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Water mites (Hydrachnidia) of the Biała Łada and Czarna Łada Rivers in the Lublin Region

Wodopójki (Hydrachnidia) rzek Biała Łada i Czarna Łada na Lubelszczyźnie

SUMMARY

The collections of water mites (Hydrachnidia) from the years 1973 and 1974 of two upland rivers – the Biała and Czarna Łada (south-eastern Poland) were elaborated. Among 1,178 individuals, 43 species were distinguished: 34 species in the River Biała Łada and 27 in the River Czarna Łada. Rheophiles and rheobionts were dominating. Some mountain species, rare in the upland areas also occurred. Seasonal changes of numbers and clear negative impact of water pollution and hydrotechnical works on water mites were found in the studied rivers, too.

Keywords: Hydrachnidia, water mites, upland rivers, the Lublin Region

STRESZCZENIE

Opracowano zbiory wodopójek (Hydrachnidia) z lat 1973 i 1974 dwu rzek wyżynnych – Białej Łady i Czarnej Łady (Polska południowo-wschodnia). Wśród 1178 osobników wyróżniono 43 gatunki: 34 w Białej Ładzie i 27 w Czarnej Ładzie. Dominowały reofile i reobionty. Występowały także niektóre rzadkie na wyżynach gatunki górskie. Stwierdzono sezonowe zmiany liczebności oraz wyraźny negatywny wpływ na wodopójki zanieczyszczenia wody i zabiegów hydrotechnicznych w badanych rzekach.

Słowa kluczowe: Hydrachnidia, wodopójki, rzeki wyżynne, Lubelszczyzna

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INTRODUCTION

In the Department of Zoology, Animal Ecology and Wildlife Sciences at the University of Life Sciences there are still scientifically undescribed abundant materials of water mites from the years 1973–1976 of running waters of the Roztocze and Lublin Upland Regions.

This paper is the continuation of the studies on water mites of Roztocze and the Sandomierska Lowland in south-eastern Poland which began in the year 1973 (7, 8, 9). It refers to two upland rivers – Biała Łada and Czarna Łada, which are the tributaries of the River Łada and the River Tanew in the catchment of the River Vistula (Fig.1). The scientific description of these rivers is advisable because the studies of water mites of upland rivers are scarce and the fauna of these water courses is rich and interesting.

The aim of the studies of the Biała Łada and Czarna Łada Rivers was the recognition of: species composition, quantitative structure, ecological character of water mites in the varied environments, as well as the influence of water pollution on these organisms.

MATERIAL AND METHODS

The River Biała Łada with the total length of 45 km and the catchment area of 256 km^2 is a tributary of the River Łada which flows into the River Tanew (Fig. 1). It rises at lowland springs in limestone rocks covered with loess of the Western Roztocze in the vicinity of the village Goraj (14). Next, it flows through the Sandomierska Lowland and in the vicinity of Biłgoraj it joins the River Czarna Łada which makes the River Łada.

Material was collected with the use of a hydrobiological sampler in the River Biała Łada at 5 study sites, 9 times in the year 1973, from March till November (45 samples, 920 individuals). Similarly, in the River Czarna Łada in the year 1974, at one study site (13 samples, 258 individuals). In the quantitative analysis the number of species at study sites and the environments as well as dominance: eudominants D_1 – over 10% of all individuals, dominants D_2 – 5.1–10.0 %, subdominants D_3 – 2.0–5.0 % and recedents D_4 – less than 2.0 %, were taken into consideration.

Significant ecological diversity of water mites allows to distinguish the groups of species with particular environmental preferences. In the studied waters the following groups were distinguished: rheobionts, rheophiles and crenophiles as well as stagnobionts and stagnophiles. This classification is based on numerous literature data as well as authors' own studies, however, its character is regional and refers to the area of Middle Europe (3). In the study period in the year 1973 waters of the River Biała Łada except for the sites 1, 4 and 5 were clean and well oxygenated: water temperature 6.5–13 °C, oxygen 8.4–15.8 mg/dm^3, pH 7.2–8.0, general oxidizability 3.5–8.0 mg O_2/ dm^3, calcium 18.0–40.0 mg/ dm^3, magnesium 3.5–10.5 mg/ dm^3, nitrates 0.05–0.13 mg N/ dm^3 (13).

