Grape Powdery Mildew
The sexual stage in NZ

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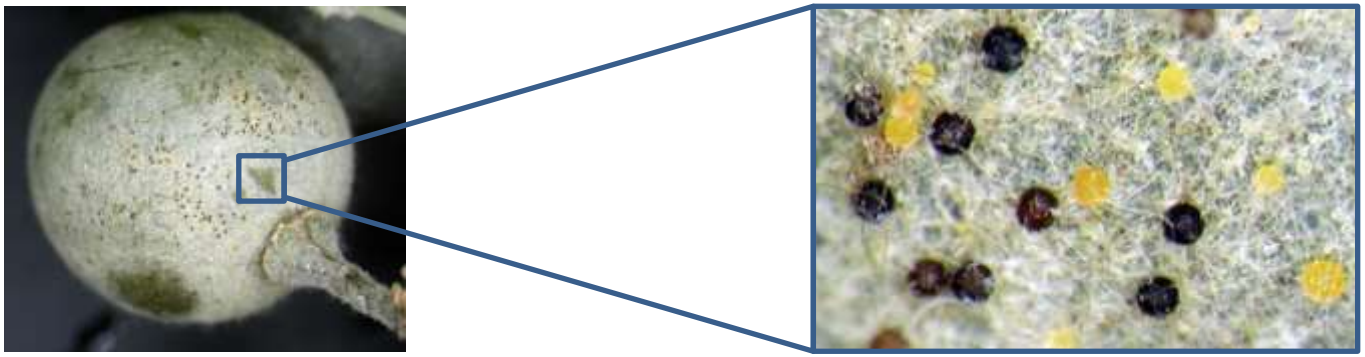
What lessons can we take …

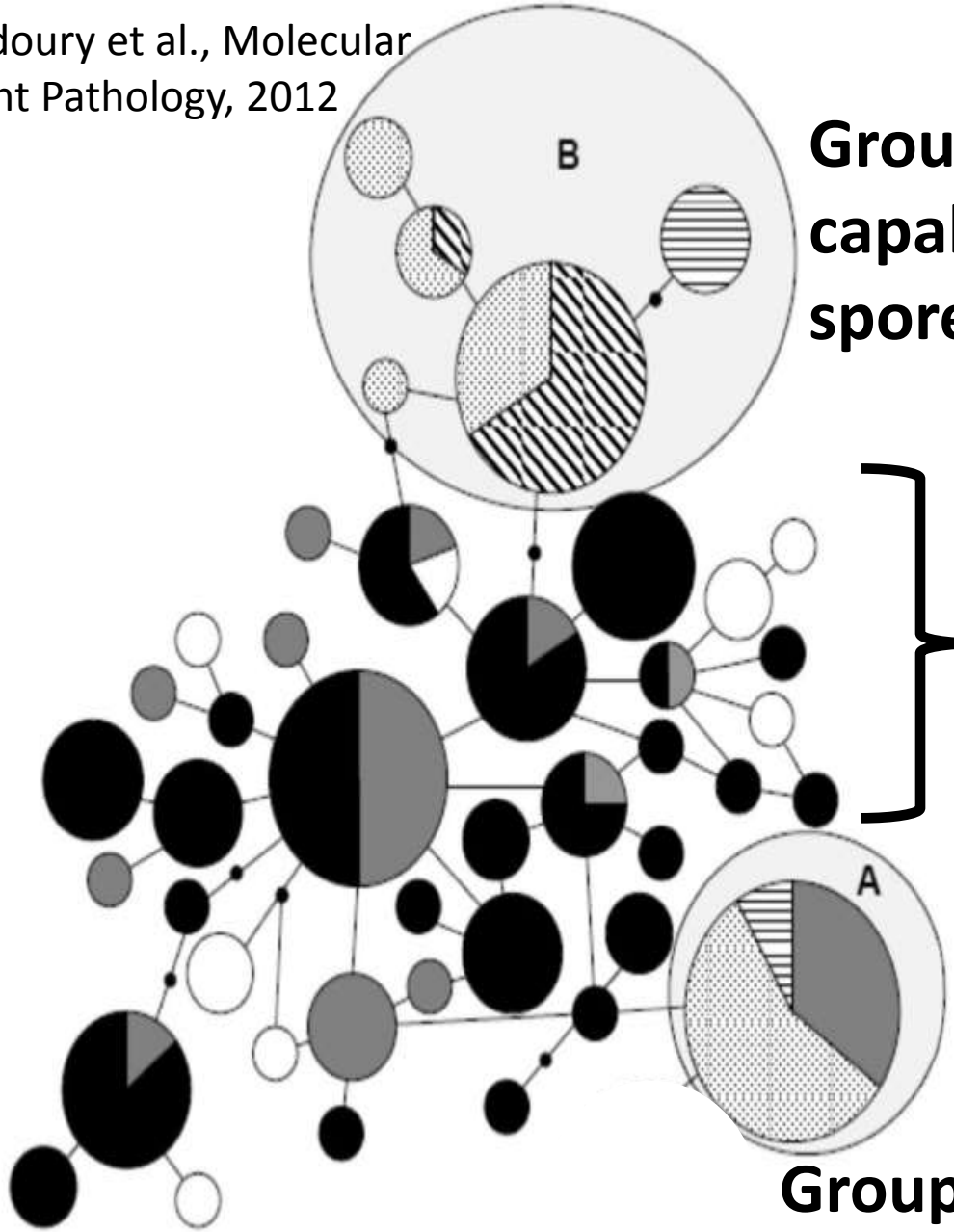
- control at the border is not perfect - new pathogens do still enter NZ
- managing biosecurity at the species level is not always appropriate

