

BIOLOGICAL PHEROMONES in fight against pests



What is OLEFINE ?

OLEFINE is a research project funded by the EU Horizon 2020 programme for Research and Innovation. It aims to optimize, scale-up and validate a biotech process for large-scale production and commercialization of high-added-value chemicals (insect pheromones) for use as non-toxic insecticide replacements. The program, which will last 48 months, involves 5 academic and 4 industrial partners.



Technical University
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Nowadays everybody is aware of the toxic effects of the conventional insecticides that are used to protect our plants from pest insects. The insecticides are harmful for the farmer, who sprays them on the field, for the pollinating insects and insecticide residues on fruits and vegetables are harmful for the consumer. But are there other safer ways to protect the plants from insects? Yes, one of most promising methods is mating disruption, where small amounts of sex pheromones are released in the field to prevent the males from finding the females. This way females do not get fertilized and can not lay eggs that develop into larvae destroying the plants. The technology is simple and effective, but until now quite expensive.

The EU-funded project OLEFINE will solve this problem, making pheromones so cheap that they will become an affordable alternative to insecticides. Currently, pheromones are produced by chemical synthesis, which is an expensive and polluting process. The scientists in OLEFINE will use biotechnology instead to produce pheromones at low cost by brewing, in the same way insulin is made for diabetes treatment and enzymes are produced for washing powders.

Instead of using chemical synthesis, researchers copy the insects' biosynthesis into yeast cells and cultivate them. In this way, yeast cells can produce a sex pheromone that is identical to the one that the female insects secrete to attract the males.

OLEFINE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760798. <http://www.olefine.eu/>.

The idea

started shaping when Irina Borodina from DTU-Biosustain got in touch with Dimitris Raptopoulos, of the plant protection company Novagrica, and Maria Konstantopoulou, senior researcher at the NCSR "Demokritos", who emphasized that the high cost of pheromone chemical synthesis was a major barrier for wider application of pheromones in agriculture.

As DTU-Biosustain works with creating cell factories for industrial biotechnology, the next step was to investigate if pheromone production by yeast fermentation would be a better alternative to chemical synthesis.



Pheromones: the fastest growing segment of the biopesticides market!

According to EPA definition, pheromones are volatile chemicals produced by a given species to communicate with other individuals of the same species to affect their behavior.

Sex pheromones are among the most potent stimuli known in terms of sensory perception and precision of the behavioral responses they elicit, and being non-toxic natural products can reduce insecticide load in the environment. The adoption of integrated pest management, the increasing need for sustainable agriculture, limited usage of conventional insecticides, and environmental conservation are expected to improve the current scenario of agricultural practices across the global community. Agricultural pheromones have also advanced toward innovations such as trap designs, types of formulation, and various application methods to provide solutions in terms of managing insect populations without the application of insecticides.

The growing popularity of microencapsulated spray pheromones for their easy applicability, reachability (the required crop height for effective mating disruption), and efficient release rate of technical ingredients are expected to fuel the growth of the market for the next five years. The manufacturers capitalized on advanced studies of different pheromones secreted by major insect pests which can be regarded as effective methods to limit the application of insecticides.



The OLEFINE EU Horizon 2020 project is featured in The Guardian (June 12, 2018)

....Scientists, at the Technical University of Denmark (DTU), are exploring using engineered yeast cells to produce pheromones.

"We aim to produce pheromones by fermentation and it will make the pheromones affordable for the protection of row crops, like maize and soybean," said Dr Borodina. One of the pests her group is targeting is the fall armyworm, which poses a major threat to food security in Africa and elsewhere. "African farmers have tried to treat this pest with insecticides, but it has become resistant. So there is an urgent need for a solution because otherwise people will starve."

Make Society More Sustainable

Irina Borodina is one of the female frontrunners at BioPhero. She and the rest of the team have developed the technology at DTU Biosustain in collaboration with researchers from Lund University in Sweden. BioPhero has received funding from Syddansk Innovation and Novo Seed and Syngenta Ventures.



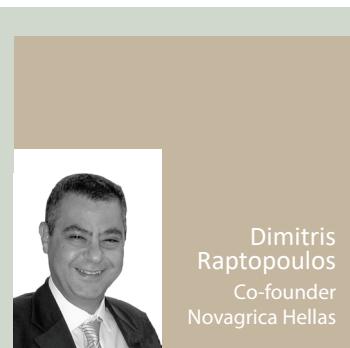
Irina Borodina
Senior Researcher
DTU Biosustain

"Our technology is aimed at producing biological pheromones. The pheromones currently available are chemical-based and expensive to make. This means that they are mainly used to combat pests in high-value organic fruit—e.g. grapes, apples, plums, and citrus fruits. When our technology is fully developed, we hope to be competitively priced with pesticides," she says.

protect soy fields in Brazil from the cotton bollworm, maize in Africa from the fall armyworm and rice paddies in Asia against pests.

"From a biodiversity perspective, it is better to use pheromones than insecticides. Pheromones only work on insects of a given species and do not affect other insects. Insecticides, on the other hand, kill all insects and their natural enemies. The more you spray, the harder it is to maintain a balance in nature", says Dr Borodina.

A new non-toxic technology can prevent harmful insects from multiplying, thus reducing the use of pesticides in agriculture. The idea is to develop pheromone-based products that can be used as a substitute for chemical pesticides to combat pest insects in agriculture. The eco-friendly pest control, which is based on the fermentation of yeast cells, will help create a sustainable agriculture that benefits our health and the environment. Among other things, the technology being developed will help to



Dimitris
Raptopoulos
Co-founder
Novagrica Hellas

The agricultural insect pheromones market is projected to grow exponentially due to factors such as the successful implementation of IPM practices for sustainable agriculture, supportive regulations to encourage their use, and the impact of pheromones on the reduced application of insecticides. Overall, the semiochemicals market has been growing over the last 5 years at a compound annual growth rate (CAGR) over 16%, which is slightly more than the total biopesticide market. The major restraining factors for the agricultural pheromones market are the higher costs of active ingredients and the cost of manual labor. The synthesis of pheromones bio-organically will undoubtedly increase the market opportunities for manufacturers as it will reduce the complex processes involved in chemical synthesis and will bring down the manufacturing costs of the technical ingredients.