

Management strategies for solenopsis mealybug in the Australian cotton farming system

The solenopsis mealybug *Phenacoccus solenopsis* originates from North America and was first identified in Australia in the Emerald and the Burdekin regions during the 2009-10 cotton season.

Key attributes:

- wide host range
- high reproductive rate
- very short egg incubation (1/2 to 2 hrs)
- behavioral protection - shelter under leaves/bracts and in soil cracks
- high survival rates without host
- good tolerance to cold
- effective dispersal by wind, water, birds, other insects, humans, farm equipment and animals.
- difficult to kill as the mealy wax on their bodies prevents chemical penetration.

Damage symptoms on cotton

Establishment to squaring

- distorted terminals
- stunted plants with thick, curly leaves
- leaves initially turn brown on the under surface and red on the upper surface.
- at high populations leaves turn yellow, then brown and drop
- bracts become brown and papery
- small squares/bolls turn brown and drop
- in severe cases plant death occurs.

Boll fill

- reduced plant vigour
- reduced boll development
- fewer, smaller, and deformed bolls.

Maturation

- early crop senescence
- honeydew contamination of lint.

All life stages of mealybug cause cumulative damage as long as the infestation persists.



The earlier mealybug infests cotton, the greater the potential damage

The earlier mealybug establish on the plant, the greater the potential damage. At the 4-5 leaf growth stage, establishment can result in 100% yield loss. Establishment of mealybug up to early boll stage causes significant yield loss. Mealybug infestation at mature (near cut out) stage can cause up to 80% reduction of fruits on top 8 nodes.



**Top: Early damage causes browning of leaves
Bottom: Mealybug damage to lint**

Mealybug in the farming system

Mealybug overwinter as large and small nymphs under the soil within the root zone, using a wide variety of hosts. Surveys have shown a link between on-farm weediness (including ratoons and cotton volunteers) and mealybug incidence. Weed and cotton hosts allow mealybug populations to multiply early in the season. They also provide a habitat on which populations can overwinter and survive until the next season.

Cotton fields with a history of mealybug are more likely to be infested early and can suffer significant damage. Stressed crops (mainly water or nutrient stress) are more likely to have a higher mealybug incidence. Seasons with a wetter than average winter/spring have a higher risk of mealybug infestations.

Table 1: Risk factors for mealybug

High risk	<ul style="list-style-type: none">• Previous history of mealybug• Weedy fallow or field margins (including ratoons and volunteers)• Ineffective or poor crop destruction• Early season chemical use• Low beneficial activity• Wetter than average winter – spring
↕	<ul style="list-style-type: none">• Late weed control• Late harvest of previous crop• Seed dressings
Low risk	<ul style="list-style-type: none">• Clean fallow• High beneficial activity (particularly lacewings, cryptolaemus and other ladybeetle species)• Good weed control – in and around field margins summer-winter



Surveys have shown a clear link between on-farm weediness and mealybug incidence

Visually monitor for mealybug

1. On the plant

- underside of leaves
- junction of the petiole and leaf blade of top 10 nodes
- inside bracts at squaring and boll setting.

Towards the end of the season if densities are high, mealybugs move to the top of the plant where they crowd on to the upper stem and tips. At low densities, mealybug can be present anywhere on the plant.

2. Around the paddock

- Visit areas that are under stress where populations may develop first e.g. tail drains.
- Check weeds in and around fields
- Investigate stunted or dead plant patches

Monitor abundance of adults, nymphs and natural enemies over time to provide a picture of population changes.

Thresholds

Current action thresholds are based on glasshouse trials only, but may be used as a guide until field thresholds are determined.

- Seedling cotton: 25 mealybug per plant
- Squaring cotton: 110 mealybug per plant
- Early boll stage: 150 mealybug per plant

Key management strategies

Biological control

Natural enemies are very effective at reducing high mealybug populations, and minimising population build-up.

Key predator species include ladybeetles, lacewings, native cockroaches, earwigs and spiders. Of the ladybeetles, the mealybug destroyer *Cryptolaemus montrouzieri* and the three banded ladybeetles are the most effective. (Note that cryptolaemus larvae and lacewing nymphs may look similar to mealybug to the untrained eye).



Cryptolaemus (left) and lacewing (right) larvae

A parasitoid of mealybug, *Aenasius bambawalei*, is also providing control of this pest.



Parasitised mealybug

Since natural enemies currently provide the only means of controlling mealybug, it is important to promote and preserve these beneficials. Avoid early season use of broad spectrum insecticides, and select the softest option when controlling other pests to conserve mealybug predators.

Release of key mealybug predators may be worth trialling in hotspots early in the season to augment natural enemy activity.

Cultural control

Farm and crop hygiene is critical to preventing early infestation of crops. A focus on minimising mealybug build-up and survival will limit the size of infestations, and the overall impact of this pest in crops.

