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SYNECOLOGICAL CHARACTERIZATION OF WATER MITE ASSEMBLAGES (ACARI, HYDRACHNIDIA) OF THE FISH PONDS OF LASY JANOWSKIE LANDSCAPE PARK

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Abstract. In two fish ponds in Lasy Janowskie Landscape Park 48 water mite species were caught. In the pond Momoty Duże, situated in the Lasy Janowskie reserve, more species (38), higher species diversity (3.88), and a larger share of lake fauna (33.2%) were observed than in Momoty Małe (33, 3.67 and 22.6% respectively). In the combined collected material small water body species were dominant (70.6%). Similarity between the Hydrachnidia assemblages of the two ponds was 50.1%. The large number of species and individuals caught and the high values for the species diversity index confirm the significant role of fish ponds as a habitat for water mites. A characteristic trait of the ponds was the very small percentage of vernal species and of tyrpho-biontic and tyrphophilic species. Although more species and a larger share of lake fauna were found in the pond situated in the reserve (Momoty Duże) than in the pond outside the reserve (Momoty Małe), the differences in the structure of the fauna were slight. The lack of pronounced differences between the two ponds was due to their similar habitat characteristics and similar use.

Key words: water mites, Hydrachnidia, fish ponds, synecological groups, species diversity

INTRODUCTION

Research on aquatic invertebrates, including water mites (Hydrachnidia), mainly focuses on natural water bodies, while water bodies arising as a result of human activity are often overlooked. However, the number of such water bodies is growing and they play a significant role in the surface water system. At the same time, progressive degradation of natural water bodies is widespread. For this reason it is worthwhile to expand research on the fauna inhabiting water bodies of anthropogenic origin (such as fish ponds), which may constitute an alternative environment for fauna.

The Hydrachnidia fauna of fish ponds has been considerably less well researched than that of other types of standing water bodies. The world literature lacks studies on this subject. A few publications can be cited from the Polish literature: Bazan [1962], Narloch [1965], Biesiadka and Kowalik [1980], Kowalik [1980], Stryjecki [2004a, 2006].

In some regions of Poland, including the Lublin region, fish ponds are an important element of the surface water network, in terms of both prevalence and occupied surface area. One area in which fish ponds are a dominant element of the surface water is the Lasy Janowskie Landscape Park. The ponds are mainly located in the western part of the park, in the region with the villages of Gwizdów and Maliniec, and in the southern part of the park, in the region of the village of Momoty. Two pond complexes (Imielty Ług and Momoty Duże) are under reserve protection [Rąkowski *et al*. 2006].

The main objective of the study was to provide new data on the ecology of the Hydrachnidia of fish ponds. An additional objective was to compare the structure of the water mite fauna in the pond situated in the nature reserve and in the pond that is not under reserve protection.

STUDY SITES AND METHODS

The study was carried out in Lasy Janowskie Landscape Park. Samples were collected from two ponds: Momoty Duże and Momoty Małe. Momoty Duże is situated in the Lasy Janowskie reserve, which is a forest reserve [Rąkowski *et al*. 2006].

The Momoty Duże pond in the Lasy Janowskie reserve (N: 50°36'34.45", E: 22°26'56.17"). The pond has an area of about 20 ha and is surrounded by a pine forest. The bottom was hard and sandy near the shore and muddy in the centre. Vegetation growing by the shore consisted mainly of *Phalaris arundinacea* L., *Poa palustris* L., *Carex gracilis* Curtis., narrow leaf cattail *Typha angustifolia* L., and some *Schoenoplectus lacustris* (L.) Palla. Single *Polygonum amphibium* L. plants and clusters of *Eleocharis palustris* (L.) Roem. and Schult were observed near the shore. *Potamogeton lucens* L. grew in the central part of the pond. The basic physical and chemical parameters of the water measured during the study were as follows: temperature 5.3–23.6°C (average 15.8), pH 7.40–9.07 (8.06), electrolytic conductivity 171–752 μS/cm (361), dissolved oxygen 6.5–13.3 mg dm^{-3} (9.2), and oxygen saturation 67.0–133.4% O_2 (93.1).

