Teka Kom. Ochr. Kszt. Środ. Przyr. – OL PAN, 2012, 9, 215–223

FAUNISTIC AND ECOLOGICAL CHARACTERISTICS OF THE WATER MITES (ACARI: HYDRACHNIDIA) OF ASTATIC POOLS IN POLESIE NATIONAL PARK

Robert Stryjecki

Department of Zoology, Anima Ecology and Wildlife Management, University of Life Sciences in Lublin
Akademicka str. 13, 20-950 Lublin, robstry@wp.pl

Summary. A total of 30 water mite species were noted in four astatic pools in Polesie National Park, including 9 that were new to the park. The dominants were *Hydryphantes planus* (15.8%), *Tiphys ornatus* (10.1%), *Thyas dirempta* (8.1%), *Piona nodata* (6.8%), *Arrenurus inexploratus* (6.1%) i *A. truncatellus* (6.1%). Most abundant in the material collected were vernal species (87.7%, 20 sp.) and tyrphobionts and tyrphrophiles (11.9%, 8 sp.). The least numerous were species associated with small pools (0.4%, 2 sp.). No lake species were noted in the water bodies investigated. The greatest numbers of individuals (356) and species (23), as well as the highest species diversity (3.51), were observed in the pools situated in Bagno Bubnów. These values confirm that Bagno Bubnów is a highly valuable part of Polesie National Park in terms of Hydrachnidia fauna.

Key words: water mites, Hydrachnidia, astatic pools, synecological groups, species diversity

INTRODUCTION

The Hydrachnidia of Polesie Lubelskie, including Polesie National Park, have been fairly well researched, but particular types of water bodies have been investigated in varying degrees. The greatest number of studies concern lake fauna [Kowalik 1973, 1977, 1978, Kowalik and Stryjecki 1999, Kowalik *et al*. 2002]. A good deal of data can also be found on water mites inhabiting peat-bog pools, both acidic [Kowalik 1980, 1996, Kowalik and Stryjecki 2000] and carbonate [Kowalik 1980, 1996, Kowalik and Stryjecki 2000, Stryjecki 2010a]. Somewhat less well-researched are the fauna of small permanent pools [Kowalik 1980, Kowalik and Stryjecki 2000, Kowalik *et al*. 2002, Stryjecki 2010b, 2011] and fish ponds [Stryjecki 2007]. In comparison with these types of water bodies, the Hydrachnidia fauna of astatic pools is the least known. Some data on this topic can be found in a few publications [Kowalik 1980, Kowalik *et al*. 2002,

Stryjecki 2010b], but current knowledge of water mites inhabiting the astatic water bodies of Polesie Lubelskie, and in particular of Polesie National Park, is still far from satisfactory.

The reason for the focus on water mites inhabiting the lakes, ponds and peat bog pools of Polesie National Park is obvious, as these water bodies dominate the landscape of the park. Nevertheless, for a complete analysis of the Hydrachnidia fauna of Polesie National Park, other types of water bodies, including astatic pools, should be investigated as well. These pools are an important element of the surface water network and a vital habitat for water mites.

The aim of this study was to present faunistic and ecological data on the water mites inhabiting astatic pools in Polesie National Park. Thus far there have been no separate studies dedicated to this question, so research on the Hydrachnidia of the park will be more complete owing to this study. The data presented can be a reference for determining long-term changes in the water mites of the astatic pools of the park in the future.

STUDY SITES AND METHODS

Samples were taken from four pools situated in Polesie National Park.

Pool 1 in Czemernik (N: 51°20'33.43", E: 23°16'38.2"). The pool is situated on the edge of Bagno Bubnów. The surface area of the pool was about 500 m^2 and the maximum depth was 0.7 m. Most of the surface of the pool was covered with *Typha latifolia* L. There was a large amount of suspended solids in the water. The bottom was soft and muddy with a large amount of detritus. The pool dried out completely in the summer months.

Pool 2 in Czemernik (N: 51°20'20.81", E: 23°16'12.13"). One of several small, ephemeral pools situated in a wet meadow. The surface area of the pool was about 10 m^2 and the maximum depth was 0.2 m. The bottom was covered with turf and thick patches of moss. Flooded meadow vegetation was present near the shores and in the middle of the pool. The pool dried out completely in the summer months.

