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Caddisfly communities of the flow profile Revúca and Ľubochnianka

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Abstract. In this work we investigated two caddisfly communities (*Trichoptera*) along the profiles of the river flows Revúca and Ľubochnianka in Central Slovakia. Family *Brachycentridae*, represented by the species *Micrasema minimum* was dominant in both communities. The greatest differences in community composition were found at the site Ľubochnianka 2 between acal-psammal and moss substrates, as well as at the site Revúca 1. The greatest differences in the species composition of caddisflies and evenness were found in the upper section of Revúca river. Analysis of caddisfly communities on different substrates has shown that species *Anitella obscurata* preferred fine grained substrate of acal-psammal, whereas species *Hydropsyche incognita* and *Micrasema minimum* were the most dominant on microhabitat moss.

Key words: Caddisflies, microhabitat, Revúca, Ľubochnianka, the low Tatra Mts

Introduction

The study is focused on caddisfly communities (*Trichoptera*) along the profiles of Ľubochnianka and Revúca river flows in the National Park Veľká Fatra (Fig. 1). We assessed the abundance of caddisfly species in these flows, evaluated species dominance on individual substrates and indices of diversity and evenness. At various locations we also monitored the distribution and preference of caddisflies for different types of microhabitats (Table 1). Both streams flow through the northern part of the Veľká Fatra mountains. Both rivers are left tributaries of the River Váh. Historically, the flows are similar. River basin of Revúca covers 266 km^2, while Ľubochnianka basin only 118 km^2. Water quality of the Revúca river is degraded by several factors, especially by urbanization and agriculture. Ľubochnianka river is influenced by forestry (Krno *et al.* 2009).

Larvae of *Trichoptera* are important bioindicators of water quality. They indicate a degradation of the river (Lorenz *et al.* 2004) and reflect the impact of human activities on the water ecosystem (Woodcock *et al.* 2007). Caddisflies colonize different enviroments including running waters, backwaters, lowland and mountain streams. About 7000 species have been identified around the world, including almost 800 species described from Europe (Botosaneanu 1967). 221 species were identified in Slovakia (Chvojka *et al.* 2001).

Material and Methods

Macro-invertebrates were collected by multi-habitat sampling methods (Hering 2004) from the profiles of two streams - Ľubochnianka and Revúca. The samples were taken three times in 2007 (May, August and November) and once in 2008 (March) from different substrates (psammal, acal, microlithal, mesolithal, macrolithal and moss). We used the „kicking method“, which uses kicking to disturb the bottom substrate. Benthic macro-invertebrates were captured by hydrobiological mains STAR, 25x25 cm, openings 0.5 mm. The samples were transferred to laboratory, fixed by formaldehyde 4% and identified under the stereomicroscope to specific taxonomic levels and species. We used the determination keys of Waringer (1997) and Sedlák (1980) for species determination. For the autecological analysis, calculation of saprobic index, diversity and evenness indices, we used specialized software Asterics (3.1.1 version). For the PCA analysis of *Trichopteran* communities in the each studied localities was used the CANOCO for Windows (version 4, Šmilauer 2002). Hierarchical classification of *Trichopteran* communities, based on the qualitative-quantitative similarity and for the analysis of caddisflies communities related the different microhabitats, we used the Monte Carlo permutation test-1000 permutations. Analysis of *Trichoptera* community similarity was performed using the PAST (1.95 version, 2001) software.

Characteristic	Reach			
	Ľ1	**Ľ2**	**R1**	**R2**
Altitude (m)	640	488	625	500
Geographic co-ordinates	49° 01´ 23,9"	49° 06´ 17,4"	48° 56´ 44,2´´	49° 03´ 11,6´´
Geographic co-ordinates	19° 08´ 49,8"	19° 08´ 19,5´´	19° 15´ 01,9´´	19° 18´ 07,9´´
Slope (%)	54	16	40	10
		Microhabitats (%)		
Macrolithal	12	21	11	29
Mesolithal	75	58	56	51
Microlithal	5	6	20	3
Acal	4	0	4	8
Psammal	0	6	6	3
Moss	4	6	4	1
Other macrophytes	0	2	0	5
		Land use (%)		
Forest	87.0	90.3	70.8	69.6
Meadows	7.6	3.9	11.2	8.9
Scrub	5.3	4.0	4.7	3.3
Pasture	0.1	1.8	11.7	12.1
Fields	0.0	0.0	0.3	3.5
Urban	0.0	0.0	1.3	2.6

Table 1. Characteristics of the Revúca and Ľubochnianka rivers.

