Myrtle rust report: New Caledonia

Assessment of myrtle rust situation in New Caledonia

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Contents

Myrtle rust advisory mission

Various stakeholders from North and South Provinces met throughout the week to discuss myrtle rust in New Caledonia. Discussions were held in Noumea, Bourail, and Farino areas with government, nursery industry and environmental personnel.

Although myrtle rust is a very recent incursion in New Caledonia, it is encouraging that the response to the disease has been rapid and well informed, using many of the resources developed in Australia and available in the internet.

Discussions were productive and at a high level. It was evident that there was a good general knowledge of myrtle rust internationally and a lot of research had been undertaken to develop action plans for New Caledonia. There were a lot of questions indicating a good level of interest in the disease and its potential impacts.

It was a great opportunity to assemble all interested parties to learn and discuss myrtle rust and to encourage and develop ongoing relationships and networks between all the different groups. This is a positive opportunity for improving biosecurity systems, nursery practices and environmental systems generally which are long term benefits to the country.

We had the opportunity to visit a wholesale nursery which provided some biosecurity and disease training and allowed participants to see myrtle rust and to learn how to assess plants for disease symptoms. Again, there was a high level of interest and plenty of relevant questions which invoked much discussion.

We also visited a small, untreated nursery which highlighted the potential severity of the disease if susceptible species are grown without fungicide treatment.

We travelled into the field near the initial detection of myrtle rust and found significant levels of myrtle rust on many Syzygium jambos trees along a creek. A large number of environmental personnel gathered to see the disease and to undertake training in disease identification and decontamination. There was a lot of productive discussion and questions and it is anticipated that many of these field workers will be in a position to report any disease sightings in the future.

On the final day, a presentation and summary were delivered at a meeting at the Government and the feedback from all participants was positive with support for ongoing management of myrtle rust.

Myrtle Rust overview

Introduction

Puccinia psidii is a fungus that affects plants in the Myrtaceae family. The name *P. psidii* refers to the sexual stage of the lifecycle of the fungus. *Uredo rangelii* is one of several names referring to the asexual stage of the lifecycle of the fungus. The common name of the fungus is myrtle rust in Australia, while internationally it has been commonly known as Eucalyptus rust or guava rust.

Puccinia psidii is native to South America but there have been detections in Mexico, Florida and Hawaii. More recently, there have been reports of *P. psidii* in China, Japan and New Caledonia

Myrtle rust was first detected in Australia on a cut flower farm in the Central Coast area of New South Wales in April 2010. Since then, it has spread to the natural environment moving north to the Daintree in Far North Queensland and south to Victoria.

Myrtle rust cannot be eradicated from Australia, however, it is still a notifiable pathogen in all Australian jurisdictions, where currently no positive detections have been recorded, requiring any detection of the disease to be reported to the relevant state or territory biosecurity agency within 24 – 48 hours.

As myrtle rust was recently introduced to Australia, the long-term effect on plants and ecosystems in Australia is not yet known. However, preliminary studies have identified 39 genera and 160 species as being hosts, some of these with significant economic and environmental importance.

Myrtle rust will continue to spread because it produces thousands of spores that are easily disseminated by wind, human activity and animals.

Invasive significance

Puccinia psidii has evolved in South America but it is rarely severe on native vegetation in Brazil, even though it has been identified from a range of native Myrtaceae and causes occasional epidemics in native guava plantations (Ribeiro and Pommer 2004). Eucalyptus species (native to Australasia) have been widely planted as hardwood timber species in South America and the pathogen has jumped hosts with serious outbreaks recorded in 1972, with monoculture contributing to these epidemics.

In Brazil, the impact of *P. psidii* on introduced eucalypts was so significant, including reduced growth, destruction of growing shoots leading to stem malformation and tree mortality, that the term “eucalyptus rust” was used to describe the disease (Ferreira 1983). Infection can affect growth rates and subsequent profitability (Booth *et al*. 2000), with wood volume production losses up to 41% in some Brazilian plantations (Takahashi 2002).

Puccinia psidii has also had a significant impact on industries relying on Myrtaceae including the all-spice (*Pimenta dioica*) industry in Jamaica. In Hawaii, the non-native rose apple, *Syzygium jambos* (an Asian species), was severely affected at a landscape scale, with widespread crown dieback and many instances of complete tree death (Uchida and Loope 2009). *Syzygium jambos* was so severely affected that it became an abundant source of spores for essentially ubiquitous dispersal on wind currents, enabling rapid spread of the rust statewide and exposure of many additional Myrtaceae hosts (Uchida and Loope 2009).

