NURSERY PAPERS
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REVOLUTIONISING BIOSECURITY:

Innovative surveillance tools for tospoviruses and thrips in the nursery industry

Innovative technology is transforming how Australia's nursery industry protects itself against biosecurity threats. Tospoviruses and thrips, capable of causing devastating damage to crops, remain a top concern for the sector.

To tackle this, a collaborative project (NY19007) led by the Victorian Department of Jobs, Precincts and Regions and the University of Queensland is developing cutting-edge surveillance tools and strategies. These advancements aim to equip the nursery industry with the knowledge and technology needed to identify and manage these threats more effectively, ensuring a more resilient future.

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 mainly by thrips, tiny insects that act as vectors, meaning they spread the viruses to plants while feeding. Thrips are a persistent challenge for nurseries, with approximately 7,700 species—though only about 10% are seen as agricultural pests.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*)
- Greenhouse Thrip (*Heliothrips haemorrhoidalis*).

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.

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

Better biosecurity measures needed

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 started in 2020, 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

- 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 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 their 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, it requires specialised expertise and 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 the identification 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 lets nurseries accurately identify thrips without needing to rely on structural features.

The role of nanopore sequencing

A breakthrough in this project is the integration of portable nanopore sequencing technology. A pocket-sized nanopore sequencing device can read DNA sequences in real time, enabling the 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 transportable, and trials show it will likely be suitable for on-site testing so nurseries don't need to send samples to external laboratories

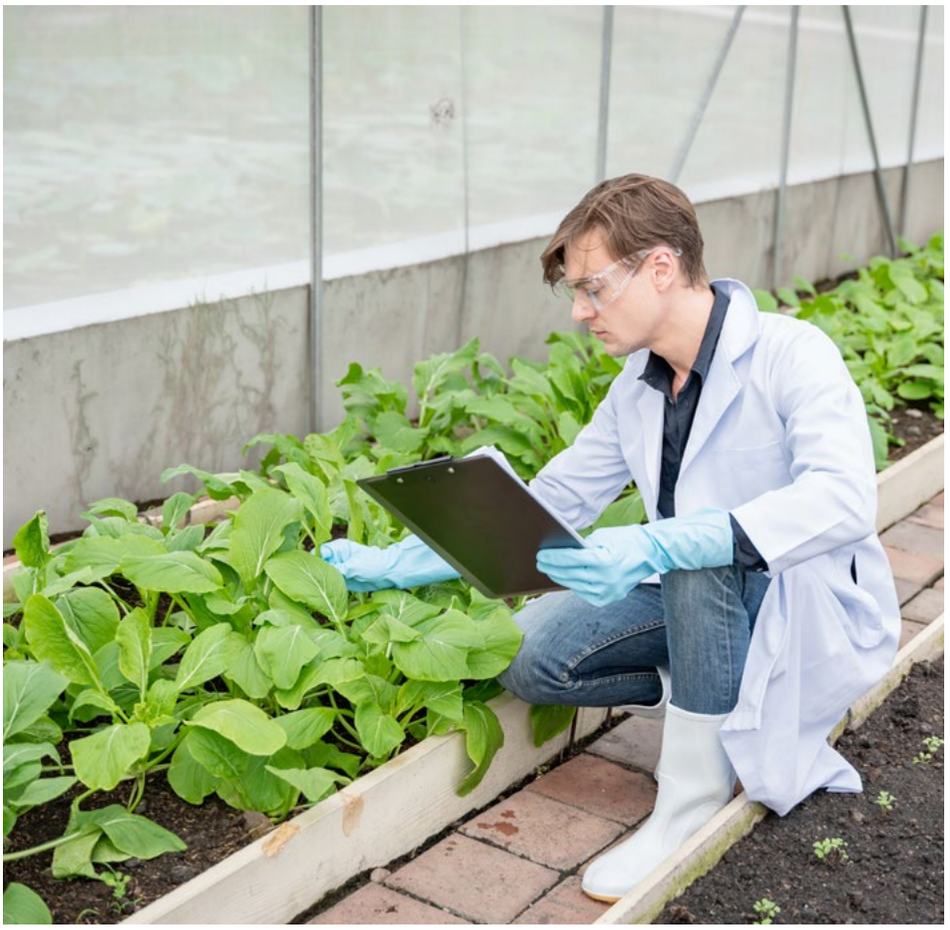
Practical applications and outcomes

PhD student Chester Chao has successfully developed DNA barcoding assays—laboratory tests that use genetic sequences to identify species and detect pathogens—for thrips, enabling researchers to:

- identify multiple thrip species from mixed samples, improving diagnostic accuracy
- detect orthotospoviruses carried by thrips, adding a critical layer of biosecurity capability.

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

The development of these assays and the integration of nanopore sequencing are significant steps 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. Soon, 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 individual businesses and the sector more broadly. 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

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