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CADDISFLIES (TRICHOPTERA) OF THE MIDDLE RIVER WIEPRZ AND ITS VALLEY IN THE NORTHERN PART OF NADWIEPRZAŃSKI LANDSCAPE PARK[1]

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Summary. The papers presents the results of the studies from the year 2009 on Trichoptera of the River Wieprz as well as running and standing waters in its valley in the northern part of the Nadwieprzański Landscape Park and its buffering zone. 1168 caddisfly specimens were collected in general, belonging to 35 species. The most individuals were recorded in rivers and permanent standing waters, while the highest species diversity occurred in permanent and astatic standing waters. The caddisfly fauna of the River Wieprz was rather poor and consisted of common taxa. Two assemblages which can be regarded as typical of medium-sized upland river of the Lublin Region were distinguished. The comparison between the faunas of the studied part of the river and the sites of similar morphology situated above (the Południowopodlaska Lowland) and below (Roztocze Region) the Nadwieprzański LP was also provided.

Key words: caddisflies, Trichoptera assemblages, river Wieprz, Nadwieprzański Lansdcape Park

INTRODUCTION

The Nadwieprzański Landscape Park has been established primarily to protect the most valuable fragment of the valley of the River Wieprz within its whole course – the gorge running through the Łuszczowska Plain which is the subregion of the Lublin Upland [Michalczyk and Wilgat 1998]. The park, with the total area of 6261 ha, was set up in 1990. The River Wieprz is regarded as the landscape and natural axis of the park which encompasses the whole gorge as well as a fragment of the valley above. This part of the river valley is particularly valuable for it has been preserved in natural shape [Rąkowski *et al*. 2004]. This part of the river as well as remaining waters situated in the valley, either

[1] I should like to express my gratitude to Prof. Dr. hab. Stanisław Czachorowski for the help in identification and confirmation of larval *Hydropsyche exocellata*.

running or standing ones, have not been the subject of the detailed trichopterological studies. The only fragmentary data about caddisflies of this area are given in short notes referring to saline waters discharged by the coal mine „Bogdanka" [Buczyńska and Buczyński 2006, Buczyński and Buczyńska 2011]. The aim of this paper is faunistic and ecological analysis of the caddisflies inhabiting the northern part of the Nadwieprzański Landscape Park (together with its buffering zone), with particular emphasis on the assemblages of Trichoptera of the River Wieprz, on the background of habitat conditions of this valuable natural ecosystem.

STUDY AREA AND METHODS

Caddisflies were collected at 15 study sites situated in the northern part of the park (Fig. 1), representing the following types of waters:

– standing waters – astatic water bodies (abbreviation AW as well as the numbers of study sites also in Figs and Table): small pools in Ciechanki Krzesimowskie (7) and Ciechanki Łańcuchowskie (9), a fen covered by sedge swamps in Ciechanki Łańcuchowskie (10), an alder forest in Łańcuchów (14); permanent water bodies (PW): a small eutrophic pond in Spiczyn (1), an oxbow in Ciechanki Krzesimowskie (8), a peat bog excavations situated in meadows (11) and in forests (12) in Ciechanki Łańcuchowskie;

– running waters – rivers (RW) – the River Wieprz in Kijany (4), Łęczna (6), Łańcuchów (15), the River Bystrzyca in Spiczyn (2), the River Świnka in Łęczna (5); anthropogenic small courses (AC) – meadow ditches in Spiczyn (3) and Ciechanki Łańcuchowskie (13).

