Pink rot of potato

A re-emerging problem in Tasmania: isolate diversity, fungicide resistance, pathogenicity & population dynamics

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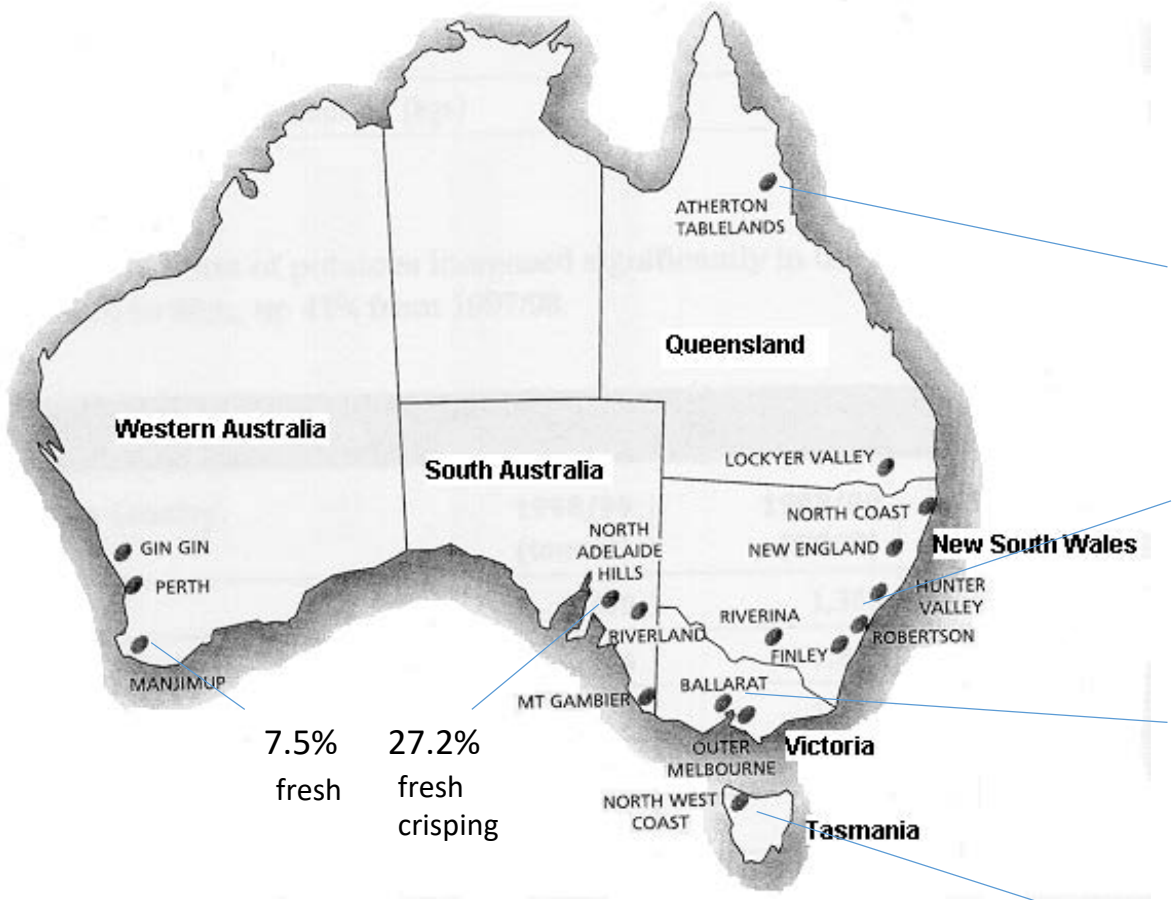
Potatoes in Australia

Australia is a relatively small potato producer (*c.* 0.3% of global production)

Average yields are generally good

- National average *c.* 40 t/ha
- Tasmania commonly 65 t/ha with occasional crop at or near 100 t/ha

No imports of fresh potato permitted



Pink rot – re-emerging issue

Up to 30% yield losses in certain properties in the south-eastern South Australia with further losses happening during storage as a result of secondary bacterial infections (Wicks et al.2000).

Significant yield losses have been reported in Tasmania with negative impacts worsening in the last two growing seasons.

Project scope

Study isolate diversity

- Comparing growth dynamics, culture characteristics & pathogenicity of different isolates.
- Determining if resistance to the major fungicide (Metalaxyl-m) exists.

Examine capacity to predict disease risk based on pre-plant soil testing

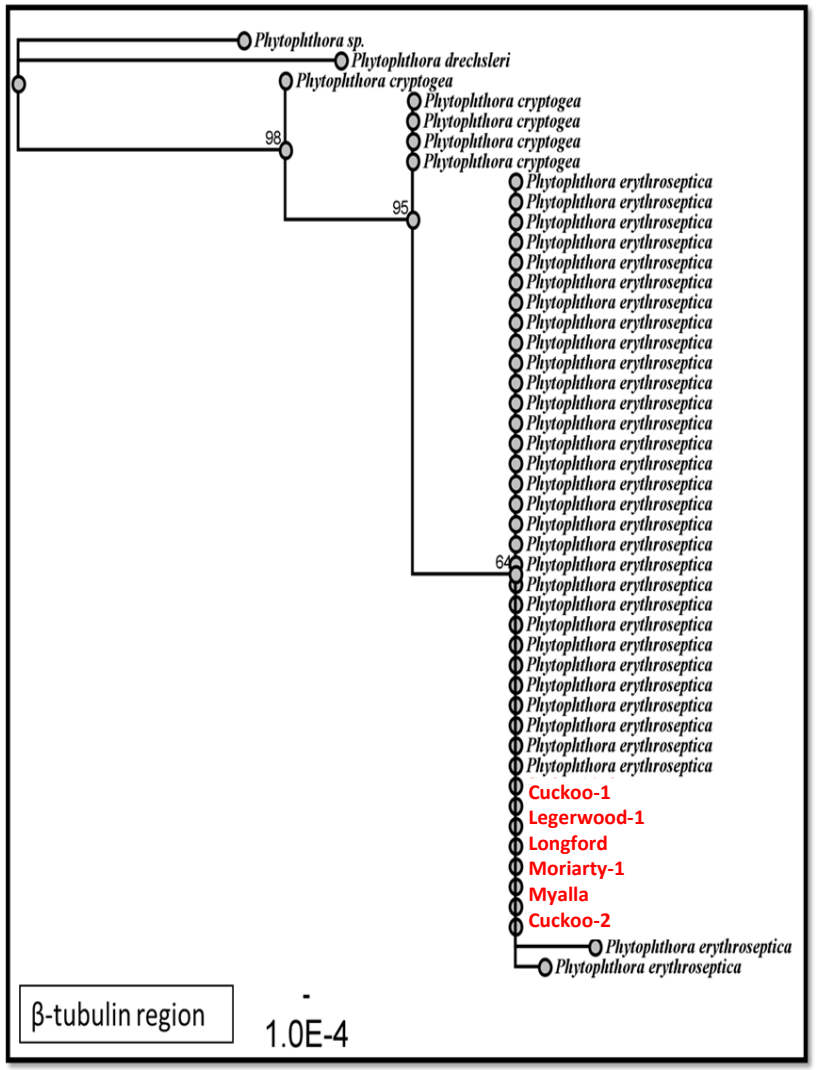
- Study pathogen population dynamics within cropping systems
- Impact of soil-borne inoculum on emergence