Grape Powdery Mildew - *Erysiphe necator*

- present in New Zealand over 100 years
- until recently known only in the asexual form ...
- sexual state discovered in Hawke's Bay in 2013 (Peter Wood, Plant and Food Research)
- **discovery of sexual state coincided with anecdotal reports of increase in disease**
  - overseas reports of a difference in pathogenicity between sexual and asexual populations
  - gathered base line data on NZ genetic diversity



Gadoury et al., Molecular Plant Pathology, 2012

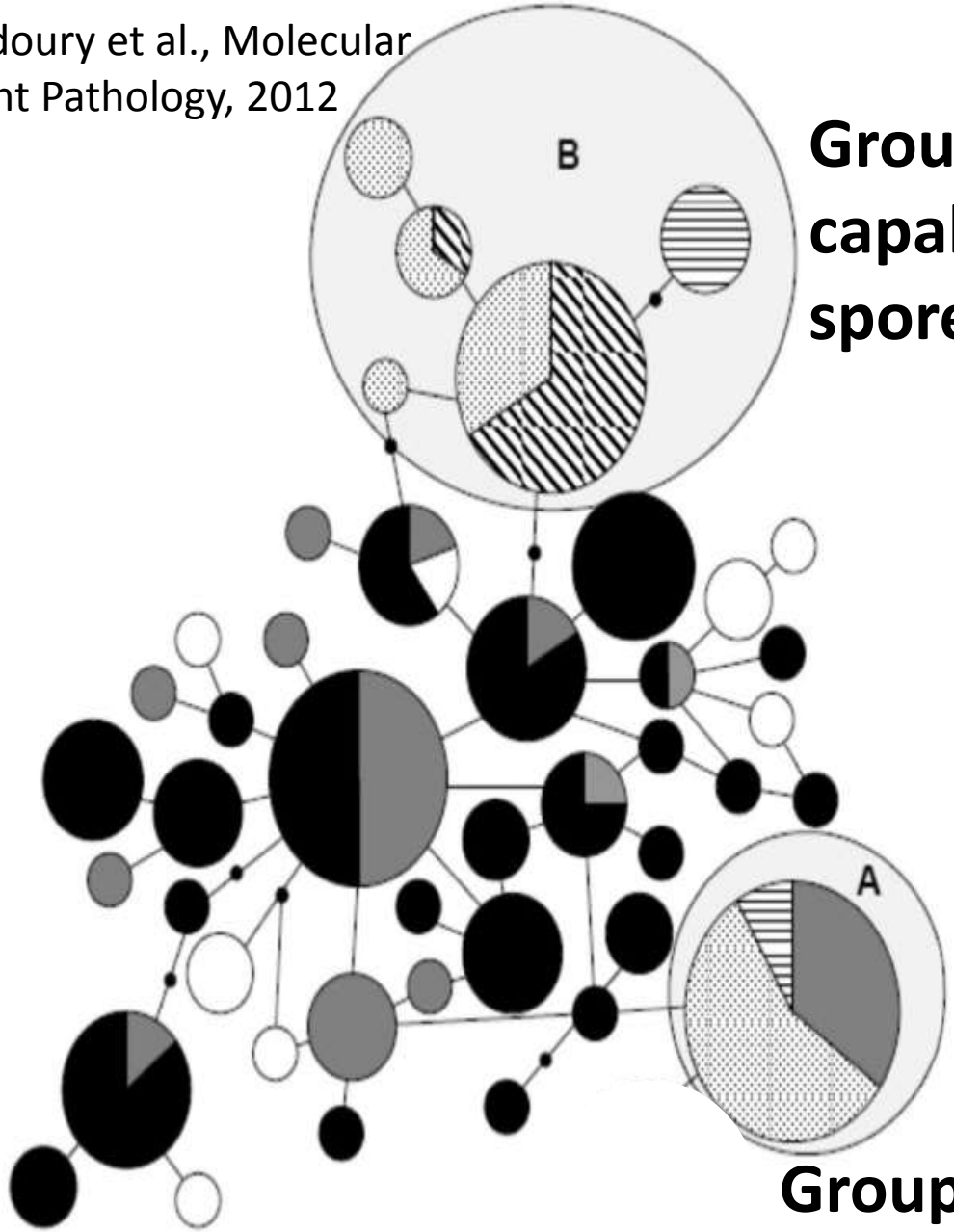


Group B – on cultivated grapes capable of forming sexual spores with right mating types

On wild grape species in USA, genetically diverse

Group A – on cultivated grapes asexual spores only

Gadoury et al., Molecular Plant Pathology, 2012



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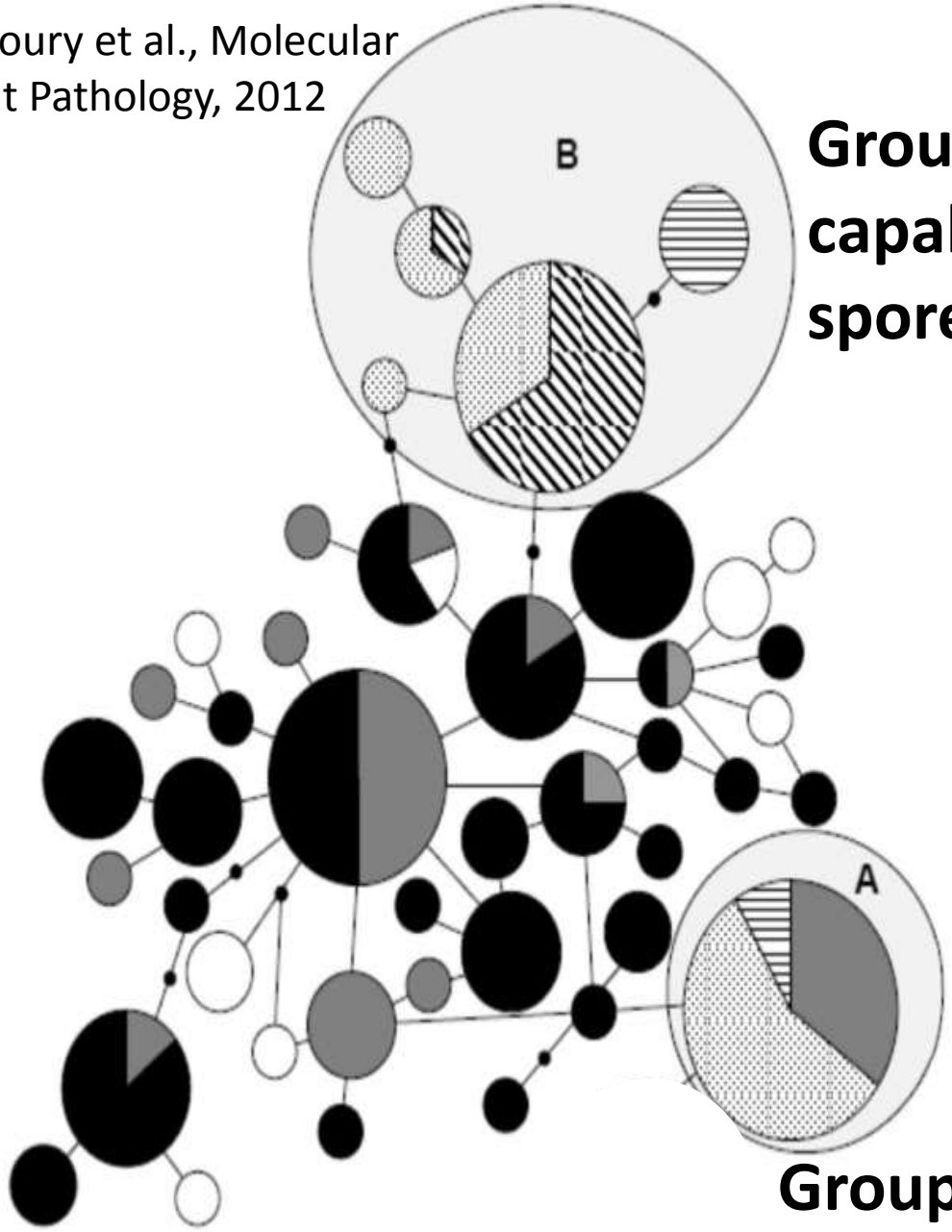


