Non Botrytis Bunch Rots

identification and management

Background

Bunch rots have long been associated with losses of grape yield and reductions in wine quality in vineyards. Their correlation with particular climatic conditions, namely warm temperatures and high moisture, and the grapevines growing stages can influence infection and affect yields. Bunch rots are caused by a range of fungi, yeasts, and bacteria. A common and much researched rot is botrytis (grey mould, *Figure 1*), attributed to the fungus *Botrytis cinerea*. However, there is a variety of other bunch rots that can cause significant declines in grape yield and wine quality, given favourable climatic conditions and opportunities to infect the plant (*Table 1*).

Influences of bunch rot infection and consequences

As with many fungi-related plant diseases, the likelihood of bunch rot occurring is enhanced by warm, wet conditions, particularly post veraison. While the disease is often expressed later in the season, the period of initial infection for the sub tropical ripe and bitter rots can often occur earlier at flowering, when it coincides with warmer temperatures (*Figure 2*).

While the incidence of bitter rot appears to be linked to temperatures above 25°C, both for inflorescences and berries, ripe rot has a much wider temperature-related range of infection. Furthermore, in related research by NWGIC, two species of *Colletotrichum* were shown to be responsible for ripe rot found in Cabernet Sauvignon and Chardonnay berries at three vineyards in the Hastings Valley.

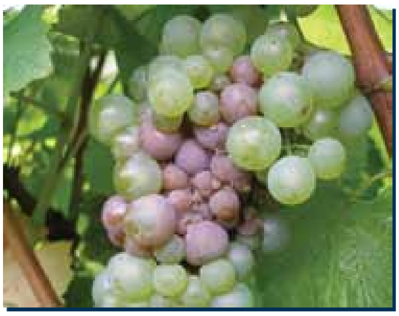

Figure 1 The common bunch rot grey mould, caused by *Botrytis cinerea*.

Many of the bunch rots are opportunistic. That is, they take advantage of damage of the fruiting structure to enter and infect the plant. Berry skins, normally a natural physical barrier to fungal infection, can be damaged through piercing by fruit flies (associated with sour rot), wounded by earlier diseases such as botrytis, or damaged from weather events such as frost, rainfall (berry splitting during ripening), high temperatures (sunburn) and storms. Growers may find that canopy management that reduces the likelihood of botrytis infection (i.e. reduced foliage and more open canopies), may actually increase the susceptibility of the vineyard to ripe rot through berry sunburn. However, most of the other bunch rots will find open, well ventilated canopies less conducive to infection.

The incidence of ripe rot in berries from one season to the next not only relies on suitable climatic conditions, but also suitable overwintering material for the fungus. *Colletotrichum acutatum*, the causal agent for ripe rot, was found

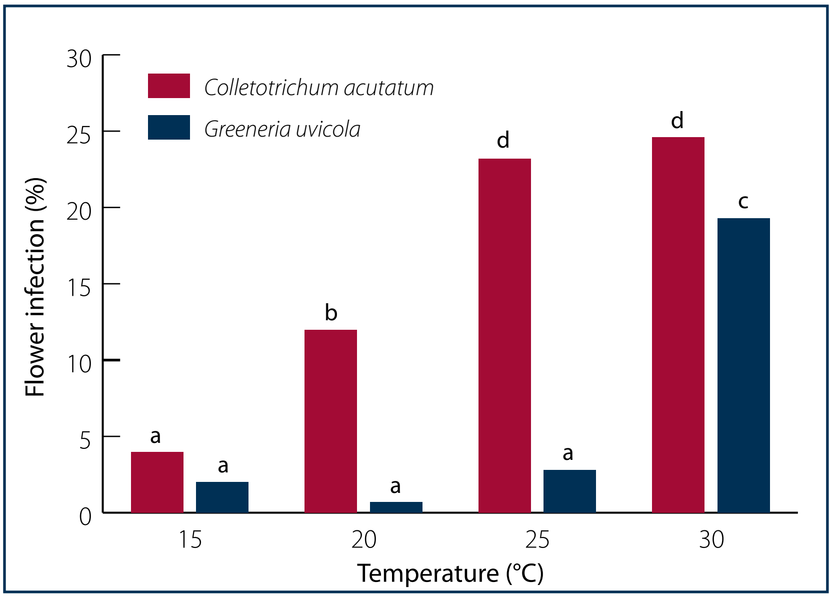

Figure 2 Detached Chardonnay flowers infected with ripe rot (*Colletotrichum acutatum*) and bitter rot (*Greeneria uvicola*) at a range of temperatures. Letters indicate the treatment is significantly different to those with a different letter.

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Table 1 Non-botrytis bunch rots causal organisms, symptoms and favoured conditions for development

Bunch rot **Causal organism**	**Visual Symptoms**	**Favoured Conditions**
Alternaria rot *Alternaria* spp.	Tan fungus, brown with age 	Opportunistic High humidity, wet bunches
Cladosporium rot *Cladosporium*	Black circular area Velvet, olive green spores 	Opportunistic Late/post harvest after rain
Black mould *Aspergillus*	Tan to brown with dusty black/brown spores 	Opportunistic Warm to hot regions
Blue Mould *Penicillium*	Masses of dusty blue-green spores 	Opportunistic Cooler regions following rain or botrytis
Bitter rot *Greeneria uvicola*	Series of rings of black spores may be present 	Sub tropical regions

