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Water mites (Hydracarina) of small eutrophic water bodies in the Olsztyn Lake District (northeastern Poland)

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Abstract – In 11 water bodies 1166 specimens of water mites belonging to 58 species were collected. The most numerous species were *Tiphys bullatus* (Thor) and *Arrenurus globator* (Müll.). The greatest number of water mites were found in field ponds (51 species, 59.9% of collected imagines). In midforest waters 25 species (33.5% imagines) and in village reservoirs 15 species (6.6% imagines) were recorded. The water mite assemblages were dominated by species of the astatic spring fauna and those characteristic for small water bodies.

Key words: small eutrophic water bodies, water mites, synecological groups

Wodopójki (Hydracarina) drobnych, eutroficznych zbiorników wodnych na Pojezierzu Olsztyńskim (północno-wschodnia Polska). W 11 zbiornikach zebrano 1166 wodopójek należących do 58 gatunków. Najliczniejszymi gatunkami były *Tiphys bullatus* (Thor) i *Arrenurus globator* (Müll.). Najwięcej wodopójek zebrano w zbiornikach śródpolnych (51 gatunków, 59.9% zebranych imagines). W zbiornikach śródleśnych zebrano 25 gatunków (33.5% imagines), a w zbiornikach wiejskich 15 gatunków (6.6% imagines). Fauna wodopójek była zdominowana przez gatunki astatycznej fauny wiosennej i gatunki drobnozbiornikowe.

1. Introduction

Small water bodies are an important element of the ecological landscape. In them there occurs a very rich fauna of water mites, constituting a specific faunistic element particularly important in the lowland parts of Poland. In numerous faunistic studies concerning Hydracarina small eutrophic water bodies were only fragmentarily presented (Bazan-Strzelecka 1963, Biesiadka 1972, 1979, Biesiadka and Kowalik 1980, Kowalik 1984, Biesiadka and Cichocka 1993, Cichocka 1996), no separate work having been concentrated on the fauna of water mites in them.

The aim of the present work was to determine the species composition and quantitative structure of water mites and to distinguish synecological elements characteristic of small eutrophic water bodies in the vicinity of Olsztyn. Besides, seasonal changes in the fauna of water mites in these waters were analyzed.

2. Study area

2.1. General description

The investigation was conducted in the northeastern part of the Olsztyn Lake District which includes the western part of the Mazurian Lake District. The Olsztyn Lake District covers 3820 km^2 with 7 concentric moraine bows whose axis of symmetry is the River Łyna (Kondracki 1994). The soils have developed from boulder clay drifted by the continental glacier of the last glaciation. They are characterized by great compactness and poor permeability, this favouring the formation of numerous water bodies. The climate of the region is fairly severe with hard winters and cool summers. The maximum insolation occurs in June and July. The air humidity is high (81–82%), the mean precipitation reaching 600 mm (Panfil 1985).

The investigation was conducted at 11 stations localised northeast of Olsztyn (55°50'–53°55' N, 20°25'–20°45' E) (fig. 1). The area is rather sparsely forested. The

