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Cylindrocladium diseases of nursery plants

Various species of the fungus *Cylindrocladium* cause a wide range of destructive diseases in nursery plants and are particularly prevalent in more tropical areas. *Cylindrocladium scoparium* occurs worldwide, and is the most commonly reported causal agent of Cylindrocladium diseases in Australia, although a number of other species are also important pathogens including *Cylindrocladium spathiphylli*.

This nursery paper was prepared by Lindy Coates, Leif Forsberg and Tony Cooke (Department of Agriculture, Fisheries and Forestry (DAFF), Queensland) as part of levy funded project *NY11001 Plant health, biosecurity, risk management and capacity building for the nursery industry.* It provides an overview of the fungus *Cylindrocladium* and how to prevent and control this disease of nursery plants.

Nursery Industry Plant Health & Biosecurity Project
BUILDING INDUSTRY CAPACITY & MANAGING RISKS

Cylindrocladium diseases of nursery plants

Symptoms

Cylindrocladium species (spp.) are capable of causing disease in a number of different plant tissues, including leaves, flowers, stems, crowns and roots. These fungi can cause leaf spots, root rots, basal stem rots or cankers, shoot blights, cutting rots, needle blights and damping-off in seedlings. Most recordings of diseases caused by *Cylindrocladium* spp. are from young plants or recent field plantings.

Symptoms vary according to host species, host age/developmental stage, environmental conditions and the species of *Cylindrocladium* infecting the host. In general however, leaf spots first appear as water-soaked lesions, eventually turning tan to dark brown. They are usually circular to irregular in shape, and surrounded by a red, dark brown or purple border and chlorotic zone (Figures 1a, b, d and e).

Symptoms of Cylindrocladium leaf spot can be similar in appearance to early symptoms of myrtle rust in some hosts (in particular, prior to the appearance of yellow rust pustules), as seen in Figures 1b and c. It is important to distinguish these diseases, as different disease management strategies will be required.

