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# Myrtle rust: Life cycle, host range and epidemiology

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National Myrtle Rust Workshop

10 March 2011



Industry &  
Investment



# Collaborators

- Industry & Investment NSW (Angus Carnegie, Jonathan Lidbetter)
- CSIRO (Darren Kriticos, Ruth Aveyard)
- University of Tasmania (Morag Glen)
- Royal Botanic Garden Sydney (Peter Wilson)
- Taxonomists from various organisations (John Walker, Roger Shivas, Michael Priest, Jack Simpson)
- .....
- And many others who have helped sourcing plants etc.

# What's in a name?

Myrtle rust =  
(*Uredo rangelii*)



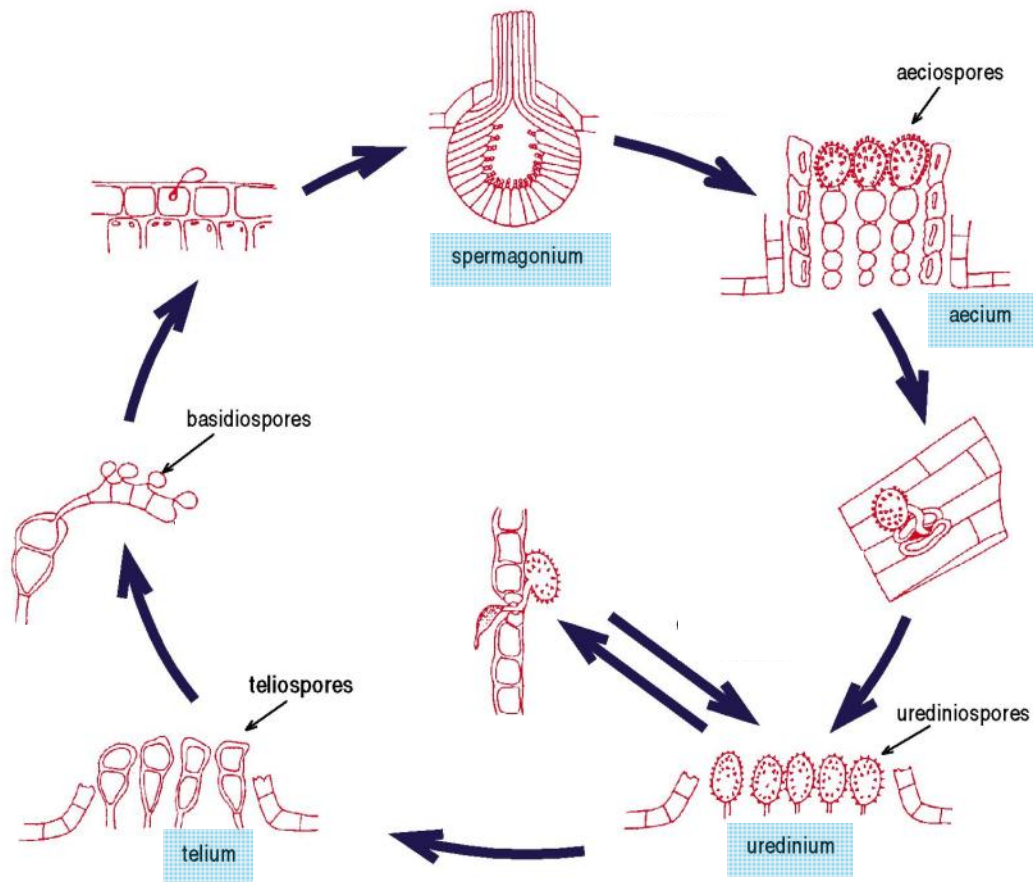
Guava/Eucalyptus rust =  
(*Puccinia psidii*)



Teliospores have now been found in the rust pathotype affecting Myrtaceae in Australia

