

QUALITATIVE AND QUANTITATIVE STRUCTURE OF ROTIFERS IN SELECTED POST-PEAT WATER BODIES OF POLESKI NATIONAL PARK

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Summary. Forty planktonic rotifer species have been reported in 7 examined post-peat water bodies, including 3 rare for Polish fauna, 3 eutrophobionts, 1 oligotrophobiont, and 2 distrophobionts. Small density of rotifers, analysis of species belonging to particular ecological forms and representing various food preferences, have indicated the possibility of a food privation or difficult accessibility for food in majority of studied post-peat water bodies. The dominance structure as well as analysis of faunistical similarities have indicated very significant differences between planktonic rotifer groups settling particular post-peat water bodies. Negligible faunistical similarity of some post-peat water bodies have not seemed to be associated with carbonate, humic, or eutrophic character of examined aquatic ecosystems.

Key words: planktonic rotifer, post-peat water bodies, ichthyofauna

INTRODUCTION

Post-peat water bodies are one of the most interesting yet least recognized aquatic ecosystems present in Poleski National Park. Studies upon the planktonic rotifers and their fish fauna in 7 post-peat water bodies of different characters (carbonate, humic, and eutrophic) were carried out in 2008.

Rotifers are the fundamental component of a fine zooplankton within various water reservoirs. They are consumers of bacteria, algae, protozoans, and decayed organic matter. Thus, they play an important role in trophodynamics of water reservoirs [Radwan 1973]. Some rotifer species can also be quite good indicators of water fertility and purity [Karabin 1985, Radwan *et al.* 1988, Paleolog *et al.* 1997].

Rotifers settling various types of post-peat water bodies form poorly recognized plankton communities and studies upon them have been undertaken

to learn their qualitative and quantitative structure as well as to compare rotifers settling different types of post-peat water bodies. Moreover, the structure of fish fauna settling studied post-peat water bodies has been also taken into account to recognize the structure of that zooplankton component. Therefore, the characterization of rotifers from studied post-peat water bodies may also contribute to learning the food abundance of those ecosystems for local fish [Hillbricht-Ilkowska 1964, Arndt 1993].

STUDY AREA, MATERIAL AND METHODS

Material for study was collected in spring and autumn 2008 from 7 post-peat water bodies of Poleski National Park. They were: post-peat water body Moszne – humic (No 34 – N 51°27'30", E 23°06'44"), post-peat water body Jagodno – eutrophic (No 54 – N 51°24'46", E 23°02'48"), and others – carbonate (No 56 – N 51°22'55", E 23°17'23", No 61 – N 51°22'18", E 23°18'15", No 62 – N 51°22'25", E 23°15'53", No 68 – N 51°22'13", E 23°16'24", and No 72 – N 51°21'15", E 23°16'42").

Plankton was strained off from every post-peat water body every sampling date in three replicates. Samples were collected by drawing 10 dm³ water using „Toń II” type bucket from 0 to 0.5 m depth. Such collected water was filtered through the plankton net No 25 and concentrated to constant volume of 100 cm³. Samples were fixed with Lugol's iodine and preserved using 4% formaldehyde plus glycerin solution after several hours. The species affinity and rotifer population was determined in fixed samples with a help of reversed microscope. Number of individuals in a sample was recalculated onto 1 dm³ water in a post-peat water body. Two fishings (in spring and autumn) were carried out to determine the structure of fish fauna in studied post-peat water bodies. Fish was caught using trap-type fishnets and Samus 750 type generator set. Passive fishing tools were exposed for 12 hours. Number and weight of caught fish was recalculated onto 1 hour of fishing.