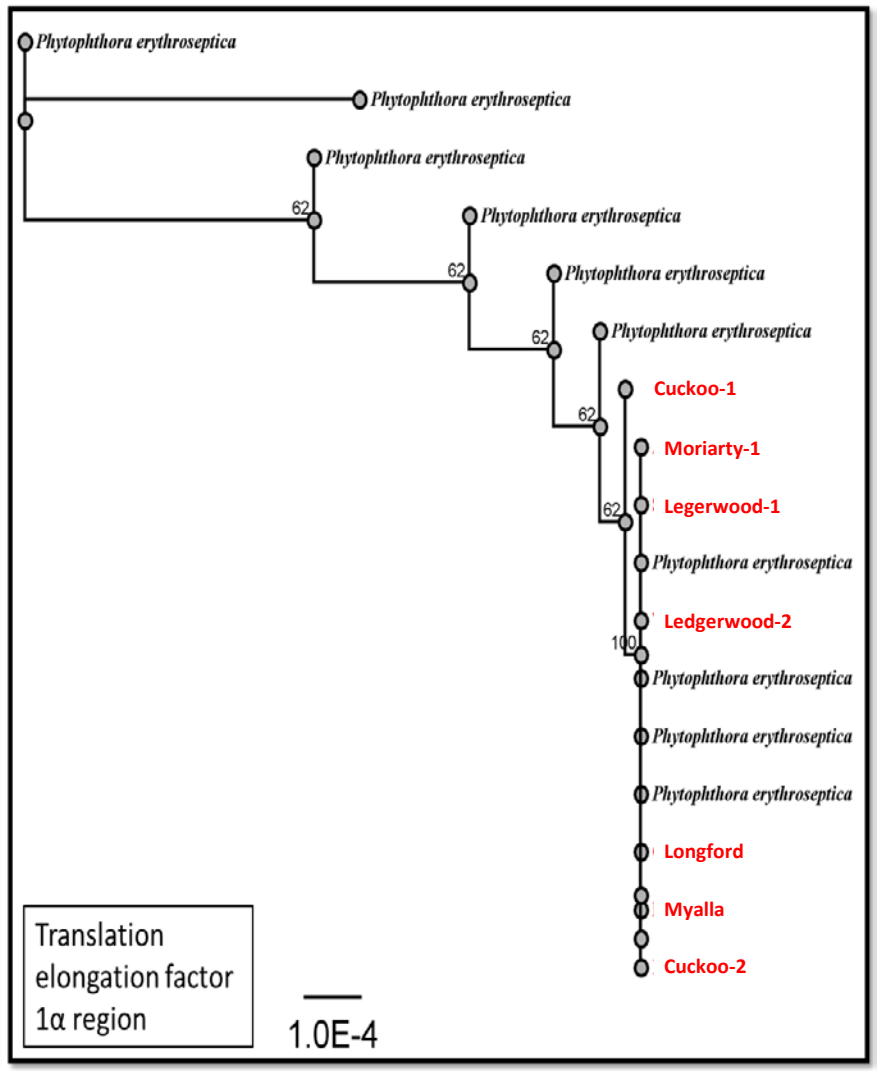
Pathogen isolate diversity

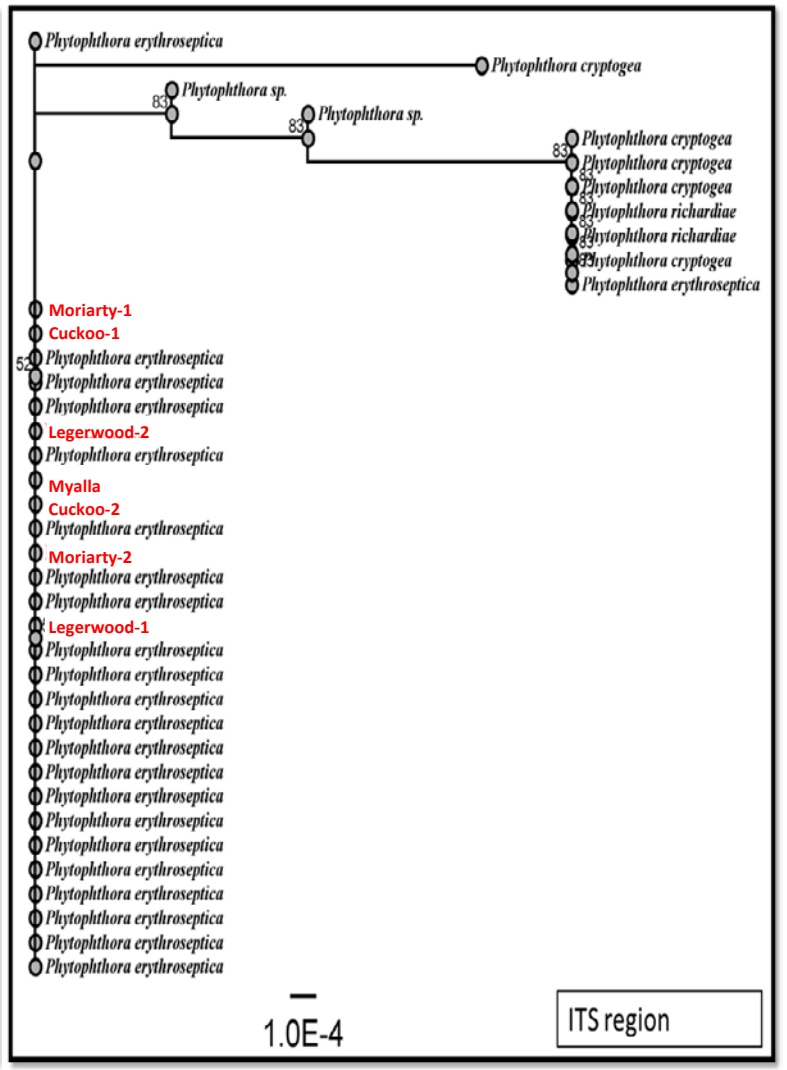
Diseased tubers collected from seven commercial field sites in NW and NE Tasmania

