

PhD in plant virology

Study of the factors and mechanism(s)
underlying cross-protection



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The French National Research Institute for Agriculture, Food, and Environment (INRAE) is a major player in research and innovation. It is a community of 12,000 people with 272 research, experimental research, and support units located in 18 regional centers throughout France. Internationally, INRAE is among the top research organizations in the agricultural and food sciences, plant and animal sciences, as well as in ecology and environmental science. It is the world's leading research organization specializing in agriculture, food and the environment. INRAE's goal is to be a key player in the transitions necessary to address major global challenges. Faced with a growing world population, climate change, resource scarcity, and declining biodiversity, the Institute has a major role to play in building solutions and supporting the necessary acceleration of agricultural, food and environmental transitions.

WORK ENVIRONMENT AND ACTIVITIES

You will work in the research unit entitled UMR SVQV (UMR-1131 – ‘Santé de la Vigne et Qualité du Vin’) that associates scientists and technicians from the INRAE, Colmar and from the University of Strasbourg. The main goal of SVQV research unit is to gain an understanding of the relationships between grapevine and both its fungal and viral pathogens – including virus vectors – in order to develop innovative solutions for a more environmentally friendly viticulture in the context of global warming. The research conducted in the unit is based on complementary expertise in plant pathology, entomology, genetics, genomics and metabolomics. You will be part of the Virology Vection team which focuses more specifically on the (i) development of resistance strategies to the virus responsible of fanleaf disease (*Grapevine fanleaf virus*, GFLV) and (ii) on the identification of the factors involved in virus transmission by different vectors (nematodes and aphids).

SCIENTIFIQUE CONTEXT

GFLV is a major threat to the world viticulture. Present across the world and affecting 2/3 of the French vineyards, it can cause up to 80% yield loss. The ban of the nematicides targeting its nematode vector, *Xiphinema index*, has led winegrowers with few solutions to fight this virus.

Cross-protection is a well-known phenomenon in plant virology, involving the inoculation of a mild virus (cross-protecting virus) to protect a plant against subsequent infection by related severe viruses (challenging virus). This phenomenon, discovered almost a century ago, has been described for a number of pathosystems. It has since been used as a biocontrol method to protect plants of agronomic interest from damage caused by various viral species, such as citrus tristeza virus on citrus or pepino mosaic virus on tomatoes. Despite this century of hindsight, the factors and mechanism(s) underlying this phenomenon remain poorly understood.

YOUR MISSIONS

The aim of your work will be to study the factors involved in cross-protection against GFLV. In particular, although the genetic relatedness between cross-protecting and challenging variants has been highlighted in numerous articles, the degree of relatedness required for cross-protection to occur is still unknown. This lack of data has led to a long, tedious and sometimes fruitless empirical search for

variants that protect against certain viral strains. The first objective of your work will be to determine the degree of genetic relatedness required between cross-protecting and challenging variants for the establishment of cross-protection against GFLV. In addition to this genetic relatedness, two other parameters have been shown to impact cross-protection efficiency in other pathosystems, and will therefore be examined as part of your thesis: these are (i) the relative fitness of the cross-protecting and challenging variants (defined here as their relative ability to infect and accumulate within a host) and (ii) the time interval between their inoculations. Finally, you will examine whether one or more plant defense pathways are involved in this phenomenon. This work will be carried out on herbaceous hosts (*Nicotiana benthamiana*, *Arabidopsis thaliana*); your results will be compared with data obtained on vines.

Your work will enable you to develop skills in plant pathology, molecular biology and bioinformatics (analyses of transcriptomic data).

THE PROFILE WE ARE LOOKING FOR

- **Required training:** Master's degree or degree of equal standing.
- **Required knowledge:** virology, training in basic molecular biology and microbiology techniques. Good writing and communication skills in English.
- **Required skills:** we are looking for a candidate who is curious, motivated and able to work independently and as part of a team.

↳ Terms and conditions

- Unit: UMR SVQV 1131 (Team 'Virology and Vection')
- Workplace: Centre INRAE Grand Est-Colmar
- Reference:
- Contract: **PhD**
- Duration: **36 months**
- Starting date: **January 2025**
- Gross salary: **2200€/month**

↳ Application procedure

Send a cover letter, a CV, your master's grades as well as the contact details of one or two referees.

to:

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Application deadline: October, 18th 2024

PhD start date: January, 1st 2025