13th October 2017

Parliament of Tasmania
Government Administration Committee B
Att: Ms Natasha Exel
Inquiry Secretary
Legislative Council
Parliament House
Hobart TAS 7000

By email – brt@parliament.tas.gov.au

Dear Ms Exel,

Re: Sub Committee Inquiry into Blueberry Rust

As the largest blueberry grower in Tasmania and as one of three growers who have currently identified as having blueberry rust, Costa makes the enclosed submission to the Committee and its inquiry into blueberry rust.

Should the Committee decide to conduct any public hearings, Costa would welcome the opportunity to appear before the Committee and speak to its submission.

Yours faithfully

Michael Toby
Corporate Affairs Manager

encl.

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Overview of Costa

- **Costa's Tasmanian berry operations**

Costa is Australia's leading grower of blueberries and raspberries, producing some 45% of Australia's blueberries.

Tasmania is a key blueberry growing region for Costa covering the summer production period. It is also the only location where Costa grows the four main berry types, namely blueberries, raspberries, strawberries and blackberries.

Tasmania is strategically important with respect to Costa's ability to supply the Australian market for 52 weeks of the year, with the Tasmanian berry season running from November through to late April.

The Costa Tasmanian farms are located in the North West region of Tasmania, and their proximity to the water provides distinct temperature advantages for summer berry production compared to Southern Victoria.

As at October 2017 Costa farms circa 190 hectares of blueberries, raspberries, strawberries and blackberries on the North West Coast of Tasmania, as well as operating a distribution centre and modified atmosphere facility in East Devonport.

Costa owns and operates the distribution centre incorporating state of the art cooling and refrigeration plant, packing lines and a dedicated modified atmosphere storage facility.

The distribution centre also services the Costa-Driscoll's join venture third party growers of which there are six, with at least two of these growing blueberries.

A circa $11.2 million capital investment is currently being completed to expand and upgrade the distribution centre and the modified atmosphere facility.

This upgraded distribution centre will enable Costa to increase its capacity to store, fast cool, pack and consolidate a greater volume of berries for sale and distribution, and will cater for our Tasmanian expansion through to 2020.

The expansion of the modified atmosphere facility has already been completed and has expanded storage capacity to 1,000 pallets. This enables a greater volume of blueberries to be stored at a constant temperature for circa 6 to 8 weeks, thereby further extending the Tasmanian blueberry season.

During the peak of the harvest season, Costa provides employment for 1,700 people.

By the end of financial year 2017, Costa has invested circa $40 million on its Tasmanian berry growth projects since 2009.

- **Tasmanian Blueberry footprint**

Costa is the largest blueberry grower in Tasmania, with two main production sites on the North West coast at Nine Mile (Sulphur Creek) and Lebrina. In total, as at October 2017 Costa has circa 66 hectares of blueberries, with the largest site at Nine Mile (58 hectares), followed by Lerbrina (7 hectares) and East Devonport (1 hectare).

During the peak of the blueberry season Costa has a workforce of circa 500 to harvest its blueberry crop. The year round workforce required to maintain and administer the blueberry crop is approximately 35 FTE's.

A further blueberry planting program of 25 hectares is scheduled for 2019/2020 at the Nine Mile farm.

Costa's history of blueberry production and experience of dealing with rust

Costa has an Australia wide blueberry growing footprint spanning four states, including New South Wales. Costa farms 270 hectares of blueberries at a site located in Corindi (approximately 35 minutes north of Coffs Harbour) on the mid north coast.

Blueberry rust is present in New South Wales and is not reportable. It has been endemic for at least 15 years. The rust first appeared on a very small plot of Emerald variety blueberry plants on a farm in New South Wales. These affected plants had been through at least 18 months of quarantine in Australia before being planted. The rust spread to plants in a nearby nursery and other farms on the mid north coast of New South Wales and Queensland.

The New South Wales Department of Primary Industries took 6 to 9 months to declare the rust as endemic. During that time and after, no plants were destroyed nor were affected growers required to remove plants from their farms.

Up to 90% of Australia's blueberry crop is grown in New South Wales and the rust has not affected the ability of growers in this state to export their product to other states and overseas.

For the interstate movement of blueberries from New South Wales, an 'ICA31'[1] is used which sets out those procedures to be complied with in the pre-harvest treatment and inspection of blueberries for blueberry rust.

Blueberry rust has also been reported in Victoria (Australia), Europe, Argentina, Asia, Mexico, Canada and the United States.[2]

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[1] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/532807/ica-31-pre-harvest-treatment-and-inspection-of-blueberries-for-blueberry-rust.pdf

[2] New South Wales Department of Primary Industries website - http://www.dpi.nsw.gov.au/biosecurity/plant/established-plant-pests-and-diseases/blueberry-rust

Blueberry rust spores are very easily and quickly spread to nearby plants by wind and rain. Blueberry rust can be spread over longer distances by people transporting infected plants, fruit, packaging, equipment and clothing.[3]

The New South Wales Department of Primary Industries[4] notes the following plants are considered hosts of blueberry rust in Australia and have associated movement restrictions in some states:

- *Vaccinium* species (blueberry and cranberry)
- *Gaylussacia* species (huckleberry)
- *Rhododendron* species (including azalea)
- *Tsuga* species
- *Lyonia* species
- *Menziesia* species
- *Pernettya* species
- *Hugeria* species
- *Pieris* species
- *Leucothoe* species
- *Oxycoccus* species

Blueberry rust containment is dealt with through a range of activities, including crop monitoring, a regular spray program, cleaning protocols when moving equipment and machinery and worker hygiene.

Cooperation with Biosecurity Tasmania

Costa has at all times worked cooperatively with Biosecurity Tasmania to put in place hygiene and quarantine protocols to manage containment at its Nine Mile farm.

An operations and Harvest Hygiene Protocol covers the following activities:

- Pruning
- Trellising
- Integrated Pest Management
- Planting
- Solid fertiliser application
- Shelter belt maintenance
- Mulch applications
- General farm clean-up
- Excavation
- Netting
- Slashing and mowing
- Block establishment
- Nursery maintenance
- Irrigation
- Harvesting
- Electrical repairs
- Mulching
- Machinery use and maintenance

[3] New South Wales Department of Primary Industries website - http://www.dpi.nsw.gov.au/biosecurity/plant/established-plant-pests-and-diseases/blueberry-rust

[4] New South Wales Department of Primary Industries website - http://www.dpi.nsw.gov.au/biosecurity/plant/established-plant-pests-and-diseases/blueberry-rust

We believe these protocols have been very effective and to date have ensured that the rust has not spread to other farms.

During the 2016/17 season (after the rust was found on Costa's farm), all Tasmanian blueberry growers had access to ship product to the mainland. This was also the case in 2014 and beyond. Costa believes Biosecurity Tasmania deserves considerable credit for having negotiated this access in both a timely and responsible manner, without having compromised the future sustainability of the industry.

