PHERA

pheromones for row crop applications

"Pheromones are the next generation of insect control because they work harmoniously with nature, without the environmental disturbance and pest resistance associated with traditional insecticides."

Jean Pierre Princen
President, ISCA Europe

NEWSLETTER **May 2021**

Mating disruption (MD) with sex pheromones is an efficient, safe and environmentally friendly method for pest control instead of using toxic insecticides.[1] By permeating the environment with sex pheromones, it is possible to disrupt the chemical communication between insect males and females, preventing the mating. Most importantly, MD targets specific insect pest species and thus supports the biodiversity, a great advantage in comparison to insecticides.

Multiple MD solutions have been developed in the last four decades, but the commercial MD applications have been limited to the high-value crops, as apples or grapes, due to the high cost of the chemical synthesis of pheromones.

Novel cheaper pheromone production methods are the cornerstone innovation that will enable pheromone use in low-value row crops, as corn, soybean, rice, or cotton. Another important innovation are sprayable slow-release formulations for convenient application of pheromones in row crops.

In OLEFINE and PHERA EU projects, we use biotechnology to produce pheromones via yeast fermentation. Biotechnological production presents several advantages: cheap renewable feedstocks, no need of catalysts, stereoisomers' ratios and major/minor pheromone components' ratios will often be similar to the ones naturally produced in insect pheromones glands.[2]

The majority of the lepidopterans pheromones are 10-18 carbon chain length fatty alcohols, aldehydes or fatty alcohol acetates with one to three double bonds. The insects can produce specific compounds due to the high substrate specificity of the pheromone biosynthetic enzymes. When these enzymes are expressed in yeasts, the yeasts imitate the same biosynthesis process that happens in insect pheromone glands and produce the pheromones of choice.[2]

"BioPhero has developed and scaled the technology for biological manufacturing of pheromones at a record speed. We look forward to delivering the first pheromone to our customers, pheromone formulators, worldwide, and to expanding our pheromone portfolio to enable sustainable pest management in row crops. BioPhero and our partners are guided by the vision to make pheromone-based pest control a mainstream crop protection method, helping growers and AgChem companies to increase productivity in a sustainable way". Kristian Ebbensgaard, CEO of BioPhero.

BioPhero has optimized the production of different pheromones by engineering oleaginous yeast *Yarrowia lipolytica* as a cell factory. The

downstream processing has been developed by BioPhero and BPF and the processes were up-scaled. The following pheromones are available:

- (*Z*)-11-hexadecenal[4], the main pheromone component of the cotton bollworm *Helicoverpa armigera*, rice stem borers *Chilo suppressalis* and *Scirpophaga incertulas*, and the diamondback moth *Plutella xylostella,*
- *(Z)*-11-hexadecenyl acetate, the main pheromone component of the diamondback moth *Plutella xylostella* and the Mediterranean corn borer *Sesamia nonagrioides*, and
- (*Z*)-9-tetradecenyl acetate, the main pheromone component of the fall armyworm *Spodoptera frugiperda*.

In the upcoming season, multiple field trials will be conducted by PHERA partners Novagrica, ISCA Europe, Russell IPM, and SEDQ on different insects in different geographies. The partners will evaluate the performance of fermented pheromones and of their novel formulations.

Cotton Bollworm
[Helicoverpa armigera]

Diamondback Moth
[Plutella xylostella]

Rice Stem Borers
[Chilo suppressalis]
[Scirpophaga Incertulas]

Fall Armyworm
[Spodoptera frugiperda]

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Acknowledgements

PHERA project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 886662.

Project partners: