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Taxonomical and ecological study of water mite communities (Acari, Hydrachnidia) from the river Someşul Mic catchment area and their role as indicators of water quality

- Summary of the thesis -

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Content of the Thesis

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Introduction

The water mites represent a group of aquatic invertebrates as neglected as it is important as structural and functional element in lotic ecosystems. All species of the group Hydrachnidia, in the larva stage, are ectoparasites, and in the deutonympha and adult stages predators, thereby exerting a significant role in aquatic food chains from the zoobenthic communities.

In Romania, until now, the studies on water mites had only a fauna character. The scientist Constantin Motaş made the first studies on this taxonomic group, but they were not pursued a long time. Therefore we felt that detailed studies are required to fill the list of species of water mites from Romania and knowledge of their biology and ecology. Also, the study of this group is even more necessary considering that recently the importance of thorough knowledge of these bodies was internationally established for practical reasons too, given their quality as indicators as water quality.

The objectives of the study:

- To establish a comprehensive list of species of the Hydrachnidia from the catchment area of the Someşul Mic River
- The ecological study of water mite communities in relation with local environmental factors from the studied area
- Highlighting the role of water mites as indicators of water quality

Original contributions of the study

From the 56 species of Hydrachnidia identified in this study, 40 are reported for the first time in Someşul Mic catchment area, seven are new species reported for the Romanian fauna and two species are reported for the first time in the Carpathian Region.

Ecological aspects approached, concerning the structure and dynamics of water mites (Acari, Hydrachnidia) and their relationships with abiotic parameters, are for the first time accomplished in Romania. It is the first study on the water mites drift in Romania. Also, this group of benthic organisms was used for the first time in assessing river water quality in our country.

I mention that a part of this study was financed from the CNCSIS project, type A, code 199/2003 (Project manager Professor Claudiu Tudorancea) and from the CNCSIS project, type Td, code 156/2003-2005 (Project manager, Mirela Cîmpean).

1. Short history of the water mite research on the international and national level

This chapter includes a brief bibliographic summary of the most important work on the taxonomic and ecological study of Hydrachnidia both nationally and globally.

2. The water mites (Acari, Hydrachnidia), general characterization

Water mites are considered a monophyletic group and their origin presumes a terrestrial ancestor from the suborder Parasitegona, which subsequently invaded aquatic environments (Di Sabatino et al., 2000b).

Group origin dates from the Jurassic-Triassic period and the organization of life cycles and ontogenetic development have enabled the group dispersion and a high diversification of aquatic environments occupied (Smith & Cook, 1991).

Scientists are considering Hydrachnidia as a group with an intermediate rank between suborder and superfamily (Smith & Cook, 1991). Thus, water mites (Acari, Hydrachnidia), which are also named Hydrachnellae, are classified systematically in:

Phylum Arthropoda,
Subphylum Chelicerata,
Class Arachnida,
Subclass Acari,
Order Actinedida,
Suborder Parasitengona,
Group Hydrachnidia

Hydrachnidia is characterized by a specific life cycle, unique among mites, similar to that of holometabolous insects, having a parasitic heteromorphous larval stage, two inactive pupa-like resting stages (proto- and tritonymph) and two free-living stages as predators (deutonymph and adult) (Di Sabatino et al., 2000b).

Currently, are known over 5,000 species of water mites worldwide, representing more than 300 genera, 50 families and 8 superfamilies (Viets, 1987).

During development, water mites have explored and invaded successfully various aquatic habitats and develop some adaptations. Hydrachnidia inhabits both lotic ecosystems and the lentic ones. Within lotic ecosystems are different habitats in which exists a typical fauna of water mites.

3. The list of the water mite species from Romania

In 1979, researcher Konnerth-Ionescu, has compiled a list of all species of water mites described so far in Romania. In this paper a total inventory of 267 species and 18 subspecies of water mites are present. A revised list of species of water mites (Acari, Hydrachnidia) of Romania (Cîmpean, 2006, 2007) is present in thesis. From the Konnerth-Ionescu list (1979), after reviewing the species in accordance with current systematic of the group, remained only 249 valid species in Romanian fauna, the rest were invalid or synonymous species. Synonyms are also listed. To the remaining 249 valid species list of Konnerth-Ionescu, another 12 species, new to the fauna of Romania reported in recent years, were added. Five of them were indentified in the Retezat Mountains: *Thyas palustris* Koenike, 1912, *Zschokkea oblonga* Koenike, 1892, *Lebertia dubia* Thor, 1899, *Pionacercus leuckarti* Piersig, 1894 and *Arrenurus zachariasi* Koenike, 1896, (Cîmpean & Gerecke, 2006), and the other seven: *Panisellus thienemanni* Viets, 1920, *Thyas barbigera* Viets, 1908, *Sperchon mutilus* Koenike, 1895, *Torrenticola barsica* Szalay, 1933, *Torrenticola similis* Viets, 1939, *Atractides latipes* (Szalay, 1935), *Feltria menzeli* Walter, 1922, in the Someşul Mic catchment area (Battes et al., 2000-2001; Cîmpean et al., 2003; unpublished data).

These 261 species of water mites are systematically assigned to 61 genera. Genera, with the greatest number of species present in Romanian fauna, are *Arrenurus*, including 36 species, followed by *Lebertia* and *Atractides*, with 23 and 22 species.

4. Physical and geographical characterization of the Someşul Mic catchment area

Someşul Mic River is part of the Someş River catchment area, located in the northwest of the Transilvania Basin and the limits of the catchment area placed on the ridges of Apuseni Mountains, Gutîiului, Ţibleşului, Rodnei Bârgăului and Călimanului (Ujvari, 1972). The catchment area of Someşul Mic River occupies an area of 3773 km2; the river has a length of 178 km and a multiannual average flow of 14.5 m3 / s in Cluj-Napoca (Sofronie, 2000).

Someşul Mic River is formed of two mountain rivers: Someşul Cald and Someşul Rece, which are joined at the eastern foot of the Gilău Mountains in the Someşul Rece locality. Given the larger sizes of the Someşul Cald River, it is considered the source of Someşul Mic River.

Someşul Cald River has a catchment area of 534 km2 and a length of 64km, stems from the under the Piatra Arsă Peak (1550 m asl), from the central massif of Bihor - Vlădeasa, a limestone region (Triassic - Jurassic) with karsts phenomena.

Someşul Rece River has a catchment area of 335 km2 and a length of 45 km and rises from Muntele Mare Mountains; from under the Runcului Peak (1609 m asl). The Someşul Rece basin is located southwest of the Someş River basin. Someşul Rece drains, by its tributaries, the central part of the Gilău Mountains (Gîştescu, 1990).

5. Localization and characterization of the quantitative sampling stations

Samples collecting program, from the catchment area of Someşul Mic, includes 10 sampling stations, five are located in the catchment area of the Someşul Cald, four on the Someşul Rece River and one on Someşul Mic, upstream of the city of Cluj-Napoca (fig.1.).

Name of the station, the code used for each station, elevation, GPS coordinates, maximum depth and width of the riverbed are presented in Table 1.

Table1 Data of localization, maximum depth and width of the riverbed of the sampling stations studied

The code and the name of the sampling stations		Elevation (m asl)	GPS coordinates	Maximum depth (m)	The width of the riverbed (m)
SC 1	Someşul Cald (downstream of the river's gorge)	1159	N 46^{0}38’38.7’’ E 22^{0}43’38.3’’	0.30	5
SC 2	Bătrâna (downstream of Molhaşul Mare from Izbuc)	1213	N 46^{0}35’38.1’’ E 22^{0}45’48’’	0.40	4
SC 3	Someşul Cald (upstream of Doda Pilii)	1029	N 46^{0}38’25.2’’ E 22^{0}49’38.1’’	0.60	25
SC 4	Valea Firii (downstream of Humpleu Cave)	1065	N 46^{0}40’10.8’’ E 22^{0}49’37.4’’	0.30	8
SC 5	Someşul Cald (upstream of Tarnița Lake)	550	N 46^{0}42’10.8” E 23^{0}12’15.1”	0.50	8
SR 1	Someşul Rece (at the springs)	1512	N 46^{0}28’54’’ E 23^{0}03’19’’	0.40	0.5
SR 2	Someşul Rece (downstream of Blăjoaia)	1271	N 46^{0}33’25’’ E 23^{0}03’26’’	0.40	12
SR 3	Someşul Rece (adduction from the catchment area of Arieş River)	1035	N 46^{0}36’53.7’’ E 23^{0}07’25.8’’	0.70	20
SR 4	Someşul Rece (downstream of Măguri-Răcătău)	662	N 46^{0}39’56.6’’ E 23^{0}13’34’’	0.40	8
SM	Someşul Mic (upstream of Cluj-Napoca)	354	N 46^{0}45’51.3” E 23^{0}32’ 28.8”	0.60	35