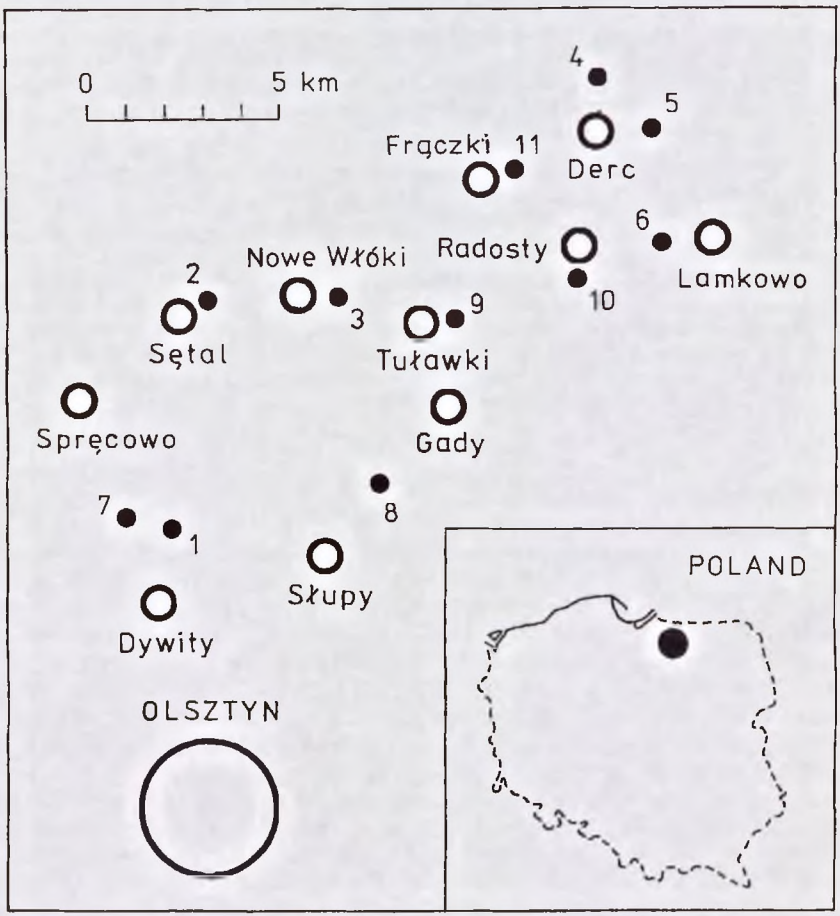

Fig. 1. Location of investigated stations (1–11) in the vicinity of Olsztyn.

hydrographic net is composed of rivers, small eutrophic reservoirs, streams, and drainage ditches. Six of the investigated stations were established in field ponds (Stations 1–6), two in midforest swamps (Stations 7 and 8), and three in village fire-control reservoirs (Stations 9–11). All were characterized by great seasonal variation in the water level. With respect to the degree of astaticism two groups were distinguished, i.e. water bodies drying up completely in summer (Stations 3, 6, 7, 9) and those which only partly dried up (1, 2, 4, 5, 8, 10, 11).

2.2. Field water bodies

Field ponds with an area of 0.005–0.1 ha lie in lowland peat bogs overgrown with *Carex vesicaria* L., *Comarum palustre* L., *Calla palustris* L., *Alisma plantago-aquatica* L., *Hottonia palustris* L., *Juncus* sp., *Glyceria maxima* (Hartman) Holmberg, and *Phragmites australis* (Cav.) Trin. ex Steudel. The pH ranged from 6.1 to 7.6. Among permanent water bodies a pond of 1 ha (Station 2) differed distinctly from the remaining ones. It was 2 m in depth, with a sandy-muddy bottom. Its shores were overgrown with *Typha latifolia* L., *P. australis*, and *G. maxima*, and on the east side there spread a belt of *Equisetum limosum* L. about 50 m in length and 5 m in width. At a greater depth *Elodea canadensis* Rid. was observed. The pH measured every day varied from 7.6 to 8.4. From May to September the water level fell about 30 cm.

2.3. Midforest water bodies

The two investigated forest stations are surrounded by coniferous forest. The Station 7, with an area of 0.2 ha, is polyhumous with a developed peat bog of transitional type. Its central zone was overgrown by *T. latifolia*, *Sphagnum* sp., moss, and liverworts. Its pH varied from 5.6 to 6.4. During summer a considerable decrease (of about 1 m) in the water level was observed. In August and September samples were only taken in the floating mossy cover. The Station 8, with an area of about 0.5 ha, lies on the edge of the forest, surrounded by a low type peat bog with littoral vegetation (*C. vesicaria*, *Juncus* sp., *G. maxima*, *A. plantago-aquatica*, *Utricularia vulgaris* L., and liverworts). Up to August a fall in the water level by 30 cm was observed, while the pH ranged from 5.7 to 6.8.

2.4. Village reservoirs

The three investigated reservoirs (Stations 9–11) situated in villages are used in fire control. The area of these strongly eutrophicated water bodies varies from 0.1 to 0.3 ha, the depth to 1 m, and the pH from 7.0 to 8.9. The littoral zone was overgrown with sedge while *Lemna minor* L. occurring on the water surface. Up to autumn the level fell about 80 cm.