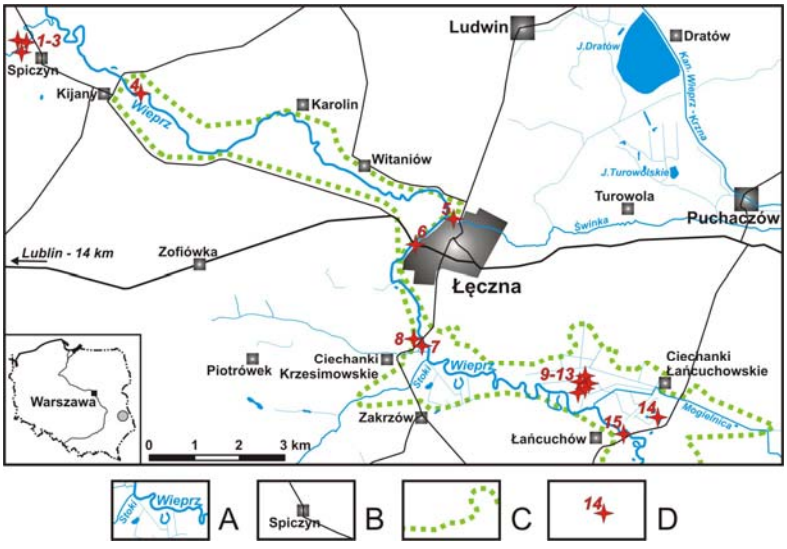

Fig. 1. Northern part of the Nadwieprzański Landscape Park – the study area: A – waters, B – villager or towns, C – borders of the park, D – study sites

Caddisfly larvae and pupae were collected with a hydrobiological sampler, a dredge as well as handpicked from submerged plants, branches, stones etc. Imaginal stages were caught with an entomological net, within water bodies or by shores, especially among aquatic or land vegetation. Material was gathered once a month from April till October 2009.

Analyses of trichopteran fauna were based on typical ecological indices. The dominance classes: eudominants > 10%, dominants 5.01–10%, subdominants – 2.01–5%, recedents < 2% were assumed after Biesiadka [1980]. Species diversity was calculated using following indices: PIE index – according to Hurlbert`s formula [Lampert and Sommer 1998] as well as Shannon`s index of total species diversity [Odum 1982]. Faunistic similarities between the species of the studied habitats according to formula of Bray-Curtis (quantitative) and Jaccard (qualitative) as well as species co-occurrence were calculated and presented with the use of BioDiversity Pro programme [McAleece *et al*. 1997].

RESULTS

During the studies, 1168 caddisfly specimens were collected: 1092 larvae, 11 pupae and 65 imagines (36 ♂ and 29 ♀). Together they represented 35 species (Tab. 1) which is ca. 12,5% of the whole Polish fauna of caddisflies.

The most specimens were found in rivers (824 individ.), much less in permanent water bodies (164) and artificial running waters (158), the least – in temporary habitats (22). As for the particular study sites, the richest in specimens were 2, 15, 3, 11 and the poorest ones – 9, 1, 7, 10. The habitats that were characterized by the highest number of taxa (Tab. 1) were running waters (24 taxa), then permanent waters (15) and small ditches (12), the lowest number was recorded in astatic waters (7). As for the particular sites: the richest in taxa were the rivers in Łęczna (sites no. 5 and 6 – 12 species at each one) and the peat bog excavation in meadows (site no. 11 – 11 species). The least taxa – 1–3 – were found in all of the astatic waters.

Species diversity expressed with PIE index of the studied habitats ranged from 0,64 for artificial ditches to 0.89 in permanent standing waters (Tab. 1). The value reached by astatic waters was also relatively high (0,78), whereas for rivers was rather low – 0.69. In comparison, the general scheme of the values of Shannon`s index was very similar: the highest in case of permanent standing waters (1.04), a bit lower for astatic (0.73) and running waters (0.89), and the lowest one for artificial courses (0.68).

