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Topic 1.3 — Assessment of other myrtle rust biotypes

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Topic 1.3 — Assessment of other myrtle rust biotypes

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Contents

Executive summary

Native New Zealand plant species (pōhutukawa, mānuka, rawiri mānuka and kānuka) were susceptible to the South African strain of *Austropuccinia psidii*.

The level of susceptibility and resistance variety both within the plant hosts and between the species tested.

1 Recommendations

1. The need to continue vigilance at the border to prevent any further introductions of *A. psidii* strains is essential, and efforts to assist in preventing the spread internationally are recommended.
2. Control or management tools should be developed to be applicable against the pandemic biotype of *A. psidii* as well as other strains of *A. psidii,* where possible.
3. Conservation of New Zealand's germplasm is critical, in view of the variation in susceptibility within species. This should be undertaken at an individual plant level (family), rather than at a province level, to detect and prevent deployment of highly susceptible families.

2 Introduction

The pandemic biotype is one of at least nine different strains of *Austropuccinia psidii* that are known to cause disease on Myrtaceae both within the pathogen's native host region (South America) and internationally (Graca et al. 2011; Stewart et al. 2017; Zhong et al. 2011) (Figure 1.3.1). Whilst the pandemic biotype has caused the most devastation, other strains such as the one affecting *Eucalyptus* spp. in Brazil and Uruguay (Coutinho et al. 1998; Pérez et al. 2014) and the new strain found in South Africa infecting both native and introduced Myrtaceae species (Roux et al. 2016), are considered high risk biosecurity threats. The introduction of other strains such as these to New Zealand could create further issues by either expanding the susceptible host range of New Zealand Myrtaceae to *A. psidii* or by sexually recombining with the pandemic biotype, already present, to create strains with greater virulence.

Given the rapid global dispersion of the pandemic biotype, an understanding of the level of susceptibility of Myrtaceae species in New Zealand to other strains of *A. psidii* is essential to future-proof against any further introduction. The objective of this study was to screen seed collected from natives species of New Zealand Myrtaceae against overseas strains of *A. psidii* that are not currently present in New Zealand.

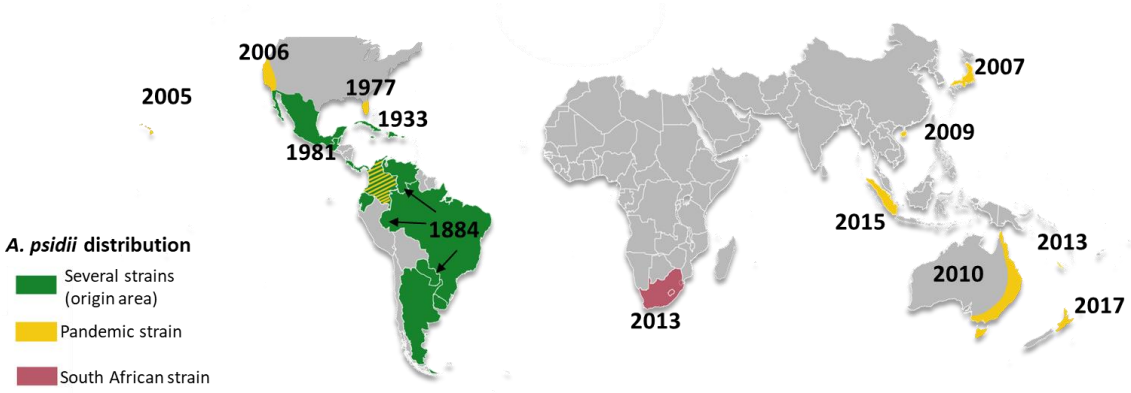

Figure 1.3.1. Global distribution of *Austropuccinia psidii* and the year the pathogen was first recorded in different countries or regions.

