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# Dependence between occurrence of selected species of psammic rotifers and phytopsammon abundance

Zależność występowania wybranych gatunków wrotków psammonowych od zagęszczenia fitopsammonu

## SUMMARY

Correlations between densities of dominant species of psammic (i.e. sand-loving) rotifers and densities of cyanobacteria and algae were studied on beaches of 16 natural lakes and 11 artificial water bodies. The lakes are located in the Bytów, Drawsko and Wielkopolska Lakelands (NW Poland), while the artificial water bodies, on the Silesian Upland (SW Poland). The psammon was dominated by diatoms and green algae in lakes of the Bytów and Drawsko Lakelands, and by cyanobacteria and diatoms, in lakes of the Wielkopolska Lakeland. In artificial water bodies in Upper Silesia, diatoms and cyanobacteria were the most abundant. Rotifer densities differed significantly between zones of the psammolittoral. Densities of some rotifer species were significantly correlated with the abundance of chlorophytes.

## STRESZCZENIE

Badano zależność występowania dominujących gatunków wrotków psammonowych od zagęszczenia sinic i glonów występujących w plażach jezior i zbiorników antropogenicznych. Badania prowadzono w 16 jeziorach naturalnych położonych na terenie Pojezierzy: Bytowskiego, Drawskiego i Wielkopolskiego oraz w 11 zbiornikach antropogenicznych położonych na terenie Wyżyny Śląskiej. W jeziorach pojezierzy Bytowskiego i Drawskiego w psammonie dominowały okrzemki i zielenice, natomiast w jeziorach Pojezierza Wielkopolskiego sinice i okrzemki. W zbiornikach sztucznych na terenie Górnego Śląska obserwowano dominację okrzemek i sinic. Zagęszczenie

wrotków różniło się statystycznie w poszczególnych strefach psammolitoralu. Stwierdzono statystycznie istotną korelację między zagęszczeniem większości dominujących gatunków wrotków a zagęszczeniem Chlorophyta.

K e y w o r d s: psammon, Rotifera, algae, Cyanobacteria, psammolittoral

## INTRODUCTION

So far, researchers have focused on effects of abiotic factors on rotifers inhabiting beaches of natural lakes and artificial water bodies (Bielańska-Grajner 2001, 2004, 2005, 2007; Ejsmont-Karabin 2003a, 2003b, 2004; Radwan, Bielańska-Grajner 2001). Total density of rotifers was found to depend on sand grain size, and some rotifer species preferred habitats with specific grain size (Bielańska-Grajner 2005, Ejsmont-Karabin 2004). Few studies have been concerned with the influence of biotic factors, including cyanobacteria and algae, on rotifer communities in the psammon (Bielańska-Grajner 2005).

The aim of this study was to determine if densities of selected groups of cyanobacteria and algae in individual zones of the psammolittoral are similar and to verify to what extent the densities of dominant species of psammic rotifers depend on densities of cyanobacteria and algae.

## MATERIAL AND METHODS

Material was collected in the psammolittoral of 16 natural lakes, located in the Bytów Lakeland (4 oligotrophic), Drawsko Lakeland (3 oligotrophic, 3 mesotrophic), and Wielkopolska Lakeland (2 mesotrophic, 4 eutrophic), and of 11 artificial water bodies on Silesian Upland, including 4 dam reservoirs and 7 flooded sand pits.

In the psammolittoral of each reservoir, samples were collected in 3 zones: (1) euarenal – exposed sand, 1 m from the shoreline; (2) higroarenal – at the shoreline; and (3)

hydroarenal – under water, ca. 1 m from the shoreline. The material was collected with a plastic cylinder, 3.5 cm in diameter, with sharp edges. Rotifers were flushed from sand with distilled water, vigorously, by short mixing of sand and water, and next the sample volume was reduced to 50 ml. In each sample, rotifers were counted in 5 subsamples without preservation, and in 5 subsamples after preservation with a drop of Lugol's solution and next formalin. The mean number of individuals from the analysed subsamples was calculated and expressed per 1 $dm^3$ of sand.

