Figure 6. Parasitised TPP nymph, showing the wasp's exit hole. - *R. Lamberts*

was not just the interest shown by growers, but also the enthusiasm from home gardeners, who released more than 10,000 *Tamarixia* in the 2020-21 season," said Sally.

Early observations showed that the psyllid survived over winter, spread significantly from the initial release sites and could achieve up to 40% parasitism of psyllid nymphs (Figure 6).

COULD *TAMARIXIA* BE A SOLUTION FOR AUSTRALIA AS WELL?

While *Tamarixia* is now commercially available in New Zealand, introducing it to Australia would require at least a similar number of hoops as encountered by the Wellington researchers.

Critically, it would need to be shown to be host specific to TPP; nobody wants another cane toad! *Tamarixia* was found to predate on a NZ psyllid, although it was non-preferred compared to TPP. Given the large number of Australian psyllid species, this is likely to prove a challenging task as well as a potential barrier to introduction.

However, even the best biosecurity cannot guarantee Australia will be free of 'hot psyllids' forever. Starting the process sooner rather than later, to determine if *Tamarixia*, or a local species, is a potential control option, may be worthwhile insurance.

NEW SMARTPHONE TECHNOLOGIES FOR PATHOGEN DETECTION

POTATO R&D FORUM 2021

Dr Jean Ristaino, Director of the Emerging Plant Disease and Global Food Security cluster at North Carolina State University

Figure 7. Dr Jean Ristaino, a pathologist and distinguished professor in North Carolina University's Department of Entomology and Plant Pathology

Imagine if you could detect disease even before symptoms develop in the field... and you could do it using your smartphone!

This is what a project run out of North Carolina State University is seeking to achieve.

They are investigating two methods.

One is detection of release of volatile organic compounds (VOCs). A sample of plant leaf is placed in a small glass container for around 15 minutes, then the atmosphere is pumped through a chamber containing a test strip (Figure 8). Chemicals on the strip

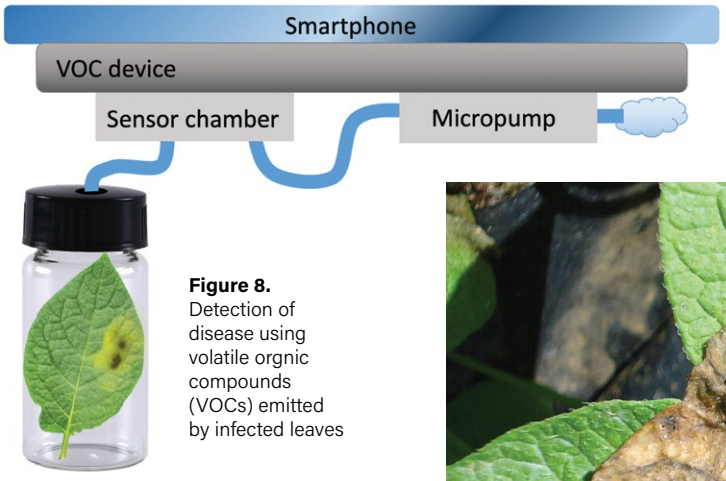

Figure 8. Detection of disease using volatile orgnic compounds (VOCs) emitted by infected leaves

change colour in response to specific VOCs emitted in response to infection. Results have been shown to be 98% accurate.

The second is microneedle patch technology (Figure 9). These are already widely used in human medicine to deliver drugs as well as to diagnose disease and monitor blood sugar levels. The patches cost only a few cents to produce and can even be 3D printed using biodegradable materials.

In this case, the microneedle patches are used to sample DNA from plant leaves. The patch is held against the plant leaf for a few seconds, allowing the tiny needles to pierce the plant tissues. The patch is then immediately washed in a buffer solution to remove the DNA. This is analysed using rapid LAMP (Loop-mediated isothermal amplification) assays to detect specific regions of DNA, revealing the presence of one – or many – plant pathogens.

Figure 10. Late blight (*Phytophthora infestans*) of potatoes could be the first plant disease to be detected using this technology. *- J. Ristaino*

By excluding large amounts of coarse plant material, this method is much faster than more traditional methods of DNA extraction and analysis.

According to Dr Ristaino, "We started off the work with *Phytophthora infestans* ... but now we're planning on scaling the technology into the field, looking at multiple pathogens as they occur in space and time." The ultimate objective is to develop "wearable sensors" that can monitor plant health during the cropping cycle.

"They would have to be resilient to climate, and ideally we want to wirelessly transmit data, rather than having to physically go out and remove the patches or volatile sensors. This is really the next big step, getting field ready," said Dr Ristaino.

As Dr Ristaino observed, "As I read outside the discipline of plant pathology and traditional diagnostics, and learn more about what's going on in the medical community, I'm seeing a lot of opportunities for new applications of this technology in agriculture."

With massive advances in medical technology over the last 18 months, there could be significant spinoff benefits to horticulture. Exciting times, indeed!

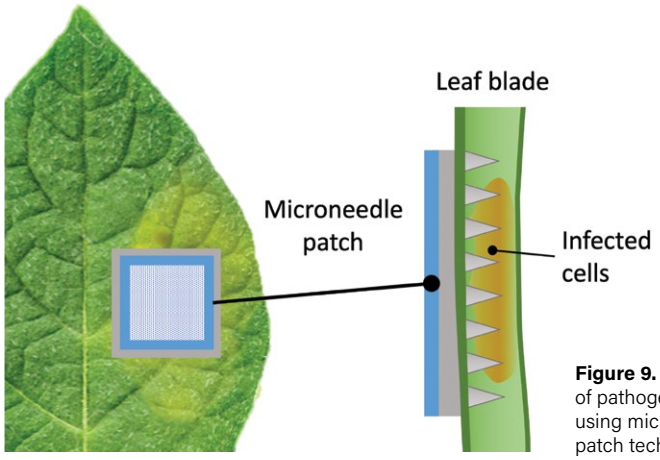

Figure 9. Extraction of pathogen DNA using microneedle patch technology

This work was funded by the NC State Plant Science Initiative. A new video on the technology is available at https://drive.google.com/file/d/13dtnbUdBiPOiFQW47RSr3z0xly7BtTPK/view