DATA ON CILIATES (PROTOZOA: CILIOPHORA) FROM THE AQUATIC ENCLOSURE OF CONSTANȚA NATURAL SCIENCES MUSEUM COMPLEX

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Abstract. *The hereby research paper contains data referring to the ciliates communities which populate the sedimentary field from the aquatic field of the section Micro-reservation/CMSN, resulted out of the embankment of a part of Tabacarie Lake. The data related to the structure of the species are accompanied by corresponding information related to the ecology of each of the 34 species that were identified. In the quality composition of the epibiosis of the basins with salt water from Delfinariu, basins that discharge part of their water in the aquatic field to which this paper refers to, there has been identified an interesting diversity of ciliates belonging to 74 species, with high resistance to significant variations of salinity and sodium hypochlorite concentration. This research paper also discusses the range of species identified in the field of sweet water, comparatively with the structure of ciliate list from marine water.*

Keywords: *ciliates, ecological features, basins within Constanța Museum Complex.*

Rezumat. Date privind ciliatele (Protozoa: Ciliophora) din incinta acvatică de la Complexul Muzeal de Ştiinţe ale Naturii Constanța. *Actuala lucrare cuprinde date referitoare la comunitățile de ciliate care populează domeniul sedimentar şi perifitonul din incinta acvatică a secției Microrezervație/CMSN, rezultată prin indiguirea unei secțiuni a lacului Tăbăcărie. Datele privind structura în specii sunt însoțite de informații referitoare la ecologia fiecăreia din cele 34 de specii identificate. În compoziția calitativă a epibiozei bazinelor cu apă sărată de la Delfinariu, bazine care îşi deversează o parte a apelor în incinta acvatică la care se face referință, a fost identificată o diversitate interesantă de ciliate aparținând la 74 de specii, rezistentă la variații semnificative ale salinității şi concentrației de hipoclorit de sodium. Lucrarea ia în discuție gama de specii întâlnite în condiții de apă dulce, comparativ cu structura listei de ciliate din apa marină.*

Cuvinte cheie: *ciliate, caracteristici ecologice, bazine în incinta Complexului Muzeal Constanța.*

INTRODUCTION

The ciliates are protozoa which populate the majority of freshwater aquatic and marine environments characterized by a great ecological plasticity.

The Romanian specialised literature is poor in information regarding the ciliofauna of the paramarine lakes, except for Techirghiol Lake (TUCULESCU, 1965).

The poor information regarding the ciliofauna characteristic to the above mentioned ecosystems would be the result of the difficulty to analyse the samples due to low dimensions (rendered in micrometers) of the ciliates, as well as their difficult handling manoeuvres taking into account the imminent cytolysis at the fragile species.

MATERIAL AND METHODS

Our researches carried out between 1997 and 2004 established a list of species attached to information regarding their ecological characteristics (DUMITRACHE, 2004; DUMITRACHE, 2006). There were analysed samples from low depth areas of the lakes, from the mud accumulated at its inferior part; there were also analysed zooplankton samples, as well as fragments from the paludal vegetation.

These researches were continued between 2004 and 2008 with other aspects regarding the ecology of the above mentioned species; the focus was set on the samples collected from the plankton and the benthos of Tabacarie Lake, as well as from the analysis of certain fragments belonging to the paludal vegetation; the total number of the collected samples was 217.

To these there can be added 72 samples collected from the covered pools with sea water from Dolphinarium enclosure which shelter the live patrimony (two sea lions and one dolphin).

The daily pouring of sodium hypochlorite to water in view of impeding the microorganism proliferation constitutes a rigorous selection factor of certain types of ciliates resistant to a high concentration, taking into account the fact that immediately after the pouring into the pools the concentration may reach 1 mg/l so that in 6-7 hours it could reach 0.1 mg/l and then 0 due to the recirculation system of the pool water. The values of the abiotic factors from the enclosure of the covered pools are kept relatively constant; the salinity varied between 13.8 and 18.3 PSU and the temperature of the water ranged between 19-24 C degrees due to acclimatizer system (CMSN data, determination by PhD student Angelica Curlisca). The pH values were higher than 7.

The samples collected from the pools consisted in the epibiosis from their side walls, but also in fragments of algae macrophytic fauna collected from the bottom of the pools at the periodical cleaning carried out by the diver.

After the sample collection, the ciliates were separated from the sediment by means of different methods (Uhlig, Webb, Dragesco) (DRAGESCO & DRAGESCO-KERNEÉIS, 1986; WEBB, 1956), others were collected by means of direct use of the pipette and transfer to the Petri dishes.