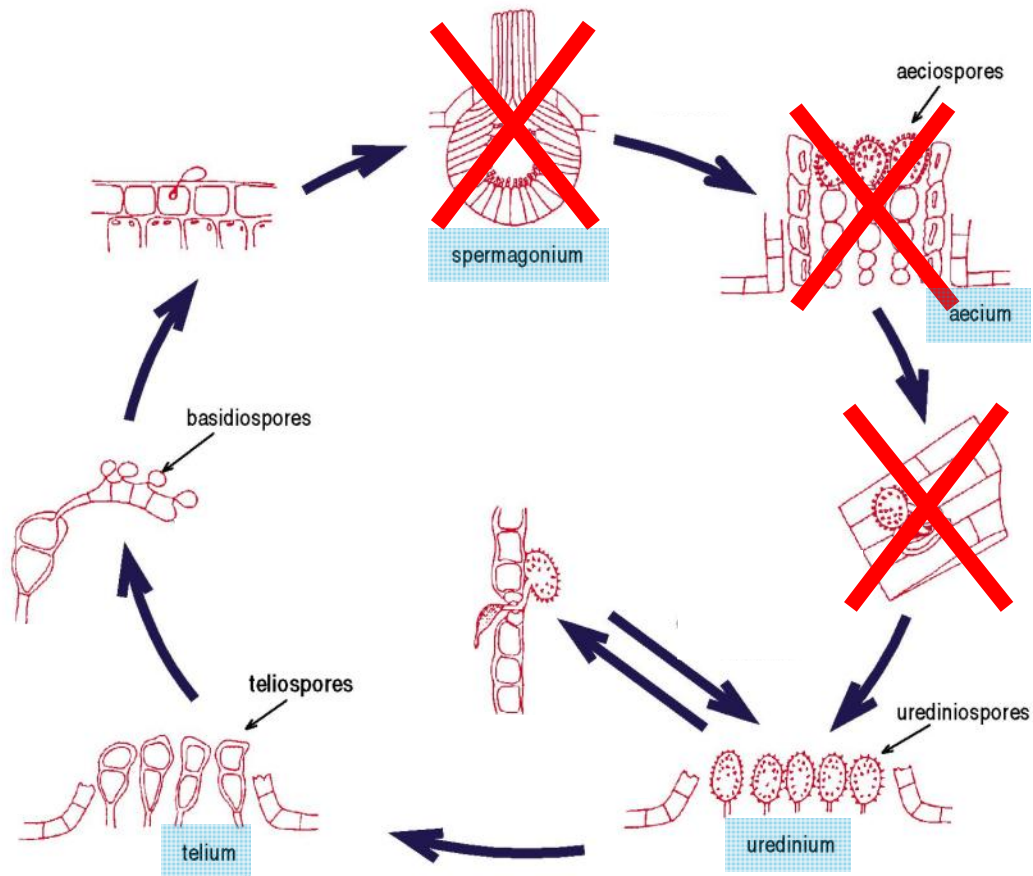
# Life-cycle

Typical life-cycle of rust fungus with no alternate host



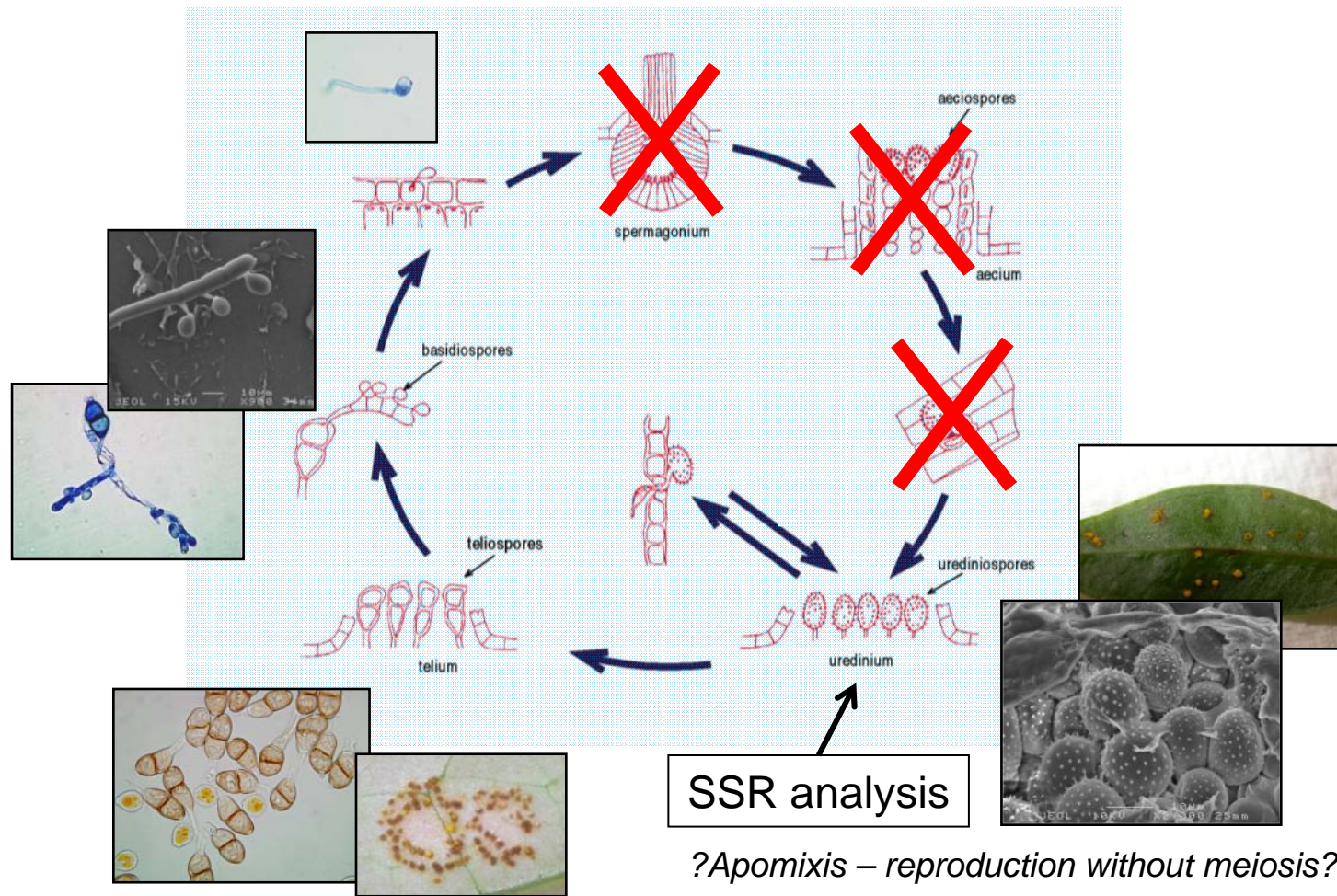
# Life-cycle

## Putative life-cycle of *Puccinia psidii*



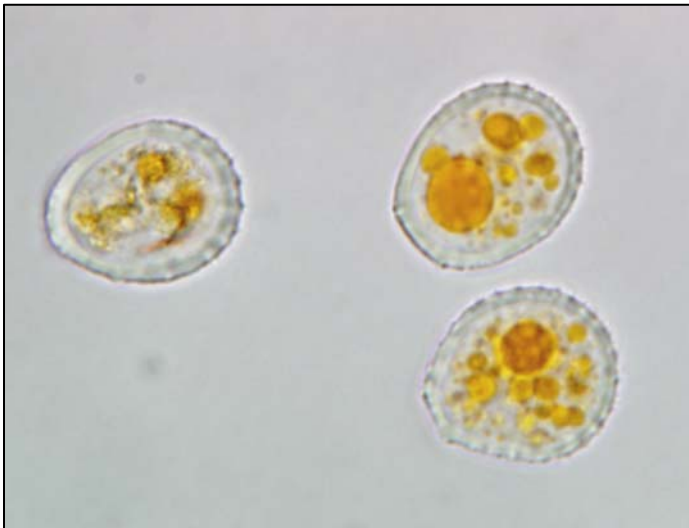
# Life-cycle

What we know so far about the rust pathotype found in Australia



# Host range

- High security quarantine (QC3)
- Whole plants. 5 reps/species/trial. Each species tested in two trials.
- Rust inoculum from *Syzygium jambos*.
- Positive control: *Syzygium jambos*.
- Optimum conditions for infection (20°C, 24 h dew, dark) and disease development (20°C, 12-h photoperiod)
- Visible symptoms assessed 3 wks after inoculation



# Host range

## Key observation

- Only young actively growing shoots developed disease symptoms



*Melaleuca alternifolia*

New regrowth since inoculation

Young tip inoculated 3 wks earlier

Inoculated older leaves that did not develop disease symptoms



# Host range

## Key observation

- Restricted development of the rust on some species



*Eucalyptus regnans*



*Callistemon White Anzac*

# Host range

## Key observation

- Different responses of individual plants within some species

No symptoms or sporulation

Sporulation

*Syzygium australe*  
Captain Cook

Different trials



*Eucalyptus agglomerata*

Same trial



# Host range

- 101 species/cultivars tested so far
- Rust caused visible symptoms on most species and produced spores



