Wine Australia for Australian Wine

Factsheet

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Non–Botrytis bunch rots: questions and answers

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Summary

Bunch rots on grapevines can be caused by a range of fungi, yeasts and some bacteria, including acetic acid bacteria. This factsheet discusses rots that are not caused by Botrytis cinerea (grey mould); forinformation on B. cinerea, see Wine Australia's Botrytis Management factsheet.

Identifying the disease

Q1: What are non–Botrytis bunch rots?

A: Essentially, any bunch rot caused by organisms other than Botrytis cinerea is a non-Botrytis bunch rot. The majority of the organisms concerned are fungi, and so (like Botrytis) they spread through the formation of fungal spores that can be carried in the wind or by rain splash. Many are opportunistic pathogens that infect berries through wounds (e.g. berry splitting after rain events). Bunch rots reduce grape yields and have negative effects on grape and wine quality. This factsheet discusses some of the more common non-Botrytis bunch rots that occur in Australia.

Figure 1: Botrytis cinerea (grey mould). Non-Botrytis bunch rots look different from this and shouldn't be confused with B. cinerea. (Photo: Chris Steel).

Q2: What do they look like?

A: The most important point, of course, is that non-Botrytis bunch rots don't look the same as Botrytis cinerea (grey mould). Figure 1 shows Botrytis cinerea as a reference point.

Many of the non-Botrytis bunch rots produce black moulds and look similar, while others are more distinctive. Here we will review some of the more frequently encountered non-Botrytis bunch rots found in vineyards.

Alternaria rot

The fungus Alternaria can readily be isolated from the surface of apparently healthy grapes and in most circumstances does not cause berry rot. Alternaria is an opportunistic pathogen that causes problems when the berry skin is compromised, such as when berries split or are damaged by insects. The fungus is tan in colour, becoming brown/black with time. Fluffy grey tufts of fungus develop through cracks in the skin of a berry. Infection can occur through the skin in wet bunches or under very high humidity (Figure 2).

Aspergillus rot or black sooty mould

This fungus is common in warm to hot areas. Affected berries develop a dusty mass of brown or black spores, which has the appearance of black soot. Some strains of some species of Aspergillus produce a mycotoxin, ochratoxin A, which is harmful to human health. There is a wide range of species or strains of the Aspergillus fungus that cause this type of rot (Figure 3). Aspergillus is sometimes associated with sour rots (see below) and in some circumstances can occur late in the season when grapes are grown specifically for the purpose of making botrytised ('Noble Rot') dessert wines.

Aspergillus fungus is also commonly found in vineyard soils. Bunches contaminated with soil or other vineyard debris can theoretically be a source of the disease.

Figure 2: Alternaria rot (Photo: Lindsay Greer).

Figure 3: Aspergillus niger (Photo: Chris Steel).

Figure 4: Bitter rot (Greeneria uvicola). (Photo: Lindsay Greer).

Bitter rot or Greeneria rot

Bitter rot caused by the fungus Greeneria uvicola is frequently seen as a series of concentric rings of black sporulation around the circumference of the berry. Infected grapes develop a brownish colour, which darkens and has a rough appearance as the bunch rot develops. It is at this point that the concentric rings of sporulation start to appear on the berry surface (Figure 4). Berries sometimes shrivel and drop but more often remain attached to the bunch.

Bitter rot is associated with vineyards that experience warm and wet conditions close to harvest. The disease is commonly found in vineyards in eastern Australia north of Sydney and extending into Queensland.

Black spot or anthracnose of grapes

Black spot is caused by the fungus Elsinoë ampelina. The fungus produces a black spot on the pre-veraison berry, which hardens and leaves a black mark on the mature berry (Figure 5). Similar symptoms are seen on young leaves and shoots. Black spot is mainly a problem on table grape varieties rather than on wine grapes.

Botryosphaeria rot

Fungi associated with Botryosphaeria rot are normally associated with trunk diseases (bot canker) of grape vines, but under some circumstances this group of fungi can affect mature grape berries. The fungus produces black speckles or pustules on the berry surface (Figure 6). Older vines (which are more likely to suffer from trunk diseases) are more susceptible, as are vines grown in warm and wet climates. The rot often occurs in situations where a bunch is touching infected wood in the canopy.

Figure 5: Black Spot (Elsinoë ampelina). (Photo: Chris Steel).

Figure 6: Botryosphaeria rot. (Photo: Lindsay Greer).

Cladosporium rot

The fungus causes a dark, soft, circular area to develop on the berry. Under high humidity, the conidiophores (spore-producing bodies) and conidia (spores) of the fungus look velvet-like and are olive green in colour (Figure 7). It is typically a post-harvest disease found on late-harvest fruit after rain. Generally, this rot is of minor importance and attacks the odd berry rather than the whole bunch. However, this bunch rot has occasionally been reported as being a more major problem on wine grapes.