RESEARCH SITES

The River Biała Łada – study sites (Fig. 1)

1. Goraj settlement (50° 43' 14.45'' N, 22° 40' 8.14'' E) – river bed regulated, 2 m wide, 0.2–0.5 m deep, bottom of sand and mud, current slow, water periodically polluted with municipal sewage, river banks – meadows and pastures.
2. Radzięcin settlement (50° 41' 12.39'' N, 22° 42' 8.65'' E) – river bed natural, 4 m wide, 0.5 m deep, bottom of stones and sand, covered with *Potamogeton* sp. at some places, current fast, river banks – meadows.

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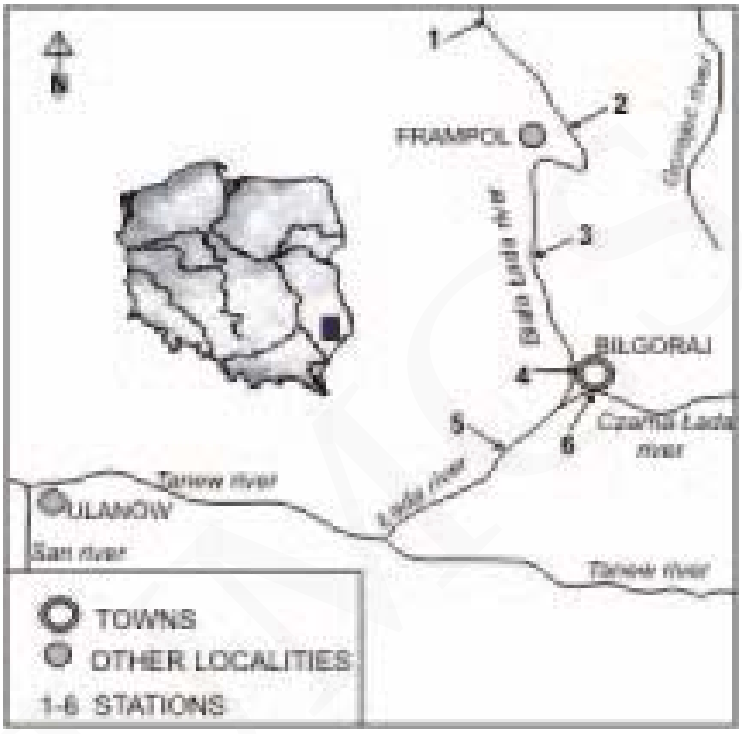


Fig.1. Distribution of localities.

3. Korytków Mały settlement (50° 37’ 17.26’’ N, 22° 39’ 42.83’’ E) – river bed natural, 3 m wide, 0.3–0.7 m deep, bottom of sand covered with patches of *Elodea canadensis*, current fast, river banks – meadows and fields.
4. Biłgoraj city (50° 32’ 23.51’’ N, 22° 44’ 24.07’’ E) – river bed regulated, 8 m wide, 0.4–1.0 m deep, bottom of sand and mud, covered with *Potamogeton* sp. at some places, current moderate, water periodically polluted with sewage, river banks – urban development.
5. The River Łada, Sól (50° 30’ 52.42’’ N, 22° 39’ 20.62’’ E) settlement – river bed natural, 5 m wide, 1.0 m deep, bottom of mud, *Potamogeton* sp. at some places, current slow, river banks with buildings, water strongly polluted with organic sewage.

The River Czarna Łada is a small water course flowing through boggy, marshy and covered with trees area of the Solska Forest and in the vicinity of Biłgoraj it joins the River Biała Łada.

The waters of this river in the study period in the year 1974 contained significant amount of humus due to the character of the catchment. Water temperature

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5.2-14.3 °C, light brown colour, pH 5.6–7.0, oxygen 8.2–15.0 mg/ dm^3, general oxidizability 8.0–15.3 mg 0_2 / dm^3, Ca 10.7–16.1 mg/ dm^3, Fe 0.5–1.9 mg/ dm^3, nitrates 0.06–0.10 N/mg/ dm^3 (13).

