The Last Natural River of Eastern Europe? Caddisflies (Trichoptera) of the Neman River

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CZACHOROWSKI S. 2004. THE LAST NATURAL RIVER OF EASTERN EUROPE? CADDISFLIES (TRICHOPTERA) OF THE NEMAN RIVER. – *Latv. entomol.*, 41: 44-51.

Abstract: Caddisflies were investigated during the spring, summer and autumn in 1997-1999, in 40 localities, situated between Lida and Grodno (Belarus – middle course of the Neman River). 74 species of Trichoptera were collected. In the qualitative analysis fauna of rivers and streams, valley water bodies (oxbows, periodical pools) and springs were distinguished. In the quantitative analysis, water bodies with poor fauna (springs and artificial waters) were distinguished very closely. The caddisflies of the Neman River and large and small tributaries were different. Some assemblages typical for potamal and rithral zone were distinguished. Different dominant species occurred in all these assemblages. The effect of "neighbouring water bodies" and animal migrations were shown for all waters bodies occurring in a lowland river valley. It could be expected that relative eurytopic strategies and the wide geographical distribution of some caddisflies are an adaptation to living in a changing post-glacial landscape (a lakeland landscape) and in a landscape with large lowland rivers.

Key words: lowland river, Belarus, caddisflies, changes of fauna, benthos.

Introduction

Large lowland rivers whose flood regimes have not been changed by human activity are not frequently found in Europe. Transformations caused by man have resulted in changes to both the ecological relationships and aquatic habitats. Numerous habitats, which are home to aquatic invertebrates, have disappeared or have been largely transformed (Ward, 1998). For this reason it is difficult to restore the initial character of aquatic fauna. In the countries of Eastern and Central Europe, sections of large lowland rivers have survived relatively unchanged. One of them is the Neman River.

An interesting problem is the inter-relations of hydrobionts of neighbouring water reservoirs of a large river, estuaries, old riverbeds, periodical reservoirs, etc. Does the fauna in these habitats differ significantly? Is there any migration? What strategies do species employ? Is the local region a vital factor for the aquatic entomofauna? The answers to these questions will enable a prediction of the consequences of regulating lowland river valleys (e.g. the plan to built storage reservoirs in the middle and low

course of the Vistula River).

The structure of zoned distribution of aquatic fauna in a longitudinal section of a river, especially in mountain rivers, has been studied for a long time. Much less attention has been devoted to the structure of habitat distribution in the latitudinal section, with account taken of valley reservoirs which are hydrologically isolated, but otherwise connected genetically to the river and the valley which its has created (Waringer, Graf, 2002).

Earlier only water beetles in the upper course of the Neman River (Moroz, 2000) and caddisflies in the Lithuanian part of the river (Pliuraite, 1999) were investigated.

Methods

The research was conducted in 1997-99 in Belarus in the middle part of the Neman River, between Lida and Grodno (Fig. 1), as well as in surrounding tributaries. Altogether, 40 sites were examined. Larvae were caught with a hydrobiological scoop and a drag net, imagines were caught occasionally with an entomological net and, at one site, by light-trap method.

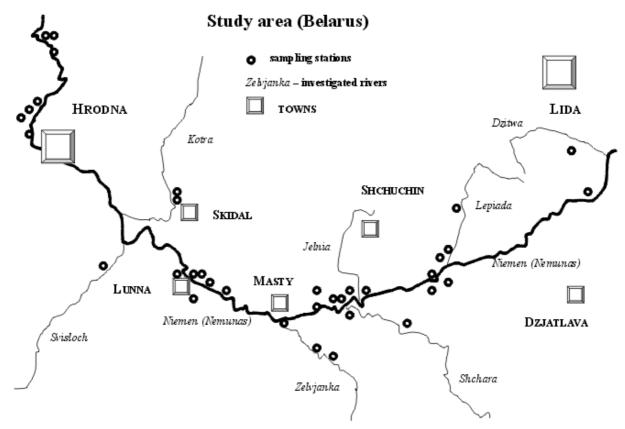


Figure 1. Study area, the Neman River (Belarus).

Results

Altogether, 3007 larvae, chrysalides and imagines were caught; belonging to 75 species (Table 1) – nearly 60% of the known fauna of Belarus. The largest number of Trichoptera were caught in rivers – 2355 (65 species), much fewer – in old riverbeds: 268 (21 species), streams – 149 (14 species) and periodical reservoirs (171 individuals, 8 species). The smallest numbers of caught individuals were in springs and in artificial reservoirs (Table 1).

The eudominant species were: *Hydropsyche* contubernalis (26%) and *Anabolia laevis* (17%); dominant species: *Hydropsyche pellucidula* (7%), *Brachycentrus subnubilus*, *Caetopterys* sp. (villosa?), *Halesus digitatus*, *Limnephilus vittatus* (Table 1).