Incidence of blueberry rust in other parts of the world

Given that blueberry rust is common in other parts of the world and in particular Oregon, USA, which has a comparable climate to that of Tasmania, Costa has previously sought expert opinion from Dr. Bernadine Strik from the University of Oregon as to the impact of blueberry rust in Oregon and how it is effectively managed in that location. This opinion is included in its entirety at Appendix 1 and is summarised as follows:

- Blueberry rust has been reported in Oregon since blueberry production began in the 1950's and has not affected the commercial viability of the industry, with there not having been any significant commercial outbreak of rust in that time.

- Blueberry rust has a common alternate host in the hemlock tree (Tsuga sp.) There is information that blueberry rust can also infect other genera of plants, specifically: Rhododendron, Lyonia, Pernettya and Pieris. These are all found in Tasmania.

- One of the best ways to guard against rust is the use of growing tunnels.

- Although it can be spread on clothing, equipment, and packing materials, blueberry rust spreads most easily by wind.

- According to an update of the 'Compendium of Blueberry and Cranberry Diseases' (2016) published by the American Pathological Society, outbreaks of rust in Maine and occasional outbreaks in the mid-Atlantic states of the USA are likely caused by spores blown a long distance by wind from the southern USA. Experts from Cornell University (New York) are of the same opinion regarding outbreaks that occasionally occur in New York.

- Eradication of infected plants as a viable method of control is not recommended. When the disease is found on a cultivar (eg. Legacy at Costa's Nine Mile farm), spores are likely present in alternate hosts around the farm or there may be another source of infection. Spores are easily spread by wind and alternate hosts are present. Eradication would very likely be the equivalent of *'closing the barn door after the horse has fled'*.

- Considering how widespread blueberry rust is throughout most blueberry production regions, including Australia and New Zealand, it seems highly likely that this pest is already at other locations in Tasmania (eg. other farms or alternate hosts that are endemic). This is more likely if blueberry rust has been identified previously in the State (as it was in 2014).

Other plants that host blueberry rust in Tasmania

In July 2017 Costa commissioned a report from RMCG titled 'Blueberry Rust Hosts'. This report is included in its entirety at Appendix 2.

Consistent with Dr Strik's opinion, the RMCG paper also notes that blueberry rust has a common alternate host in Tsuga sp (hemlock) whilst also listing Rhododendron, Lyonia, Pernettya and Pieris as being recognised hosts. As noted above these are all found in Tasmania.

Hemlock is endemic to Tasmania and can be an annual or biennial. Broad flower heads are produced in summer, which comprise hundreds of tiny white flowers. Thousands of tiny seeds are produced in autumn. It reproduces by seed, and from fragments of the root system if disturbed, such as by earthmoving equipment. Hemlock can be usually found on disturbed ground or in damp areas. It is also common on roadsides.

Rhododendron and azaleas are recognised hosts of blueberry rust. These are grown in many Tasmanian gardens and may be found as 'environmental weeds'. Their evergreen nature, together with the relatively mild climate, would support the survival and the risk of spread of blueberry rust.

Rhododendron is also found in large scale commercial Tasmanian gardens. In particular the Emu Valley Rhododendron Garden established in 1981 is located at 55 Breffny Road, Romaine, Tasmania. The garden covers 11 hectares and has over 22,000 plants in a *'natural ampitheatre'* with the peak flowering for rhododendron being mid-September to mid-November.

According to the Emu Valley Rhododendron Garden website[5], they are a *'non-profit community organisation developing, maintaining and operating a multiple award-winning rhododendron garden.'* The garden is widely known internationally and its unique design makes it one of Australia's major rhododendron gardens.

Pieris is a genus of seven species of shrubs and are commonly grown as ornamental plants. One of the most popular types is Pieris japonica. It is also known as the lily of the valley shrub. It is grown in all cooler regions of Australia, including Tasmania. The evergreen

[5] https://www.emuvalleyrhodo.com.au/

nature of some of the shrubs, together with the relatively mild climate in Tasmania, would support the survival and thus risk of spread of blueberry rust.

Costa has no evidence to suggest that these plants are directly responsible for the incidences of rust that have been found on our own farm and that of the three other farms since 2014. Indeed Dr Strik notes in her paper that hemlock trees in particular are very widespread in Oregon and although they occur near many blueberry farms, rust is not a problem in commercial blueberry fields in Oregon.

However, what the existence of other actual and potential blueberry rust hosts does illustrate is the futility of eradication by removing and destroying only blueberry plants. To be absolutely sure of the effectiveness of an eradication policy, then it is reasonable to expect that all actual and potential host plants should also be removed and destroyed.

It is also reasonable to expect that at the very least a dedicated and sufficiently resourced programme should be maintained by Biosecurity Tasmania to check and monitor not only all blueberry plants, but all plants that are actual and potential blueberry rust hosts.

This would simply not be practical or economical and would greatly diminish the viability of the Tasmanian blueberry industry.

Containment versus eradication

From Costa's experience of growing blueberries in New South Wales for 30 years and having dealt with rust for the past 15, the most effective approach is to manage it through containment.

It is an established fact that blueberry rust was detected in the Melbourne metropolitan area towards the end of 2014. Blueberry rust was also detected in Tasmania towards the end of 2014, with all infected plants subsequently destroyed under Tasmania's biosecurity protocols.[6]

It is believed that the incidence of rust in Tasmania in 2014 was as a result of infected nursery stock that was imported from Victoria originally via Queensland. In early 2015, the Tasmanian Minister for Primary Industries was reported as calling on Victoria to explain how it allowed diseased blueberry plants to be shipped to Tasmania.[7] The Minister was also reported to have written to his Victorian counterpart asking for full disclosure about why Victoria certified rust-infested blueberry plants as being disease-free.

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[6] New South Wales Department of Primary Industries website - http://www.dpi.nsw.gov.au/biosecurity/plant/established-plant-pests-and-diseases/blueberry-rust

[7] Blueberry cull to stop rust disease spread in Tasmania - Rose Grant and Alex Blucher, Tas Country Hour 17th January 2015 http://www.abc.net.au/news/rural/2015-01-17/tasmania-pulls-blueberry-bushes-to-stop-fungus/6023214

If eradication does in fact work, then the Committee should consider why Costa found rust in 2016 after plants were removed and destroyed from the rust affected grower's farm in 2014. Further this was also after the State government declared the state 'rust free' in July 2016.

The re-emergence of rust less than two years later would strongly indicate that eradication as a form of dealing with the problem did not work and was simply unsuccessful.

A major concern is that carryover spores are/were already present and host species (other than blueberry plants) in the area will continue to be a major source of inoculum. Costa believes this was the likely reason our Nine Mile farm was infected after the 2014 incursion and the declaration of the state to be 'rust free'.

