Effects of a fungicide and a herbicide mixture on a benthic community and the emergence pattern of merolimnic insects in a microcosm experiment

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Introduction

Fig. 1: Experimental Site at the UBA.

As recent research has proved repeatedly, not only single substances but mixtures are present in aquatic eco-systems (Schreiner et al., 2016). Because pesticide mixtures can have stronger combined adverse effects than singular pesticides (Malaj et al., 2014) it is of high interest to investigate these effects on non-target organisms like aquatic macro-invertebrates.

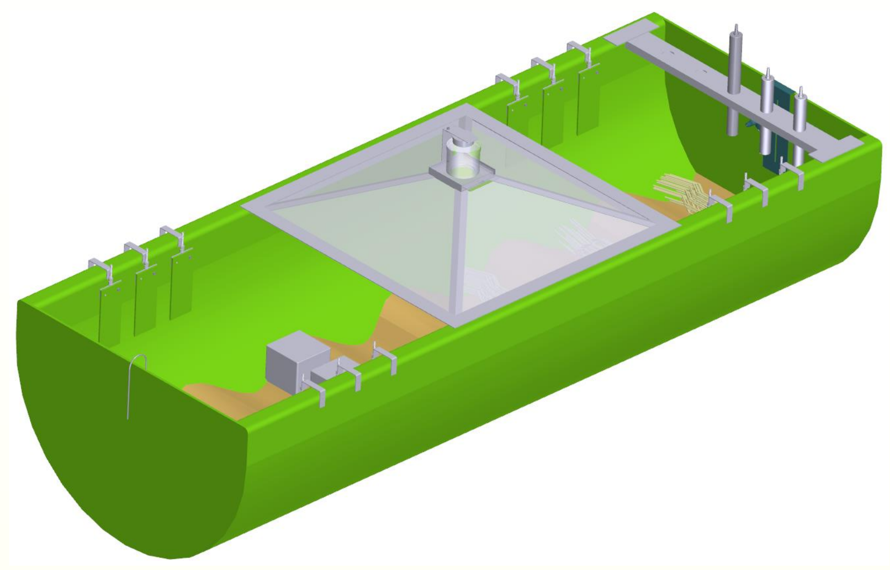


Fig. 2: Scheme of one microcosm.

Material & Methods

- 3 controls & 6 treated mesocosms
- 1 fungicide mixture (day 0): Tebuconazole, Kresoxim-Methyl, Pyrimethanil
- 1 herbicide mixture (day 35): Metazachlor, Isoproturon, Terbuthylazine
- Increasing concentrations between RAC (X0) and 3 times NOEC (X3):

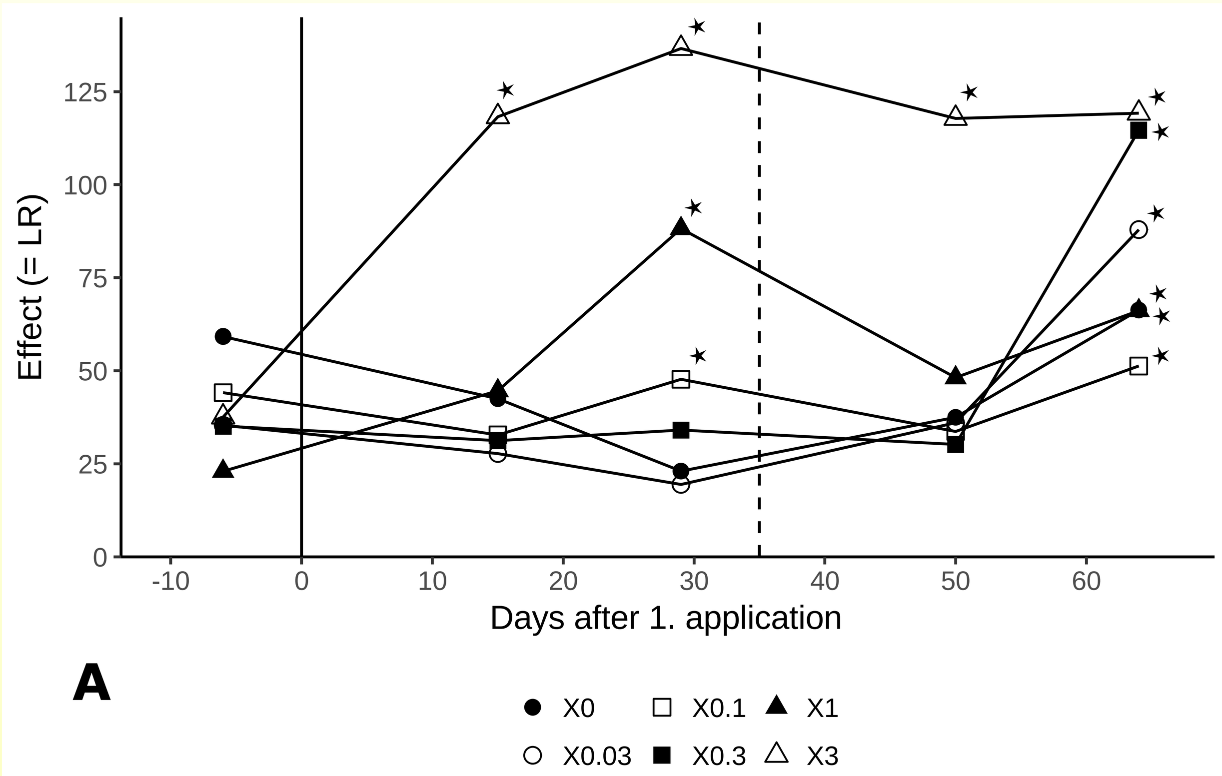
RAC | X0.03 | X0.1 | X0.3 | X1 | NOEC | X3