Shapiro-Wilk test was applied to verify the normality of all variables distribution. Non-parametric Kruskal-Wallis rank ANOVA test from SAS package [SAS Institute Inc. 2001] was used to verify the significance of differences of rotifer densities between particular post-peat water bodies. Similarity of rotifer communities between post-peat water bodies was determined using Jaccard index by means of cluster method and applying Multi Variate Statistical Package – MVSP-3,1. The similarity analysis was performed with a help of Unweighted Pair-Group Method Using Arithmetic Averages – UPGMA. Following items were calculated: rotifer dominance coefficient, level of equilibrium of the dominance structure [Bielańska-Grajner 2005], Shannon-Wiener index [Shannon and Wiener 1963], as well as rotifer species were classified to particular ecological associations [Radwan 1973, Ejsmont-Karabin *et al.* 2004].

RESULTS AND DISCUSSION

In total, 40 planktonic rotifer species were recorded in 7 studied post-peat water bodies. The largest number (11 to 12) of them were present in eutrophic post-peat water body Jagodne and carbonate post-peat water body No 61, while the smallest number (only 7) in humic post-peat water body Moszne. That number slightly varied in remaining carbonate post-peat water bodies oscillating between 9 to 10 (Tab. 1). The species diversity expressed by Shannon-Wiener index was not either differentiated between carbonate post-peat water bodies and amounted from 2.4 to 2.8. The index was lower in humic post-peat water body Moszne – 1.9, while very low in eutrophic post-peat water body Jagodne 0.6 (Tab. 1).

Table 1. Features of plankton rotifer associations in selected post-peat water bodies of Poleski National Park in 2008

Features of investigation	No of object – torfianki according to Poleski National Park maps						
	34	54	56	61	62	68	72
Number of euplanktonic species	0	1	1	1	3	3	3
Number of benthos-periphytic species	5	5	5	8	6	5	3
Number of periphytic species	1	4	3	3	1	2	4
Number of epibiontic species	1	1	0	0	0	0	0
Number of rare species	0	1	1	0	0	0	1
Number of indicator eutrophic species	1	2	0	1	0	1	1
Number of indicator oligotrophic species	0	0	1	0	0	0	0
Number of indicator dystrophic species	0	0	0	0	0	2	1
Number of predatory species	0	0	0	0	0	0	0
Number of detritivorous species	0	0	1	0	1	1	1
Number of herbivorous species	0	3	1	2	2	3	2
Number of omnivorous species	7	8	7	9	7	6	5
Total number of species	7	11	9	12	10	10	10
Shannon index	1.9	0.6	2.4	2.7	2.6	2.6	2.8
Density – individuals per 1 dm ³	19 ^a	407 ^b	17.5 ^a	20 ^a	17.5 ^a	17.5 ^a	63 ^c

Explanations: No 34 – post-peat water body Moszne – humic; No 54 – post-peat water body Jagodne – eutrophic; No 56, 61, 62, 68, and 72 – carbonate. Populations marked with the same letter (17.5^a and 19^a) do not significantly differ.

Although the plankton in lakes of Łęczyńsko-Włodawskie Lakeland [Radwan 1973, Demetraki-Paleolog 2009] and rivers of Lublin province [Demetraki-Paleolog 2007] consisted of the largest number of euplanktonic species, that population ranged from zero in humic to only 3 in some carbonate post-peat water bodies (Tab. 1). Number of benthos-periphyton and periphyton species was much higher; their sum ranged from 6 to 11, which made up from 70% to 92% of the total number of species in those ecosystems (Tab. 1). It seems that the share of those species is not associated with the character of post-peat water bodies, because the highest and lowest percentage of particular ecological forms was usually reported in carbonate post-peat water bodies, hence in those the most studied.

Rare species for Polish fauna were found in three post-peat water bodies: carbonate No 72 – *Lepadella rottenburgi*, carbonate No 56 – *Trichocerca capia*, and eutrophic No 54 – *Platylabus patulus*.

