



Avocado Nursery Diseases

INTRODUCTION

The production of vigorous, pathogen free nursery trees provides confidence to customers and assists in promoting future sales. Diseases that can affect avocado nursery trees range from viroids, seed decays, root rots, stem lesions and dieback, graft cankers to leaf spots.

Avocado nursery trees can be sent to many growing areas in Australia. Therefore, a disease outbreak in a nursery will be more than of local interest. The movement of pathogens capable of existing in the soil for many years can have far reaching consequences. They may contaminate the field site leading to healthy replacements also becoming diseased. Pathogens may also impact other agricultural enterprises or move into natural ecosystems.

Customers expect that nursery trees should not only be free of disease symptoms, but also free of the pathogen propagules that precede disease expression in the future. For this reason, disease prevention, early detection and appropriate management is vital.

ABOUT THIS FACT SHEET

This fact sheet provides an overview for understanding, identifying and preventing the complex of diseases that can affect avocado nursery trees. It includes advice on symptoms, spread and management of these diseases.

Within this fact sheet, diseases are separated into **viroid** and **non-viroid** pathogens. Then further, into groups based on their seriousness.

- » **Group 1** pathogens are considered the most serious. This group contains viroids that may be introduced into the production process and are destructive in both the nursery and post-nursery phase. It also contains non-viroid pathogens that can cause the death of the plant, e.g. *Phytophthora*; and
- » **Group 2** pathogens are those that have the potential to be destructive but are unlikely to cause the death of the plant either in the nursery or in the field after planting.

Pathogens in both groups may negatively impact plant growth in the nursery and after field planting may impact production. Management actions outlined here should assist in preventing infestations.

FURTHER INFORMATION AND SUPPORT

The Nursery Industry Accreditation Scheme Australia (NIASA) now includes best practice advice in disease prevention, detection and management for commercial production of avocado trees. Information in the NIASA guidelines is more detailed than recommendations provided here. A copy of the Guidelines is available at nurseryproductionfms.com.au/niasa-accreditation.

Reliable identification of a disease is an obvious prerequisite for the successful application of management procedures. The Nursery & Garden Industry Queensland's (NGIQ) Pest Identification Tool www.pestid.com.au may assist in initial diagnosis. The tool is provided to assist nursery producers

in identifying and treating pest insects, diseases, disorders and weeds. It also includes information on predatory insects and other beneficial species. You can view the information in the tool on your computer or mobile device. The tool is unique because it is electronic, portable and being updated on a regular basis.

However, do not rely on picture taxonomy to identify a problem with a plant pest; when in doubt nursery managers are advised to consult with a reputable diagnostic laboratory. Links to fact sheets specific to Australian production nurseries are provided where relevant.

A CHANGING NEED — A BRIEF HISTORY OF ANVAS

The Avocado Nursery Voluntary Accreditation Scheme (ANVAS) was originally introduced in 1977–78 because infestations of orchards suffering from *Phytophthora cinnamomi* often occurred as a result of planting infected seedlings. This was in part due to avocado nursery trees being sold that appeared healthy, but were actually infested with *P. cinnamomi*. ANVAS was therefore solely introduced to grow plants free from *Phytophthora*. In 1980 the virus tested tree registration program was introduced to address the presence of *Avocado sunblotch viroid* (ASBVd) and grow trees free of virus pathogens. The two programs worked independently for a time but were eventually amalgamated in 1984 to reduce administration. ANVAS was regulated by the Australian Avocado Growers Federation (AAGF) and government pathologists worked with nurseries to maintain and upgrade practices as required. In 2003, governance of ANVAS was given to Avocados Australia Limited (the first national avocado peak body).

Prior to 2018, ANVAS was last updated in 1996 and received little formal modernisation since then. A review of ANVAS in 2014 recommended important changes to strengthen the program such that they provide a holistic approach to producing pathogen free avocado seedlings within a robust

administration system. Based on these recommendations and current best practice nursery production, the ANVAS program has received a complete overhaul.

Avocados Australia Limited still provide ANVAS accreditation services, however technical nursery production requirements of the ANVAS program now sit within the NIASA best practice management guidelines. As such, there is an expectation that ANVAS accredited nurseries will have a continual and progressive approach to improve growing practices, providing plants of the highest quality. NIASA 'High Health Avocado Production' guidelines are included as an appendix to the NIASA Guidelines and provide additional avocado specific guidance beyond that used generally to produce other nursery lines. These will ensure avocado seedlings have the highest chance of starting healthy and maintain conditions suitable for optimal growth and high health. While the program is mostly self-regulated, a modern audit system is in place to ensure that growers are using the guidelines and maintaining plant health to produce plants that are free of a wide range of pathogens*, not just *Phytophthora*. The program will easily allow new or emergent pathogens to be included as required.

