PRESS RELEASE

An ecological solution against pathogenic fungi

Neuchâtel/Frick, 12 December 2024. **Researchers from University of Neuchâtel, HE-Arc Engineering and FiBL (The Research Institute of Organic Agriculture) have joined forces to develop targeted, sustainable ways of combating soil pathogenic fungi without harming the environment. Supported by a grant for collaborative projects from the Swiss National Science Foundation, their project will start in January 2025 and run for four years, with funding of CHF 1.9 million.**

Fungal pathogens are responsible for 13% of agricultural losses worldwide every year. Synthetic fungicides are the most effective means of combating them, but their main drawbacks are the development of resistance and harmful effects on ecosystems and human health. To avoid these pitfalls, we can turn to alternative control methods available on the market: biofungicides. However, they are still less effective than synthetic fungicides. Particularly in the soil, where the presence of a wide variety of microbes limits their growth, dispersal and action. This is why three researchers from the University of Neuchâtel, HE-Arc Engineering and FiBL are developing an alternative strategy that is more effective against well-defined targets.

Lettuces and endives

The most important pathogen to combat is *Rhizoctonia solani* (also known as bottom rot) infecting lettuces. In a particularly bad season, losses can reach almost 100% of the harvest. 'With the help of the Office Technique Maraîcher (OTM), one of our partners in this project, we have also identified another potential fungal target: *Sclerotinia sclerotiorum*, a disease that affects endives among others,' explains Saskia Bindschedler, a microbiology professor at the University of Neuchâtel (UniNE).

Other target diseases will be added during the course of the project, by consulting vegetable growers in order to better understand their needs and develop formulations to meet them. These exchanges will be organised by FiBL in collaboration with CEDD-Agro-Eco-Clim, a centre promoting sustainability and agroecology in the Arc jurassien region, co-directed by Jérémie Forney, an agroecology professor at the UniNE.

Alginate and chitosan microcapsules

In practice, the beneficial bacteria, in association with a fungus-highway, are enclosed in a microcapsule, which allows for their preservation until both are delivered to their target environment. Once in the soil, the fungus will be able to break the barrier of the microcapsule and spread its hyphae, creating a bridge for the bacteria to actively reach their target.

The microencapsulation will be carried out by the group led by Alexandra Kämpfer-Homsy, a professor at HE-Arc Ingénierie, using totally natural materials. 'We are going to develop a device that will trap the bacteria-fungi in microdroplets of alginate, a natural gel,' explains the microfluidics specialist. These droplets will then be encapsulated in chitosan, a substance derived from chitin, the main component of e.g. shrimp shells'. The main challenge will then be to improve the reliability of the process and then increase the production volume so that the formulation can be industrialised in the future.

Effective combinations

At UniNE, the team led by Saskia Bindschedler will be tasked with isolating effective fungus-bacteria combinations. 'By effective, we of course mean an ability to inhibit the growth of the target fungal pathogen, an absence of antagonistic interactions between the two types of organism, an ability to interact as fungal highways and, finally, characteristics that are beneficial for the growth of the plants to be protected', explains the biology professor. Another important role will be to check the environmental safety of the process. In other words, ensuring that the inoculated bacteria and fungus, by colonising the roots of the plant to be protected, never take over from the rest of the microbial community.

Finally, the project will enter an application phase, in which FiBL's expertise will be called upon. Natacha Bodenhausen, a soil science researcher, will use pot and field experiments to test the effectiveness of the beneficial microbes against pathogenic fungi, with the help of the OTM and the Fondation rurale interjurassienne (FRI). Then, once the microcapsules have been inoculated in the field, the institute will carry out genetic monitoring of the microbial communities that develop around the roots of the plants to be protected, to ensure that the environment not targeted by the remedy is well preserved.

More

The project on SNF-website : https://data.snf.ch/grants/grant/10002724

Contacts :

***Prof. Saskia Bindschedler**, Laboratory of Microbiology, UniNE*
Tél. +41 32 718 22 52 ; saskia.bindschedler@unine.ch

***Prof. Alexandra Kämpfer-Homsy**, Medical Devices Competence Group,*
HE-Arc Ingénierie – University of Applied Sciences Western Switzerland (HES-SO)
Tél. +41 32 930 25 53 ; alexandra.kaempfer-homsy@he-arc.ch

***Dr. Natacha Bodenhausen**, Nutrient Management & Symbiosis,*
Department of Soil Sciences, FiBL
Tél. +41 62 865 72 99 ; natacha.bodenhausen@fibl.org