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WATER MITES (ACARI, HYDRACHNIDIA) OF THE RIVER SZUM AND STREAM KRUPIEC IN THE ROZTOCZE REGION

Abstract

On the basis of the biological collections from the years 1973–1974, the paper about water mites of springs in the Roztocze Region (Biesiadka and Kowalik 1978) as well as the springs of the River Szum and the Stream Krupiec (the Rozotocze region, south-eastern Poland). This paper completes the study of the remaining collections of water mites from these years from both riverine and stream habitats. 1822 water mites belonging to 46 species were caught. Species composition together with qualitative and quantitative structure were analyzed and the ecological groups of water mites were distinguished. For the Stream Krupiec the creation of landscape and faunistic nature reserve was proposed.

Keywords: water mites, Hydrachnidia, springs, river, stream, synecological groups

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Introduction

The studies on water mites (Hydrachnidia) inhabiting water bodies in Roztocze and Sandomierz Basin (Lublin Voivodeship, Poland) were conducted in the years 1973–1975. Results of those studies were very interesting due to regional specificity of water mite fauna and considerable ecological diversity of aquatic habitats (Kowalik and Biesiadka 1978; Biesiadka and Kowalik 1977, 1978, 1979; Kowalik 1984, 1990; Zawal and Kowalik 2013).

The present paper contains the results of current analyses of leftover biological material collected in the years 1973–1974, conducted to study the occurrence and ecology of water mites in the River Szum and its small tributary, the Stream Krupiec. Earlier (Biesiadka and Kowalik 1978) the results of the studies on the water mites inhabiting springs of those water courses were published (Table 1, + – species). The remaining collections of water mites from the year 1974 from riverine and stream habitats were identified at present and provided in this publication. Therefore, there is the supplementary data to the paper about the water mites of those water courses (Biesiadka and Kowalik 1978). The aim of the paper contains the question about the differences in species and quantitative structures of water mites as well as their ecological status in two hydrologically different water courses. These are: the River Szum with typical stream stretch ("Szum" Nature Reserve) and the Stream Krupiec with numerous springs (large limnocrene, rheocrenes, helocrenes). It was also important and necessary to correct the erroneous identification of the springs of the River Szum (a large limnocrene) near the railway station in Krasnobród (Biesiadka and Kowalik 1977, 1978, 1979). The correct name of those springs: "springs of the Stream Krupiec near the railway station in Józefów Roztoczański".

Material and methods

The River Szum is 25 km long and has a catchment area of 134 km^2; it is a right-bank tributary of the River Tanew (Michalczyk and Zielińska 1996). The spring of the River Szumis situated in the bogland area of Bagna Międzyrzeki (Roztocze National Park), and the river flows into the Tanew in the village of Szostaki (Figure 1).

In its upper reaches, between Górecko Stare and Górecko Kościelne, the River Szumflows across a deep forest valley situated in "Szum" Nature Reserve

Table 1. Water mites (Hydrachnidia) of the River Szum and the Stream Krupiec (1973–1974)