P. erythroseptica is homothallic
Inbreeding + homozygosity limits genetic diversity with likely lack of variability in virulence

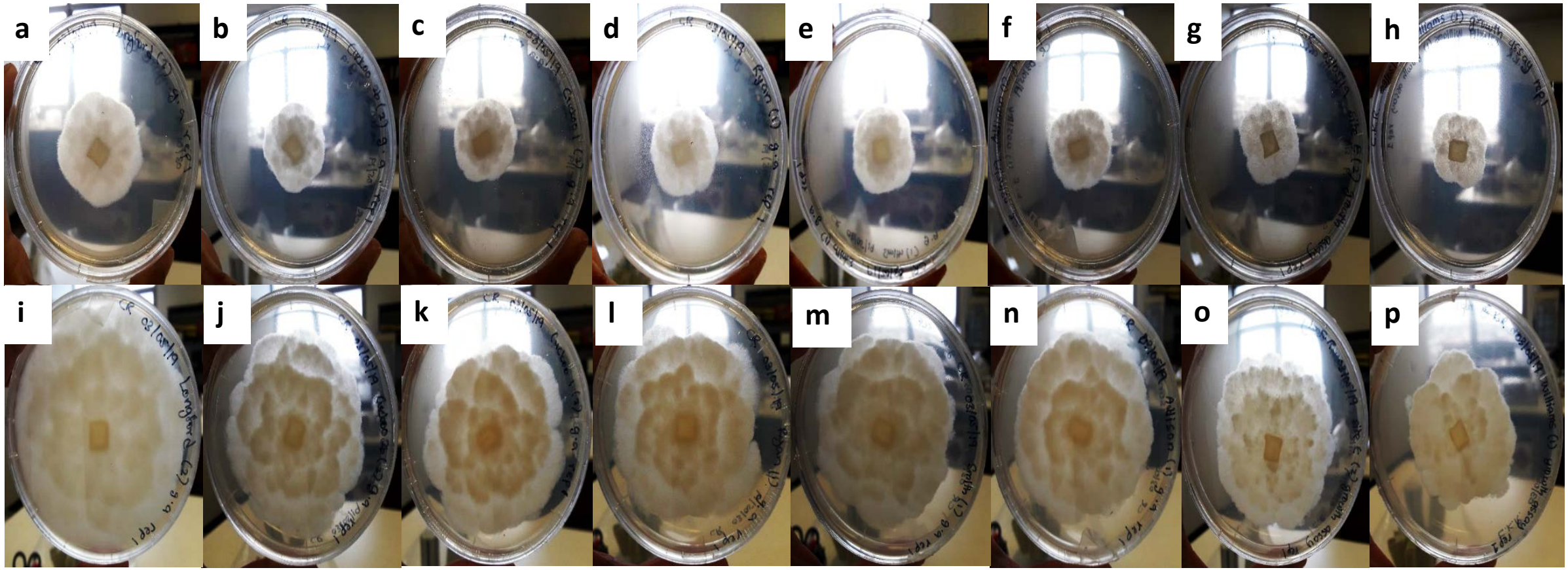
Isolate diversity





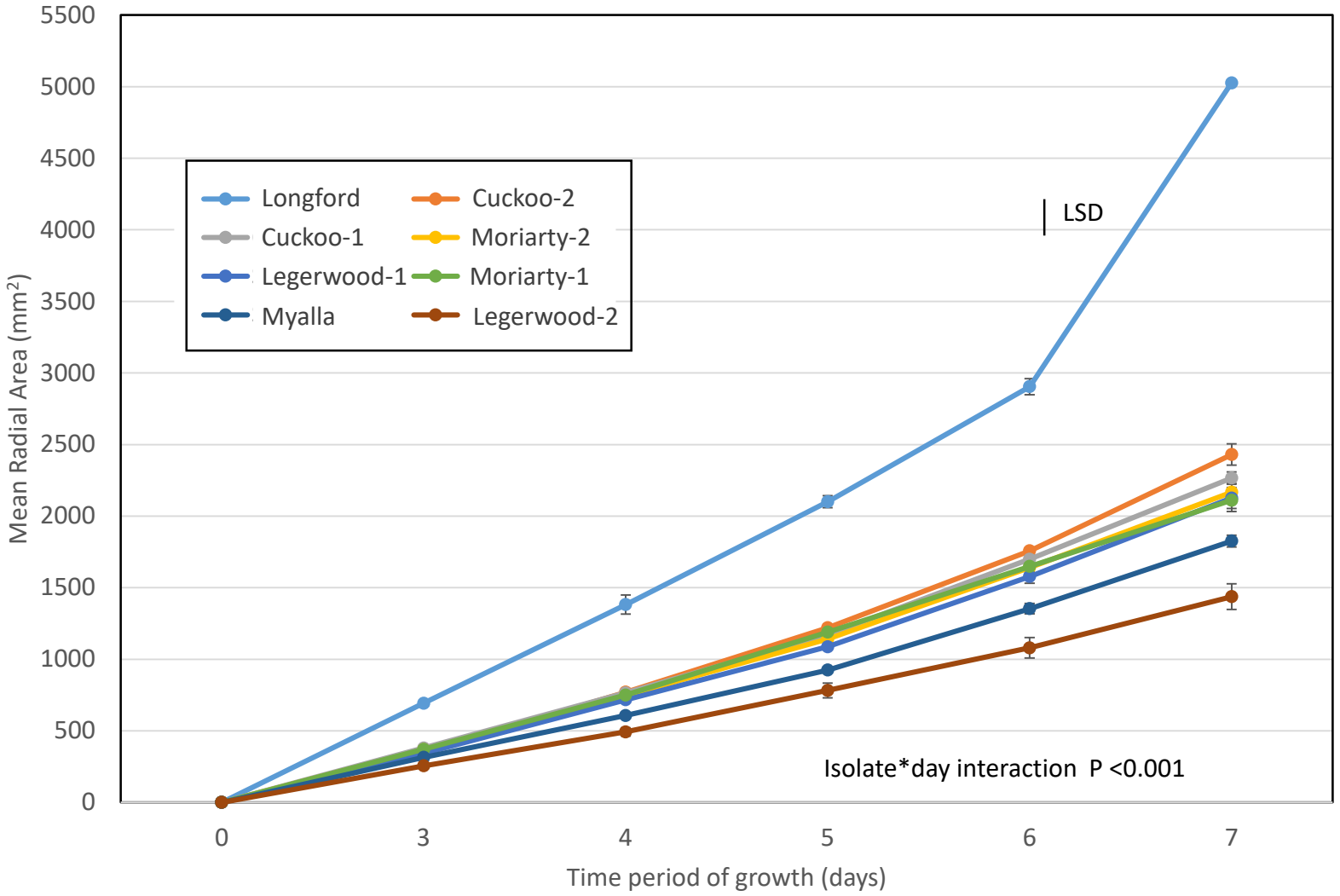


Isolate growth rate



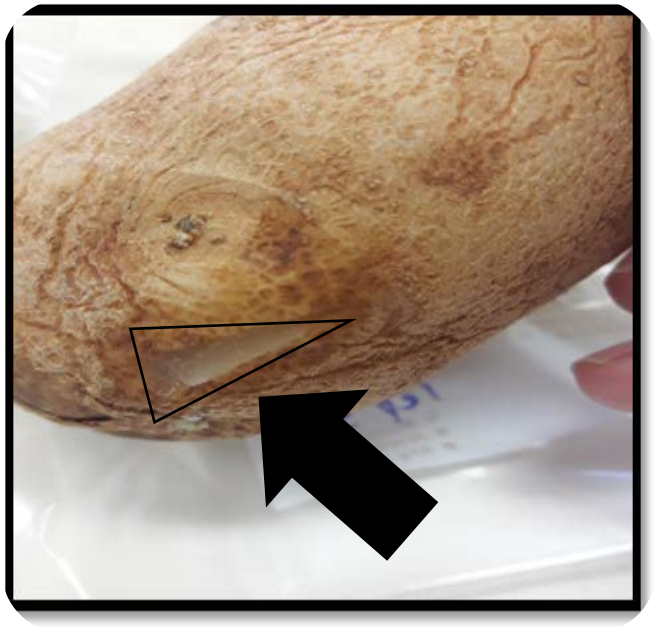