Presence of only several indicator species was confirmed in studied post-peat water bodies. Two eutrophobionts were found in eutrophic post-peat water body with strongly advanced succession (No 54): *Anuraeopsis fissa* and *Keratella cochlearis tecta*. The former made up 92% of the whole rotifer population. Only individuals of a single species – *Chromogaster ovalis* – belonged to oligotrophobionts; they were present in carbonate post-peat water body No 56. Two species rare in Lublin province – *Macrochaetus subquadratus* and *Microcodices chlajna* – were from dystrophobiont group; they were found only in carbonate post-peat water body No 68 (Tab. 1).

Detritivorous, herbivorous, predatory, and omnivorous species can be distinguished among rotifers referring to their various food preferences [Gliwicz 1974]. The detritivorous species usually composed the most numerous group in freshwater plankton [Gliwicz 1974, Karabin and Ejsmont-Karabin 1996, Wallyach and Ricci 2002]. Detritivorous species are also the most abundant in such specific ecosystems as rivers [Demetraki-Paleolog 2007]. Only individuals of that species were found in studied post-peat water bodies and only in 4 out of 5 carbonate post-peat water bodies (Tab. 1). Herbivores, then omnivores were more than detritivores. Predominance of herbivores over detritivores is often associated with low trophic and poor nutritional abundance of waters [Gliwicz 1974]. The author claims that in the case of low mineral concentrations in water, fine algae with large body surface area and being an easy food for herbivorous rotifers, win the fight. The finest detritus fraction in these waters is poor, which makes worse conditions for detritivorous organisms, while better ones for phytoplanktonivores.

The rotifer density in post-peat water bodies was low, which also indicates poor nutritional abundance of these ecosystems. Only in eutrophic post-peat water body Jagodne (No 54), it was slightly higher amounting to 407 ind. dm⁻³. The level was much lower in carbonate post-peat water body No 72–63 ind. dm⁻³, whereas in remaining post-peat water bodies, it oscillated from 17.5 to 20 ind. dm⁻³ (Tab. 1).

Rotifer dominance structure seems to be very interesting (Fig. 1). Up to 21 rotifer species belonged to dominant species in examined post-peat water bodies, which made up over 50% of all reported species. Such large number of dominant species was affected by substantial faunistic diversity, because the group of dominants differed in particular post-peat water bodies (Fig. 1). Łuczak and Wierzbowska [1981], Müller [1984], as well as Bielańska-Grajner [2005] classified the rotifer associations into those having balanced and imbalanced dominance structure. These authors consider an association as balanced if: all three dominance classes are present (dominants, sub-dominants, and recedents), at least three species belong to dominants, and no species exceeds 45% of population.