Costa also contends that the two other Tasmanian growers who have reported rust since Costa self-reported in August 2016 more than likely caught the rust from the 2014 affected farm or some other source. Given these farms are to the west of the Costa farm and noting the prevailing winds and that the accepted view is that rust is likely carried by the wind, it is highly unlikely and virtually impossible that Costa was responsible for these farms contracting rust. In addition, since self-reporting Costa has maintained hygiene protocols consistent with the requirements of Biosecurity Tasmania.

Conclusion

Eradication may well lead to perverse consequences and create more problems than it seeks to solve.

From Costa's experience of dealing with rust at our farm in New South Wales for last 15 years, blueberry rust is more than likely already endemic in Tasmania at least as a result of the 2014 outbreak which also could have caused other plant hosts to have contracted rust and vice versa.

If an eradication policy were to be adopted, and every reported incidence of rust resulted in removing and destroying plants, then the logical conclusion would be that at the end of such an eradication process, no blueberry plants (as well as other plants that are hosts) would be left in the state of Tasmania as this would be the only sure way of eradicating rust.

In our submission Costa has referenced other plant hosts for blueberry rust that exist in Tasmania. An eradication policy would also necessitate a preparedness to eradicate all other plants that are actual and potential blueberry rust hosts to remove any doubt that rust could reoccur or occur from other plants. This would be both impractical and uneconomical for growers, Biosecurity Tasmania and the Tasmanian government.

The Committee also needs to ponder the question as to what other grower(s) may currently have rust on their farms, and are either legitimately unaware of its presence, or are aware but are understandably reluctant to self-report because they fear the consequences will be the destruction of their crop and their livelihood.

END.

Appendix One

Thoughts related to Discovery of Blueberry Rust at Nine Mile, Tasmania

Dr. Bernadine Strik, Professor of Horticulture, Oregon State University and Strikly Berry Consulting, LLC
October 2, 2016

Blueberry rust was recently identified on a Costa farm located at Nine Mile (hereafter "9-Mile") in Tasmania, Australia. I have been requested to provide my professional opinion as to the incidence and impact of blueberry rust in Tasmania, particularly with regard to my experiences in Oregon, USA, where we share as similar climate to that found at 9-Mile (refer to cover letter attached).

I am dividing this document into several sections: overview of berry industry in Oregon; my professional experience; brief description of blueberry leaf rust; the incidence and impact of leaf rust in Oregon; a comparison of Oregon and the Nine Mile region of Tasmania; management of rust; and a summary.

Berry industry in Oregon

Oregon is an internationally recognized berry crop production region with a high volume of diverse, high-quality crops produced. There are over 10,000 hectares of berry crops (blueberry, blackberry, red and black raspberry, cranberry, and strawberry) and 10,000 ha of wine grapes in Oregon. Over half of the berry crop area is planted to northern highbush blueberry (e.g., cultivars Duke, Draper, Liberty, Ozarkblue, Legacy, Aurora). We also grow some rabbiteye blueberry (less than 5% of our area), including the cultivars Powderblue and Ochlockonee. Our growers harvested over 45 million kilograms of blueberry fruit in 2016.

Professional experience

I have been a professor at Oregon State University (OSU) for over 29 years since obtaining my Ph.D. in berry crop physiology at the University of Guelph, Canada, in 1987. Here in the Department of Horticulture at OSU I am responsible for educational programs for the commercial berry crop industries (extension), research, and teaching. I teach undergraduate and graduate student courses on berry and grape physiology/production systems and recently developed an on-line blueberry course for an international industry audience. I have advised over 25 graduate students (Masters and Ph.D.) in my career to date. My research areas of focus include whole plant physiology, improving yield and quality, machine harvest efficiency, pruning, optimization of production systems, plant nutrition, and organic production systems in berry crops. Recently the economic impact of my programs for Oregon growers was estimated at $10 million per annum. I have published over 105 refereed scientific journal articles, 36 scientific papers in the journal of the International Society for Horticultural Science, *Acta Horticulturae*, and 10 invited book chapters. In addition to many workshops, schools, and presentations to industry, I have authored 58 extension publications for a grower audience. I belong to many professional organizations and hold many leadership positions including being elected as chair of the Section for Vine and Berry Fruits in the International Society for Horticultural Science. My educational and research programs are world renowned and I am honored to have received many awards including being elected as a Fellow of the American Society for Horticultural Science, their highest honor, in 2007 and the OSU Alumni Association Distinguished Professor Award.

In addition to my professor position at OSU, I am an independent consultant through my company, Strikly Berry Consulting LLC. For over 15 years I have advised various companies worldwide on berry crop production systems for improved yield and quality and on various problem solving or trouble-shooting issues. I am very familiar with the Costa blueberry farm at Nine Mile through my consulting relationship with the company.

I am a plant physiologist, not a pathologist. However, in my role at Oregon State University and through my consulting business I work with all issues related to yield and quality. When necessary, I contact discipline colleagues for more information on pests. I have certainly done so in the past on various diseases including blueberry rust; this has broadened my experience since I have been involved in rust management in several production regions worldwide. I have commonly been asked to provide an expert opinion by companies, universities, and federal agencies worldwide.

Blueberry leaf rust disease

Blueberry leaf rust is found in many production regions worldwide. The severity of this disease varies with climate, cultivars grown, and production system used.

Scientific name/types. When searching through the literature, one can get confused as the taxonomy of this pest (the latin name) has changed several times. Dr. Jay Pscheidt, OSU Extension Plant Pathologist, informed me that as recently as early September 2016 the taxonomic name was changed once again to: *Naohidemyces vaccinii* (Jørst.) S. Sato, Katsuya & Y. Hirats. ex Vanderweyen & Fraiture 2007 (Urediniomycetes, Uredinales) [the names after the scientific name are the authorities – those who deserve credit for naming it]. You will also see this same rust referred to by its older scientific names: *Pucciniastrum vaccinii* Jørst. 1952 and *Thekopsora vaccinii* (Jørst.) Hirats. f. 1955.

There has been surprisingly little scientific research done on this fungal pest and the various factors that affect its rate of development. In addition, there is some evidence there may be two forms of the fungus (an eastern north American and a western form), but this appears to relate to slight morphological differences in the fungi and not in the disease's growth or impacts on blueberry. The rust is not systemic in the plant.

Alternate hosts. Blueberry rust has a common alternate host, the hemlock tree (*Tsuga* sp.). There is information that blueberry rust can also infect other genera of plants, specifically: *Rhodondendron, Lyonia, Menziesia, Pernettya* (now known as *Gaultheria lanceolata* sp.), *Ugeria, Peiris, Leucothoe,* and *Oxycoccus*. The disease may also overwinter on native *Vaccinium* species that are evergreen (e.g. in Florida or in Oregon). In areas where hemlock trees or other hosts are not present, yet rust is prevalent, the rust may overwinter on non-senescent blueberry leaves (cultivars that are not fully deciduous, particularly in milder climates or in evergreen production systems where leaves are retained in adapted cultivars to get an early fruit crop). For example, rust may be an issue on susceptible varieties in Corindi, Australia and in areas of Mexico when evergreening; this is resolved, in my experience, by growing in tunnels (eliminates adverse impact of rainfall).

