FOREST GROWERS RESEARCH

Bio-Protection
Bioprotection science for New Zealand

New approaches to pest, weed and disease management from fundamental research

Travis Glare
Bio-Protection
Research Centre

Bio-Protection Research Centre 2017

supported by forestgrowers commodity levy

About the Centre

Bio-Protection Research Centre

- Seven partner organisations
- Hosted by Lincoln University
- Established in 2002
- Conducting fundamental through to applied research
- All plant based primary sectors covered
- Links with key bioprotection groups in NZ

Bio-Protection
Bioprotection science for New Zealand
SCION forests · products · innovation
Massey University
agresearch
Plant & Food RESEARCH
Lincoln University
University of Otago
UC University of Canterbury

Mission

Bio-Protection
Bioprotection science for New Zealand

The sustainable reduction and prevention of damage to our land-based plant ecosystems from pests, weeds and diseases

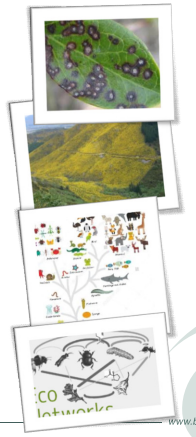
Big questions in plant protection

What makes an organism a disease?

How will organisms evolve?

Why are some species invasive in some places?

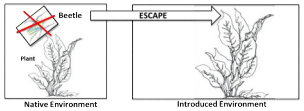
How do organisms interact?



What have we found?

Why are some species invasive?

Weed competitiveness is due to climate niche shifts and lack of natural enemies, but not increased phenotypic plasticity or competitiveness



NZ plants escape specialist natural enemies

Pyropteron chrysidiforme (Dock moth): 8% of plants

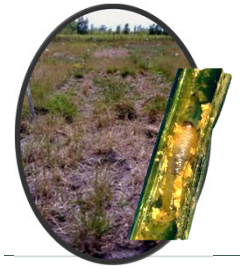
Gastrophysa viridula (Green dock beetle): 12% of plants

Hypera rumicis (Weevil): 28% of plants

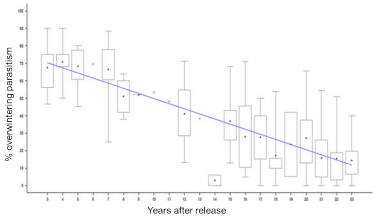
What have we found?

Making biocontrol more resilient

Evasive behaviour by the Argentine stem weevil strongly associated with decline in parasitoid control. Investigating the evolutionary cause; the asexual parasitoid is limited in genetic variability



Dramatic decline in over wintering parasitism levels over 22 years (national trend) >300 mean pop parasitism observations

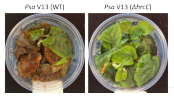


What have we found?

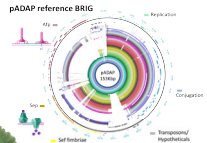
Understanding disease- the good and the bad

Shown role of key effectors in *Phytophthora agathidicida* (kauri dieback) and *Pseudomonas syringae* pv. *actinidiae* (Psa)

Effectors are critical for *Psa* virulence



A. chinensis Hort16a 50 days post infection

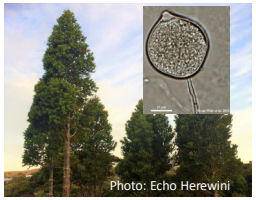


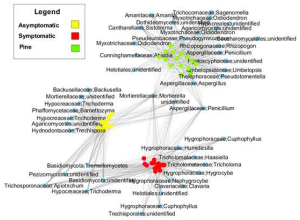
Making biopesticides more effective: how genetic variation in bacterial insect disease is driving field performance

What have we found?

Characterised fungi and bacteria in soils from uninfected and infected sites, and identified microbes for biocontrol screening against *P. agathidicida*

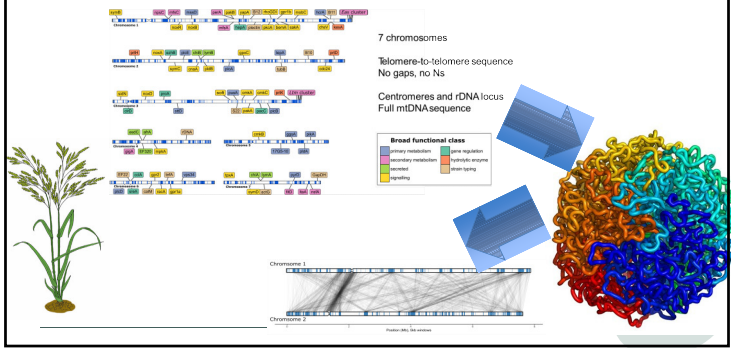
Working with Māori communities to understand how kauri dieback moves between trees





What have we found?

Complete chromosome assembly of the *Epichloë festucae* endophyte genome and resolved its 3D organisation in the nucleus

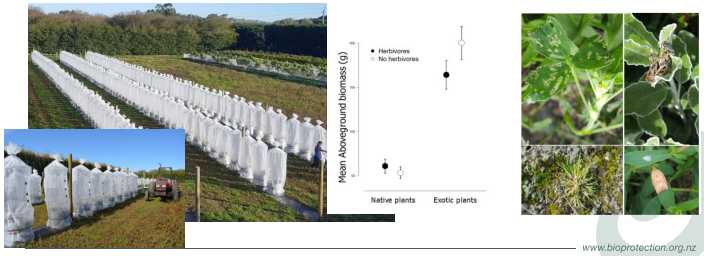


What have we found?

Mesocosm experiment found that the effects of alien plants on ecosystem carbon cycling depend on both soil biota and herbivores, suggesting that understanding cross-taxa interactions is critical for the future of bioprotection

Altered interactions with herbivores:

Herbivores consumed more exotic biomass



Outcomes

Better prediction and response-Know which organisms are the biggest risk

Novel approaches, as well as maintaining and improving existing biocontrols- links to applied programmes

Integrated pest management systems

Māori integrated into the biosecurity and bioprotection effort

Skilled practitioners for industry and government

- Rapid evolution
- What makes a disease?
- Better biocontrols
- Complex ecosystems
- Māori Bioprotection
- Trained workforce

Future focus: The next BPRC

Focus on ecosystem health- both productive and natural

How to fix ecosystems and make resilient

- new tools and approaches
- integrated pest management

Social, economic and cultural aspects

Toitū te marae a Tāne
Toitū te marae a Tangaroa
Toitū te iwi
If the world of Tāne (all living things on land) endures
If the marae of Tangaroa (the lakes, rivers and sea) endures
The people endure

Bio-Protection
Bioprotection science for New Zealand

Bio-Protection Research Centre
PO Box 84
Lincoln University
Lincoln 7647, New Zealand
P + 64 3 325 3696
F + 64 3 325 3864
www.bioprotection.org.nz

FOREST GROWERS RESEARCH

Bio-Protection
Bioprotection science for New Zealand

www.fgr.nz

Travis Glare
Potential for Biocontrol of Pathogens
travis.glare@lincoln.ac.nz
www.bioprotection.org.nz

16 October 2019

supported by forestgrowers commodity levy