# Host range

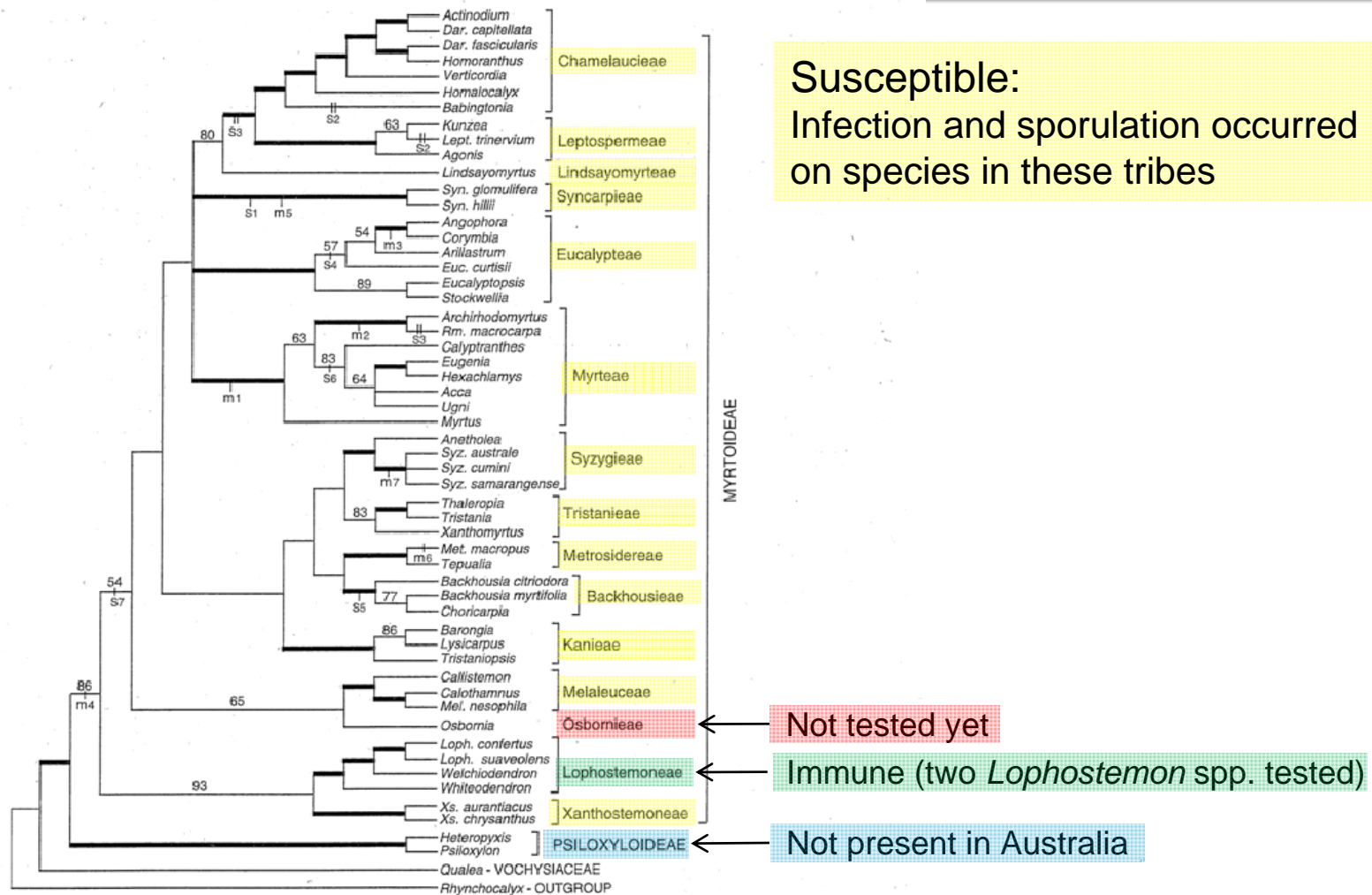


Fig. 2. Strict consensus of a single island of 90 equally parsimonious of 1701 steps (CI = 0.58; RI = 0.74; RC = 0.52) found from heuristic searching of the *matK* plus spacer data. The distributions of informative indels are mapped on the tree: *m* = *matK* indel; *s* = spacer indel. Support for clades shown as in Fig. 1

Wilson et al (2005)







# Host range

Species	Presence of visible symptoms with sporulation (= susceptible)	
	Australian rust pathotype	Other <i>P. psidii</i> pathotypes <sup>1</sup>
<i>Asteromyrtus magnifica</i>	Yes	No
<i>Corymbia calophylla (rosea)</i>	No	No
<i>Corymbia tessellaris</i>	Yes	No
<i>Eucalyptus grandis x camaldulensis</i>	No	Not tested
<i>Eucalyptus moluccana</i>	No	Yes
<i>Leptospermum laevigatum</i>	Yes	No
<i>Lophostemon confertus</i>	No	No
<i>Lophostemon suaveolens</i>	No	No
<i>Psidium guajava</i>	No	Yes
<i>Sannantha virgata</i>	No	Not tested
<i>Waterhousea unipunctata</i>	No	Not tested

<sup>1</sup> Based on summary in OCPPO Contingency Plan (2007)

# Host range

## Response of endangered species to the rust

Species	Status (based on New South Wales Flora online)	Presence of visible symptoms with sporulation (= susceptible)	
<i>Callistemon linearifolius</i>	NSW TSCA: Vulnerable ROTAP: 2RCi	Yes <sup>1</sup>	
<i>Darwinia procera</i>	ROTAP: 2RCa	Yes <sup>2</sup>	
<i>Darwinia glaucophylla</i>	NSW TSCA: Vulnerable ROTAP: 2RCi	Yes <sup>2</sup>	
<i>Eucalyptus camfieldii</i>	NSW TSCA: Vulnerable ROTAP: 2VCi	Yes <sup>2,3</sup>	
<i>Melaleuca biconvexa</i>	NSW TSCA: Vulnerable	Yes <sup>2,4</sup>	
<i>Syzygium paniculatum</i>	NSW TSCA: Endangered ROTAP: 3VCi	Yes <sup>1</sup>	

<sup>1</sup> Test performed on whole plants.

<sup>2</sup> Test performed on cuttings and detached small shoots of each species obtained from the field.

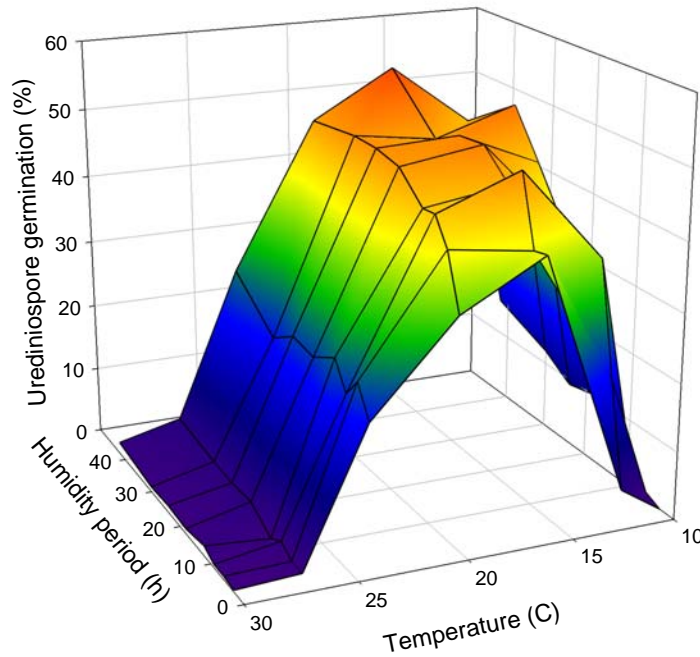
<sup>3</sup> Fruiting bodies of the fungus developed on juvenile leaves only.

<sup>4</sup> Only one fruiting body observed.

