Actividades divulgación Proyecto AGROALNEXT_2022

Lugar	Universitat Politècnica de València (UPV).
Localidad	València
Provincia	València
Fecha	24 de Octubre del 2023
Proyecto:	Incorporación de la información del proyecto, para su divulgación, en Conference of the IOBC/WPRS Working Group "Integrated Protection in Viticulture"
Código proyecto	AGROALNEXT_2022/032
Grupo de investigación	idm Instituto Interuniversitario de Reconocimiento Molecular y Desarrollo Tecnológico INSTITUTO AGROFORESTAL MEDITERRÁNEO UNIVERSITAT POLITÈCNICA DE VALÈNCIA

INFORME DE LA ACTIVIAD:

En el periodo del **3 – 5 October 2023** se ha asistido al Conference of the IOBC/WPRS Working Group “Integrated Protection in Viticulture” en LOGROÑO - LA RIOJA - SPAIN dando difusión del proyecto mediante un poster.

En dicho poster se ha presentado el siguiente Abstract:

Innovative biopesticides to control grapevine fungal pathogens

The essential oil components (EOCs) are widely used as natural bioactive molecules of plant origin with antimicrobial activity. However, their high volatility, high reactivity and low water solubility limit their applications. One way to overcome these drawbacks is to develop controlled release systems of these natural antimicrobials against fungal plant pathogens. In this sense, the development, synthesis, and characterization of EOCs encapsulated in mesoporous silica microparticles capable of releasing the natural bioactive molecules in a controlled manner, can significantly increase their antimicrobial activity compared to free bioactive molecules. A key innovative aspect of this project is the development of functionalized materials with molecular gates consisting of mesoporous silica materials loaded with natural bioactive molecules and functionalized with saccharide derivatives or sugars. This will reduce the high volatility of natural bioactive molecules and increase their fungicidal activity through preferential delivery of molecules by opening the biomolecular gates in the presence of amylases excreted by fungi. In this study, the effect of *in vitro* treatments with new formulations of different EOCs on the mycelial growth and conidial germination of representative grapevine fungal pathogens: *Botrytis cinerea* (causal agent of grey mold disease), *Dactylonectria torresensis* and *Ilyonectria liriodendri* (causal agents of black-foot disease), and *Phaeoacremonium minimum* and *Phaeomoniella chlamydospora* (causal agents of Petri disease), was evaluated. The goal is to obtain new innovative biopesticides using natural resources in the context of sustainable agriculture.
This research forms part of the AGROALNEXT programme (AGROALNEXT/2022/032) and was supported by MCIN with funding from European Union NextGenerationEU (PRTR-C17.I1) and by Generalitat Valenciana

Innovative Biopesticides to Control Grapevine Fungal Pathogens

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ABSTRACT

The **Essential Oil Components (EOCs)** are widely used as natural bioactive molecules of plant origin with antimicrobial activity. However, their high volatility, high reactivity and low water solubility limit their applications. One way to overcome these drawbacks is to develop **controlled release systems of these natural antimicrobials against fungal plant pathogens**. In this sense, the development, synthesis, and characterization of EOCs encapsulated in an inorganic mesoporous support capable of releasing the natural bioactive molecules in a controlled manner, can significantly increase their antimicrobial activity compared to free bioactive molecules. A key innovative aspect of this project is the development of functionalized materials with molecular gates consisting of mesoporous support materials loaded with natural bioactive molecules and functionalized with saccharide derivatives or sugars. This will reduce the high volatility of natural bioactive molecules and increase their fungicidal activity through preferential delivery of molecules by opening the biomolecular gates in the presence of amylases excreted by fungi. In this study, the effect of *in vitro* treatments with new formulations of different EOCs on the mycelial growth and conidial germination of representative grapevine fungal pathogens: *Botrytis cinerea* (causal agent of grey mold disease), *Dactylonectria torresensis* and *Ilyonectria liriodendri* (causal agents of black-foot disease), and *Phaeomoniella chlamydospora* (causal agent of Petri disease), was evaluated. The goal is to obtain new innovative biopesticides using natural resources in the context of sustainable agriculture.

DEVICE PREPARATION

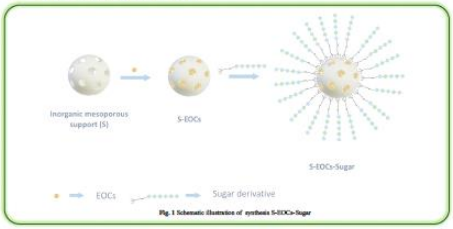


Fig. 1 Schematic illustration of synthesis S-EOCs-Sugar

CHARACTERIZATION

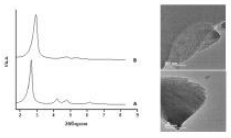


Fig. 2 Left: PXRD patterns of (A) inorganic mesoporous support and (B) calcined inorganic mesoporous support. **Right:** Representative transmission electron microscopy images of inorganic mesoporous support.

