

## FAUNISTIC AND ECOLOGICAL CHARACTERISTICS OF THE WATER MITES (ACARI: HYDRACHNIDIA) OF SMALL PONDS IN POLESIE NATIONAL PARK

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**Summary.** A total of 36 species of water mites were found in three small ponds in Polesie National Park, including 2 species new to the park – *Hydrachna leegei* and *Hydryphantes placationis*. The dominants (dominance > 5%) were *Hydrodroma despiciens* (12.4%), *Midea orbiculata* (12.2%), *Arrenurus forpicatus* (11.3%), *Piona nodata* (8.9%), *P. conglobata* (6.1%), species of the genus *Eylais* (5.7%), *Arrenurus tubulator* (5.7%), *Hydryphantes planus* (5.5%) and *Arrenurus globator* (5.3%). Most numerous in the material collected were small water body species (43.0% of the fauna collected, 12 species), followed by vernal species (23.2%, 11 sp.) and tyrphobiotic and tyrphophilic species (20.0%, 10 sp.), while the least abundant were lake species (13.8%, 3 sp.). The greatest numbers of individuals (432) and species (33), as well as the highest species diversity (3.72), were noted in the pond in Sęków, located on the edges of Bagno Bubnów. The rich and diverse Hydrachnidia communities of this pond confirm that Bagno Bubnów is a highly valuable area of Polesie National Park in terms of Hydrachnidia.

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

### INTRODUCTION

The Hydrachnidia of Polesie Lubelskie, including Polesie National Park, have been fairly well researched, but particular types of water bodies have been investigated in varying degrees. The greatest number of studies concern lake fauna [Kowalik 1973, 1977, 1978, Kowalik and Stryjecki 1999, Kowalik *et al.* 1999, Kowalik *et al.* 2002]. A good deal of data can also be found on water mites inhabiting peat-bog pools, both acidic [Kowalik 1980, 1996, Kowalik and Stryjecki 2000a] and carbonate [Kowalik 1980, 1996, Kowalik and Stryjecki 2000a, b, Stryjecki 2010a]. Compared with these types of water bodies, the Hydrachnidia of small eutrophic pools has been very poorly researched. Some data on this topic can be found in a few publications [Kowalik 1980, Kowalik and Stryjecki 1999, 2000a, Stryjecki

2010b], but these data are fragmentary because the studies concentrated on other types of water bodies, barely mentioning small, permanent eutrophic pools.

This concentration on water mites inhabiting the lakes, fish ponds [Stryjecki 2007] and peat-bog pools of Polesie National Park is understandable, as these water bodies dominate the landscape of the area. Nevertheless, for a complete analysis of the Hydrachnidia of Polesie National Park, other types of water bodies must be investigated as well, including small eutrophic pools. These water bodies are an important element of the surface water network and constitute a significant habitat for water mites.

The aim of this study was to present faunistic and ecological data on the water mites inhabiting selected small, permanent pools in Polesie National Park. Thus far there have been no separate studies dedicated to this question, so this study makes the research on the Hydrachnidia of the park more complete. The data presented can be a reference for determining long-term changes in the water mite fauna of this type of water body in the future.

#### STUDY SITES

Samples were taken from three pools situated in Polesie National Park.

A pool in Sęków (N: 51°22'31.16", E: 23°15'4.97"). The pool is located on the edge of Bagno Bubnów. The area of the basin was 150 m<sup>2</sup>, but the area of the surface varied considerably; in spring or after heavy rainfall the pool was part of a large flooded expanse. Samples were taken from the pond at depths up to 1 m. The pool was surrounded by flooded *Salix* sp., with *Carex* sp. occurring on some portions of the shore. Small *Juncus* sp. and *Equisetum* sp. communities were noted as well. Flooded grasses and isolated *Polygonum amphibium* L. plants grew by the shore. The bottom was hard and sandy with a small amount of muddy sediment. The water appeared clear, with visibility to the bottom. The physical and chemical indicators of the water at this site were as follows: temperature 14.6–25.3°C (average 17.8°C), pH 7.19–8.08 (average 7.64), electrolytic conductivity 257–447 μS/cm (average 384 μS/cm), dissolved oxygen 2.3–7.58 mgO<sub>2</sub>·dm<sup>-3</sup> (average 3.93 mgO<sub>2</sub>·dm<sup>-3</sup>).