3. Material and methods

The material was collected using a hand sampler with a triangular frame with 25-centimetre sides and equipped with a bag of bolting cloth. Samples were taken once a month from April to October 1994, usually among the littoral vegetation at a depth of 0.2–0.5 m and in the deeper zone at 1 m. At all the stations the temperature and pH, and also falls in water level, were measured in the successive months. A total of 107 samples containing 1166 water mites (868 imagines and 298

deutonymphs) were collected. In quantitative analyses of species and synecological groups only imagines were taken into consideration.

4. Results

4.1. General description of collected water mites

At the investigated stations 868 adult water mites from 58 species and 298 deutonymphs were collected (Table I). In the species structure water mites of the Arrenuridae (20 species, 299 individuals) and Hydryphantidae (17 species, 123 individuals) families prevailed. From the Pionidae family 11 species and a fairly large number of individuals (366) were recorded. From the Limnesiidae family 3 species (47 individuals) and from Unionicolidae 2 species (10 individuals) were identified. The remaining families (Hydrachnidae, Limnocharidae, Hydrodromidae, and Mideidae) were represented by single species. The most numerous species were *Tiphus bullatus* (20.51% of the collected material) and *Arrenurus globator* (15.9%). *Piona nudata*, *Pionopsis lutesces*, and *Hydryphantes planus* were fairly numerous while the remaining species occurred in small numbers.

Among the collected species five synecological groups were distinguished, i.e. small reservoir species, tyrphophilous species, astatic spring species, lake species, and crenophilous species (fig. 2). Most of them (29 species) were among the astatic spring fauna. The small reservoir group was composed of 17 species. Also 9 tyrphophilous species, 2 lake ones, and 1 crenophilous species were recorded. In the quantitative structure the astatic spring and small reservoir elements prevailed.

Among water mites collected in small eutrophic water bodies of the Olsztyn Lake District the following 9 species rare in Poland were identified: *Hydrachna incognita*, *Piersigia intermedia*, *Hydryphantes tenuipalpis*, *Thyas palustris*, *Parathyas thoracata*, *Arrenurus knauthei*, *A. mediorotundatus*, *A. papillator*, and *A. pugionifer*.

4.2. Occurrence of Hydracarina in particular types of water bodies

4.2.1. Field water bodies

In six investigated ponds 520 individuals from 51 species were caught, this constituting 59.9% of the collected Hydracarina. The chief element of this fauna were astatic spring species (fig. 2), the most numerous species being *Piona nodata*, *Hydryphantes planus*, and *Arrenurus integrator*. The group of small reservoir species was also numerous. The most frequent species was *Arrenurus globator* recorded mainly at Station 3. Other fairly numerous species were *Pionopsis lutescens*, *Limnesia undulata*, *Piona pussilla*, *Arrenurus maculator*, and *A. batillifer*. The number of tyrphophilous and lake elements was much smaller.

The Station 3 at Nowe Włóki was particularly interesting, being characterized by the greatest diversity of species (36) and the largest number of individuals (304). It was followed by a small (0.05 ha) water body in the vicinity of Derc (Station 4) where 150 individuals of 19 species were collected. The pond near Sętal (Station 2) showed a very poor fauna of water mites, only 26 individuals from 8 species being found there.

Table I. Number of water mites (Hydracarina) collected in the investigated small eutrophic water bodies in the vicinity of Olsztyn in 1994.

Taxa	Stations											Total
	Field						Forest		Village			
	1	2	3	4	5	6	7	8	9	10	11	
Hydrachnidae												
Hydrachna incognita Wainst.			1				1					2
Limnocharidae												
Limnochares aquatica (L.)	11											11
Piersigidae												
Piersigia intermedia Williams.			2									2
Hydryphantidae												
Hydryphantes bayeri Pisarov.			1				1					2
— *crassipalpis* Koen.			2						1			3
— *dispar* (Schaub)										2		2
— *frici* Thon				1						1		2
— *hellichi* Thon				1		2	1					4
— *peroviensis* Udalz.										2		2
— *planus* Thon			11	2	1	10	20					44
— *ruber* (Geer)						6	23					29
— *tenuipalpis* Thon			1									1
— *thoni* Piers.			2									2
Thyas barbigera Viets			2			2	9	1				14
— *dirempta* Koen.			2		1		4					7
— *pachystoma* Koen.			1				2					3
— *palustris* Koen.						1	1					2
Parathyas thoracata (Piers.)			1									1
Thyasides dentatus (Thor)			1				1	2				4
Euthyas truncata (Neum.)							1					1