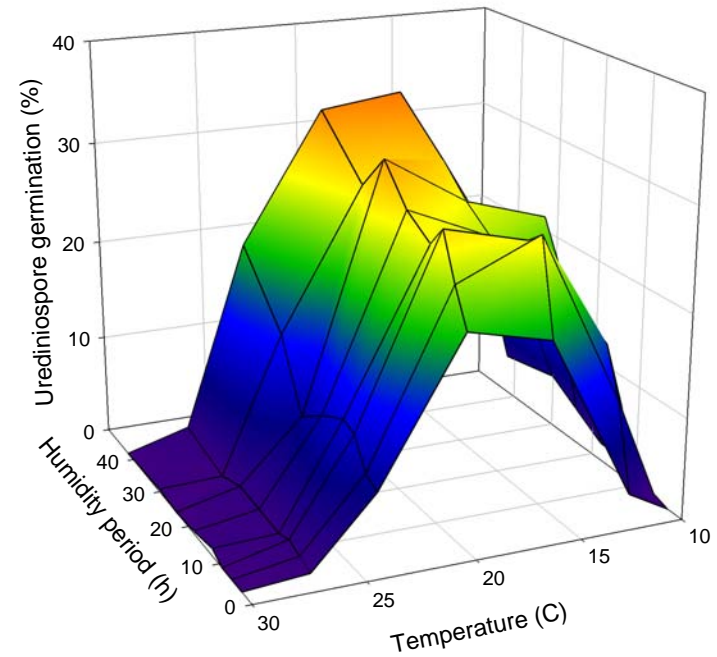
# Epidemiology

## Effect of temperature on spore germination – Australian pathotype

Experiment 1

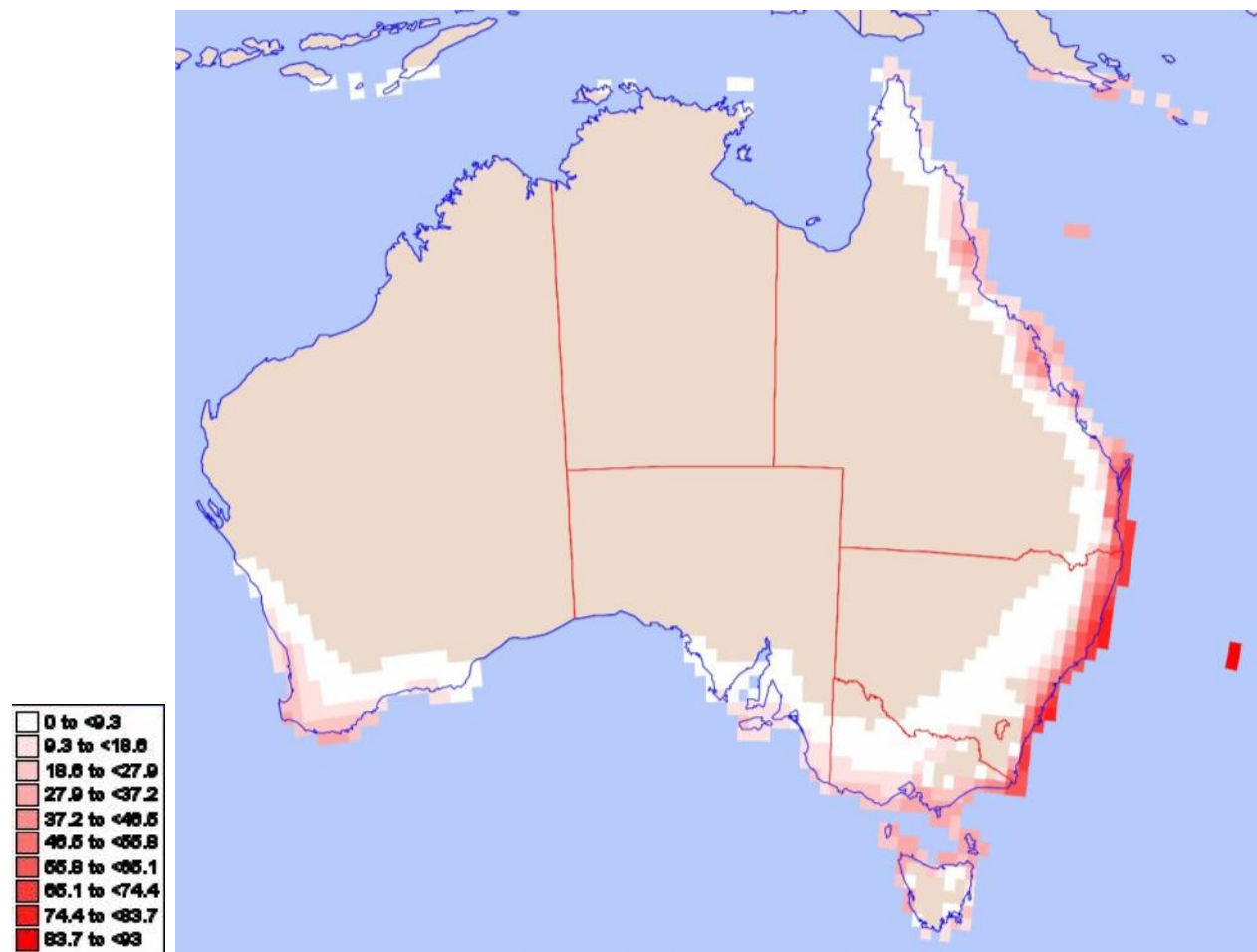


Experiment 2