A pool in Pieszowola (N: 51°28'53.13", E: 23°10'8.19"). The pool is situated within a fish pond complex. The area of the pool was 130 m<sup>2</sup> and its depth was about 0.8 m. Flooded *Salix* sp. grew on the shores. *Carex* sp. with some *Juncus* sp. and grasses occurred near the shore, with patches of *Iris pseudacorus* L. in places. *Lemna trisulca* L. was abundant on the surface of the water, forming a cover on the water surface together with smaller amounts of *Lemna minor* L. The bottom was muddy with large amounts of decomposing plant remains. The water contained large amounts of suspended solids; the bottom could not be seen. The physical and chemical indicators of the water at this site were as follows: temperature 11.6–24.8°C (average 17.4°C), pH 5.48–7.38 (6.51), electrolytic conductivity 79–132 μS/cm (98), dissolved oxygen 0.8–5.2 mgO<sub>2</sub>·dm<sup>-3</sup> (average 2.2 mgO<sub>2</sub>·dm<sup>-3</sup>).

A pool by Lake Łukie (N: 51°24'32.97", E: 23°5'39.26"). The pool is located right next to Lake Łukie, with a direct connection to the lake water. The area was 80 m<sup>2</sup> and the depth about 1 m. Dense *Phragmites australis* (CAV.) TRIN. ex STEUD. grew on the south side. Sedges and grasses grew on the remaining shores. The dominant plants were *Stratiotes aloides* L., which occurred regularly throughout the pool, and *Hydrocharis morsus-ranae* L., which covered most of the water surface. Abundant *Lemna trisulca* L. communities also grew on the surface, as well as smaller amounts of *Lemna minor* L. Sediments were muddy, with a black colour and a putrid smell. The water contained large amounts of suspended solids; the bottom was not visible. The physical and chemical indicators of the water at this site were as follows: temperature 14.0–19.5°C (average 16.2°C), pH 6.85–7.67 (7.26), electrolytic conductivity 346–555 µS/cm (435), dissolved oxygen 1.1–9.5 mgO<sub>2</sub>/dm<sup>3</sup> (average 4.39 mgO<sub>2</sub>/dm<sup>3</sup>).

#### METHODS

Semi-quantitative samples were collected using a dip net with a round frame 0.25 m in diameter and a net with 250 µm apertures. The material was collected from 2005 to 2007, from April to September. The Shannon index with a base 2 logarithm was used for analysis.

#### RESULTS

A total of 506 water mites belonging to 36 species were collected from the pools studied (Tab. 1). In the material collected there were 2 species that had not previously been noted in Polesie National Park – *Hydrachna leegei* and *Hydryphantes placationis*.

The dominants (dominance > 5%) were *Hydrodroma despiciens* (12.4% of the material collected), *Midea orbiculata* (12.2%), *Arrenurus forpicatus* (11.3%), *Piona nodata* (8.9%), *P. conglobata* (6.1%), species of the genus *Eylais* (5.7%), *Arrenurus tubulator* (5.7%), *Hydryphantes planus* (5.5%) and *Arrenurus globator* (5.3%).

Based on data from the literature [Biesiadka 1972, Davids 1972, Cichocka 1998], the water mites collected were classified into four synecological groups: eurytopic species typical of small water bodies, species typical of vernal astatic water bodies, tyrphobiotic and tyrphophilic species, and lake species.

In the material collected (from all three pools combined), small water body species were the most highly represented (43.0% of the fauna collected, 12 species). The second most abundant group was vernal species (23.2%, 11 sp.). Less abundant were tyrphobiotic and tyrphophilic species (20.0%, 10 sp.), and the least numerous were lake species (13.8%, 3 sp.) – Tab. 1.

