



Lychee **FIELD GUIDE**

- Insect and Mite Pests
- Natural Enemies of Lychee Pests
- Disorders and Diseases
- Biological Pest Control
- Biosecurity and Exotic Pests



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INTRODUCTION

This field guide is designed to assist lychee growers to identify the major pests, natural enemies, disorders and diseases they may see in their orchards. A section has been added which highlights significant pest and disease threats which are not currently recorded in Australia.

Lychees are produced from Cooktown in far north Queensland to Coffs Harbour in northern New South Wales, many of the pests and diseases in this publication are common to all growing areas, but growers may encounter other problems which are not included.

Contents

INSECT AND MITE PESTS	<i>Page</i>
Elephant beetle	4
Flatid planthopper	6
Flower caterpillar	8
Fruit piercing moth	10
Fruitspotting bug	12
Green tree ant and coastal brown ant	14
Green vegetable bug	16
Leafminer	18
Leafroller	20
Litchi erinose mite	22
Looper	24
Macadamia nutborer	26
Mealybug and scale	28

Redshouldered leaf beetle	32
Stem-girdler and borer	34
Swarming leaf beetle	36
Tea red spider mite	38
Yellow peach moth	40

NATURAL ENEMIES OF LYCHEE PESTS

Assassin bug	42
Lacewing	44
Ladybird	46
Parasitic wasp	48
Predatory mite	50
Tachinid fly	52

DISORDERS AND DISEASES

Corky lump	54
Pepper spot	56
Tree decline	58

BIOLOGICAL PEST CONTROL 60

BIOSECURITY AND EXOTIC PESTS 62

Lychee Exotic Pest threats

Lychee fruit borer	64
Lychee longicorn beetle	66
Oriental fruit fly	68

Lychee Exotic Pathogen threats

Brown blight or downy blight	70
Longan and lychee witches' broom disease	72

Watch threats

Fall armyworm	74
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<i>Acknowledgements, Sources of Information, Other References and Resources, Limitations, Naming and Copyright</i>	76-77
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ELEPHANT BEETLE

Xylotrupes gideon

Description

- Elephant beetles are large (30-40mm long) and brown-black in colour. The male has a large bilobed projection on the head and another on the thorax. Males are larger than females.
- Larvae are large, up to 5-10cm long, white and C-shaped.
- Larvae live in soil, especially soils high in organic matter, and thick under tree mulch is favoured.

Distribution

- Throughout coastal Queensland and New South Wales.
- More of a problem in un-netted or drape netted orchards.



Elephant beetle on net



Male elephant beetle



Adult elephant beetle and damage to fruit

Damage

- Beetles chew whole fruit and sometimes whole panicles of fruit are damaged.
- Beetles may initially be attracted to damaged and split fruit.
- Undamaged fruit may be spoiled by dripping juice from damaged fruit.
- More of a problem with late maturing cultivars.

Action level

- Control when 30 or more beetles are found in 20 trees throughout the crop.

FLATID PLANTHOPPER

Colgaroides acuminata, Siphanta hebes

Description

- Adults are pale green and triangular in shape, 8-13mm long. Adults and nymphs congregate on new shoots and fruit stalks. They move short distances with wing assisted jumps.
- Nymphs have a feathery appearance with waxy filaments and congregate on leaves and fruit. Nymphs can jump relatively long distances.

Distribution

- Throughout all lychee growing districts.



Adult flatid on flower panicle



Juvenile flatid on fruit stem



Nymphs and wax residues on mature fruit

Damage

- Produce honeydew which supports sooty mould on fruit stems and fruit.

Action level

- Control when 20% or more of monitored trees have flowers or fruits infested with planthoppers. Sample 5-10 trees per 0.5 ha.

FLOWER CATERPILLAR

Larvae (caterpillars) from several families of moths including *Geometridae*, *Lymantriidae*, *Pyralidae* and *Tortricidae*

Description

- Adult moths are small, 10–15mm long and grey to fawn in colour.
- Larvae are translucent and grow up to 15mm in length. They may spin silken runways throughout the panicle which are partially covered in frass (droppings).

Distribution

- Throughout all lychee growing districts.



Larva feeding on young fruit



Webbing and frass in panicle



Young larva shaken from flowers

Damage

- Buds, flowers and young fruit chewed and damaged.
- Damaged buds and flowers generally fall off.
- Webbing in flowers can indicate presence of larvae.

Action level

- Control when two or more larvae infest more than 10% of panicles examined.
- Do not confuse spider webs with caterpillar webbing.

FRUIT PIERCING MOTH

Eudocima fullonia, *Eudocima materna*
and *Eudocima salaminia*

Description

- Moths are large, with a wingspan of 100mm. The forewings may be brown, cream or green, depending on the species. Hind wings are yellow orange with black patches and spots.
- Larvae feed only on native vines and are not found on lychee trees.

Distribution

- Throughout all lychee growing districts.



E. materna adult



E. fullonia adult



E. salaminia feeding on fruit

Damage

- Feeding results in small circular holes in the skin of the fruit.
- Flesh beneath puncture turns opaque. Juice may squirt from the hole when fruit is squeezed. The feeding punctures provide entry for bacteria and yeasts that result in fermentation and mould development.
- Late varieties are more adversely affected as the moth populations are at their highest.
- Moths may be present throughout the year, but appear strongly linked to larval host plants.

