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## Article

### Water mites (Hydrachnidia) of the River Drawa (NW Poland)

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#### ABSTRACT

The water mite communities of the River Drawa were investigated in the year 1988. The samples were taken in April, July and September. A total of 1349 specimens belonging to 52 species of water mites were collected. We decided to distinguish *Lebertia cf. gibbosa* despite of its synonymization with *L. inaequalis*, because we collected both species and found sound distinguishing features. The status of the species should be rechecked. The most abundant species was *Hygrobates setosus* (13.4%) followed by *Sperchon papillosus* (10.5%), *S. clupeiifer* (9.8%), *Torrenticola amplexa* (8.5%), *Hygrobates longipalpis* and *Limnesia maculata* (each 7.0%), *Hygrobates calliger* (5.8%), *Lebertia inaequalis* (5.2%) and *Arrenurus albator* (4%). The largest synecological group was rheophiles and rheobionts (71.1% specimens) followed by lake species (16.5%), small water bodies species (11.9%), species from astatic waters and crenophilous species (0.2% specimens). The most stagnophilous species were connected with marginal pools with and muddy bottom covered by plants and sections of river after lake or spring. More specimens (894) and species (31) were caught in the lotic zone of the river than in the lentic zone (455 specimens, 28 species). Rheophilous species were divided into two groups: one connected with lotic zones but with rather slow-flowing water and sandy bottom, and another one connected with fast-flowing water with gravel and stones on the bottom, partially covered by mosses.

**KEY WORDS:** Flowing waters; *Lebertia cf. gibbosa*; rheobionts; rheophilous species; stagnophilous species.

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#### INTRODUCTION

The research on water mite fauna from flowing waters in Europe has very long tradition. However, recently research is focused on taxonomic work (e.g. Martin *et al.* 2010; Pešić *et al.* 2018; 2019; 2020a, b), biology of particular species (e.g. Martin and Davids 2002; Martin and Stur 2006; Słowińska *et al.* 2020), autecology (e.g. Di Sabatino *et al.* 2000) and bioindication (e.g. Miccoli *et al.* 2013; Blattner *et al.* 2021). Despite of wide knowledge about water mites occurring in flowing waters, there is still a lack of information about faunal structure of water mites in particular rivers or streams especially with correlation to environmental and physico-chemical parameters. There is some information available for rivers: upper Danube, Goldersbach, Łada, Northern Dvina, Yokonga, Mezen, Onega, Pechora, Neman (Biesiadka 1974; Kowalik and Biesiadka 1981; Gerecke and Schwoerbel 1991; Gerecke 2002; Biesiadka *et al.* 2004; Tsember and Shubina 2013). Some

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information about dependence of water mite fauna structure on environmental and physico-chemical parameters can be found in van der Hammen and Smit (1996) and Boboescu *et al.* (2010) works.

On the background of Europe, in Poland there has been a great body of research on water mite fauna structure from flowing waters. Characterizations of the Hydrachnidia communities of rivers in lowland areas of Poland can be found in studies by Bazan-Strzelecka (1964, 1986), Biesiadka (1970, 1972), Biesiadka and Kasprzak (1977), Kowalik (1981), Cichocka (1996, 2006), Stryjecki (2009, 2010), Zawal and Sadanowicz (2012), Stryjecki *et al.* (2012, 2013a, 2018), Zawal and Kowalik (2013), Bańkowska *et al.* (2015) and Zawal *et al.* (2017). Similar data from upland areas of Poland is found in works by Kowalik (1981), Kowalik and Biesiadka (1981), Stryjecki and Kowalczyk-Pecka (2013b), Kowalik *et al.* (2014), and Biesiadka *et al.* (2015). The most important research works on mountainous areas include works by Kupiszewska (1965), Biesiadka (1974, 1979), and Biesiadka and Cichocka (1993). Among the studies, those taking the environmental and physico-chemical parameters into account are of particular value (Cichocka 2006; Zawal *et al.* 2017; Stryjecki *et al.* 2018; Stryjecki 2019, 2020).

The aim of this research was recognition of structure of water mite fauna in medium, lowland rivers based on some environmental parameters.

