Pests and Pathogens of Ginger

A guide to farm biosecurity measures to reduce the risks of weeds, pests and diseases impacting production

Plant Protection Series – Volume 2

AgriFutures Ginger

AUSTRALIAN GINGER

Plant Health AUSTRALIA

Image by Australian Ginger

Front cover and back cover images by Australian Ginger.

Plant Health Australia is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, PHA services the needs of Members and independently advocates on behalf of the national plant biosecurity system.

PHA's efforts help minimise plant pest impacts, enhance Australia's plant health status, assist trade, safeguard the livelihood of producers, support the sustainability and profitability of plant industries and the communities that rely upon them, and preserve environmental health and amenity.

www.planthealthaustralia.com.au

Australian Ginger, also known as the Australian Ginger Industry Association (AGIA), is the peak body for Australian ginger growers. Australian Ginger represents the Australian ginger industry as a member of PHA.

www.australianginger.org.au

AgriFutures Australia is a Research and Development Corporation (RDC) that represents a range of industries including the Australian ginger industry, for which it aims to deliver research and innovation to benefit farmers and producers.

agrifutures.com.au

This publication was developed by Plant Health Australia, Australian Ginger, and the Queensland Department of Primary Industries with financial support from AgriFutures.

This publication is designed for use by farmers and their staff, contractors, researchers and consultants working in the ginger industry. It shows simple procedures that you can use to minimise the risk of introducing and spreading weeds, pests and diseases onto properties.

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Industry Information

Ginger Biosecurity in Australia

Biosecurity is the management of risks to the economy, the environment and the community, from new pests entering, establishing and spreading in your area. Biosecurity is a shared responsibility and a national priority. Biosecurity involves government actions at the border, pre-border work in other countries, regional and interstate restrictions, emergency responses for new pests as well as measures on-farm.

In Australia, biosecurity involves three layers of protection:

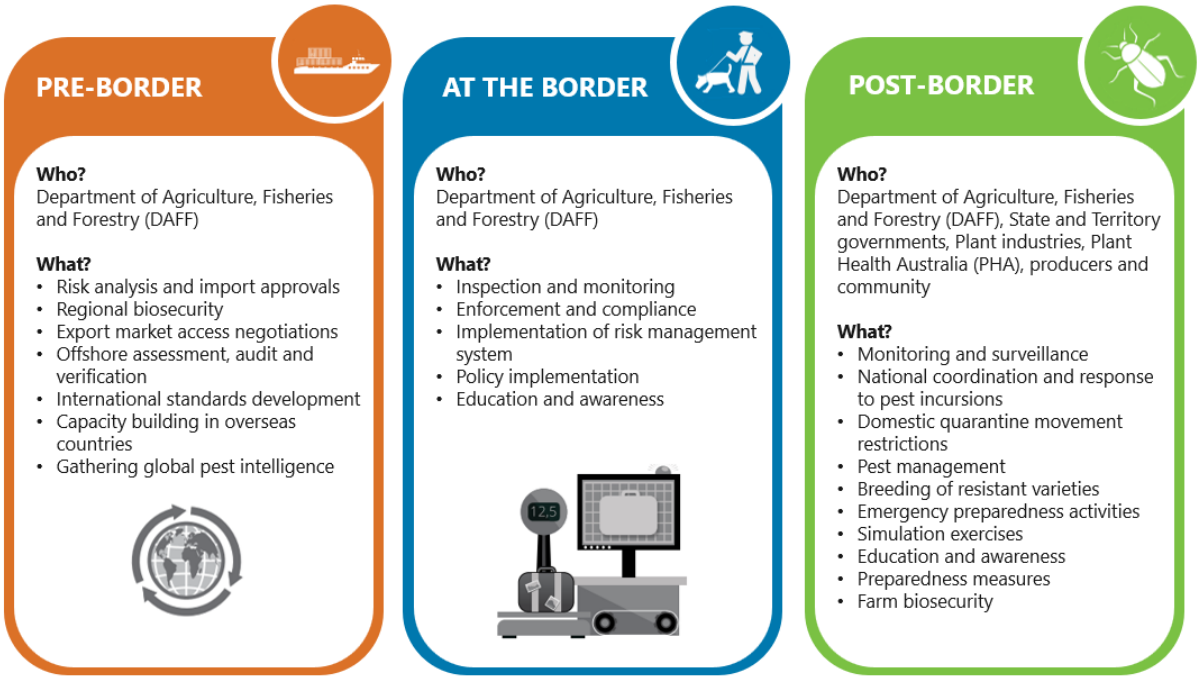


Figure 1. *The biosecurity continuum.*

Pests and diseases do not respect farm boundaries or state borders

Due to its geographic isolation Australia has been protected from many pests that growers must contend with overseas.

Biosecurity is crucial to maintain this favourable pest status, safeguarding the future profitability and sustainability of Australia’s plant industries.

Pathways for Entry and Spread of Pests and Diseases

There are several potential entry pathways by which exotic ginger pests and diseases could enter Australia. The risks posed by these pathways are initially mitigated by international quarantine measures, which are managed by the Australian Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF), and involve comprehensive border controls to screen imported goods, plant material and travellers entering Australia.

There are a variety of mechanisms and pathways by which pests and pathogens of ginger could enter and spread within Australia (**Figure 2**). Examples include soil which may harbour eggs, larvae or spores, or rain which can splash disperse fungal spores thereby presenting a risk of spreading organisms to new locations.

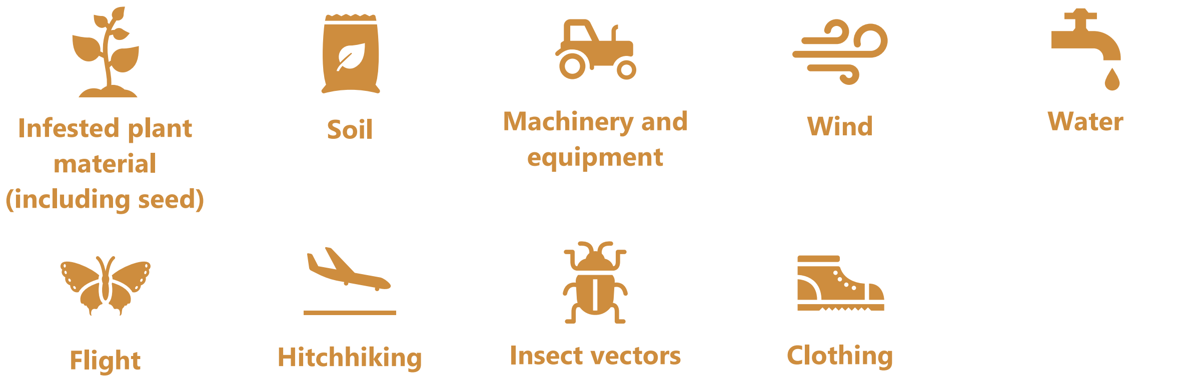


***Figure 2**. Examples of pathways for entry and spread of pests and diseases.*

Case study: Importation of fresh ginger from Fiji

The Australian Commonwealth, through DAFF, currently permits the importation of fresh ginger (*Zingiber officinale*) from Fiji on the condition strict biosecurity requirements and standards are met.

Several measures are in place to mitigate potential risks of introducing pests and diseases into Australia with imported goods, including fumigation of consignments with methyl bromide and a requirement that the imported rhizomes are free from shoots, roots, soil and other contaminants such as seed, animal and plant debris, and free from biosecurity pests and diseases.

Biosecurity is a shared responsibility and both producers, and the general public can play their part in helping to reduce the risk of spreading pests and diseases by not planting ginger purchased from shops or markets, including both fresh ginger produced in Australia as well as ginger imported from other countries such as Fiji.

For more information, visit DAFF's website, Q&A page and import conditions on BICON.

Movement restrictions in relation to fire ants

To manage the risk of spread of fire ants (*Solenopsis invicta*), the state of Queensland has fire ant biosecurity zones and movement restrictions in the *Biosecurity Regulation 2016*.

Fire ant biosecurity zones
Queensland Government
https://www.fireants.org.au/stop/biosecurity-zones

Case study: Fire ants

Fire ants (*Solenopsis invicta*) are a pest species with the potential to cause serious economic and environmental damage. These ants pose a risk to human health, lifestyle and amenity as well as businesses and the environment, including crops, insects, spiders, lizards, frogs, birds and mammals.

What do fire ants look like?

- Copper-brown body and head with a brown-black coloured abdomen
- 2-6 mm in length (Note: A single nest can contain ants of all sizes)

Figure 3. *Solenopsis invicta. Image by Bugwood.org. https://wiki.bugwood.org/Solenopsis%5Finvicta.*

How do I recognise a fire ant nest?

Nests typically appear as a mound or flat patch of loose sifted soil without any obviously visible entrance or exit holes.

Figure 4. *Fire ant nest. Image by Queensland Government.*

Figure 5. *Fire ant nest. Image by Queensland Government.*

Figure 6. *Fire ant nest. Image by Queensland Government.*

Where might I find a fire ant nest?

Nests are typically constructed on cleared or open areas. They are also often found near waterbodies, property boundaries, mulch, soil, green waste, quarry products, turf and potted plants (Queensland Government, 2025).

How do fire ants spread?

Fire ants are highly mobile with a single queen capable of flight up to distances of 5 km. Ants can also spread by floating as a living 'raft' of ants on water during wet weather and flooding events. They can also spread by hitchhiking on organic material such as turf and potted plants, machinery, containers and goods, and can be spread in soil, nursery stock, mulch, animal manures, straw as well as other earth and plant materials.

What do I do if I believe I have seen fire ants?

Report suspected sightings of fire ants online at fireants.org.au or call 13 22 68 (132 ANT).

When making a report, you will need:

- The location of suspect ants or nests
- A description of ant behaviour, such as swarming when disturbed
- A photo or video for identification (ideal but not mandatory)

Where applicable, remember to follow fire ant biosecurity zones and movement restrictions in place in the *Biosecurity Regulation 2016*. Current fire ant biosecurity zones can be viewed online.

Where can I find more information?

More information can be found at fireants.org.au. The Queensland Government also offers free online training about fire ants and how to correctly perform treatment. Online training is also available for residents, primary producers, pest managers and workplaces.

Pest and Disease Management

In ginger cultivation, diseases generally cause more damage than pests, making their prevention and control critical for commercial production. The most significant diseases are rhizome rots, commonly caused by ***Pythium* spp., *Fusarium* spp**., and ***Rosellinia* spp**. These lead to black, decaying rhizomes, while above-ground symptoms include yellowing of leaf tips, sheaths, and margins, progressing to complete leaf desiccation and plant death. Bacterial wilt, caused by ***Ralstonia solanacearum***, is another serious and widespread disease in regions such as Indonesia, Malaysia, the Philippines, and Thailand. It is characterised by progressive yellowing and wilting from the lower leaves upward, with severely affected stems and rhizomes exuding a milky fluid when cut. Leaf spot diseases caused by ***Phyllosticta*, *Colletotrichum*, *Helminthosporium*, *Cercospora***, and ***Septoria*** species are also prevalent.

Figure 7*. Leaf spot of ginger caused by Phoma zingiberis (syn. Phyllosticta zingiberi). Image by GmbH (n.d.).*

Figure 8. *Ginger plants showing symptoms of bacterial wilt caused by the bacterium, Ralstonia solanacearum. Image by Pathak & Kakati (2024).*

Most insect pests have only local impact, although certain foliage pests can cause significant damage in specific areas or seasons. In Asia, particularly India, the yellow peach moth/shoot borer (***Conogethes punctiferalis***) is the most important foliage pest, while in the Philippines, ***Ostrinia furnacalis*** is a key concern.

Figure 9*. Yellow peach moth (Conogethes punctiferalis). Image by NBAIR (2013).*

Nematodes (root-knot and burrowing nematodes) also attack ginger, forming galls on roots, and in severe cases, killing the crop.

