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Community structure of caddis larvae (Trichoptera) in the Szalajka Stream, North Hungary

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Abstract. A total of 674 caddis larvae belonging to 18 species were caught from July, 1974 to June, 1975 along the Szalajka Stream, using the quadrant method. Using community structural characteristics, assemblages collected at the spring could be distinguished from the others, and they also showed lower diversity, using different kinds of diversity orderings. The number of species and individuals increase in conjunction with the distance from the spring. Spring assemblages were dominated by shredders, stream assemblages were dominated by predators. Spatial and temporal distributions of caddis larvae were also discussed.

Synopsis

Trichoptera are important members of spring and stream macroinvertebrates. Here, an attempt is made to characterise the community structure of caddis larvae along the Szalajka Stream. Our results show that the assemblages of caddis larvae of the Szalajka Spring are different from the assemblages collected along the stream.

Introduction

The aim of the present study was to provide basic data on the changes in species composition, density and functional feeding groups of caddis larvae along the Szalajka Stream. Furthermore, we wanted to give information on their population changes in time.

Experimental Methods

Caddis larvae were collected monthly from July 26, 1974 to June 18, 1975 at five collecting sites, using the methods of KAMLER & RIEDEL (1960). Sampling sites were established out at different stream reaches of the Szalajka Stream. The first sampling site (S1) can be found at the spring of the Szalajka Stream, S2, S3, S4, and S5 sampling sites are 300, 500, 800 and 1200 m from the spring, respectively.

The identification of the caddis larvae was done mainly from HICKIN (1967) and LEPNEVA (1966). Only individuals identified to species level were used in the statistical analysis.

Longitudinal and temporal changes in the community of caddis larvae were indicated using different methods. Species richness was measured through the number of species, density through the number of individuals, using STATISTICA computer program (2000).

Exp. (Rényi) scale dependent diversity and the Right-Tail-Sum (RTS) diversity were calculated (RÉNYI 1961, TÓTHMÉRÉSZ 1995, TÓTHMÉRÉSZ 1997) as Exp (Rényi) diversity is practical at high number of species, RTS diversity at a low one. Both Exp (Rényi) and RTS diversity have varying sensitivities to the occurrence of rare and abundant species as α changes. Diversity profiles were calculated using the NuCoSA computer program (TÓTHMÉRÉSZ 1996).

Non-metric multidimensional scaling (NMMS), using Bray-Curtis metric and cluster analysis using Jaccard index and group average method (UPGMA) were applied to show the similarity pattern among the assemblages collected at different sampling sites and dates by SYN-TAX computer program (PODANI 1997).

The distribution of caddis larvae among functional feeding groups and longitudinal zones is based on the work of MOOG (1995).

Results & discussion

Altogether 674 individuals belonging to 18 caddisfly species could be identified based on larval sampling. The dominant species is *Rhyacophila fasciata* (115 individuals) followed by *Rhyacophila tristis* (85), *Rhyacophila obliterata* (65), *Silo pallipes* (65), *Potamophylax nigricornis* (55) and *Halesus digitatus* (53). The other species are represented by less than 50 individuals.

Longitudinal distribution of caddis larvae

Chaetopteryx fusca is the dominant species at the first sampling site (S1), *Potamophylax nigricornis* at the second one (S2), and *Rhyacophila fasciata* at the next three (KISS 1997) (S3, S4 and S5; Table 1). In the Börzsöny Mountains (North Hungary), *Halesus digitatus* and *Potamophylax rotundipennis* were the dominant species (KISS 1998, SCHMERA 1999). Both the numbers of species and individuals are low at the first sampling site (S1, Fig. 1). The next four sampling sites show higher number of species (Fig. 1.A) and individuals (Fig. 1.B). Diversity ordering of the assemblages collected at different sampling sites (Fig. 2) show that the assemblage collected at the first sampling site (S1) is less diverse than at the others (Fig. 2). There are no differences between the two kinds of diversity ordering. Based on the similarities of the species compositions it can be stated that the third (S3) and fourth (S4) sampling sites are the most similar presenting one cluster, and the first sampling site is the most different (Fig. 3). This result corresponds to the result showed at Mauerbach, Austria (BAUMGERTEN & WARINGER 1997). They also show that assemblages collected close to the spring are different from the others. Longitudinal zonation patterns of functional feeding groups sampled at sites 1 to 5 are shown in Fig 4.A. Shredders are more abundant at the first sampling site (S1) but predators dominate the other sampling sites. Furthermore, crenal and rhithral species are represented by more than 80% at each sampling site. However, some littoral specific caddis species are present at the first sampling site (S1, Fig. 4.B)

Temporal distribution of caddis larvae

Both the numbers of species and individuals show an annual fluctuation (Fig. 5). The mean number of species varies between 2 and 6, the highest mean number of species was recorded in May, the lowest one in September (Fig. 5.A). Generally it can be stated that the numbers of species are high in spring and summer, low in autumn and winter. Considering the density measured through the number of collected individuals, its seasonal change shows almost the same picture (Fig. 5.B). High numbers of individuals were found in spring and in summer, low ones in autumn and in winter. However, the highest number of individuals could be found in May, the lowest one in December.