Penicillium rot or blue mould

Penicillium rot or blue mould is easily identified, as this fungus produces a mass of dusty blue–green spores. The rot often occurs in berries that have split following rain events or other events that lead to skin damage. Penicillium rot is frequently associated with sour rot (see below) and occurs more frequently in cool-climate vineyards. The distinctive colour of this rot means it is one of the easiest bunch rots to identify (Figure 8).

Rhizopus rot

Berries affected with Rhizopus rot develop a soft brown rot that drips juice. High humidity causes cobweb-like black mycelia (the vegetative parts of a fungus) to develop (Figure 9). Dark sporangia (the structures that produces and contain the spores) appear in skin cracks or wounds in the berry skin. The fungus can spread to other berries in the cluster. Rhizopus is often associated with sour rot (see below).

Phomopsis rot

Phomopsis is normally only associated with cane and leaf blight, but in situations of high disease pressure (such as warm and wet conditions close to harvest,

Figure 7: Cladosporium rot. (Photo: Chris Steel).

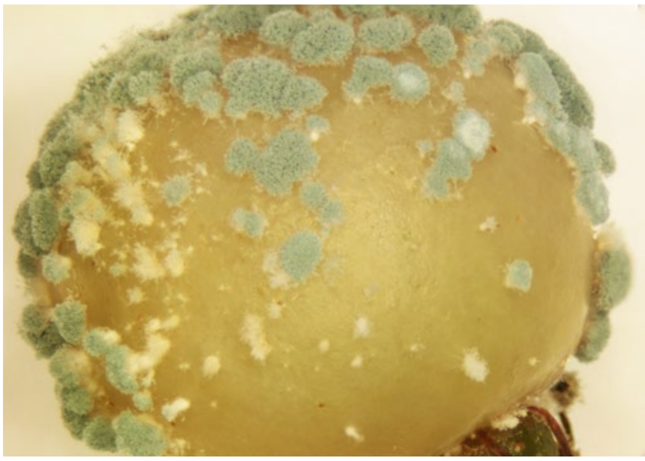

Figure 8: Penicillium rot. (Photo: Lindsay Greer).

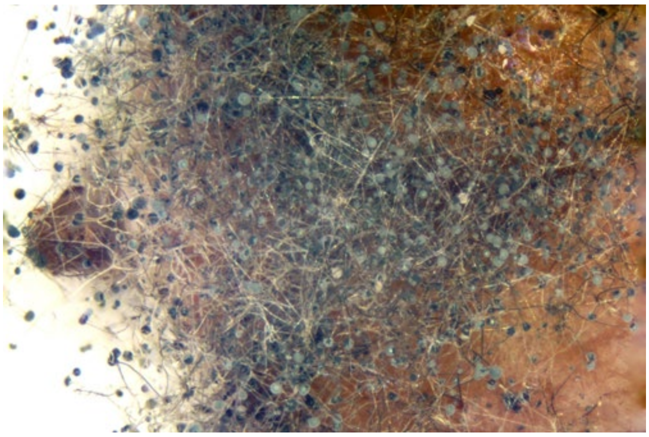

Figure 9: Rhizopus rot. (Photo: Lindsay Greer).

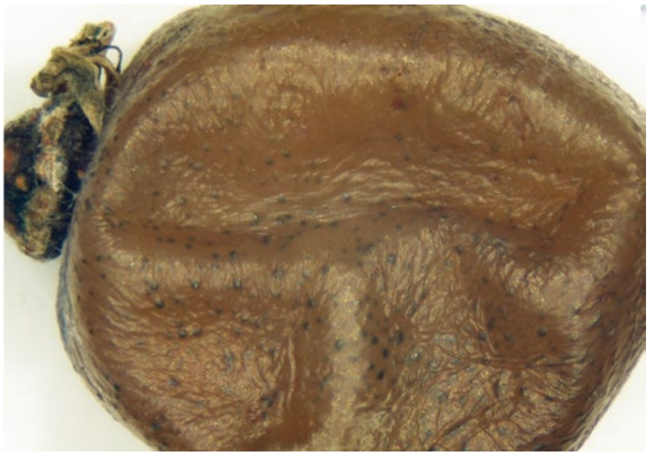

Figure 10: Phomopsis. (Photo: Lindsay Greer).

coupled with berry damage and diseased vegetative tissues), it can also cause a non-Botrytis bunch rot (Figure 10).