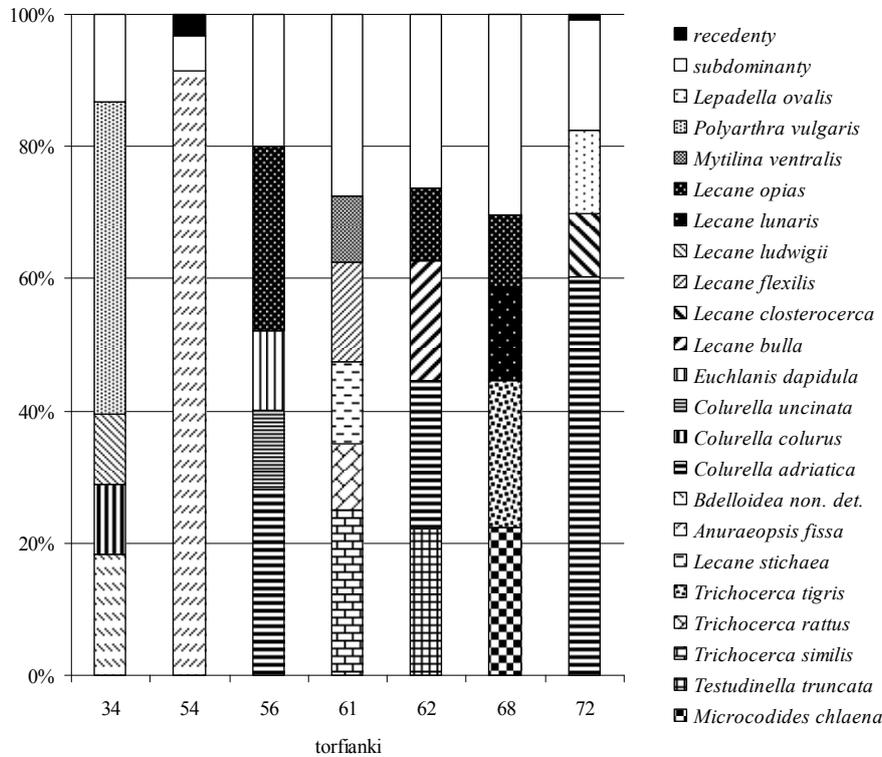


Fig. 1. Percentage of particular rotifer species in selected post-peat water bodies of Poleski National Park in 2008

Explanations: No 34 – post-peat water body Moszne – humic; No 54 – post-peat water body Jagodne – eutrophic; No 56, 61, 62, 68, and 72 – carbonate

According to such criteria, balanced rotifer association was absent in all studied post-peat water bodies. The most imbalanced rotifer association settled eutrophic post-peat water body Jagodne (No 54). The percentage of the only dominant – *Anuraeopsis fissa* – was up to 92%, while the recedents were absent at all (Fig. 1). In other post-peat water bodies, number of dominating species was higher and amounted from 3 to 4; however, recedents were absent, or like in post-peat water body No 72, dominance of particular species – *Columella adriatica* – exceeded 60%.

Cluster analysis of planktonic rotifer associations carried out on a base of the quantitative composition revealed the presence of very slight faunistical similarities between particular post-peat water bodies. The similarities expressed as Jaccard index ranged from only 0.08 to 0.2 (Fig. 2). Nevertheless, the faunistical analysis allowed for distinguishing the three groups of post-peat water bodies that were similar to one other. One of them consisted of two carbonate (No 68 and 61) and humic post-peat water body Moszne (No 34). The similarities oscillated from 0.2 to 0.23 (Fig. 2). Carbonate post-peat water bodies

No 62 and 56 forming another group were characterized by worse faunistical similarity (Fig. 2). Carbonate post-peat water body No 72 and eutrophic post-peat water body Jagodne (No 54) composed another group of faunistically similar post-peat water bodies; their similarity expressed by Jaccard index was 0.15 (Fig. 2).

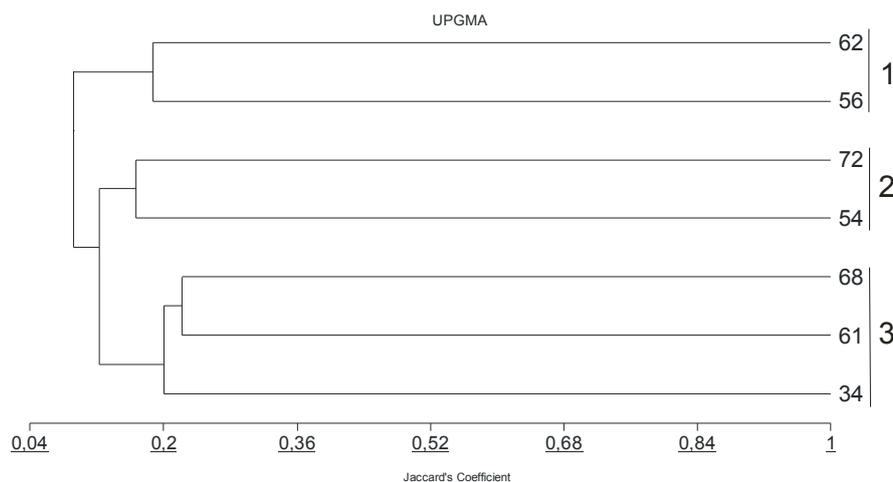


Fig. 2. Similarity structure of rotifer associations on a base of quantitative composition of rotifers in selected post-peat water bodies of Poleski National Park in 2008