Table 1. List of water mites collected in the small ponds of Polesie National Park (2005–2007)

Taxon	Study sites			Total	SG
	Sęków	Pieszowola	Lake Łukie		
<i>Hydrachna conjecta</i> Koen.	1			1	S
<i>Hydrachna cruenta</i> Müll.	6			6	S
<i>Hydrachna globosa</i> (Geer)	2			2	S
<i>Hydrachna leegei</i> Koen.	1			1	A
<i>Hydrachna</i> sp.	1			1	-
<i>Eylais hamata</i> Koen.	1			1	A
<i>Eylais</i> sp.	27	2		29	-
<i>Hydryphantes crassipalpis</i> Koen.	3			3	A
<i>Hydryphantes dispar</i> (Schaub)	6			6	A
<i>Hydryphantes placationis</i> Thon	2			2	A
<i>Hydryphantes planus</i> Thon	28			28	A
<i>Hydryphantes</i> sp. (deutonymphs)	6			6	-
<i>Hydrodroma despiciens</i> (Müll.)	61	1	1	63	S
<i>Oxus</i> sp.	1			1	-
<i>Limnesia connata</i> Koen.	1			1	T
<i>Limnesia fulgida</i> Koch	2	14	1	17	S
<i>Unionicola gracilipalpis</i> (Viets)	1			1	L
<i>Neumania deltoides</i> (Piers.)	1			1	L
<i>Piona alpicola</i> (Neum.)	1			1	T
<i>Piona carnea</i> (Koch)	1	1		2	T
<i>Piona conglobata</i> (Koch)	29	2		31	S
<i>Piona nodata</i> (Müll.)	44	1		45	A
<i>Piona</i> sp. (deutonymphs)		2		2	-
<i>Tiphys ornatus</i> Koch	11			11	A
<i>Pionopsis lutescens</i> (Herm.)	2	2		4	S
<i>Midea orbiculata</i> (Müll.)	62			62	L
<i>Arrenurus batillifer</i> Koen.	1	17		18	S
<i>Arrenurus bifidicodulus</i> Piers.	1	6		7	A
<i>Arrenurus boruzkii?</i> Ssujetow	1			1	T
<i>Arrenurus crenatus</i> Koen.	2			2	T
<i>Arrenurus cuspidator</i> (Müll.)		1		1	S
<i>Arrenurus fimbriatus</i> Koen.		3	1	4	T
<i>Arrenurus forpicatus</i> Neuman	57			57	T
<i>Arrenurus globator</i> (Müll.)	26	1		27	S
<i>Arrenurus inexploratus</i> Viets		2		2	A
<i>Arrenurus maculator</i> (Müll.)	1			1	S
<i>Arrenurus pustulator</i> (Müll.)	22			22	T
<i>Arrenurus robustus</i> Koen.	2			2	T
<i>Arrenurus stecki</i> Koen.	1			1	T
<i>Arrenurus truncatellus</i> (Müll.)	2			2	A
<i>Arrenurus tubulator</i> (Müll.)	13	16		29	S
<i>Arrenurus</i> sp. (juv.)	2			2	-
Total specimens	432	71	3	506	
Total species	33	13	3	36	

Synecological groups: A – astatic vernal water body species, S – small water body species, L – lake species, T – tyrphobiontic and tyrphophilic species

Water mites from the pools in Sęków and Pieszowola were analysed more thoroughly. In the pool by Lake Łukie the number of individuals caught was too small for any ecological indicators to be applied.

Of the three pools studied, the most water mites were collected (432 individuals) and the most species were noted (33) in the pool in Sęków (Tab. 1). The most abundant species in this pool were *Midea orbiculata* (14.3%), *Hydrodroma despiciens* (14.1%) and *Arrenurus forpicatus* (13.2%). The most numerous synecological group in the pool was small water body species (36.4%, 11 sp.). Water mites characteristic of astatic water bodies were also numerous (25.1%, 10 sp.). Somewhat less abundant were tyrphobiontic and tyrphophilic species (22.3%, 9 sp.), while lake species had the smallest quantitative and qualitative share (16.2%, 3 sp.). The species diversity of the fauna was 3.72.

