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Autor(en): **Nicoara, M. / Cojocaru, I.**

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INTERNATIONALE ENTOMOLOGEN-TAGUNG BASEL 1999

Dynamics of the entomological fauna living in aquatic ecosystems in Iasi area

by **M. Nicoara & I. Cojocaru**

Résumé. La faune entomologique a été collectée entre juin 1996 et avril 1997, de trois écosystèmes aquatiques situés aux environs de la cité de Iasi. Les lacs étudiés ont été: Ciric, Badarau et Aroneanu. On a obtenu des données qui concernent: la profondeur Secchi, le pH, la température, l'O₂ dissous, le CO₂, le contenu en NH₃ et chlorures et aussi en matières organiques dissoutes. Le principal objectif de la recherche a été l'étude de la diversité biologique à la suite de l'enrichissement en nutriments et aux accidents anoxiques survenus pendant l'été. Les échantillons ont compris des espèces diverses d'insectes qui appartiennent aux ordres: Collembola, Ephemeroptera, Plecoptera, Odonata, Heteroptera, Coleoptera, Trichoptera, Lepidoptera et Diptera et, aussi, d'autres espèces des macroinvertébrés benthiques. Les insectes ont été dominants surtout sous forme larvaire. L'abondance relative la plus élevée a été enregistrée par Diptera et Heteroptera, qui sont plus résistantes à la pollution. On a calculé, aussi, le rapport adultes/larves.

Keywords. population dynamics - aquatic insects - Romania

Introduction

Aquatic ecosystems surveyed were: Lake Aroneanu, Ciric Complex (consisted of 3 lakes noted Ciric I, II and III) and Lake Badarau - all dam lakes situated a few kilometers near the town of Iasi. First two to North, in this order on the Ciric Brook's course, a left hand tributary of Bahlui River, and the last to North-East on the course of Badarau Brook.

These lakes are not too deep (4.5 m maximum) and not too large (up to 50 km²), and exposed to colmatation. Their waters may bloom in the warm period due to the richness of nutrients drained from the neighbouring cultivated hills.

Main goal was to check actual biological diversity, consequently to water enrichment in nutrients and to anoxic accidents occurred in summertime.

Samples consisted of various insects (besides other benthic macroinvertebrates) belonging to Orders: Collembola, Ephemeroptera, Plecoptera, Odonata, Heteroptera, Coleoptera, Trichoptera, Lepidoptera and Diptera.

Materials and method

Entomological fauna belonging to 3 aquatic ecosystems from Iasi area has been surveyed between June 1996 - April 1997. Ecosystems were: Lake Aroneanu, Lake Ciric and Lake Badarau, in the neighbourhood of Iasi town.

Samples consisted of water for physical and chemical analysis, and aquatic organisms (benthic-pelagic forms). Following data were collected: Secchi depth, pH, temperature, dissolved oxygen, free CO₂, NH₃, chlorides, dissolved organic matter.

A 0.5 mm mesh size net was used for the pelagic forms, while for benthic ones a Marinescu grab, 225 cm² covering area.

Table 1. Entomological fauna structure: June - November 1996 - Lake Ciric (Iasi)

No.	Species	Site 1		Site 2		Site 3		Site 4		Site 5	
		ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.
1	<i>Podura aquatica</i>					12	6.81				
2	<i>Isotoma</i> sp.									2	0.41
3	<i>Cloeon dipterum</i>	9	2.27	44	9.28	81	46.02	269	67.25	280	58.33
4	<i>Siphonorus</i> sp.									1	0.2
5	<i>Ordella</i> sp.							2	0.5		
6	<i>Nemura</i> sp.							1	0.25		
7	<i>Perlodidae varia</i>							1	0.25		
8	<i>Coenagrion puella</i>	1	0.25	5	1.05			9	2.25	2	0.41
9	<i>Gerris lacustris</i>	5	1.26	4	0.84	3	1.7	5	1.25	4	0.83
10	<i>Corixa</i> sp.							1	0.25		
11	<i>Sigara jactans</i>	144	36.45	59	12.44	18	10.22	1	0.25	82	17.08
12	<i>Nepa cinerea</i>	1	0.25			2	1.13	1	0.25		
13	<i>Ranatra linearis</i>	1	0.25								
14	<i>Naucoris cimicoides</i>	2	0.5	5	1.05	5	2.84	7	1.75	2	0.41
15	<i>Notonecta viridis</i>	56	14.17	55	11.6					1	0.2
16	<i>Plea minuta</i>			7	1.47	2	1.13	1	0.25	2	0.41
17	<i>Noterus crassicornis</i>					1	0.56	28	7.0	16	3.33
18	<i>Laccophilus hyalinus</i>					7	3.97	8	2.0	6	1.25
19	<i>Hydrovatus cuspidatus</i>							1	0.25		
20	<i>Hygrotus versicolor</i>									1	0.2
21	<i>Hydroporus dorsalis</i>							1	0.25		
22	<i>Colymbetes fuscus</i>			1	0.21						
23	<i>Rhantus pulverosus</i>									2	0.41
24	<i>Cybister lateralimarginalis</i>	1	0.25								
25	Dytiscidae (larvae)	45	11.39	4	0.84			2	0.5	4	0.83
26	<i>Haliplus fulvus</i>					1	0.56	2	0.5		
27	<i>Peltodytes caesus</i>									1	0.2
28	Haliplidae (larvae)							1	0.25		
29	<i>Helophorus aquaticus</i>									1	0.2
30	<i>Hydrophilus flavipes</i>			1	0.21						
31	<i>Berosus spinosus</i>	2	0.5							3	0.62
32	<i>Laccobius</i> sp.					6	3.4	1	0.25		
33	<i>Hydrobius</i>					1	0.56	1	0.25	1	0.2

