

**Importing the rust fungus *Uromyces
pencanus* as a biocontrol agent for
Chilean needle grass into NZ –
a decade long journey**

Alana Den Breeyen

Chantal Probst, Jane Barton, Freda Anderson

The 'first' step...



- Biological control programme initiated in Argentina in 1999
- *Nassella* spp. native to Peru, Chile, Uruguay & **Argentina**

Nassella trichotoma – serrated tussock

Nassella neesiana – Chilean needle grass

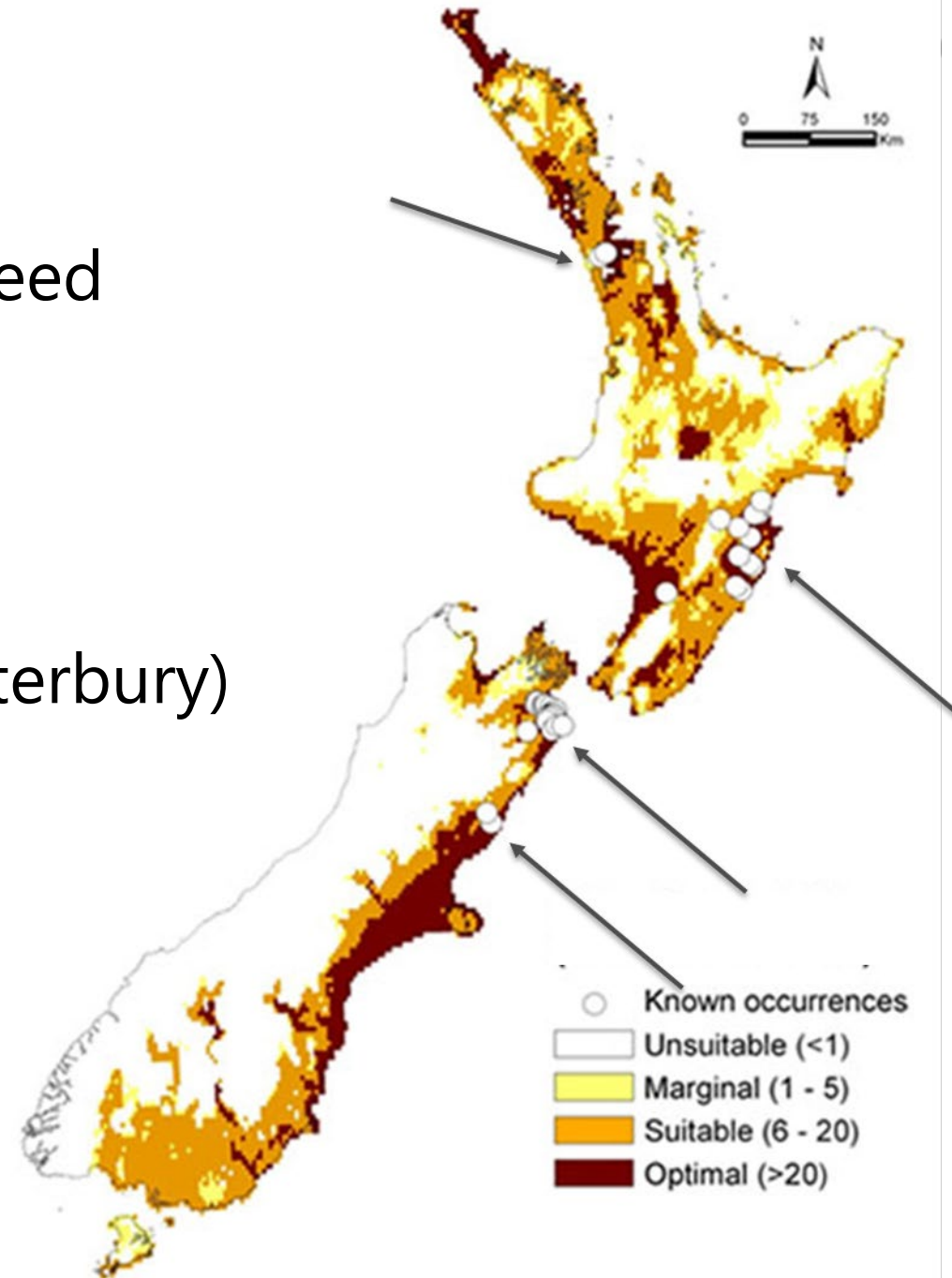


Image: Seona Casonato

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The 'reason why' step...