The dominance structure was as follows: the eudominants were represented by *Brachycentrus subnubilus* and *Anabolia* sp. (larvae belong to *A. furcata* or *A. laevis*), dominants by *Limnephilus lunatus* and *Halesus digitatus*, the class of subdominants encompassed *Limnephilus flavicornis, Triaenodes bicolor, Ironoqia dubia* and *Limnephilus stigma*. The remaining species belonged to recedents. Species from two first classes represent typical element of running waters

Table 1. The occurrence of caddisflies (Trichoptera) at the study sites of the Nadwieprzański Landscape Park

	Species/Taxon	AW	PW	RW	AC	N	D
1.	*Anabolia furcata* Brau.			15		4	0.34
2.	*Anabolia laevis* (Zett.)			6,15		3	0.26
	Anabolia sp. *(furcata/laevis)*		12	4,5,6,15	3,13	279	23.89
3.	*Athripsodes aterrimus* (Steph.)		11,12	5		15	1.28
4.	*Brachycentrus subnubilus* Curt.			2,4,6,15,		357	30.57
5.	*Ceraclea alboguttata* (Hag.)			5		1	0.09
6.	*Cyrnus flavidus* McL.		11			5	0.43
7.	*Grammotaulius nigropunctatus* (Retz.)	10				1	0.09
8.	*Halesus digitatus* (Schrank)			4,5,6,15		73	6.25
9.	*Halesus tesselatus* (Ramb.)			6,15		9	0.77
	Halesus sp.				3	4	0.34
10.	*Holocentropus dubius* (Ramb.)		11		13	16	1.37
11.	*Holocentropus picicornis* (Steph.)		11			4	0.34
12.	*Hydropsyche angustipennis* (Curt.)			5		7	0.6
13.	*Hydropsyche contubernalis* McL.			2		23	1.97
14.	*Hydropsyche exocellata* Duf.			5		1	0.09
15.	*Hydropsyche incognita* Pitsch			5,6		8	0.68
16.	*Hydropsyche pellucidula* (Curt.)			5,6		4	0.34
17.	*Ironoquia dubia* (Steph.)			5	3	35	3
18.	*Leptocerus tineiformis* Curt.		7,11			23	1.97
19.	*Limnephilus auricula* Curt.	7,14		6	13	8	0.68
20.	*Limnephilus centralis* Curt.	9				1	0.09
21.	*Limnephilus decipiens* (Kol.)		1			1	0.09
22.	*Limnephilus extricatus* McL.				3	5	0.43
23.	*Limnephilus flavicornis* (Fabr.)		7,11	5,6		46	3.94
24.	*Limnephilus griseus* (L.)			5		2	0.17
25.	*Limnephilus lunatus* Curt.		6,15	1	3,13	103	8.82
26.	*Limnephilus marmoratus* Curt.				13	3	0.26
27.	*Limnephilus nigriceps* (Zett.)		11			8	0.68
28.	*Limnephilus politus* McL.	14	11			9	0.77
29.	*Limnephilus rhombicus* (L.)			5,6		4	0.34
30.	*Limnephilus stigma* Curt.	10,14	11		13	28	2.4
31.	*Limnephilus subcentralis* Brau.	10				2	0.17
	Limnephilus sp.	14	7,11,12	6	3	19	1.63
32.	*Mystacides longicornis* (L.)			2		2	0.17
33.	*Oligostomis reticulata* (L.)			6	3	15	1.28
34.	*Phryganea bipunctata* Retz.		11			2	0.17
	Phryganeidae			6		1	0.09
35.	*Triaenodes bicolor* Curt.		11	4,6,15	13	37	3.17
	Number of taxa	7	15	24	11	-	-
	Number of specimens/dominance	22	164	824	158	1168	100%
	PIE	0.78	0.89	0.69	0.64	-	-
	H’	0.73	1.04	0.69	0.68	-	-

AW – astatic waters, PW – permanent standing waters, RW – rivers, AC – anthropogenic small courses (ditches), N – number of species, D – dominance (%), PIE – Hurlbert`s Index, H’– Shannon`s index. The numbers of study sites like in the text and Fig.1

– rheobionts and rheophiles, while the third class – except for *Ironoqia dubia* – covers species characteristic for standing waters and almost stagnating zones of rivers with well developed vegetation – elodeids in case of *T. bicolor* and helophytes in case of two species of the genus *Limnephilus*. *Ironoqia dubia* is regarded as a rheophilous limnexen – its typical habitats are streams which partly dry up in summer [Wallace 1991, Czachorowski 1998]. In the studied area its larvae were found in running waters of permanent character, also in medium-sized river Świnka (site 5).