The study site 6 – Biłgoraj city (50° 32' 23.51'' N, 22° 44' 24.07'' E) – river bed natural, 8.0 m wide, 0.3-1.0 m deep, bottom of sand and mud with patches of *Elodea canadensis* at some places, not numerous stones covered with *Fontinalis antypyretica*, current moderate, river banks – meadows and the city.

RESULTS AND DISCUSSION

In the collected material 1,178 individuals and 43 species of water mites were found in total – 34 in the River Biała Łada and 27 in Czarna Łada (Tab. 1).

The River Biała Łada

In the River Biała Łada in the year 1973, 8 species rare in Poland were collected: *Eylais koenikei* – site 2, 1 individ. (stagnobiont, temporary water bodies), *Torrenticola brevirostis* – sites 3, 1 individ. (rheobiont, boreal-montane species?), *Lebertia dubia* – site 1, 4 individ. (springs, streams, oligotrophic lakes), *T. stadleri* – site 3, 3 individ. (streams, rivers), *Neumania papillosa* – site. 3, 1 individ. (rivers, lakes), *Nautarachna crassa* – site 4, 1 individ. (springs, running waters), *Brachypoda celeripes* – site 3, 1 individ. (streams, rivers), *Albia stationis* – site 3, 5 individ. (streams, rivers) and *Mideopsis rotoczensis* – site 3, 4 individ. (streams, rivers). The male of *Nautarachna crassa* recorded during the studies corresponded with the description of the male of *N. karamani* made by Viets in 1937. However, the authors agree that both species should be synonimized. This is also the view of Smith (12).

In the River Biała Łada the most numerously collected were the water mites of the following families: *Hygrobatidae* – 532 individ. (57.8% of the whole material), *Lebertidae* – 189 individ. (20.5%) and *Sperchonidae* – 150 individ. (16.3%). Similarly in the River Czarna Łada – *Lebertidae* – 126 individ. (47.7%), *Hygrobatidae* – 77 individ. (28.0%) and *Sperchonidae* – 34 individ. (12.9%). Most of the species belonging to these families are typical of running waters (rheobionts and rheophiles) and springs (crenophiles). Rheobionts (13 spec.) comprised 40.0% of numbers, rheophiles (13 spec.) 58.2%, stagnobionts and stagnophiles (5 spec.) 1.3%, crenophiles (3 spec.) 0.7% respectively.

In this river the most numerously collected were the water mites of ecologically diversified natural sites 3 (546 individ., 25 spec.) and 2 (323 individ., 17 spec.). Very small population of water mites was found at ecologically transformed (regulation of a river bed, pollution) site 1 (21 individ., 7 spec.) and 4 (30 individ., 11 spec. – Table 1). In the River Łada, strongly polluted with municipal sewage from Biłgoraj (study site 5), no water mites were caught.

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Table 1. The occurrence of water mites (Hydrachnidia) in the Biała Łada and Czarna Łada Rivers.*– rare species, A – ecological character: S – stagnobiont, SF – stagnophile, R – rheobiont, RF – rheophile, K – crenophile, Cz. Ł. – Czarna Łada in Biłgoraj, B–E Biała Łada – study sites: B – Goraj, C – Radzięcin, D – Korytków Mały, E – Biłgoraj, Σ – sum of individuals in the River Biała Łada, numbers in brackets show dominance of a species (D %).