## MATERIAL AND METHODS

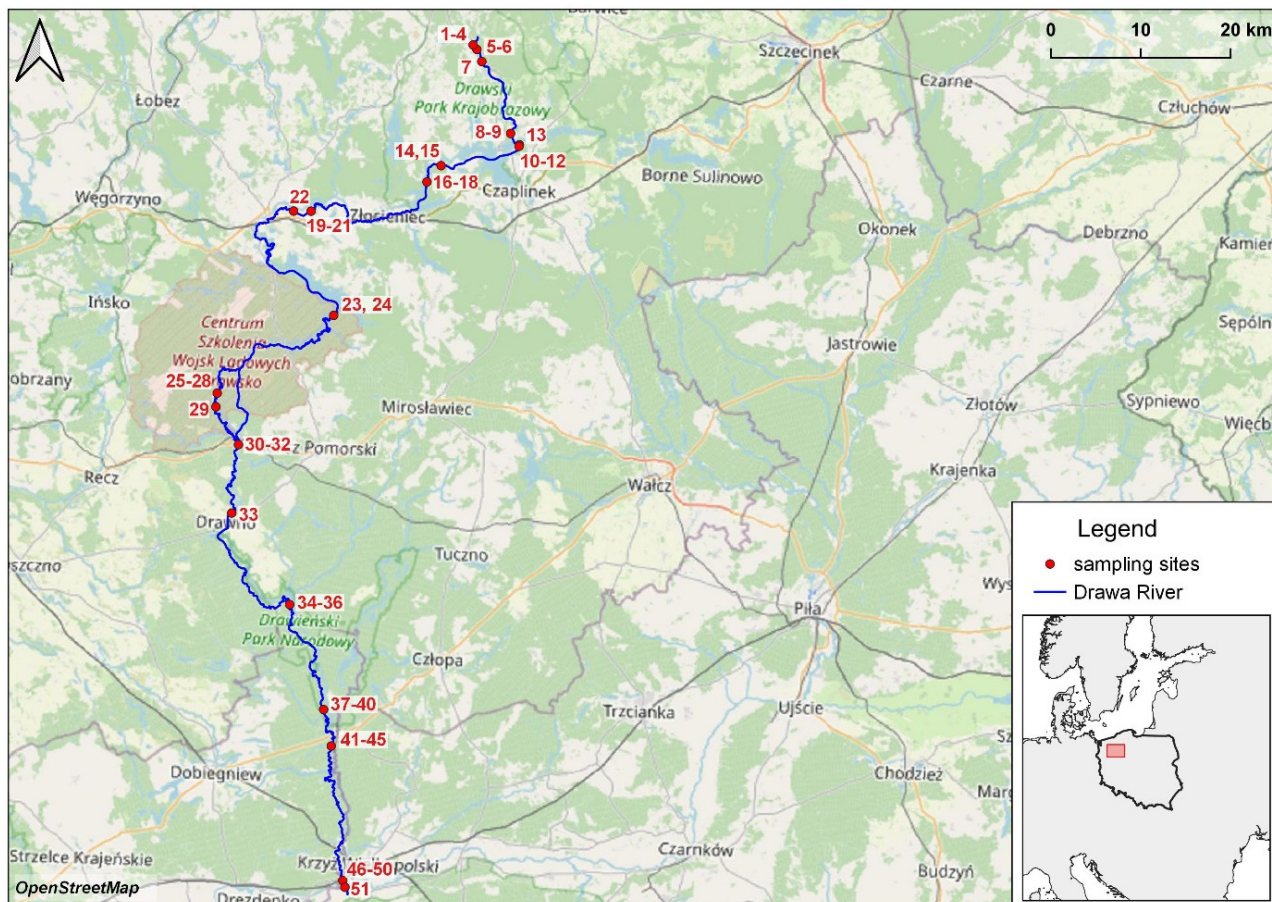
Water mites were collected in April, July and September of 1988 with a hand net (mesh size 300  $\mu\text{m}$ ); they were separated in the fieldwork and preserved in Koenike's liquid, as far as possible. Samples were taken using a semiquantitative approach described by Gerecke *et al.* (1998) in which one sample is taken from particular substrate, with the sampling time proportional to the estimated percentage coverage of the substrate.

Water flow (m/s) was measured using a SonTek acoustic FlowTracker flowmeter. The bottom substrates, i.e. mud, sand, gravel, stones, rocks, were estimated as a share in the whole substratum following Braun-Blanquet (1964) methods modified by Stępień *et al.* (2015, 2019), where the sum of all substrates had to amount to 100%. The records were also made for additional categories for vascular plants and mosses coverage-abundance scales: 1 (< 5% coverage of the bottom), 2 (5–10%), 3 (11–25%), 4 (25–50%), 5 (50–75%), and 6 (75–100%). The substrates were split into organic, fragmented sludge-mud, and inorganic - all the others. Inorganic substrates were categorized depending on the grain size: sand < 2 mm, gravel - 2–20 mm, stones - 21–100 mm, rocks > 100 mm. A total of 69 samples were collected in 19 localities (Fig. 1). All habitats in each locality were included.

NMDS (non-metric multidimensional scaling) was used for testing the grouping of the springs sections based on faunistic data. Multivariate ordination analyses were used to determine the environmental parameters responsible for the distribution of water mite species in the River Drawa (Canoco for Windows 4.5 package). The Detrended Correspondence Analysis (DCA) (Hill and Gauch 1980; ter Braak and Prentice 1988) was used to assess the length of the biotic data gradient with detrending by segments. As it was long (13.07 SD units), the Canonical Correspondence Analysis (CCA) (ter Braak 1986; ter Braak and Verdonschot 1995) was applied to identify environmental factors that significantly influenced biota distribution.

The significance of the effect of the respective environmental variables on species composition was determined using stepwise variable selection ( $p < 0.05$ ). The Monte Carlo test with 499 unrestricted permutations under full model was conducted in order to pinpoint the significant variables.

The significance of statistical differences ( $\alpha = 0.05$ ) was assessed by Kruskal–Wallis test (STATISTICA v.13 PL).



**Figure 1.** Map of the study area with sampling localities.

### Study area

The River Drawa, a right-bank tributary of the Noteć River, is 185.9 km long and its catchment area is 3,296.4 km<sup>2</sup>. It flows out from Lake Krzywe, and then flows through the nature reserve of the Valley of Five Lakes (lakes, Krzywe, Krąg, Długie, Głębokie and Małe), next through Lake Żerdno and Drawsko, and finally through lakes Wilczkowo, Lubie and Wielkie Dębno. The main sources of pollution of Drawa are the cities: Złocieniec, Drawsko Pomorskie, Kalisz Pomorski, and Drawno. The water quality in 2006 was assessed as class III (Złoczowska *et al.* 2008).

