears a supplementary nutrient sources (caused by pollution) will be changes in the quantitative and qualitative evolution of microbial population.

These aspects will be producing negative effects on water utilization in various economical and social interests or on the health of the people who living in riverside area.

The aim of this study is the establishing of the microbial pollution (indicated indirectly by total number of germs TNG) and in the same time we follow up certain ecophysiological groups of bacteria involved in substances recycling.

Microorganisms play a very important role in the cleaning process of the Siret river and in the wetlands near the main river course.

We are monitoring the microbiological indicators in two years, 2004-2006, on seasonal sample. There were collected water sample during the spring (March-April, summer (June July) autumn (October-November) and winter (January-February)

The sample station was selected to offer a significant image of development level of bacteria communities.

Water sample were analyzed by inoculation on the selective culture media. For interpreting the analyzed data it make the geometrical media for each sampling station, on season and ecophysiological bacteria group.

In the same time, it was monitoring several physico– chemical parameters: temperature T, pH of the water, oxygen.

Also, we are follow up the influence of the wetlands microbiota to river microbiota.

The total surface of the Siret river is 44.871 km^2, out of which DA Siret, takes care of 28878. The Siret River is 559 km long. Up to 2006 there have been analyzed the following aquatic ecosystems: the Rogojesti and Bucegea lakes, the Oniscani, Rachiteni, Zamostea- balta Neagra slops.

In august 2007, there have been colected samples from Siret River, up stream and down stream of the Galbeni lake Bacau. The study was intersted in analiying the quantitative distribution of ecofiyiological goups of germs.

The Galbeni lake lies on the Siret River, dowun stream from its junction with Bistrita river and up stream of the jonction Bahna brook. The Galbeni lake started to be used since 1983.

The forced industrialization from that place in the past caused the appearance of some major infectional areas; the most dangerous being planed within the Siret basin: the towns of Suceava, Falticeni, Radauti and Bacau.

Table 1. The evolution at the indicators of water

Year / Parametric	1999	2001	2003	2005
The Siret River- Dragesti				
pH	7,6	7,8	7,4	8,0
Total nr of salts residuum	351,6	343,9	341,6	333,3
NO_3	0,755	8,5	0,7	0,992
NO_2	0,030	0,11	0,024	0,025
SO_4	70,6	57,5	62,2	57,8
CBO_5	4,80	3,9	3,6	4,69
CCOCr	18,87	18,4	19,7	12,45
The Galbeni accumulation				
pH	7,6	7,7	7,5	7,9
Total number of salts Rezidum	291,7	291,1	297,4	269,1
NO_3	0,780	8,7	0,7	1,042
NO_2	0,025	0,16	0,031	0,027
SO_4	62,9	52,6	59,3	50,5
CBO_5	6,88	6,4	2,7	3,51
CCOCr	24,86	14,1	19,7	13,33

The human activities intensified continually and because more and more complex. On the hole as it

concerns the water and soil pollution it can be said that since 1992-1994 this process was in a continuous decrease, especially because of the less intense economic activities that took place in the area. Never the less the waste on the bottom of the lakes, they still contain numerous noxe (table no 1).

The conclusion that can be drow after analyzing the above table is that between 1980 and 1995 the Galbeni lake was very polluted.

Due to the great power of self purification of the Siret river the residual accumulation upstream of Galbeni lake are less detected as a result of crop pollution.

The studies made in 1997, provides that along the Galbeni lake, there can be identified different degrees of pollution.

The results of this study are synthesized in the following table (table no 2):

Table 2. The ecological state of the Galbeni lake in the year 1997 (P. Olariu şi col., 2005)

Indicators	Limits STAS			Line end of lake			Barrage		
	I	II	III	Min.	Med.	Max.	Min.	Med.	Max
oxygen									
Concentration O_2	6	5	4	7,4	8,9	11,6	7,8	9,2	10,8
CBO_5	5	7	12	4,0	25,5	67,0	4,2	7,1	11,2
CCOMn	10	15	25	7,2	49,8	13,1	8,8	13,9	20,1
Nutrients									
Azotes total	0,3			1,43	11,2	30,3	0,94	2,12	3,3
NO_2	1	3		0,10	0,13	0,14	0,11	0,12	0,13
NO_3	10	30		3,2	4,0	4,8	4,2	5,1	5,6
Phosphor total	-	0,1		0,13	0,23	0,30	0,06	0,28	0,60
biological components									
Phytoplankton				250	492	710	200	750	1550
Zooplankton				1320	•	•	•	•	•
Biomass				0,35	3,26	6,90	0,45	2,84	5,52
physic - chemical indicators									
PH				7,4	7,6	7,8	7,6	7,7	7,8
Residuum	750	1000	1200	278	391	517	278	318	369
Hardness				15,7	17,3	19,3	13,0	14,7	16,5
Calcium	150	200	300	53	70	91	66	69	72
Magnesium	50	100	200	23	33	39	12,2	21,9	29,2
Fe total	0,3	1,0	1,0	0,38	1,26	2,84	0,29	1,27	3,20
Chlorides				28	29	31	27	42	67
Ammonium	1	3	10	0,6	12,9	37,2	1,0	1,6	2,6
characterization sapro - biologic									
phosphor total							Eutrof		
azoth minim							Mezotrof		

The information contained in the above table emphasize the fact that there are significant differences between the upstream concentration and the downstream concentration due to the pores of purification of the lake Galbeni.

