



## Diagnostics and Surveys

### Virus surveys

Detected 7 of 8 viruses associated with Grapevine leafroll disease (Grapevine leafroll viruses 1, 2, 3, 4, 5, 7, and 9 (GLRaV-1, 2, 3, etc.)), 3 of 4 viruses associated with the rugose wood disease complex (Grapevine rupestris stem pitting associated virus (GRSPaV), Grapevine virus A (GVA) and Grapevine virus B (GVB) and two viruses associated with grapevine degeneration (Tomato ringspot virus (ToRSV) and Grapevine fanleaf virus (GLFV) as well as Grapevine fleck virus and Grapevine Syrah virus -1 in Pacific Northwest vineyards in collaboration with Drs. Naidu Rayapati and Ken Eastwell at Washington State University and Alex Karasev at the University of Idaho. GLRaV-3 (Fig. 1) is the most common of the leafroll viruses in Washington, Idaho and southern Oregon, where most plants are self-rooted. In these areas the populations of the vector, the grape mealybug (Fig. 2), were much higher than in the Willamette Valley of Oregon.



Fig. 1 (Left) Pinot noir infected with Grapevine leafroll associated virus – 3, notice green veins, reddening of the interveinal areas, downward curling of the leaves and uneven ripening of the fruit. Fig. 2 (Right) Cluster of Merlot grapes infested with Grape mealybug, crawlers are the small orange bodies in the cottony mass, also note shriveled fruit.

## Uncharacterized Diseases

Several new virus-like diseases (Fig. 3 and 4) have been observed in Oregon that have tested negative for known viruses of grapevine. These are being mapped in the field and monitored over time (years) to look at rates of spread. In addition, steps are underway to characterize any viruses that may be associated with these diseases, this includes, dsRNA extraction, cloning and sequencing, plus testing for other pathogens such as phytoplasmas and xylella.



Fig. 3 (left) Pinot noir showing bright red foliage in late summer, Brix° plateau at 18, compared to 25-26 in adjacent green leafed vines. Plants exhibiting these symptoms (Fig. 3 & 4) tested negative for leafroll viruses in ELISA and RT-PCR. Fig. 4 (right) graft unions appear to be healthy without any signs of necrosis or pitting.



Fig. 5 (left) Cabernet franc plants exhibiting leafroll-like pigmentation (green leaves with red interveinal coloration), Fig. 6 (upper right) closeup of leaf showing lack of leafrolling, Fig. 7 (lower right), shows healthy graft union without any signs of necrosis or stem pitting. Brix° levels in symptomatic plants are 3-4 points behind adjacent green plants at harvest.

## Outreach and Disease Management



Fig. 8 (left), shows a topworked vineyard, where every second plant in each row was grafted one year (plant 1, 3, 5, 7 etc.) with the remaining plants grafted the following year. Different sources of the self-rooted Pinot noir were used each year. One source was infected with Grapevine leafroll associated virus-2. Growers are now aware of the potential risks of introducing viruses when topworking vineyards.

As a result of understanding the problem and how it was introduced, growers are now having wood sources tested for viruses prior to topworking vineyards. Most of the vineyard in Fig. 8 has been removed. However, over six years of observation, there has not been any new GLRaV-2 infections in this block, suggesting that root grafting is not an important means of transmission for this virus.



Fig. 9 (left) Grafted Pinot noir infected with Tomato ringspot virus. Plants decline over several years and diseased area is in shape of oval longer down the row than across rows. Fig. 10 (right) graft union showing necrosis, also note the adventitious roots at the base of the scion. Grower was advised to hill the plants such that these adventitious roots were beneath the soil line.

See handout for list of collaborators and publications