Figure 11. *Left - Healthy ginger rhizome. Right - Ginger rhizome showing symptoms of stunting caused by the root knot nematode, Meloidogyne javanica. Image by Hajihassani et. al (2019).*

Figure 10. *Nematode egg masses on ginger roots. Image by Hajihassani et. al (2019).*

Examples of integrated management practices for ginger pests include, but are not limited to:

- ✓ Provide adequate drainage including by selecting a well-drained cultivation site, planting on raised beds of at least 25–30 cm and avoiding water stagnation
- ✓ Practise crop rotation
- ✓ Solarisation
- ✓ Use healthy planting rhizomes for planting and source pest-free and disease-free ginger propagation material through the AGIA Tissue Culture Scheme
- ✓ Treat seed rhizomes with fungicides before planting
- ✓ Apply mulch
- ✓ Use certified fertiliser and when acquiring compost and mulches, look for compliance with Australian standards and apply only well-rotted compost
- ✓ Improve overall soil health including amendments to improve soil pH
- ✓ Seed treatment with fungicides
- ✓ Remove unhealthy and diseased plants and consult your agronomist for advice if you notice anything unusual

Figure 12. *Raised beds are commonly used for ginger planting to ensure adequate drainage. Image by Australian Ginger.*

Managing Soilborne Pathogens

Soilborne pathogens such as *Pythium* spp., *Fusarium* spp. and nematodes present an ongoing challenge to the productivity and profitability of the Australian ginger industry. Crop losses in ginger have been reported for root-knot nematodes (*Meloidogyne incognita* and *M. javanica*), Pythium Soft Rot (*Pythium myriotylum*) and Fusarium Yellows (*Fusarium oxysporum* f. sp. *zingiberi*) (Smith, Smith & Stirling, 2011).

Case study: Nematodes

Figure 13. Nematode damage appearing as galling in ginger roots. Image by Nisha (2024).

Nematodes are soil-borne pathogens which can severely infest ginger plants to cause plants to exhibit stunted growth, a reduction in tillering and yellowing of leaves. Infected plants often dry out and die earlier than healthy ones, leading to a poor yield and quality at harvest. Infected rhizomes also serve as a source of inoculum during storage (Nisha, 2024).

Root-knot nematodes, which include members of the genus *Meloidogyne* such as *M. incognita* and *M. javanica*, have been reported to cause crop losses in ginger (Smith, Smith & Stirling, 2011). Several management strategies have been proposed for root-knot nematodes, examples of which are summarised below (**Table 1**) (Nisha, 2024; Stirling, 1997).

Table 1. *Management strategies for root-knot nematodes (Bandyopadhyay & Khalko, 2016; Dahlin & Hallmann, 2020; Nisha, 2024; Praneetha et. al, 2025; Rudolph & Pfeufer, 2021; Stirling, 1997).*

Strategy	Notes	Effectiveness
Hot water seed treatment	**Hot water treatment** (48 °C for 20 min) effectively eliminated nematodes from seed without compromising germination.	Effective and non-damaging to seed quality.
Sawdust mulching	Growing ginger on **sawdust mulch**, then using seed from rhizomes not in contact with soil, produced nematode-free seed.	Produces clean seed and suppresses nematodes.
Crop rotation	Field trials on clay-loam soils demonstrated that rotating ginger with **green panic** (*Panicum maximum*) or **forage sorghum (cv. Jumbo)** kept nematode levels low.	Forage sorghum and green panic effective; lablab less effective.
Organic amendments	Organic amendments, particularly **sawdust** and/or **poultry manure**, were as effective at reducing nematode populations as conventional nematicide treatments.	Poultry manure & sawdust yield results comparable to nematicides lowers nematode populations while improving soil health and water retention capacity.
Early-harvest systems	For **early-harvest ginger**, nematode populations built up over successive crops despite organic amendments; full control comparable to chemical treatment was only achieved with nematicides.	Organic amendments + crop rotation not enough; nematicides still often needed
Biofumigation	Involves suppression of soil-borne pests and pathogens by natural compounds, such as those produced by plants (most commonly Brassicas). Some plants produce chemicals called glucosinolates that can decompose to become organic compounds toxic to soil-borne pests such as nematodes by disrupting their cell membranes, for example, radish (*Raphanus sativus*), which has the potential to suppress cyst nematodes in the soil. When considering biofumigation for your property, use non-host species and speak to your agronomist for further advice.	The effectiveness of biofumigation varies depending on the target soil-borne pathogen, the type of chemicals released into the soil produced from plant-derived organic compounds as well as soil type and characteristics, with lighter, sandy soils with low organic matter more favourable.
Biocontrol agents	Nematode effective fungi *Pochonia chlamydosporia, P. lilacinum, Fusarium* spp., *Aspergillus nidulans* and *Scopuloriopsis* spp. are effective in reducing nematode populations in ginger. Rhizome treatment with *Trichoderma* spp./*P. lilacinum* and green leaf mulching with *G. macualta*.	Significant decrease in the populations of root-knot nematodes and boost in ginger yield.

Removal of weeds	Weeds in ginger cultivation areas often serve as hosts of root-knot nematodes. Application of neem cake at the time of planting is recommended for the control of nematodes associated with ginger. In areas where nematodes are prevalent, an additional application of neem cake should be carried out at 45 days after planting.	Maintaining clean weed-free fields will help in mitigating nematode problems.

Case study: Pythium soft rot

Pythium Soft Rot (PSR) of ginger is a disease that impacts most ginger growing regions worldwide. Outbreaks of PSR in Queensland between 2007–2008 caused losses of immature ginger of between 5–30% in some fields (Le et. al, 2014).

PSR is caused by soil-borne water mould (oomycete) pathogens, in particular *Pythium myriotylum*, however, other species in the genus *Pythium* including *P. aphanideramtum* have also been associated with PSR in ginger (Le, Smith & Aitken, 2016).

Disease development is favoured by extended periods of wet weather with high rainfall, soil moisture at or near saturation and high soil temperatures ranging from 26–30°C (Sharma, Sachan & Krishna, 2021; Le et. al, 2014).

Figure 14. *Australian ginger crop suffering from Pythium Soft Rot with symptoms visible as yellowing of above-ground plant parts. Image by Le, Smith, Hudler & Aitken (2014).*

What do symptoms look like in ginger?

(Le et. al, 2014; Smith & Abbas, 2012)

- Wilting and yellowing of above-ground plant parts
- At a paddock level, yellow patches of ginger plants (**Figure 14**)
- Watery brown lesions form at the intersection of the rhizome and stem (collar)
- Rot and collapse of the stem (caused by the expansion and merging of collar lesions)

Figure 15*. PSR affecting a ginger rhizome. Image by Sharma, Sachan & Krishna (2021).*

How does it spread?

Pythium spp. can be spread in soil, water and infected planting material (Smith & Abbas, 2011).

- *Pythium* spp. has been proven to persist in soil for several years with yield impacts up to 7 years after PSR outbreaks (Le et. al, 2014).
- Spores of *Pythium* spp. can be spread in water (Le et. al, 2014).
- *Pythium* spp. may be spread through infected planting material such as rhizome pieces used for planting (Smith & Abbas, 2011).

Prevention and Control

- Don't move soil from one block or paddock to another.
- Clean footwear, machinery, tools and equipment between use. *Pythium* spp. can be spread in soil attached to farm machinery such as tractors as well as on tools and footwear (Le et. al, 2014; Smith & Abbas, 2011).
- Improve drainage to reduce outbreaks and the risk of *Pythium* spreading to surrounding blocks (Smith & Abbas, 2011).
- Use clean, disease-free ginger planting material.
- Crop rotation with that are non-host plants or poor hosts of *Pythium spp.* (Smith & Abbas, 2011).
- Improving soil health, for example, through minimum tillage of cover crops and application of organic amendments has been suggested to be beneficial for suppressing PSR.

Pests and Diseases of Australian Ginger

Several pests and pathogens are either currently under quarantine arrangements or are already managed by Australian ginger producers. Identification of these pests supports mechanisms to be put in place to better align industry and government resources and provide a stronger base for biosecurity risk management for the industry. Contact your agronomist for advice.

Examples of ginger pests already present in Australia are listed below. Of the pests and pathogens listed below, **three** are currently considered to be **pests of biosecurity significance** to the Australian ginger industry due to their potential impact on ginger production and meet at least one of the following criteria:

- currently under quarantine arrangements or restricted to regions within Australia,
- notifiable by law,
- have market access implications,
- able to be prevented from entering a farm through good biosecurity practices

***Table 2**. Pests of the Australian ginger industry.*

Order	Scientific name	Common name	Biosecurity significance?
Lepidoptera	*Conogethes punctiferalis* (syn. *Dichocrocis punctiferalis*)	Shoot Borer/ Yellow Peach Moth	No
Lepidoptera	*Spodoptera frugiperda*	Fall armyworm	No
Bacteria	*Dickeya chrysanthemi* (syn. *Erwinia chrysanthemi*)	Bacterial soft rot of ginger	No
Bacteria	*Ralstonia pseudosolanacearum*	Bacterial wilt of ginger	Yes
Fungi	*Fusarium oxysporum* f. sp. *zingiberi*	Fusarium yellows / Rhizome rot	No
Oomycetes	*Pythium* spp.	Pythium soft rot	No
Nematodes	*Meloidogyne enterolobii*	Guava root knot nematode	No
Nematodes	*Meloidogyne incognita*, *M. hapla*, *M. javanica* and *M. arenaria*	Root-knot nematodes	No
Nematodes	*Pratylenchus* sp.	Root-lesion nematodes	No
Nematodes	*Rotylenchulus reniformis*	Reniform nematode	Yes
Nematodes	*Radopholus similis*	Burrowing nematode (established pathotypes)	Yes

LEPIDOPTERA

Conogethes punctiferalis (syn. Dichocrocis punctiferalis)(Shoot Borer/ Yellow Peach Moth)

Status Established in Australia

Group Lepidoptera

Family Crambidae

Host range

Wide host range of over 120 plant species across 19 families including ginger, turmeric, corn, papaya, lychee, durian, sunflower, cotton, castor, mango, guava, peach, plum, chestnut, orange, grapes, cardamom and pomegranate.

Impact and Biology

Major pest of ginger in the field. This species has been recorded as a pest of ginger in India and Sri Lanka. Up to 40% yield losses in ginger have been reported. This pest is favoured by humid conditions (RH: 60-90%) and temperatures in the range of 30-33°C.

Where is it now?

Australia.

How does it spread?

This pest may be spread with the movement of infested plant material including shoots, stems, fruit and seeds. It is considered unlikely to be transported with ginger rhizomes.

Symptoms

On ginger, larvae feed on leaves and false stems causing leaves to yellow and wither. Wilting and yellowing of a centre shoot is often a sign of damage. Later, larvae may bore into shoots and feed on the inner core. Larvae usually mature before they reach the rhizome and damage it, however, they have been reported to occasionally damage rhizomes. Boring by this species can also predispose ginger to attack by secondary pathogens.

Management

- Pruning and destroying infested pseudo stems
- Light trapping of catch adults
- Chemical and biological controls available. Contact your agronomist for advice
- Larvae may be killed by nematodes including *Steinernema* sp. and *Oscheius* sp.

Figure 16. *C. punctiferalis on ginger. Image by Senthil Kumar et. al (2018).*

Figure 17. *Shoot borer in Ginger. Image by Khethariagritech (2024).*

Figure 18. *Image by NBAIR (2013).*

Spodoptera frugiperda (Fall armyworm)

Status Established in Australia

Group Lepidoptera

Family Noctuidae

Host range

Wide host range including over 350 plant species including cotton, maize, rice, sorghum, sugarcane, wheat and sweet corn. Damage to ginger by fall armyworm has also been reported. Fall armyworm is noted to have a particular preference for grasses.

Impact and Biology

Fall armyworm (FAW) is native to tropical and subtropical areas including South and Central America, the Caribbean and parts of the United States of America. Populations can increase rapidly due to fall armyworms producing eggs in masses containing 100 to 200 eggs. FAW larvae feeding on leaves, stems and reproductive parts of plants. On ginger, the larvae have been observed to feed on leaves and can enter the whorl and cause damage from the inside, resulting in 'shot holes' that become visible as the leaf unfurls. If the damage is severe, the upper leaf can detach. This defoliation leads to reduced yield.

Where is it now?

Northern and eastern Australia. Fall armyworm infestation of ginger reportedly first occurred in Bundaberg in February 2021.

How does it spread?

The adult moth stage are strong fliers and cover distances of hundreds of kilometres including using storm fronts. Larvae can spread between neighboring plants by ballooning or on alternate plant hosts including infested cut flowers, fruit and vegetables. FAW have been found on imported plant material moved in international trade.

Figure 19. *Fall armyworm caterpillar. Image by Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org.*

Figure 20. *Male fall armyworm moth. Image by Lyle Buss, University of Florida, Bugwood.org.*

Symptoms

On ginger, FAW larvae feed on leaves and in doing so, create holes.

Management

Management approaches include insecticide applications as well as biological controls such as with *Bacillus thuringiensis* (Bt), virus products and parasitic wasps such as *Trichogramma*. Management of this pest is challenging due to its ability to move across long distances and to develop insecticide resistance.

For more information, a guide is available for products to combat fall armyworm.

