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Snapshot from SoilMan project

Suppression of plant pathogens and detoxification by soil biota – belowground support for healthy arable soils

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Sustainable arable management promotes soil biodiversity and offers the potential to optimize benefits from functions and ecosystem services, fulfilled and provided by soil biota. To adapt agricultural activity to current demands while ensuring a sustainable agricultural production, knowledge of management impacts on the ecosystem service/disservice balance and the self-regulation of soils is essential. In this context, it is known, that the reduction of soil tillage intensity and the application of mulching techniques, on the one hand, promote the survival of soil borne, mycotoxin-producing plant pathogenic fungi aboveground, but on the other hand, enhance the diversity of antagonistic, fungivorous and mycotoxin-degrading soil biota. However, so far the resulting ecosystem service/disservice balance and involved self-regulation mechanisms are still unclear.

To analyse and assess the role of fungivorous decomposer key species (earthworms: *Lumbricus terrestris*, collembolans: *Proisotoma minuta,* enchytraeids: *Enchytraeus crypticus* and *E. christenseni)* during bioregulation of economically important plant pathogenic fungi (*Fusarium*) and degradation of their mycotoxins (deoxynivalenol (DON), zearalenone (ZEN), 3-acetyl-deoxynivalenol (3-AcDON) and fumonisin B1 (FB1)), mesocosm field studies in Germany (loam soil) and Romania (clay soil) as well as microcosm laboratory studies were conducted as part of the SoilMan project.

In the context of the detoxification of *Fusarium* mycotoxins, it is hypothesised that
(1) fungivorous soil faunal key species and their interactions regulate and control the mycotoxin degradation in crop residues,
(2) degradation rates differ between mycotoxins depending on substrate size and soil texture,
(3) leaching of mycotoxins represents a potential risk to arable soils.

The results reflect that fungivorous soil faunal key species significantly enhance degradation rates of mycotoxins by up to 300%. The detoxification potential of primary decomposers (earthworms) is higher as compared to that of secondary decomposers (collembolans, enchytraeids). Degradation rates differ depending on respective mycotoxin and soil conditions

but are independent of substrate size. Moreover, mycotoxins leach from infected crop residues. Whereas some of them enter the soil water and can potentially reach the ground water (DON), the fate of others is, so far, unclear (ZEN).
The present study contributes to a deeper understanding of the interrelationship between soil management and the ecosystem service/disservice balance.