No	Species	A	Cz. Ł.	B	C	D	E	Σ
1		2	3	4	5	6	7	8
1	*Limnochares aquatica* (L.)	S	1					
2	*Eylais bisinuosa* Piersig	RF*	1					
3	*E. extendens* (O. F. Müll)	S		1				1
4	*E. koenikei* Halb.	S*			1			1
5	*Protzia eximia* (Protz)	R*	1					
6	*Sperchonopsis verrucosa* (Protz)	R	1			2		2
7	*Sperchon clupeifer* Piers.	R	29 (11.2)		39 (12.0)	18 (3.3)	3	60 (6.6)
8	*S. squamosus* Kram.	K		1				1
9	*S. papillosus* Thor	R?	2		6			6
10	*S. setiger* Thor	R	3		76 (23.5)	6		82 (9.0)
11	*S. thienemanni* Koen.	K			1			1
12	*Teutonia cometes* (Koch)	SF*	5					
13	*Lebertia dubia* Thor	K		4				4
14	*L. fimbriata* Thor	R				6		6
15	*L. inaequalis* (Koch)	RF	58 (22.4)		2	53 (9.7)	4	59 (6.4)
16	*L. insignis* Neum.	RF	21 (8.2)			6		6
17	*L. oblonga* Koen.	R	7 (2.7)		2	42 (7.6)	1	45 (5.0)
18	*L. pilosa* Maglio	R*	4					
19	*L. porosa* Thor	RF	24 (9.4)	1	13 (4.0)	14 (2.6)	1	29 (3.2)
20	*L. pusilla* Koen.	R*	1					
21	*L. rivulorum* Viets	RF	11 (4.3)		13 (4.0)	27 (4.9)		40 (4.4)
22	*Torrenticola amplexa* Koen.	R	13 (5.0)		1	18 (3.3)		19 (2.1)
23	*T. brevirostris* Halb.	R*				1		1
24	*T. stadleri* (Walter)	R*				3		3
25	*Limnesia undulatoides* Davids	S	1					
26	*Hygrobates calliger* Piers.	R	4		24 (7.4)	78 (14.3)	2	104 (11.3)
27	*H. fluviatilis* (Ström.)	RF	9 (3.5)	12	106 (32.8)	67 (12.3)	4	189 (20.6)
28	*H. longipalpis* (Herm.)	SF	33 (12.8)		1	4	1	6
29	*H. longiporus* Thor	R	9 (3.5)				1	1
30	*H. properus* Láska	RF*	1					
31	*H. setosus* Bess.	RF	10 (3.8)		29 (9.0)	152 (27.8)	11	192 (20.8)
32	*Atractides distans* (Viets)	RF	2			3		3
33	*A. nodipalpis* (Thor.)	R		1	7 (2.1)	28 (5.1)	1	37 (4.0)
34	*Neumania papillosa* (Soar)	RF*				1		1
35	*Piona neumani* (Koen.)	S		1				1
36	*Nautarachna crassa* (Koen.)	RF*					1	1
37	*Forelia variegator* (Koch)	SF	2			3		3
38	*Brachypoda celeripes* Viets	RF*				1		1
39	*Albia stationis* Thon	RF*				5		5
40	*Aturus scaber* Kram.	R			1			1
41	*Mideopsis crassipes* Soar	RF	4		1	4		5
42	*M. roztoczensis* Bies. et Kow.	RF*				4		4
43	*Arrenurus crassicaudatus* Kram.	S	1					
	Number of individuals		258	21	323	546	30	920
	Number of species		27	7	17	24	11	34

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The most numerous and common were two rheophilous species *Hygrobates fluviatilis* (20.6 %) and *H. setosus* (20.8%), which were most often found by the bank among plants and in the places with slow current. On the contrary, in the environments with fast current and sandy or stony bottom, rheobiontic species were dominating: *Hygrobates calliger*, *Sperchon setiger*, *S. clupeifer*, *Lebertia oblonga*, *Torrenticola amplexa* and *Atractides nodipalpis*. Among aquatic moss (*Fontinalis antypyretica*) on stones and branches, *Lebertia rivulorum* (3.4%) was quite numerously found and singly – *Albia stationis*, *Torrenticola amplexa*, *Aturus scaber* and *Sperchon clupeifer*. *Hygrobates setosus* was separated from *H. nigromaculatus* (11). *H. nigromaculatus* was previously characterized as a species of both environments – either running or standing waters. Martin et al. (11), separating *H. setosus*, described it as a rheophilous species in the opposition to *H. nigromaculatus*, which was regarded as typical of standing waters. Because those species were commonly mistaken, major part of data concerning *H. nigromaculatus* certainly referred to *H. setosus*, which was given only by Kłosowska et al. (10) from the area of Poland.

