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WATER MITES (*ACARI, HYDRACHNIDIA*) IN WATER CANALS OF THE "LASY JANOWSKIE" LANDSCAPE PARK

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Abstract: In the years 1996-1997, water mites in water canals in the "Lasy Janowskie" Lanscape Park were examined. 1,972 individuals of water mites were collected which belonged to 55 species. In the material collected stagnobionts of *Arrenurus, Limnesia, Piona* and *Neumania* genera were dominants. However, in habitats with faster water flow, rheobionts and rheophils of *Sperchon* and *Lebertia* genera occurred. Pond waters exerted the greatest effect on the shaping of *Hydrachnidia* groupings in the canals. Based on own studies and data from literature, it may be presumed that man-made reservoirs, including water canals, may be places of occurrence of rich and varied fauna of *Hydrachnidia*. The number of species, individuals and the biological diversity in artificial reservoirs, are sometimes greater than in natural ones.

Keywords: water mites, *Hydrachnidia*, water canals, anthropogenic reservoirs

INTRODUCTION

Studies of water invertebrates, including water mites – *Hydrachnidia*, in the majority of cases concern natural reservoirs. There are relatively few reports concerning the fauna of water mites in man-made water reservoirs. Here may be mentioned studies of water mites in small ponds in the open-cast coal mine [1], acid and alkaline peat ponds [3, 5-8], reservoirs in sand pits [8], fire-fighting reservoirs [4], and melioration canals [3].

A habitat different from the above-mentioned reservoirs of stagnant water are canals, where water flow of various intensity occurs. It should be expected that in such reservoirs, an important environmental factor, i.e., the water current, will significantly affect the shaping of water mite fauna. The aim of the present study was to examine the fauna of *Hydrachnidia* in this type of reservoirs.

SITE OF STUDY AND METHODS

The study was conducted in the area of "Lasy Janowskie" Landscape Park (Sandomierz Basin). Two study sites were chosen: Site 1 on the canal discharging water from a big set of ponds to the Łukawica River in the Bania village, and Site 2 on the canal carrying water from fish ponds to the River Bukowa in the Momoty village. At each site (canal) the samples were collected above and below water damming.

Site 1, at a point above water damming, was a ditch with a width of 3.0-3.5 m and a depth of about 0.8 m, with slowly flowing water. The sediments were muddy, and in the middle of the trench – sandy. The following macrophytes occurred in the canal in large numbers: *Elodea canadensis, Sagittaria sagittifolia, Hottonia palustre* and *Hydrocharis morsus-ranae*. The site at a point below the water damming was a fast-flowing stream. The width of the stream was about 1.5 m, and the depth – 0.1-0.2 m, the bottom was sandy. In the current, *Sparganium simplex* was observed with some shoots of *Elodea canadensis*. *Scirpus sylvaticus* and *Glyceria aquatica* grew at the banks. The basic physical and chemical factors of the water were as follows: temperature 2.4-19.4°C (12.1 on average), pH 6.31-7.40 (6.86), electrolytic conductivity 132-512 μS cm^{-1} (206), dissolved oxygen 4.9-8.6 mg dm^{-3} (7.5), saturation with oxygen 47.0-93.0% O_2 (71.1).

At site 2, at a point above water damming, water flow was slow, sediments muddy, water plants well-developed with the domination of: *Potamogeton natans, Sagittaria sagittifolia* and *Elodea canadensis*. At a point below the damming, water was flowing rapidly through a narrow stream channel of sandy-stony bottom almost deprived of plants. The basic physical and chemical factors of water reached the following values: temperature 5.8-16.7°C (12.1 on average), pH 6.73-7.03 (6.75), electrolytic conductivity 139-411 μS cm^{-1} (264), oxygen dissolved 3.7-8.4 mg dm^{-3} (6.4), saturation with oxygen 37.6-80.7 O_2 (60.2).

Hydrobiological sampling was conducted once a month, from March-November, during the period 1996-1997. Standard indices applied in ecology were used for the analysis of the material collected: Domination (D), Stability of Occurrence (C), Ecological Importance ($Q = \sqrt{D \cdot C}$) and Faunistic Similarity (Jaccard formula). Quantitative faunistic similarity was calculated according to Biesiadka formula [2].

