



Master internship at Agroscope

Title

Flavescence Doree in grapevines: understanding the molecular mechanisms responsible for symptom development

Introduction

Flavescence Doree (FD) is an emerging quarantine disease that arrived in Switzerland in 2004 in Ticino. It is caused by the phytoplasma *Candidatus Phytoplasma vitis*, and is transmitted from vine to vine mainly by the leafhopper *Scaphoideus titanus*. The insect is present in Ticino, in the Lake Geneva region and in Valais. Due to global warming, it is gradually expanding its territory northwards by a few kilometers each year.

Its presence in new wine-growing areas is at the origin of the development of numerous epidemic outbreaks north of the Alps since 2015. Insecticide control is used to progressively reduce the number of FD-positive vines in the areas recently affected by the epidemic. However, in areas where the disease has not been detected early enough, FD becomes established in wild plants in the landscape and its eradication is no longer an option.

This Master's project is part of a larger effort by Agroscope to study the still poorly understood molecular mechanisms that lead to the development of devastating symptoms in susceptible grape varieties such as Chardonnay, while other grape varieties such as Merlot seem more tolerant.

An experimental transmission system allowing the study of several strains of FD is established in our laboratory. For this internship, the student will quantify the response to infection in several vine varieties using metabolomic, molecular and microscopic approaches. A transcriptomic analysis will be conducted on the shoots of resistant and susceptible grapevines that are strongly altered at the level of the lignification process in order to search for the genes most deregulated by the presence of the FD phytoplasma and to identify the mechanisms responsible for this deregulation. In parallel with the sequencing of the complete genome of this non-cultivable phytoplasma (currently in progress in the lab), the student will participate in the functional analysis of this genome in order to identify and characterize the diversity of effectors and other virulence genes in different strains of FD.

The results of this work will be used to understand and characterize the remission that allows, in rare cases, a diseased plant to survive the infection by eliminating the FD phytoplasma by mechanisms that are not yet understood.

This internship in grapevine phytopathology will allow the candidate to become familiar with the physiology and molecular mechanisms of plant-microorganism interactions. It will be an opportunity to develop practical skills in molecular biology adapted to the study of genomes and metabolomics while keeping a close link with the problematic in the field and the affected vineyard plots in Switzerland.

Depending on the progress of the project and the interests of the candidate, this project will also allow the development of practical skills in the various techniques used routinely at Changins to characterize plant-microorganism interactions, including qPCR, HTS, bioinformatics analyses and microscopy (optical, fluorescence and transmission electron microscopy).

The student will work closely with the PhD student involved in the project under the supervision of the scientist in charge of the project. He/she will benefit from a dynamic research context including 2 postdocs, 2 PhD students and a very collaborative and friendly team as well as a network of partners in the canton of Vaud and in Ticino.

Indicative bibliography

Bertazzon, N., Bagnaresi, P., Forte, V., Mazzucotelli, E., Filippin, L., Guerra, D., Zechini, A., Cattivelli, L., & Angelini, E. (2019). Grapevine comparative early transcriptomic profiling suggests that Flavescence dorée phytoplasma represses plant responses induced by vector feeding in susceptible varieties. *Bmc Genomics*, 20(1), Article 526.



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- Margaria, P., Ferrandino, A., Caciagli, P., Kedrina, O., Schubert, A., & Palmano, S. (2014). Metabolic and transcript analysis of the flavonoid pathway in diseased and recovered Nebbiolo and Barbera grapevines (*Vitis vinifera* L.) following infection by Flavescence dorée phytoplasma. *Plant Cell Environ*, 37(9), 2183-2200.
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- Prezelj, N., Covington, E., Roitsch, T., Gruden, K., Fragner, L., Weckwerth, W., Chersicola, M., Vodopivec, M., & Dermastia, M. (2016). Metabolic Consequences of Infection of Grapevine (*Vitis vinifera* L.) cv. "Modra frankinja" with Flavescence Dorée Phytoplasma. *Frontiers in Plant Science*, 7(711).
- Teixeira, A., Martins, V., Frusciante, S., Cruz, T., Noronha, H., Diretto, G., & Gerós, H. (2020). Flavescence Dorée-Derived Leaf Yellowing in Grapevine (*Vitis vinifera* L.) Is Associated to a General Repression of Isoprenoid Biosynthetic Pathways. *Frontiers in Plant Science*, 11, Article 896.

Information about Agroscope

Agroscope is an innovative research institute for agriculture and nutrition. Agroscope is part of the federal administration and is attached to the Federal Department of Economic Affairs, Education and Research EAER. It has research stations at a number of sites around Switzerland.

We offer a stimulating work environment in a multidisciplinary research team as well as a close support throughout the project. Agroscope has excellent research facilities with well-equipped laboratories, greenhouses, climate chambers and sites for field experiments and field studies.

Place of Work

1260 Nyon (Changins) VD - Switzerland

Application

If this challenge appeals to you we look forward to receiving your e-mail application to christophe.debonneville@agroscope.admin.ch or olivier.schumpp@agroscope.admin.ch

For further information, please feel free to contact Dr. Christophe Debonneville (+41 58 484 95 91) or Dr. Olivier Schumpp (+41 58 460 43 71).

Start date: upon agreement.