KANGAROO ISLAND

GRAPEVINE TRUNK DISEASE

SURVEY



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1. SUMMARY

With financial support from Primary Industries and Regions South Australia (PIRSA), the South Australian Research and Development Institute (SARDI), the Grape and Wine Research and Development Corporation (GWRDC) and Cornell University (USA), Dr Mark Sosnowski and Mr Matthew Ayres of the South Australian Research & Development Institute (SARDI), Dr Trevor Wicks (ex. SARDI) and Prof Wayne Wilcox (Cornell University USA) travelled to Kangaroo Island to visit vineyards, survey for grapevine trunk diseases and deliver a grapevine disease management workshop.

The survey confirmed that grapevine trunk diseases occur in vineyards on Kangaroo Island, with botryosphaeria dieback detected in most vineyards and eutypa dieback in three of the 12 vineyards assessed. The severity of symptoms was low but based on experience in older regions in South Australia, without intervention, cordons and trunks will continue to die-back and vines will become unproductive and die. These results serve as a timely early warning to grapegrowers on Kangaroo Island, proving impetus to manage trunk diseases to lessen the impact on production.

Recommendations were provided to Kangaroo Island growers at a workshop, including cutting out wood infected with trunk disease pathogens and preventing any new infection by protecting pruning wounds. Information was also provided on the latest recommendations for managing the foliar diseases powdery and downy mildew along with botrytis bunch rot.

2. INTRODUCTION

Grapevine trunk diseases such as eutypa and botryosphaeria dieback contribute to grapevine decline, reducing productivity and longevity, causing considerable economic loss to the $8.3 billion Australian wine industry. It was estimated that eutypa dieback cost South Australian growers up to $2800 per hectare through lost production (Wicks and Davies 1999).

Trunk pathogens infect vines through pruning wounds, colonise woody tissue and cause dieback of cordons and trunks, observed as dark wedge-shaped tissue in cross-section. The *Eutypa lata* fungus produces toxic metabolites which are translocated to the foliage, causing stunted shoots, necrotic and distorted leaves, reduced bunch size and uneven ripening. Management of trunk diseases is based on removing infected wood material and preventing infection through pruning wounds (Sosnowski *et al*. 2009).

Kangaroo Island, at its closest point, is only 13 km from the Fleurieu Peninsula on the mainland of South Australia. In a survey of the southern Fleurieu Peninsula in 2008, eutypa dieback was observed in up to 34% of vines in vineyards (Sosnowski *et al* 2010). Spores of *E. lata* are purported to travel up to 50 km from their source. In addition *E. lata* can be hosted on 88 different species of woody plants, including fruit trees and ornamental species, many of which occur on the island. Botryosphaeria dieback can be introduced on planting material and is also hosted by many tree species, including native Australian species. This would suggest that both eutypa and botryosphaeria dieback threaten Kangaroo Island vineyards, but prior to 2012 there have been no reports of these diseases.

During a previous visit to Kangaroo Island in February 2012, dieback symptoms were observed in a vineyard and samples taken back to SARDI laboratories for diagnosis. A fungus responsible for botryosphaeria dieback was isolated and morphologically identified as *Neofussicocum luteum*. This led to a return visit in November 2012, with funding for travel provided by PIRSA, SARDI and GWRDC by Mark Sosnowski, Matthew Ayres (SARDI), Trevor Wicks (ex. SARDI) and Wayne Wilcox (Cornell University, USA). The aims were for the project team to conduct a comprehensive survey of trunk diseases in vineyards across Kangaroo Island and to deliver a workshop to update growers on the latest information of grapevine disease management from research in Australia and the USA.

3. GRAPEVINE TRUNK DISEASE SURVEY

Twelve vineyards across Kangaroo Island were inspected and included 59 blocks which ranged in age from 3 to 19 years. In total, 17 cultivars were included with Shiraz and Cabernet sauvignon the most common. In each block, 200 vines were visually assessed (Figure 1a&b) for both foliar symptoms of eutypa dieback and cordon dieback (ie. two or more spurs dead). The number of vines with any symptoms was counted and incidence calculated. Samples of wood with dead tissue were collected (Figure 1c) from each block where symptoms were observed and taken back to the SARDI laboratory for diagnosis. In addition, any other interesting observations in the vineyard were noted, photographed and discussed with vineyard owners/managers (Figure 1d).