In the pool in Pieszowola, 71 Hydrachnidia individuals belonging to 13 species were collected (Tab. 1). Most abundant were *Arrenurus batillifer* (23.9%), *A. tubulator* (22.5%) and *Limnesia fulgida* (19.7%). Small water body species were clearly dominant in this pool, constituting as much as 80.6% of the fauna collected (8 sp.). Vernal species constituted 13.4% of the water mites collected (3 sp.), while tyrphobiontic and tyrphophilic species accounted for 6.0% (2 sp.). No lake species were found in the pool in Pieszowola. The species diversity of the Hydrachnidia communities of this pool was 2.88.

## DISCUSSION

Thirty-six water mite species were found in the small pools studied in Polesie National Park. Seven species have been noted in the acidic peat-bog pools of the park [Kowalik 1996] and 52 in its carbonate peat-bog pools [Kowalik 1980, 1996, Stryjecki 2010]. In the dystrophic lakes of the park, 34 species have been noted in Lake Długie and 36 in Lake Moszne, while 45 have been collected in the eutrophic Lake Łukie [Kowalik and Stryjecki 1999]. Considering that data concerning the Hydrachnidia of lakes and peat-bog pools have been collected over the last 45 years, while small pools have been studied in only three seasons, the 36 species found in three small pools can be considered a fairly high number. Further, intensive research on these habitats would surely lengthen the list of species occurring in these water bodies.

Despite intensive research conducted over many years on the water mites of Polesie National Park, two species new to the park were noted in the pools studied. The fact that new species were found that had not been noted in other types of water bodies indicates that small pools are a significant element of the surface water network of the park, and the fauna inhabiting them enrich the park's biological diversity.

The richest fauna was noted in the pool in Sęków. The large number of taxa (33) and individuals (462) collected was due to the character of the habitat (a large pool, morphometrically diverse, periodical flooded expanses with well-developed astatic zones, well-developed aquatic vegetation). This habitat diver-

sity resulted in species diversity and high abundance of fauna. In contrast, the fauna in the pool by Lake Łukie was found to be extremely poor – during the entire period of the study only 3 individuals were collected. At times very low oxygen content ( $1.1 \text{ mg O}_2 \text{ dm}^{-3}$ ) was noted in the pool and the sediments had a putrid smell. Putrefactive processes may have been taking place, negatively affecting water mites and limiting their occurrence in the pool.

In the material as a whole, most abundant were small water body species (43.0%, 12 sp.) and vernal species (23.2%, 11 sp.). These two synecological groups are usually dominant in small permanent pools [Biesiadka 1972, Kowalik 1980, Cichocka 1996a, b, Stryjecki 2004]. Quantitative proportions between small water body species and vernal species depend on the degree of permanence of the pools – in permanent pools whose water level shows little variation, small water body species are dominant, while in pools with well-developed astatic zones the share of vernal species can sometimes exceed that of small water body species [Cichocka 1996b, Stryjecki 2004]. This phenomenon could be seen when comparing the pools in Sęków and Pieszowola. In the pool in Sęków, small water body species were dominant (36.4%, 11 sp.), but water mites typical of astatic water bodies also had a large share (25.1%, 10 sp.). The large share of representatives of vernal species resulted from the well-developed astatic zones in the pool – large flooded expanses formed by the shores of the pool in spring, and dried up in the summer. Such habitats favoured water mites associated with vernal water bodies. According to Cichocka [1996b], periodic flooded expanses favour the development of vernal fauna and the spread of this fauna to other types of water bodies. In the pool in Pieszowola, the shores were steep and the water level was relatively constant over the course of the season, so that the astatic zones in this pool were not well developed. These characteristics of the habitat resulted in very clear dominance of small water body species (80.6%), while the proportion of vernal species was much smaller than in the pool in Sęków (13.4%).

