

A SYNECOLOGICAL CHARACTERIZATION
OF THE WATER MITE COMMUNITIES
(ACARI: HYDRACHNIDIA) OF THE TANEW RIVER
IN THE NAD TANWIĄ RESERVE

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Summary. A total of 17 water mite species were collected in the Tanew River in the Nad Tanwią reserve. The dominant species were *Hygrobates calliger* (34.4%), *Lebertia pusilla* (17.3%), *Aturus scaber* (11.3%), *Atractides nodipalpis* (8.7%), *Sperchon setiger* (6.1%) and *Lebertia glabra* (5.5%). The material collected contained species that are rare in Poland – *Lebertia glabra* and *L. pusilla*, and a species rarely found anywhere in Europe – *Sperchon turgidus*. The most species were collected in lentic habitats (15 sp.). There were 13 species noted in lotic habitats and 9 in the rapids. The Hydrachnidia communities of the stretch of the river investigated were characterized by a preference for habitats in currents. Rheobiont species were most abundant (89.5%, 10 sp.), with smaller percentages of crenophiles (6.8%, 4 sp.) and rheophiles (3.7%, 3 sp.). The greatest similarity was noted between communities inhabiting the rapids and lotic habitats (47%). The community of species inhabiting lentic habitats was markedly different from the fauna of the lotic zone. In the yearly cycle, a marked peak in abundance was observed in the summer, with the highest numbers of both adults and deutonymphs collected in August (106 and 13.5 ind.). A substantial mountain component was noted in the material collected (17.3%). The faunistic composition and character of the water mite communities indicate that the Nad Tanwią reserve is a site of great natural value, with unique Hydrachnidia fauna.

Key words: water mites, Hydrachnidia, Nad Tanwią reserve, habitat diversity, species diversity, mountain component

INTRODUCTION

Roztocze is one of the most distinctive areas of the Lublin region – it clearly stands out from neighbouring areas and its borders are visible even on a simple topographical map [Czarnecka and Janiec 2002]. The southern edge zone of Roztocze, bordered by the faults of the outer edge of the region, is worthy

of particular attention. Situated here are the gorges of the Tanew, Sopot and Szum rivers, protected by a reserve due to their unique landscape value [Michalczyk and Wilgat 1998, Czarnecka and Janiec 2002, Rąkowski 2006].

Roztocze is classified topologically as an upland, but numerous characteristics distinguish it from neighbouring areas: marked elevation above the surrounding areas, certain morphological and hydrographical features, a climate similar in some respects to a mountain climate, the presence of large, natural forest complexes with mountain plant communities, and the occurrence of mountain elements in the flora and fauna. Thus it is functionally like a mountainous region, and certain ecosystems, like the gorges, are exactly like mountain ecosystems [Liana *et al.* 1992].

The fauna inhabiting Roztocze is considered to be poorly researched [Liana *et al.* 1992]. Thus far in Roztocze 117 water mite species have been identified [Biesiadka and Kowalik 1977, 1978, 1979, Kowalik 1980, 1981, Kowalik and Biesiadka 1978a, b, Stryjecki 2006a, b, Stryjecki and Kowalik 2002]. This is very likely not a complete list of species. Further research on the aquatic ecosystems of the region would unquestionably reveal more taxa.

The aim of the study was to further knowledge of the water mites of Roztocze by presenting data on the water mites of the Tanew River in the Nad Tanwią reserve. Until now, apart from very fragmentary data, there have been no studies on the Hydrachnidia fauna of the reserve. A faunistic valorization of the reserve is presented based on the water mite fauna inhabiting it. Habitat diversity of the communities is discussed, as well as phenological changes during the yearly cycle. In addition, the theory concerning the large proportion of mountain component in the fauna of Roztocze compared to other regions of lowland Poland has been verified with respect to Hydrachnidia.

STUDY SITES AND METHODS

Samples were collected from the stretch of the Tanew River within the boundaries of the Nad Tanwią reserve (N: 50°23'43.05", E: 23°11'23.04"). A general description of the reserve can be found in many papers [e.g. Michalczyk and Wilgat 1998, Czarnecka and Janiec 2002, Rąkowski 2006]. Samples were collected from three habitats:

A – lentic habitats

These were small coves in the most shallow zones of the river, near the banks. Water depth was 0.05–0.15 m. The bottom was covered with a thin layer of muddy sediment. No aquatic vegetation was present here. Clumps of coarse detritus occurred in places (fallen leaves, twigs and branches). These were habitats with stagnant water or minimal water flow.

