

Kauri Dieback – progress towards control and management

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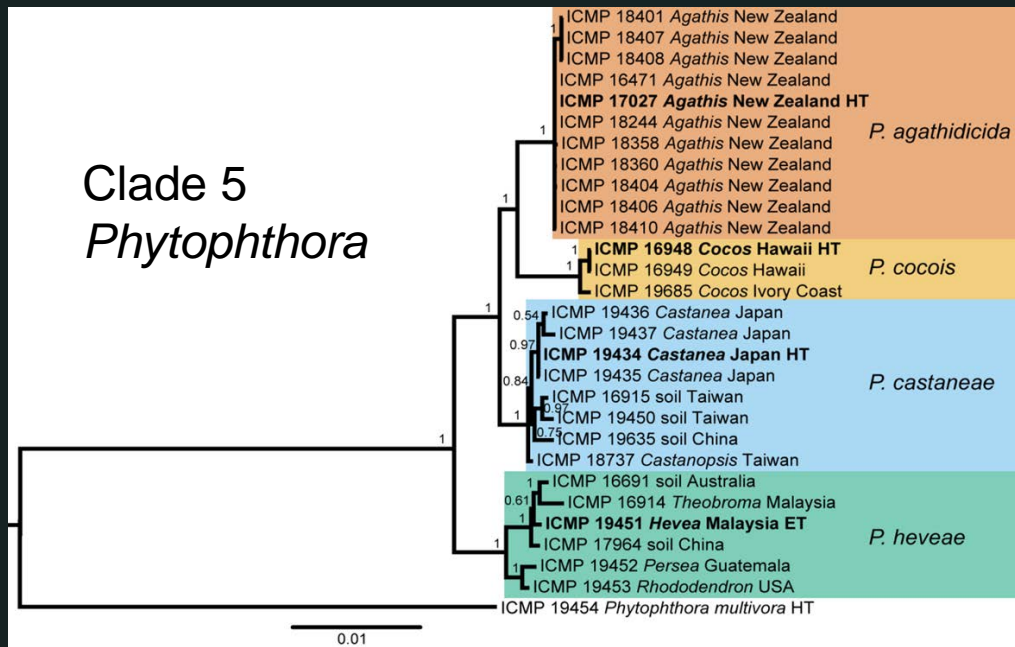
Overview

- Significance of species description.
- Root infection and FISH assay.
- Search for resistance.
- Role of phosphite.
- Improved detection / diagnostics.
- Engagement program.
- Next steps.



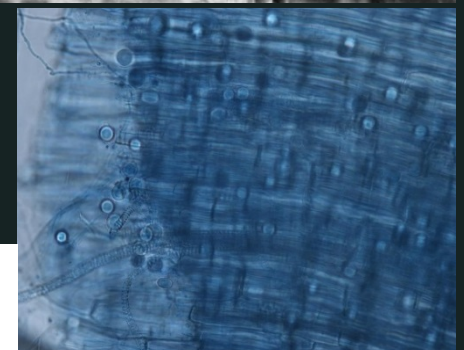
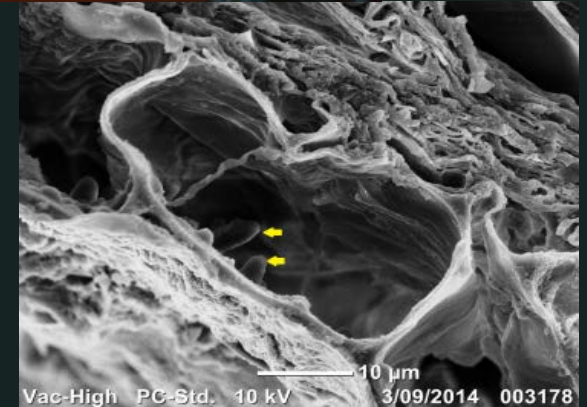
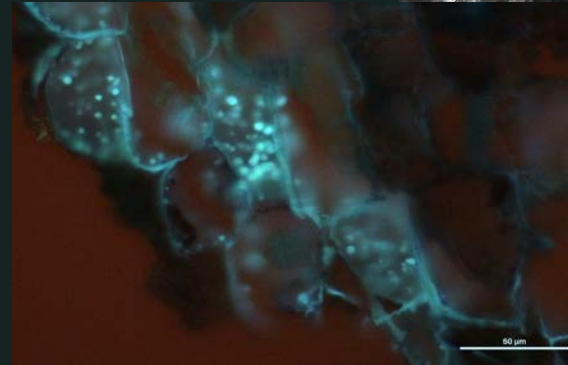
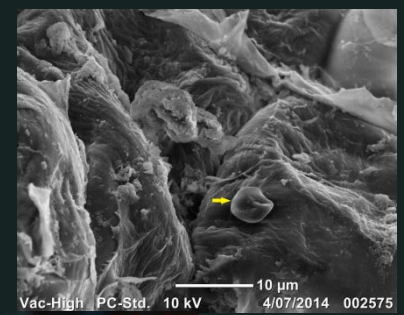
Describing the “kauri killing” *Phytophthora*!