Rivers		EK	Szum				Krupiec			
No.	Species, study sites		1	2	3	Σ–D%	4	5	6	Σ–D%
1	*Eylais extendens* (O. F.Mull.)	S	1			1				–
2	*Panisus michaeli* Koen. .	K*	2			2	6+	22+		28–2.1
3	*P. torrenticolus* Piers.	K*	5+			5		14+		14
4	*Panisopsis setipes* (Viets).	K*	1+			1		7+		7
5	*Parathyas palustris* Koen.	K	9+			9				–
6	*Protzia eximia* (Protz).	R*	1			1				–
7	*Sperchonopsis verrucosa* (Pr.)	R	7	2		9			1	1
8	*Sperchon clupeifer* Piers.	R	1+	5		6				–
9	*S. compactilis* Koen.	RF			1	1				–
10	*S. longissimus* Viets.	K*	2+			2				–
11	*S. papillosus* Thor	R?	1+	30	1	32–6.0				–
12	*S. setiger* Thor	R	1	20	13	34–6.3	1	3	11	15
13	*S. squamosus* Kram.	KF				–		2+		2
14	*S. thienemanni* Koen.	K	19+			19–3.5		67+		67–5.2
15	*Lebertia cognata* Koen.	KF	3+			3	165+			165–12.8
16	*L. dubia* Thor	KF		12		12–2.2	4+			4
17	*L. fimbriata* Thor	RF				–		1	4	5
18	*L. glabra* Thor	KF*				–		6	12	18
19	*L. inaequalis* (Koch)	RF		12	2	14–2.6				–
20	*L. insignis* Neum.	RF			2	2				–
21	*L. oblonga* Koen.	RF		6	1	7				–
22	*L. porosa* Thor	RF		13		13–2.4			1	1
23	*L.rivulorum* Viets	RF		1		1				–
24	*L. rufipes* Koen.	KF				–	122+	6+		128–10.0
25	*L. salebrosa* Koen.	KF	3+			3	4+	7+		11
26	*L. stigmatifera* Thor	K	5+			5		14	1	15
27	*Oxus ekmani* (Thor)	SF*?				–	27+			27–2.0
28	*Torrenticola stadleri* (Walt.)	R*	2			2				–
29	*Limnesia fulgida* Koch	S				–			1	1
30	*L. koenikei* Piers.	SF		1		1	4+			4
31	*Hygrobates fluviatilis* (Strom)	RF	2+	4	1	7	3	72	65	140–10.8
32	*H. longipalpis* Herm.	RF?	48	22	1	71–13.3		2		2
33	*H. nigromaculatus* Leb.	RF	17	166	21	204–38.3		3	3	6
34	*H. norvegicus* (Thor)	K*	4			4	1	12+		13
35	*H. setosus* Bess.	RF	14	5	7	26–4.8		3		3
36	*Atractides nodipalpis* (Thor)	R		3		3			1	1
37	*A. tener* (Thor)	R	10	2		12–2.2		1		1
38	*Piona disparilis* (Koen.)	KF				–	402+	2+		404–31.3
39	*P. rotundoides* (Thor)	S				–		1	1	2
40	*Wettina podagrica* (Koch)	KF?	2	1		3			2	2
41	*Forelia variegator* (Koch)	SF		1	2	3	1+			1
42	*Ljania bipapillata* Thor	RF	1+			1				–
43	*Aturus scaber* Kram.	R	2			2				–
44	*Mideopsis crassipes* Soar	RF		1+	4	5				–
45	*M. roztoczensis* Bies. et Kow.	RF*		6	2	8				–
46	*Arrenurus cylindratus* Piers.	KF?				–	196+	3+	1	200–15.6
	Number of specimens		163	313	58	534	936	248	104	1288
	Number of species		25	20	13	37	13	20	13	30

* – rare species, EK – ecological character: S – stagnobiont, SF – stagnophile, R – rheobiont, RF– rheophile, K – crenobiont, KF – crenophile, the River Szum: 1 – "Szum" Nature Reserve, 2 – Sigła, 3 – Szostaki, the Stream Krupiec: 4 – limnocrene, 5 – spring zone of the stream, 6 – Majdan Kasztelański, Σ – total number of individuals, D% – dominance, + species published in 1978–1979.

(area: 17 ha, length of the river stretch: 2 km). The character of that stretch of the river resembles a mountain stream, with rapids and small waterfalls, known in Polish as "szum" or "szypot". The Reserve is combined with a small dammed reservoir. Below Górecko Kościelne, near the road to the villages of Aleksandrów and Sigła, there is a small river pond on the Szum. Then the river crosses meadows and fields, and flows into the Tanew.

In 1974, five times, at three research sites (1, 2 and 3) chemical properties of the river water were tested (Stępień et al. 1983). It was noted that the water was clean and well oxygenated and characterized by the following parameters: oxygen: 4.6–16.0 mg O_2 /dm^3; oxygen saturation: 40–143%; pH: 6.5–7.7; low electrolyte content (K, Mg, Fe) apart from calcium: 16.9–30.2 mg Ca/dm^3; water temperature: 5.2–13.2°C; nitrate concentration: 0.05–0.13 mg N/dm^3; chemical oxygen demand: 6.5–7.4 mg O_2 /dm^3.