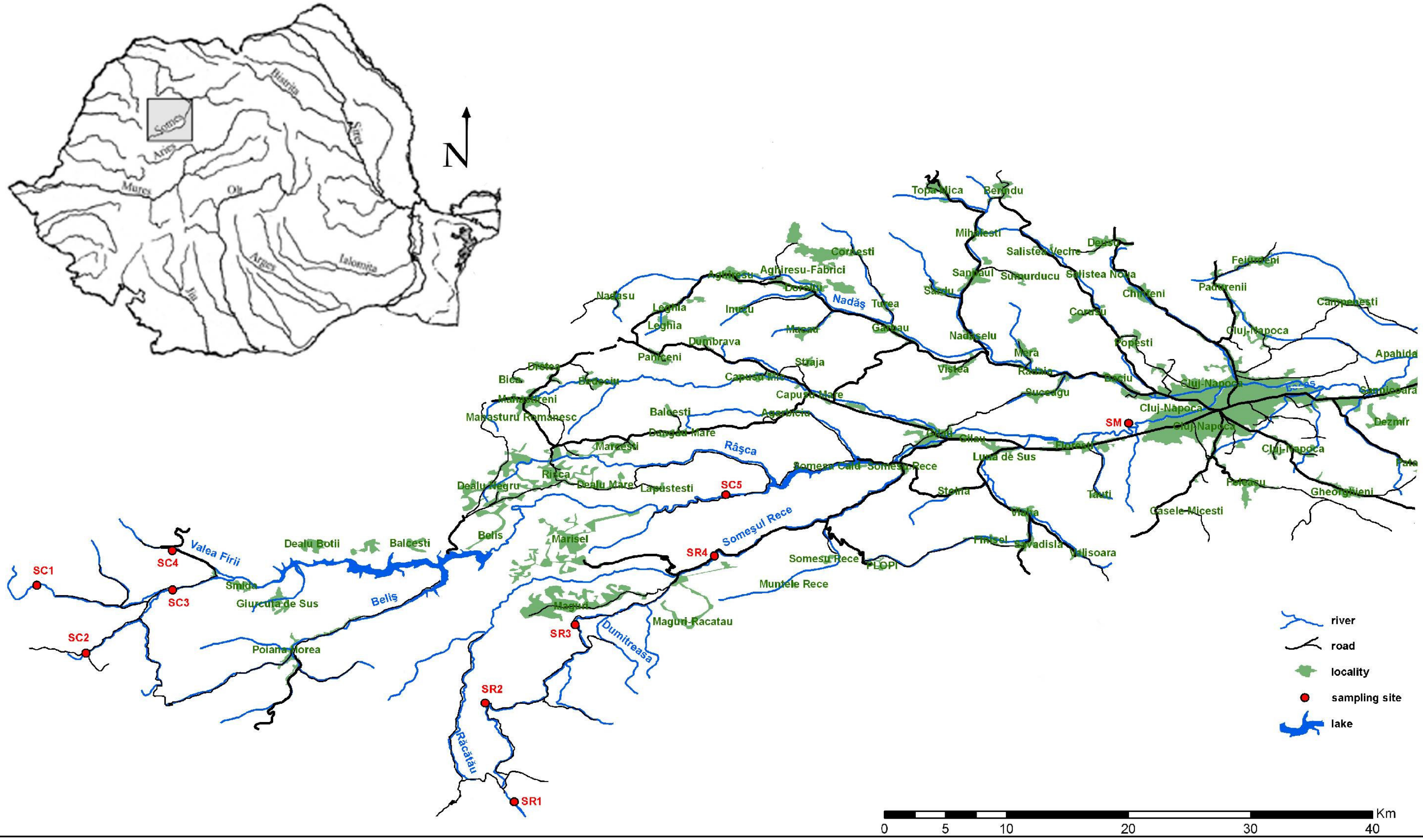

Fig. 1. Localization of sampling station from Someşul Mic catcment area (**SC 1 -** Someşul Cald (downstream of the river's gorge), **SC 2 -** Bătrâna (downstream of Molhaşul Mare from Izbuc), **SC 3-** Someşul Cald (upstream of Doda Pilii), **SC 4 -** Valea Firii (downstream of Humpleu Cave), **SC 5-** Someşul Cald (upstream of Tarniţa Lake), **SR 1-** Someşul Rece (at the springs), **SR 2-** Someşul Rece (downstream of Blăjoaia), **SR 3-** Someşul Rece (adduction from the catchment area of Arieş

6. Material and methods

The sampling program consisted in collecting quantitative samples of benthic invertebrates from ten stations (described in the chapter 5) and qualitative sampling from several collection points and from hyporheic zone. Quantitative samples of benthic invertebrates were collected monthly from March to November, in 2003-2004.

From each station, 3 samples were collected, a total of 356 quantitative samples were gathered. For the quantitative sampling Surber sampler was used and the samples were preserved with formaldehyde 38% in the field. Qualitative collection of water mite was achieved with a hand net with 250 μm mesh size and the selected organisms were preserved in Koenike's solution. Hyporheic fauna samples were also collected using Karaman- Chappuis method. Drift samples were collected over 24 hours, in 3 o'clock range, on 10-11 august 2005, using two nets.

From the each sampling station a set of physico-chemical parameters of water were measured: water temperature, dissolved oxygen, conductivity and pH.

Aquatic mites were identified to species level using the typical methodology of this group (Di Sabatino et al., 2000b).

For the analysis of water mite communities various statistics indexes, using the PAST statistical program (PAlaeontological Statistics, ver. 0.93 (Hammer et al., 2002)) and XLSTAT statistical software (trial version, www.xlstat.com), were used.

In tables 2, 3, 4 and 5 abbreviations used for water mite species, sampling station included in collection program, data of the sampling and drift samples are summarized.

Table 2. Abbreviations used for water mite species

Genera	Species	Sp. CODE	Genera	Species	Sp. CODE
Panisus	*michaeli*	**Pami**	*Atractides*	*gibberipalpis*	**Agi**
Protzia	*eximia*	**Pex**	*Atractides*	*latipes*	**Ala**
Protzia	*invalvaris*	**Pin**	*Atractides*	*loricatus*	**Alo**
Wandesia	*thori*	**Wath**	*Atractides*	*nodipalpis*	**Ano**
Sperchonopsis	*verrucosa*	**Spve**	*Atractides*	*oblongus*	**Aob**
Sperchon	*brevirostris*	**Sbr**	*Atractides*	*tener*	**Ate**
Sperchon	*clupeifer*	**Scl**	*Atractides*	*acutirostris*	**Aac**
Sperchon	*glandulosus*	**Sgl**	*Atractides*	sp.(dy)	**Asp.(dy)**
Sperchon	*hispidus*	**Shi**	*Feltria*	*minuta*	**Fmi**
Sperchon	*mutilus*	**Smu**	*Feltria*	*setigera*	**Fse**
Sperchon	*squamosus*	**Ssq**	*Feltria*	*zschokkei*	**Fzs**
Sperchon	*thienemanni*	**Sth**	*Feltria*	*rubra*	**Fru**
Sperchon	sp. (dy)	**Ssp.(dy)**	*Feltria*	*sp. (dy)*	**Fsp.(dy)**
Lebertia	sp.	**Lsp.**	*Frontipodopsis*	*reticulatifrons*	**Fre**
Monatractides	*madritensis*	**Mma**	*Axonopsis*	*inferorum*	**Axin**
Torrenticola	*amplexa*	**Tam**	*Woolastookia*	*rotundifrons*	**Wro**
Torrenticola	*anomala*	**Tan**	*Ljania*	*macilenta*	**Ljma**
Torrenticola	*barsica*	**Tba**	*Lethaxona*	*cavifrons*	**Leca**

Torrenticola	*dudichi*	**Tdu**	*Aturus*	*crinitus*	**Atcr**
Torrenticola	*elliptica*	**Tel**	*Aturus*	*scaber*	**Atsc**
Torrenticola	*jeanneli*	**Tje**	*Aturus*	*spatulifer*	**Atsp**
Torrenticola	*similis*	**Tsi**	*Aturus*	sp. (dy)	**Atsp.(dy)**
Torrenticola	sp. (dy)	**Tsp.(dy)**	*Kongsbergia*	*alata*	**Kal**
Hygrobates	*calliger*	**Hca**	*Kongsbergia*	*clypeata*	**Kcl**
Hygrobates	*fluviatilis*	**Hfl**	*Kongsbergia*	*ruttneri*	**Kru**
Hygrobates	*foreli*	**Hfo**	*Kongsbergia*	sp. (dy)	**Ksp.(dy)**
Hygrobates	*nigromaculatus*	**Hni**	*Stygomononia*	*latipes*	**Stla**
Hygrobates	*norvegicus*	**Hno**	*Krendowskia*	*latissima*	**Kla**
Hygrobates	sp. (dy)	**Hsp.(dy)**	larvae		**la**

Table 3. Abbreviations used for sampling stations included in collection program

Catchment area	**Sampling station**	**Code**
Someşul Cald	Someşul Cald (downstream of the river's gorge)	**SC 1**
	Bătrâna (downstream of Molhaşul Mare from Izbuc)	**SC 2**
	Someşul Cald (upstream of Doda Pilii)	**SC 3**
	Valea Firii (downstream of Humpleu Cave)	**SC 4**
	Someşul Cald (upstream of Tarniţa Lake)	**SC 5**
Someşul Rece	Someşul Rece (at the springs)	**SR 1**
	Someşul Rece (downstream of Blăjoaia)	**SR 2**
	Someşul Rece (adduction from the catchment area of Arieş River)	**SR 3**
	Someşul Rece (downstream of Măguri-Răcătău)	**SR 4**
Someşul Mic	Someşul Mic (upstream of Cluj-Napoca)	**SM**

Table 4. Abbreviations used for data of the sampling

Abbreviation	**Data of the sampling**	**Abbreviation**	**Data of the sampling**
IV03	April 2003	**IV04**	April 2004
V03	May 2003	**V04**	May 2004
VI03	June 2003	**VI04**	June 2004
VII03	July 2003	**VII04**	July 2004
VIII03	August 2003	**VIII04**	August 2004
IX03	September 2003	**IX04**	September 2004
X03	Octomber 2003	**X04**	Octomber 2004
XI03	November 2003	**XI04**	November 2004

Table 5. Abbreviations used for the drift sample

Schedule of the drift sample	**Code**
6-6.30	**D6**
9-9.30	**D9**
12-12.30	**D12**
15-15.30	**D15**
18-18.30	**D18**
21-21.30	**D21**
24-24.30	**D24**
3-3.30	**D3**

7. Physico-chemical parameters of the water

To highlight the impact on water mite communities, a number of physico-chemical parameters: temperature (° C) pH, dissolved oxygen (mg / l) and conductivity (mS / cm) were analyzed.

PH values of the water at the sampling stations located in the catchment are of the Someşul Cald River stood about 8.5, with a 7.5 minimum and a maximum of 9.5, which reflects the alkaline nature of water in the area, due to limestone substrate. On Someşul Rece River, the situation is different, the pH value of the water source recorded the 5.24 minimum and 6.94 average value. At the SR2 and SR3 stations, pH values of the water ranged between 6 and 9.2 with an average of 7.85 and 8.19. At the Măguri-Răcătău downstream station (SR4) pH recorded the highest values on the Someşul Rece River with the 9.75 maximum and 8.72 average values. At the station located on Someşul Mic upstream of Cluj-Napoca, pH values ranged between 7.34 and 8.9 with an average of 8.01 (Fig. 2.).

