A new outdoor test system with stream mesocosms

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Introduction

Lentic (static) aquatic mesocosms are most frequently used to refine aquatic risk assessment of pesticides when a potential risk is indicated by lower tier studies. However, small lotic water bodies (streams and ditches) in agricultural areas are often the most exposed water bodies.

Lotic water bodies differ strongly from lentic water bodies in terms of their abiotic environmental factors and their biocenoses. For example, the species composition of the EPT-taxa (Ephemeroptera, Plecoptera, Trichoptera) which play a key role in the river assessment in context with the Water Framework Directive is clearly distinct: Different taxa of mayflies (Ephemeroptera) or caddisflies (Trichoptera) inhabit lentic and lotic water bodies and stoneflies (Plecoptera) are exclusively found in running waters.

Thus, the extrapolation of results from lentic mesocosm studies to small lotic water bodies is subject to many uncertainties. This applies particularly if the most sensitive species are primarily found in lotic water bodies. For that reason, a new outdoor stream mesocosm system was developed within the last 5 years in accordance with the EFSA guidance document on aquatic risk assessment of PPP (EFSA 2013) and validated in a pilot study focussing on macroinvertebrates.

Material & Methods

Test design

An 8 weeks pilot study with 4 stream mesocosms was performed in May/June 2014. The data were compared with the data of three lentic mesocosm studies (each 4 replicates) and a natural reference stream in Central Germany (Gleen).

Test set-up

The stream mesocosms are modular systems (Fig. 4), which can be adapted to the specific requirements of each study (e.g. regarding sediment, microhabitats, bioassays and sampling techniques). The standardisation of the particular module components provides a high level of homogeneity between the replicates.

Macroinvertebrate substrate sampler (MASS) containing basalt stones, deadwood and leaves of Salix (Fig. 6) were used for introduction of species. 10 MASS per stream mesocosm were inserted into two different kind of streams for a period >4 weeks (Fig. 7) for colonisation. One week before start of the study the MASS were transferred into the stream mesocosms.

In addition, stream organisms of a third stream were captured by netting to enrich the biocenosis of the mesocosms.

Outcome

The new stream mesocosm test system features:

- A high replicability regarding abiotic conditions including flow conditions.
- The possibility to adapt the velocity.
- In accordance to GLP-requirements.

A detailed description of the technical aspects is presented on the poster: Technical realisation and validation of an outdoor stream mesocosm. Ebke ET AL. (2015); Setac Europe 25th annual meeting.

A pilot study shows that the physico-chemical properties of the water between the replicates run very similar. Optimal temperature conditions could be arranged in May/June. A representative macroinvertebrate community could be established and be monitored over the whole study duration (8 weeks):

- 75 different species;
- 21 taxa fulfil MDD criteria suggested by Brock ET AL. (2014);
- of which are 9 EPT-taxa;
- the stream mesocosm diversity of macroinvertebrates is comparable with the tested reference stream Glen;
- the stream mesocosms hold a high percentage of supposed sensitive species to different classes of insecticides.

A detailed description of the biological results is presented on the poster: The macroinvertebrate community in an outdoor stream mesocosm. Ebke ET AL. (2015); Setac Europe 25th annual meeting.

References:


Brock et al. (2014): The minimum detectable difference (MDD) and the interpretation of treatment-related effects of pesticides in experimental ecosystems. Environ Sci Pollut Res Int. 22(2):1160-74.

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