The Momoty Małe pond in Momoty (N: 50°36'17.43", E: 22°24'26.8"). Area about 5 ha. The shores were strongly overgrown with flooded grasses and sedges. The slope of the bottom was fairly steep. Sediments were of sand and silt. *Phragmites australis* (Cav.) Trin. ex Steud. and *Typha angustifolia* grew by the shore. Clusters of *Potamogeton lucens* grew in the central part of the pond. Physicochemical water parameters: temperature 3.7–25.3°C (15.2), pH 7.27–9.76

(8.25), electrolytic conductivity 113–475 μS/cm (289), dissolved oxygen 5.5–13.9 mg dm^{-3} (9.4), and oxygen saturation 61.0–117.0% O_2 (94.1).

Hydrobiological samples were collected once a month, from March to November, though two seasons. Samples were taken from the littoral zone of the ponds using a hand net with a square frame with sides 0.25 m in length and mesh size 250 μm, at a distance of 10 m. From the central part of the ponds samples were collected using a dredge with 0.25 m sides and 250 μm mesh size, at a distance of 10 m.

On the basis of literature data [Kowalik 1984, Cichocka 1998, Biesiadka 2008, Di Sabatino *et al*. 2010] the species caught were classified into four synecological groups: small water body species, lake species, tyrphobionts and tyrphophiles, and vernal species. Deutonymphs, as well as a rheobiontic species (1 individual of *Hygrobates calliger*), were not taken into account in the analysis of synecological groups. Faunistic similarity was calculated in Biodiversity Pro v. 2 software [McAleece *et al*. 1997]. Species diversity was calculated using the Shannon-Wiener formula with a log base 2. The names of species followed Biesiadka [2008], supplemented for the genus *Limnesia* from a work by van Haaren and Tempelman [2009].

RESULTS

In the two fish ponds studied a combined 2.213 Hydrachnidia individuals (1.562 adults and 651 deutonymphs) belonging to 48 species were caught (Table 1). The dominant species in the material (dominance > 5%) were *Piona* sp. deutonymphs (22.7%), *Limnesia maculata* (12.9%), *L. undulatoides* (9.4%), *Arrenurus crassicaudatus* (9.2%), *Piona pusilla* (6.8%), *Limnesia* sp. deutonymphs (5.6%) and *Piona variabilis* (5.4%). Differences in dominance structure were noted between the ponds. In Momoty Duże 1,107 individuals belonging to 38 species were caught, and the dominants were *Piona* sp. deutonymphs (27.4%), *Arrenurus crassicaudatus* (13.7%), *Piona pusilla* (9.6%), *Limnesia maculata* (7.8%), *L. undulatoides* (5.9%) and *Forelia brevipes* (5.3%). In Momoty Małe the number of individuals caught was similar (1,106), but fewer species were noted (33). The dominant species here were *Limnesia maculata* (18.2%), *Piona* sp. deutonymphs (18.1%), *Limnesia undulatoides* (12.9%), *Neumania limosa* (6.9%), *Limnesia* sp. deutonymphs (6.6%) and *Piona variabilis* (6.2%) – Table 1.

Small water body species were dominant in the combined material – the 23 species from this synecological group accounted for 70.6% of the fauna collected. The group with the second largest quantitative share was lake species (27.5%, 19 sp.) The percentages of the other two ecological groups, i.e. tyrphobiontic and tyrphophilic species and vernal species, was very small (1.7%, 3 sp. and 0.2%, 1 sp., respectively) – Fig. 1. Differences were noted between the ponds in the proportions of different synecological groups. In Momoty Duże small water body

Table 1. List of species and numbers of water mites caught in the ponds studied in Lasy Janowskie Landscape Park

