WINE INDUSTRY ASSOCIATION WESTERN AUSTRALIA

Australian Government

Grape and Wine Research and Development Corporation

Scoping study on the non-Botrytis bunch rots that occur in Western Australia.



FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **RT 05/05-2**

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Research Organisation: **Wine Industry Association, Western Australia**

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Executive summary:

This study was aimed at determining the presence and impact that non-Botrytis bunch rots are having in Western Australian vineyards. Bunch rots remain a significant burden to the WA wine industry and with the expansion of the industry in recent years there is the potential that non-Botrytis bunch rots are having a major impact. With new research being performed in Australia this study also presented the opportunity to inform and educate growers about non-Botrytis bunch rots.

A survey of 24 vineyards was conducted in the Perth hills (2), Margaret River (6), Swan Valley (5), Pemberton (5), Blackwood valley (1) and Great Southern (5) to determine the incidence and severity of non-Botrytis bunch rots in WA. For the survey, white varieties were chosen between verasion and harvest.

The 2006/07 vintage in WA was considered "atypical" due to a lack of rainfall at critical growth periods and high temperatures leading to early harvests. With the vintage being so early it is difficult to determine what impact this had on the bunch rot development this season and therefore further surveys are required.

Botrytis cinerea was the most prominent fungal species recorded throughout the survey and remains the most destructive bunch rot in WA. Several other fungi including, *Aspergillus* spp., *Penicillium* spp. and *Alternaria* spp. were also frequently isolated. Botryosphaeria berry rot was also recorded in this study and was found in more vineyards than expected. The impact *Botryosphaeria* species are having as a bunch rot in WA is uncertain at present and needs to be investigated further.

Two seminars were presented in the Margaret River and the Swan Valley regions to provide information to growers regarding research undertaken on non-Botrytis bunch rots. The seminars were attended by Associate Professor Chris Steel from Charles Sturt University who gave the growers the opportunity to ask questions regarding non-Botrytis bunch rots and their management.

Background:

Bunch rots remain one of the biggest problems facing the Western Australian grape and wine industry. Bunch rots result in reduced yields, lower wine quality and in severe cases entire harvests of fruit being rejected by the winery. In Western Australia, *Botrytis cinerea* is considered the primary cause of bunch rots and vignerons invest heavily in control measures to minimise its impact. However, it is uncertain as to the extent and impact that other non-botrytis bunch rots are having on WA vineyards.

Non botrytis bunch rots are increasingly gaining importance in Australia and overseas as primary pathogens in their own right. Studies in eastern Australia have identified two fungi, *Colletotrichum acutatum* and *Greeneria uvicola* as major bunch rots of grapes in regions that experience sub-tropical climates (Steel *et al.* 2007). Management techniques based around controlling *Botrytis cinerea* do not work in these regions as these two organisms are favoured by different weather conditions (Steel *et al*. 2005). Fungicides used to control *Botrytis cinerea* also have little efficacy on these organisms (Steel *et al*. 2005).

With the development of the WA wine industry in recent times the industry has expanded into new growing regions which experience different climates and weather patterns. With

this expansion there is the possibility that several non botrytis bunch rots may exist in WA and differ among regions and between regions. With the possibility that these non-botrytis bunch rots exist in WA vineyards it is important to raise the awareness of growers that other rots occur and that management changes and control measures may need to be altered.

Objectives:

This study was conducted to determine the population dynamics of various fungi associated with bunch rots of grapes in several grape-growing regions of Western Australia.

Conduct workshops to disseminate information to growers about the population dynamics of bunch rots in WA, whether it remains solely *Botrytis* or that of other pathogens. The workshops included an interstate pathologist currently working on non-botrytis bunch rots who can discuss management techniques.

Method:

To determine the incidence and severity of any potential non-botrytis bunch rots in WA a total of 24 vineyards in the Perth hills (2), Margaret River (6), Swan Valley (5), Pemberton (5), Blackwood valley (1) and Great Southern (5) regions were surveyed.These various regions were chosen as they exhibit a range of differences in varieties grown, soil type and climate. Vineyards in each region that have experienced bunch rot problems in the past were initially invited to participate in the survey, whilst the remainder of vineyards were selected at random.

