

Botrytis

An opportunistic pathogen

Introduction

In cool, moist areas *Botrytis* fungi cause severe damage in many nursery crops, especially those in the species complex *Botrytis cinerea*.

The generic name *Botrytis* is derived from the classical Greek word 'botrus', meaning grapes. Grapes refer to the bunching of the conidia (spores) on their conidiophores (organs that produce spores). *Botrytis cinerea* is in part derived from the Latin for 'grapes like ashes', where 'ashes' refers to the greyish colour of the spores 'en masse'. Hence the name 'grey mould' for the disease it produces in horticulture. The clusters of light grey or almost colourless spores at the end of dark brown stalks are easily seen with a 10x hand lens. The fungus is generally referred to by its asexual stage because the sexual stage is rarely produced. *Botrytis cinerea* is considered to be a species complex with genetically variable populations and an extremely wide range of hosts.

Diseases caused by the genus *Botrytis*, especially *B. cinerea*, are among the most common and widely distributed diseases of ornamental, fruit and vegetable crops. It is arguably the most common disease of nursery crops. Diseases appear as blossom blights, damping-off, stem cankers or rots, leaf spots and diebacks, and also

Botrytis - the 'noble mould'

In cool, wet, humid weather *Botrytis* sp. produces the disease known as 'bunch rot' in grapes, which causes the loss of affected bunches. When wet conditions are followed by dry weather, infection can result in the production of sweet dessert wines (Sauternes). It is also referred to as 'noble rot' or 'noble mould' when it is used to deliberately infect ripe grapes, especially in making sweet wines. Infected grapes become shrivelled, thereby concentrating the juice and increasing the sugar content.

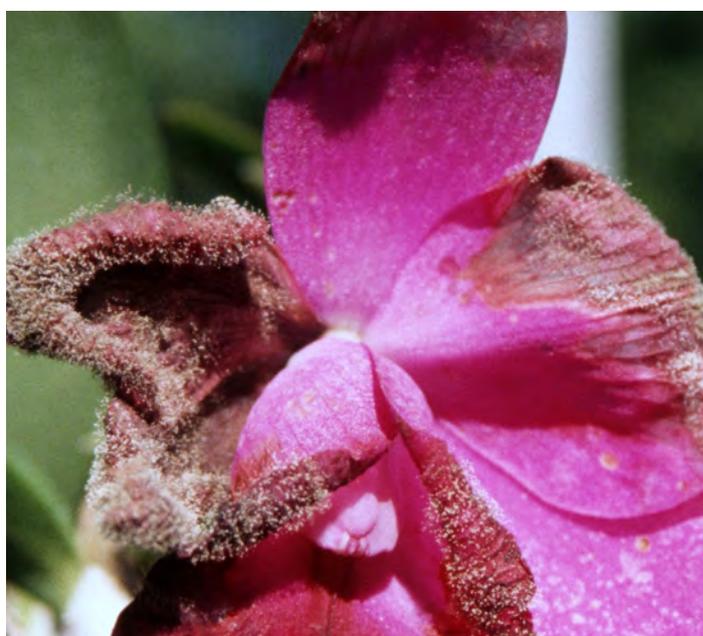


Fig. 1. Severe *Botrytis* sp. infection on *Cordyline* (above) and orchid flower (below).

tuber, corm and bulb rots. Serious diseases in horticulture include grey mould of seedlings in nurseries, grey mould of strawberry and many vegetables, calyx end rot of apple, onion neck rot, blight or grey mould of many ornamentals, corm rot of gladiolus and soft rot of fruit and vegetables in storage, transit and markets.

Many flower crops in the nursery are prone to damage by *Botrytis* species. These include African violet, azalea, begonia, camellia, Geraldton wax, geranium, gladiolus, lisianthus, protea and rose. Incipient flower infections at harvest can result in a major postharvest problem for cut flowers.