Pool in Pieszowola (N: 51°28'43.02", E: 23°9'43.37"). The pool is situated on the edge of a fish pond complex. The surface area was about 30 m^2 and the maximum depth was about 0.4 m. Flooded grasses covered the shores and bottom. Isolated clumps of *Carex* sp. with some *Juncus* sp. grew near the shores. *Lemna minor* L. was present on the surface. The bottom was hard and sandy.

Pool in Nowiny (N: 51°27'54.43", E: 23°14'26.67"). A small pool situated in a meadow, with a surface area of 80 m^2 and maximum depth of 0.6 m. *Carex* sp., *Juncus* sp. and *Polygonum* sp. grew near the shore. Mats of string algae developed periodically. The bottom was soft and muddy with a large amount of detritus. The pool dried out periodically and then refilled with water.

Field research was carried out in 2006–2007. Samples were taken once a month, from April to September. The material was collected with a dip net

with 250 μm apertures (semiquantitative samples). Faunal similarity between the pools was calculated according to the Bray-Curtis formula using the software BIODIVERSITY PRO v.2 [McAleece *et al*. 1997]. Species diversity was calculated using the Shannon-Wiener formula (base 2 logarithm). Species nomenclature was applied according to Biesiadka [2008].

RESULTS

A total of 601 Hydrachnidia individuals (474 adults and 127 deutonymphs) were collected in the water bodies investigated. There were 30 species belonging to 9 genera and 4 families (Tab. 1). The most frequently represented families were Hydryphantidae (44.9% of the material collected, 13 sp.), Pionidae (35.9%, 8 sp.) and Arrenuridae (18.6%, 8 sp.). The dominants (dominance > 5 %) were *Hydryphantes planus* (15.8% of the material collected), *Tiphys ornatus* (10.1%), *Thyas dirempta* (8.1%), *Piona nodata* (6.8%), *Arrenurus inexploratus* (6.1%) and *A. truncatellus* (6.1%).

There were 9 species noted in the material collected that had not previously been observed in Polesie National Park: *Vietsia scutata*, *Thyas barbigera*, *T. bruzelii*, *T. dirempta*, *T. palustris*, *Thyasides dentatus*, *Tiphys latipes*, *Arrenurus bisulcicodulus* and *A. papillator*.

The highest faunal similarity was noted between the pool in Nowiny and the pool in Pieszowola (40.2%). The most distinct in terms of water mite fauna was pool 1 in Czemernik (Fig. 1).

The water mites collected were classified into synecological groups based on data from the literature [Biesiadka 1972, 2008, Cichocka 1998]: eurytopic species typical of small pools, vernal species associated with astatic water bodies, and tyrphobiontic and tyrphophilic species.

Vernal species were the most highly represented (87.7%, 20 sp.) in the material collected (from all four pools). The second most numerous group was tyrphobiontic and tyrphophilic species (11.9%, 8 sp.). The least abundant were species associated with small pools (0.4%, 2 sp.) – Fig. 2. No lake species were noted in the pools.

Closer analysis was made of the fauna from pool 1 in Czemernik and the pool in Nowiny. Too few individuals were collected from pool 2 in Czemernik and the pool in Pieszowola for any ecological indicators to be applied.

Of the four pools investigated, the highest number of individuals (327) was caught in pool 1 in Czemernik (Tab. 1). The most abundant species were *Hydryphantes planus* (18.6%), *Arrenurus inexploratus* (11.3%), *A. truncatellus* (10.4%), *Piona nodata* (7.6%), *Arrenurus bisulcicodulus* (5.8%), *Tiphys latipes* (5.5%) and *T. pistiliifer* (5.5%). The most numerous synecological group in this pool was species associated with astatic water bodies (84.9%, 16 sp.). The second most abundant group was species characteristic of peat bog pools (15.1%, 4 sp.). No lake species or species associated with small pools were noted here (Fig. 2). The species diversity of the fauna was 3.51.