* It is impossible to guarantee that all plants are free of all pathogens as this would require inspection and testing of every plant. Therefore, the approach taken was to strengthen measures to prevent infestation into the production nursery environment and to take steps to detect infestation should it be inadvertently introduced. The system provides a 95% chance of detecting infestation at or below 5% incidence if in fact an infestation is even present.

VIROIDS

Two viroid diseases are known to infect avocado, *Avocado sunblotch viroid*, and *Potato spindle tuber viroid*.

SUNBLOTCH

CAUSE

Avocado sunblotch viroid (ASBVd)

IMPORTANCE

A serious **Group 1** viroid that will threaten orchard production if trees are propagated from infected seed or scion wood.

SYMPTOMS

Infected trees may remain symptomless and leaves often will not show obvious symptoms. The most consistent symptom in the nursery will be white, yellow or pink streaks on young stems. Bleached or chlorotic areas may appear on leaves. Fruit have the most obvious symptoms and may appear similar to those caused by chimera.

SPREAD

Infected seed, cuttings and grafting wood; sap contaminated pruning blades, harvesting clippers and injection equipment; natural root grafting between trees. Pollen transmission is possible, but only the seed of the developing fruit is infected and not the fruit bearing tree.

MANAGEMENT

- » Test mother trees used for seed, cuttings, or grafting wood for the presence of ASBVd. ASBVd is systemic in infected avocado trees but its concentration varies widely between branches.
- » All equipment (pruning tools, harvesting clippers, injection equipment) should be thoroughly cleaned and disinfected between trees.



Avocado stems (right) and fruit (above) from trees infected with ASBVd.

POTATO SPINDLE TUBER

CAUSE

Potato spindle tuber viroid (PSTVd)

IMPORTANCE

A **Group 2** viroid that requires further research to understand whether strains of PSTVd present in Australia will infect avocado. PSTVd has only been reported as a pathogen of avocado in Peru where infected potatoes were grown between rows of avocado trees.

SYMPTOMS

Many strains have been reported that cause symptoms ranging from mild to severe. The disease has been reported from Peru where potato and avocado are often interplanted. Trees are often symptomless, but where there is coinfection with sunblotch, they show bunchiness of the inflorescence, reduced fruit size and number, with eventual decline and death of the tree.

SPREAD

Mechanical transmission by sap contaminated pruning blades, harvesting clippers and injection equipment. No known insect vector.

MANAGEMENT

- » Only source cuttings or grafting wood from healthy trees.
- » Avoid growing solanaceous crops within or near avocado orchards.



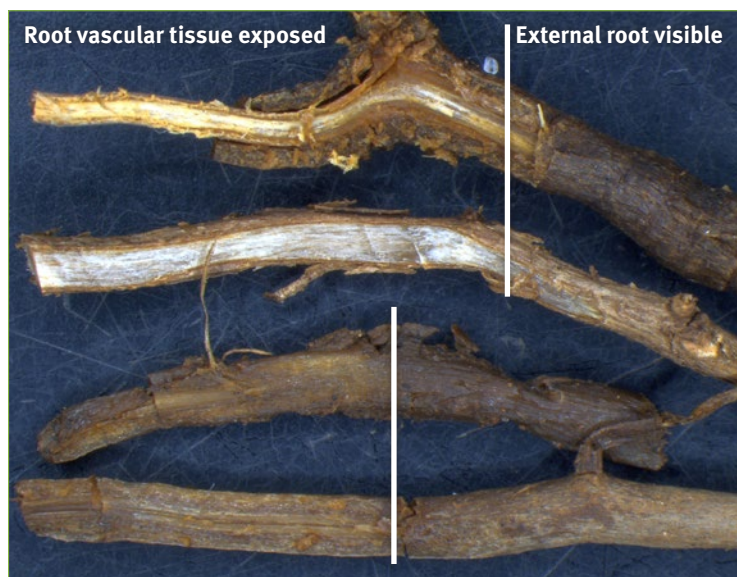
SOILBORNE PATHOGENS

Root rots, caused by soilborne pathogens, are the most insidious, tenacious and damaging of all the diseases that can occur in the nursery. Generally, nursery trees infected with such pathogens will show no visible above ground symptoms until in the post-nursery stage. However even partial loss of roots can have dire consequences for the health of the tree. Root decay interferes with nutrient uptake and distribution in plant tissues, the incorporation of nitrogen into amino acids and the supply of growth hormones. Furthermore avocado feeder roots have very few or no root hairs which means that water uptake is poor; the entire root system needs to be active and healthy to produce vigorous trees.