Symptoms

Botrytis fungi are capable of causing a wide range of symptoms. Blights, spots, blotches, wilts, cankers, rots, and damping off are typical symptoms among a range of hosts (Figs 1-5).

In many cases, a furry grey mould appears on infected tissue in humid conditions. The smoky-grey spores (Figs 2-3) are readily released and clouds of spores can be seen coming from the conidiophores after periods of high humidity. Small black resting structures known as sclerotia (Fig. 4) may be evident on dead plant tissue. In some cases, plant tissue dies but few spores are produced. Symptoms can therefore appear similar to dieback caused by other fungi (Figs 3 and 5).

Epidemiology

The fungus is a necrotroph (a pathogen that kills and obtains its nutrients from dead plant cells). It is a weak pathogen and efficient saprophyte, persisting as mycelium, spores and/or sclerotia on innumerable host sources, both in debris in and on the soil and on growing plants. It can penetrate healthy plant tissue directly through wounds or insect injuries, or by first producing mycelium in dead or dying flower petals, foliage or senescent bulb scales. As the mycelium of the fungus contains few food reserves, the dead or dying plant tissue serves as a food source and gives the fungus sufficient energy to penetrate adjacent healthy plant tissue directly.

Prolific sporulation occurs in cool, moist conditions. Conidia are dry and are mainly wind dispersed. They are released by conidiophores during a change in relative humidity, and ejected into the air by water splash or wind. When cool, moist conditions continue to prevail the conidia will infect dying and dead plant tissue, especially fallen petals, and even pollen grains deposited on a plant surface prior to invading the host plant.

Seedlings in flats are commonly infected when a foreign plant part (e.g. petals from a surrounding host plant) falls on the foliage, or when seedlings have been injured from fertiliser, salinity or pesticide burn. The conidia will germinate on the dying or dead tissue when free moisture is present, infect a



Fig. 2. Lavender dieback caused by extensive grey mould infestation (above). Grey mould flower and stem dieback on viola.

plant and then spread rapidly to adjacent seedlings, which eventually become covered with a fuzzy grey growth.

Grey mould is a disease favoured by high relative humidity (93-100%). The optimum temperature range for sporulation, spore release, germination and infection is 18-23°C. The disease is greatly reduced above 25°C and below 15°C.

Disease Management

Control in protected cropping environments is often more easily achieved than in open cropping environments.

In fact, grey mould has often been referred to as a 'disease of bad management' and this certainly applies in protected cropping environments. Grey mould is almost impossible to manage using fungicides without an integrated program of cultural control in the nursery. The key to successfully managing the disease in nurseries is to reduce humidity, increase airflow and use sub-irrigation to replace over-head watering and misting. In addition proper nursery hygiene, clean planting material and balanced crop nutrition will help to avoid infection. Put in place as many of the below points as possible to reduce development of *Botrytis* sp.

- Leaf wetness sensors can be used to monitor conditions favourable for infection as a basis for the timely application of fungicides if they are required.
- Remove and destroy dead plant residues and rogue and destroy infected plants.
- Remove fading flowers before petal fall.
- Avoid conditions that predispose plants to attack. Keep plants healthy and vigorous and maintain good ventilation in a seedling crop to promote rapid drying of plants.
- Reduce damage to plants caused by fertiliser burn, and pesticide application.
- Use disease-free seed, plants, stock plants or propagating stock (bulbs, corms, tubers, rhizomes).
- Handle all plants carefully during transplanting to avoid any damage.
- Avoid growing highly susceptible plants during conditions that favour disease development

Pesticides

Fungicides should only be used as one component in the management of grey mould; do not solely rely on fungicides to prevent and eliminate this pathogen.