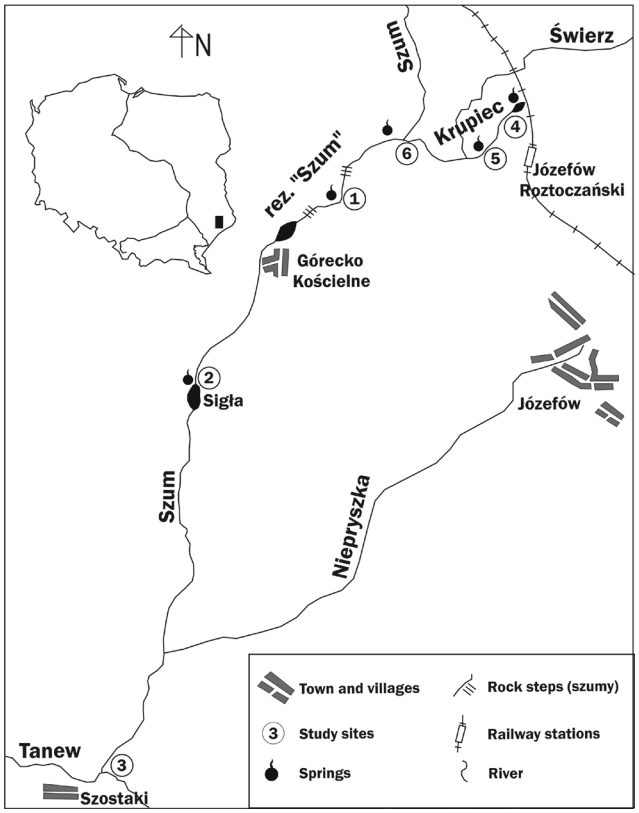

Figure 1. Spatial distribution of research sites

During the identifications of water mite species as well as the determination of their ecological characters the following papers were used: Lundblad (1968), Viets (1978) as well as new studies of Biesiadka (2008) and Gerecke (2009), Di Sabatino et al. (2009, 2010a, b). The species *Hygrobates setosus* was also distinguished on the basis of the paper of Martin et al. (2010).

The River Szum – Research Sites (Figure 1)

1. Geographical position: N 50° 30' 48'', E 22° 59' 21''

"Szum" Nature Reserve below the village of Górecko Stare. A gorge section of the river resembling a mountain stream; width: 1–3 m; depth: up to 0.7 m; limestone rapids covered with willow moss (*Fontinalis antipyretica*); sandy or rocky bottom, in some places covered with submergent plants; very rapid current, marginal wetlands present but not very numerous. Mixed forest on the banks.

2. Geographical position: N 50° 29' 14'', E 22° 57' 10''

The village of Sigła near Aleksandrów, above the river pond; width: 2–3 m; depth: 0.8 m; sandy bottom covered with Canadian waterweed (*Elodea canadensis* L.); slow current. Sedge peat bog and mixed forest on the banks.

3. Geographical position: N 50° 24' 59'', E 22° 55' 29''

The village of Szostaki, where the Szum flows into the River Tanew; width: 3 m; depth 0.5 m, sandy bottom with sparse submergent vegetation; rapid current. Meadows and pastures on the banks.

The Stream Krupiec – Research Sites (Figure 1)

A small (4 km) tributary of the River Szum, the Krupiec takes its origin from numerous artificially dammed springs (spring pond) near the railway station of Józefów Roztoczański. Below the pond it flows across a sandy, at some places boggy, forest valley. The stream is fed by numerous rheocrene and helocrene springs. Then the spring has been dammed to form a small reservoir, and below the reservoir the stream flows into the Szum in the village of Majdan Kasztelański.