In its upper section, the river flows slowly, meandering among forests and meadows. After leaving Lake Lubie, it gets shallower, taking on the character of a mountain river with fast water current and rocky and gravelly bottom. In the Drawieński National Park, the river is wide and deep, but with a fast current, which is intensified by numerous obstacles such as fallen trees. The banks of the river are usually high and covered with forest vegetation. The last section of the river – from the national park to the estuary – is relatively wide, with slow flowing water, and has the character of a medium-sized lowland river (Kondracki 2011).

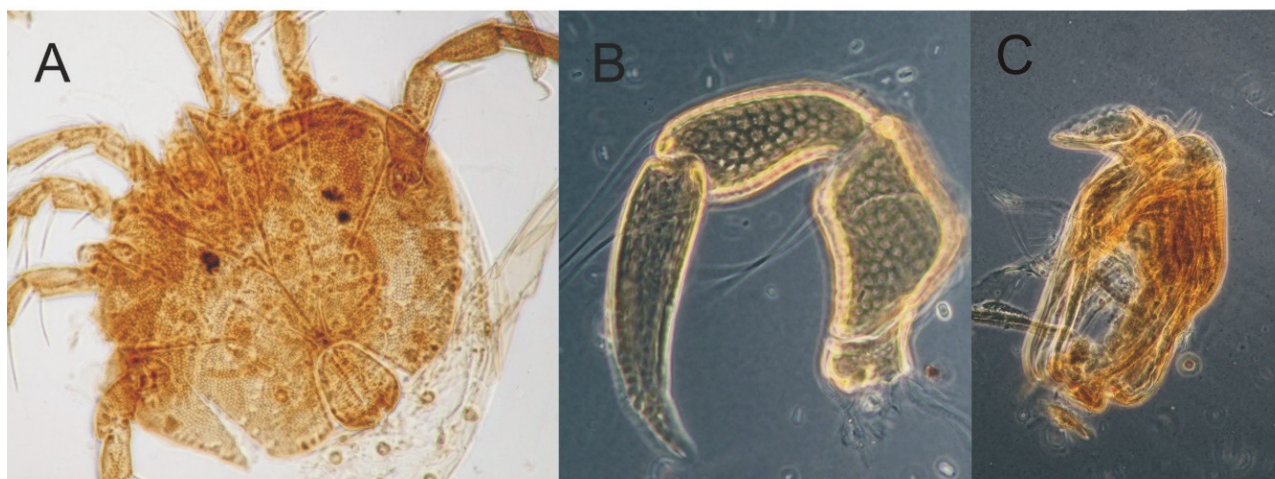
Nineteen localities were established along the entire length of the river (Fig. 1), where 51 sites were located, which included all types of habitats occurring in particular localities. The habitats were divided into the following categories: current environments (sites: 2, 3, 5, 8, 10, 11, 14, 17, 18, 19, 20, 21, 24, 25, 30, 32, 34, 35, 37, 38, 40, 41, 42, 43, 45, 46, 47, 48, 49, 51), marginal pools (sites: 6, 7, 9, 12, 13, 15, 16, 23, 26, 29, 31, 33, 36, 39, 44, 50), limnocren-eucrone (site 1), limnocren-hypocrene (site 4), gills of *Orconectes limosus* (Rafinesque, 1817) (site 28), gills of *Unio tumidus* Retzius, 1788 (site 27).

## RESULTS

In the River Drawa a total of 1349 specimens belonging to 52 species of water mites were collected. The species belonged to 23 genera and 17 families. The most abundantly represented families were Hygrobatidae (33.2% of the total number of water mites, 7 species), Sperchontidae (22.3%, 3 species), Lebertiidae (9.1%, 7 species), Torrenticolidae (8.5%, 1 species) and Limnesiidae (7.3%, 3 species). The group of edominants (dominance > 10%) consisted of *Hygrobates setosus* (13.4%) and *Sperchon papillosus* (10.5%); dominants (dominance 5.1%–10%) were: *S. clupeiifer* (9.8%), *Torrenticola amplexa* (8.5%), *Hygrobates longipalpis* and *Limnesia maculata* (7.0%), *Hygrobates calliger* (5.8%), *Arrenurus albator* (4.4%) and *Lebertia inaequalis* (5.2%) (Table 1). The most frequent were *Torrenticola amplexa* and *Sperchon clupeiifer* (30.8%), *S. papillosus* and *Hygrobates calliger* (25.0%), *H. setosus*, *Atractides nodipalpis* and *Lebertia rivulorum* (21.2%) (Table 1). We found 12 individuals of very interesting and rare species *Lebertia cf. gibbosa* Lundblad, 1926 (Fig. 2).

The NMDS (stress = 0.2665) ordering (Fig. 3) showed two groups of species: 1 – rheobionts and rheophiles, connected with current habitats; 2 – stagnophilous species (characteristic for lakes, for small water bodies and for vernal astatic waters), connected with marginal pools and with the initial section of the river. Coordinate 1 illustrates the gradient of increasingly rheophilic conditions, from stagnant to current waters.

The water mites caught in the River Drawa were assigned to five synecological groups: rheobionts and rheophiles, crenophiles, species characteristic for lakes, eurytopic species characteristic for small water bodies, species characteristic for vernal astatic waters. The rheobionts and rheophiles were most abundant (71.1 % of the material collected, 22 species). The second most abundant synecological group was the species characteristic for lakes, which accounted for 16.5% of the fauna collected, and 10 species. Less abundant were eurytopic species characteristic for small water bodies (11.9 %, 16 species) and crenophiles and species characteristic for vernal astatic waters (0.2%, 1 and 3 species respectively) (Fig. 4). The differences in the abundance of particular synecological groups in the whole collected material were statistically significant [Kruskal-Wallis test:  $H(4, N = 52) = 18.15920$   $p = 0.0011$ ]. Domination of rheobionts and rheophiles were visible in current habitats and marginal pools (Fig. 4), but in the first type of environment the differences between number of specimens from particular synecological groups were statistically significant [Kruskal-Wallis test:  $H(3, N = 30) = 3.908292$   $p = 0.02715$ ], but not in second one [Kruskal-Wallis test:  $H(3, N = 27) = 3.019177$   $p = 0.3887$ ].