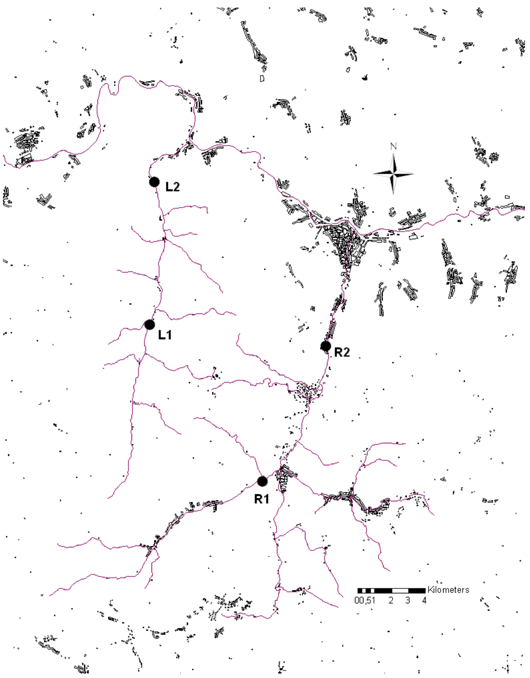

Fig.1. Location of the sample collections Ľubochnianka (L1, L2), Revúca (R1,R2).

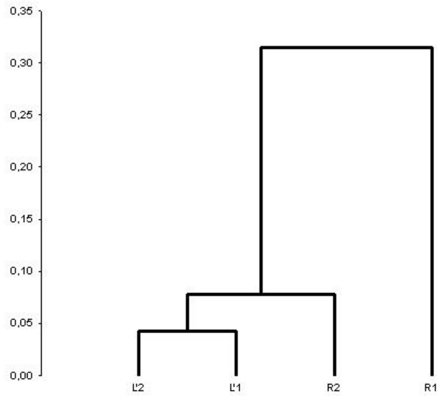

Fig. 2. Hierarchical classification of the similarity of monitored sites.

Results

During this study we captured in total 32 taxa of caddisflies (*Trichoptera*), which belonged to 12 families. The family *Brachycentridae* with *Micrasema minimum* species was the most dominant. Species *Sericostoma personatum/flavicorne* and *Hydropsyche incognita* were also considered to be dominant (Table 2). Hierarchical classification of *Trichopteran* communities classified the taxocenoses of the site Revúca 1 as significantly different from all other sites (Fig. 2). This site was also characterized by the lowest number of taxocenoses, lowest species diversity and evenness (Table 3).

PCA analysis of the caddisflies communities in the studied localities showed us the least species diversity in the Revúca 1 stream (Fig. 3). At the site Ľubochnianka 2, significant difference in species composition between acal- psammal and moss microhabitats was detected. Significant difference between these two types of microhabitats was also observed at Revúca 1 river site (Fig. 4).

In this study we captured 6 species of *Trichoptera*, which were dominant at all studied locations. Species *Anitella obscurata* had the highest dominance on the fine microhabitat acal- psammal (Fig. 5), species *Micrasema minimum* and *Hydropsyche incognita* preferred moss (Fig. 6) and species *Sericostoma p./flavicorne*, *Ecclisopteryx dalecarlica*, *Odontocerum albicorne* were represented on each substrate (Fig. 7).

