Increase of plant resistance with rhizosphere competent entomopathogenic fungi (EPF)

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Background

Entomopathogenic fungi are able to kill insects and are as such a potential mean for pest control. Recently it was discovered that these fungi can also colonize plant roots. Most previous work with EPF has ignored the habitat preferences and survival of the fungus outside of the host. It is possible that factors associated with fungal biology outside of the host are more important when selecting an isolate than how pathogenic it is against a particular host in a laboratory bioassay.

Objective

Practical Q: What is the role of rhizosphere competent EPF in regulating pest populations and how can we use and implement this for more effective microbial control programs? Scientific Q: Do plants benefit from the association? Is the `bodyguard` concept relevant in soil? What mechanism? Have different phylogenetic groups different strategies in association with plants? What triggers the change from endophytic (mycelium) to parasitic (spores) stage? Aboveground?

Introduction

We have isolated several EPF from plant-roots in natural habitats and tested on virulence for a range of insects. A small selection is now studied for rhizosphere competence. Study on defence mechanisms (direct infect+kill, toxicants, induced or indirect defence, multitrophic relations) in conjunction with Universities is needed to make progress on the fundamental aspects.

Figure 1. The grubs of the cockchafer (*Melolontha melolontha*) are damaging grassfields and ornamental tree production in large parts of Europe

Results

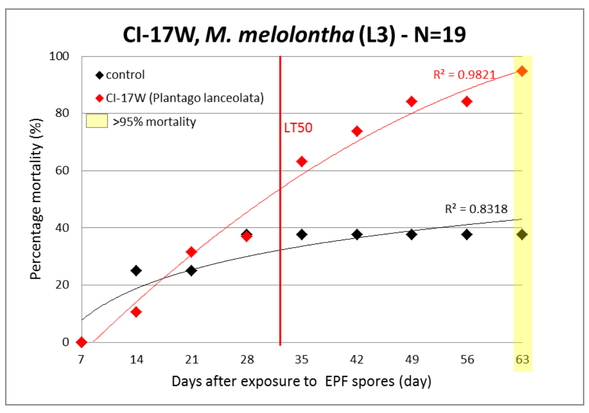


Figure 2. Several EPF isolated from plant-roots show high virulence for several soil insect species.

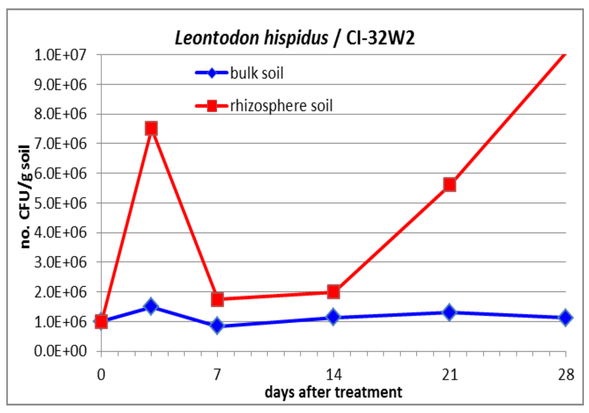


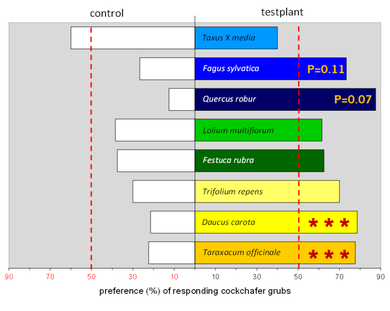
Figure 3. First tests show that some of these isolated EPF strains perform well in the rhizosphere of the plants from which isolated.

The percentage of plants with EPF was higher in the extensively managed meadows (76%) than in the more intensively managed meadows (46%). So far 14 isolates of the 64 found are identified and tested of which two show high virulence for several soil insects.

