



australian almonds

Almond IPM Workshop

Module 2

Spring

Presented by:
Craig Swanbury
Manager
Fruit Doctors P/L

Ben Brown
Industry Liaison Manager
Almond Board of Australia



Spring Pests & Diseases

- Pests
 - Bryobia mite
 - Aphids
 - Earwigs



Photo: UC Davis

Spring Pests & Diseases

- Diseases
 - Blossom/Twig Blight
 - Shot Hole
 - Bacterial Spot
 - Anthracnose
 - Phytophthora
 - Rust



Photo: SARDI

Bryobia Mite - Description

- General appearance
 - Eggs are red and round but with no stalk
 - Eggs are laid in clumps at the base of buds, bark scales, tree crown, etc where protection is best



Photo: UC Davis

Bryobia Mite - Description

- General appearance
 - Newly hatched mites are bright red and have 6 legs
 - After the 1st moult, mites have 8 legs and resemble adults (body is greener / legs pinkish relative to adults)
 - Adults are larger, are brown in colour and have eight legs (1st pair of legs are longer than the other 3 pairs)



Photo: UC Davis

Bryobia Mite - Description

- Distinguishing features
 - Adults have a shield appearance and have no spots as opposed to the two-spotted mite
 - No web-spinning produced
 - If eggs are alive and rubbed with fingers there will be a red stain



Two-spotted mite

Photo: Aust Summerfruit

Bryobia Mite - Description

- Life cycle
 - Eggs overwinter on the trees
 - Juveniles hatch during August (coincides with leaf and flower opening)
 - Moults live 2-3 weeks, reproduce without mating
 - 2 to 3 generations until December (eggs laid during hot weather don't usually hatch until the following spring so numbers generally decline late summer)
 - Actively feed on leaves during cooler / milder periods
 - Rest on woody parts during the warmest part of the day

Bryobia Mite - Damage

- Flowers
 - Nil
- Fruit
 - Colonisation only, no damage

Bryobia Mite - Damage

- Leaves
 - Feeding causes whitish/greyish stippling on leaves
 - Rarely causes leaf drop
 - Reduces photosynthetic ability of the tree
 - Damage more exaggerated when trees stressed
- Twigs
 - Nil

Bryobia Mite – Natural Enemies

- Parasites
 - Nil
- Predators
 - Lacewing larvae
 - Predatory mites
- Pathogens
 - Nil



Bryobia Mite – Management

- Monitoring
 - Monitor for egg presence & numbers on bark, tree crown & dormant spurs in winter
 - Monitor 1-2 weekly for motiles, hatchings & leaf damage from shuck fall till end of December
- Action level
 - When high mite activity and damage extending to outer canopy (prior to January)
 - Trees will tolerate moderate activity without economic loss

Bryobia Mite – Management

- Appropriate action
 - Best controlled with a dormant oil spray (starting when trees are young will avoid problems later on)
 - Do not chemically control low numbers
 - If chemical control is required the choice of a soft, selective miticide is preferred, e.g. Acramite

Bryobia Mite – Management

- Additional management notes
 - Spray coverage with dormant oil is essential, ground speed must be <4km/hr
 - Do not worry about chemical control beyond hull split

Black Peach Aphid - Description

- General appearance
 - Winged and wingless adults are shiny black
 - Approx 2mm long



Black Peach Aphid - Description

- Life cycle
 - Eggs over winter on bark or below ground on roots
 - Wingless adults emerge after budswell and settle on flowers and young leaves
 - Winged adults form
 - Short life cycle e.g. egg to adult can be less than 2 weeks
 - Hardened growth / hot and dry conditions reduce aphid numbers

Black Peach Aphid - Damage

- Flowers
 - Infestation & deformation
- Leaves
 - Infestation & deformation
 - Adults suck on leaves, extracting sap & produce honeydew
 - May result in sooty mould



Black Peach Aphid – Natural Enemies

- Parasites
 - Parasitic wasps
- Predators
 - Ladybirds
 - Syrphid flies
 - Lacewing larvae