Algae and cyanobacteria were collected for analysis with the same cylinder, and were similarly flushed from sand and next preserved with Lugol's solution and formalin. The organisms were counted in 1-ml Sedgwick-Rafter Counting Chambers, in 20 squares, and classified to the major taxonomic groups: Cyanobacteria, Bacillariophyceae, Euglenophyta, Chlorophyta, and Zygnematophyceae (i.e. Conjugatophyta). Densities of cyanobacteria and algae were expressed per 1 $cm^3$ of sand.

Raw data were standardized, and the nonparametric Kruskal-Wallis test was used to determine the significance of differences in densities of rotifers, cyanobacteria and algae between the zones. Pearson's correlation was used to check if there is any dependence between densities of dominant species of rotifers and cyanobacteria or algae. All analyses were performed by using Statistica 7.1 Pl.

## RESULTS AND DISCUSSION

In lakes of the Bytów and Drawsko Lakelands, the psammon was dominated by diatoms and chlorophytes, while cyanobacteria and diatoms, in lakes in the Wielkopolska Lakeland. In artificial water bodies in Upper Silesia, diatoms and cyanobacteria prevailed.

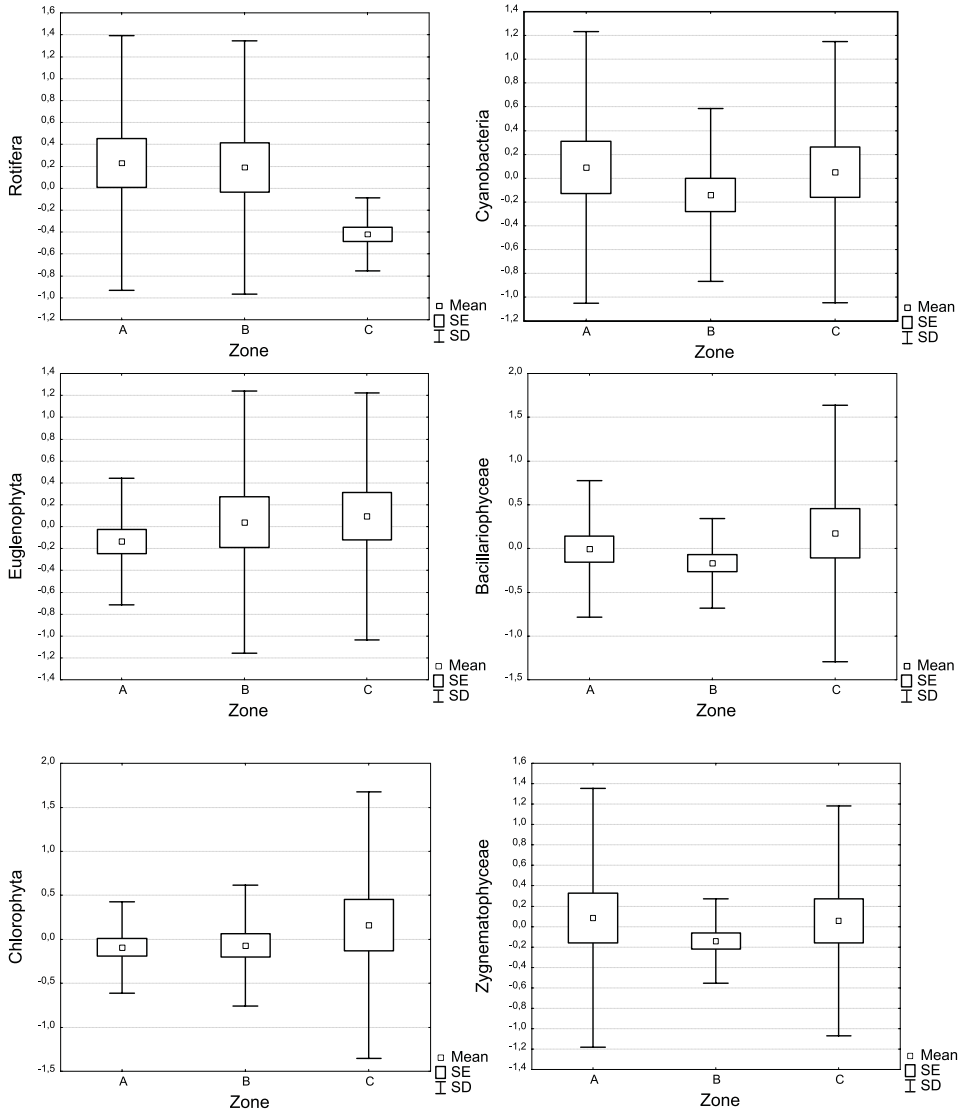


Fig. 1. Mean, standard error and deviation for densities of rotifers, cyanobacteria and algae, in individual zones of the psammolittoral of lakes and artificial water bodies

The Kruskal-Wallis test revealed significant differences (H= 21.26; p= 0.000) in mean densities of rotifers between zones of the psammolittoral in the studied lakes and artificial water bodies (Fig. 1). No significant differences were found in distribution of the studied cyanobacteria and algae between zones of the psammolittoral. The greatest variation in densities of Bacillariophyceae and Chlorophyta was observed in the hydroarenal (Figs. 2, 3), of Cyanobacteria and Zygnematophyceae in the euarenal and hydroarenal (Figs. 4, 5), and of Euglenophyta in the hygro- and hydroarenal (Fig. 6).