- Serious agricultural and environmental weed
- 3500–4000 ha infested in NZ
- **Potential to invade 15 million ha**
(1 million ha high-producing pasture in Canterbury)

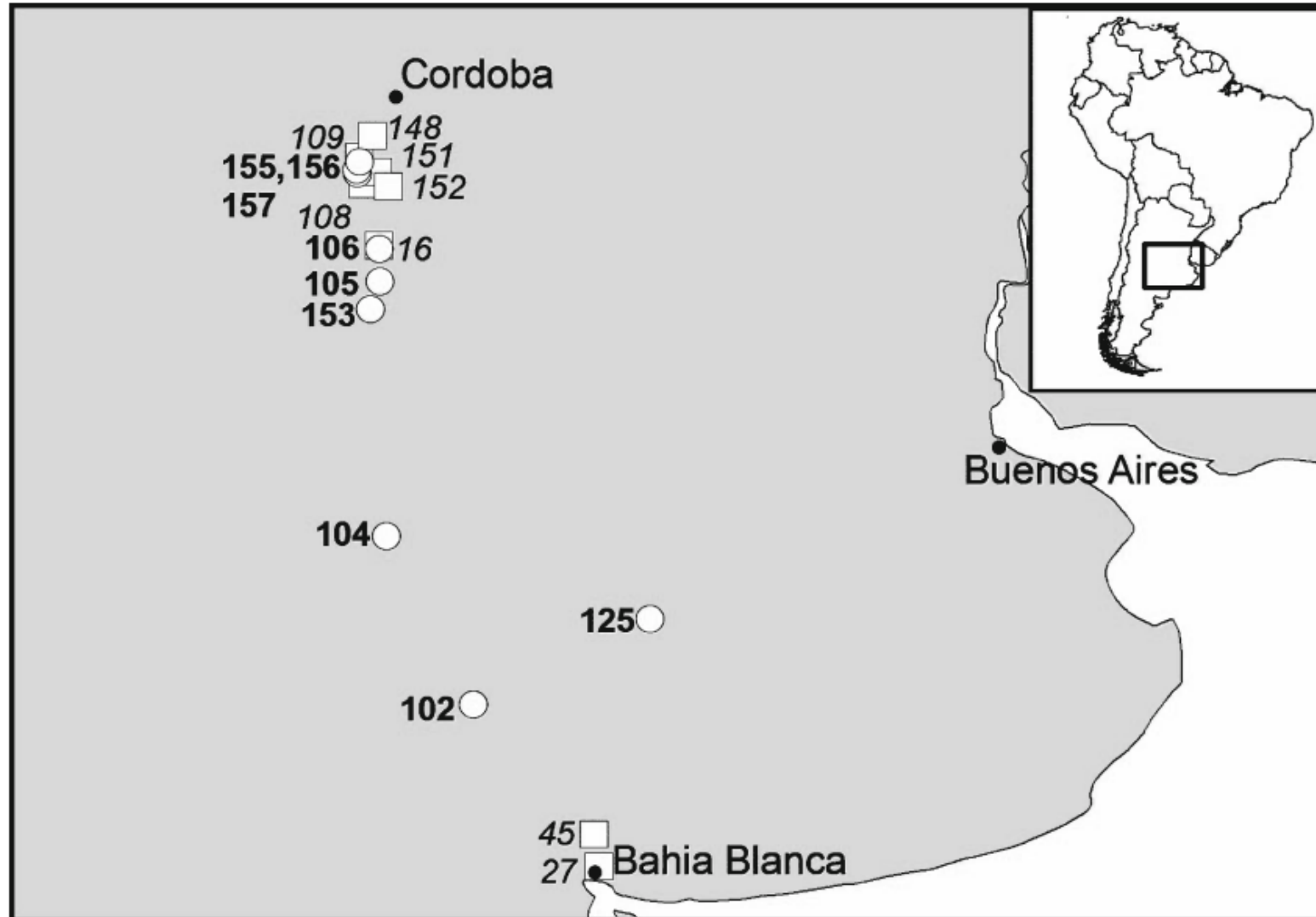


(Graeme Bourdôt et al. 2010)

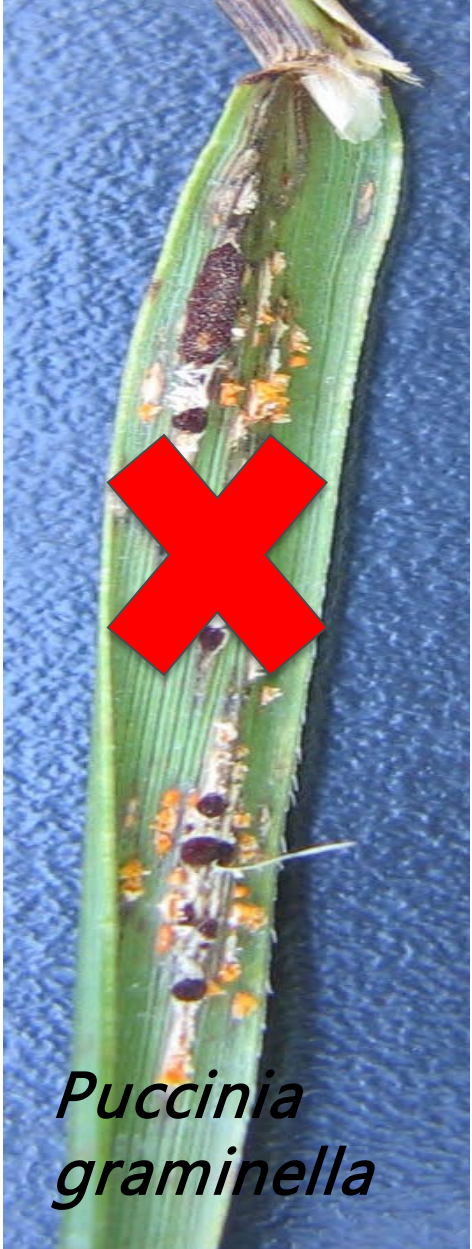
The 'survey the scene' step...