B – lotic habitats

Habitats located in the middle part of the river. Water depth was 0.2–0.4 m. The bottom was sandy with isolated macrophytes. Clumps of coarse detritus occurred in places (fallen leaves, twigs and branches). The current was very strong.

C – rapids

A quasi-mountain habitat situated in the rapids. The bottom was hard and rocky, covered with stones of different sizes, with sandy sediment in places. Thick patches of moss grew on the rocks. The current was very fast and the water flow was turbulent.

The field research was conducted in the years 2001–2002. Samples were collected once a month, from March to October, using a dip net with 250 μm apertures. In each habitat (lentic, lotic, rapids) samples were collected in the same way: over a distance of 5 m, which with a dip net diameter of 0.25 m gives a total area of 1.25 m^2 . Similarity of fauna between habitats was calculated according to the Bray-Curtis formula using BIODIVERSITY PRO software v. 2 [McAlecece *et al.* 1997]. Species diversity was determined using the Shannon-Wiener formula (base 2 logarithm) and Pielou's evenness index (J'). Species nomenclature was applied according to Biesiadka [2008], except for the genus *Lebertia*, for which Gerecke's nomenclature [2009] was used.

RESULTS

A total of 781 Hydrachnidia individuals (730 adults and 51 deutonymphs) were collected in the Tanew River in the Nad Tanwią reserve. A total of 17 species belonging to 6 families and 9 genera were noted (Tab. 1). The dominant group (dominance > 5%) consisted of *Hygrobatas calliger* (34.4%), *Lebertia pusilla* (17.3%), *Aturus scaber* (11.3%), *Atractides nodipalpis* (8.7%), *Sperchon setiger* (6.1%) and *Lebertia glabra* (5.5%). The material contained species that are rare or very rare in Poland – *Lebertia pusilla* (rare species) and *L. glabra* (very rare in Poland). Moreover, one species was found that is very rare in all of Europe, known from only a few sites – *Sperchon turgidus*.

The species identified were classified into three synecological groups: rheobionts, rheophiles and crenophiles. The Hydrachnidia fauna of this stretch of the Tanew had a strong preference for habitats in currents. Rheobiont species were most abundant (89.5%, 10 sp.). Less numerous were crenophiles (6.8%, 4 sp.) and rheophiles (3.7%, 3 sp.) – Tab. 1. Certain differences were noted in the proportions of each synecological group in different habitats. In the rapids, complete dominance of rheobionts was observed (97.3%). In lotic habitats, the percentage of rheobionts was also very high (92.8%), but there was a noticeable share of crenophile species (6.3%). Rheobionts were also the most numerous group in the littoral zones (58.6%), but there was a substantial proportion of rheophiles (24.1%) and crenophiles (17.3%) as well (Fig. 1).

Table 1. Species composition and numbers of water mites collected in the Nad Tanwią reserve

No	Taxon	SG	A	B	C	Σ
1.	<i>Paniscus michaeli</i> Koen.	Cf	1			1
2.	<i>Protzia eximia</i> (Protz)	Rb		2	1	3
3.	<i>Sperchonopsis verrucosa</i> (Protz)	Rb	2	6	6	14
4.	<i>Sperchon turgidus</i> Viets	Rb	1	1		2
5.	<i>Sperchon setiger</i> Thor	Rb	5	37	6	48
-	<i>Sperchon</i> sp. (deutonymphs)	-		7	2	9
6.	<i>Lebertia dubia</i> Thor	Cf	1			1
7.	<i>Lebertia glabra</i> Thor	Cf	11	28	4	43
8.	<i>Lebertia inaequalis</i> (Koch)	Rf		1		1
9.	<i>Lebertia oblonga</i> Koen.	Rf	1	1		2
10.	<i>Lebertia pusilla</i> Koen.	Rb	6	103	26	135
-	<i>Lebertia</i> sp. (deutonymphs)	-	1	5	4	10
11.	<i>Hygrobates calliger</i> Piers.	Rb	40	179	50	269
12.	<i>Hygrobates fluviatilis</i> (Ström)	Rb	3	1		4
13.	<i>Hygrobates setosus</i> (Bess.)	Rf	24			24
-	<i>Hygrobates</i> sp. (deutonymphs)	-	2	18	4	24
14.	<i>Atractides nodipalpis</i> (Thor)	Rb	2	46	20	68
15.	<i>Atractides tener</i> (Thor)	Rb	1	12	9	22
-	<i>Atractides</i> sp. (deutonymphs)	-		3	5	8
16.	<i>Wettina podagrica</i> (Koch)	Rf	5			5
17.	<i>Aturus scaber</i> Kram.	Rb	1	26	61	88
	Total specimens		107	476	198	781
	Total species		15	13	9	17
H'			2.77	2.48	2.48	2.79
J'			0.71	0.67	0.78	0.68