The species with the widest spectrum of occurrence in all of the habitats were: *Limnephilus auricula* – absent only in permanent water bodies, *Limnephilus lunatus* and *Triaenodes bicolor* – absent in astatic waters, *Limnephilus stigma* – not found in running waters.

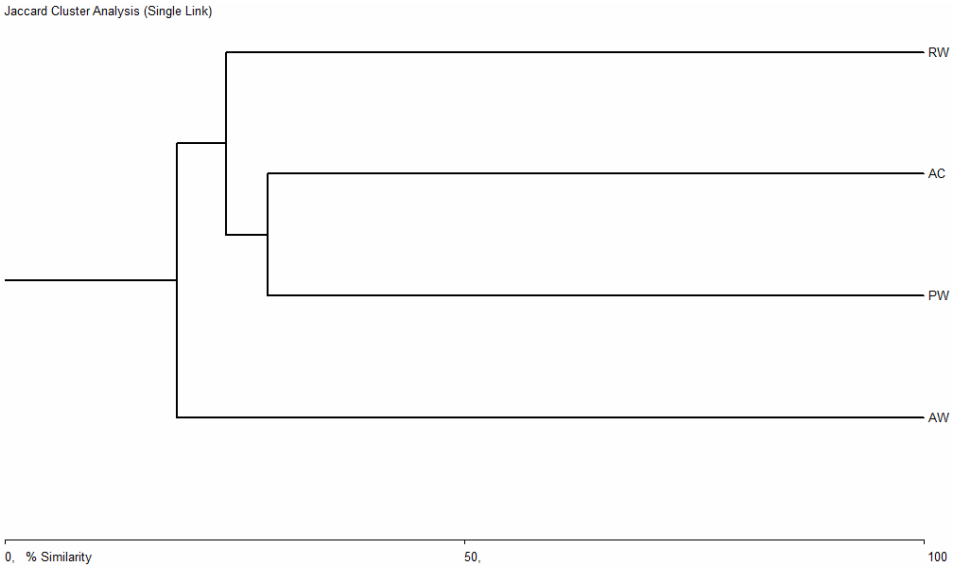

Fig. 2. Cladogram of qualitative faunistic similarities between particular habitats in Nadwieprzański Landscape Park. Designations of habitats like in the text

Faunistic similarities between the assemblages of the examined types of waters are given in Fig. 2 (qualitative one) and 3 (quantitative one). In the first case, the most distinctive feature is the highest similarity between the faunas of standing waters and artificial courses (J = 28.5%), which form the largest block together with running waters as well as the clear separateness of the fauna of astatic waters. The highest similarity in this analysis can be explained to some extent by the morphological character of these habitats. Both belong to permanent waters with well developed vegetation – helophytes are crucial for the development of e.g. *Limnephilus stigma* and submerged vegetation is especially important for *Triaenodes bicolor* and *Holocentropus picicornis*. The dissimilarity of the fauna of astatic waters is expected and understandable – this species

composition is dominated by the taxa which end their development in late spring or early summer just before the drying out of waters.

In contrary, the cladogram of quantitative similarity (Fig. 3) shows the highest similarity between the fauna of astatic and permanent waters (14%) and the most separate group which are the caddisflies inhabiting rivers. In general, all similarities are rather low therefore far-reaching conclusions cannot be drawn except for the case of the rivers – their fauna is simply dominated by the species connected with water current that are absent in other examined habitats.