Measured parameters (selection)

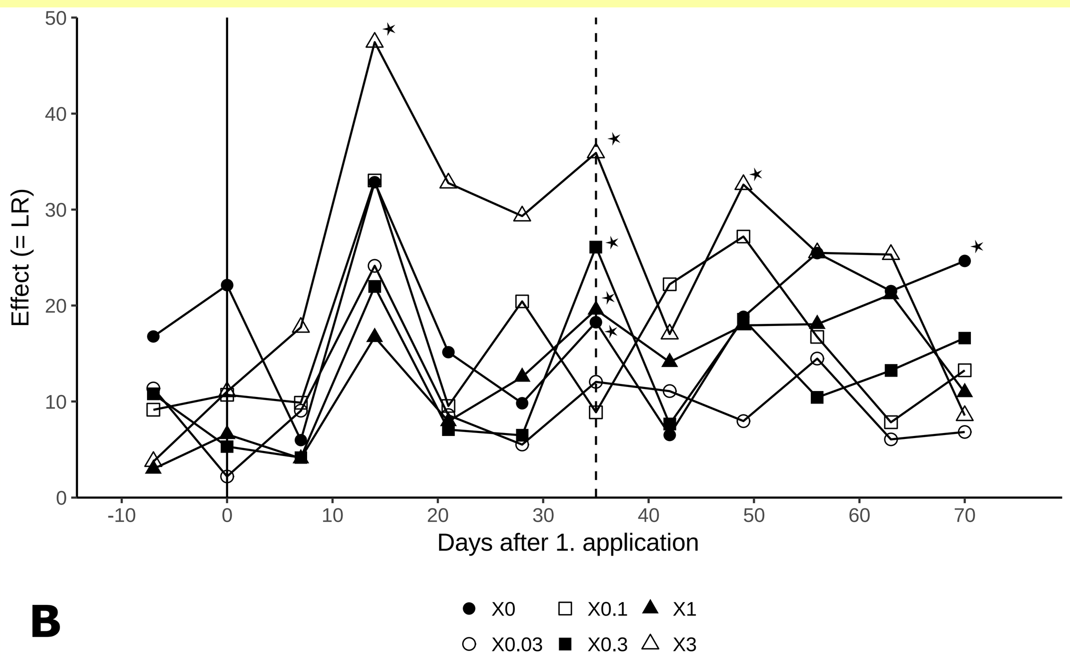
- Macroinvertebrate community/abundance
- Emergence of merolimnic insects
- Fitness of *G. roeseli* and stable isotope analysis (rf. Bayer 2017)