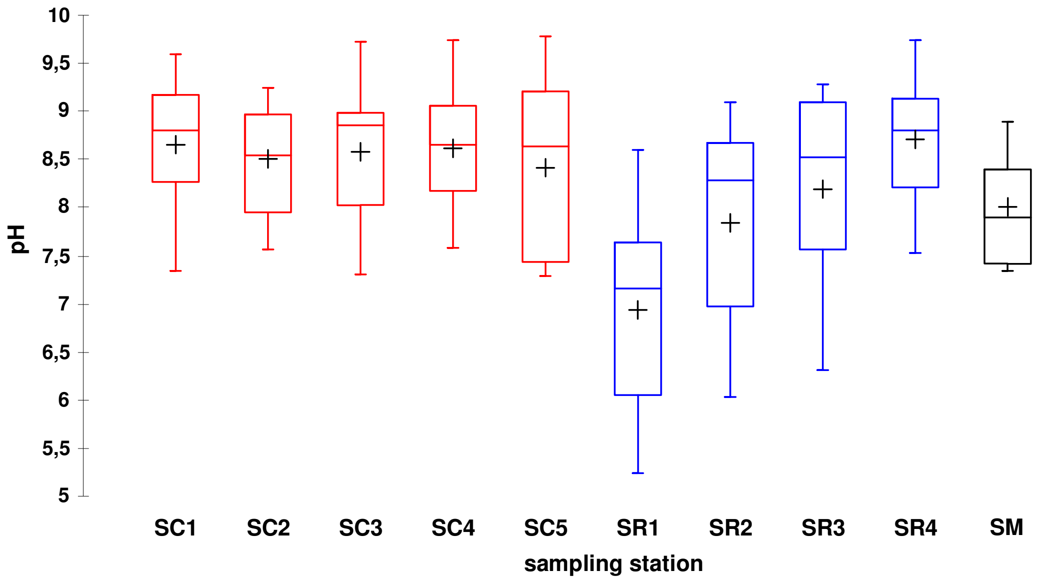

Fig. 2. pH values of the water at the sampling station of the Someşul Mic River catchment area (☐ 25%-75%; + mean; — median; I - Q1–1.5 (Q3–Q1) - Lower limit, Q3+1.5 (Q3–Q1) - upper limit (Q1- quartile 25%, Q3- quartile 75%); °; x outliers)

8. Benthic invertebrate communities in the studied area

At all 10 sampling stations, during the 2 years of study, frequency, percentage numerical abundance and density of taxa from benthic invertebrate communities were analyzed.

Annual average densities of benthic invertebrate taxa, at the stations surveyed in 2003 compared with 2004 are presented in the following tables 6 and 7.

Table 6. Annual average density (ind / m²) of benthic invertebrate taxa at stations on the Someşul Cald River in 2003 and 2004

Station/year	SC1		SC2		SC3		SC4		SC5	
Taxa	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**
Turbellaria	1,80	11,11	77,24	41,27	3,59	0,53	35,94	2,47	22,80	57,41
Nematoda	6,29	14,81	59,36	89,15	33,69	12,70	15,05	10,49	68,20	10,49
Molusca	3,59	3,70	31,25	63,49	2,70	0	0,45	0	54,64	49,69
Oligochaeta	34,14	85,19	238,60	266,93	1587,60	884,66	959,57	297,53	3154,68	566,36
Hydrachnidia	315,14	859,26	380,90	160,58	402,52	212,70	71,65	24,38	662,54	723,15
Amphipoda	4,49	18,52	20,64	5,56	0	1,06	126,24	15,74	3,54	1,23
Copepoda	3,14	0	11,01	0	113,66	0	3,82	0	0,98	0,62
Ostracoda	66,04	333,33	201,65	45,77	15,72	0,53	5,17	1,54	180,03	1,85
Coleoptera	24,93	144,44	733,29	308,99	516,62	149,74	75,02	16,36	452,24	491,36
Chironomidae	5082,43	39359,26	5079,60	4235,71	9685,53	8852,38	1685,98	4204,94	8056,41	2751,23
Alte diptere	268,87	651,85	432,98	176,19	521,56	295,77	215,41	97,22	322,52	221,91
Ephemeroptera	3217,88	10303,70	7940,64	2855,56	2861,19	1161,90	4373,99	513,89	2602,20	1509,57
Plecoptera	2129,16	4177,78	3971,31	2722,22	1567,39	757,67	2425,88	413,58	2081,76	1231,79
Trichoptera	2925,65	19600	1380,11	455,56	721,92	436,51	717,88	317,90	320,36	89,51
TOTAL	14083,56	75562,96	20558,57	11426,98	18033,69	12766,14	10712,04	5916,05	17982,90	7706,17

Table 7. Annual average density (ind / m²) of benthic invertebrate taxa at stations on the Someşul Rece and Someşul Mic Rivers in 2003 and 2004

Station/year	SR1		SR2		SR3		SR4		SM	
Taxa	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**
Turbellaria	7,19	14,81	200,08	481,48	28,89	259,26	38,13	51,85	0,39	0
Nematoda	234,05	170,37	85,69	144,44	28,69	37,04	102,20	33,33	125,79	166,67
Molusca	2,25	3,70	41,27	137,04	5,11	66,67	140,33	11,11	1718,75	172,22
Oligochaeta	1073	1470,37	1330,58	1262,96	248,82	1003,70	2762,58	2251,85	9884,04	10422,22
Hydrachnidia	194,74	203,70	244,50	2077,78	47,96	381,48	524,37	2348,15	127,95	50
Amphipoda	24,93	162,96	0,39	3,70	0,79	0	8,25	11,11	1715,21	161,11
Copepoda	1446,54	470,37	143,08	340,74	33,61	33,33	28,30	11,11	16,12	55,56
Ostracoda	643,08	1087,04	324,69	529,63	29,87	196,30	22,01	22,22	5,50	5,56
Coleoptera	8,31	7,41	1706,37	12514,81	222,48	2414,81	531,05	1607,41	79,80	0
Chironomidae	2450,81	5301,85	4227,59	14544,44	893,47	5637,04	5776,73	3459,26	10335,89	8766,67
Alte diptere	281,45	596,30	523,98	2429,63	136,79	1337,04	378,14	1337,04	726,42	227,78
Ephemeroptera	0	0	2718,95	16325,93	1965,21	5277,78	5075,86	15088,89	3483,10	3266,67
Plecoptera	4280,55	13092,59	968,55	2337,04	834,91	2900	159,98	566,67	0	0
Trichoptera	216,76	1031,48	3609,67	14344,44	1010,81	15400	1312,50	2811,11	3730,54	788,89
TOTAL	10863,66	23612,96	16125,39	67474,07	5487,42	34944,44	16860,46	29611,11	31951,06	24083,33

10179 is the total number of water mite individuals analyzed from all the 356 quantitative samples collected. In the 200 samples collected in 2003, 6695 individuals were identified, and in the 156 samples collected in 2004, 3484 individuals were identified. Distribution of the number of water mite individuals at all stations is represented in Fig. 3.

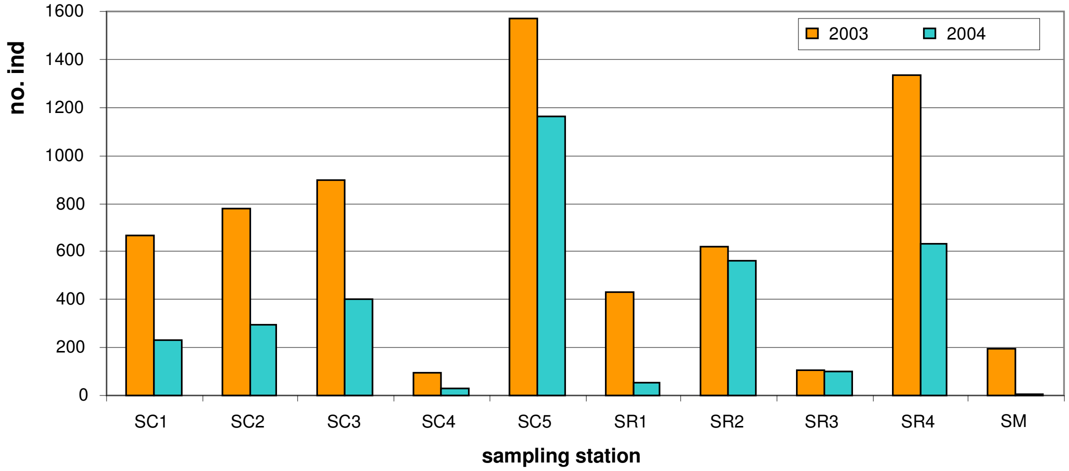

Fig. 3. Total number of water mite individuals from quantitative samples in 2003 compared to 2004 from the studied sampling stations

9. Species diversity of the water mite communities (Acari, Hydrachnidia) from the studied area

In the Someşul Mic catchment area, from the sampling stations considered in this study, 56 species of water mites (Acari, Hydrachnidia), which are systematically assigned in 10 families and 22 genera, were identified (Table 8.).

Table 8. List of identified water mite species and their presence in the Someşul Cald catchment area (SC), in the Someşul Rece River (SR) and at the station located on Someşul Mic River (SM)

No.	Family	Genera	Subgenera	Species	Author, year	SC	SR	SM
1	Hydryphantidae	***Panisellus***		***thienemanni***	(Viets, 1920)		x	
2	Hydryphantidae	***Panisus***		***michaeli***	Koenike, 1896		x	
3	Hydryphantidae	***Thyas***		***barbigera***	Viets, 1908	x		
4	Hydryphantidae	***Protzia***		***eximia***	(Protz , 1896)	x		
5	Hydryphantidae	***Protzia***		***invalvaris***	Piersig, 1898	x	x	
6	Hydryphantidae	***Wandesia***		***thori***	Schechtel, 1912	x		
7	Sperchontidae	***Sperchonopsis***		***verrucosa***	(Protz, 1896)	x	x	
8	Sperchontidae	***Sperchon***	Sperchon	***brevirostris***	Koenike, 1895	x	x	
9	Sperchontidae	***Sperchon***	Hispidosperchon	***clupeifer***	Piersig, 1896	x	x	x
10	Sperchontidae	***Sperchon***	Sperchon	***glandulosus***	Koenike, 1886	x	x	
11	Sperchontidae	***Sperchon***	Sperchon	***hispidus***	Koenike, 1895	x	x	x
12	Sperchontidae	***Sperchon***	Sperchon	***mutilus***	Koenike, 1895		x	
13	Sperchontidae	***Sperchon***	Sperchon	***squamosus***	Kramer, 1879		x	
14	Sperchontidae	***Sperchon***	Sperchon	***thienemanni***	Koenike, 1907		x	
15	Lebertiidae	***Lebertia***		***glabra***	Thor, 1897		x	
16	Lebertiidae	***Lebertia***		***insignis***	Neuman, 1880	x		
17	Lebertiidae	***Lebertia***		***stigmatifera***	Thor, 1900		x	
18	Lebertiidae	***Lebertia***		***schechteli***	Thor, 1913		x	
19	Torrenticolidae	***Monatractides***	Monatractides	***madritensis***	(Viets, 1930)	x	x	
20	Torrenticolidae	***Torrenticola***	Torrenticola	***amplexa***	(Koenike, 1908)	x	x	x