SPECIES	LOCATIONS			
	R1 (D)	R2 (D)	Ľ1 (D)	Ľ2 (D)
Rhyacophila nubila (ZETTERSTEDT, 1840)	0.65 (SR)	5.12 (D)	1.83 (RD)	1.81 (RD)
Rhyacophila obliterata (McLACHLAN,1879)	0.18 (SR)	0.99 (SR)	0.26 (SR)	0
Rhyacophila pubescens (PICTET, 1834)	0	0.19 (SR)	0	0
Rhyacophila fasciata (HAGEN, 1859)	0	0	0.08 (SR)	0
Rhyacophila tristis (PICTET, 1834)	0.13 (SR)	0	1.06 (RD)	1.25 (RD)
Rhyacophila sp.juv.	1.21 (RD)	2.42 (SD)	1.62 (RD)	1.00 (RD)
Agapetus fuscipes (CURTIS, 1834)	0	0	0.20 (SR)	0
Glossosoma boltoni (CURTIS, 1834)	0	0.26 (SR)	0.36 (SR)	0.42 (SR)
Glossosoma conformis (NEBOISS, 1963)	0	0.15 (SR)	0	0
Glossosoma sp. juv.	0	0	0	0.09 (SR)
Hydroptila spp.	0	0	0	0.02 (SR)
Philopotamus montanus (DONOVAN, 1813)	0	0	0.02 (SR)	0
Hydropsyche incognita (PITSCH, 1993)	8.32 (D)	16.84 (ED)	7.86 (D)	24.50 (ED)
Polycentropus flavomaculatus (PICTET, 1834)	0	0.50 (SR)	0.04 (SR)	0
Brachycentrus montanus (KLAPÁLEK, 1892)	0.02 (SR)	3.35 (SD)	4.16 (SD)	1.29 (RD)
Brachycentrus subnubilis (CURTIS, 1834)	0	0	0.01 (SR)	0
Micrasema minimum (McLACHLAN, 1876)	80.40 (ED)	49.16 (ED)	58.30 (ED)	55.50 (ED)
Drusus annulatus (STEPHENS, 1837)	0	0	0	0.005 (SR)
Ecclisopteryx dalecarlica (KOLENATI, 1848)	3.59(SD)	0.50 (SR)	3.01 (SD)	1.20 (RD)
Annitella obscurata (McLACHLAN, 1876)	0.67 (SR)	0.37 (SR)	0.27 (SR)	1.83 (RD)
Chaetopteryx fusca/vilosa (BRAUER, 1857, FABRICIUS,1798)	0.37 (SR)	0	0.04 (SR)	0
Allogamus auricollis (PICTET, 1834)	0	0	0	0.04 (SR)
Halesus tesselatus (RAMBUR, 1842)	0.10 (SR)	0	0	0
Potamophylax latipennis (CURTIS, 1834)	0	0	0.04 (SR)	0
Potamophylax rotundipennis (BRAUER, 1857)	0	0	0.04 (SR)	0
Silo pallipes (FABRICIUS, 1781)	0	0.09 (SR)	0.05 (SR)	0.15 (SR)
Silo piceus (BRAUER, 1857)	0	0.05 (SR)	0	0
Silo sp. juv.	0	0.002 (SR)	0	0.23 (SR)
Lasiocephala basalis (KOLENATI, 1848)	0.07 (SR)	0	0.15 (SR)	0.01 (SR)
Sericostoma p./flavicorne (SPENCE, 1826)	3.45 (SD)	19.07 (ED)	18.87 (ED)	9.57 (ED)
Odontocerum albicorne (SCOPOLI, 1763)	0.43 (SR)	0.14 (SR)	1.56 (RD)	1.03 (RD)

Table 2. Dominance of *Trichoptera* species in Ľubochnianka and Revúca rivers.
Explanation: ED-eudominant, D-dominant, SD-subdominant, RD-recedent, SR- subrecedent

LOCALITIES	R1	R2	Ľ1	Ľ2
Abundance (m^2)	8870	8452	10137	7356
Number of taxa	15	18	23	19
Index of diversity (Shannon-Wiener-Index)	0.660	1.425	1.223	1.063
Simpson index of dominance	0.743	0.350	0.465	0.560
Evenness	0.257	0.503	0.396	0.393

Table 3. Characteristics of community (*Trichoptera*) at the studied sampling sites.

