Blueberry Rust: Can this Pathogen be Stopped Over Winter?

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Blueberry rust has posed biosecurity challenges in many Australian states in the past decade. Management options include reducing its survival over winter to break the disease cycle. Is that needed in colder growing regions like Tasmania?

What is blueberry rust and where is it?

Blueberry rust is caused by the fungal pathogen *Pucciniastrum minimum*. It leads to disease mainly on leaves, but also on fruit. Infections are characterised by small dark red-brown spots on the upper side of the leaves, and clumps (pustules) of yellow-orange spores on the underside of the leaf. These spores can easily spread the disease to new plants and orchards, as they are airborne and also spread by human activity.

Blueberry rust is currently present and declared endemic in all Australian states except South Australia. Blueberry growers wishing to export to South Australia must comply with an Interstate Certification Assurance (ICA) arrangement, including a fungicide protocol.

Key management options

Blueberry rust can be managed and reduced by a range of options, starting with monitoring for its presence regularly. As the pathogen infects more readily in moist, warm conditions, cultural practices such as row orientation to prevailing winds and canopy pruning will promote ventilation and reduce moisture on leaves.

A range of conventional and organically approved fungicides can be used at key times in the season when infection risk is high, to control or suppress the rust. If hotspots of rust infection occur in an orchard, management can be more targeted to those areas, and the area planted with more resistant cultivars.

To increase the non-chemical tools for rust management, current research is seeking to understand more about how the rust survives over winter. In cooler regions, including Tasmania, many growers use deciduous varieties that do not retain foliage over winter. This is thought to provide a break in the disease cycle, as the fungus can only survive on living material (and is rarely/never found on branches or dormant buds). However, for evergreen and semi-deciduous varieties, pathogen survival over winter could be limited by environmental conditions or planned defoliation.

Breaking the disease cycle over winter – what is the effect of cold temperatures?

In warm regions with evergreen or semi-deciduous varieties, leaves can remain infected all year round. In colder regions growing evergreen or semi-deciduous varieties, it is not known whether cold temperatures could render the spores unviable. This is a question that has been the focus of one part of a current research project, funded by the Tasmanian government. Some growing regions can experience sub-zero minimum temperatures during winter months, and understanding survival limits of the pathogen is important.

Laboratory trials have exposed infected leaves to temperatures of -5°C, 0°C or +5°C for either 4, 8 or 16 hours. To determine if those temperatures reduce spore viability, the spores from treated leaves were then placed in optimal conditions to promote germination. Results

Figure 1. Example of batches of leaves infected with rust which were subjected to different temperatures for different time periods. Photo credit: Karina Griffin

showed that spore germination was slightly reduced by exposure to sub-zero temperatures (-5°C) compared to the higher temperatures, but levels of germination were still high enough to assume they would be able to germinate and reinfect new foliage in the field, as least in the short term, after temperature exposure.

Leaves that were exposed to the same range of cold temperatures for either 4, 8 or 16 hours were then monitored for 2 weeks (in conditions simulating that they were still attached to a plant). This found that one week following low temperature exposure all leaves were still producing active rust pustules that could germinate. By two weeks, leaves exposed to -5°C leaves had minimal to no active rust pustules, but leaves exposed to 0 and 5°C maintained a moderate to high level of active rust pustules.

What does this mean? It is likely, if leaves do not defoliate after they are exposed to low temperatures of 0°C and above they will continue to produce active spores, and the rust infection cycle will continue. However, exposure below 0°C could prevent future spore production. Further investigation under field conditions would be needed to validate this.

Breaking the disease cycle over winter – is defoliation an option?

Previous research in NSW has suggested that infected leaves that fall to the orchard floor will cease being a source of viable spores after 6 weeks, and therefore not pose a risk for re-infection of new leaves. Therefore, defoliation is an option in warmer regions to reduce inoculum and likely to be effective in cooler regions also, but cost-effective ways to attain defoliation, and the impact on yield, needs to be considered.

Semi-deciduous cultivars such as *Legacy* retain leaves over winter. Research in Tasmania has been conducted over the past three years with *Legacy*, with both hand defoliation and trial of chemical defoliants. In two years of trials, hand defoliation of all foliage during winter has been shown to have no significant reduction in fruit yield in the same season.

Chemical defoliants that have been trialled in *Legacy* in 2022 and 2023 include zinc sulphate, copper sulphate, and a combination of urea and copper sulphate. While all treatments led to successful defoliation, flower buds were impacted and unacceptably low yields (around 20% compared to control plants) were the result.

Current trials are being conducted with the growth regulator ProTone®, which showed promise as a defoliant with less impact on yield in a screening trial in 2023. This product was applied to *Legacy* plants as part of a larger trial in autumn this year, with two applications providing complete defoliation. Assessments of yield will be conducted in December-January.

Figure 2. Hand defoliated *Legacy* blueberry plants
Photo credit: David Page

What other research questions are being addressed?

We are recording weather data in representative blueberry orchards in Tasmania to work out when and for how long temperatures are below zero. In addition, we are trialling thermal mapping via UAV to visualise how temperature differs across orchard blocks.

We are also monitoring leaf development in two common blueberry cultivars (*Legacy* and *Brigitta*) and relating it to temperature. This will enable growing degree day models to be developed, to better estimate when new leaves will expand and require protection from rust infection.

Figure 3. Thermal imagery (L) and visible satellite image (R) of a block of blueberries in southern Tasmania on uniform terrain. Thermal imagery was taken pre-dawn and shows that temperatures differed by 2-3 °C across most of the block. Photo credit: Jacob Virtue (thermal imagery) and Google Maps

Further reading about Blueberry rust

Simpson, M. 2023. Managing blueberry rust. NSW DPI Management Guide.
https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0012/1496685/Managing-blueberry-rust.pdf

Search the industry Resource Library at **berries.net.au/resource-library** by entering **'blueberry rust'** into the Search box. There you will find all previously published resources related to Blueberry rust, including articles published in this industry journal.

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