Fig. 3. Cladogram of quantitative faunistic similarities between particular habitats in Nadwieprzański Landscape Park. Designations of habitats like in the text

The fauna of the main natural river in the park – Wieprz is not particularly rich in species – it consists of 13 ones (15 taxa in general) – in comparison, 12 species were found in the River Świnka at the same time. Most of them are typical rheophiles and rheobionts. Only a few are the species typical of temporary waters which is strictly associated with the formation of the river banks – due to fluctuations in annual water levels, the part of some lentic zones may function as a temporary habitats, providing shelter for such species like *Limnephilus auricula* or *Oligostomis reticulata*. Taking into consideration the dominance structure in which *Anabolia* sp., *Halesus digitatus, Limnephilus lunatus*, *Brachycentrus subnubilus* and *Limnephilus flavicornis* belong to the highest dominance classes, it can be found that the character of this stretch is typical for a river with shaded banks and well developed helophyte swamps in lentic zones.

Co-occurrence of the species in the River Wieprz (Fig. 4) showed two large groups (assemblages) of caddisflies. The upper group of the cladogram encompassed rheophiles as well as rheobionts – filter feeders from the genus *Hydropsyche*.

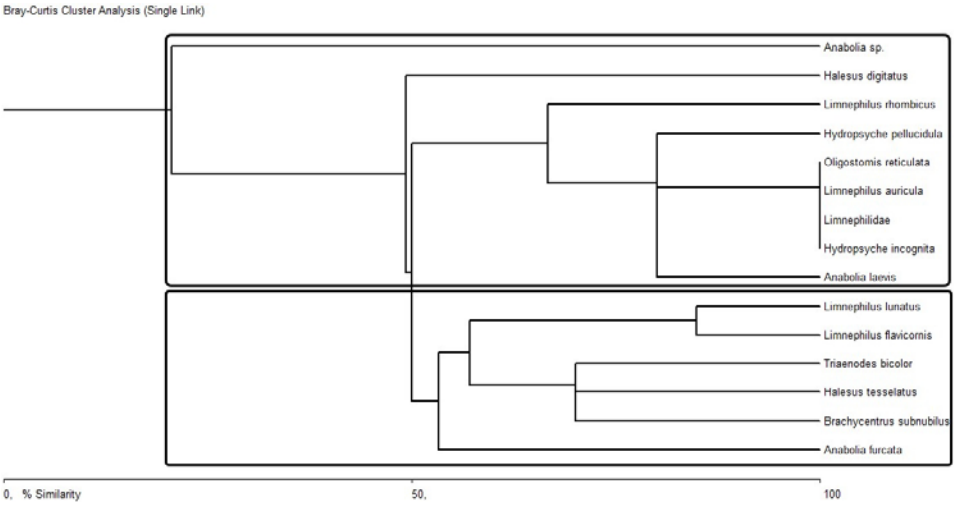

Fig. 4. Co-occurrence of the caddisfly species in the River Wieprz in Nadwieprzański Landscape Park

In this group there were four taxa which the probability of the co-occurrence 100%, however, they belonged to recedents and no significant conclusions about their linkages can be made on this basis. More remarkable were two important and distinctive groups which occurred in the lower block of the cladogram: *Triaenodes bicolor*, *Halesus digitatus* and *Brachycentrus subnublius* as well as the second group *Limnephilus lunatus* and *L. flavicornis*. Due to the high values of the similarity these species can be regarded as characteristic for this part of the river. Except for *Brachycentrus nubilus*, the rest of the species represent the element strongly associated with plants (treated as their habitat or source of feeding), preferring slowly flowing or almost stagnant waters and this combination also emphasis the general character of the fauna of this river.

In the whole material, only one species, *Ceraclea alboguttata* is included in the Red List of threatened animals in Poland [Szczęsny 2002] which is a very poor result for the area of such natural values.

DISCUSSION

The number of caddisfly species recorded during the studies is not very high – for comparison, the same number of species was found in the Krzczonowski Landscape Park [Czachorowski and Buczyński 2004] which is also situated in the Lublin Upland, however, in the second landscape park in the Lublin Region with available data on caddisflies – „Lasy Janowskie" LP [Czachorowski *et al*. 2000], 63 species were found. Nevertheless, worth mentioning are two facts – the data presented in this paper refers to one half of the park only and there are the number and types of the habitats which influence the species diver-

sity the most than the protection itself. The second statement refers especially to „Lasy Janowskie" LP which is much richer in varied habitats then two parks in the Lublin Upland.

