



Effectiveness of pathogens in reducing populations of invasive plants: The Australian bridal creeper case study

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Outline

- Introduce the case study
- Effectiveness:
 - Before and after release comparisons
 - Fungicide exclusion experiments
- Conclusions



Coast Swainson Pea after bridal creeper biocontrol

Target invasive plant

Bridal creeper (*Asparagus asparagoides*)

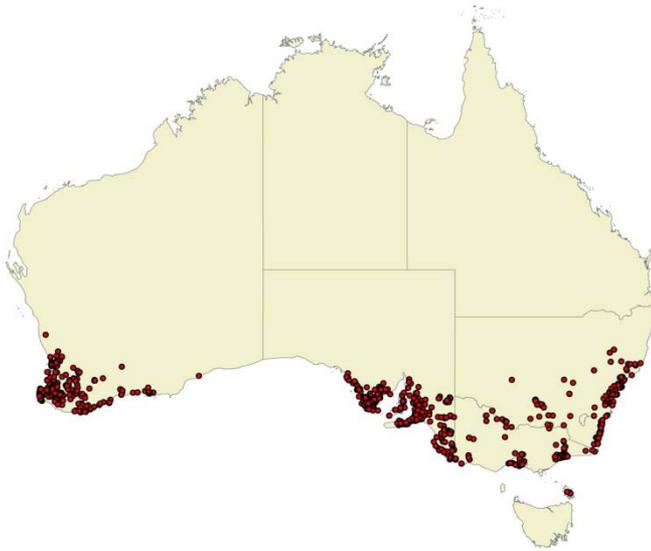
- a scrambling vine native to South Africa.
- introduced in Australia in the mid 1800's as an ornamental.
- became a major invasive plant across temperate regions, smothering large areas of native vegetation.
- extensive below-ground rhizomes and tubers.
- senesces in summer.



Pathogen agent released

Rust fungus *Puccinia myrsiphylli*

- Introduced in 2000
- Macrocytic and autoecious
- Released at > 2000 sites



Releases as of July 2008



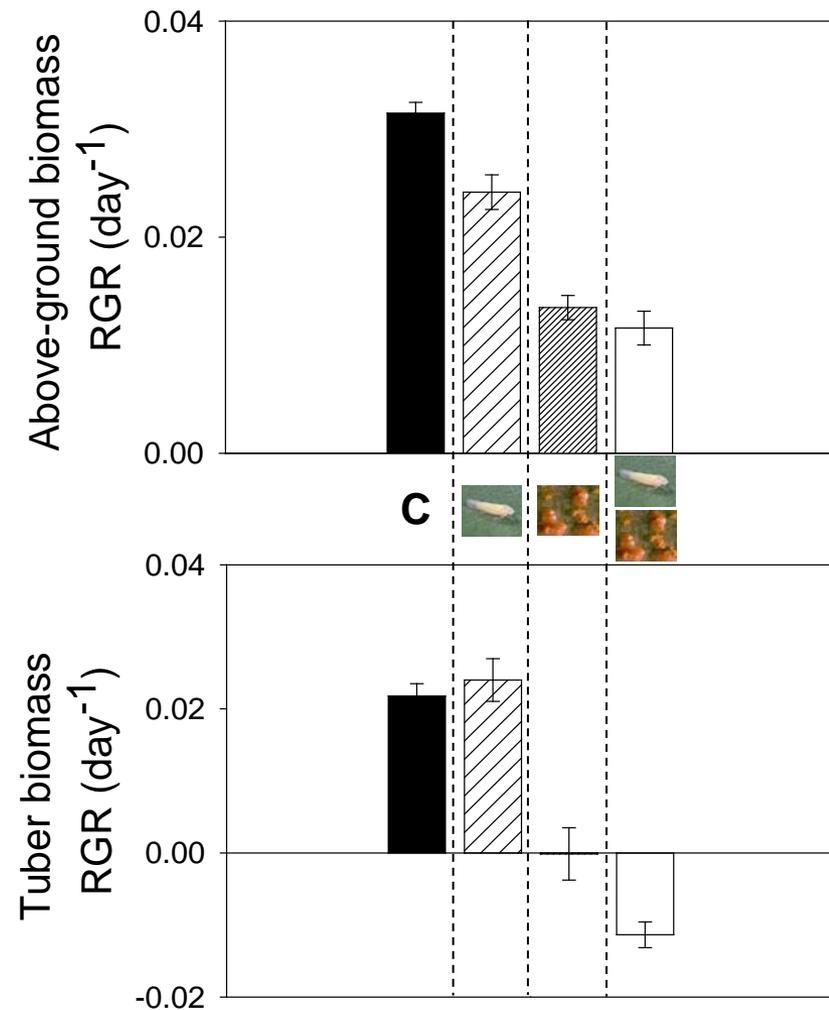
Insect agents released

Undescribed Erythroneurini leafhopper

- Introduced in 1999
- Previously *Zygina* sp.
- Released at ≈ 900 sites



Impact on bridal creeper



Turner et al. 2010. *Biological Control* 54: 322-330.