Lifecycle

The myrtle rust fungus, *P. psidii*, has several stages in its lifecycle although this can vary depending on the environment in which the fungus is growing. *Puccinia psidii* can reproduce quickly and simply through asexual reproduction whereby urediniospores are produced in pustules or uredinia at the infection site. These spores are dispersed to other leaves or hosts where they can then infect and produce pustules, which then produce more urediniospores. In some circumstances, the fungus may extend its lifecycle through sexual reproduction whereby teliospores are produced. This is usually a strategy for survival in adverse conditions. However, the role of teliospores in the lifecycle of *P. psidii* remains unclear. This needs to be assessed for the Australian environment.

Symptoms

Myrtle rust attacks young, soft, actively-growing leaves, shoot tips and young stems. Fruit and flower parts are also susceptible. The first signs of rust infection are tiny spots or pustules. These symptoms can appear 2-4 days after infection. Symptoms can vary depending on the host species, susceptibility level within a host species, and age of the host leaf.

After a few days, the pustules or uredinia erupt with the production of distinctive, yellow spores. These are the urediniospores. The infected area spreads radially outwards and multiple pustules eventually merge and coalesce with age. Secondary infections can occur within days but are usually confined to new young tissue, shoots and expending foliage.

Left untreated, the disease can cause deformed leaves, heavy defoliation of branches, dieback, stunted growth and even plant death.

Disease impacts

Puccinia psidii impacts range from minor leaf spots to severe foliage and stem blight as well as infection on flowers and fruit of some species causing reduced fecundity. New growth and young plants are worst affected but the disease has also been recorded on mature trees of some species. Tree death, as a result of repeated infection has also been recorded in Australia along with regenerating seedlings of the same species becoming infected and killed while still at the cotyledon stage. The most highly susceptible species recorded to date are *Syzygium jambos, Eugenia reinwardtiana, Agonis flexuosa, Gossia inophloia, Melaleuca quinquenervia, Rhodamnia rubescens, Rhodamnia maideniana, Rhodamnia angustifolia, Chamelaucium uncinatum* and *Decaspermum humile*.

The effect of the disease on native Myrtaceae at an ecosystem level in Australia has yet to be determined as the full host and geographic ranges of the disease is unknown, and the susceptibility and damage caused to individual species is not fully understood. This could take many years and will be dependent on a range of factors including the rate of natural and human-assisted spread, and climatic conditions in potentially suitable areas over that time. The impact of the disease will vary with local environmental conditions and susceptibility of the host species, but at this stage it appears that moist conditions following periods of rainfall along with newly flushing plants are ideal for spore germination.

Commercial impacts at this stage are also difficult to measure. The nursery and garden industries have been impacted with losses of stock and subsequent necessity for disease management through plant selection and fungicide programs. The lemon myrtle (*Backhousia citriodora*) and Eucalyptus industries are in the process of screening for myrtle rust resistance.

Habitat requirements

Invasive species are dependent on specific habitat requirements for survival. An understanding of such survival requirements may assist in managing the incursion.

All plants in the Family Myrtaceae have the potential to be infected by myrtle rust. The disease in Australia has been identified from a range of native forest ecosystems including coastal heath, coastal and river wetlands, sand island ecosystems and littoral, montane, subtropical and tropical rainforests. The disease is prevalent in urban and peri-urban environments around major cities and towns, commonly reported from botanic gardens and nature reserves as well as backyard gardens.

Disease development for *Puccinia psidii* is favoured following periods of rainfall and conditions of high humidity or fog when extended periods of leaf wetness are more likely to be achieved promoting spore germination and infection of the host. It is also necessary for spores to encounter a host plant during stages of active growth or flush, which can occur several times and at different times throughout the year depending on the host species and climatic conditions, with periods of rainfall promoting more active plant growth (Pegg *et al*. 2013).

