

## Mycotoxins and fungal pathogens CONTrol by ACTinomycetes

Mycotoxins and fungal pathogens CONTrol by ACTinomycetes - Potentialities of actinomycetes from soils for the development of novel biocontrol products to manage cereals fungal diseases and mycotoxins risk

## ABSTRACT

Cereals represent the primary calory intake around the globe. To ensure sufficient access and yield to these resources, but also their innocuity, is of outstanding importance for the future. The fungal pathogens of cereals represent a major risk and lead to various issues such as yield loss, but also to the apparition of harmful molecules such as mycotoxins, from the field to the storage. Until now, the main solution for the control of moulds are the application of fungicides. However, misuse and excessive use of these fungicides can lead to environmental pollution, pesticide resistance, and public health concerns. As a consequence, agricultural policies aims are more and more directed towards the promotion of alternative technologies/strategies development for the management of pests and diseases. One of these alternative strategies is the use of agroecological concepts such as biocontrol of plant pathogens or pests by microorganisms which are naturally present in the soil ecosystems. Among these soil inhabitants, actinomycetes bacteria show some of the most promising features for the biocontrol applications. Carrying a large toolbox of molecules of interests (e.g. enzymes, active metabolites such as antibiotics) that allow them to settle in the soil environment, they are also able to interact directly with the plant (endophytic habitat, plant growth promoting traits). If they have been thoroughly studied for their secondary metabolites production (i.e. antibiotics), their use as biocontrol agents is increasingly considered, but only a scarce number of products is available on the market. Their ability to inhibit the growth of filamentous fungi has been largely documented in vitro and showed some promising applications for the control of phytopathogens and mycotoxigenic moulds. Unfortunately, there is still a lack of studies performing in planta or field tests, and most studies are limited to the in vitro characterization of actinomycetes isolates, hampering the potential development as biocontrol agents. The main objective of this project is to propose a global approach to evaluate the potential of actinomycetes isolates for the control of wheat fungal diseases from in vitro testing till in plantaefficacy. Moreover, the identification of active metabolites will provide useful information about the mechanisms of inhibition, but will also offer the opportunity to discover new molecules of interest. This project gathers four complementary research teams from UMR Qualisud, UMR BGPI, and TUB (Germany) to build a pluridisciplinary consortium able to answer the whole problematic.



This consortium is composed of microbiologists, molecular biologists, phytopathologists, biochemists and chemists, all expert in their domains. This multidisciplinary collaboration will allow to perform competitive and high quality research for the development of biocontrol solution based on actinomycetes action.

Keywords : Pathogens mycotoxins, Cereals, Actinomycetes, France, Biocontrol fungal

Year : 2016 Project number : 1605-052 Type of funding : AAP OS Project type : AAP Research units in the network : BGPI-PHIM Start date : 2017-09-01 End date : 2019-12-31 Flagship project : no

Project leader : Sabine Galindo Project leader's institution : UM Project leader's RU : QUALISUD

Budget allocated : 126000 € Total budget allocated ( including co-financing) : 126000 € Funding : Labex

## GOAL

The main objective of this project is to propose a global approach to evaluate the potential of actinomycetes isolates for the control of wheat fungal diseases from in vitro testing till in planta efficacy. Moreover, the identification of active metabolites will provide useful information about the mechanisms of inhibition, but will also offer the opportunity to discover new molecules of interest. This project gathers four complementary research teams from UMR Qualisud, UMR BGPI, and TUB (Germany) to build a pluridisciplinary consortium able to answer the whole problematic. This consortium is composed of microbiologists, molecular biologists, phytopathologists, biochemists and chemists, all expert in their domains. This multidisciplinary collaboration will allow to perform competitive and high quality research for the development of biocontrol solution based on actinomycetes action.

## ACTION

The overall approach will consist in the selection of actinomycetes strains previously isolated by UMR Qualisud. In accordance with the convention on biological diversity (Nagoya Protocol) and to facilitate their putative industrial applications, all actinomycetes strains used in this project were isolated in France.

Two main applications will be considered for the valorization of the strains: their potential as biocontrol agents and/or as producers of new metabolites of interest. Strains will be selected on the basis of in vitro and in silicocriteria to reduce the number of studied strains to the most promising ones regarding:

-their antagonist activity against the selected toxigenic and phythopathogenic fungi (direct confrontation and Cell-Free Extracts CFEs);

-their enzymatic activities that could reflect a potential to degrade fungi cell wall, but also to grow on poor substrates such as residuals and wastes from agriculture (lignocellulosic residues from beetroots, grape pellicles, coffee pulps...);

-Their technological properties (growth yield, sporulation, dehydration)

-Their ability to colonize the rhizosphere, to ensure a sustainable effect (endophyte capacity).

-Their potential as plant growth promoters (PGPR) mostly through in vitroand molecular method analysis Strains selected regarding their in vitro characteristics will then be studied for their in planta activity and



active metabolites fractions.