Action level

- Not known.
- Exclusion netting and bait traps.

FRUITSPOTTING BUG

Amblypelta lutescens and *Amblypelta nitida*

Description

- Adults are green to yellow-green or brownish and 12–15mm long.
- Nymphs (immatures) are pear-shaped, pinkish, orange or green with two distinctive dark spots on the upper surface of the abdomen. Spots are not present on first instars.

Distribution

- Throughout coastal and sub-coastal areas of lychee growing districts.



Adult fruitspotting bug and nymph



Lesions on immature fruit skin and seed caused by fruitspotting bug

Damage

- Feeding on green fruit results in fruit drop. Heavy infestations can cause major green fruit loss if not controlled.
- Small black 'pin pricks' visible on internal surface of the fruit skin but little external damage.
- Characteristic tan coloured lesion on seed.

Action level

- A banana spotting bug (*A. lutescens*) pheromone lure and sticky trap can be used to trap pests allowing growers to monitor the presence of the pest and determine if chemical control is necessary.
- Control when 5% or more of fallen fruit shows signs of fruitspotting bug damage.
- For more information <https://www.horticulture.com.au/globalassets/hort-innovation/resource-assets/mt10049-fruitspotting-bugs-2016-pdf.pdf>

GREEN TREE ANT AND COASTAL BROWN ANT

Oecophylla smaragdina and *Pheidole megacephala*

Description

- Green tree ants are about 8mm long.
- Coastal brown ants are 2–3mm long.

Distribution

- Green tree ants are generally found in coastal regions of northern Australia.
- Coastal brown ants are found along the east coast of Australia.



Coastal brown ants
Left: worker Right: soldier



Nesting made by green tree ants weaving leaves together



Green tree ants



Green tree ant and scale

Damage

- No direct damage. Ants tend scales or mealybugs for the honeydew and interfere with natural control by parasites and predators.
- Ants transport scales and mealybugs from tree to tree, helping establish new colonies.

Action level

- Ant control should occur prior to fruit set. (Green tree ants may assist with control of caterpillars and fruitspotting bugs).

GREEN VEGETABLE BUG

Nezara viridula

Description

- Adult is bright green and shield shaped, 13-15mm long. Newly hatched nymphs are orange in colour, turning brown-black then green with two rows of white spots on the upper abdomen, which also has a pink fringe.
- Adults and nymphs emit a foul smell when handled.
- Eggs are laid in clusters (50-100 eggs in each cluster), cream in colour, turning pink just before hatching.
- Parasitised eggs are black in colour.
- Green vegetable bug adults are frequently parasitised by Tachinid flies.



Green vegetable bugs



5 day old green vegetable bug eggs "unparasitised"



Nymph

Distribution

- Throughout all lychee growing districts.

Damage

- Sucking damage to young plant tissues, fruits and seeds.
- Feeding causes distortion in growth, drying or corkiness of fruit tissues.

Action level

- Rarely a problem but increasing reports of damage from central Queensland orchards.

LEAFMINER

Conopomorpha litchiella

Description

- The adult moth is 5mm long and grey in colour.
- Larvae are small when they hatch (1-2mm) and grow to about 7mm. They are pale green in colour.

Distribution

- Commonly found in lychee growing areas in eastern Queensland.



Leafminer larva on stem



Leafminer larva in panicle stalk



Damaged panicle from leafminer larva



Leafminer damage on lychee leaves

Damage

- Larvae tunnel along the leaf midrib, causing leaf tip to die.
- Panicle may also be damaged.

Action level

- Action level for damage to panicle not known.
- Damage to leaves may not be worth controlling except on young tree.

LEAFROLLER

Lobesia sp., *Adoxophyes* sp. and *Platyepplus aprobola*

Description

- There are several species of leafrollers with similar life cycles.
- The adult moths are generally small up to 10mm long and inconspicuous.
- Larvae are 10–15mm long, variously coloured and fast moving.

Distribution

- Throughout all lychee growing districts in Queensland.



Leafroller larva



Leafroller damage on young leaf flush

Damage

- Young leaves are rolled and fixed with silk.
- Larvae feed on the leaves hidden in the roll.
- Some leafrollers will also feed on developing panicles and flowers.

Action level

- Control when 5% or more of plant parts are infested. Examine 5 leaves on 20 trees widely spaced throughout the crop.

LITCHI ERINOSE MITE

Aceria litchii

Description

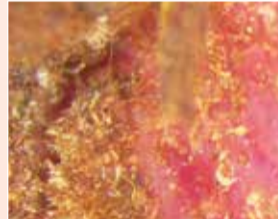
- Mites are not visible by eye.
- Live on the underside of leaves amongst the erinea (velvety growth) which is produced as a reaction to saliva injected during feeding.
- Mites move to new flush (leaf, flowers and fruit).
- Mites move to surface of erinea when leaves/panicles are picked and left to dry.

Distribution

- Throughout all lychee growing districts.



Eriophyid mite



Eriophyids on fruit erinea



Erinea on young flush



Erinose mite symptoms on underside of leaf



Erinea on lychee fruit

Damage

- Reddish-brown velvety growth on underside of leaves. Leaves become distorted.
- Flowers are brown and fuzzy.
- Erinea may also occur on fruit.