Table 1. Species composition and numbers of water mites collected in the astatic pools of Polesie National Park

No	Takson	SG	A	B	C	D	∑
1.	*Hydrachna leegei* Koen.	V		1		1	2
-	*Hydrachna* sp.	-			1		1
2.	*Hydryphantes crassipalpis* Koen.	V	1		3		4
3.	*Hydryphantes dispar* (Schaub)	V			1		1
4.	*Hydryphantes octoporus* Koen.	V	7				7
5.	*Hydryphantes planus* Thon	V	61	10	11	13	95
6.	*Hydryphantes ruber* (Geer)	V	8		4		12
-	*Hydryphantes* sp. (deutonymphs)	-	57		11		68
7.	*Vietsia scutata* (Protz)	T	2				2
8.	*Thyas barbigera* Viets	V		1	1		2
9.	*Thyas bruzelii* Ldbl.	V		1			1
10.	*Thyas dirempta* Koen.	V	10		38	1	49
11.	*Thyas pachystoma* Koen.	V	5		1		6
12.	*Thyas palustris* Koen.	V	2				2
-	*Thyas* sp. (deutonymphs)	-			3	1	4
13.	*Thyasides dentatus* (Thor)	V	2		8	2	12
14.	*Euthyas truncata* (Neum.)	V	1		4		5
15.	*Piona alpicola* (Neum.)	T			1		1
16.	*Piona clavicornis* (Müll.)	V	10		12		22
17.	*Piona coccinea* (Koch)	S			1		1
18.	*Piona nodata* (Müll.)	V	25	13	1		39
-	*Piona* sp. (deutonymphs)	-	1	1	3	2	7
19.	*Tiphys ensifer* (Koen.)	V	2				2
20.	*Tiphys latipes* (Müll.)	V	18			1	19
21.	*Tiphys ornatus* Koch	V	4		35	22	61
22.	*Tiphys pistiliifer* (Koen.)	T	18				18
-	*Tiphys* sp. (deutonymphs)	-	1	1	43	1	46
23.	*Arrenurus bisulcicodulus* Piers.	T	19	1	3		23
24.	*Arrenurus fimbriatus* Koen.	T			2		2
25.	*Arrenurus inexploratus* Viets	V	37				37
26.	*Arrenurus maculator* (Müll.)	S			1		1
27.	*Arrenurus papillator* (Müll.)	T			3		3
28.	*Arrenurus pustulator* (Müll.)	T			4		4
29.	*Arrenurus stecki* Koen.	T	1		2		3
30.	*Arrenurus truncatellus* (Müll.)	V	34		3		37
-	*Arrenurus* sp. (deutonymphs)	-	1		1		2
	Total specimens		327	29	201	44	601
	Total species		20	6	21	6	30

SG – synecological groups: T – tyrphobiontic and tyrphophilic species, V – vernal species, S – small water bodies species. Study sites: A – pool 1 in Czemernik, B – pool 2 in Czemernik, C – pool in Nowiny, D – pool in Pieszowola

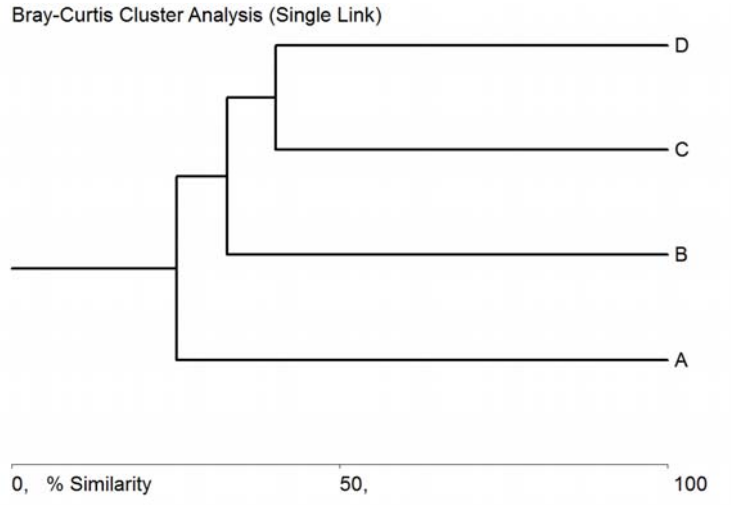

Fig. 1. Faunal similarities between astatic pools investigated in Polesie National Park: A – pool 1 in Czemernik, B – pool 2 in Czemernik, C – pool in Nowiny, D – pool in Pieszowola

