Post-doctoral position in meta-metabolomic

CRIOBE – Université de Perpignan - France

Contract period : two years
Start date : Ideally March 2020, can be discussed
Proportion of work : Full time
Remuneration : 25 – 30 k€

Project Title : Development of an Innovative Methodology in order to evaluated the environmental impact and Residue of BioControl producTs : IMPACT

Description of the project:
Pesticides use is permanently increasing for several reasons and it causes many negative environmental consequences. Biocontrol products (BPs) can be considered as an alternative. However, there is a lack of viable tools in order to study their efficacy and environmental impact. In order to answer this question, the PALVIP project was put in place (palvip.univ-perp.fr). The UPVD is one of the partner and its action deals with the development of new adapted methodologies in order to evaluate the environmental impact and residue of BPs. This approach is based on metabolomics (EMF).
The goal of the proposed project has several objectives:
(1): the main one is to develop and optimize the EMF approach. The effort will be focused on the statistical data processing part. It is the tricky step of the workflow and needs more developments.
(2): then, this procedure will be used in order to evaluate the environmental impact of the BPs tested in the PALVIP project.
(3): finally, a detailed protocol of the global workflow useful for the evaluation of the environmental impact of BPs will be written.

Skills and qualifications
We are looking for highly motivated candidates with a PhD in metabolomics and environmental chemistry or related fields. The main tasks of the postdoctoral researcher will be to analyze untargeted metabolomic data obtained by high-resolution mass spectrometry (UPLC-HRMS) from diverse environmental matrices (soil, plant parts...).
Candidates with relevant background in UPLC-HRMS, and experience in the analysis of metabolomic data (data preprocessing, biomarker identification, metabolite annotation) and experience within W4M, metaboAnalyt, cytoscape, gnps.. are very encouraged.
Excellent communication skills in English (both written and spoken) is required.

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Project description

Objectives
Objective 1: Development of an innovative methodology in order to evaluate the environmental of Biocontrol products - BPs (focused mainly on the statistical data processing development)
Objective 2: Evaluation of the environmental impact of BPs
Objective 3: Writing of a detailed protocol useful for the evaluation of the environmental impact of BPs

State of the art
In view of the European (Directive 2009/128/CE) and National (Ecophyto II) decisions, the use of conventional phytosanitary products must be reduced in the coming years. Biocontrol products (BPs) could be considered as an alternative. However, the development of BPs requires adapted tools in order to study both their efficacy and environmental impact. In this context, the PALVIP project (Protection Alternatives des productions Végétales Interrégionale Pyrénéenne) was set up. It involves a range of stakeholders including universities (University of Perpignan, University of Girona, Autonomous University of Barcelona), technical structures (CA66, INCAVI) and SMEs that develop biopesticides. The goal of this project is to develop a global and innovative approach based on a combination of conventional and “omic” approaches in order to characterize the biocontrol products supplied by the SMEs involved in the project in terms of (1): their activity, (2): their mode of action and (3): their environmental impact. As Catalogne and Roussillon regions are mainly specialized in viticulture, fruit and vegetable crops, BPs dedicated to these kind of crops will be studied in this project. The University of Perpignan is involved in the action dealing with the “Environmental impact evaluation”.

Concerning the study of the environmental impact, the half-life, t1/2, has been often used so far in order to study the fate of pesticides in the environment. However, this value gives restricted information as it does not describe all the phenomena occurring after the pesticide application such as the formation of by-products and the effect on biodiversity. Besides, BPs are complex mixtures and yield chromatograms that are extremely difficult to interpret, which precludes the t1/2 from being considered as a viable tool. Moreover, in one hand, the European Food Safety Authority requires, within the framework of European legislation (SANCO/11470/2012– rev. 8), the extended risk assessment and ecotoxicological monitoring of pure natural compounds as well as plant extracts.; and in the other hand the central purchasing groups are beginning to question the need to request residual analyses for foods treated with biocontrol products (Journée Prospective Arboriculture, FranceAgrimer, Octobre 2016, Paris) In this context, new adapted analytical methodologies must be developed to overcome these difficulties

Expected Progress beyond the state of the art
An innovative methodology based on metabolomics (LC-MS), the EMF (Environmental Metabolic Footprinting) was recently developed in the laboratory. This new tool could allow us determining: (1): the resilience time that corresponds to the time required for the dissipation of the product and
the effect on the matrix; soil for instance and (2): the dissipation time that corresponds to the time required for the BPs residues dissipation in order to evaluate the PHI (Preharvest interval). It corresponds to the time needed for the dissipation of the xenometabolome (active substances + by-products). It will be reached when there won’t be any statistical differences between the xenometabolome profiles of treated and control samples (fruits, vegetables). This tool must be developed for the different BPs and matrices.

