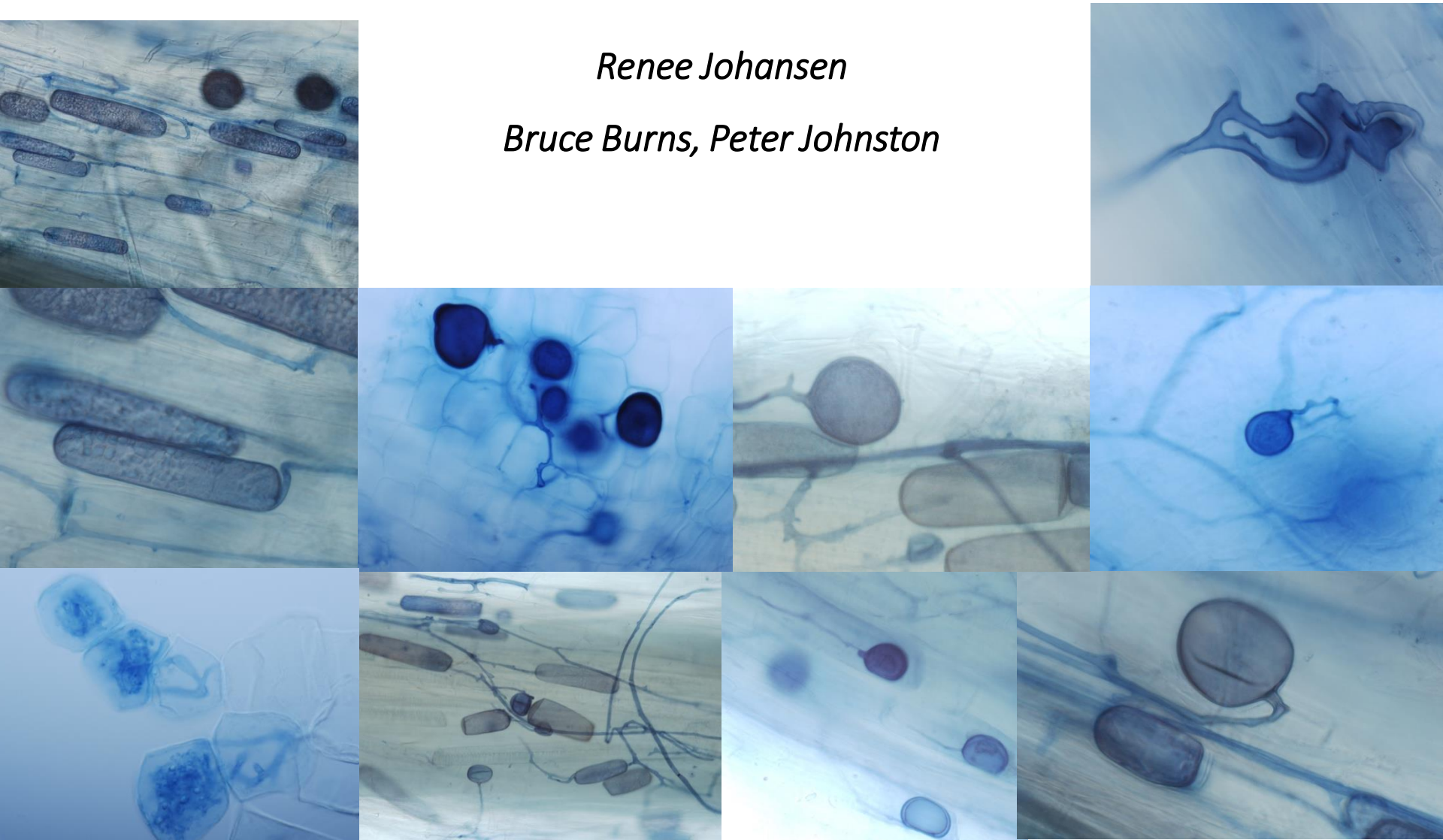
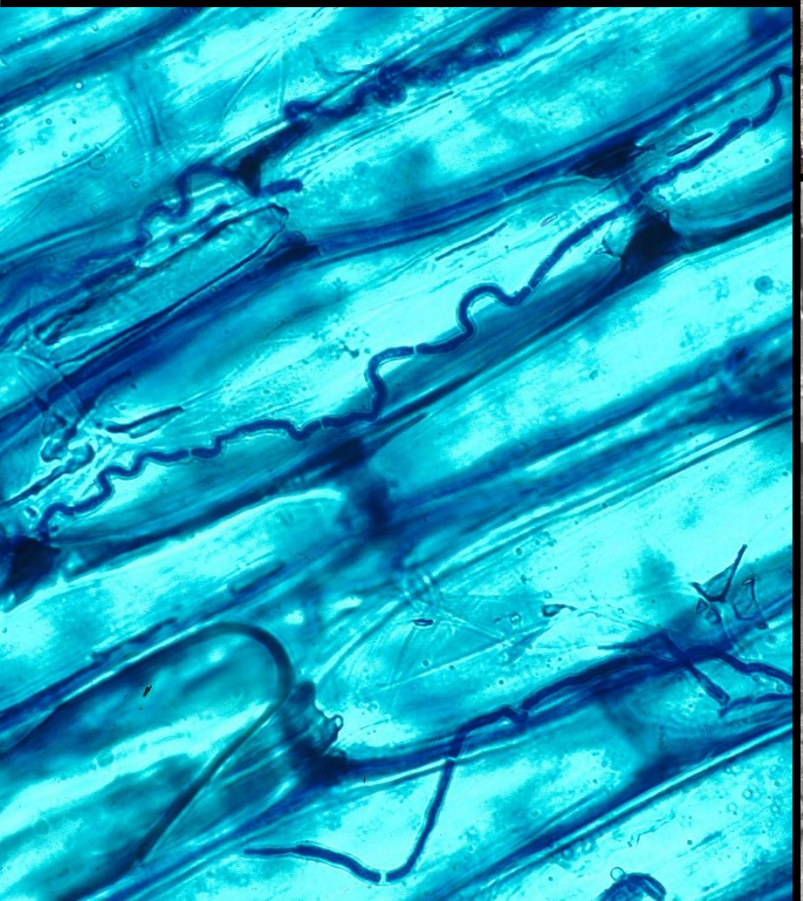
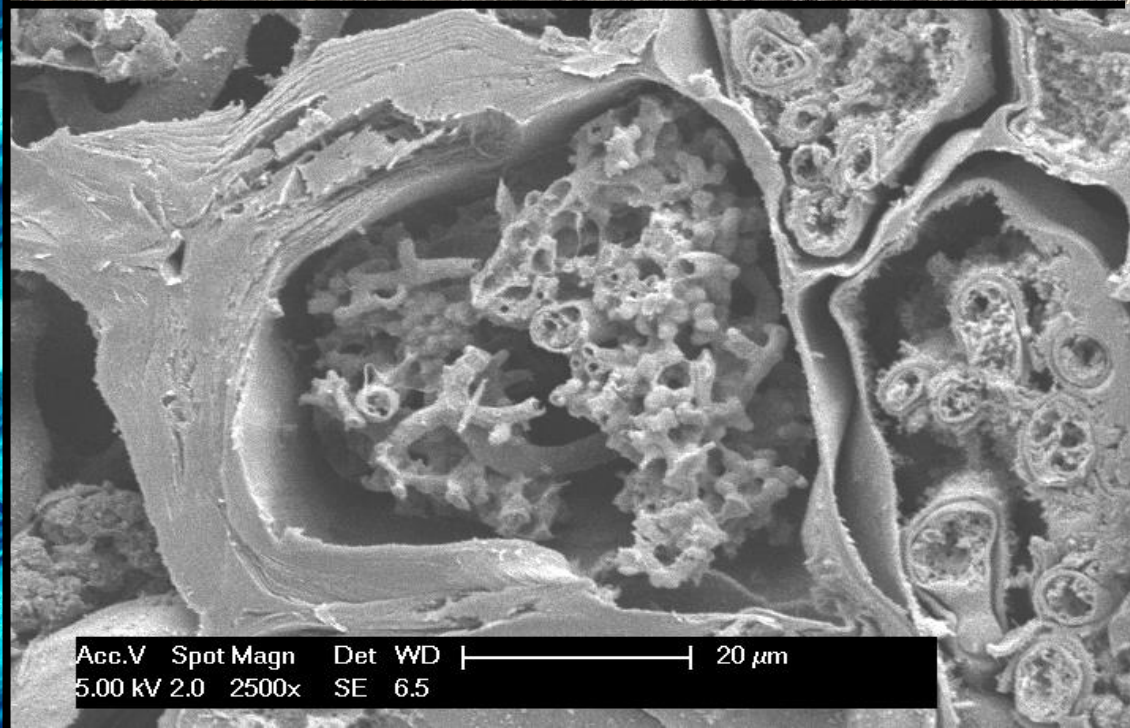
Hidden complexity: exploring the biogeography of dune grass root fungi with next generation sequencing

