Role of wood traits (anatomy and composition) on grapevine varietal susceptibility to wood fungal pathogens

Internship offer (6 months) - Master 2 or end-of-study Engineer school

Starting period: not before March 2027

To apply, send your CV and motivation letter to the supervisors (see contacts below).

Scientific context:

Secondary xylem (or wood) represents the niche where interactions between perennial plant hosts and diverse fungal vascular communities take place (Yadeta and Thomma, 2013). Wood characteristics are thus key drivers of plant interactions with fungal species and disease expression. Yet, the specific role of anatomical and biochemical wood traits in the development of wood-colonising fungal species needs to be further explored.

Cultivated grapevine (*Vitis vinifera* L.) is exposed to a series of threats, and fungal trunk diseases are a major concern (Bertsch et al. 2013). One of the symptoms often associated with these diseases are wood necrosis (together or not with external foliar symptoms), usually enriched with fungal communities belonging to different taxa and ecological categories (Bruez et al., 2020; Galarneau et al., 2025; Gastou et al. 2026a). The consequent reduction in wood integrity and functionality creates issues at plant and vineyard levels (Gramaje et al., 2018). Even if no grapevine cultivar has been identified as being completely resistant to this class of diseases, there is evidence that a gradient of varietal susceptibility exists (Gastou et al., 2024; Etienne et al., 2024). Phenotypic traits such as stem xylem anatomy, healthy wood fungal communities and biochemical composition have been characterised in cultivars of contrasted varietal susceptibility, showing significant variation across cultivars, with different levels of correlation to diseases susceptibility and wood integrity (Pouzoulet et al., 2020; Gastou et al., 2026b). Therefore, extend the phenotyping of wood properties to a broad panel of grapevine diversity with known genetic variability, and phenotyping the development of a range of fungal species on wood samples of contrasted composition are two complementary steps toward a better understanding of the underlying mechanisms of grapevine varietal susceptibility to trunk diseases.

Objectives:

The aim of this internship is to investigate (1) the potential relationships between xylem anatomical traits of apparently healthy wood collected from trunks and the level of varietal susceptibility to wood diseases such as esca, and (2) how contrasting healthy wood composition (based on previous wood characterisation) might influence fungal propagation in different ways.

Methods:

(i) Phenotyping the variability of xylem anatomical traits of the trunk in a selection of 20 grapevine genotypes (belonging to the INRAE-ResDur program, a source of grapevine genetic variability originally studied for resistance to downy mildew and powdery mildew; Merdinoglu et al., 2018) of contrasting susceptibility to trunk diseases (incidence of symptom expression and necrosis proportion per genotype), using a quantitative wood anatomy approach (cross-sectioning of standardised wood

samples - previously collected in the field - using a microtome, staining techniques, and image analysis as done by Gastou et al. 2025); (Gärtner et al., 2015);

(ii) Inoculating five fungal species on healthy wood blocks for which the contrasting structural composition is known at varietal level (Gastou et al., 2026b). Different fungal pathogens isolated from grapevine wood and part of the UMR SAVE strain collection will be used. Following inoculation, the development of necrosis will be monitored by image analysis, as well as by the weight loss of the wood.

(iii) Statistical analysis and data interpretation using the literature.

Prerequisites:

- Interest in plant pathology / wood anatomy / image analysis / microscopy
- Seriousness, motivation and patience in conducting experiments
- Good communication skills (in French or in English) and the ability to work well in a team
- Skills in data analysis would be appreciated

Supervisors:

The student will be co-supervised by Chloé DELMAS (DR INRAE) (**chloe.delmas@inrae.fr**) and Samuele MORETTI (postdoctoral researcher INRAE) (**samuele.moretti@inrae.fr**) and will join the research team "Physiopathology" of UMR SAVE.

Name and address of the laboratory:

UMR 1065 Santé et Agroécologie du Vignoble (SAVE). **INRAE** Centre Nouvelle-Aquitaine Bordeaux, 71 avenue Edouard Bourlaux, 33882 Villenave d'Ornon.

References

Bertsch, C. et al. 2013. Grapevine trunk diseases: complex and still poorly understood. *Plant Pathology*, 62(2): 243-265. **Bruez, E. et al. 2020.** Major changes in grapevine wood microbiota are associated with the onset of esca, a devastating trunk disease. *Environmental Microbiology,* 22:5189-5206. **Etienne, L. et al. 2024.** Exploring the role of cultivar, year and plot age in the incidence of esca and Eutypa dieback: Insights from 20 years of regional surveys in France. *Plant Pathology*, 73 : 2344–2358. **Galarneau, E.R., et al. 2025.** Biochemical characterization of wood decay and metabolization of phenolic compounds by causal fungi of grapevine trunk diseases. *PLOS ONE*, 20(4): e0315412. **Gärtner, H., et al. 2015.** A new sledge microtome to combine wood anatomy and tree-ring ecology. *IAWA Journal*, 36(4), 452-459. **Gastou, P., et al. 2024.** Large gradient of susceptibility to esca disease revealed by long-term monitoring of 46 grapevine cultivars in a common garden vineyard. *OENO One*, 58(2). **Gastou P., et al. 2025.** Intraspecific variation in functional strategies underlies susceptibility to a vascular disease in grapevine. submitted. bioRxiv preprint, 2025. https://doi.org/10.64898/2025.12.15.694483. **Gastou, P., et al. 2026a.** Differential impacts of drought and esca expression on Ascomycota fungi in the trunks and young organs of mature grapevines. Phytobiomes Journal, 10(1), 57-71. **Gastou, P., et al. 2026b.** Contrasting wood chemical traits are associated with differences in wood degradation and esca susceptibility among grapevine cultivars. *Journal of Experimental Botany*, erag510. **Gramaje, D., et al. 2018.** Managing grapevine trunk diseases with respect to etiology and epidemiology: Current strategies and future prospects. *Plant Disease* 102:12-39. **Merdinoglu, D., et al. 2018.** Breeding for durable resistance to downy and powdery mildew in grapevine. *OENO One*, 52(3): 203-209. **Pouzoulet, J., et al. 2020.** Behind the curtain of the compartmentalization process: Exploring how xylem vessel diameter impacts vascular pathogen resistance. *Plant, Cell & Environment* 43(11): 2782-2796. **Yadeta, K.A. and J. Thomma, B.P.H., 2013.** The xylem as battleground for plant hosts and vascular wilt pathogens. *Frontiers in Plant Science*. 4:97.