Optimum temperatures for fungal survival in Australia are unknown at this stage. Laboratory based studies and research conducted in Brazil suggested that the urediniospores need moderate temperatures (8-27°C, ideally 13-22°C) for germination (Piza and Ribeiro 1989). However, the temperature range for rust survival has been found to be broader in Australia than the research and models suggest. The physiology of the plant and its response to climate is possibly more significant than the capability of the fungus alone. During drought for several months in Brisbane, the level of rust declined but some patches still existed. Even the microclimate within a plant may be sufficient to maintain the rust. Fog and dew could provide sufficient moisture as well. Low levels of rust activity were also identified in sites where moisture levels remained relatively high such as Melaleuca swamps and areas close to permanent waterways and gullies. For disease development the plant has to be flushing at the same time, and this was reduced during the drought. When the rain returned the disease recovered rapidly (Pegg & Giblin unpublished data). There is a need to continue collecting climate information in the Australian environment.

Low light conditions are also preferred, with at least 8 h of darkness required for a reasonable germination rate (Piza and Ribeiro 1988).

Dispersal strategies

Invasive species often have distinct dispersal characteristics that enable colonisation of an area. Understanding these dispersal strategies helps conceptualise barriers to movement that can be put into place as part of the response.

Myrtle rust can spread rapidly because it produces large numbers of small spores that can be dispersed over long distances by wind. The disease can also spread through the movement of:

- infected or contaminated planting material, nursery stock, plant cuttings, flowers and germplasm
- animals and insects such as bees, birds, bats and possums that have been in contact with rust spores
- contaminated plant waste, timber, wood packaging and dunnage
- contaminated equipment and tools used on or around plants (e.g. chainsaws, secateurs)
- contaminated clothing, shoes and other personal effects

Initial detections in both New South Wales and Queensland were focussed around commercial operations including production and retail nurseries. Other focal points included amenity plantings in or near carparks at major tourist destinations, botanical gardens and revegetation areas using susceptible species.

Myrtle rust is likely to infect plants in wet and humid conditions, and rust pustules can mature to release spores in as little as 10-12 days.

Recommendations for New Caledonia

1. Myrtle rust training and education

It is important that the nursery industry, forestry industry, scientific community, natural resource management community, revegetation groups and the general public are provided with information and tools to learn about myrtle rust so that educated decisions can be made relevant to their situation. At the same time, all of these stakeholders can play an important role in providing information relating to the impacts of myrtle rust in their community.

The following measures can be recommended to reduce the spread and impact of myrtle rust

a. Hygiene measures

Vehicles
Leave vehicles in a designated car park and don't allow bushland plants to come into direct contact with the vehicle. If possible, limit the number of vehicles entering the bushland area. Preferably, vehicles that have been in contact with myrtaceous plants should be washed thoroughly before going to a new bushland site.

People
If possible, limit the number of sites you visit to one site per day. Minimise the number of personal items you carry, as all items that come into contact with myrtaceous plants could spread myrtle rust. People working in or visiting bushland should change into clean clothes (including hats, gloves and footwear) before moving to another bushland site. Particularly avoid moving from an infected site to a nursery.

Clothing and footwear
After visiting bushland or an infected area, consider going directly to a suitable location where you can wash hats, gloves, gaiters, backpacks and clothes. Wipe down any other personal effects and protective equipment, such as chainsaw chaps, reflective vests, hard hats, visors, protective eyewear and glasses with water and detergent, methylated spirits or wet wipes.
To clean footwear, remove soil, leaves and mud, and then wash using water and detergent.
Cleaning should occur when you leave each site or as soon as you arrive home.

Equipment and tools
Minimise the number of items you bring to the site to minimise the spread of myrtle rust.
If possible, clean equipment such as secateurs, shovels and chainsaws when moving between sites.
To clean, remove soil, leaves and mud, and clean with water and detergent.
Wipe electronic items, such as mobile phones and GPS units, with wet wipes.

Plant material
Do not remove myrtaceous plant material from bushland.
If you use trailers, trucks or skips that have been in contact with myrtaceous plants, we recommend that you wash them before moving between sites.

Working in bushland
Always ensure that clothing, equipment, vehicles and machinery is clean and free of plant debris before starting work in a new bushland area.
If possible, organise your work program to account for measures to minimise the spread of myrtle rust, and allow for decontamination and cleaning requirements.
Set up a 'wash down' area so people can wash their face and hands, and clean their footwear, when leaving the site.