Vineyards were surveyed as described by Steel *et al*. (2007) whereby five rows per vineyard were randomly chosen and a total of 100 bunches per row were visually assessed for rot incidence. Rot severity was rated on a 0-4 scale with 0= no symptoms; 1= one or two berries in a bunch with rot symptoms; 2= one tenth to one quarter of the berries in a bunch with rot symptoms; 3= one third to a half of the berries in a bunch with rot symptoms; 4= greater than half of the berries in the bunch with rot symptoms.

Five random bunch samples from each of the vineyards surveyed were taken back to the laboratory for moist incubation. These random samples did not show any visual signs of infection at the time of sampling. Fungal growth on the moist incubation trays were plated out onto ½ Potato Dextrose Agar (PDA) plates and identified using growth and spore morphology.

The survey was targeted between veraison and harvest as this is the most susceptible stage for bunch rots. Although all cultivars are believed to be susceptible to non botrytis bunch rots only white varieties were surveyed, as the rots present on these grapes were easier to see with the naked eye.

After the results from the survey were collected and analysed, growers in the Margaret River and Swan Valley (including Perth Hills and Mooliabeenee Associations) regions were invited to attend seminars. These seminars were designed to present the information gained from this study and also inform growers of the experiences with non-botrytis

bunch rots in eastern Australia. Associate Professor Chris Steel from Charles Sturt University was invited to present his research findings at the seminars and to answer grower questions regarding non-botrytis bunch rots.

Results/Discussion:

Weather conditions

The 2006/07 vintage in Western Australia was considered atypical due to a lack of rainfall at critical growth stages and warm weather leading to harvests earlier than previously experienced. Evidence from growers indicates this was the fastest harvest on record with most regions harvesting both white and red varieties some 4 weeks faster than historically experienced.

Figures 1, 2 and 3 show the climatic data from May 2006 to April 2007 compared with the long term climatic conditions for Pearce (Swan Valley, Perth Hills), Pemberton and Mount Barker (Great Southern), respectively. Long term data for Margaret River was unavailable.