Explanations: SG – synecological groups: Cf – crenophiles, Rb – rheobionts, Rf – rheophiles, A – pool areas, B – midstream zone, C – rapids, H' – Shannon index, J' – Pielou index

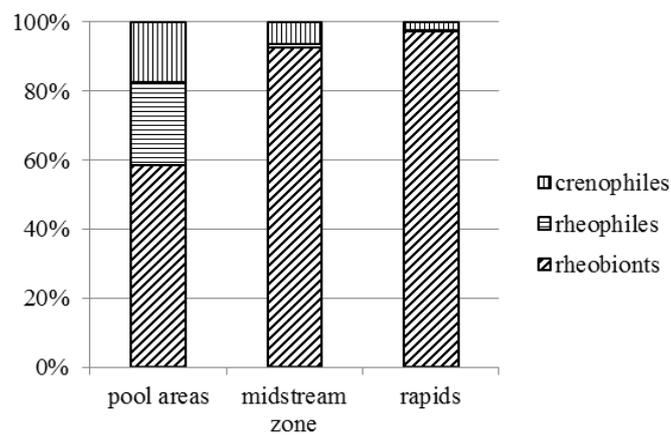


Fig. 1. Percentage share of synecological groups of water mites in each habitat

The most species were collected in lentic habitats (15 sp., 107 individuals). There were 13 species found in lotic habitats (476 ind.) and 9 sp. (198 ind.) in the rapids (Tab. 1). The greatest similarity of fauna was noted between communities inhabiting the rapids and lotic habitats (47%). The community of species collected in lentic habitats differed from the fauna in the lotic zone. Similarity of Hydrachnidia inhabiting the lentic and lotic zones of the river was only 26%.

Changes in the numbers of adults and deutonymphs over the yearly cycle followed a similar time course – one marked peak was observed in the summer. Maximum numbers of water mites were noted in August (106 adult individuals and 13.5 deutonymphs – mean values from two seasons) – Fig. 2. In this month a large number of *Hygrobatas calliger* (both adults and deutonymphs) was found.

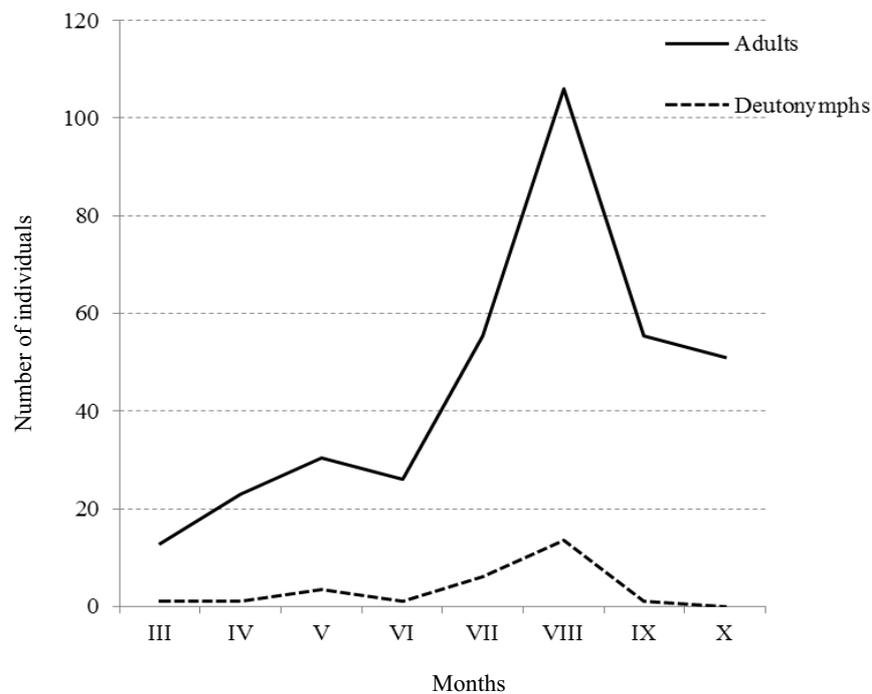


Fig. 2. Seasonal changes in numbers of water mites in the Nad Tanwią reserve (mean values from 2001–2002)

Species diversity of the Hydrachnidia fauna in the Nad Tanwią reserve was 2.79 (with Pielou's evenness index equal to 0.68). The values of the Shannon index were the same in the lotic habitats and in the rapids – $H' = 2.48$, but the values for Pielou's evenness index differed in these habitats – $J' = 0.67$ in lotic habitats and $J' = 0.78$ in the rapids. Species diversity was higher in lentic habitats than in the lotic zone – 2.77 (Tab. 1).