Action level

- Mite seasonal cycle is tied to flushing activity.
- Control when erinose mite damage is evident on 20 trees widely spaced throughout the crop. Time sprays to leaf flushing.
- The presence of erinose mites can be determined by placing symptomatic leaves or fruit samples within a paper-bag and checking for their presence 24 hours later. Live mites, if present, will be visible on the surface of the leaves or erinea under a strong magnifying lens (x 20) or microscope.

LOOPER

Conspicuous looper *Oxyodes tricolor*
Castor oil looper *Achaea janata*

Description

- Moths of both loopers are dark brown in colour, about 25mm long and 55mm across the out-stretched wings.
- Larvae of castor oil looper grow to 50mm long, with two black spots near the head. Larvae of conspicuous looper grow to about 40mm long; they are mainly black and may have two red spots near the head.
- Larvae have a distinctive gap between the three pairs of true legs (near the head) and the first pair of pro-legs (i.e. suction cups) along the remainder of the larvae.

Distribution

- Throughout all lychee growing districts.



Conspicuous looper



Castor oil looper



Castor oil looper moth



Damage on lychee leaves from looper

Damage

- Leaves chewed or with holes, and trees may be stripped of foliage. Usually confined to outer canopy. Infestations are more common on new flushes.

Action level

- Control when 25% or more of trees sampled are infested and 30% or more of leaves have been chewed, after examining 5 flushes on each of 20 trees.
- Control is necessary only if small trees and critical growth flushes are affected.

MACADAMIA NUTBORER

Cryptophlebia ombrodelta

Description

- Adult moths are reddish-brown with a 23–25mm wide wingspan. Female moths have a characteristic dark “spot”.
- Fully-grown larvae are up to 20mm long, pinkish in colour with discrete dark green spots in longitudinal lines down either side of body.
- Small white to pink scale-like eggs, about 1mm diameter.

Distribution

- Throughout all lychee growing districts.



Macadamia nutborer moths, female (with dark spot) and male



Macadamia nutborer larva damage in young fruit

Damage

- Green fruit damage caused by a single larva boring into fruit and seed. Only young fruit drop. Larval frass generally indicate presence.
- Damaged mature fruit will weep and stain other fruit in the panicle.

Action level

- Biological control:
 - refer to the biological control section in this field guide well before the season to be aware of options. An appropriate purchasing and release strategy should then be put into place.
- Chemical control:
 - where chemical control is to be utilized: control when 5% or more of 5 fruit panicles on 20 trees sampled are infested with unhatched eggs or young larvae. Commence monitoring when fruit 20mm long.
- Intervention needs to be around egg hatch to be effective.

MEALYBUG AND SCALE

Superfamily *Coccoidea*

Description

- Scale insects refer to a large group of insects within the superfamily *Coccoidea*.
- There are over 20 families of scale; including soft scale (family *Coccidae*), mealybugs (family *Pseudococcidae*) and hard armoured scales (family *Diaspididae*).
- All scale are sap-suckers and there is a large amount of diversity in the group.
- Adult female scale often do not have functional legs and are sedentary and once attached to the plant do not move.
- Some species are parthenogenetic (meaning they can reproduce without mating), some are hermaphroditic (have both male and female reproductive organs).
- Males, when they do occur, are very different to females and rarely seen. Superficially they are similar to whiteflies or gnats.



Citrus mealybugs on young shoots with green tree ants



Ant attending citrus mealybugs

- First instar nymphs (that hatch from eggs or are live-born) are called crawlers and the main way that scale are spread. Ants can also act as vectors and herd the scale so that they can feed from the honeydew secretions produced by scale.
- There are a number of scale and mealybugs found in lychee. Citrus mealybug, green shield scale, soft brown scale and pink wax scale can all be commonly found.

Distribution

- Throughout all lychee growing districts.

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MEALYBUG AND SCALE *cont.*

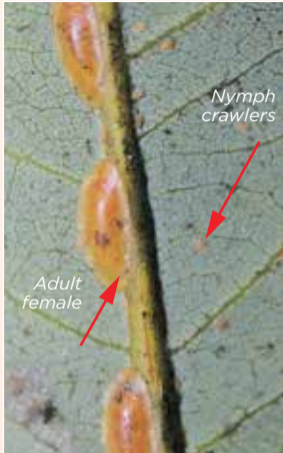
Superfamily *Coccoidea*

Damage

- Direct physical damage to infested fruit, twigs and leaves is minor on lychee. However, if severe infestations occur they can cause twig and stem dieback and leaf deformation of new growth.
- Scale covered fruit are unsaleable, and contamination of fruit with honeydew encourages sooty mould growth.
- Scale insects can be problematic for exporters of fruit to quarantine markets.

Action level

- Biological control:
 - refer to the biological control section in this field guide and investigate alternatives for scale control.
- Chemical control:
 - check 20 trees spaced throughout the crop or lychee block. Control when 5% or more of 5 sample leaves, stem or fruit are infested with 5 or more scale.



Adult soft brown scales on underside of leaf with nymph crawlers



Icerya sp. on a lychee panicle



Seychelles scale (*Icerya seychellarum*)



Immature green shield scale on lychee fruit



Scale and sooty mould

REDSHOULDERED LEAF BEETLE

Monolepta australis

Description

- Beetles are 4–5mm long, yellow in colour with distinct red spots on wing covers.
- Beetles usually emerge after rain.
- Larvae live in soil and feed on roots of grasses and weeds.