Explanations: No 34 – post-peat water body Moszne – humic; No 54 – post-peat water body Jagodne – eutrophic; No 56, 61, 62, 68, and 72 – carbonate

Only brown bullhead was found in a complex of Jelino post-peat water bodies. In practice, the presence of this fish species had no influence of *Rotatoria* association settling.

CONCLUSIONS

1. Forty planktonic rotifer species were found in 7 post-peat water bodies. Their largest number was present in eutrophic and one of the carbonate post-peat water bodies, while the smallest – in humic one. The species diversity was the highest in carbonate, lower in humic, and the lowest in eutrophic post-peat water body.

2. Three rare species for Poland were reported in post-peat water bodies: *Lepadella rottenburgi*, *Trichocerca capica*, and *Platyias p-atulus*, as well as small number of indicator species: 3 – eutrophic, 1 – oligotrophic, and 2 – dystrophic. Small number and population of euphobionts can indicate poor food abundance of carbonate and humic post-peat water bodies.

3. Unlike rivers and lakes of described region, number of periphytic and benthos-periphytic prevailed over the euplanktonic species in studied post-peat water bodies. Character of a given post-peat water body (carbonate, humic, or eutrophic) seemed to have no influence on the prevalence extent.

4. Unlike the majority of rivers and lakes of discussed region, the prevalence of herbivorous over detritivorous species occurred in post-peat water bodies, which along with low rotifer density may indicate a poor availability or even deficiency of food resources in examined aquatic ecosystems.

5. Studied post-peat water bodies were characterized by large number of dominating species (21), the composition of which was very diverse between particular post-peat water bodies. Despite of that, rotifer communities in all post-peat water bodies were considered as imbalanced – most often due to the lack of recedents or, as in the case of eutrophic post-peat water body, due to the dominance of a single species.

6. Rotifer communities present in particular post-peat water bodies considerably differed. Very close faunistical similarity of some post-peat water bodies did not seem to have any association with their character (carbonate, humic, or eutrophic).

7. Fish was found only in the post-peat water body complex Jagodno, while its presence had no substantial effects on qualitative and quantitative composition of rotifers.

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STRUKTURA JAKOŚCIOWA I ILOŚCIOWA WROTKÓW W WYBRANYCH ZBIORNIKACH POTORFOWISKOWYCH POLESKIEGO PARKU NARODOWEGO

Streszczenie. W siedmiu badanych torfiankach stwierdzono 40 gatunków wrotków planktonowych, wśród nich: 3 gatunki rzadkie dla fauny Polski, 3 eutrofobionty, 1 oligotrofobiont i 2 dystrofobionty. Niewielkie zagęszczenia wrotków, analiza gatunków należących do poszczególnych form ekologicznych i reprezentujących różne preferencje pokarmowe wskazała na możliwość występowania ubóstwa pokarmowego lub małej dostępności pokarmu w większości badanych torfianek. Struktura dominacji oraz analiza podobieństw faunistycznych wskazują na bardzo duże różnice między zgrupowaniami wrotków planktonowych zasiedlającymi poszczególne torfianki. Niewielkie podobieństwo faunistyczne niektórych torfiarek nie wydawało się mieć związku z charakterem: węglanowym, humusowym bądź eutroficznym badanych ekosystemów wodnych. W badanych torfiankach wśród ichtiofauny stwierdzono jedynie sumika karłowatego w kompleksie torfianek Jelino. Obecność tego gatunku praktycznie nie miała wpływu na zasiedlający je zespół *Rotatoria*.

Słowa kluczowe: wrotki planktonowe, zbiorniki potorfowe, ichtiofauna