



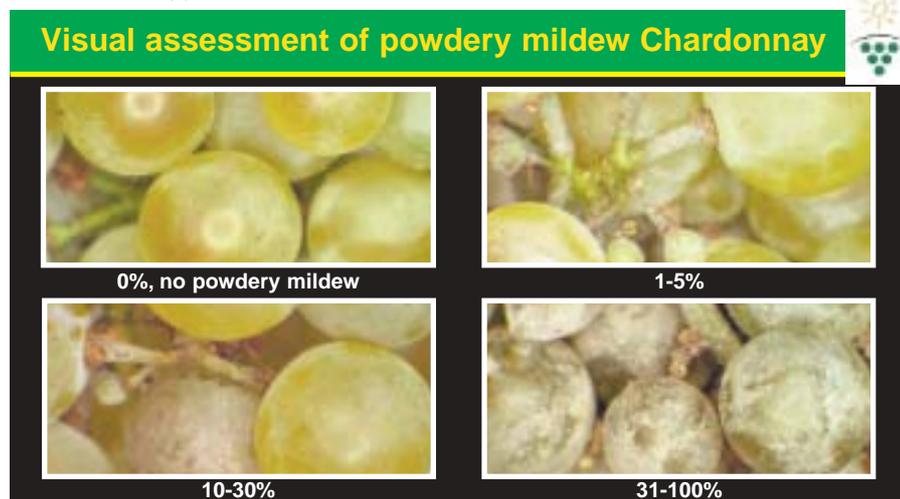
Powdery mildew and wine quality

Introduction

Powdery mildew, caused by the fungus *Uncinula necator*, is a widespread and economically important disease of grapevines. The fungus grows superficially on green tissues of grapevines and other members of the *Vitaceae*. Powdery mildew costs the Australian grape and wine industry approximately A\$30 million per year in terms of lost yield, reduced quality and disease management¹.

The disease can have several effects on grapes and wine. Research in the USA showed that powdery mildew affected vine growth, winter hardiness and yield², and caused delayed ripening of grapes, in terms of lower total soluble solids (a measure of sugar content) and higher acidity^{3,4}. Wine made from infected grapes of the cultivar Rosette was reported to have 'mildew-like' off aromas². Likewise, wines made from infected Thompson Seedless, Carignane and Ribier grapes were bitter, with distinct 'off tastes'⁵. In contrast, there were no detectable off aroma characteristics in wine made from Verdelho grapes affected by powdery mildew in South Australia⁶, although increased phenolic content and bitterness were reported.

Figure 1. The four infection categories for Chardonnay grapes in 2002, corresponding to the percentage area of the bunch affected by powdery mildew.



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Research in progress in the Cooperative Research Centre for Viticulture

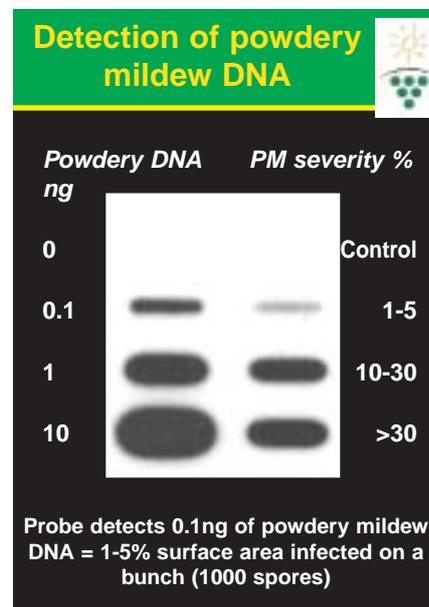
The aim of this study was to determine the effect of known levels of powdery mildew infection on grape and wine quality over several seasons. This information will assist

wineries to make decisions about the suitability of fruit for winemaking.