**Figure 2.** *Lebertia cf. gibbosa* – A. Ventral view; B. Pedipalp; C. Gnathosoma.

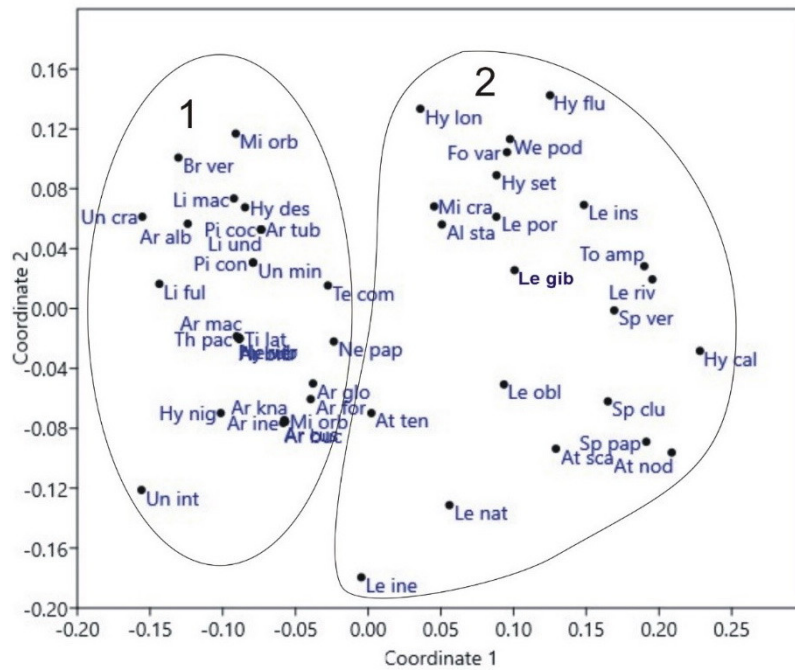


Figure 3. Non-metric multidimensional scaling of faunistic assemblages of the River Drawa.