# Epidemiology

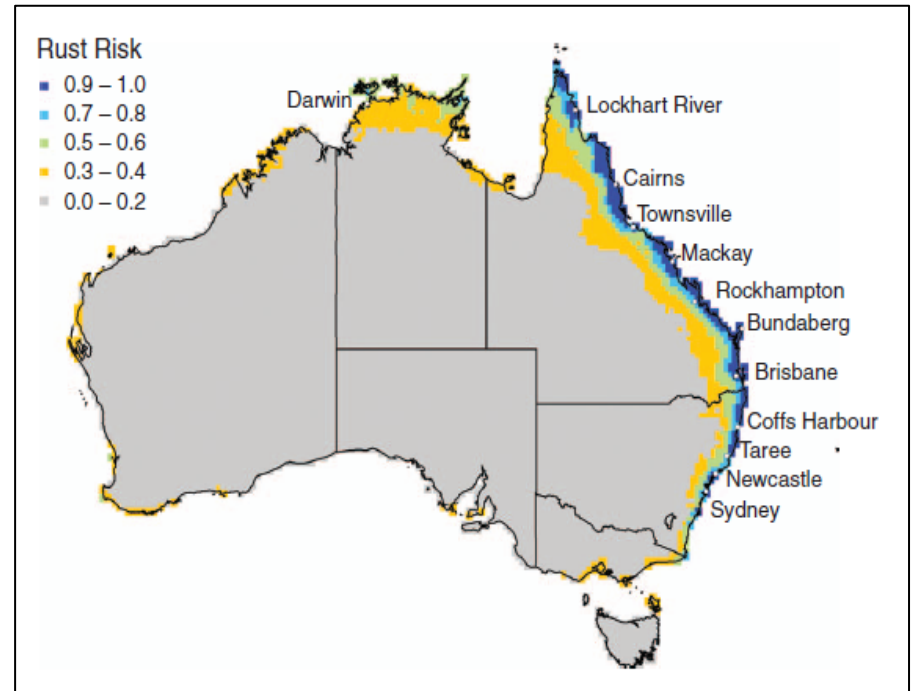
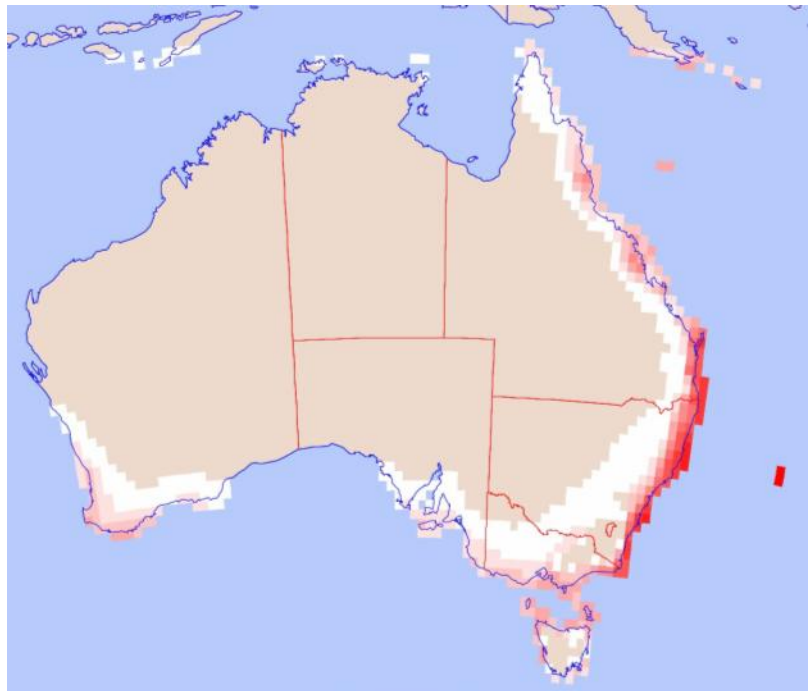
## Climate suitability for *Puccinia psidii* sensu lato (CLIMEX Ecoclimatic Index)



Kriticos(unpublished)

