

WATER MITES (ACARI: HYDRACHNIDIA) OF THE NORTHERN PART OF NADWIEPRZAŃSKI LANDSCAPE PARK

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Summary. In the northern part of the Nadwieprzański Landscape Park 55 water mite species were found. Far more individuals and species were collected in standing water bodies than in running water (767 ind., 47 sp. and 18 ind., 9 sp., respectively). The dominant species in the material collected were *Piona nodata* (21.4%), *Hydrodroma despiciens* (14.6%), *Limnochares aquatica* (11.5%), *Arrenurus bruzelii* (9.4%) and *Tiphys ornatus* (6.4%). The species diversity of the Park's water mites is determined by the standing water bodies of the valley (peat bog pools, oxbow lakes). Comparison of current and historical data shows that water mite fauna of the Park is becoming impoverished. The degree and rate of impoverishment varies depending on the type of water body.

Key words: water mites, Hydrachnidia, Nadwieprzański Landscape Park, running water, standing water, species diversity

INTRODUCTION

The Nadwieprzański Landscape Park was established in 1990. It has a surface area of 621 ha, and its buffer zone is 11.185 ha [Rąkowski 2004]. The park covers the middle stretch of the Wieprz river valley which runs along in a narrow strip. The Wieprz valley, which has remained preserved in its natural state, has the greatest natural value in the park, owing to the river with its natural course, numerous oxbow lakes and vast wetland areas, including wet meadows, peat bogs, peat pits, marshy meadows and alder carrs [Rąkowski 2004].

The aquatic invertebrate fauna of the Park has not been well researched. Among the hydrobionts of the Park the greatest amount of data concerns water mites (Acari: Hydrachnidia). The water mites of river Wieprz and the water bodies of its valley have been researched both before the establishment of the Park

[Kowalik 1980, 1981, Kowalik and Biesiadka 1981, Kowalik and Stryjecki 1999] and after it [Kowalik and Stryjecki 2000]. Nevertheless, the current state of research of the Hydrachnidia fauna of this area must still be considered unsatisfactory.

The aim of the present study was to present new data on the water mite fauna of river Wieprz and the various water bodies of the river valley (peat bog pools, oxbow lakes, temporary pools, permanent eutrophic water bodies, meadow ditches) located within the northern part of the Nadwieprzański Landscape Park, and to discuss the changes in this fauna that have taken place over the last 30 years.

STUDY SITES, MATERIALS AND METHODS

Samples were collected from running water bodies – the river Wieprz in Kijany (N: 51°20'13.23", E: 22°46'49.50"), Łęczna (N: 51°18'13.90", E: 22°52'14.32") and Łańcuchów (N: 51°15'53.92", E: 22°56'9.47"), the river Bystrzyca in Spiczyn (N: 51°19'58.05", E: 22°44'21.81"), the river Świnka in Łęczna (N: 51°18'31.05", E: 22°52'53.32") and a meadow ditch in Spiczyn (N: 51°19'58.05", E: 22°44'21.81"), as well as from standing water bodies – a peat bog pool by a meadow in Ciechanki Łańcuchowskie (N: 51°16'35.65", E: 22°55'27.07"), a forest peat bog pool in Ciechanki Łańcuchowskie (N: 51°16'28.96", E: 22°55'20.94"), an oxbow lake in Ciechanki Łęczyńskie (N: 51°17'4.55", E: 22°52'18.29"), a pool in an alder carr in Łańcuchów (N: 51°16'5.21", E: 22°56'56.19"), temporary pools in Kijany (N: 51°20'14.76", E: 22°46'58.75"), Ciechanki Łańcuchowskie (N: 51°16'35.75", E: 22°55'27.69") and Ciechanki Łęczyńskie (N: 51°17'7.72", E: 22°52'12.83"), and a small eutrophic water body in Spiczyn (N: 51°19'57.85", E: 22°44'33.57"), for a total of 14 sites.

In river Wieprz water mites were collected from the lentic zone. The current was slow and the bottom was silty, with sparse aquatic vegetation. The vegetation by the shore consisted mainly of *Glyceria maxima* and *Salix* spp. In river Bystrzyca water mites were collected from the lentic zone as well. The river bottom was muddy and sparsely covered with *Sagittaria sagittifolia* and *Potamogeton filiformis*, while *Phragmites australis* and *Urtica* sp. grew on the shores. The Świnka river had well-developed lentic and lotic zones. Its bottom consisted of sand and silt, with numerous large blocks of stone. *Nuphar lutea* grew on the bottom, and *Glyceria maxima* and other grasses were present by the shores. The meadow ditch was about 1 m wide and 0.2–0.4 m deep, with a constant, distinct water flow. There was a cover of *Lemna minor* on the surface, and *Glyceria maxima* and *Phragmites australis* grew by the shores.