RESULTS

In the canals examined in the "Lasy Janowskie" Landscape Park, 1 972 water mites were collected (1 636 imagines and 336 deutonymphs) belonging to 55

species from 15 families (Tab. 1). The following families were represented most numerously: *Arrenuridae* (22.9% of the whole collected material, 8 species), *Limnesiidae* (21.5%, 3 species), *Pionidae* (15.5%, 14), *Mideidae* (13.4%, 1 species) and *Limnocharidae* (10.2%, 1 species). Eudominants (domination above 10%) were stagnobiontic species: *Arrenurus crassicaudatus* (15.2% of all water mites collected), *Limnesia maculata* (14.5%), *Midea orbiculata* (13.4%) and *Limnochares aquatica* (10.2%). Dominant species also showed the greatest stability of occurrence (C from 41.9 to 70.1%); therefore, they were of the greatest ecological importance in the biotops examined (Q from 20.7 to 32.7)

Table 1. Quantitative compilation of water mites in water canals examined in the „Janowskie Forest" Landscape Park

No.	Takson	Site 1 Canal at Łukawica River in Bania Village	Site 2 Canal at fish ponds in Momoty	Total in water canals examined
1.	*Limnochares aquatica* (L.)	201		201
2.	*Eylais extendens* (Müll.)	10		10
3.	*Eylais muelleri* Koen.	1		1
4.	*Eylais rimosa* Piers.	12		12
5.	*Eylais undulosa* Koen.	3		3
-	*Eylais* non det.	33		33
6.	*Hydryphantes planus* (Thon)	1		1
7.	*Thyas barbigera* Viets	1		1
8.	*Hydrodroma despiciens* (Müll.)	9		9
9.	*Sperchon clupeifer* Piers.		1	1
10.	*Sperchon compactilis* Koen.	1		1
11.	*Sperchon setiger* Thor		1	1
12.	*Lebertia exuta* Koen.	1	1	2
13.	*Lebertia fimbriata* Thor		2	2
14.	*Lebertia inaequalis* (Koch)	7	18	25
-	*Lebertia* sp. (deutonymphs)		1	1
15.	*Frontipoda musculus* (Müll.)	1	3	4
16.	*Oxus angustipositus* Viets	1		1
17.	*Oxus ovalis* (Müll.)	2	1	3
18.	*Oxus strigatus* (Müll.)	1	6	7
19.	*Limnesia maculata* (Müll.)	50	236	286
20.	*Limnesia polonica* Schecht.	1		1
21.	*Limnesia undulata* (Müll.)	50	45	95
-	*Limnesia* sp. (deutonymphs)	11	27	38
22.	*Hygrobates longipalpis* (Herm.)	1	3	4
23.	*Hygrobates nigromaculatus* Leb.	1		1
24.	*Unionicola aculeata* (Koen.)	1		1
25.	*Unionicola crassipes* (Müll.)		19	19
26.	*Unionicola gracilipalpis* (Viets)		4	4
27.	*Neumania deltoides* (Piers.)		22	22
28.	*Neumania limosa* (Koch)	5	41	46
29.	*Neumania vernalis* (Müll.)	1		1

Table 1. Continuation

No.	Takson	Site 1 Canal at Łukawica River in Bania Village	Site 2 Canal at fish ponds in Momoty	Total in water canals examined
30.	*Piona coccinea* (Koch)		1	1
31.	*Piona conglobata* (Koch)	3	5	8
32.	*Piona longipalpis* (Krend.)	3		3
33.	*Piona neumani* (Koen.)		5	5
34.	*Piona paucipora* (Thor)	9	4	13
35.	*Piona pusilla* (Neum.)	27	1	28
36.	*Piona rotundoides* (Thor)	7	16	23
37.	*Piona stjoerdalensis* (Thor)	1	7	8
38.	*Piona variabilis* (Koch)	5		5
-	*Piona* sp. (deutonymphs)	20	129	149
39.	*Hydrochoreutes krameri* Piers.	16	1	17
40.	*Tiphys torris* (Müll.)		2	2
-	*Tiphys* sp. (deutonymphs)		2	2
41.	*Pionopsis lutescens* (Herm.)		1	1
42.	*Forelia brevipes* (Neum.)	17	8	25
43.	*Forelia liliacea* (Müll.)	11		11
-	*Forelia* sp. (deutonymphs)	4		4
44.	*Brachypoda versicolor* (Müll.)	22		22
45.	*Midea orbiculata* (Müll.)	265		265
46.	*Mideopsis crassipes* Soar	28		28
47.	*Mideopsis orbicularis* (Müll.)	54	9	63
48.	*Arrenurus albator* (Müll.)	16	3	19
49.	*Arrenurus buccinator* (Müll.)	29		29
50.	*Arrenurus crassicaudatus* Kram.	132	167	299
51.	*Arrenurus globator* (Müll.)	27	1	28
52.	*Arrenurus latus* Barr. et Mon.	2		2
53.	*Arrenurus muelleri* Koen.	1		2
54.	*Arrenurus sinuator* (Müll.)	4	24	28
55.	*Arrenurus tubulator* (Müll.)	17	24	41
-	*Arrenurus* sp. (deutonymphs)	3	2	5
	Total indyviduals	1129	843	1972
	Species	45	32	55

Significant differences in the species composition and the number of individuals of water mites were observed between sites (Tab. 1). At Site 1 a considerably larger number of individuals (1129) and species (45) were collected, compared to Site 2 (843 and 32, respectively). The structure of dominance at the sites examined varied; at Site 1 the most numerous species were: *Midea orbiculata* (23.5% of total water mite number at this site), *Limnochares aquatica* (17.8%) and *Arrenurus crassicaudatus* (11.7%). At Site 2 these were: *Limnesia maculata* (28.0%), *Arrenurus crassicaudatus* (19.8%) and deutonymphs *Piona* sp. (15.3%). Qualitative faunistic similarity between the sites was 40%, while quantitative similarity – only 12.9%.

