

## Effects of organic farming on populations of insect pathogenic fungi in the soil environment (project 3)

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The objectives of the PhD project are to investigate:

- Genetic diversity and population structure of insect pathogenic fungi in the soil environment of conventionally and organically grown plots in an experimental vegetable cropping system
- Survival and activity of insect pathogenic fungi in soil from conventional and organic vegetable cropping systems
- Links between the genetic groups of insect pathogenic fungi prevalent freely in soil and as infections in insect associated with selected crop plants

Regulation of pest populations by natural enemies is one of the ecological mechanisms in nature that should be accommodated by organic farming. Fungal pathogens are among the natural enemies which regulate insect populations. A significant part of the life cycle of insect pathogenic fungi occurs in the soil of agricultural fields as well as more natural habitats (Meyling & Eilenberg 2007). Knowledge is still lacking about the activity of the fungi while in the soil environment and how agricultural practices affect the population structures of these fungi in the soil. There is also a limited knowledge of the links between the reservoir of insect pathogenic fungi in the soil and the populations of insects living within and above the soil environment.

In the DARCOF III project VegQure (Organic Cropping Systems for Vegetable Production: Product Quality, Natural Regulation and Environmental Effects) three organic cropping systems and a conventional control system have been farmed for production of vegetables since 2006 (about VegQure: [www.veggure.elr.dk](http://www.veggure.elr.dk) and [www.darcof.dk/research/darcofiii/leaflets/VegQure1.pdf](http://www.darcof.dk/research/darcofiii/leaflets/VegQure1.pdf)). The VegQure system includes organic farming practices of varying degrees of sustainability including one system with naturalized elements within the cropping system. As a reference, VegQure also includes a conventional cropping system. The experimental cropping system will create basis for field collections of samples for isolation of insect pathogenic fungi in organically and conventionally farmed plots. A driver's license will be necessary to travel to and from the field site. Isolation and characterization of fungal populations as well as controlled experiments will be carried out in laboratory facilities.

Newly developed specific DNA-based methods have revealed that some taxa of insect pathogenic fungi contain much genetic diversity globally (Rehner & Buckley 2005). Much diversity is found also at local scale, however, within agroecosystems the bulk of diversity appear to be contained in more natural habitats such as hedgerows (Meyling & Eilenberg 2007). Knowledge is not available of how organic farming practices affect genetic composition of the populations of insect pathogenic fungi in agroecosystems and to which degree natural elements in fields can enhance genetic diversity. This can, however, be investigated in the VegQure system. The development of microsatellite markers for several groups of insect pathogenic fungi (Rehner & Buckley 2003; Enkerli et al. 2005) further makes it possible to study the population structure of the fungi in detail. In part, the fungal populations will be characterized in collaboration with Dr. Jürg Enkerli, Zürich, Switzerland. Molecular markers will also be used to establish links between fungal pathogens isolated from the soil and as infections in insects. Interactions that the characterizations suggest to occur can then be investigated in laboratory experiments involving soil, fungi and insects from the VegQure system. The PhD project thus aims to include the most novel molecular tools to study the effects of organic farming systems on the naturally occurring populations of insect pathogenic fungi in the agroecosystem of VegQure and the interactions between the fungi and their insect hosts.

### References

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