Blueberry rust – scientific advice

Prepared and approved by Tasmanian Institute of Agriculture

27 July 2017

Conclusion

- Based on the scientific knowledge of the lifecycle of the disease, **permanent eradication of the disease (i.e. eradication beyond 2-5 years) in the current outbreak is not feasible** because of the effort needed to locate and survey all potential plant hosts and then remove them. Infections at a very low incidence in a given area can be missed, even by the most well-trained personnel.
- **The rust pathogen cannot be eradicated** from the State even temporarily because dissemination has advanced beyond the stage when it can be contained.
- Science-based checklists of conditions tending to favour the prospects of an eradication campaign point to two key factors working against successful eradication of a rust fungus; that is, (1) rust spores are easily and rapidly dispersed, and (2) rust fungi can complete multiple generations in a single growing season through rapid, asexual propagation. New infections cannot be detected until disease symptoms are evident days later. This means that any removal of plants with visible rust symptoms may not represent the entire pathogen population.

Summary

- The Tasmanian Institute of Agriculture is working closely with the Department of Primary Industries, Parks, Water and Environment (DPIPWE) to provide independent scientific advice to assist with the response to blueberry rust in Tasmania.
- We are committed to supporting Tasmania's agriculture industry through research, development and extension that is responsive to industry needs and supports productive, profitable and sustainable industries.
- After reviewing the best available science and consulting with subject experts, the Tasmanian Institute of Agriculture believes that containment is the most effective strategy to manage blueberry rust in Tasmania.
- Based on the best available science, we believe attempted eradication of blueberry rust would be a high-cost and unsustainable approach to the industry's long-term viability in Tasmania.
- Given the prevalence of the disease globally and its ability to spread across large distances, it is possible the disease would reoccur in Tasmania within five years after an attempted eradication. A re-appearance of the disease from existing undetected infections on plants in the State is also feasible.
- A science-based and well-implemented containment strategy that involves all industry members is recommended as the most effective way of managing blueberry rust in Tasmania.

Background

Rust fungi, in general, are extremely difficult to eradicate once infections are detected beyond an infection focus of several host plants. They produce a spore type (urediniospores) that is relatively resistant to damage by UV light and which can survive and travel more than 1000 km by air. This spore type has potential to survive mild winters in climates like Tasmania.

Agencies responsible for biosecurity have checklists of conditions tending to favour the prospects of an eradication campaign, and these are based on evidence from multiple case studies. Two key factors working against eradication of rust fungi are that the pathogen is highly mobile – rust spores are easily and rapidly dispersed – and that the pathogen reproduces asexually – rust fungi can complete multiple generations in a single growing season through asexual propagation.

Rust fungi have complicated life cycles. Evidence from diagnostics tests coordinated by DPIPWE indicates that that rust infections in Tasmania are caused by *Thekospora minima*. *Thekospora minima* does not need its alternate host to complete its lifecycle if the uredinial spore state can survive Tasmania's mild winter. *Thekospora minima* has the potential to produce five different spore states. Three spore states can potentially form on blueberries, which belong to the genus of *Vaccinium*: uredinia, telia and basidia. **It is assumed that uredinia have been observed in Tasmania.** This spore state also forms on other ericaceous plants such as *Rhododendron* spp According to Bioesecurity Tasmania, *Thekospora minima* has not been observed on other ericaceous plants during surveys conducted in Tasmania, Victoria and New South Wales. Whether or not infections are occurring on plants other than blueberry in Tasmania is unknown.

Two other spore states – aecia and pycnia (spermatia) - form on an alternate host: *Tsuga* spp (a genus of conifers). The abundance of plants belonging to this genus in Tasmania is likely to be low. If *Tsuga* spp. are present in Tasmania, then it is not known whether or not infections of *Thekospora minima* are occurring on plants of this genus.

Uredinia produce highly mobile, airborne spores that can initiate new infections on healthy plants of the same species, if not others. These spores have similar physical characteristics to pollen: they can potentially stick to the clothing of orchard workers when they were reaching into an infected blueberry bush, or via a spore plume released from rust pustules. In the absence of biosecurity measures, workers could potentially transport spores via their clothing to healthy blueberry bushes in another location, including other properties.

The **disease of Blueberry rust** (but NOT the pathogen) could be eradicated **temporarily** if there was an intensive survey accompanied by immediate removal of affected material by double-bagging and burial underground. This may have been the case with the 2014 incursion. However, the rust is highly likely to re-appear in the short to medium term (e.g. within 2-5 years) for the following reasons:

- Rust symptoms at the current (three) infected properties (IPs) are throughout the entire production area and not limited to a few plants.
- It is conceivable that spores (urediniospores) have already moved from current infected properties (IPs), via the air, to other blueberry plantations or another ericaceous host, in which case there may be a very low level of undetected infections elsewhere that are surviving the current winter. It is not known whether other ericaceous hosts play or will play a significant role in the disease epidemiology in Tasmania. If other ericaceous hosts play no role, then abundant

numbers of blueberry plants in Tasmania provide a potential habitat for the rust to establish and persist.

- Undetected infections may have already established at locations in Tasmania beyond the infected properties via the transport of airborne spores over long distances, or from one location to another by workers wearing contaminated clothing. Even a highly trained specialist cannot always detect infections present at a very low incidence. If an infection is detected, then the rust pustule (lesion) may have already produced and released its spores to the air currents. If the alternate host (*Tsuga* spp) can be located and aecia have established, then looking for aecia in large trees would be extremely difficult and unlikely to be conclusive.
- The time between a spore landing on an uninfected leaf and the production of new spores can be as little as 10 days under weather conditions that are highly favourable for disease development. The minimum latent period for rust strains present in Tasmania is still unknown. New infections cannot be detected until disease symptoms are evident days later. This means that removal of plants with visible rust symptoms may not represent the entire pathogen population.
- It is also possible, albeit unlikely, that spores will be introduced to blueberry plants by future airborne movement of spores from elsewhere (NSW, Qld, New Zealand). Blueberry rust has had an extended presence in neighbouring regions and the direction of prevailing winds has perhaps reduced the chance of spore movement in Tasmania. Even so, there are known instances of spore movements in seemingly unpredictable directions due to unusual weather patterns or storm cells.
- If a vigilant blueberry grower detected the first rust infection on their property - say within one week of symptom appearance - then it is conceivable that they could eradicate the rust from their individual property. In practice, symptom detection usually occurs much later.
- It is not known how many generations (disease cycles) the rust can complete in a single growing season in Tasmania. Multiple generations provide an abundant source of airborne inoculum for all plantations in a given region.
- The rust was detected in a nursery in Victoria in 2014. Victoria has been assessed as ‘rust free’ based on implementation of an accepted biosecurity survey protocol following this detection.