It should be notice the fact that all these concentrations witch most of the times overpass the limits of the 3rd quality category, also influence the quality of the accumulate sediments.

The circuit of the substances in the water is based on the character and the intensity of the microbial processes.

The biochemical activity of the micro organisms influences to a great extent the transformation and the regeneration of the biogen elements especially N and P, witch are very useful for the primary producers from the water basins.

The microorganisms development is very closely related to the medial factors, the O_2 content, the mineral and organic substances, the active reaction, the temperature, the phytoplankton and zooplankton's development, being necessary a complex description in order to illustrate the state of the aquatic ecosystems.

METHODS AND WORKING TECHNICS

Collecting the sample:

The water sample have been taken from the superficial horizon (15/20cm from the surface of the water) by using sterile hypodermics of 20ml

After being collected the water samples were carried to the laboratory in the frigorific bogs at 4 degrees Cº and analyzed in maximum 24 hours, in order to avoid the possible major modifications that could appear in the community of microorganisms.

The microbial analysis of the water samples collected consisted in the quantitative determination of the microorganisms, with major implications in the circuit of the biogene elements. For each water sample we have worked with 5 types of dilutions and selective environments specific to each physiologic group.

The discovery of the mesofile bacteria's existence presupposes the water sample's insemination or of the decimal dilutions through the incorporation process, in a agar agar environment incubated at 37ºC, for 48 hours after witch formed colonies will be counted.

The results analysis will be make by counting the formed colonies both at the surface and the depth of the environment, without taking into account those having

more than 300 colonies and it is reported to a 1 cm^3 volume which had been inseminated within the analyzed sample. If dilution has been used, the following formula is applied.

$$\mathbf{UFC/cm^3 = \sum(n \times d)/N \times V}$$

UFC=units forming colonies;
n= number of colonies developed in a Petri box
d= the inverse proportion of the sample's dilution
N=the number of Petri boxes taken into account
V=the sample's volume take in

An essential process for the aquatic ecosystems is the denitrification process, meaning the reduction NO_3 to NO_2 and the air N_2

The denitrification is a very important biologic process for nature and is the major means of forming the atmospheric nitrogen between terrestrial and aquatic environments. It is the final level of nitrogen's bio-geochemical circuit in nature.

Table 3. Characteristic microbiologic of station

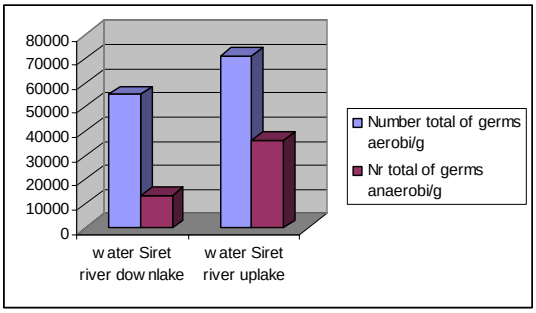
No	Groups of bacteria	Station	No germs/ml august 2005
1.	NTG	Rogojesti	2.110
		Bucegea	2.185
		Oniscani	2.390
		Balta Răchiteni	1.640
		Zamostea-balta Neagră	2.132
2.	Denitrificatori	Rogojesti	300
		Bucegea	115
		Oniscani	178
		Balta Răchiteni	275
		Zamostea-balta Neagră	355
3.	Sulfatoreducători	Rogojesti	3
		Bucegea	0,6
		Oniscani	1,1
		Balta Răchiteni	1,1
		Zamostea-balta Neagră	1,5

The microbiological analysis of the water sample taken from the Galbeni lake consist in a quantitative determination of the aerobe and anaerobe germs, and some groups of ecophisiologic microorganisms involved in the elements circuit in nature.

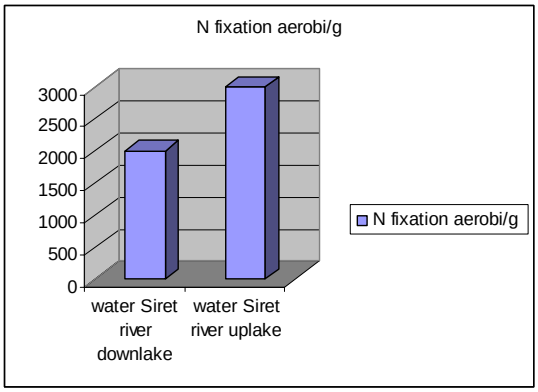
Their analysis revealed some important characteristics of the lake's bacterioflora and of the Siret river that is in the nearly area (table 3 and table 4).

