



Master internship at Agroscope

Title

A region, a vineyard and a plant, three scales to study the genetic diversity of the grapevine fanleaf virus, a major pathogen of our vineyards.

Introduction

Grapevine fanleaf virus (GFLV) is the main contributor to grapevine degeneration disease, the oldest and one of the most costly viral grapevine diseases in Europe. The virus is widespread in Switzerland and there is no cure to the disease. The removal of infected plants is only a short-term remedy since *Xiphinema index*, the soil nematode responsible for its spread, will invariably transmit the virus to replacement vines. To add a level of complexity to the disease management, nematodes can remain viruliferous several years after their last contact with an infected vine. As a result, the only long-term disease strategy available to date is a long fallow (>5 years) to decontaminate the soil of viruliferous nematodes.

This project is part of a multidisciplinary research program aimed at better understanding the biology and genetic diversity of GFLV and *X. index* in Switzerland in order to provide wine growers with an effective and environmentally friendly management strategy. The project focuses on viral diversity and will be divided into three parts, with an increased resolution at each step. The initial part of this project is the "low resolution - large scale" monitoring of GFLV in a selected region. Samples will be collected from several vineyards, and viruses will be enriched and by sequenced high-throughput sequencing (HTS) in pooled samples. Phylogenetic analyses will be used to compare the diversity to other viticultural regions. During the second stage, a "medium-resolution-medium-scale" analysis will be performed to measure the intra-vineyard virus incidence and genetic diversity. A selected area will be mapped and plant phenotypes will be described and assessed for virus presence and genotypes by HTS. This second stage should identify GFLV-infected plants with no or mild symptoms. Those asymptomatic GFLV positive plants will be sequenced with "high-resolution" in the third stage, using a third generation sequencer (single molecule sequencing- Oxford Nanopore Technologies) to obtain virus species/haplotypes that cause no or few symptoms on selected vines under certain conditions. Those isolates will be made available for future potential control strategy and their sequences will be used to determine the pathogenicity.

This project is a good opportunity to develop practical skills in virology of a perennial host. The student will use classical molecular biology techniques such as DNA/RNA extraction, PCR and different forms of virus enrichment (double-stranded RNA, Virion associated nucleic acids (VANA), and immunocapture) and HTS data analyses, bioinformatics and phylogenetic.

The internship will be supervised at the scientific and technical level by Arnaud Blouin as part of a larger scientific team including virologists and entomologists from Agroscope.

Indicative bibliography

1. Maclot F, Candresse T, Filloux D, Malmstrom CM, Roumagnac P, Van der Vlugt R, Massart S (2020) *Illuminating an ecological blackbox: using high throughput sequencing to characterize the plant virome across scales. Frontiers in Microbiology 11:578064*
2. Adams IP, Fox A, Boonham N, Massart S, De Jonghe K (2018) *The impact of high throughput sequencing on plant health diagnostics. European Journal of Plant Pathology 152:909-919*
3. Saldarelli P, Giampetruzzi A, Maree H, Rwahni MA (2017) *High-throughput sequencing: advantages beyond virus identification. Grapevine viruses: molecular biology, diagnostics and management. Springer, pp 625-642*
4. Garcia S, Hily J-M, Komar V, Gertz C, Demangeat G, Lemaire O, Vigne E (2019) *Detection of Multiple Variants of Grapevine Fanleaf Virus in Single Xiphinema index Nematodes. Viruses 11:1139*



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 arnaud.blouin@agroscope.admin.ch or olivier.schumpp@agroscope.admin.ch

For further information, please feel free to contact Arnaud Blouin, (+41 58 465 71 31) or Dr. Olivier Schumpp (+41 58 460 43 71).

Start date: upon agreement