- Field surveys in Argentina from 2003-2008



The 'main suspects'...



What are and why do we work with rust fungi?



- **Obligate biotrophs**

= Cannot live without their host

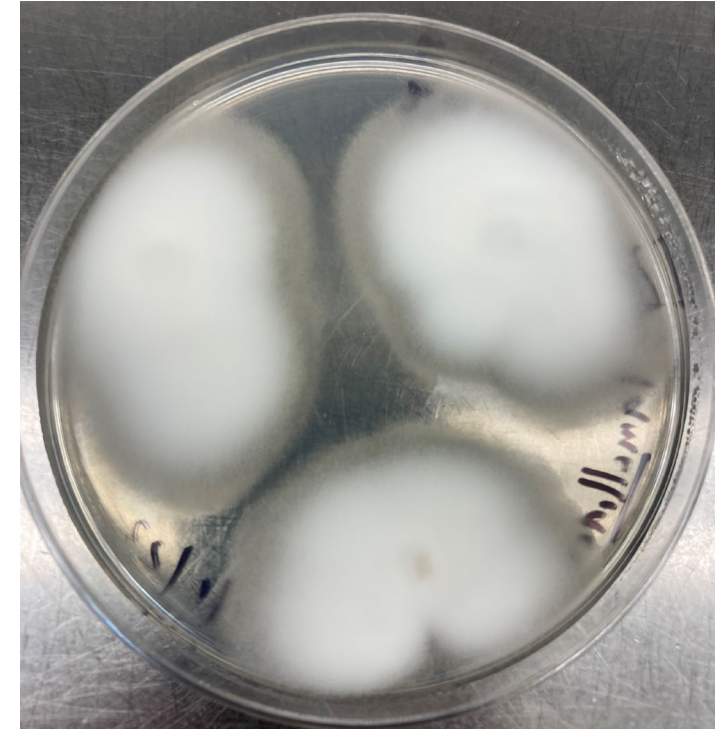
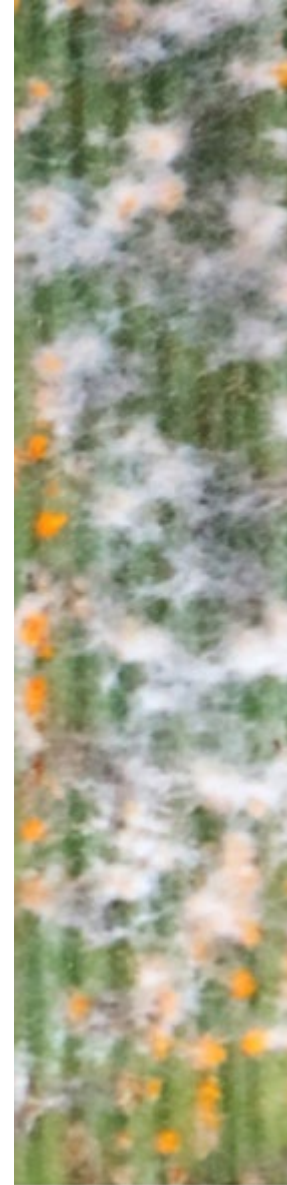
- 26 of the 36 plant pathogens released as BC agents are rust or smut fungi
- Highly host specificity
- Dry, airborne spores (spread readily)
- Self-spreading – <1 m to >50 km
- Often cause heavy disease symptoms



The 'remove the mycoparasite' step...