Bunch rot Causal organism	Visual Symptoms	Favoured Conditions
Sour rot Complexes–associated with *Aspergillus* and rhizopus rots	Juice from infected berries smells like vinegar 	Opportunistic Berry damage
Botryosphaeria bunch rot Botryosphaeriaceae fungi	Water-soaked appearance, white mycelium growth, occasional cracking of the skin. In more severe cases, berries dry out and turn black before being mummified and susceptible to secondary infection 	Bot canker infected grapevines/ vineyards with a history of bot canker
Ripe rot *Colletotrichum* spp.	Round redish skin spots to salmon/orange coloured spores, berries shrivel 	Sub tropical regions, associated with open canopies, sunburn
Rhizopus rot *Rhizopus*	Soft, brown with web-like black mycelia 	Opportunistic High humidity

to overwinter on mummified berries and stems, winter spurs and canes in Chardonnay samples taken from a vineyard in the Hunter Valley. These infected plant tissues are likely to be the primary source of infection in the next growing season.

Yield and quality

Bunch rot of grapes can cause serious losses in grape quantity and wine quality and accurate estimates are difficult to assess, although in some vineyards in some seasons, yield losses can approach 100%. Bunch rot management practices frequently fail in growing seasons where rain falls close to harvest (e.g. Riverina, February/March 2010). Wine quality is compromised in several ways:

- Formation of taints, off flavours and undesirable aromas
- Loss of red wine colour
- Oxidation problems; and
- Potential formation of carcinogenic mycotoxins.

Quantifying the value of these losses to the industry is difficult. However, rough estimates can be made if one assumes an overall 1% loss due to bunch rots and an average yield of 10 t/ha across the 160,000 ha of vines grown in Australia; this would then equate to $8 million if the average value of the national crop was $500/t. It would be expected that wetter or warmer seasons may incur a greater percentage of losses in those regions.

Management of bunch rots

Given the strong relationship climate has with the incidence of many bunch rots in vineyards, the choice of what grape variety to grow can have a bearing on the development of the disease. For example, varieties that are harvested before the onset of autumn rains (e.g. January harvest of Semillon in the Hunter Valley) could have a reduced likelihood of developing the disease compared to later harvested varieties such as Cabernet Sauvignon.

Vineyard management can also affect the chances of bunch rot infection in a grape vine. Practices that reduce vineyard humidity or the source of disease could include:

- pruning to improve ventilation of the canopy,
- selection of row direction to take advantage of prevailing winds,
- improved drainage and soil management to reduce surface water pooling
- removal of diseased and old wood from the vineyard

Another component of vineyard management may include fungicide spraying. NWGIC research compared the suppression of ripe and bitter rots from the application of nine commercial fungicides (*Table 2*). It showed that the most effective suppressants of the two diseases were fluazinam and pyraclostrobin.

Further NWGIC research showed that the application of the strobilurin fungicide (active ingredient pyraclostrobin) on Chardonnay inflorescences reduced the incidence of ripe and bitter rots at veraison from 88% to 0% and from 86% to 2%, respectively.

Future management issues

Long term climate forecasts suggest a future with generally warmer conditions and changes in precipitation patterns that are likely to worsen the incidence of grapevine fungal diseases.

Projected mean temperature increases during a winegrape growing season, modelled using a mid-range climate change scenario, are likely to be between 0.5°C and 1.0°C by 2030 and 0.9°C and 1.9°C by 2050, varying with geographic location. Higher mean temperatures are expected when berries are most vulnerable to disease due to phenological progression moving ripening periods closer to mid-summer. Overall warmer temperatures increase the incidence of heat waves and increased overnight minimum temperatures which will likely further worsen the incidence of disease.

Long-term precipitation forecasts are less clear than future likely temperature increases. Precipitation changes outlined by the International Panel of Climate Change Fourth Assessment Report include an overall decrease in precipitation in southern Australia. A general tendency for a poleward expansion of the subtropical dry zone (that historically has kept most of the Australian continent arid) is widely reported in the literature, which may result in generally drier conditions for southern Australia. However, with the majority of the decrease modelled to occur in winter and spring, summer rainfall totals are projected to remain relatively unchanged or even increase, particularly on the east coast. Coupled with a likely increase in extreme rainfall events, levels of humidity favourable to the development of grapevine fungal diseases will likely continue to occur.

Table 2 Percentage of suppression of ripe rot and bitter rot by variety of fungicide active chemicals when tested at standard concentration (1 µM).

Fungicide	*C. acutatum*	*G. uvicola*
Azoxystrobin	27.5	37.1
Boscalid	10.0	0.0
Captan	10.5	4.9
Chlorothalonil	10.0	12.1
Fluazinam	87.3	99.6
Iprodione	7.0	16.2
Pyraclostrobin	81.9	72.0
Pyrimenthanil	16.2	1.5
Trifloxystrobin	35.9	30.4

Further information	www.nwgic.org

Detailed information about climatic variability in the Australia region can be found at http://www.bom.gov.au/climate/ahead/. For a less formal but fun look at drivers of inter-annual variability of climate (with a NSW focus) go to http://www.dpi.nsw.gov.au/agriculture/resources/climate-and-weather/variability/climatedogs.

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Greer, L.A., Harper, J.D.I., Savocchia, S., Samuelian, S.K. and Steel, C.C. (2011). Ripe rot of south-eastern Australian wine grapes is caused by two species of Colletotrichum: *C. acutatum* and *C. gloeosporioides* with differences in infection and fungicide sensitivity. *Austalian Journal of Grape and Wine Research* **17**: 123–128.

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