A significant correlation was found between the abundance of chlorophytes and densities of several rotifer species: *Cephalodella gibba* (Ehrb.), *Cephalodella gracilis* (Ehrb.), *Colurella adriatica* Ehrb., *Lecane lunaris* (Ehrb.), and *Lecane psammophila* (Wisz.). Density of *Cephalodella gibba* was significantly correlated also with Euglenophyta, while densities of *Colurella adriatica* and *Lecane lunaris*, with Bacillariophyceae. The density of cyanobacteria was strongly correlated with densities of *Lecane psammophila* and *Lepadella patella* (Müll.) (Tab. 2). There is little published information on the mode of nutrition of benthic rotifers. Schmid-Araya, Schmid (2000) showed that many benthic rotifers are predatory or feed on chlorophytes. Many researchers believe that chlorophytes and diatoms are important components of the diet of rotifers (Schmid-Araya, Schmid 1995, 2000, Turner, Palmer 1996, Duggan et al. 1998). Results of this study confirm that there is positive significant correlation between psammic rotifers and chlorophytes (Tab. 2).

Table 1. Significant coefficients of correlation (*r*) between densities of selected species of rotifers and densities of algae and cyanobacteria, in the psammolittoral of the studied lakes and artificial water bodies

| Taxa | Chlorophyta | Euglenophyta | Bacillariphyceae | Cyanobacteria |
|---|---|---|---|---|
| *Cephalodella gibba* N=47 | 0.27, p=0.0001 | 0.26, p=0.0002 | - | - |
| *Cephalodella gracilis* N=47 | 0.34, p=0.01 | - | - | - |
| *Colurella adriatica* N=56 | 0.33, p=0.013 | - | 0.74, p=0.000 | - |
| *Lecane lunaris* N=26 | 0.49, 0.01 | - | 0.40, p=0.04 | - |
| *Lecane psammophila* N=29 | 0.47, p=0.009 | - | - | 0.77, p= 0.000 |
| *Lepadella patella* N=48 | - | - | - | 0.32, p=0.000 |

## CONCLUSIONS

- Rotifer density differs significantly between individual zones of the psammolittoral, and is the lowest in the hydroarenal.
- Densities of dominant species of psammic rotifers probably depend on the abundance of chlorophytes, and to a lesser extent on densities of cyanobacteria and diatoms in the psammon.

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