No	Taxon	The Momoty Duże fish pond	The Momoty Małe fish pond	Total in the ponds	SG
1.	*Limnochares aquatica* (L.)	16		16	T
2.	*Eylais rimosa* Piers.		1	1	S
3.	*Hydrodroma despiciens* (Müll.)		11	11	S
4.	*Oxus angustipositus* Viets	1		1	L
5.	*Oxus musculus* (Müll.)		1	1	L
6.	*Oxus ovalis* (Müll.)	5		5	S
7.	*Oxus strigatus* (Müll.)	1		1	S
8.	*Limnesia curvipalpis* Tuzovskij	8	1	9	S
9.	*Limnesia fulgida* Koch	8		8	S
10.	*Limnesia maculata* (Müll.)	86	201	287	S
11.	*Limnesia undulata* (Müll.)	1	1	2	S
12.	*Limnesia undulatoides* Davids	65	143	208	S
-	*Limnesia* sp. (deutonymphs)	51	73	124	-
13.	*Hygrobates calliger* Piers.	1		1	Rb
14.	*Hygrobates longipalpis* (Herm.)		25	25	L
15.	*Hygrobates trigonicus* Koen.		4	4	L
16.	*Unionicola crassipes* (Müll.)	25	43	68	L
17.	*Unionicola figuralis* (Koch)		2	2	L
18.	*Unionicola gracilipalspis* (Viets)	3	1	4	L
19.	*Neumania deltoides* (Piers.)		2	2	S
20.	*Neumania limosa* (Koch)	1	76	77	S
21.	*Piona alpicola* (Neum.)		1	1	T
22.	*Piona coccinea* (Koch)	14	40	54	S
23.	*Piona conglobata* (Koch)	21	4	25	S
24.	*Piona dispersa* Sokolow	1		1	S
25.	*Piona imminuta* (Piers.)	15	4	19	L
26.	*Piona neumani* (Koen.)	1	18	19	S
27.	*Piona nodata* (Müll.)	2	1	3	V
28.	*Piona paucipora* (Thor)	2	6	8	L
29.	*Piona pusilla* (Neum.)	106	45	151	S
30.	*Piona rotundoides* (Thor)	14	8	22	L
31.	*Piona stjoerdalensis* (Thor)	4	27	31	L
32.	*Piona variabilis* (Koch)	52	69	121	S
-	*Piona* sp. (deutonymphs)	303	200	503	-
33.	*Hydrochoreutes krameri* Piers.		10	10	L
34.	*Pionopsis lutescens* (Herm.)	15		15	S
35.	*Forelia brevipes* (Neum.)	59	4	63	S
36.	*Forelia liliacea* (Müll.)	2		2	L
-	*Forelia* sp. (deutonymphs)	7		7	-
37.	*Brachypoda versicolor* (Müll.)	1		1	L
38.	*Midea orbiculata* (Müll.)	7		7	L
39.	*Mideopsis orbicularis* (Müll.)	6	4	10	L
40.	*Arrenurus albator* (Müll.)	9		9	L
41.	*Arrenurus buccinator* (Müll.)	8		8	T

42.	*Arrenurus crassicaudatus* Kram.	152	53	205	L
43.	*Arrenurus cuspidator* (Müll.)	1		1	S
44.	*Arrenurus forpicatus* Neum.		1	1	T
45.	*Arrenurus globator* (Müll.)	2	2	4	S
46.	*Arrenurus latus* Barr. et Mon.	1		1	L
47.	*Arrenurus sinuator* (Müll.)	6	11	17	S
48.	*Arrenurus tubulator* (Müll.)	7	13	20	S
-	*Arrenurus* sp. (deutonymphs)	17			-
	Total individuals	1107	1106	2213	
	species	38	33	48	

Explanations: SG – synecological group: T – tyrphobiontic and tyrphophilic species, S – small water bodies species, L – lake species, V – vernal species, Rb – rheobiont species

