Phytophthora taxon Agathis (PTA) **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Fungi	Oomycota	Peronosporea	Peronosporales	Peronosporaceae

Common name PTA (English)

Synonym *Phytophthora heveae*

Similar species *Phytophthora cinnamomi, Phytophthora castaneae*

Summary Commonly known as PTA, *Phytophthora* taxon Agathis is a soil and water-borne microscopic oomycete (a disease causing agent) that only affects the kauri (*Agathis australis*) causing foliage yellowing, canopy thinning, development of lesions on the lower trunk and roots and tree death. Recent research suggests that PTA is a distinct and previously undescribed species of *Phytophthora*.

view this species on IUCN Red List

Species Description
Superficially resembling a fungus, *Phytophthora* taxon Agathis is a soil and water-borne microscopic oomycete. It is similar in appearance to *P. castaneae* (syn *P. katsurae*), but it differs from this species morphologically in its rugose (wrinkled), as distinct from bullate (puckered), oogonia (Beever *et al.*, 2009).
Please follow this link for more details and to view an informative poster Beever, *et al* 2008. Kauri (*Agathis australis*) under threat from Phytophthora? Landcare Research.

Notes
Phytophthora taxon Agathis was first recorded from an *Agathis australis* host as *P. heveae* in 1972 (Gadgil, 1974). Recent phylogenetic analysis has indicated that *Phytophthora* taxon Agathis is more closely related to *P. castaneae* (syn *P. katsurae*), but it differs from this species morphologically in its rugose, as distinct from bullate, oogonia (Beever *et al.*, 2009).

Habitat Description
Phytophthora taxon Agathis has been isolated from the margin of bleeding lesions it induces on the 'Lower risk/conservation dependant', kauri (see *Agathis australis* in IUCN Red List of Threatened Species) and from the soil underneath both healthy and unhealthy trees (Beever *et al.*, 2009).

General Impacts
Phytophthora taxon Agathis causes a number of symptoms, more commonly known as 'kauri dieback disease' (Auckland Regional Council, 2009) or 'kauri collar rot' (Beever *et al.*, 2009) in kauri forests in New Zealand. Symptoms affect both old and young trees (Waipara *et al.*, 2010) and include yellowing of foliage, loss of leaves, canopy thinning and dead branches. Bleeding lower trunk and root lesions may also develop, resulting in excessive bleeding of resin (gummosis). These lesions may eventually girdle the trunk, leading to tree mortality (Beever *et al.*, 2009). The selective mortality of kauri caused by this disease may lead to changes in forest composition, with forest dominance likely to shift towards unaffected podocarp species such as rimu, *Dacrydium cupressinum* (Beever *et al.*, 2009).
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Management Info
Preventative measures: Phytosanitary stations utilising TriGene, a disinfectant, have been installed along public walking tracks to assist visitors with removal of potentially PTA spore infested soil from their footwear and equipment (Waipara *et al.* 2010). Hygeine procedures guidelines have been produced, suggesting actions that can be taken to minimise the risk of spread of PTA (Auckland Regional Council, 2010b) (See Cultural control). While there are no plans to do so at the present, the Auckland Regional Council states that parks or reserves containing kauri forests may need to be closed to public access in the future to minimise risk of spread (Auckland Regional Council, 2010a).
Monitoring: Current methods for determining the presence of PTA involves surveying for symptoms (including gummosis), sampling in tree lesions and by soil baiting (Randall *et al.*, 2010). Current research has demonstrated that *Phytophthora* species could also be detected via stream baiting, although PTA itself was not detected (Randall *et al.*, 2010).
Cultural : Hygeine procedures to minimise the risk of spreading PTA include: ensuring that all footwear, tools and equipment/machinery are totally soil-free when entering and exiting a forest area containing kauri; if entering/exiting a stream system or moving onto or off a medium to high use track (>1000 people per annum), portable phytosanitary packs must be used to ensure that PTA is not carried onto the stream/track from surrounding kauri or between high risk areas. Phytosanitary backpack kits are also to be used when leaving an area showing symptoms of PTA. Keeping to defined park tracks at all times is important as any movement of soil around the roots of a tree has the potential to spread the disease (Auckland Regional Council, 2010b). If diseased kauri and vegetation (including weeds and native vegetation in diseased zones) are to be trimmed or cleared they must be left in-situ or disposed of at a landfill site, not to green waste (Auckland Regional Council, 2010b). Additional procedures apply for the felling or pruning of kauri with pruned material and logs either being left in-situ if possible or moved to a landfill. Stumps and roots should be left in the ground to prevent soil movement. Any tools or machinery that have been in contact with kauri or soil in kauri areas must be treated as contaminated and work in the vicinity of kauri should be avoided during wet conditions (Auckland Regional Council, 2010c).
Chemical : Disinfectant products such as TriGene Advance (2%) and Phytoclean (10%) have been shown to be effective in controlling PTA, killing propagules of PTA, and reducing the infective capacity of soil containing PTA (Bellgard *et al.*, 2010).
Other: Methods such as resistance breeding have been successfully used overseas against other related *Phytophthora* tree diseases such as the protection of the 'Vulnerable (VU)' Port Orford Cedar (see *Chamaecyparis lawsoniana* in IUCN Red List of Threatened Species) against *Phytophthora lateralis* (Dorena Genetic Resource Center, 2009) however more research is needed to find both intermediate and longer term management tools for this disease in New Zealand (Auckland Regional Council, 2010a).
Please follow this link for more details and to view an informative poster Beever, *et al* 2008 Kauri (*Agathis australis*) under threat from Phytophthora? Landcare Research.

Pathway
The native range and known introduced range outside of New Zealand of *Phytopthora* taxon Agathis is unclear (Beever *et al.*, 2009). Information on long distance dispersal methods is therefore lacking.

Principal source: Gadgil, P.D. 2009. *Phytopthora* taxon Agathis, a new pathogen of kauri? No, just an old one under a different name. Forest Health News, 199.
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Summary: Abstract: Kauri *Agathis australis*, an iconic tree of New Zealand, is under threat from an introduced disease-causing pathogen provisionally named *Phytophthora* taxon *Agathis* (referred to as PTA). This soilborne, Pythiaceous species belongs to the Chromista and causes a collar rot resulting in yellowing of the foliage and thinning of the canopy, which eventually causes death of the infected tree. The management and containment of this pathogen requires rapid and reliable detection in the soil. The current method for soil detection utilizes a soil bioassay involving lupin baits and soil flooding in a process that takes between ten and twenty days. We describe a real-time PCR assay based on TaqMan chemistry for the specific detection of PTA, which targets the internal transcribed spacer (ITS) region of the nuclear ribosomal DNA. This TaqMan real-time PCR assay could be used with DNA extracted directly from bulk soil samples to enable rapid quantification of PTA within soil. The detection limit was 2 fg of PTA DNA from pure culture, or 20 fg in the presence of DNA extracted from soil. The assay was validated using soil samples taken from a PTA-infested site and soil spiked with a known concentration of oospores. We conclude that the TaqMan real-time PCR assay offers a more time-efficient method for detection of PTA in soil than existing methods

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