

Effects of chronic exposure to low-level herbicide concentrations in mesocosms

Theme: Water Framework Directive

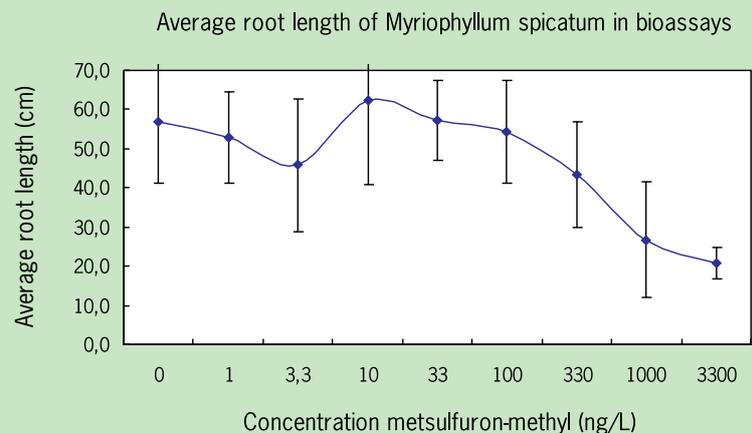
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Problem

Current knowledge of risks of long-term exposure to low concentrations of pesticides is limited. Adequate methods which evaluate these risks are not available. Experimentally derived standards are required to underpin a tiered risk assessment scheme.

Approach

To meet the scientific questions, we performed an experimental study in mesocosms. The sulfonylurea herbicide metsulfuron-methyl was used as a model-compound. As this compound is more toxic to aquatic macrophytes than to algae, and it is rather stable at relatively high pH, it may pose a long-term risk to macrophyte-dominated communities and ecosystems. Target concentrations were low, the highest values equaling 1 and 3.3 times the 50%-effect concentration (EC_{50}) of the standard-test organism *Lemna minor*: Concentrations were kept at a constant level. (No-)Effect concentrations (NOECs and EC_{50} s) were based on Time-Weighted-Average values.



Average root length of *Myriophyllum spicatum*.

Results

- In the mesocosm experiment the macrophyte *Myriophyllum spicatum* provided the most sensitive endpoint (range EC_{50} 48 – 530 ng/L)
- Macrophyte endpoints showed a high variability, which is often observed for sub-lethal endpoints of macrophytes
- Phytoplankton and periphyton Chlorophyll-a increased at higher concentrations (> 926 ng/L)
- The first-tier acceptable concentrations according to 91/414/EEC are 72 ng/L (EC_{50} *Lemna*/10) and 29 ng/L (NOEC *Lemna*/10). The Water Framework Directive (WFD) Maximum Permissible Concentration is 10 ng/L (NOEC *Elodea*/10)
- Our study shows that the WFD approach seems to be protective. The 91/414/EEC approach is also protective if the standard is derived from the NOEC of *Lemna*

Future use in risk assessment

The experimental results contribute to a tiered risk assessment scheme that harmonizes WFD and 91/414/EEC.



Experimental mesocosm.

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