It is critical that avocado nursery growers are mindful of the root health of their trees. Root systems must be observed directly several times during propagation. It should always be of the highest quality and quantity. At least 90% of the roots should have white, actively growing root tips; only young unsuberized roots are efficient in nutrient and water uptake. The root system should be well developed with uniform distribution from the top to the bottom of the bag or pot. If most of the roots are suberized it indicates that the plants are growing under stressful conditions. Avocado roots have a high oxygen requirement, are intolerant of waterlogging and are stressed by drought and cold.

Several pathogens may at times infect roots in an avocado nursery. They include *Verticillium*, *Rhizoctonia*, *Phytophthora*, *Phytophthium*, *Pythium*, *Calonectria* (previously *Cylindrocladium*) and *Dactylonectria* (previously included in the genus *Cylindrocarpon*); with the exception of *Calonectria* none are as serious as *Phytophthora*. Reliable identification of the pathogen is a prerequisite for the application of appropriate management procedures. Many other fungi may also be present but are not known to act as a pathogen of avocado roots, e.g. *Fusarium*.

For more information on the management of [soilborne diseases](#) in production nurseries refer to the management plan. Factsheets produced for the Australian production nursery industry are available for [Phytophthora](#), [Pythium](#), [Rhizoctonia](#), [Calonectria \(previously Cylindrocladium\)](#) and [Fusarium](#).



Suberized avocado roots with relatively healthy roots on top and unhealthy roots on the bottom. Note that all roots are uncut on the right (showing roots externally) and cut on the left to show internal vascular tissue. Externally, suberized roots can appear healthy even when vascular tissue is not.

PHYTOPHTHORA ROOT ROT

CAUSE

Phytophthora cinnamomi (Pc) and all species of *Phytophthora* are **Group 1** non-viroid pathogens. Other species of *Phytophthora* reported as causing root rot to avocado trees overseas include *P. niederhauserii*, *P. nicotianae* and *P. multivora*.

IMPORTANCE

Pc is undeniably the most serious disease problem of mature avocado trees. Pc rarely kills trees in a nursery, and nursery trees can often tolerate a degree of root rot with no obvious effect on above ground tree health. The pathogen may not be present in an orchard until it is introduced with infected nursery plants and can kill mature avocado trees.

SYMPTOMS

Infected feeder roots are black, firm and brittle compared to suberized healthy roots. The entire root system may be invaded, and white feeder root tips may be absent or few in number. There may be yellowing and drooping of leaves beginning at the base, or leaves may wilt rapidly, remaining attached to the plant.

SPREAD

Phytophthora swimming spores may spread in splashing water drops and infested irrigation water; in contaminated soil, tools, foot-ware, vehicles, and with infected seed taken from fruit in contact with the soil. It only takes a single propagule (swimming spore or resting spore) to initiate a new infection if environmental conditions are favourable.

This will give a single lesion (<1mm) on a root that will quickly give rise to a new centre of infestation. *Phytophthora* can build-up inoculum rapidly in the nursery. *Phytophthora* can also be spread by insects such as fungus gnats and shore flies.

MANAGEMENT

Take every precaution to exclude the pathogen from the nursery.

- » Use clean seed for propagation.
- » Only use media with good aeration and drainage that is free of pathogens.
- » Disinfest irrigation water and regularly monitor the level of disinfectant in treated water.
- » Maintain a high standard of nursery hygiene.
- » Grow plants under optimal conditions; do not overwater.
- » Grow plants on raised benches, or otherwise totally isolated from soil and with free drainage.
- » Submit plants to a diagnostic laboratory to confirm the identity of the pathogen in question.
- » Effective fungicides are available, but should not be used routinely. They should only be used to reduce inoculum levels during containment of a disease outbreak, or to protect healthy plants at high risk stages. It is not recommended to sell infected plants; prior to applying fungicides all obviously diseased plants must be removed and destroyed.
- » Examine root systems and test for the presence of the pathogen regularly during all phases of propagation.
- » For more information refer to the [soilborne diseases](#) pest management plan and [Phytophthora](#) factsheet.