More information

Guide: Fall armyworm and ginger minor use permits and withholding table
https://agrifutures.com.au/wp-content/uploads/2022/08/Ginger-and-FAW_11.10.21.pdf

Quick Guide: Fall armyworm
Plant Health Australia
https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Fall-Armworm-Quick-Guide.pdf

BACTERIA

Dickeya chrysanthemi (syn. *Erwinia chrysanthemi*) (Bacterial soft rot of ginger)

Status Established in Australia

Group Bacteria

Family Pectobacteriaceae

Host range

This bacterium has been reported on potato, ginger (*Zingiber officinale*) and Japanese ginger (*Zingiber mioga*).

Impact and Biology

This bacterium is a causal agent of bacterial soft rot, a disease that primarily impacts stored ginger and leads to softening of rhizome tissue over time and the presence of an unpleasant odour. In addition to causing post-harvest rot of ginger, this bacterium can also cause rotting of ginger seed-pieces. Disease development is reported to be favoured by high soil temperatures, waterlogged, saturated soils and by mechanical damage to ginger rhizome pieces used for planting.

Figure 21. *Yellowing leaves due to rot. Image by NVH (2024).*

Where is it now?

Queensland. Periodic outbreaks of this disease on ginger have been reported in Queensland, particularly in waterlogged soil.

Symptoms

On ginger, symptoms include rotting of ginger seed-pieces or harvested ginger (post-harvest rot), premature yellowing of newly emerged shoots, death of shoots and seed-pieces with a mushy, soft texture and an unpleasant odour.

On *Z. mioga*, this bacterium causes soft rot and rotting of flower buds.

On potato, this bacterium causes stem rot and blackleg.

How does it spread?

Bacteria in the genus *Dickeya* may be transmitted through contaminated water and plant material. *Dickeya* spp. can also enter through plant wounds, hence, mechanical damage to ginger rhizome pieces used for planting has been associated with disease occurrence.

Management

This bacterium has not been reported as a major problem for ginger in Australia, with periodic outbreaks reported primarily in waterlogged conditions. This bacterium is mainly a problem in stored ginger.

Ralstonia pseudosolanacearum (Bacterial wilt of ginger)

BIOSECURITY SIGNIFICANCE

Status Established in Australia

Group Bacteria

Family Burkholderiaceae

Synonyms Formerly referred to as *Ralstonia solanacearum*.

Host range

Ginger. Multiple races of this pathogen exist. Race 1 strains cause slow wilting whilst Race 4 strains are very specific to ginger.

Impact and Biology

Soil-borne bacteria that can cause bacterial wilt of ginger.

Symptoms

On ginger, symptoms include:

- Yellowing and wilting of lower leaves
- Base of pseudostems with a water-soaked appearance
- Presence of dark black, water-soaked patches at the collar region at the base of pseudostems
- Discoloured vascular tissue dark brown to black in colour
- Wilting of individual plants and pseudostems
- When injured, pseudostems and rhizomes ooze a milky substance

Where is it now?

Queensland.

Bacteria in the *R. solanacearum* complex were found to have caused outbreaks of bacterial wilt in ginger first reported in 1955 and later in 1965, in parts of Queensland. Bacteria that triggered the 1955 outbreak were believed to have entered Australia on latently infected rhizomes imported from China.

Figure 22. *Ginger plants exhibiting symptoms of bacterial wilt. Image by Pathak & Kakati (2024).*

Figure 23. *Ginger plants exhibiting symptoms of bacterial wilt. Image by Pathak & Kakati (2024).*

How does it spread?

These bacteria can survive and spread through soil and water. Bacterial wilt of ginger may also spread on latently infected rhizomes.

Management

Strategies for reducing the impact of bacterial wilt in ginger include:

- Crop rotation with non-host crops including biofumigants i.e. mustard. Contact your agronomist for advice
- Use of clean, disease-free planting material (rhizomes)
- Select planting areas and soils with good drainage
- Chemical treatment with fungicides may also be an option

FUNGI

Fusarium oxysporum f. sp. zingiberi (Fusarium Yellows or Rhizome rot)

Status Established in Australia

Group Fungi

Family Nectriaceae

Host range

Ginger.

Impact and Biology

Fusarium oxysporum f. sp. zingiberi (*Foz*) is the causal agent of Fusarium Yellows. This fungal pathogen infects ginger rhizomes and has been reported to persist in infested soil for many years. Cooccurrence in wet soil of *Fusarium* and *Erwinia chrysanthemi,* the causal agent of bacterial soft rot, has also been reported to cause poor emergence in ginger. Several ginger cultivars grown in Australia are susceptible to this pathogen including 'Queensland' and 'Canton'.

Symptoms

- Initial symptoms include yellowing of leaves of affected tillers
- Affected leaves appear faded and older leaves tend to dry up first, followed by the younger ones
- Damaged plants appear stunted
- Discolouration and rotting of rhizomes, yellowing of plants, stunting and dieback
- Affected rhizomes are shrivelled and rotten and brown inside. Rhizomes may show a brownish ring around the cortical area when cut open. Due to these defects, affected rhizomes are unsellable
- Newly planted ginger seed-pieces that rot within just a few weeks of planting
- Infected seed-pieces germinate to produce a weak, yellow shoot that dies or fail to germinate entirely
- If infected ginger seed-pieces are stored, dry rot and surface fungal growth may develop; the latter which is white and cottony in appearance

Management

Purchase ginger seed-pieces (rhizome sections for planting) from reputable suppliers and ensure seed-pieces are not contaminated with *Fusarium*. Fungicides have also been shown to be effective in reducing the number of seed-pieces that rot. It is also recommended to plant on ridges or a slope. Crop rotation is also advised as this pathogen can persist in soil for many years in the soil.

***Figure 24**. Fusarium Yellows in the ginger cultivar 'Queensland'. Arrows highlight stunting and yellowing on leaves and brown discolouration of the rhizome. Image by Prasath et. al (2023).*

***Figure 25**. Fusarium Yellows in the ginger cultivar 'Canton'. Arrows highlight stunting and yellowing on leaves and brown discolouration of the rhizome. Image by Prasath et. al (2023).*

***Figure 26**. Rotting rhizome due to infestation by F. oxysporum. Image by Meenu & Jebasingh (2020).*

Where is it now?

Queensland. Reported to have been present in ginger growing areas in Queensland since approximately 1930.

How does it spread?

This pathogen is often seed transmitted though it may also be spread with the movement of infested plant material such as infected rhizomes. Disease spread is favoured by inadequate drainage and heavy precipitation.

OOMYCETES (Water moulds)

Pythium spp. (Pythium soft rot)

Status Established in Australia

Group Oomycetes

Family Pythiaceae

Host range

Ginger.

Impact and Biology

Pythium Soft Rot (PSR) of ginger is a disease that impacts most ginger growing regions worldwide. It is caused by soil-borne oomycete pathogens, particularly *Pythium myriotylum*, however, other species in the genus *Pythium* including *P. aphanideramtum* have also been associated with PSR in ginger. Outbreaks of PSR in Queensland between 2007-2008 caused losses of immature ginger of between 5-30% in some fields. *Pythium* spp. can also persist in soil for several years, for example, yield impacts have been recorded up to seven years after outbreaks of *P. myriotylum*. Disease development is favoured by extended periods of wet weather with high rainfall, soil moisture at or near saturation and high soil temperatures ranging from 26–30°C. *Pythium* spp. can invade mature plants through roots or the collar region. This disease also impacts stored ginger.

Figure 27. *Australian ginger crop suffering from PSR with symptoms visible as yellowing of above-ground plant parts. Image by Le, Smith, Hudler & Aitken (2014).*

Figure 28. *PSR affecting ginger rhizome. Image by Sharma, Sachan & Krishna (2021).*

Symptoms

- Wilting and yellowing of above-ground plant parts
- Collapse of affected shoots
- formation of watery brown lesions where the rhizome and stem intersect (collar) which eventually expand and merge together causing the stem to rot and collapse

Where is it now?

Queensland.

How does it spread?

- Water
- Infected planting material including rhizomes and seed ginger (sections of rhizome used for planting)
- Soil and sawdust/manure exposed to infected soil

Management

- As *P. myriotylum* can be spread in soil, including soil attached to farm machinery such as tractors, it is important not to move soil from one paddock or block to another and to adequately clean machinery and equipment between uses
- Areas infected with *Pythium* spp. are recommended to be fallow and cultivated with rotation crops that are non-hosts such as oats, sorghum, corn, lablab, brassicas and grass mixes. A fallow period of at least a year has been observed to significantly reduce the prevalence of PSR in ginger crops
- Motile zoospores may also be spread with water; hence, good drainage is important to prevent movement of soil and surface water between blocks. The use of clean rhizome material for planting, use of footbaths and cleaning of machinery and equipment between uses are also recommended to reduce spread

More information

Controlling *Pythium* and Associated Pests in Ginger
https://agrifutures.com.au/wp-content/uploads/publications/11-128.pdf

Controlling *Pythium* in Ginger: Phase 2
https://agrifutures.com.au/wp-content/uploads/publications/13-110.pdf

NEMATODES

Meloidogyne enterolobii (Guava root knot nematode)

Status Established in Australia

Group Nematodes

Family Meloidogynidae

Host range

Described as a highly polyphagous species. Hosts include ginger, jackfruit, guava (*Psidium guajava*), capsicum, watermelon, coffee, cassava, cucumber, carrot, soybean, cotton, tomato (*Solanum lycopersicum*), sweet potato, mulberry tree, black mulberry and beans. The common name of this nematode 'Guava root knot nematode' reflects the considerable damage caused to guava trees (*Psidium guajava*).

Impact and Biology

This plant-parasitic root-knot nematode feeds on the roots of the host plant on which it causes galls to develop.

Symptoms

Symptoms on ginger include galling of roots.

Where is it now?

Queensland and the Northern Territory. Suspected of guava root-knot nematode infestations must be reported to Biosecurity Queensland on 13 25 23 or the Exotic Plant Pest Hotline on 1800 084 881.

Management

Cultural control strategies such as crop rotation, planting of cover crops and adherence to good farm hygiene including sterilisation of equipment. Other management approaches include chemical controls such as the application of nematicides and use of biological control agents such as *Trichoderma*.

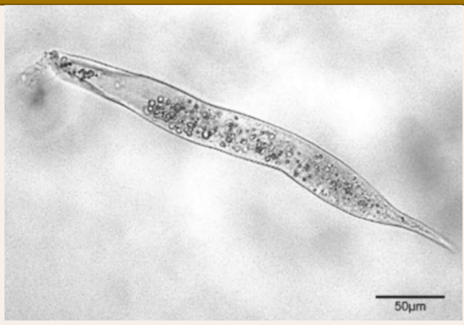


***Figure 29**. Juvenile individual of M. enterolobii. Image by de Oliveira Cost et. al (2025).*

***Figure 30**. Gall development on the roots of a cucumber plant affected by Guava root-knot nematode. Image by Business Queensland (2023).*

How does it spread?

This nematode may be spread through the movement of infested plant material, soil and water.

How does it spread?

Root-knot nematodes survive in soil and infected rhizomes serve as primary inoculum. Further spread is facilitated by movement of infected material, such as infected ginger rhizomes being planted into uninfested soils. Warm and moist soils are favourable.

More information

Sampling guide for Guava root-knot nematode
https://ausveg.com.au/app/uploads/2025/08/VG23007-GRKN-Project-Info-and-Contact_final-A4_updated.pdf

Meloidogyne spp. (Root knot nematodes) –*M. incognita, M. hapla, M. javanica* and *M. arenaria*

Status *M. incognita*, *M. hapla*, *M. javanica* and *M. arenaria*: Established in Australia

M. thailandica: Exotic.

Group Nematodes

Family Meloidogynidae

Host range Ginger.

Impact and Biology

Root knot nematodes (*Meloidogyne* spp.) are microscopic soil-dwelling roundworms that cause significant damage to ginger crops worldwide. Root-knot nematode females are globose and sedentary at maturity. They range in length from 400 to 1000 µm. These pests invade the plant's root system, inducing the formation of galls or "knots," which interfere with water and nutrient uptake. Once they establish a feeding site, they permanently remain at that location within the plant root.

Symptoms

Symptoms on ginger include:

- Infected plants showing stunting, chlorosis and marginal necrosis of leaves
- Galling and rotting of roots and underground rhizomes
- Infested rhizomes with brown, water-soaked areas in the outer tissues; especially in angles between shoots
- *M. incognita* has been observed to produce root nodules that gradually become brown, rotted and rupture

Where is it now?

M. incognita, *M. hapla*, *M. javanica* and *M. arenaria* are present in Australia whilst *M. thailandica* is considered exotic. *M. incognita* has been reported from Queensland and Western Australia whilst *M. javanica* has been reported from Queensland and Western Australia (particularly north of Bunbury and in the southwest).

