GPGV knowledge boost

Pests & Diseases

A comprehensive review of Grapevine Pinot Gris Virus (GPGV) has just been completed to improve Australia's knowledge base in relation to the virus. Following the review, a number of clear research areas have been identified to assist the industry with its transition to effective management of GPGV. This work was led by Vinehealth Australia, largely funded by Wine Australia and authored by **Fiona Constable**, from Agriculture Victoria Research, **Libby Tassie**, from Tassie Viticultural Consulting, and **Suzanne McLoughlin**, of Vinehealth Australia.

Background

Grapevine Pinot Gris Virus (GPGV) is a relatively 'new to science' virus first described in 2012. It has been found to be associated with a disease called grapevine leaf mottling and deformation (GLMD) in Italy in Pinot Gris. Since 2012, the virus has continued to be detected in multiple scion (wine and table grape) and rootstock varieties in Asia, Europe, North America, South America and now Australia, with varying impacts.

In Australia, GPGV was first detected in 2016, after the diagnostic test became available in 2014. It was initially considered by the Consultative Committee on Emergency Plant Pests, the group convened under the Emergency Plant Pest Response Deed, to determine whether (1) GPGV met the criteria for an Emergency Plant Pest and (2) if GPGV was technically feasible to eradicate. More detections of the virus followed both in wine and table grapes between 2016 and 2018, which confirmed its presence could not be attributed to a

Grapevine Pinot Gris Virus symptoms including stunted shoots in Traminer. Photo courtesy P. Saldarelli, University of Bari, Italy.

single isolated incident and, thus, that it was unlikely GPGV could be eradicated. The official status of the virus in Australia is now 'established and present in New South Wales, Victoria and South Australia'. GPGV has, therefore, ceased being regulated at the Australian border.

The rise of new viruses

With the advent of the laboratory method 'deep sequencing' (also known as next generation sequencing or high-throughput sequencing) in the past decade, new plant viruses are being discovered and diagnosed, and Grapevine Pinot Gris Virus is one of these. We suspect more will follow.

But is GPGV a virus we should be worried about? Will it impact yield and vine growth? Or is it like Grapevine rupestris stem pitting-associated virus (GRSPaV) which is one of the most prevalent grapevine viruses worldwide and has not been found to be detrimental to vine health?

The need for knowledge

With the discovery of GPGV in Australia, as part of our 'transition to management' for this virus, the project, 'A comprehensive review of Grapevine Pinot Gris virus' was conceived as the first step in addressing the Australian industry's limited knowledge of the virus. The project aimed to:

- understand the risk of GPGV to Australian wine and grape industries
- empower the local nursery and vine improvement sector to adopt appropriate management strategies to maintain high-health status of planting material and restrict distribution of GPGV-infected propagation material through the grape and wine supply chain
- empower growers to manage infected blocks and to minimise spread of GPGV
- identify field sampling techniques and timing of sample collection via a small 'preliminary sampling trial', to ensure laboratory detection, and evaluate appropriate diagnostic tests to ensure GPGV strains present in Australia can be detected with accuracy
- identify gaps in knowledge of GPGV biology and epidemiology and its impact on Australian viticulture; and
- identify priorities for future research and development in Australia to understand GPGV in the Australian environment.

Varietal sensitivity to GPGV and symptoms of GLMD

The association between the disease GLMD and the virus GPGV is complex and remains unclear. Vines infected with GPGV can be symptomatic for GLMD, asymptomatic (displaying atypical symptoms) or symptomless. GLMD symptom expression has been reported to vary between grape varieties, environments and growing seasons and

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therefore is not a definitive indicator of GPGV infection. From overseas surveys it seems that although many varieties may be infected with the virus, they do not show symptoms. Therefore, GLMD symptom expression makes prevalence of GPGV very hard to quantify on a per vine or landscape level. Laboratory testing is thus the only definitive means of determining infection for this particular virus.

In general, infection of a grapevine with a virus can negatively impact long term vine sustainability. In some cases, large impacts on yield and grape quality can be found through reductions in bunch size and fruit set, delays in maturity and reduced colour in red varieties. Sometimes, the presence of a virus can cause graft incompatibilities and resulting vine death. Other times, infection of a vine with a single virus may not lead to quantifiable issues, but when more than one virus is present, impacts can be felt. In north east Italy, GLMD-affected varieties can suffer both agronomically and economically, including reduced yield and quality impacts.