***Mycelial in vitro* growth of isolates -** Longford, Cuckoo 2, Cuckoo 1, Moriarty-2, Legerwood-1, Moriarty-1, Myalla & Legerwood-2
a-h – day 3 i-p – day 7

Isolate growth rate



Pathogenicity: lesion depth

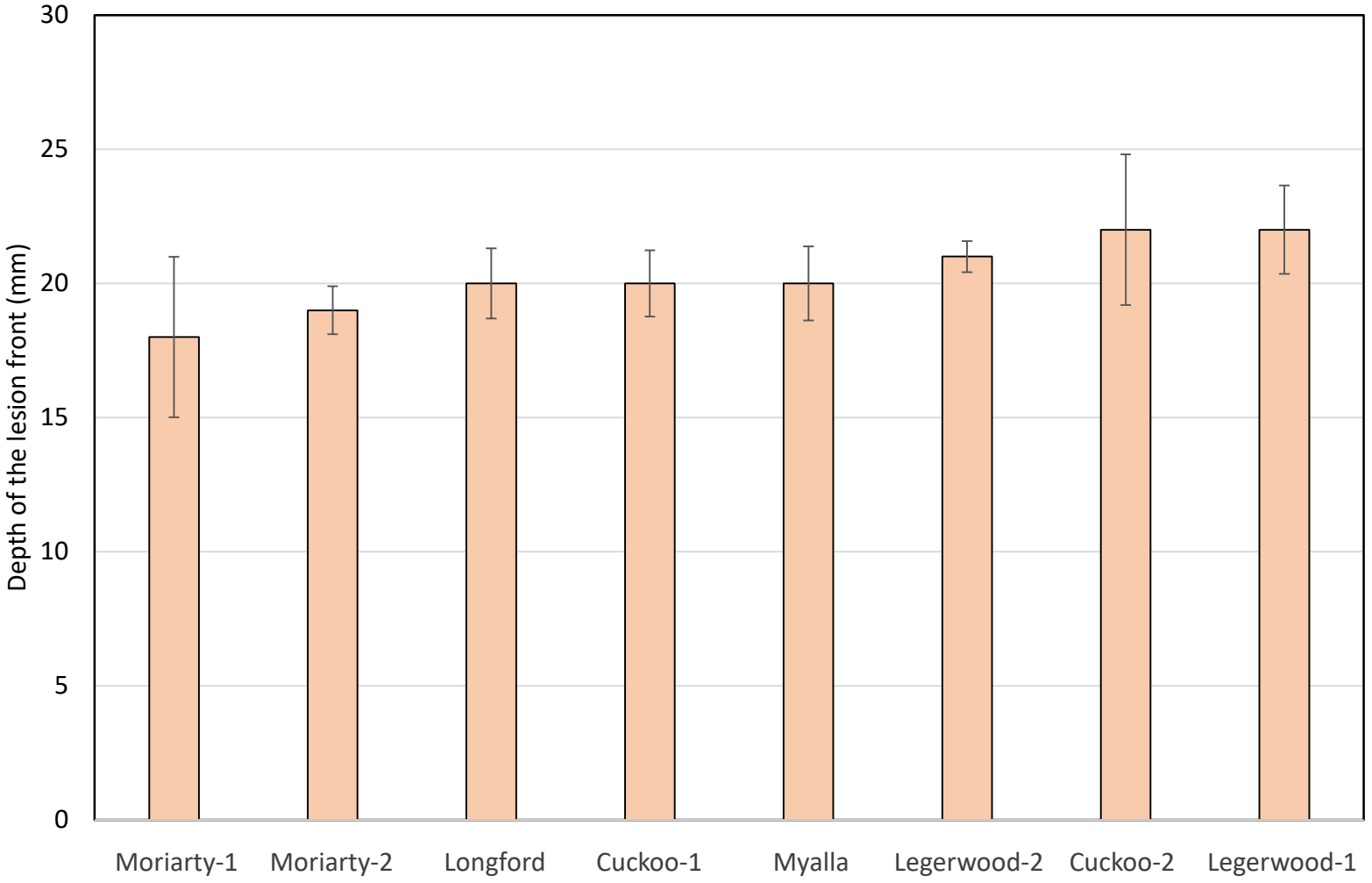
40 healthy potato tubers were used per isolate.
Each were surface sterilized with 0.5% NaOCl.