Wood samples were processed in the laboratory as follows. Bark was removed from each sample using a sharp knife. The exposed wood was surface sterilised in chlorine bleach and rinsed in water. Using secateurs, wood samples were cut into small chips taken from each side of the margin between live and dead wood tissue. Wood chips were placed on agar plates, which were incubated at 23°C under fluorescent light for 12 h each day for 7 days. Fungal cultures were identified by morphological characteristics.



Figure 1. The survey team; Mark Sosnowski, Matthew Ayres, Trevor Wicks and Wayne Wilcox, inspected 59 blocks in 12 vineyards across Kangaroo Island, taking samples for diagnosis and engaging in discussions with growers from each vineyard.

Dieback symptoms characteristic of trunk disease were observed in 10 of the 12 vineyards surveyed, with a total of 32 blocks recorded with incidences ranging from 1 to 45%. Symptoms included missing or dead spur positions or arms (Figure 2a&b). When bark was stripped back from surrounding cordon, dead tissue was observed extending away from dead spurs (Figure 2c&d), which when cut in cross section, appeared wedge-shaped (Figure 2e&f).

Foliar symptoms characteristic of eutypa dieback were observed in two of the 12 vineyards surveyed, with a total of seven blocks recording incidences ranging from 1 to 33%. Symptoms included stunted shoots, with yellowing leaves that were cupped and had necrotic margins (Figure 2g&h; Figure 3).

The influence of vine age is shown in Figure 4, where the youngest vines with dieback and foliar symptoms were 6 and 7 years old, respectively. As vine age increased, so too did the incidence of symptoms. These results are consistent with other Australian regions, where the youngest vines ever recorded with eutypa foliar symptoms is 7 years of age. This reflects the time it takes for symptoms to arise after infection has occurred, so pruning wounds may be infected in 1 or 2 year old vines but symptom development may take 6 or more years to become evident. Therefore it is important to protect pruning wounds from infection from the first pruning season. As vines age symptoms become more severe due to; longer incubation time, greater number of wound sites for infection and exposure to more pruning events.