- Remove weeds in and around the field
- Early removal of affected plants may reduce mealybug numbers in the rest of the crop. Do not place removed plants near water channels
- Avoid physical contact with infested plants as mealybug easily adhere to clothing and implements

- Destroy crops soon after harvest and control volunteers and ratoons
- Clean all equipment that has been in affected fields
- Use industry Come-Clean-Go-Clean protocols to minimise mealybug spread.

Chemical control

There are currently no insecticides registered for the control of solenopsis mealybug in cotton or other broad acre field crops. Trials with registered insecticides for the control of other sucking pests have had little impact on mealybug and are often disruptive to beneficials that control mealybug.

While some insecticides are showing promise, it is not expected that insecticides will be the main means of managing this pest, as mealybug tend to colonise protected parts of the plant (e.g. undersides of leaves or in bracts), making contact difficult.

Preserving beneficials needs to be considered when selecting chemicals to control mirids in fields where mealybug is also present. Delaying mirid control until threshold may increase the number of beneficials and reduce the likelihood of a mealybug outbreak.

An integrated approach to the management of mealybug infestations is critical.

- Avoid plant stresses - healthy plants are much less susceptible to attack
- Implement a good farm hygiene program, which includes weed management
- Avoid early season use of broad spectrum insecticides
- Preserve natural enemies as they are central to mealybug control.

Further information

See also the ***Solenopsis mealybug in Australia – an overview*** factsheet.

Information about the ‘Come Clean, Go Clean’ protocol can be found in the publications area of the CRDC website (crdc.com.au).

Best bet strategies for managing mealybug in cotton

Pre season: Control weeds, ratoons, volunteers in field and crop margins. Monitor areas that are under stress where populations may develop first e.g. tail drains. Seed dressings have shown promise in glasshouse trials.

	Vegetative (establishment – squaring)	Boll fill	Maturation	Harvest – crop destruction
Damage symptoms	<ul style="list-style-type: none"> Distorted terminals and stunting Crinkled, bunchy leaves. Brown at lower leaf base, red on upper surface. At high populations leaves go yellow, brown and are shed Bracts become brown and papery Small squares/bolls turn brown and drop In severe cases plant death occurs 	<ul style="list-style-type: none"> Reduced plant vigour Reduced boll development Fewer, smaller and deformed bolls Small bolls with heavy infestations turn black 	<ul style="list-style-type: none"> Early crop senescence Small bolls with heavy infestations turn black and partially (crack) open Honeydew contamination of lint. 	<ul style="list-style-type: none"> Honeydew contamination of lint.
Monitoring	<p>Monitor abundance of adults, nymphs and natural enemies over time to provide a picture of population changes.</p> <p>Monitor for mealybugs and beneficials</p> <ul style="list-style-type: none"> under leaves inside bracts of squares 	<p>Monitor for mealybugs and beneficials in top 10 nodes</p> <ul style="list-style-type: none"> under leaves inside bracts of squares and bolls 	<p>Monitor for mealybug and beneficials on</p> <ul style="list-style-type: none"> upper tips and leaves inside bracts and on bolls 	
Beneficials	<p>Natural enemies have proven to be very effective at reducing high mealybug populations, and minimising the build-up of populations in crops. Key predator species include ladybeetles, lacewings, native cockroaches, earwigs and spiders. Of the ladybeetles, <i>Cryptolaemus montrouzieri</i> and the three banded ladybeetle are the most active.</p> <p>A parasitoid of mealybug, <i>Aenasius bambawalei</i>, first found in a cotton field in Byee in 2012 is also providing control of this pest</p> <p>Release of key mealybug predators e.g. lacewings and <i>Cryptolaemus</i> may be worth trialling in hotspots early in the season to augment natural enemy activity.</p>			
Cultural control and farm hygiene	<p>Early removal of affected plants may reduce mealybug numbers in the rest of the crop</p>	<p>Mealybug can be spread on clothing. Check more heavily infested fields/areas last.</p> <p>Movement of machinery has the potential to spread mealybug between fields and farms.</p>		<p>Come clean, Go Clean.</p> <p>Clean machinery between infested and clean fields.</p> <p>Heavily infested fields may mature earliest.</p>
Thresholds*	<p>Seedling cotton – 25 mealybug per plant</p> <p>Squaring cotton – 110 mealybug per plant</p>	<p>Early boll stage – 150 mealybug per plant</p>		
Chemical control	<p>There are currently no insecticides registered for the control of this pest in cotton or other broadacre field crops</p> <p>It is not expected that insecticides will be the main means of managing solenopsis mealybug.</p> <p>Be aware that broadspectrum insecticides to control mirids or aphids will flare mealybug by disrupting beneficial populations.</p>			
Communication	<p>Sharing information between agronomists and growers can provide an early-warning of mealybug activity and trigger crop monitoring</p>			