PYTHIUM ROOT ROT

CAUSE

Pythium species.

IMPORTANCE

Pythium is a water mould (same group as *Phytophthora*) that “nibbles” the feeder roots and is a **Group 2** non-viroid pathogen. This can reduce tree vigour if growing conditions are too wet due to poor drainage or excess irrigation. It is not a problem in mature trees because they quickly overcome root pruning by producing new roots.

SYMPTOMS

Pythium species cause necrosis of white feeder root tips. At times symptoms are difficult to distinguish from those caused



Roots infected with *Phytophthora cinnamomi*.

by Pc, but root damage is less severe. *Pythium* infection will at times produce a soft watery rot of feeder root tips.

SPREAD

By infested irrigation water and water splash; contaminated soil adhering to nursery tools and footwear; insect transmission by fungus gnats or shore flies.

MANAGEMENT

Control measures for *Pythium* root rot are similar to those for *Phytophthora* root rot. Species of *Pythium* that produce resting spores (oospores) which withstand dry conditions, can become nursery “residents” in dirty pots and flats, benches, hoses and pathways. Cultural practices that reduce the prevalence of *Pythium* should be rigorously implemented if plant growth is being impacted. Refer to *Phytophthora* management above, however, plants infected with *Pythium* may grow into healthy, thriving mature plants when grown under optimal conditions and treated with care if planted in the field. For more information refer to the [soilborne diseases](#) pest management plan and [Pythium](#) factsheet.

PHYTOPYTHIUM ROOT ROT

The genus *Phytopythium* is a new genus that was separated from *Pythium* using molecular based evidence in 2015. It currently has 18 formally characterized species, including *Pp. vexans*. Most *Phytopythium* species are also important pathogens causing root rot and damping off of many ornamental plants. Their exact role in causing root rot symptoms is not fully understood, but *Pp. vexans* has been detected from avocado production nursery seedlings in Australia and overseas. Morphologically, *Phytopythium vexans* appear to be a cross between *Pythium* and *Phytophthora*, which can complicate identification of all three genera.

Research overseas has shown that the severity of root rot due to *Pp. vexans* varies significantly with the exact isolate ('strain') in question. In other words, some isolates of *Pp. vexans* cause very limited root disease symptoms and others can be as pathogenic as *P. cinnamomi*. As such, *Phytopythium* species have not been categorised as either a **Group 1** or **Group 2** until such a time as more information is available.

Symptoms, spread and management are as per *Phytophthora* and *Pythium*.

BLACK ROOT ROT

CAUSE

Calonectria ilicicola and various species of *Dactylonectria*. These species have been recently renamed, with advances in DNA sequence-based data and improvements in fungal naming rules. *Calonectria* used to be known as *Cylindrocladium*. The genus *Cylindrocarpon* should no longer be used and has been split into a number of genera including *Neonectria*, *Ilyonectria*, *Cylindrodendrum*, *Cylindrocladiella*, *Dactylonectria* and others. Only *C. ilicicola* and a number species of *Dactylonectria* are known pathogens of avocado seedlings.

IMPORTANCE

These fungi are serious **Group 1** non-viroid pathogens of avocado nursery plants. They are very damaging to the root system of nursery trees and young trees in the field; they are not known as pathogens of mature trees.

SYMPTOMS

In the nursery infected plants will have brown to black lesions along the feeder roots which coalesce to completely destroy the root system. It is difficult to distinguish between *Phytophthora* root rot and black root rot. Nursery plants may be stunted and wilted, and when infected stock is planted in the field without chemical intervention, trees may die within a year of planting.

SPREAD

Infections are initiated by germination of various types of spores that can be splash dispersed from rainfall or overhead irrigation, spread with air currents, fungus gnats and shore flies. Infected plant material and infested media will also spread the pathogens, e.g. residual roots or soil adhering to pots which have not been steam sterilised.



Seedlings infected with *Calonectria ilicicola* (left and middle) compared with healthy plant (right). Photo by Louisa Parkinson, UQ.



Seedling infected with *Dactylonectria macrodidyma*. Photo by Louisa Parkinson, UQ.