Grapes harvested from commercial vineyards in South Australia were sorted according to the percentage surface area affected by powdery mildew. In 2001, Chardonnay grapes were classified into four categories: 0, 1-5%, 10-30% and 31-100% infection (Figure 1), and Cabernet Sauvignon grapes into two; 0% and 1-20%⁷. Chardonnay grapes were harvested also in 2000, 2002 and 2003, and infection categories differed slightly from year to year.

Infection categories were confirmed by microscopic examination and by use of a *U. necator*-specific DNA probe, developed in our laboratory (Figure 2).

Figure 2. Detection of powdery mildew in Chardonnay must using a powdery mildew-specific DNA probe in a slot blot. Slots on the left contain various concentrations of DNA of the pathogen, slots on the right contain DNA from must samples representing the four infection categories. The intensity of the signal corresponds to the quantity of pathogen DNA.





This probe has potential as a diagnostic tool for industry to quantify powdery mildew in consignments of grapes without the need for detailed microscopic examination.

The population of bacteria, filamentous fungi and yeasts on the surface of grapes with severe powdery mildew was larger than that on healthy grapes. The total microbial population on chardonnay grapes with 31-100% powdery mildew infection in 2001 was approx 2.3×10^6 cfu/ml, while that on healthy grapes was 4.7×10^5 cfu/ml. Corresponding figures for clarified juices were 1,145 and 25 cfu/ml, respectively⁷.

Fungi commonly detected on the grapes included *Alysidium*, *Alternaria*, *Apergillus*, *Aureobasidium*, *Candida*, *Cladosporium*, *Monilia*, *Penicillium*, *Pithomyces*, *Rhizopus*, *Saccharomyces* and *Sporobolomyces* spp. Bacteria included *Bacillus* and *Pseudomonas* spp. and unidentified actinomycetes. While these organisms die out during clarification of the juice and the early stages of fermentation, these observations suggest that in seasons with rain close to harvest, powdery mildew may predispose the grapes to bunch rot and contamination by spoilage organisms.

The Chardonnay grapes with >30% infection gave juice and wine a chemical composition quite different from the lower infection levels and the disease-free control. Severely affected grapes had lower total soluble solids and the corresponding wine had less alcohol, indicating delayed grape maturity. The concentrations of 'total phenolics', hydroxycinnamates and flavonoids were highest in juice and wine from grapes with >30% infection, and these compounds would normally be considered to have a negative effect on quality, contributing bitterness and astringency to white wines. For the infected Cabernet Sauvignon grapes, the concentrations of total soluble solids, alcohol and total phenolics were all lower

than the uninfected control⁷. These differences may have influenced the sensory perception of the resulting wines.

Responses from a trained 'in-house' tasting panel at the Australian Wine Research Institute and from a tasting carried out with wine industry personnel indicated no obvious mouldy off-flavour associated with wines made from powdery mildew-affected Chardonnay or Cabernet Sauvignon grapes in 2001.

However, the increased phenolic content of the Chardonnay wines made in 2001 was reflected in the sensory attributes identified by the trained tasting panel. The wines made from grapes with powdery mildew were rated significantly higher in 'oily' and 'viscosity' characters than wines from healthy grapes. Other differences were also apparent as a result of the sensory evaluation, but were considered likely to be related to differences in fermentation rate, total soluble solids and acidity of the juice⁷.

Conclusions

From our research to date, it is clear that powdery mildew can greatly affect the chemical composition of Chardonnay and Cabernet Sauvignon grapes and wines. Infection on Chardonnay grapes resulted in increased viscosity and oily taste attributes of the wine, which can be considered detrimental to quality, although other flavour effects were not apparent. The disease was also associated with an increased microbial population on the surface of the grapes.

In our studies the grapes were harvested by hand and experienced minimal damage during picking and transport to the winery. It is likely that the effects of powdery mildew would be accentuated in grapes that were machine harvested and subjected to a period of skin contact during storage and transport to the winery, conditions that are quite common in Australian winemaking, and this is currently being investigated.

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