Introduction/spread. This disease can spread on clothing, equipment, and packing materials, but spreads most easily by wind. According to a very recent update (in press) of the Compendium of Blueberry and Cranberry Diseases published by the American Pathological Society, authored by Dr. Phil Brannen, Professor of Pathology, University of Georgia, outbreaks of rust in Maine and

occasional outbreaks in the mid-Atlantic states of the USA are likely caused by spores blown a long distance by wind from the southern USA; experts from the Cornell (New York) are of the same opinion regarding outbreaks that occasionally occur in New York (http://www.fruit.cornell.edu/berry/ipm/ipmpdfs/BB%20leaf%20rust%20fast%20fact.pdf) . According to a news report (NZ Herald, 2004; http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=3574202), this disease was most likely introduced into New Zealand from windborne spores (from Australia).

According to Dr. Annemiek Schilder, Plant Pathologist at Michigan State University, infections of blueberry rust are quite rare in Michigan (even though hemlock trees are prevalent), but it can occur and require control in fields that are affected when rainy weather occurs during the summer (http://msue.anr.msu.edu/news/beware_of_blueberry_leaf_rust).

I have not seen direct research papers on the climatic requirements of this fungus. The required conditions for spread/growth appear to be 48 hours of leaf wetness (Univ. Cornell; see citation above) with spore germination between 20 °C (for infections to start in spring; University of Cornell; see citation above) and 30°C (upper limit; (http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/fruit-and-nuts/berry-diseases/blueberry-rust/about-blueberry-rust). The report of "optimal germination temperature of 21 °C" as reported by Agriculture Victoria Australia (see citation) is not supported by other literature that I have found.

As mentioned earlier, this pest can overwinter on blueberry leaves – when infected leaves do not fall from the bush (as is the case in an evergreen system or in mild climates), these overwintering uredinospores can re-infect new leaves in spring (when temperatures and weather ideal). It is possible that infection may occur from leaves on the ground (infected ones); however, there has been no research on this that I am aware of and blueberry leaves decompose quickly over winter in most climates (I'm not aware of the impact of this on the overwintering fungus). In areas with other host plants, re-infection of new growth on deciduous blueberry plants may occur in spring from these alternate hosts.

Oregon and rust

Blueberry rust has been present in Oregon for some time. It has been listed in our Pacific Northwest Disease Control Handbook as a "rare disease" for as long as I can remember while working here at OSU. Just this past month, the section on blueberry rust in this handbook was revised. The main reason for this is the recent discovery of blueberry rust on an evergreen, ornamental blueberry cultivar (Peach Sorbet) at a commercial nursery in Oregon. Blueberry rust has been positively identified on a blueberry farm on the Oregon coast – the disease was not causing any economic loss to the plant/fruit at the time. Less than 1% of our blueberry production is on the Oregon coast. The revision in the Handbook now says "leaf rust is usually of minor importance, being a problem on lowbush blueberry or ornamental blueberries that do not shed their leaves in autumn".

Despite the fact that hemlock trees are very widespread in Oregon and are common near many blueberry farms and we have many native *Rhododendron* and *Gaultheria* species here which are reported to serve as alternate hosts (see above), rust is not a problem in commercial blueberry fields in Oregon. In addition, we have one cultivar, Legacy, that does not typically shed all of its leaves in autumn. This cultivar behaves similarly at 9-Mile. All of our other cultivars lose their leaves in autumn (with the exception sometimes of some very minute, late-growing leaves at the tips of

vigorous shoots in late autumn in some over-fertilized cultivars). Legacy is very widely planted in Oregon. The oldest fields are over 13 years. Despite having all the necessary hosts and some cultivars of blueberry that retain leaves, the OSU Plant Clinic's identification of blueberry rust from the aforementioned nursery, was the first finding of rust on a submitted sample in 60 years. This is not a reflection of a recent introduction as rust has been reported in Oregon since blueberry production began in the 1950s; it is a reflection of the low level of concern by growers (no samples sent in for identification).

I asked Dr. Pscheidt why he thinks we do not have a problem with blueberry rust in commercial blueberry fields here in Oregon. The most likely scenarios are: 1) Legacy may be resistant or not highly susceptible. Cultivars of northern, southern, and rabbiteye blueberry differ in their sensitivity to blueberry rust. The sensitivity of Legacy has not been tested scientifically. While rust has been identified on Legacy at 9-Mile the susceptibility of the cultivar is not known; 2) the fungicides our growers use may also control rust. This is certainly possible. However, we have also not seen this disease in certified organic fields where little to no fungicides are used; and 3) our climate is likely not very conducive to good infection of blueberry rust. Note that we have never had a significant commercial outbreak of blueberry rust in the main blueberry growing region of Oregon (the Willamette Valley) despite having variable weather over the 65 years blueberries have been grown here. We have a temperate climate with warm summers and relatively little rain in summer. This seems to be the most likely reason, as blueberry rust is most prevalent in warm, humid climates and areas with summer rain (e.g., Florida and Georgia, USA).

Comparing Oregon and Tasmania

Tasmania also has alternate hosts (Tasmania Herbarium, Dept. of State Growth, 2014 Census of Vascular Plants via Tasmania Government web site; link provided below) that would support blueberry rust: *Rhododendron ponticum* is reported as an introduced and naturalized species; *Pernettya lanceolata* (now called *Gaultheria lanceolata*) is considered endemic within the State; and there are many other endemic species of *Gaultheria* which would likely be a good host for blueberry rust. Source:
http://www.tmag.tas.gov.au/__data/assets/pdf_file/0008/137276/2016_Census_of_Tasmanian_Vascular_Plants.pdf

In addition, the climate of Tasmania (area of Nine-Mile) and Oregon's Willamette Valley (where most of our blueberries are grown) are very similar. The enclosed graphs show long-term averages (15+ years) for minimum and maximum average temperature and total rainfall by month for Burnie and Devonport Tasmania (most similar weather to the 9-Mile location) and Aurora, Oregon (representative of the Willamette Valley). The months in Oregon have been shifted so the seasons in the Northern hemisphere correspond to the southern hemisphere.