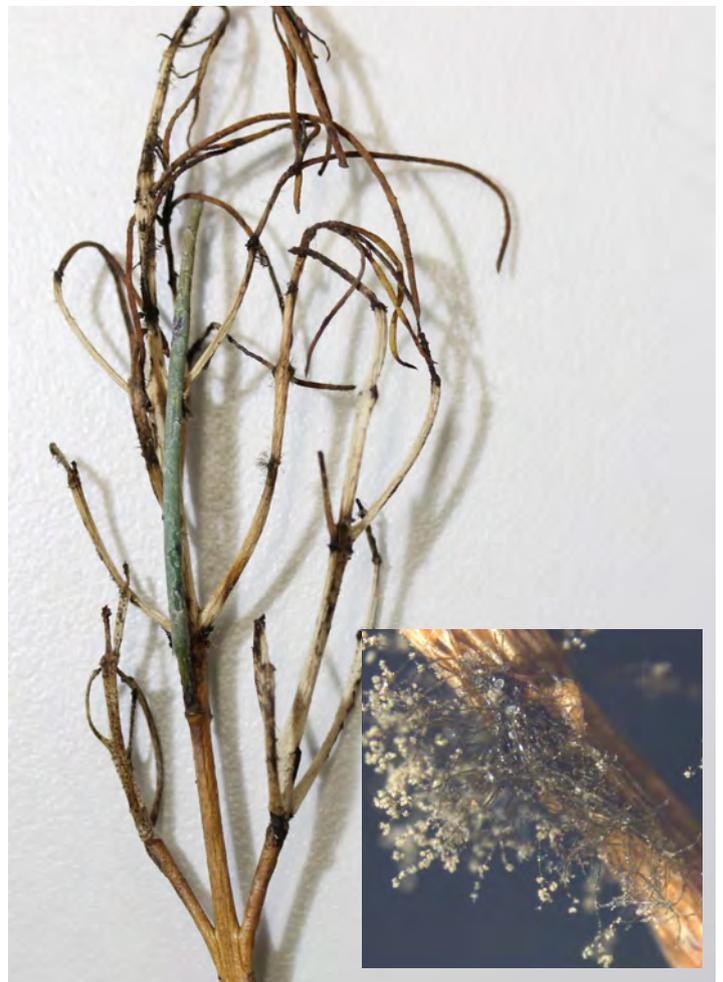


Fig. 3. Botrytis dieback (above) and close up of fungal growth on dying stems (insert above) on *Verticordia nitens*. Necrotic lesion on the leaf of *Dracaena* caused by *Botrytis* (below)

With that said, there are many products registered against *Botrytis* sp. that can be used in production nurseries. It is recommended to put in place cultural management strategies outlined above and protectant fungicides when environmental conditions favour disease development to protect healthy plants. Such products are contact only, but have a broad spectrum mode of action and include chlorothalonil, mancozeb, thiram and wettable sulfur (to avoid phytotoxicity, do not apply sulfur within 2 weeks of an oil product and never apply above about 25-27°C – refer to the label). Many of the above listed active ingredients are on the minor use permit PER81491.

If a significant infestation is already present, a more aggressive integrated approach must be taken. Modify management actions as per above and apply a relatively systemic or translaminar product such as azoxystrobin, boscalid, pyraclostrobin, cyprodinil + fludioxonil, iprodione or tebuconazole + trifloxystrobin. Rotate between mode-of-action groups unless the label details a specific resistance management strategy. Please note that additional products may be suitable and some listed here may not be suited to your exact situation; always read the label prior to use.