Table I (*continued*)

Taxa	Stations											Total
	Field						Forest		Village			
	1	2	3	4	5	6	7	8	9	10	11	
Hydrodromidae												
Hydrodroma descipiens Müll.			6						1			7
Limnesiidae												
Limnesia connata Koen.	1											1
— *fulgida* Koch	5	3	3	11			1			2		25
— *undulata* (Müll.)	12	1	1	1			4			2		21
Unionicolidae												
Neumania spinipes (Müll.)				1								1
— *vernalis* (Müll.)	4		2	3								9
Pionidae												
Piona alpicola (Neum.)					2			2				4
— *clavicornis* (Müll.)			7	1								8
— *conglobata* (Koch)				1						9		10
— *nodata* (Müll.)			8	34	17	2	7	5				73
— *obturans* (piers.)			2									2
— *paucipora* (Thor)	1											1
— *pusilla* (Neum.)	14		4									18
Tiphys bullatus (Thor)	2	1	6		1			166		2		178
— *ensifer* (Koen.)	1						3					4
— *ornatus* Koch							3	1				4
Pionopsis lutescens (Herm.)	4		27	7	15	3	1	6		1		64
Mideidae												
Midea orbiculata (Müll.)			1									1

Table I (*continued*)

Taxa	Stations											Total
	Field						Forest		Village			
	1	2	3	4	5	6	7	8	9	10	11	
Arrenuridae												
Arrenurus batillifer Koen.		1	8	1	1			1				12
— *bicuspidator* Berl.				1								1
— *bifidicodulus* Piers.	1		7	1			6					15
— *bisulcicodulus* Piers.			5									5
— *bruzelii* Koen.			1	2								3
— *buccinator* (Müll.)		1					2					3
— *cuspidator* (Müll.)		3	2					2				7
— *fimbriatus* Koen.	1		2							11		14
— *globator* (Müll.)	3		102	15		2			1	15		138
— *inexploratus* Viets			5				2					7
— *integrator* (Müll.)			27	1		1						29
— *knauthei* Koen.			2									2
— *maculator* (Müll.)		2	1	10				1		3		17
— *mediorotundatus* Thor							1					1
— *papillator* (Müll.)								2				2
— *pugionifer* Koen.							4					4
— *stecki* Koen.	1		1							2		4
— *tricuspidator* (Müll.)	1											1
— *truncatellus* (Müll.)	1	1	17			1	4		1	1		26
— *virens* Neum.				8								8
Imagines	63	13	274	102	38	30	102	189	4	53		868
Deutonymphs	2	13	30	48	66	46	17	27	15	32	2	298
Total	65	26	304	150	104	76	119	216	19	85	2	1166

