A NEW CILIATE IN THE ROMANIAN BLACK SEA WATERS - *LABOEA STROBILA* (PROTOZOA, CILIOPHORA, OLIGOTRICHIA)

Cristina TABARCEA

NIRDEP - National Institute for Marine Research and Development "GrigoreAntipa", 300, Mamaia Blvd., RO-900581, Constanța 3, Romania
e-mail: elisatabco@yahoo.com

Abstract. The planktonic ciliates in the Romanian Black Sea waters have been little studied, although they have high ecological significance in the matter and energy flow of pelagic ecosystems. Among other common zooplankters, the protozoan Laboea strobila was identified for the first time in the shallow-water area of the Romanian continental shelf in the spring of 2011. In the paper, the author presents data on the morphometry and distribution of this recently reported protozoan in the Black Sea.

Key words: protozoan, pelagic ecosystem, recently reported, distribution

1. INTRODUCTION

The microzooplankter *L. strobila* Lohmann, 1908 an aloricate ciliate with world-wide distribution in coastal waters (Sanders, 1995) was reported in the northern part of the Black Sea at the beginning of the last decade, as *Strombidium strobilis* (Selifonova, 2001) and a few years later, in the north-western part of the basin (Kurilov, 2004). As a mixotrophic ciliate, which gives the opportunity to participate both in primary and secondary productivity, its role in the pelagic ecosystem is significant (Sanders, 1995).

This paper aims to report the presence of the protozoan *Laboea strobila* in the Romanian Black Sea plankton and to show some preliminary data concerning its morphometry and distribution.

2. MATERIAL AND METHOD

In April 2011, a number of 11 microzooplankton samples were collected from seven stations along the Romanian Black Sea shelf (Table 1 and Fig. 1).

Table 1: Sampling stations coordinates and depth

Station	Longitude	Latitude	Bottom depth	Sampling depth
ST 1	29°50'50"	44°52'30"	44 m	0.5 m
ST 2	30°15'25"	44°17'42"	84 m	0.5 m
ST 3	30°15'33"	44°10'43"	96 m	30 m
				80 m
				0.5 m
ST 4	28°39'11"	44°03'29"	11 m	30 m
				80 m
				0.5 m
ST 5	28°43'50"	43°58'11"	29 m	0.5 m
ST 6	28°36'39"	43°48'45"	15 m	0.5 m
ST 7	28°38'10"	43°45'10"	35 m	0.5 m

