NURSERY PAPERS

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Rust diseases and their management in production nurseries

Rusts can be very damaging to a large number of plants grown by the production nursery industry and are sometimes difficult to manage. Rusts are highly specialised, obligate parasites of plants that obtain their nutrients from living plant cells; they cannot gain nutrients from dead plant material. Rusts may parasitise one species of a plant during their life cycle or may sometimes attack two unrelated species. They have complicated lifecycles, producing up to five different types of spores that serve different functions. Rusts are generally quite host-specific, attacking only a small number of closely related plant species, but exceptions occur. Successful management of rust diseases generally involves a range of integrated approaches including cultural practices and pesticides during high risk periods.

Leaf spots caused by blueberry rust (*Thekopsora minima*) on the lower (left) and upper leaf (right). Photos by Roger Shivas, DAF.

INTRODUCTION

Worldwide there are about 8000 species and 200 genera of rust fungi. Many are extremely destructive pathogens of cereals and other agricultural plants. Rust is the common name for disease caused by one of the rust fungi (Uredinomycotina). Some common genera in Australia include *Aecidium*, *Coleosporium*, *Melampsora*, *Phragmidium*, *Puccinia*, *Transchelia*, and *Uromyces*.

Most rusts have a very restricted host range, affecting one or a few species. Other important rust hosts in nurseries include Acacia, blueberry, bamboo, carnation, chrysanthemum, daylily, fig, frangipani, fuchsia, geranium, iris, monstera, peach and rose.

RUST HISTORY: Rust disease of cereals has been known since ancient times, having been recorded in the Bible and by the Greeks and Romans. Romans attributed rust diseases to the wrath of the gods and designated a particular deity, Robigus, as the god of rust. They held an annual festival where they offered sacrifices to protect their crops from the disease. Rust was not known to be caused by a fungus until 1797.

Nursery & Garden Industry Australia

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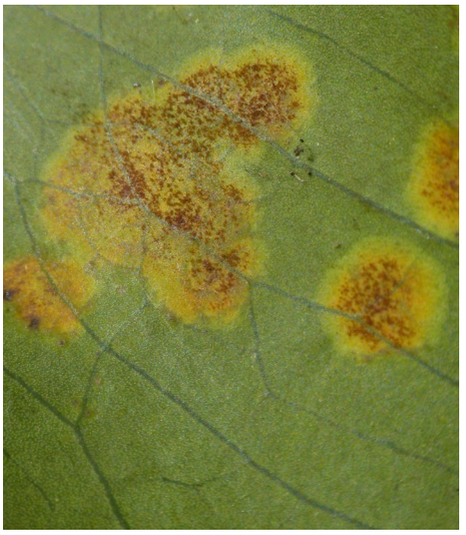

Leaf spots on *Monstera deliciosa* caused by the rust *Puccinia paullula* (left) and close up of spores (right). Photos by Alistair McTaggart, DAF.

RUST SYMPTOMS

Small, chlorotic leaf spots appear on the upper surface of leaves, young shoots, flowers and fruit affected by rust. These develop into yellow, orange, red, brown or black pustules. Infection may cause leaf distortion and severe defoliation. The fungus destroys the leaf tissue, reducing the plant's photosynthetic capacity. This often results in poor shoot growth and twig or leaf dieback. In extreme cases plants may be killed by rusts, particularly if severe damage occurs repeatedly to flushing growth e.g. in the case of myrtle rust. Some of the rusts (*Uromycladium* spp.) induce galls on the stems, leaves and pods of Acacia. White rust (*Puccinia horiana*) can be a serious problem in chrysanthemums, not to be confused with 'white rust' of brassica crops, which is not actually a rust.

SPREAD AND INFECTION

Rust fungi release millions of spores from pustules which are rapidly transported long distances by wind. The spores also spread with infected plants, contaminated clothing, infested equipment, by insects and on animals. Rust spores are not borne internally in seed but can be carried with seed. Rusts survive between crops on regrowth, volunteer plants and alternative hosts.

Rust spores land on the leaf surface, germinate and enter through stomata, or form a special organ (appressorium) that allows the rust to enter through the cuticle and epidermis. The fungus then penetrates plant cells and forms a specialised structure (haustorium) that absorbs nutrients from the cell. Eventually spore-producing structures are produced, which rupture the epidermis to form characteristic pustules containing thousands of spores that are dispersed by wind.

Spore germination and infection are influenced by environmental conditions, especially temperature and humidity. A film of water is needed on the leaf surface for several hours for germination and infection (i.e. rain, overhead irrigation or >90% humidity). Each rust has its own optimal temperature range. The ideal temperature for myrtle rust is 18-22˚C. New pustules can be produced and spores released within 10-14 days, with more rapid spore production under optimal conditions.