Spatial and temporal distribution of caddis larvae

Spatial and temporal distribution of caddisfly assemblages is presented using non-metric multidimensional scaling (Fig. 6). Sixty assemblages collected at different times and sites are indicated in the ordination space. Autumn and winter collections of the first sampling site (S1) are well separated from the others at the positive value of both axes. Furthermore, the other assemblages collected at the first sampling site (S1) could be found at the positive value of the first axis. The other assemblages are more or less randomly organised.

Conclusions

1. Lotic species are dominant in the sampling (for instance members of the genus *Rhyacophila*).
2. Species richness, abundance and diversity of the assemblages of caddis larvae increase as the distance from the spring grows. The lowest diversity of the assemblages of caddis larvae can be found at the spring, which is supported by both species richness and different kinds of diversity orderings.
3. Based on species compositional similarity, the assemblage collected at the spring is the most different.
4. Seasonal distribution of caddis larvae shows fluctuation, the highest numbers of species and individuals were found in spring and summer, the lowest ones in autumn and winter.
5. All in all, using different kinds of community characteristics, the assemblages of caddis larvae collected at the Szalajka Spring show differences from the others collected along the Szalajka Stream.

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Table 1. List of species and their relative abundance at the different sampling sites

Species	S1	S2	S3	S4	S5
Rhyacophilidae					
Rhyacophila dorsalis (Curtis, 1834)		3,48	3,42		5,99
Rhyacophila fasciata Hagen, 1859		14,78	25,64	19,35	15,57
Rhyacophila obliterata McLachlan, 1863	3,45	18,26	3,42	6,45	14,37
Rhyacophila pubescens Pictet, 1834		11,30	9,40	4,61	4,79
Rhyacophila tristis Pictet, 1834		17,39	14,53	11,06	14,37
Hydropsychidae					
Hydropsyche angustipennis (Curtis, 1834)			5,98	4,61	2,40
Hydropsyche fulvipes (Curtis, 1834)				1,84	
Hydropsyche instabilis Curtis, 1834			5,13	6,91	1,20
Psychomyidae					
Tinodes rostocki McLachlan, 1878					1,20
Limnephilidae					
Potamophylax nigricornis (Pictet, 1834)	31,03	20,00			8,38
Halesus digitatus (Schrank, 1781)	13,79	5,22		3,69	18,56
Stenophylax permistus McLachlan, 1895		4,35		4,61	2,40
Micropterna lateralis (Stephens, 1837)		3,48			
Chaetopteryx fusca Brauer, 1857	46,55				
Goeridae					
Silo pallipes (Fabricius, 1781)	5,17		13,68	13,36	4,79
Sericostomatidae					
Sericostoma personatum Kirby et Spence, 1869			3,42	15,21	3,59
Beraeidae					
Ernodes articularis (Pictet, 1834)					1,20
Odontoceridae					
Odontocerum albicorne Scopoli, 1763		1,74	15,38	8,29	1,20
Number of individuals	**58**	**115**	**117**	**217**	**167**

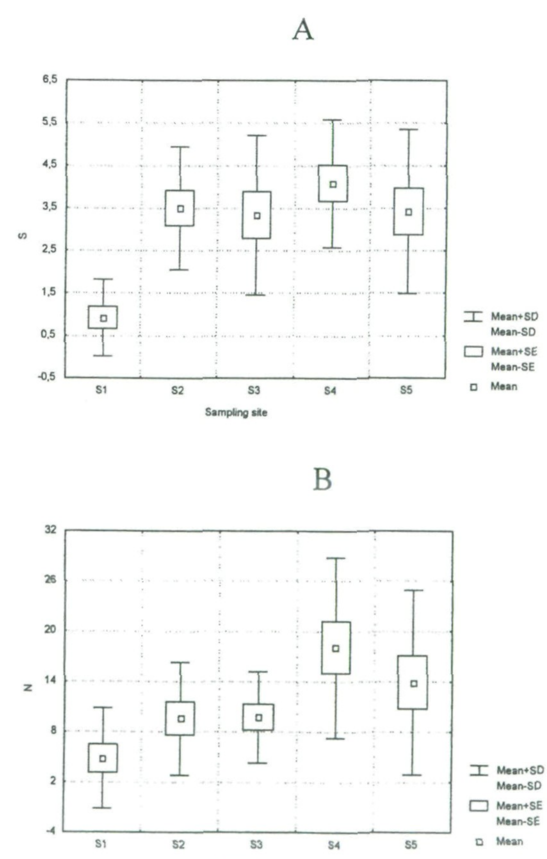

Fig. 1. Longitudinal changes in the species richness (A) and density (B) of caddis larvae along Szalajka stream, North Hungary