Table 4. Characteristic microbiologic of Galbeni in August 2007

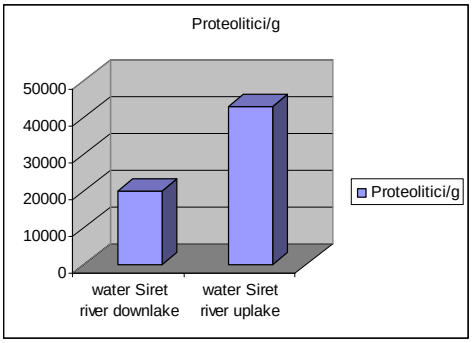
No	Samples	No total of germs aerobic/g	No total of germs anaerobic/g
1	water Siret river downlake	55,3 x 10^4	13,5 x 10^2
2	water Siret river uplake	71,3 x10^3	36,3x 10^3

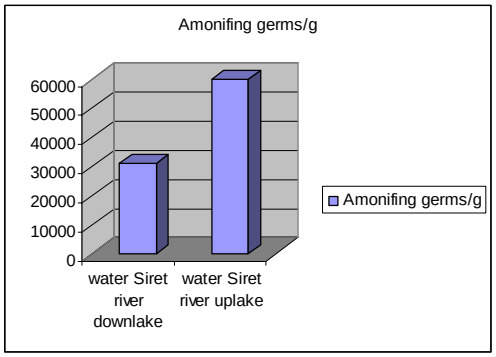


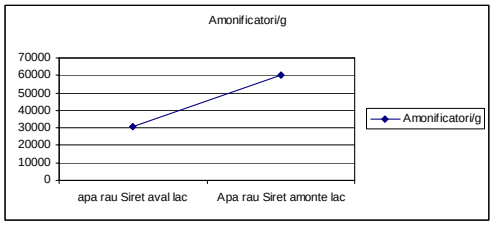
No	Sample	N fixation aerobe/g
1	water Siret river downlake	2x 10^3
2	water Siret river uplake	3x10^3



No	Sample	Proteolitic germs/g
1	water Siret river downlake	2x10^5
2	water Siret river uplake	4,3x10^5







ABSTRACT

The microbiological analysis of the water sample taken from the Galbeni lake consist in a quantitative determination of the aerobe and anaerobe germs, and some groups of ecophisiologic microorganisms involved in the elements circuit in nature.

Their analysis revealed some important characteristics of the lake's bacterioflora and of the Siret river that is in the nearly area .

An essential process for the aquatic ecosystems is the denitrification process, meaning the reduction NO_3 to NO_2 and the air N_2

The denitrification is a very important biologic process for nature and is the major means of forming the atmospheric nitrogen between terrestrial and aquatic environments. It is the final level of nitrogen's bio-geochemical circuit in nature.

CONCLUSIONS

Due to the great power of self purification of the Siret river the residual accumulation upstream of Galbeni lake are less detected as a result of crop pollution.

The studies made in 1997, provides that along the Galbeni lake, there can be identified different degrees of pollution.

The discovery of the mesofile bacteria's existence presupposes the water sample's insemination or of the decimal dilutions through the incorporation process, in a agar agar environment incubated at 37ºC, for 48 hours after witch formed colonies will be counted.

The results analysis will be make by counting the formed colonies both at the surface and the depth of the environment, without taking into account those having more than 300 colonies and it is reported to a 1 cm^3 volume which had been inseminated within the analyzed sample. If dilution has been used, the following formula is applied.

REFERENCES

1. DUNCA SIMONA, NIMIȚAN ERICA, AILIESEI OCTAVIȚA, COMĂNESCU ȘT., *Microbiologie aplicată*, Edit Tehnopress, Iasi, 2004.
2. MĂZĂREANU, C. – *Microbiologie generală*, Ed. AlmaMater, Bacau, 1999.
3. NICOLESCU DORINA - Le role ecologique du bacterioplancton dans le functionement des ecosistemes aquatique du Delta du Danube, Rev Roumain Biol. Anim., 38,1p,79-91, 1993.
4. NIMIȚAN ERICA, COMĂNESCU, ST. – *Ecologia microorganismelor*, Ed. Cermi, Iasi, 1997.
5. ZARNEA G. – *Tratat de microbiologie generală*, vol 5, Ed. Acad. Rom. Buc., 1994.

AUTHORS' ADDRESS

RĂDUCANU DUMITRA - The Bacău University, Faculty of Sciences, Department of Biology, Calea Mărășești Street, No 157, 600115, Bacău, Romania, e-mail: dumitra_manea@yahoo.com.

AILIESEI OCTĂVIȚA - The "Alexandru Ioan Cuza" University, Bulevardul Carol I, No.11, 700506, Iasi, Romania, e-mail: octavita@uiac.ro