Merit

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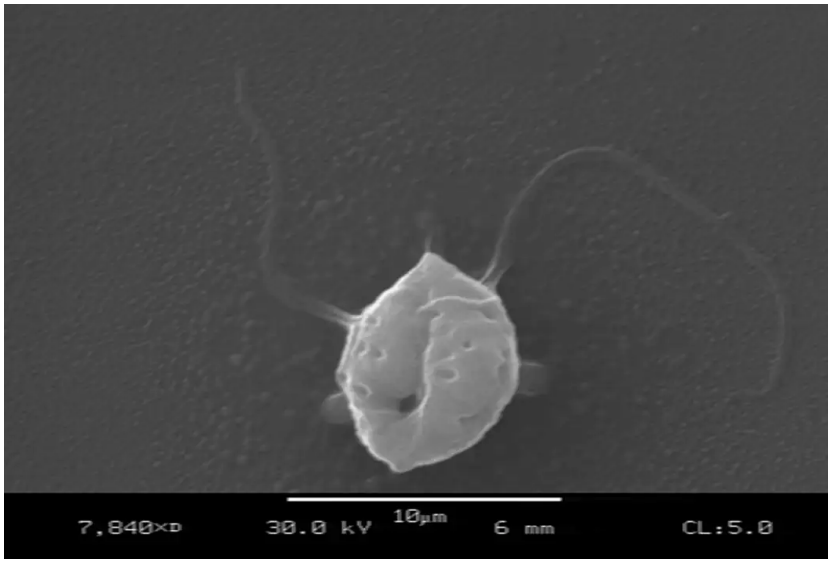
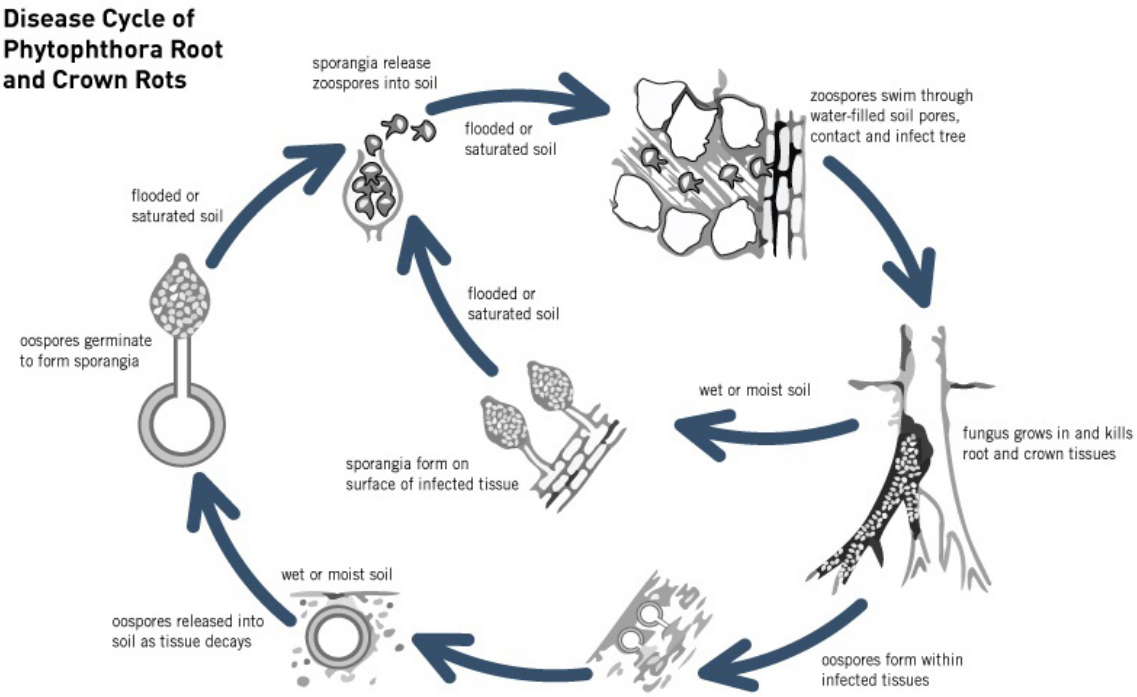
Kauri Dieback Report

Kauri Dieback is a fungus-type pathogen that damages the Kauri trees' root system. Its scientific name is Phytophthora Taxon Agathis (PTA). The disease reduces the trees' ability to take water and nutrients from the soil. There is no known cure for PTA, and no infected trees have lived. The disease has infected trees in Northland, Great Barrier, and the Coromandel Peninsula. PTA is a water mould, a particular type of fungus called an oomycete. Kauri trees are crucial for New Zealand's ecosystem because they protect the plant and animal life below. This report will compare and contrast how soil moisture levels affect the movement of PTA and how it spreads.