Our climate is a little more continental with colder winters than in Tasmania. However, this should have no impact on rust as it is overwintering during this time. Our minimum temperatures are quite similar in spring through autumn. When we look at the average monthly maximum temperature, the Willamette Valley has a warmer average summer and early autumn. Early spring temperature averages are similar between the regions. Note that temperatures in Oregon are higher and would appear to be more within the range considered ideal for germination/spread of blueberry rust (reported to be between 20 to 30 °C). In fact, the average maximum temperature at Burnie and Devonport is quite cool and is rarely above 20 °C – I realize this is an average maximum, but this

cool weather would not be expected to lead to rapid, large outbreaks. With regard to rainfall, it is clear that the regions differ little in spring (Oct – Dec) rainfall. There is more average rain in Tasmania in January and February than in Aurora, Oregon, but it is difficult to know if this would have much if any impact. Autumn rainfall is very similar among regions.

When we consider summer rain, it is important to consider that growers in Oregon often use overhead irrigation for watering plants (older fields), but more commonly for evaporative cooling. Use of this common technique would essentially lead to leaf wetness ideal for rust development. However, we do not have blueberry leaf rust of any commercial significance. This overhead irrigation or cooling is not used at 9-Mile in Tasmania thus reducing incidences of the required 48 hour leaf wetness for blueberry rust.

Management of rust

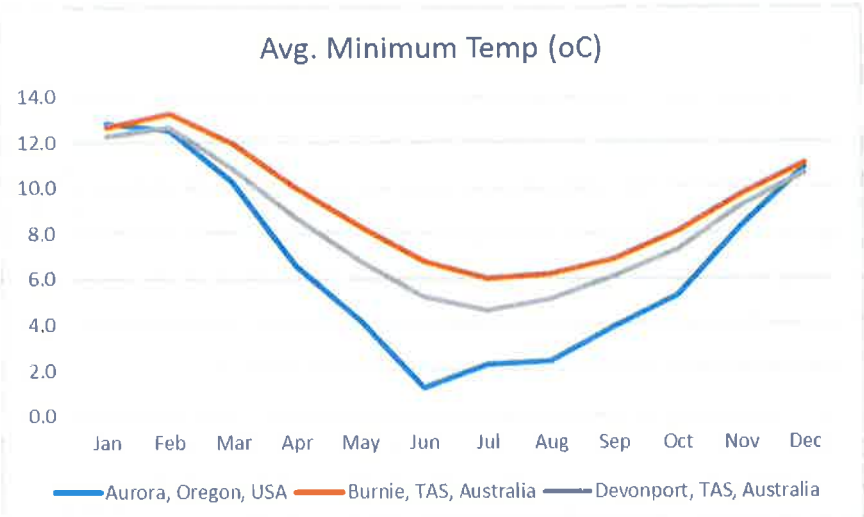
We have not needed to control blueberry rust in Oregon other than in a commercial nursery where judicious use of fungicides has effectively controlled the pest. However, much can be learned from other production regions. Growers in regions where rust is prevalent have had success managing this disease using production systems (including tunnels), cultivar resistance, and fungicides. We do have insecticides registered and effective for control (per Phil Brannen), if needed in the USA. For example in the Pacific northwest: https://pnwhandbooks.org/plantdisease/host-disease/blueberry-vaccinium-corymbosum-rust; the northeast: http://msue.anr.msu.edu/news/beware_of_blueberry_leaf_rust; and the southern production regions: http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2010/2_19_10BlueberrySprayGuide.pdf. In a recent report by Melinda Simpson, Wollongbar Primary Industries, NSW, at the International Society for Horticultural Sciences *Vaccinium* Symposium in Florida, USA in April 2016 (in press) all six of the fungicides tested significantly reduced blueberry leaf rust.

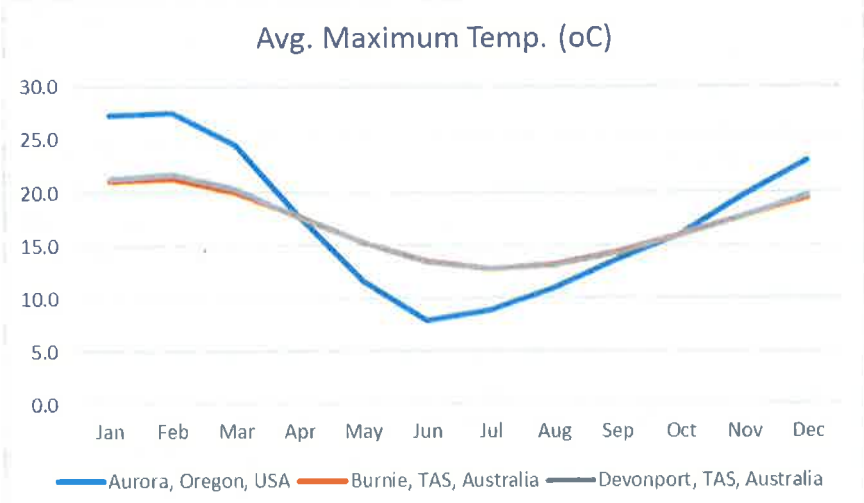
No growers, worldwide, that I am aware of control the fungus through management of dropped leaves (on the ground) although this is mentioned in some publications, or through forcing defoliation (on varieties that do not naturally senesce) – these might be possible options in Tasmania. I'm not aware of any trials on these methods (mainly because other methods have been successful for growers I think).

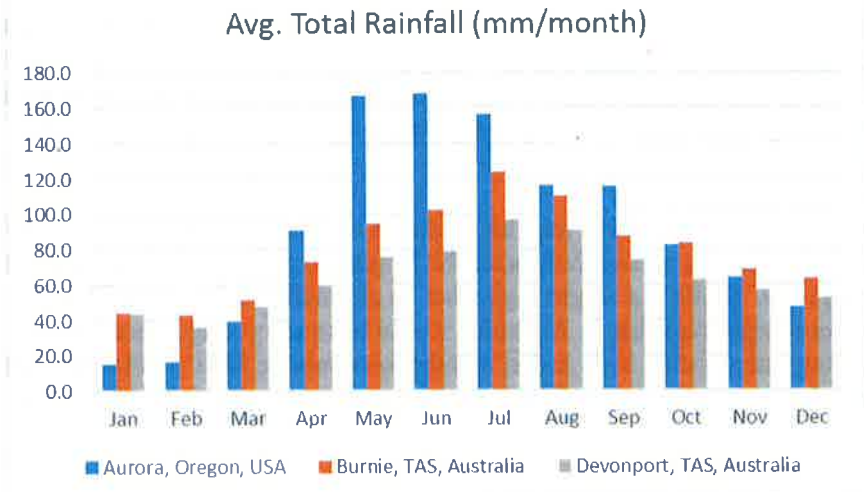
I do not recommend eradication of infected plants as a viable method of control. When the disease is found on a cultivar (e.g. Legacy at 9-Mile), spores are likely present in alternate hosts around the farm or there may be another source of infection (distance infected source). Spores are easily spread by wind and alternate hosts are present. It would very likely be the equivalent of closing the barn door after the horse has fled.