Black Peach Aphid – Management

- Monitoring
 - Fortnightly from budswell to early summer
- Action level
 - More than 3 colonies per tree (if no predator activity)
 - Rarely a problem in most orchards
- Appropriate action
 - Dormant oil sprays just prior or at budswell
 - Selective aphicides

Black Peach Aphid – Management

- Additional management notes
 - Normally occur in patches (“hot spots”)
 - Spot spraying may be all that is required
 - Be vigilant with new trees as infestations can be introduced from the nursery
 - Presence of ants will often indicate their presence due to the sap sucking

European Earwig - Description

- General appearance
 - Brown & elongated with distinctive chewing mouth parts (i.e. pincers) at the end of their abdomen
 - Juveniles are approx 5mm long & lighter brown in colour or olive
 - Adults are approx 12-13mm long & are a darker brown colour



Photo: WA Agric

European Earwig - Description

- Life cycle
 - Adults rest below ground in Autumn
 - Eggs are laid late winter. 2nd instars become active in August and resemble small adults.
 - There are 6 instars / maturity takes 10-15 weeks
 - Males die shortly after leaving the nest in late winter
 - Females may live through to mid summer and lay more eggs in early summer

European Earwig - Damage

- Flowers
 - Although not common, adults will feed on new blossoms causing small irregular bite holes
 - Can ultimately cause flower drop & reduce fruit numbers
 - Graze on developing buds

European Earwig - Damage

- Leaves
 - More commonly, adults will feed on growing tips, new shoots & leaves, causing small irregular bite holes
 - In some cases may reduce shoot growth, leaf area & photosynthetic potential (main risk is with young trees with earwigs harbouring in tree guards)
 - Will not cause defoliation

European Earwig – Natural Enemies

- Predators (birds)

European Earwig – Management

- Monitoring
 - Nocturnal activity
 - Will rest during the day in protected areas:
 - Early season – under soil and organic matter at the base of the trunk, not enough leaf cover to nest in trees. Will move up into trees during the night to feed.
 - Mid season – will nest in tight shaded places in the tree when there is enough leaf cover, commonly between fruit clumps & branches. Will move out on to trees during the night to feed.

European Earwig – Management

- Action level
 - No action threshold established
 - No chemicals currently permitted for control of European Earwigs in almonds
 - Future potential exists in the use of pesticide baits

European Earwig – Management

- Appropriate action
 - Remove tree guards quickly once their use has passed on young trees
 - Remove alternate shelter / habitat (e.g. large weeds, debris) from base of trunk
 - Could consider cultivation (exposes and kills some adults, nymphs and many eggs potentially)
 - Chemically control populations in other sources, e.g. in & around houses, sheds, etc

European Earwig – Management

- Additional management notes
 - Not known to feed on almond fruit

Blossom/Twig Blight & Brown Rot

- Caused by the fungi *Monilinia laxa* & *Monilinia fructicola*
- Favoured by wet, foggy conditions through bloom
- All varieties susceptible



Photo: UC Davis

Blossom/Twig Blight - Symptoms & Damage

- Blossom
 - Attacks all flowering parts (stigmas / anthers) and spreads through to the peduncle
 - The blossom turns brown, withers and dies



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Blossom/Twig Blight - Symptoms & Damage



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Blossom/Twig Blight - Symptoms & Damage

- Leaves & Twigs
 - The fungus moves from the blossom to the leaves & twigs & kills them as well
 - The twigs which die often produce gumming at the dead & live junction



Photo: SARDI

Blossom/Twig Blight - Symptoms & Damage

- Fruit
 - The same fungus can infect the green fruit but not common
 - The fungus is more commonly known to infect the green hulls as they split & is consequently associated with hull rot

Blossom/Twig Blight – Seasonal Development

- Fungi survive from one season to the next & over winter on infected twigs & fruit
- Fungi produces spores which are spread by wind & rain
- As little as 3-5 hours of leaf wetness required for infection under ideal conditions (20°C high RH)
- Flowers are susceptible from petal emergence to petal fall, but most susceptible when open

Blossom/Twig Blight – Management

- Monitoring
 - Monitor blossom weekly from budswell to petal fall
- Action level
 - If present or preventative spray action at full bloom according to weather and risk management
- Appropriate action
 - One fungal spray application through blossom common industry practice (e.g. Rovral)