Renee Johansen

Bruce Burns, Peter Johnston






Acc.V Spot Magn Det WD 20 µm
5.00 kV 2.0 2500x SE 6.5


Wales: Broadhaven

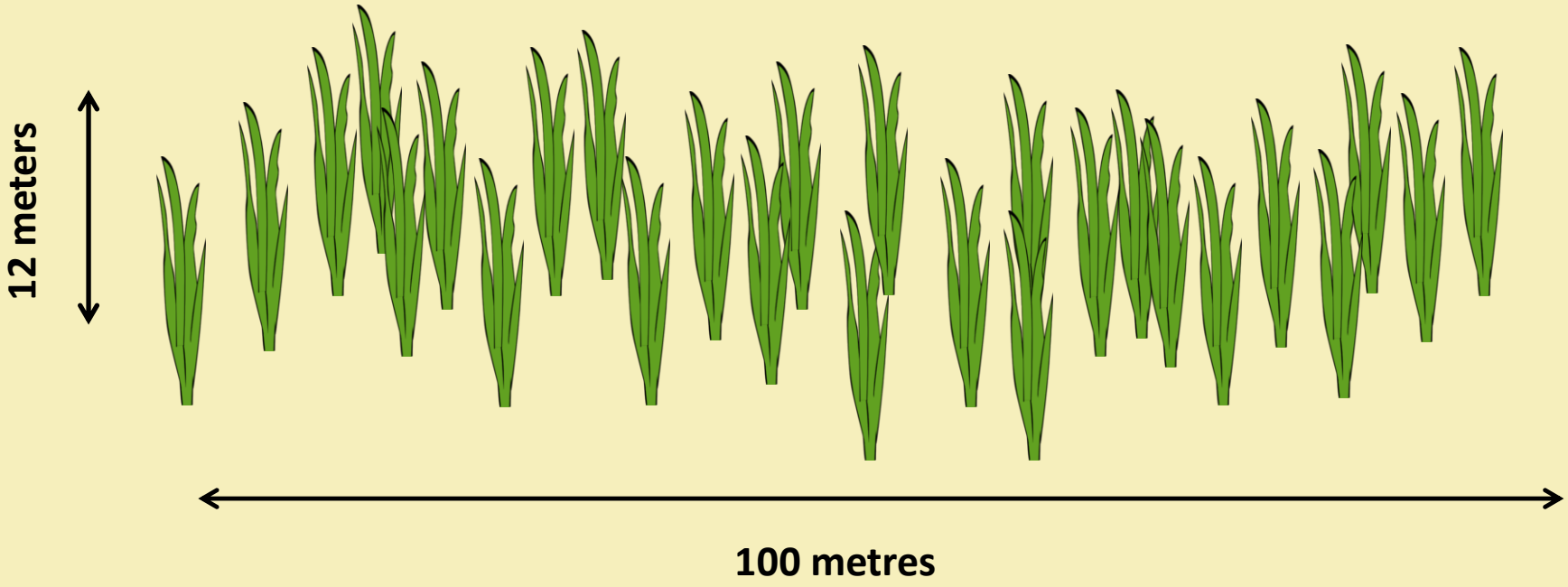

Australia: Dennington


NZ: Waikawa


NZ: Oreti

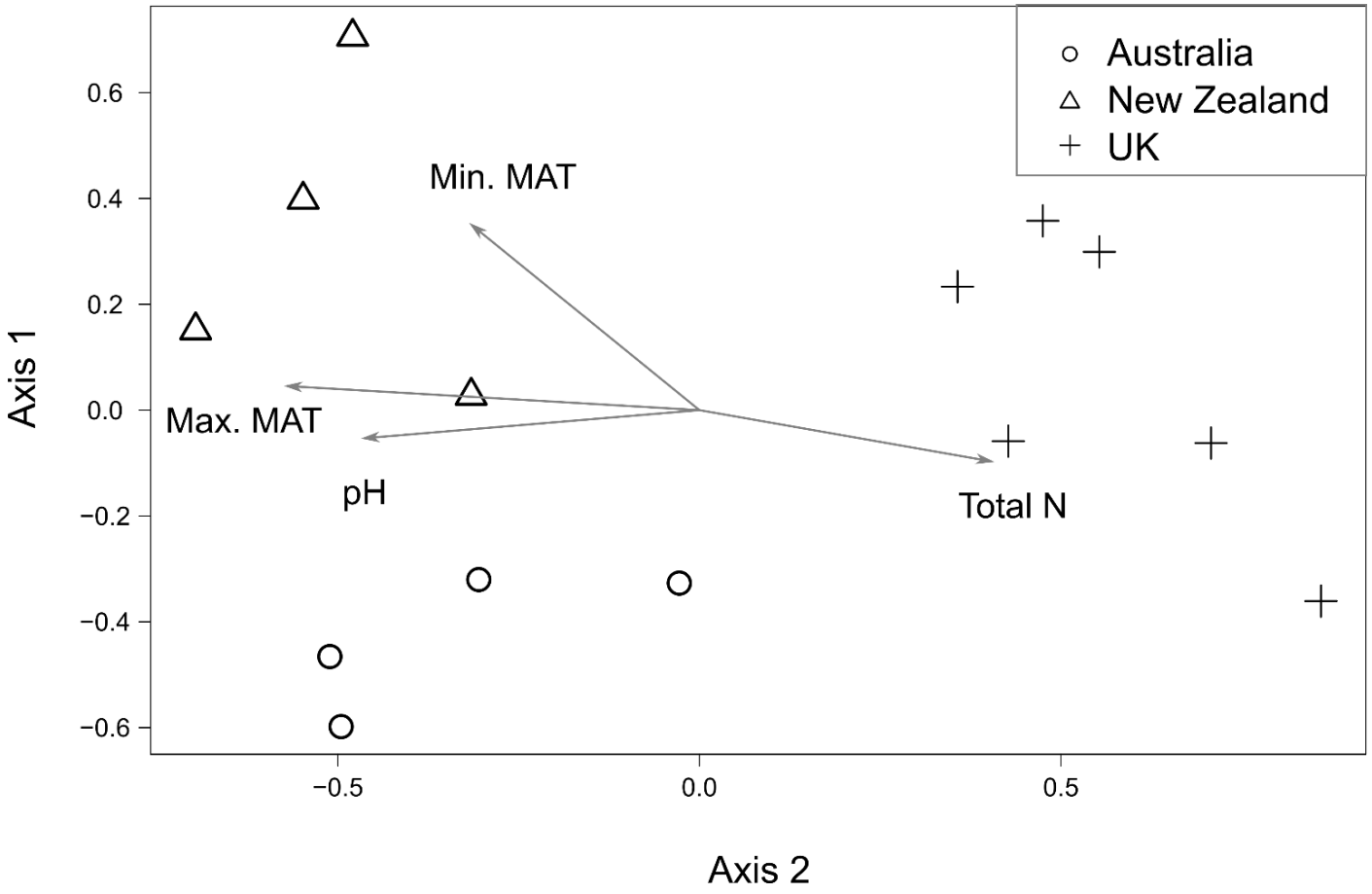
Global sampling

24 samples of marram roots per location



Fungal communities differ by country

- Differences correlate with temperature and soil resource gradients

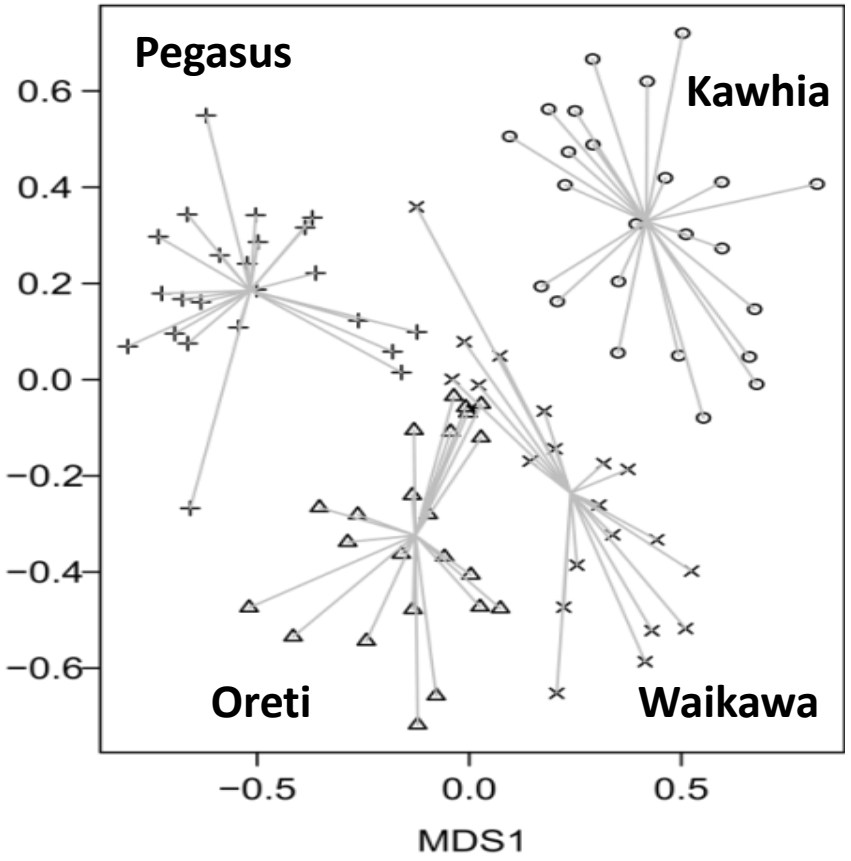


but many fungi are shared

Region	Sequences in shared OTUs
New Zealand	89%
Australia	96%
United Kingdom	90%

- **94% of 'most frequent' OTUs found in multiple places**