How does it spread?

Root-knot nematodes survive in soil and infected rhizomes serve as primary inoculum. Further spread is facilitated by movement of infected material, such as infected ginger rhizomes, into uninfested soils. Warm and moist soils are favourable.

***Figure 31**. Left: Healthy ginger. Right: Ginger rhizome affected by Meloidogyne javanica and exhibiting symptoms of stunting. Image by Hajihassani et. al (2019).*

***Figure 32.** Nematode egg masses on ginger roots. Image by Hajihassani et. al (2019).*

***Figure 33.** Water-soaked lesion on ginger rhizome due to infestation of M. incognita. Image by Kaushal, Sharma & Sharma (2023).*

Management

- Hot water seed treatment
- Crop rotation
- Application of organic amendments such as sawdust and poultry manure to improve soil health and reduce nematode populations in the soil
- Nematicides
- Biocontrol agents like *P. chlamydosporia*, *P. lilacinum*, and *Trichoderma* spp. have been found to significantly reduce nematodes and enhance yield

Pratylenchus sp. (Root-lesion nematodes)

Status Established in Australia

Group Nematodes

Family Pratylenchidae

Host range

Over 400 host plant species including ginger, potato, peanut, monocots, and fruits.

Impact and Biology

Lesion nematodes travel through the soil and consume the root tissues of hosts plants particularly during the vegetative growth stage. This root damage reduces plant vigour. In ginger, damage by lesion nematodes is reported to drastically lower yield. Lesion nematodes thrive in temperate climates and are favoured by well-draining soils with moderate moisture content and a coarse texture such as sandy loams and silt loams.

Symptoms

- Tiny, dark necrotic lesions on roots
- Infested roots may turn black, deteriorate and as lesions spread, lose their ability to function
- Infected plants may show stunted growth and decreased vigour due to poor nutrient and water absorption
- Leaves, in particular older leaves, may show yellowing and chlorosis
- Due to reduced root function, plants may be wilted, particularly in hot and dry weather, due to a reduced ability to transport water

Management

- Use clean, disease-free, nematode-free ginger rhizome material for propagation
- Avoid spreading nematodes in infected soil by adequately cleaning items such as machinery, equipment and footwear on a regular basis
- Use crop rotations (rotation of ginger with non-host crops) to disrupt the nematode life cycle and lower population numbers in the soil
- Improve general soil health with organic amendments including addition of organic material in the form of compost and manure.
- To discourage reproduction of nematodes, ensure adequate drainage and do not over-irrigate
- Chemical controls with nematicides or biological control with beneficial entomopathogenic fungi or predatory nematodes may also be an option. Consult your agronomist for further advice on appropriate chemical and biological controls
- Consult your agronomist if you find anything unusual and to seek advice on appropriate crop rotations and control methods. Regular soil testing may be used to monitor nematode populations

Figure 34. *Ginger plants exhibiting root-lesion nematode infestation. Image by Pathak & Kakati (2024).*

Figure 35. *Ginger plants exhibiting root-lesion nematode infestation. Image by Pathak & Kakati (2024).*

Where is it now?

Australia.

How does it spread?

These nematodes may spread through movement and planting of infested rhizome material.

Rotylenchulus reniformis (Reniform nematode) — BIOSECURITY SIGNIFICANCE

Status Established in Australia

Group Nematodes

Family Hoplolaimidae

Host range

Wide host range including ginger, turmeric, sweet potato, cotton and melon.

Impact and Biology

Reniform nematodes are root parasites typically found in tropical and warm temperate regions. For example, reniform nematodes are reported to affect ginger in Hawaii. These nematodes typically reside within the top 15 cm of the soil profile but may sometimes occur at depths greater than 150 cm. To move through the soil, these nematodes require a film of water hence, they are sensitive to soil water content. Notably, only females are reported to parasitise plant roots.

Symptoms

General symptoms on plant hosts include:

- Reduced root systems
- Leaf chlorosis
- Stunting
- Reduction in yield

For example, *R. reniformis* has been correlated with plant damage and yield loss in turmeric in Vietnam.

Where is it now?

Queensland. Reported as a pest of cotton in Central Queensland.

How does it spread?

This nematode can be spread via movement of contaminated soil, including soil attached to machinery and equipment. They may also spread with floodwater, water for irrigation and from drainage which may contain soil particles. Spread over longer distances may occur with the movement of plant material.

Figure 36. *Ginger plant exhibiting symptoms from Reniform nematode infestation. Image by Pathak & Kakati (2024).*

Figure 37. *Ginger plant exhibiting symptoms from Reniform nematode infestation. Image by Pathak & Kakati (2024).*

Figure 38. *Banana roots exhibiting necrosis of roots caused by R. reniformis. Image by Howard Ferris.*

Management

Suggested management approaches include, but are not limited to, the application of nematicides and crop rotation with non-host or resistant crops.

Radopholus similis (Burrowing nematode established pathotypes)

BIOSECURITY SIGNIFICANCE

Status	Established in Australia
Group	Nematodes
Family	Pratylenchidae

Host range

Wide host range of over 300 plant species including ginger, banana (*Musa* spp.), citrus, coffee, coconut, pepper, sugarcane and tea. *R. similis* was first reported in Queensland, Australia in 1903 and by 1920, was linked to serious root damage and root rot in banana. It has not been recorded as a pathogen of ginger in Australia.

Impact and Biology

R. similis is a soilborne nematode that affects the roots and rhizomes of host plants. Isolates of *R. similis* from different countries are reported to vary in their host preferences. For example, *R. similis* isolates from Fiji (Veikoba and Naqali) and Australia, have been found to differ in pathogenicity on ginger and banana, with Fijian isolates showing a host preference toward ginger and found to cause significantly greater damage to ginger rhizomes compared to Australian isolates. Differences in damage on different hosts by *R. similis* is represented by different 'pathotypes' including 'citrus' and 'banana' pathotypes (or 'races'), with Fijian isolates representing a potential newly evolved 'ginger' pathotype.

How does it spread?

This nematode is considered to spread primarily through the movement of infected plant material as well as soil. For example, *R. similis* could potentially be transported through international trade of ginger rhizomes and in soil adhering to ginger rhizomes. *R. similis* can also be readily transported in soil on shoes and tools.

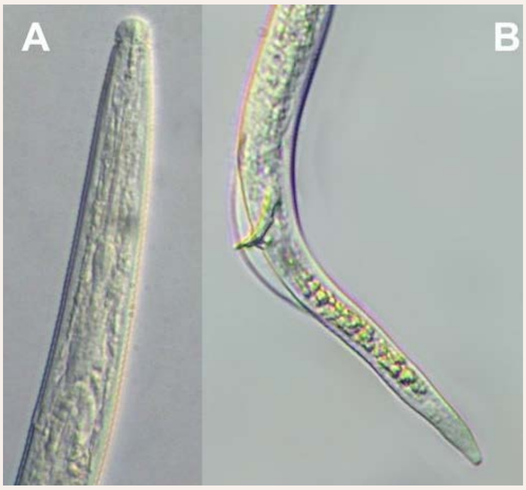


Figure 39. *Male Radopholus similis. A - Head, B - Tail. Image by Nicholas Sekora, UF/IFAS Entomology and Nematology Department, published in Sekora and Crow (2018).*

Where is it now?

Australia (restricted) – especially present in banana growing regions. *R. similis* was not detected on any Australian ginger farms during a survey of Australian ginger farms conducted during 2014–15 across Southeast Queensland. In contrast, *R. similis* is known to occur in Australian banana plantations and is currently considered a major pest of banana in banana-producing areas of Queensland and northern New South Wales.

Symptoms

Symptoms on plant hosts may include:

- Stunting and necrosis of roots.
- formation of dark, necrotic lesions on roots

Consult your agronomist if you notice anything unusual.

Management

- Use clean, nematode-free planting material and plant only in uninfested soil
- Prevent soil movement on tools, machinery and footwear
- Remove all infested host material such as infested rhizomes
- Crop rotation with non-hosts such as brassicas (canola and mustard), *Crotalaria spectabilis* (crotalaria) and Sudan grass. Consult your agronomist for further advice on suitable choices for crop rotation
- Improve general soil health, for example, organic matter levels

Exotic Pests and Diseases of Ginger

Exotic pests pose a major threat to the Australian ginger industry. The climate of Australia's production regions would allow each of these pests and diseases to survive, spread and establish, should they be introduced into the country.

Make sure that you, your staff and your contractors are familiar with priority exotic pests and diseases, any of which would have serious consequences should they make it through border controls.

Several exotic pests and pathogens have been identified to be of biosecurity significance to the Australian ginger industry due to their potential impact on the industry were they to enter Australia. Of these, two are currently deemed **high priority** due to their potential to have a significant economic impact on the industry were they to enter Australia.

***Table 3**. Exotic pests and pathogens of ginger identified to be of biosecurity significance.*

Order	Scientific name	Common name	High priority?
Coleoptera (Beetles)	*Adoretus sinicus*	Chinese Rose Beetle	No
	Adoretus versutus	Rose Beetle	No
	Caulophilus oryzae (syn. *Caulophilus latinasus*)	Broad nosed grain beetle	No
	Holotrichia spp.	White grubs	No
	Palaeopus costicollis	Yam weevil	No
Diptera (Flies)	*Celyphus* sp.	Rhizome fly	No
	Chalcidomyia atricornis	Shoot fly	No
	Eumerus albifrons and *E. figurans*	Ginger maggots	No
	Mimegralla albitarsis (syn. *Calobata indica*) and *M. coeruleifrons*	Rhizome flies	No
Hemiptera (True bugs)	*Aspidiella hartii*	Yam / Rhizome scale	Yes
Fungi	*Phoma zingiberis* (syn. *Phyllosticta zingiberis*)	Leaf spot of ginger	No
Nematodes	*Radopholus similis*	Burrowing nematode (exotic pathotypes)	Yes

COLEOPTERA (Beetles)

Chinese Rose Beetle *Adoretus sinicus* and Rose Beetle *Adoretus versutus*

Group Coleoptera

Family Scarabaeidae

Host range

Adoretus beetles are polyphagous and feed on a wide variety of plants. Hosts include ginger, banana, sweet potato, beans, sugarcane, maize, cacao and ornamentals.

Impact and Biology

These beetles, which are reddish brown in appearance, feed on the leaves of ginger plants thereby reducing leaf surface area and the plant's photosynthetic capacity. *A. sinicus* can cause serious damage to crop, ornamental plants and trees. These beetles are considered native to parts of eastern and southeast Asia as well as many Pacific Islands. *A. versutus* has been observed to cause 80% damage on ginger.

Figure 40. *Adult beetle. Image by Staff (2021).*

Figure 41. *Leaves of a cacao plant displaying a lace-like (shot-hole) appearance characteristic of beetle feeding damage. Image by Bhanu (2025).*

Symptoms

Symptoms on ginger include:

- Leaves that are reduced to veins and display a skeleton-like, shredded, lace-like (shot-hole) appearance thereby reducing leaf surface area and the plant's photosynthetic capacity
- Affected plants appear weak due to leaf damage and reduced photosynthesis

How does it spread?

These beetles may spread through flight, with dispersal particularly favoured by strong winds, the movement of infested plants and plant material including roots, including cultivated plants in soil. Much of the spread of *A. sinicus* throughout southeast Asia and numerous Pacific islands is believed to have occurred through the trade of plants.

Management

Tillage in planted fields can destroy beetle eggs and larvae and adult beetles located near the surface. Use of entomopathogenic fungi may also be an option. For example, *Metarhizium anisopliae*, *M. majus*, *Beauveria brongniartii* and *B. bassiana* have been shown to kill grubs and adult beetles, particular in wet seasons. Chemical control including application of insecticides may also be an option. Consult your agronomist for further advice on suitable choices for crop rotation, chemical and biological control.

Broad nosed grain weevil *Caulophilus oryzae (syn. Caulophilus latinasus)*

Group Coleoptera

Family Curculionidae

Host range

Hosts include ginger, chestnut, chickpea, sweet potato, millet, yam, avocado, maize and feathergrass. This beetle has been found on ginger from the West Indies.

Impact and Biology

This beetle impacts the leaves, roots and stored products of host plants. This beetle has been reported to feed on wheat, wheat flour, barley and ginger. It has been reported in stored products such as dried ginger roots, tubers of yam, sweet potato and taro, and to breed in stored maize, chickpeas, millet and root crops.

Symptoms

This beetle has been reported to feed on ginger and has been reported in stored products such as dried ginger roots. The beetles are approximately 3mm in size.