The material collected included a substantial mountain component, as *Lebertia pusilla* – a mountain species – accounted for 17.3% of the fauna collected in the reserve.

DISCUSSION

According to Liana *et al.* [1992], the fauna inhabiting Roztocze has not been well researched. This is still true today. To date 117 water mite species have been identified in Roztocze [Biesiadka and Kowalik 1977, 1978, 1979, Kowalik 1980, 1981, Kowalik and Biesiadka 1978a, b, Stryjecki 2006a, b, Stryjecki and Kowalik 2002]. This may seem a substantial number, but in the nearby Lasy Janowskie Landscape Park 148 species have been found [Stryjecki 2002]. Thus in Roztocze, which is far larger and has a more diverse landscape than Lasy Janowskie Landscape Park, we would expect far more species than the 117 that have thus far been identified. Despite the many years of research conducted since the 1960s, many new species are still being identified in Roztocze, including species new to Poland [Stryjecki 2006b]. Of the 17 species collected in the Nad Tanwią reserve, five had not been previously noted in Roztocze. These were *Sperchonopsis verrucosa*, *Sperchon turgidus*, *Lebertia glabra*, *L. pusilla* and *Aturus scaber*. Thus the current number of species identified in Roztocze is 122. The identification of five new species in the small area encompassed by the reserve indicates that our knowledge of the Hydrachnidia fauna of Roztocze is still inadequate.

Several species were found in the Nad Tanwią reserve that are interesting in terms of their faunistic status. There was one species noted that is rare in the Lublin region – *Protzia eximia*, one that is rare in Poland – *Lebertia pusilla*, and one that is very rare in Poland – *Lebertia glabra* [Biesiadka 1979, 2008, Kowalik and Biesiadka 1978a]. Moreover, one species was found that is very rare not only in Poland but in all of Europe, known only from a few isolated sites – *Sperchon turgidus* [Biesiadka 2008, Di Sabatino *et al.* 2010]. Thus of the 17 species collected in the Nad Tanwią reserve, three were rare or very rare in Poland and Europe. Thus we can state that the Hydrachnidia communities of the reserve are of very high faunistic value.

The most species were caught in lentic habitats (15 sp.). – Tab. 1. The high number of species here was due to the presence of species typical for this habitat as well as species associated with lotic habitats, but migrating in the direction of the banks and occurring in the littoral zone as well (although in smaller numbers than in the lotic zone). The large number of species and the even distribution of dominance in lentic habitats contributed to the high value for the Shannon index, which at 2.77 was the highest in all the habitats (Tab. 1). *Hygrobatas setosus* was abundant in the littoral zone of the river. This water mite was found only in lentic habitats, which confirms its predilection for this type of habitat [Biesiadka 1979, Kowalik 1981, Cichočka 1996, Zawal and Sadanowicz 2012]. There were

13 species noted in lotic habitats, where the highest number of individuals was collected (476 ind.). The high abundance of water mites in the lotic zone confirms that the Hydrachnidia communities in the Nad Tanwią reserve have a strong preference for habitats in currents. The fewest species were noted in the rapids flowing over moss-covered rocks (9 sp., 198 ind.). The habitat conditions here (rocky bottom, very strong current) limited the species composition to taxa adapted to this type of habitat. The dominant species here was *Aurus scaber*, a species characteristic of environments with river debris, mosses, and rapid water flow [Biesiadka 1970, 1974, 1979, Cichocka 1996].

The Hydrachnidia fauna of the Nad Tanwią reserve had a strong preference for habitats in currents – rheobiont species were dominant (89.5%, 10 sp.), with a much smaller proportion of crenophiles and rheophiles (Tab. 1). This synecological structure of the fauna resulted from the habitat conditions, i.e. well-developed current environments in the river. The high percentage of rheobionts and rheophiles is common in lowland rivers with well-developed lotic zones [Biesiadka 1970, Kowalik 1981, Cichocka 1996] and, of course, in mountain rivers [Biesiadka 1974, 1979]. The substantial share of crenophile species noted in the reserve (6.8% of the fauna, 4 sp.) was due to that fact that several springs flow into the Tanew River within the reserve, and these species could migrate from them into the river. Moreover, species associated with springs are a permanent component of water mite communities inhabiting cold, well-oxygenated flowing water [Kowalik and Biesiadka 1978a, b, Biesiadka 1979, Kowalik 1981, Cichocka 1996, Gerecke 2009, Di Sabatino *et al.* 2010], and these are the conditions prevailing in the river.