Phytophthora Taxon Agathis moves through the soil using tiny tail-like structures called flagella. Oospores are spores that are 'dormant' resting in the soil. Oospores get spread by humans or animals, such as pigs or dogs, who move and disturb the soil. Oospores eventually germinate to become sporangia (the reproductive organ of the disease), a structure that produces zoospores. Zoospores released during or after rain travel via the moisture in the soil. They move using their flagella to propel through the water and find Kauri roots to attach to.



Zoospores germinate to produce mycelia, the branded tubular structure that infects the Kauri roots. The mycelia spread throughout the tree's root system to inundate the tissues at the base of the Kauri trunk. After some time, the infected tree will no longer be able to carry nutrients and water to the tree canopy. Once a tree is infected, it becomes a breeding ground for PTA. More sporangia form in the infected areas of the tree's roots, releasing dozens of zoospores each time it rains. Oospores also form in infected tissue and get released into the soil. This cycle repeats, infecting more and more trees each time.



The most fluctuating abiotic factor in the spread of PTA is moisture levels in the soil. Phytophthora reproduces two ways, creating two different types of spores. Zoospores are a water-borne spore that perishes quickly without water and dies in seawater. If the moisture levels are correct, they can travel 0.7m an hour, the fastest way PTA spreads. Oospores are tough and live in the soil. They can survive in dried soil on boots and equipment for eight years.

The Kauri Protection Programme states “Zoospores are released during and immediately after rain.” This is because it is easier for them to move. The more moisture and liquid in the soil, the easier the zoospores can swim and find other Kauri roots. If there is little moisture in the soil, it restricts the oomycete's movement and can't infect other trees. We commenced an experiment using small pieces of bread dampened with different amounts of water to show how moisture levels affect the spread of fungi. We put the bread in an airtight bag for 72 hours.

Water Drops	Fungal Growth Coverage %
0	0
2	10
4	17
6	25
8	40
10	45

As we theorised, the pieces of bread grew mould, a fungus commonly found in everyday life. According to the table above the bread with more water was covered in a higher percentage of mould after 72 hours. This is compared to the bread with no or little water. This experiment helps to show us that with more water the mold can spread easier. Fungi's complete extracellular digestion, meaning they absorb nutrients through small molecules in their cell membranes. Digestive enzymes are secreted into the food source to break down the food enough to be absorbed. The Scipad states, "The enzymes released from the hypha tip require a wet environment for release and subsequent digestive activity." This means that fungi cannot complete nutrition without moisture. Therefore, water does not only help with movement and reproduction but nutrition as well.

Phytophthora movement affects the species surrounding biodiversity by destroying a core part of their environment. Scientifically, the Kauri tree provides a better soil environment for younger or smaller flora and fauna. Its root systems help support the steep hillsides of Aotearoa, and its thick canopy blocks harsh sunlight, rain and wind gusts, allowing the native plants below the canopy to grow. Animals, like native birds, also strive in this environment. So what makes a disease like PTA so concerning? If Kauri trees become extinct because of it, the repercussions could be detrimental to New Zealand wildlife.

The images above show two Kauri trees. The photos on the left depict a Kauri tree displaying symptoms of PTA. Some common symptoms are yellowing leaves, dead or dying branches, bleeding gum, and a thinning canopy. Advanced cases of PTA exhibit a dead tree with bare remains of a trunk and large branches. The image on the right presents a healthy Kauri tree full of thick and green foliage, protecting the environment below. Without the Kauri tree's dense canopy blocking out the sunlight and holding in moisture, the soil will harden and temperatures will rise creating a knock-on effect that will destroy the biodiversity. The above photos show us how a dead Kauri tree creates a hole in the protective layer of New Zealand forests.

To conclude, Phytophthora Taxon Agathis is devastating for Kauri, and high moisture levels help it move, reproduce and digest. This needs a serious solution fast before the knock-on effect destroys New Zealand's biodiversity.