



BIOCOMES

New biological control products
for sustainable farming and forestry

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New antagonists for powdery mildew control in cereals

Introduction

Wheat, barley, rye and triticale are grown on 44,146,000 ha in the EU. Powdery mildew is a key fungal disease in these crops. Powdery mildew is regularly controlled with single or multiple applications of specific mildew or broad-spectrum fungicides across Europe. The powdery mildew pathogen *Blumeria graminis* developed resistance to a range of fungicides. Biological control of powdery mildews is a relatively unexplored area. Compared to other major groups of diseases, limited systematic screenings for potential antagonists of powdery mildews have been carried out. No BCA is registered for control of powdery mildew in cereals in the EU. BIOCOMES develops a new BCA for control of powdery mildew in cereals.

Approach

One of the objectives of BIOCOMES is to develop a new microbial biological control agent (BCA) for spray applications for control of powdery mildew in wheat and other small grain cereals. BIOCOMES follows an approach of stepwise screening. Such a development of a new BCA requires screening of a high number of candidate antagonists. Antagonists for commercial use have to meet many different requirements. Important aspects such as efficacy, cost-effectiveness, production costs, ecological characteristics, product quality, applicability for the end-user and protection of IP are considered in a cost effective and fast screening program. The superior isolates and formulations are selected for further market implementation with protected IP. Assessments of economic and environmental sustainability and risk assessments support all essential decisions during the entire development to ensure that robust solutions are being developed. This approach applies the following major steps:

- To build a collection of fungal isolates from powdery mildew pustules as candidate antagonists;
- To select potential candidates using high throughput screening systems and data-mining;
- To select antagonists with high efficacy against powdery mildew and suitable characteristics as regards mass production and product formulation;
- To develop a pilot product based on newly selected fungal antagonists for tests in multiple field trials;
- To determine the mode of action of the new antagonists for further optimization of applications.



Application of antagonists in experimental field plots.

Results

More than 1,200 fungal isolates were obtained from powdery mildew pustules collected in different European regions. Isolates representing 120 different OTUs (operational taxonomic unit) were screened for important ecological characteristics such as spore production, cold tolerance, drought tolerance and UV-B resistance using high throughput screening methods. Information available in databases was used for first risks assessments. Isolates belonging to 25 OTUs with known pathogens to humans, animals or plants or known mycotoxin producers were excluded. Isolates able to grow at 36°C were also excluded. 185 isolates fulfilling all tested selection criteria were tested in bioassays on wheat plants. Their effect on conidia production of *Blumeria graminis* f.sp. *tritici* was quantified. The best ten isolates were subsequently tested in the open field on potted spring wheat plants and small field plots in a spring wheat crop. Isolates belonging to two different species significantly reduced the number of conidia of the powdery mildew pathogen. The modes of action of selected isolates have been investigated. A series of field experiments in the last project year gave first promising results for two antagonist isolates. However, due to technical difficulties, final conclusive results under field conditions could not yet be obtained.

Next steps

After BIOCOTES, the potential of the acquired efficient antagonistic isolates will further be evaluated. Investments will be made in upscaling production, formulation and shelf life studies, complemented by broader field testing. This will allow a solid evaluation of economics and decisions on market introduction of the new BCA.



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