Table 1. Entomological fauna structure: June - November 1996 - Lake Ciric (Iasi) (continuation)

	<i>fuscipes</i>										
34	<i>Helochaeres lividus</i>	1	0.25	1	0.21	6	3.4			3	0.62
35	<i>Hydrous piceus</i>	1	0.25								
36	Hydrophilidae (larvae)					3	1.7			2	0.41
37	<i>Spercheus</i> sp. (larvae)					2	1.13				
38	<i>Helichus</i> sp.			1	0.21						
39	<i>Limnophilus flavicornis</i>							1	0.25		
40	<i>Limnophilus rhombicus</i>							3	0.75		
41	<i>Limnophilus</i> sp.	1	0.25	2	0.42						
42	<i>Stenophylax rotundipennis</i>							2	0.5		
43	<i>Beraeodes</i> sp.	1	0.25	7	1.47	10	5.68				
44	Lepidoptera (pupae)					5	2.84				
45	<i>Culex</i> sp.							2	0.5		
46	Tipulidae (larvae)	1	0.25			1	0.56	1	0.25	3	0.62
47	<i>Chironomus plumosus</i>	117	29.62	268	56.54	4	2.27	45	11.25	61	12.7
48	<i>Stratiomys furcata</i>	1	0.25	3	0.63	2	1.13				
49	<i>Stratiomys longicornis</i>	5	1.26	7	1.47	2	1.13	1	0.25		
50	<i>Stratiomys</i> sp.							1	0.25		
51	<i>Eulalia cincta</i>					2	1.13	1	0.25		
	Total	395		474		176		400		480	
	H (S)	2.302		2.192		3.0835		2.0136		2.0574	
	E	0.54		0.53		0.69		0.41		0.46	
	I dc	0.66		0.68		0.56		0.78		0.75	

Table 2. Entomological fauna structure: November 1996-April 1997 - Lake Badarau (Iasi)

No.	Species	Site 1		Site 2		Site 3	
		ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.
1	<i>Podura aquatica</i>	1	0.5	118	26.16	1	0.3
2	<i>Gerris lacustris</i>					2	0.61
3	<i>Baetis</i> sp.					9	2.77
4	<i>Cloeon dipterum</i>			10	2.21		
5	<i>Ephemerella ignita</i>			1	0.22	187	57.71
6	<i>Coenagrion puella</i>			3	0.66		
7	<i>Epitheca</i> sp.					5	1.54
8	<i>Sigara jactans</i>	1	0.5	18	3.99	1	0.3
9	<i>Nepa cinerea</i>					3	0.92
10	<i>Ranatra linearis</i>			1	0.22		
11	<i>Noterus crassicornis</i>			3	0.66		
12	<i>Rhantus pulverosus</i>			1	0.22		
13	<i>Hydroporus</i> sp.					1	0.3

Table 2. Entomological fauna structure: November 1996-April 1997 - Lake Badarau (Iasi) (continuation)