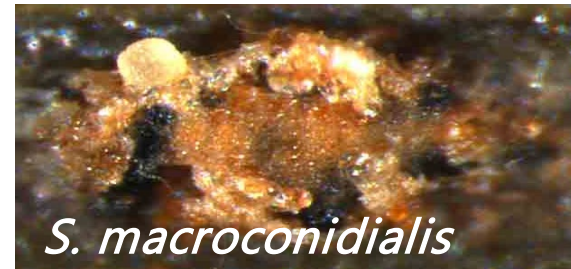
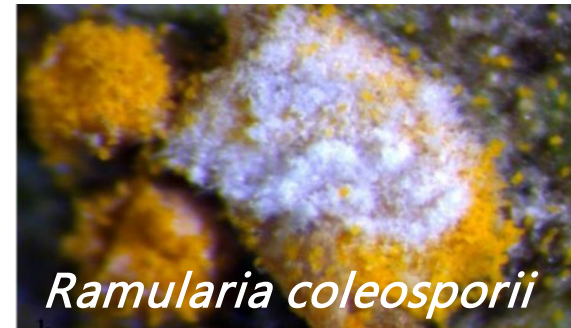
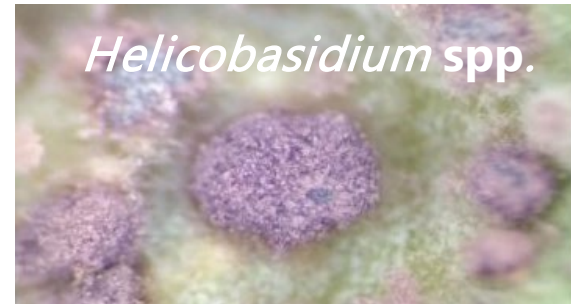


- Mycoparasite identified
- *Simplicillium* sp.
- Not prevalent in field
- Interfered with spore production
- Eliminated by storing at -70°C



Known mycoparasites of rust fungi in New Zealand

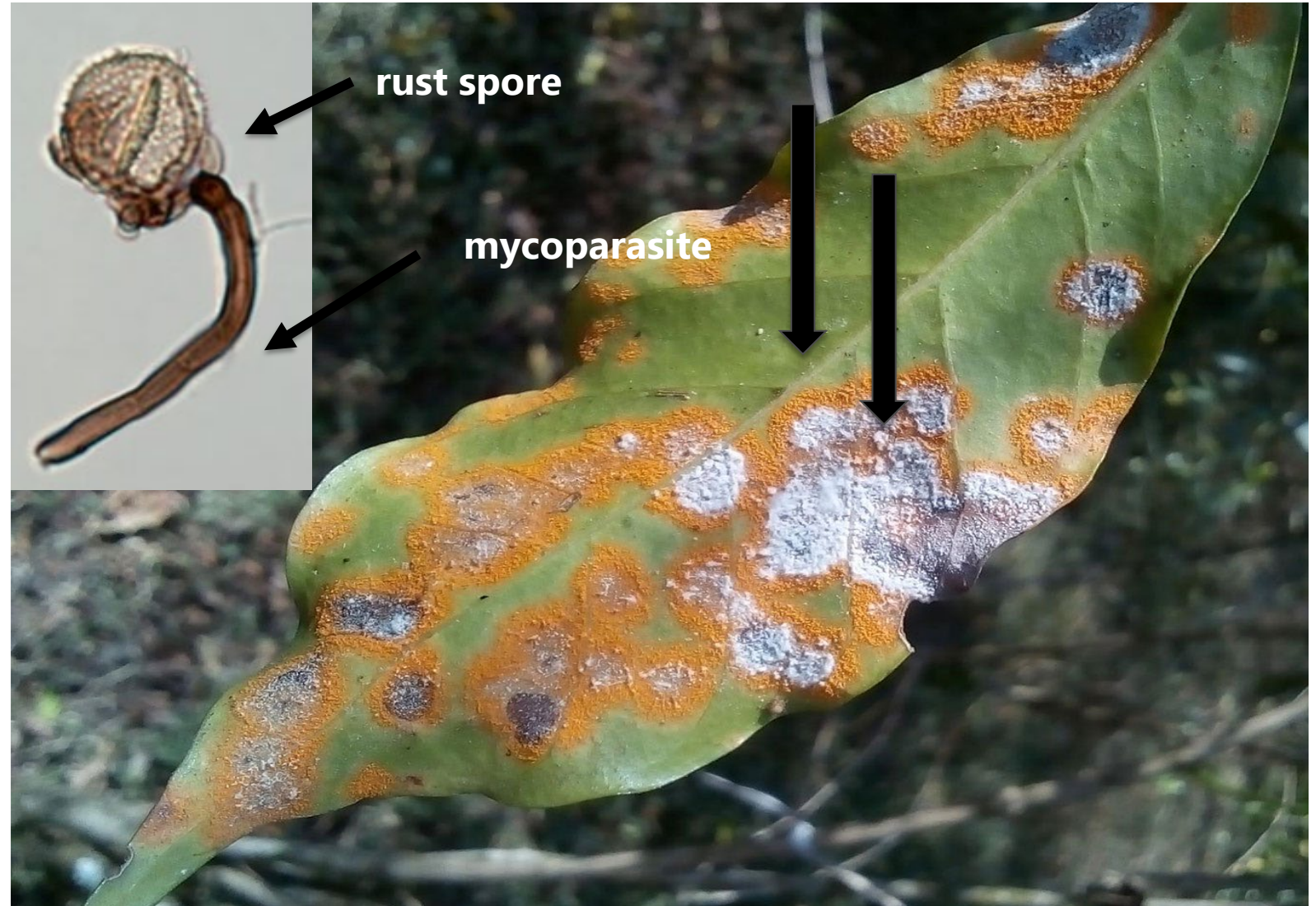
- *Sphaerellopsis filum* – generalist - 60 records in the NZ Biota
- *Helicobasidium* spp. – generalists
- *Fusarium* sp.
- *Ramularia coleosporii*
- *Cladosporium uredinicola*
- *Cladosporium aecidiicola*
- *Cladosporium* sp.
- *Acremonium* sp.
- *Sphaerellopsis macroconidialis**