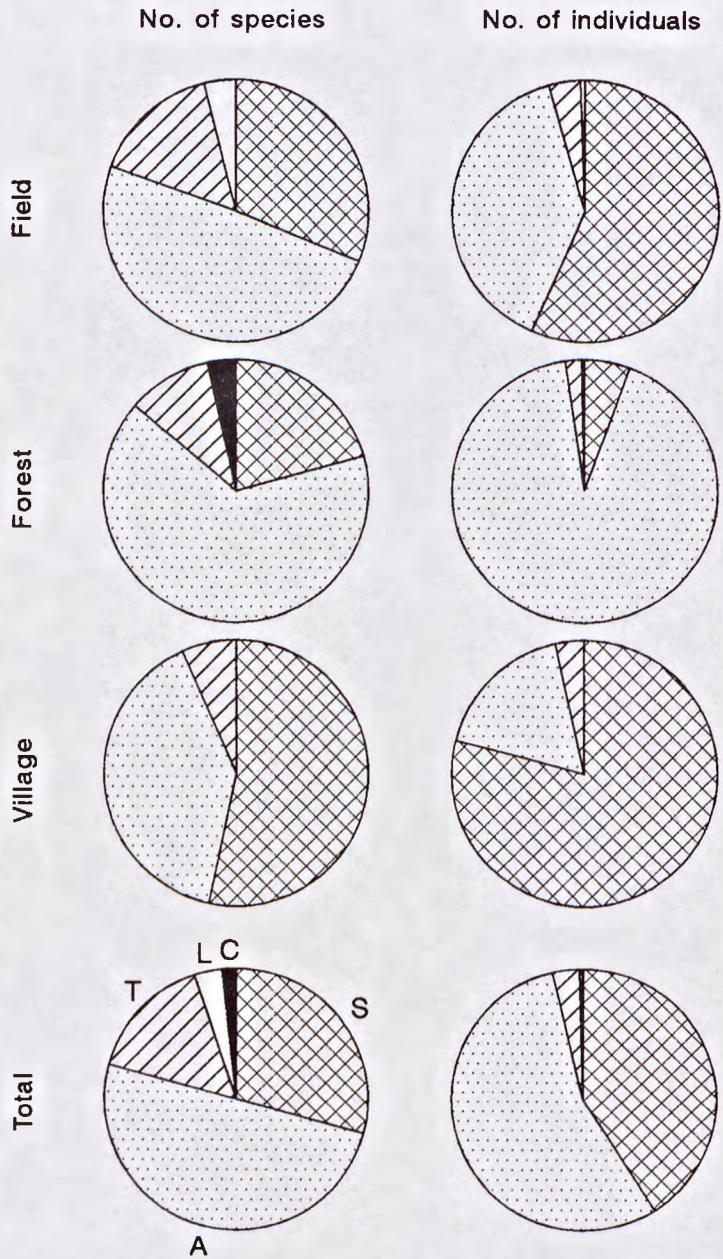

Fig. 2. Synecological characteristics of water mites (Hydracarina) collected in small eutrophic water bodies in the vicinity of Olsztyn in 1994: A — astatic spring species, C — crenophilous species, L — lake species, S — small reservoir species, T — tyrphophilous species.

4.2.2. Midforest water bodies

In forest swamps 29 species (291 individuals) were identified, this constituting 33.5% of the collected water mites. The occurrence of 19 species of astatic spring fauna, 6 small reservoir, and 3 tyrphophilous ones was found. Besides, 1 crenophilous species, *Arrenurus mediorotundatus*, was recorded at Station 7 (fig. 2) in a water body situated on a transitory peat bog with an acidic water reaction (pH about 6) and temperature in summer about 5 °C lower than at other stations.

The greatest specific diversity (19 species) was observed among astatic spring fauna. *Tiphys bullatus* was most numerous (166 individuals) at Station 8. *Hydryphantes ruber*, *H. planus*, *Piona nodata*, and *Thyas barbigera* were also fairly numerous. The small reservoir group was represented by 6 species (*Hydrachna incognita*, *Pionopsis lutescens*, *Limnesia fulgida*, *L. undulata*, *Arrenurus cuspidator*, and *A. maculator*). The tyrphophilous species (*Piona alpicola*, *Arrenurus buccinator*, and *A. papillator*) constituted only 2.1% of the number of collected individuals in spite of the peaty character of these habitats and low pH.

4.2.3. Village reservoirs

Among all the investigated water bodies village reservoirs showed the poorest fauna. The collected 57 individuals of 15 species constituted scarcely 6.6% of the whole material. The dominant species belong to the small reservoir and astatic spring fauna groups (fig. 2), *Arrenurus globator* being most numerous. In the reservoir at the Frączki village (Station 11) only two deutonymphs were recorded.

4.3. Seasonal changes in the number of individuals and species

Changes in the number of individuals and in the species diversity were observed to occur in particular months (fig. 3). The greatest number of species (41)

