

# PACKAGE OF PRACTICES FOR MANAGING MEALYBUG ON COTTON

## Status of mealybugs on cotton in India

- The solenopsis mealybug, *Phenacoccus solenopsis* (Tinsley), and the pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green), were found to infest cotton plants from all nine cotton growing states of the country.
- The solenopsis mealybug, *P. solenopsis* was found to be the predominant mealybug species, comprising 95% of the samples examined from 47 locations representing 9 cotton growing states of India. It was hitherto not reported to occur in India, but now appears to be widespread on cotton in almost all cotton-growing states of the country. It is considered to be an exotic species that has its origin in the USA.
- Papaya mealybug *Paracoccus marginatus* Williams and Ganara de willink also infests cotton and was found to be sporadic cum potential pest in South Zone.

**The solenopsis mealybug, *P. solenopsis* is a polyphagous pest, with a wide host range. It establishes and spreads more easily than many other insect species because of the following factors.**

- The bugs possess a waxy coating on the dorsal side that protects them from insecticides and natural mortality factors
- Have a high reproductive rate
- Have the ability to hide in the soil cracks and crevices, and corner regions of plants
- Have the propensity to spread through natural carriers such as raw cotton seeds, wind, water, rain, birds, human beings and farm animals
- Have immense potential to emerge as crop pests, thereby causing severe economic damage to a wide range of crops and pose a grave threat to agriculture in the introduced country.
- The host range includes several ornamental plants, fruit crops, vegetables and field crops. A record of 91 and 16 host plants spread across 24 and 11 families for *P. solenopsis* and *M. hirsutus*, respectively has been made in India till date.

## Nature of damage

**Plants infested during vegetative phase exhibit symptoms of distorted and bushy shoots, crinkled and/or twisted and bunched leaves, and stunted plants that dry completely in severe cases. Late season infestations during reproductive crop stage result in reduced plant vigour and early crop senescence.**



Mealybug *Phenacoccus solenopsis* (female)



Mealybug infestation on young plant



Mealybug infestation on cotton boll



Mealybug infested cotton field

## Tips for management

It is important to remember that mealybug crawlers spread through human interventions such as spraying, irrigations, frequent movement through the infected area etc. Therefore avoid disturbing mealybug affected plants. It is important to remember that young cotton plants can overcome mealybugs and it is better not to resort to chemical sprays on young plants that have slight infestation of the mealybugs in early vegetative stages of the crop. It has been observed that the mealybugs were unable to establish colonies on the cotton crop during early vegetative and peak vegetative stages. It is only in rare cases, which is generally possible on a few susceptible genotypes, that mealybugs colonize plants during vegetative stage.




All over the country, several parasitoids (predominantly *Aenasius* sp.) and coccinellid beetle predators are now found to keep mealybug populations under control, thereby preventing spread and damage. Insecticides such as profenophos, chlorpyrifos, monocrotophos etc. which are being commonly used for mealybug control, destroy the parasitoids and predators and can result in mealybug outbreaks. Therefore, insecticide applications should be avoided until peak boll formation stage, so as to allow further establishment of the parasitoid and predator complex in the ecosystem. Eco-friendly insecticides such as neem oil based botanicals and buprofezin can be used if necessary in the initial stages so as to keep mealybugs under check while causing minimum disturbance to the ecosystem.




However during peak boll formation stage, mealybugs can establish colonies but are initially restricted to a few plants along the border rows, adjacent to the source of infestation and thus can be effectively managed through early detection and initiation of interventions to control early stages of infestation. If timely scouting and appropriate control measures are not initiated cotton crop is likely to be severely damaged with mealybugs.

Insecticides should not be applied all over the field to manage mealybugs. Such a practice disrupts the ecosystem and does not allow naturally occurring parasitoids and predators to establish natural control. Therefore, the following practices are advised:

- Locate infested plants with more than one twig infested completely with mealybug colonies.
- Do not allow physical contact with the infested plant. Do not disturb the plant vigorously. If possible, the affected twig can be gently detached from the plant, collected in plastic bags and taken far away from fields to be destroyed by burning.
- If at least 10% infested plants exceed grade-2 (at least one stem completely colonized with mealybugs) in more than 40 plants randomly sampled plants per acre, chemical control measures may be initiated.
- Insecticide application should start first on the neighboring plants and then as spot application near the root zone, base of the plant and other infested parts.