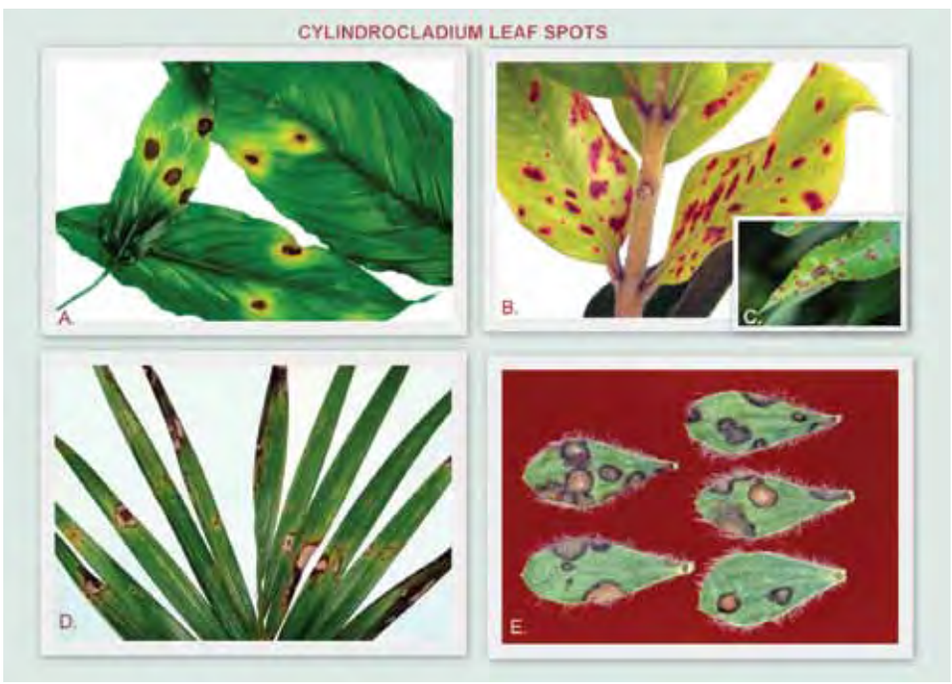

Figure 1: (a) Cylindrocladium leaf spot on *Spathiphyllum* sp. Note distinctive chlorotic halo surrounding lesions, (b) Cylindrocladium leaf spot on *Metrosideros* sp. (New Zealand Christmas bush), (c) Myrtle rust on *Syzygium jambos*. Note similarity of symptoms with Cylindrocladium leaf spot on *Metrosideros* sp., (d) Cylindrocladium leaf spot on Kentia palm, and (e) Cylindrocladium leaf spot on *Melaleuca* sp.

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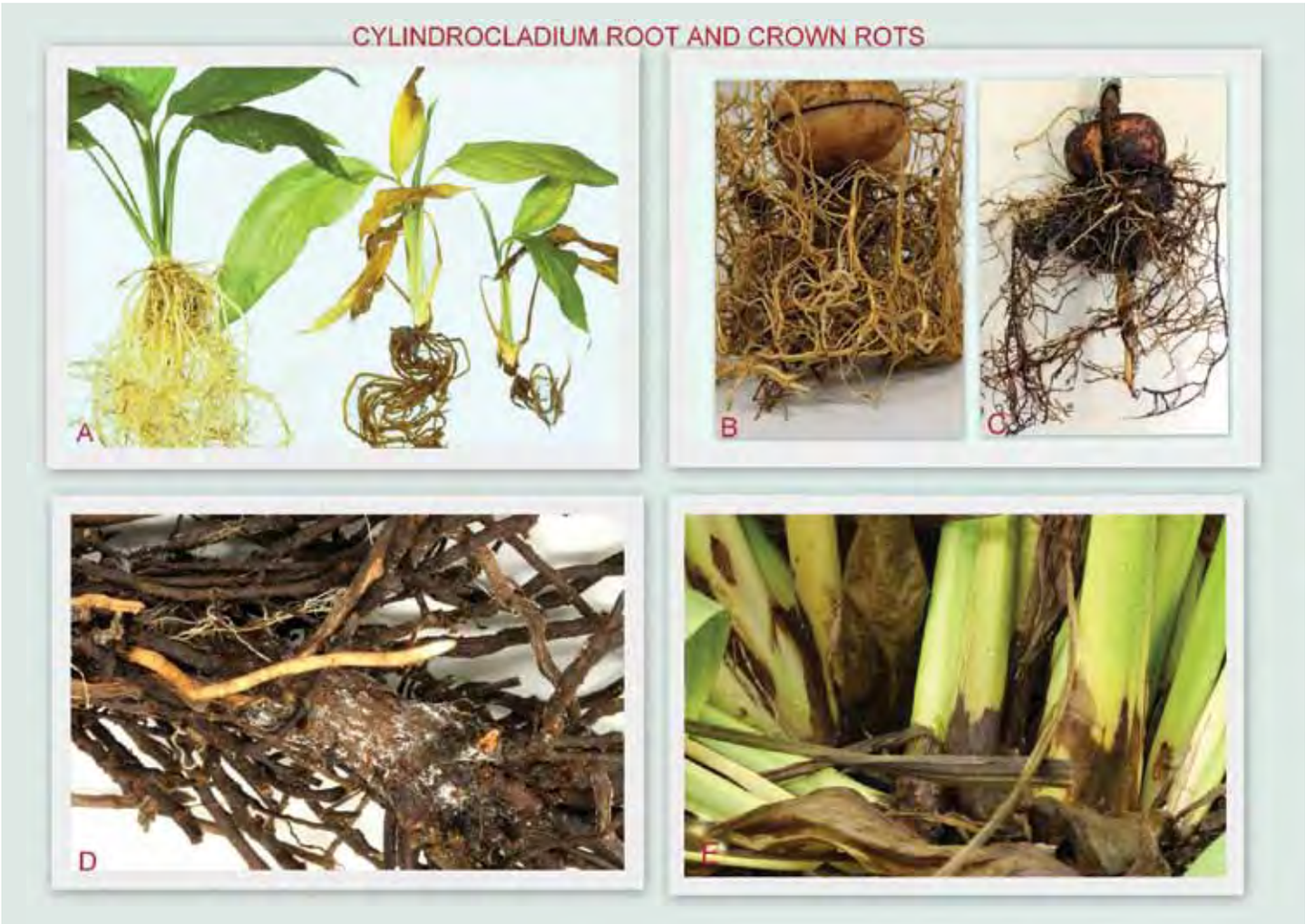