The analysis of similarities of fauna revealed a relatively high level of clustering of lothic and lenthic water reservoirs in river valleys. The most distinct fauna were found in land melioration ditches (Fig. 2, 3). Both a qualitative (Fig. 2) and quantitative approach (Fig. 3) showed that the fauna of rivers and

streams are distinct by 10-20%. The similarity of fauna of anthropogenic reservoirs (the reservoir in a quarry) and springs, as well as the fauna of periodical reservoirs, and that of old riverbeds (Fig. 2 – qualitative approach) is higher. In a quantitative approach, the fauna of periodical reservoirs is more distinct (Fig. 3).

The analysis of the fauna similarities of river habitats showed that the fauna of Trichoptera in the Neman River, the fauna of large rivers and of small tributaries are clearly distinct.

In the rivers whose fauna was analysed, the following species belonged to the group of eudominants: *Hydropsyche contubernalis* (32%), *Anabolia laevis* (17%), and the following species were dominant: *Hydropsyche pellucidula*, (8%), *Brachycentrus subnubilus* (7%), *Chaetopterys villosa* (7%), *Halesus digitatus* (6%).

The following species found in small streams belonged to the group of eudominants: *Hydropsyche contubernalis* (27%), *Limnephilus elegans* (20%), *Halesus digitatus* (15%). One species was included in the group of dominants – *Limnephilus lunatus* (7%).

In old riverbeds, the following eudominants: *Triaenodes bicolor* (38%), *Anabolia laevis* (17%), *Limnephilus politus* (14%) and the dominants: *Athripsodes aterrimus* (7%) and *Limnephilus nigriceps* (6%), proved the most numerous.

In periodical reservoirs an unusual structure of domination was found: the species *Limnephilus*

vittatus (eudominant – 90%) proved the most numerous. There were no dominants.

The species composition, and above all the dominance structure, reflects the zonation of distribution of fauna in the longitudinal section of watercourses.

Table 1. Caddisflies of the Neman River collected in the middle part of the river, tributaries and in the water bodies on the Neman Valley.

Taxon (species)	Rivers	Old river beds	Streams	Temporary pools	Springs	Artificial waters	Drainage channels	Total	Dominance (%)
Anabolia brevipennis (Curt.)	1							1	0,03
Anabolia laevis (Zett.)	73							73	2,43
Anabolia sp. (laevis?)	390	44	4	3	40	15		496	16,49
Apatania auricula (Forss.)	2							2	0,07
Athripsodes aterrimus (Steph.)	3	18						21	0,70
Athripsodes bilineatus (L.)	2							2	0,07
Athripsodes cinereus (Curt.)	1							1	0,03
Beraeodes minutus (L.)	1							1	0,03
Brachycentrus subnubilus Curt.	173							173	5,75
Ceraclea dissimilis (Steph.)	54							54	1,80
Ceraclea sp. 2	2							2	0,07
Chaetopteryx sp. (villosa?)	176							176	5,85
Cyrnus flavidus McL.		4						4	0,13
Cyrnus trimaculatus (Curt.)	7							7	0,23
Glyphotaelius pellucidus (Retz.)		1						1	0,03
Goera pilosa (Fab.)	2							2	0,07
Grammotaulius nigropunctatus (Retz.)	1	2						3	0,10
Halesus digittatus (Schr.)	149	3	22					174	5,79
Halesus tesselatus (Ramb.)	24		1					25	0,83
Holocentropus picicornis (Steph.)		4						4	0,13
Hydropsyche angustipennis (Curt.)	55			1				56	1,86
Hydropsyche contubernalis McL.	747		40					787	26,17
Hydropsyche ornatula McL.	1							1	0,03
Hydropsyche pellucidula (Curt.)	194		15				2	211	7,02
Hydropsyche siltalai Doeh.	3		5					8	0,27