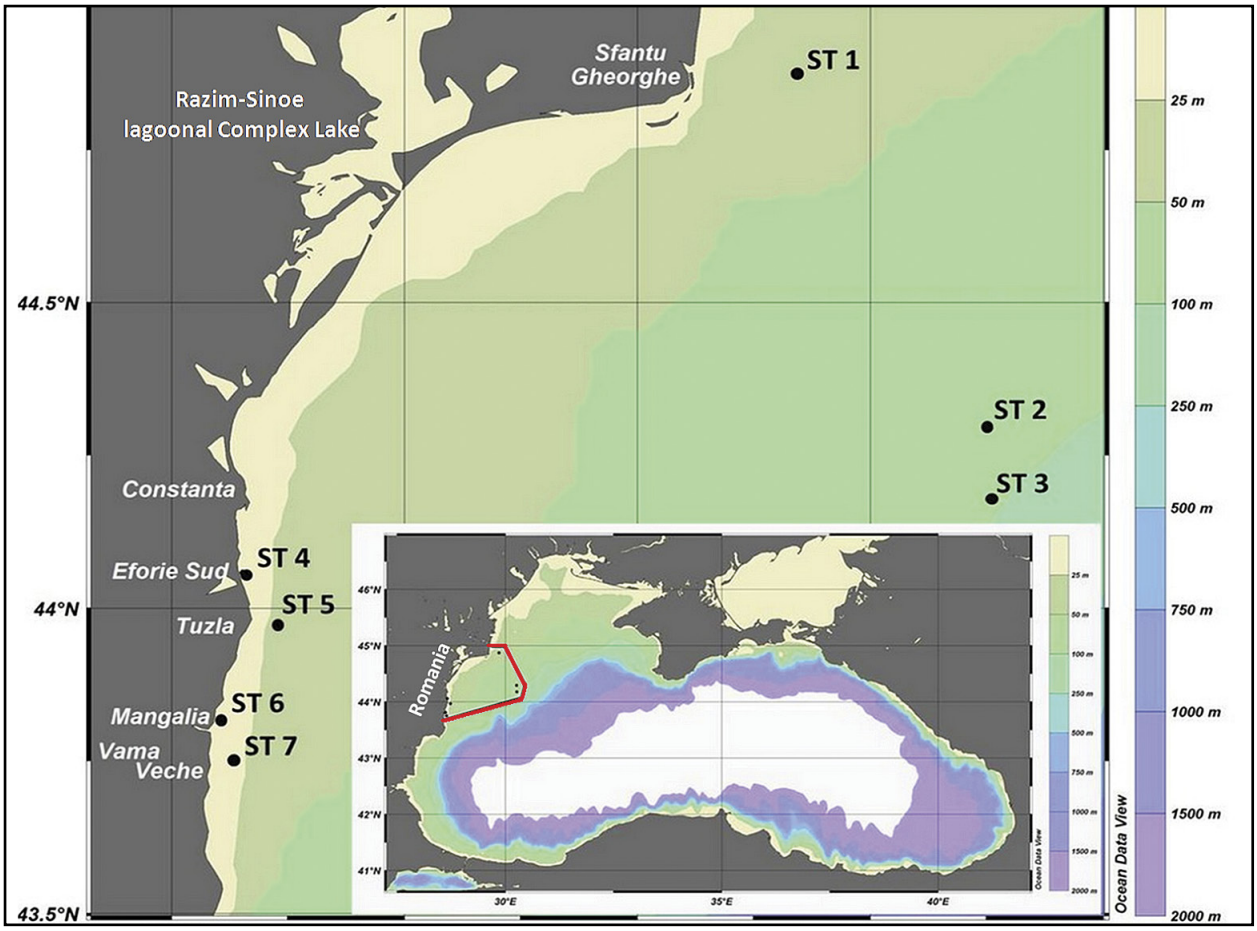

Fig. 1 - Map of the study area with the position of sampling stations

A 500 ml water volume was collected directly from a Niskin bottle and preserved immediately with buffered formaldehyde to a final concentration of 4%. After two weeks, the samples were reduced through sedimentation to 100 ml and, after another two weeks, to a final volume of 10 ml. All *L. strobila* cells from samples were identified and counted under an inverted microscope (Olympus XI 51) at a 40x magnification, using the identification keys and information given by different authors (Montagnes *et al.*, 1988; Agatha, 2004; Agatha *et al.*, 2004). Abundance was expressed as number of cells per litre (cells/L). The length (without distended cell surface) and width of 100 randomly selected cells were measured with Imaging Software Cell*. In order to compare the results with those from literature on other marine environments, the appropriate shape assumed for this planktonic infusorian was the cone (Hillebrand*et al.*,1999). Just for comparative observations, the cell volume was estimated also by assuming the geometric shape characteristic of the Black Sea planktonic infusoria (Bryantseva & Kurilov, 2003). In both cases, the factor for naked ciliates preserved with formalin (0.14 pg μm^{-3}) - was used for the biomass-carbon conversion (Putt & Stoecker, 1989). Data were processed with Microsoft Excel.

3. RESULTS

Laboea strobila (Fig. 2) individuals size were 63-113x42-71 µm, usually 87 x 53µm (Table 2).