- Clade geographically restricted to south-eastern Asia / South Pacific – origin?
- Limited diversity in pathogen \approx Founder population.
- Proximal hypothesis, PA is an exotic incursion.
- Target host is NZ kauri.
- What role do other resistant/ tolerant tree / plant species play in disease aetiology?



Confirming root infection

- PA colonises, establishes and commences invasion of cortical cells within five d.p.i.
- Lignitubers, stromata and oospores that are formed in plants, remain viable and can initiate further infection.



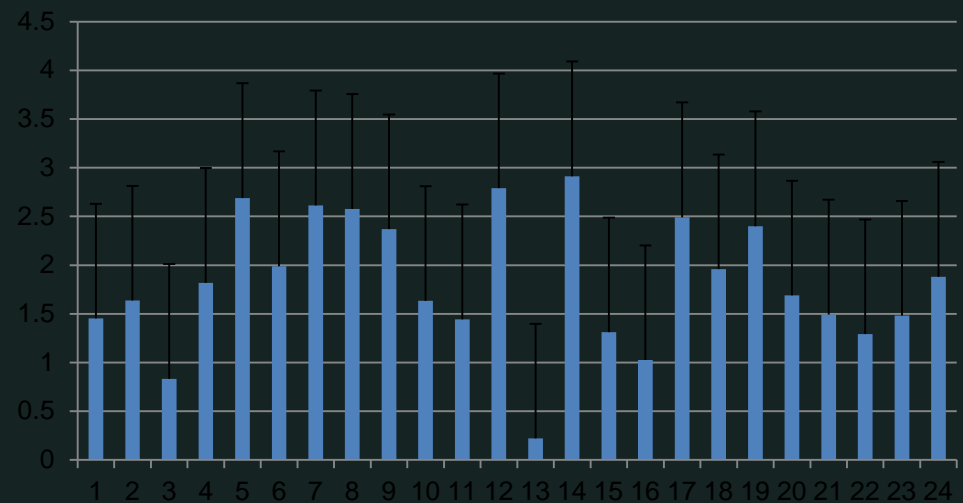
Search for resistance in kauri



Non-destructive sampling of shoots.
Kane – Scion “pruning” shoots
at Holt’s Forest



Predicted lesion extension
LSD = 1.178 (p=0.05)



The role of phosphite

- Remedial therapy showing promising responses.
- Need to understand how long one dose lasts.
- Other forms of less-invasive applications, e.g. bark paints/penetrants.
- Potential to incorporate plant growth promoters and/or fungicide.



