PRE-PHD INTERNSHIP + PHD POSITION AT INRA-SUPAGRO MONTPELLIER

Studying the phenotypic plasticity of Vitis vinifera to water deficit

Context of the study - Grapevine plant functioning and development is dependent on water availability. While moderate water deficit (WD) can be beneficial for the composition of grape to be used for wine production, drought negatively impacts both grape yield and quality. The knowledge about the physiological and genetic mechanisms regulating grapevine plant and fruit responses to WD remains largely insufficient to develop efficient strategies for the selection of varieties tolerant to drought.
G_2WAS$_{2020\text{-}2024}$ (***G**rape **G**enes for **WA**ter **S**carcity*) is a program funded by ANR (*French Agency of Research*) to study the physiological responses of a diversity panel of 279 grapevine varieties to water deficit at intra- and inter-annual scales, by integrating the dynamics of production, storage and utilization of carbon resources in the different plant organs (https://umr-agap.cirad.fr/research/main-projects/g2was).
The internship is positioned in the WP2 of the project, where the diversity of the responses to soil water deficit will be explored with 16 contrasted genotypes exposed to 9 levels of WD. PhenoDyn facilities (www6.montpellier.inra.fr/lepse_eng/M3P/PHENODYN-platform) will be used to finely control the soil water status and the microclimate. The first objective of this WP is to gain mechanistic insight into the mechanisms of the response to drought through a range of physiological and transcriptional analyses of both vegetative and reproductive organs. The results of this study will be used to select the level of WD to be applied in further experiments to the panel of the 279 genotypes and to determine the more relevant biological indicators for the GWAS (*Genome-wide association study*).

Internship matters and PhD perspectives - The intern will be in charge to monitor the impact of WD on grapevine fruit development. The panel of the 16 genotypes to be selected will include 2 microvine lines, a plant model which is very convenient for physiological and transcriptomic studies[1]. During the first year, WD experiments will be performed in greenhouses thanks to the Montpellier Plant Phenotyping platform. Then inter-annual effects will be monitored outdoors. The study will perform a special focus on fruit ripening, monitoring growth and the variations of the content in primary and secondary metabolites at single berry level (Shahood et al. 2019). For primary metabolites, analyses will quantify sugars (glucose and fructose), organic acids (malic and tartaric acids) and main cations, to decipher the impact of WD deficit on water importation in respect to the changes in fruit osmotic potential. For secondary metabolites, the study will focus on phenolic (anthocyanidins) and aromatic (to be confirmed) compounds. Transcriptome profiling will be done to identify the changes induced by WD in gene expression at specific fruit developmental stages[2] (Rienth et al., 2016). Two very different regulatory levels impacting carbon and water demand will be explicitly addressed: i) synchronicity in the start of ripening (firmness and image analyses), ii) transcriptomic and metabolic regulations at single berry level.

> Due to administration rules, we propose a pre-PhD internship from April to July 2020 + 3 year-PhD fellowship in the wake (upon condition of selection).

Skills and knowledge - Taste for experimentation in plant biology (lab, greenhouse, field), data management and analysis, statistics and bioinformatics (R packages). Background in fruit physiology will be appreciated. A minimum of autonomy is expected.

Location: UMR AGAP - DAAV Team, at INRA-SupAgro Campus (Montpellier)
Duration: Pre-PhD (4 m) + PhD (36 m)
Benefits: Pre-Phd (550 €/m), PhD (2 600 €/m, including social contributions)
Contacts: Pr. L. Torregrosa (laurent.torregrosa@supagro.fr), Dr. C. Romieu (charles.romieu@inra.fr)

[1] Torregrosa L., Rienth M., Romieu C., Pellegrino A. (2019) The microvigne, a model for grapevine physiology studies and genetics. OenoOne 53, DOI: https://doi.org/10.20870/oeno-one.2019.53.3.2409.

[2] Rienth M., Torregrosa L., Gauthier S., Ardisson M., Brillouet J-L., Romieu C. (2016) Temperature desynchronizes sugar and organic acid metabolism in ripening grapevine fruits and remodels its transcriptome. BMC Plant Biology 16:164, DOI 10.1186/s12870-016-0850-0.