Insect agents released

Crioceris sp. leaf beetle

- Introduced in 2002
- Released at 82 sites
- Confirmed established at only 3 sites



Before and after release: photo points

Reduction of bridal creeper density following biological control at Yanchep NP, WA



2000



2003



+

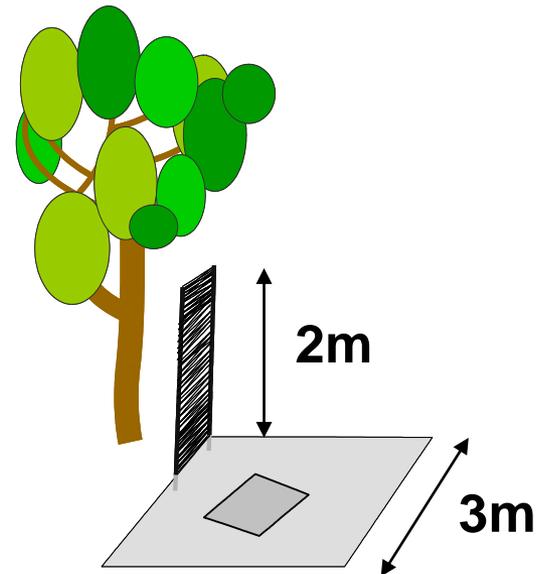
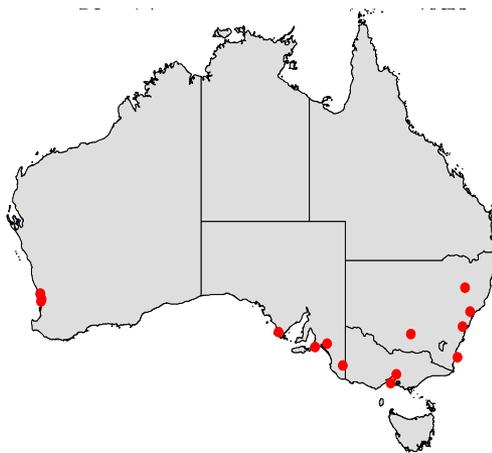


Leafhopper

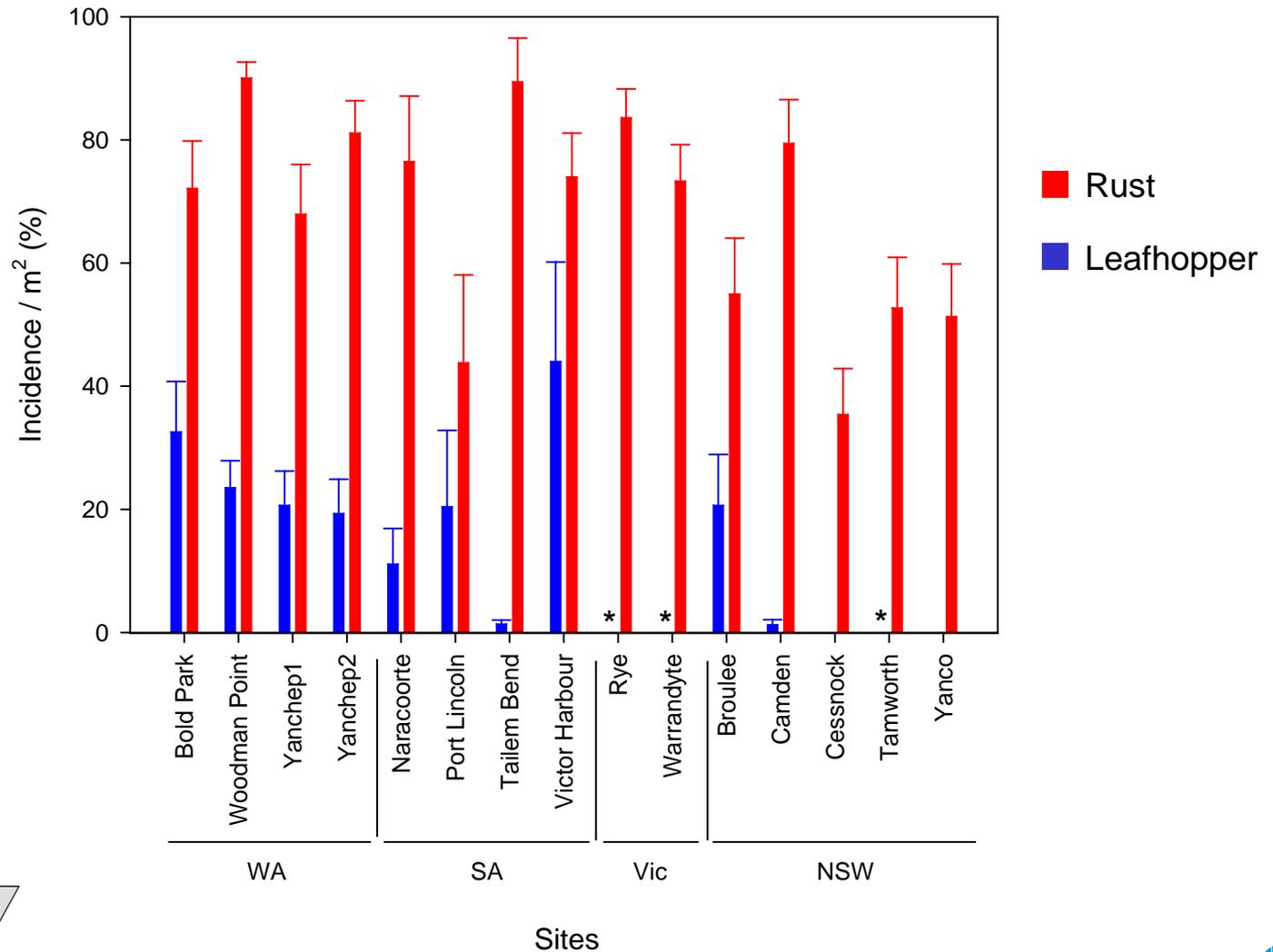
Before and after release: quantitative comparisons