Stream-based surveillance

Oomycete	Ex-Farm	Ex-forest
<i>Phytophthora amnicola</i>	16	29
<i>P. amnicola</i> (hybrid with <i>P. chlamydospora</i>)	4	-
<i>P. cinnamomi</i>	-	2
<i>P. citricola</i> s.s	2	-
<i>P. kernoviae</i>	2	-
<i>P. multivora</i> and <i>P. plurivora</i>	12	3
<i>P. chlamydospora</i>	8	2
<i>Phytophthora</i> "taxon Waitakere"	12	2
<i>Phytophthium</i> spp.	30	31
<i>Pythium</i> spp.	14	33

- Fishing for *Phytophthora* with "leaf" baits
- Landscape-level surveillance



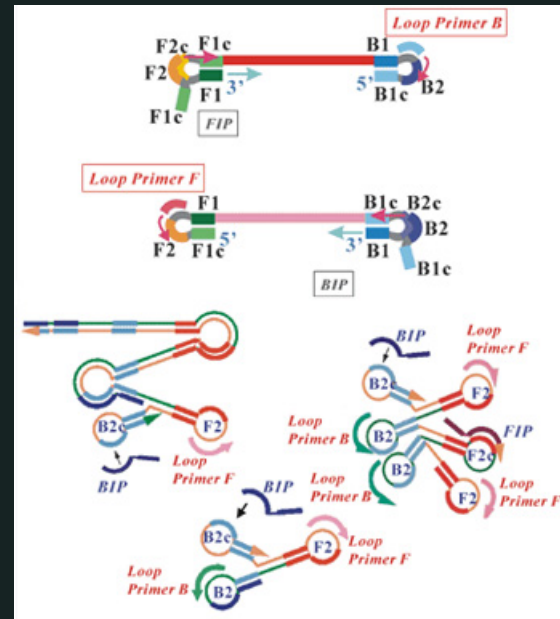
Next generation engagement

- Partnership with MBIE Participatory Science Platform, Royal Society of NZ.
- Primary- and Middle-school children learning about *Phytophthora* through stream baiting.
- Students designed bait cassettes and carried out surface dis-infestation steps in lab.