GPGV has been found overseas and in Australia as mixed infections with other viruses in single vines and this presents a difficulty in attributing symptoms directly to GPGV. In addition, visual symptoms of GLMD can reflect mite or cold damage and therefore making the link between these 'generic' symptoms and an underlying virus can be problematic.

Because of the broad range of scion and rootstock varieties identified to be infected with GPGV from the literature, we can presume that most *Vitis* species are susceptible to infection. This broad reach of the virus, therefore, increases the likelihood that it is not restricted in distribution in Australia. In north-east Italy where GPGV was first detected, the varieties of Pinot Gris, Pinot Blanc, Pinot Noir, Gewürztraminer, Tocai Friulano and Glera (Prosecco) have been reported as the most sensitive to infection, also showing GLMD symptoms. In some of these varieties, reduced yield has been reported due to low bunch numbers and bunch weight, bunch shatter and desiccation, millerandage and delayed ripening.

For the nursery and vine improvement sector, and table grape and winegrape growers, the symptoms to look out for include delayed budburst, stunted shoots, chlorotic mosaic or mottled leaves which are sometimes distorted; all most apparent early in the growing season. Sometimes, symptoms of poor lignification, shoot tip necrosis, zig-zag shoot growth and reduced cane weight may also be apparent. Although these symptoms might suggest infection with GPGV, it is important to remember that these symptoms might also be associated with other causes such as bud mites, fungi, nutritional or management issues, or environmental impacts. Refer www.awri.com.au/wp-content/uploads/8_phenology_restricted_spring_growth.pdf.

Field sampling and diagnostic testing for GPGV

The preliminary field sampling trial undertaken on two blocks of varying varieties in two differing climatic regions showed that GPGV could be detected consistently by sampling a minimum of two shoots per vine, or 10 leaves per vine. While GPGV could be detected in these blocks in autumn, winter and spring, the ability to detect in summer remained untested. According to overseas literature, virus titre is considered to be highest in spring. Testing at different time points was therefore important to provide the nursery and vine improvement sector and growers with some guidance as to whether GPGV testing would need to be undertaken at a different time of the year to testing for other grapevine viruses, which would incur a time and cost penalty.

Importantly, this trial also involved validating the effectiveness of a range of overseas laboratory tests in detecting Australian GPGV samples, some of which were found to contain multiple GPGV strains. This work highlighted the inability of some of these overseas tests to detect GPGV in known positive samples. This finding confirmed that not all overseas laboratory tests are equally as effective in detecting the strains of GPGV that we have in Australia.

To ensure reliable detection of GPGV, there is merit in ensuring diagnostic laboratories are using the same diagnostic tests, or as a minimum, that there is regular proficiency testing between laboratories to ensure efficacy of the diagnostic protocols used.

Reducing GPGV spread

The virus is transmitted by vegetative propagation and grafting. Bud and blister mites (*Colomerus vitis*) are potential vectors of GPGV and it is important to control these pests to reduce spread of the virus. However, all GPGV-infected grapevines, regardless of symptom expression, may also act as an infection source for a variety that is sensitive, which could then exhibit GLMD symptoms, assuming the virus is the sole cause of this disease. Overseas the virus has been detected in some vineyard weed species, but their role in the spread of GPGV is unknown.

It is therefore important to take a cautious approach across the viticulture supply chain to reduce the risk of spread of GPGV via infected propagation material and vector transmission until further information is known. Recommended management strategies for GPGV are outlined in Figure 1.

Recommendations to improve further knowledge of GPGV in Australia

This review provided an excellent opportunity to determine what we know and what we don't know about GPGV based on overseas research and limited studies in Australia. A number of key research areas were identified in this review which, if prioritised amongst other biosecurity needs, would greatly assist in Australia's transition to management of GPGV. These are to:

- undertake a field survey to quantify incidence and distribution of GLMD and GPGV in Australia, including symptom expression, varietal sensitivity, agronomic impact and genetic diversity
- quantify varietal response to GPGV infection on its own and with other viruses
- ensure that all Australian laboratories undertaking diagnostic testing for GPGV are using tests that will detect all the strains present in Australia to minimise distribution of infected propagation material
- evaluate effective virus removal strategies