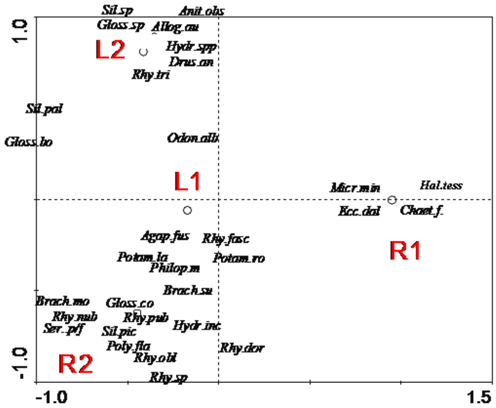

Fig. 3. PCA diagram of caddisflies species in the studied localities.

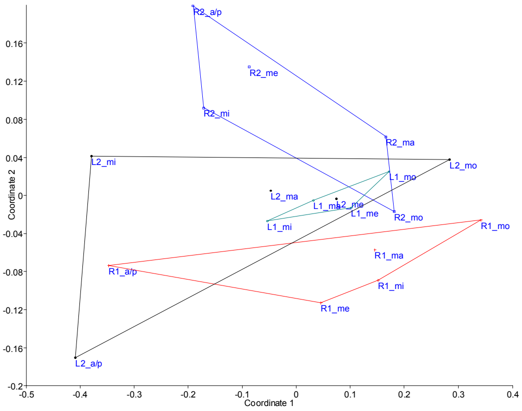

Fig. 4. Caddisflies communities in different microhabitats. Explanation: a/p- acal/psammal, mo- moss, mi-microlithal, me- mesolithal, ma-macrolithal

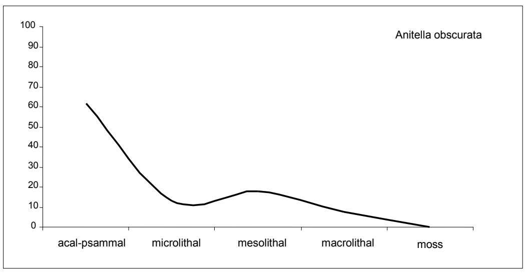

Fig. 5. Microhabitat distribution of the *Anitella obscurata* (%).

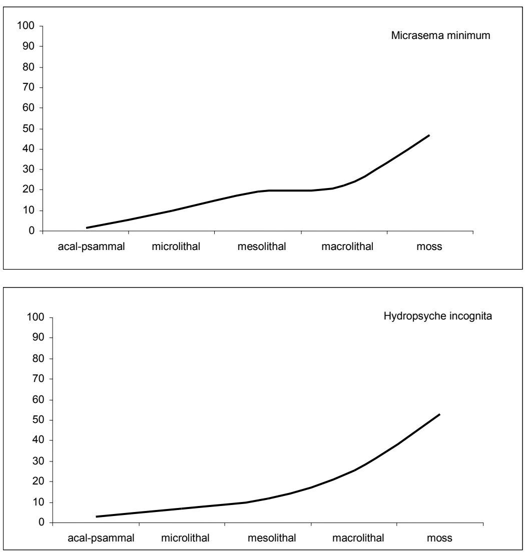

Fig. 6. *Micrasema minimum* and *Hydropsyche incognita* dominance (%) different microhabitats.

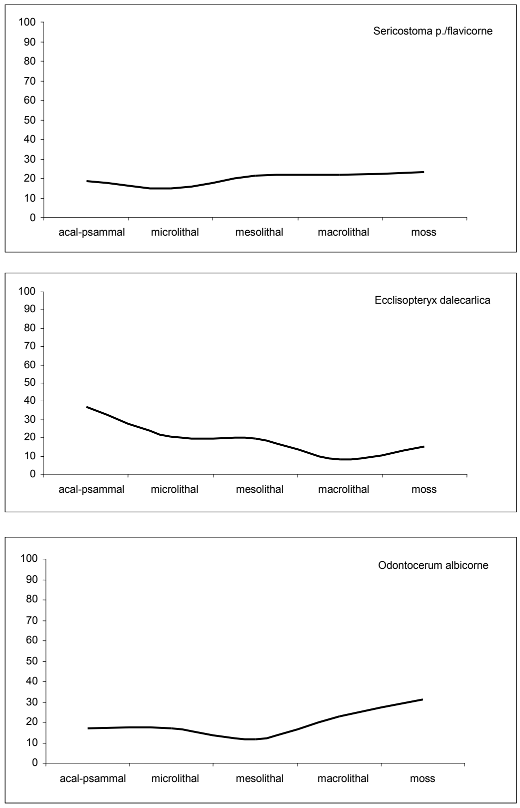

Fig. 7. *Sericostoma p./flavicorne, Ecclisopteryx dalecarlica* and *Odontocerum albicorne* dominance (%) different microhabitats.