1. Geographical position: N 50° 31' 24", E 23° 02' 25"

An artificially dammed limnocrene with the area of ca. 300 m^2 near the railway station of Józefów Roztoczański. It is situated in a forest gully and fed by numerous springs at the bottom of the reservoir, which has the maximum depth of 1 m. The bottom is sandy, in some places covered with shed leaves

and overgrown with green algae from the family Characeae (*Chara* sp.) and clusters of other threadlike algae. Seasonal variability of physical and chemical parameters of water has been noted in the spring reservoir, depending on physical and biological factors (Stępień et al. 1983). Water temperature: 5.8–12.0°C; pH: 5.6–7.4, oxygen content: 8.5–14.0 mg/dm^3, oxygen saturation: 70–115%. The presence of humus compounds (rotting leaves and needle cover) result in very low calcium (4.9–11.2 mg/dm^3) and magnesium (1.0–2.5 mg/dm^3) contents, and a heightened oxygen demand level: up to 11.3 mg O_2 /dm^3.

2. Geographical position: N 50° 31' 23", E 23° 02' 24"

A sloughy, boggy stream springing from a limnocrene; width: 3 m, depth: 0.2 m, sandy and muddy bottom covered with aquatic plants; moderate current. Numerous rheocrenes and helocrenes (spring zone of the stream). Forest on the banks.

3. Geographical position: N 50° 31' 18", E 23° 01' 44"

The village of Majdan Kasztelański, where the Krupiec flows into the Szum; width: 2.5 m, depth: 0.6 m; sandy bottom sparsely covered with submergent plants; rapid current. Forest on the banks.

The water mites were collected with a hydrobiological sweep net and sporadically also with a towed dredge, from 6 research sites, three times during each season (spring, summer, and autumn 1974). At some more diversified sites samples were collected several times in order to take into account habitat preferences of water mites: from the current, from the banks, from aquatic plants, from the spring. In total, 60 samples were collected, containing 1822 water mite individuals representing 46 species, as well as several dozen deuteronymphs.

The quantitative analysis took into account the number of species at research sites and in ecological groups (habitat preferences), as well as dominance: eudominants (D_1) – over 10.0% of th total number of individuals; dominants (D_2) – 5.1–10.0%, subdominants (D_3) – 2.0–5.0%, and recedents (D_4) – less than 2.0%.

Results and discussion

The collected material contained the total of 1822 water mite individuals representing 37 species in the River Szum (534 individuals) and 30 species in the Stream Krupiec (1288 individuals) – Table 1.

The River Szum

Eight water mite species rare or very rare in Poland were recorded: 5 crenobiontic and crenophilous species at research site 1 in the springs of "Szum" Nature Reserve: *Panisus michaeli* (2 individuals), *P. torrenticolus* (5 indiv.), *Panisopsis setipes* (1 indiv.), *Sperchon longissimus* (2 indiv.) and *Hygrobates norvegius* (4 indiv.); 2 rheobiontic species were found in the river: *Protzia eximia* (1 indiv.) and *Torrenticola stadleri* (2 indiv.), as well as 1 rheophilous species, namely *Mideopsis roztoczensis*, found at sites 2 and 3 (6 and 2 individuals respectively) (Table 1).

The most abundant and also the most common were two rheophilous species: *Hygrobates nigromaculatus* (38.3%) and *H. longipalpis* (13.3%). They were collected in the largest numbers from locations with a moderate current and near the bank, among plants. In habitats associated with the river current, i.e. in the rapids and at the rocky or sandy bottom, rheobionts and rheophiles were comparatively abundant: *Sperchon papillosus*, *S. setiger*, *Lebertia inaequalis*, *L. porosa*, *Hygrobates setosus*; *Mideopsis crassipes* and *M. roztoczensis* were also recorded, but in lower numbers. Individual rheobionts were collected among water moss and algae covering the rocks: *Protzia eximia*, *Sperchonopsis verrucosa*, *Sperchon squamosus, Ljania bipapillata* and *Aturus scaber*.

As for ecological groups (Figure 2), those which were represented by the highest numbers in the river included: rheophiles – the most numerous, represented by 13 species, 359 indiv. (67.2%), i.a. *Hygrobates nigromaculatus* (38.3%), *H. longipalpis* (13.3%) and *H. setosus* (4.8%); rheobionts – less numerous, represented by 9 species, 100 indiv. (18.9%), mainly *Sperchon setiger* (6.3%) and *S. papillosus* (6.0%). Crenobionts were represented by 8 species, 47 indiv. (8.8%) and the most abundant species included *Sperchon thienemanni* and *Parthyas palustris*; crenophiles were represented by 4 species, 21 indiv. (3.9%) and the most abundant species was *Lebertia dubia*. Furthermore, two stagnophiles were collected: *Limnesia koenikei* and *Forelia variegator* (0.7%), as well as one stagnobiont: *Eylais extendeus* (0.1%).