The next step consisted in the general examination of the ciliates from the Petri dishes with the binocular eyeglasses. For analysis there were collected drops with the pipette and transferred on a lamella, the decrease of the speed was done by adding a few drops of MS-222 Merck solution prepared for this scope by means of adding water from the same ecosystem.

Certain species were determined "in vivo", for others there were used colours of the nuclear device such as green acetic methyl; in the case of other species there was necessary the use of the techniques for the highlight of infraciliature and other taxonomic details by use of the techniques Chatton-Lwoff and Bodain (Wilbert variant) (DRAGESCO & DRAGESCO-KERNÉIS, 1986).

RESULTS AND DISCUSSIONS

The qualitative spectrum of the ciliates from the samples analysed is composed of 72 forms among which 14 were identified only to the genus (Table 1).

From the total amount of 72 species, 25 were identified in the covered pools of the Dolphinarium enclosure, the rest being part of the benthos and periphyton of Tabacarie Lake and its appendix from CMSN Constanta, 5 forms being common to both ecosystems.

The sediments of the low depth areas of Tabacarie Lake, as well as the muddy accumulations are very populated by ciliates; thus, as far as the preferred habitat of freshwater species is concerned, 27% of the species were identified in benthos, plankton and periphyton, 22% are strictly benthonic; 17% are strictly planktonic, whereas the other variants represent combinations and they are less represented.

As for the tolerance to salinity of the freshwater species, 46% of the species have euryhaline valence; 10% are oligoeuryhaline and oligomesoeuryhaline, the other categories being low represented.

The ciliates trophic spectrum is mostly bacterivore – 60% of the species, the rest to 100% is represented by predator and omnivorous species.

In accordance with the information provided by FOISSNER (1986), 19% of the species are indicating areas with alpha-polymesosaprobic and alpha-betamesosaprobic, whereas 17% are strictly metasaprobic, the other categories being represented by lower percentages (Table 1).

The 25 species identified in the epibiosis of the pools of the Dolphinarium enclosure are mostly marine; preserving the populations of these species selections in the conditions of sudden chlorinity variations (by adding daily sodium hypochlorite) and salinity (the values of this abiotic factor are artificially preserved in constant parameters by adding NaCl) is due to the euryhaline properties of the majority of species (45%); 30% are oligo/euryhaline, whereas the rest have oligo-stenohaline values.

The success of preserving them in this artificial biotope is provided by the bacteria feeding strategy of the majority of species.

In conclusion, from a systematic point of view, more than half of the species belong to the ciliate superior classes, with differentiated ciliature, improved mouth structure, as a result with acquisitions in the phylogenetic evolution which allow the adjustment to a complex and selective artificial environment such as the one from the Dolphinarium's covered pools.

The study of the ciliate fauna characteristic to the epibiosis of the pools should be deepened with other biometry aspects and observation of the tolerance limits to extreme variations of the abiotic factors, as a future task.

In brief, the ciliates are organisms with special ecological plasticity capable to adapt to environments characterized by special variations of the abiotic factors, their study creating new interesting perspectives.

Table 1. Qualitative composition of ciliates in the analysed samples.
Tabel 1. Compoziția calitativă a ciliatelor din probele analizate.

No.	TAXA	T.S.	H.P.	G.S.	Tabacarie sediments	Tabacarie periphyton	Dolphinarium pools - epibiosis
1	*Holophrya binucleata* (KAHL, 1930)	oms	Ba,Cy,Al	a-p	+	+	-
2	*Holophrya gargamellae* (FAURE-FREMIET, 1924)	oms	Ba,Cy,Al	a-p	+	+	-
3	*Holophrya ovum* (SCHEWIAKOFF, 1893)	oms	Ba,Cy,Al	a-p	+	+	+
4	*Holophrya oblonga* (FAURE-FREMIET, 1924)	?	Ba,Cy Al,Cil	-	-	-	+
5	*Prorodon marinus* (CLAPAREDE & LACHMANN, 1858)	he?	Cil	-	-	-	+
6	*Prorodon ovum* (EHRENBERG, 1838)	he	Cil	-	-	-	+
7	*Urotricha globosa* (CLAPAREDE & LACHMANN, 1857)	he?	Ba, Al	b	+	-	-
8	*Plagyocampa rouxi* (KAHL, 1930)	he	Ba, Al	-	+	-	-
9	*Pseudoprorodon sulcatus* (?) (KAHL, 1930)	?	Al, Fl	-	-	+	-
10	*Coleps hirtus* (NITZSCH, 1817)	he?	O	a-b	+	-	-
11	*Coleps spetai* (KAHL, 1930)	os	Al, Cy	b	+	+	-
12	*Lagynophrya rostrata* (KAHL, 1930)	os	Al	o	+	-	-
13	*Lagynophrya acuminata* (KAHL, 1930)	os	Al	o	-	+	-
14	*Pleuronema coronatum* (KENT, 1881)	he?	O	b	+	+	-