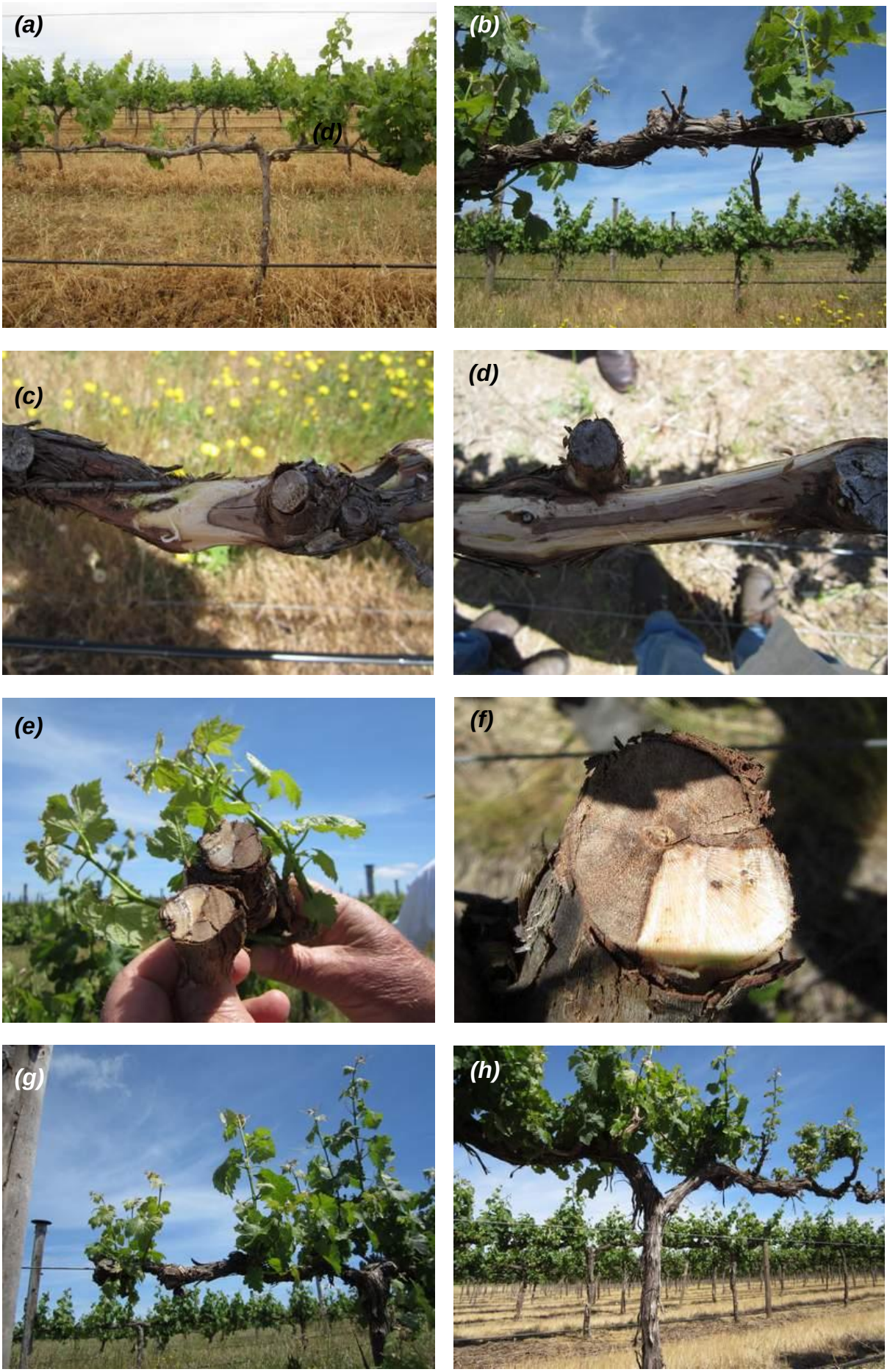


Figure 2. Trunk disease symptoms observed in Kangaroo Island vineyards in November 2012; (a-b) dying arms and dead spur positions, (c-d) dead wood tissue extending from old wounds, (e-f) wedge-shaped staining of dead wood in cross section of cordon and (g-h) stunted shoots.



Figure 3. Typical foliar symptoms of eutypa dieback with shortened shoot internodes and yellowing, cupped leaves with necrotic margins, observed in a Kangaroo Island vineyard.

