An effective and environmentally friendly solution to control fire blight disease caused by Erwinia amylovora in pome fruit crops

Reporting

Project Information

PhageFire

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Project website

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Project closed

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Spain

Periodic Reporting for period 3 - PhageFire (An effective and environmentally friendly solution to control fire blight disease caused by Erwinia amylovora in pome fruit crops)

Reporting period: 2022-08-01 to 2024-03-31

Summary of the context and overall objectives of the project

Fire Blight is a devastating disease caused by the bacterium Erwinia amylovora in rosaceous plants. It can provoke yield losses of up to 95%, causing costs of ca. 4,3 - 8,1 M€.
E. amylovora responds poorly to the few available treatments which traditionally include rapid removal of infected branches or cutting the whole tree off, combined with the preventing use of copper-bases pesticides and antibiotic sprays. However, first approach causes significant financial losses and the use of copper-based pesticides is limited. Additionally, antibiotics are forbidden in the EU because of the development of antibiotic-resistant bacteria and its limited efficiency.
Coming from the clear need to improve control strategies of this disease, Bacteriophages are natural viruses which exclusively prey on pathogenic bacteria. They are harmless for humans and the environment. Therefore, they are a promising treatment option to prevent infections by E. amylovora.
So, PhageFire, being a phage-based pesticides, will suppose one step towards a real and effective solution against Fire Blight that will enhance significantly the quality, productivity and competitiveness of the fruit sector

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

PhageFire project was finalized in March 2024 with all tasks accomplished. In second period the consortium had already tested in field a first formulation and in the last period, results from the in-field tests performed in the second campaign have been analyzed. In addition, our knowledge of the phages has been enlarged; therefore, the final phages cocktail has changed to make PhageFire product even more aggressive against E. Amylova.
Once final selection of phages to be in the cocktail was agreed propagation methodologies to multiply the different components of the cocktail and production parameters were determined to have the most efficient production set-up.
Final aim of the consortium is to launch PhageFire into the market due to its potential benefits for pome fruit growers and the sector. However, previous to commercialization the consortium needs to confirm PhageFire environmental and human safety. in that sense, the consortium has performed all necessary studies required by the European regulation in matter of PPP and a dossier to apply for the emergency use authorization in different MS has been prepared and is now under evaluation.
Selection of the MS was based on market and sales strategy. Finally In order to protect the consortium´s interests a patent has been submitted to EPO.
At the beginning of the project some problems due to cross-contamination during the isolation of phages were faced. These problems resulted in an innovative isolation process, and new phages identified and characterized. Final cocktail includes phages that were compatible with each other during co-infection and that exhibited different receptor specificities and maximal efficacy in vitro.
The first field trials allowed to identify problems with the adjuvants when preparing in-situ the final version of the cocktail to apply in field. This made necessary to re-evaluate the adjuvants, final formulation includes UV-protective agents and surfactants environmental friendly agents.
To perform the in-field trials, it was necessary to get official permits from EU. During the season 2023, permissions were obtained to perform studies in ES, HG, PT, BE, GR and RO

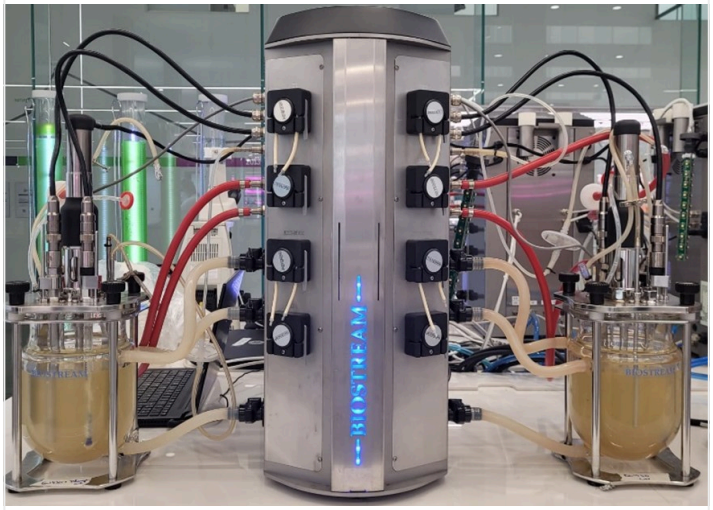
The dossier to get the emergency authorization includes efficacy studies (field trials), environmental and safety risks studies and physical chemical studies. The results of all studies are official since they have been performed under GLP guidelines and are satisfactory in general. All tests confirm efficacy against E. Amylova and safety of the project.
The latest changes on the formulation of the product have affected the work done of the industrial partner since they have to re-define the propagation parameters of the new phages included in the cocktail after first round of field trials in 2022. Things like the temperature, propagation strains, their OD or the MOI need to be adjusted again. Also, adjustments in the culture medium have been applied to improve the stability of the product. During this period the titer of the cocktail regarding the PFU/ml of the phages has improved reaching a peak of 1x10^11PFU/ml in some experience. The product will contain 1x10^11PFU/ml.
All this knowledge needs to be protected. During this period consortium has discussed the best way to protect the results of the project. Different options like trade secret or register trademark were studied but the most suitable option for all partners was a patent application. Finally, an application to the EPO has been submitted. This patent application is extendable to any MS for a period of time of one year. Important work has been also done on the marketing and commercialization plan. A communication campaign aimed at generating new leads and raising awareness of the product was successfully launched during March 2024.

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)

PhageFire project has a “multi- actor approach” character that has connected partners from different fields such as researchers, growers and industry. Therefore, the project has impacted in different parts of the agriculture sector. Phages and phage-therapy knowledge is short and PhageFire work has made its contribution in this field. Researchers will publish scientific papers with their findings on phages. This will be useful for scientists to keep advancing in this technology.
Moreover industry is giving an effective solution against FB to growers that will be natural, environmentally friendly, safe and cost-effective based in a state of the art principle, phage therapy. Finally growers will be able to produce closer to the customers’ demand nowadays since it reduces health risks associated to chemicals toxicity. Growers’ production will be more and healthier.

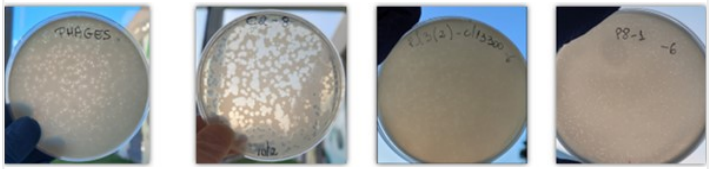
Phagefire kit to apply in-field

PhageFire two components cocktail bottles



One litter fermenters for E. amylovora strains growing

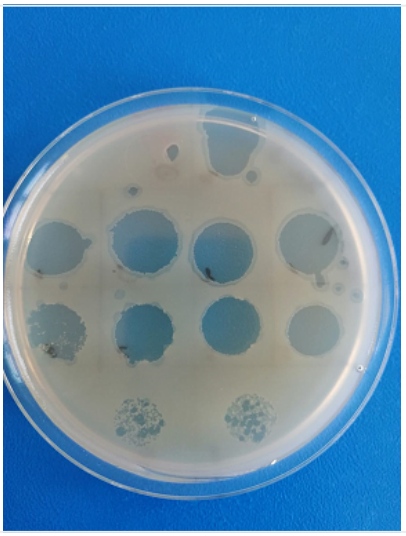
Phages production, lab scale and industrial scale



Phages morphology studies

Applying Phagefire in field

Field tests with PhageFire



Plaque morphlology investigations.

Trees in bloom

Systemic symptoms.

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Permalink: https://cordis.europa.eu/project/id/958645/reporting