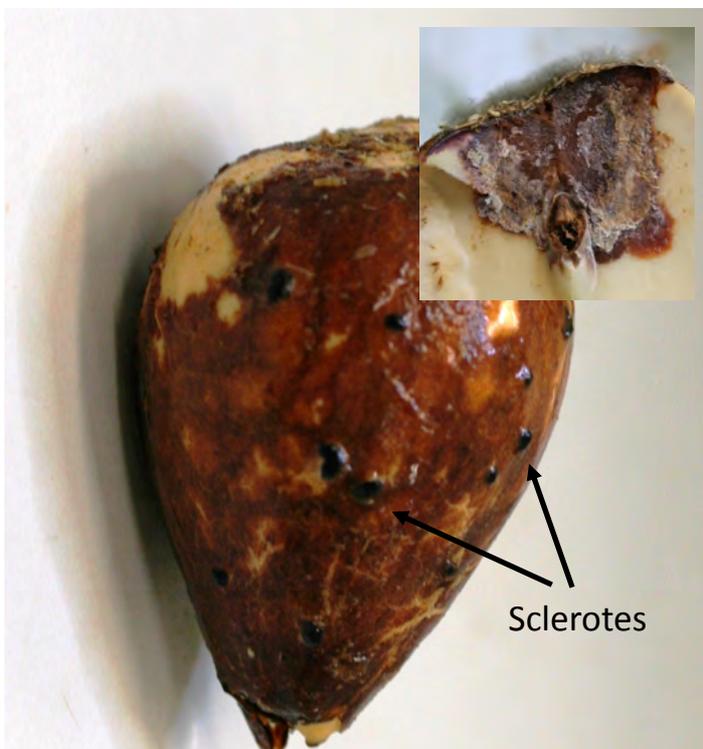


Fig. 4. Avocado seeds infected with *Botrytis* sp. showing black sclerotes and internal decay of seeds (insert)

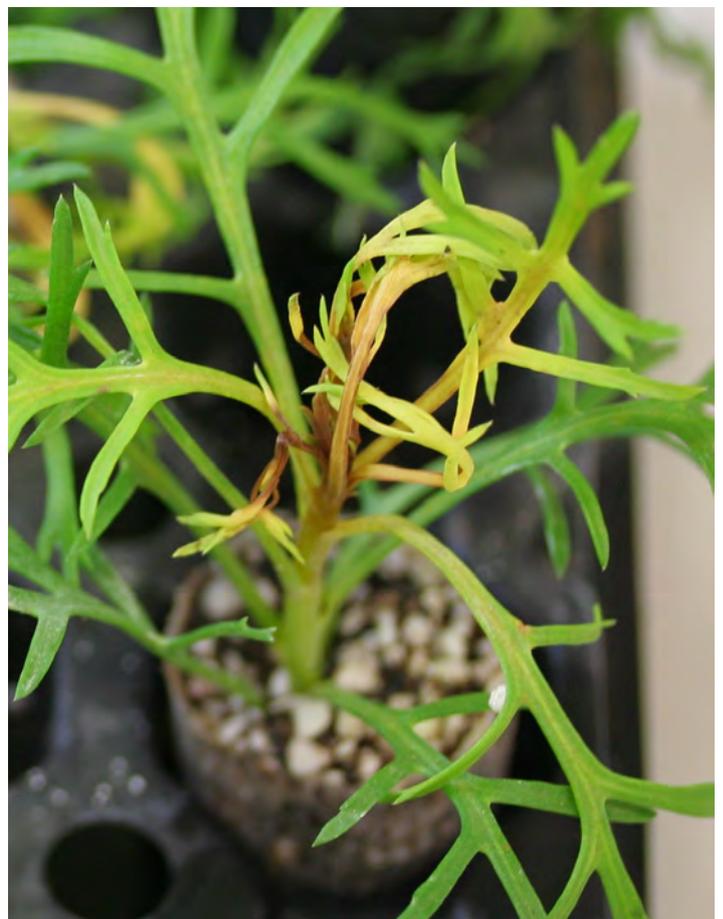


Fig. 5. Leaf blight on strawberry caused by *Botrytis* sp. (above). Tip dieback caused by *Botrytis* sp. on marguerite daisy (below).

This document was prepared by Ken Pegg and Andrew Manners (Agri-science Queensland, Department of Agriculture and Fisheries, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of the nursery levy and Hort Innovation funded project Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry (NY15002) in 2017. All photos by DAF.