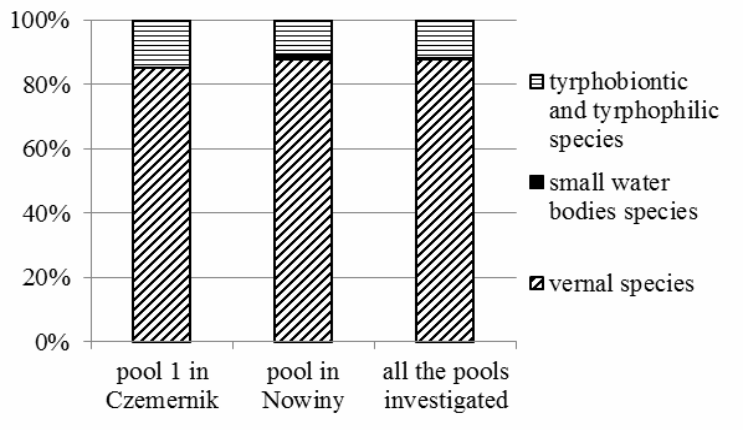

Fig. 2. Percentage share of ecological groups in astatic pools of Polesie National Park

The highest number of species (21) was noted in the pool in Nowiny (Tab. 1). The most abundant species were *Thyas dirempta* (18.9%) *Tiphys ornatus* (17.4%), *Piona clavicornis* (5.9%) and *Hydryphantes planus* (5.5%). Astatic vernal species clearly dominated in the pool (87.8%, 13 sp.). The remaining Hydrachnidia populations consisted of tyrphobionts and tyrphophiles (10.8%, 6 sp.) and species associated with small pools (1.4%, 2 sp.) (Fig. 2). No lake species were noted here. The species diversity of the Hydrachnidia populations of the pool was 3.29. The total species diversity in the pools investigated was 3.85.

DISCUSSION

A total of 30 water mite species were found in the astatic pools investigated in Polesie National Park. Seven species have been noted in the acidic peat-bog pools of the park [Kowalik 1996] and 52 in its carbonate peat-bog pools [Kowalik 1980, 1996, Stryjecki 2010a], while 34–35 species have been collected in lakes [Kowalik and Stryjecki 1999]. Taking into account that data concerning the Hydrachnidia of lakes and peat-bog pools have been collected over the last 45 years, while astatic pools have been investigated in only two seasons, the 30 species found in four pools should be considered a substantial number.

As many as 9 species were collected that had not previously been noted in Polesie National Park. Of these, 8 species are new to all of Polesie Lubelskie. These numbers indicate how poorly researched the habitats of the astatic water bodies of the park and of Polesie Lubelskie had been. Further, more intensive study of these habitats would most likely add to the list of species present in these water bodies.

The presence of 9 species new to Polesie National Park, thus far not found in its other water bodies, indicates the important role of astatic pools as a habitat for water mites. This makes them a significant element of the surface water network of the park, and the fauna inhabiting them enhance the park's biological diversity.

The highest similarity of fauna was noted between the pool in Nowiny and the pool in Pieszowola (40.2%). The high faunal similarity between these two pools was due to their geographic proximity and similar habitat characteristics. In the pool in Nowiny, the water dried up for short periods of the year, while in the pool in Pieszowola some water remained all year in the form of small puddles. The two pools in Czemernik were completely different; the water dried up in the summer and the pools ceased to function.

The most highly represented in the material collected were vernal species (87.7%, 20 sp.). The marked dominance of vernal water mites is typical of Hydrachnidia communities inhabiting astatic pools [Biesiadka 1972, Cichocka 1996, Stryjecki 2004]. The very large quantitative share of vernal water mites results from the specific character of these habitats, i.e. substantial fluctuations in the water level, with the pool drying out completely at times. In such extreme habitat conditions only highly specialized species are able to function, while water mites from other synecological groups (species associated with small pools, lake species, and to a lesser degree tyrphobionts and tyrphophiles as well), do not find suitable conditions for living in astatic water bodies. For some species characteristic of astatic pools (e.g. *Hydryphantes planus*), the periodic drying out of the pool seems to be the main factor contributing to the development of a large population of the taxon [Stryjecki 2004].

