IMPACT OF PESTICIDES ON HYPHOMYCETES LEAF PROCESSING AND MACROINVERTEBRATE SHREDDING ACTIVITY

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Introduction

Pesticides applied in agricultural catchments are subsequently transported to stream recipients through e.g. tile drainage and surface runoff. This gives rise to short pulses of pesticide contamination in the stream, where lipophilic compounds rapidly adsorb to organic matter, consequently impacting stream dwelling organism feeding hereon.
The impacts of pyrethroid insecticides on stream macroinvertebrates are well studied and responses are known to even very low concentrations (10-100 ng/L). However, the potential impact of pesticides on aquatic microbes is probably equally important. Microbial organisms are essential in organic matter breakdown, and their growth additionally increases the food quality of organic matter for macroin vertebrates. Consequently, pesticides impacting microbial organisms have the power to reduce organic matter breakdown and food quality for macroinvertebrates, consequently, decreasing ecosystem decomposition rates.

Hypotheses

Lipophilic pesticides adsorb to organic material and lower the food quality for macroinvertebrates, subsequently reducing the degradation rate.

Insecticides reduce the degradation rate of organic material by direct negative influence on the macroinvertebrates. However, due to short half life periods for pyrethroids (~24 h), direct impact will only be short term.

Fungicides reduce the degradation rate of organic material by inhibiting the hyphomycetes colonizing the leaves. This reduces the food quality for macroinvertebrates which subsequently decreases the degradation rate further.

In mixtures of high concentration, propiconazole and alpha-cypermethrine interact synergistically, thereby creating new scenarios not resembling the impact of one pesticide alone.

Photo 1 Water and Gammarus pulex were collected at Hagenstrup Møllebæk, Uldstrup, Denmark (above photo). The stream consists mainly of ground water and originates in the area just upstream the sampling location. Halesus radiatus were collected in Silkeå, near Korinth, Denmark.

Photo 2 21 leaf packs of 300 mg (+/- 25 mg) were added to all aquariums. Every week, 3 leaf packs were randomly withdrawn from each aquarium to quantify the degradation progress during the experiment.

Methods

We exposed preconditioned leaf packs of beech (Fagus sylvatica) to the fungicide propiconazole (100, 1000 or 2000 µg/L) and/or the insecticide alpha-cypermethrine (100, 1000 or 2000 ng/L) for three hours (figure 1). Subsequently, we studied post exposure leaf degradation for four weeks in the laboratory in the presence or absence of two macroinvertebrate shredders (Gammarus pulex and Halesus radia tus) applying a classic crossed factorial design. Samples were collected every week during the experiment, and the ratio between macroinvertebrates and leaf material were kept constant. At the end of the experiment changes in leaf pack weight, FW/DW-ratio and C/N-ratio will be determined.

	NONE	LOW	MEDIUM	HIGH
NONE	control	×	×	×
LOW	×	×	×	
MEDIUM	×	×	×	
HIGH	×			×

Figure 1 12 different pesticide treatments were investigated in the presence and absence of macroinvertebrates, resulting in 24 different scenarios. The highest concentrations were included as controls for setup functionality, but were considered environmentally improbable and therefore not mixed with the low and medium concentrations.

Preliminary results

Preliminary results indicate decreasing microbial litter processing with increasing concentrations of either propiconazole or alpha-cypermethrine. Additionally, the binary mixture further reduced microbial litter processing compared to single compound exposures (figure 2).

In the presence of macroinvertebrates, no immediate differences among treatments were apparent at the end of the experiment. However, more samples are yet to be processed, and may alter the present trend.

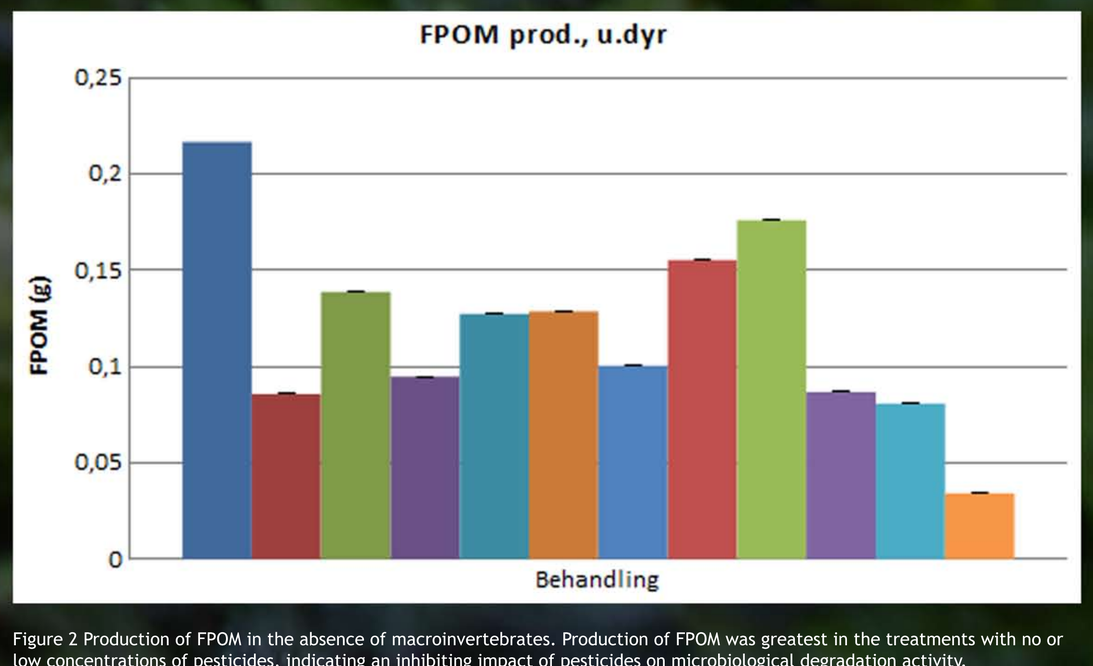

Figure 2 Production of FPOM in the absence of macroinvertebrates. Production of FPOM was greatest in the treatments with no or low concentrations of pesticides, indicating an inhibiting impact of pesticides on microbiological degradation activity.

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