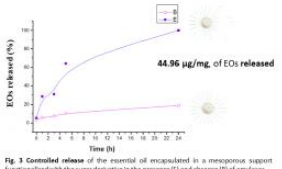
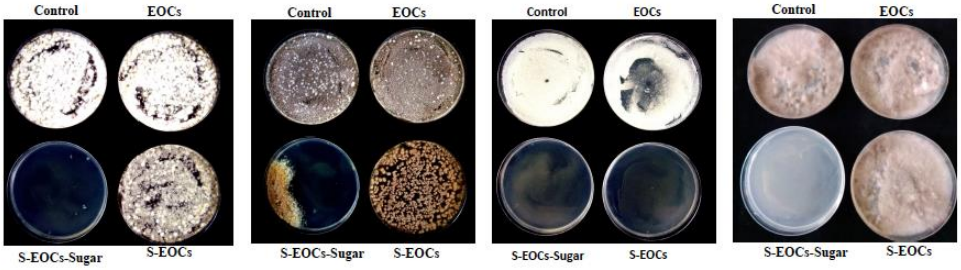


Fig. 3 Controlled release of the essential oil encapsulated in a mesoporous support functionalized with the sugar derivative in the presence (B) and absence (B) of amylases.

ANTIFUNGAL ACTIVITY

Fungal isolates of *Botrytis cinerea*, *Dactylonectria torresensis*, *Ilyonectria liriodendra* and *Phaeomoniella chlamydospora* were grown on potato dextrose agar (PDA) and incubated for 1-2 weeks at 25 ºC in darkness. A conidial suspension was prepared for each isolate by flooding the agar surface with 10 mL of sterile distilled water (SDW) and scraping with a sterile spatula. The resulting spore suspension was filtered through two layers of cheesecloth into a 250 mL erlenmeyer flask. The filtrate was diluted with SDW and the conidial concentration was adjusted with a hemacytometer to 10x6 conidia/mL. Then, our system, S-EOCs-Sugar, was dispersed at the concentration of 5mg in 500 µL of the conidial suspension, and then plated on PDA Petri dishes. According to the release study, EOCs and S-EOCs were similarly dispersed to reach an equivalent concentration of the EOC to the one of the S-EOCs-sugar, to corroborate the better performance of our system.The pictures presented below were taken the 5th day of incubation at 25 ºC in darkness, time enough to see the effect of our system in the fungal activity.



CONCLUSIONS AND FUTURE WORK

A delivery system for EOCs controlled release based on a sugar derivative has been prepared and characterized. Our preliminary results show a **great antifungal activity** of the presented system.

The following will be carried out:

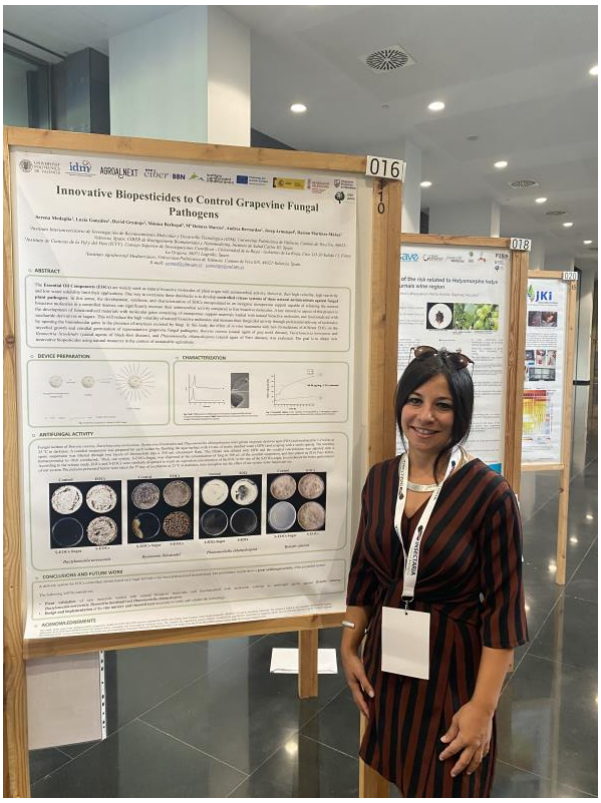
- **Plant validation** of new materials loaded with natural bioactive molecules and functionalized with saccharide coatings as antifungal agents against *Botrytis cinerea*, *Dactylonectria torresensis*, *Ilyonectria liriodendri* and *Phaeomoniella chlamydospora*.
- **Design and implementation** of the **vine nursery and vineyard tests** necessary to verify and validate the technology.

ACKNOWLEDGEMENTS

This study forms part of the AGROALNEXT programme (AGROALNEXT/2022/032) and was supported by MCIN with funding from European Union NextGenerationEU (PRTR-C17.I1) and by Generalitat Valenciana. This research is funded by the Generalitat Valenciana and Agència Valenciana de la Innovació (INNEST/2022/192 project) and is susceptible toba co-founded by European Union. This research was supported by projects PID2021-126304OB-C41 and PID2021-128141OB-C22 funded by MCIN/ AEI /10.13039/501100011033/ and by European Regional Development Fund - A way of doing Europe. This study was also supported by Generalitat Valenciana (CIPROM/2021/007). A.B. thanks to the MCIN har BG20/00020 contract and har PAID-PD-22 project funded by UPV.

FOTOS DE LA ACTIVIDAD:

- Presentación del Poster durante la sesión de poster



- Foto de grupo de los asistentes al congreso

Y para que conste a los efectos oportunos

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