The peat bog pool by the meadow had a surface area of about 1400 m² and a maximum depth of 8 m. Samples were collected both from the shore (using a hand net), and from deeper zones in the pool (with a dredge). Macrophytes were abundant in the pool – *Myriophyllum* sp., *Hydrocharis morsus-ranae*, *Hottonia palustris*, *Nuphar lutea*, *Utricularia* sp. and *Lemna trisulca* – and *Carex*

spp., *Phragmites australis* and *Schoenoplectus* sp. grew on the shores. In the shaded peat bog pool in the forest, which had a surface area of about 1500 m², there was little aquatic vegetation: *Ceratophyllum* sp. occurred in places, and there was a cover of *Lemna trisulca* on the surface of the water. Samples were collected in this pool from *Carex* sp. and from patches of *Ceratophyllum* sp., to a depth of 1.5 m. The oxbow lake, with a surface area of about 1500 m², had a muddy bottom; *Carex* sp. occurred on the shores and in the shallow water, and there was a cover of *Lemna* sp. on the surface. The pool in the alder carr, with an area of about 150 m², was part of a large flooded expanse in the forest. It was an astatic pool; considerable fluctuations in water level were noted, but water was present for the entire study period. The water in the pool was shallow and brown, with many fallen leaves. *Carex* sp., *Iris pseudacorus*, *Urtica* sp. and numerous umbellifers grew on the shores. The temporary pools had diverse surface area (from 200 to 3700 m²) and were extremely ephemeral; they formed in depressions in fields or meadows and due to evaporation they were present for only 1–2 months. The eutrophic water body in Spiczyn took the form of a small pond with a surface area of about 3500 m². The bottom consisted of sand or sand mixed with silt, with *Typha latifolia*, *Juncus* sp. and shrubby *Salix* sp. occurring in places. Samples were taken from the part of the pool near the shore.

Hydrobiological samples were collected with a hand net and a dredge, once a month from April to August 2009. Species diversity was calculated using the Shannon-Wiener formula (base 2 logarithm).

RESULTS

In the water bodies studied 785 Hydrachnidia specimens were collected (769 adults and 16 deutonymphs). There were 55 species belonging to 19 genera and 13 families (Tab. 1). The most frequently represented families were Pionidae (34.9% of the material collected, 11 sp.), Arrenuridae (20.0%, 13 sp.), Hydrodromidae (14.6%, 1 sp.) and Limnocharidae (11.5%, 1 sp.). The dominant species (dominance > 5%) were *Piona nodata* (21.4%), *Hydrodroma despiciens* (14.6%), *Limnocharis aquatica* (11.5%), *Arrenurus bruzelii* (9.4%), and *Tiphys ornatus* (6.4%).

Far more individuals and species were found in the standing water bodies than in running water (767 ind., 47 sp. and 18 ind., 9 sp., respectively) – Table 1.

The species collected in the rivers and in the meadow ditch were classified into three ecological groups: rheobionts, rheophiles, and rheoxenes. The rheophiles were represented by the most individuals (7 individuals, 2 species), followed by the rheobionts (5 ind., 3 sp.), while the number of rheoxenes was the smallest (4 ind., 3 sp.). One crenobiontic species was found (in the meadow ditch) – *Sperchon squamosus* (1 ind.).

The species collected in the standing water bodies (peat bog pools, oxbow lakes, astatic and temporary pools, small eutrophic pools) were classified into the

Table 1. Species composition and numbers of water mites collected in the Nadwieprzański Landscape Park (2009)