Methods

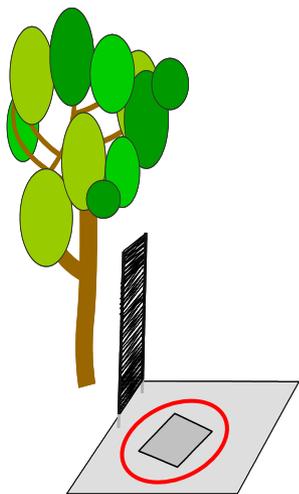
- 15 sites across Australia.
- 3-4 permanent plots (3X3m) with trellises (1X2m) per site.
- Growth and reproductive parameters of bridal creeper measured in mid-spring:
 - in a 1 m² quadrat within each plot and climbing on the trellis.
 - 1 to 3 years before release and up to 8 years after release.
- Incidence of rust and leafhopper also measured.



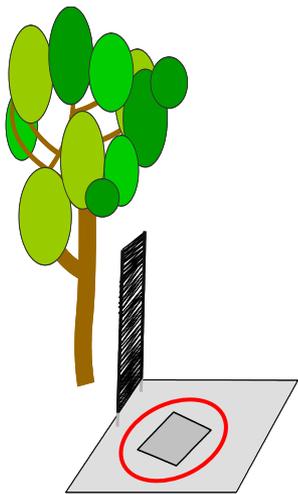
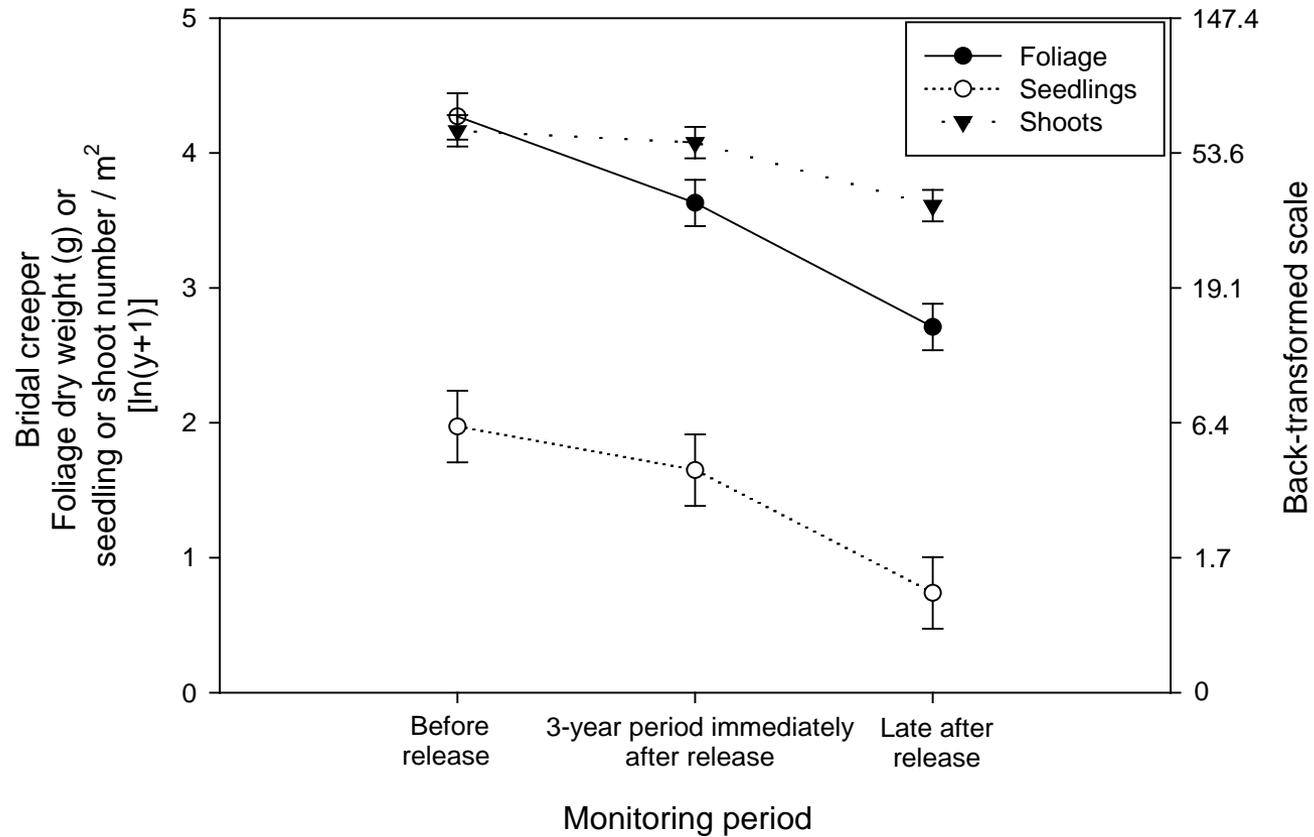
Before and after release: quantitative comparisons