If there are multiple sites in an area, limit the movement of people and equipment between these sites.

b. Treating infected plants with fungicides

If myrtle rust becomes established the following fungicides (active ingredient) currently recommended are (Appendix 1):

- Triadimenol 250g/L
- Triforine 190g/L
- Mancozeb 750-800g/kg
- Azoxystrobin 250g/L
- Copper oxychloride 500g/kg
- Propiconazole 250g/L

Chemicals can be used as a preventative and/or curative measure and it is important to rotate them to maintain their usefulness.
Fungicide treatment will not be suitable for all situations (such as for large mature trees or in extensive bushland)

c. Removing and disposing of infected plants

If myrtle rust becomes established, eventually those plants which are highly susceptible will deteriorate in condition. Therefore, it is recommended that those plants are removed and disposed of appropriately. Do not use infected plants as mulch, as this may spread myrtle rust.

Removal

To minimise the potential spread of spores, spray infected plants with an approved fungicide the day before you intend to remove the plant. If it is not possible to treat with a fungicide, carefully wet the plant foliage to dampen any spores that are likely to be dispersed during the removal process.
The method of plant removal will depend on the size and number of plants:

- small plants can be enclosed in a plastic bag to reduce spore dispersal before being pulled or dug out of the ground.
- large plants can be cut into smaller pieces, wrapped in black plastic and placed in the sun for 3-4 weeks (solarisation). Alternatively, plant parts can be placed in plastic bags and sealed for offsite disposal.

Disposal

Dispose of infected plants (or plant parts) by implementing any of these options:

- burying on-site (deep enough that decaying material can't be disturbed for several weeks/months)
- placing in general domestic waste bins or transporting in a covered vehicle/trailer to a general waste disposal site (not green waste)
- securely covering and sealing the entire plant within black plastic (or similar) and placing in direct sunlight for 3-4 weeks (solarisation).

d. Removing and disposing of healthy myrtaceous plants as a preventative measure

In order to reduce the inoculum levels of the rust, individuals might choose to remove healthy plants as a precaution. This is especially relevant for Highly and Extremely Susceptible species which will eventually become infected. This is more important in nurseries and highly sensitive areas such as national parks and botanical gardens.

2. Nursery industry – wholesale, retail, revegetation, trade

It is critical that the nursery industry becomes involved in all aspects of myrtle rust management across all jurisdictions of New Caledonia, especially where there is movement of plants and plant material.

In order to continue the trade of healthy plants, nurseries growing Myrtaceae will need to consider the use of fungicides. This might be costly and labour intensive but will ensure that the spread of myrtle rust is reduced. It will eventually become evident that infected plants will be unsaleable. Nurseries will need to alter the layout of their stock, to group all Myrtaceae in a separate section. There will also need to be increased awareness and hygiene of nursery staff.

As the susceptibility of different species becomes known, it will be desirable for businesses to eliminate certain highly susceptible species in order to reduce spore levels in their nurseries. Nurseries can consider changing to different species within a genus, changing genera within Myrtaceae, or considering plants outside the Myrtaceae family.

3. Environment

It is important that stakeholders working with myrtaceous plants are educated about myrtle rust, its symptoms and the potential impacts. If myrtle rust is found in bushland, control or eradication is unlikely to be achievable.

The long-term impacts of myrtle rust in New Caledonia are unknown at this stage. It is important that the collection of information and data begins now. It is important to monitor the spread of the disease geographically and to monitor the impacts of the disease on different myrtaceous species over time. The establishment of a database to capture all relevant information is ideal. It is important that host species are correctly identified by a qualified botanist. It is also essential that any symptoms suspected of being myrtle rust are confirmed by a suitably qualified pathologist as there are many other factors, especially insect damage, which may cause similar symptoms.

It will be important to capture information from nurseries, revegetation sites, recreational areas and backyards, and the natural environment. This information can then feed into ongoing international research.

In order to monitor the impacts and assess the data, we recommend the following protocols are used to provide consistency:

- Record host list of genera and species infected with myrtle rust (Appendix 2)
- Rate susceptibility of infected hosts over time (Appendix 3) examining changes in susceptibility and identifying potential variation in susceptibility within species for use in resistance breeding programs
- Ensure that suspect infected samples are confirmed as positive by personnel with expertise in myrtle rust identification (using hand lens as a minimum, or ideally using a microscope)
- Use assessment protocols to monitor incidence and severity of myrtle rust in a site (to be provided as a separate document)
- Organise further molecular diagnostic work for the identification of the strain of *Puccinia psidii* present in New Caledonia (this can be arranged with Australian scientists)

Appendix 1

List of Fungicides currently permitted for use in Australia (APVMA http://www.apvma.gov.au)