Discussion

Sampling sites were situated in the metharitral part of the studied river flows. In the river Revúca, 20 species of caddisflies were found. Krno (1978) determined 31 species of *Trichoptera* at this location. The sampling was carried out at 29 sampling sites including 6 sites at the Revúca river. These taxa were classified into 5 different categories: eudominant, dominant, subdominant, recedent and subrecedent. Species *Micrasema minimum* was eudominant at all studied locations. Krno (1978) described this species as very rare. The dominant species included *Potamophylax latipennis*, *Sericostoma* sp., *Chaetopteryx villosa*, *Silo pallipes* and *Rhyacophila fasciata*.

Species *Potamophylax latipennis*, *Silo pallipes* and *Rhyacophila fasciata* were not found during our research. We also determined species *Rhyacophila dorsalis*, *Rhyacohila nubila*, *Rhyacophila obliterata*, *Rhyacophila tristis*, *Hydropsyche incognita*, *Brachycentrus montanus*, *Ecclisopteryx dalecarlica*, *Anitella obscurata*, *Halesus tesselatus*, *Lasiocephala basalis* and *Odontocerum albicorne*. Krno (1978) located some of these species in alpine streams or torrents, some of them were not mentioned. Species *Rhyacophila nubila* was found at all 6 locations. This species has very low demands on water quality. Taxa of the *Rhyacophilidae* family have a high tolerance to decreased water quality in general. We can find this species in the waters with increased phosphorus content. *Micrasema minimum* showed the highest abundance on moss substrate at this location, most probably due to favourable trophic conditions. In the locality 2-

Revúca 2, we have recorded 18 taxons of caddisflies (*Trichoptera*). Eudominant species included *Micrasema minimum*, *Hydropsyche incognita* and *Sericostoma p./flavicorne*. *Micrasema minimum* could be eudominant thanks to the optimal conditions for periphyton growth (prefers shallow and exposed streams) and high supply of nutrients. Determination of *Hydropsyche incognita* species is currently rather difficult. This species has been often confused with *Hydropsyche pellucidula* (Chvojka *et al.* 2001). Krno (1978) observed *Potamophylax latipennis* and *Chaetopteryx villosa* as the most dominant species.

Comparison of sites Revúca 1 and Revúca 2 showed that Revúca 1 is subjected to significant organic and human pollution. Revúca 2 shows slight eutrophication because of increased supply of phosphorus. Dominance of the species *Rhyacophila nubila* can be explained through its low demands on water quality and high tolerance to phosphorus. The degraded water quality could be caused not only by environmental factors, but also human activities, which affect the Revúca stream. The known negative influences include agriculture, municipal landfills and small hydropower plant, which is located in Liptovská Osada (Krno *et al.* 1999).

At the Ľubochnianka river, *Micrasema minimum* and *Sericostoma p./flavicorne* species were eudominant. Krno (1982) also confirmed *Micrasema minimum* as the dominant species at this site. High dominance species included *Allogamus auricollis* and *Chaetopteryx fusca*. Mayer (1936) found *Chaetopteryx villosa* to be dominant in all stream zones. This could be caused by the fact, that some larval stages can be adapted to different conditions (substrate, water quality, altitude). This species was found to be subrecedent in our study. *Allogamus auricollis* was subrecedent as well. The most dominant family was *Brachycentridae*. Krno (1982) indicates that *Glossosomatidae* family is also characteristic for this location.

At the location Ľubochnianka 2, we also recorded the species *Micrasema minimum*, *Sericostoma sp./flavicorne* and *Hydropsyche incognita*, which were classified as eudominant. If we compare the two sites sampled at Ľubochnianka river, the Lubochnianka 1 is less disturbed, with higher number of caddisfly taxons (23) and higher abundances. The Ľubochnianka river is relatively well preserved with only a few disturbances caused mainly by forestry.

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