Taxon	Running waters					Standing waters							Total
	A	B	C	D	Total	E	F	G	H	I	J	Total	in NLP
1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Hydrachna globosa</i> (Geer)	2				2	2		1				3	5
<i>Hydrachna leegei</i> Koen.									13			13	13
<i>Hydrachna</i> sp. (deutonymphs)						1						1	1
<i>Limnochares aquatica</i> (L.)						90						90	90
<i>Eylais muelleri</i> Koen.							1					1	1
<i>Eylais rimosa</i> Piers.						5						5	5
<i>Eylais tantilla</i> Koen.							1		2			3	3
<i>Eylais</i> sp.						6	9	3	1			19	19
<i>Eylais</i> sp. (deutonymphs)	1				1	7							8
<i>Piersigia intermedia</i> Williamson									2			2	2
<i>Hydryphantes crassipalpis</i> Koen.								1				1	1
<i>Hydryphantes hellichi</i> Thon									1			1	1
<i>Hydryphantes placationis</i> Thon						2						2	2
<i>Hydryphantes planus</i> Thon									9			9	9
<i>Hydryphantes ruber</i> (Geer)							1			1		2	2
<i>Hydryphantes tenuipalpis</i> Thon									1			1	1
<i>Hydryphantes</i> sp. (deutonymphs)									7			7	7
<i>Thyas dirempta</i> (Koen.)									3			3	3
<i>Thyas pachystoma</i> Koen.									2			2	2
<i>Thyas palustris</i> Koen.									1			1	1
<i>Hydrodroma despiciens</i> (Müll.)						114				1		115	115
<i>Sperchon clupeiifer</i> Piers.	1				1								1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Arrenurus batillifer</i> Koen.						9	5	5				19	19
<i>Arrenurus bicuspidator</i> Berl.						4						4	4
<i>Arrenurus bifidicodulus</i> Piers.						1	5	4	8			18	18
<i>Arrenurus bruzelii</i> Koen.						47	1	26				74	74
<i>Arrenurus fimbriatus</i> Koen.						1	1					2	2
<i>Arrenurus globator</i> (Müll.)						9						9	9
<i>Arrenurus inexploratus</i> Viets							1	1	3			5	5
<i>Arrenurus integrator</i> (Müll.)							1		1			2	2
<i>Arrenurus maculator</i> (Müll.)						5	2					7	7
<i>Arrenurus mediorotundatus</i> Thor									4			4	4
<i>Arrenurus sinuator</i> (Müll.)						1						1	1
<i>Arrenurus tricuspator</i> (Müll.)						9						9	9
<i>Arrenurus tubulator</i> (Müll.)						2						2	2
<i>Arrenurus</i> sp. (deutonymphs)						1						1	1
Total specimens	13	1	3	1	18	385	34	71	275	2	0	767	785
Total species	5	1	2	1	9	25	14	17	17	2	0	47	55

Explanations: A – river Wieprz (in Kijany, Łęczna and Łańcuchów), B – river Bystrzyca in Spiczyn, C – river Świnka in Łęczna, D – meadow ditch in Spiczyn, E – peat bog pool by a meadow in Ciechanki Łańcuchowskie, F – forest peat bog pool in Ciechanki Łańcuchowskie, G – oxbow lake in Ciechanki Łęczyńskie, H – pool in an alder carr in Łańcuchów, I – temporary pools (in Kijany, in Ciechanki Łańcuchowskie and in Ciechanki Łęczyńskie), J – small eutrophic water body in Spiczyn

the following ecological groups (after [Cichocka 1998]): small water body species, species typical of astatic vernal pools, lake species, and tyrphobiontic and tyrrophilic species. The peat bog pool by the meadow in Ciechanki Łańcuchowskie, the oxbow lake in Ciechanki Łęczyńskie and the pool in the alder carr in Łańcuchów were subjected to closer analysis than the other water bodies, where too few individuals were collected for proper application of a dominance index. In the peat bog pool by the meadow, small water body species were dominant (67.0%, 15 sp.). The proportion of tyrphobionts and tyrrophiles was significant (25.2%, 3 sp.), while lake species and species typical of astatic vernal pools occurred infrequently (7.0%, 5 sp. and 0.8%, 2 sp., respectively) – Fig. 1. Small water body species dominated in the oxbow lake (64.7%, 9 sp.). Vernal species were the second most numerous group (32.4%, 6 sp.). The proportion of lake species was very small (2.9%, 2 sp.), and tyrphobionts and tyrrophiles were not noted at all. The synecological groups in the pool in the alder carr had different proportions, with vernal species strongly dominant (91.0%, 13 sp.). Small water body species constituted 7.9% of the fauna collected (2 sp.), while peat bog species made up only 1.1% (2 sp.). No lake species were found in this pool – Fig. 1.