To eudominants (over 10.0%) in the River Biała Łada belonged rheophilous species: *Hygrobates fluviatilis* (20.6%), *H. setosus* (20.8%) and rheobiontic *H. caliger* (11.3%). To dominants (5.1–10.0%) – rheobionts: *Sperchon setiger* (9.0%), *S. clupeifer* (6.6%) and rheophilous *Lebertia inaequalis* (6.4%) – Table 1. In the group of subdominants (2.1–5.0%) 5 species (rheobionts and rheophiles) were included: *Lebertia oblonga*, *L. rivulorum*, *Atractides nodipalpis*, *Lebertia porosa* and *Torrenticola amplexa*. The remaining 23 species were recedents (less than 2%). Those were rheobionts (7 species) , rheophiles (8 species), stagnobionts (3 species) and stagnophiles (2 species) as well as crenophiles (3 species). Moreover, in this river single deutonymphs were collected: *Lebertia* sp., *Atractides* sp., *Piona* sp. and *Aturus* sp..

Seasonal changes in numbers of water mites in the River Biała Łada, especially at natural sites 2 and 3, showed two peaks – summer one (June–July) and autumn one (September–November) – Figure 2. In this period at site 2, *Hygrobates fluviatilis*, *Sperchon setiger*, *S. clupeifer* (summer and autumn), and *H. setosus* (autumn) were dominating while at site 3, *Hygrobates setosus* (autumn) and *H. calliger*, *H. fluviatilis*, *Lebertia inaequalis*, and *L. oblonga* (summer and autumn) were dominating. Seasonal changes in numbers of species at those two sites also showed two peaks – summer and autumn ones.

The River Czarna Łada in Biłgoraj

At study site 6 in the River Czarna Łada in Biłgoraj in the year 1974, 258 individuals, 27 species were caught (Tab.1). Six species were included in rare ones in Poland: *Eylais bisinuosa* – 1 individ. (lowland rheophile), *Protzia eximia* – 1 individ. (mountain rheobiont), *Teutonia cometes* – 5 individ. (stagnophile, boreal-

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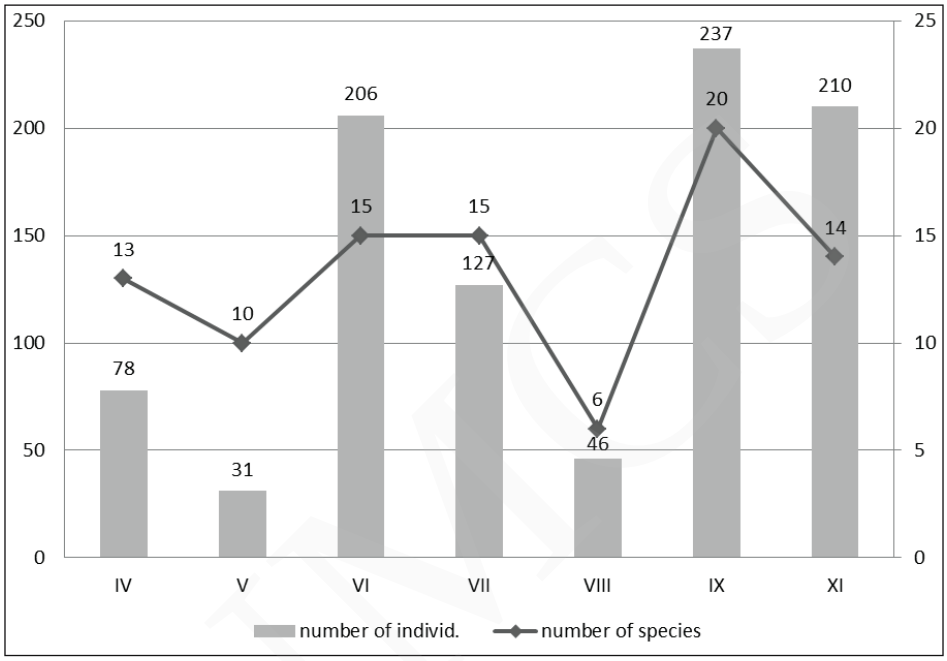


Fig. 2. Seasonal changes of numbers of water mites (Hydrachnidia) in the River Biała Łada (the year 1973).

montane species?), *Lebertia pilosa* – 4 individ. (lowland rheobiont), *L. pusilla* – 1 individ. (mountain rheophile) and *Hygrobates properus* (mountain rivers and streams).