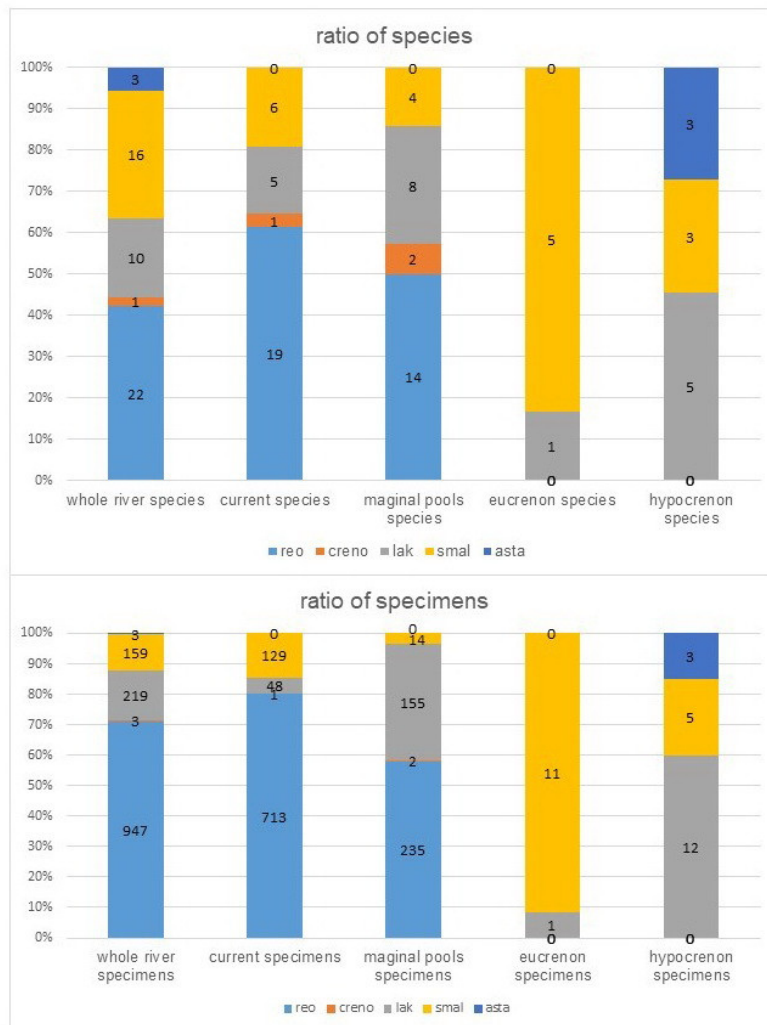
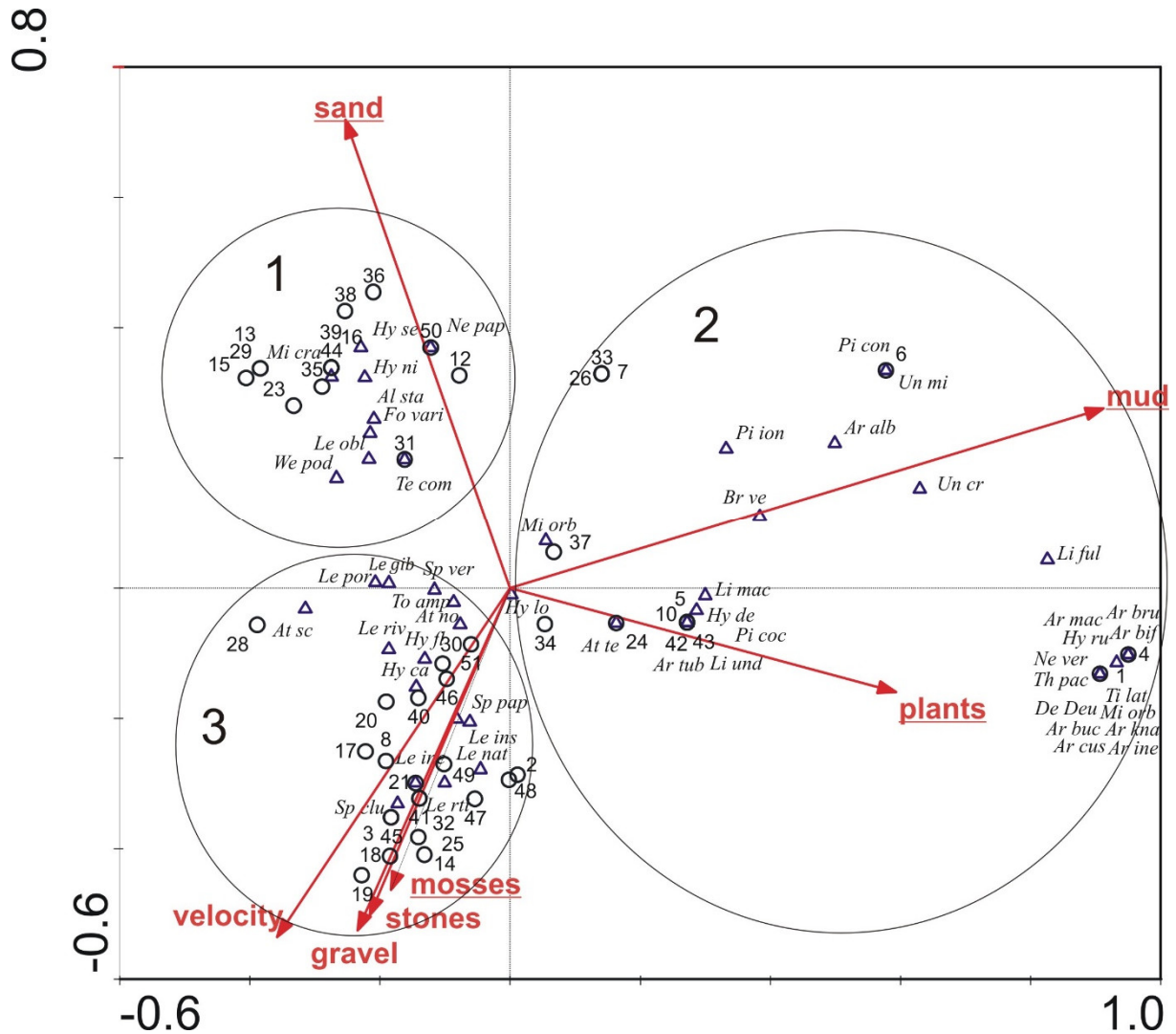


Figure 4. Percentage share of particular syncological groups of the water mite fauna of River Drawa.



**Figure 5.** CCA diagram showing the relationship between water mites and environmental parameters.

## DISCUSSION

The number of species of the water mites in the River Drawa was average compared to other rivers. Similar numbers of species were previously found in the rivers: Raba (47 species), Wieprz (42), Upper Danube (42), Goldersbach (47), Łada (43), Northern Dvina (56), Szum (46), Bukowa (51 species) (Biesiadka 1974; Kowalik and Biesiadka 1981; Gerecke and Schwoerbel 1991; Gerecke 2002; Tsember and Shubina 2013; Zawal and Kowalik 2013; Kowalik *et al.* 2014; Stryjecki *et al.* 2018). Lower number of species was characteristic for rivers: Wełna (34 species), Białka Tatrzańska (20), Dunajec (11), Tanew (17), Yokonga (37), Mezen (35), Onega (11), Branew (32), Czartosowa (19), Łuk (15 species) (Biesiadka 1970, 1979; Stryjecki *et al.* 2013; Tsember and Shubina 2013; Stryjecki 2019, 2020). On the other hand, much higher species richness was noted in the following rivers: Pasłęka (80 species), Pechora (87), Neman (80), Krapiel (116 species) (Cichocka 1996 Biesiadka *et al.* 2004; Tsember and Shubina 2013; Zawal *et al.* 2017). The above list clearly shows that the number of species of water mites is a very good measure of the habitat diversity of rivers, and the values of 40–60 species characterize medium-sized rivers of varied habitat character. Lower species richness occurs in smaller rivers, having lower habitat diversity, or in rivers that are under human pressure. The greatest species diversity of water mite fauna is characteristic for rivers with very diverse environments (Cichocka 1996; Zawal *et al.* 2017).

**Table 1.** Species composition and numbers of water mites collected in particular habitats of the River Drawa: n.i. - number of individuals, dom. - domination.

