



# 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.itgb.unl.pt/labs/plant-microbiome-interactions

# SUPERVISOR (NAME AND E-MAIL)

Juan Ignacio Vílchez <u>nacho.vilchez@itqb.unl.pt</u>

## 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 desiccationtolerant microorganisms. Frontiers in Microbiology, 7, 1577. DOI: 10.3389/fmicb.2016.01577

## PROJECT TITLE AND SHORT DESCRIPTION

Project Title: Root Exudates as Drivers of Beneficial Microbiota Recruitment Under Stress

### Project Description:

Plants shape their root microbiome through the secretion of exudates—complex mixtures of metabolites that influence microbial recruitment and activity. This project aims to uncover how root exudate composition changes in response to abiotic (e.g., drought, salinity) and biotic (e.g., pathogen attack) stresses, and how these changes affect the assembly of beneficial microbial communities in the rhizosphere. Using a model crop system such as tomato or maize, we will profile root exudates under control and stress conditions using untargeted and targeted metabolomics (LC-MS/MS, GC-MS). In parallel, microbiome sequencing (16S rRNA and ITS) will track corresponding shifts in microbial community composition. We hypothesize that stress-induced exudate changes serve as selective signals that promote the recruitment of plant growth-promoting rhizobacteria (PGPR) and beneficial fungi.

To test this, we will use synthetic exudate mixtures in gnotobiotic growth systems inoculated with defined microbial consortia. Dual RNA-Seq of root-microbe interactions will further reveal stress-responsive signaling and transcriptional changes on both sides. This research will provide mechanistic insight into how plants use exudates to adaptively recruit microbial allies under stress. It offers clear applications in agriculture, from microbiome-informed crop breeding to the development of targeted bioinoculants that work in synergy with plant exudate profiles. The project will also strengthen the fellow's expertise in plant-microbiome interactions, metabolomics, and microbial ecology within a strong European research network.

### SCIENTIFIC AREA WHERE THE PROJECT FITS BEST\*

Life Sciences (LIF)