Methods and Materials

Seeds from four plant species: *Metrosideros excelsa* (pōhutukawa), *Leptospermum scoparium* (mānuka), *Kunzea linearis* (rawiri mānuka) and *Kunzea robusta* (kānuka), were collected from four different locations in the North Island, from individual plants. Appropriate permissions (i.e. mana whenua, landowner) were obtained to collect the seed. The seeds were sent to South Africa where they were germinated and grown to a size appropriate for screening. Two sets of seedlings from the same seed lot were germinated for inoculation in two separate experiments. In the first inoculation there were 131 plants and 159 in the second inoculation (Table 1.3.1).

Table 1.3.1. Species and number of seedlings inoculated with the South African strain of *Austropuccinia psidii*.

Host species	Number of seedlings	
	Inoculation 1	Inoculation 2
Rawiri mānuka	4	13
Kānuka	28	32

Mānuka	62	89
Pōhutukawa	37	25
Total	*131*	*159*

The seedlings were inoculated against the South African strain of *A. psidii* using the protocol described by Roux et al. (2016). After inoculation, seedlings were kept in the dark for 24 hours, to facilitate the infection, before being moved to a glasshouse where they were maintained at approximately 25°C. Seedlings were assessed daily for uredinospore development and scored up to 14 days post-inoculation. Disease severity was assessed using the rating scales from Junghans et al. (2003) and another unpublished scoring system developed by Geoff Pegg, which was based on the percentage of the leaf affected.

Seed from the same seed lots that were sent to South Africa were sent to Uruguay for testing against the strain of *A. psidii* that has caused problems in *Eucaplytus* spp. in South America (Photo 1). Seed will be germinated, inoculated and screened once border inspections have been completed. This strain has caused problems in eucaplyts in South America and is different from the strains present in New Zealand and South Africa.

Photo 1. Eucalypt leaves infected with *Austropuccinia psidii* in Uruguay.

A third set of seed from the same seed lots was sent to Australia. Delays in testing because of permit review by DAWR (see Section 1.1) have delayed assessing these seeds against the pandemic biotype using the same inoculation and assessment protocols as described above.

3 Results and discussion

All species were able to be infected with the South African strain of *A. psidii* but there was variation within each species in susceptibility (Figure 1.3.2). The screening assay showed that all four plant species could be infected by myrtle rust but it gives no indication if these plants would die from the disease. Plants would need to be left for a longer period of time to determine this and this was outside the scope of the project.