Blossom/Twig Blight – Management

- Additional management notes
 - A two spray program may be needed if bloom is extended & conditions are foggy & wet
 - Spray at night time to avoid bee flight
 - Several fungicides are known to affect bee brood & larvae (i.e. Captan, Rovral)
 - Rovral needs to be buffered to below pH 7 to remain stable

Shot Hole

- Caused by the fungus *Wilsonomyces carpophilus*
- Most prevalent during a prolonged, wet, Spring
- Fungus causes lesions on leaves fruit & twigs



Photo: UC Davis

Shot Hole - Symptoms & Damage

- Leaves
 - Lesions start as small purplish spots which expand to chlorotic (yellowing) then necrotic (dead) tan coloured spots 3-10mm in diameter
 - With warm dry conditions lesions abscise rapidly leaving circular clean holes
 - Under cool / wet conditions tiny tan / dark spore structures can form in the centre of lesions



Photo: SARDI

Shot Hole - Symptoms & Damage

- Leaves
 - Symptoms can easily be confused with copper toxicity, herbicide drift, bacterial spot and nitrogen deficiency
 - Bacterial spot (spots more angular and necrotic tissue has a tendency to adhere to the leaf, no dark spore structure in leaf lesions)

Shot Hole - Symptoms & Damage

- Fruit
 - Most commonly found on upper fruit surfaces
 - Lesions start as small, round, purple spots (1-2mm diameter)
 - Lesions eventually become raised / corky and develop a lighter centre
 - Fruit lesions can produce gumming if they abscise



Photo: SARDI

Shot Hole - Symptoms & Damage

- Twigs
 - Small, round, purple spots with a black fruiting structure in the middle of the lesion as with leaves

Shot Hole – Seasonal Development

- Fungus over winters within infected buds & twigs
- Cool to moderate temperatures & free moisture necessary for shot hole spores to be produced, germinate and infect tissue
- Infection requires 8-12 hours wetness at 20-25°C
- Symptoms take 5-14 days to appear
- More common in sprinkler irrigated orchards due to the spread of spores via water droplets

Shot Hole – Management

- Monitoring
 - Monitor orchards in Spring for lesions & the black fruiting structures
- Action level
 - If present

Shot Hole – Management

- Appropriate action
 - Fungal spray(s) through petal fall or early Spring registered for shot hole (e.g. Bravo)
- Additional management notes
 - Post harvest leaf removal and copper spray in wet autumns

Bacterial Spot

- Caused by the Bacterium *Xanthomonas arboricola*
- Favoured by warm / wet humid weather in spring
- Fruit, leaves and twigs affected
- Primarily a disease of NePlus and Fritz

Bacterial Spot

- Leaves
 - Old and young leaves can show leaf spot and tatter symptoms
 - Symptoms first visible as angular / irregular greyish water soaked lesions (1-3 mm) and will be first visible within 24 hours of infection
 - Lesions are generally clustered along the midrib, leaf tip and margins
 - As lesions enlarge, centres become purple and necrotic. As lesions dry out leaf tatter symptoms develop

Bacterial Spot

- Fruit
 - Infected nuts develop corky lesions
 - Lesions produce a lightly coloured-tan ooze containing bacteria
 - Larger lesions are sunken and surrounded by a grey yellow area (similar in appearance to anthracnose)
 - Infected nuts can abort prematurely or remain as stick tights (these mummies harbour viable bacteria)

Bacterial Spot

- Seasonal Development
 - Bacterium overwinters in infected stick tights, leaf debris and twigs
 - Strong evidence that leaves are only susceptible when emerging and that mature leaves are only susceptible after physical damage / abrasion

Bacterial Spot

- Management
 - Plant resistant cultivars / Chemical options limited
 - Copper only registered chemical with proven efficacy against a range of bacteria (not very effective once a primary infection has occurred)
 - Autumn / bud swell, bloom and before (but within 7 days) of spring rain events.
 - Copper is phytotoxic to almonds when sprayed on foliage causing leaf spotting and premature leaf fall
 - Hydroxide forms are the least phytotoxic