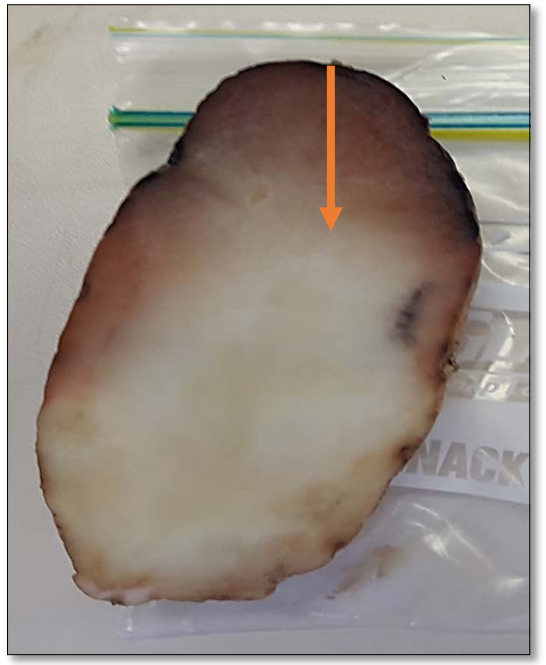
The potatoes were placed in zip lock bags and left in the dark at room temperature.

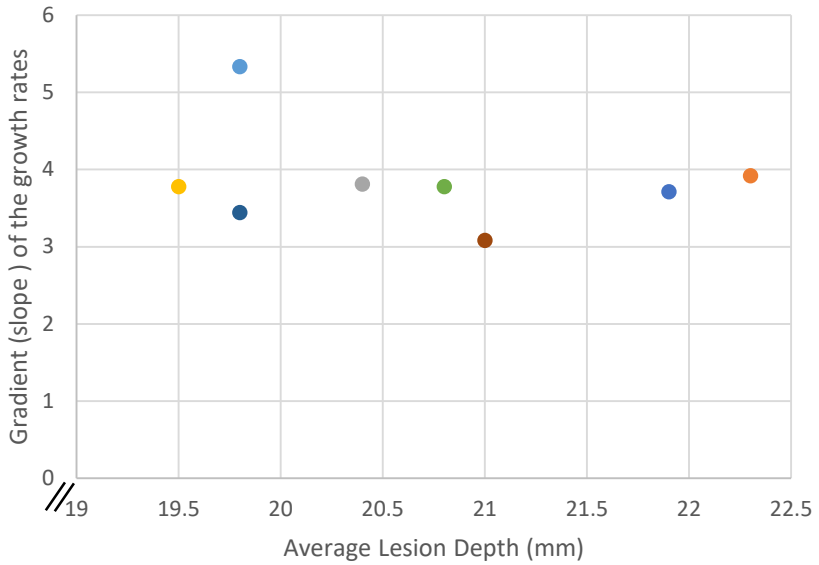
10 days later….

Pathogenicity: lesion depth



Mean depth of lesion front (mm) 10 days after inoculation to potato tubers





Lack of association between *in vitro* growth rate & pathogenicity

Current management practices

There is a high reliance on the use of fungicides

Mefenoxam or metalaxyl-M (e.g. RidomilGold) is the most commonly used fungicide.

It targets ribosomal RNA polymerase of the pathogen (single site mode of action).

Continuous use of this fungicide in production regions overseas has led to fungicide insensitivity

Current management practices

Resistant isolates can have:

- 2.5 - 3 x greater growth rate and oospore production compared to sensitive isolates.
- Build up greater soil inoculum levels.
- Higher fitness based on their ability to compete for space and colonize plant tissue
- But, this does not mean they will necessarily increase tuber rot aggressiveness in the field or in storage.

It is unknown whether Australian isolates exhibit any level of fungicide insensitivity

Salas, B, Stack, RW, Secor, GA & Gudmestad, NC (2000), *Plant Disease*, vol. 84, no. 12, pp. 1327-1333.
Benson, JH, Geary, B, Miller, JS, Hopkins, BG, Jolley, VD & Stevens, MR (2009), *American Journal of Potato Research*, vol. 86, no. 6, pp. 472-475.

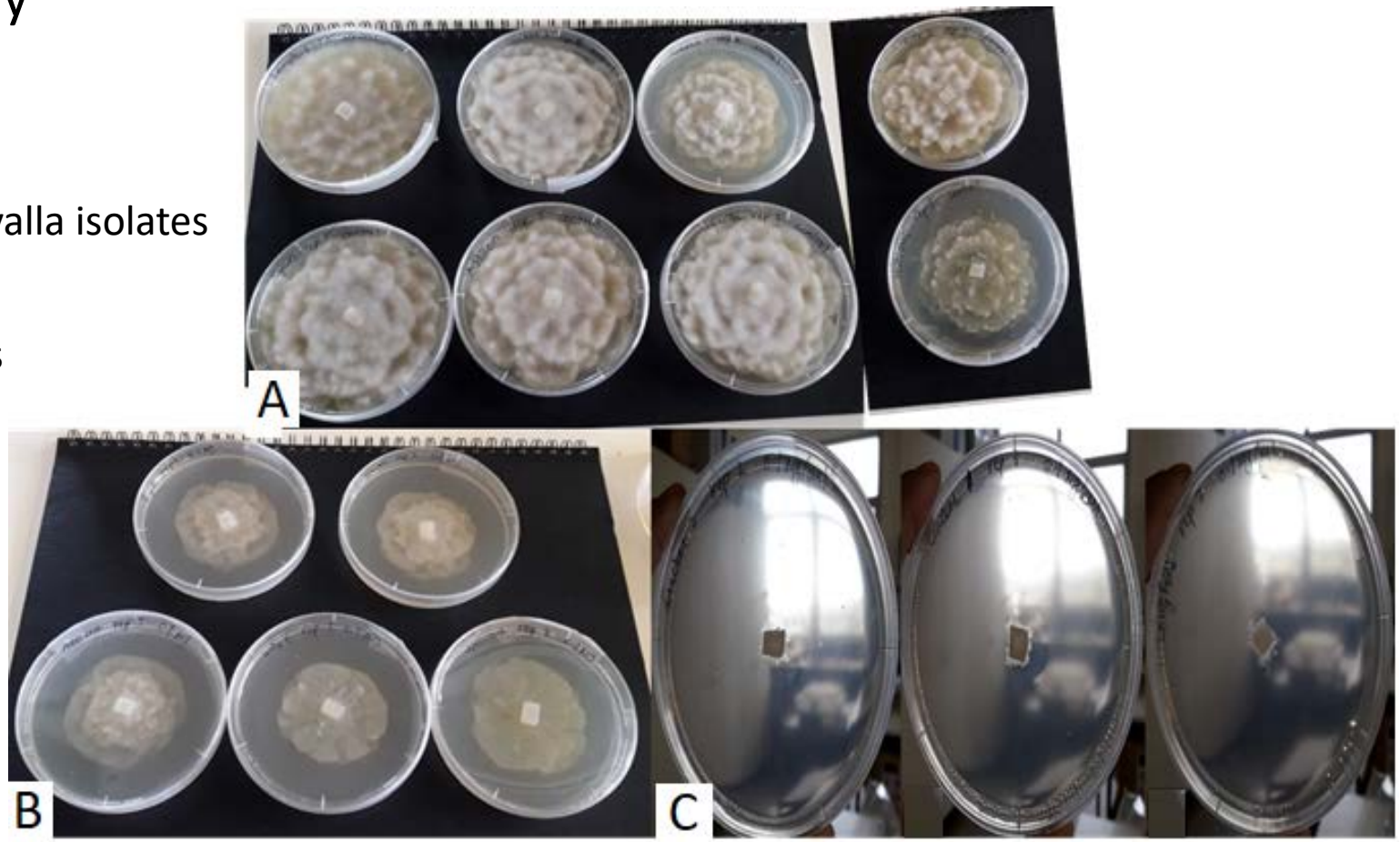
Metalaxyl-m (RidomilGold 480SL) resistance