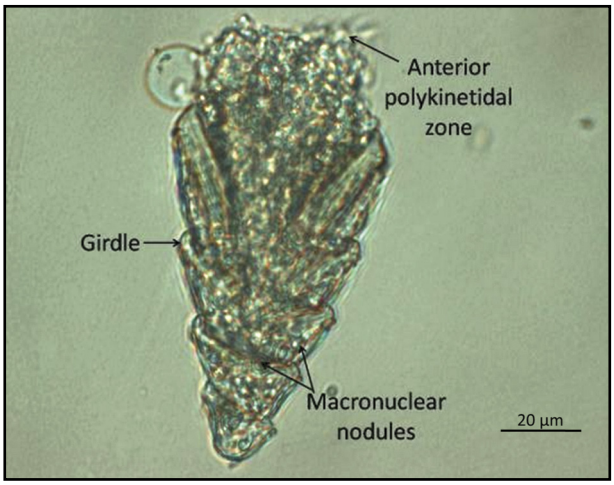

Fig. 2 – *Laboea strobila* from the Romanian Black Seacoast (ventral view)

Table 2: Some morphometric characteristics of L. strobila populations in Black Sea (n = 100)

Population	Morphometric character	$\bar{Z}$	M	SD	SE	CV	Min.	Max.
Romanian Black Sea	Cell length (l)	85.93	86.51	10.05	1.01	11.7	62.88	112.58
	Cell width (w)	53.83	53.02	4.73	0.47	8.8	42.05	70.57
	Cell length: Cell width ratio (l/w)	1.6	1.62	0.17	0.02	10.4	1.2	2.1

$\bar{Z}$ (Average); M (Median); SD (Standard Deviation); SE (Standard Error); CV (Coefficient of variance (%));Min. (Minimum); Max. (Maximum);

The estimated mean value of cell volume was 66391 µm^3 (SD= ± 17801.6), while the mean value of cell biomass was 0.009 µg C/L (SD= ± 0.002).

Throughout the investigated area, *Laboea strobila* occurred with a frequency of 45.5 % in the surface water layers, and 25 % in the deep layers. The mean density and biomass were 57.7 cells/L (SD= ± 96.9), and 0.3 µg C/L (SD= ± 0.7), respectively.

In the surface layers, the abundance ranged between 0 and 254 cells/L, with highest value in open waters (St. 2). Much lower abundances (8 - 36 cells/L) were found in the shallow waters (St. 4, 5, 6 and 7) (Fig. 3). The highest biomass (2.36 µg C/L) was also registered in Station 2, while the lower values, ranging between 0.07-0.33 µg C/L, were recorded in shallow waters stations.

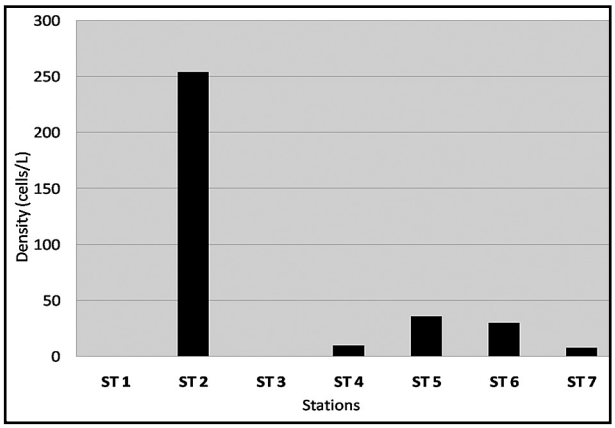

Fig. 3 - The density of *L. strobila* registered in the surface water layers, in April 2011

The vertical distribution was analysed only in the open water stations (St. 2 and St. 3). The density of the ciliate was high in the surface layer (254 cells/L), low (8 cells/L) at the 30 meter horizon and the species was absent at the 80 meter horizon. The results obtained correspond to the data mentioned in the literature (Zhang *et al.*, 2002). A different situation was found in Station 3. Even if situated at a small distance from ST 2, the ciliate was absent.

4. DISCUSSION

The study of the planktonic ciliates in the Black Sea basin is incomplete and often limited to the tintinnid species. The situation is generally due to the use of the improper techniques for the collection and analysis of these organisms. In the recent years, the increased attention paid to this group has led to the description of a large number of taxa (Selifonova, 2001; Kurilov, 2004; Gavrilova, 2005).