MANAGING RUST IN THE NURSERY

It is important to know the species of rust likely to infect particular nursery lines and how to recognise early symptoms (small pale spots that later turn yellow). Regularly check plants especially in the spring, when the climate favours more frequent spore production and infection. Fungicides can be applied during high risk periods.

Strategies to reduce rust infection include:

- Plant resistant varieties if available. This is one of the most important strategies.
- Remove infected plants and destroy fallen leaves with minimal disturbance – spores can be easily dislodged. Be aware that clothing and equipment can become contaminated with spores and potentially spread rust.

MYRTLE RUST: An important rust is myrtle rust (*Austropuccinia psidii*) which was first detected in Australia in 2010 and quickly spread along the east coast. It has a very wide host range in the Myrtaceae and affects 364 plant species from 57 genera. Recent research indicates that it has caused significant damage and tree mortality in Australian natural ecosystems. A number of threatened plant species have been significantly impacted as well as common key species in the environment, and further research is required to identify resistance. For more information refer to the detailed report, **Managing Myrtle Rust in Australia**.

Myrtle rust (*Austropuccinia psidii*) on *Rhodamnia rubescens* (left) and *Eugenia reinwardtiana* (right). Photos by Alistair McTaggart, DAF.

- Keep plants well ventilated to allow leaves to dry quickly. Overcrowding plants will encourage rust as this prevents the drying of leaves after rainfall, irrigation, dew or fogs.
- Avoid overhead irrigation of highly susceptible plants, particularly during high risk periods. If possible, allow better ventilation after overhead irrigation if required e.g. by using fans.
- Obtain plants from reputable suppliers and return consignments that are infected with rust.
- Do not propagate from infected plants. This will multiply your problem.

Begin fungicide applications at the first sign of rust. There are a number of active ingredients with registrations against rust that are relevant to the production nursery industry (also see the minor use permit **PER81491**). These include the actives azoxystrobin (11), mancozeb (M3), chlorothalonil (M5), metalaxyl (4) + copper (M1), tebuconazole (3) + trifloxystrobin (11), mancozeb + thiophanate methyl (1) and oxycarboxin (7). Myrtle rust has additional products available on PER81491.

It is recommended producers rotate between mode-of-action groups to reduce the risk of pesticide resistance. For more information refer to the **webinars** on pesticide resistance and fungicides.

RUST OR SMUT?

Rust and smut fungi are closely related but differ in several ways. Rust fungi sometimes require two different host plant species to complete their lifecycle. Rusts commonly produce numerous red to yellow pustules on leaves and stems that release thousands of airborne spores. Rusts can produce up to five different types of spores in their life cycle.

Smut fungi complete their life cycle on one host and produce fewer types of spores, typically attacking grasses including corn and cereal crops. Smut fungi produce spore masses in inflorescences, often just in the flowers. Smut spores may be spread by wind or attached to healthy seeds that may then infect subsequent seedlings.

Dark regions are spore masses of *Ustilago spinificis* (a smut) on flowers of *Spinifex longifolius*. Photo by Roger Shivas, DAF.

BIOSECURITY – RUSTS NOT PRESENT IN AUSTRALIA

Many rust species that could seriously impact production of certain nursery plant lines – coffee rust, grapevine rust, asparagus rust and others – are not present in Australia. As the nursery plant trade continues to move plants internationally, there is a high potential for exotic rust fungi to enter and become established here. As rust fungi are virtually impossible to eradicate once introduced, it is highly likely that new rust epidemics will occur. Most rusts affect only one or a few plant species but the recently introduced Myrtle rust has a wide host range. As 10% of Australian flora belong in the Myrtaceae, it is critically important to prevent the introduction of other strains of Myrtle rust known to be present overseas that could potentially increase the severity of this pathogen.

Rust pustules on the stems and leaves of *Uromyces geranii* on *Geranium potentilloides*. Photos by Alistair McTaggart, DAF.

This document was prepared by Ken Pegg, Andrew Manners, Tony Cooke & Lindy Coates (Agri-science Queensland, Department of Agriculture & Fisheries, Brisbane QLD 4001) in 2018 as part of the Hort Innovation and levy-funded project '*Building the resilience & on-farm biosecurity capacity of the Australian production nursery industry*' (NY15002). Thanks to Roger Shivas (DAF) for reviewing this paper.

LINKS TO RESOURCES

CRC Plant Biosecurity Final Report 'Managing myrtle rust in Australia' *http://www.pbcrc.com.au/sites/default/files/managedfiles/2063 Final Report CRC 2063 Pegg etal 2017.pdf*

Shivas RG, Beasley DR, McTaggart AR (2014). Online identification guides for Australian smut fungi (Ustilaginomycotina) and rust fungi (Pucciniales). IMA Fungus 5: 195–202. Available at: *http://collections.daff.qld.gov.au/web/key/rustfungi/Media/Html/host.html*
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