MANAGEMENT

- » Take every precaution to exclude these pathogens from the nursery. Strict hygiene, pasteurised growing media, water disinfection and good growing conditions are essential.
- » Submit plants to a diagnostic laboratory to confirm the identity of the pathogen in question.
- » Spread of the disease can be reduced by drenching healthy plants with registered fungicides, provided the disease is detected and identified early.
- » Remove diseased plants from the nursery, and discard old nursery stock that may be acting as a reservoir of the pathogen.
- » Planting infected nursery stock in the orchard will contaminate the field site, and healthy replacements may become infected.
- » For more information refer to the [soilborne diseases](#) pest management plan and [Calonectria \(previously Cylandrocladium\)](#) nursery paper.



Healthy roots (left) and roots infected with *Calonectria* (right).



Avocado roots infected with *Calonectria*.

RHIZOCTONIA ROOT ROT

CAUSE

Rhizoctonia solani

IMPORTANCE

Rhizoctonia damage is rarely seen in avocado nurseries today due to aerated steam treatment of growing media, seed picked directly from trees, and good nursery hygiene to ensure that seedlings do not come in contact with contaminated soil/media. It is a **Group 2** non-viroid pathogen.

SYMPTOMS

Prior to the use of pasteurised growing media, the fungus was often recorded attacking the seed cotyledons, embryo and radicle of young avocado seedlings. The pathogen can attack the feeder roots. Roots become encrusted with growing media that is held together by threads of tough brown mycelium. It rarely invades the stem or becomes aerial through the leaves in an avocado nursery. *Rhizoctonia* can be found in the field on the roots of mature trees, but the attack is not severe and regeneration of roots proximal to regions of infection quickly occurs.

SPREAD

Spread depends on scattering of contaminated soil or plant fragments. There is no important airborne phase. *Rhizoctonia* can spread via infected organic material and fungal growth within or above the growing media.

MANAGEMENT

- » Good nursery hygiene and collection of healthy plant material.
- » If introduced it can become a nursery “resident” due to the formation of long-lived sclerotia. If the disease problem persists decontaminate the entire growing area. Fungicides can be used to help protect healthy plants and stop the spread of fungal growth.
- » For more information refer to the [soilborne diseases](#) pest management plan and [Rhizoctonia](#) factsheet.



Minor lesions typical of black root rot that are easily overlooked.

VERTICILLIUM WILT

CAUSE

Verticillium dahliae

IMPORTANCE

The disease is very rare in avocado nurseries. It is a **Group 2** non-viroid pathogen.

SYMPTOMS

Young avocado trees wilt and generally die. In older trees in the field, leaves on one or more branches suddenly wilt, and dead brown leaves remain attached to the branch for several months. When the bark is peeled back dark brown streaks in the xylem tissue are clearly visible. Often the affected tree sends out new shoots and the tree recovers completely.

SPREAD

The soilborne fungus invades the tree through the roots; mycelium and spores move upwards in the xylem causing a sudden wilting and collapse of young trees. It is possible to transmit the disease during grafting; graft wood from an infected tree may contain spores of the fungus. However such grafting wood rarely survives in the nursery.

MANAGEMENT

Mother trees with a history of the disease must not be used as a source of graft wood or cuttings. Fungicide sprays are not effective. Remove any dead seedlings from the growing area regardless of the cause.



Dieback caused by *Verticillium*.



Discoloured stem caused by *Verticillium* (above) compared to a healthy stem (below).

SEED DECAY PATHOGENS

Seed needs to be free of decay organisms such as fungi belonging within the family Botryosphaeriaceae and species within the genus *Colletotrichum*. Seed extracted from ripe fruit with anthracnose or stem end rot, are likely to be infected with these organisms. *Rhizoctonia solani* may infect seed if it is extracted from fruit on the ground, or if it is planted in *Rhizoctonia* infested growing media. [*Botrytis cinerea*](#) is able to infect seed in cool moist conditions, particularly where the seed coat has not been totally removed.

IMPORTANCE

Seed decay pathogens are **Group 1** non-viroid pathogens. Loss of seedlings may occur if infected seed are used. Further research is required on fungi from the family Botryosphaeriaceae that are probably seedborne; use of seed infected with these fungi may increase risk of graft incompatibility and/or branch dieback after the seedling has been planted in an orchard (perhaps without showing symptoms in the nursery).