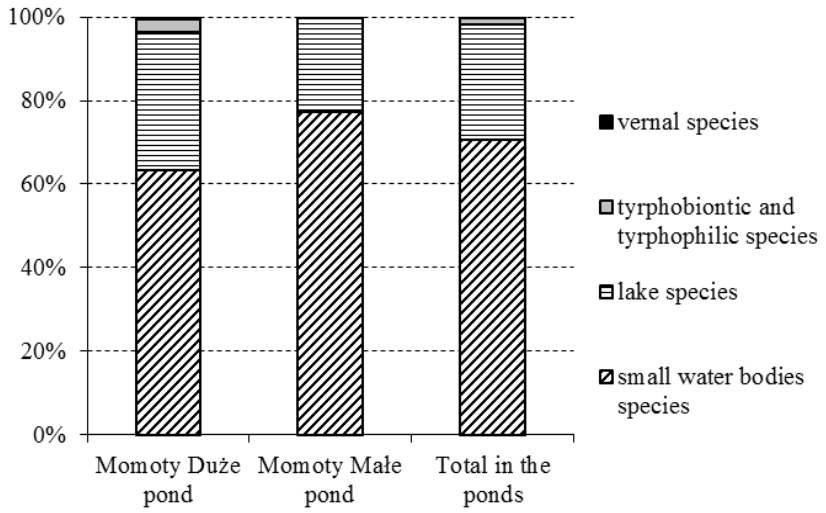

Fig. 1. Percentage shares of synecological groups of water mites in the ponds studied in Lasy Janowskie Landscape Park

species had the largest qualitative and quantitative share, with the 20 species from this synecological group accounting for 63.2% of the fauna. Lake species (14) accounted for 33.2%. The two tyrphobiontic and tyrphophilic species accounted for 3.3% of the fauna, and the one vernal species (*Piona nodata*) for only 0.3%. In Momoty Małe the synecological group with the highest numbers was also small water body species, with a percentage share as high as 77.1% (17 sp.). The second largest group was lake species (22.6%, 13 sp.). The share of the other two ecological groups was negligible; the two tyrphobiontic and tyrphophilic species made up only 0.2% of the fauna collected, while vernal species, represented by *Piona nodata*, accounted for only 0.1% (Fig. 1).

The similarity between the Hydrachnidia assemblages in the two ponds was 50.1% (Bray-Curtis formula). The species diversity index for both water bodies combined was 4.04. Greater species diversity was noted in Momoty Duże (3.88). In Momoty Małe the species diversity was 3.67.

DISCUSSION

The 48 species recorded in the two fish ponds – 38 in Momoty Duże and 33 in Momoty Małe – should be considered high numbers. Previous studies on fish ponds in Poland have found from 12 to 42 species [Bazan 1962, Narloch 1965, Biesiadka and Kowalik 1980, Kowalik 1980, Stryjecki 2004a, 2006]. It is worth emphasizing that more species were found in the ponds in the present study than in many lakes of the ŁęcznaWłodawa Lakeland [Kowalik 1978]. The values for the species diversity index in the ponds (3.67 and 3.88) are also comparable with those noted in the lakes of the Łęczna-Włodawa Lakeland, and in some cases even higher [Kowalik and Stryjecki 1999]. Therefore, despite the fact that fish ponds are anthropogenic water bodies which have functioned for a shorter time and moreover – unlike lakes – do not function continuously (each year the fauna must be regenerated), in many cases they are an equally valuable habitat for water mites as natural water bodies, i.e. lakes.

In the two fish ponds taken together small water body species were dominant (70.6%) in the collected fauna (Fig. 1). The high dominance of small water body species is completely natural. Species of this synecological group are usually dominant in fish ponds [Bazan 1962, Narloch 1965, Biesiadka and Kowalik 1980, Kowalik 1980, Stryjecki 2004a, 2006]. A characteristic distinguishing the fish ponds of Lasy Janowskie is the fairly high percentage of lake species (27.5%). In another fish pond from this area – Imielty Ług – the percentage of lake species was as high as 84.6% [Stryjecki 2004a]. The smaller percentage of lake species in the ponds Momoty Duże and Momoty Małe in comparison with Imielty Ług was due to greater human impact (intensive fishing economy and regular draining of the fish ponds), as well as to the smaller surface area of these ponds.

A very small percentage of tyrphobiontic and tyrphophilic species was noted in the fish ponds (1.7%, 3 sp.). Rich and varied water mite fauna associated with peat bog waters had been recorded in Lasy Janowskie [Stryjecki 2004b]. The percentage of tyrphobiontic and tyrphophilic species was also much higher in Imielty Ług [Stryjecki 2004a]. The negligible percentage of species from this ecological group in the two ponds was most likely due to the physicochemical properties of the water, which were unsuitable for tyrphobiontic and tyrphophilic fauna.