Mycoparasitism:

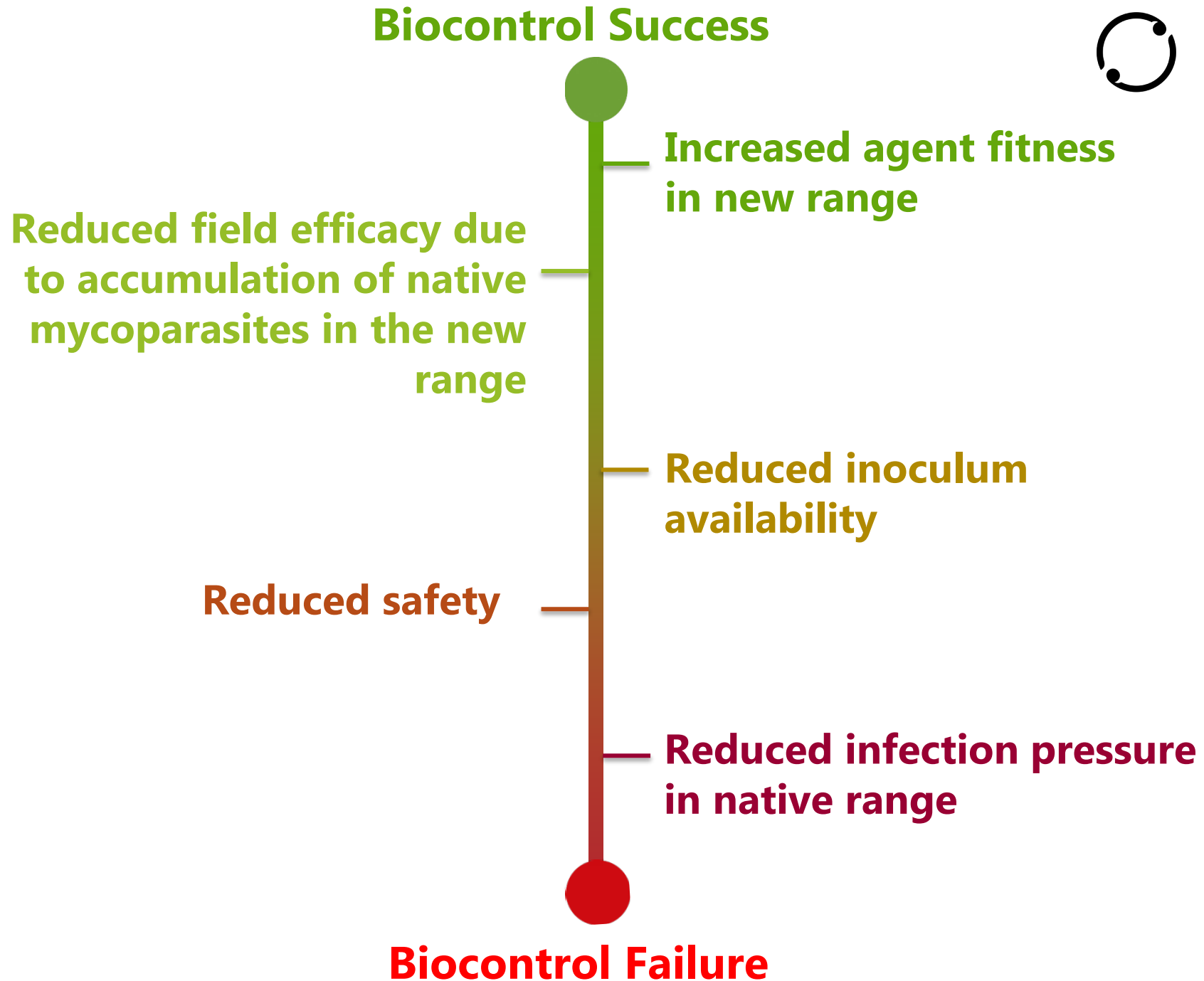
- Mycoparasitic interactions are common in nature
- Form part of the mycobiota of plants

Where one fungus parasitises another, the natural enemy of the plant's natural enemy



The Issue for Biocontrol:

Variable establishment and effectiveness of fungal biocontrol agents



The 'most important' step...