By far the most interesting of the pools studied was the one in Sęków, with the most taxa (33) and individuals (432) noted and the highest species diversity (3.72). The pool is situated on the edges of Bagno Bubnów – a vast area of carbonate peat bogs – but the characteristics of the pool (its sandy, hard bottom, the physical and chemical properties of the water, the occurrence of macrophytes) distinguish it from the peat-bog pools situated in the heart of Bagno Bubnów. Due to its close proximity to the peat-bog pools and the periodic water flow between them (flooded expanses in the spring), the faunas of these two types of water bodies show a high degree of similarity – as many as 21 species were found to be common to the small pond and the peat-bog pools closest to it. Water mites migrated mainly from the small pond and its astatic zones to the peat-bog pools; there was migration by species characteristic of vernal water bodies (e.g. from the genus *Hydryphantes*), small water body species (e.g. *Hydrodroma despiciens*) and lake species (e.g. *Midea orbiculata*). All of these species, which are not typhobiontic or typhophilic, found suitable conditions for living in the peat bogs of Bagno Bubnów; due to the carbonate character of the peat bog there was no environmental stress associated with low pH [Stryjecki 2010a].

The total number of species found in the water bodies of Bagno Bubnów (small pools and peat-bog pools) is 58, which together with their high species diversity indices (4.29 in the peat-bog pools and 3.72 in the small pool) confirms that Bagno Bubnów is the most valuable area of Polesie National Park in terms of Hydrachnidia.

#### CONCLUSIONS

1. The Hydrachnidia of the small pools of Polesie National Park were dominated by small water body species and vernal species. In the pool that had well-developed astatic zones, a fairly high proportion of water mites associated with vernal water bodies was noted (while small water body species were still dominant), whereas in the pool without astatic zones, very high dominance of small water body species was noted, with a small proportion of vernal species.

2. Small permanent pools are an essential element of the surface water network of Polesie National Park. These ponds increase the species diversity of the Hydrachnidia of the park.

3. Bagno Bubnów is the most valuable area of the Polesie National Park in terms of Hydrachnidia. The water bodies situated here (small pools and peat-bog pools) are inhabited by rich and diverse water mite fauna. The number of taxa caught and the species diversity of the Hydrachnidia communities of Bagno Bubnów stand out against other regions of the park.

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CHARAKTERYSTYKA FAUNISTYCZNO-EKOLOGICZNA WODOPÓJEK  
(ACARI: HYDRACHNIDIA) DROBNYCH ZBIORNIKÓW WODNYCH  
W POLESKIM PARKU NARODOWYM

**Streszczenie.** W trzech drobnych zbiornikach w Poleskim Parku Narodowym stwierdzono 36 gatunków wodopójek, w tym 2 gatunki nowe dla obszaru Parku – były to *Hydrachna leegei* i *Hydryphantes placationis*. Dominantami (dominacja > 5%) były: *Hydrodroma despiciens* (12,4%), *Midea orbiculata* (12,2%), *Arrenurus forpicatus* (11,3%), *Piona nodata* (8,9%), *P. conglobata* (6,1%), gatunki z rodzaju *Eylais* (5,7%), *Arrenurus tubulator* (5,7%), *Hydryphantes planus* (5,5%) i *Arrenurus globator* (5,3%). W zebranych materiale najliczniejsze były gatunki drobnozbiornikowe (43,0% zebranej fauny, 12 gatunków), następnie gatunki fauny wiosennej (23,2%, 11 gat.), tyrfobionty i tyrfofile (20,0%, 10 gat.), a najmniej liczne były wodopójki jeziorne (13,8%, 3 gat.). Najwięcej osobników (432), gatunków (33) oraz największą różnorodność gatunkową (3,72) stwierdzono w zbiorniku w Sękowie, położonym na obrzeżach Bagna Bubnów. Bogate i zróżnicowane zgrupowania Hydrachnidia tego zbiornika potwierdzają tezę, iż Bagno Bubnów stanowi bardzo cenny pod względem fauny Hydrachnidia obszar Poleskiego Parku Narodowego.

**Słowa kluczowe:** wodopójki, Hydrachnidia, drobne zbiorniki, grupy synekologiczne, różnorodność gatunkowa