15	*Phithothorax processus* (KAHL, 1931)	?	Al	?	+	-	-
16	*Lacrymaria coronata* (CLAPAREDE & LACHMANN 1858)	he	Cil	b	+	-	+
17	*Lacrymaria acuta* (KAHL, 1930)	he	Cil	b	+	-	-
18	*Lacrymaria olor* (MÜLLER, 1788)	he	Cil	b	+	+	-
19	*Stentor polymorphus* (MÜLLER, 1773) EHRENBERG 1830	oms	O	a-b	+	+	-
20	*Trachelophyllum sigmoides* (KAHL, 1931)	he?	Ba,Fl, Cil	b-a	+	-	-
21	*Trachelophyllum apiculatum* (PERTY, 1936)	he?	Ba,Fl, Cil	b-a	+	+	-
22	*Didinium nasutum* (MÜLLER, 1786)	oe?	Cil	a-b	+	+	+
23	*Mesodinium pulex* (KAHL, 1933)	oe?	Ba, Al, Fl	-	-	-	+
24	*Mesodinium rubrum* (LOHMANN, 1908)	oe?	Ba, Al, Fl	-	-	-	+
25	*Spathidium* sp.	he	Cil	-	+	-	-
26	*Lionotus (Lithonotus) lamella* (EHRENBERG, 1838)	he	Cil	a	+	-	+
27	*Loxophyllum helus* (STOKES, 1884)	he?	Cil	b	+	+	+
28	*Loxodes striatus* (ENGELMANN, 1862)	os?	Ba,Fl,Al	p	+	-	-
29	*Loxophyllum laevigatum* (SAUERBREY, 1928)	oe	Cil	b	-	-	+
30	*Remanella multinucleata* (KAHL, 1933)	he?	Al,Fl	-	-	-	+
31	*Remanella rugosa* (KAHL, 1933)	he?	Al,Fl	-	-	-	+
32	*Trithigmostoma cucullulus* (KAHL, 1931)	he	Ki,Al,Cy, Ba	a-p	+	+	-
33	*Plagiopyla nasuta* (STEIN, 1860)	oe?	Ba,Sb,Al, Fl	p-i	+	-	-
34	*Uronema marinum* (DUJARDIN, 1841)	he	Ba	a	-	-	+
35	*Pleuronema marinum* (DUJARDIN, 1841)	he	Ba,Fl,Al	b	-	-	+
36	*Vorticella* sp.	oe?	Ba,Al	b?	-	-	+
37	*Stentor polymorphus* (KAHL, 1930)	oms	O	b-a	+	+	-
38	*Bresslaua* sp.	?	?	?	+	-	-
39	*Colpoda ecaudata* (LIEBMANN, 1836)	ome	Ba	p-i	+	-	-
40	*Colpoda inflata* (KAHL, 1931)	ome	Ba,Fl	a-p	+	-	-
41	*Colpoda steinii* (KAHL, 1935)	ome	Ba	a-p	+	-	-
42	*Bursaria* sp.	?	?	?	+	-	-
43	*Nassula picta* (EHRENBERG, 1833)	oe?	Cy	b	+	-	-
44	*Tetrahymena pyriformis*-complex (EHRENBERG, 1830)	oms?	Ba	p-i	+	-	-
45	*Ophryoglena atra* (EHRENBERG, 1831)	-	histofag	-	+	+	-
46	*Paramecium aurelia*-complex (EHRENBERG, 1838)	ome	Ba	a-b	+	+	-
47	*Paramecium caudatum* (EHRENBERG, 1838)	ome	Ba,Al	p-a	+	-	-
48	*Paramecium putrinum* (HILL, 1752)	ome	Ba,Sb,Cy, Al	p-a	+	-	-
49	*Paramecium trichium* (HILL, 1752)	ome	Ba,Cy,Al	p	+	-	-
50	*Lembadion bullinum* (PERTY, 1852)	oe?	Ba,Al,Fl	b	+	-	-
51	*Uronema nigricans* (MÜLLER, 1786)	he	Ba,Fl	a-p	+	-	-
52	*Vorticella campanula* (KAHL, 1930)	he?	Ba,Al	a-b	+	+	-
53	*Spirostomum teres* (CLAPAREDE & LACHMANN 1859)	oe?he?	Sb,Ba,Al, Cy	p	+	-	-
54	*Metopus* sp.	he	Ba,Fl,Al	p-m	+	-	-
55	*Saprodinium* spp.	os	Ba,Sb	p-m	+	-	-
56	*Strombidium viride* (FOISSNER, 1986)	oe	Ki,Al,Ba	b	+	-	-
57	*Uroleptus* sp.	oe?	Ba,Al	a-p	+	-	-
58	*Paruroleptus* sp.	he	Ba,Al	b-a	+	-	-
59	*Oxytricha* sp.	he?	Ba,Fl,Ki	a	+	-	-
60	*Stylonichia mytilus*-complex (MÜLLER,1773)	ome	O	a	+	+	-
61	*Condylostoma arenarium* (SPIEGEL, 1926)	he	Fl,Cil	-	-	-	+
62	*Trachelostyla caudate* (KAHL, 1932)	oe?	Cil	a	-	-	+
63	*Trachelostyla* dubia (DRAGESCO, 1960)	oe?	Cil	a	-	-	+
64	*Oxytricha gibba* (MÜLLER, 1786)	he	Ba,Fl,Ki	-	-	-	+
65	*Euplotes patella* (MÜLLER, 1786)	he	Ba,Fl,Al	b	+	-	-
66	*Euplotes* sp. 1	he?	Ba, Al, Ki, Fl	-	-	-	+
67	*Euplotes* sp. 2	he?	Ba, Al, Ki, Fl	-	-	-	+
68	*Euplotes* sp. 3	he	Ba,Fl	a	+	+	-
69	*Diophrys scutum* (DUJARDIN, 1841)	os?	Al,Fl	-	-	-	+
70	*Uronychia transfuga* (MÜLLER, 1786)	os?	Ba,Al,Fl	-	-	-	+
71	*Aspidisca steini* (BUDDENBROCK,1920)	he?	Ba	?	-	-	+
72	*Aspidisca* sp.	he?	Ba	a-b	+	-	-