Host specificity testing

- 65 species tested
- No native *Nassella* species in NZ
- Stipoid grasses – Stipeae Tribe
- Three native taxa only
- Host specific - pustules only developed on target weed in NZ



The 'necessary' steps...



2011

2017

2020



Expired



Environmental Protection Authority
Te Mana Rauhi Taiao



Convention on Biological Diversity



Nagoya Protocol

Provides a transparent legal framework for the effective implementation of fair and equitable sharing of benefits arising out of the utilization of genetic resources

The 'unforeseen' step...



- Further host range test results became available
- Pustules developed on two native Australian *Austrostipa* species
- Neither species grows in NZ
- Further testing of 3 native NZ taxa recommended



Achnatherum petriei



Anemanthele lessoniana



Austrostipa stipoides

The necessary steps...



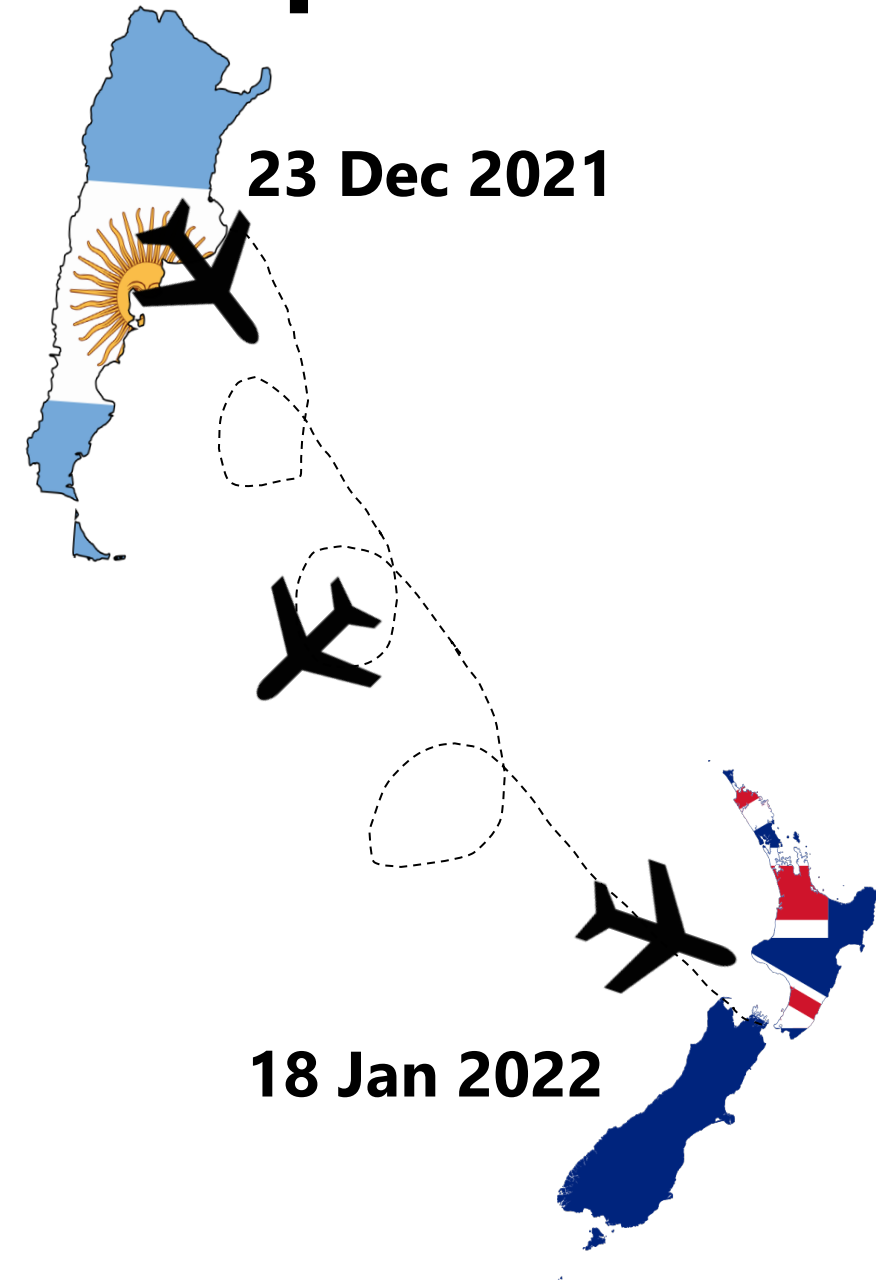
Environmental
Protection Authority
Te Mana Rauhi Taiao