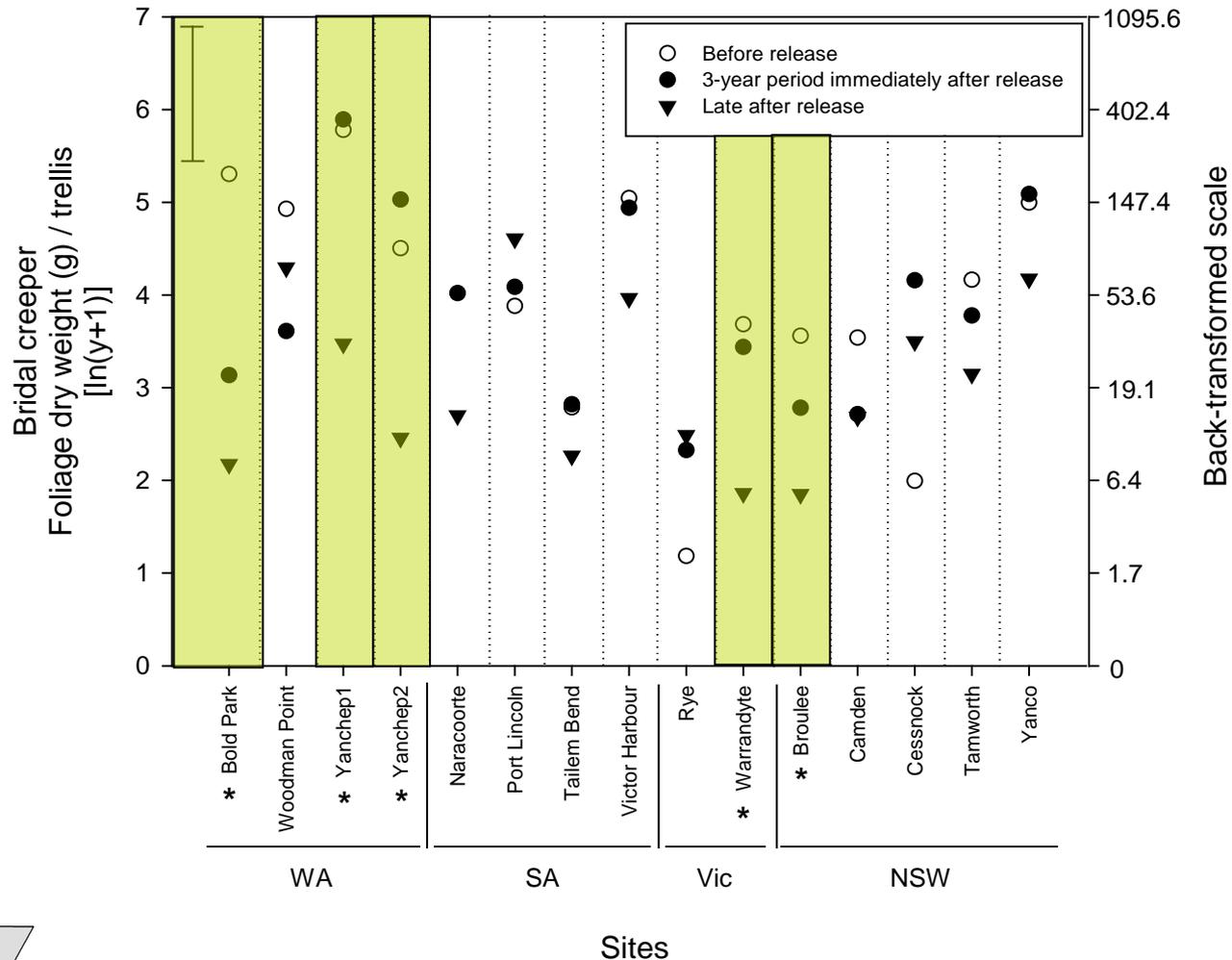
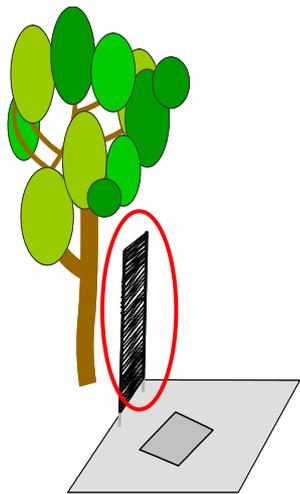
* = leafhopper not release at that site.