Bacterial Spot

- Other Management
 - Manage trees to maximise air flow through canopies
 - Establish wind breaks
 - Practice good hygiene (remove infected fallen fruit, mummies, pruning's and clean equipment regularly)

Anthracnose

- Caused by the fungus *Colletotrichum acutatum*
- Most prevalent during mild, wet, Springs
- Fungus causes withered blossom, rusty lesions on fruit & twig dieback



Photo: UC Davis

Anthracnose - Symptoms & Damage

- Fruit
 - Infection appears as circular, sunken tan brown, rusty orange lesions on the hull (rust colour due to spore masses)
 - Infected young fruit shrivel and abort looking like ‘blanks’ / usually occurs in clusters
 - Infected older fruit often exude gum in addition to the lesions



Photo: SARDI

Anthracnose - Symptoms & Damage

- Leaves
 - Commonly die, turn brown & curl up from a toxin released into the tree from the infected fruit (leaves can remain attached for a short time)
 - If infected directly by fungus, water-soaked patches or spots develop on the leaf margins or tips which turn yellow

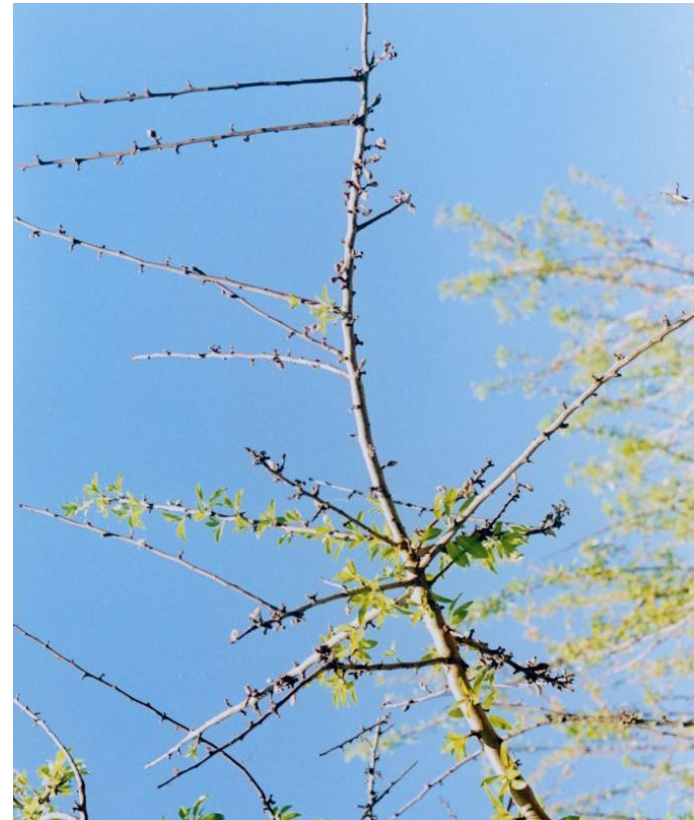


Photo: SARDI

Anthracnose - Symptoms & Damage

- Twigs
 - Die following the release of a toxin from the infected fruit (up to approximately 2-3cm diameter wood)
 - Symptoms can continue to be expressed in the following season after infection

Anthracnose – Seasonal Development

- Fungus survives between seasons on buds, peduncles and mummified fruit which have shrivelled & aborted
- Spores are produced in warm (10-25°C), wet weather in spring and spreads via rain splashes
- Trees are susceptible from early bud movement to hull split

Anthracnose – Management

- Monitoring
 - Developing fruit and leaves
 - Over-wintering mummies with lesions
 - Bloom to early Spring (extend to November in wetter seasons)
- Action level
 - If present

Anthracnose – Management

- Appropriate action
 - Prune out & destroy suspected infected wood
 - Fungal spray(s) at pink bud, bloom & early Spring registered for anthracnose (e.g. Bravo, Amistar, Cabrio, Tilt)
- Additional management notes
 - Most varieties susceptible, Nonpareil reported to be the least

References

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Acknowledgments

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