Time waiver

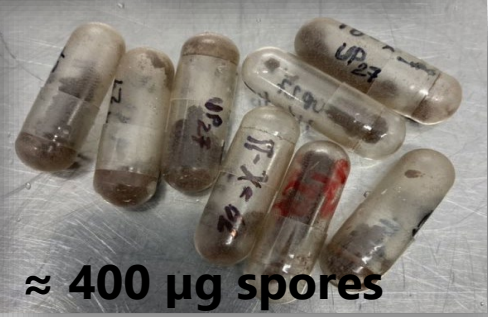
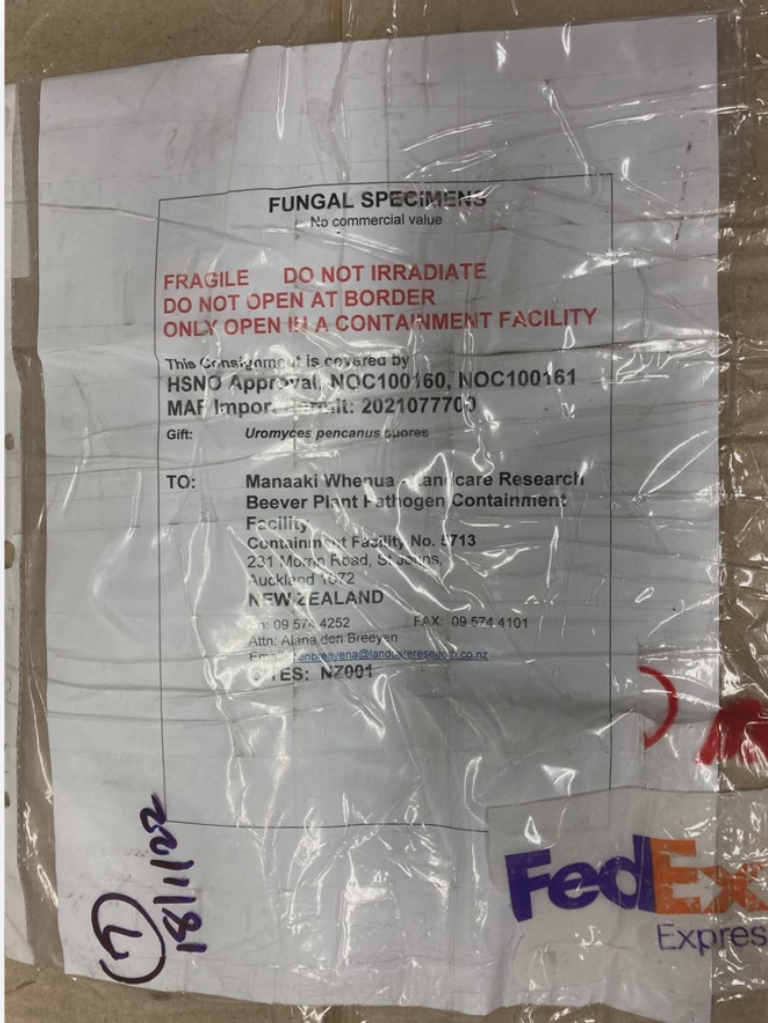
'Heading in the right direction' step...



- September 2021 - Argentinian export permit approved
- 3 months to export
- Delayed
 - 7 days to leave Argentina
 - short stay in Tennessee
 - couple of days at FedEx Facility NZ



The 'what we thought were the last few steps' step...



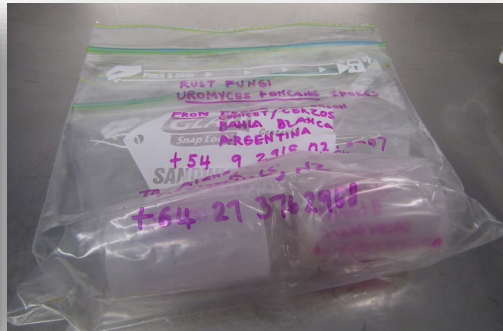
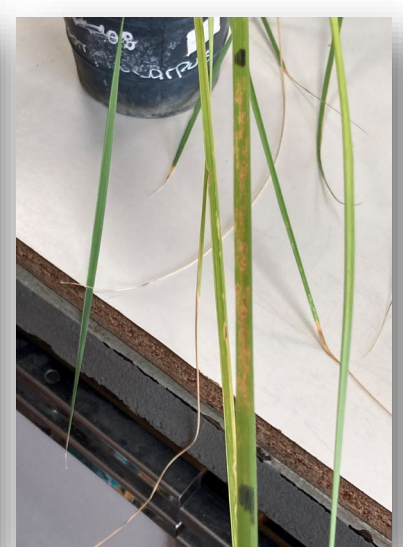
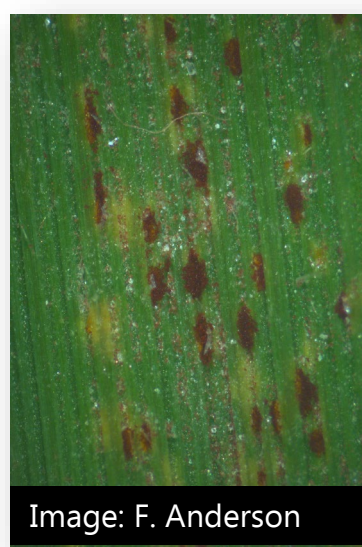
The 'final final' steps....