Before and after release: quantitative comparisons



Before and after release: quantitative comparisons

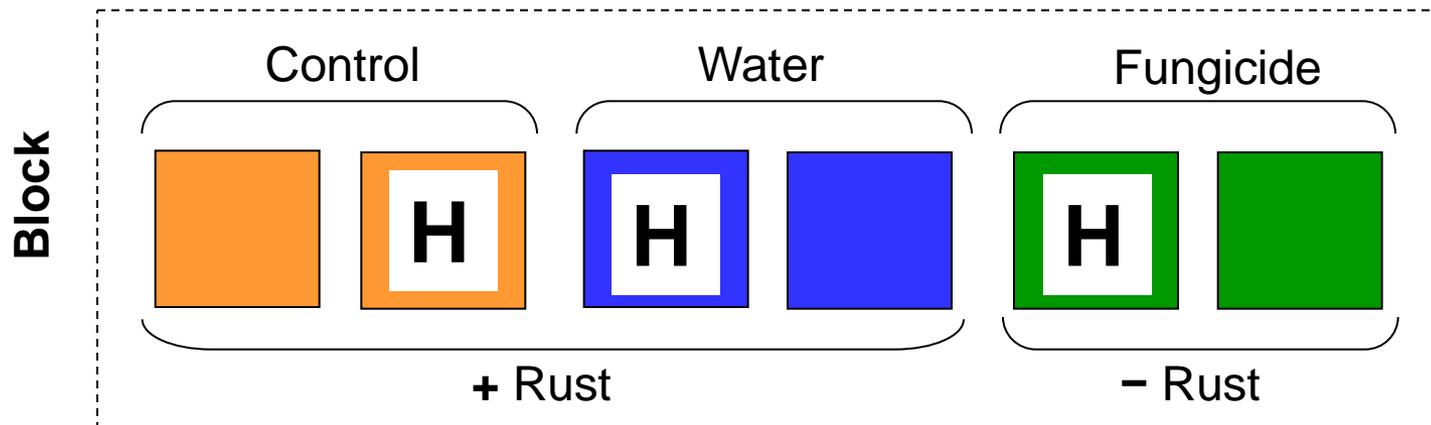


* = significant difference between 'Before release' and 'Late after release' measurements for that site.

Fungicide exclusion experiments

Methods

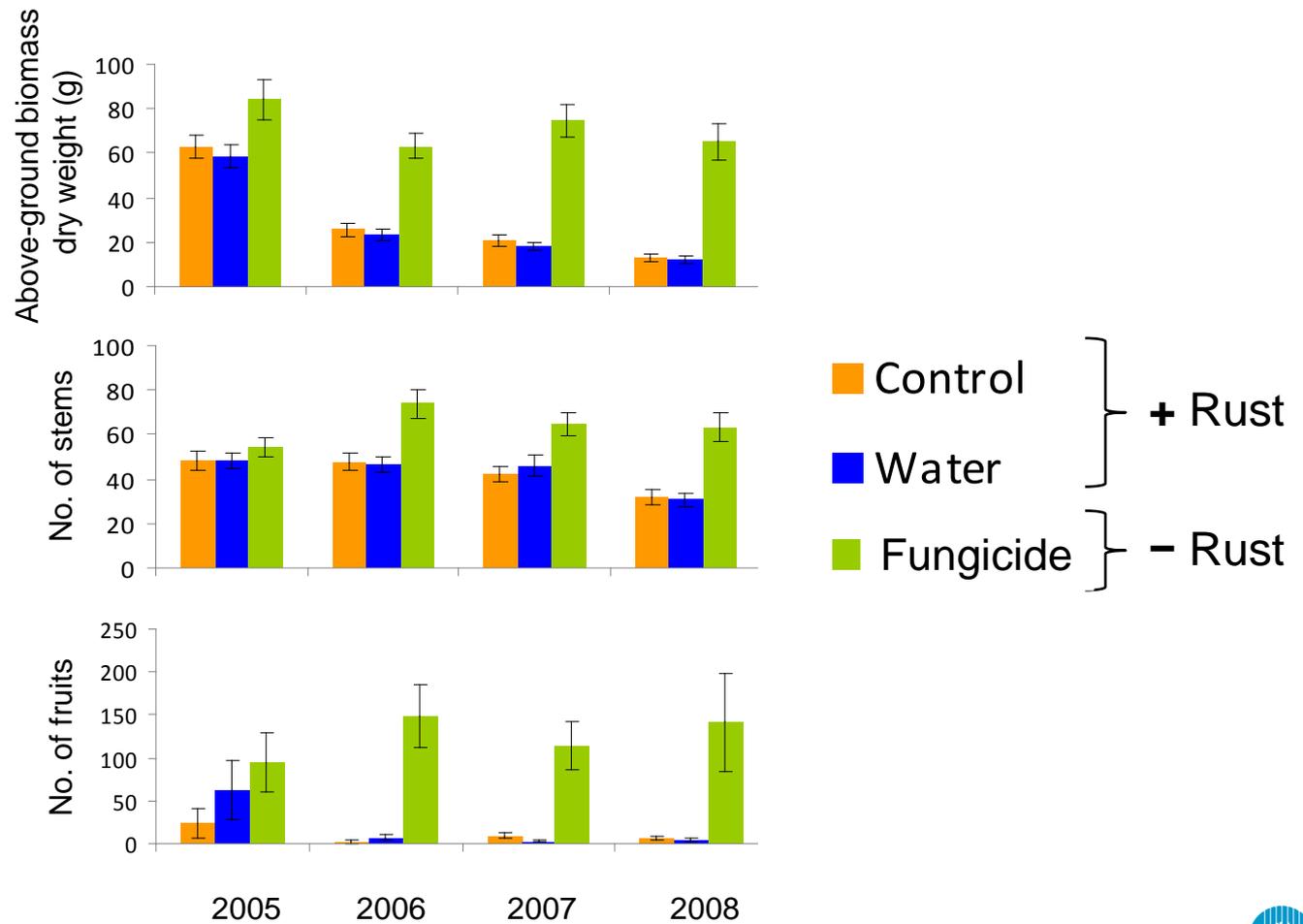
- Conducted over 4 years.
- 6 sites in NSW and WA.
- 3 treatments: control, water and fungicide monthly applications.
- 30 permanent quadrats (1m²) per treatment at each site (5 blocks)
- Measurements taken:
 - Bridal creeper above-ground growth and reproductive parameters each year.
 - Cover of associated vegetation each year.
 - Rust incidence and severity each year.
 - Bridal creeper below-ground biomass at the end of experiments.



