

What's more? Viruses in an important agricultural pest

Focus and aim of the project

In the last decade, the abundance and ubiquity of insect viruses have been recognized and shown to be of great biological relevance. While the long-standing characterization of insect viruses was based on infection with clear symptoms, high throughput sequencing created an opportunity to further expand the knowledge on asymptomatic viral infections. However, the main focus of insect virus discovery has taken place in insect species that have an effect on human health and therefore, unearthing viruses in agriculturally important insects is lagging behind.

Over the years, we retrieved a large set of sequencing data from a noctuid moth species, the beet armyworm, *Spodoptera exigua*, which is a major polyphagous pest responsible for substantial yield losses worldwide. To combat *S. exigua*, there is a growing market for the application of specific biological control agents like viruses that offer a safe alternative for ineffective conventional pesticides. The production of these viruses requires a continuous and healthy moth mass rearing. Therefore, our research aims to gain more insights in the virus diversity of both field and laboratory populations of *S. exigua*. We will unravel the moth's virome via the obtained Illumina sequencing datasets of DNA, RNA and small RNA. State-of-the-art bioinformatics tools will be used to screen for known and new viruses present in these populations. Besides describing the virome of *S. exigua* (1), this analyses will give us the opportunity to determine the viral variants (2), screen for endogenous viral elements (3) and study evolutionary patterns (4).

Relevance for the PE&RC mission

This project aims to study virus populations found in field and laboratory populations of an important agricultural pest. Viruses in lepidopteran species, even the ones that cause asymptomatic viral infections, have a great impact on the insect's fitness, can affect its behavior and can change trophic interactions in the ecosystem, including those with plants and parasitoids. However, the role of viruses as herbivore-associated organisms in the beet armyworm and in a wider ecological context remains unexplored. The first step to understand the impact of insect viruses on the ecosystem, is to describe the viruses and their genetic diversity. In that way, we can explore the threats they pose for mass rearing, their potential as new, safe biocontrol agents and begin to understand their impact on ecosystems, which strongly aligns with the PE&RC mission 'to understand the functioning of natural and managed ecosystems to improve the quality of life'.

Strengthening the institutional collaboration

The project will initiate the collaboration between the PE&RC groups WUR-Virology (Astrid Bryon and Vera Ros and NIOO-Microbial Ecology (Mark Zwart), merging expertise in insect virology and virus ecology and evolution. Both groups study virus biodiversity in different systems, and this joint project will strongly benefit from combining their approaches and knowledge. Dr. Bryon and Dr. Ros have ample experience on virus-host interactions. As these interactions may be substantially affected by other viruses present, a virome analysis is needed. Joining forces with Dr. Zwart, expert in virus ecology and evolution, will enable both groups to further develop virome identification, a complex process partly determined by the bioinformatic analysis used. The combination of these two different pipelines will lead to an improved detection. Furthermore, not only identifying viruses but also analyzing viral variants (Dr. Zwart) and viral integrations into the host genome (Dr. Bryon) will yield important insights in virus evolution.

Groups, scientists and PhD candidate involved

Groups and scientists

Laboratory of Virology, Plant Sciences Group, Wageningen University

Dr. ir. Astrid Bryon, Assistant Professor

Dr. ir. Vera Ros, Associate Professor

Microbial Ecology, Netherlands Institute of Ecology (NIOO-KNAW)

Dr. Mark Zwart, Senior Scientist

PhD candidate

Annamaria Mattia

We ask to fund 4 months of work for the PhD candidate (appointed from March 2020 to March 2024, Laboratory of Virology, Wageningen University), to perform the project as outlined above. Laboratory work is to be performed at the Laboratory of Virology, research expenses will be covered by the chair group and a VIDI grant assigned to dr. ir. Vera Ros.