The Chironomidae community response to substrate changes in a lowland river (Balkan Peninsula)

Djuradji Milošević1, Dubravka Čerba2, Jelena Tomović3, Simona Kovačević3, Katarina Zorić3, Krešimir Žganec3, Vladica Simić3, Ana Atanacković4, Vanja Marković5, Margareta Kračun5, Sandra Hudina6, Jasna Lajtner5, Sanja Gottstein5, Andreja Lucić3, Momir Paunović 3

1Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Serbia
2Department of Biology, University of Josip Juraj Strossmayer in Osijek, Croatia
3Institute for Biology and Ecology, Faculty of Science, University of Zagreb, Croatia
4Institute for Biology and Ecology, Faculty of Science, University of Kragujevac, Serbia
5Division of Biology, Faculty of Science, University of Zagreb, Croatia

INTRODUCTION

Lowland rivers are exposed to severe anthropogenic degradation, which leads to the alteration of natural substrates. Such degradation in river morphology can significantly influence the community structure of aquatic macroinvertebrates by increasing the quantity of manmade substrates (e.g. riprap). Due to the preferences of specific taxa, a survey of the community composition can significantly bias the result of a community structure analysis, characteristic for a particular habitat. Chironomidae larvae are the dominant group among aquatic macroinvertebrates, and yet their sensitivity to substrate composition changes has only been considered in a few studies.

THE AIM

In this work, we wanted to test whether the community structure in the Sava River (Balkan Peninsula) differed significantly on natural and artificial substrate. Also, the intention was to detect which taxa group contributed to the changes in the community structure.

METHODOLOGY

Sava river was investigated in September 2011, at 8 sites distributed along the low reaches, where five samples have been taken from both types of substrate, natural and disturbed. The distribution and separation of the sampling sites, based on the chironomid community structure, were visualized by a Non Metric Dimensional Scaling (NMDS) analysis. To classify sampling sites into clusters, the group average clustering method was performed using the Bray-Curtis similarity index.

RESULTS

A total of 3315 specimens were recorded, distributing in over 44 taxa. The NMDS and the group average clustering method presented two groups of sites mostly influenced by the substrate type (Fig 2). Such result was confirmed by the PERMANOVA, where significant effect of substrate types was recorded (pseudo-F=4.51, P<0.0001). The IndVal analysis presented significant taxa for both substrate types (Table 1).

CONCLUSION

The substrate specificity strongly influencing the chironomid community structure, where different indicator taxa inhabited different microhabitats in the same sampling sites. This information stresses the importance of the substrate type, pointing out that in determining the representative community for a certain habitat, artificial substrates should be avoided in sampling design. This is especially true for bioassessment and river typology methods where the community structure is used as a multivariate indicator.

ACKNOWLEDGEMENTS

We want to thank Dr Henk Moller Pillot for the great support and useful advices regarding this work. This work has been supported by the European Communities 7th Framework Programme Funding under Grant agreement no. 603629-KRF-2013-6.2-Globaqua and by the project of bilateral cooperation between Croatia and Serbia entitled “Assessing the scale of bioncentration of large rivers in Croatia and Serbia” financed by the Ministry of Science, Education and Sports of the Republic of Croatia and the Ministry of Education, Science and Technological Development of the Republic of Serbia, project period 2011-2012.

Table 1. Representative and significant Chironomidae taxa for groups of sites (natural (N) and artificial (A) substrates). Asterisks next to IndVal values indicate their significance level: *<0.05, **<0.01, ***<0.001.

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Gr</th>
<th>InV</th>
<th>Taxa</th>
<th>Gr</th>
<th>InV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microtendipes pedellus</td>
<td>A</td>
<td>50.8***</td>
<td>Cryptochironomus sp.</td>
<td>N</td>
<td>62.1**</td>
</tr>
<tr>
<td>Harnischia sp.</td>
<td>A</td>
<td>74.7***</td>
<td>Polypedilum nubeculosum (Meigen 1804)</td>
<td>N</td>
<td>75***</td>
</tr>
<tr>
<td>Lipinnella arnesiolicola</td>
<td>A</td>
<td>47.8***</td>
<td>Polypedilum sicilicolum (Schrank 1803)</td>
<td>N</td>
<td>69***</td>
</tr>
<tr>
<td>Microtendipes pedellus</td>
<td>N</td>
<td>86.3***</td>
<td>Procladius sp.</td>
<td>N</td>
<td>61.3***</td>
</tr>
<tr>
<td>Potthastia gaardii (Meigen 1838)</td>
<td>A</td>
<td>75***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1 Location of the sampling sites along the Sava river.

Fig. 2 Non Metric Dimensional Scaling (NMDS) plot describing the influence of substrate specificity on the Chironomidae community.