Distribution

- Throughout all lychee growing districts.



Redshouldered leaf beetle



Redshouldered leaf beetle

Damage

- Adult beetles skeletonise foliage, especially young leaf flush and will feed on emerging panicles and flowers, when present.
- Beetle swarms can invade the orchard and cause serious damage within 2 to 3 hours.

Action level

- Disregard individual beetles or groups fewer than ten. Swarming beetles in dense aggregations cause damage.

STEM GIRDLER AND BORER

Stem girdler *Orthorrhinus klugi*, *Eutyrrhinus meditabundus*, *Asynonychus* sp.

Borer *Carmenta chrysophanes*

Citrus branchborer *Uracanthus cryptophagus*

Description

- Larvae of a number of boring insects including longicorn beetles (citrus branchborer) and the lychee stem girdler (also known as the clearwing moth) cause death to lychee branches.
- Stem-girdlers are ring-barking weevils, about 5mm long, mottled grey and brown in colour.

Distribution

- The above species have specific ranges, however, stem girdler and borer symptoms are observed throughout all lychee growing districts.



Adult and larva of citrus branch borer



Longicorn stem borer larva



Dead branch from borer damage

Damage

- Sudden death of a part of the tree. Affected branches can crack and fall off as a result of feeding by larvae.

Action level

- No satisfactory action level is available for these pests. Removal and destruction of affected branches may be of some benefit.

SWARMING LEAF BEETLE

Rhyparida spp.

Description

- Shiny, brown or black beetles about 4-7mm long.
- Beetles usually emerge after rain.
- Larvae live in soil and feed on roots of grasses and weeds.

Distribution

- Throughout all lychee growing districts, more common in north Queensland.



Brown swarming leaf beetle



Black swarming leaf beetles



Damage to leaf flush

Damage

- Flowers, new leaves and young shoots chewed.
- Young plants and the tops of shrubs, and large trees may be totally defoliated.
- Young trees severely stunted if successive flushes are continually removed.

Action level

- Control when 5% or more of flushes infested following examination of 5 young flushes on 20 trees widely spaced throughout the crop.

TEA RED SPIDER MITE

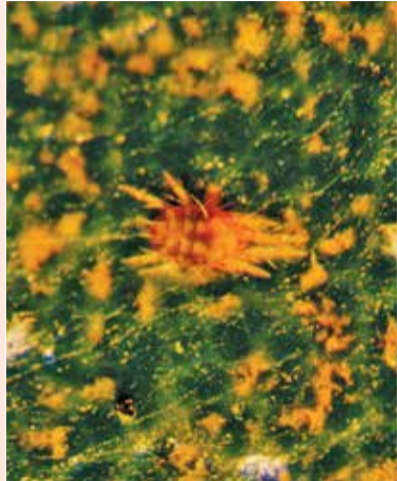
Oligonychus coffeae

Description

- Adults are maroon coloured and about 0.4mm long, have 8 legs and are spider-like in appearance. They are difficult to see by eye.

Distribution

- Throughout all lychee growing districts.
- Often seen in orchards where overuse of broad spectrum insecticides occurs.



Tea red spider mite



Bronzing on leaf and upward curling of the leaf surface

Damage

- Mites live on the upper leaf surface and feed by sucking.
- Mite feeding leads to bronzing and upward curling of the leaf surface.
- Generally a greater problem under hot dry conditions.

Action level

- Generally controlled by small predatory ladybirds. Control not normally required.
- Control when 20% of tree foliage is bronzed and live mites are present. Examine 5-10 trees per 0.5 ha.

YELLOW PEACH MOTH

Conogethes punctiferalis

Description

- Moths are medium sized with a wingspan of 25mm. The wings are mainly orange-yellow in colour with numerous conspicuous black spots. The abdomen is also spotted. Larvae are 15mm long and pink in colour.
- Larva spends its entire life in the fruit and pupates on the outside of the fruit in shelters of webbed frass.

Distribution

- Throughout all lychee growing districts. More common later in season on late varieties.



Yellow peach moth



Larva tunnelling damage in lychee



Larva of yellow peach moth on lychee

Damage

- Damage to fruit caused by larva tunnelling inside.
- Webbed frass around entry hole in fruit skin.

Action level

- Control if more than 1% of fruit or trees sampled are infested. Examine 5 adjacent trees at 6 widely spaced locations throughout each 0.5 ha of crop. Determine percentage fruit loss by examining fruit after picking.

ASSASSIN BUG

Pristhesancus plagipennis

Description

- Adults are 20–30mm long, dull tanned brown colour with clear wings.
- Have strong curved piercing or sucking mouthparts.



Adult assassin bug



Assassin bug ambushing prey by hiding in flowers



Assassin bug nymph on lychee flower



Adult assassin bug preying on a fruitspotting bug

Benefit

- Ambush prey by hiding in flowers.
- Adults and nymphs feed by piercing and sucking body fluid of prey.
- Feed on wide range of lychee insect pests.



Young assassin bug with ladybird

LACEWING

Green lacewing *Mallada* sp.