First Results

1) Effects on benthic organisms

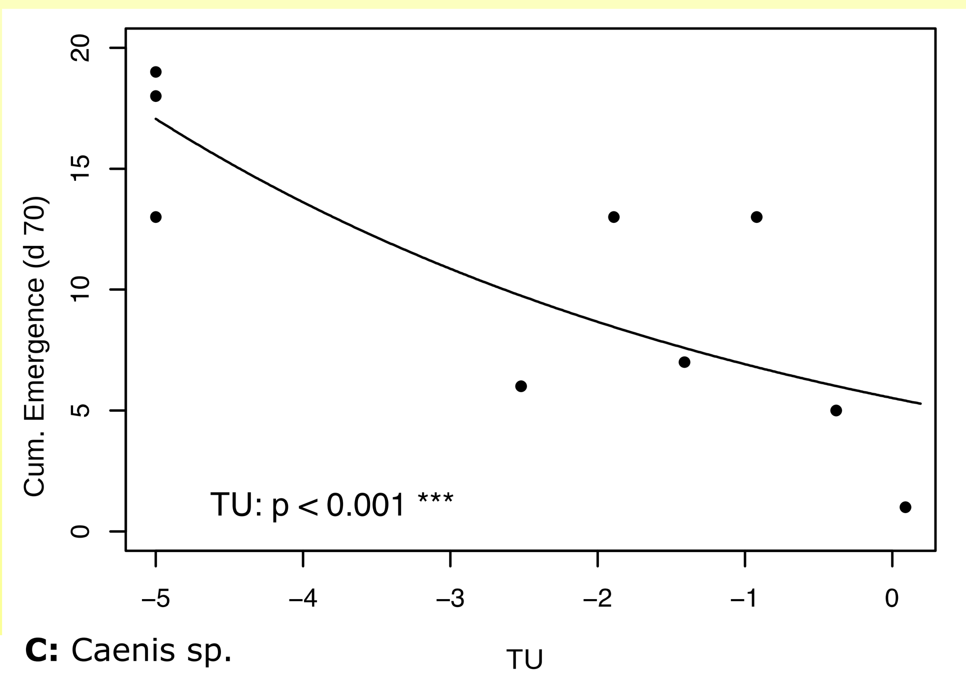


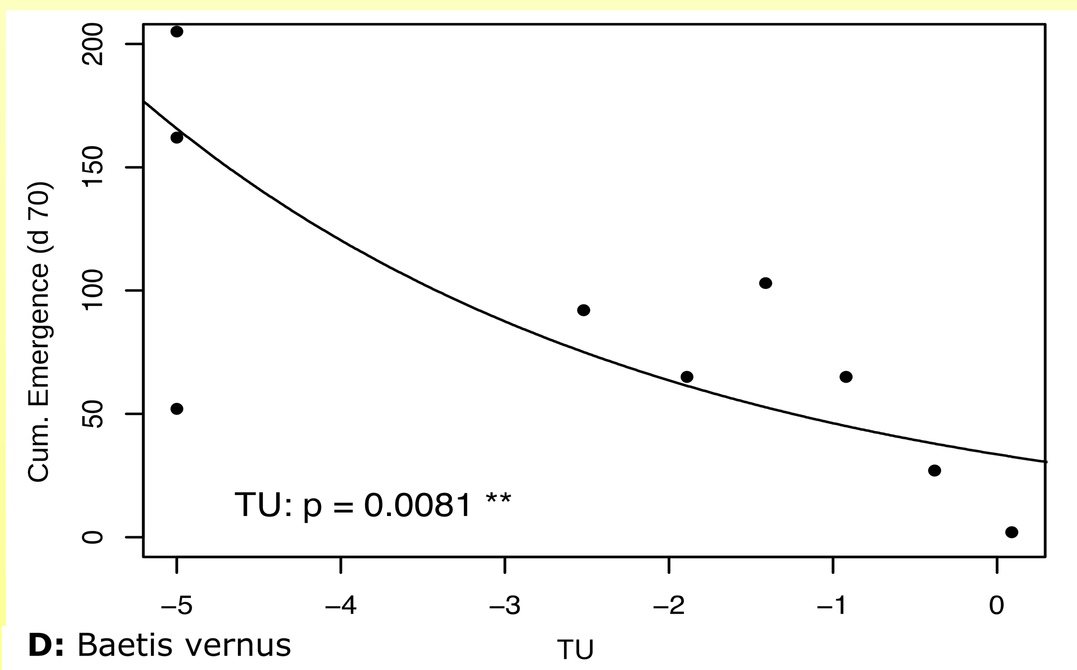
1. *No significant* overall treatment effect (**A**)
2. *Significant* treatment effect for day 64
3. For highest treatment (X3) after application every day a *significant* treatment effect
4. On day 29 additionally a *significant* treatment effect in second highest treatment (X1) and in third lowest treatment (X0.1)



1. *No significant* overall treatment effect (**B**)
2. Highest Treatment (X3) *significantly different* from control on day 14, 35, 49
3. Lowest treatment (X0) *significantly different* on day 70

2) Effects on emergence of merolimnic insects





Regression of the cumulative emergence after the last sampling on day 70 against the toxic units (TU) of this day. For *Caenis sp.* (**C**) and *Baetis vernus* (**D**):
The higher the TU, the lower the cumulative emergence (*significant).*

Preliminary Conclusion

- Direct effects of mixtures for benthic macroinvertebrates and emerged insects in the two highest treatments X3 and X1
- Indirect effects of mixtures in lower concentrations (also in RAC) became visible at the end of the experiment → longer time scale

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References:
Bayer (2017). Effects of a fungicide and a herbicide mixture on the food web structure of a benthic community and the fitness of the omnivore *Gammarus roeselii* in a microcosm experiment. (Thesis in progress)
Malaj et al. (2014). Organic chemicals jeopardize the health of freshwater ecosystems on the continental scale. Proc. Natl. Acad. Sci. 111: 9549-9554.
Schreiner et al. (2016). Pesticide mixtures in streams of several European countries and the USA. Science of the total Environ. 573: 680-689.