Management

The risk of spread of these beetles through trade of whole grain can be minimised if the grain is milled and processed. Trapping using maize or wheat seed, or ground barley as a bait has shown some success.

Figure 42. *C. oryzae. Image by Juliana Cardona-Duque, University of Puerto Rico, Bugwood.org.*

Figure 43. *C. oryzae. Image by Anyi Mazo-Vargas, University of Puerto Rico, Bugwood.org.*

How does it spread?

Adult beetles have wings and are capable of flight but are not considered strong fliers. This beetle may also be spread with the movement of infested plant material and machinery. As a pest of stored grain, this species may also be spread through trade of whole grain, however, the risk can be minimised if the grain is milled and processed.

White grub *Holotrichia* spp.

Group Coleoptera

Family Scarabaeidae

Host range

Ginger.

Impact and Biology

Several species in the genus *Holotrichia*, including *H. consanguinea*, *H. fissa*, *H. coracea* and *H. seticollis* are known to attack ginger rhizomes in hilly areas of India. These pests consume roots and young rhizomes, in doing so, creating large holes in the rhizome which diminishes its market value.

Symptoms

Symptoms in ginger include leaf yellowing and pseudo stems that may be severed at their bases. Heavy infestations may lead to loss of an entire crop.

Figure 44. *White grub larvae on ginger. Image by Momin et. al (2018).*

How does it spread?

Adults are capable of flight and grubs can move through the soil.

White grub *Holotrichia* spp. (continued)

Management

To reduce pest populations, it is recommended that land be fallowed two years in a row.

Light traps may also be used to lure adult insects for subsequent destruction to reduce populations. Suitable options to limit spread of the pest may include planting of resistant crops such as sunflowers as well as trap crops including sorghum, maize and onions. Chemical control with pesticides may also be an option. In addition, predatory organisms that attack white grubs, such as the entomopathogenic fungi *Beauveria bassiana* and *Metarhizium anisopliae,* have also been found to reduce rhizome damage when introduced to vermicompost and soil. Consult your agronomist for further advice on suitable choices for crop rotation, chemical and biological control.

Yam weevil *Palaeopus costicollis*

Group Coleoptera

Family Curculionidae

Host range

Hosts include ginger, yam and sweet potato.

Impact and Biology

This weevil impacts the rhizome of the host plant. Damage has been observed on ginger rhizomes. This weevil is also reported to infest tubers of yams (*Dioscorea* sp.) with larvae reported to tunnel into and consume the yam tuber. Adults later emerge from the yam by chewing exit holes approximately 2 mm wide. All developmental stages of this weevil species have been reported inside yam (*Dioscorea* sp.) tubers. Tubers that are heavily damaged may fail to develop and show rotting that diminishes marketability.

Symptoms

- Holes in tubers. Exit holes created by emerging adults may also be visible; in yams these are approximately 2 mm wide.
- Localised rotting of tubers.

How does it spread?

This weevil may be spread with the movement of infested plant material and soil. Weevils may be transported on infected yam heads used for planting. For example, larvae of this weevil have been found on yam imported into the United States of America (Florida) from Jamaica. This weevil is unable to fly; however, individuals are capable of crawling on the soil.

Figure 45. *P. costicollis. Image by Juliana Cardona-Duque, University of Puerto Rico, Bugwood.org.*

Figure 46. *P. costicollis. Image by Juliana Cardona-Duque, University of Puerto Rico, Bugwood.org.*

Figure 47. *Yam weevil damage. Left: Damage on yam (Dioscorea sp.). Right: Damage on rhizomes of ginger (Zingiber officinale). Image by Sherwood (2007).*

Yam weevil *Palaeopus costicollis* (continued)

Management

- Choose land in fallow for at least two years
- Practice crop rotation and intercropping with crops that are not alternative hosts such as vegetables, legumes and maize.
- Remove all tubers from the field after harvest
- Practice shallow burying of setts at planting to prevent exposure to yam weevil adults
- Use of heat-treated planting material (@ 51°C for 35 minutes) which are then placed in an insecticidal dip for 15 minutes
- Use of chemicals, as suggested by your agronomist

DIPTERA (Flies)

Rhizome fly *Celyphus sp.*

Group Diptera

Family Celyphidae

Host range

Ginger. Also reported on turmeric.

Impact and Biology

This fly impacts the rhizome of the host plant. In Kerala, India, maggots of this genus have been recorded on ginger rhizomes and to tunnel into and consume ginger rhizomes.

Symptoms

- Rhizomes that have been tunnelled into and consumed.

How does it spread?

This fly may be spread with the movement of infested plant material and soil. Adults are also capable of flight.

IMAGE PLACEHOLDER

Management

Management of rhizome maggots such as *Celyphus* sp. includes chemical control such as application of insecticides and use of clean, disease-free rhizomes for planting as there is potential for the maggots to be carried over in infested rhizomes.

Shoot fly *Thressa atricornis* (syn. *Chalcidomyia atricornis*)

Group Diptera

Family Chloropidae

Host range

Ginger.

Impact and Biology

Maggots of this fly impact the shoots and rhizome of the host plant. In Kerala, India, maggots of this species have been recorded on ginger rhizomes which tunnel into and consume ginger rhizomes.

How does it spread?

This fly may be spread by the movement of infested plant material. Adults are also capable of flight.

IMAGE PLACEHOLDER

Symptoms

Maggots of this species extensively tunnel rhizomes and roots causing rotting of rhizomes.

Management

Use clean, disease-free planting material. Chemical control options are also available including insecticide application.

Ginger maggot *Eumerus albifrons* and *Eumerus figurans*

Group Diptera

Family Syrphidae

Host range

E. albifrons: Hosts include ginger, turmeric and cabbage.

E. figurans: Hosts include ginger, lily, narcissus and taro.

Impact and Biology

E. albifrons: This maggot affects the rhizome of the host plant. On ginger, maggots have been reported to tunnel into and consume ginger rhizomes.

E. figurans: *E. figurans* is a pest of ginger during storage, with maggots attracted to injured and rotting bulbs, corms and roots. Damage caused is reported to be secondary in nature, however, attack may aid in the spread of bacterial and fungal organisms causing rot. Infections may lead to lower yield and lower-quality rhizomes.

Symptoms

- Extensive tunnelling inside rhizomes
- Infested rhizomes may rot and soften

How does it spread?

These maggots may be spread with the movement of infested plant material.

IMAGE PLACEHOLDER

Management

- Remove and destroy any rotting bulbs, corms or roots
- Clean storage areas thoroughly before and after storin ginger to prevent infestation
- Use clean, healthy, disease-free plant material for planting
- Dispose of severely infested rhizomes to prevent spread of maggots
- Introduce natural predators to help control the maggot population. Consult your agronomist for advice on appropriate biological controls.

Rhizome flies (*Mimegralla albitarsis (syn. Calobata indica)* and *Mimegralla coeruleifrons*)

Group Diptera

Family Micropezidae

Host range

Mimegralla albitarsis and *M. coeruleifrons* have been reported on ginger. In addition, *M. albitarsis* has been reported on species in the family Zingiberaceae, *Colocasia* sp., wild turmeric and cardamom whilst *M. coeruleifrons* has also been reported to attack wild ginger (*Zingiber* sp.), turmeric (*Cucuma longa*) and *Colocasia* sp.

Impact and Biology

Maggots of *M. coeruleifrons* tunnel and feed inside ginger rhizomes causing losses of around 30% in the yield of ginger rhizomes. Rhizome flies are reportedly attracted to ginger plants that are already weakened or damaged by other factors. For example, infestation by maggots of *M. coeruleifrons* is generally reported in rhizomes infected by *Pythium* spp., *Fusarium* spp. or *Ralstonia solanacearum*. Rhizome flies are also favoured by damp growing conditions and crowded plantings which provides ample cover and sources of food. Field observations have found maggots of *M. coeruleifrons* to be incapable of infesting healthy rhizomes. Maggots of *M. albitarsis* have also been reported to infest ginger rhizomes, with larvae reported to feed on underground stems causing plant yellowing and rhizome rot.

Management

- Select healthy, disease-free, robust rhizomes for planting
- Remove infected, rotten rhizomes and plant debris and ensure adequate drainage to discourage conditions favourable for Rhizome flies
- Remove and destroy any maggots present and consult your agronomist if you notice anything unusual
- Chemical control such as insecticide application
- Crop rotation with non-host crops

Figure 48. *Rhizome flies. Image by Pathak & Kakati (2024).*

Figure 49. *Rhizome fly infestation on ginger rhizome. Image by Pathak & Kakati (2024).*

Symptoms

***M. albitarsis*:**

- Plant yellowing, wilting and drying
- Rhizome rot

***M. coeruleifrons*:**

- Wilting and yellowing of leaves progressing upwards from lower leaves
- Rhizome rot with rotten rhizomes giving off an unpleasant odour
- Yellowing and drying of leaves including lower leaves and the main shoot
- Collar area of pseudo stem becomes softened and water-soaked
- Plants with stunted growth and poor root development
- Tunnels formed by maggots inside ginger rhizomes

How does it spread?

These flies may be spread with the movement of infested plant material and soil. Adults are also capable of flight.

HEMIPTERA (True bugs)

Yam or Rhizome scale *Aspidiella hartii* HIGH PRIORITY

Group Hemiptera

Family Diaspididae

Host range

Hosts include members of the families Dioscoreaceae and Zingiberaceae including ginger, yam, Taro (*Colocasia antiquorum, C. esculenta*), (*Cucuma longa*), sweet potato (*Ipomoea batatas*), *Cyperus odoratus* and *Tripsacum laxum*.

Impact and Biology

This pest extracts sap from the host plant's phloem which can reduce plant vigour; particularly when present in large numbers.

This pest also affects rhizomes which can reduce yam and ginger marketability. This insect affects ginger rhizomes both in the field and in storage and is considered a major storage pest of ginger rhizomes. Impact on ginger in storage may include negative impacts to sprouting, weight loss as well as shrivelling of buds and rhizomes.

How does it spread?

This pest may be spread over long distances with the movement of infested tubers or rhizomes, including of ginger, on which live scales can persist; posing a heightened risk particularly if infested rhizomes are used for planting. This insect, particularly crawlers (first instar nymphs), can move distances up to 1 metre and may also be transported by wind, insects and birds.

Figure 50. *Yam scale. Image by Salerno et. al (2018).*

Figure 51. *Rhizome scale on ginger. Image by Momin et. al (2018).*

Symptoms

Severely infested rhizomes have a withered and dry appearance and may feature encrustations. Yellowing, defoliation, reduction in fruit set and loss of plant vigour may also be observed.

Management

- When, avoid storing infested rhizomes
- Trim and discard any branches and leaves that are severely infested. To increase air circulation and humidity levels around the plants, make sure they are spaced appropriately
- For seed production, choose robust rhizomes that have not been infested with yam scale. In the case of a persistent infestation, treat seed material prior to storage and planting
- Submerge the rhizomes in a chemically treated solution prior to storage
- Drip irrigation and spread of well-rotted sheep dung or poultry manure is recommended
- Promote beneficial insects that consume scale insects, such as parasitic wasps, lacewings and ladybugs
- Adult scale insects may be attracted and captured using yellow sticky traps, which can aid in population monitoring

FUNGI

Leaf spot of ginger *Phoma zingiberis (syn. Phyllosticta zingiberis)*

Group Fungi

Class Dothideomycetes

Host range

Ginger.

Impact and Biology

This fungus affects the leaves of host plants and is responsible for causing leaf spot in ginger. This fungus has the potential to cause yield loss in ginger due to damage caused to leaves, particularly tissue containing chlorophyll required for photosynthesis.

Symptoms

- Spots on ginger leaves that have a dark brown margin surrounded by a yellow halo and with a near-white centre
- If a large number of spots form on a single leaf, the entire leaf may brown and dry out
- Pycnidia may also be visible on the leaf surface at the centre of spots

How does it spread?

This fungus may be spread with the movement of infected plant material with infected debris and seed serving as primary inoculum. Spores may also be spread by wind, rain and water splash. Spores of this fungus are reported to remain viable in soil at depths of 25 cm for up to 6 months therefore movement of infested soil may also be a potential mechanism for spread.

Figure 52. *Leaf spot of ginger. Image by GmbH (n.d.).*

Management

Fungicide application has been suggested for control of leaf spot of ginger. Disease severity may be reduced by cultivating ginger under partial shade conditions. Partial shade reduces the severity of *Phyllosticta* leaf spot and sunburn in ginger, while improving tiller numbers and yield. Studies in India found lower disease incidence under shaded compared to open cultivation eliminating the need for fungicidal sprays, reducing chemical pollution.

