

NRP Endocrine Disruptors

Final Summary

Original project title Endocrine disruption in soil invertebrates: assessing multigeneration effects and developing a proteomic biomarker approach
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Project number 4050-66591

Impact of endocrine disruptors on soil invertebrates

Soil invertebrates play an important role for the function and fertility of a soil. This project focuses on the effect of endocrine disrupting insecticides on collembola (springtails) and on their impact on the protein pattern of the organisms.

Research questions

Research in the area of endocrine disruption is mainly focused on vertebrates or aquatic invertebrates. Although the soil constitutes an essential resource of our environment very little is done in this field. Many of the pollutants and natural chemicals produced and emitted end up in the soil. Here they can have an impact on soil organisms, which are essential to maintain fertility and functioning of the soil. An increasing need exists for methods to assess the side effects of these chemicals on soil ecosystems and to evaluate their endocrine disrupting potential on soil invertebrates. In this project we worked with two collembola species: *Folsomia candida* (parthenogenic reproduction) and *Folsomia fimetaria* (sexual reproduction) which don't have the same endocrine system as vertebrates.

In the first part of this project we looked at the effect of pesticides on the reproduction of the springtails. The chosen insecticides are known for interacting with insect hormones. The aim was to define the toxic levels of these insecticides, to elucidate the way they act and to look at their effect on several generations of springtails.

In the second part we focused on subtle changes inside the organisms by looking at protein patterns. The aim was to find a biomarker, a protein that could indicate an effect on the hormone system before this effect is visible in terms of reproduction.

Results

We discovered that some of the tested insecticides have an effect on *Folsomia candida* at concentrations which can potentially occur in the environment. Another astonishing finding was that this effect is transferred into the next generation. So even if the second generation of springtails is not exposed to the insecticide, an effect on its reproduction can be observed with some of the tested insecticides. The multigenerational test protocol which we developed can be used in the future as starting point to characterize the effects of potential endocrine disruptor compounds in collembola or in other invertebrates.

We were able to establish the protein pattern of *Folsomia candida* and to identify some of the proteins. A toxicoproteomic approach was applied, which means that we looked at the protein pattern of the collembola before and after an exposure to the chosen insecticides. However, only small changes in protein pattern were observed after an exposure, and it was not possible to identify the proteins which were induced or repressed compared to the control. We then developed a more sensitive method involving radiolabeling of the collembola, and this method shows first promising results.

Perspectives

The project continues under the direction of Dr. Kristin Becker van Slooten (EPFL). As mentioned above, work on radiolabelling is ongoing in collaboration with Prof. Emanuela Felley-Bosco (University of Lausanne). Furthermore, the effect of IGR on the sex ratio of *Folsomia fimetaria* is studied and first attempts are made to look at bioaccumulation of pesticides in collembola.