Sektion 46
Biologischer Pflanzenschutz III

46-1 - Optimierung nachhaltiger entomopathogener Pilze durch wirksame formulierung zur Überwindung von Umweltstress

Optimization of sustainable entomopathogenic fungi by effective formulation to overcome environmental stress

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Currently, sustainability in agroecosystem by developing microbial-based insecticides in both agricultural land and forest has been receiving interest worldwide. The main goal of the bilateral project "Bio-Entosource" is to study the biodiversity of entomopathogenic fungi (EPF) in order to develop new conceptual strategies for a biological pesticide for sustainable use in agriculture and forestry. The scientific cooperation between Germany and Brazil serves to validate the optimization of EPP in interaction with harmful insects in apple, soybean and eucalyptus in two different ecoclimatic zones.

About 45 new EPF have been isolated from soil samples of organic apple orchard by using insect Bait-method. These new EPF serves as the research basis for the various experiments regard to their functional biodiversity. Consequently, standardized pathogenicity assay, agar-chitin plate assay and influence of 7 different temperature experiment have been carried out to select potential EPF. The aim of these tests is to gain an appropriate understanding in order to overcome the limiting factors of in-field environmental stress such as UV radiation, drought, rain etc. In this regard, bilaterally used model system soy, white flies (*Bemisia tabacii*, *Trialeurodes vaporariorum*) and, in the perennial system, apple codling moth (*Cydia pomonella*) have been examined.

Depending on the fungal strain, various procedural measures have been carried out to optimize the biological effectiveness of the EPP. For this purpose, various factors such as media composition, oxygen concentration, pH value and temperature are being examined through liquid fermentation. Biological efficiency of potential EPF (JKI-BI 1496) is now being evaluated through several experiments of production and formulation with different media composition consist of polysaccharides (0.5% and 1% chitin, chitosan and colloidal chitin) to achieve the potential efficacy against *Cydia pomonella.* Later on, with the selected EPF, several environmental conditions (temperature, humidity, CO2, UV spectra) will be simulated and modulated under standardized conditions using a UV environmental simulator. Various natural UV-protectants (lignin alkali, humic acid, sesame oil and green tea) will be experimented to prolong the persistence of EPF spores exposed to UV radiation not only in the laboratory, but also in the field. These findings serve as the basis for enhancing the efficacy of EPF treatments that maintain their good biological activity even in complex agro-ecosystems.

A suitable formulation is also to be found that stabilizes the EPF product in order to ensure its effectiveness under various environmental conditions for a defined period. In addition, these findings can be used to better estimate the consequences of climate change.

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46-2 - A split-root setup to study local and systemic interactions between rhizospheric entomopathogenic fungi and oilseed rape pests and diseases

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Interactions of plants with beneficial fungi can decrease the damage produced by pests and diseases. The beneficial effects of such interactions can be due to direct effects of the fungus against the pathogen or pest, such as competition, antibiosis or pathogenesis or they may be indirect by inducing a systemic response in the plant. We established a split-root system in oilseed rape plants to differentiate local from systemic effects of the entomopathogenic fungus *Metarhizium brunneum*, a known insect pathogen and plant endophyte, against the root cabbage fly, *Delia radicum,* and the fungal plant disease *Verticillium longisporum*. We were able to obtain plants that developed two similar root systems in each compartment and successfully established *M. brunneum* in one of the compartments. The entomopathogen *M. brunneum* did not grow endophytically into non-inoculated roots of the split-root system as shown by PCR. There was a significant mortality of larvae and pupae of *D. radicum* in the inoculated compartment (32%), together with a 15% reduction in the root damage. In the induced compartment, there was a reduction in larvae-pupae survival (16%) and root damage (9%) although not statistically significant. Therefore, detrimental effects of *M. brunneum* on *D. radicum* are probably due to direct infection by the fungus and plant-mediated effects, if present, should act only on a local scale. We are currently evaluating if there are systemic effects in the interaction of the oilseed rape plant with *M. brunneum* against *V. longisporum*, and the results will be presented.

46-3 - Kombinierter Einsatz von zwei *Metarhizium*-Isolaten für eine verbesserte Wirksamkeit gegen die Drahtwurmarten *Agriotes obscurus*, *Agriotes sputator* und *Agriotes lineatus*

Combined use of two Metarhizium-isolates for improved effectiveness against the wireworm species Agriotes obscurus, Agriotes sputator and Agriotes lineatus

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Die bodenlebenden Drahtwurmarten *Agriotes obscurus*, *Agriotes sputator* und *Agriotes lineatus* zählen zu den bedeutsamsten Kartoffelschädlingen in Deutschland. Der Fraß der Schnellkäfer-Larven beeinträchtigt die Qualität des Ernteguts und bietet Eintrittsstellen für Phytopathogene. Fruchtfolge und Bodenbearbeitung können eine Drahtwurmpopulation nur langsam reduzieren und ein regulär zugelassenes Pflanzenschutzmittel steht nicht zur Verfügung.

Das Projekt „AgriMet“ beschäftigt sich mit der Entwicklung einer Bekämpfungsstrategie gegen Drahtwürmer auf der Basis eines Bodengranulates und einer spritzbaren Formulierung des insektenpathogenen Pilzes *Metarhizium brunneum*. Die Formulierungen werden bei der Kartoffelpflanzung ausgebracht und sollen durch die Reduzierung der Drahtwurmpopulation den Anteil an unbeschädigten Kartoffeln zur Ernte steigern. Die Wirksamkeit der genannten Formulierungen war nach der Applikation in praxisnahen Feldversuchen allerdings gering und schwankte zwischen den drei Versuchsjahren.

Die Wirksamkeitsprüfung der Formulierungen im Labor hat gezeigt, dass sich die Drahtwurmarten *A. obscurus*, *A. sputator* und *A. lineatus* in ihrer Anfälligkeit gegenüber dem für die Formulierungen verwendeten *M. brunneum*-Isolat JKI-BI-1450 deutlich unterscheiden. Auf Grund der diversen Artenzusammensetzung im Freiland ist die Wirksamkeit der Formulierungen gegen mehrere Drahtwurmarten Voraussetzung für eine erfolgreiche Bekämpfungsstrategie.

In einer Versuchsreihe wurde getestet, ob der kombinierte Einsatz von zwei *Metarhizium*-Isolaten ein breiteres Drahtwurmartenspektrum abdecken kann. Dazu wurde in einem Laborversuch die letale Konzentration (LC_{50}) und letale Zeit (LT_{50}) der Isolate einzeln und kombiniert verglichen. Bestätigt der kombinierte Einsatz eine verbesserte Wirksamkeit, steht ein weiterer Baustein für die Bekämpfung von Drahtwürmern mit dem insektenpathogenen Pilz *Metarhizium* spp. zur Verfügung.