

Biocontrol of Aflatoxin Contamination Using Atoxigenic Strains from Almond and Pistachio Orchards. (BIOCONTROL-A)

Resumen:

Aflatoxins (AF), the most toxic and carcinogenic compounds among the mycotoxins, are mainly produced by the fungi *Aspergillus flavus* and *A. parasiticus*. Because these fungi are common soil residents of almond and pistachio orchards, these nuts are one of the main sources of human exposure to AF. The consumption of almond and pistachio has increased in recent years in the European Union (EU) due to their positive effects on the consumers' health. Spain has the largest area (587.000 ha) under almond cultivation after USA and its pistachio growing-area is exponentially expanding. Contaminated batches of Spanish nuts by AFs have been frequently detected. Application of atoxigenic strains of *A. flavus* has successfully reduced crop AF-contamination in the USA and Africa. This biological control strategy uses endemic atoxigenic *A. flavus* strains, considered best adapted, to displace the AF-producing fungi. Unfortunately, EU farmers do not have the benefit of this type of biological control technology since there are not registered atoxigenic strains in this area. The aim of current project is to: i) improve substrate and application methods of atoxigenic *A. flavus*; ii) select new biological control agents for their patent and future registration in EU and USA; and iii) construct mechanistic models of risk for AF-contamination. The expected results will have a positive impact improving food safety and the environment and securing economic benefits to EU farmers and agri-food industries. In addition, this project supports capacity building, provides the foundation to the fellow in pursuing his independent scientific career and strengthens collaboration with research groups from EU and USA, three small-medium enterprises (SEMs), and a spin-off company.

Objetivos:

The main goal is to find atoxigenic isolates of *A. flavus*, which could be used as potential Biological Control Agents.

Objetivos contribución:

Specific objectives are: identify the risk factors associated to aflatoxin contamination in Andalusia region and identify atoxigenic Andalusian isolates of *A. flavus*

Entregables:

Scientific papers related with the current Project.

Impacto:

3.1 Enhancing research- and innovation-related human resources, skills, and working conditions to realise the potential of individuals and to provide new career perspectives

The proposal includes the acquisition of several multidisciplinary transferable skills for the fellow such as: coordinating international groups, managing the budget and resources, or acquiring skills in the preparation of grant applications. The proposal will allow him to learn new tools, enabling him to answer interesting questions about plant disease epidemiology and biological control. The skills acquired by the fellow in USA and Italy will be transferred to his Spanish group, which will therefore be in the best position to address the growing mycotoxins problem in Andalusia region and which will have a major impact on communication media, such as newspapers "El País" or "ABC". If the proposal is funded, Dr. Trapero's group will complement other excellent groups focused in molecular and/or chemistry aspects of AF located at different Spanish public institutions (e.g. Universities of Granada, Lleida, and UCM or CSIC-IATA, etc.). The scientific achievements of the fellow and the absence of epidemiologists in the Spanish System make it reasonable to predict that the applicant will obtain a research position within the Spanish System of Science. If the proposal is funded, it will provide him with an opportunity to apply a Consolidator Grants from EU Research

Council about AF topic with the help of UCO and in close cooperation with other EU research groups. The presently registered BCAs in USA and Africa provide a competitive edge over other EU growers, which have limited recourses to control of AF on nuts. In Spain, for example, there are only two available fungicides to manage *Aspergillus* spp. in apple and grape, although these pathogens affect severely other crops such as corn, grapevine, or nuts. This project will allow us to select the first biocontrol strains of *A. flavus* to be registered in EU in the near future. These BCAs could be valuable not just for almond and pistachio crops but also to other susceptible crops grown in similar climatic conditions. In addition, the risks models from this project will also improve competitiveness of the EU growers. The funding of this project will result in the formalization and strengthening of the scientific collaboration among the USA and EU Universities, small-medium companies and farmers. The proposal is a distinct plus for the health of the nuts end-users, the EU consumers.

3.2 Effectiveness of the proposed measures for communication and results dissemination

Communication and public engagement strategy of the action

As in years before, the Trapero's team will join Research Nights, an EU-wide initiative bringing together the public at large and researchers. This event will offer an important platform for promoting the project and disseminating its results. At the same time, the project will be presented to secondary school pupils during the Open Days of UCO that are at the beginning of scholar course. Likewise, we will publish this information at a regular basis on the pages-webs of UCO, Horta Srl, and UCDavis.

The main results will be popularized via conventional print-media channels in Spain. For this purpose, BIOCONTROL-A will rely on the Dept. of Public Relations of UCO to make popular the research results on the social media. During the last phase of this project, two dissemination days will be organized in Italy and Spain to present the ultimate scope and results of project to inform farmers, partner organizations, and advisors. Both seminars will be recorded on video that will be made available to the general public via the partner websites and to direct posting to forums such as YouTube. Finally, both Prof. Michailides and the fellow consider that the grant is an excellent opportunity to participate in the 2nd edition of the famous Compendium of Nut Crop Diseases in Temperate Zones of the APS, in which Prof. Michailides is editor, and to make a Spanish edition, since it has been frequently requested by the advisors and the APS.

Dissemination of the research results

The BIOCONTROL-A results will be mainly disseminated to scientific community through the 39th and 40th Mycotoxin Workshop and the annual APS congress. Likewise, the results will be published in international scientific journals such as Applied Environmental Microbiology, Environmental Microbiology, or the World Mycotoxin Journal. The obtained strains during the BIOCONTROL-A project will be stored in the mycology library of UCO and two representatives of each VCG will be deposited in the Fungal Biodiversity Centre (CBS) at Netherland. The whole collection will be available upon request to other researchers. At the end of the project, the research community will be informed about the main results through the "On the shoulders of giants", a very popular research program on the National Spanish Radio (the fellow has previously contributed to this radio program).

Exploitation of results and intellectual property

The selected BCAs will be deposited in the in Fungal Biodiversity Centre (CBS) according to the Budapest Treaty of Depositing Microorganisms for the Purposes of Patent Procedure. The trials prior

to registration and commercial exploitation of the BCAs in EU will be conducted in collaboration with EU agrochemical companies and the UCO, following similar agreements that are being coordinated by the UCO Office for Transfer of Research Results. Because of the prolonged duration of the registration phase, this is not included in this proposal. Likewise, the fellow will be intellectual coowner of BCAs and application methods, that could be develop in USA. The developed risk models for AF contamination will be transferred to web-pages of partners Universities for free use by advisors. The UCO has its own legal department that manages intellectual property issues.

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