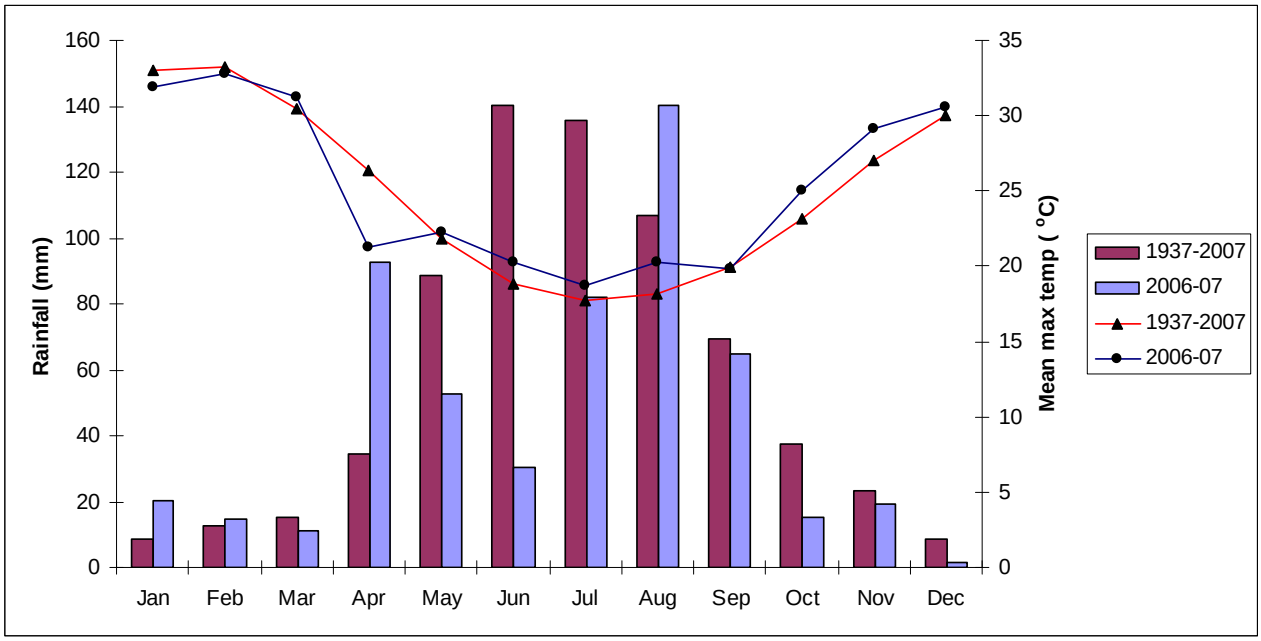


Figure 1: Average Maximum temperature and rainfall from May 06 to April 07 for Pearce. Columns represent rainfall while lines represent temperature. Source data Bureau of Meteorology (2007).

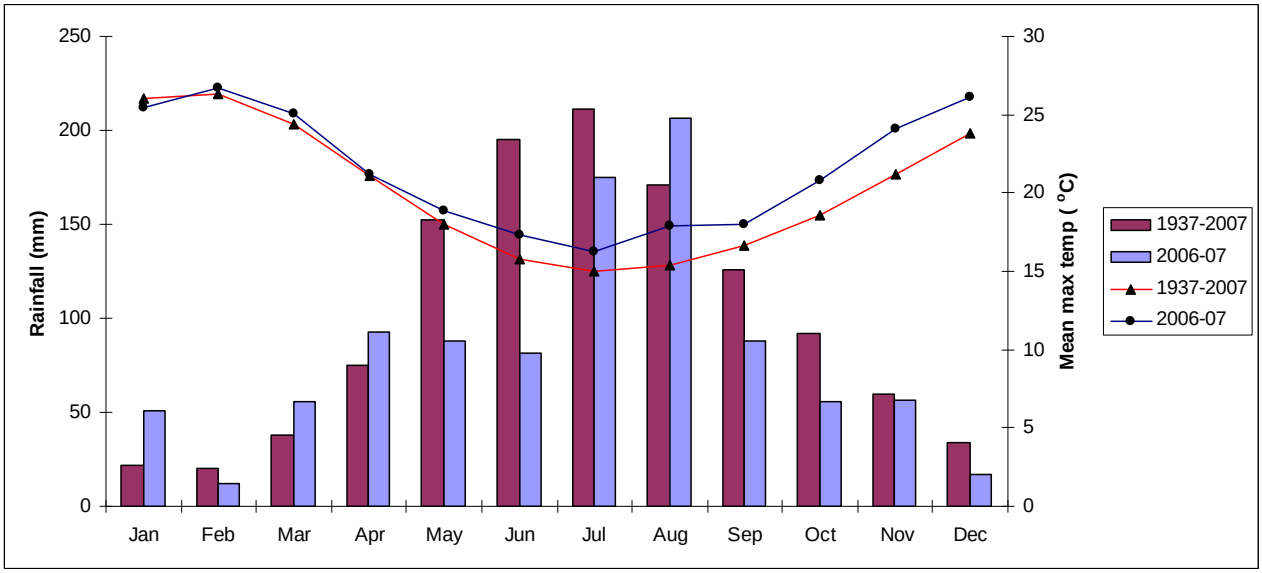


Figure 2: Average Maximum temperature and rainfall from May 06 to April 07 for Pemberton. Columns represent rainfall while lines represent temperature. Source data Bureau of Meteorology (2007).