Eudominants (over 10.0% of the total abundance) included the rheophiles: *Hygrobates nigromaculatus* (38.3%) and *H. longipalpis* (13.3%) (Table 1). Dominants (5.1–10.0%) included the rheobionts *Sperchon setiger* (6.3%) and *S. papillosus* (6.0%). Subdominants (2.1–5.0%) included 4 rheobionts and rheophiles: *Lebertia inaequalis*, *L. porosa*, *Hygrobates setosus* and *Atractides*

tener, as well as one crenobiont – *Sperchon thienemanni*, and one crenophile – *Lebertia dubia*. The remaining 27 species were crenophiles (below 2.0% of the total abundance). Furthermore, individual deuteronymphs representing the genera *Sperchon, Hygrobates* and *Lebertia* were also collected from the river.

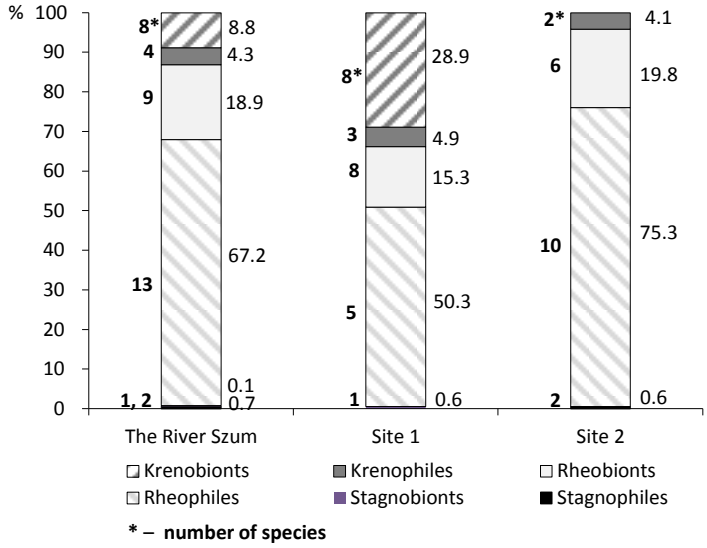

Figure 2. Percentage proportions of the respective ecological groups of water mites in the River Szum

In "Szum" Nature Reserve, 163 water mite individuals belonging to 25 species were collected. Percentage proportion of rheophiles was the highest (Figure 2): 5 species, 82 indiv. (50.3%); they were represented mainly by *Hygrobates longipalpis* (30.0%), *H. nigromaculatus* (10.4%) and *H. setosus* (8.5%). In rheocrenes, percentage proportion of the crenobionts was the highest: 8 species, 47 indiv. (28.8%), and the most abundant species were *Sperchon thienemanni* and *Parathyas palustris*. The presence of rheobionts was recorded: 8 species, 25 indiv. (15.3%), i.a. *Sperchonopsis verrucosa* and *Atractides tener*, as well as crenophiles: 3 species, 8 indiv. (4.9%). In habitats associated with the current, in the rapids (Polish: "szypoty") and at the rocky and sandy bottom, low numbers or single specimens of 10 rheobiontic and rheophilous species were collected, as well as the stagnobiontic *Eylais extendens* in a marginal wetland.

At research site 2, in the village of Sigła, in the slow current and at the sandy bottom covered in some places with the Canadian waterweed, 313 water mite individuals representing 20 species were collected. The highest abundance (Figure 2) characterized rheophiles: 10 species, 236 indiv. (75.3%), i.a. *Hygrobates nigromaculatus* (53.0%), *H. longipalpis* (7%). *Lebertia porosa* (4.1%) and *L. inaequalis* (3.8%). Rheobionts were much less numerous: 6 species, 62 indiv. (19.8%), including *Sperchon papillosus* (9.5%) and *S. setiger* (6.3%), and stagnophiles were recorded only sporadically: 2 species, 0.6%. Two crenophilous species, *Lebertia dubia* and *Wettina podagrica* (4.1%) were collected from the helocrene. Among plants near the bank and in the current, the most abundant species were rheophilous: *Hygrobates nigromaculatus* (53.0%) and *H. longipalpis* (7.0%). Rhehobionts were comparatively abundant both at the sandy bottom and in the current: *Sperchon papillosus* (9.5%), *S. setiger (*6.3%), as well as the rheophiles: *Lebertia inaequalis* (3.8%) and *L. porosa* (3.9%). *Mideopsis roztoczensis*, a rare species in Poland, was also recorded.

