Comparative efficacy of disinfectants against Phytophthora Taxon Agathis (PTA)

Introduction
Phytophthora taxon Agathis (PTA) has been recognized as a threat to the health of kauri (Agathis australis) in northern New Zealand (Beever et al. 2009). Affected trees show a collar rot associated with unusual gummosis leading to tree death. While trees showing such symptoms have been reported widely, they are not universally present. In order to reduce further movement of PTA, Auckland Regional Council (ARC) has instigated various precautionary policies, including the use of footwear hygiene procedures for park visitors (Fig 1).

This project has investigated the efficacy of various disinfectants against PTA:

Methods and Materials

Mycelial inhibition
Actively growing 6.5 mm diameter plugs of PTA were placed on plates amended with the five disinfectant treatments. The plates were incubated at 20°C and colony growth scored at 4 days. To check on viability plugs were removed after 8 days, plated to fresh PDA plates and assessed for growth 3–5 days.

Oospore inhibition
Oospore suspensions (containing 0.56 oospores from 56-day old clarified V8 liquid culture) were added to plates containing 0.6% water agar amended with each of the five disinfectant treatments at levels identified as lethal to mycelium after 10 days (at 20°C), viability was assessed using tetrazolium staining (Jiang & Erwin 1990) as follows: pink=dormant; red=activated; black=non-viable.

Results

Mycelial inhibition (Fig 4)

- Trigene and Phytoclean completely suppressed growth of PTA mycelium at all concentrations and no mycelium grew from plugs after 8 days exposure.
- Virkon (at 0.2 and 0.1% a.i) completely suppressed growth of PTA and no mycelium grew after 8 days exposure.
- Janola (at 0.2, 0.1 and 0.05% a.i) completely suppressed PTA. No mycelium grew after 8 days exposure.
- Citricidal inhibited PTA growth at all concentrations, but mycelial plugs grew out after 8 days exposure.

Oospore inhibition (Fig 5)

- The majority (c. 80%) of the oospores in the unamended control were dormant, about 10% were activated and the remainder (c. 10%) were non-viable (Fig 5).
- Virkon and Janola significantly reduced oospore viability, whereas Trigene Phytoclean and Citricidal had little effect (Fig 5).

Conclusions

- TriGene II Advance (2%) is a suitable disinfectant for controlling PTA, killing propagules of PTA, and reducing the infective capacity of soil containing PTA.
- Phytoclean is as effective as TriGene. Consideration could be given to registering this product, or similar quaternary ammonium products, for phytosanitary applications in New Zealand.
- Virkon and Janola effectively suppress the spread of PTA inoculum contained in soil. However these products have limited application because of reports of corrosivity to metal tools and “bleaching” of clothing.

References

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Figure 1: Name posting over feet mat coated with disinfectant, Auckland Regional Park

Figure 2 & 3: Rubber gumboot being pressed into soil “spiked” with PTA oospores (1500 g) and then sprayed with disinfectant to run off

Figure 4: Rubber gumboot being pressed into soil “spiked” with PTA oospores (1500 g) and then sprayed with disinfectant to run off

Figure 5: Oospore viability counts after 10-days incubation in the 5 disinfectant treatments as compared to control (Table 1). The contents were plated to P5ARP selective medium for Phytophthora species and colony forming units (CFUs) per ml were counted after 3 days.

Table 1. Summary of efficacy of various disinfectants against PTA and all soil fungi/bacteria (Table 1).

<table>
<thead>
<tr>
<th>Disinfectant</th>
<th>Treatment</th>
<th>Mean CFUs/ml from soil biomass water</th>
<th>PTA (CFU/ml)</th>
<th>PTA (cfu/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigene (2%)</td>
<td>Complete inhibition</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Phytoclean (10%)</td>
<td>Complete inhibition</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Virkon (1%)</td>
<td>Complete inhibition</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Janola (1%)</td>
<td>Complete inhibition</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Citricidal (1% )</td>
<td>Complete inhibition</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>RO water control</td>
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</tbody>
</table>

PTA Oospore preparation

PTA Oospore inoculum

PTA Oospore colonies growing from a trimmed leaf-bait of Himalayan Cedar (Cedrus deodara)