Continuation of theTable 8

No.	Family	Genera	Subgenera	Species	Author, year	SC	SR	SM
21	Torrenticolidae	***Torrenticola***	Torrenticola	***anomala***	(Koch, 1837)	x		x
22	Torrenticolidae	***Torrenticola***	Torrenticola	***barsica***	(Szalay, 1933)	x	x	x
23	Torrenticolidae	***Torrenticola***	Torrenticola	***dudichi***	(Szalay, 1933)	x	x	x
24	Torrenticolidae	***Torrenticola***	Torrenticola	***elliptica***	Maglio, 1909	x	x	
25	Torrenticolidae	***Torrenticola***	Torrenticola	***jeanneli***	(Motas & Tanasachi, 1947)	x		
26	Torrenticolidae	***Torrenticola***	Torrenticola	***similis***	(Viets, 1939)	x	x	
27	Hygrobatidae	***Hygrobates***	Hygrobates	***calliger***	Piersig, 1896	x	x	x
28	Hygrobatidae	***Hygrobates***	Hygrobates	***fluviatilis***	(Ström, 1768)			x
29	Hygrobatidae	***Hygrobates***	Hygrobates	***foreli***	(Lebert, 1874)	x	x	x
30	Hygrobatidae	***Hygrobates***	Hygrobates	***nigromaculatus***	Lebert, 1879	x	x	
31	Hygrobatidae	***Hygrobates***	Rivobates	***norvegicus***	(Thor, 1897)		x	
32	Hygrobatidae	***Atractides***	Atractides	***gibberipalpis***	Piersig, 1898	x	x	
33	Hygrobatidae	***Atractides***	Atractides	***latipes***	(Szalay, 1935)	x		
34	Hygrobatidae	***Atractides***	Atractides	***loricatus***	Piersig, 1898		x	
35	Hygrobatidae	***Atractides***	Atractides	***nodipalpis***	Thor, 1899	x	x	x
36	Hygrobatidae	***Atractides***	Atractides	***oblongus***	(Walter, 1944)	x	x	
37	Hygrobatidae	***Atractides***	Atractides	***tener***	Thor, 1899	x	x	
38	Hygrobatidae	***Atractides***	Tympanomegapus	***acutirostris***	(Motas & Angelier, 1927)	x		
39	Feltriidae	***Feltria***	Feltria	***minuta***	Koenike, 1892	x	x	
40	Feltriidae	***Feltria***	Feltria	***setigera***	Koenike, 1896	x	x	x
41	Feltriidae	***Feltria***	Feltria	***zschokkei***	Koenike, 1896	x	x	
42	Feltriidae	***Feltria***	Feltriella	***menzeli***	Walter, 1922	x	x	
43	Feltriidae	***Feltria***	Feltriella	***rubra***	Piersig , 1898	x		
44	Frontipodopsidae	***Frontipodopsis***		***reticulatifrons***	Szalay, 1954	x	x	
45	Aturidae	***Axonopsis***	Brachypodopsis	***inferorum***	Motaş & Tanasachi, 1947		x	
46	Aturidae	***Woolastookia***		***rotundifrons***	(Viets, 1922)	x	x	
47	Aturidae	***Ljania***		***macilenta***	Koenike, 1908	x	x	x
48	Aturidae	***Lethaxona***		***cavifrons***	Szalay, 1943	x	x	
49	Aturidae	***Aturus***		***crinitus***	Thor, 1902	x	x	x
50	Aturidae	***Aturus***		***scaber***	Kramer, 1875	x	x	x
51	Aturidae	***Aturus***		***spatulifer***	Piersig, 1904	x	x	x
52	Aturidae	***Kongsbergia***		***alata***	Szalay, 1954	x	x	
53	Aturidae	***Kongsbergia***		***clypeata***	Szalay, 1945		x	
54	Aturidae	***Kongsbergia***		***ruttneri***	Walter, 1930		x	
55	Momoniidae	***Stygomononia***		***latipes***	Szalay, 1943	x	x	
56	Krendowskiidae	***Krendowskia***		***latissima***	Piersig, 1895	x		

The 56 water mite species, identified in the Someşul Mic catchment area, represents 21.45% of the 261 species founded in Romania (Fig. 4). We can affirm that the species diversity of Hydrachnidia in the Someşul Mic catchmenta area is high, if we compare it with the surface. Someşul Mic catchment area, with a surface of 3773 km2 (Sofronie, 2000), represents 1.6% of the total area of Romania.

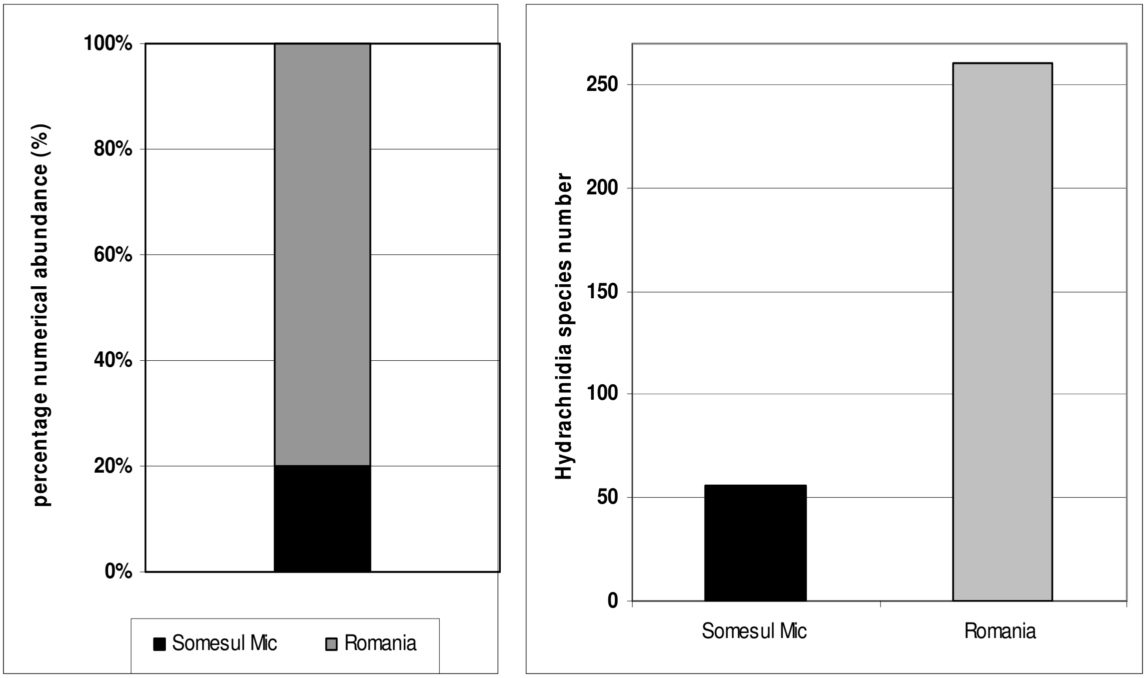

Fig. 4. Percentage numerical abundance (%) (left) and number of water mite species (right) from Someşul Mic catchment area compared with Romania

In the present study, from the 56 water mite species identified in the catchment area of Someşul Mic River, 40 are recorded for the first time in this area, 7 are new species reported for the fauna of Romania (Table 9.) of which 2 species are first reported in the Carpathian region: *Panisellus thienemanni* şi *Feltria menzeli.*

Table 9. List of new species recorded for the Romanian Fauna and their location

No.	Family	Genera	Species	Author, year	Location
1	Hydryphantidae	***Panisellus***	***thienemanni***	(Viets, 1920)	SR1 - hyporheic
2	Hydryphantidae	***Thyas***	***barbigera***	Viets, 1908	bog from Ic Ponor - zoobenthic
3	Sperchontidae	***Sperchon***	***mutilus***	Koenike, 1895	SR1 - zoobenthic and hyporheic
4	Torrenticolidae	***Torrenticola***	***barsica***	(Szalay, 1933)	SC2, SC3, SC5, SR2, SR3, SR4, SM - zoobenthic
5	Torrenticolidae	***Torrenticola***	***similis***	(Viets, 1939)	SC2, SC3, SC5, SR4 - zoobenthic
6	Atractides	***Atractides***	***latipes***	(Szalay, 1935)	SC5 - zoobenthic
7	Feltriidae	***Feltria***	***menzeli***	Walter, 1922	Someşul Cald Gorge - drift

10. The structure of the water mite communities form the studied rivers

Frequency, percentage numerical abundance and species density of Hydrachnidia, at the 10 sampling stations, during the 2 years of study, were examined. In the present study the following diversity indices: Shannon-Wiener, Simpson Menhinick, Margalef and Jaccard index for the analysis of similarity between stations based on water mite communities were applied.

In Someşul Cald catchment area, at the SC1 and SC4 stations, affected by low water temperature and SC5 station, influenced by the Fântânele-Beliş dam, low values of Shannon-Wiener diversity index are present. With lower values of Shannon-Wiener index based on water mite communities from Someşul Rece stations, are present at river sources, SR1 characterized by acid pH and low temperatures. Also, in the station located on Someşul Mic, upstream of Cluj-Napoca, which is anthropically influenced, we remark low values of Shannon-Wiener diversity index (Fig. 5.).