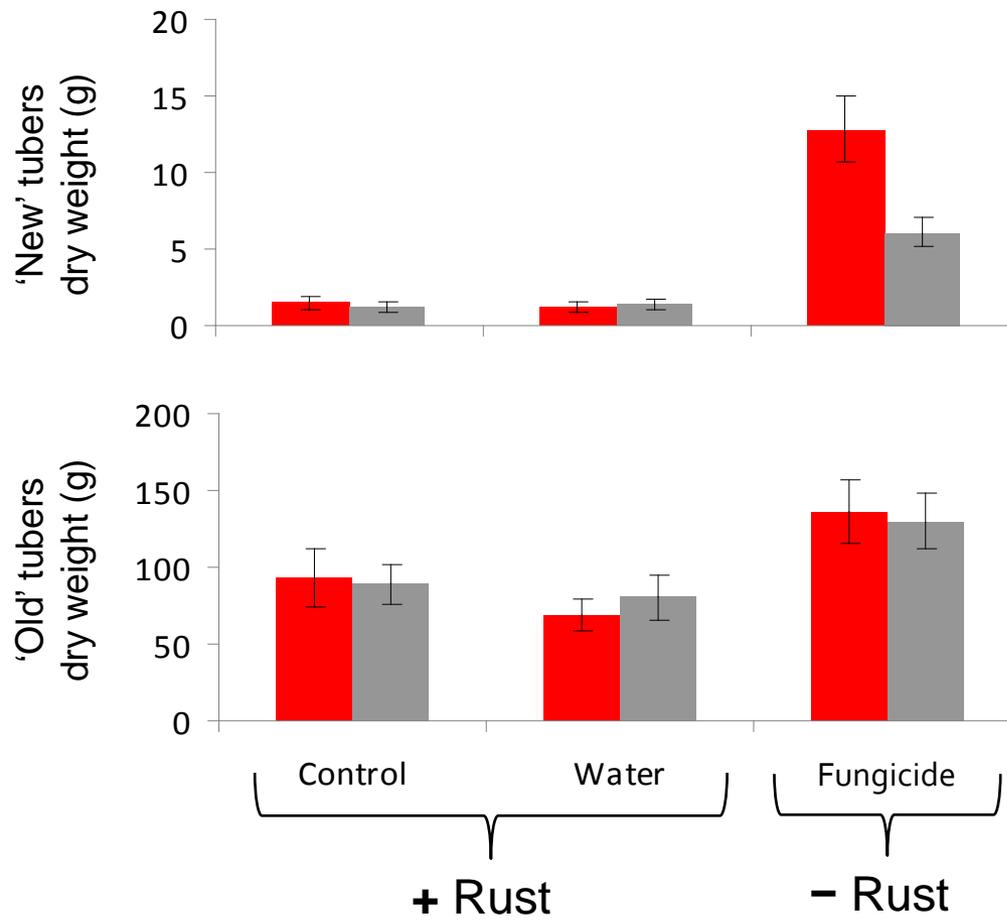
H = Foliage harvested in early October each year