Following the analysis of samples collected in April 2011, a new aloricate ciliate was identified for the Romanian coast. With a conical body, sinistrally spiralling girdle that usually performs 4.5 whorls and without tail, it was determined as *Laboea strobila* Lohmann, 1908.

Thus, it was identified as *Laboea strobila* in the Romanian waters in April 2011.

The morphometric measurements of 100 specimens revealed a low linear positive correlation between length and width (R^2 = 0.258), while between length and cell volume there is a high power correlation (R^2 = 0.674), which indicates an allometric growth (Fig. 4 and Fig. 5, respectively).

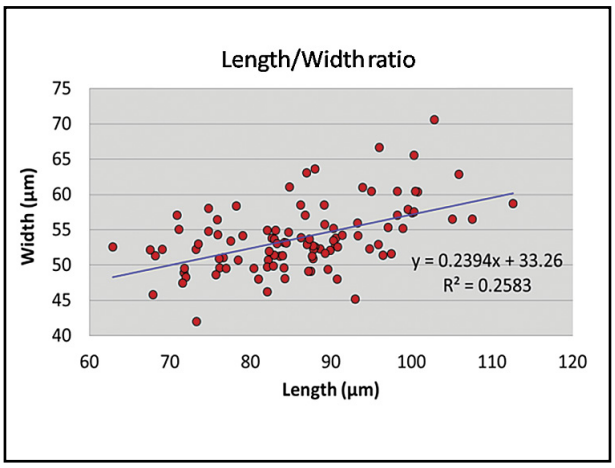

Fig. 4 - Correlation between length and width of the *L. strobila* from the Romanian Black Sea coast

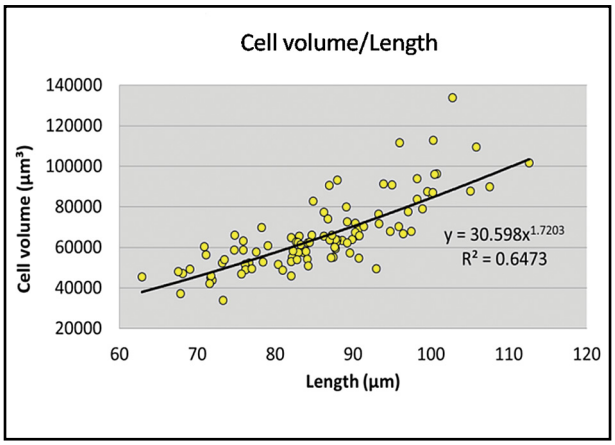

Fig. 5 - Correlation between length and cell volume of the *L. strobila* from the Romanian Black Sea coast

As regards the comparison of the length/width ratio, established for the Black Sea population, with other marine sectors (Agatha *et al.*, 2004), it can be noticed that the population from the Black Sea is characterised by a smaller ratio (1.6) than the populations from other basins (Fig. 6). Starting with the Black Sea populations and continuing with Adriatic, Irish and North Sea populations, the tendency of l/w ratio is increasing.

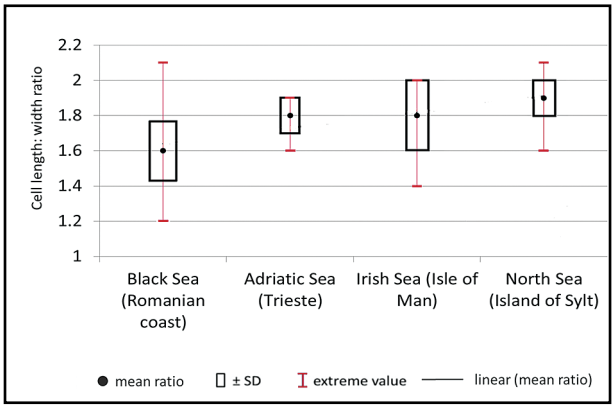

Fig. 6 - Length:/ width ratio of *L. strobila* populations in different parts of the world (based on original results and data from Agatha *et al.*, 2004)

Comparing the results of cell volume assuming cone with the results assuming paraboloid and 1/2 a sphere with a common basis shape, recommended for the Black Sea according to Bryantseva and Kurilov (2003), it was noticed that, in the second case, the differences are quite significant, obtaining values at 1.7 times higher. In order to compare the values obtained by both formulae, a 0.603 (SD = 0.0062) coefficient was calculated.