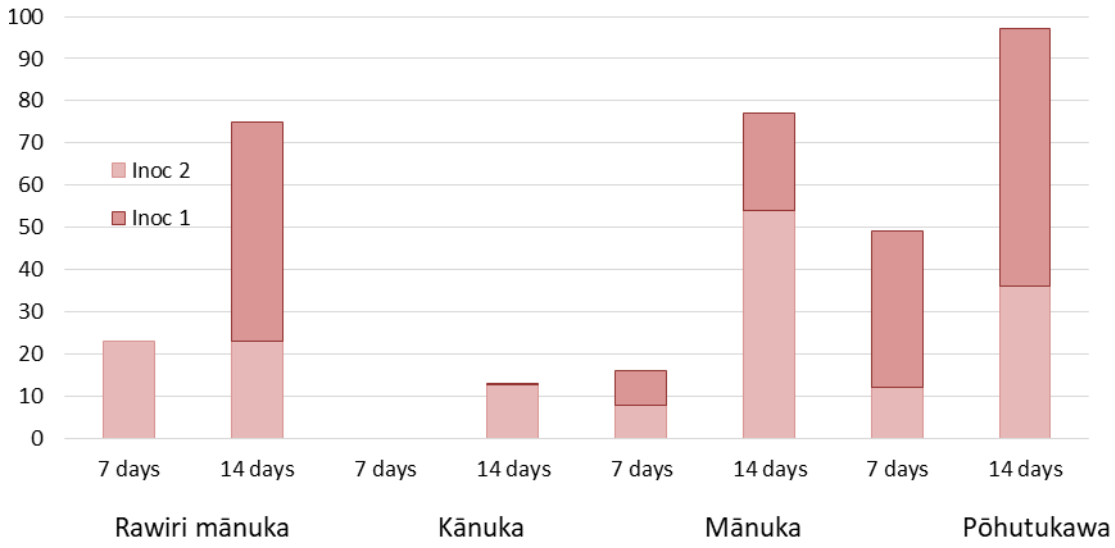

Figure 1.3.2. Percentage of seedlings with yellow myrtle rust lesions 7 and 14 days after inoculation with the South African strain of *Austropuccinia psidii* for four Myrtaceae plant species: *Kunzea linearis* (rawiri mānuka), *Kunzea robusta* (kānuka), *Leptospermum scoparium* (mānuka), and *Metrosideros excelsa* (pōhutukawa).

Pōhutukawa was the most susceptible species tested. Considering the iconic status of pōhutukawa in New Zealand, this result is concerning. The high level of infection (close to 100% in the first inoculation) of seedlings means the level of resistance in this host is likely to be low. However, variation in the level of tolerance (degree of infection within a host) could provide mechanisms for pōhutukawa trees to survive infection. Myrtle rust infection occurs in the new flush (new stems or leaves) of trees and not in older plant material (Coutinho et al. 1998), so mature trees would be expected to be more tolerant to this pathogen given the level of older material present within the canopy. Conversely, if this strain of *A. psidii* were to establish in New Zealand, it could have an effect on the regeneration of pōhutukawa, especially in areas that had optimal conditions for this disease. For seedlings, the majority of material is new growth that would be vunerable to this pathogen.

Mānuka was also susceptible but lesions took slightly longer to develop on the plants than for the pōhutukawa. Of particular concern was that some of the mānuka seedlings were flowering and these became infected. Further work would be required to determine how susceptible flowers from a vareity of different genotypes were to this strain of *A. psidii* and if this strain were to establish in New Zealand, whether flowers across the country would become infected. Regardless, these findings are concerning for natural regeneration of this species as well as the potential effect on mānuka-based indsutries such as the oil and honey industries.

The sample size of rawiri mānuka was small but showed it was also susceptible. Rawiri mānuka has a limited distribution from Northland through to Waikato and is a threatened species (de Lange 2014). The introduction of another strain of *A. psidii* could have serious consequences for the survival of this species, especially as the host range extends across regions of New

Zealand that have been predicted to be suitable for myrtle rust and/or where the pandemic biotype has already established.

Kānuka was the most resistant of the four species tested with no seedlings at 7 days showing infection and just over 10% of seedlings infected at 14 days post-inoculation.

These results provide an indication of the genetic susceptibility or resistance of the plant species tested, what is lacking is the effect of the environment. The inoculations were completed in glasshouses under optimal environmental conditions for the pathogen to infect the plant and produce uredinospores (yellow pustles). If this pathogen were to establish in New Zealand, environment factors such as temperature, humidity and rain could all have an effect on disease establishment and development.

Testing seedlings germinated from the same seed lots as those inoculated in South Africa has not yet been completed in Australia against the pandemic biotype nor against the strain of *A. psidii* that has affected *Eucalyptus* spp. in Uruguay. For all three experiments the same screening and assessment methods have been used to allow direct comparison of the susceptibility of these seed lots to three different strains of *A. psidii.* This will provide information on whether New Zealand Myrtaceae may be more susceptible or resistant to different strains.

New Zealand Myrtaceae species are susceptible to the South African strain of *A. psidii* and this work highlights the need to continue national and global efforts to prevent the spread of other strains worldwide. Whilst the focus in New Zealand is now on disease management of the pandemic biotype of *A. psidii,* continued monitoring of this pathogen in New Zealand is essential so if other strains were to be introduced they could be eradicated, if detected early enough, or to change management plans for combatting this disease. The need to ensure any control or management tools developed are future-proofed against other strains of *A. psidii*, where possible, is paramount, as is the need to conserve New Zealand's unique Myrtaceae germplasm.

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