Rheophiles (eudominants and dominants) occurred numerously: *Lebertia inaequalis* (22.4 % of the total number), *L. porosa* (9.4 %) and *L. insignis* (8.0 %), rheobiontic *Sperchon clupeifer* (11.2%) and lacustrine-riverine species *Hygrobates longipalpis* (12.8%). The numbers of rheobionts (11 species) except for *Lebertia oblonga* (7 individ.), *Hygrobates longipalpis* (9 individ.) and *Torrenticola amplexa* (13 individ.) was very low (1–3 individ.): *Protzia eximia*, *Sperchonopsis verrucosa*, *Sperchon papillosus*, *S. setiger*, *Lebertia pusilla*, and *Hygrobates calliger*. Rheobionts (11 spec.) comprised 28.7% of total numbers, rheophiles (10 spec.) 55.0%, stagnobionts and stagnophiles (6 spec.) 16.6%. Among singularly occurring stagnobionts (3 spec.) and stagnophiles (3 spec.), the most numerous was *Hygrobates longipalpis* – 33 individ., 12.8% of total numbers. Water mites were caught most numerously in autumn (September–November) – 120 individ., 21 spec. and in spring (March–April) – 70 individ., 12 spec.

The fauna of water mites of the studied rivers was rich and diversified, typical of running waters of uplands and lowlands. The species composition and domina-

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tion of rheophilous and rheobiontic species confirmed it as well as the significant number – 14 – of rare and very rare species in Poland (Tab. 1).

The similar ecological character and species structure as well as the numbers of water mites were found in the earlier studied upland river of the Lublin Region – Bystrzyca Lubelska (7) as well as in streams and rivers of Roztocze (9). In those water courses – like in the Rivers Biała Łada and Czarna Łada – rheophiles and rheobionts were dominating. Some rare mountain species also occurred there: *Protzia eximia*, *Lebertia pusilla, L. fimbriata, Hygrobates properus* as well as boreal-montane *Torrenticola brevirostris* and *Teutonia cometes* (Tab. 1). Undoubtedly it was the result of ecological character of the studied rivers current environments: fast current, low temperature and high oxygen content as well as bottom of sand or stones overgrown by periphyton and aquatic moss (13).

If in lowland rivers are sections with clear and well oxygenated water as well as diversified stream habitats, the fauna of water mites is specific, with the character of upland or submountain stream. It was showed in the studies of, e.g. Biesiadka (2) – referring to the water mites of the River Wełna (the Wielkopolsko-Kujawska Lowland), Kowalik and Biesiadka (9) and Kowalik (7, 8) – concerning the rivers of the Lublin Region, as well as Cichocka (5, 6) – studies of the rivers of the Masurian Lake District and Biesiadka et al. (4) – studies of the rivers of the basin of the River Neman (Belarus).

In stream habitats of the River Biała Łada and Czarna Łada the dominants were the rheobionts and rheophiles from the genera: *Hygrobates, Sperchon* and *Lebertia.* Rare spring-stream and mountain species also occurred (Tab. 1). However, in lowland and upland rivers in which stream sections are poorly developed, stagnobionts and stagnophiles are dominating while rheobionts and rheophiles are not numerous (1, 2, 5, 6, 7).

Water mites as organisms sensitive to hydrotechnical degradation of environments and water pollution were sporadically collected at sites 1 and 4 in the River Biała Łada, however, they were not found at site 6 in the River Łada below the city of Biłgoraj (Tab. 1).

It would be interesting to compare the current situation of water mite fauna in both rivers within the past 40 years.

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