Taking into consideration the number of species and biodiversity in particular habitats in the Nadwieprzański Landscape Park, it can be concluded that their fauna is dominated by common and typical species. The most numerous fauna was found in rivers, but it were standing waters – permanent and temporary ones – which had the highest values of diversity indices. The fauna of River Wieprz – the most valuable and natural element of the park – turned out to be rather average on the background of its examined tributaries. Its caddisfly assemblages are typical of medium-sized upland river, with clear lentic zone in which the species preferring slow current and vegetation can develop. Similar assemblages were distinguished by Majecki [2006] in similar rivers of the Łódź Region. For instance, in the examined area, 13 species were found in the River Wieprz at three sites and at the same time, in the River Świnka – 12. The values of PIE for the rivers` sites also showed that caddisfly assemblages in Łańcuchów (no. 15) and Kijany (4) had much less diversified fauna than the River Świnka which is regulated and transformed. Only in Łęczna (no. 6) the main river had the highest values of this index (PIE = 0.84). Such results may also be associated with the water quality of the River Wieprz. According to the annual report of the Regional Inspectorate of Environmental Protection in Lublin from 2009 [Roguska and Grzywaczewska 2010], this stretch of the River Wieprz showed moderate ecological potential and its waters was described as endangered (III class). These factors may be considered as limiting for taxa species which may result in decrease in species diversity of Trichoptera.

In order to estimate the caddisfly assemblages of the studied part of the River Wieprz it was compared to the faunas inhabiting this river in Roztocze (3 sites) [Buczyńska unpubl. data] and in the Południowopodlaska Lowland (1 site) [Buczyńska 2006] (Fig. 5). These localities were chosen due to the similar parameters of the river morphology. In general, the species richness was the highest in Roztocze (28 taxa) while the part of the river presented in this paper and the lowland site reached similar values (15 and 16, respectively). However, the qualitative similarities between 7 sites showed that the faunas of three geographical regions are clearly different and the upland assemblages of caddisflies had the highest similarity. Together, the fauna of 7 sites comprises of 42 taxa and on this background the studied stretch of the river provides no impressive results. Moreover, as for species composition – the fauna of the River Wieprz consisted of common taxa while in Świnka – two rare in the national scale species were collected: *Ceraclea alboguttata* and *Hydropsyche exocellata*. The second one was recorded in Poland for the first time ten years ago at the same site [Serafin 2003], moreover, it was also found in 2011 in Ewopole, in the Wieprz-Krzna Canal [Buczyńska unpubl. data]. Despite the fact that this hydropsychid is very rarely caught in Poland, it is also one of the most tolerant to pollution