Brown lacewing *Micromus* sp.

Description

- Green lacewing larvae are mobile and camouflage themselves by sticking the carcasses of their prey on their backs.
- Adults are green-yellow in colour, 10–18mm long, and have lacy see-through wings. Eggs are laid in groups on long stalks.
- Brown lacewing larvae are smooth with brown and white markings, and do not camouflage themselves.
- Adults are pale brown with brown, speckled wings. Cream, oval eggs are attached singly to the underside of leaves.



Hatched green lacewing eggs



Lacewing larvae



Green lacewing larva on fruit



Brown lacewing adult

Benefit

- Effective predator.
- Feeds on many insects including mealybugs, scales, small caterpillar larvae and mites.



Green lacewing larva



Green lacewing adult

LADYBIRD

Mealy bug predator *Cryptolaemus montrouzieri*

Hard scale predator *Chilocorus circumdatus*

Description

- Adults of *Cryptolaemus* are $\approx 4\text{mm}$ long and generally rounded in shape.
- *Cryptolaemus* is predominantly black.
- *Chilocorus* is bright orange in colour.
- Larvae of *Cryptolaemus* grow to 13mm, are white in colour with long waxy appendages.
- *Chilocorus* larvae are yellow-brown with black setae (hairs).

Larval ladybird

Citrus mealybug



Cryptolaemus ladybird adult and larva with citrus mealybugs in background



Cryptolaemus ladybird larva and adult



Chilocorus ladybird larva (left) and adult *Chilocorus* ladybird (right)

Benefit

- Adults and larvae are voracious predators of aphids, mites, scales, mealybugs and eggs. *Cryptolaemus* is mainly a mealybug predator and sometimes it eats other soft scales. *Chilocorus* is only a hard scale predator.

PARASITIC WASP

Leptomastix sp., *Encarsia* sp.,
Aphytis sp., *Anicetus* sp.

Description

- Many wasps are parasites of insect pests of lychee.
- The host life stage that parasitic wasps attack will depend on the species (e.g. egg, larva or pupae stage).
- The adult wasps range in size depending on the species.



Adult parasitic wasp (Leptomastix sp.) with parasitised citrus mealybugs



Adult parasitic wasp (Aphytis lingnanensis) laying its egg in a scale

Benefit

- Parasitic wasps lay their eggs in, or on, a range of lychee pests including, scale insects, aphids, caterpillars, beetles etc. Each species of parasitic wasp targets a different pest species (or group of closely related pests) and stage (e.g. egg, larva or pupae) of that pest.
- Wasp larvae feed and develop in the host, subsequently killing it.
- Adult wasps feed on the honeydew secretions of target hosts and nectar of flowers.
- Wasps may also feed on pests directly, sometimes causing substantial mortality to pests acting as a predator.

PREDATORY MITE

Amblyseius sp. and *Phytoseiulus* sp.

Description

- There are a number of predatory mites with varying appearances however most are tear drop or pear shaped. Some are more circular.
- Many common predatory mites are a little bit larger than two-spotted mite. They can often be seen without magnification although a x 10 magnifier assists greatly. Some predatory mites are relatively large (even up to about 5mm).
- Predatory mites are generally faster moving than the pest mites they feed on.
- Eggs of predatory mites are generally larger than that of spider mites and may be spherical to ovoid. Spider mite eggs are almost always spherical and white.



Phytoseiulus persimilis consuming a two-spotted mite



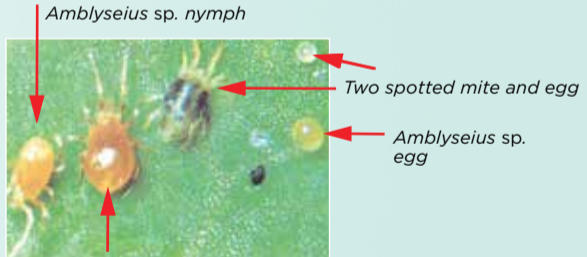
Amblyseius sp. mite



Phytoseiulus sp. mite on erinea

Benefit

- Predatory mites feed on adult and immature stages of pest mites including litchi erinose mite and tea red spider mite.



Amblyseius sp.

TACHINID FLY

Family *Tachinidae*

Description

- Tachinid flies are parasites of other insects.
- They can be mistaken for ordinary houseflies.
- Adult flies are thick bodied, hairy, dull black, grey or metallic in colour with many having a checker-board patterned abdomen.
- Flies are 4-10mm long.



Adult tachinid fly



This tachinid fly has laid its small white eggs just above the legs of the caterpillar in front of it

Benefit

- The fly lays its eggs directly on lychee insect pests (caterpillars and bugs).
- Upon hatching, the fly maggots will burrow through their hosts skin and feed on its internal organs causing death of the pest.
- Different species are parasites of green vegetable bugs, leafrollers and loopers.
- Adult flies feed on nectar or honeydew secretions from other insects.

Photo Credit: John A. Weidhass, Virginia Polytechnic Institute and State University, Bugwood.org

CORKY LUMPS ON BRANCHES

Description

- Scaly/corky growths on the trunk and branches.
- Can occur in isolated patches on major branches or may cover the whole branch and trunk.
- Insect larvae and slaters may reside under cover of the scaly/corky growths.
- Severe growth may cause a loss of tree vigour.