Permit ID	Description	Status	Issue Date	Expiry Date	Jurisdiction
PER12141	Benzalkonium Chloride/Infected Materials/Decontamination	CURRENT	03-May-10	31-May-20	Qld only
PER12156	Triadimenol, Triforine, Mancozeb, Azoxystrobin, Copper oxychloride, oxycarboxin and propiconazole/Nursery stock (non-food), ornamentals and cut flowers/Myrtle Rust (Uredo rangelii)	CURRENT	09-Sep-10	30-Aug-13	All states
PER12318	Triadimenol, Triforine, Propiconazole & Azoxystrobin/Myrtaceae quarantine movement/Myrtle Rust (Uredo rangelii)	CURRENT	05-Aug-10	30-Aug-13	All states
PER12319	Triadimenol, Triforine, Propiconazole & Azoxystrobin/Hosts at Infected premises/Myrtle Rust (Uredo rangelii)	CURRENT	05-Aug-10	30-Aug-13	All states
PER12828	Copper oxychloride, Mancozeb & Triforine/Ornamentals & Non-fruit bearing plants of the Myrtaceae family/Myrtle rust	CURRENT	30-May-11	31-Aug-13	All states
PER13328	Copper Hydroxide/Nursery stock (non-food)/Specified diseases	CURRENT	28-May-12	31-May-15	All states (ex Vic-no permit req)
PER13907	Triadimenol, Azoxystrobin, Propiconazole, Potassium bicarbonate & Phos acid/Riberries, Anise myrtle & Lemon myrtle/Myrtle Rust	CURRENT	26-Feb-13	31-Aug-16	All states
PER13915	Agriquat/Motor Vehicles & tools/Citrus canker, guava myrtle rust	CURRENT	01-Apr-13	31-May-20	NSW only

Appendix 2

List of Myrtaceae infected with myrtle rust (as at 30.5.13) in Queensland, Australia, including susceptibility rating

Ref: *Puccinia psidii* in Queensland, Australia: disease symptoms, distribution and impact. Pegg GS, Giblin FR, McTaggart AR, Guymer GP, Taylor H, Ireland KB, Shivas RG, Perry S 2013 (unpublished)

ALPHABETICAL	Common name	Susceptibility
Acmena hemilampra	blush satinash	RT
Acmena ingens	red apple	RT
Acmena smithii	lilly pilly/satinash	MS-RT
Acmenosperma claviflorum	grey satinash	MS
Agonis flexuosa	willow peppermint/myrtle	ES
Anetholea anisata (Backhousia)	aniseed myrtle	HS-RT
Asteromyrtus brassii	Brass's asteromyrtus	RT
Austromyrtus dulcis	midgen berry, midyim	HS-RT
Austromyrtus sp. (Lockerbie scrub)		RT
Austromyrtus tenuifolia	narrow leaf myrtle	RT
Backhousia angustifolia	curry myrtle	RT
Backhousia bancroftii	Johnstone river hardwood	RT
Backhousia bundara (Prince Regent)	no common name	RT
Backhousia citriodora	lemon myrtle	HS-MS
Backhousia hughesii	grey teak	MS
Backhousia leptopetala (Choricarpia)	brown myrtle, rusty turpentine	HS
Backhousia myrtifolia	grey myrtle, ironwood	MS
Backhousia oligantha	no common name	HS
Backhousia sciadophora	shatterwood	RT
Backhousia subargentea (Choricarpia)	giant ironwood	RT
Chamelaucium uncinatum	Geraldton wax	ES
Corymbia citriodora subsp. variegata	spotted gum	RT
Corymbia ficifolia x C. ptychocarpa	summer red	RT
Corymbia henryi	large leaved spotted gum	RT
Corymbia torelliana	cadagi	RT
Darwinia citriodora	lemon-scented Darwinia	MS
Decaspermum humile	silky myrtle	ES
Decaspermum humile (NQ form)	no common name	RT
Eucalyptus carnea	broad-leaved white mahogany	HS-RT
Eucalyptus cloeziana	Gympie messmate	RT
Eucalyptus curtisii	Plunkett mallee	HS-RT
Eucalyptus grandis	rose gum	MS-RT
Eucalyptus planchoniana	bastard tallow wood	RT
Eucalyptus tereticornis	forest red gum	RT
Eucalyptus tindaliae	Tindale's stringybark	MS
Eugenia natalitia	forest myrtle	MS
Eugenia reinwardtiana	beach cherry	ES
Eugenia uniflora	Surinam cherry, Brazilian cherry	MS
Eugenia zeyheri	no common name	MS
Gossia acmenoides	scrub ironwood	HS
Gossia bamagensis	no common name	MS-RT
Gossia bidwillii	scrub python tree	RT
Gossia floribunda	cape/scented ironwood	RT