Eradication of a cultivar within a blueberry farm may have serious economic consequences. At 9-Mile for example, Legacy is required as a cross pollinator for Brigitta to get good fruit set and yield and is planted in alternating rows. While one might argue that an alternative cultivar could be chosen/planted, these are not readily available in Australia, would be much younger than the existing plants, and replanting into existing beds and in an otherwise mature field is not a successful commercial practice. Instead, I would recommend various proven control methods be adopted to manage the disease.

Climate figure comparators.







Summary

Blueberry rust is an important disease, requiring management, in warm, humid areas and where blueberry plants are grown in evergreen production systems (e.g. Georgia and Florida, USA, Mexico, and Corindi, Australia). These conditions do not apply to production in Tasmania or Oregon's Willamette Valley. While blueberry rust may be spread on clothing, equipment, and packing materials, it spreads very easily by wind. In most regions, the pest is thought to have been introduced by wind over very long distances. Blueberry rust can be retained (survive) even in areas where blueberry plants are deciduous on alternate hosts. Some of these alternate hosts are endemic in Tasmania.

Considering how widespread blueberry rust is throughout most blueberry production regions, including in Australia and New Zealand, it seems highly likely that this pest is already at other locations in Tasmania (e.g. other blueberry farm(s) or alternate hosts that are endemic); this is more likely if blueberry rust has been identified previously in the State.

Based on experience in a similar climate (Oregon), blueberry rust is not expected to be a significant commercial problem on the blueberries grown in Tasmania (no evergreen production systems). Regardless, proven economical control methods could be used in years when the pest appears, as has been illustrated in similar production regions.

End of report

Appendix Two

RMCG

Blueberry Rust (*Thekopsora minima*) Hosts

In Tasmania
31 July 2017

1 Disease Life cycle

Thekopsora minima is an heteroecious rust which lives on needles of Tsuga spp. (aecial stage) and leaves of ericaceous plants (telial stage). It has two alternate life cycles depending on climate and fungal spore stage. In colder climates, it requires *Tsuga* spp as a host to complete its lifecycle. Tasmania's climate would, in most areas, allow the fungus to overwinter on evergreen ericaceous plant leaves, including blueberries. This means, *Tsuga* spp are not an obligatory host in most areas of Tasmania.

Vaccinium spp are a major ericaceous host of the rust fungus (*Thekopsora minima*). This includes for instance *V. angustifolium* (lowbush blueberry), *V. corymbosum* (highbush blueberry), *V. erythrocarpum* (cranberry).

In Tasmania, *V. corymbosum* (highbush blueberries), is considered a major host.

An image of the disease life cycle is in Attachment 1. The asexual cycle (telial stage) taking place in mild climates, where Tsuga Spp. are not needed for survival, is indicated by a red circle.

Southern Highbush and Rabbiteye (low chill) blueberry varieties are semi or fully evergreen. Southern highbush blueberry varieties are more susceptible to blueberry rust than other types (Rabbiteye, deciduous Northern Highbush). The evergreen nature of Southern Highbush and Rabbiteye blueberry types, together with a relatively mild climate, supports the survival and thus risk of spread of the disease.

All recognised blueberry rust hosts have movement restrictions placed on them by biosecurity agencies in Australia. Depending on occurrence and biosecurity status of blueberry rust in a region, further biosecurity regulations may apply.

2 Recognised Hosts

This section provides brief information about the one *Pinaceae* and recognised alternate *Ericacea* hosts of *Thekopsora minima* blueberry rust. These hosts are listed in biosecurity regulations and publications on management of blueberry rust in Australia.

2.1 TSUGA SPP.

- The genus *Tsuga* belongs to the gymnosperms (non-flowering plants); common names are hemlock; hemlock fir; hemlock spruce.
- The family is *Pinaceae*, pine family,
- All species are evergreen trees

Tsuga spp. are a common ornamental plant in Tasmania.

Tsuga must not be confused with poison hemlock poison hemlock, a highly poisonous plant (*Conium maculatum*) in the parsley family.

2.2 ALTERNATE ERICACEOUS BLUEBERRY RUST HOSTS

RHODODENDRON SPP. (RHODODENDRONS AND AZALEAS)

- Any shrub of the genus Rhododendron: **evergreen** shrubs or small shrubby trees having leathery leaves and showy clusters of campanulate (bell-shaped) flowers. The group of azaleas, formerly a separate genus, now belongs to the genus rhododendron. The genus is native to South Asia but widely cultivated and naturalised in temperate climates worldwide.
- **Family *Ericaceae*: heath family – heathers**

Rhododendrons and azaleas are grown in many Tasmanian gardens and may be found as 'environmental weeds'. Their evergreen nature, together with the relatively mild climate, would support the survival and thus risk of spread of blueberry rust.

LYONIA SPP.

Evergreen or deciduous shrubs or small trees of United States to Antilles and eastern Asia to the Himalaya.

- Genus *Lyonia*: more or less advanced dicotyledonous trees and shrubs and herbs
- **Family *Ericaceae*: heath family – heathers**
- Species:
  - *Lyonia mariana*, stagger bush, staggerbush - deciduous shrub of coastal plain of the eastern United States having nodding pinkish-white flowers; poisonous to stock
  - *Lyonia ligustrina*, (also *Vaccinium ligustrium*) he-huckleberry, male berry, maleberry, privet andromeda - deciduous much-branched shrub with dense downy panicles of small bell-shaped white flowers

- *Lyonia lucida*, fetter bush, shiny lyonia, fetterbush - showy evergreen shrub of southeastern United States with shiny leaves and angled branches and clusters of pink to reddish flowers that resemble an umbel; it is referred to as Pieris in some references.

While *Lyonia* spp are not native to Australia, *Lyonia* spp. have been produced by nurseries as garden plants and can be found in Tasmanian home gardens. The evergreen nature of some of the shrubs, together with the relatively mild climate in Tasmania, would support the survival and thus risk of spread of blueberry rust.

PIERIS SPP.

Pieris is a genus of seven species of shrubs, native to mountain regions of eastern and southern Asia, eastern North America and Cuba. Known commonly in North America as andromedas or fetterbushes, they are broad-leaved **evergreen** shrubs.

- **Family *Ericaceae*: heath family – heathers**
- Species
  - *Pieris cubensis* (Grisebach) Small. Western Cuba.
  - *Pieris floribunda* (Pursh ex Simms) Benth. & Hook. – mountain andromeda, mountain pieris, mountain fetterbush. Eastern United States.
  - *Pieris formosa* (Wallich) D.Don – Chinese pieris, Himalayan pieris. The Himalaya, southwestern China (Yunnan), northern Myanmar.
  - *Pieris japonica* (Thunb.) D.Don ex G.Don – Japanese andromeda. Eastern China, Japan, Taiwan.
  - *Pieris nana* (Maxim.) Makino (syn. Arcterica nana). Japan, eastern Siberia.
  - *Pieris phillyreifolia* (Hook.) DC. – climbing fetterbush. Southeastern United States.
  - *Pieris swinhoei* Hemsley - southeastern China (Fujian, Guangdong)
  - *Lyonia lucida* is referred to as *Pieris* in some references

Pieris spp. are commonly grown as ornamental plants. One of the most popular types is *Pieris japonica*. It is also known as lily of the valley shrub. It is grown in all cooler regions of Australia, including Tasmania. Many different varieties of *Pieris* exist with different combinations of flower and leaf colour. The evergreen nature of some of the shrubs, together with the relatively mild climate in Tasmania, would support the survival and thus risk of spread of blueberry rust.