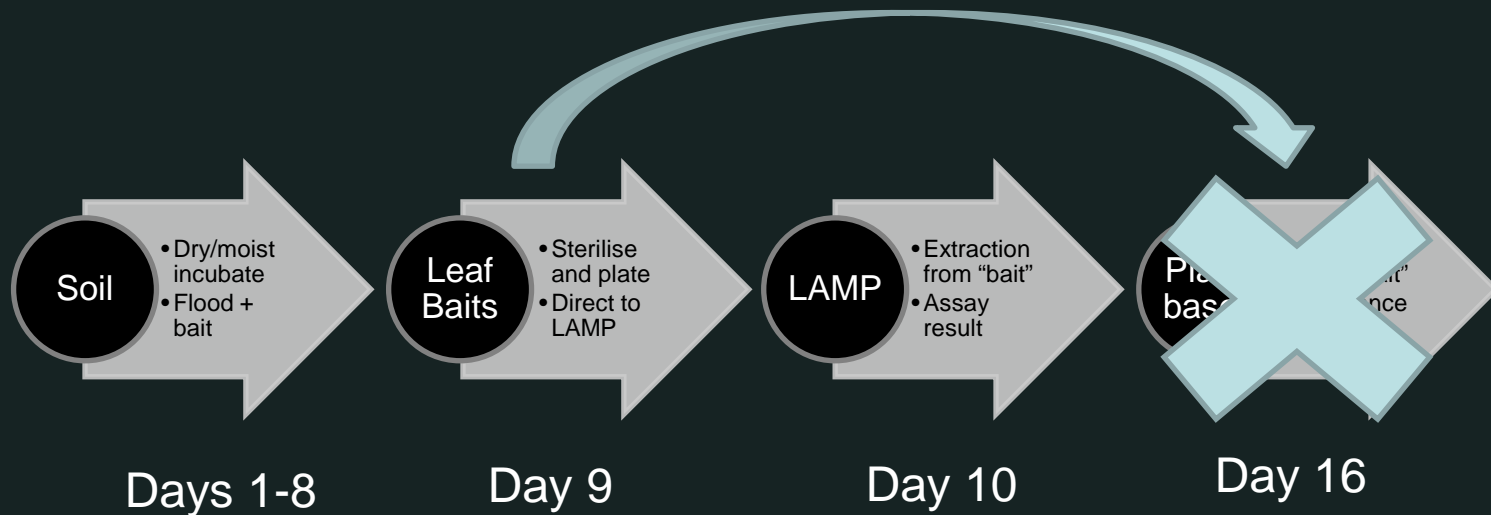


LAMP assay for *P. agathidicida*

- LAMP assay carried out isothermally (same temperature) so no thermocycler.
- Portable, hand-held devices.
- Pre-mixed, conjugate solutions allow one-step extraction and assay from crude-extract.
- Application to other pests.



Improved diagnostics: duplex assay, soil bioassay + LAMP



The role of soil ecology?

