



Natural bioregulators - suppression of plant pathogens and detoxification by soil biota

Christine van Capelle (1), Friederike Meyer-Wolfarth (2), Torsten Meiners (3), Mignon Sandor (4), and Stefan Schrader (1)

(1) Johann Heinrich von Thünen Institute, Institute of Biodiversity, Braunschweig, Germany (christine.vancapelle@thuenen.de), (2) Julius Kühn-Institute, Institute for Plant Protection in Field Crops and Grassland, Braunschweig, Germany, (3) Julius Kühn-Institute, Institute for Ecological Chemistry, Plant Analysis and Stored Product Protection, Berlin, Germany, (4) University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture, Cluj-Napoca, Romania

Today's arable soils are exposed to numerous threats derived from intensive cultivation accompanied by global climate change. Soil degradation and loss of biodiversity, on the one hand, but predicted improved conditions for several plant pathogens, on the other hand, are, therefore, continuous key issues in agricultural production. Farmers have to face the challenge of ensuring the provision of arable products while dealing with increased plant disease incidence and, at the same time, preserving soil biodiversity, health, fertility and resilience for future agriculture.

In order to adapt management practices to these demands, the reduction of tillage intensity and the application of mulching techniques have become more popular over the last decades. However, this technique has the potential to promote both, the provision of ecosystem services but as well of disservices by soil biota. Crop residues improve the survival of certain soil-borne plant pathogens, in particular fungi, potentially leading to increased infection rates of following crops and higher levels of toxic contaminants in crop products and residues. At the same time, soil biodiversity belowground is promoted, including various fungivorous species, which, in turn, act as fungal antagonists and can contribute to mycotoxin degradation. Fungal feeders, thus, represent bioregulators, which play an important role in the natural self-regulation system of soils. However, so far, our understanding of self-regulation including the contribution of beneficial species, functional groups and interactions is still limited. The present study contributes to a deeper understanding of the interrelationship between soil management and the ecosystem service/disservice balance.

With regard to European arable soils, *Fusarium* species are a main cause of increased plant disease incidence and mycotoxin contamination. To assess the biocontrol-impact of different fungivorous soil faunal species on the fungal plant pathogen *Fusarium graminearum* and the degradation of its mycotoxins deoxynivalenol (DON), zearalenone (ZEN), 3-Acetyl-DON and Fumonisin B1, field and laboratory studies were conducted within the EU project Soil-Man.

The antagonistic potential of common, abundant and directly or indirectly fungal feeding species was analysed: *Lumbricus terrestris* (earthworms), *Proisotoma minuta* (collembolans) as well as *Enchytraeus crypticus* and *E. christenseni* (enchytraeids). They all are involved in the provision of a wide range of ecosystem services. To assess impacts of substrate size and soil conditions, two size classes of artificially infected maize stubbles were added to soils of different texture. A leaching experiment was carried out to assess whether mycotoxins can be leached from plant residues. After an experimental time span of 6 weeks, samples of maize stubbles, soil and leaching water were analysed for mycotoxin occurrence via liquid chromatography coupled to high-resolution mass spectrometry (LC-HRMS).

In the context of pathogen suppression and detoxification of mycotoxins by fungivorous soil organisms it is hypothesised that biocontrol potentials of soil biota (1) are induced and directed by abundance, activity and interactions of functional groups and species in the soil fauna community; (2) differ depending on residue size and soil texture.