MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2025

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

IITQB NOVA

RESEARCH GROUP AND URL

iPlantMicro Lab
https://www.itqb.unl.pt/labs/plant-microbiome-interactions

SUPERVISOR (NAME AND E-MAIL)

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SHORT CV OF THE SUPERVISOR

I obtained my degree in Environmental Sciences from the University of Granada (Spain) under the supervision of Dr. Manzanera with the prize for Excellence and best Research Project in 2009, which provided 4 patents. Later, I completed my master and doctoral studies until 2016, thanks to funding from the Spanish government's and, again, thanks to the supervision of Dr. Manzanera. At this time, I explored plant-microbial interaction mechanisms under stressful conditions by metabolomics, proteomics and transcriptomics, and biochemical tests, as well as the first attempt to assess the biosafety of bioinoculants. During this stage, I established many of my current collaborations thanks to mobility grants (Madrid, Ireland, and Germany). Thus, the production of this period consisted in 1 book chapter, 2 conference paper, 1 oral communication, 12 posters in international conferences, and 16 scientific publications (5 as first author). In addition, I accumulated 200 ECTS teaching credits. After defending my thesis with “Outstanding Cum Laude with International Mention”, I was hired for a postdoctoral position by Dr. Zhang at the Shanghai Center for Plant Stress Biology (China), where I was able to improve my expertise in plants and microorganisms molecular biology, as well as interaction processes and epigenetics. This leaded to achieve the first evidence linking them to specific stress and recruiting processes in rhizosphere. Until publication of my postdoctoral thesis in 2020, the scientific production in the group grew remarkably with 1 book chapter, 2 international patents, 4 contributions to international conferences and 20 research articles (10 as first author, highlighting a Nature Plants). During this time, I received my first projects funded as PI: 2 PIFI Program in 2017 and 2020, and a NSFC Program project in 2018. At the end of 2020, I was hired to fill a vacant strategic position within the GREEN-IT research unit linked to ITQB- NOVA. My contract as an Auxiliar Researcher gave rise to the formation of the Interaction Plant-Microbiome laboratory (iPlantMicro), which became official in May 2022. Thus, we have achieved a total of 12 publications, as well as 12 posters and 8 oral communications in international congresses. We get expertise in root exudates and seed microbiota, which allow us to obtain funding from ERA-NET (EJP-Soil) in 2021, as well as stablishing collaborations with companies, as in the case of PunaBio, or more recently with AsfertGlobal or TIMAC.

5 SELECTED PUBLICATIONS

- 1. Vílchez et al. (2020). DNA demethylases are required for myo-inositol-mediated mutualism between plants and beneficial rhizobacteria. Nature Plants, 6(8), 983–995. DOI: 10.1038/s41477-020-0707-2
- 2. He, D., Singh, S.K., Peng, L., Kaushal, R., Vílchez, J.I., et al. (2022). Flavonoid-attracted Aeromonas sp. from the Arabidopsis root microbiome enhances plant dehydration resistance. The ISME Journal, 16(11), 2622-2633. DOI: 10.1038/s41396-022-01288-7
- 3. Vílchez et al. (2016). Biosafety test for plant growth-promoting bacteria: Proposed Environmental and Human Safety Index (EHSI) protocol. Frontiers in Microbiology, 7, 1514. DOI: 10.3389/fmicb.2015.01514

- 4. Gil, T., Rebelo Romão, I., do Carmo-Gomes, J., Vergara-Diaz, O., Amoroso Lopes de Carvalho, L., Sousa, A., Kasa, F., Teixeira, R., Mateus, S., Katamadze, A., Pinheiro, D., Vicente, R., & Vílchez, J.I. (2024). Comparing native and non-native seed-isolated strains for drought resilience in maize (Zea mays L.). Plant Stress, 12, 100462. DOI: 10.1016/j.stress.2024.100462
- 5. Vílchez et al. (2016). Plant drought tolerance enhancement by trehalose production of desiccation-tolerant microorganisms. Frontiers in Microbiology, 7, 1577. DOI: 10.3389/fmicb.2016.01577

PROJECT TITLE AND SHORT DESCRIPTION

Project Title: Decoding the mechanisms of microbiota inheritance in plants: from seeds to soil and beyond

Project Summary:

Plant-associated microbiota are key drivers of host development, stress tolerance, and productivity. While the role of the microbiome in plant health is increasingly recognized, the processes by which plants transmit microbial communities across generations remain largely unknown. This project aims to unravel the biological mechanisms governing microbiota inheritance in plants, with a focus on seed-associated microbes and their establishment in the rhizosphere and phyllosphere of progeny plants. Using a combination of gnotobiotic plant systems, amplicon and shotgun metagenomics, and spatial microbial profiling, we will investigate how microbial communities are transmitted via seeds, how they interact with early plant development, and to what extent the inherited microbiota shapes or is shaped by local soil communities. The research will also explore the influence of plant genotype, environmental filtering, and agronomic practices on vertical microbiota transmission.

This interdisciplinary approach integrates plant biology, microbial ecology, and evolutionary theory, and will provide fundamental insights into microbiome heritability. The expected outcomes include a better understanding of plant-microbiota co-adaptation and practical implications for sustainable agriculture, such as microbiome-informed breeding or microbial inoculant strategies that enhance vertical transmission efficiency.This fellowship will not only advance our understanding of plant microbiome inheritance but also foster the applicant's career development through training in cutting-edge microbiome technologies, academic publishing, international collaboration, and science communication.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Life Sciences (LIF)