Differences in *Hydrachnidia* fauna composition were also noted within the sites, between the points of sampling, i.e. above and below water damming. At Site 1, above the damming, 654 individual mites belonging to 35 species were collected, whereas below – 475 individual mites of 33 species. Greater differences were observed at Site 2; above the damming 556 mites of 27 species were caught, while below – only 286 mites of 21 species. Above the weirs damming water, at the stretches of slow water flow and muddy bottom, stagnobionts of the following genera dominated: *Arrenurus, Limnesia, Piona* and *Neumania*. Below the weirs, at places of fast water flow and sandy-stony bottom, apart from stagnobionts carried with the water current, species characteristic of current environment were collected. These were rheobionts and rheophils: *Sperchon clupeifer, S. setiger, Lebertia inaequalis,* and *L. fimbriata.*

Seasonal changes in the numbers of water mites in the waters examined had a slightly different course in the case of imagines and deutonymphs (Fig. 1). Maximum numbers of *Hydrachnidia* imagines were observed in spring (May); then an early summer decrease in numbers was noted (June, July). In August a second peak occurred – smaller than the first one – in the occurrence of adult forms, the numbers of which decreased again in autumn. Maximum numbers of deutonymphs were noted also in May. After decreasing of their occurrence in early summer (June), in July the numbers of deutonymphs increased, reaching a peak in numbers which, however, was smaller than in the spring. In autumn the numbers of deutonymphs was lower than in spring and summer (Fig. 1).

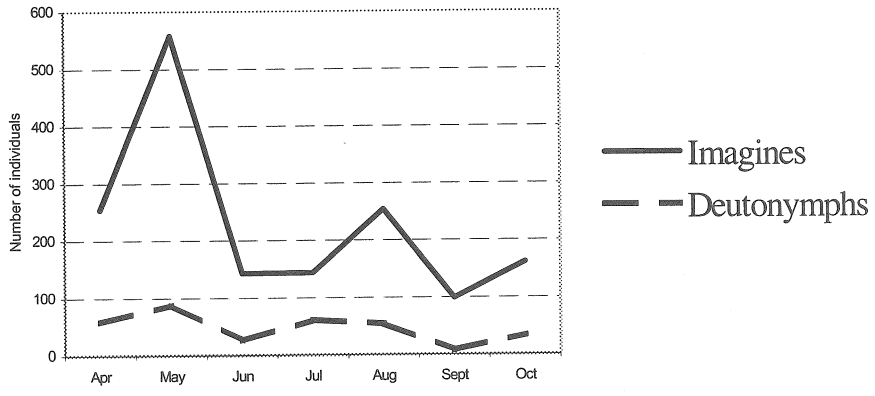

Fig. 1. Seasonal changes in the numbers of water mites

DISCUSSION

Studies of man-made water reservoirs indicate that these reservoirs may be a habitat of a rich *Hydrachnidia* fauna. Kowalik [6] observed 34 species of water mites in alkaline peat ponds in the Polesie National Park. Kowalik and Stryjecki [7] noted 39 mites species in alkaline peat ponds in the Chełm Landscape Park, while in acid peat ponds, an alkaline pond and sand pit – 52 species [8]. In the view of the above, the fauna of water mites in water canals at „Lasy Janowskie" Landscape Park should be considered as rich and divergent – at two study sites 1,972 individuals of water mites which belonged to 55 species were collected. A considerable number of species and individuals collected in the canals examined, as compared to anthropogenic stagnant water reservoirs, results, among other things, from the transitory character of the canals' habitat. Due to various water flow these reservoirs are inhabited by the species associated with stagnant as well as running waters. A greater species abundance and biological variety were observed in the canals examined, compared to many other study sites in the Park, including natural reservoirs [9, 11]. This resulted from the great variety of canal habitats: in a relatively short course there are many microhabitats with the changeable speed of the current, and with various types of sediments and water plants.