In vitro fungicide sensitivity assay

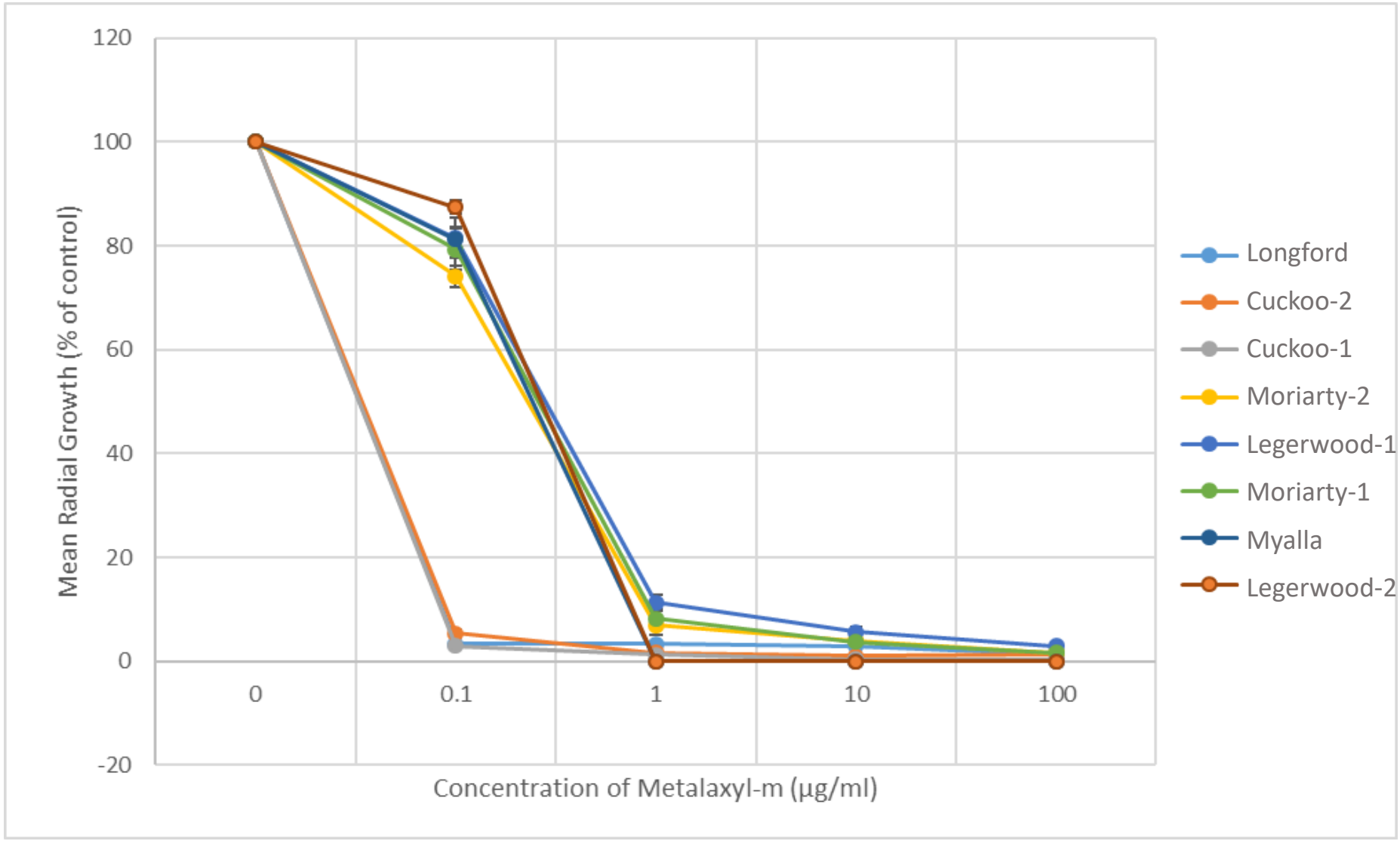
A. All 8 isolates
   - 0.0µg/ml of metalaxyl-m