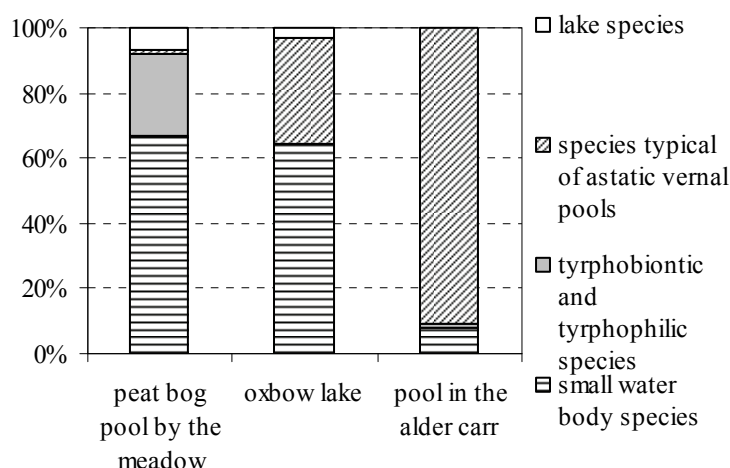


Fig. 1. Percentage share of the ecological groups in selected water bodies of Nadwieprzański Landscape Park

The highest species diversity was noted in the peat bog pool by the meadow in Ciechanki Łańcuchowskie: $H = 3.10$. It was somewhat lower in the oxbow lake in Ciechanki Łęczyńskie (2.98) and lowest in the pool in the alder carr in Łańcuchów (2.23). Too few specimens were collected in the remaining water bodies for proper estimation of species diversity.

DISCUSSION

Analysis of the water mite fauna of the Nadwieprzański Landscape Park reveals a striking disproportion between running water and standing water. Although river Wieprz forms the hydrological axis of the Park and determines the water conditions in this area, the water mite fauna of this watercourse is extremely poor. In the stretch of the river under investigation, Kowalik and Biesiadka [1981] noted 12 water mite species. At that time (1975) the Wieprz was already quite polluted, and now the degree of pollution has increased (WIOŚ 2008, 2009). Water mites are known to be very sensitive to water pollution, and the first to be eliminated are rheobiontic and rheophilic species [Kowalik 1981, Kowalik and Biesiadka 1981, Gerecke and Schwoerbel 1991]. Thus the effects of the pollution of the Wieprz taking place over many years have led to the degradation and impoverishment of its fauna. As many as 9 species were not found in the Wieprz River during this study, though some of them (like *Lebertia porosa*, *L. pilosa*, *Hygrobates fluviatilis*) were pretty numerous in the past [Kowalik and Biesiadka 1981]. Another factor contributing to the changes in fauna noted has been the homogeneity of the habitats where water mites were collected (the littoral zone of the river with slow water flow, muddy bottom and sparse vegetation). It can, therefore, be concluded that the extremely low number of individuals and species collected in the Wieprz results from the polluted state of the water and the lack of habitat variation in the river.

In the case of river Świnka, the impoverishment of the fauna had other causes. The river had high habitat diversity which potentially could create favourable conditions for the development of diverse Hydrachnidia populations; however, conditions of environmental stress prevailed here due to salination; electrolytic conductivity reached 1,532 $\mu\text{S}/\text{cm}$. Kowalik [1981] noted 7 water mite species in the estuarine stretch of the river, but this research was conducted in 1973–1974, when the scale of human impact (salination of the water) was smaller than it is today. Most water mites are haloxenes, and thus highly sensitive to increased salinity [Gerecke 1991, Di Sabatino *et al.* 1992]. Saline water discharged for many years from a hard coal mine to the Świnka river has led to the impoverishment of the river's Hydrachnidia fauna [Kowalik 2002].

The water mite fauna of river Bystrzyca downstream from Lublin has been severely degraded for many years [Kowalik 1981], and the fact that in 2009 only one water mite was found in its estuarine stretch confirms the highly detrimental influence of treated wastewater introduced into the river from the sewage treatment plant in Hajdów.

Among the standing water bodies of the park, the richest fauna by far is found in the complex of pools in Ciechanki Łańcuchowskie. The peat bog pool by the meadow is the most interesting of these – 385 individuals and 25 species were collected, the highest numbers of all the study sites. Small water body species dominated (67.0%, 15 sp.), but the share of peat bog species was also significant (25.2%, 3 sp.). The mixed character of the fauna was due to the ecologi-

cal conditions in the pool, i.e. the influence of the adjacent peat bog on one side and of the meadow catchment on the other.