GAYLUSSACIA SPP. (HUCKLEBERRIES)

Gaylussacia spp are **deciduous or evergreen** trees, shrubs and herbs of North America. Any of several shrubs of the genus *Gaylussacia* bearing small berries resembling blueberries are called black huckleberries in the USA.

- **Family Ericaceae: heath family – heathers**
- Species
  - *Gaylussacia baccata*, the black huckleberry, is a common huckleberry found throughout a wide area of eastern North America.

Three other *ericaceous* species are called huckleberry in the USA. They are common in North America but not of the genus *Gaylussacia;* they are *Vaccinium* species like the blueberry. Some of these 'huckleberries', such as *V. membranaceum*, *V. parvifolium* and *V. deliciosum*, are used in ornamental plantings in North America.

It appears that *Gaylussacia* spp (huckleberries) are not grown in Australia. However, plant collectors and nurseries may have grown them from seed. They may be sold under different names.

In Australia, *Vaccinium myrtillus*, the native European blueberry is called huckleberry, bilberry or even lowbush blueberry. It appears that *Vaccinium myrtillus* is not grown widely in Australia and Tasmania. However, internet gardening chats talk about growing the plants from seed extracted from dried fruit which is sold for its medicinal value.

MENZIESIA SPP.

The genus *Menziesia* belongs to **deciduous** shrubs of North America and eastern Asia.

- **Family *Ericaceae*: heath family – heathers**
- Species:
  - *Menziesia ferruginea*: false azalea, fool's huckleberry - straggling shrub of northwestern North America having foliage with a bluish tinge and umbels of small bell-shaped flowers
  - *Menziesia pilosa*, minnie bush, minniebush - low shrub of the eastern United States with downy twigs

Menziesia spp are not native to Australia. *Menziesia* spp. may have been produced by nurseries as garden plants and may be found in Tasmanian home gardens.

PERNETTYA (GAULTHERIA) SPP.

The genus covers any aromatic **evergreen** shrub of the *ericaceous* genus *Gaultheria*, of America, Asia, **Australia**, and New Zealand

- **Family *Ericaceae*: heath family – heathers**
- Species of this large genus include e.g.:
  - *Gaultheria hispida*, snow berry - a shrub native to rainforest, wet sclerophyll forest, sub-alpine heath of Tasmania
  - *Gaultheria depressa*, mountain snow berry, alpine wax berry - a small ground hugging shrub native to rocky alpine areas of Tasmania and New Zealand.
  - *Gaultheria hispidula*, creeping snowberry, maidenhair berry, moxie plum - slow-growing procumbent evergreen shrublet of northern North America and Japan having white flowers and numerous white fleshy rough and hairy seeds
  - *Gaultheria procumbens*, checkerberry, creeping wintergreen, mountain tea, teaberry, wintergreen, groundberry, ground-berry - creeping shrub of eastern North America having white bell-shaped flowers followed by spicy red berrylike fruit and shiny aromatic leaves that yield wintergreen oil
  - *Gaultheria shallon*, salal, shallon - small evergreen shrub of Pacific coast of North America having edible dark purple grape-sized berries

Gaultheria spp that are not native to Australia, would have been produced by nurseries as garden plants and would be found in Tasmanian home gardens. The evergreen nature of these shrubs, together with the relatively mild climate in Tasmania, would support the survival and thus risk of spread of blueberry rust.

HUGERIA SPP.

The 'genus'? *Hugeria* belongs to:

- **Family Ericaceae: heath family – heathers**
- Species names:
  - The status of the nine names (including infraspecific names) for the genus *Hugeria* recorded in *The Plant List (http://www.theplantlist.org/)*, is as follows:

STATUS	TOTAL	
Accepted	1	*11.1%*
Synonym	**8**	***88.9%***
Unplaced	0	*0%*
Unassessed	0	*0%*

For instance, *Hugeria japonica* (Miq.) Nakai is a synonym of *Vaccinium japonicum* Miq. It is not clear whether '*Hugeria*' plants are grown in Tasmania.

LEUCOTHOE SPP.

Genus Leucothoe: deciduous and **evergreen** perennial shrubs with white flowers; glossy foliage and potentially containing a poisonous substance like that found in genus Kalmia, the genus is native to the USA and Asia.

- **Family Ericaceae: heath family – heathers**
- The genus covers about 50 species; selected species are:
- **Selected species**
  - Leucothoe axillaris (Coastal Doghobble; southeastern United States)
  - Leucothoe davisiae (black laurel; Sierra Nevada, northern California & Oregon)
  - Leucothoe fontanesiana (Highland Doghobble or Drooping Leucothoe; southeastern United States)
  - Leucothoe grayana (Japan)
  - Leucothoe griffithiana (eastern Himalaya, southwest China)
  - Leucothoe keiskei (Japan)
  - Leucothoe populifolia (southeastern United States)
  - Leucothoe racemosa (Swamp Doghobble or Sweetbells; eastern United States)
  - Leucothoe recurva (Redtwig Doghobble; southeastern United States)
  - Leucothoe tonkinensis (southern China, northern Vietnam)

While Leucothoe spp are not native to Australia, Leucothoe spp. may have been produced by nurseries as garden plants and may be found in Tasmanian home gardens, unless their potentially poisonous nature prohibited wide-spread use.

OXYCOCCUS SPP.

Related to Oxycoccus: Vaccinium oxycoccos

Oxycoccus is a genus of **evergreen** plants of the subfamily *Vacciniaceae*, frequently included in the genus *Vaccinium*. They are primarily small creeping subshrubs with slender stems and small coriaceous leaves.

The flowers are reddish pink and have four petals, four sepals, and eight stamens. The fruit is a dark red berry. *Oxycoccus quadripetalus* grows widely in sphagnum and peat bogs, Species of *Oxycoccus* are cultivated in North America and Europe.

- Species: There are four species, distributed in the cold and temperate regions of Eurasia and North America.

It appears that *Oxycoccus* species are not commonly grown in Australia. However, plant collectors and nurseries may have grown and sold them. They may be sold under different names such as Cranberries. It appears that they are not grown in Tasmania.

3 Potential Ericaceous Blueberry Rust Hosts

Tasmania has a range of endemic and introduced Ericaceous plants.