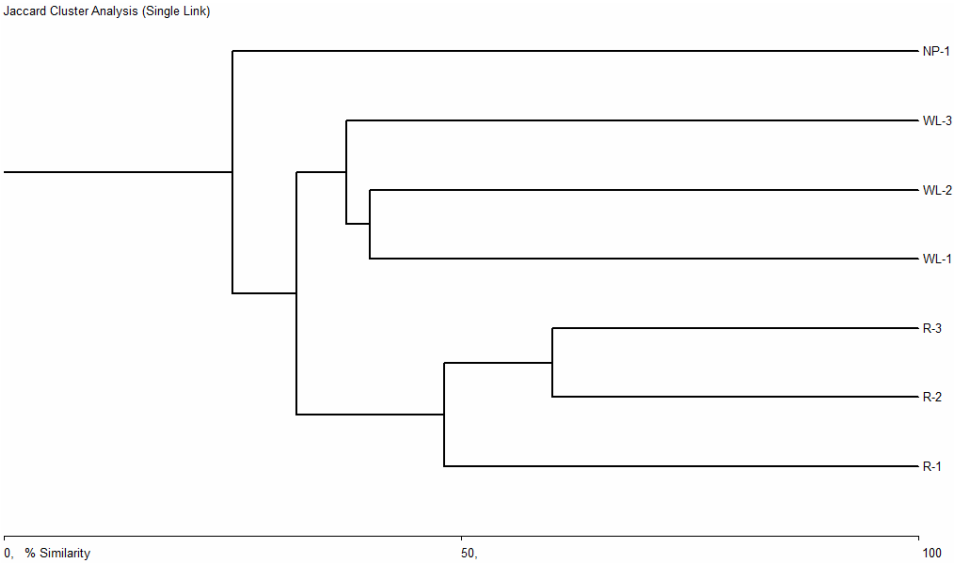

Fig. 5. Cladogram of qualitative similarities between the faunas of the sites on the River Wieprz. NP-1, site in the Południowopodlaska Lowland, Ruska Wieś, WL-1 – the Lublin Upland, Łańcuchów (site no. 15), WL-2 – the Lublin Upland, Łęczna (site no. 6), WL-3 – the Lublin Upalnd, Kijany (site no.4), R-1 – Roztocze, Zwierzyniec, R-2 – Roztocze, Żurawnica, R-3 – Roztocze, Brody Małe

and salinity species of the genus *Hydropsyche* [Gallardo-Mayenco *et al.* 1998, Bonada *et al*. 2004], therefore it can found suitable habitats in waters influenced by a coal mine like Świnka.

The most valuable habitats with respect to caddisflies in the park are standing and astatic waters. In the first case the most valuable water body is a peat bog excavation situated in meadows in Ciechanki Łańcuchowskie where 11 species were recorded and PIE index reached 0.88 for this site. This place has been the subject of many zoological and botanical studies and its natural values have been confirmed by many authors [Kowalik and Stryjecki 2000, e.g. Gajuś-Lankamer and Wójcik 2002]. However, the remaining waters of this kind of habitat were extremely poor, even the small pond in Spiczyn, with clear water and well developed vegetation. The fauna of astatic water bodies was also poor in species but this is distinctive in this type of habitats; for instance Majecki [2006] in the same environments by the River Grabia and Widawka recorded 7 species just like Czachorowski with Szczepańska [1991] in the vicinity of Mikołajki (taking into consideration the sites that dry out completely for some period during the year). The most numerous species in this habitat in the NLP were *Limnephilus stigma* and *Limnephilus auricula*. The second one was also collected in high numbers in two comparative papers, however, *Limnephilus griseus* – the firm eudominant according to the authors mentioned above was absent in the studied area.

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CHRUŚCIKI (TRICHOPTERA) ŚRODKOWEGO ODCINKA RZEKI WIEPRZ I JEJ DOLINY W PÓŁNOCNEJ CZĘŚCI NADWIEPRZAŃSKIEGO PARKU KRAJOBRAZOWEGO

Streszczenie. Praca przedstawia wyniki badań z 2009 r. nad Trichoptera rzeki Wieprz oraz wód płynących i stojących w jej dolinie na obszarze północnej części Nadwieprzańskiego Parku Krajobrazowego i jego otuliny. Ogółem zebrano 1168 osobników należących do 35 gatunków. Najwięcej osobników odnotowano w rzekach i trwałych zbiornikach wód stojących, natomiast największa różnorodność gatunkowa cechowała trwałe i astatyczne wody stojące. Fauna chruścików rzeki Wieprz okazała się dosyć uboga i złożona z pospolitych taksonów. Wyróżniono w niej dwa zgrupowania, które można uznać za typowe dla średniej rzeki wyżynnej Lubelszczyzny. Dokonano również porównania fauny badanego fragmentu Wieprza i stanowiska o podobnej morfologii leżącymi powyżej (Nizina Południowopodlaska) i poniżej (Roztocze) NPK.

Słowa kluczowe: chruściki, zgrupowania Trichoptera, rzeka Wieprz, Nadwieprzański Park Krajobrazowy