Species	males	females	deutonymphs	total	dominance	frequency	currents		marginal pools		limnocrene-eucrenon		limnocrene-hypocrenon		<i>Orconectes limosus</i> -gills	<i>Unio tumidus</i> -gills
							n.i.	dom.	n.i.	dom.	n.i.	dom.	n.i.	dom.		
<i>Hydrodroma despiciens</i> (O.F. Müller)	13	29	1	43	3.2	3.8	41	4.6	2	0.5	–	–	–	–	–	–
<i>Parathyas pachystoma</i> Koenike	1	–	–	1	0.1	1.9	–	–	–	–	–	–	1	3.7	–	–
<i>Hydryphantes ruber</i> De Geer	–	1	–	1	0.1	1.9	–	–	–	–	–	–	1	3.7	–	–
<i>Lebertia natans</i> (Viets)	2	–	–	2	0.1	3.8	2	0.2	–	–	–	–	–	–	–	–
<i>Lebertia oblonga</i> (Koenike)	7	2	–	9	0.7	5.8	9	1	–	–	–	–	–	–	–	–
<i>Lebertia rivulorum</i> (Viets)	4	6	5	15	1.1	21.2	11	1.2	7	1.7	–	–	–	–	–	–
<i>Lebertia inaequalis</i> (Koch)	24	46	–	70	5.2	7.7	70	7.8	–	–	–	–	–	–	–	–
<i>Lebertia insignis</i> (Neuman)	4	7	2	13	1.0	11.5	11	1.2	2	0.5	–	–	–	–	–	–
<i>Lebertia porosa</i> (Thor)	1	1	–	2	0.1	3.8	1	0.1	1	0.2	–	–	–	–	–	–
<i>Lebertia cf. gibbosa</i> Lundblad	8	4	–	12	0.9	9.6	10	1.1	2	0.5	–	–	–	–	–	–
<i>Lebertia</i> sp.	–	1	1	2	0.1	1.9	2	0.2	–	–	–	–	–	–	–	–
<i>Sperchon clupeifer</i> (Piersig)	28	98	6	132	9.8	30.8	128	14	4	1	–	–	–	–	–	–
<i>Sperchon papillosus</i> Thor	38	103	–	141	10.5	25.0	141	16	–	–	–	–	–	–	–	–
<i>Sperchonopsis verrucosa</i> (Protz)	14	14	–	28	2.1	15.4	27	3	1	0.2	–	–	–	–	–	–
<i>Teutonia cometes</i> (Koch)	1	1	–	2	0.1	1.9	–	–	2	0.5	–	–	–	–	–	–
<i>Torrenticola amplexa</i> (Koenike)	56	58	1	115	8.5	30.8	105	12	10	2.4	–	–	–	–	–	–
<i>Albia stationis</i> Thon	3	2	–	5	0.4	3.8	1	0.1	4	1	–	–	–	–	–	–
<i>Aturus scaber</i> Kramer	1	3	–	4	0.3	5.8	2	0.2	–	–	–	–	–	–	2	–
<i>Brachypoda versicolor</i> (O.F. Müller)	2	25	11	38	2.8	5.8	22	2.5	16	3.9	–	–	–	–	–	–
<i>Atractides nodipalpis</i> (Thor)	5	19	–	24	1.8	21.2	24	2.7	–	–	–	–	–	–	–	–
<i>Atractides tener</i> (Thor)	2	–	–	2	0.1	1.9	2	0.2	–	–	–	–	–	–	–	–
<i>Hygrobatas calliger</i> Piersig	31	47	–	78	5.8	25.0	78	8.7	–	–	–	–	–	–	–	–
<i>Hygrobatas fluviatilis</i> (Ström)	2	5	–	7	0.5	9.6	6	0.7	1	0.2	–	–	–	–	–	–

Table 1. Continued.