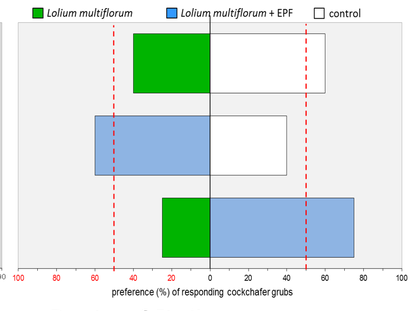
Results

- An olfactometer was developed to study the behaviour of *M. melolontha* grubs.
- Although polyphagous not all plants were olfactory attractive.
- Two-choice tests showed high preference for dandelion and wild carrot and strong repellence for common tansy.
- The non-attractive Italian ryegrass (*L. multiflorum*) when inoculated with an EPF became attractive for the grubs.

An olfactometer for soil insects. Gauze prevents contact of the grubs with the plant-roots.



Olfactory attraction of *M. melolontha* grubs to several plant species.



Roots of Italian ryegrass with EPF turned olfactory attractive for the grubs.

Results

Headspace collection from the roots of the attractive dandelion and wild carrot, the repellent common tansy and the non-attractive ryegrass showed different odour profiles. Analysing and comparing attraction of the grubs to some of the typical plant-species related odours may elucidate the components involved in grubs' olfactory choices

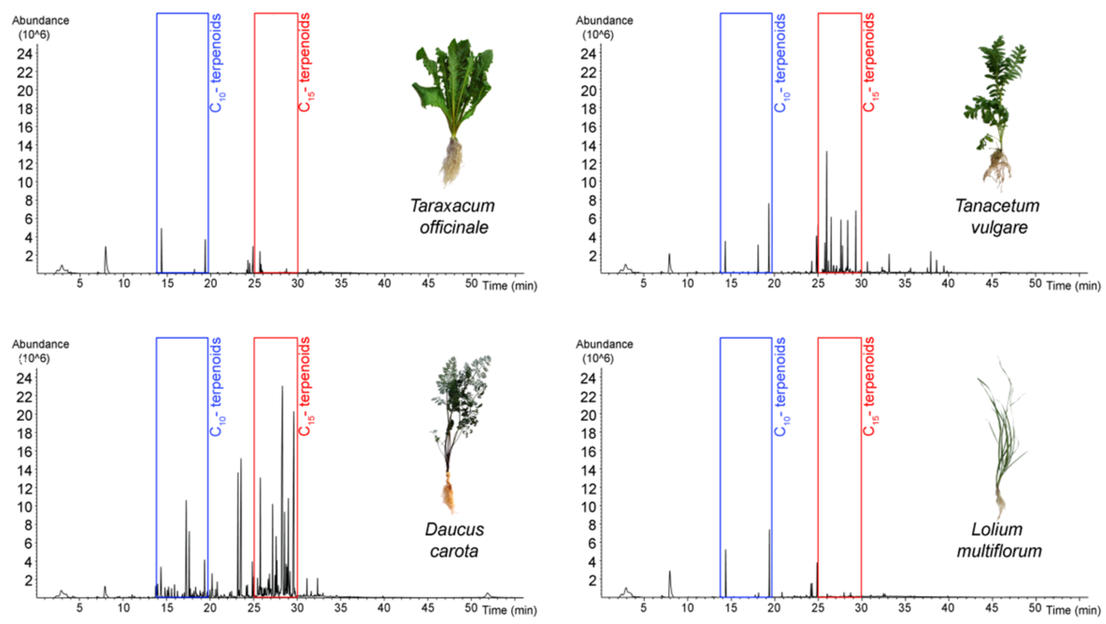


Figure 4. Headspace profile of roots from *T. officinale* (dandelion), *D. carota* (wild carrot), *T. vulgare* (common tansy) and *L. multiflorum* (Italian ryegrass). Elisabeth Eilers, MPI Jena

Conclusions

- Rhizosphere competent EPF with high virulence for soil insects are found. The relation between plant and EPF is still to be determined.
- Olfactory behaviour of cockchafer grubs indicate the existence of a tritrophic relation between plant-roots, EPF and soil insect.

Acknowledgements

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