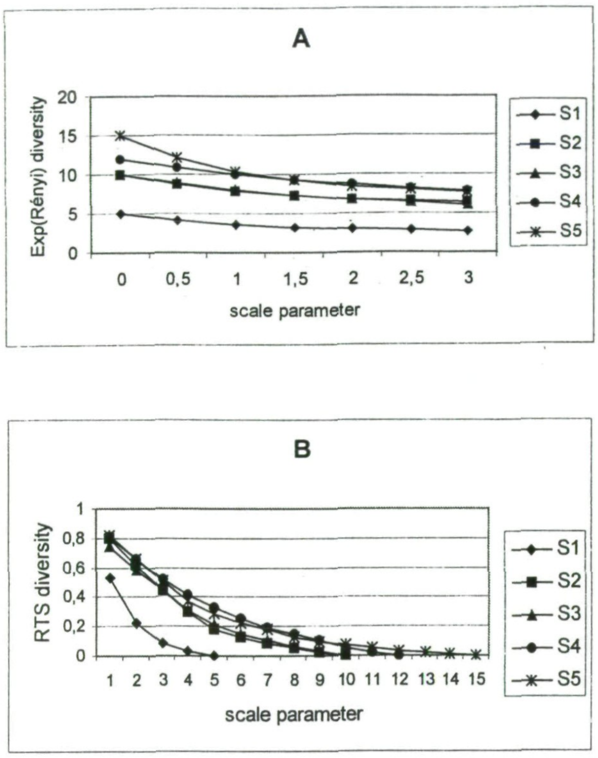

Fig. 2. Exp (Rényi) (A) and RTS (B) diversity ordering of assemblages of caddis larvae at the different sampling sites

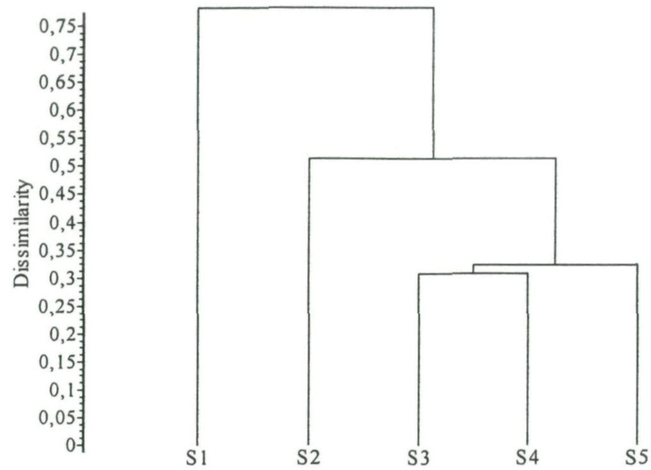

Fig. 3. Group average (UPGMA) cluster analysis (Jaccard distances) of sampling sites 1 to 5 along the Szalajka stream, based on the presence/absence data of caddis larvae

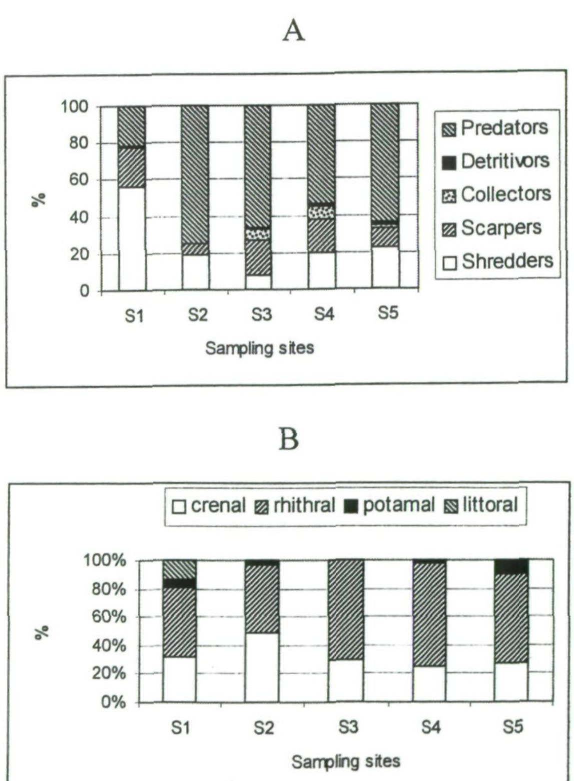

Fig. 4. Longitudinal distribution of functional feeding groups of caddis larvae (A) and species of caddis larvae typical for crenal, rhithral, potamal and litoral zones at five sampling sites (B) at the Szalajka stream

