



Thesis: Biocontrol agent influence on grapevine trunk diseases under various plant physiological stresses

Project Description:

Grapevine Trunk Diseases (GTDs) have become within the span of a mere two decades a subject of major concern for the wine industry. GTDs have deleterious effects on vineyards; they are associated with a decrease in harvest quality and quantity, they induce poor wine quality and they reduce the lifespan of grapevine in many vine-growing areas. It was estimated that around 13% of French vineyards is unproductive due to GTDs, mainly because of Esca and Botryosphaeriaceae dieback, and losses were estimated at around 1 billion euros in France in 2014. Because both diseases are the most prevalent GTD in Europe, numerous studies have focused on them, especially on their management by biocontrol agents (BCA) (Leal et al., 2022; Yacoub et al., 2020). Among BCAs, a focus has been carried out on *Pythium oligandrum*, its relationship with the grapevine roots and its ability to protect grapevine against some GTD pathogens, the protection level was of 40 to 60% (Yacoub et al., 2016, 2018). In addition, Fernandez et al. (2023) observed that the aggressiveness of pathogens *in planta* could be increased under abiotic stresses, especially heat and water stress. Both abiotic stresses affected both grapevine and pathogen physiology (Songy et al., 2019).

The aim of this PhD project is to evaluate the potential of the oomycete BCA, *P. oligandrum*, as a useful biocontrol agent under abiotic stress, in the context of GTDs. The experiments will mainly be carried out under controlled conditions in greenhouse with the Ugni blanc cultivar, which is very susceptible to Esca. To achieve this goal, fungal culture, plant production, molecular biology (qPCR, RNA seq), bioinformatics and biostatistics (notably network analysis) will be used.

About the research units:

This project takes place both at the University of Pau and Pays de l'Adour (UPPA) and at the University of Reims Champagne-Ardenne. The two research units are:

- 1- The Institute of Analytical Sciences and Physico-Chemistry for Environment and Materials (IPREM, CNRS-UPPA). Dr Amira Yacoub and Prof. Patrice Rey who leads projects on Grapevine Trunk Disease and biocontrol.
- 2- The 'Induce Resistance and Plant Protection' research unit from University of Reims Champagne-Ardenne. Prof. Florence Fontaine and Dr Patricia Trotel-Aziz have been working on GTDs for several years and have a background on biocontrol.

This PhD is part of the research project entitled: “Agroecological Protection To Control Esca, A Grapevine Trunk Disease”, whose acronym is WinEsca. It is an ANR-Industrial Chair funded by the French Research Agency (ANR) and 2 companies:

- Maison Hennessy, from the LVMH group, the world’s n°1 brand of Cognac,
- Greencell, a leader company in microbial ecology and industrial fermentation, producing microorganisms for plant growth and plant health (biocontrol).
- Academic laboratories in Bordeaux, Reims, Montpellier, Austria, Spain and Switzerland.

WinEsca website: <https://iprem.univ-pau.fr/en/projects/chairs-of-excellence/winesca.html>

The PhD student will join the IPREM team in Pau made up of the 2 WinEsca coordinators and 1 professor, 3 postdocs, 2 other PhD students, 1 assistant-engineer, 1 technician, all involved in the Winesca project.

Qualifications required:

Master 2 diploma allowing to apply for a PhD.

- Ranked in the first third of the Master 2.
- Expected skills and knowledge:
 - o Biocontrol, plant physiology and biostatistics,
 - o Ability to work with several disciplines and different types of actors,
 - o Oral and written skills,
 - o Organizational skills and autonomy are required.

Application:

The applications must include:

- 1) A cover letter outlining your interest in this project,
- 2) A curriculum vitae with exams results and ranking,
- 3) Recommendations from at least two relevant referees who will provide a letter.

Send the files as a single pdf file to patrice.rey@univ-pau.fr and florence.fontaine@univ-reims.fr.

Application Deadline: 17/05/2023

Duration a 3-year period

Start date: September 2023

Gross annual salary range: 24 528€ / year

Location: Pau, France

References

- Fernandez O., Lemaître-Guillier C., Songy A., Robert-Siegwald G., Lebrun MH, Schmitt-Kopplin P., Larignon P., Adrian M., and Fontaine F. 2023. The combination of both heat and water stresses may worsen Botryosphaeria dieback symptoms in grapevine. *Plants* 12, 753, doi.org/10.3390/plants1204753
- Songy A., Fernandez O., Clément C., Larignon P., Fontaine F. 2019. Grapevine trunk diseases under thermal and water stresses. *Planta*, 249 :1655-1679.
- Leal C., Gramaje D., Fontaine F., Richet N., Trotel-Aziz P. and Armengol J. 2022. Evaluation of *Bacillus subtilis* PTA-271 and *Trichoderma atroviride* SC1 to control *Botryosphaeria* dieback and black-foot pathogens in grapevine propagatopn material. *Pest Management Science* Doi 10;1002/ps.7339
- Yacoub A, Gerbore J, Magnin N, Chambon P, Dufour MC, Corio-Costet MF, Guyoneaud R, Rey P. 2016. Ability of *Pythium oligandrum* strains to protect *Vitis vinifera* L., by inducing plant resistance against *Phaeoconiella chlamydospora*, a pathogen involved in Esca, a grapevine trunk disease. *Biological Control*, 92:7-16.
- Yacoub A, Gerbore J, Magnin N, Haidar R, Compant S, Rey P. 2018. Transcriptional analysis of the interaction between the oomycete biocontrol agent, *Pythium oligandrum*, and the roots of *Vitis vinifera* L. *Biological Control*, 120:26-35.
- Yacoub A, Magnin N, Gerbore J, Haidar R, Bruez E, Compant S, Guyoneaud R, Rey P. 2020. The biocontrol root-oomycete, *Pythium oligandrum*, triggers grapevine resistance and shifts in the transcriptome of the trunk

pathogenic fungus, *Phaeoconiella chlamydospora*. *International Journal of Molecular Sciences* 21, 6876 (doi:10.3390/ijms21186876).