Water mite fauna at the research site 3, where the Szum flew into the Tanew, was poor in species and the occurring water mites were not very abundant (58 individuals, 13 species), therefore, neither that research site nor the research site 6 on the Stream Krupiec were not taken into account in the quantitative analysis and in the graphic documentation. Poor condition of water mite fauna at those two sites was due to the effect of unfavourable habitat conditions: rapid current, sandy bottom with no plants. Apart from *Sperchon setiger* and *Hygrobates nigromaculatus*, only individual specimens of the remaining 11 species were recorded and the records were sporadic; *Mideopsis roztoczensis*, a rare species in Poland was among them.

The Stream Krupiec

The total number of 1288 water mite individuals was collected. They represented 30 species; 6 species rare in Poland were among them, namely 5 crenobionts and crenophiles: *Panisus michaeli*, *P. torrenticolus*, *Panisopsis setipes*, *Lebertia glabra* and *Hygrobates norvegicus*, and one stagnophile: *Oxus ekmani* (Table 1). Ecological character of the studied stream was idiosyncratic. Its initial stretch was formed by a spring pond being a large limnocrene (research site 4), with numerous rheocrenes and helocrenes flowing into the shallow (depth: 0.2 m) stream near the pond. Therefore, the species composition and quantitative structure of water mite

fauna from the Stream Krupiec was also idiosyncratic: characteristic for both a spring and a stream.

Crenophiles definitely dominated in the stream, being represented by 8 species and 916 individuals (71.1%) (Figure 3), mainly *Piona disparilis*, *Arrenurus cylindratus*, *Lebertia cognata* and *L. rufipes*. The second largest group was that of crenobionts: 7 species, 162 indiv. (12.5%) i.a. *Sperchon thienemanni*, *Panisus michaeli* and *P. torrenticolus* (Table 1, Figure 3). Rheophiles were also abundant: 6 species, 157 indiv. (12.0%), represented mainly by *Hygrobates fluviatilis*. Abundances of the remaining groups were not high. Stagnophiles: 3 species, 37 indiv. (2.8%); rheobionts – 4 species, 18 indiv. (1.3%) and stagnobionts – 2 species, 3 indiv. (0.2%).

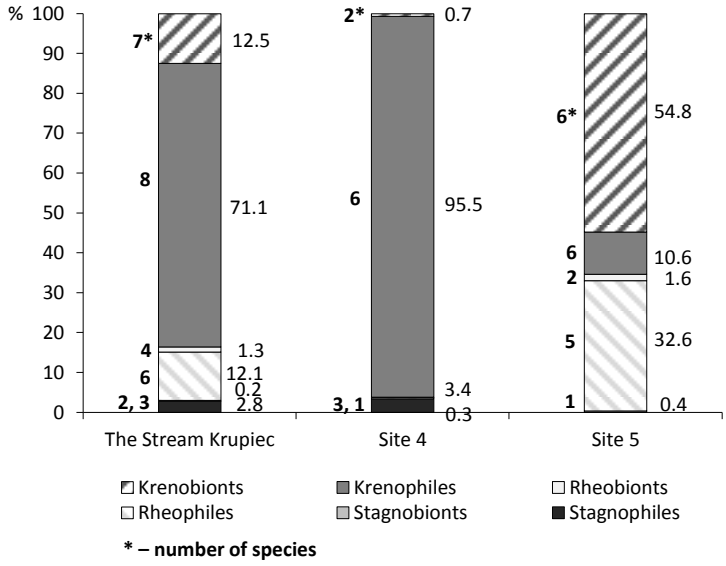

Figure 3. Percentage proportions of the respective ecological groups of water mites in the Stream Krupiec