The greatest effect on the water mite fauna in canals exerted fish ponds, from which the water was discharged through canals to rivers. This is the reason for a high percentage of stagnobionts of *Arrenurus, Piona* and *Neumania* species which dominated also in fish ponds of the Park [10]. Considerable differences in the structure of domination between the canals studied could be explained also by the effect of pond waters. At Site 1 water from dystrophic pond flowed and *Midea orbiculata* – a species typical for this type of water – dominated in this canal. At Site 2 water from eutrophic pond was carried and that is why *Limnesia maculata* dominated at this site. Apart from stagnobionts and stagnophilous species originating from the ponds, in the canals, at its courses of fast water flow, autochthonous current habitat fauna developed. These were rheobionts and rheophils of *Sperchon* and *Lebertia* genera, commonly appearing in the Park.

Among all species of water mites observed in the „Lasy Janowskie" Landscape Park, 2 species – *Eylais muelleri* and *Arrenurus muelleri* occurred only in canals [10]. This is an evidence of small faunistic distinctiveness of the canals, compared to stagnant and running waters in the Park. Simultaneously, the canals were characterised by certain specific features: the number of individuals and species of the *Eylais* genus collected in canals were the greatest (59 individuals, 4

species). Moreover, selected species reached their greatest numbers in the whole territory of the Park in the canals (*Limnochares aquatica, Frontipoda musculus, Neumania deltoides, Brachypoda versicolor, Midea orbiculata*). Also in this type of water certain species rare in Poland and in the Park were collected (*Eylais muelleri, Sperchon compactilis, Oxus angustipositus, Arrenurus muelleri*). The above data show that water canals are not only a supplementary environment for water mites (small water bodies species, peat, spring fauna and lake species), but they may also constitute the main habitat for selected species in some areas. Biesiadka [1] noted that in the area of Konin, *Hydrachna schneideri,* a very rare species in Poland, occurred only in worked-out coal-mine water reservoirs. In the analysis of occurrence of this species in Poland, the above-mentioned author showed that reservoirs of clay and sand pits seem to be the most typical habitat for this water mite. Kowalik and Stryjecki [8] also collected the greatest number of species and individuals of *Hydrachna* genus in a sand pit. A rare species – *Hydrachna skorikowi* and: *H. cruenta, H. globosa* and *H. goldfeldi* were collected there. Based on the above-mentioned data, it may be presumed that artificial reservoirs created as a result of human activity, may be a place of occurrence of rare species of water mites.

Seasonal changes in the numbers of water mites in the canals examined were generally similar to the changes in numbers noted in the ponds of the Park [10]. It should be emphasized that anthropogenic effect had a great influence on the dynamics of *Hydrachnidia* occurrence in the canals. Emptying the ponds caused a rapid increase in the numbers of water mites, whereas lifting of the weirs resulted in removing them out of the canals. Therefore, the changes in *Hydrachnidia* numbers observed in canals only to some extent resulted from natural life cycles.

CONCLUSIONS

1. The fauna of water mites in water canals in the "Lasy Janowskie" Landscape Park was of a mixed character – stagnophilous-rheophilous, but a clear dominance of the stagnophilous element both in the species and quantitative structure was observed. The composition of *Hydrachnidia* fauna resulted from the transitional ecological character of the canals – between stagnant and running waters.
2. Fish ponds, from which water was carried through the canals, exerted the greatest effect on the water mite fauna of in the biotops examined. Varied water current resulted in the development of autochthonic reophilous fauna.

3. Water canals and other man-made reservoirs may be the habitats for the occurrence of numerous and diverse fauna of *Hydrachnidia*, including rare ones. The number of species, individuals and biological diversity in artificial reservoirs are sometimes greater than in natural reservoirs. Therefore, these reservoirs should be considered as an important element in the network of surface waters.

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FAUNA WODOPÓJEK *(ACARI, HYDRACHNIDIA)* KANAŁÓW WODNYCH PARKU KRAJOBRAZOWEGO „LASY JANOWSKIE"

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Streszczenie. W latach 1996-1997 badano wodopójki kanałów wodnych Parku Krajobrazowego „Lasy Janowskie". Złowiono 1972 osobniki wodopójek należących do 55 gatunków. W zebranym materiale dominowały gatunki stagnobiontyczne z rodzajów *Arrenurus, Limnesia, Piona* i *Neumania*. W miejscach o szybszym przepływie wody wykształcała się fauna prądolubna, z reobiontami i reofilami z rodzajów *Sperchon* i *Lebertia.* Na kształtowanie się zgrupowań *Hydrachnidia* kanałów największy wpływ miały wody stawowe. Na podstawie badań własnych oraz danych literaturowych można stwierdzić, iż zbiorniki antropogeniczne, a w tym – kanały wodne, mogą być miejscem występowania bogatej i zróżnicowanej fauny *Hydrachnidia*, także gatunków rzadkich, zaś liczba gatunków, osobników i różnorodność biologiczna bywają niekiedy większe niż w zbiornikach naturalnych.

Słowa kluczowe: wodopójki, *Hydrachnidia*, kanały wodne, zbiorniki antropogeniczne