

Short-time changes in composition of chironomid assemblages at a cross-section of the River Tisza

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Introduction

Collection of drifting chironomid pupal exuviae is a suitable and widely used method for qualitative and quantitative investigations on nonbiting midge assemblages of running waters (COFFMAN 1973, FRANQUET & PONT 1996, GARCIA & LAVILLE 2000, GENDRON & LAVILLE 1995, RUSE 1995, RUSE & DAVISON 2000, WILSON 1989). The exuviae are easily collected from the water surface using a drift net (ELLIOTT 1970, LANGTON 1991).

The Tisza is a typical lowland river with extreme seasonal water level fluctuations with catastrophic floods in spring and sometimes autumn and very low water level in summer, although rainfalls can also cause unexpected floods in summer. The river is endangered by heavy metal pollution from mines in its catchment area. The Hungarian section of the Upper-Tisza is characterized by high habitat heterogeneity: typical fast-flowing habitats in the main channel, and slow-flowing habitats behind the spurs and reefs. These habitats contribute to high biodiversity, emphasizing the importance of research on macroinvertebrate assemblages of the River Tisza.

In Summer of 2003 a complete ecological water quality assessment (DÉVAI et al. 1999) began at a cross-section of the Hungarian reach of the Upper-Tisza. During these investigations we studied the chironomid assemblages. We tested the collection by drift net comparing day and night samples within one cross-section of the river.

Key words: pupal exuviae, Chironomidae, Hungarian section of the Upper-Tisza, day and night samples

Materials and methods

The study was conducted at one cross-section of the Hungarian reach of the Upper-Tisza between Tiszamogyorós and Lónya, NE Hungary (651 rkm, N 48°19'03", E 22°15'03", at a sandy section of the river.

Drifting chironomid pupal exuviae were collected by drift net (opening 48 × 25 cm, mesh size 250 µm)

from a pontoon bridge in the main flow during 10 minutes. Sampling was carried out at midday and midnight during a 20-days period from 14 July to 02 August in 2003. During the first 7-days period there was a small flood highly increasing the quantity of floating litter. Water temperature and the water velocity were measured every time.

Because of the high density of exuviae, it was necessary to take subsamples ranging from 1/2 to 1/32 of the whole sample. The numbers of specimens of the species were standardized to a unit surface of water (m²). The specimens were identified to species level using keys by LANGTON (1991), LANGTON & VISSER (2003), PANKRATOVA (1983) and SÆTHER et al. (2000).

The species composition of the samples was compared by multidimensional scaling (MDS) using the squared Euclidean distance for the binary data and the Euclidean distance for the abundances (LEGENDRE & LEGENDRE 1998). Means of the number of specimens, number of species, and the Shannon diversity of the daytime and night samples were compared by the usual t-test (ZAR 1984).

Results

During the investigation the water temperature was almost constant and did not differ appreciably between daytime and night (mean 25.2 °C daytime and 24.2 °C night). The water velocity was almost constant, although it slightly increased during the flood.

A total of 42 479 pupal exuviae were collected (8559 daytime and 33 920 night), among which 8145 exuviae were identified. There was significant difference between the standardized numbers of specimens of day and night samples (Table 1). A total of 61 species were found during the investigation. The total number of species was 55 daytime and 50 at night, which do not show significant difference. The lowest number of species (10) was found the second

Table 1. Minimum, maximum and mean values of number of specimens, number of species and Shannon diversity (* indicates significant differences).

	daytime	at night	<i>p</i>
Total number of specimens	8559	33920	
Min. number of specimens per sample	56	243	
Max. number of specimens per sample	1142	8525	
Mean of the standardised number of specimens per sample*	1100	4270	0.014
Total number of species	55	50	
Min. number of species per sample	10	18	
Max. number of species per sample	31	32	
Mean number of species per sample*	21	25.65	0.003
Min. of Shannon diversity per sample	2.303	2.890	
Max. of Shannon diversity per sample	3.434	3.466	
Mean of Shannon diversity*	3.013	3.232	0.004

day of the flood. Eleven species occurred only in day samples and 6 only in night samples. The number of species per sample was significantly higher in the night samples (25.6) than day samples (21; Fig. 1). The Shannon diversity also was significantly higher in the night samples (Table 1). The MDS ordination of day and night samples (Fig. 2) revealed the differences in both species composition and abundance.

The recorded species belong to four subfamilies: 4 Tanypodinae, 1 Diamesinae, 5 Orthocladiinae and 51 Chironominae. All of the most abundant species (mean relative abundance > 5%) belong to Chironominae: *Beckidia zabolotzskyi* (Goetghebuer, 1938); *Chironomus cf. balatonicus*; *Cryptochironomus rostratus*

Kieffer, 1921; *Kloosia pusilla* (Linnaeus, 1767); *Lipiniella moderata* Kalugina, 1970; *Rheotanytarsus rhenanus* Klink, 1983.

