MODES OF VIRUS SPREAD OBSERVED IN AUSTRALIAN VINEYARDS

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Introduction

- Viruses can cause major yield loss, reduced wine quality and sugar content
- Shiraz (syn. Syrah) is the principal wine grape variety in Australia. In 2013, 432,000 tonnes were produced with an increase of 14% over 2012 (Anon., 2013).
- Shiraz, Malbec and Merlot are very sensitive to grapevine virus A (GVA) and show a disorder called Shiraz Disease.
- Many other grapevine varieties and rootstocks do not show the symptoms of SD.

Materials and Methods

Sikla (SiQ2) was used for the isolation of total nucleic acids from plants and insects. Viruses were detected either by RT-PCR (Reverse-Transcription Polymerase Chain Reaction) or by ELISA.

Results

Virus spread Mode 1 - by grafting:

The pattern of distribution of SD was random (Mode 1) indicating spread occurred via humans rather than via insect vectors.

Virus spread Mode 2 - by insect vectors:

This mode of virus spread occurs naturally via insect vectors. A characteristic vineyard which showed the SD symptoms (Fig.5) on Shiraz grafted on the Ramsey rootstock was located in the Riverland. Test results showed that SD-affected samples from this vineyard were positive for GVA as well as for Grapevine leafroll-associated virus 3 (GLRaV-3). Another example of Mode 2 was observed in Willunga, south of Adelaide. Again GVA and GLRaV-3 were detected in this vineyard. Both mealybugs and scale insects were also observed on these vines although a higher population of grapevine scale insects (Fig.6) were noticed. Scale insects tested positive for GVA and GLRaV-3. DNA bar-coding performed on these insects showed 100% homology with the species Parthenolecanium persicae (Grapevine scale).

Economic impact

- Six years after grafting Shiraz to GVA-positive Chardonnay (top-working; Fig.6) at McLaren Vale, the vineyard lost 98% of its yield.
- In Langhorne Creek, a large block of Shiraz top-worked on Chardonnay developed SD in 20% of its vines by displaying restricted spring growth (RSG). The whole block has been removed (Fig 8).
- The cost of removing infected vines, replanting and taking into account the elapsed time ahead of the first profitable crop, is estimated to be around $400,000/ha.
- Locations of diseased vineyards are required for ongoing research. Shiraz samples from the Yarra Valley with SD symptoms are currently being tested. There may severe consequences for the health of Australian Shiraz vineyards if this disease takes hold.

Concluding remarks:

- The spread of leaf roll virus types 1 and 3 as well as Grapevine virus A occurs via two modes:
- * Mode 1 via human action by planting infected cuttings or performing top-working of established virus infected vines. In this mode, no natural spread of virus occurs and the virus can be controlled by removing the infected vines.
- * Mode 2, viruses spread by phloem-sucking insects like scale insects and mealybugs (Figure 7). We have seen this mode of transmission in Robe, Willunga and the Riverland. In Mode 2, GVA is accompanied either by LR1 or LR3. The most severe combination is GVA-associated Shiraz Disease in the presence of LR3. It is believed, but not proven, that GVA requires a 'helper' virus for its spread. The most severe combination is GVA-associated Shiraz Disease in the presence of LR3. It is believed, but not proven, that GVA requires a 'helper' virus for its spread.
- Being the variety of choice in South Australia and being sensitive to GVA, Shiraz vineyards may be at risk unless a thorough survey on the virus-vector-plant relationship is conducted.
- By removing infected vines and re-planting with clean, virus-tested material, the grower can greatly reduce the eventual likelihood of losing the whole vineyard as is currently happening.