Fungicide exclusion experiments

Bridal creeper measurements at time of harvest each year



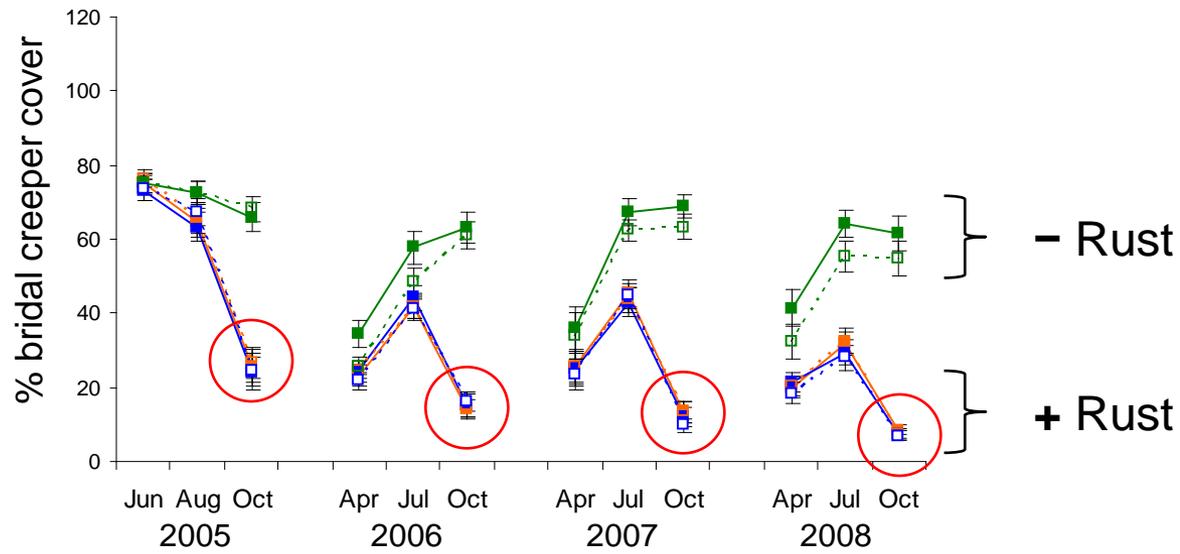
Fungicide exclusion experiments



■ Above-ground biomass **harvested** each year

■ Above-ground biomass **NOT harvested** each year

Fungicide exclusion experiments

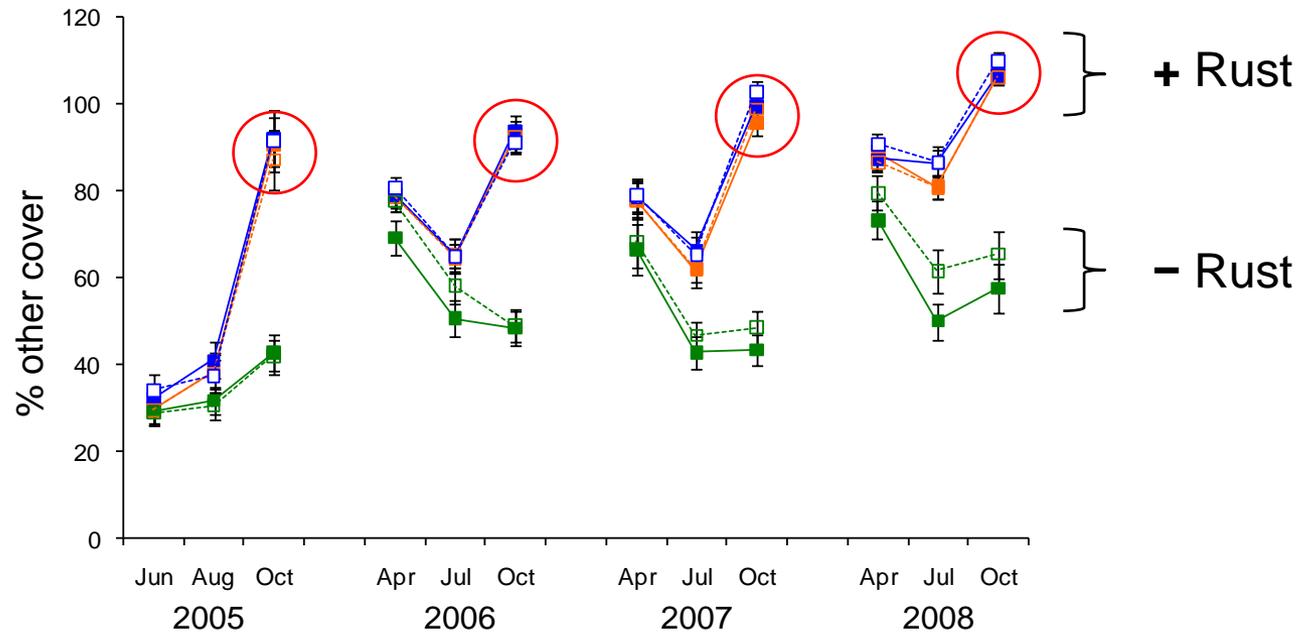


- Rust



+ Rust

Fungicide exclusion experiments



Significant increase in bare ground and leaf litter across all sites
Small increase in both native and invasive plant species