Distribution

- Throughout most lychee growing districts but more prevalent in warmer and wetter growing areas.



Insect larva and slater on scaly growth



Corky lumps and growth on branches (top & bottom images)

Causal agent

- The cause has not been fully identified in Australian lychee trees.
- Potentially a result of damage to the bark caused by insects or by a fungus.
- In Hawaii, similar symptoms in both rambutan and lychee have been attributed to the fungus *Dolabra nepheliae*:
 - the same fungus has been recorded on rambutan in the Northern Territory.

Action

- If tree vigour affected, control may be necessary.
- Prune to open up the canopy to allow air circulation and light penetration.

PEPPER SPOT

Colletotrichum gloeosporioides species complex

Description

- Black “pepper” like spots, pinhead and slightly larger in size, appearing on the outer surface (predominantly at the stem end) of green and colouring fruit.
- Spots are superficial and if severe could render the fruit unmarketable.
- Spots also occur on small stems, leaves and leaf petioles.

Distribution

- Found predominately in wetter coastal lychee growing areas.
- Commonly observed on mature fruit of the variety Kwai Mai Pink (B3 or Bosworth 3).



Pepper spot on young fruit



Pepper spot on mature fruit

Causal agent

- Pepper spot is caused by fungi within the *Colletotrichum gloeosporioides* species complex. These fungi also cause the common postharvest disease, anthracnose.
- Spores of the fungus are spread by rain splash. Warm, wet weather favours the development of the disease.

Action

- Monitor for symptoms on small stems and petioles prior to flowering.
 - Use appropriate field sprays of protectant fungicides:
 - one to two pre flowering fungicide applications, followed by an approved spray program from panicle emergence to harvest.
 - Maintain good orchard hygiene:
 - remove dead limbs and mummified fruit from trees to reduce inoculum.
 - ensure marcotts are sourced from pepper spot free trees.



Pepper spot symptoms on leaf petiole and leaf

TREE DECLINE

Description

- Slow or sudden tree death has been regularly recorded throughout Australian lychee growing areas.
- The decline or dieback has been observed in young trees (generally 3 to 7 years of age) and in older trees (15–20 years of age).
- In young trees the decline is usually sudden (over several days), whereas in older trees the decline is slow and tree health declines over a few years.

Distribution

- Throughout all lychee growing districts.
- Slow decline symptoms in older trees have been predominantly observed on the variety Kwai Mai Pink (KMP) in southern growing areas.
- Sudden decline symptoms in younger trees have been predominantly observed in Fay Zee Siu and Kwai Mai Pink.



Dead Kwai Mai Pink with relatively healthy trees on either side



Sudden dieback in young tree



Older Kwai Mai Pink showing poor post pruning recovery



Recovered tree after pruning

Causal agent

- The exact cause of slow and sudden decline are unknown, but isolated organisms include *Phytophthora* spp., *Phytopythium* spp. and *Fusarium* spp.
- Trees on poorly drained soils may be more susceptible to slow decline symptoms.
- A lack of root vigour in younger trees leading to a shoot:root imbalance may be the trigger for sudden decline.

Action

- Some growers have reported success in saving trees by:
 - pruning when symptoms first appear.
 - boosting nutrition by the addition of urea.
- There are currently no registrations or permits for chemical control.
- A better understanding of the causes of the decline is required.

BIOLOGICAL PEST CONTROL

What is it?

- Biological pest control is a method of controlling pests such as insects, mites, weeds and plant diseases using other organisms.
- Biological control is the management of a pest through the use of their natural enemies (biological control agent).
- A biological control agent is an organism such as an insect, fungus or virus.

Importance to pest control

- Consumers are increasingly valuing the idea of clean and green produce. Biological control options have an important part to play in managing pests.
- In Queensland a famous example of biological control was the introduction of the cactus moth *Cactoblastis cactorum* to control the spread of prickly pear. A less successful example is the introduction of the cane toad as a biological control agent for cane grub.
- Commercial providers of biological control agents provide solutions for aphids, fruitspotting bug, macadamia nutborer, mealybug, scale, soft brown scale and twospotted mites. The list of biological control agents continues to grow.

- For more information see the web site hosted by the Association of Beneficial Producers Inc. (ABC Inc.) - <http://www.goodbugs.org.au/index.html>

Integrated Pest Management

- Uses many tools to manage pests; including cultural practices, pesticides, predators and parasites.
 - USA Overview - <https://www.evergreen.ca/downloads/pdfs/Fruit-Tree-Pest-Management.pdf>
 - IP&DM manual for custard apple - <https://www.horticulture.com.au/globalassets/hort-innovation/resource-assets/cu13001-custard-apple-ipdm-manual.pdf>

Links to commercial providers of biological pest control and pheromone lure traps for horticultural crops

- Biological Services - <https://biologicalservices.com.au/>
- BioResources Pty Ltd - <http://www.bioresources.com.au/>
- BioWorks Pty Ltd - <http://www.bioworksonline.com.au/>
- Bugs for Bugs - <http://www.bugsforbugs.com.au/>
- Ecogrow - <http://www.ecogrow.com.au/>
- Organic Crop Protectants (OCP) - <https://ocp.com.au/product/insect-tech-range/>



BIOSECURITY

Australia's geographic isolation and lack of shared land border have, in the past, provided a degree of natural protection from exotic threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industry. Rapid increases in overseas tourism, imports and exports, mail and changing transport procedures (e.g. refrigeration and containerization of produce), as well as the potential for pests to enter via natural routes increases the risk of exotic pests entering Australia.