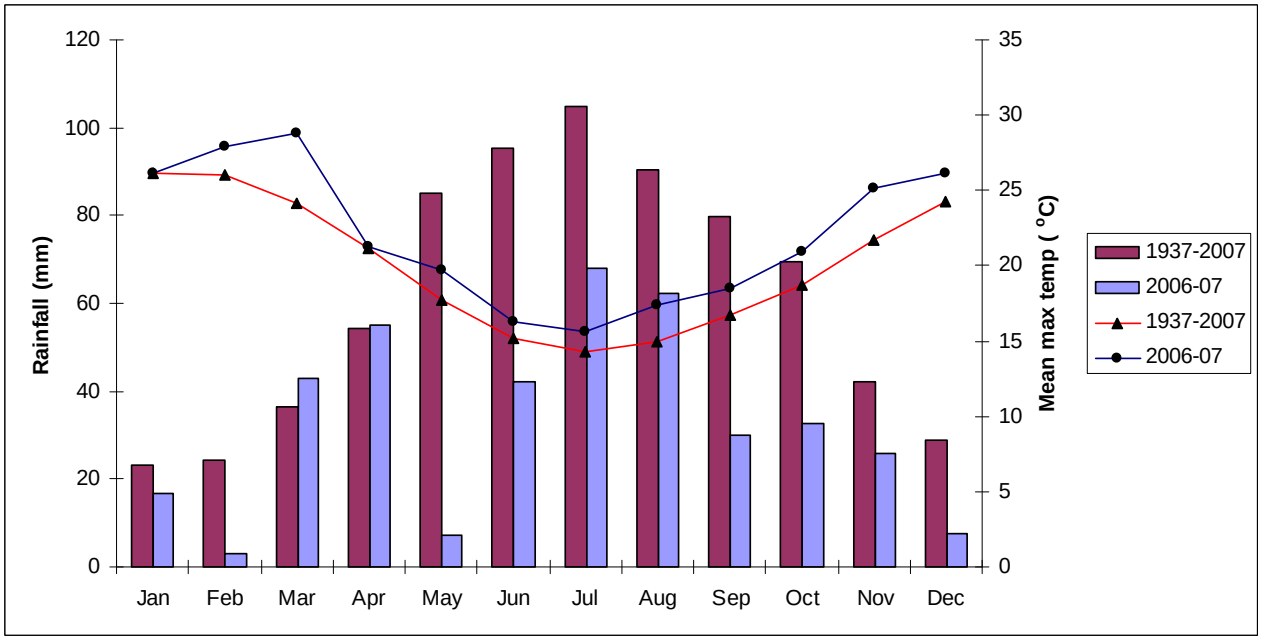


Figure 3: Average Maximum temperature and rainfall from May 06 to April 07 for Mount Barker. Columns represent rainfall while lines represent temperature. Source data Bureau of Meteorology (2007).

Figures 1, 2 and 3 indicate that during May, June, July, September, October, November and December of 2006 all three viticultural regions experienced below average rainfall. The rainfall shortage was slightly relieved by above average rainfall in August for both Pearce and Pemberton (Figs 1 and 2) but not for Mount Barker (Fig 3). Combined with less rainfall there was an increase in mean maximum temperature from May until December 2006 for all 3 regions, leading to increased physiological development of the grapevines.

As weather plays an important component in the development of grape bunch rots it cannot be said that the results from this year's survey will represent the results of a typical vintage. Reports from growers suggest that the yields from this vintage were

lower than in previous years but the disease levels were also lower, meaning the quality was high for the fruit harvested. Therefore further surveys in years where 'typical' weather conditions occur is recommended to verify or challenge the results of this study. However, the results from this study indicate some interesting trends and findings with bunch rots in WA vineyards.

Survey and moist incubation

Several fungi were isolated and identified from the vineyards surveyed; indicating bunch rots in Western Australia are caused by a complex of species. Of the fungi isolated *Botrytis cinerea* was the most frequent, with this species being found in all 6 regions and in the majority of vineyards in each region (Table 1). *Aspergillus* spp., *Penicillium* spp. and *Alternaria* spp. were found in 5 of the 6 regions surveyed at various percentages (Table 1). Of the regions surveyed the Great Southern had the greatest diversity of fungi isolated with 10 different fungal species (Table 1). Unexpectedly, *Botryosphaeria* species were isolated from 3 regions with the highest percentage being found in Swan Valley vineyards.

Table 1: Percentage of vineyards in each region where positive identification of individual bunch rot fungi was made, based on moist chamber incubation and microscopic examination of berries showing symptoms. MR= Margaret River, SV= Swan Valley, BV= Blackwood Valley, PM= Pemberton, PH= Perth Hills, GS= Great Southern.