Activities assigned to the recruited staff member

Action 1. Data acquisition

Workplan:
The postdoctoral researcher activities will contribute to the PALVIP project. This project lasts 3 years and began in January 2018 (01/2018 - 12/2020). Each year (2018, 2019 and 2020), field experimentations are performed. The UPVD is in charge of the analyses of some samples regarding the environmental impact evaluation of the BPs tested. Each year, samples of (1): vine leaves (treatment against oidium), (2): peach (trees treatment against Monilia fructigena) and (3): soil (use of herbicide in salad crops) must be analysed.

The postdoctoral researcher will be recruited as soon as possible. At this point of the project, the analyses of the samples collected in 2018 and 2019 will be already performed. He will contribute to the acquisition of the last data; he will perform both the extraction and the analysis (LC-MS) of the samples collected in 2020. This part of the project (Action 1) will be a small contribution of the postdoctoral researcher as PhD. students involved in the project (Mélina Ramos and Hikmat Ghosson) already developed the extraction and the analysis protocols.

Action 2. Statistical tool development

Development of the different steps of the data statistical processing

Workplan:
This Action 2 will be the main part to develop. Indeed, the postdoctoral researcher will be recruited based on his bioinformatics skills.

After the acquisition of the LC-MS data, metabolic profiles are obtained representing the matrix metabolome (xenometabolome + endometabolome).

Step (1): these raw data must be processed in order to obtain a matrix compiling all the information contained in the LC-MS profiles.

Step (2): then, statistical tools must be developed in order to compare control and treated samples and hence evaluate the resilience time and/or the PHI interval. For that, multivariate statistical analyses (PCA, PLSDA, OPLSDA) will be considered.

We are just at the beginning of the development of this part - statistical processing - and we need a qualified person in order to select the appropriate tools and to set up a robust protocol describing the 2 steps of the data processing.

After developing the tool, the postdoctoral researcher will process the data acquired over the 3 years of the PALVIP project in order to evaluate the environmental impact of the BPs tested.
**Action 3. Protocol writing regarding the environmental impact evaluation**

Protocol writing of the different steps of the EMF approach: (1): samples collection - (2): data acquisition and (3): statistical processing

**Workplan:**

The last Action 3 of the project will deal with the writing of the global protocol describing the different steps (detailed below) of the workflow put in place in order to evaluate the environmental impact of BPs:

1: sample collection - 2: extraction protocol for each matrix - 3: LC-MS analysis - 4: statistical data processing

The postdoctoral researcher will write this protocol once all the steps will be developed. This protocol will be presented in a manner that is similar to OECD or Sanco guidelines documents.

**Resources dedicated to the activities of the recruited staff member**

The recruited postdoctoral researcher will contribute to the PALVIP project (Poctefa) that began in January 2018 (duration of the project: 01/2018 - 12/2020).

He will (1): perform the last data acquisition, (2): develop the statistical data processing and (3): write a detailed protocol of the global workflow.

In order to perform these diverse tasks, resources are needed and will be available:

- the last data acquisition (year 2020), i.e. both extraction and LC-MS analyses, will be financed by the PALVIP project (analyses performed on the Bio2mar platform) - last year of the project.
- also, data already acquired for the PALVIP project by Ph.D. students (years 2018 and 2019) will be available at his arrival in the laboratory. It will be useful for the development of the ad hoc statistical tool dedicated to the determination of the PHI and the resilient time.

In conclusion, the recruited postdoctoral researcher will have all the necessary resources in order to develop the proposed project.

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2 M-V. Salvia et al. (2017) Environmental Metabolic Footprinting (EMF) vs. half-life: a new and integrative proxy for the discrimination between control and pesticides exposed sediments in order to further characterize pesticides' environmental impact. ESPR, DOI 10.1007/s11356-017-9600-6