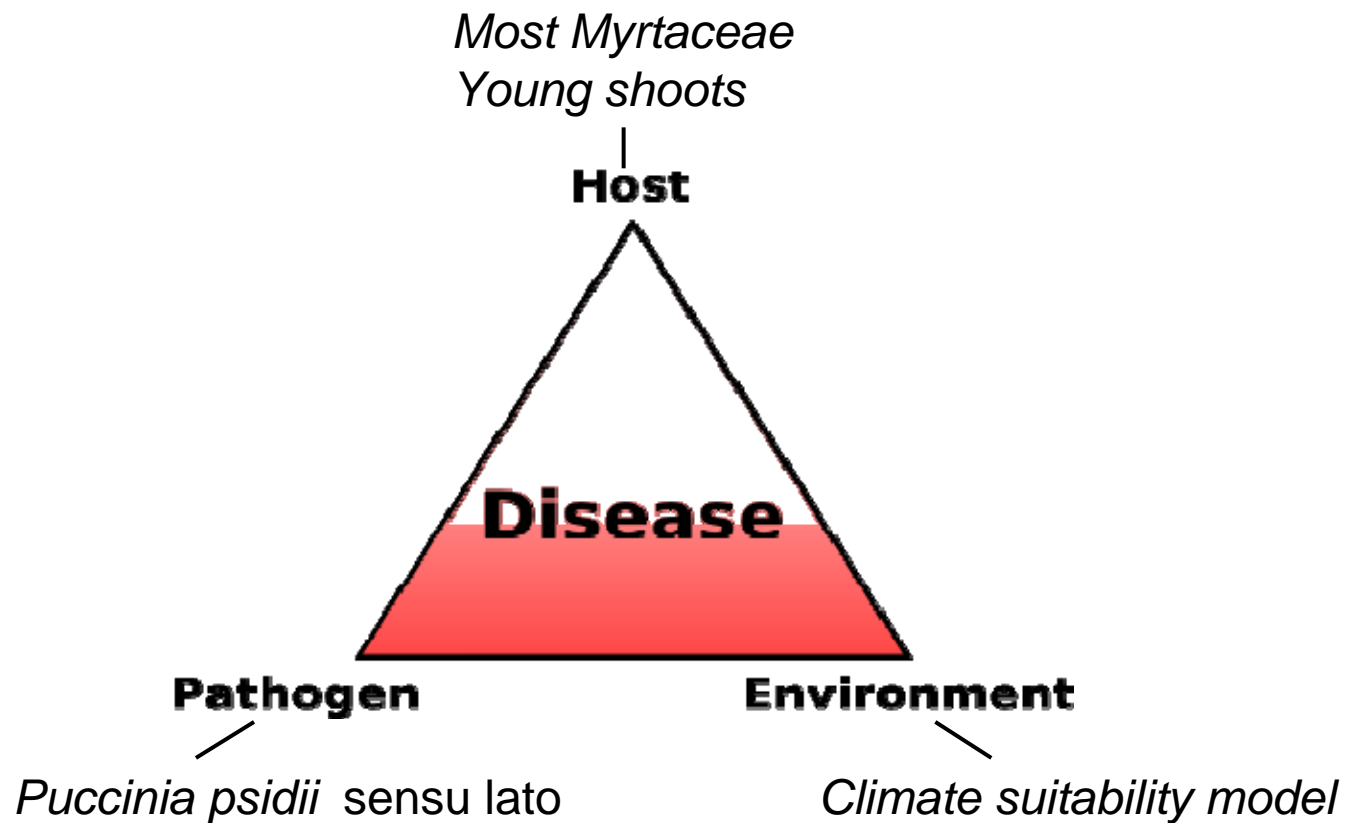


# Epidemiology

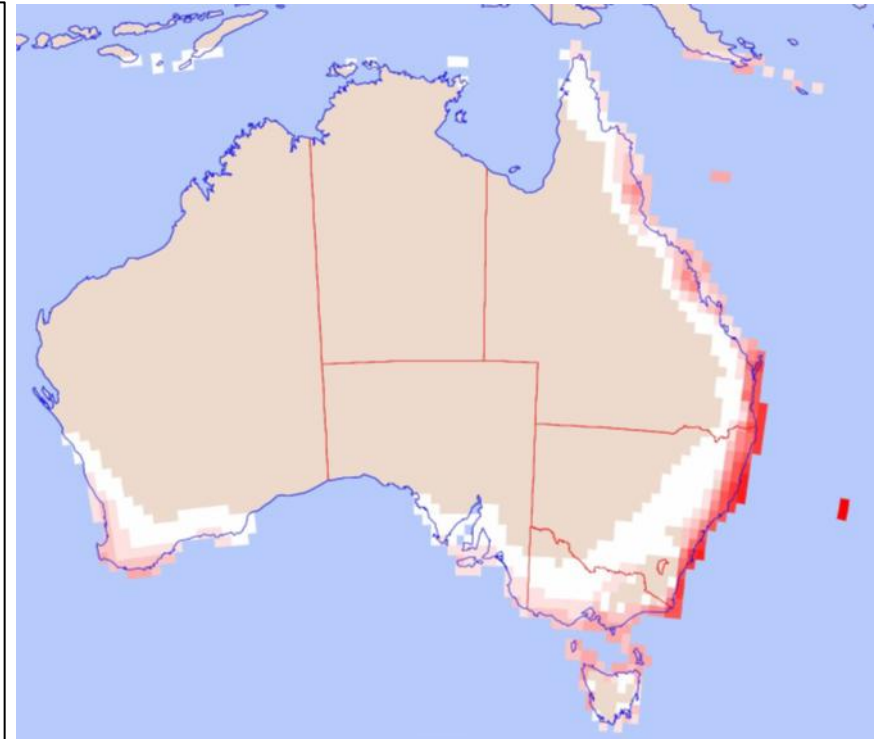
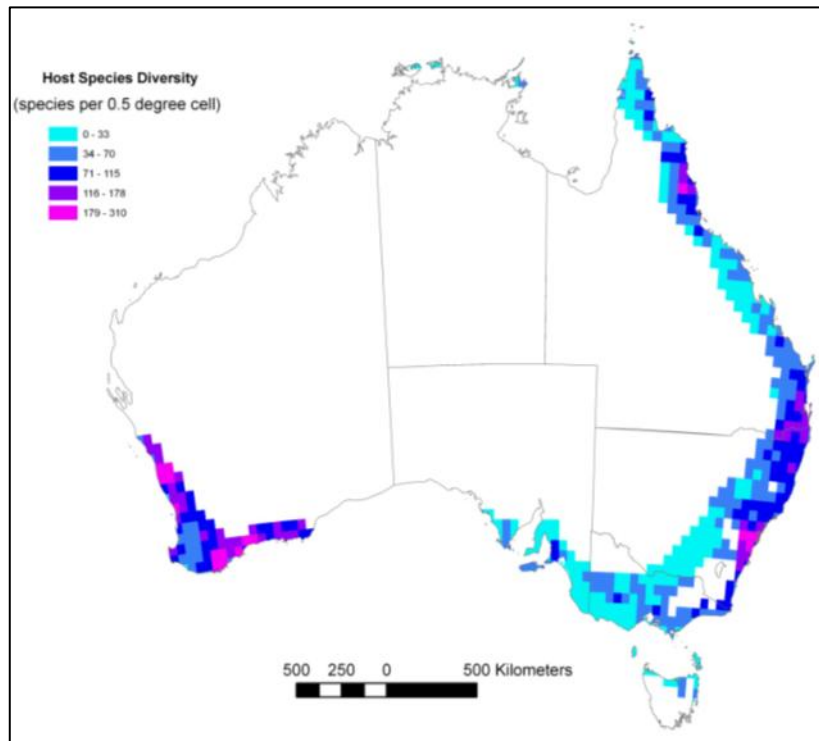


