Susceptibility of threatened Myrtaceae species in Australia

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Myrtle rust
(Austropuccinia psidii)

- Origin in South America
  (Winter, 1884)

- Rusts usually have narrow host ranges, myrtle rust: 400+ susceptible species in 70 genera
  (Granados et al., 2017)

- Myrtaceae has 5 pathogenic rust fungi: myrtle rust most widespread and devastating
  (Beenken, 2017)
Myrtaceae in Australia
~ 2250 spp.

- Myrtle rust detected in 2010
  (Carnegie et al., 2010)

- One strain
  (Machado et al., 2015)


368 susceptible species
288 field data

(Giblin & Carnegie, 2014; Carnegie et al., 2016)
Genera of Australian Myrtaceae

*Melaleuca*  
~200 spp.

*Eucalyptus*  
~850 spp.

*Melaleuca*  
(prev. *Callistemon*) 37 spp.
Negative impacts

Endangered species => ecological communities

e.g. *Gossia gonoclada*

=> ecological communities e.g. Castlereagh Swamp Woodland Community Blue Mountains Swamps
~18% native Myrtaceae have been tested
~ 57% expected to be exposed to myrtle rust now or in the future

(Berthon et al., in review)

We tested susceptibility of 13 coastally restricted species / subspecies which distribution overlaps with myrtle rust

endangered species (multiple provenances and subspecies)
& from survey results for susceptibility confirmation

(Map by Katherine Berthon)
11 species occur in area overlap with climatic suitability for MR
were grown from seed in glasshouse conditions => 9 of them are endangered

- **Eucalyptus amplifolia**
  2 subspecies:
  - *amplifolia* (2 provenances)
  - *sessiliflora*

  *Least concern*

- **Eucalyptus camphora**

  EPBC/NSW: *Vulnerable*

11 species occur in area overlap with climatic suitability for MR
9 of them are endangered

• *Eucalyptus castreensis*

  NSW: Endangered

• *Eucalyptus copulans*

  EPBC & NSW: Endangered

11 species occur in area overlap high climatic suitability for MR
9 of them are endangered

• **Eucalyptus largeana**
  NSW: Endangered

• **Eucalyptus macarthurii**
  2 provenances
  EPBC & NSW: Endangered
11 species occur in area overlap with climatic suitability for MR. 9 of them are endangered.

- **Eucalyptus magnificata**
  - NSW: Endangered

- **Eucalyptus pachycalyx**
  - Subsp. *pachycalyx*: Least concern
  - Subsp. *waajensis*: NSW/QLD: Endangered

• **Eucalyptus parvula**
  
  EPBC: Vulnerable  
  NSW: Endangered

• **Eucalyptus scoparia**

  2 provenances  
  EPBC: Vulnerable  
  NSW: Endangered

• **Callistemon megalongensis**

  EPBC: Critically endangered  
  NSW: Critically endangered

• Three inoculations
• We assessed the number of individuals of each species showing signs of infection (uredinia) and the susceptibility level
• Variation in susceptibility of infection intra and interspecific

(Zauza et al., 2010)

• Several susceptibility scales:

<table>
<thead>
<tr>
<th>Score</th>
<th>Rating</th>
<th>Description</th>
<th>Equivalent for other scales</th>
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<tbody>
<tr>
<td>0</td>
<td>Resistant</td>
<td>No infection</td>
<td>Morin¹ 1</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>Infection but no sporulation</td>
<td>Fernandez² 0</td>
</tr>
<tr>
<td>2</td>
<td>Medium</td>
<td>Infection and minimal sporulation</td>
<td>Pegg³ 2</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>Infection and abundant sporulation on leaves, twigs and/or fruits.</td>
<td>Sandhu⁴ HR</td>
</tr>
</tbody>
</table>
Scales of susceptibility

Resistant

Medium

Low

High
Susceptibility results

- **All** species showed susceptibility to myrtle rust (at least one individual infected per species)
- High degree of variation in susceptibility (48% resistant)
- 5 species moderate to high severity of infection
Intraspecific variability
Summary

• This study adds 11 species to the host list => 379 hosts in Australia
• Resistance within Eucalyptus spp varied between 6 - 94 % => opportunity to look resistance genes, promising for these threatened species
• Different provenances or subspecies may be more exposed than others => investigation of subpopulations difference in susceptibility is an important area for future study
Future steps

2,000 Myrtaceae species (only 379 known status):

1) Find a rapid screening tool;
2) Prioritize species that occur in the area;
3) Potentially focus on threatened spp or that could become threatened e.g. rainforest
   - It is necessary to assess the impacts and severity levels of these affected plants in order to guide management decisions to maximise their persistence in the wild
   - Monitoring of susceptible species’ populations in the wild and seed collection for seed banking would be the first steps towards their conservation
Thank you!

For more information, please email: laura.fernandez@hdr.mq.edu.au
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Questions?
biosecurity built on science
Reconciling Susceptibility Scales

- **Resistant**
  - No Infection

- **Medium**
  - Infection with low-medium sporulation

- **Low**
  - Infection with no spores

- **High**
  - Infection and abundant spores
  - Stems and fruits affected
  - Mature leaves infected
# Susceptibility Equivalents

<table>
<thead>
<tr>
<th>Our Rating</th>
<th>Louise Morin</th>
<th>Laura Fernandez</th>
<th>Pegg et al. 2014</th>
<th>Sandhu and Parks 2013</th>
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</thead>
<tbody>
<tr>
<td>R</td>
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<td>0</td>
<td></td>
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<tr>
<td>L</td>
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<td>H</td>
<td>5</td>
<td>4-5</td>
<td>HS-ES</td>
<td>S-VS</td>
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</tbody>
</table>
Intraspecific variability
Species listing categories (NSW)

**Critically endangered**
• Species and ecological communities are listed as critically endangered if they are facing an extremely high risk of extinction in Australia in the immediate future.

**Endangered**
• Species or ecological communities are listed as endangered if they:
  - face a very high risk of extinction in Australia in the near future, as determined by the criteria prescribed in the regulation
  - are not eligible to be listed as a critically endangered species or ecological community.

**Vulnerable**
Species and ecological communities are listed as vulnerable if they:
- face a high risk of extinction in NSW in the medium-term future, as determined by the criteria prescribed in the regulation
- are not eligible to be listed as an endangered or critically endangered species or ecological community.