14	<i>Rhynchites</i> sp.	1	0.5				
15	<i>Hydropsyche</i> sp.					1	0.3
16	<i>Limnophilus</i> sp.					7	2.16
17	<i>Sialis flavilatera</i>					1	0.3
18	<i>Psychoda</i> sp.			1	0.22	1	0.3
19	<i>Anopheles</i> sp.					1	0.3
20	<i>Chironomus plumosus</i>	195	97.98	294	65.18	102	31.48
21	Limoniidae	1	0.5				
22	<i>Eulalia cincta</i>			1	0.22	2	0.61
	Total	199		451		324	
	H (S)	0.18		1.4065		1.663	
	E	0.07		0.4		0.42	
	I dc	0.98		0.91		0.89	

Table 3. Entomological fauna structure: September - December 1997 - Lake Aroneanu (Iasi)

Legend: ind.m⁻² = number of individuals per square meter
rel. abund. = relative abundance
H (S) = Shannon-Weaver diversity index
E = equitability index
I dc = McNaughton dominance-constancy index

No.	Species	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6	
		ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.	ind.m ⁻²	rel. abund.
1	<i>Cloeon dipterum</i>					8	9.41						
2	<i>Coenagrion puella</i>							2	1.38	1	1.21	1	0.5
3	<i>Lestes</i> sp.											2	1.0
4	<i>Sigara jactans</i>	70	46.35	54	62.79			44	30.55	54	65.85	87	43.71
5	<i>Sialis flavilatera</i>							2	1.38				
6	<i>Berosus spinosus</i>			2	2.32			5	3.47				
7	<i>Colymbetes fuscus</i>					1	1.17						
8	<i>Rhantus pulverosus</i>			1	1.16								
9	<i>Limnophilus</i> sp.	13	8.6					5	3.47	15	18.29		
10	<i>Chironomus plumosus</i>	62	41.05	11	12.79	75	88.23	33	22.91	8	9.75	108	54.27
11	<i>Ceratopogoninae varia</i>	6	3.97	14	16.27	1	1.17	53	36.8	4	4.87	1	0.5
12	<i>Stratiomys</i> sp.			4	4.65								
	Total	151		86		85		144		82		199	
	H (S)	1.5298		1.6328		0.6293		2.0465		1.461		1.142	
	E	0.76		0.63		0.31		0.72		0.62		0.49	
	I dc	0.87		0.79		0.97		0.67		0.84		0.97	

Numbers of organisms were reported to surface unit (m²) and statistically processed. The imagos-larvae ratio has also been considered.

A number of complex ecological indicators were obtained. Biological diversity has been expressed by Shannon-Weaver index. Equitability was calculated according to Piellou.

Numerical relative abundance for each species, and McNaughton index expressing communities' dominance were calculated.

Different faces were investigated (covered and uncovered by aquatic macrophytes; soft and hard bottom, respectively) trying to assess relationship between entomofauna and environmental conditions: water column quality, sediment etc.

Results and discussions

Due to the lack of information regarding biological diversity in the aquatic ecosystems of Iasi area, we could not process to a comparative analysis. Still, we tried to emphasize changes occurred in fauna according to variation of the environmental parameters, both in space and in time. Lack of space obliged us to present synoptic tables, only. Our efforts concern species living in those particular lakes, and presence of water quality indicator species, especially.

Observations made on the basis of the biological material sampled entitled us to consider that:

1. Quality of surveyed lakes proved to be critical. Almost every sampling site recorded a large amount of organic matter (black fetid silt), and a very small amount of dissolved oxygen. Dominant were insects, especially larvae. Among them, Diptera and Heteroptera realized the largest numbers, being more resistant to physical and chemical stress pollution caused.

2. Biological diversity was different from lake to lake, site to site, and according to sampling session. Shannon-Weaver index was maximum (3.0835) in Lake Ciric, but less in Lake Aroneanu (2.0465) and Lake Badarau (1.663); maximum equitability was 0.69; 0.76 and 0.42, respectively.

3. Lake Ciric contained the largest number of taxa: 51, while Lake Badarau 22, and Lake Aroneanu 12. As Order, largest number of taxa belonged to Coleoptera (22 species), suited by Heteroptera (8 species), in Lake Ciric.

4. Maximum number of individuals belonged to *Cloeon dipterum* (280 ind.m⁻²) in Lake Ciric, while in Lakes Badarau and Aroneanu to *Chironomus plumosus* (294 ind.m⁻² and 108 ind.m⁻², accordingly).

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Author's address

Mircea Nicoara, Ion Cojocaru
Faculty of Biology, University "Al. I. Cuza" Iasi
Bd. Carol I, 20 A
RO-6600 Iasi,
ROMANIA