Group B – on cultivated grapes capable of forming sexual spores with right mating types

- **higher pathogenicity**
- **more likely to develop fungicide resistance**

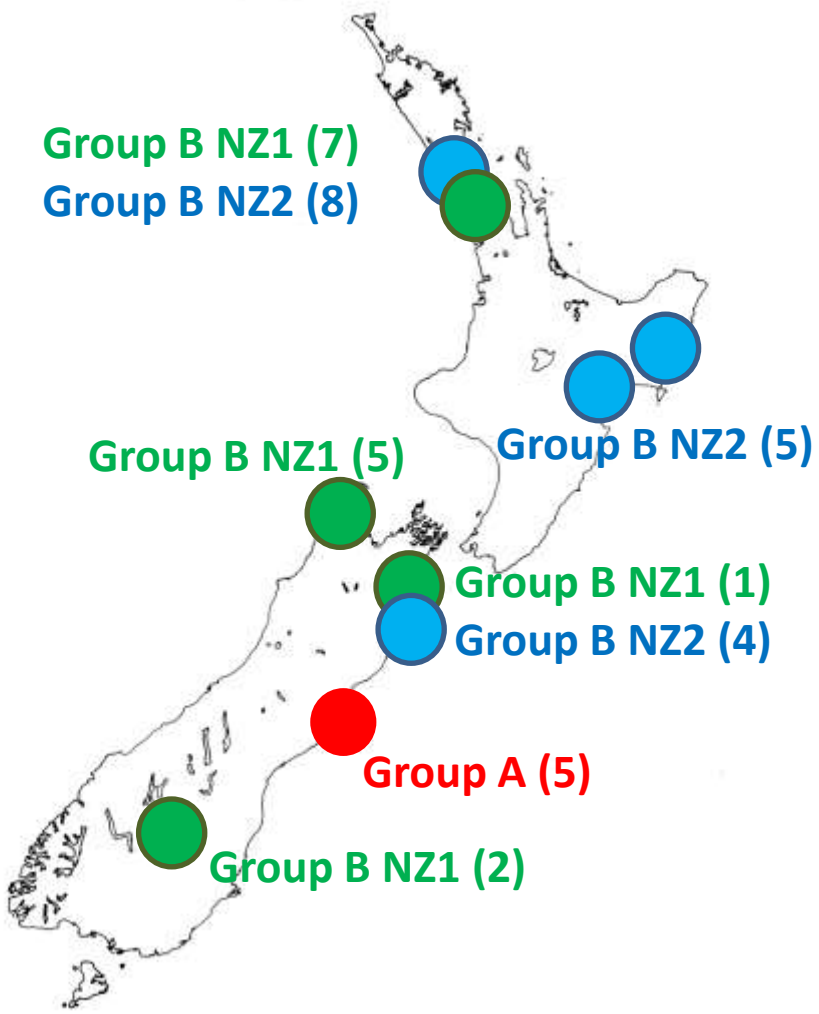
Group A – on cultivated grapes asexual spores only

Genetic characterisation *Erysiphe necator* in New Zealand

- Only 37 isolates
  - commercial vineyards Auckland, Hawke's Bay, Gisborne, Nelson, Marlborough and Otago
  - Backyard garden vines Canterbury
- both Group A and Group B populations, but only Group B detected in vineyards
- two Group B haplotypes
  - only one forming sexual spores?
    - Based on mating type gene ratios