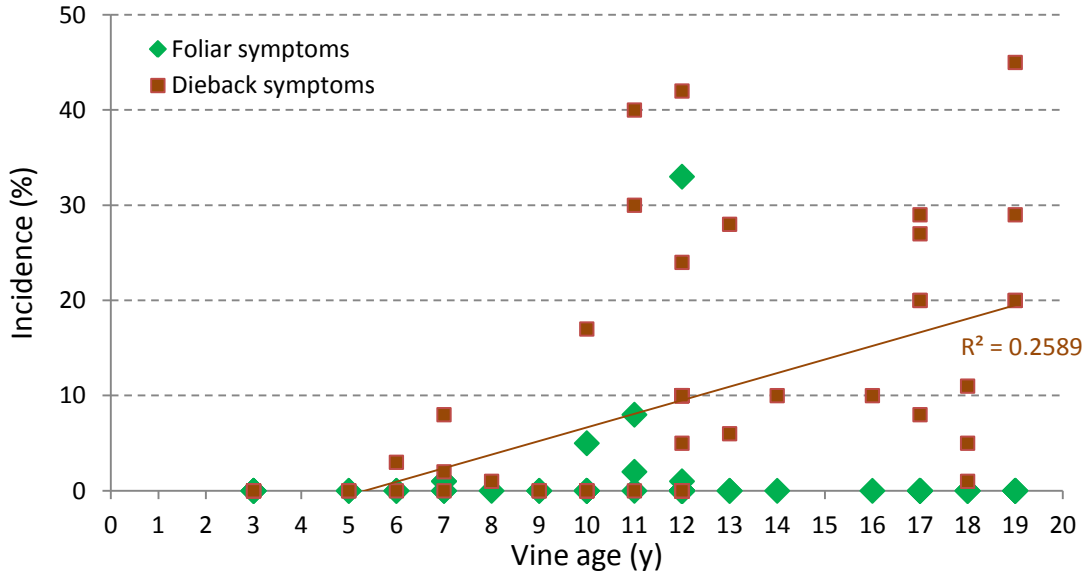


Figure 4. Influence of vine age on foliar and dieback symptoms in Kangaroo Island vineyards during November 2012

Of the 17 cultivars surveyed, seven were recorded with dieback symptoms and five with foliar symptoms of eutypa dieback (Figure 5). However, 12 cultivars were only represented by one or two blocks so do not provide a comprehensive representation. From previous surveys in South Australia (Wicks 1975, Highet and Wicks 1998, Loschiavo *et al*. 2007, Sosnowski *et al*. 2010) most *Vitis Vinifera* cultivars have been recorded with foliar and dieback symptoms with varying incidence. Therefore, all cultivars should be considered susceptible and managed for trunk diseases accordingly.

Diagnostic analysis in the laboratory at SARDI revealed that most wood samples taken from vine blocks with dieback symptoms yielded fungal species belonging to the genera *Diplodia* and *Neofussicoccum* in the family Botryosphaeriaceae (Figure 6a), which are causal agents of botryosphaeria dieback. Furthermore, wood samples from seven blocks in three different vineyards yielded the fungus *Eutypa lata*, which causes eutypa dieback (Figure 6b). In one block, *E. lata* was identified in wood from vines without foliar symptoms. This occurs commonly in South Australian vineyards as foliar symptom expression varies from season to season (Sosnowski *et al.* 2007). In addition, two cultures belonging to the Diatrypaceae family were also isolated but are yet to be identified to the species level. Species of the Diatrypaceae have recently been associated with eutypa dieback in Australia (Trouillas *et al.* 2011, Pitt *et al.* 2013) and strategies recommended for control of *E. lata* have been shown to be effective against these species (Gramaje *et al.* 2012).

