Schweizerische Eidgenossenschaft
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Eidgenössisches Departement für
Wirtschaft, Bildung und Forschung WBF

Agroscope

Master internship at Agroscope

Titre

Exploration of the virome of fungal endophytic communities in grapevines

Introduction

The development of new sequencing methodologies has revealed the presence of a wide diversity of viruses in all the environments studied. Among them, viruses infecting plant endophytic fungi (mycoviruses) can occasionally influence the interaction between the plant and its endophyte by limiting the virulence of the phytophathogenic fungi or by stimulating the quality of the interaction to enable the host plant to cope with environmental changes. (Márquez et al., 2007; Prospero and Rigling, 2016; Zhang et al., 2020). In addition, important variations of plant viral composition are observed according to environmental constraint: in a defined pedoclimatic environment, the study of plant viroma shows that the biodiversity of phytoviruses is significantly higher when the plot is cultivated, compared to a plot left in the wild (Bernardo et al. 2017).

Agroscope's virology and mycology groups are joining forces to identify and evaluate the role of the virome of fungal endophytic communities in grapevines of a vineyard in Upper Valais. There, thanks to an ancestral method of cultivation, grapevines of *Vitis vinifera* cv. Savagnin blanc of more than 100 years old rub shoulders with young grapevines that are regularly renewed according to the most recent cultivation methods. This unique plant material will allow us to study the fungal and mycoviral communities of vines that are strongly influenced by human interventions in comparison with communities derived from very old vines cultivated according to ancestral methods, with less environmental perturbations.

Form the sampling of those vines, more than 250 single fungal isolates were cultured and identified, comprising 46 different fungal species. In line with these promising results, work is in progress to evaluate the biodiversity of fungal viruses derived from welded/grafted grapevines.

The master's internship will start in the fall semester of 2021 with the sanitation of fungal isolates in which mycoviruses were detected, in order to obtain isogenic fungal strain with and without mycoviruses. The study of the mycovirus-free strains will make it possible to evaluate the effect of the presence/absence of the mycovirus on its fungal host when it is cultivated on an artificial medium or when it colonizes a plant and develops as an endophyte. This internship will be an opportunity to develop practical skills from fungal manipulation, to the extraction of viral RNA from complex matrices, as well as practical skills in qPCR. The student will develop bioinformatics skills for sequence analysis and primer/probe design for screening and quantification of viral genomic fragments in fungal isolates. Depending on the progress of the project and the interest of the student, the reconstruction of complete viral genomes by RACE-PCR and the analysis of Illumina and/or nanopore sequencing data for genomic or transcriptomic studies will be planned.

The internship is associated with an ongoing PhD project and will benefit from a very good scientific and technical dynamics. The student will be supervised by a team of 4 people, including 2 scientists from the mycology group, the PhD student involved in the project and a scientist from the virology group.

Indicative bibliography

Bernardo P, Charles-Dominique T, Barakat M, Ortet P, Fernandez E, Filloux D, et al. (2017) Geometagenomics illuminates the impact of agriculture on the distribution and prevalence of plant viruses at the ecosystem scale. The Isme Journal 12: 173. doi:10.1038/ismej.2017.155

Ma Y, Marais A, Lefebvre M, Theil S, Svanella-Dumas L, Faure C, et al. (2019) Phytovirome Analysis of Wild Plant Populations: Comparison of Double-Stranded RNA and Virion-Associated Nucleic Acid Metagenomic Approaches. J Virol 94(1)

Marquez LM, Redman RS, Rodriguez RJ, & Roossinck MJ (2007) A virus in a fungus in a plant: Three-way symbiosis required for thermal tolerance. Science 315(5811): 513-515

Prospero S., Rigling D. (2016) Using molecular markers to assess the establishment and spread of a mycovirus applied as a biological control agent against chestnut blight. BioControl 61:313-323.

Zhang H., Xie J., Fu Y., Cheng J., Qu Z., Zhao Z., Cheng S., Chen T., Li B., Wang Q., Liu X., Tian B., Collinge D.B., Jiang D. (2020) A 2-kb Mycovirus Converts a Pathogenic Fungus into a Beneficial Endophyte for Brassica Protection and Yield Enhancement. Mol Plant 13:1420-1433.

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 olivier.schumpp@agroscope.admin.ch .

For further information, please feel free to contact Dr. Olivier Schumpp, phone +41 58 460 43 71, olivier.schumpp@agroscope.admin.ch or Dr. Katia Gindro, phone +41 58 465 43 74, katia.gindro@agroscope.admin.ch.

Start date: 1 September 2021 or upon agreement.