It is vital for the future sustainability and viability of the lychee industry to minimise the risks posed by exotic pests by responding to them effectively. Through biosecurity awareness, planning and practices, the industry will be better placed to maintain domestic and international trade, negotiate access to new overseas markets, and reduce the social and economic costs of pest incursions on both growers and the wider community.

EXOTIC PESTS

The following pages identify and describe a few of the high priority exotic pests of lychees. These pests were identified during the development of the *Industry Biosecurity Plan for the Lychee Industry* in consultation with industry, government and scientists. They have been assessed as high priority pests based on their potential to enter, establish, and spread in Australia (e.g. environmental factors, host range, vectors) and the cost to industry of control measures.

Plant Health Australia (PHA) has a range of fact sheets, contingency plans and diagnostic protocols relevant to these pests. Pest risk review documents are also available for some pests. Pests and diseases can spread quickly over large distances, report anything unusual on your orchard as soon as possible by calling:
Exotic Plant Pest Hotline: 1800 084 881

Qld Phone: 132523 or email: info@daf.qld.gov.au

NSW Phone: 1800 680 244 or email: biosecurity@dpi.nsw.gov.au

Endorsed National Diagnostic Protocols are available from the National Plant Biosecurity Diagnostic Network Biosecurity Australia.
<https://www.plantbiosecuritydiagnostics.net.au>

LYCHEE FRUIT BORER

Conopomorpha sinensis

Description

- A moth related to *C. litchiella* (leafminer - refer page 18) whose larvae (caterpillars) bore through the pericarp (skin) of lychee and feed on the fruit.
- Mature larvae are 6–10mm long and brownish or green in colour, depending on diet.
- The moth can complete 4 to 5 generations during a lychee season.

Distribution

- China, Taiwan, India, Thailand and Vietnam.



Adult moth



Pupal stage



Larva in immature fruit



Larva in mature fruit

Damage

- Fruit borer larvae penetrate and feed on lychee fruit generally at the stem end.
- Damaged fruit often falls from the tree.
- Fruit can have late infestations and the damage is not obvious at picking.

Action

Any suspicious symptoms or problems should be immediately reported to Biosecurity Australia via your local agronomist or DAF office.

Exotic Plant Pest Hotline: 1800 084 881

Qld Phone: 132523 or email: info@daf.qld.gov.au

NSW Phone: 1800 680 244 or

email: biosecurity@dpi.nsw.gov.au

LYCHEE LONGICORN BEETLE

Aristobia testudo

Description

- A serious pest (branch borer) of lychee in China.
- The adult is 25–35mm long and patterned with orange and black markings.
- Characteristic dense tufts of hairs on the ends of some antenna segments.

Distribution

- North-east India (Sikkim, Assam), Bangladesh, China, Myanmar, Thailand, Laos, Vietnam.



Lychee longicorn beetle

Photo credit: *Aleksey Gnilenkov, Wikimedia Commons*

Damage

- Like many of their Australian relatives the larvae create long tunnels (up to 600mm) into the xylem wood.
- The tunneling results in death of the branch.

Action

Any suspicious symptoms or problems should be immediately reported to Biosecurity Australia via your local agronomist or DAF office.

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NSW Phone: 1800 680 244 or email: biosecurity@dpi.nsw.gov.au

ORIENTAL FRUIT FLY

Bactrocera dorsalis

Description

- Fruit fly are a serious pest of a wide range of fruits and vegetables causing up to 100% damage to crops.
- Major hosts are apple, guava, mango, peach and pear.
- It is a recorded pest of lychee.

Distribution

- Currently restricted to mainland Asia and Taiwan.
- Also recorded in Hawaii, California and Florida.



Oriental fruit fly

Photo Credit: *Florida Division of Plant Industry , Florida Department of Agriculture and Consumer Services, Bugwood.org*

Damage

- Female fruit flies lay their eggs through the skin of the fruit often through cracks and wounds caused by other pests.
- The eggs may hatch but due to the juicy nature of mature fruit the larvae rarely survive.
- Serious pest which if present would cause major biosecurity and trade restrictions.

Action

Any suspicious symptoms or problems should be immediately reported to Biosecurity Australia via your local agronomist or DAF office.

Exotic Plant Pest Hotline: 1800 084 881

Qld Phone: 132523 or email: info@daf.qld.gov.au

NSW Phone: 1800 680 244 or email: biosecurity@dpi.nsw.gov.au

<https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/oriental-fruit-fly>

BROWN BLIGHT OR DOWNY BLIGHT

Phytophthora litchii (previously known as *Peronophythora litchii*)

Description

- Fruit rot or downy blossom blight of lychee is a oomycete pathogen (water mould) that infects flowers as well as developing and ripe fruit.
- The infection period is rapid during cool (18-25°C) wet weather.

Distribution

- A serious disease of lychee in China, Taiwan, Vietnam and Thailand.
- Causes loss of fruit and downgrades harvested fruit due to an off taste and reduced shelf life.
- The disease has been reported in Papua New Guinea.