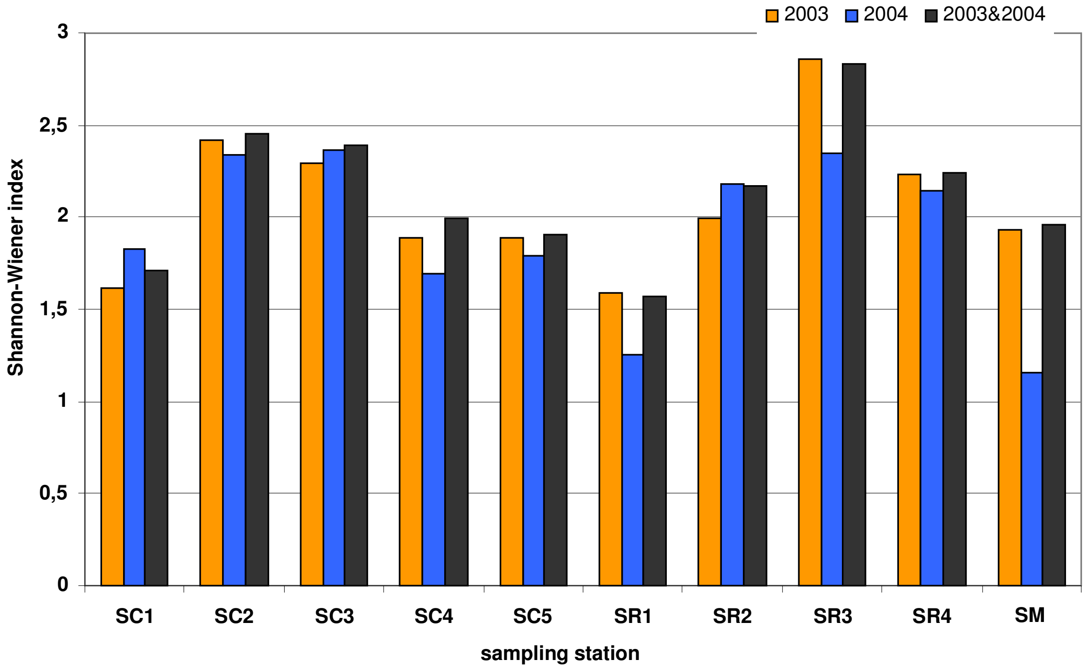

Fig. 5. Value of the Shannon-Wiener diversity index of the water mite communities, from samples in 2003 compared to 2004 from the studied sampling stations

Jaccard index revealed similarity based on water mite communities composition ot the different sampling stations, especially highlighted the differences between certain stations. It was noted the station from the source of Someşul Rece River, which by specific abiotic conditions provide a water mite community very different from the rest stations and the station from Somesul Mic, upstream of Cluj-Napoca, which, due to antropic influences, the water mites community is also different (Fig. 6.).

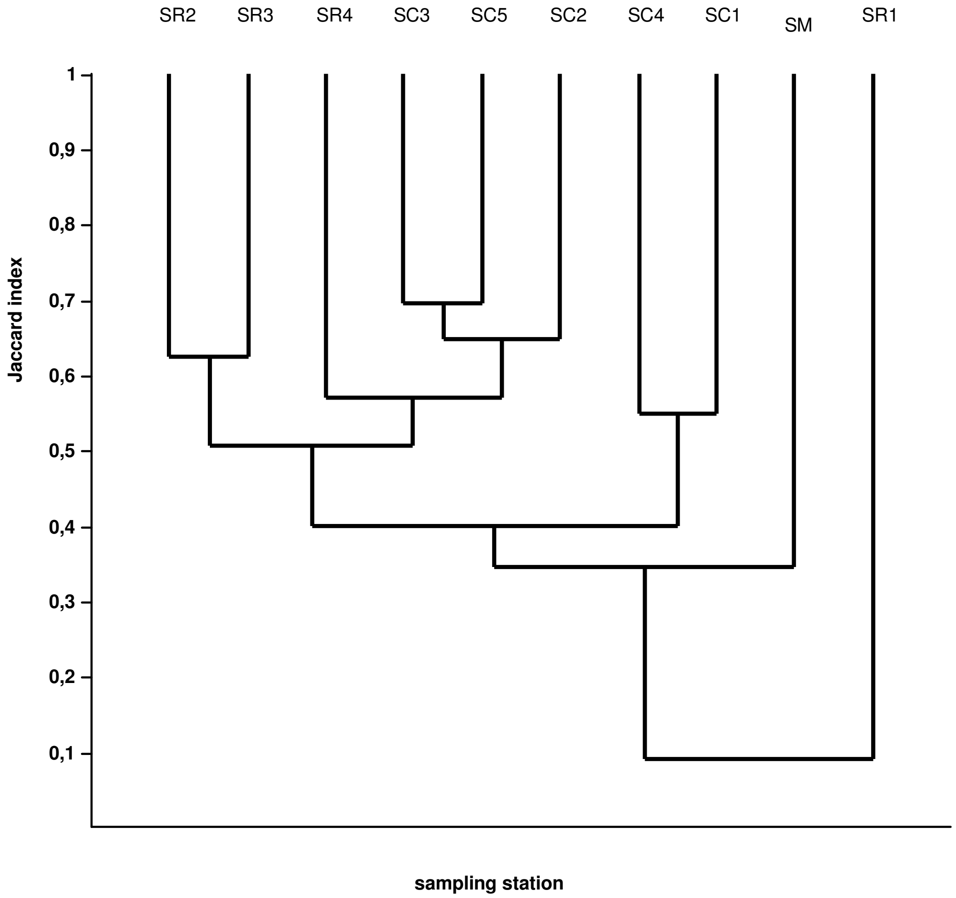

Fig. 6 The similarity of sampling stations based on water mite communities, calculated using the Jaccard index

Dispersion Index (ID) and $\chi 2$ test was applied to test spatial distribution patterns of water mite species. For species with clumpled distribution was calculated Green Index (GI), to calculat the degree of clustering. Most water mite species were clumpled distribution, but with low clustering degree.

Multivariate analyses were performed (Principal Component Analysis (PCA) and Canonical Correspondence Analysis (CCA)) to depict the relations between the environmental parameters and the water mite communities.

A Principal Component Analysis (PCA) was performed based on the mean of the water physico-chemical parameters (dissolved oxygen (mg/l), water conductivity (µS/cm), water temperature (°C) and pH) measured in sampling sites from Someşul Mic hydrographic basin. PCA factors explained 75.90% of the total variance (Fig. 7.). The first PCA factor explained 45.83% of the total variance and was positively correlated with conductivity (r - 0,897) and with water temperature (r - 0,616). The second PCA factor accounted for 30.07%

of the total variance and was positively correlated with pH (r - 0,669) and with the amount of dissolved oxygen (r – 0,665).

Three groups of sites were distributed on F1 as follows: 1. sites SR1, SR2 and SR3, where the measured values of conductivity and temperature were low; 2. sites SC1, SC3, SC4, SC5 and SR4; 3. SC2 and SM. The last two sites were linked due to high values of conductivity (SC2) and conductivity and temperature (SM) measured here. F2 was related to two groups of sites: SC3, SC4, SC5 and SR3 with high values of dissolved oxygen and slightly alkaline pH values; and SR1 and SR2 are more isolated based on their slightly acid pH values (Fig. 7.).

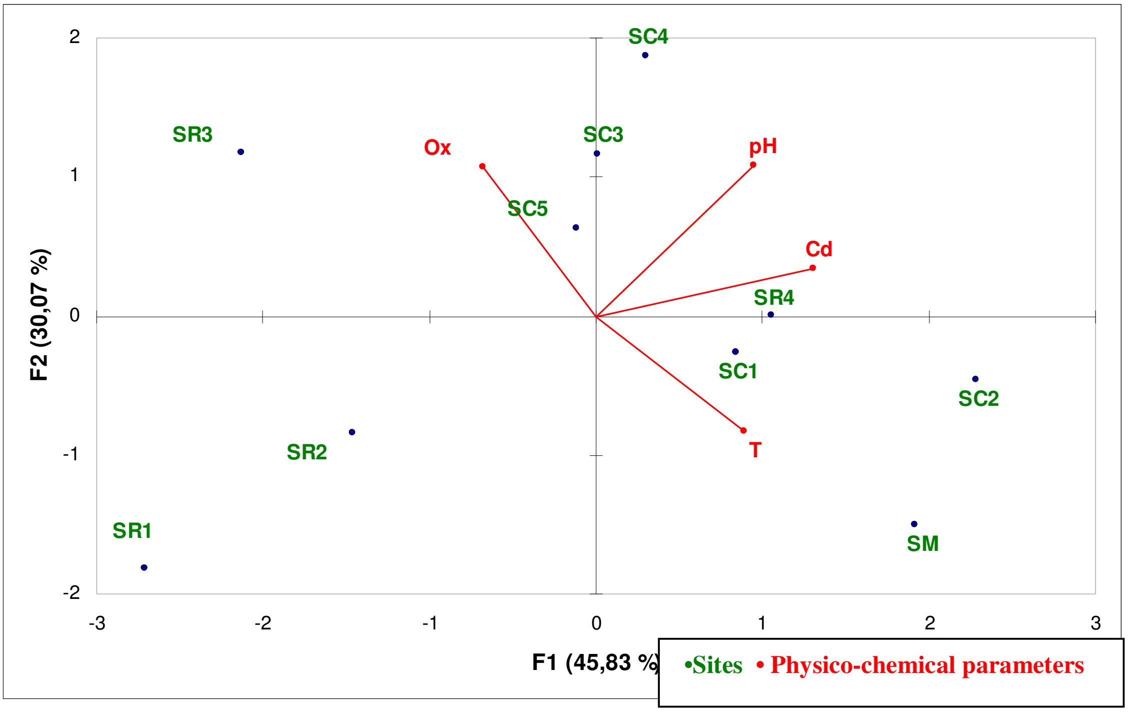

Fig. 7. Principal Component Analysis based on the water physico-chemical parameters in Sites from Someşul Mic hydrographic basin (Ox- dissolved oxygen (mg/l), Cd – water conductivity (µS/cm), T – water temperature (°C)) (for other abbreviations see table 3)

To explain the relationship between the water mite communities and water physico-chemical parameters (dissolved oxygen (mg/l), water conductivity (µS/cm), water temperature (°C) and pH), Canonical Correspondence Analysis (CCA) was computed (Fig. 8.). The first two factors corresponded to 72.69% of the total variance. The first axis accounted for 41.81% of the species-parameters relationship and was a gradient of decreasing pH. Crenobiont or crenophil, stenotherm species (*Panisus michaeli, Sperchon mutilus, S. squamosus, S. thienemanni, Hygrobates norvegicus, Atractides loricatus)* were distributed along this axis, and were sampled at SR1, where the pH was slightly acid. The second axis (30.78%) was strongly correlated with water temperature and with dissolved oxygen. The species were linked based on the water temperature: *Hygrobates fluviatilis,* an euritherm species (Di Sabatino şi colab., 2000a), together with *Aturus spatulifer* were present at one site with high water temperature values (SM). Exactly contrary to the distribution of the previous species, species inhabiting the hyporheic habitat were grouped: *Woolastookia rotundifrions, Wandesia thori, Krendowskia latissima, Stygomononia latipes* (Tanasachi & Orghidan, 1955; Schwoerbel, 1961a; Motaş & Tanasachi 1963; Petrova, 1968; Gerecke, 1994, 1999; Di Sabatino et al., 2000b; Gerecke et al., 2009), together with *Sperchon brevirostris, Atractides oblongus, Atractides gibberipalips şi Feltria rubra,* in sites characterized by low water temperature (SC1, SC2 and SC4). The temperature was reduced due to the upwelling phenomenon. The species belonging to *Torrenticola* genus were distributed in SC3, SC5 and SR4 (pH slightly alkaline). These species are pH-tolerante (Di Sabatino et al., 2000b). In SR2 and SR3 characterized by low conductivity and temperature values *Hygrobates caliger, H. foreli*, *Sperchon glandulosus, S.clupeifer, Atractides tener* and *Feltria zschokkei* are scattered.