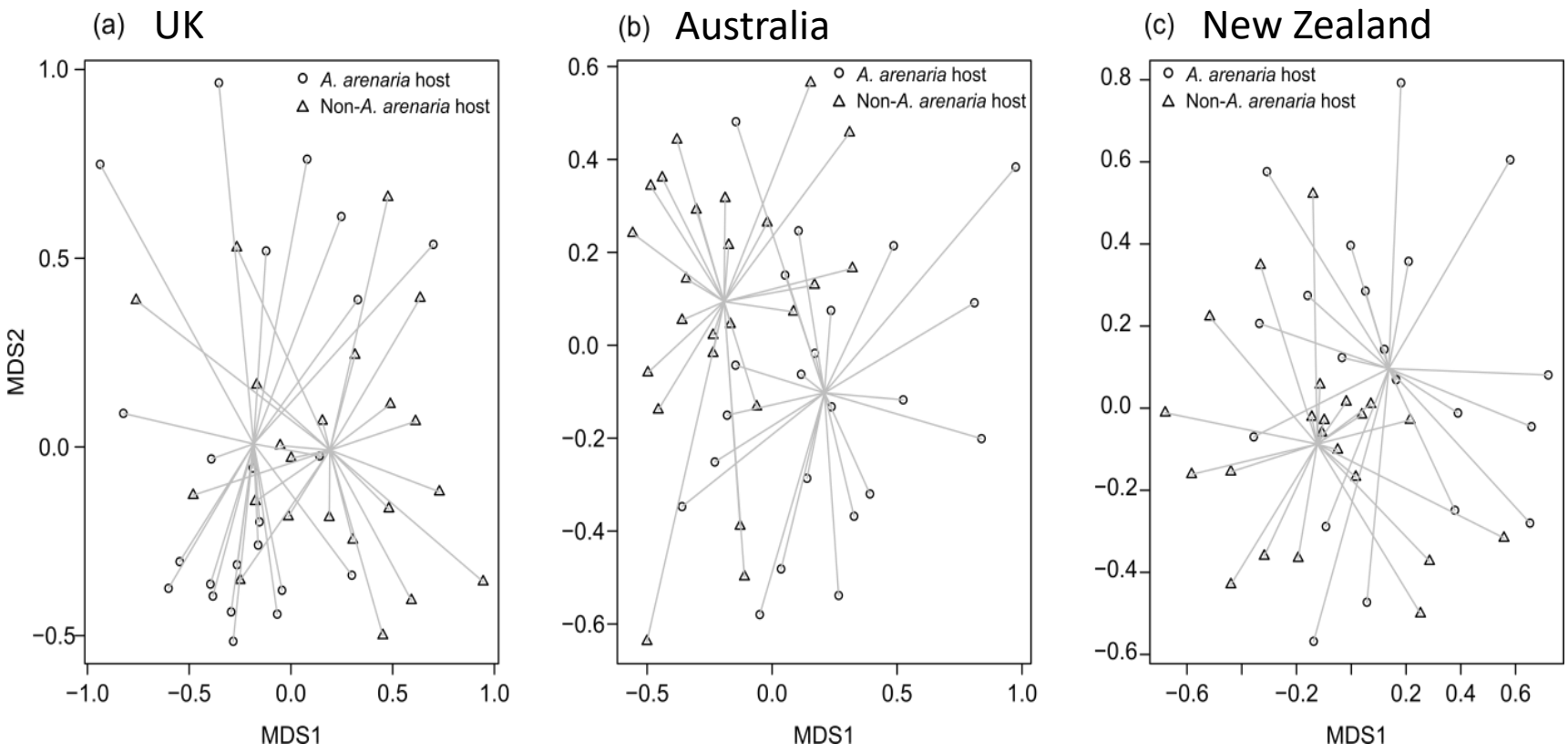
Fungal communities differ within countries



New Zealand dunes

Fungal communities differ by host

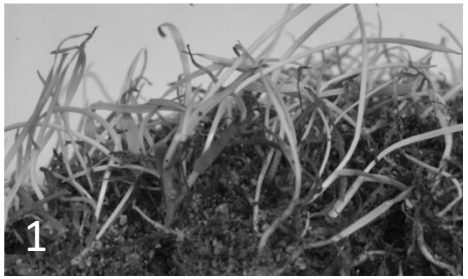
- But again most fungi are shared - < 2% seqs in ‘unique’ OTUs

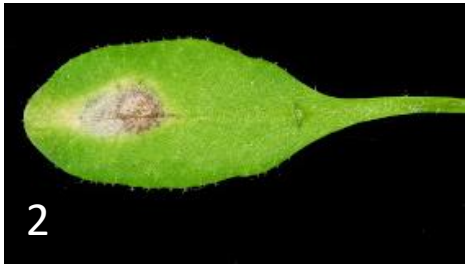


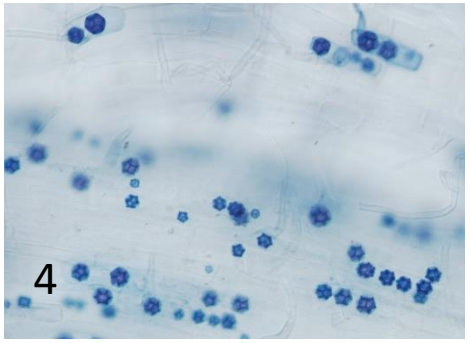
Globally shared top OTUs

1. Microdochium bolleyi
2. Monographella cucumerina
3. Alternaria infectoria
4. Olpidium brassicae

11 'frequent' NZ OTUs = poor matches with known specimens







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DUNE **RESTORATION TRUST OF NEW ZEALAND**

Beyond Myrtle Rust

Towards Ecosystem Resilience

Renee Johansen
Project Manager
Manaaki Whenua Landcare Research

Funded by: Ministry for Business, Innovation and Employment

Myrtle Rust: the problem

- Disease caused by a rust fungus (*Austropuccinia psidii*) – multiple strains
- South/Central American native, blew in from Australia in 2017, wind transmitted
- Attacks myrtles (Myrtaceae family), 480/6000 species worldwide so far
- Both native and exotic myrtles in NZ infected

New growth is susceptible

Seedlings most vulnerable, but plants of all ages must continue replacing leaves

Lophomyrtus obcordata
(Rohutu)

Syzygium smithii
(Lilly pilly)

Lophomyrtus obcordata
(Rohutu)