NEMATODES

Burrowing nematode (exotic pathotypes) *Radopholus similis* — HIGH PRIORITY

Group Nematodes

Family Pratylenchidae

Host range

Wide host range of over 300 plant species including ginger, banana (*Musa* spp.), citrus, coffee, coconut, pepper, sugarcane and tea.

Impact and Biology

R. similis is a soilborne nematode that affects the roots and rhizomes of host plants. Isolates of *R. similis* from different countries are reported to vary in their host preferences. Whilst isolates of *R. similis* isolates exist in Australia, they have been found to differ from Fiji (Veikoba and Naqali) in pathogenicity on ginger and banana, with exotic Fijian isolates showing a host preference toward ginger and found to cause significantly greater damage to ginger rhizomes compared to Australian isolates. Differences in damage on different hosts by *R. similis* is represented by different 'pathotypes' including 'citrus' and 'banana' pathotypes (or 'races'), with Fijian isolates representing a potential newly evolved exotic 'ginger' pathotype.

Symptoms

- Reduction in above and below-ground growth of ginger; specifically, a reduction in shoot and rhizome weight, shoot biomass and number of live shoots
- Leaf yellowing and death of shoots
- Eventual death of the plant

How does it spread?

This nematode is considered to spread primarily through the movement of infected plant material as well as soil. *R. similis* could potentially be transported through international trade of ginger rhizomes and in soil adhering to ginger rhizomes. *R. similis* can also be readily transported in soil on shoes and tools.

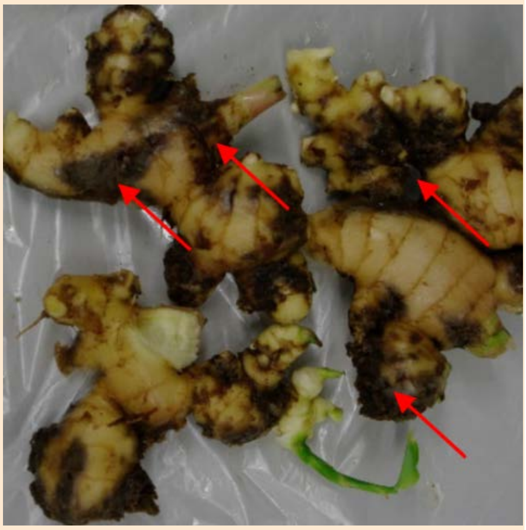


Figure 53. *Lesions observed on ginger due to damage by Radopholus similis. Image by Cobon et. al (2019).*

***Figure 54**. Ginger rhizomes damaged by burrowing nematode rejected at harvest. Image by Jackson (2021).*

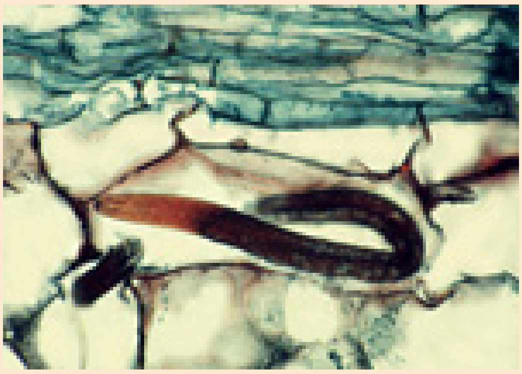
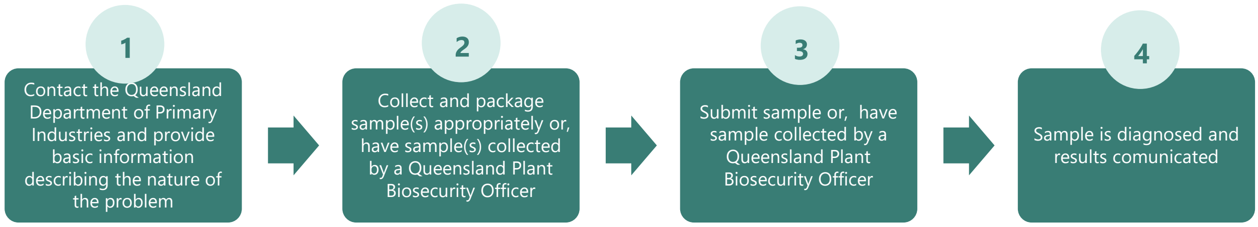


Figure 55. *R. similis* feeding in the cortex of a ginger root. Image by M. McClure, University of Arizona, Bugwood.org.

Diagnosing and Reporting Suspect Pests



Step 1: Contact the Queensland Department of Primary Industries

The Queensland Department of Primary Industries (DPI), including through Biosecurity Queensland, provides several plant pest and disease testing services:

Commercial growers and consultants can submit samples for plant pest and disease diagnostics through the **Grow Help Australia** program. Testing is performed based on a fee-for-service model with pricing information published on the Queensland Government website.

Biosecurity Queensland's **Plant Biosecurity Laboratory** performs identification of plant pathogens and insects. Whilst the laboratory has a particular focus on processing samples of potential biosecurity concern, the facility may also process agricultural and horticultural samples.

Individuals are advised to contact Queensland DPI prior to sending in samples to receive further instructions. When making an initial enquiry prior to sample submission to Biosecurity Queensland's Plant Biosecurity Laboratory, individuals are advised to provide basic information including photographs if available describing the nature of the pest or disease problem via email to plantbiodiagnostics@dpi.qld.gov.au (**Figure 56**).

Email: plantbiodiagnostics@dpi.qld.gov.au

Name:

Address:

Phone Number:

Details of the sample for testing:

Host plant affected: e.g. ginger

Degree of the problem: e.g. Number of plants infected

Photos that show the symptoms or pest:

Any other important information:

Figure 56. *Information to be provided by individuals to the Queensland Department of Primary Industries prior to sample submission.*

Table 4. Contact and location information as well as testing performed by the Queensland Department of Primary Industries through Grow Help Australia and the Plant Biosecurity Laboratory.

	Grow Help Australia	Plant Biosecurity Laboratory
Contact information	Email: growhelp@dpi.qld.gov.au Phone: 13 25 23	Email: plantbiodiagnostics@dpi.qld.gov.au Phone: 13 25 23
Tests provided	✓ Plant pests and pathogens ✓ Fungal pathogens (in seeds only) ✓ Certain pathogen groups (mainly *Phytophthora*) in growing media, soil and water ✓ Nematology ✓ Plant pathogens to support accreditation schemes and export requirements	✓ Plant pests and diseases (priority being samples of potential biosecurity concern)

Grow Help Australia
Queensland Government
https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crops/test/grow-help-australia

Plant Biosecurity Laboratory
Queensland Government
https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crops/test/plant-biosecurity-laboratory

If you suspect an exotic plant pest or disease, phone the **Exotic Plant Pest Hotline** on **1800 084 881**.

Step 2: Collect and package your sample

How do I collect a sample?

The Queensland Department of Primary Industries has specific guidelines for the collection and packaging of plant samples for testing by Grow Help Australia and the Plant Biosecurity Laboratory.

The Queensland Department of Primary Industries makes the following recommendations to ensure individuals collect samples that are suitable for testing:

- Send both health and unhealthy plant specimens to allow a comparison to be made between healthy plants and those showing symptoms
- Send multiple plant samples to ensure sufficient material is provided for testing
- **Do not** send samples treated with fungicides.
- Collect samples **before** applying fungicides and avoid treating samples with fungicides for at least 14 days before sending. This is because fungicides can inhibit detection of pathogens such as bacteria and can negatively impact the accuracy of results.
- Sampling techniques and requirements vary depending on the pest or pathogen and can involve the collection of soil samples or other plant material such as stalks.

The Queensland Department of Primary Industries has developed guidelines for sample collection for different plant types and for specific pests and diseases. Guidelines have been developed for container nursery plants and hydroponic crops, in-ground fruit and tree crops, vegetable crops, postharvest fruit and vegetables, pathogenic nematodes, *Phytophthora*, insects, mites and other pests, virus infections, environmental dieback and street tree, parkland and garden dieback.

Table 5. Summary of selected guidelines developed by QLD DPI for pathogenic nematodes and insects, mites and other pests. Guidelines are available in full online at: https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crops/test/grow-help-australia/package.

Disease/Pest Type	Collect
Pathogenic Nematodes	• Approximately 300 grams of field moist soil • If testing plants for root nematode infection, collect infested roots and adjoining soil • If testing possible foliar nematode infection, submit 5 to 10 crowns with new growth showing deformity • Ensure that the sample is made up of many smaller subsamples, randomly collected across the field
Insects, mites and other pests	• For small insects on plant foliage, send them live in a zip-lock bag • For large insects, collect and kill in a freezer overnight and once dead, wrap in tissue paper and place in a small container and ensure insects remain dry

How do I package a sample?

Where possible and depending on your location, samples destined for the Queensland Plant Biosecurity Laboratory may be collected by a Queensland Plant Biosecurity Officer. Alternatively, the individual submitting the sample, may need to collect, package and send the sample themselves.

If collecting and packaging a sample yourself, adhere to the Queensland government guidelines available online and summarised below.

Collecting and Packaging Samples for sending to the Plant Biosecurity Laboratory

- For plant specimens, include damaged or infected plant parts that show a representative range of symptoms and separate all above-ground plant parts from roots to avoid contamination of leaves.
- For inspect specimens, the specimen must be dead, placed in a solid container and then into a freezer overnight at a temperature of -20°C.
- Complete a **sample submission form**
- Package your sample(s) appropriately:
    - Package different samples separately and label each sample clearly with a waterproof marker.
    - Use packaging that will not compress or damage your sample.
    - Begin by pre-wrapping plant samples in dry paper.
    - Triple package each sample:

    - Layer 1: Put the sample into a press-seal plastic bag or screw-cap specimen container
    - Layer 2: Put this inside another press-seal plastic bag or plastic container
    - Layer 3: Put this inside a padded bag, tough bag, corrugated cardboard box or bio bottle
  - Print out and place your completed **sample submission form** in a separate plastic bag inside the final layer of packaging.
  - Ensure the package weights less than 15 kg and can be lifted by one person.
- Address the package appropriately and mark it to the attention of: 'Plant pathology' (for plant diseases) or 'Entomology' (for insects)

Complete a Sample Submission Form

To submit a sample, a **sample submission form** must also be completed. When sending a sample both to Grow Help Australia or to the Plant Biosecurity Laboratory, a physical copy of the sample submission form should be printed out and sent with the sample.

- When sending a sample to Grow Help Australia, complete the **sample submission form online** and print the confirmation email that states your sample submission has been registered online and include the printed email in the sample package
- When sending a sample to the Plant Biosecurity Laboratory, print out and place your completed **sample submission form** in a separate plastic bag inside the final layer of packaging

Sample Submission Form for Grow Help Australia
Queensland Government
https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crops/test/grow-help-australia/form

Sample Submission Form for the Plant Biosecurity Laboratory
Queensland Government
https://www.publications.qld.gov.au/ckan-publications-attachments-prod/resources/df823a3d-894e-4192-800a-c19cdde72a5d/plant-biosecurity-laboratory-sample-submission-form.pdf?ETag=7fab7ce4358d65e5c8c6a3cd71a4bfd0

For samples directed to Grow Help Australia, invoices will be directed to individual who completed the submission form. Therefore, Queensland DPI advises crop consultants submitting samples on behalf of a grower to complete the form on the grower's behalf or to ask the grower to complete the form. For more information, visit the Queensland Government webpage on Receiving results from Grow Help Australia.

Adhering to legislation whilst moving sample material for testing

As outlined in the Queensland *Biosecurity Regulation 2016*, a sample may be moved into the State, or into or from a biosecurity zone if it is being directed to an approved facility for testing and is quarantine secured. Where required, a sample may also be directed from a biosecurity zone out of the state provided that the sample is being directed for testing and is quarantine secured.

To be deemed *quarantine secured* under the Queensland *Biosecurity Regulation 2016*, a sample must be sealed within three layers of packaging to mitigate the risk of escape of the sample or any biosecurity matter (**Figure 57**).

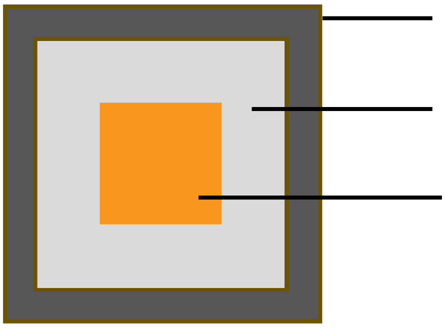


Figure 57. *Packaging layers required to be considered quarantine secured under the Queensland Biosecurity Regulation 2016.*

Step 3: Submit your sample

How do I send a package?

