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Sustainable bio-production of insect pheromones and their precursors

OBJECTIVE

Insect sex pheromones are a sustainable alternative to conventional pesticides, whose use is being progressively restricted by European legislation due to sustainability concerns. Pheromones are being successfully employed in pest management for detection, population monitoring and control methods. Chemical synthesis is currently the only industrial approach for pheromone manufacturing. This project will make use of synthetic biology tools in combination with transcriptomic analysis and bioinformatics to identify biosynthesis enzymes that facilitate the biomanufacturing of pheromones, as well as related chemical structures recently discovered in autochthonous plant species from which pheromone chemical synthesis can be easily and affordably undertaken in few steps. The new enzymes will be refactored in a bioengineered yeast chassis optimized for monoterpenoid production. Selected yeast strains will be upscaled for pilot production, and extraction protocols for monoterpenoid products will be put in place. In a parallel high risk-high benefit approach aimed at developing a self-sustained pheromone production platform, the same biosynthetic enzymes will be transferred to a newly developed biofactory-improved tobacco plant chassis, and the production of volatile pheromones in transgenic tobacco lines will be studied.

IMPACT

The introduction of biomanufacturing in industrial pheromone production will expand the use of sex pheromones in integrated pest control, reducing its current environmental impact and, most importantly, providing sustainable production platforms for those pheromones whose complexity and/or stereochemistry makes chemical synthesis unaffordable at the agronomic scale.

ACTIVITIES

WP1. Prospection of genetic resources

WP2. Yeast metabolic engineering

WP3. Process production and pilot optimization in yeast

WP4. Metabolic engineering in plant biofactories

WP5. Exploitation, Management and Coordination

Contacto:

València Parc Tecnològic
C/Benjamín Franklin, 5-11
e46980 - Paterna - Valencia
T. +34 96 136 60 90
informacion@ainia.es
www.ainia.es

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