Hydropsyche sp.	10		4				14	0,47
Hydroptila sp.	8						8	0,27
Ithytrichia lamellaris Eat.	2						2	0,07
Lepidostoma hirtum (Fabr.)	1						1	0,03
Leptocerus interruptus (Fabr.)	6						6	0,20
Leptocerus tineiformis Curt.							0	0,00
Limnephilidae indet. juv.			6				6	0,20
Limnephilus auricula Curt.	2						2	0,07
Limnephilus binotatus Curt.	1						1	0,03
Limnephilus bipunctatus Curt.	3						3	0,10
Limnephilus decipiens (Kol.)	1	1					2	0,07
Limnephilus extricatus McL.	3						3	0,10
Limnephilus flavicornis (Fabr.)	10	11		6			27	0,90
Limnephilus fuscicornis Ram.	8	2					10	0,33
Limnephilus griseus (L.)	2						2	0,07
Limnephilus ignavus McL.	2						2	0,07
Limnephilus lunatus Curt.	35	3	11	1			50	1,66
Limnephilus marmoratus Curt.		1					1	0,03
Limnephilus nigriceps (Zett.)		15					15	0,50
Limnephilus politus McL.	7	38					45	1,50
Limnephilus rhombicus (L.)	27	2	1	1			31	1,03
Limnephilus sp.	1						1	0,03
Limnephilus sp. elegans?			30				30	1,00
Limnephilus stigma Curt.	1	5		2			8	0,27
Limnephilus subcentralis Brau.	2	1					3	0,10
Limnephilus vittatus (Fabr.)	1	8		155			164	5,45
Lype phaeopa (Steph.)	1						1	0,03
Molanna angustata Curt.	11						11	0,37
Mystacides azurea (L.)	11						11	0,37
Mystacides longicornis (L.)	7	1			4		12	0,40
Nemotaulius punctatolineatus (Retz.)	1						1	0,03
Neureclipsis bimaculata (L.)	15						15	0,50
Notidobia ciliaris (L.)	1		2				3	0,10
Oecetis testacea (Curt.)	1						1	0,03
Phryganea bipunctata Retz.						1	1	0,03
Phryganea grandis L.		2			1		3	0,10
Phryganea rotundata (?)	4						4	0,13
Phryganea sp.	1	1					2	0,07
Plectrocnemia conspersa (Curt.)	26						26	0,86
Polycentropus flavomaculatus (Pict.)	4						4	0,13
Polycentropus irroratus (Curt.)	1						1	0,03

Potamophylax cingulatus (Steph.)	3							3	0,10
Potamophylax latipennis (Curt.)	10		3					13	0,43
Potamophylax rotundipennis (Brau.)	5		2					7	0,23
Potamophylax sp.	1							1	0,03
Psychomyia pusilla (Fabr.)	4		3					7	0,23
Rhyacophila fasciata Hag.	23							23	0,76
Rhyacophila nubila (Zett.)	3							3	0,10
Rhyacophila obliterata McL.					1			1	0,03
Sericostoma sp.	2							2	0,07
Silo pallipes (Fabr.)	1							1	0,03
Triaenodes bicolor (Curt.)	13	101		2				116	3,86
Triaenodes sp.	3							3	0,10
Trichostegia minor (Curt.)	1							1	0,03
Ylodes consperus (Ramb.)	5							5	0,17
Ylodes simulans (Tied.)	3						_	3	0,10
Number of individuals	2355	268	149	171	41	20	3	3007	
Number of species	65	20	13	8	2	3	2	75	

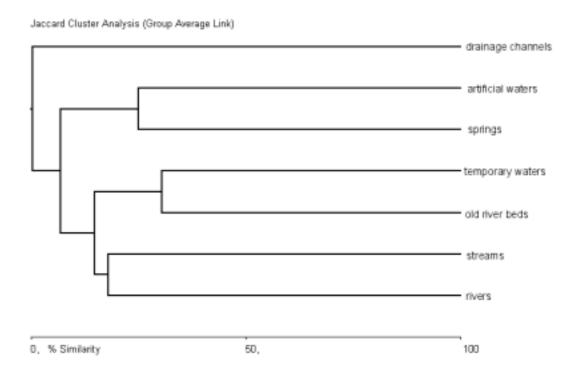


Figure 2. The dendrogram of faunistic similarities between types of waters, qualitative approach (Jaccard formula).

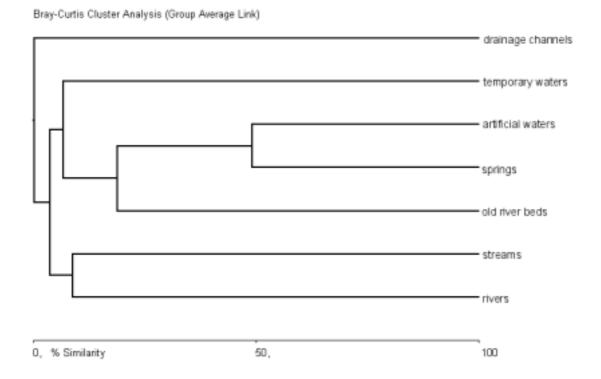


Figure 3. The dendrogram of faunistic similarities between types of waters, quantitative approach (Bray-Curtis formula).

The largest number of species was found, as a unique habitat, in the middle part of the Neman River. However, it should be taken into account that the number of sites on the Neman was also the largest. Two eudominants were found: *Hydropsyche contubernalis* (63%) and *Anabolia laevis* (20%). There were no dominants, two subdominants were found: *Ceraclea dissimilis* and *Brachycentrus subnubilus*.