Leaf litter



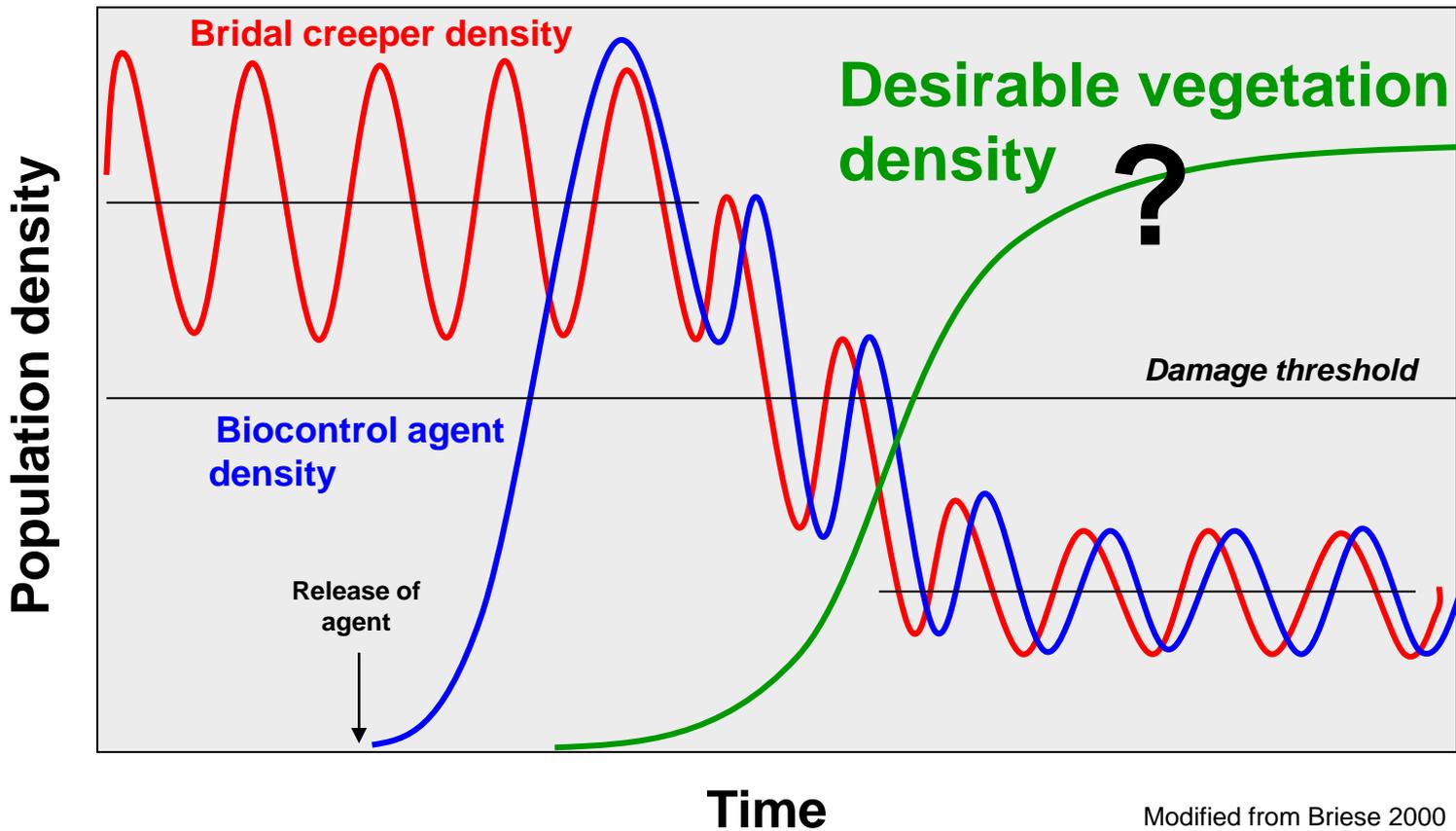
Clematis glycinoides



Asparagus scandens

Conclusions

Did we achieve our goal?



Modified from Briese 2000

Conclusions

Why has this rust fungus been so effective?



- A single genotype of bridal creeper present in Australia
- Rust fungus isolate released:
 - Perfectly ‘matched’ to the invasive genotype.
 - Sourced from the Western Cape Province of South Africa, which climatically matched bridal creeper-infested regions in Australia.
 - Infect all foliage, irrespective of age.
 - Well-synchronised with its host.
- Both plant and pathogen are active in winter:
 - Good rainfall and almost daily dew formation.

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- Peter Turner (DECC, NSW).
- John Virtue and colleagues (DWLBC, South Australia), John Hosking and Royce Holtkamp (I&I NSW), Greg Lefoe and colleagues (DPI Victoria).

Acknowledgements

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