Downy blight disease affecting flowers & leaves



Brown blight of ripe fruit covered with white spore masses

Damage

- Diseased flowers turn brown and become covered with whitish spore masses during moist weather.
- Young and ripe fruits, flower stalks and leaves are also infected, their tissues turning brown and dying, especially during periods of heavy rain.
- Infected panicles suffer increased fruit drop.

Action

Any suspicious symptoms or problems should be immediately reported to Biosecurity Australia via your local agronomist or DAF office.

Exotic Plant Pest Hotline: 1800 084 881

Qld Phone: 132523 or email: info@daf.qld.gov.au

NSW Phone: 1800 680 244 or

email: biosecurity@dpi.nsw.gov.au

LONGAN AND LYCHEE WITCHES' BROOM DISEASE

Description

- Cause unknown, suspected *Phytoplasma* or virus which affects leaves and flowers of lychee.

Distribution

- China, Taiwan, Thailand and Brazil.



Witches' broom disease on longan

Damage

- A characteristic symptom of the disease is the loss of flowers from panicles, resulting in a 'broom-like' appearance of inflorescences.
- Young leaves of infected shoots are small and light green in colour, with curved margins. They appear stunted and deformed, and tend to roll up rather than expand.
- Mature leaves are light yellow-green with marbled yellow spots and brown veins. Leaves form blisters and become distorted and dry before falling off
- Shoots on infected branches become compacted clusters.
- The inflorescences (flowers) are unable to extend. The flower organs develop abnormally, and consequently, the flowers either fail to produce fruits or develop into small and empty fruits.

Action

Any suspicious symptoms or problems should be immediately reported to Biosecurity Australia via your local agronomist or DAF office.

Exotic Plant Pest Hotline: 1800 084 881

Qld Phone: 132523 or email: info@daf.qld.gov.au

NSW Phone: 1800 680 244 or email: biosecurity@dpi.nsw.gov.au

FALL ARMYWORM

Spodoptera frugiperda

Description

- The fall armyworm is not known to be a pest of lychee, but could be, given the range of fruit species affected.
- It is an invasive pest and its larval (caterpillar) stage prefers to feed on leaves of grass family members (maize, sorghum, rice, sugarcane) and cotton. It has also recorded to feed on the leaves of subtropical and tropical fruits such as citrus, coffee, guava, figs, mango, papaya.
- Adult moths are highly mobile and can fly long distances (up to 200km). This pest is highly reproductive, reproducing at a rate of several generations per year.
- Adult moths, male and female, have light brown, grey to straw coloured wings and are approximately 17mm long and have a wingspan of 38mm.



Large larvae of fall armyworm

Distribution

- A relative new pest, now established in north eastern Australia, the Northern Territory and Western Australia. The fall armyworm is native to tropical and subtropical regions of the Americas. It is also widely distributed in Asia and Africa.
- Australia's climate and the production of suitable hosts are favourable for fall armyworm to establish and spread.

Damage

- Larvae feed on leaves, young shoots, stems and flowers.
- Voracious eaters.
- Damage similar to that caused by loopers.

Action

- Not defined as yet.

ACKNOWLEDGEMENTS

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SOURCES OF INFORMATION, OTHER REFERENCES AND RESOURCES

- Field Guide to lychee insect pests, beneficial insects, and disorders/diseases. P Chay et al. (2004)
- Field Guide to lychee insect pests, natural enemies, diseases and disorders. P Chay et al. (2008)
- Lychee DPI notes
- Lychee Information Kit (from the Agrilink Series). C Menzel et al. (2002)
- Rambutan, Identification and Monitoring the Major Insects and Mites. D Astridge (2004)
- Tropical Fruits Grower's Handbook and Problem Solver. P Chay et al. (2005)

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LIMITATIONS

Pest monitoring allows the recording of pest hot spots for strategic spraying. Monitoring assists in knowing when to apply insecticides or other methods of pest control at the most effective and economical times.

A recommendation is the use of a hand lens (x 10) for proper examination of samples as some insects and mites are small and difficult to see by eye.

The Action levels contained in this publication are still “best guesses” and have been cross-referenced with lychee, citrus and rambutan recommendations, and field experience.

Before making key management decisions, it is recommended that growers seek further advice from pest & horticultural consultants, government extension officers, experienced growers and suppliers of beneficial insects.

This field guide does not give specific advice regarding which chemical pesticides to use as chemical registrations and permits change. Up-to-date information on chemical registrations and permits can be found on the websites for Australian Pesticide and Veterinary Medicines Authority (APVMA) www.apvma.gov.au and the grower section of the Australian Lychee Growers Association (ALGA) www.australianlychee.com.au

NAMING

Where possible the authors have used the industry recognized common name and scientific name (*Genus species*) for the pests, natural enemies and diseases listed in this publication, for example litchi erinose mite (*Aceria litchii*). In some cases where identification of the individual has not occurred or there are a number of species that are known under the same common name, the Family name is provided e.g. for Flower caterpillar (larvae from several families of moths including *Geometridae*, *Lymantriidae*, *Pyrilidae* and *Tortricidae*).

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Lychee
FIELD GUIDE

e: algaeo@australianlychee.com.au
w: www.australianlychee.com.au