Organism	MR	SV	BV	PM	PH	GS
Aspergillus spp.	66.7	60	0	20	50	20
Botrytis cinerea	83.3	100	100	100	100	60
Rhizopus sp.	50.0	40	0	0	0	20
Penicillium spp.	66.7	40	0	20	100	60
Botryosphaeria spp.	0	60	0	0	50	20
Sour rot	0	20	0	20	50	0
Fusarium spp.	50	0	100	20	0	40
Alternaria spp.	50	0	100	40	50	60
Pestalotia spp.	0	0	0	0	0	20
Stemphylium spp.	0	0	0	0	0	40
Cladosporium spp.	0	0	0	20	0	40

In general the Pemberton and Swan Valley regions had the highest incidence of *Botrytis cinerea* in the 2006/07 season and this was often associated with the highest level of severity (Table 2). The high incidence of Botrytis bunch rot in the Pemberton region was not unsurprising as this is region often experiences cooler weather and summer rainfall (Figure 2). However, what was surprising was that the Botrytis bunch rot that did occur was evident while the berries were still green and quite hard, thus indicating they had only just begun to move through veraison. A similar situation of *Botrytis cinerea* affecting green berries occurred in the Hunter Valley in the 1980s (Chris Steel *pers comm*.). It is likely that high rainfall in January for both the Swan Valley and Pemberton regions influenced the level of Botrytis bunch rot found (Figures 2 & 3).

With *Botrytis cinerea* found in the majority of vineyards surveyed and the incidence and severity being high for some vineyards it indicates that management of Botrytis in WA

remains critical for good quality fruit. Although wineries differ in there acceptance of grape quality a general rule is that up to 5% infection is allowable before rejection. With the 2006/07 vintage being one where disease pressure was low it was interesting to find 5 of the 19 vineyards in Table 2 had Botrytis incidence higher than this level. This suggests that efficient Botrytis management in years where weather conditions are favourable for disease expression will be critical to prevent large losses.

As previously mentioned the presence of Botryosphaeria berry rot in WA vineyards was unexpected. *Botryosphaeria* species are more widely regarded around the world as trunk rot pathogens and several species have previously been associated with grapevine decline in WA (Taylor *et al*. 2005). It is uncertain as to what impact the Botryosphaeria berry rot is having on WA vineyards. In the Hunter valley region however, *Botryosphaeria* species were considered likely secondary pathogens (Steel *et al*. 2007). Interestingly, in this study it was found via visual infection as well as through moist incubation tests, indicating high humidity is favourable for symptom expression to occur. Further research is required into the infection process of *Botryosphaeria* species as a berry rot.

Table 2: Percent incidence and severity of *Botrytis cinerea*, *Botryosphaeria* species, and other bunch rots in all regions of WA in 2006/07 based on visual assessment. Other bunch rots include *Fusarium* spp., *Alternaria* spp., *Cladosporium* spp., and *Penicillium* etc. Results are the means of the 500 bunches visually examined as part of the survey. Gt Southern data not shown.

	Botrytis cinerea		***Botryosphaeria* spp.**		**Others**	
	Incidence	**Severity**	**Incidence**	**Severity**	**Incidence**	**Severity**
Marg River 1	2	0.05	0	0	0.6	0.01
Marg River 2	0.4	0.01	0	0	0	0
Marg River 3	0.4	0.01	0	0	0.2	0.01
Marg River 4	0.6	0.01	0	0	0	0
Marg River 5	0.8	0.01	0	0	0	0
Marg River 6	0	0	0	0	0.6	0.01
Swan Valley 1	1	0.01	0	0	0	0
Swan Valley 2	9.6	0.15	0.6	0.01	0.6	0.01
Swan Valley 3	2.8	0.06	0	0	0.4	0.01
Swan Valley 4	8.4	0.19	0.8	0.01	0.8	0.01
Swan Valley 5	3.8	0.08	0.4	0.01	9.2	0.18
Pemb 1	3.8	0.06	0	0	0	0
Pemb 2	5.2	0.08	0	0	0	0
Pemb 3	3.8	1	0	0	0.2	0.01
Pemb 4	20.8	0.35	0	0	0	0
Pemb 5	8	0.14	0	0	0	0
Perth hills 1	3.4	0.03	0	0	0	0
Perth hills 2	0.6	0.01	0	0	0.4	0.01
Blackwood 1	2	0.04	0	0	0	0

The Botryosphaeria berry rot was recorded in three different regions with different climatic conditions so there is the potential for it to be found in other regions of the state. The Swan Valley appeared to be region in which favoured Botryosphaeria berry rot development and it is unclear as to whether this is a result of favourable weather conditions, growth of susceptible cultivars or a different species of *Botryosphaeria*

present. Further surveys are required to determine its distribution, the species involved and cultivar susceptibility.