MANAGEMENT

- » Only extract seed from fruit without symptoms of disease such as anthracnose and stem end rot.
- » Only take seed from hard unripened fruit. This removes the seed coat (husk), which increases the speed of germination, as well as the percentage germination.
- » Do not plant seed extracted from immature fruit, which can increase risk of producing unhealthy seedlings.
- » Mature fruit, intended as a seed source, should be harvested directly from the tree, avoiding contact with the ground, which can increase the risk of infection of a range of soilborne pathogens, including *Phytophthora*.

- » Store seed appropriately.
- » Hygienically remove plants growing from seed showing signs of pathogen infection.



Avocado seed from which fungi from the family Botryosphaeriaceae were isolated.



Lesions on seed caused by *Colletotrichum*.



Avocado seed infected with *Botrytis*. Externally black, raised sclerotes may be present (left), internally there may be dark discoloration. Fuzzy fungal growth may also occur over the surface of the lesion (right).

STEM AND GRAFT CANKERS

ANTHRACNOSE

CAUSE

Species within the genus *Colletotrichum*

IMPORTANCE

Colletotrichum is well known as the cause of the postharvest fruit disease anthracnose, and of the field disease Pepper Spot). It can also cause seed decay, stem lesions and death of the graft union in the nursery (**Group 1** non-viroid pathogen). Stem and graft infection is very serious as it can cause the death of nursery plants.

SYMPTOMS

Pink or orange spore masses develop on stem lesions or at the graft union in humid weather. The fungus infects young stems in the field, but remains quiescent until the tissue becomes injured. There can also be direct infection by spores of the fungus through wounds on young stems, and grafted scion pieces in the nursery. Grafts will die.

SPREAD

Spores produced on infected tissue are spread by water splash. Seed, cuttings and scionwood used for propagation may also carry the pathogen.

MANAGEMENT

- » Grafting material should be taken from young, healthy Mother Trees which have been sprayed with registered fungicides, preferably about two weeks prior to taking cuttings.
- » Do not cut scion material in the rain (not even when slightly drizzly), in foggy conditions or other situations in which plant material may be damp, moist or wet.
- » Disinfest secateurs regularly.
- » Do not injure the stems of young plants in the nursery.

- » Sunburn exacerbates stem lesions; put plants under an appropriate shade cloth density for their age.
- » Nursery trees with symptoms should be destroyed, and surrounding plants sprayed with an appropriate fungicide.
- » Refer to the [latent fungal infections nursery paper](#) for more information.
- » Refer to seed decay management actions where *Colletotrichum* is acting as a seed pathogen and the anthracnose section where it is acting as a leaf spot pathogen.



Stem necrosis and internal cortical vascular discolouration caused by *Colletotrichum*.



Minor symptoms of *Colletotrichum* graft necrosis (above) that could easily lead to more severe symptoms. This tree also has stem necrosis in the scion. Advanced *Colletotrichum* graft necrosis (below).

GRAFT CANKERS AND DIEBACK

CAUSE

Fungi in family *Botryosphaeriaceae*

IMPORTANCE

These fungi are **Group 1** non-viroid pathogens that may cause cankers at the graft union, or stem dieback with an associated browning of leaf margins. The latter is more likely to occur in plants kept well after the intended dispatch date. They can also exist in nursery trees as latent pathogens, and attack mature trees years later especially when the trees are stressed. With changing climatic conditions, particularly higher temperatures, changes in rainfall patterns, and more catastrophic environmental events (drought, flooding) these diseases are likely to increase in importance to the avocado industry.

SYMPTOMS

A brown discolouration is evident at or near the graft union, and there may be wilting of the scion. Older trees may have dieback and marginal leaf necrosis. Young trees with latent or wound infections at the graft union may not develop cankers until after field establishment. This is most likely to occur when such trees are stressed (e.g. from drought, sunburn, nutrient deficiency, waterlogging, extreme temperatures, damage by insects or other pathogens).

SPREAD

Spores are released from dead twigs and branches during rain and water dispersed. Some spores are fired into the air and are wind dispersed or spread in water. The fungi can be present in plant tissue without showing obvious symptoms, thus they can spread in asymptomatic nursery plants.

MANAGEMENT

- » Do not source seed, cuttings and scion wood from Mother Trees with dead twigs and branches. Source propagation material from young, healthy, non-stressed trees.
- » Do not collect cuttings or scion wood in wet weather.
- » Disinfest secateurs regularly.
- » Remove all vegetative debris from the nursery and immediate surroundings.
- » Destroy all nursery plants with necrotic tissue at or near the graft union.