Phenological analysis revealed one marked peak in abundance in the summer. The highest numbers of water mites, both adults and deutonymphs, were noted in August (Fig. 2), when both older individuals, of the first generation, and younger ones, of the second generation, were collected. The temporary co-occurrence of the two generations contributed to the summer peak in abundance of adults. The fact that numbers of deutonymphs were highest at this time of the year also indicates the reproductive peak occurring in some species (e.g. *Hygrobates calliger*) in the summer (July–August). This pattern of changes in numbers shows that in many water mite species inhabiting flowing waters a change of generations takes place in the summer. This is confirmed by data reported by Bader [1980] concerning the lifespan of certain water mite species.

Roztocze is included topologically among highlands, but functionally it is like a mountainous region, and certain ecosystems, such as the gorges, are exactly like mountain ecosystems [Liana *et al.* 1992]. In many animal groups that have been studied, a greater proportion of mountain species has been observed than in other regions of lowland Poland [Łętowski and Kucharczyk 1997]. This tendency can also be seen in the Hydrachnidia communities of the Nad Tanwią reserve. While only one mountain species was identified (*Lebertia pusilla*), it accounted for as much as 17.3% of all the fauna collected. The very high percentage of this mountain species was a consequence of the habitat conditions

in this stretch of the Tanew – the stretches of rivers in the edge zone of Roztocze (Sopot, Szum, Tanew) are similar to mountain streams, so that the fauna inhabiting them – like the habitat in which it occurs – is largely characteristic of mountainous regions.

CONCLUSIONS

1. In the Nad Tanwią reserve one species rare in Poland and one very rare species were collected, as well as one species that is very rare in all of Europe. Therefore the reserve is of high value not only in terms of its landscape features but in terms of its fauna as well.

2. The Hydrachnidia fauna of the reserve had a strong preference for habitats in currents – rheobiont species were dominant (89.5%, 10 sp.), with a considerably lower proportion of crenophiles and rheophiles. This synecological structure was due to habitat conditions, i.e. well-developed current environments in the river.

3. The Hydrachnidia communities of the reserve included a significant mountain component (17.3%). This very high percentage resulted from the habitat conditions in this stretch of the Tanew, which was very similar to a mountain stream.

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CHARAKTERYSTYKA SYNEKOLOGICZNA ZGRUPOWAŃ WODOPÓJEK (ACARI: HYDRACHNIDIA) W RZECE TANEW W REZERWACIE NAD TANWIĄ

Streszczenie. W rzece Tanew w rezerwacie Nad Tanwią stwierdzono 17 gatunków wodopójek. Dominowały: *Hygrobates calliger* (34,4%), *Lebertia pusilla* (17,3%), *Aturus scaber* (11,3%), *Atractides nodipalpis* (8,7%), *Sperchon setiger* (6,1%), i *Lebertia glabra* (5,5%). W zebranych materiale stwierdzono gatunki rzadkie na terenie Polski: *Lebertia glabra* i *L. pusilla*, oraz gatunek

bardzo rzadki w skali Europy – *Sperchon turgidus*. Najwięcej gatunków złowiono w zastoiskach przybrzeżnych (15 gat.). W strefie nurtu stwierdzono 13 gatunków, a na progach 9. Zgrupowania Hydrachnidia badanego odcinka rzeki miały wybitnie prądolubny charakter. Największy udział miały gatunki reobiontyczne (89,5%, 10 gat.), mniejszy gatunki krenofilne (6,8%, 4 gat.) oraz reofilne (3,7%, 3 gat.). Największe podobieństwo stwierdzono między zgrupowaniami zasiedlającymi progi i strefę nurtu (47%). Odrębny faunistycznie był zespół gatunków zasiedlający zastoiska przybrzeżne. W cyklu rocznym obserwowano wyraźny szczyt liczebności w lecie. W sierpniu łowiono maksymalne liczebności zarówno imagines, jak i deutonimf (odpowiednio 106 i 13,5 osobn.). W zebranych materiale stwierdzono znaczny udział elementu górskiego (17,3%). Uwzględniając skład faunistyczny i charakter zgrupowań wodopójek należy stwierdzić, iż rezerwat Nad Tanwią stanowi cenny przyrodniczo obiekt, z unikalną fauną Hydrachnidia.

Słowa kluczowe: wodopójki, Hydrachnidia, rezerwat Nad Tanwią, zróżnicowanie siedliskowe, różnorodność gatunkowa, element górski