Introduction

Terrestrial Model Ecosystems (TME) are discussed as a potential tool to investigate effects of xenobiotics on soil communities under realistic environmental conditions and follow-up the recovery of soil microfauna populations after initial effects (Shenfield 1997). In a joint research project of the RWTH Aachen and Ross-Nickoll M., the community structure of most important groups of micro-arthropods (Collembola and oribatids) was investigated on a grassland site with homogeneous soil properties and vegetation cover. Large, undisturbed soil cores (30 cm diameter, 30 cm length) as TME were cored on this site to be exposed under indoor conditions for several months. In two preliminary studies, data on mesofauna requirements of pesticide registration were collected on this site (Shenfield 1997). In a joint research project of the RWTH Aachen and Ross-Nickoll M., the community structure of most important groups of micro-arthropods (Collembola and oribatids) was investigated on a grassland site with homogeneous soil properties and vegetation cover. Large, undisturbed soil cores (30 cm diameter, 30 cm length) as TME were cored on this site to be exposed under indoor conditions for several months. In two preliminary studies, data on mesofauna requirements of pesticide registration were collected on this site (Shenfield 1997).

Materials & Methods

1. Experimental design

- Coring of 40 TME
- 20 TME Control
- 10 TME 10 ppm
- 10 TME 100 ppm

2. TME coring

- Sampling 5 spots, 1 sample per TME
- 5 samples per TME

3. Maintenance of soil cores

- TME soil core
- PVC plate holder

4. Application

- Model compound: lindane
  - High insecticidal & acaricidal activity
  - Persistent enough to detect long-term processes
  - Bound to the upper soil layer
  - Reported DT50 in soil: 40-70 d
  - Inhibits GABA-receptors

5. Sampling

- Animals were extracted by means of a hydraulic pile pusher (sinking max. 3 m deep, size of soil core)

6. Microarthropods extraction

- Animals were extracted by means of an improved high-speed method (MacPadyne 1996) for 14 days, with an increasing temperature of about 20°C one day after sampling to 60°C at termination

7. Sorting & Determination

- Animals were presorted in an appropriate solution (30% ethonal + glyceral + water)
- All extracted arthropods were sorted & counted by hand, based on groups of collembolans, Oribatidae, Acarina, some nematodes, mites, and others
- Collembolans were prepared for taxonomical and determined to species level using appropriate keys

Results & Discussion

1. Effect of lindane on abundances

- Clear response in collembolan immediately after lindane application
- Seasonal maximum of collembolan abundance in summer
- Trend to recovery after 4 months of exposure (lower dose group)
- Recovery in only one TME through mass growth of Desoria trispinata at T1

2. Effect of lindane on dominance structure

- Collembolan communities characterised by high dominance of certain species and many subordinate species
- Change of dominant species during the year (D. pulicaris disappears, L. cyanus becomes dominant)

- Only shift in species composition over the time
- Dominance of juvenile oribatid species markedly stagnating in the treatments, but increasing in control: Effect on reproduction?

3. Effect of lindane on community structure

- Microarthropods are affected by the low and the high dose, but not affected by the intermediate dose
- Numbers tend to recover at the end of the experimental period, but no complete equilibration during the experimental duration could be observed
- Test design considered feasible to reveal short & long-term structural effects on different communities of the soil mesofauna

Conclusion

- Methods of soil coring and sampling are well suited for experimental requirements
- Population of collembolans and oribatids in TME are sufficiently stable over the time
- Community of oribatids is more resistant against seasonal changes, collembolans show a larger variation

- Microarthropods are affected by the low and the high dose, but not affected by the intermediate dose
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Outlook

- Further experiments in 2006: Dose-response studies
- Inclusion of further taxa (Enchytraeidae, Nematomorpha)
- Further investigations to improve extraction and species determination efficacy
- Adaptation of experimental design for regulatory demands of pesticide registration