AWRI Australian Wine Research Institute

Fact Sheet
VITICULTURE

Recognising and understanding bacterial inflorescence rot

Background

Pseudomonas syringae is a widely distributed bacterium that inhabits plant surfaces, soil and water and has many host plants. *Pseudomonas syringae* pv. *syringae* (PSS) was first reported in 1976 on grapevines in Argentina. Even though symptoms were observed, they were not associated with any yield or quality loss, and it was considered a weak pathogen. In Australia in 2000, PSS was identified as the cause of a condition called bacterial leaf spot (BLS) in the Adelaide Hills, but it was not until the 2006/07 season in Tumbarumba that the disease was first associated with significant yield loss. The name given to the disease responsible for yield loss is bacterial inflorescence rot (BIR). The regions most at risk from PSS are those in cool climates, such as the Adelaide Hills, Tumbarumba, Yarra Valley and Tasmania.

Disease symptoms and damage

Whitelaw-Weckert et al. (2011) described the symptoms of PSS as follows:

> Disease symptoms in vineyard-grown plants first appeared at flowering, about 60 days after budburst. They included brown, longitudinal striations on the shoots, rachises and leaf petioles and veins, accompanied by necrotic rachises and abscission of up to 60% of inflorescences. The leaves were initially covered in small dark spots with yellow halos. The leaf spots enlarged, became irregular in shape and were generally bounded by the small leaf veins. Affected tissue split as it became dry and brittle. As infection progressed, the spots tended to merge until much of the leaf was covered and the leaves senesced. Drops of bacterial ooze were sometimes visible near shoot lesions.

Examples of some of these symptoms are shown in Figures 1 to 3. Figure 4 shows inflorescence infection by downy mildew, which could be confused with PSS. Grapevine tissue that has been infected by PSS is also at risk of *Botrytis* infection. If symptoms are observed, it is advised that samples are sent to a testing facility to confirm the cause. A list of testing facilities is provided at the end of this fact sheet.

Figure 1. Necrotic inflorescences caused by PSS. Images: Adrian Utter

Figure 2. Necrotic spots on leaves from PSS infection. Images: Adrian Utter and Melanie Whitelaw-Weckert

Figure 3. Lesion from PSS infection on a petiole. Image: Melanie Whitelaw-Weckert.

Figure 4. A necrotic inflorescence caused by downy mildew infection. © State of Western Australia (Department of Primary Industries and Regional Development, WA)

The role of climate

Wet weather in the growing season and high humidity are both associated with BLS and BIR. Rainfall and water on surfaces are important for the movement of PSS through the environment. Moisture on the leaf surface allows PSS to enter the leaf through the stomata. The increased humidity caused by heavy spring rains and overhead sprinklers are the most likely causes for increased disease pressure in vineyards (Hall et al. 2016).

Life cycle of PSS

Following grapevine dormancy in spring, PSS that has overwintered in the bark or buds gets washed or splashed onto leaves. The bacteria have mobility in water and enter the leaf via the stomata. Once inside the leaf, they infect cells and reproduce and move systemically via the xylem. Through xylem movement, bacteria infect the inflorescences and cause BIR. This results in tissue death and causes the inflorescences to shrivel. Leaves show spots that develop into necrosis. Petioles and rachis may show lesions. In summer, infected inflorescences will have

rotted or dried up and infected leaves will be tattered. In the winter, PSS can overwinter in buds and wood. There is evidence that bacterial leaf spot symptoms and disease severity increase in vineyards in subsequent seasons, and that transmission to other nearby vineyards may occur.

Management

Pseudomonas syringae pv. *syringae* is readily spread on pruning equipment. Where this bacterium has been identified or is suspected, it is important to clean and disinfect vineyard equipment regularly, especially pruning equipment. It is recommended to disinfect snips and secateurs between plants to stop the spread.

There are no agrochemicals registered for control of PSS, but copper is thought to have some effect. The application of copper chelate as a soil drench is said to control the pathogen in the vine, but more research would be required to confirm this.

Anecdotal evidence suggests that conversion from spur pruning to cane pruning can reduce PSS pressure, perhaps because old wood harbouring inoculum is removed. Suckers located on the trunk are often found to be infected with PSS and should be removed. High humidity causes symptoms to be more severe, so actions to open the canopy and promote airflow are beneficial.

Quality of material for testing

Early detection of PSS is crucial to prevent further spread of the bacteria through vineyards. Vines with early symptoms (e.g. leaves showing small dark spots with yellow halos) are preferred for testing, as the bacteria is easily detectable through culturing and molecular techniques. Once material gets to the stage of complete necrosis, secondary pathogens will become dominant and detection of PSS through culturing will become difficult and, in some cases, unachievable, although it may still be detected through molecular assays. It is important that once collected, material is not left in bags at room temperature or higher for more than a day as this will increase the rate of necrosis and provide favourable environments for growth of secondary bacteria. Material should be stored at 4°C (if possible) either in a fridge or an esky with ice bricks until ready to send. Contact your testing facility before sending samples.

Testing facilities

Crop Health Services
Main Loading Dock
5 Ring Road
La Trobe University
Bundoora VIC 3083
Phone: 03 9032 7515
Email: chs.reception@agriculture.vic.gov.au

EMAI (Elizabeth Macarthur Agricultural Institute)
Private Bag 4008
Narellan NSW 2567
Phone: 02 4640 6333
Email: laboratory.services@dpi.nsw.gov.au

Plant Diagnostic Services
Department of Natural Resources and Environment Tasmania
13 St Johns Avenue
New Town, TAS 7008
PH: (03)6165 3245
Email: plantdiagnosticservices@nre.tas.gov.au
Attention: Alison Dann

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References and further information

Hall, S.J., Dry, I.B., Blanchard, C.L., Whitelaw-Weckert, M.A. 2016. Phylogenetic relationships of *Pseudomonas syringae* pv. *syringae* isolates associated with bacterial inflorescence rot in grapevine. *Plant Dis.* 100(3): 607-616.

Morris, C.E., Monteil, C.L., Berge, O. 2013. The life history of *Pseudomonas syringae*: linking agriculture to earth system processes. *Ann. Rev. Phytopathol.* 51: 85-104.

Whitelaw-Weckert, M.A., Whitelaw, E.S., Rogiers, S.Y., Quirk, L., Clark, A.C., Huang, C.X. 2011. Bacterial inflorescence rot of grapevine caused by *Pseudomonas syringae* pv. *syringae*. *Plant Pathol.* 60: 325-337.

NSW DPI Agriculture. Bacterial rot of grapevine caused by *Pseudomonas syringae.* Video available from: https://www.youtube.com/watch?v=mCmOBuedd1U

Contact

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