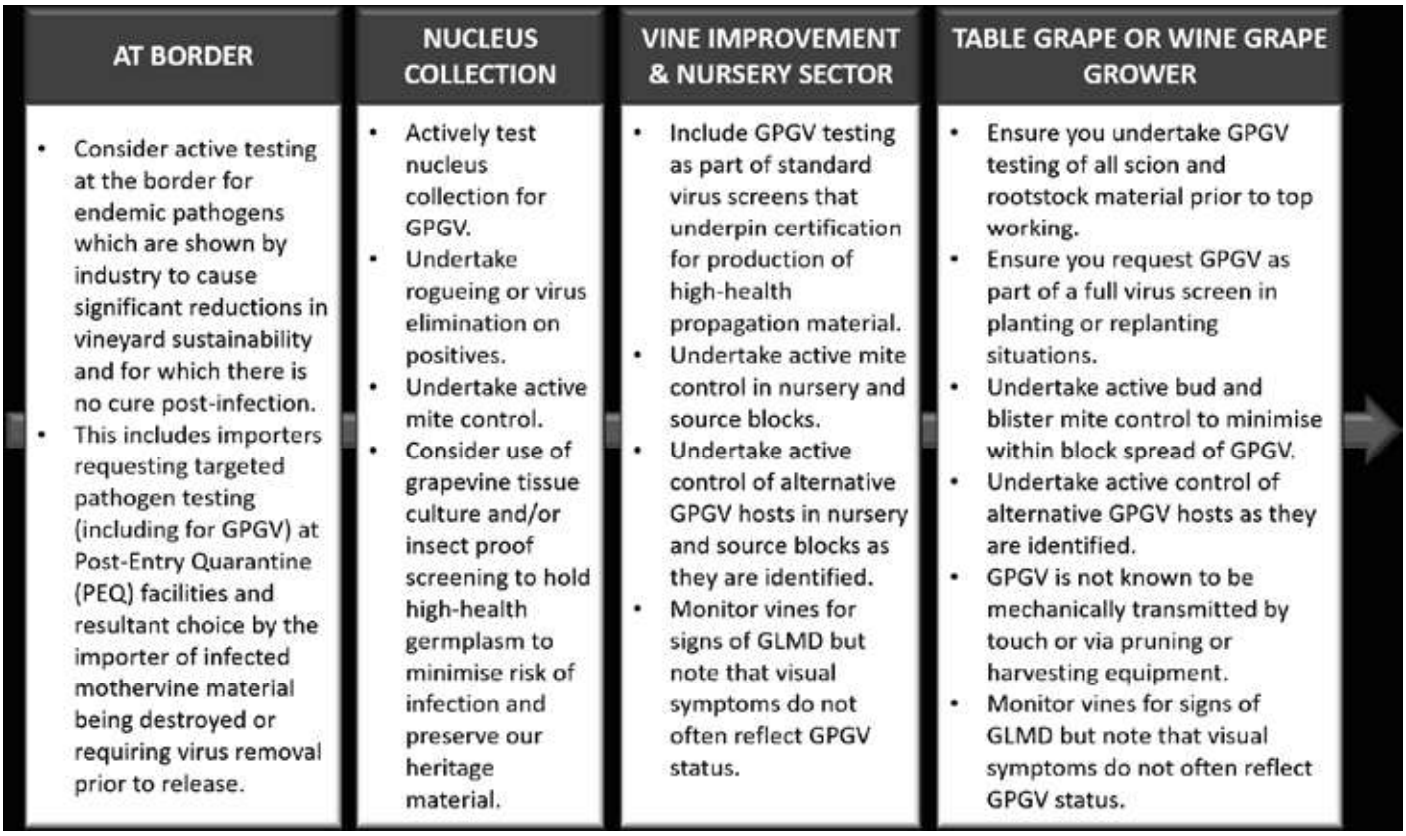

Figure 1. Current recommended strategies for GPGV across the viticulture supply chain.

- conduct a large sampling trial over several seasons, with multiple table and winegrape varieties to confirm the most reliable time to conduct GPGV testing
- better understand the Australian vectors of GPGV and their management; and
- identify alternative hosts of GPGV in Australia and their role in GPGV spread.

Conclusion

The impact of GPGV on vine health and productivity has been reported as variable overseas and at this early stage in Australia, it is probably similar. Taking a cautious approach to minimise the spread of GPGV is therefore suggested as part of our early 'transition to management' phase.

In conjunction, we advocate the need for targeted research to assist in improving and refining local management strategies for GPGV as part of a broader prioritised research, development and extension plan for biosecurity that includes other grapevine infecting viruses occurring in Australia and exotic virus species.

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