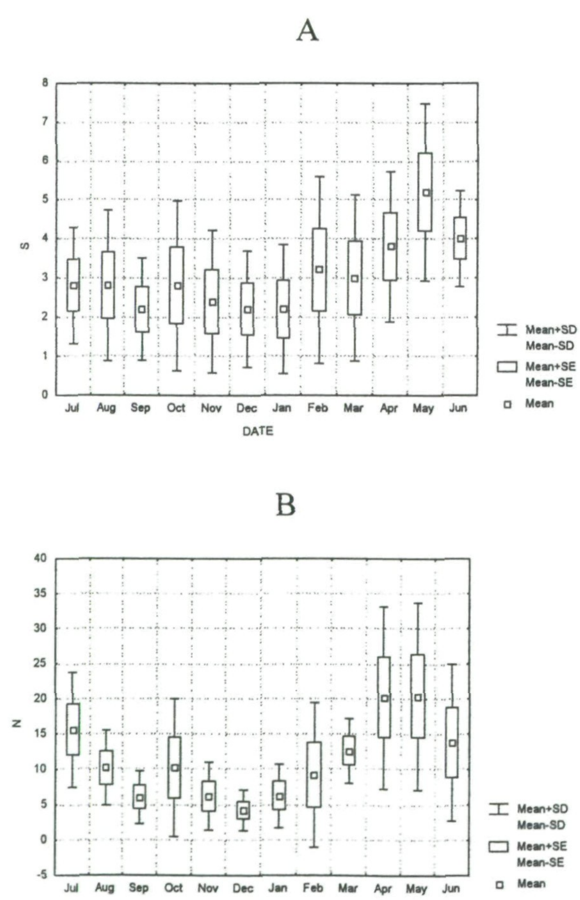

Fig. 5. Temporal changes in the species richness (A) and density (B) of caddis larvae at Szalajka stream

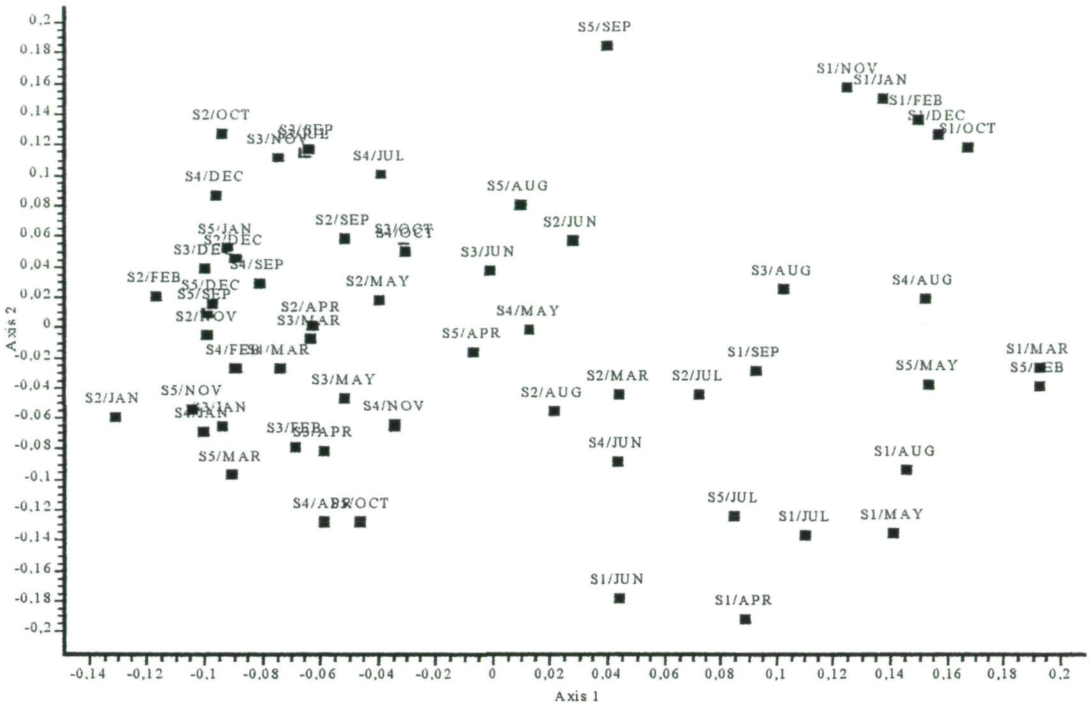

Fig. 6. Non-metric multidimensional scaling of the collected caddis larva assemblages at different sampling sites and dates