Packages can be delivered by courier, dropped off in person or sent by express post (if under 2 kg). If posting samples, Queensland DPI recommends posting your package(s) on a Monday, Tuesday or Wednesday, if possible, to avoid potential delays with transport over weekend periods. Prolonged time in transit can lead to sample deterioration to the point identification may not be possible.

Table 6*. Contact information and addresses for Grow Help Australia and the Plant Biosecurity Laboratory.*

	Grow Help Australia	Plant Biosecurity Laboratory	
Contact information	Email: growhelp@dpi.qld.gov.au Phone: 13 25 23	Email: plantbiodiagnostics@dpi.qld.gov.au Phone: 13 25 23	
Location	Department of Primary Industries Loading Dock, Basement 3 Joe Baker Street DUTTON PARK QLD 4102	**Courier or drop-off address:** Plant Biosecurity Laboratory Ecosciences Precinct B3 Loading Dock Joe Baker Street DUTTON PARK QLD 4102	**Postal address:** Plant Biosecurity Laboratory Ecosciences Precinct GPO Box 267 BRISBANE QLD 4001

Step 4: Sample Receipt & Diagnostics

What happens once I submit a sample?

Several facilities are currently approved by the Queensland Government for receipt and handling of diagnostic samples and testing for plant pests and diseases.

Once your sample has been received at a facility, the testing and diagnostic process will commence.

Figure 58. *Image by Business Queensland.*

Receiving results

Once the testing process has been completed, the results will be provided to you.

Individuals that have submitted samples to Grow Help Australia will receive:

- a final written report that includes details of the specific tests completed and the results
- interpretation of results
- practical advice (wherever possible) on how to remedy any issues identified through the testing undertaken

For more information, visit the Queensland Government webpage on Receiving results from Grow Help Australia.

Case Study: Root knot nematodes

Root knot nematodes are round worms that inhabit soil and can attack and damage many types of plants. Numerous species of root knot nematodes, which include members of the genus *Meloidogyne*, are known to damage ginger. Several species of root knot nematodes are already present in parts of Australia with examples including but not limited to:

- ***Meloidogyne enterolobii* (Guava root knot nematode)** reported in Queensland and the Northern Territory (Business Queensland, 2023).
- ***Meloidogyne incognita*** reported as widespread in Queensland and as present in Western Australia (Business Queensland, 2022; DPIRD WA, 2016).
- ***Meloidogyne javanica*** reported to be widespread in Queensland and as present in Western Australia, particularly north of Bunbury and in the southwest (Business Queensland, 2022; DPIRD WA, 2016).

Figure 59. *Juvenile individual of M. enterolobii. Image by de Oliveira Cost et. al (2025).*

Figure 60. *Left: Healthy ginger. Right: Ginger rhizome affected by Meloidogyne javanica and exhibiting symptoms of stunting. Image by Hajihassani et. al (2019).*

Symptoms of root knot nematode damage caused by *Meloidogyne* species on ginger may include galling of roots, stunting (including stunting of rhizomes), wilting and yellowing (chlorosis) (Business Queensland, 2022; Hajihassani et. al, 2019; Xiao et. al, 2017).

Due to the similarity of the symptoms caused by different species of root knot nematodes, identification of a root knot nematode to species level typically requires molecular testing or examination by an individual with expertise in nematode taxonomy and diagnostics (Business Queensland, 2022; DPIRD WA, 2016).

Queensland DPI performs testing for plant pests and pathogens and provides guidelines for sample collection including the following recommendations for pathogenic nematode sample collection:

- Collect approximately 300 grams of field moist soil
- If testing plants for root nematode infection, collect infested roots and adjoining soil
- If testing possible foliar nematode infection, submit 5 to 10 crowns with new growth showing deformity
- Ensure that the sample is made up of many smaller subsamples, randomly collected across the field

Once a sample is received for testing, nematode analysis typically involves "extraction, identification and a count of the nematodes present" (Business Queensland, 2022).

Sample guidelines specifically for *M. enterolobii* (Guava root knot nematode) have also been developed in partnership by the Northern Territory and Queensland Governments and AUSVEG.

Sampling guide for Guava root-knot nematode
AUSVEG, Northern Territory Government and Queensland Government
https://ausveg.com.au/app/uploads/2025/08/VG23007-GRKN-Project-Info-and-Contact_final-A4_updated.pdf

Reporting a Suspect Pest

Pests and diseases can have a serious impact on your business, industry and community. By playing your part and reporting anything unusual, you can help reduce the chance any new pest or disease is here to stay.

As a grower, if you notice any unusual pests or diseases on your property, contact your local agronomist or Australian Ginger. They can provide you with initial diagnostic advice about what you have seen and can work with you to report anything unusual through appropriate channels such as the **Exotic Plant Pest Hotline on 1800 084 881**. Refer to the **Useful Contacts** section of this manual for more information.

Whether it is an insect, mite, snail or disease, it is important that unusual pests or diseases are reported in a timely manner. The earlier a report is made, the more likely it is that a pest may be controlled or eradicated.

How do I make a report?

In Australia, any unusual plant pest should be reported as soon as possible to the relevant State or Territory government agency through the **Exotic Plant Pest Hotline on 1800 084 881**.

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in the relevant State or Territory government agency, who will ask some questions about what you have seen and may arrange to collect a sample.

what was seen (describe the pest or send a photo) and when was it was first noticed

where it was found and what it was on

how many pests are present/**how infected is the crop**

how widely distributed it is

Do not send samples without first speaking to someone from the relevant State or Territory government agency, who can discuss the correct type of sample, its packaging, handling and appropriate laboratory for diagnosis. They may say it is nothing new and refer you back to your Production Service to work out the best management option.

Why should I report an unusual pest?

You will have access to support, knowledge and advice from your relevant State or Territory government agency and your industry organisations. This is the best way to:

- get the facts about the pest,
- take the right action to limit spread on your property and neighbouring properties,
- either eradicate or approximately manage the pest, and
- help to keep local businesses and the community profitable.

If you have found a suspected exotic plant pest, the following general precautions should be taken immediately to contain the pest and protect other parts of your farm:

- mark the location of the pest detection and limit access to the area for both people and equipment,
- wash hands, clothes and boots that have been in contact with affected plant material or growing media, and
- restrict operations in the area while waiting for the identification of the suspected exotic pest.

Contact Information for Reporting Suspect Pests

Spotted anything unusual? Call the Exotic Plant Pest Hotline 1800 084 881

New South Wales

Answered 08:30 – 16:30 Monday to Friday. Please leave a message outside of these hours, which will be followed up the next business day.

biosecurity@dpi.nsw.gov.au

Online reporting form

Queensland

Answered 08:00 – 17:00 Monday to Friday (09:00 – 17:00 Thursday). Calls are answered outside these hours by a third party who will take your message and organise a response from a biosecurity officer as soon as possible, depending on the urgency of the report.

13 25 23

What happens if you spot something new?

If a pest or disease you reported is of concern, several activities will be carried out by the State or Territory biosecurity agency both on and off your property to better understand the situation.

The State or Territory biosecurity agency will:

- in consultation with the property owner, conduct trace forward and trace back to determine where the pest came from and where it may have travelled to. Having accurate records of your farm inputs, machinery movements and produce movements help speed this process up.
- engage with their jurisdiction counterparts and peak plant industry bodies, to keep them updated and seek their advice.

It may take time to correctly diagnose the pest or disease and determine whether control actions are needed, and this may cause some uncertainty, but the biosecurity agency will work with you to minimise disruption. Throughout these investigations (and the duration of a response), your personal information, including your address, will remain confidential.

What happens on your property if an Emergency Plant Pest is detected?

As more information is known and diagnostics confirm if the pest is an **Emergency Plant Pest**, (refer to the **Preparing for Emergency Responses** section later in this manual for a definition of an Emergency Plant Pest) measures may be put in place to reduce the risk of the pest or disease spreading. These could include:

- restriction of operations in the immediately impacted area
- restricted movement of people, vehicles and machinery on and off the property
- restricted movement of all host material on and off the property
- farm hygiene measures including footbaths and handwash etc and decontaminating vehicles and machinery entering or leaving the property
- treatment and control measures to eradicate the pest/disease
- guidance on the activities that are still permitted on your property until the pest is eradicated.

What happens beyond your property gate?

Pests or diseases can vary greatly, including how far and quickly they can spread. Depending on the Emergency Plant Pest, areas surrounding your property may also be subject to quarantine restrictions. Surveillance may be conducted across neighbouring properties and businesses that you have sent goods to or received goods from to help work out how far the pest or disease has spread.

Throughout the process, the State or Territory biosecurity agency will keep you informed of what actions you need to take and what may be happening on your property. As a signatory to the Emergency Plant Pest Response Deed (EPPRD)(defined in the later section **Preparing for Emergency Responses**), AGIA may also support you by providing answers to questions and addressing any concerns you have about how emergency response actions are being conducted.

The State or Territory biosecurity agency together with the Australian, State and Territory governments, Affected Industry Parties (if signatories to the EPPRD) and Plant Health Australia, will meet regularly to progress the response. If you are an affected ginger grower, you will be represented in this process by AGIA. If you have experienced losses due to a direct action ordered by the government agency managing the response (Lead Agency), AGIA may also work with you and the Lead Agency to determine any Owner Reimbursement Costs you may be eligible for.

Through every stage of a response, it is important to keep up to date with the latest information as the situation can change quickly. Up to date information is disseminated by the Lead Agency and Australian Ginger based on nationally agreed talking points and can also be found on the outbreak.gov.au website.

What happens next?

Once the size and nature of the incursion is determined, it is determined whether a national eradication program might be undertaken.

For more information on what happens during an incursion, refer to the section **Preparing for Emergency Responses**.

The aim of an eradication is always to get you and your industry back to business as quickly as possible and if relevant, return proof of freedom status to restore any markets that have been closed due to the incursion.

Want to learn more?

Queensland Biosecurity Manual *Version 21.0 (October 2023)*
Queensland Government
https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/379138/qld-biosecurity-manual.pdf

Preparing for Emergency Responses

The Emergency Plant Pest Response Deed

The Emergency Plant Pest Response Deed (EPPRD) is a formal, legally binding document between Plant Health Australia (PHA), the Australian Government, each State and Territory Government and Plant Industry signatories that defines how responses to Emergency Plant Pests (EPPs) are managed and funded. It came into effect on 26 October 2005 after several years of negotiation between government and industries. Australian Ginger is the peak industry body that is signatory to the EPPRD on behalf of the Australian ginger industry.

The current version of the EPPRD can be downloaded from the PHA website.

What is an Emergency Plant Pest?

An Emergency Plant Pest, or EPP, is an exotic pest or disease (or disease vector) that would be economically and/or environmentally harmful and is considered to be in the national interest for Australia to be free of.

The full definition of an EPP can be found on the PHA website.

Categorising EPPs

EPPs are also categorised to guide Cost Sharing of response costs between Government and Industry signatories. There are four different categories which reflect the relative benefit to industry or the public being free of the EPP into the future. For example, Category 1 pests have a high public benefit of eradication with 100% of response costs funded by Government EPPRD signatories. Category 4 pests have a high industry benefit of eradication with the costs shared by Government (20%) and Industry (80%) EPPRD signatories.

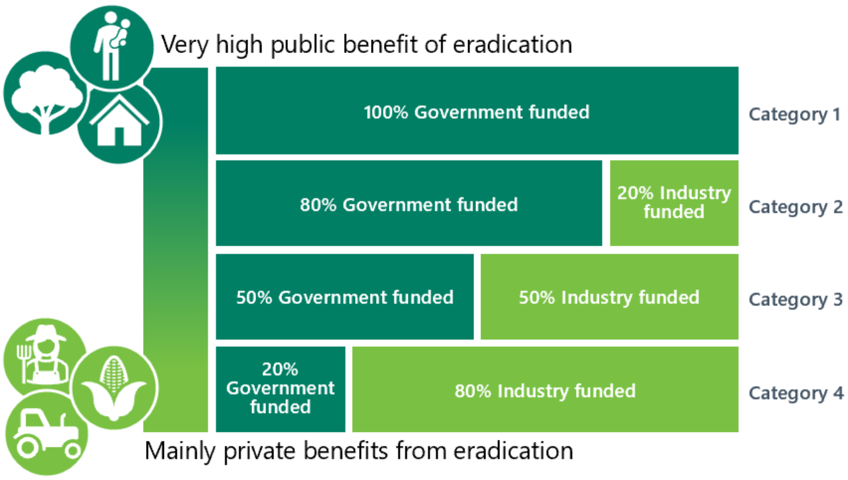


Figure 61. *Emergency Plant Pest (EPP) categorisation related to Cost Sharing arrangements within a Response Plan.*

How is industry involved in an EPP response?

