

How the structure of the virome and the genetic diversity of Grapevine fanleaf virus affect the symptoms observed in grapevines in a vineyard

Starting date: upon agreement

Duration: 6 to 12 months

Working Place: 1260 Nyon (Changins) VD - Switzerland

Language: French/english

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Grapevine fanleaf virus (GFLV) is the main contributor to grapevine degeneration disease, the oldest and one of the costliest 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 vector, 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.

Objectives

Preliminary studies have demonstrated a considerable range of grapevine symptoms within an infection cluster comprising approximately 400 plants. These included variations in growth vigour, leaf colour and distortion, and abnormalities in cane growth. Concurrently, the virome structure within this cluster has been observed to exhibit a high degree of variability between plants, with the presence of a diverse array of "latent viruses" documented. Additionally, the composition of GFLV has also been found to vary considerably between plants, with a notable variation in the number of isolates within a plant and a substantial genetic diversity.

The project will include the sequencing of viral-enriched RNA from collected plants and the reconstruction of the virome through the application of bioinformatics techniques, with a particular focus on GFLV genomes. The resulting data will then be employed to facilitate a comparison of the viral status with the phenotypic data obtained previously.

Experimental approach

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.

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. 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



Work environment, scientific and technical supervision

This internship in grapevine virology will allow the candidate to become familiar with the genetic diversity of virus populations at the plant and plot scale and the impact of virome structures on the development of a large diversity of plant symptoms. It will be an opportunity to develop practical skills in molecular biology adapted to expression studies while keeping a close link with the problematic in the field and the affected vineyard plots in Switzerland.

The internship will be supervised at the scientific and technical level by Arnaud Blouin as part of a larger scientific team including virologists from Agroscope. The student will benefit from the opportunity to engage in dynamic research within a multidisciplinary research team comprising three staff scientists, one postdoctoral researcher, one doctoral student, and a highly collaborative and collegial team, as well as a network of partners.

The laboratory is equipped with excellent research facilities including greenhouses, climate chambers and sites for experiments and field studies.

Information about Agroscope

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