(T. H. Booth & T. Jovanovic, pers. comm.)  
(from Glen et al. 2007)

# Epidemiology



# Predicting hot spots for epidemics?



Australian Virtual Herbarium and Atlas of Living Australia

# Will we see this level of impact?



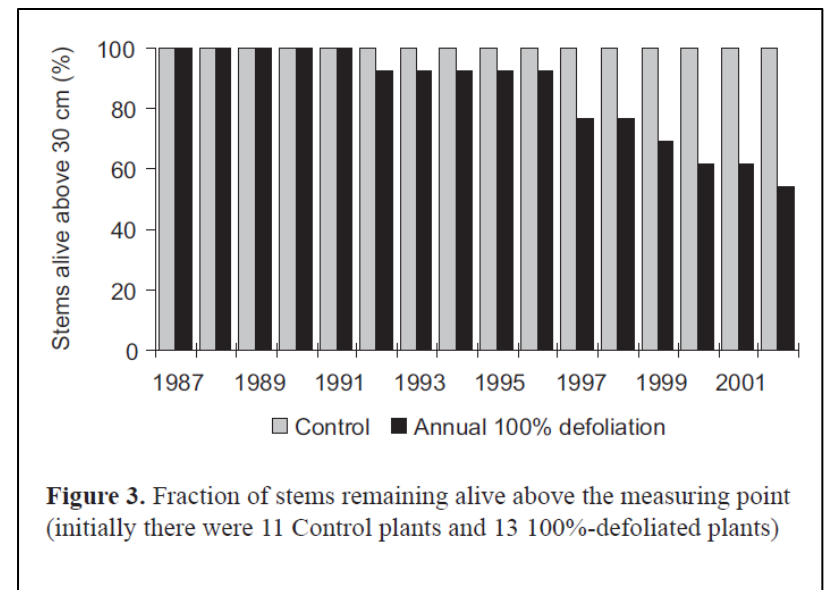
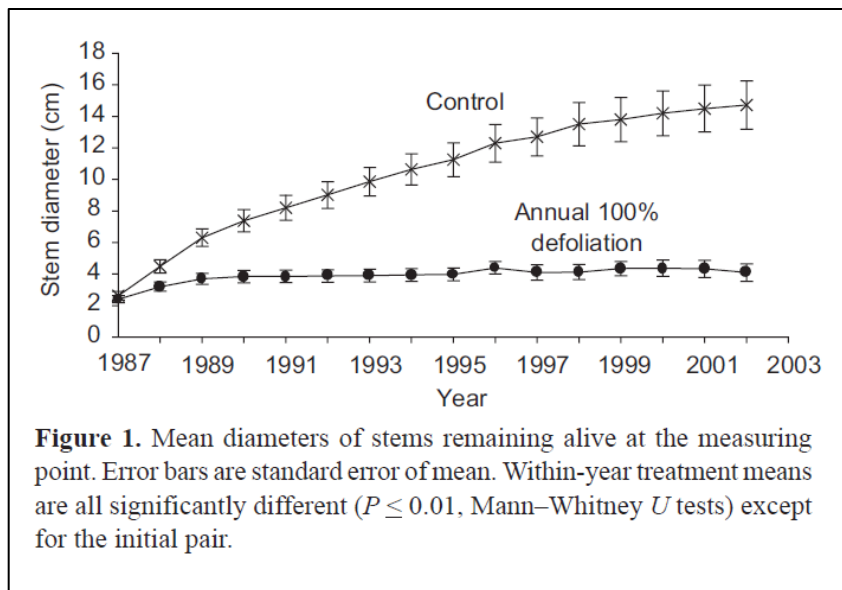
*Syzygium jambos* affected by *Puccinia psidii* on Maui, Hawaii (March 2008)  
(<http://www.hear.org/>)

# Will we see this level of impact?

## Impact of repeated defoliation on jarrah (*Eucalyptus marginata*) saplings

A.J. Wills<sup>1,2</sup>, T.E. Burbidge<sup>1</sup> and I. Abbott<sup>1</sup>

Australian Forestry 2004 Vol. 67, No. 3 pp. 194–198



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# Thank you

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