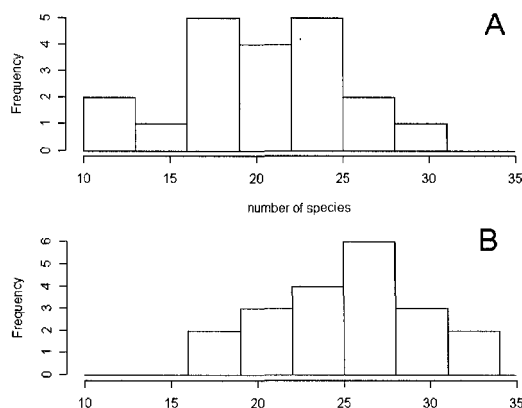


Fig. 1. Histograms of the number of species of the samples. (A) Samples during daytime. (B) Samples at night.

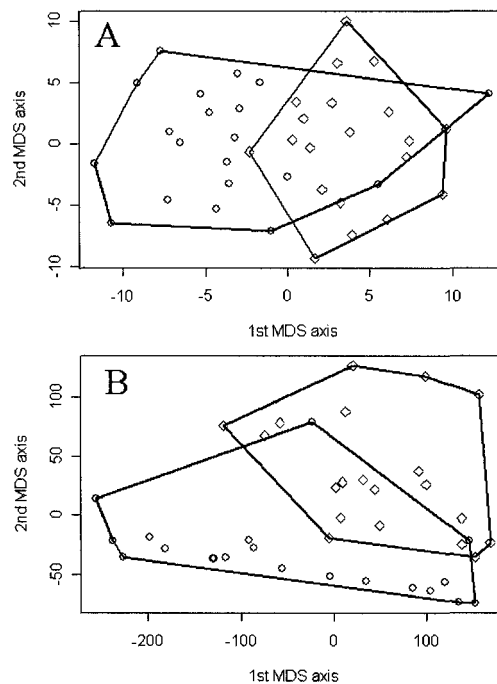


Fig. 2. Ordination of all samples (day and night) by MDS based on the presence/absence data (A) and abundances (B) of species. Number of differential species was used as dissimilarity index for the binary data and the Euclidean distance was applied for the abundances (○ = day samples, ◇ = night samples).

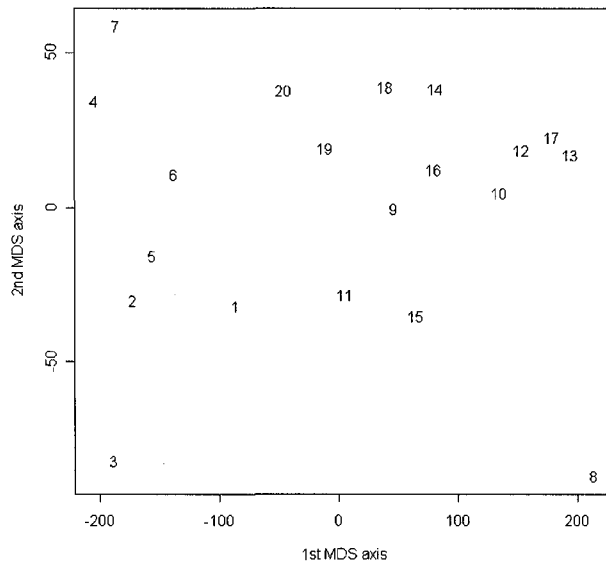


Fig. 3. Ordination of the samples taken during the daytime by MDS based on the abundances using the Euclidean distance. Numerical figures indicate the day when the sample was taken during the sampling period.

No pronounced tendency for changes was seen in the relative abundance of these species, although the first seven days (time effected by flood) slightly differ from the other days, as revealed by MDS ordination of abundance data (Fig. 3).

Discussion

The fact that 61 species were found during this short summer period in only one site means that the chironomid assemblages of the sandy section of the Upper-Tisza may have high species richness and diversity. Other investigations on large sandy rivers of Europe also result high species richness, as summarized in GARCIA & LAVILLE (2000).

The results suggest a stable chironomid assemblage of 21–25 species at this section of the river in summer. The species richness is due to the large representation of the rare species, presumably reflecting high heterogeneity of the habitat structure. In addition, many further species are expected to occur in spring and autumn.

Differences between diel emergence patterns of chironomid species were also reported by other studies (FRANQUET & PONT 1996, GENDRON & LAVILLE 1992, HAYES & MURRAY

1988). They found that Orthocladiinae were dominant during daytime and Chironominae at night. We found that both night-time and daytime emergences were characterized by strong dominance of Chironominae.

The differences between day and night samples suggest that if the goal is to collect the most species as possible, sampling should be carried out at day for a longer period. If the goal is to survey the abundance of frequent species, collecting a few samples at night is sufficient. To explore the total richness of the chironomid fauna, the best solution is to combine day and night sampling.

The slightly different composition of the chironomid assemblage at the first period was probably caused by the physical damage by the increased quantity of the floating litter on the exuviae, especially sand taken up from the sediment. In summary, we found no characteristic changes in the composition of the chironomid assemblage during this short-time period.

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