In the spring pond of the Krupiec (research site 4, a large limnocrene), 936 water mite individuals, representing 13 species, were collected (Table 1, Figure 3). Water mites of some springs of that stream had been described before and erroneously qualified as water mite fauna of the springs of the River Szum (Biesiadka and Kowalik 1978). In the present study, the error has been corrected

and additional information has been provided. Mass occurrence of crenophiles was noted in the studied limnocrene: 6 species, 893 individuals (95.5%). The most abundant (eudominant) was *Piona disparilis* (42.9%), a species preferring cold waters of lakes and flood plains of mountain rivers and large limnocrenes (Biesiadka and Kowalik 1977). Also the following crenophiles were classified as eudominants: *Arrenurus cylindratus* (20.9 %), *Lebertia cognata* (17.6%) and *L. rufipes* (13.0%). Groups that were not abundant included stagnophiles, represented by 3 species (3.4%): *Oxus ekmani*, *Limnesia koenikei* and *Forelia variegator*; crenobionts, represented by 2 species (0.7%): *Panisus michaeli* and *Hygrobates norvegicus*, and reophiles, represented by just 1 species (0.3%): *Hygrobates fluviatilis*. From March till August, rather numerous deuteronymphs of *Piona disparilis* and less numerous deuteronymphs of *Lebertia rufipes* and *Oxus ekmani* were collected from the limnocrene, whereas deuteronymphs of *Lebertia sp.* and *Sperchon sp.* were collected from the stream.

In the spring zone of the Stream Krupiec, below the limnocrene (research site 5), 248 water mite individuals, representing 20 species, were collected. Crenobionts, represented by 6 species and 136 individuals (54.8%) (Figure 3), definitely dominated. Rheophiles were less numerous: 5 species, 81 indiv. (32.6%) similarly to crenophiles: 6 species, 26 indiv. (10.4%). Rheobionts were represented by merely 2 species, 4 indiv. (1.6%), and stagnobionts were even less abundant, being represented by 1 species, 1 indiv. (0.4%).

Among reheobionts, the most abundant, especially in rheocrenes, were the eudominant *Sperchon thienemanni* (27.0%) and the dominants: *Panisus michaeli* (8.8%), *P. torrenticolus* (5.6%), and *Lebertia stigmatifera* (5.6%). Either less numerous (eudominants) or individual (recedents) crenobionts, i.e. *Hygrobates norvegicus* and *Panisopsis setipes*, were collected from rheocrenes and helocrenes, as well as the crenophiles: *Lebertia salebrosa*, *L. rufipes*, *L. glabra*, *Sperchon squamosus*, *Piona disparilis* and *Arrenurus cylindratus*. *Hygrobates fluviatilis* clearly dominated (29.0%) among 5 reophilous species in the stream.

At research site 6, where the Krupiec flew into the Szum, water mite fauna was both very poor in species and not very abundant (13 species, 104 individuals). The most abundant was the rheophilous species *Hygrobates fluviatilis* (62.5%), whereas the rheobiontic *Sperchon setiger* and the crenophilous *Lebertia glabra*, rare in Poland, were less numerous (11 and 12 individuals respectively). Among the remaining 10 species, individual specimens representing all ecological groups were collected.

The Szum was clearly dominated by the rheophiles: *Hygrobates nigromaculatus*, *H. longipalpis* and *H. setosus*, and the rheobionts: *Sperchon setiger* and *S. papillosus*. In the Krupiec the crenophiles were the most abundant: *Piona disparilis*, *Arrenurus cylindratus*, *Lebertia cognata* and *L. rufipes*.

Species composition and abundance structure of water mite fauna in the Szum and the Krupiec were hardly similar to that of the springs and upland rivers of Roztocze that had been studied before (Kowalik and Biesiadka 1978; Biesiadka and Kowalik 1977, 1978, 1979; Zawal and Kowalik 2013), as well as to the water mite fauna of the Lublin Upland (Kowalik 1981, 1984). In the quantitative structure of dominating species the differences were found too. Interpretation of these differences is hard and less effective due to the high diversity of environments and variability of ecological conditions in running waters. The ecological character of many water mite species show territorial (geographical) and regional diversity (Biesiadka 2008).