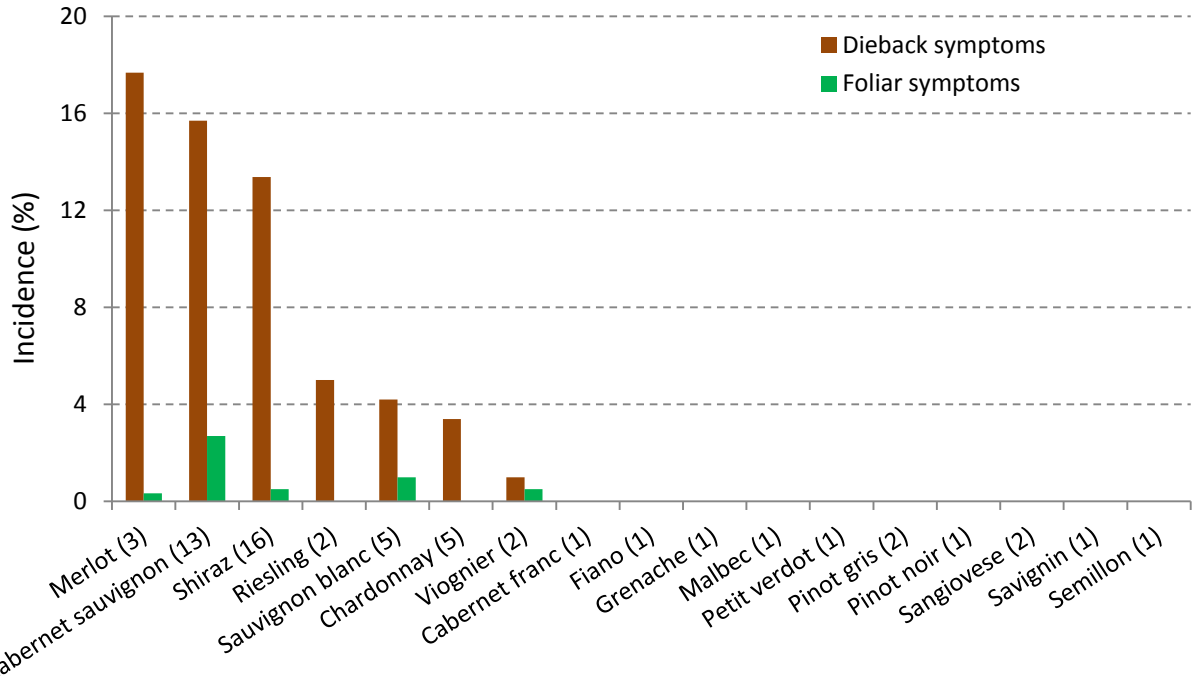


Figure 5. Grape cultivars surveyed and incidence of foliar and dieback symptoms of trunk disease in Kangaroo Island vineyards during November 2012. Figures in brackets next to cultivars indicate the number of blocks surveyed.

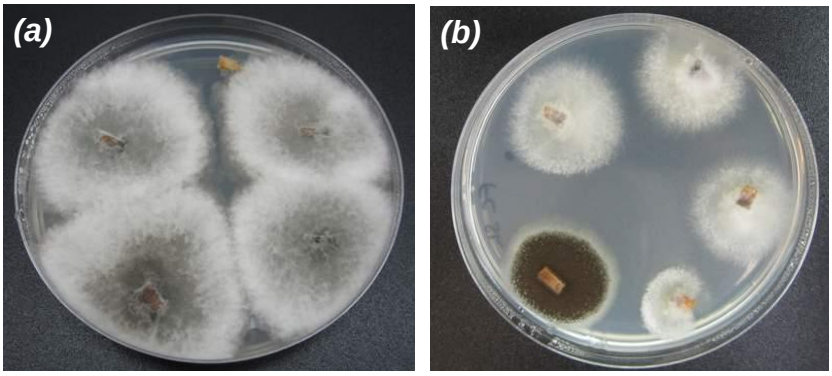


Figure 6. Fungal cultures isolated from wood samples; (a) species of Botryosphaeriaceae and (b) white cultures of *Eutypa lata.*

This is the first record of the occurrence of botryosphaeria and eutypa dieback disease on Kangaroo Island and serves as an early warning to growers to be vigilant in managing vines to reduce the impact of trunk disease. Management of trunk disease is based on preventing infection of pruning wounds using paints, pastes and fungicides and removing existing infection by remedial surgery (Sosnowski *et al.* 2009). Current research at SARDI is developing optimal strategies to apply pruning wound protectants using tractor-driven sprayers.

4. OTHER OBSERVATIONS

During the survey, a number of other disorders were noted. Earwigs were observed in a few vineyards and were causing significant damage in one particular vineyard. Leaves had been stripped (Figure 7a) and stems damaged (Figure 7b) by the earwigs, which were found hiding from the sun under rubber post caps (Figure 7c). Following discussions with the grower, the best form of management was to apply appropriate insecticide under post caps at the first sign of shoot damage.

Herbicide damage was also evident by the distorted shoots and leaves in a number of vineyards (Figure 7d). Salt damage (Figure 7e) was observed in low lying sections of vineyards associated with a high water table. Leaves with variegation (Figure 7f) caused by genetic mutation or chimera were also seen but this is not likely to have any impact on production. Flag shoots of powdery mildew were spotted (Figure 7g) alerting the growers to the presence of inoculum, and serving as a reminder to apply appropriate sprays to reduce spread of the disease. Other interesting observations included damage to shoots from wind (Figure 7h) as well as significant damage caused by possums (Figure 7i&j) and kangaroos (Figure 7k).