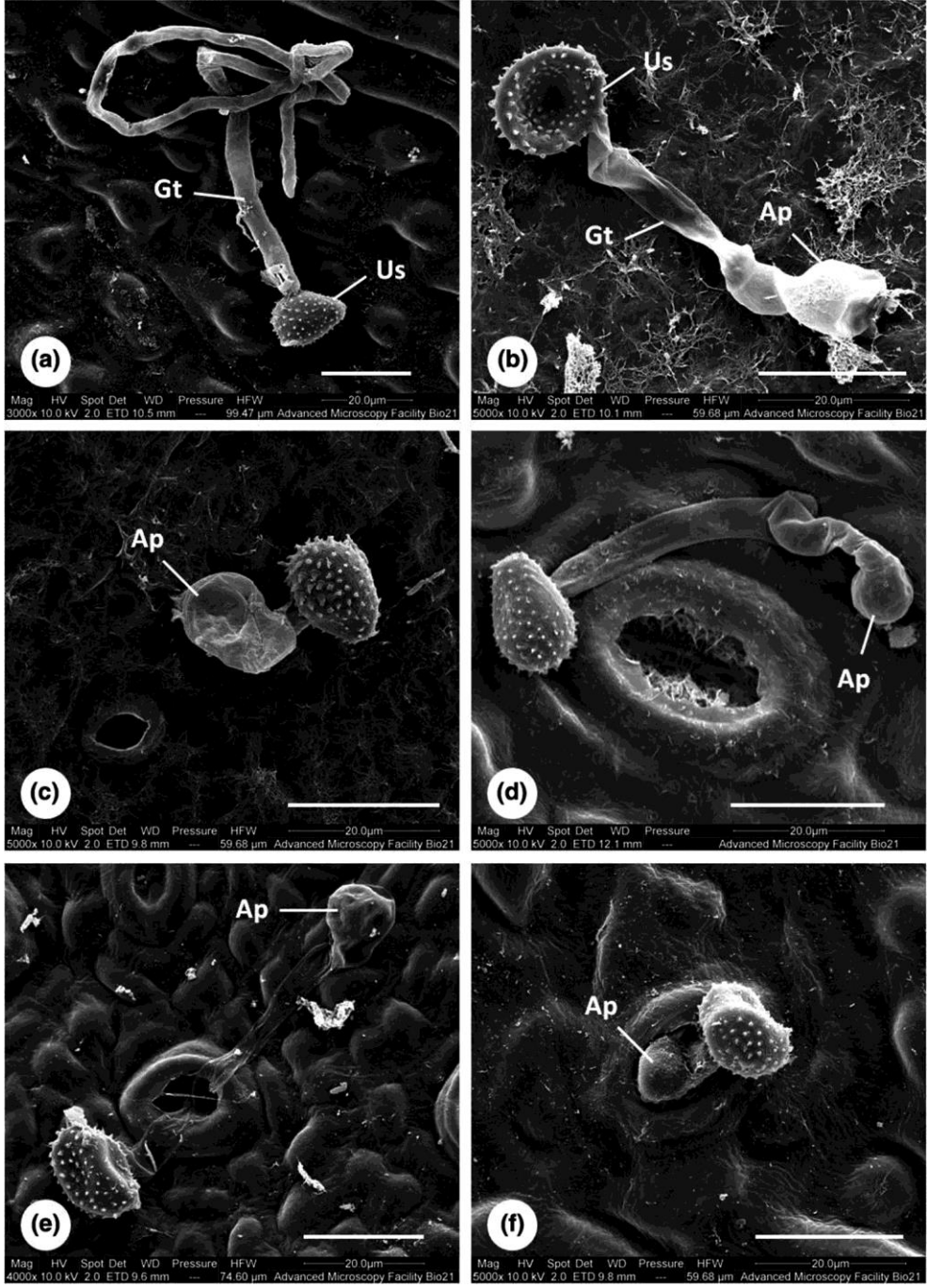
Images: Peter de Lange, Eric McKenzie, Rob Beresford

