NURSERY PAPERS

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STRENGTHENING BIOSECURITY:

Enhancing surveillance for tospoviruses and thrips in the nursery industry

Effective biosecurity measures are critical to maintaining the productivity and resilience of Australia's nursery industry. Tospoviruses and thrips are among the most significant threats, capable of causing widespread damage to crops.

Recognising this, a collaborative project (NY19007) led by Agriculture Victoria and the University of Queensland is developing innovative surveillance tools and strategies to safeguard nursery production.

This project aims to equip the nursery industry with the knowledge and technology to identify and manage these threats more effectively.

Thrips and tospoviruses: a growing challenge

Tospoviruses, a group of plant viruses from the genus *Orthotospovirus* within the family *Tospoviridae*, are notorious for causing significant economic losses in agricultural and horticultural crops worldwide.

These viruses are transmitted primarily by thrips, tiny insects that act as vectors. Thrips are a persistent challenge for nurseries, with approximately 7,700 species known to science—though only about 10% are regarded as agricultural pests and only 16 of these are known virus vectors.

Among the major pest species in Australian nurseries are the Western Flower Thrip (*Frankliniella occidentalis*), Tomato Thrip (*Frankliniella schultzei*), Plague Thrip (*Thrips imaginis*), Onion Thrip (*Thrips tabaci*), Melon Thrip (*Thrips palmi*) and Greenhouse Thrip (*Heliothrips haemorrhoidalis*). Western flower, tomato, onion and melon thrips are known vectors of tospoviruses in Australia.

These pests feed on plants, weakening them and often transmitting harmful tospoviruses like **Tomato spotted wilt virus (TSWV)**, which further complicates management efforts. The ability of these pests to adapt to different environments and species, as well as their capacity to spread rapidly, makes them a critical threat to biosecurity.

Greenlife Industry Australia

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This communication project has been funded by Hort Innovation using the nursery research and development levy and funds from the Australian Government.

Hort Innovation NURSERY FUND

A need for improved biosecurity measures

Given their impact on plant health, managing thrips and the viruses they carry is essential to the survival and growth of the nursery industry. This project, which will run from 2020 to 2026, seeks to strengthen on-farm surveillance by improving diagnostic accuracy and equipping nurseries with practical tools and strategies to mitigate these threats.

Once implemented, these solutions will integrate seamlessly into existing industry biosecurity frameworks like **Biosecure HACCP**, ensuring nurseries can stay ahead of emerging risks. The project also aims to provide better tools for **early detection** and **rapid response**, ultimately reducing the spread of pests and diseases in the nursery sector.

WHAT THE PROJECT DELIVERS

KEY OUTCOMES INCLUDE:

- **Understanding pest dynamics**: mapping the prevalence and seasonal population changes of tospoviruses and thrips in nursery production systems, as well as their interactions with surrounding landscapes. This information will allow nurseries to anticipate potential outbreaks and take preventative measures.
- **Genetic insights**: assessing the genetic variability of thrips and tospoviruses to improve species identification and enhance pest management strategies. With a better understanding of the genetic make-up of these pests, more targeted solutions can be developed.
- **Smart surveillance tools**: developing advanced diagnostic methods, including **DNA barcoding** and **portable nanopore** sequencing, for rapid and accurate pest detection. This will enable nurseries to quickly identify the species of thrips present and whether they are carrying viruses.
- **Tailored strategies**: creating a practical surveillance framework in collaboration with industry stakeholders to detect exotic tospoviruses that may enter Australia. This will help prevent new threats from spreading and ensure nurseries are prepared for potential biosecurity breaches.

These advancements aim to enhance nursery biosecurity practices and improve preparedness for potential outbreaks, contributing to the long-term sustainability of the industry.

An adult female thrips (*Frankliniella* sp.). Photograph credit: Queensland Department of Primary Industries

The nanopore DNA sequencing device. Photograph credit: Nga Tran

INNOVATING WITH DNA BARCODING TECHNOLOGY

Traditional methods vs. new technology

Traditional thrip identification methods rely on examining fine anatomical features under a microscope—an intricate and time-consuming process requiring specialised expertise. The current identification process involves **clearing** and mounting thrip specimens to study their physical characteristics, such as bristles and body parts, which can be challenging even for experienced researchers. These traditional methods are not only labour-intensive but are also limited in their accuracy, particularly when distinguishing between closely related species.

However, **technological advancements** are transforming this landscape. By using **DNA barcoding**, researchers can now identify thrip species based on their unique genetic sequences, providing a faster and more reliable approach. DNA barcoding involves extracting DNA, sequencing it, and matching the genetic sequence to known reference data. This allows for the accurate identification of thrips without needing to rely on morphological features.

