

Analysis of the antifungal activity of the members of the RISP multigenic family

hosting laboratory	“Tree-Microbe Interactions” Department (UMR IAM), Stress Response and Redox Regulation (SR ₃) team
location	Faculté des Sciences et Technologies, 54500 Vandœuvre-lès-Nancy, France
supervisor	Benjamin PETRE, Assistant Prof. Université de Lorraine
dates	jan./mar. - june/sept. 2020
contact	B. Petre - benjamin.petre@univ-lorraine.fr (+33 3 72 74 51 60)
Web links	B. Petre ORCID - https://orcid.org/0000-0002-3204-4249 UMR IAM - https://mycor.nancy.inra.fr/IAM/ Université de Lorraine - https://www.univ-lorraine.fr/

The masculine gender is used by convention, but refers to a man or a woman.

The Stress Response and Redox Regulation (SR₃) team of the “Tree-Microbe Interactions” Department (UMR IAM) in Nancy, France, is looking for a motivated and talented undergraduate student to carry out a six-month internship research project in functional genomics of plant-parasite interactions starting early 2020. Applications should include a CV, with the name and e-mail address of at least one reference person, as well as a cover letter of up to one A4 page, and must be sent to Benjamin PETRE by e-mail before midnight on 20 December 2019.

The successful candidate will have the following responsibilities:

- acquire and analyse experimental data,
- interpret research results,
- communicate research results, by writing and orally.

The successful candidate must be:

- able to work in a team, using English and/or French,
- open to the acquisition of new skills and knowledge,
- able to follow protocols and accurately record the progress of its work,
- rigorous, organized, and autonomous; able to plan ahead.

The successful candidate must have:

- a solid theoretical background in cell biology, molecular biology, and biochemistry,
- a practical experience in a research laboratory of at least six weeks.

The following elements will be appreciated:

- knowledge/skills in plant biology, microbiology, plant-parasite interactions, protein biochemistry, genetic and protein engineering,
- a clear professional project, related or not to academic research,
- a real interest in biology and in the scientific enterprise.

Scientific context

Modern agriculture seeks to reduce the use of chemical (or conventional) pesticides by developing *biopesticides*, which are derived from molecules naturally present in the environment. The internship project fits in this context, by proposing to characterize the antifungal activity of members of the RISP antifungal peptide family; a family specific to trees of the Salicaceae family (poplar and willow). The project is based on the discovery by the UMR IAM of a new peptide in poplar called RISP (*Rust Induced Secreted Protein*) (Petre et al., 2016). RISP is a thermostable peptide with targeted antifungal activity against fungi of the Pucciniales family, the main agents of crop rust diseases. The potential for the development of biopesticides from RISP is currently being assessed within the UMR IAM.

Objectives and approaches of the internship project

The overall objective of the internship project is to identify which members of the RISP family have the most promising properties (i.e. thermostability and antifungal activity) to explore the development of biopesticides. The operational objective of the internship project is to evaluate the antifungal activity of the ten still uncharacterized members of the RISP family, using a functional genomics approach. To this end, the student in charge of the project will carry out three tasks. First, he will clone the coding sequences of the ten members into expression vectors using genetic engineering (task 1). Then, he will try to obtain tagged recombinant proteins by protein engineering (task 2). Finally, he will functionally characterize the proteins obtained, in particular by evaluating their biochemical properties, thermostability, and antifungal activity towards fungi of the Pucciniales family (task 3). Depending on the progress of the project, research addressing more mechanistic aspects (research on the mode of action of RISP, for example) may be considered.

Benefits for the student

During the project, the student will acquire in-depth skills and knowledge in functional genomics, with a particular focus on molecular biology, genetic engineering, protein engineering, and molecular physiology of plant-parasite interactions. He will benefit from the technical and scientific support of the following collaborators of the UMR IAM: Tiphaine Dhalleine (Engineer, SR₃ team - in charge of the protein engineering platform), Nicolas Rouhier (Professor, SR₃ team), Sébastien Duplessis (INRA Research Director, Ecogenomics of Interactions team), and Pascal Frey (INRA Research Director, Forest pathogen fungi ecology team). An industrial partner (BAYER SAS, Lyon) will potentially be involved in the internship project, depending on the progress of the project. The student will have the opportunity to present regularly the progress of his project during the SR₃ team lab meetings, and will have access to all the resources and structures of the UMR IAM. He will benefit from active support in the preparation of the report and the internship defense. The internship project is part of an original and integrative approach that will provide the student with an intellectually stimulating environment conducive to his personal and professional development.

Reference

Petre B, Hecker A, Germain H, Tsan P, Sklenar J, Pelletier G, Séguin A, Duplessis S, and Rouhier N (2016) **The Poplar Rust-Induced Secreted Protein (RISP) Inhibits the Growth of the Leaf Rust Pathogen *Melampsora larici-populina* and Triggers Cell Culture Alkalinisation.** [Front Plant Sci](#) 7:97