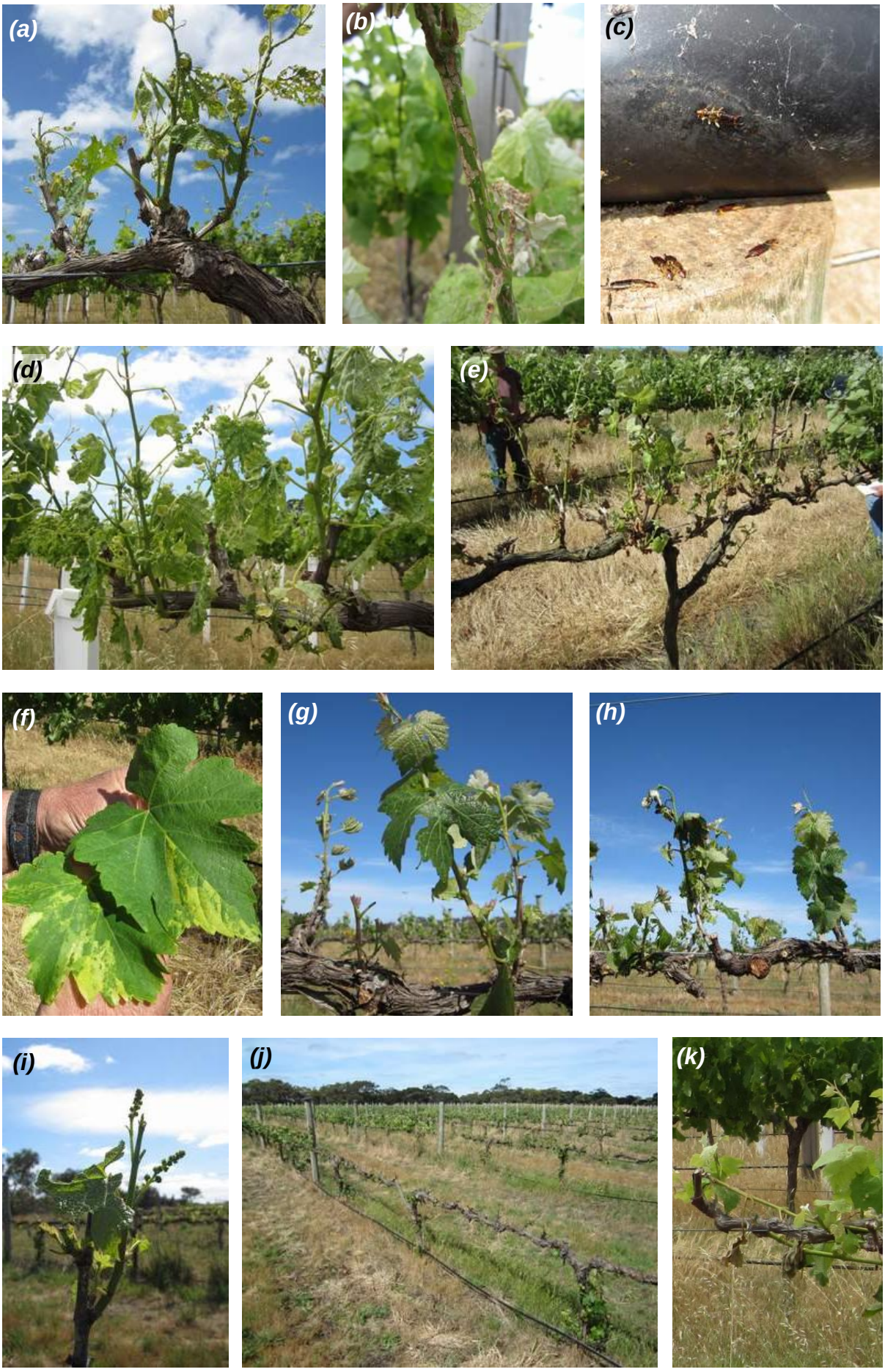


Figure 7. Other disorders noted on Kangaroo Island in November 2012; (a-c) leaf and stem damage caused by earwigs, which sheltered from the sun under rubber post caps, (d) herbicide damage, (e) salt damage, (f) variegation caused by genetic mutation (chimera), (g) powdery mildew flag shoot (left), (h) wind damage, (i-j) possum damage and (k) kangaroo damage.