Ripe rot or Colletotrichum rot

Berries affected by ripe rot initially suffer from a loss of berry turgor. As the rot develops, orange- to salmon-pink-coloured spore masses are discharged from the berry surface. This colouration makes ripe rot easily identifiable. The berries then shrivel and can drop. In subtropical environments, ripe rot frequently occurs

Figure 11: Ripe rot (Colletotrichum). (Photo: Navideh Sadoughi).

Figure 12: Sour rot. (Photo: Lindsay Greer).

late in the season following an earlier bitter rot infection (see above). Ripe rot is associated with vineyards that experience warm and wet conditions close to harvest, and is more frequently found in open canopies where the fruit is exposed. There are two species of the fungus responsible for ripe rot, Colletotrichum acutatum and Colletotrichum gloeosporioides. The two fungi produce similar symptoms, although they differ in fungicide sensitivity and in appearance when examined by microscopy. C. acutatum is the predominant species found in vineyards.

Sour rot

Various fungi, yeasts, acetic acid bacteria and vinegar fly larvae, combined with other organisms, can cause sour rot. Aspergillus, Penicillium and Rhizopus (discussed above) are three groups of fungi often found in association with sour rot. In contrast, Botrytis cinerea (grey mould) is generally not found on individual bunches affected with sour rot.

The most obvious sign of sour rot is the distinctive smell of acetic acid (vinegar) and the appearance of watery berries with thin skins (Figure 12). There is now good evidence to support a link between insect damage and the occurrence of sour rots in vineyards. Not only do insects such as vinegar fly cause damage to the skin, but they have also been shown to transmit on their bodies the bacteria and yeasts associated with sour rot. Some of the yeast species associated with sour rot are ethanol-tolerant and can survive fermentation, leading to wine spoilage during wine production.

Disease occurance

Q3: How do I get non-Botrytis rots in my vineyard?

A: The majority of fruit-rotting diseases are caused by fungi. Fungi produce many spores, which can be dispersed by wind, dust and rain. Insects can carry them on feet or mouthparts. The diseases can carry over from the previous season on mummified berries, dead wood, bark, canes and spurs, vineyard debris and decaying vegetation, or in the soil. Many of the fungi associated with non- Botrytis bunch rots can also be found on the vegetative parts of the vine, such as the leaves, shoots and wood (e.g. in Botryosphaeria rot). Many also infect plants other than grapevines. For instance, ripe rot isolates from grapes are able to infect olives, strawberries and blueberries, and vice versa. It is possible that ripe rot could spread from nearby non-grape host plants into vineyards, particularly from other fruit and nut trees. Similarly, many perennial woody plants, such as fruit and nut trees and native Australian trees, can harbour wood-rotting fungi responsible for Botryosphaeria bunch rots. It is not known to what extent neighbouring plants may provide a reservoir for the fungi responsible for non-Botrytis bunch rots.

Q4: What conditions favour the development of these diseases?

A: Like Botrytis, other berry rots are favoured by wet weather and high relative humidity during the growing season. Higher rainfall increases the risk and amount of these diseases. A sequence of favourable seasons can increase the incidence and severity of these diseases. Some grapevine varieties are more likely to be affected than others, particularly if they have dense clusters and vigorous canopies.

Any damage to the berry skin (e.g. insect damage, hail, berry splitting after rainfall) will lead to a greater incidence of all bunch rots, including Botrytis cinerea. Different environmental factors predispose grape berries to attack by the different types of non-Botrytis bunch rots. For example, Aspergillus rots tend to occur more frequently in hot and dry climates, while Penicillium rot is associated more with cooler climates. Regions that experience warm and wet conditions (e.g. the Hunter Valley) are prone to ripe rot and bitter rot. These differences are due to the fact that each of the different types of bunch rots is caused by a different fungal organism with a different growth habit.

Other environmental factors that might influence non-Botrytis bunch rot development include water availability, heat and light. The infection of a given grape berry might also be influenced by biological factors, such as the microflora living on the berry. Two or more bunch rot pathogens frequently occur together on a bunch, and even on a single berry.

Q5: What impact is seasonal climate variability likely to have on bunch rot occurrence?

A: The bunch rot pathogen profile varies from season to season, largely due to climatic influences but also in response to management practices. Regional climate will also influence the types of fruit rots found. As mentioned above bunch rot profiles will tend to vary between:

- warm and wet vineyards (e.g. bitter rot and ripe rot)
- warm and dry vineyards (e.g. Aspergillus rot), and
- cool and wet vineyards (e.g. Penicillium rot).

However, it must be stressed that these are generalisations and there will always be exceptions.

Predicting climate variability is difficult, but warmer and wetter summers are likely to lead to increased outbreaks of non-Botrytis bunch rots.

Q6: How can I predict which rot I will have this season?