Figure 2: (a) Cylindrocladium root rot in *Spathiphyllum* sp. Note healthy plant on left, and affected plants on right with necrotic root systems and collapse of aboveground parts, (b) Healthy root system in a young avocado plant, (c) Diseased root system in a young avocado plant affected by Cylindrocladium root rot, (d) Diseased root system in a young avocado plant affected by Cylindrocladium root rot – note contrast between healthy root and diseased roots, and white fungal growth on roots, (e) Cylindrocladium crown rot in *Spathiphyllum* sp.

Symptoms of root infections include necrotic and discoloured roots (Figures 2a-d), and may involve both lateral and tap roots. Lesions may coalesce (fuse) to completely destroy the root. Root infections can spread to the crown (Figure 2e), subsequently leading to stunting of growth, discolouration of foliage, defoliation and plant death (Figures 2a). In some cases the plant can produce new roots as quickly as root rot progresses, and as a result plants may appear symptomless until plant stress occurs.

Cylindrocladium root rot can be easily misdiagnosed as Phytophthora root rot, as symptoms of the two diseases are very similar. Accurate disease identification may require pathogen culturing in a professional diagnostics laboratory.

Conditions encountered during propagation (such as high temperatures, high humidity and crowding of plants) can promote infection of cuttings by *Cylindrocladium* spp. Infections can start at either end of the cutting, but usually start at the lower end. Stem infections typically lead to blackened stems.

Cylindrocladium spp. can also cause damping-off diseases in various hosts e.g. *Melaleuca* sp. (Figure 3).

Spread

Asexual spores of *Cylindrocladium* spp. (conidia) are readily produced on infected leaf and stem tissue, and are spread by splashing water, such as that from rainfall, overhead irrigation and mist propagation. Spores are also produced in large numbers in leaf litter which collects at the base of plants as a result of defoliation due to infection. Spore masses are seen as white 'tufts' during very humid conditions, and can be splashed onto adjacent plants or cuttings, or washed down onto newly formed roots. Cuttings which manage to survive and produce roots despite being infected in this way, however, may become symptomless carriers of the disease.

Symptom development may be suppressed during propagation when environmental conditions are optimal for plant growth, but can suddenly appear later on when plant stress occurs.

Cylindrocladium spp. can sometimes also produce sexual spores (ascospores) on infected plant tissue. These spores are exuded from their fruiting bodies (perithecia) and can be dispersed by water splash, wind and possibly insects. However, because these spores are very susceptible to desiccation, or drying out, (as are conidia), dispersal by wind is not likely to be as important in the disease cycle as water splash.

Highly resistant fungal structures called microsclerotia can be produced in infected leaf, stem, flower or root tissue, and can infest soil. These structures, which consist of clusters of thick-walled chlamydospores, can survive for long periods during adverse environmental conditions, germinating or sporulating when conditions are favourable for disease development.

Sporulation, infection and development of Cylindrocladium diseases are favoured by warm, moist, humid conditions.