It is worth noting the nearly complete lack of species associated with astatic water bodies in the ponds. This synecological element was represented by just one species, *Piona nodata*, and its percentage share was only 0.1%. There were

dikes around the ponds and the shores sloped steeply into the water. Therefore there were no typical habitats for the development of these species, i.e. shallow astatic zones. Moreover, the ponds were drained in the winter and refilled in the spring. The hydrological cycle was thus completely different from that of typical habitats of vernal fauna, which may also have contributed to the lack of these species in the ponds. In typical habitats for vernal fauna (astatic water bodies) in Lasy Janowskie as many as 45 species from this ecological group have been recorded [Stryjecki 2004c].

Certain differences were observed between the ponds in species composition and synecological structure. In Momoty Duże, situated in the Lasy Janowskie reserve, more species (38), higher species diversity (3.88) and a higher percentage of lake fauna (33.2%) were noted than in Momoty Małe (33 sp., 3.67 and 22.6%). The poorer faunistic and ecological parameters in Momoty Małe were most likely due to the greater human impact in comparison with Momoty Duże (intensive carp production, drainage in May and ploughing of the bottom). Furthermore, this pond was smaller and younger than Momoty Duże, which also may have influenced the structure of the fauna. However, in general it can be stated that the fauna of the two ponds was similar (50.1% similarity), due to the similar physicochemical properties of the water and to their similar habitat characteristics. The fauna of the Imielty Ług pond (a large, old, dystrophic water body with an extensive fishing economy) clearly stands out in contrast with these ponds [Stryjecki 2004a].

CONCLUSIONS

1. The large number of species and individuals caught and the high values for the species diversity index confirm the significant role of fish ponds as habitats for water mites.

2. A characteristic trait of the ponds was the very small percentage of vernal species and of tyrphobiontic and tyrphophilic species. The negligible percentage of vernal species was due to the lack of astatic zones in the ponds, and the small proportion of tyrphobiontic and tyrphophilic species was a result of the physicochemical properties of the water.

3. In the pond situated in the reserve (Momoty Duże) more species and a higher percentage of lake fauna was noted than in the pond located outside the reserve (Momoty Małe), but the differences in the structure of the fauna were very slight. The lack of pronounced differences between the two ponds was due to their similar habitat characteristics and similar use.

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CHARAKTERYSTYKA SYNEKOLOGICZNA ZGRUPOWAŃ WODOPÓJEK (ACARI, HYDRACHNIDIA) STAWÓW RYBNYCH PARKU KRAJOBRAZOWEGO LASY JANOWSKIE

Streszczenie. W dwóch stawach na terenie Parku Krajobrazowego Lasy Janowskie złowiono 48 gatunków wodopójek. W stawie Momoty Duże położonym w rezerwacie Lasy Janowskie stwierdzono większą liczbę gatunków (38), większą różnorodność gatunkową (3,88) i większy udział elementu jeziornego (33,2%) niż w stawie Momoty Małe (odpowiednio: 33 gat., 3,67, 22,6%). Łącznie w zebranym materiale dominowały gatunki drobnozbiornikowe (70,6%). Zgrupowania

Hydrachnidia badanych stawów były do siebie podobne w 50,1%. Złowienie dużej liczby gatunków i osobników, a także wysokie wartości wskaźnika różnorodności gatunkowej potwierdzają tezę o znaczącej roli stawów rybnych jako siedliska życia wodopójek. Charakterystyczną cechą badanych stawów był śladowy udział gatunków wiosennych i tyrfobiontycznych i tyrfofilnych. W zbiorniku położonym na terenie rezerwatu (staw Momoty Duże) stwierdzono więcej gatunków i większy udział elementu jeziornego niż w zbiorniku położonym poza rezerwatem (staw Momoty Małe), jednak różnice w strukturze fauny były nieznaczne. Brak wyraźnych różnic między oboma stawami wynikał z podobnego charakteru siedliskowego i podobnego sposobu użytkowania.

Słowa kluczowe: wodopójki, Hydrachnidia, stawy rybne, grupy synekologiczne, różnorodność gatunkowa