Water mites inhabiting temporary pools are adapted both to avoiding and to surviving dry periods in the yearly cycle [Wiggins *et al*. 1980]. This phenomenon was observed at the site in Nowiny. The pool dried up completely in July, while in August it was filled with water again. As many as 135 individuals be-

longing to 13 species were noted in the sample taken. There were more deutonymphs (79) than adults (56) in the material collected, which may indicate that the pool was re-colonized by water mites carried there as larvae by insects. However, many adult, fully-developed individuals were also noted in the sample, which indicates that they had survived the dry period buried in bottom sediment. The data confirm the observations of many authors regarding the resistance of water mites to the drying out of water bodies. According to Viets [1923, cited by Tutaj 1936], species of the genus *Thyas* are very resistant to the drying out of water bodies; a minimal amount of water in the moss or sludge on the bottom is sufficient for them. Szalay [1928, cited by Małecki 1971] determined that some species of water mites have a tendency to bury themselves in mud and live for as long as the bottom is moist. According to Szalay [1928, cited by Małecki 1971], a minimally moist bottom is sufficient for water mites living in temporary water bodies; they bury themselves in it, and as soon as the water body is filled again, they resume their normal way of life. According to Lunblad [1930, cited by Małecki 1971], mud in a dried up water body never completely dries out in our climatic conditions; it retains a certain amount of moisture which is sufficient for the survival of water mites. According to Wiggins *et al*. [1980], deutonymphs and adults of many species occupying temporary water bodies survive the dry period buried in sediment. Some water mite species can also survive in the form of eggs.

In the two pools in Czemernik, situated in Bagno Bubnów, a total of 23 water mite species were collected. Taking into account earlier data [Kowalik 1980, 1996, Stryjecki 2010a, 2011], the total number of species observed in Bagno Bubnów is 62. The large number of species noted in particular types of water body (small pools, peat bog pools, and astatic pools) together with the high species diversity indices confirm that Bagno Bubnów is the most valuable area of Polesie National Park in terms of Hydrachnidia.

CONCLUSIONS

1. Astatic pools are an important element of the surface water network of Polesie National Park. These pools enhance the species diversity of the Hydrachnidia of the park. As many as 9 species new to Polesie National Park were collected in the pools investigated.

2. Vernal species clearly dominated the Hydrachnidia communities of the astatic pools in Polesie National Park. The second most numerous group was tyrphobiontic and tyrphophilic species, while the least abundant were species associated with small pools. No lake species were observed in the pools investigated.

3. The greatest numbers of species and individuals were collected in the pools situated in Bagno Bubnów. The large number of species together with

high values for the species diversity index confirm that Bagno Bubnów is the most valuable area of Polesie National Park in terms of Hydrachnidia.

REFERENCES

Biesiadka E., 1972. Hydracarina of the National Park of Great Poland (in Polish). Pr. monogr. Przyr. Wielkop. Parku Nar. 5, 102 pp.

Biesiadka E., 2008. Warer Mites (Hydrachnidia) (in Polish), in: Fauna of Poland – characteristics and checklist of species Bogdanowicz W., Chudzicka E., Pilipiuk I., Skibińska E., (eds), Muzeum i Instytut Zoologii PAN, Warszawa, 3, p. 149–219.

Cichocka M., 1996. Water mites (Hydracarina) of peat lands in Bagna Biebrzańskie (in Polish). Fragm. Faun. 39, 207–221.

Cichocka M., 1998. Water mites (Hydracarina) of the peat-bogs in Mazurian Lakeland. Faunistical and ecological study (in Polish). Wydaw. WSP w Olsztynie, 133, 128 pp.

Kowalik W., 1973. Water Mites (Hydracarina) of the Sosnowica Lakes in the Łęczna and Włodawa Lake District (in Polish). Ann. UMCS, sec. C, 28, 331–351.

Kowalik W., 1977. Occurrence and Distribution of water mites (Hydracarina) in the near-bottom zone of Piaseczno Lake (in Polish). Ann. UMCS, sec. C, 32, 25, 324–344.

Kowalik W., 1978. Occurrence of Hydracarina in the Lakes of various trophy in the Łęczna--Włodawa Lake District (in Polish). Ann. UMCS, sec. C, 33, 32, 443–468.

Kowalik W., 1980. Water mites (Hydracarina) of astatic waters of the Lublin Region (in Polish). Ann. UMCS, sec. C, 35, 25, 343–364.

Kowalik W., 1996. Water mites (Hydracarina) of acid and carbonate peatbog ponds in the Polesie National Park (in Polish), in: Radwan S. (ed.), Functioning of wetland ecosystems in protected areas of the Polesie region. Wydaw. UMCS Lublin, p. 123–126.