No *Collectotrichum*, *Greeneria* or *Phomopsis* species were recorded during this survey. It is difficult to determine whether this is a result of the weather conditions experienced or whether these rots do not play a significant role in the bunch complex in WA. Steel *et al*. (2007) mentioned that although the environmental conditions for bitter rot and ripe rot are not known, warm and wet conditions close to harvest are important. These conditions did not occur during the 2006/07 season in any of the WA regions surveyed. *Greeneria uvicola* and *Phomopsis viticola*, as the taxonomy currently stands, have not been recorded in WA vineyards to date. A survey for *Phomopsis viticola* is currently being undertaken by the Department of Agriculture and Food WA.

Seminars

Seminars on non-botrytis bunch rots were held in Margaret River and the Swan Valley in June 2007. A total of 25 and 14 growers attended the Margaret River and Swan Valley seminars, respectively. The main aims of the seminars were to inform growers that non botrytis bunch rots exist and outline what occurred with the survey. Associate Professor Chris Steel from Charles Sturt University presented his findings on work performed in the Hunter Valley including work performed on epidemiology of bitter and ripe rot and some work on their control.

Outcome/Conclusion:

In Western Australian vineyards several fungi contribute towards a bunch rot complex. *Botrytis cinerea* remains the major organism causing bunch rots in WA. This study has also indicated several other fungi may play a role in causing bunch rots in WA vineyards, in particular *Botryosphaeria* species. *Botryosphaeria* species are regarded more as trunk rot pathogens but their impact as bunch rots pathogens is relatively unknown.

The climatic effect on bunch rots experienced this year is difficult to gauge. Most regions in WA had harvests that were some four weeks early which will have had an effect on the development of the bunch rots found. As described previously weather plays an important role in bunch rot development and therefore further surveys are required.

Several areas of future research have been highlighted from this study;

- Further monitoring is required in years with “typical” weather to determine whether other non-Botrytis bunch rots are occurring.
- A more intensive survey is required for a greater understanding of the role *Botryosphaeria* species play in the bunch rot complex.
- The different species of *Botryosphaeria* involved need to be determined and whether there is any relationship between these and the trunk rot causing species.
- Further investigation is required into the cause behind the *Botrytis* found on green berries in the Pemberton region.

Western Australian grape growers were informed of the results of this study through seminars presented in the Swan Valley and Margaret River. The aims of these seminars were to make growers aware that although *Botrytis cinerea* is the most frequently

occurring bunch rot, others do exist and should modify their management techniques accordingly.

Project Extension

- A poster and abstract titled "Non-Botrytis bunch rots occurring in Western Australian vineyards" was presented at the Australian wine industry technical conference (AWITC) and Australasian Plant Pathology society (APPS) conference in 2007.
- An article summarising this study was published in the Australian Viticulture magazine Vol 11(5) pg 44-48.

Reference

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Taylor, A., Hardy, GESt.J., Wood, P., and Burgess, T. (2005) Identification and pathogenicity of *Botryosphaeria* species associated with grapevine decline in Western Australia. *Australasian Plant Pathology,* **34(2)**: 187-195.

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Mr Colin Gordon (DAFWA)

Assoc. Prof. Chris Steel (CSU)

DAFWA wine grape project members

Survey participants

Grower associations

Budget	Funding required from GWRDC		Actual Expenditure
Car Hire for survey	5,400.00		8,750.00
Accommodation	1,800.00		1800
Laboratory analysis/consumables	1,500.00		1,000.00
Travel for eastern states pathologist	3,000.00		2000
Seminar costs, venue, catering	1,000.00		1000
Labour	1,850.00		0
Final report	200.00		200
Total	14,750.00		14,750.00
Add 10 % GST	1,475.00		1,475.00
Total funds requested from GWRDC	16,225.00	**Total Expended**	16,225
		Remitted to GWRDC	0