Industries that are signatories of the EPPRD are represented and consulted in each step of a response. As a signatory to the EPPRD, Australian Ginger provides representation for the Australian ginger industry in key decision-making activities in response to an EPP.

In response to an EPP affecting the ginger industry, Australian Ginger is termed an Affected Industry Party and will be asked to be a member of two committees:

- the **Consultative Committee on Emergency Plant Pests (CCEPP)**
- the **National Management Group (NMG)**

During a response, **Industry Liaison Officers (ILOs)** are also mobilised. ILOs are industry representatives that are invited to work in a control centre during a response and are a critical link between the Incident Management Team and affected industry/s. They provide an industry perspective on response activities and provide updates to industry regarding the response.

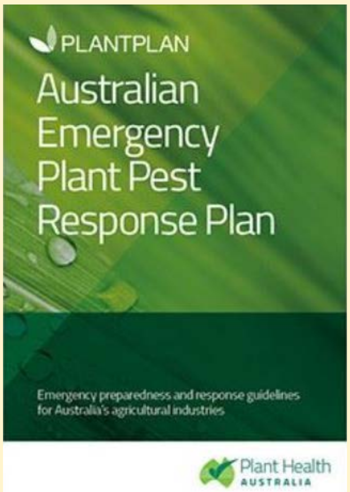
Committees involved in an EPP Response

The CCEPP

The CCEPP is comprised of authorised representatives from Governments, Affected Industry Parties (i.e., Australian Ginger), and Plant Health Australia. The CCEPP is responsible for providing technical guidance on the response and making recommendations to the NMG.

The NMG

This group is also comprised of authorised representatives from Government Parties, Affected Industry Parties and Plant Health Australia. The NMG is responsible for making key decisions on national policy and resourcing needs throughout a response. Decisions made by the NMG including approving the Response Plan are made based on the advice from the CCEPP.



What is a Response Plan?

A Response Plan covers all activities required to eradicate the EPP, as well as activities to be undertaken if the EPP is found to either be no longer technically feasible or too costly to eradicate. The Plan also includes a response budget that outlines what response costs will be shared between government agencies and the affected parties (industries). The Response Plan is prepared by the Lead Agency in collaboration with the CCEPP. The Lead Agency is the government department responsible for biosecurity in the state or territory where the pest was detected. If the pest incursion has spread across state borders each state shares the role of Lead Agency.

Overview of an EPP incident

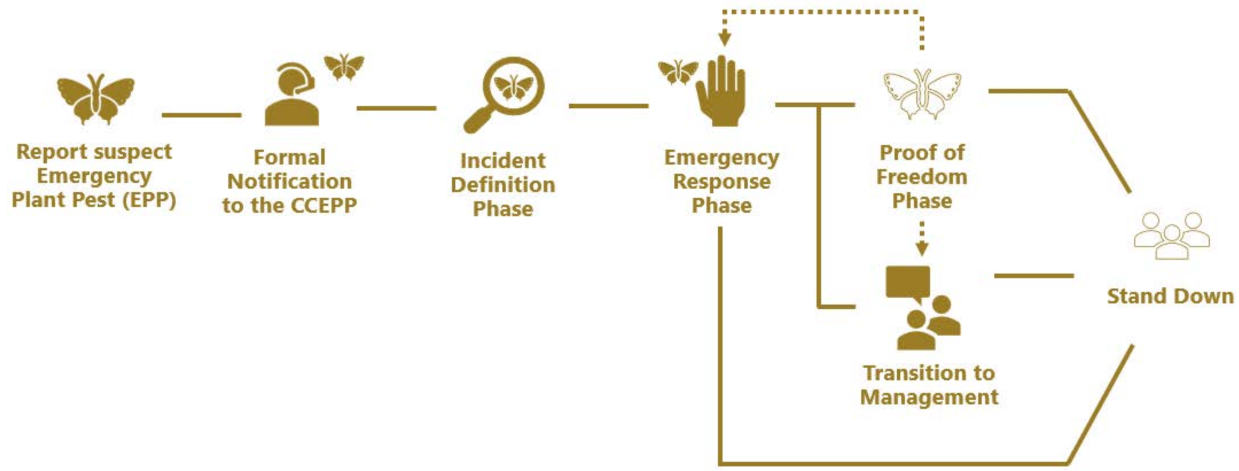


Figure 62. Overview of an EPP incident. Note: The dotted lines between the Proof of Freedom Phase and the Emergency Response Phase and Transition to Management Phase represent the possibility for further pest populations detected during the Proof of Freedom Phase to trigger either a return to an Emergency Response Phase; or if eradication is considered no longer feasible, the emergency response may be stood down or enter a Transition to Management Phase.

Report suspect EPP

The suspect EPP is detected and reported to the State or Territory government.

Formal Notification to the CCEPP

Within 24 hours of a suspected EPP being detected a formal notification to the CCEPP takes place. This involves the Chief Plant Health Manager of the state or territory in which the pest or disease was detected notifying the Chair of the CCEPP (the Australian Chief Plant Protection Officer).

Incident Definition Phase

The Incident Definition phase involves collecting information to help identify appropriate actions to be taken and starting any initial response activities. The aim is to determine whether a Cost Shared eradication program should be undertaken based on current knowledge of the EPP and its distribution. During this phase, emergency containment measures may be implemented and a Response Plan developed.

Emergency Response Phase

If the NMG agrees to a Response Plan, an Emergency Response may commence. This phase involves implementing the Response Plan to eradicate the EPP which may involve activities such as surveillance and tracing, destruction and/or decontamination, movement restrictions and providing updates to industry on the response's progress to industry and the public.

Proof of Freedom Phase

A Proof of Freedom Phase may follow an Emergency Response if the CCEPP determines that the eradication appears to have been successful. The aim of this phase is to confirm if the pest has been eradicated. The key requirements to achieve Proof of Freedom are defined in the Response Plan. This is usually in the form of a surveillance plan that includes the host plants to survey, where to look, how often surveillance needs to occur, and the length of time required to prove pest freedom. This phase continues until the NMG determines that the EPP has been eradicated. In some cases, further pest populations are detected which can trigger either a return to an Emergency Response Phase; or if eradication is considered no longer feasible, the emergency response may be stood down or enter a Transition to Management Phase.

Transition to Management Phase

In some cases, it may not be feasible to eradicate an EPP. If this occurs, Transition to Management may commence to help industry learn how to manage the pest as it becomes established in Australia. This phase generally lasts for a maximum period of 12 months unless agreed by the NMG. The activities during this phase are determined in consultation with the affected industries and may include the development of control options through new research, gaining new chemical registration or grower education and training programs.

What are Owner Reimbursement Costs?

To contain the spread and eradicate an EPP, a property may need to be quarantined, crops may need to be destroyed, or a grower may be required to undertake actions that are not part of their normal production practices (such as additional chemical controls or a period of forced fallow). Implementing these requirements often results in additional costs or potential losses to growers.

Owner Reimbursement Costs, or ORCs, are payments made to eligible individuals to cover specific costs or losses incurred during a response. They are an agreed Cost Sharable component of the EPPRD.

Where to find more information on Owner Reimbursement Costs

The Guidelines for owner reimbursement costs under the plant pest deed provide an overview of the framework for calculating ORC payments for the plant industry sectors, with the provision of the EPPRD defining:

- what comprises an ORC payment,
- who may receive a payment,
- how Cost Sharing is applied, and
- the general valuation and payment processes undertaken.

For more information on ORCs, refer to the PHA website.

Want to learn more?

Free training is available on Biosecurity Online Training platform (BOLT). Register your free account to get started.

- Growers - Pest Reporting and Responses course
- Researchers – Pest Reporting and Responding course
- Plant Surveillance
- Plant Biosecurity in Australia course
- Hitchhiker Pests

The Outbreak website is also a great resource to stay informed on the latest response information.

Learn more about the guidelines for responding to EPPs in PLANTPLAN. The latest version of PLANTPLAN is available on the PHA website.

Production Value Summary Record

As noted in the above section, ORCs are payments made to individuals to cover costs or losses incurred during a response and are an agreed component of the EPPRD.

Completing a production value summary each year and keeping supporting documentation will increase the accuracy of Owner Reimbursement Cost calculations if required during an eradication under an approved Response Plan.

Year/Season:

<table>
<tr><th colspan="5">Crop value</th></tr>
<tr><td rowspan="3">Area cropped</td><td colspan="4">Total:</td></tr>
<tr><td colspan="4">Breakdown by variety</td></tr>
<tr><td>Variety</td><td colspan="2">Location</td><td>Area cropped</td></tr>
<tr><td>Yield</td><td>Variety</td><td>Crop Type</td><td>Yield</td><td>Comments</td></tr>
<tr><td rowspan="2">Market price</td><td rowspan="2">Market location</td><td rowspan="2">Variety</td><td colspan="2">Price</td></tr>
<tr><td colspan="2">Evidence (e.g. receipts)</td></tr>
<tr><th colspan="5">Capital items</th></tr>
<tr><td>Items installed on site (e.g. harvest bins, protective covers etc.)</td><td colspan="2">Item details</td><td>Amount</td><td>Cost (depreciated)</td></tr>
</table>

Crop management and harvesting costs		
Labour costs	Detail (e.g. Number of staff hours for harvest over set period)	Amount
Machinery costs	Detail (e.g. Cost to run/hire machinery for harvest or other activity)	Amount
Fertiliser and Pest management costs	Detail (e.g. amount of fertiliser or spray used and cost)	Amount
Contractor costs	Detail (e.g. cost of contractor and relevant activity)	Amount
Crop management and harvesting costs (continued)		
Other costs relating to crop management and harvesting		
Replanting costs		
Costs from when the final crop has been harvested to when a new plant crop has been planted	Detail	Amount
Net profit from season		
Total sales	Value:	Evidence (e.g. receipt):
Total costs	Value:	Evidence (e.g. receipt):
Total net profit	Value:	Evidence (e.g. receipt):

Useful Contacts

General Contacts

ORGANISATION	
Australian Ginger Industry Association (AGIA) (Australian Ginger)	**Email:** admin@australianginger.org.au **Website:** https://www.australianginger.org.au/
AgriFutures	**Phone:** +61 02 6923 6900 **Website:** https://agrifutures.com.au/rural-industries/ginger/
Plant Health Australia	**Phone:** 02 6215 7700 **Email:** biosecurity@phau.com.au **Website:** https://www.planthealthaustralia.com.au/
Farm Biosecurity	**Phone:** 02 6215 7700 **Email:** biosecurity@phau.com.au **Website:** https://www.farmbiosecurity.com.au/

Government

ORGANISATION	
Australian Department of Agriculture, Fisheries and Forestry	**Phone:** 02 6272 3933 **Website:** https://www.agriculture.gov.au/
New South Wales Government - Department of Primary Industries and Regional Development	**Phone:** 1800 680 244 (Biosecurity) or (02) 6391 3100 **Website:** https://www.dpi.nsw.gov.au/
Queensland Government – Department of Primary Industries	**Phone:** 13 25 23 **Email:** info@daf.qld.gov.au **Website:** https://www.daf.qld.gov.au/

Contact Information for Reporting Suspect Pests

Spotted anything unusual? Call the Exotic Plant Pest Hotline 1800 084 881

New South Wales

Answered 08:30 – 16:30 Monday to Friday. Please leave a message outside of these hours, which will be followed up the next business day.

biosecurity@dpi.nsw.gov.au

Online reporting form

Queensland

Answered 08:00 – 17:00 Monday to Friday (09:00 – 17:00 Thursday). Calls are answered outside these hours by a third party who will take your message and organise a response from a biosecurity officer as soon as possible, depending on the urgency of the report.

13 25 23

Note: In some states, the Exotic Plant Pest Hotline operates only during business hours. Outside these hours, leave your full contact information and a brief description of the issue and your call will be followed up as soon as possible. Every report will be taken seriously, checked out and treated confidentially.

Diagnostic Contacts

LABORATORY	
Plant Biosecurity Laboratory	**Phone:** 13 25 23 **Email:** plantbiodiagnostics@dpi.qld.gov.au **Sample submission form:** https://www.publications.qld.gov.au/dataset/plant-biosecurity-laboratory/resource/df823a3d-894e-4192-800a-c19cdde72a5d **More information:** https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crops/test/plant-biosecurity-laboratory
GrowHelp	**Phone:** 13 25 23 **Email:** growhelp@daf.qld.gov.au **More information:** https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crops/test/grow-help-australia/about

Reporting Suspect Fire Ants or Nests

	Phone: 132 ANT (13 22 68) **Online:** http://www.fireants.org.au/report

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