Gossia fragrantissima	sweet/small-leaved myrtle	MS
Gossia gonoclada	angle-stemmed myrtle	HS
Gossia hillii	scaly myrtle	ES-HS
Gossia inophloia (Austromyrtus)	thready-barked myrtle	ES
Gossia macilwraithensis	no common name	MS
Gossia myrsinocarpa	Malanada ironwood, small flowered lignum	HS-MS
Gossia punctata	dotted myrtle	MS
Homoranthus melanostictus	no common name	MS
Homoranthus papillatus	mouse bush	MS
Lenwebbia lasioclada	velvet myrtle	RT
Lenwebbia prominens	southern velvet myrtle	HS
Lenwebbia sp. Blackall Range	Blackall Range myrtle	RT
Leptospermum liversidgei	lemon-scented tea tree, olive tea tree	MS
Leptospermum luehmannii	bronze-barked tea tree	RT
Leptospermum madidum	weeping tea tree	MS
Leptospermum petersonii	Lemon-scented tea tree	RT
Leptospermum semibaccatum	no common name	RT
Lindsayomyrtus racemoides	Daintree penda	RT
Lophostemon suaveolens	swamp box	RT
Melaleuca fluviatilis	weeping tea tree/paperbark	HS
Melaleuca formosa (Callistemon)	Kingaroy bottlebrush, cliff bottlebrush	RT
Melaleuca leucadendra	broad-leaved paperbark	HS-RT
Melaleuca linariifolia	snow in summer	RT
Melaleuca nervosa	paperbark	HS
Melaleuca nesophila	showy honey myrtle	RT
Melaleuca nodosa	prickley-leaved paperbark	ES-HS
Melaleuca pachyphylla	wallum bottlebrush	RT
Melaleuca paludicola	river bottlebrush	HS
Melaleuca polandii	no common name	HS
Melaleuca quinquenervia	coastal/broad-leaved paperbark	ES-RT
Melaleuca salicina	pink tips	RT
Melaleuca saligna	willow/white bottlebrush	MS
Melaleuca viminalis (Callistemon)	willow bottlebrush	HS-MS
Melaleuca viridiflora	broad-leaved paperbark	HS
Metrosideros collina	Fiji Christmas bush	RT
Metrosideros collina x villosa	Fiji Christmas bush	RT
Metrosideros kermadecensis	Kermadec pohutukawa	RT
Metrosideros thomasii	NZ Christmas bush	RT
Mitrantia bilocularis	no common name	MS
Myrciaria cauliflora	no common name	RT
Myrtus communis	common myrtle	HS
Pilidiostigma glabrum	plum myrtle	MS-RT
Pilidiostigma tetramerum	no common name	MS
Rhodamnia acuminata	Cooloola ironwood	RT
Rhodamnia angustifolia	narrow-leaved malletwood	ES
Rhodamnia arenaria	Cape York malletwood	MS
Rhodamnia argentea	silver myrtle, malletwood	HS-MS
Rhodamnia australis	tropical ironwood	HS
Rhodamnia blairiana	small malletwood	HS-RT
Rhodamnia costata	malletwood	HS
Rhodamnia dumicola	rib-fruited malletwood	HS
Rhodamnia glabrescens	smooth malletwood	MS