B. Moriarty-1 & 2, Legerwood-1 & 2 & Myalla isolates
   - 0.1µg/ml of metalaxyl-m,

C. Cuckoo 2, Cuckoo 1 & Longford isolates
   - 0.1µg/ml of metalaxyl-m.



Metalaxyl-m (RidomilGold 480SL) resistance



Disease prediction from soil inoculum

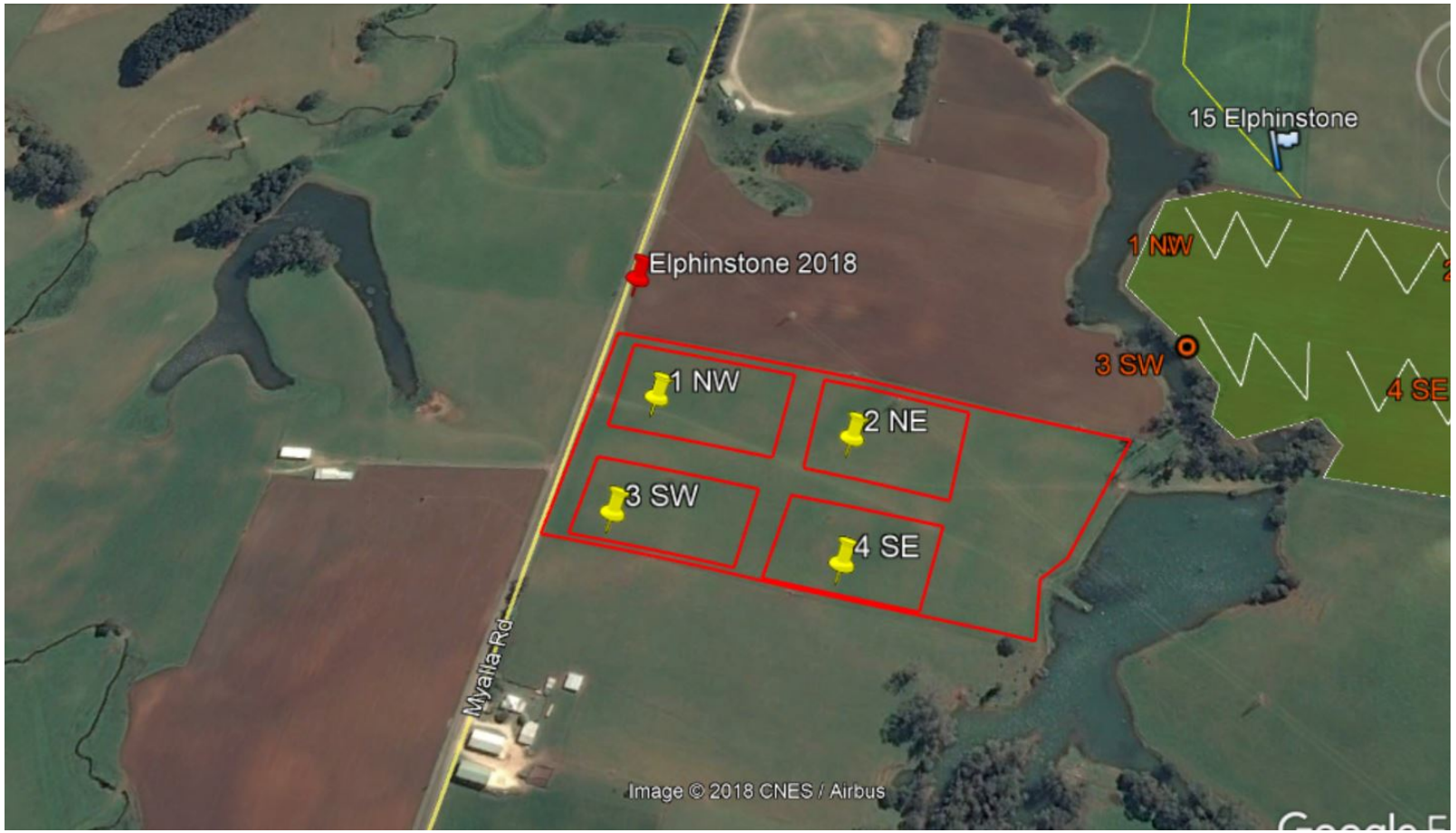
The South Australian Research and Development Institute (SARDI) run a commercial service for growers testing field soils for pathogen inoculum levels - Predicta-Pt

They are currently developing a risk assessment test for pink rot

They have a reliable (qPCR based) detection system and the current studies with which we are involved are an attempt to validate the test for its capacity to predict disease risk

https://www.pir.sa.gov.au/research/services/molecular_diagnostics/predicta_pt

Disease prediction from soil inoculum



Preplant soil sampling:

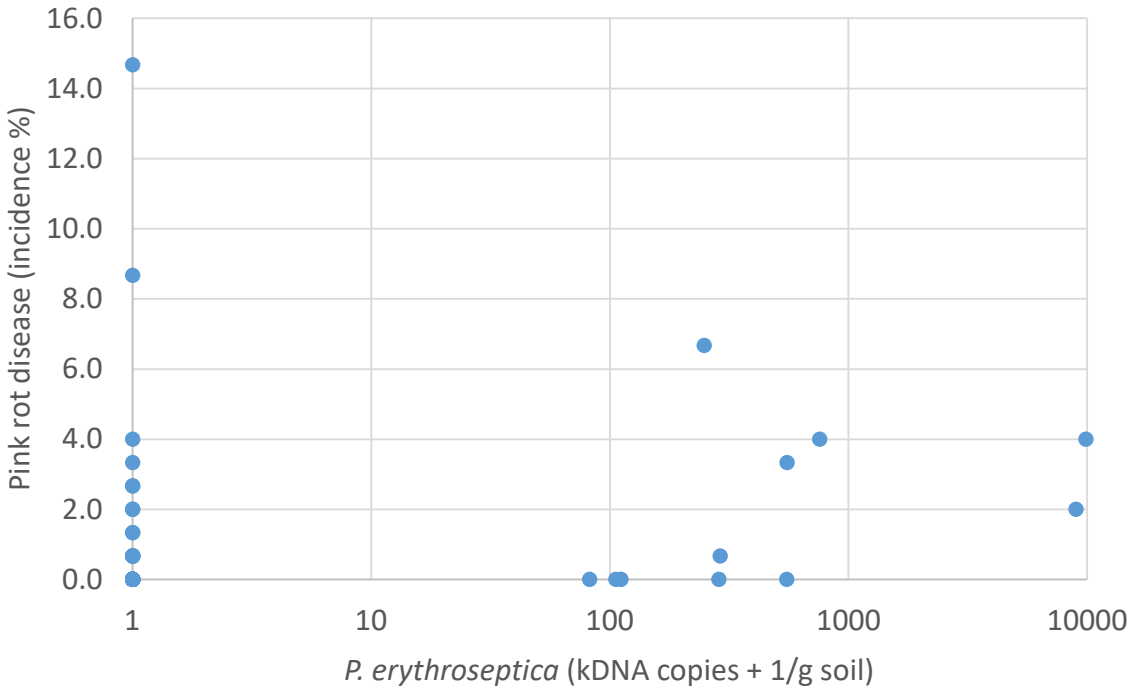
10 fields assessed (4 quadrats)
each 1 quadrat ~1 ha
Samples pooled for extraction & pathogen DNA quantified