In large rivers, the following species were found eudominants: belong to Hydropscyhe pellucidula, Anabolia laevis and Halesus digitatus. Hydropsyche angustipennis was included in the dominants. Two species belonged to the class of subdominants: *Hydropsyche* tesselatus and Limnephilus lunatus.

In small rivers, *Chaetopteryx villosa* (52%), proved to be the eudominant, whereas the following belonged to the dominance class: *Halesus digitatus*, *Plectrocnemia conspersa*, *Rhyacophila fasciata*, *Limnephilus rhombicus* and *Anabolia* sp. The following belonged to the subdominants: *Potamophylax latipennis* and *Hydropsyche contubernalis*.

In the streams which were investigated, the following proved to be eudominants:

Chaetopteryx villosa (36%) and Anabolia laevis (19%). The following were dominants: Halesus digitatus and Plectrocnemia conspersa, the following were subdominants: Rhyacophila fasciata, Potamophylax latipennis, Brachycentrus subnubilus and Hydropscyhe contubernalis.

Comparing the percentage of particular species in flowing waters of various sizes, the differences in the dominance structure were noticeable. Some species were included in different classes of dominance, depending on the size of the watercourse. For example, the dominance of Anabolia sp. increased with the size of the river; whereas for Halesus digitatus the dominance was the greatest in large rivers, but in the Neman it was relatively small. For angustipennis, Hydropsyche the percentage was found in large rivers (5.7%), similar to Hydropsyche pellucidula (22%), whereas Hydropsyche contubernalis preferred the Neman River (63%). This may indicate preferring specific zones and habitats, while at the same time being able to exist in a much wider range of habitats.

The collected material also contained some rare species and some in danger of extinction:

Ceraclea dissimilis, Hydropsyche contubernalis, H. ornatula. H. siltalai, Ylodes simulans, Psvchomvia pusilla. Beraeodes minutus. Athripsodes bilineatus, Apatania auricula, Ithytrichia lammelaris, Leptocerus interruptus, Limnephilus binotatus, L. subcentralis, Oecetis and *Phryganea* rotundata. majority of these are species associated with large lowland rivers.

Discussion

In comparing the species composition of Trichoptera in a given area with other similar river sections, one can notice close similarities (e.g. Kownacki, 2001). This is a result of the zoned distribution of Trichoptera in lowland rivers. In the lower parts of the Neman River other species were also observed than in its middle section, e.g. Hydropsyche bulgaromanorum Mal. (Cibaite, personal information), but this is a result of zonation in the longitudinal section.

The Trichoptera of the analysed material are highly diversified, which is more noticeable in their quantitative than qualitative structure. The zonation in the vertical section is typical of the zoned distribution of fauna in watercourses.

The relationship of fauna in all the analysed valley water reservoirs is also interesting. Qualitative similarity analysis, as well as other indicates fauna migrating analyses, neighbouring reservoirs. This can explain the presence of H. contubernalis in the part of the stream close to its estuary (which is an unusual habitat for the species). The migration of larvae or the colonising of new habitats by egg laying imagines may cause this. Probably the species only partly find favourable conditions in the "unusual" habitats. It seems that the presence of these species in non-specific habitats is possible only thanks to regular colonisation from adjacent habitats, since apparently larvae lose in competition with more specialised species.

The clear distinction of trichopterans in the cross section of a lowland river has already been noticed earlier, with account taken of water reservoirs in valleys (Waringer, Graf, 2002). The possibility of migration and integration of reservoirs within a landscape has been pointed

out (Czachorowski et all., 1993). Some data show that caddisflies are, on average with dipteran, ephemeropteran and plecopteran species, slower to colonize (Malmqvist et all., 1991). Apparently, these relationships are well described by the model of a habitat island, which is a development of MacArtur's model (e.g. Minshall, Petersen, 1985; Czachorowski, Kornijów, 1993) or a model of metapopulation (e.g. Briers, Warren, 2000).

The research presented here confirms the clear distinction and adaptation of species particular habitat zones in valley water reservoirs. However, the system may be dynamic in character. A considerable portion of the species inhabits various types of valley water reservoirs, of which only part can be considered donor habitats. Constant cohabitation of these species is made possible by the physical proximity of these diverse habitats and the relatively large eurytopicity of some species. Anthropogenic transformations of some river valleys cause the disappearance of numerous habitats, e.g. periodical reservoirs, old riverbeds. The disappearance of donor habitats (valley reservoirs) may result in a decrease in the species diversity.

Taking into account the analysis of the life strategies of Trichoptera (including the synecological groups), it may be supposed that relative eurytopicity – ability to inhabit various types of lenthic and lothic waters – is an adaptation to life in a changeable post-glacial landscape and that of lowland river valleys. It may also be believed that a large portion of lacustrine Trichoptera have evolved in the landscape of the valleys of large lowland rivers (Czachorowski, 1998).

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