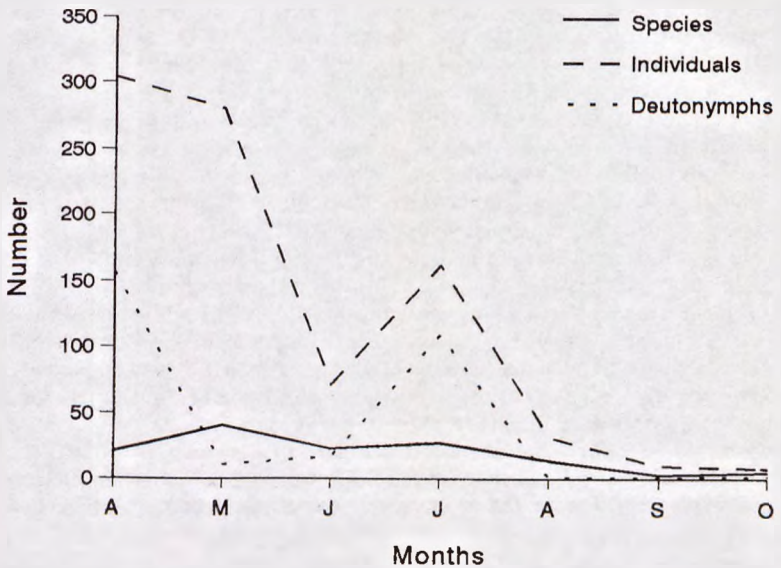

Fig. 3. Qualitative and quantitative seasonal changes of the fauna of water mites (Hydracarina) of small eutrophic water bodies in the vicinity of Olsztyn in 1994.

was found in May. In July 28 species were recorded, a distinct decrease in their number occurring in September. Also the greatest number of individuals was observed in spring (304 individuals in April, 280 in May) and in summer (162 in July). A fall in the number of species in June and in autumn was accompanied by diminishing numbers of individuals.

Among water mites of the investigated habitats numerous species occurred only up to July. They chiefly belong to the astatic spring fauna (*Tiphys bullatus*, *Hydryphantes planus*, and *Arrenurus integrator*). In July such species as *Limnochares aquatica*, *Piona alpicola*, *Arrenurus bicuspidator*, *A. bruzelii*, *A. cuspidator*, and *A. virens* emerged.

The greatest number of deutonymphs were collected in April (157 individuals) and July (109) (fig. 3), this being in accordance with the life cycle of Hydracarina which winter in the stage of egg or parasitic larva.

5. Discussion

In the investigated water bodies of the Olsztyn Lake District a characteristic trait of the Hydracarina assemblages is the dominance of the astatic spring fauna and small reservoirs elements, this concerning both the species composition and number of individuals. On account of the frequently stressed faunistic distinctiveness of mountain and submontane small water bodies (Biesiadka 1979, Biesiadka and Kowalik 1980, Biesiadka and Cichocka 1993) a comparison of the here investigated fauna of water mites with that in such regions is irrelevant. It is more useful to compare it with lowland water bodies in different areas. Biesiadka (1972) gave a fairly detailed description of the fauna of water mites in different water bodies of the Wielkopolski National Park. In the area investigated by Biesiadka (1972) the elements of the astatic spring and small reservoirs fauna were very strongly represented. It was characteristic, however, that these elements were distinctly divided with respect to the habitat: the astatic spring element occurred in seasonal waters of the inundation terrace while the small reservoir element colonized small eutrophic waters lying above this terrace. In the investigated water bodies of the Olsztyn Lake District these two elements occur together, this probably being a characteristic trait of old water bodies with well-developed astatic zones.

In the water bodies of the Biebrza Moorland the small reservoir element prevails, though with a large quantitative share of the spring element (Cichocka 1966). Hence, there is a considerable similarity between the water mite assemblages of the small water bodies of Biebrza Moorland and those in the vicinity of Olsztyn, although these are quite different kinds of waters. The similarity stresses the importance of the hydrological conditions, chiefly the annual cycle of changes of water level, for formation of the general structural traits of the fauna of water mites. The investigated water bodies of the Olsztyn Lake District are characterized by a great species diversity. In field ponds the number of species varied from 8 at Station 2 to 36 at Station 3. This variation probably depended upon the complex of such factors as the kind of substratum, character of the vegetation, food base, degree of astaticism, and chemical composition of the water. An increase in the content of inorganic nitrogen, particularly of ammonia, brings about a reduction of the water mite assemblage up to its complete disappearance (Kowalik 1980). In the case of some field water bodies this factor might have a strong negative effect.

In the ponds situated among farm buildings the fauna of water mites was very poor, with a more abundant occurrence only of the small reservoir element. The qualitative and quantitative poverty may be explained by the strong human impact leading to the degradation of habitats localised in village centres.

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