Host range

A wide range of commonly grown nursery plants are recorded as hosts for Cylindrocladium diseases, including *Abies, Acacia, Agonis, Angophora, Baeckea, Banksia, Callistemon, Camellia, Chamaelaucium, Chrysanthemum, Citrullus, Coleonema, Conocarpus, Dianthus, Erythrina, Eucalyptus, Euphorbia, Ficus, Fragaria, Gardenia, Grevillea, Hakea, Howeia, Ilex, Juglans, Juniperus, Lagerstroemia, Liquidambar, Litchi, Magnolia, Malus, Melaleuca, Metrosideros, Pelargonium, Persea, Phoenix, Photinia, Picea, Pimenta, Pinus, Prunus, Quercus, Rhododendron, Rosa, Rumohra, Spathiphyllum, Thryptomene, Trifolium, Tsuga, Ulmus* and *Washingtonia*.

Disease management

Every precaution must be taken to exclude the pathogens from the production nursery. An integrated nursery management system incorporating strict hygiene, pasteurised growing media, water disinfestation and manipulation of the production environment is crucial in the prevention and management of Cylindrocladium diseases.

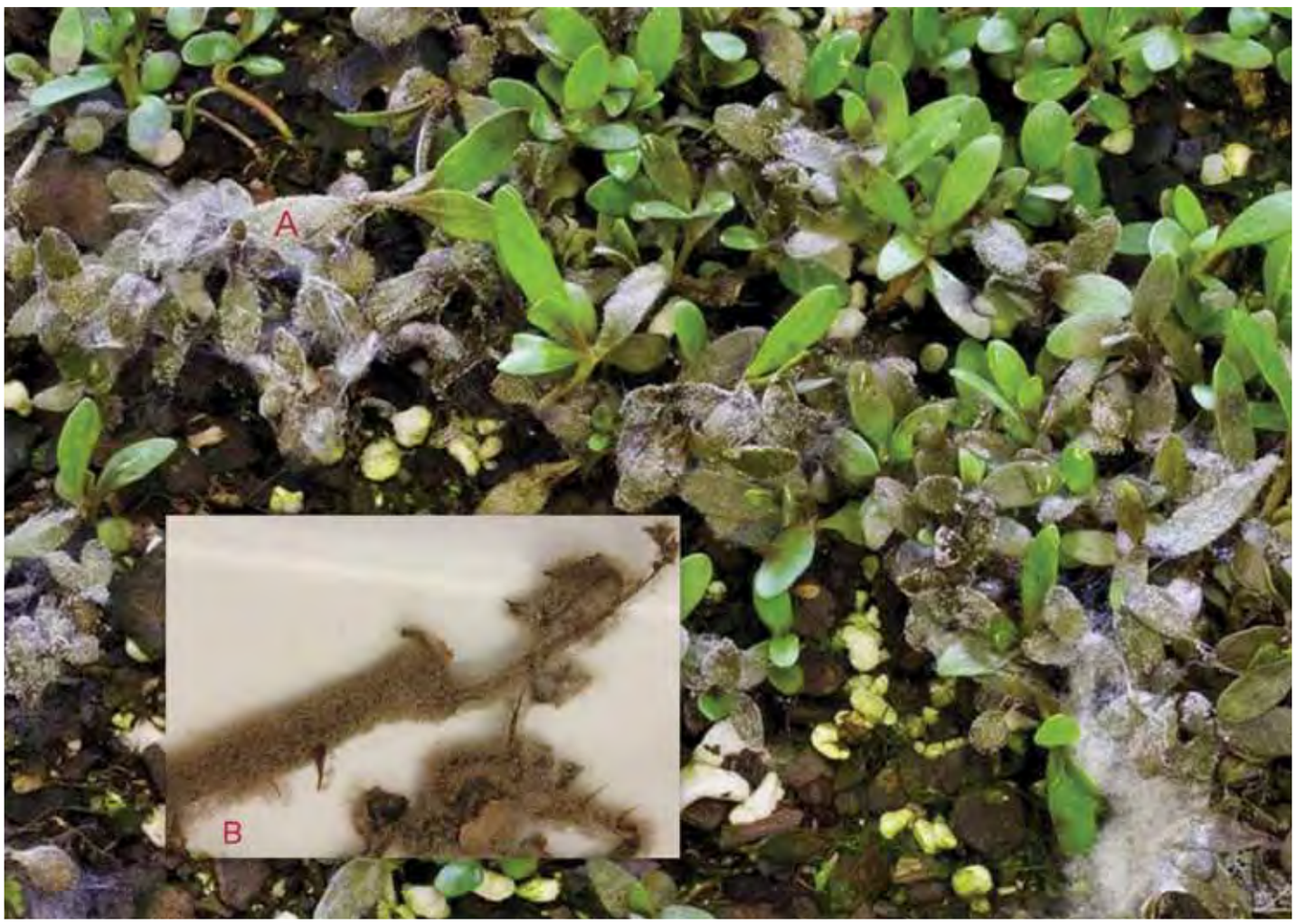

Figure 3: (a) Damping-off in *Melaleuca* sp. caused by *Cylindrocladium* sp. (b) Damping-off in seedlings can be caused by a number of different fungi including *Botrytis* sp. (pictured). Note white fungal growth of Cylindrocladium damping-off (a) in comparison to brownish-grey spore masses of *Botrytis* sp. (b).

The following strategies are recommended:

- Regularly monitor for symptom development in susceptible hosts to detect disease outbreaks (early detection, diagnosis and evaluation of the damage is essential).
- Use only healthy motherstock plant material
- Treat propagation material with appropriate chemical disinfestation agents (eg. immerse cuttings for 3 minutes in chlorine solution followed by rinsing in clean water).
- Use high quality (preferably pasteurised), well drained and well aerated growing media obtained from a reputable, NIASA accredited supplier.
- Store growing media in a manner that prevents contamination from run-off water, dust and vegetative material.
- Use irrigation water that is free of soilborne pathogens.
- Limit nursery access to essential staff.
- Prohibit transfer of plants from one production nursery to another.
- Use sterile containers, tools, equipment, etc.
