WEBFRAM 5: Incorporating uncertainty in pesticide risk assessment for soil invertebrates

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Main objective To investigate whether statistical methods can improve pesticide risk assessment for soil invertebrates, by addressing uncertainty. Here, we ask whether species sensitivity distributions (SSD) could improve the existing (deterministic) risk assessment.

Links There are 7 related **WEBFRAM** risk assessment projects. Please see also the WEBFRAM1 (coordinating project) poster and interactive website **www.webfram.com**

Methods

- A systematic review to gather soil invertebrate ecotoxicity data
- Where possible, lognormal SSD fitted to the laboratory toxicity data to describe interspecific variation in sensitivity

Database from the systematic review

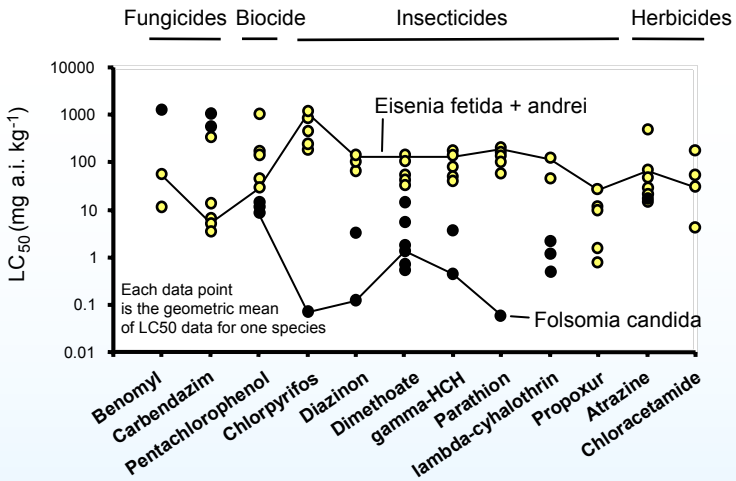
	Lower-tier (lab)	Higher-tier (field, model ecosystem)
Pesticides	250	71
Species / taxa	67	24

But…

- 96% of pesticides have data for fewer than 5 taxa
- Excludes industry (commercially sensitive) data

Results (1) - oligochaetes versus arthropods

- Arthropods (●) are more sensitive than oligochaetes (○) to a range of toxic modes of action (Figure below)
- The standard earthworm test species *Eisenia* spp. are among the least sensitive species whereas the collembolan test species *Folsomia candida* is among the most sensitive



Results (2) - about the SSD

The Figure (left) shows the best available data (acute mortality; LC50) – other endpoints have fewer data (SSD graphs are not shown here due to lack of space)

- Using a minimum of 5 species per chemical, SSD can be calculated for only 11 pesticides
- Some of the SSD are taxonomically biased (e.g. only earthworm data are available)
- Higher-tier data are too scarce to determine community NOEC for most pesticides
- Hence, for most pesticides the higher-tier effects data cannot be used to validate hazardous concentrations predicted by lower-tier SSD

Key conclusions

- There are two main obstacles to the use of SSD for improving soil invertebrate risk assessment: (1) lack of data, and (2) lack of a clear place for SSD in the current risk assessment structure (Discussion point, right)
- Arthropods should be tested routinely as they are more sensitive than earthworms to some pesticides

Discussion

The current soil invertebrate risk assessment treats earthworms and other invertebrates separately. Separate SSD for worms and arthropods might be used in the current risk assessment (assuming data is not a limitation), for example to refine earthworm and Collembola toxicity-exposure ratios. If so, how would this information be integrated to address the overall protection goal (soil invertebrate communities) ?

Full details in…

Frampton, G.K., Jänsch, S., Scott-Fordsmand, J.J., Römbke, J. & van den Brink, P.J. (in press). Effects of pesticides on soil invertebrates in laboratory studies: A review and analysis using species sensitivity distributions. *Environmental Toxicology and Chemistry* (anticipated publication Sept 2006)

Jänsch, S., Frampton, G.K., Römbke, J., van den Brink, P.J. & Scott-Fordsmand, J.J. (in press). Effects of pesticides on soil invertebrates in model ecosystem and field studies: a review and comparison with laboratory toxicity data. *Environmental Toxicology and Chemistry* (anticipated publication Sept 2006)

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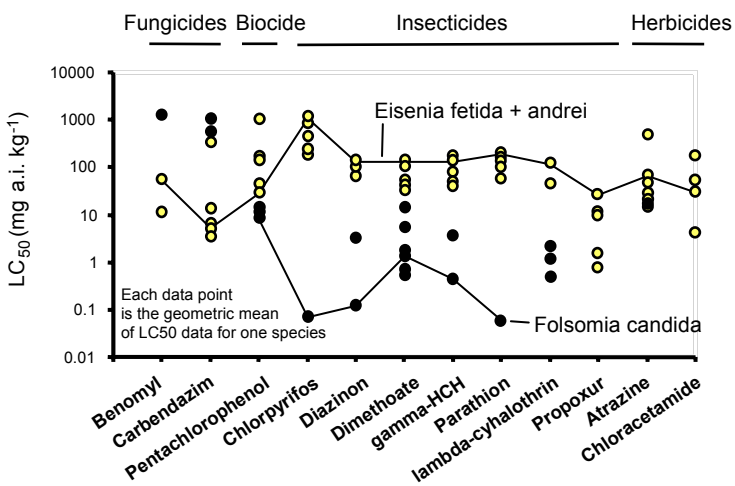

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