Kowalik W., Biesiadka E., Moroz M.D., Stryjecki R., 2002. Fauna of water mites (Hydrachnidia) in Polish and Belorussian parts of the Polesie region. Acta Agrophysica, 68, 89–95.

Kowalik W., Stryjecki R., 1999. Changes in the water mite (Hydracarina) fauna of protected water bodies in Polesie Lubelskie resulting from human impact (in Polish), in: Radwan S., Kornijów R. (eds), Problems connected with active protection of aquatic and peat-bog ecosystems in Polish national parks. Wydaw. UMCS w Lublinie, p. 211–218.

Kowalik W., Stryjecki R., 2000. Occurrence of water mites (Hydrachnidia, Acari) in anthropogenic standing water bodies (in Polish), in: Radwan S., Lorkiewicz Z. (eds), Problems connected with the protection and utilization of rural areas of high natural value. Wydaw. UMCS Lublin, p. 185–190.

Małecki Z., 1971. About water mites (in Polish). Wszechświat, 2, 37–39.

McAleece N., Lambshead P.J.D., Paterson G.L.J., 1997. Biodiversity Pro. The Natural History Museum, London.

Stryjecki R., 2004. Water mites (Acari, Hydrachnidia) of small astatic pools of the Lasy Janowskie Landscape Park (Southeast Poland), in: Weigmann G., Alberti G., Wohltmnn A., Ragusa S. (eds), Acarine Biodiversity in the Natural and Human Sphere. Phytophaga, 14, 329–336.

Stryjecki R., 2007. The role of fish ponds as important habitats for water mites (Hydrachnidia, Acari). Oceanol. Hydrobiol. Stud. 36. Suppl. 4, 73–79.

Stryjecki R., 2010a. Water mites (Acari: Hydrachnidia) of water bodies in the carbonate peat bog Bagno Bubnów in Poleski National Park. Direction and dynamics of changes. Teka Kom. Ochr. Kszt. Środ. Przyr. – OL PAN, 7, 382–388.

Stryjecki R., 2010b. Water mites (Acari: Hydrachnidia) of the northern part of Nadwieprzański Landscape Park. Teka Kom. Ochr. Kszt. Środ. Przyr. – OL PAN, 7, 388–399.

Stryjecki R., 2011. Faunistic and ecological characteristics of the water mites (Acari: Hydrachnidia) of small ponds in Polesie National Park. Teka Kom. Ochr. Kszt. Środ. Przyr. – OL PAN, 8, 202–209.

Tutaj J., 1936. Water mites of the immediate vicinity of Poznań with special regard to Kierskie Lake (in Polish), in: Pr. Kom. Mat. Przyr. Pozn. TPN, B, 8, 73 pp.

Wiggins G., Mackay R., Smith J., 1980. Evolutionary and ecological strategies at animals in annual temporary pools. Arch. Hydrobiol./Suppl., 58, 97–206.

CHARAKTERYSTYKA FAUNISTYCZNO-EKOLOGICZNA WODOPÓJEK (ACARI: HYDRACHNIDIA) ZBIORNIKÓW ASTATYCZNYCH W POLESKIM PARKU NARODOWYM

Streszczenie. W czterech zbiornikach astatycznych w Poleskim Parku Narodowym stwierdzono 30 gatunków wodopójek, w tym 9 nowych dla Parku. Dominantami były: *Hydryphantes planus* (15,8%), *Tiphys ornatus* (10,1%), *Thyas dirempta* (8,1%), *Piona nodata* (6,8%), *Arrenurus inexploratus* (6,1%) i *A. truncatellus* (6,1%). W zebranym materiale najliczniejsze były gatunki fauny wiosennej (87,7%, 20 gat.) oraz tyrfobionty i tyrfofile (11,9%, 8 gat.). Najmniej liczne były wodopójki drobnozbiornikowe (0,4%, 2 gat.). W badanych zbiornikach nie stwierdzono gatunków jeziornych. Najwięcej osobników (356), gatunków (23) oraz największą różnorodność gatunkową (3,51) stwierdzono w zbiornikach położonych na Bagnie Bubnów. Te wartości potwierdzają tezę, iż Bagno Bubnów stanowi bardzo cenny pod względem fauny Hydrachnidia obszar Poleskiego Parku Narodowego.

Słowa kluczowe: wodopójki, Hydrachnidia, zbiorniki astatyczne, grupy synekologiczne, różnorodność gatunkowa