Symptoms not always obvious

Images: Roanne Sutherland, Peter de Lange

Disease cycle

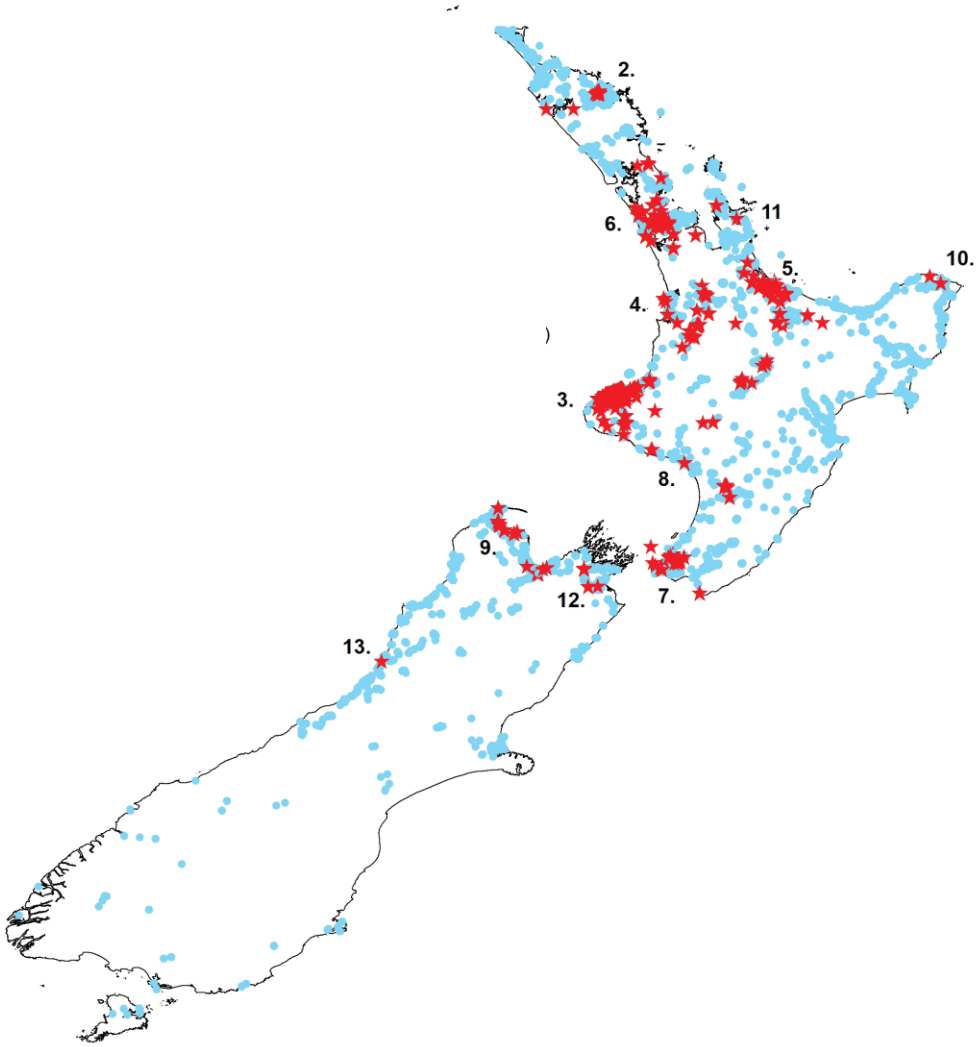
- Requires a live host
- Fungus can push directly through tissue
- Needs warm and wet – seasonal
- Multiple spore types
- Pandemic strain is here – others may behave differently



Young et al 2019, *Plant Pathology. Eucalyptus* sp.