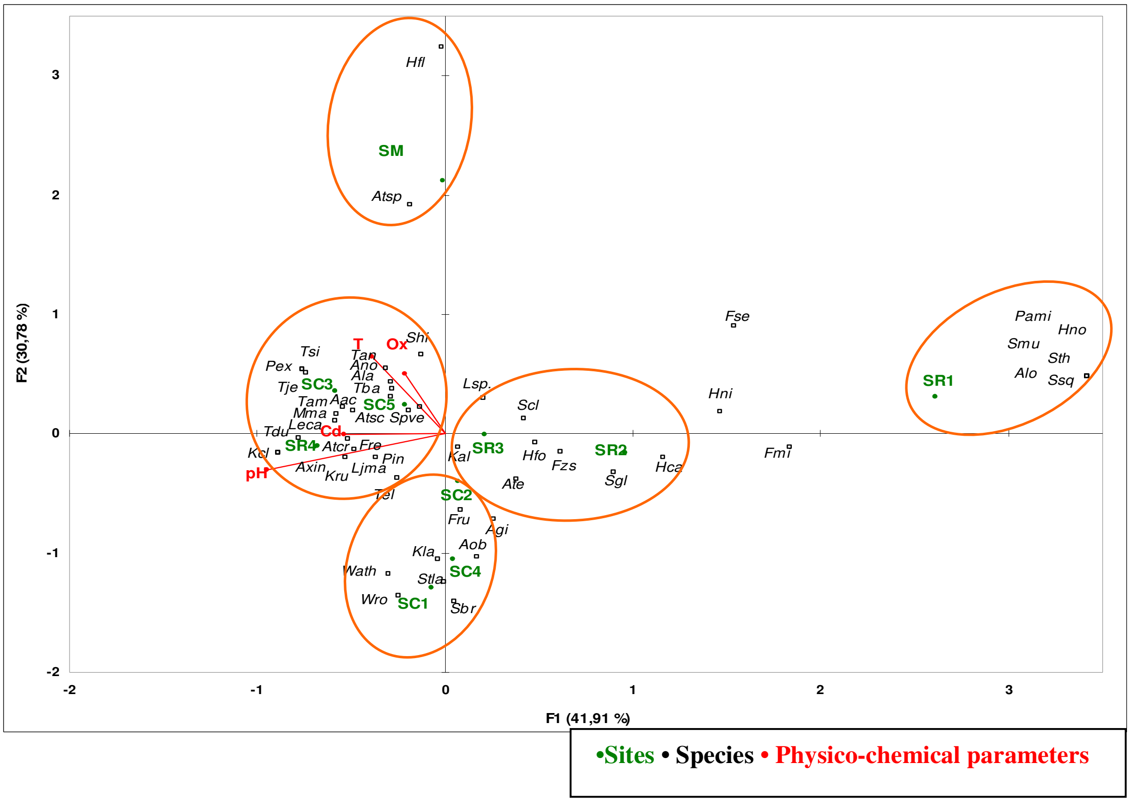

Fig.8. Canonical Correspondence Analysis based on the water mite species and physico-chemical parameters in sites from Someşul Mic hydrographic basin (Ox- dissolved oxygen (mg/l), Cd – water conductivity (µS/cm), T – water temperature (°C)) (for other abbreviations see table 2 and 3)

11. Water mites drift

Water mites drift was studied in this paper from Somesul Cald Gorges, on 10-11 August 2005. Hydrachnidia group presents the highest values of number of individuals present in the drift during the day, with maximum of 100 individuals (average between the two samples of drift at the same time) recorded at 12 o'clock, after which the number of individuals decreases during the night when 3-4 individuals are present in the drift (Fig.9.). 667 individuals of water mites systematically assigned in 18 species were present in drift samples (Table 10.).

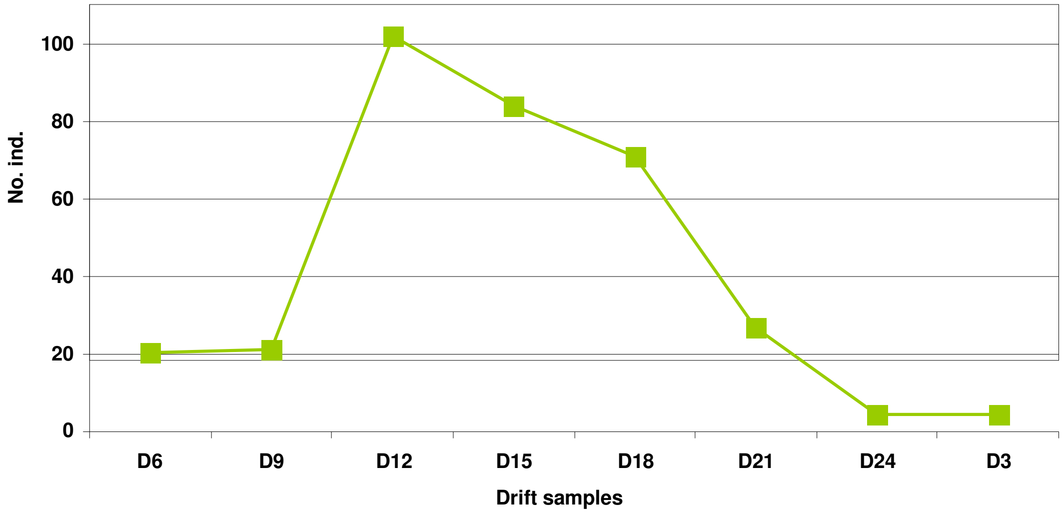

Fig. 9. The number of Hydrachnidia individuals in drift samples

Tabel 10. List of water mite species and percentage numerical abundance (%) from drift samples

Genera	Species	Percentage numerical abundance (%)
Panisus	*michaeli*	0,60
Sperchon	*brevirostris*	35,68
Sperchon	*glandulosus*	5,40
Sperchon	*thienemanni*	0,30
Sperchon	*hispidus*	0,00
Lebertia	sp.	11,69
Torrenticola	*elliptica*	0,15
Torrenticola	sp. (dy)	0,15
Hygrobates	*foreli*	0,75
Hygrobates	sp. (dy)	12,59
Atractides	*gibberipalpis*	3,45
Atractides	*nodipalpis*	8,85
Atractides	*oblongus*	0,75
Atractides	*tener*	1,05
Atractides	sp.(dy)	7,20
Feltria	*rubra*	4,65
Feltria	*menzeli*	2,70
Woolastookia	*rotundifrons*	0,60
Ljania	*macilenta*	0,60
Aturus	*crinitus*	0,30
Aturus	*spatulifer*	0,30
larvae		2,25

The overall pattern of water mites' distribution in drift samples at site located in Someşul Cald Gorge, was explained by PCA. The PCA factors explained 67.24 % of the total variance of water mites from drift samples collected over a period of 24 hours (Fig. 10.). First PCA axis (46.83%) was positively correlated with all water mite species, except *Ljania macilenta, Feltria rubra* and *Woolastookia rotundifrons*, negatively correlated with this axis. Two groups were formed: one linking the samples collected during the day (D12-D15-D18), and the second grouping samples collected during the night, in the morning and in the evening (D6, D9, D21, D24 and D3). Therefore we conclude that the light is the most important parameter that shaped the species distribution in drift samples, and that the majority of species had a day drift.

The second axis (20.41%) was positively correlated with *Aturus oblongus* and *Feltria menzeli*, both being abundant in samples collected at 9, respectively 12 o'clock (D9-D12). *Woolastookia rotundifrons* very abundant in the samples collected at 6 o'clock (D6) was negatively correlated with F2 (Fig. 10.).

