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Can a microscopic plant pathogen kill a large tuart tree?

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Since the 1990s, tuart (*Eucalyptus gomphocephala*) have been suffering a significant decline in Yalgorup National Park, approximately 100km south of Perth Western Australia, with symptoms ranging from chronic deterioration to sudden mass collapse.

Worldwide, and throughout Australia, microscopic plant pathogens belonging to the genus *Phytophthora* have been associated with significant woodland and forest declines. This is particularly marked when the pathogen is introduced to new environments which have not previously been exposed to the pathogens where plants have not evolved adequate defence mechanisms (Hansen 2008). Soil borne *Phytophthora* pathogens can cause tree death by damaging roots and vascular tissue necessary for the uptake of nutrients and water.

The role of soil borne *Phytophthora* species in tuart decline was investigated because decline symptoms are similar to declines of other trees in southwest WA involving *Phytophthora* pathogens. This research will enhance the management of tuart decline by highlighting the importance of *Phytophthora* species within the decline and focusing development of suitable control options.

Methods & Results

Throughout the distribution range of tuart, along the Swan Coastal Plan, soil and roots from declining trees were collected and processed to determine the presence of *Phytophthora* species. A new and previously undescribed *Phytophthora* species was found to be associated with declining trees throughout Yalgorup National Park. This new *Phytophthora* species was analysed using standard morphological and molecular techniques and was described as the new species *Phytophthora multivora* (Scott *et al*. 2009) (see Figure 1).

Figure 1 Reproductive structures of Phytophthora multivora *including (a) sporangia (asexual structure) and (b) oogonia (sexual structure).*

The distribution range of tuart is a narrow coastal corridor within the Swan Coastal Plain. The trees are found over a continuous strip south from Yanchep to Busselton, extending inland 5-10km.

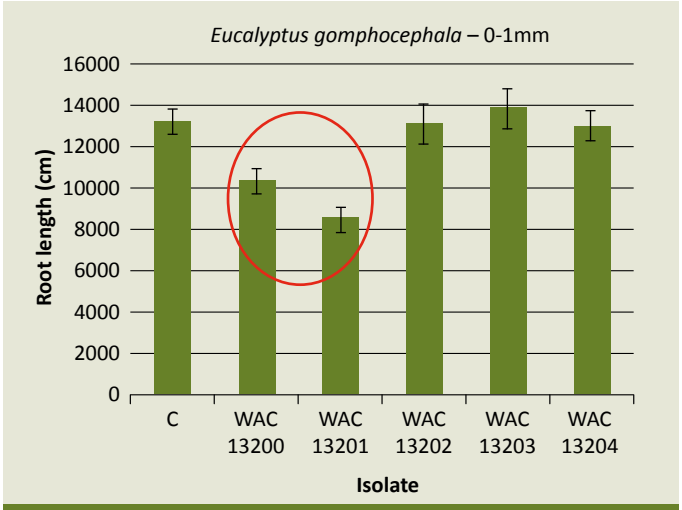

*Figure 2 Mean root length for diameters 0-1 mm (± standard error) of tuart (*Eucalyptus gomphocephala*) seedlings after 12 months growth in soil infested with* Phytophthora multivora *isolates (WAC13200 – WAC13204), or non-infested control soil (C). Red circle highlights a significant reduction in roots caused by* P. multivora *isolates compared to the control.*

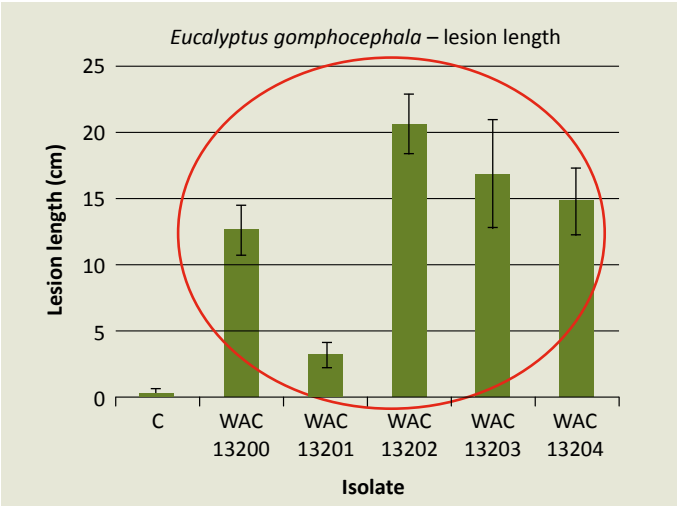

Figure 3 Mean lesion lengths (± standard error) from under-bark inoculation of tuart seedlings inoculated with Phytophthora multivora *isolates WAC13200 – WAC13204 or non-infested control soil (C). Red circle highlights a significant lesion extension caused by* Phytophthora multivora *isolates compared to the control.*

To determine if *P. multivora* is associated with tuart decline, healthy plants were artificially infected to determine if they would develop decline symptoms. The role of *P. multivora* in tuart decline was confirmed as plants growing in soil that had been artificially infected had significant fine root damage (see Figure 2), and the stems of plants that had been artificially under-bark infected developed significant expanding lesions (see Figures 3 and 4).

Further research supported the role of *P. multivora* in tuart decline. Declining trees growing on sites infested with *P. multivora* had significantly less fine roots, and the crown health of declining trees improved after injections of the fungicide phosphite, which is known to specifically control damage caused by *Phytophthora* pathogens.

Conclusions & Recommendations

Evidence suggests that *P. multivora* is a significant inciting factor associated with tuart decline, episodically causing fine root damage associated with chronic deterioration. Results confirm the need to identify healthy, non-infested sites and ensure adequate quarantine efforts are implemented to control the spread *P. multivora*. Findings may improve management of these important trees. Techniques developed to control *Phytophthora* pathogens in other tree species, including the use of phosphite application, may be further developed to control tuart decline.

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References

1. Hansen EM (2008) Alien forest pathogens: *Phytophthora* species are changing world forests. *Boreal Environment Research* 13, 33-41.

2. Scott PM, Burgess TI, Barber PA, Shearer BL, Stukely MJC, Hardy GEStJ, Jung T (2009) *Phytophthora multivora* sp. nov., a new species recovered from declining *Eucalyptus, Banksia, Agonis* and other plant species in Western Australia. *Persoonia* 22, 1-13.

Figure 4 Expanding stem lesions on tuart caused by under-bark inoculation with Phytophthora multivora.