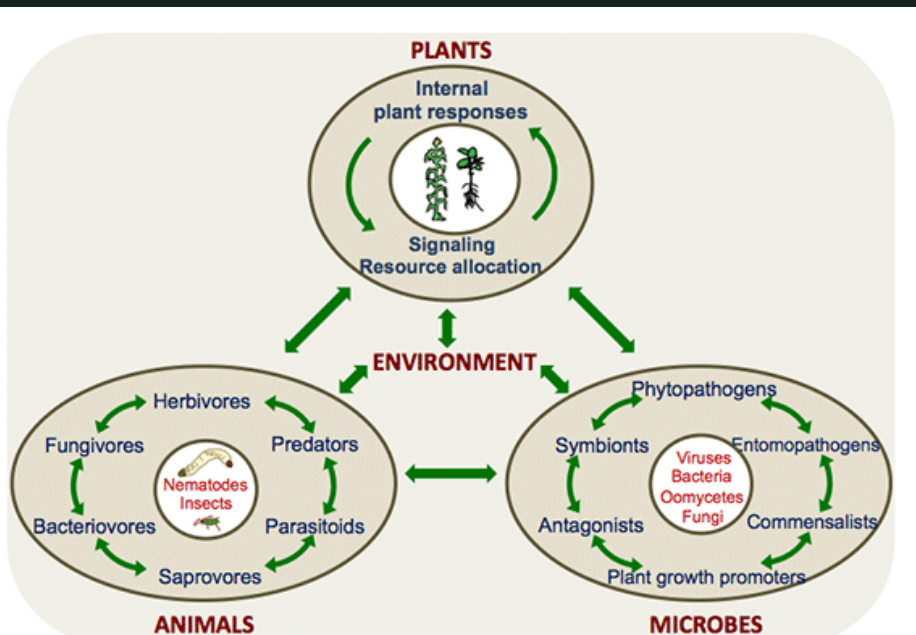
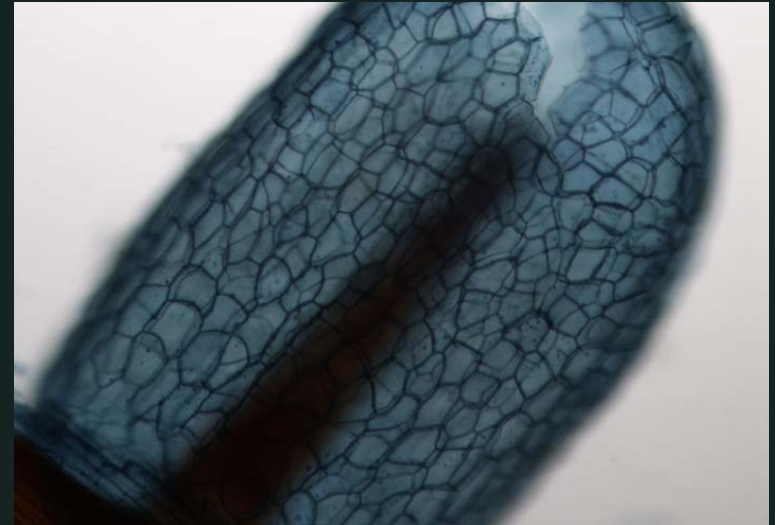
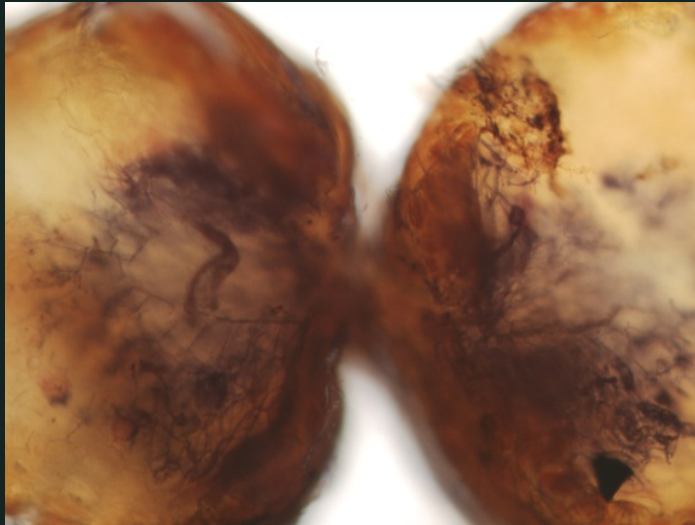
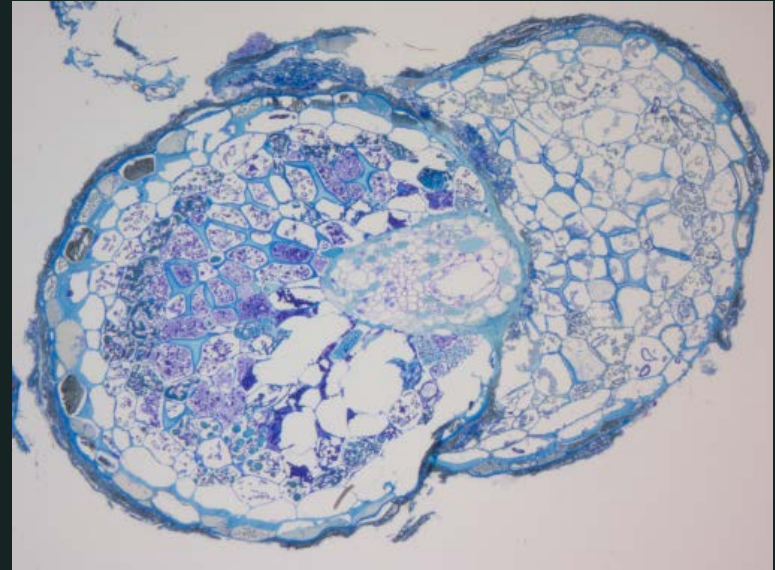


Fig 1. Dynamic and multitrophic interactions occur among the organisms and between the organisms and the environment in Phytobiomes.

- Holistic approach to plant diseases.
- Need integrated, cross-cultural, innovative solutions to improve soil and plant health
- “Probiotics” – are there beneficial microbes that we can add to the soil to combat PA?
- Application of Rongoa Herbal Remedies to combat PA or heal lesions.

Kauri helper fungi

- AMF common in root nodules, but less so in roots.
- Not all nodules colonised.
- Prevalent in cortex, almost no infection in epidermis.



Next steps..

- Characterising resistance in kauri;
 - Anatomically using FISH
 - Test seedlings of prospective parents
 - Transcriptomic analysis before and after infection (which genes activated).
- Pathogen biology;
 - Define origin more accurately
 - Study variation / diversity
- Interactions with microbes;
 - Biocontrol with mycorrhizas and other non-symbiotic microbes.



Acknowledgements