Species	males	females	deutonymphs	total	dominance	frequency	currents		marginal pools		limnocyrenon		limnocyrenon		<i>Orconectes limosus</i> -gills	<i>Unio tumidus</i> -gills
							n.i.	dom.	n.i.	dom.	n.i.	dom.	n.i.	dom.		
<i>Hygrobates longipalpis</i> (Hermann)	37	55	2	94	7.0	30.8	75	8.4	19	4.6	–	–	–	–	–	–
<i>Hygrobates nigromaculatus</i> Lebert	37	25	–	62	4.6	7.7	–	–	60	15	1	5.6	1	3.7	–	–
<i>Hygrobates setosus</i> Besseling	55	78	48	181	13.4	21.2	10	1.1	171	42	–	–	–	–	–	–
<i>Limnesia fulgida</i> (Koch)	–	3	–	3	0.2	3.8	–	–	1	0.2	–	–	2	7.4	–	–
<i>Limnesia maculata</i> (O.F. Müller)	35	58	1	94	7.0	5.8	84	9.4	10	2.4	–	–	–	–	–	–
<i>Limnesia undulata</i> (O.F. Müller)	1	–	–	1	0.1	1.9	1	0.1	–	–	–	–	–	–	–	–
<i>Forelia variegator</i> (Koch)	4	6	3	13	1.0	9.6	2	0.2	11	2.7	–	–	–	–	–	–
<i>Piona coccinea</i> (Koch)	–	1	–	1	0.1	1.9	1	0.1	–	–	–	–	–	–	–	–
<i>Piona conglobata</i> (Koch)	1	–	–	1	0.1	1.9	–	–	1	0.2	–	–	–	–	–	–
<i>Piona</i> sp.	–	1	3	4	0.3	5.8	–	–	3	0.7	1	5.6	–	–	–	–
<i>Tiphys latipes</i> (O.F. Müller)	1	–	–	1	0.1	1.9	–	–	–	–	–	–	1	3.7	–	–
<i>Neumania vernalis</i> (O.F. Müller)	–	1	–	1	0.1	1.9	–	–	–	–	–	–	1	3.7	–	–
<i>Neumania papillosa</i> (Soar)	–	1	–	1	0.1	1.9	–	–	1	0.2	–	–	–	–	–	–
<i>Unionicola intermedia</i> (Koenike)	1	2	–	3	0.2	3.8	–	–	–	–	–	–	–	–	–	3
<i>Unionicola crassipes</i> (O.F. Müller)	3	16	–	19	1.4	7.7	1	0.1	11	2.7	–	–	7	25.9	–	–
<i>Unionicola minor</i> (Soar)	–	1	–	1	0.1	1.9	–	–	1	0.2	–	–	–	–	–	–
<i>Wettina podagrica</i> (Koch)	1	1	1	3	0.2	5.8	1	0.1	2	0.5	–	–	–	–	–	–
<i>Arrenurus albator</i> (O.F. Müller)	9	64	–	73	5.4	5.8	20	2.2	52	13	–	–	1	3.7	–	–
<i>Arrenurus bruzelii</i> (Koenike)	–	1	–	1	0.1	1.9	–	–	–	–	–	–	1	3.7	–	–
<i>Arrenurus cuspidator</i> (O.F. Müller)	1	–	–	1	0.1	1.9	–	–	–	–	1	5.6	–	–	–	–
<i>Arrenurus maculator</i> (O.F. Müller)	1	2	–	3	0.2	1.9	–	–	–	–	–	–	3	11.1	–	–
<i>Arrenurus buccinator</i> (O.F. Müller)	–	2	–	2	0.1	1.9	–	–	–	–	2	11.1	–	–	–	–

Table 1. Continued.

Species	males	females	deutonymphs	total	dominance	frequency	currents		marginal pools		limnocrone-eucronon		limnocrone-hypocronon		<i>Orconectes limosus</i> -gills	<i>Unio tumidus</i> -gills
							n.i.	dom.	n.i.	dom.	n.i.	dom.	n.i.	dom.		
<i>Arrenurus globator</i> (O.F. Müller)	1	–	–	1	0.1	1.9	1	0.1	–	–	–	–	–	–	–	–
<i>Arrenurus tubulator</i> (O.F. Müller)	–	1	–	1	0.1	1.9	1	0.1	–	–	–	–	–	–	–	–
<i>Arrenurus bifidicodulus</i> Piersig	–	1	–	1	0.1	1.9	–	–	–	–	–	–	1	3.7	–	–
<i>Arrenurus forpicatus</i> Neuman	1	–	–	1	0.1	1.9	–	–	1	0.2	–	–	–	–	–	–
<i>Arrenurus inexploratus</i> Viets	3	–	–	3	0.2	1.9	–	–	–	–	3	16.7	–	–	–	–
<i>Arrenurus knauthei</i> Koenike	–	1	–	1	0.1	1.9	–	–	–	–	1	5.6	–	–	–	–
<i>Midea orbiculata</i> (O.F. Müller)	4	–	–	4	0.3	1.9	–	–	–	–	4	22.2	–	–	–	–
<i>Mideopsis crassipes</i> (Soar)	4	6	–	10	0.7	5.8	–	–	10	2.4	–	–	–	–	–	–
<i>Mideopsis orbicularis</i> (O.F. Müller)	–	6	–	6	0.4	3.8	3	0.3	3	0.7	–	–	–	–	–	–
Deutonymphs	–	–	12	12	0.9	3.8	–	–	–	–	5	27.8	7	25.9	–	–
Total	447	805	97	1349			893		409		18		27		2	3

It is interesting that in the River Drawa 12 individuals of *Lebertia cf. gibbosa* were found – the species that was previously synonymized with *L. inaequalis* (see Gerecke 2009). The specimens collected here clearly alluded to the description of this species made by Lundblad (1926) (Fig. 2), therefore it was decided to distinguish this species, at the same time pointing to the need for detailed research based on molecular data.

The high share of families with the predominance of rheophilic species (Hygrobatidae, Sperchontidae, Lebertiidae and Torrenticolidae) is characteristic for most rivers (Kowalik and Biesiadka 1981; Gerecke and Schwoerbel 1991; van der Hammen and Smit 1996; Gerecke 2002; Tsember and Shubina 2013; Zawal and Kowalik 2013; Kowalik *et al.* 2014; Stryjecki *et al.* 2018), but Torrenticolidae most often occurs in the upper sections of the rivers, or in mountainous areas (Láska 1959, 1962, 1963; Biesiadka 1979, Biesiadka and Cichocka 1991). However, a large share of this family can be also be found in typical lowland rivers (Cichocka 1996; Zawal *et al.* 2017), which is caused by a large number of habitats with a relatively fast current and a rocky or gravel bottom.

The dominant species in the River Drawa were almost exclusively rheobiotic species. The exception is *Limnesia maculata* but its occurrence was limited only to three sites located directly behind the outflow of the river from Lake Krzywe. Similar influence of lakes on water mite fauna in rivers was noted by Cichocka (1996) and Zawal (2006). Similar list of species, characteristic for small and medium-size rivers was noted by Kowalik and Biesiadka (1981), Gerecke and Schwoerbel (1991), van der Hammen and Smit (1996), Gerecke (2002), Tsember and Shubina (2013), Zawal and Kowalik (2013), Kowalik *et al.* (2014), Stryjecki *et al.* (2018). Larger rivers, with slower water flow,

are characterized by a significant share of stagnophilous species (Bazan-Strzelecka 1964; Biesiadka 1972; Biesiadka *et al.* 2004; Zawal *et al.* 2017).

