PHYTOPHTHORA DIEBACK ON NORFOLK ISLAND
DIAGNOSIS AND MANAGEMENT

Background

Phytophthora cinnamomi is a soil-borne plant pathogen. It is the main species that causes phytophthora dieback disease. It is considered one of the world's most invasive organisms, found in more than 70 countries including throughout Australia. *Phytophthora cinnamomi* is part of a group known as Oomycetes, which are fungus-like organisms but not a true fungus. *Phytophthora cinnamomi* has a wide host range, with more than 3,000 susceptible hosts. Hosts include horticultural crops such as avocadoes, pineapples and cut flowers and many Australian native species.

Phytophthora cinnamomi was first reported on Norfolk Island in 1972.[1] It has been collected several times since then from numerous hosts including avocado, macadamia, peach, and native ironwood.

Identification

Phytophthora cinnamomi is primarily identified using molecular techniques. Test kits are available from several suppliers in Australia.[2] However, a preliminary assessment of plant symptoms will provide an indication on if *Phytophthora cinnamomi* is the likely cause of declining plant health.

Biology and life cycle

Phytophthora cinnamomi lives in the soil and plant roots. It thrives in warm, moist conditions. During dry, unfavourable conditions, *Phytophthora cinnamomi* forms drought-resistant structures called chlamydospores. Under optimal conditions, it produces mycelia and fruiting structures called sporangia. The sporangia release zoospores which swim towards plant roots. The mycelia grow throughout the roots, drawing nutrients from the plant cells. An extensive spread of mycelia may cause the plant to die.

Damage and symptoms

The first signs of *Phytophthora cinnamomi* infection can be found in the roots. Look for blackened and dead roots just under the mulch layer (see Figure 1). In avocados, healthy feeder roots should be bright white and fibrous.[3]

Figure1: Roots Infected with *Phytophthora*. Credit: Richard Davis.

Because the canopy of an infected tree is lacking water and nutrients, new growth will begin to wilt, turn yellow and drop from the tree. Gradually, the decline will progress through the canopy, leading to twig, branch and tree death. This slow decline is characteristic of the disease, especially in avocado (Figure 2).

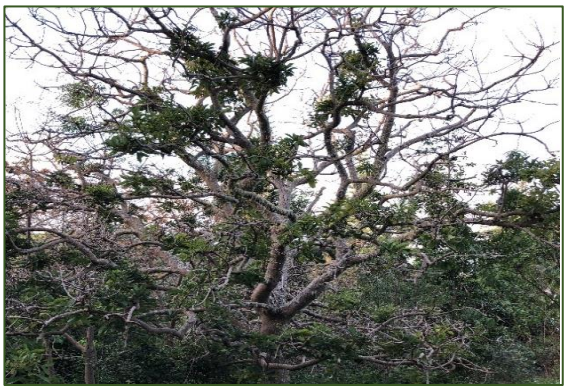

Figure 2: Avocado tree with dieback symptoms. Credit: Sandy Perkins.

[1] Benson, M.L. (1980) Dieback of Norfolk Island pine in its natural environment. Australian Forestry, vol. 43, pp. 245-52.

2 Test kits available from: treelogictools.com.au, arborcarbon.com.au

[3] Note: feeder roots can naturally senesce during flowering in avocados, so be careful with root inspections during flowering

In pineapples, the infection also starts in the roots and causes root rot. Root rot can be detected early by pulling at the plant. Plants with root rot will pull easily and healthy plants will remain firmly anchored. The infection can then spread, causing heart rot (Figure 3). Heart rot can be detected by pulling at the leaves. Plants with heart rot will surrender leaves easily.

Figure 3 Heart rot in pineapple

When diagnosing the disease, look for patterns of sick plants associated with waterlogging or poor drainage (Figure 4).

Figure 4. Pineapple root rot caused by *Phytophthora cinnamomi* where drainage is poor.

Management

Prevention. *Phytophthora cinnamomi* is soil-borne and can be moved easily in wet conditions. Prevention is a key component to managing the disease on Norfolk Island. Ensure earthmoving equipment, vehicles and visitors' boots are soil-free. Any source of potentially contaminated soil should be carefully managed to ensure it is not spread.

Drainage. The next most important preventative measure is to ensure good drainage around the root zone of the plants and gardens you are trying to protect.

Resistant rootstocks. Phytophthora-resistant rootstocks are commercially available. These could be considered when seeking to import new trees.

Suppressive soils. You can create suppressive soils in your garden to inhibit the spread of Phytophthora. Heavy mulching of trees can encourage the build-up of microorganisms that are harmless to the tree but can compete with and, in some cases, be hostile towards Phytophthora.

Gypsum. Applications of gypsum below the tree will raise the calcium levels of the soil. This can inhibit the pathogen's ability to reproduce.

Phosphonic acid. Once Phytophthora has infected a tree, phosphonic acid (also known as phosphite and phosphorous acid), can be used to limit the spread of the pathogen within the tree and boost the tree's immune response to the disease. Apply phosphonic acid when the tree is undergoing a period of rapid root growth (look for bright white root tips), but not flushing foliage. This will help the plant transport the acid to the roots where it is most beneficial. Phosphonic acid can be applied as a foliar spray or injected directly into the stem (Figure 5).

Figure 5. A stem injector used to inject phosphonic acid directly into commercial avocado trees.

Australian Government

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