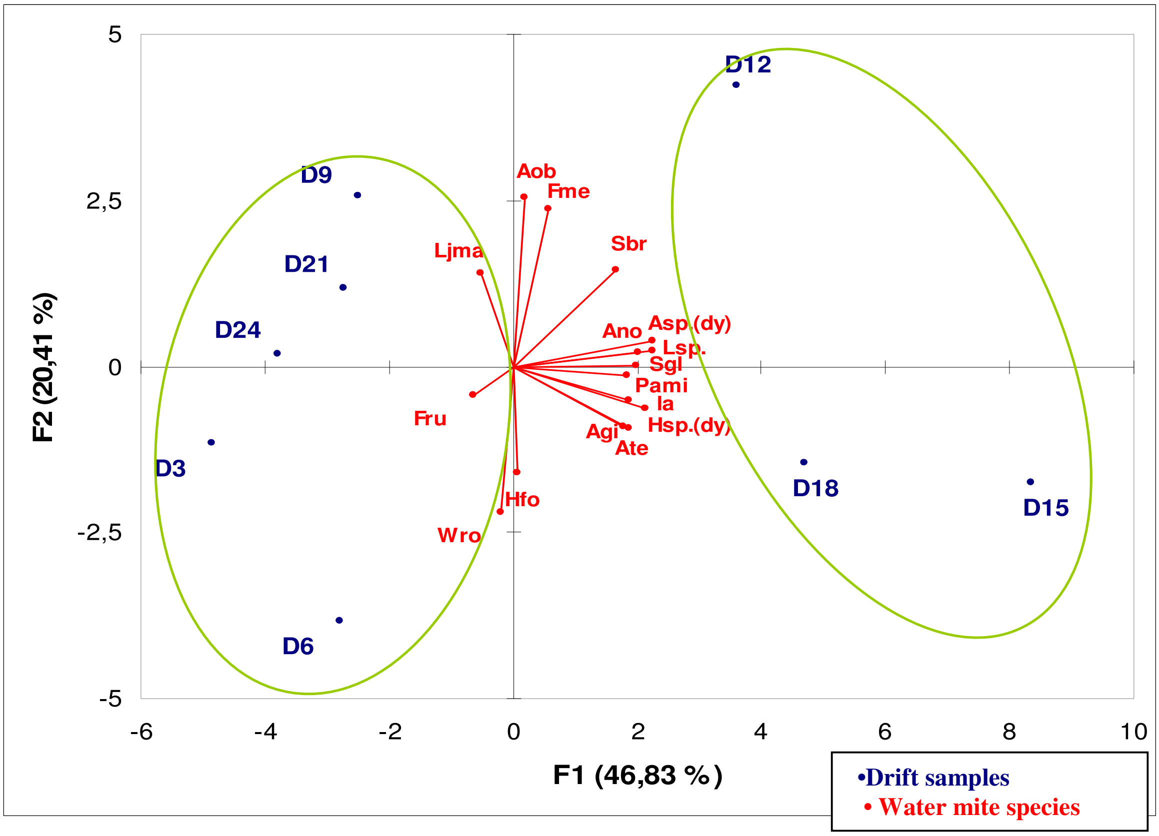

Fig. 10. Principal Component Analysis based on the water mite species from drift samples from Someşul Mic hydrographic basin (for other abbreviations see table 2 and 5)

To visualize the temporal variation of water mite species related to physico-chemical parameters of the drift samples (dissolved oxygen (mg/l), air temperature (°C) and water temperature (°C), Canonical Correspondence Analysis (CCA) was performed. In the resulting plot (Fig. 11.) species and samples were ordered in the environmental space. The cumulative percentage variance of species-environment relationship was 83.59% for the first two canonical axes. The CCA axis 1 (47.67%) was strongly correlated with increasing air temperature. Almost all taxa were distributed along this axis, except *Atractides oblongus, A. tener* and larvae, which were related to the second one (35.92%) that was negatively correlated with water temperature. Consequently, *Atractides oblongus* was identified only in samples from 9 and 12 o'clock (D9 - D12), and *A. tener* and larvae were more abundant in samples from 15 and 18 o'clock D15-D18).

The samples collected at noon (D12-D15) were related to the first CCA axis, when the most abundant species *Sperchon brevirostris*, recorded the highest densities (almost 100 individuals over this period). The samples collected during the night D24-D3 are linked due to high densities encountered by *Woolastookia rotundifrons, Feltria rubra, F.menzeli* and *Ljania macilenta* (Fig. 11.). The remaining species are present in samples from morning and evening.

In conclusion, it can be argued that most species of water mites are active in drift during the day, an exception to this rule are crenophilous species *Feltria rubra* and *F. menzeli*, who have no preference for day drift, and hyporheobiont species, *Woolastookia rotundifrons* and *Ljania macilenta*, which also appeared in drift samples both diurnal and nocturnal. Probably because of water mites bright colour a defense system (Kerfoot, 1982), these organisms are not fish prey are rarely found in their stomach (Elliott & Minshall 1968, Bishop & Hynes 1969).

An intense activity has been present in drift samples throughout the day. Searching for food can be a parameter that determines water mites drift throughout the day. Therefore there can be a behavioral drift, but certainly not the only parameter influencing.

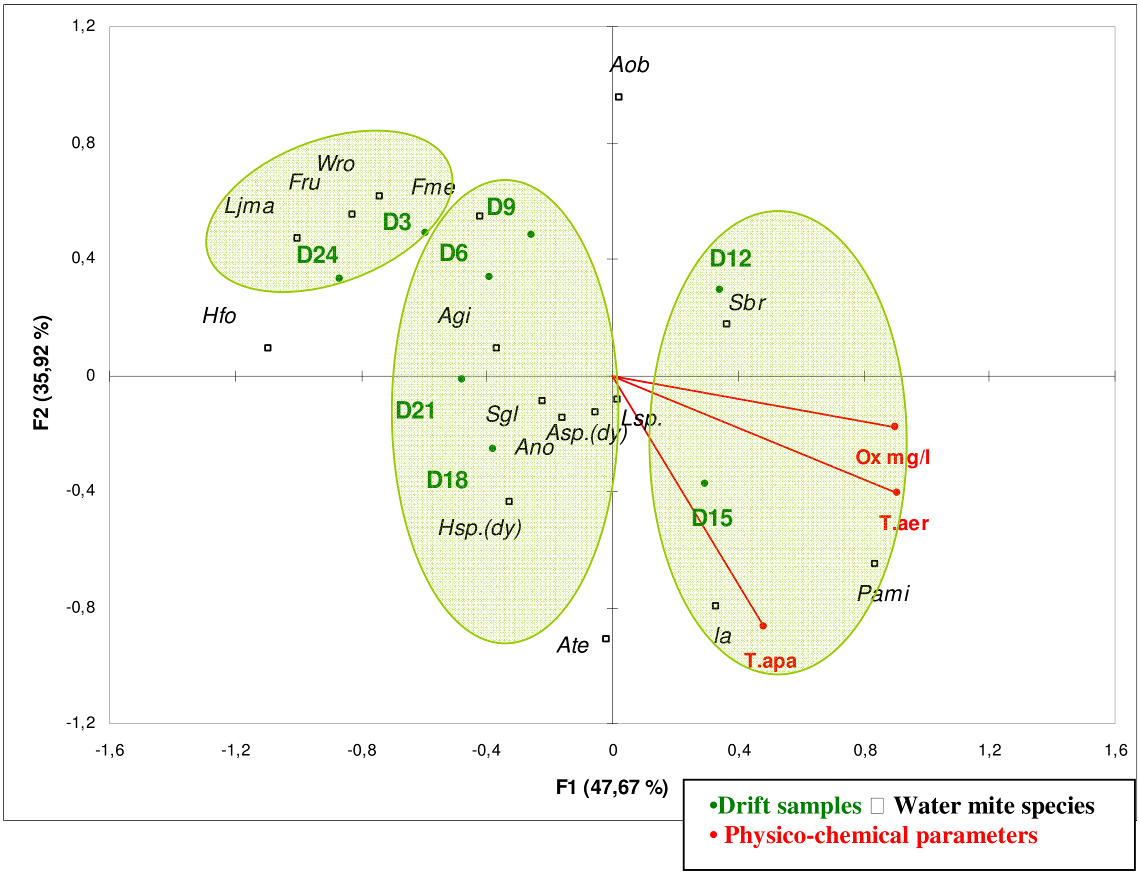

Fig. 11. Canonical Correspondence Analysis based on the water mite species and physico-chemical parameters from drift samples from Someşul Mic hydrographic basin (Ox- dissolved oxygen (mg/l), T.aer – air temperature (°C), T.apa – water temperature (°C)) (for other abbreviations see table 2 and 5)

12. The role of water mites as water quality indicators

In this paper we propose to apply compared four biotic indices calculated based on benthic invertebrate communities to have a more complete view of water quality. The results of these indices will be raised with water mite community structure and diversity indices to highlight the possibility of using this group of invertebrates to assess water quality.

Thus, to study water quality in the Somesul Mic catcment area, in addition to the 10 sampling stations included in the intensive program, were also fixed a station downstream of Cluj-Napoca, downstream of waste water treatment plant located at the following GPS coordinates N $46^{0}47'29.1''$/ E $23^{0}41'7.9''$ and codified - SE.

To asses water quality at the 11 stations from the Someşul Mic catchment area, were used the next four European biotic indices: BMWP (Biological Monitoring Working Party), developed in Britain (Walley & Hawkes, 1996, 1997), later adapted for Poland, ASPT (Average Score Per Taxon), IBE - Extended Biotic Index (Ghetti, 1997), which is used in

Italy and IBGN, Normalised Global Biotic Index (AFNOR, 2000), which is used in France. The results are summarized in table 11

Tabel 11. Water quality class at studied sampling station based on biotic indices

Station code	Water quality class based on biotic indices			
	BMWP	**ASPT**	**IBGN**	**IBE**
SC1	**I**	**I**	**I**	**I**
SC 2	**I**	**II**	**I**	**I**
SC 3	**II**	**II**	**II**	**I**
SC 4	**III**	**II**	**II**	**I**
SC 5	**II**	**II**	**II**	**I**
SR 1	**II**	**III**	**II**	**I**
SR 2	**I**	**II**	**I**	**I**
SR 3	**I**	**II**	**I**	**I**
SR 4	**I**	**II**	**II**	**I**
SM	**IV**	**IV**	**III**	**II**
SE	**V**	**V**	**V**	**V**

A negative correlation between the Simpson diversity index calculated using water mite communities and quality class based on biotic indices with higher value of Spermann correlation coefficient (rs = - 0.74 and p = 0.008) was emphasized (Fig. 12.).