The role of nanopore sequencing

A breakthrough in this project is the integration of **portable nanopore sequencing technology**. This pocket-sized device reads DNA sequences in real-time, enabling rapid identification of thrips and the viruses they carry. The **nanopore sequencer** works by passing DNA through tiny pores, generating an electronic signal that is used to decode the DNA sequence. This technology is highly portable, allowing for on-site testing in nurseries without needing to send samples to external laboratories.

Practical applications and outcomes

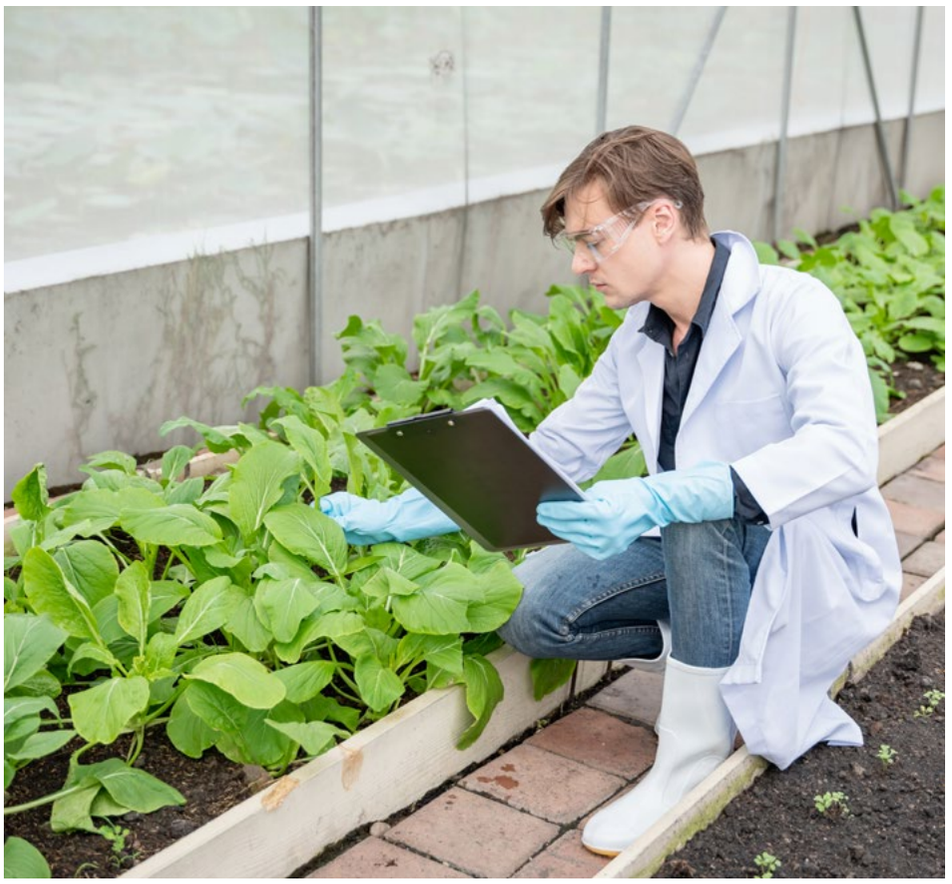
PhD students **Chester Chao** (University of Queensland) and **Eyal Zeira** (co-supervised by Agriculture Victoria and La Trobe University) have successfully developed DNA barcoding assays for thrips, enabling researchers to:

- **Identify multiple thrip species**, including virus vectors, from mixed samples, improving diagnostic accuracy.
- **Estimate the proportion of thrips species** present in mixed samples.
- **Detect orthotospoviruses** carried by thrips, adding a critical layer of biosecurity capability.

This functionality enables early detection of both pests and diseases, and estimation of risk, facilitating timely interventions.

The development of these assays and the integration of nanopore sequencing is a significant step forward in pest management and disease prevention.

It provides a reliable, efficient method for nurseries to detect and manage the risks posed by thrips and tospoviruses, improving overall biosecurity.



THE ROAD AHEAD

While DNA-based identification is currently lab-based, rapid advancements in technology suggest a future where portable devices are commonplace in nurseries. In the near future, nursery growers could use portable DNA sequencers in their operations to quickly identify pests and viruses on-site, reducing the need for laboratory testing and enabling faster decision-making.

These advances will allow growers to more efficiently monitor and manage pest and virus risks, enhancing the overall biosecurity of Australian nurseries. As the technology becomes more widespread, the nursery industry will be better equipped to handle emerging biosecurity threats, ensuring the long-term health of Australia's plant production sector.

This project underscores the importance of combining innovative science with practical industry solutions to bolster the resilience of Australia's nursery sector, paving the way for a more biosecure and sustainable future.

For more information, visit ***www.greenlifeindustry.com.au***

MORE INFORMATION

Download past nursery papers from the Greenlife Industry Australia website at ***www.greenlifeindustry.com.au/communications-centre?category=nursery-papers***

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