Two groups of species, shown in the NMDS diagram (Fig. 3) are associated with different environments: rheophilic and rheobiotic species – with lotic environments, and stagnophilic species with lenitic ones. This confirms previous data from other rivers (Kowalik and Biesiadka 1981; Gerecke and Schwoerbel 1991; van der Hammen and Smit 1996; Gerecke 2002; Tsember and Shubina 2013; Zawal and Kowalik 2013; Kowalik *et al.* 2014; Stryjecki *et al.* 2018) indicating the distinct otherness of the fauna of water mites inhabiting these two environments.

The clear domination of rheophiles and rheobions over other synecological groups, both in the entire collected material and in lotic environments, is a characteristic feature of most rivers. A clear presence of stagnophilous species (Kłosowska *et al.* 2013; Zawal *et al.* 2013; Stryjecki *et al.* 2017) in marginal pools, where they find conditions similar to stagnant waters was also noted in many other rivers. On the other hand, a very small number of crenophilic species, that were often found in small rivers (Kowalik and Biesiadka 1981; Gerecke and Schwoerbel 1991; van der Hammen and Smit 1996; Gerecke 2002; Tsember and Shubina 2013; Zawal and Kowalik 2013; Kowalik *et al.* 2014; Stryjecki *et al.* 2018; Stryjecki 2019) is specific to the Krąpiel river.

This is also confirmed by the CCA analysis (Fig. 5) which distinguishes the group of stagnophilic species (block 2) associated with muddy bottom, often covered with vegetation, which occurs in the marginal pool and initial section of the river; and two other groups species (block 1 and 3) related to the current habitats. One of these blocks is associated with a slowly flowing water environment, and sandy bottom, and the other with a faster flowing water environment, rocky and gravel bottom, often overgrown with mosses. Block 3, related to fast-flow environments, includes typical reobiotic species. On the other hand, in block 1, next to typically reobiotic species (*Lebertia oblonga*), there were rheophilic species characteristic of marginal pools of slow flowing streams (*Albia stationis*, *Hygrobates setosus*, *Mideopsis crassipes*, *Teutonia cometes*), stagnophilic species (*Forelia variegator*, *Hygrobates nigromaculatus*, and *Neumania papillosa*) and crenophilic (*Wettina podagrica*) (Di Sabatino *et al.* 2010; Gerecke *et al.* 2016). It is worth noting that three species (*Lebertia oblonga*, *Hygrobates setosus*, *Forelia variegator*) were recorded by Stryjecki (2019) in similar environments in the Branew river.

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## کنه‌های آبی (Hydrachnidia) رودخانه دراوا (شمال غرب لهستان)

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### چکیده

جوامع کنه‌های آبی رودخانه دراوا در سال ۱۹۸۸ مورد بررسی قرار گرفتند. نمونه‌برداری در ماه‌های آوریل، جولای و سپتامبر انجام شد. در مجموع ۱۳۴۹ نمونه متعلق به ۵۲ گونه کنه آبی جمع آوری شد. تصمیم گرفته شد که *Lebertia cf. gibbosa* برخلاف مترادف‌سازی آن را با *L. inaequalis* شناسایی شود، زیرا هر دو گونه جمع‌آوری و ویژگی‌های متمایزکننده خوبی پیدا شد. وضعیت گونه باید دوباره بررسی می‌شد. فراوان‌ترین گونه *Hygrobates setosus* (۱۳/۴٪) و به دنبال آن *Sperchon papillosus* (۱۰/۵٪)، *S. chupeifer* (۹/۸٪)، *Lebertia amplexa* (۸/۵٪)، *Hygrobates longipalpis* و *Limnesia maculata* (هر گونه ۷٪)، *Hygrobates calliger* (۵/۸٪)، *Lebertia inaequalis* (۵/۲٪) و *Arrenurus ablator* (۴٪) بودند. بزرگترین گروه سین‌اکولوژیک رئوفیل‌ها و رئوبایونت‌ها (۷۱/۱٪ نمونه‌ها) و پس از آن گونه‌های دریاچه‌ای (۱۶/۵٪)، گونه‌های آب‌های کوچک (۱۱/۹٪)، گونه‌های آب‌های ناپادار و گونه‌های کرنوفیلوس (۰/۲٪ نمونه) بودند. راکدترین گونه‌ها با برکه‌های حاشیه‌ای و کف گل آلود پوشیده از گیاهان و بخش‌هایی از رودخانه پس از دریاچه یا چشمه به هم مرتبط بودند. بیشترین تعداد نمونه (۸۹۴) و گونه (۳۱) در ناحیه لوتیک رودخانه نسبت به ناحیه لتیک (۴۵۵ نمونه، ۲۸ گونه) گرفته شد. گونه‌های رئوفیلوس به دو گروه تقسیم شدند: یکی با نواحی لوتیک، اما با آب کم و بیش کند جریان و کف ماسه‌ای، و دیگری مرتبط با آب سریع با شن و سنگ در کف، که تا حدی با خزه پوشانده شده است.

**واژگان کلیدی:** آب‌های روان؛ *Lebertia cf. gibbosa*؛ رئوبایونت‌ها؛ گونه‌های رئوفیلوس؛ گونه‌های ساکن.

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