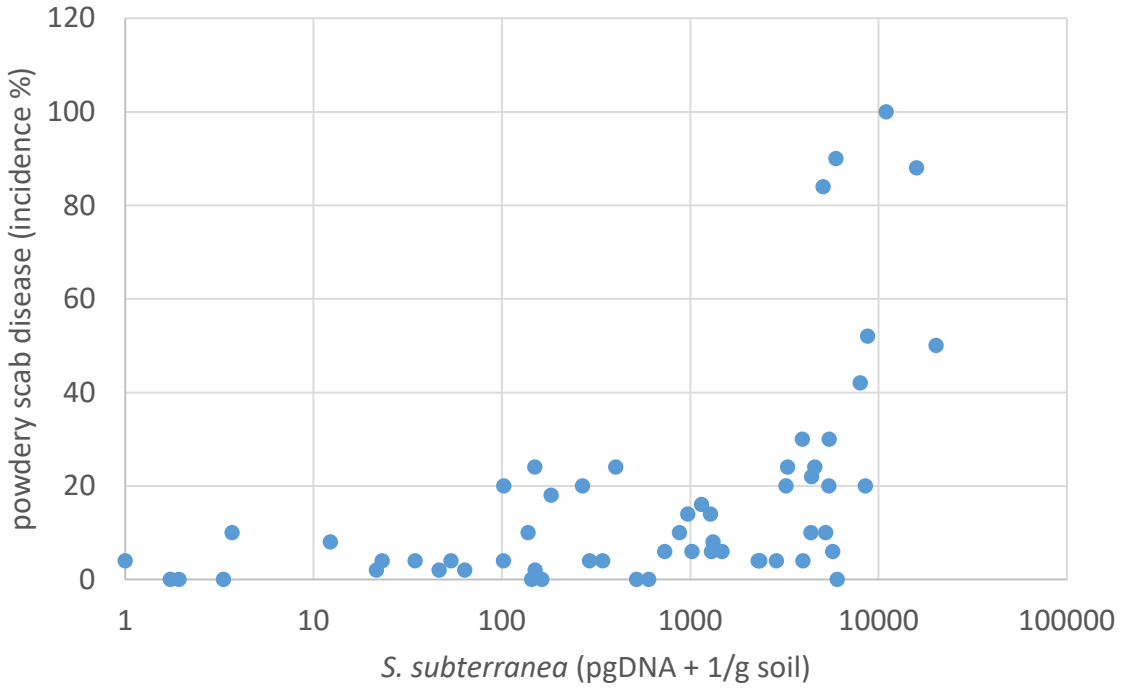
Crop measurements:

Crop emergence
Mid crop sampling
(root, stolon, early tuber disease)
Harvest disease assessment

Disease prediction from soil inoculum

Disease prediction from soil inoculum





Pre-plant inoculum levels were a (relatively) poor predictor of pink rot disease

Pathogen hits generally lead to disease but pathogen misses can also frequently lead to disease

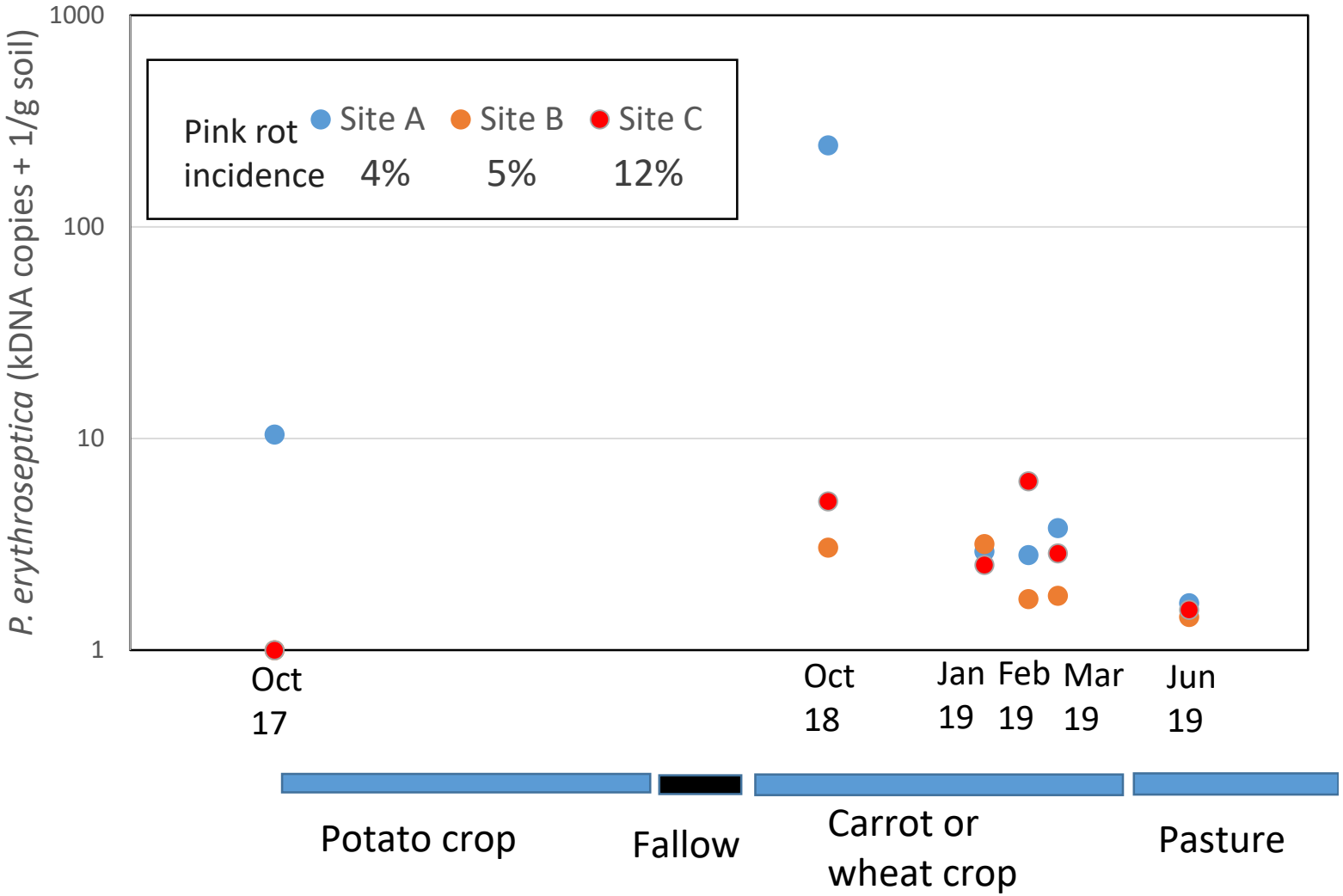
Low inoculum levels sufficient to instigate epidemic with pathogen multiplication through the season

Soil inoculum dynamics

Pre-plant levels could be very low and not indicative of disease risk.

Soil inoculum levels were raised following potato crop and then quickly declined.

Site A – had significant incidence of volunteer potatoes in first half of following carrot crop.



Soil inoculum dynamics

Studies examining pathogen dynamics during potato cropping underway

Glasshouse testing indicated even very small amounts of amended inoculum quickly ramified under conducive conditions

Preliminary field data suggests that mid crop testing may be a better indicator or risk

Opportunities for interventions (such as fungicide treatment), may then be better informed.


Any questions?