Other interesting observations included damage to shoots from wind (Figure 7h) as well as significant damage caused by possums (Figure 7i&j) and kangaroos (Figure 7k).

Also noted by one grower were some leaves with necrosis on leaves and petioles (Figure 8a). The leaves were incubated under high humidity for 2 weeks and mycelium and sclerotes were formed. Subsequent culturing on agar lead to morphological identification of *Sclerotinia sclerotiorum* (Figure 8b). This pathogen has previously been detected on grapevines in South Australia (Hall and McMahon 2001) but there have been no reports of any significant disease caused by this fungus in grapevines.

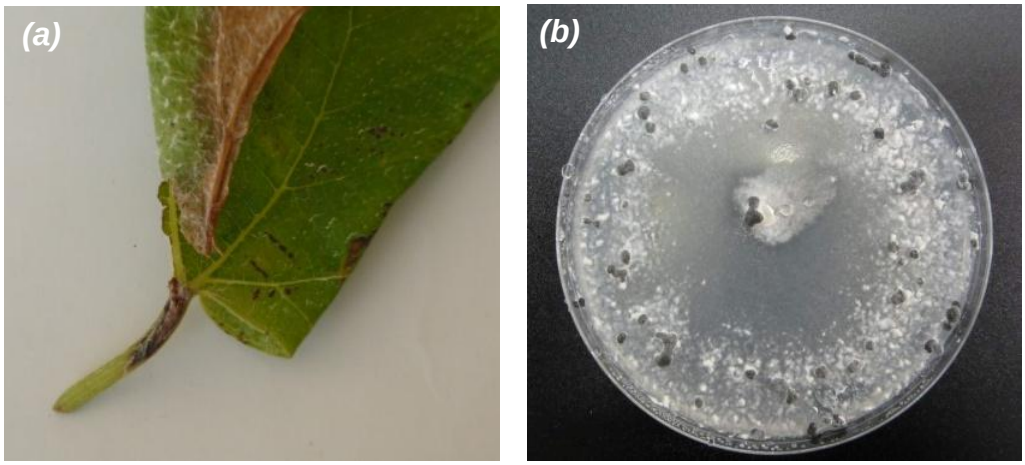


Figure 8. (a) Necrotic lesions on grapevine leaf and petiole and (b) fungal culture of *Sclerotinia sclerotiorum* isolated from petiole lesion.

5. WORKSHOP

A workshop was held at Dudley Wine cellar door where 12 growers attended (Figure 9). Mark Sosnowski provided a summary of the survey results followed by a comprehensive presentation on managing trunk disease, particularly eutypa dieback, based on research at SARDI and around the world over the past decade. Matthew Ayres provided an update on current eutypa dieback research which is improving the efficiency and effectiveness of management strategies. Trevor Wicks provided the latest information on managing powdery and downy mildew along with botrytis bunch rot in Australia and was followed by special guest Wayne Wilcox, who gave a north-east US perspective on these foliar disease with particular emphasis on fungicide resistance management. There was great enthusiasm from growers to the information delivered which will no doubt lead to improved disease management practices in vineyards on Kangaroo Island.



Figure 9. (a) Prof Wayne Wilcox (Cornell University USA) and (b) Dr Mark Sosnowski (SARDI) presenting information on managing grape diseases to Kangaroo Island grapegrowers at Dudley Wines cellar door.

6. CONCLUSIONS

This project provided the Kangaroo Island wine region with new information to assist in vineyard management which will improve the quality of wine production on the island. The survey confirmed that botryosphaeria and eutypa dieback are present on Kangaroo Island. This serves as a timely warning and growers are recommended to implement strategies to minimise further spread of trunk disease to minimise its future impact. Furthermore, new information on managing foliar diseases will reduce the likelihood of a repeat of the significant losses experienced in previous years when conditions were extremely conducive to powdery and downy mildew and botrytis bunch rot.

7. ACKNOWLEDGEMENTS

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