A: It is difficult to predict which organism will predominate in a given season. In a season that is exceptionally wet, the inoculum pressure in the vineyard will be high. Under these circumstances, the likely success of any bunch rot management practice is difficult to predict. Management of non-Botrytis bunch rots, and in particular ripe rot and bitter rot, continues to be a challenge in wet warm seasons.

Disease management practices

Q7: What viticulture practices will help reduce the risk of non-Botrytis rots?

A: There are several viticulture practices that vineyard managers can employ to reduce the risk of non-Botrytis bunch rots. These are discussed below.

Variety selection

Avoid late-maturing varieties in regions that are prone to late-summer rainfall. Most of the non-Botrytis bunch rots occur when the fruit is fully mature. Harvesting fruit before major rain events is an effective practice to manage ripe rot and bitter rot in vineyards in warm and wet growing regions. For example, February is historically the wettest month in the Hunter Valley, so a sensible management strategy for this region is to grow earlier-maturing varieties.

A further disease management strategy based on variety selection is to avoid varieties that have thin skins and tightly packed clusters, as they are prone to berry splitting.

Figure 13: Bitter rot, one of the predominant non-Botrytis bunch rots found in vineyards with warm and wet conditions around harvest. (Photo: Suren Samuelian).

Canopy management
Open canopies are generally less prone than dense ones to bunch rot attack but there are some exceptions. Over-exposed fruit is susceptible to sunburn and heat stress, which increases the susceptibility of fruit to ripe rot.

One management option in these situations is to maintain a denser canopy on the western side of a row to avoid high afternoon temperatures in summer.

Avoid pockets of excessive moisture in the vineyard
Use effective drainage in the vineyard to avoid the accumulation of pockets of water. Use drip irrigation as opposed to flood irrigation or overhead sprinklers.

Good air circulation and light penetration will dry the canopy faster and reduce disease incidence. This can be achieved by weed control and de-suckering, having well spaced shoots and choosing row direction to take advantage of the prevailing wind.

Vineyard hygiene
As a general rule, the more old, diseased wood and debris that is retained in the canopy, the higher the risk of diseases. Where possible, remove diseased bunches from the vineyard.

Use of fungicides
The non-Botrytis bunch rots are different fungi to Botrytis cinerea (grey mould) so, not surprisingly, fungicides used for Botrytis control are not always effective against them. Those fungicides that are effective cannot be applied close to harvest because of MRL restrictions. Application of fungicide sprays at flowering can reduce the level of inoculum in the vineyard, but non-Botrytis bunch rots primarily become established after veraison and close to harvest. Because of the limited number of options for fungicide use in wine grape vineyards, growers cannot rely solely on the use of chemical sprays to control non-Botrytis bunch rots.

Disease thresholds and wine quality

Q8: What impacts do non-Botrytis bunch rots have on grape yield?

A: All non-Botrytis bunch rots will lead to a reduction in overall crop yield, but the extent of this will depend on the severity of the rot in a given vineyard. The majority of the rots do not necessarily result in berry drop; ripe rot is one exception to this rule. Yield losses will vary from season to season. In severe cases, the degree of rot can mean that it is no longer economically viable to harvest the crop. As many vineyards are machine-harvested, rot-affected fruit is generally collected with clean fruit. Inclusion of the infected fruit will have a negative impact on wine quality.

Q9: What are the impacts of non-Botrytis rots on wine quality?

A: Generally, all the fungi associated with grape bunch rots lead to mouldy, musty off flavours in finished wine, although the specific effects of individual organisms are not yet understood. It is likely that many of the fungi involved with bunch rots produce the oxidative enzyme laccase, which destroys red pigmentation and can cause oxidative spoilage of wine.

Q10: What are the thresholds for fruit rejection by wineries?

A: How much rot can be tolerated in a winery depends on both the type of rot and the intended wine style. Precise information is lacking on how much of a particular bunch rot type can be tolerated in the winery before there is a noticeable impact on wine quality, as only a small number of studies have been conducted. For example, wine made with fewer than 3% of bunches

Figure 14: Sunburnt fruit with the development of non-Botrytis bunch rots. (Photo: Chris Steel).

Figure 15: Wine made with ripe rot affected grapes (right) has an off flavour described as 'hessian sack' and a browner colour than wine made from healthy grapes (left) (Photo: Chris Steel).

infected with ripe rot (Colletotrichum) has noticeable off flavours and a loss of colour. On the other hand, higher levels of sour rot contamination have been reported as not exceeding consumer rejection thresholds; however, there are no firm figures that can currently be quoted. This is partly due to the fact that estimates of bunch rot severity in fruit are still far from accurate. Determining thresholds for bunch rot tolerance in wineries requires further investigation and is part of an ongoing study.

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