3.1 AUSTRALIAN NATIVE ERICACEA

While most Australian Ericaceae, members of the heath family, belong to the subfamily Epacridoideae there are a few species in two other subfamilies. Australian members of the Ericaceae can be summarised as follows:

1. Subfamily Ericoideae: One genus - Rhododendron

2. Subfamily Epacridoideae: Around 40 genera, including Acrothamnus, Acrotriche, Agiortia, Archeria, Astroloma, Brachyloma, Budawangia, Conostephium, Croninia, Cyathodes, Cyathopsis, Dracophyllum, Epacris, Leptecophylla, Leucopogon, Lissanthe, Melichrus, Monotoca, Needhamiella, Oligarrhena, Pentachondra, Planocarpa, Prionotes, Richea, Rupicola, Sprengelia, Styphelia, Trochocarpa, Woollsia

3. Subfamily Vaccinioideae: Three genera - Gaultheria, Paphia, Pernettya

For the most part, the Australian Ericaceae are small shrubs but a few species occur as small trees. They can be found in a range of habitats and are a common component of low, exposed vegetation known as heathland. Often they will be found in areas of constant moisture but also occur in temperate open forest and woodland, sub-alpine areas and the coastal zone. They tend to be absent in the arid zone and only a few are found in rainforests.

Some of the Australian natives, endemic to Tasmania or introduced from other regions on mainland Australia, may be grown as garden plants. It is not clear, whether the above-mentioned ericaceous native plants can host *Thekopsora minima*.

3.2 INTRODUCED ERICACEA - DECLARED WEEDS

Some Ericaceous plants, introduced to Southern parts of Australia from Europe and Africa, are declared weeds in Tasmania. Of those, tree heath (*E. arborea*), is common in the southeast and berry heath (*E. baccans*), is established in the west.

Spanish heath (*Erica lusitanica*), also known as Portuguese heath, is the most widely distributed *erica* in Australia and has invaded Tasmanian native vegetation and roadsides. Nationally, Spanish heath is widely naturalised in the south-eastern parts of Australia. It is most common and widespread in Victoria, Tasmania and south-eastern South Australia. It is also naturalised in the ACT and in the coastal and sub-coastal districts of southern and central New South Wales. Spanish heath is rated for consideration in the recent 'Weeds of National Significance' assessment. The popular garden plant Heather (*Calluna vulgaris*), a related species, is already on the Australian Alert List.

It is not clear, whether the above-mentioned ericaceous weed plants can host *Thekopsora minima.* None of the currently listed host species is an *Erica* spp. or *Calluna* spp., therefore these species may not host the rust fungus.

3.3 COMMENTS

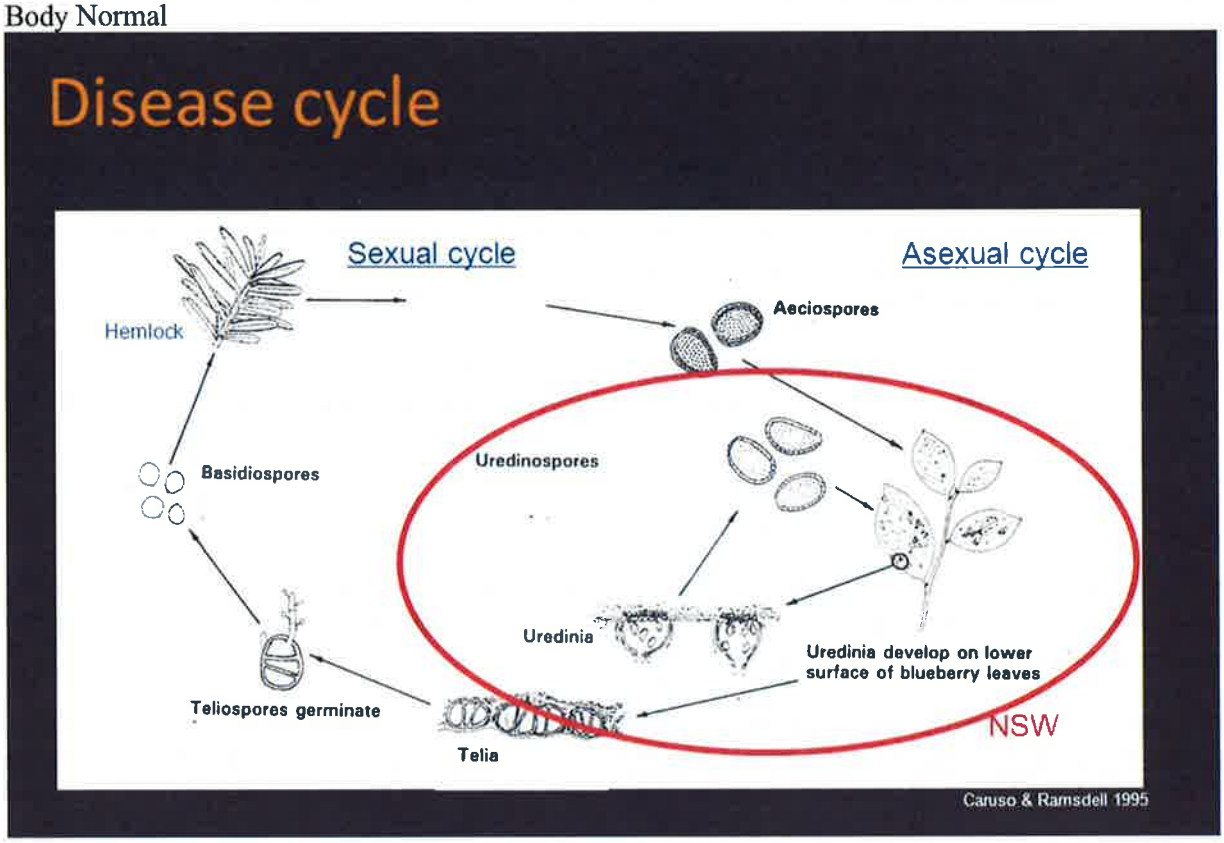
Given that all *Thekopsora minima* hosts, apart from *Tsuga*, belong to the genus *Ericacea*, ericaceous plants other than those listed in biosecurity regulations and native to Australia, may host the fungus. This could apply, even if *Erica* spp. or *Calluna* were not affected.

The plant species currently listed as recognised blueberry rust hosts, are native to the Northern Hemisphere, mostly North America and Asia; *Gaultheria* and *Rhododendron* also occurs in Australia. If introduced to Australia, the listed Northern Hemisphere species have been cultivated as garden plants.

The Biosecurity Plan for the Blueberry Industry 2016 mentions the need to control ornamental pants and weeds that could act as hosts. It does not mention native plants as potential alternative hosts and how to deal with potential risks.

Attachment 1: Blueberry rust disease cycle

Body Normal



Department of Primary Industries