

Integrative analysis of the mode of action of fungal endophytes in crops

Áreas actuales: Agroengineering: Biotechnology and bioinformatics, Interactions of plants with environment

Research Field: Agriculture, Plant Production, Plant Biology, Microbiology, Plant Pathology

Title of research line:	
Integrative analysis of the mode of action of fungal endophytes in crops	
Project description:	
<p>Fungal endophytes (FEs) are promising tools to develop novel microbial biostimulants. FEs are a diverse group of fungi that colonize internal plant tissues without causing disease symptoms. Many FEs are beneficial to the plant, with functions such as plant growth promotion (PGP) or the increase of plant tolerance to biotic and abiotic stresses. However, there is a great lack of studies that explain how do FEs really interact with the plant. For an optimal and reliable application of these promising tools, it is essential to attain a good understanding of the mechanisms that govern their interaction with the plant, the conditions that maximize or reduce the benefit, the plant and fungal genes that optimize the outcome, or the molecules that could determine it. In our previous research, we gathered a collection of isolates of more than 1000 fungal endophytes of natural populations of the model plant <i>Arabidopsis thaliana</i> (García et al. 2013 Fungal Diversity). We discovered that one of those endophytes, <i>Colletotrichum tofieldiae</i> (Ct), colonizes the root of <i>Arabidopsis</i> and transfers phosphorus to the plant, increasing plant biomass and yield under phosphate (Pi)-deficient conditions (Hiruma et al. 2016 Cell). More recently, we have demonstrated the positive effect of Ct on the growth and yield of the crops tomato and maize, pointing to Ct as a valuable inoculant with potential use as biostimulant in agriculture (Díaz-González et al. 2020 Agronomy). We observed that Ct effects on tomato and maize were independent of Pi conditions. Therefore, the effect of Ct on tomato and maize may be subject to MoAs different from what has been described for <i>Arabidopsis</i>. Thus, the general objective of this project is to determine the MoAs of Ct on the crops tomato and maize. For that, we will carry on a deep analysis of the effect of Ct on these two plant species, integrating growth, physiological, metabolic and transcriptomic data obtained under optimal and Pi-deficient conditions.</p>	
Project duration/scholarship length:	4 years
Project leader/supervisor & short bio:	Soledad Sacristán (https://orcid.org/0000-0002-5753-2644)
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Contact phone number:	+34910679147
Research group & website:	ECOLOGICAL AND MOLECULAR FACTORS INVOLVED IN FUNGAL ENDOPHYTISM AND PATHOGENESIS
Expected project outcomes to be achieved by scholarship holder:	

The PhD fellow will work in the Research Group “Ecological and molecular factors involved in fungal endophytism and pathogenesis” at CBGP (Universidad Politécnica de Madrid, UPM), in an international scientific environment whose working language is English. He/she will be under the direct supervision of the IP, Soledad Sacristán, and will **participate in every step of the research**: designing and carrying out the experiments, analyzing and interpreting the results, attending to regular group meetings for the presentation and discussion of results and preparing manuscripts for the publication of the results. He/she will attend at **least to one national or international congress** to present his/her results, and it is expected that the fellow publishes **at least one article** as main author in a indexed Q1 journal.

Thus, the PhD researcher will **gain knowledge and expertise** in the biology and growth of plants under controlled and field environments, advanced techniques in microbiology and molecular biology, bioinformatic tools, statistical analysis of data and interpretation of results, organization and planning of experiments, application of the scientific method to solve problems, oral and written communication of the working hypotheses and the results and conclusions obtained and perfection of oral and written communication in English.

Besides, as part of his/her **training program**, the PhD fellow will also attend to technical seminars and demonstrations for the management of state-of-the-art equipment in the field of molecular biology and biotechnology; attend to scientific seminars organized by CBGP, where he/she can meet and discuss with excellent international scientists (CBGP programs about 30 such seminars per academic year); participate in outreach activities presenting science to society (Science Week, etc); participate in the Junior Seminar Program of CBGP; and attend to a course on Innovation-Tech Transfer, which covers topics such as tech-valorisation and transfer, tech/science regulatory issues (patents, biosafety, etc.), entrepreneurship, grants application, etc.

Skills required:

- A solid background in the knowledge about plants and microbes interactions
- Knowledge about the techniques in microbiology and molecular biology, and bioinformatic tools
- Experience in conducting experimental work
- Skills in statistical analysis
- Fluent English (oral and written)

PhD programme:

PhD in Biotechnology and Genetic Resources of Plants and Associated Microorganisms