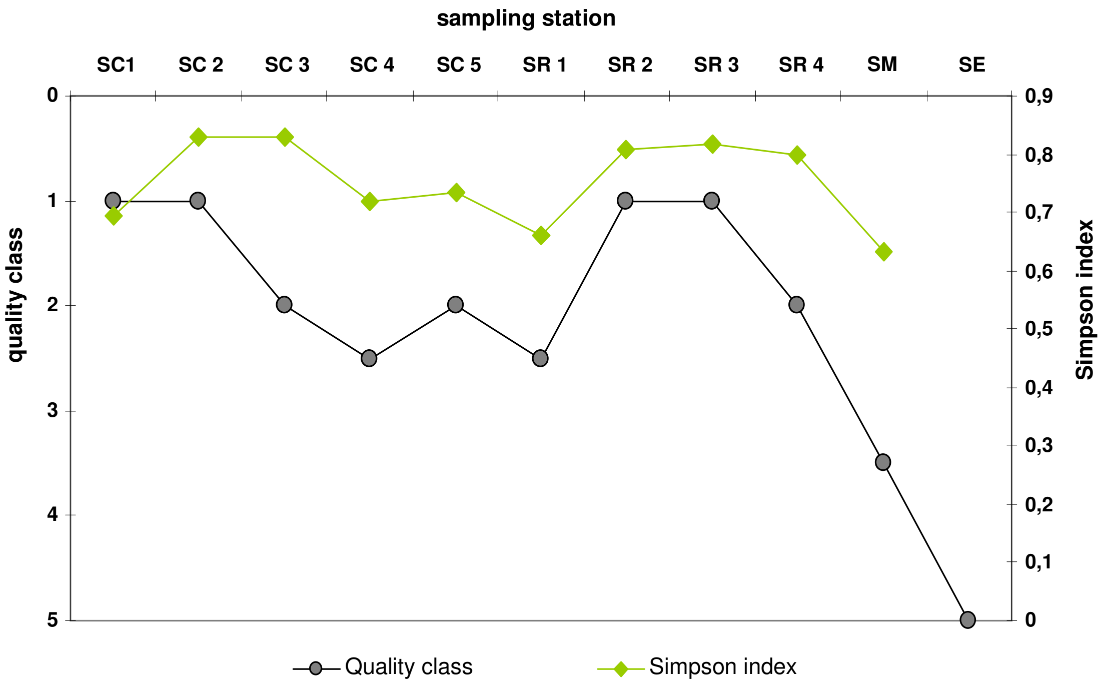

Fig. 12. Variation of Simpson index calculated based on water mite species and the water quality classes, at the stations investigated

The presence of water mite species in quality class is summarized in the table 12. In fifth quality class no water mite species was recorded.

Tabel 12. The presence of water mite species in quality class (**x** - 1-5 ind/m^2, **xx** - 6-20 ind/ m^2, **xxx** – 11-50 ind/ m^2, **xxxx** – 51-100 ind/m^2, **xxxxx** – peste 100 ind/m^2 – average density of the two years sampling, 2003-2004)

		QUALITY CLASS				
Genera	**Species**	**I**	**II**	**II-III***	**III-IV**	**V**
Feltria	*zschokkei*	x				
Feltria	*rubra*	xx				
Wandesia	*thori*	x	x			
Monatractides	*madritensis*	x	xx			
Torrenticola	*similis*	x	xxx			
Atractides	*gibberipalpis*	xx	x			
Atractides	*acutirostris*	x	x			
Frontipodopsis	*reticulatifrons*	x	x			
Woolastookia	*rotundifrons*	xxx	x			
Kongsbergia	*alata*	x	x			
Protzia	*invalvaris*	x		xx		
Sperchonopsis	*verrucosa*	x	x	x		
Sperchon	*brevirostris*	xxxx	xx	xx		
Sperchon	*glandulosus*	xxxx	x	x		
Torrenticola	*elliptica*	xxxx	xxxx	xx		
Hygrobates	*nigromaculatus*	x	x	x		
Atractides	*oblongus*	x	x	x		
Atractides	*tener*	xx	x	x		
Feltria	*minuta*	x	x	x		
Stygomononia	*latipes*	x	x	x		
Sperchon	*clupeifer*	xxx	xxx		x	
Sperchon	*hispidus*	x	xx		x	
Torrenticola	*amplexa*	xx	xxxxx		x	
Torrenticola	*barsica*	xx	xxxx		x	
Torrenticola	*dudichi*	x	xxx		x	
Aturus	*crinitus*	x	xx		x	
Aturus	*scaber*	xx	xx		x	
Aturus	*spatulifer*	x	x		x	
Lebertia	*sp.*	xxxx	xxxx	xxx	xxx	
Hygrobates	*calliger*	xxxx	x	x	x	
Hygrobates	*foreli*	x	x	x	x	
Atractides	*nodipalpis*	xx	xxx	x	xxx	
Ljania	*macilenta*	x	xx	x	x	
Feltria	*setigera*	x	x	x	x	
Torrenticola	*anomala*		xx		x	
Protzia	*eximia*		x			
Torrenticola	*jeanneli*		x			
Atractides	*latipes*		x			
Axonopsis	*inferorum*		x			
Lethaxona	*cavifrons*		x			
Kongsbergia	*clypeata*		x			
Kongsbergia	*ruttneri*		x			
Krendowskia	*latissima*		x	x		
Panisus	*michaeli*			x		
Sperchon	*mutilus*			xxx		
Sperchon	*squamosus*			x		
Sperchon	*thienemanni*			x		
Atractides	*loricatus*			xxx		
Hygrobates	*norvegicus*			x		
Hygrobates	*fluviatilis*				xxx	

* SC4 and SR1 stations had a low number of taxa and have been assigned the limit of class II-III, due to environmental conditions (low temperature of the water), not due to pollution

Hydrachnidia group can be used in water quality assessment studies successfully only if the identification to species level is done. Simpson diversity index, calculated based on water mite species, has yielded good results in its correlation with water quality classes based on biotic indices.

Hygrobates fluviatilis is the most tolerant to pollution species, and its presence and density can indicate us a degree of degradation/pollution of the aquatic environment.

Using water mites in water quality assessment is valid plus due to interspecific relationships which require the presence in rivers of other aquatic invertebrate taxa to complete life cycle (adults are predators and larvae are parasites at several groups of invertebrates).

The conclusions of the study require greater use of water mites in assessing water quality in other sampling points also, to have a more complex image.

Conclusions of the thesis

To accomplish the study of water mite communities 10 zoobenthic sampling stations were established, 356 quantitative samples were collected and 10,179 individuals of Hydrachnidia were identified.

Frequency of water mites in all samples was 92.1% and density of Hydrachnidia ranged between 50 - 2348.15 individuals/m^2 (annual average).

At all sampling stations, from the dynamics densities of water mites we noted that densities are highest in summer. Depending on the dominant species present from Hydrachnidia at a station, the period of emergence of these host species, the success rate of returning larvae in the aquatic environment and expanding the life cycle, we have maximum densities of adults in June, July or August. There is a significant positive correlation between water mite density and temperature in many aquatic sampling stations.

In the Someşul Mic catchment area, at the sampling points considered in this study 56 water mite species (Acari, Hydrachnidia) were identified, which systematically were assigned in 10 families and 22 genera, representing 21.45% of total 261 species present throughout Romania.

Of the 56 species of water mites identified in this study, 40 are reported for the first time in the catchment area of Someşul Mic River, 7 are new species reported for the Roumanian fauna: *Thyas barbigera, Sperchon mutilus*, *Torrenticola similis, Torrenticola* *barsica, Atractides latipes, Feltria menzel, Panisellus thienemanni*, and the last two species are reported for the first time in the Carpathian region.

Feltria menzeli is a candidate for the Red List of rare species of fauna of water mites in Central Europe. By reporting this species for the first time in the Carpathian region, its area extends far into Eastern Europe, so far only been reported in Italy, the Alps, the Canary Islands and North Africa.

The highest frequency values, in the 356 samples analyzed, was registred for *Atractides*, *Torrenticola* and *Sperchon* genera. From *Atractides* genera, with high frequencies calculated on all samples, were the following species: *A. nodipalpis* with the highest frequency of over 30%, *A. gibberipalips* with 22.47% and deutonymphae of these genera with a frequency over 32%. *Sperchon* genera presented two species, *S. brevirostris* and *S. glandulosus*, with frequencies exceeding 20%, calculated on all samples. *Torrenticola amplexa* and *T. elliptica* also showed frequencies above 20%.

Strong seasonal influence on the dynamics of species densities of water mites was noted, thus *Torrenticola* genera species densities had high values in spring-summer and the species of *Atractides*, *Hygrobates* and *Sperchon* had higher densities in summer-autumn period. *Frontipodopsis reticulatifrons, Wandesia thori, Woolastookia rotundifrons*, *Kongsbergia alata, K. clypeata*, *K. ruttneri, Stygomononia latipes, Ljania macilenta*, *Krendowskia latissima* and *Axonopsis inferorum*, typical hyporheic species, appeared sporadically, with low densities in the spring and early summer, in zoobenthic samples, being driven from hyporheic area because of the high water flows, a result of melting snow.

It is noted that indices of diversity and equitability, calculated based on water mite communities identified to species level, revealed, in addition to the anthropic influence (organic pollution), the one of the physico-chemical parameters (pH, temperature), the influence of dams and hydro facilities too.

Jaccard similarity index revealed similarity based on the specific composition of the different sampling stations, especially highlighted the differences between communities of water mite at some stations. The station from the sources of Someşul Rece River was noted, which by specific abiotic conditions provides a community of water mites very different from the rest of the stations and from the station located on Someşul Mic River upstream of Cluj-Napoca City which, due to the anthropic influence, has a specific community also different.

Most species of water mite had a clumpled distribution, but with a low degree. *Torrenticola* genera had the most species with high degree of clustering: *T.elliptica* at SC2 and SC3 stations, *T. amplexa* at SC5 and SR4 and *T. similis* at SC3 station. From *Sperchon* genera, *S.brevirostris* and *S. glandulosus* had the highest degree of clustering at SC1 and SR2 stations. *Atractides nodipalpis* had a high degree of clustering at SC5 and SM stations, *Hygrobares calliger* at SR2, *Feltria rubra* at SC2, and *Woolastookia rotundifons* at SC1 station.

Distribution analysis of water mites based on physico-chemical parameters of water at 10 sampling stations performed using canonical correlation analysis highlighted results similar to those obtained by analysis of similarity based on Jaccard index and emphisezed the same group of stations.

Most water mite species present in samples of drift are active during the day, an exception to this rule are are crenophilous species, *Feltria rubra* and *F. menzeli*, who have no preference for day drift., and hyporheobiont species, *Woolastookia rotundifrons* and *Ljania macilenta*, which also appeared in drift samples both diurnal and nocturnal. The search for food can be a parameter that determines the water mites to appear throughout the day in the drift, so we can talk about one behavioral drift.

Hydrachnidia group can be used in water quality assessment studies successfully only if the identification to species level is done. Simpson diversity index, calculated based on water mite species, has yielded good results in its correlation with water quality classes based on biotic indices. *Hygrobates fluviatilis* is the most tolerant to pollution species, and its presence and density can indicate us a degree of degradation/pollution of the aquatic environment.

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