5. CONCLUSIONS

a. The ciliate *L. strobila* was reported for the first time in the Romanian Black Sea waters in 2011.

b. The density of the *L. strobila* population varied between 0and 254 cells/L, with an average of 57.7 cells/L, the most abundant patches being distributed at a certain distance from the coast;

c. The mean of cell volume was 66391 µm³ (SD = ±17801.6), while the mean cell biomass was 0.009 µg C/L (SD = ±0.002);

d. Based on the measurements of 100 specimens, the morphometry of Black Sea *L. strobila* is compared to data from literature, resulting a length/width ratio smaller than in other European seas;

e. A low linear positive correlation between length and width (R^2 = 0.258), and a high power correlation (R^2 = 0.674) between length and cell volume indicate an allometric growth;

f. In order to compare the cell volume values obtained by the most frequently used formulae (for cone shape) with the recommended formulae for the Black Sea (for paraboloid and 1/2 a sphere with a common basis shape), a 0.603 (SD = 0.0062) coefficient was calculated.

ACKNOWLEDGEMENT

I am grateful to Professor Marian-Traian Gomoiu and the reviewers for the valuable support and critical comments on the paper.

REFERENCES

Agatha, S., (2004). A Cladistic Approach for the Classification of Oligotrichid Ciliates (Ciliophora: Spirotricha). Acta Protozool., **43**, 201-217.

Agatha, S., Strüder-Kypke, M.C., Beran, A., (2004). Morphologic and genetic variability in the marine planktonic ciliate *Laboea strobila* Lohmann, 1908 (Ciliophora: Oligotrichia), with notes on its ontogenesis. J.Eukaryot Microbiol., **51**(3), 267-281.

Bryantseva, Y.V., Kurilov A. B., (2003). The cell volume calculation of the microalgae and planktonic infusoria of the Black Sea. IBSS,Sevastopol, 1-20 p (in russian).

Gavrilova, N., (2005). New for the Black Sea tintinnid species. Ekologiya Morya, **69**, 5–11 (in russian).

Hillebrand, H., Dürselen, C-D., Kirschtel, D., Pollingher, U., Zohary, T., **(**1999)**.** Biovolume calculation for pelagic and benthic microalgae. J. Phycol., **35**,403-424.

Kurilov, A. V., (2004). Planktonic ciliates from coastal waters of the northwest Black Sea. Ekologiya Morya, **65**, 35-40(in russian).

Montagnes, D.J.S., Lynn, D.H., Stoecker, D.K., Small E.B., (1988). Taxonomic Descriptions of One New Species and Redescription of Four Species in the Family Strombidiidae (Ciliophora, Oligotrichida). J.Protozool., **35 (***2*), 189-197.

Putt, M., Stoecker D. K., (1989). An experimentally determined carbon volume ratio for marine oligotrichous ciliates from estuarine and coastal waters.Limnol. Oceanogr., **34**(*6*),1097-1103.

Sanders, R. W., (1995). Seasonal distributions of the photosynthesizing ciliates *Laboea strobila* and *Myrionecta rubra*(= *Mesodinium rubrum)* in an estuary of the Gulf of Maine, Aquat.Microb.Ecol, **9**, 237-242.

Selifonova, Z. P., (2001). Heterotrophic Nano- and Microplankton under Conditions of Anthropogenic Eutrophication of the Bay of Novorossiisk, Russian J. of Ecology, **32** (*4*), 266-271.

Zhang, W., Xu, K., Wan, R., Zhang, G., Meng, T., Xiao, T., Wang, R., Sun, S., Ki Choi, J., (2002). Spatial distribution of ciliates, copepod nauplii and eggs, *Engraulis japonicus* post-larvae and microzooplankton herbivorous activity in the Yellow Sea, China, Aquat. Microb. Ecol., **27**, 249-259.