Rhodamnia maideniana	smooth scrub turpentine	ES
Rhodamnia pauciovulata	small-leaved malletwood	MS
Rhodamnia rubescens	scrub turpentine, brown malletwood	ES-HS
Rhodamnia sessiliflora	iron malletwood	ES-MS
Rhodamnia spongiosa	northern malletwood	HS
Rhodomyrtus canescens	crater ironwood	HS
Rhodomyrtus effusa	grey rhodomyrtus	MS
Rhodomyrtus macrocarpa	native loquat, finger cherry	MS
Rhodomyrtus pervagata	rusty rhodomyrtus, rusty ironwood	HS-MS
Rhodomyrtus psidioides	native guava	ES
Rhodomyrtus sericea	grey rhodomyrtus	MS
Rhodomyrtus tomentosa	downy rose myrtle, Ceylon hill gooseberry	HS-MS
Rhodomyrtus trineura subsp. capensis	no common name	MS
Ristantia waterhousei	no common name	RT
Sphaerantia discolor	Tully penda	MS
Stockwellia quadrifida	stockwellia	HS
Syzygium angophoroides	Yarrabah satinash	MS
Syzygium apodophyllum	rex satinash	RT
Syzygium aqueum	water apple, water cherry	RT
Syzygium argyropedicum	silver satinash	RT
Syzygium armstrongii	white bush apple	RT
Syzygium australe	brush cherry, creek satinash	MS-RT
Syzygium bamagense	Bamaga satinash	MS
Syzygium boonjee	boonjee satinash	RT
Syzygium canicortex	yellow satinash	RT
Syzygium cormiflorum	bumpy satinash	RT
Syzygium corynanthum	sour cherry	RT
Syzygium cryptophlebium	plum satinash	MS
Syzygium cumini	Java plum	MS
Syzygium dansiei	Windsor satinash	RT
Syzygium endophloium	bark-in-wood satinash	RT
Syzygium erythrocalyx	satinash, scarlet satinash	RT
Syzygium eucalyptoides	native apple	HS
Syzygium eucalyptoides subsp. eucalyptoides	white apple	MS
Syzygium forte subsp. forte	watergum, brown satinash	HS-RT
Syzygium forte subsp. potamophilum	flaky-barked satinash	RT
Syzygium jambos	rose apple	ES
Syzygium kuranda	Kuranda satinash	MS
Syzygium luehmannii	riberry, cherry satinash	MS
Syzygium macilwraithianum	Macilwraith satinash	RT
Syzygium minutiflorum	no common name	RT
Syzygium moorei	rose apple	RT
Syzygium nervosum	no common name	HS
Syzygium oleosum	blue lilly pilly	HS
Syzygium paniculatum	Magenta cherry	RT
Syzygium pseudofastigiatum	satinash, claudie satinash	RT
Syzygium puberulum	downy satinash	MS
Syzygium rubrimolle	Laura apple	RT
Syzygium suborbiculare	rolypoly satinash	MS
Syzygium tierneyanum	river cherry, Bamaga satinash	RT
Syzygium wilsonii	powder puff lilly pilly	RT
Syzygium wilsonii x luehmannii	Cascade lilly pilly	RT

Syzygium xerampelinum	mulgrave satinash	MS
Thryptomene saxicola	rock thryptomene	MS
Tristania neriifolia	water gum	MS
Tristaniopsis exiliflora	kanuka box, water gum	HS
Tristaniopsis laurina	water gum, kanooka	RT
Uromyrtus tenella	no common name	RT
Waterhousea floribunda	weeping lilly pilly/satinash	RT
Waterhousea hedraiophylla	gully satinash	RT
Waterhousea mulgraveana	no common name	RT
Waterhousea unipunctata	rolypoly satinash	MS
Xanthostemon chrysanthus	golden penda	MS-RT
Xanthostemon oppositifolius	southern penda	HS
Xanthostemon youngii	crimson penda	MS

Appendix 3

Susceptibility Ratings

Ref: *Puccinia psidii* in Queensland, Australia: disease symptoms, distribution and impact. Pegg GS, Giblin FR, McTaggart AR, Guymer GP, Taylor H, Ireland KB, Shivas RG, Perry S 2013 (unpublished)

Hosts, including seedlings, saplings and mature trees, showing evidence of infection by *P. psidii*:

- Relatively tolerant
    - Minor leaf spots with rust pustules present on <10% of expanding leaves and shoots; 1-2 pustules per infected leaf with only 1-2 uredinia per pustule
- Moderately susceptible
    - Rust pustules present on 10-50% of expanding leaves and shoots; 3-5 pustules per infected leaf with multiple uredinia per pustule
- Highly susceptible
    - Rust pustules present on 50-80% of expanding leaves and shoots; some evidence of disease on juvenile stems; evidence of disease on older leaves and stems; multiple rust pustules per leaf/stem causing blighting and leaf/stem distortion; multiple uredinia per pustule
- Extremely susceptible
    - Rust pustules present on all expanding leaves and shoots and juvenile stems; shoot, stem and foliage dieback; evidence of older stem/shoot dieback

Host susceptibility ratings are based on as many individuals as possible but in some cases (e.g. less common species) only single trees could be assessed. If variability in susceptibility to *P. psidii* is observed, the range of susceptibility within a species is recorded.

Appendix 4

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