- Remove leaf litter which collects at the base of plants (as this can harbour spores or microsclerotia of the fungus), taking care not to spread spores during this process.
- Immediately remove diseased plants from production areas.
- Reduce free moisture on leaves by avoiding overhead irrigation, covering production areas and increasing plant spacing. Where overhead irrigation can't be avoided, ensure watering is done at times when good drying of foliage is likely.
- Use resistant cultivars/species

By the time symptoms of Cylindrocladium infection appear, it is often too late to apply fungicides. The use of fungicides for the management of Cylindrocladium diseases in nursery situations is probably best limited to the application of protectants to healthy plants at vulnerable times, e.g. when roots are damaged during transplanting. Inappropriate use of fungicides in production nurseries can lead to problems further down the supply chain, as many fungicides will only suppress disease development rather than eradicate infections.

While there may be some potential for the inclusion of organic amendments and biocontrol agents such as *Trichoderma* species in growing media for the management of Cylindrocladium diseases, there is limited information available at the present time.

Further reading

- Barnes, L.W. and Linderman, R.G. (2001) Diseases caused by *Cylindrocladium*. In: Jones, R.K. and Benson, D.M. (eds.) *Diseases of Woody Ornamentals and Trees in Nurseries*, pp. 43-45. APS Press: Minnesota.
- Crous, P.W. (2002) Taxonomy and pathology of *Cylindrocladium* (*Calanectria*) and allied genera. APS Press: Minnesota.

For additional information, consult the following nursery papers which are all available electronically from www.ngia.com.au

- The Nursery Production Plant Health & Biosecurity Project. Issue number 3. April 2012.
- Biosecurity – what is it and what does it mean to the nursery and garden industry? Issue number 4. May 2011.
- Plant health in Australia. Issue number 8. September 2009.
- What is NIASA and how can it benefit you? Issue number 3. May 2008.
- BioSecure *HACCP*. Issue number 2. March 2008.

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