Myrtle Rust in NZ: current distribution

As of September 2019

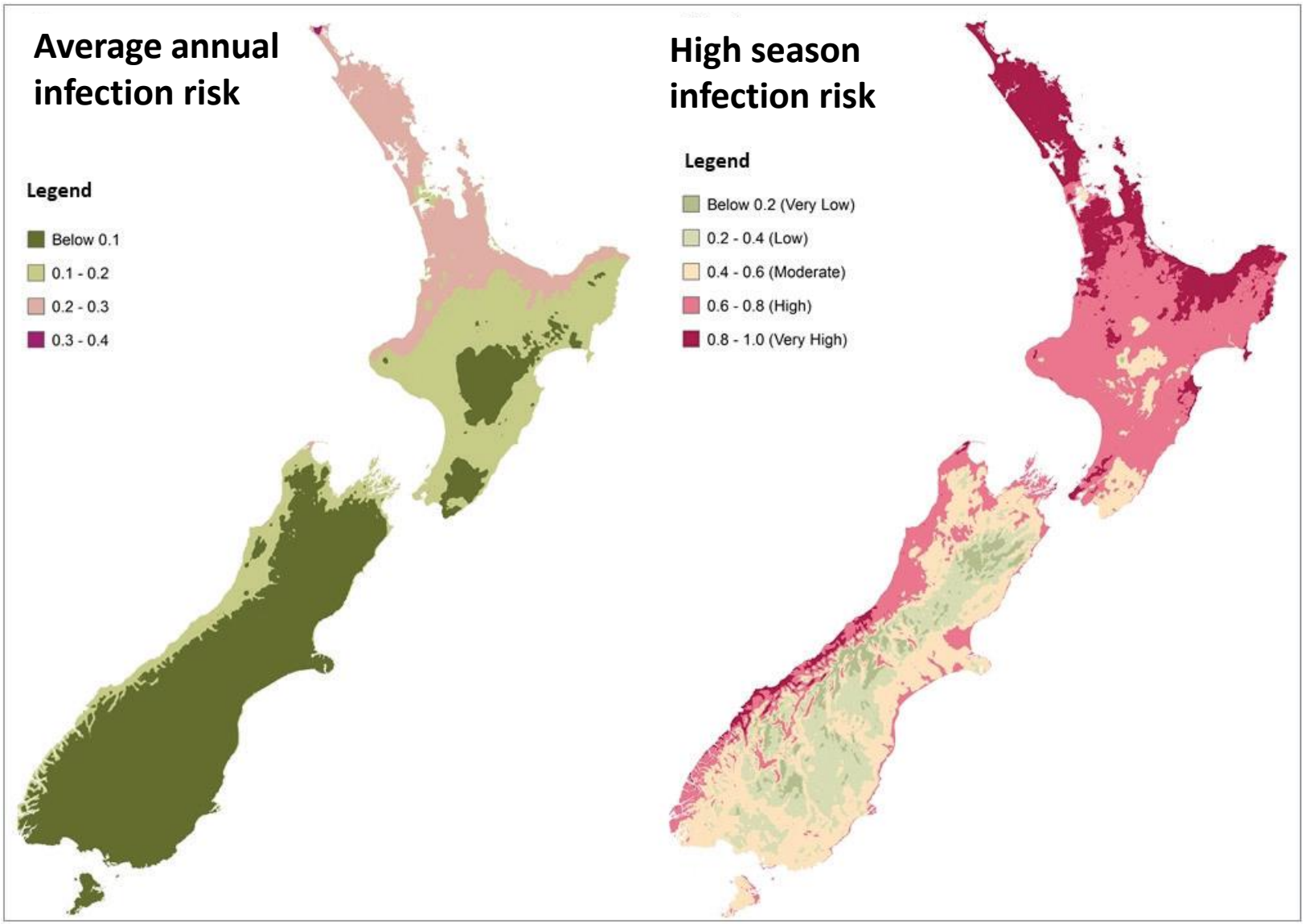


MR searched for – not found

MR found

Beresford et al, 2019, NZ Garden Journal

Myrtle Rust in NZ: Modelled Range



Myrtle Rust in NZ: host plants

- Thus far *Lophomyrtus* (Rohutu, Ramarama, bubble leaf) most impacted
- Exotic Lilly pilly/Monkey apple (*Syzygium*) also hard hit
- Much greater susceptibility seen in greenhouse tests than in field so far (manuka/kanuka/pohutukawa)
- Dry summer + lack of monitoring this season

Myrtle rust in Australia

- First detected 2010
- 2 previously wide-spread species now facing extinction
- Large tree death occurring
- Yet to reach Western Australia
- Eucalypt killing strains not yet arrived

Native guava in Australia, image: Geoff Pegg

Beyond Myrtle Rust research programme

- **Understand fungal behaviour and host relationships**
  (pathogen dynamics)


Stuart Fraser


Alistair McTaggart

- **Track what happens to invaded environments**
  (ecosystem impacts)


Gwen Grelet


Maj Padamsee

- **Develop control tools**
  (novel mitigation technologies)

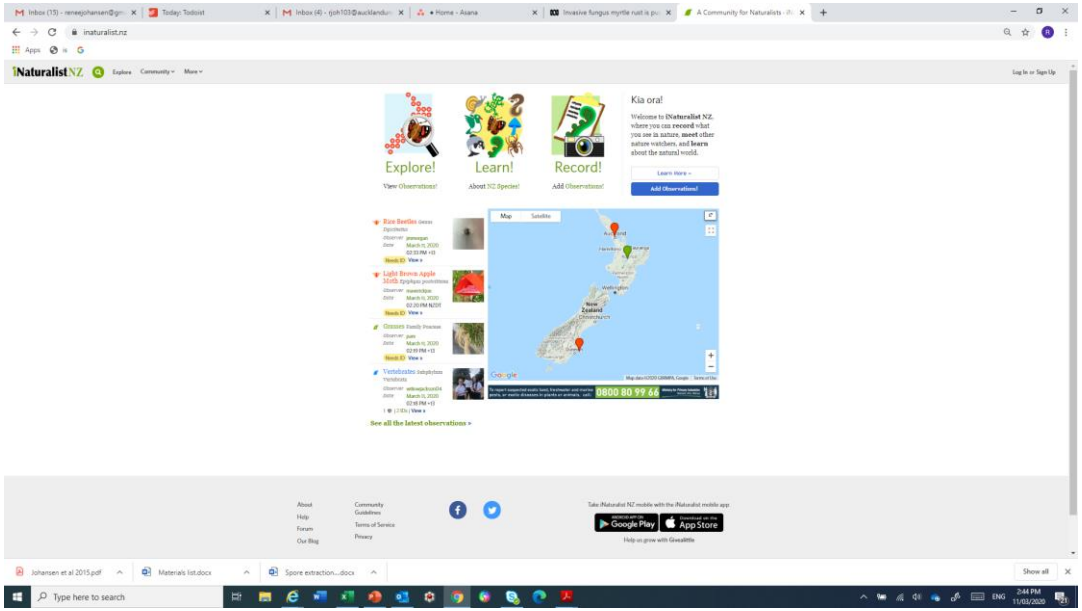

Grant Smith

- **Māori engagement**
  (Kaitiakitanga and Māori-led solutions)


Alby Marsh

Surveillance and citizen science plans

- Currently no systematic nation-wide surveillance and monitoring
- A programme to engage citizens/stakeholders to gather data from next season is in development
- Identifying data gaps and encouraging records on iNaturalist to be the focus



Want to talk more?
Get involved?
Get in touch!

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