Water mite communities in the river and the stream were dominated by rheophiles from the families Hygrobatidae and Lebertiidae, whereas crenophiles from the families Lebertiidae, Hygrobatidae and Pionidae dominated in the springs. In habitats associated with the current and the springs, some rare montane or submontane species were recorded: *Panisus michaeli, P. torrenticolus, Protzia eximia, Lebertia fimbriata, L. glabra, Torrenticola stadleri, Atractides tener*, and the boreal montane species *Hygrobates norvegicus*. Faunistic similarity of water mites from the Szum and the Krupiec, calculated according to Jaccard index, equaled 49.0%. A comparison of water mite fauna of the studied water courses in Roztocze with water mite fauna of corresponding ecosystems in Łódź Upland (Bazan 1962), Great Poland-Kujawy Lowland (Biesiadka 1970) and Masurian Lake District (Cichocka 1996, 2006) indicated the presence of regional differences in species composition and abundance of rheobionts,, rheophiles and stagnophiles. Those differences, as could be noted on the basis of data from literature and the author's own studies, had a regional character and were typical for Central Europe (Biesiadka 2008).

Water mites recorded in the springs of the Krupiec and the Szum in Roztocze were characterized by the highest faunistic similarity (48.4%) and quantitative similarity (domination of crenophiles) to water mite fauna occurring in springs of Kraków-Częstochowa Upland and Miechowska Upland (Biesiadka et al. 1990). However, *Atractides pennatus*, which occurs in great numbers in the springs of those two uplands, has not been recorded in springs of Roztocze so far. Water

mite fauna occurring in the springs of Roztocze (Biesiadka and Kowalik 1978) was much less similar to water mite fauna occurring in Masurian Lake District, where Cichocka (1997) noted a high proportion of crenobionts, and especially *Hygrobates norvegicus.*

Seasonal fluctuations of water levels (occasionally high water levels) and water current velocity during the study period provided an opportunity to conduct a comprehensive analysis of seasonal changes in water mite abundance in the Szum and the Krupiec.

Water mites are very sensitive to environmental degradation of aquatic habitats, including water pollution (Biesiadka 2008; Kowalik 1981, 1984, 1990). Studies assessing environmental naturalness and water purity of some springs and rivers of Roztocze conducted in the years 1973–1974 revealed that a majority of the studied habitats retained good quality (Stępień et al. 1983). That was also true for the Szum and the Krupiec, where the water mite fauna was very rich and diversified regionally and zoogeographically.

Taking into account the evaluation of the local environment based on its unique landscape and faunistic values, we propose establishing a small nature reserve in the neighbourhood of the railway station of Józefów Roztoczański. The reserve would encompass the spring pond (limnocrene) created by numerous valley springs of the Stream Krupiec and a small fragment of the spring zone of the stream near that limnocrene (geographical position: N 50° 31' 24", E 23° 02' 25"). The reserve would be situated very close to the southern border of Roztocze National Park.

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WODOPÓJKI (ACARI, HYDRACHNIDIA) RZEKI SZUM I STRUMIENIA KRUPIEC NA ROZTOCZU

Streszczenie

Na podstawie zbiorów z lat 1973–1974 opublikowano pracę o wodopójkach źródeł Roztocza (Biesiadka, Kowalik 1978), w tym także źródeł rzeki Szum i strumienia Krupiec (Roztocze, Polska południowo-wschodnia). W pracy uzupełniono opracowanie pozostałych zbiorów wodopójek z tych lat ze środowisk rzecznych i strumieniowych. Złowiono 1822 wodopójki, należące do 46 gatunków. Analizowano skład gatunkowy, strukturę jakościową i ilościową oraz wyróżnione grupy ekologiczne wodopójek. Na strumieniu Krupiec proponowano utworzenie rezerwatu krajobrazowo-faunistycznego.

Słowa kluczowe: wodopójki, Hydrachnidia, źródła, rzeka, strumień, grupy synekologiczne

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