- » Maintain good vigour and avoid water stress.
- » Protect pruning and grafting wounds and any bark splits with a registered fungicide.
- » Refer to the [latent fungal infections nursery paper](#) for more information.



Stem and graft necrosis caused by fungi in the family *Botryosphaeriaceae*.



Leaf spots caused by *Pseudocercospora purpurea*

LEAF DISEASES

The main leaf diseases are cercospora spot and anthracnose. Fungi in the family Botryosphaeriaceae can sometimes be found sporulating on necrotic leaf tissue but their role in leaf spot development is not known in avocado.

CERCOSPORA SPOT

CAUSE

Pseudocercospora purpurea

IMPORTANCE

Cercospora spot is currently confined to the Atherton Tablelands and may impact other growing areas if moved. Besides causing a leaf disease, it is a serious fruit pathogen and is a **Group 1** non-viroid pathogen. While this pathogen is unlikely to cause the death of avocado nursery or field trees, presence on fruit may impact on market access; New Zealand does not have this pathogen.

SYMPTOMS

Small angular leaf spots (1–5mm) develop that are purple to brown in colour and are generally surrounded by a chlorotic halo. Lesions may coalesce to form large dead areas on the leaf. Spores are produced in abundance on infected leaves in warm, rainy weather and germinate readily in a film of water.

SPREAD

Spores produced on infected leaves are spread by wind, splashing rain, irrigation water and insects to initiate new infections.

MANAGEMENT

Grafting material should be taken from young, healthy Mother Trees which have been sprayed with fungicides, as per recommendations in stem and graft canker pathogen section.

- » Do not move affected nursery trees from Atherton Tableland to other growing areas in Australia.
- » Take propagation material from young, healthy Mother Trees that have been sprayed with a registered fungicides.
- » Remove dead organic matter from the growing area to reduce inoculum levels. Remove infected material that has fallen from plants and infected leaves attached to plants where possible.
- » Reduce the length of time leaves remain wet following irrigation.
- » Increase ventilation and plant spacing to assist in leaf drying.

- » Apply an appropriate fungicide to protect healthy plant material.
- » For more information refer to the fact sheet on fungal leaf spot pathogens.

ANTHRACNOSE

CAUSE

Species within the genus *Colletotrichum*.

IMPORTANCE

Anthracnose is a **Group 2** non-viroid pathogen causing leaf spots. It can be a problem during an extended period of rainy weather or where leaf wetness is otherwise maintained for extended periods, e.g. with frequent overhead irrigation.

SYMPTOMS

The fungi cause chlorotic spots followed by necrotic brown spots. Spots may coalesce to produce a dead tip on the leaf and may cause marginal necrosis.

SPREAD

The fungi produce conidia on dead leaf tissue which are spread by water splash.

MANAGEMENT

- » Take propagation material from young, healthy Mother Trees that have been sprayed with appropriate fungicides.
- » Remove dead organic matter from the growing area to reduce inoculum levels. Remove infected material that has fallen from plants and infected leaves attached to plants where possible.
- » Reduce the length of time leaves remain wet following irrigation.
- » Increase ventilation and plant spacing to assist in leaf drying.
- » Apply an appropriate fungicide to protect healthy plant material.
- » For more information refer to the fact sheets on [Colletotrichum](#) and [fungal leaf spot pathogens](#).



Anthracnose on avocado leaves. Photo by Elizabeth Dann, UQ.

BIOSECURITY

Accurate identification of plant diseases attacking avocado nursery trees is essential when selecting effective management options and in maintaining biosecurity preparedness. Economically significant diseases which are not present in Australia, include scab (*Sphaceloma perseae*), and Laurel wilt (*Raffaelea lauricola*) which is spread by the Redbay ambrosia beetle (*Xyleborus glabratus*). A number of species of *Phytophthora* have been reported as pathogens of avocado and are not known to occur in Australia including, *P. heveae* and *P. menzei*. Other exotic diseases of lesser importance are powdery mildew (*Oidium* sp.), silver spot (*Mycosphaerella perseae*) and tar spot (*Phyllachora grisea*). Any avocado nursery trees suspected of being affected with an unknown disease should be reported to their state department of agriculture, primary industries or the Plant Health Australia hot line (1800 084 881).

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