Abbreviations used in table 1:

a = alphamesosaprobic
a-b = alphamesosaprobic-polysaprobic
a-p = alphamesosaprobic-polysaprobic
b = betamesosaprobic
b-a = betamesosaprobic-alphamesosaprobic
Ba = Cil bacteria = ciliates
Cy = cyanobacteria
Fl = heterotrophic flagellates
Fs = anaerobic mud and anaerobic zones in the pelagial
GS = saprobity level
he = holo-euryhaline
HP = preferred food
histophagus = type of feeding where the trophic base is represented by tissues
i = isosaprobic
m = metasaprobic
MH = type of feeding
NBE = normal activated sludge
O = omnivorous
o = oligosaprobic
oe = oligo-euryhaline (0-10 psu)
ome = oligo or meso-euryhaline (0-30 psu)
oms = oligo to meso-stenohaline (0-4 psu)
os = oligo-stenohaline (0-1 psu)
p = polysaprobic
p-i = polysaprobic-isosaprobic
p-a = polysaprobic-alphamesosaprobic
p-m = polysaprobic-metasaprobic
Sb = sulphur bacteria
TS = tolerance to salinity
? = incertitude regarding the feeding method, tolerance to salinity, saprobity level or community of the species concerned (FOISSNER, 1986)
+ = present species
- = absent species

Abrevieri utilizate în tabel 1:

a = alfamezosaprobă
a-b = alfamezosaprobă-polisaprobă
a-p = alfamezosaprobă-polisaprobă
b = betamezosaprobă
b-a = betamezosaprobă-alfamezosaprobă
Ba = bacteriiCil = ciliate
Cy = cianobacterii
Fl = flagelate heterotrofe
Fs = mâluri anaerobe şi zone anaerobe în pelagial
GS = grad de saprobitate
he = holoeurihaline (între 0 şi mai mult de 30 psu)
HP = hrană preferată
histofag = modalitate de hrănire în care baza trofică o reprezintă ţesuturile
i = izosaprobă
m = metasaprobă
MH = modalitate de hrănire
NBE = mâluri activate normale
O = omnivore
o = oligosaprobă
oe = oligo-eurihalin (0-10 psu)
ome = oligo sau mezo-eurihalin (0-30 psu)
oms oligo-mezo-stenohaline (0-4 psu)
os = oligostenohaline (0-1 psu)
p = polisaprobă
p-i = polisaprobă-izosaprobă
p-a = polisaprobă-alfamezosaprobă
p-m = polisaprobă-mezosaprobă
Sb = bacterii sulfuroase
TS = toleranţa la salinitate
? = reprezintă incertitudinea referitoare la modalitatea de hrănire, toleranţă la salinitate, grad de saprobitate sau comunitatea căreia îi aparţine respectiva specie (FOISSNER, 1986)
+ = specie prezentă
- = specie absentă

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