Feb–Nov 2022

- New plants grown from seed
- Fresh rust culture produced
- Export process re-started

Dec 2022

- Permission to export granted
- Hand carried into NZ
- Inoculated NZ CNG



The 'Whoohoo' steps....

Jan-Mar 2023

- Established rust culture successfully in containment

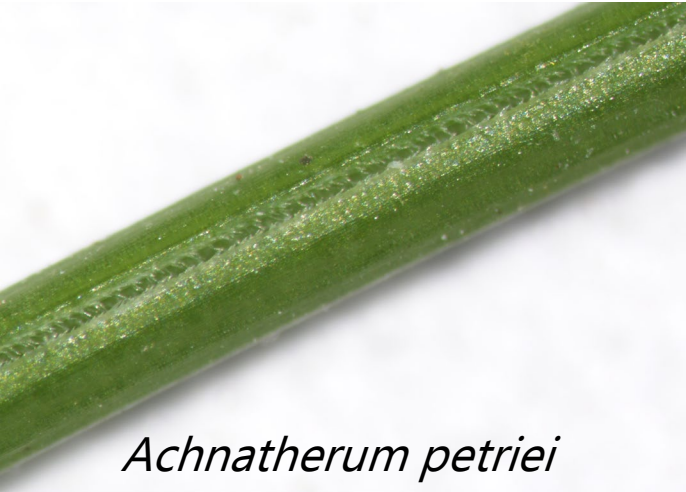


Apr-Dec 2023

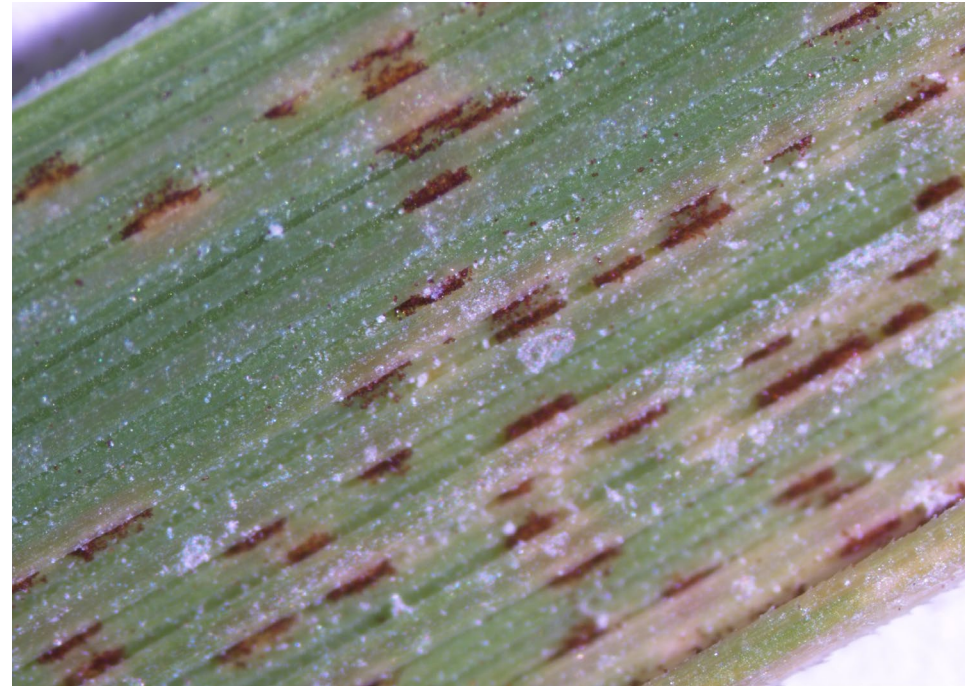
- Complete host range testing
- Apply for amended EPA permit
- Release the agent!!!!



'Host range test' step...



Achnatherum petriei
No infection



Nassella neesiana
100% infection; pustules



Anemanthele lessoniana
Infection, chlorosis;
no pustules



Austrostipa stipoides
Infection, chlorosis and leaf
lesions;
no pustules

N=4; 3 leaves per plant
30 days post inoculation

'Those who helped make the steps happen'...



Funders

- National Biocontrol Collective
- NZ Ministry for Primary Industries' Sustainable Food & Fiber Futures Fund (contract No S3F20095)

Contributors

- David López Villegas – Technological Liaison Officer, Conicet, Argentina
 - Juan Daddario – Plant Pathologist, Conicet, Argentina
 - Liam Falconer (Marlborough Regional Council)
 - Darin Underhill (Hawke's Bay Regional Council)
- } Supply of CNG seed