Unfortunately, over the last 10–20 years it has been possible to observe certain unfavourable changes in the fauna of this pool. Kowalik and Stryjecki [2000] noted 29 species in the pool, with species diversity $H = 3.74$ [Kowalik and Stryjecki 1999]. In the present study, the number of species fell to 25, and species diversity to 3.10. Moderate human impact appears to be a threat to the pool; the surrounding area is exploited by the local population for recreational purposes.

In the oxbow lake in Ciechanki Łęczyńskie, small water body species were dominant (64.7%, 9 sp.). Vernal species were also numerous (32.4%, 6 sp.) – Fig. 1. Similar quantitative proportions have been noted in the oxbow lakes of the Bug river valley [Stryjecki 2009].

Dominance of vernal species was very high in the astatic pool in the alder carr in Łańcuchów; the 13 species from this group constituted as much as 91.0% of the fauna collected (Fig. 1). The high percentage of vernal species was due to the character of the habitat – in late spring and in the summer the water level decreased substantially. Although water remained during the entire season, vernal species characteristic of temporary water bodies were numerous. The biodiversity noted in this pool was rather low, at $H = 2.23$. The low species diversity, in comparison with other water bodies in the Park, was due to uneven dominance distribution – *Piona nodata* constituted as much as 56.5% of all specimens collected.

The fauna of the temporary pools was found to be extremely sparse, with only 2 individuals collected (Tab. 1). This extreme paucity of the fauna was probably due to the excessive ephemerality of the pools; water was not present long enough for stabilised Hydrachnidia fauna, or even any at all, to arise. Other invertebrates have also been found to be extremely scarce in temporary pools, which indicates that fully functioning zoocoenoses have not formed in the pools, regardless of their ephemerality.

The lack of water mites in the eutrophic pond in Spiczyn is surprising. It contained numerous habitats that were potentially favourable sites for Hydrachnidia to live. The physical and chemical properties of the water also should not have eliminated the presence of water mites. Hence it is difficult to explain the complete lack of water mites in this body of water.

CONCLUSIONS

1. In the surface water system of the Nadwieprzański Landscape Park, the main river – the Wieprz – has little importance for water mites. The key habitats for Hydrachnidia are the standing water bodies in the river valley (peat bog pools, oxbow lakes, pools in alder carrs).

2. The most valuable area in the northern part of the park with regard to fauna is the complex of pools in Ciechanki Łańcuchowskie.

3. Over the past 30 years it has been possible to observe a gradual degradation of the fauna of the Park. The degree and rate of degradation varies depending on the type of water body.

4. The most severe degradation of fauna takes place in the rivers, due to the high degree of water pollution in the Wieprz and Bystrzyca and high salinity in the Świnka. Standing water bodies are less susceptible to degradation; however, when compared with historical data, certain unfavourable changes can be observed in these as well.

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WODOPÓJKI (ACARI: HYDRACHNIDIA) PÓŁNOCNEJ CZĘŚCI
NADWIEPRZAŃSKIEGO PARKU KRAJOBRAZOWEGO

Streszczenie. W północnej części Nadwieprzańskiego Parku Krajobrazowego stwierdzono występowanie 55 gatunków wodopójek. Znacznie więcej osobników i gatunków złowiono w wodach stojących niż w wodach płynących (odpowiednio: 767 osobn., 47 gat. i 18 osobn., 9 gat.). W całości zebranego materiału dominowały: *Piona nodata* (21,4%), *Hydrodroma despiciens* (14,6%), *Limnochares aquatica* (11,5%), *Arrenurus bruzelii* (9,4%), i *Tiphys ornatus* (6,4%). Różnorodność gatunkową wodopójek Parku kształtują dolinne zbiorniki wód stojących (torfianki, starorzecza), natomiast fauna rzeki Wieprz jest bardzo zdegradowana. Porównując dane aktualne z historycznymi należy stwierdzić, iż następuje ubożenie fauny wodopójek Parku. Ubożenie faunistyczne zachodzi w różnym stopniu i różnym tempie – w zależności od rodzajów zbiorników.

Słowa kluczowe: wodopójki, Hydrachnidia, Nadwieprzański Park Krajobrazowy, wody płynące, wody stojące, różnorodność gatunkowa