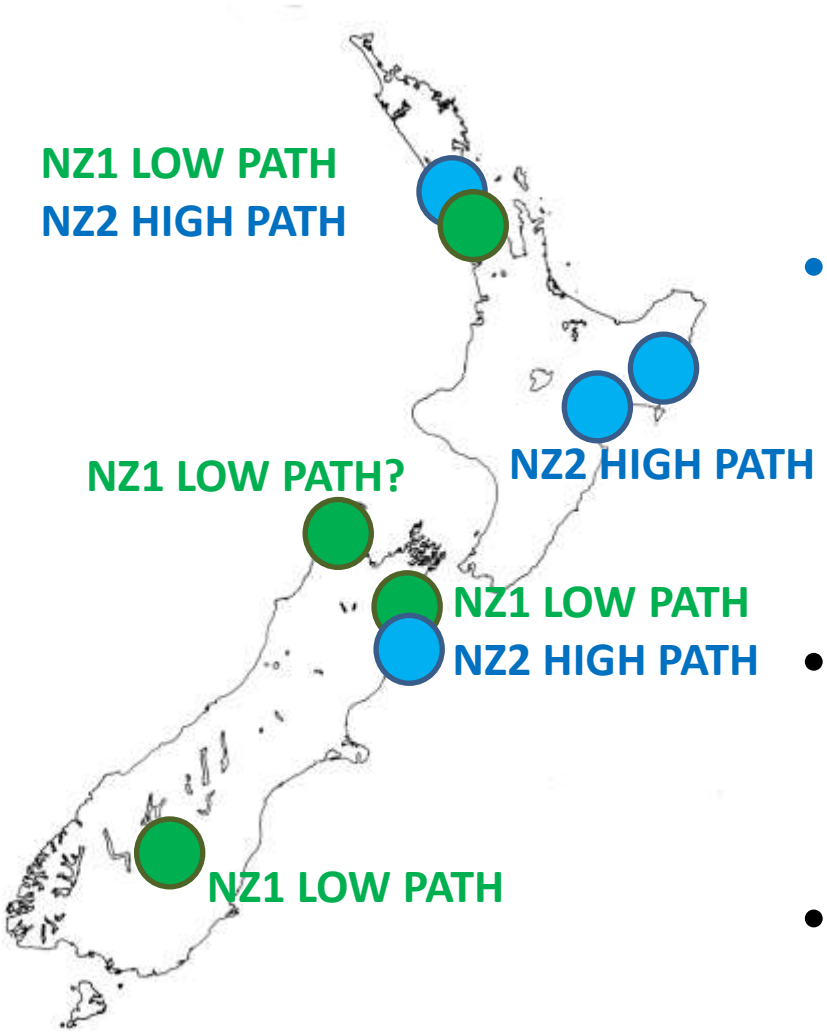
NZ samples – only 37 isolates

Number of isolates in brackets



- **Group A** (clonal, asexual) only on backyard vine
- Two **Group B** haplotypes, **NZ1 NZ2**
  - both widespread in commercial vineyards

Group B haplotypes correlate with disease level



- **Haplotype NZ1**
  - low disease
  - single mating type?; no sexual spores?
- **Haplotype NZ2**
  - high disease
  - both mating types; sexual state observed; regular sex likely
- Each vineyard or block sampled had only one haplotype
- Strong and local geographic structure to pathogenicity

“discovery of sexual state coincided with anecdotal reports of increase in disease”

- are these linked? maybe …
- but, only a small number of isolates sampled:
  - Is the haplotype NZ1 versus NZ2 correlation with pathogenicity real?
  - Does a single haplotype always dominate at a single site?
  - Could there be seasonal differences in genotype?
- need answering … more extensive survey needed

“discovery of sexual state coincided with anecdotal reports of increase in disease”

- maybe …
- But, only a small number of isolates sampled:
  - Is the haplotype NZ1 versus NZ2 correlation with pathogenicity real?
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  - Could there be seasonal differences in genotype?
- need answering … more extensive survey needed
- Why do these need answering?
  - site based disease control recommendations for PM could potentially reduce levels of fungicide use
  - seasonal change may be a disease risk indicator

Possible to use seasonal changes as disease risk indicator?

- **Europe** (Montarry et al., European J Plant Path, 2009)**:**
  - all vineyards dominated by Group B at harvest
  - early in season some of these vineyards had a proportion of Group A isolates
  - those vineyards with large group A population in spring had low disease at harvest

Possible to use seasonal changes as disease risk indicator?

- **Europe** (Montarry et al., European J Plant Path, 2009)**:**
  - all vineyards dominated by Group B at harvest
  - often a shift from low path Group A to high path Group B through the growing season
  - those vineyards with large group A population in spring had low disease at harvest
- **New Zealand?**
  - **No early season samples**
  - same Group A to Group B shift?
  - shift from low pathogenicity to high pathogenicity Group B haplotypes?

Some answers are coming

- Plant & Food and Landcare MBIE core funding, additional 2015-2016 sampling will test:
  - relationship between haplotype and mating type
  - limited sampling from spring to test for seasonal change; search for early season Group A
- If more funding available we would:
  - confirm relationship between Group B NZ-1 and NZ-2 haplotypes and disease
  - properly understand variation across a season and its relationship to disease levels
  - confirm that there is consistently limited genetic diversity at a single site

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