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What to do	When to do	Why to do	How to do	What not to do	Why not to do
<b>Cultural practices</b>					
Early crop termination	Immediate after last picking and between two cropping seasons	To prevent continuous food supply and shelter for multiplication and carry over of mealybug.	Removal of cotton crop from the fields immediately after the last picking and maintenance of host free period.	Ratoon cropping or allowing the cotton crop to continue to stand in the field after the final harvest.	Ratoon crop offer food and shelter for mealybugs and provides inoculum for next season.
Destruction of cotton stalks.	After final picking is over.	Destruction of cotton stalks following harvest reduces the shelter and food supply to mealybug and carry over to next season.	The dry cotton stalks should be pulled out of the fields or shredded and burnt off <i>in situ</i> before ploughing the field.	Stacking of cotton stalks in or nearby areas of the fields.	Mealybug populations survive on stalks and pass on to the next season.
Clean cultivation: Destroy alternate weed host growing on field bunds, water channels and wastelands in the area.	During the crop season and off-season.	Weeds especially congress grass and Xanthium are the most suitable hosts for mealybugs and assist them to survive and spread on the adjacent crop.	Biological- inoculative release of <i>Zygodromma bicolorata</i> @500-1000 beetles /ha on parthenium grass. Mechanical- Hand weeding and destructions. Spray weedicide + insecticides on bunds.	Do not allow infested plants into irrigation canal. Do not spray only weedicides.	Mealybug spread through water. If weeds are destroyed mealybugs move to the adjacent crop.
 Mealybug congregation on stem		 Mealybug infested Parthenium plant		 <i>Maconellicoccus hirsutus</i> (Green)	
Use acid delinted seeds for sowing	A the time of sowing/ planting	Delinted seeds do not carry any infective stages of the mealybugs.	Delinting should be done with sulphuric acid washed with water, neutralized with lime and dried under shade	Using fuzzy seeds for sowing.	Fuzzy seeds may harbor infective stages of mealybug, especially crawlers.
Select varieties/ hybrids approved by GEAC or SAUs of that zone.	Before planting and procurement of seed material.	Approved varieties/ hybrids are tested before release in particular zone for their tolerance to pest and other abiotic factors.	Consult the SAUs/ ICAR institute located in the area while making a choice of genotype.	Use of nondescript or F2 Bt hybrids.	Nondescript cultivars may be susceptible to mealybugs.
Grow pigeonpea, bajra or maize as border crop wherever possible.	At the time of planting.	These crops offer least support for the growth and multiplication of mealybugs.	Growing two rows of densely planted pigeonpea or maize or bajra around	Avoid growing malvaceous and solanaceous crops near the cotton fields.	Malvaceous and solanaceous crops are good hosts for

		Border rows act as barrier crop that prevent mealybug infestation from border weeds.	the cotton fields and also if possible as intercrop of 1- 2 rows after 5-6 rows of cotton.		mealybugs. They serve as shelter and spread mealybug infestation.
Regular monitoring of the pest.	After the sowing of cotton crop	The pest is initially restricted to a few plants along the border rows, adjacent to the source of infestation.	By weekly observations, the pest can be effectively managed through early detection and initiation of interventions to manage early stages of infestation.	Do not allow free movement of labour/ animals in infested fields.	Mealybugs spread through water, air, human, animal, farm implements etc.
					
Pigeonpea as border crop		Mealybug infestation: okra		<i>Cryptolaemus montrouzieri</i>	
<b>Botanical and Biological control</b>					
Neem Seed Kernel Extract (NSKE 5%) 50ml/l + Neem oil 5ml/ l + detergent powder 1gm/l can be sprayed as spot application on infested stalks.	Initial stage of infestation. When 1-2 infested plants observed of grade -2 (at least one stem completely colonized with mealybugs) in more than 40 plants per acre	Spot application restricts the spread of mealybugs. These formulations are less harmful to natural enemies and thus help in conserving ecosystem.	Spray on the crop adjacent to the infested plants and at the base of the infested plants without disturbing the mealybug colonies.	Do not use chemical insecticides at early stage of crop.	Use of insecticides disrupts native predators and parasitoids.
Fish oil rosin liquid 10ml mixed with neem 10ml/l or Karanj oil 10ml /l may be sprayed.					
Use of <i>Cryptolaemus montrouzieri</i> adults /grub@ 10 per infested plants wherever available.	Inoculative releases of the ladybug beetle, prior to the cotton season, on weeds and perennial trees harbor mealybug colonies, and also on infested cotton plants.	<i>Cryptolaemus montrouzieri</i> (Mulsant), is a naturalized predator of mealybugs & feeds voraciously on <i>P. solenopsis</i> .	Release the adult beetle during morning or evening hours to avoid direct exposure to hot sunlight.		
Spray biopesticides viz., <i>Verticillium lecanii</i> (Potency 2 X 10 <sup>8</sup> C.F.U /gm) 10gm/l and <i>Beauveria bassiana</i> (Potency 10 <sup>8</sup> spores/ml) 10ml/l.	Initial infestation during August-October i.e high humid months coinciding with vegetative growth phase of crop.	The formulations disrupt growth and multiplication of mealybugs by causing disease without harming to the other natural enemies and the environment.	Spray of biopesticides formulations during morning / evening hours on infested crop area.	Do not use pathogens formulations <i>Verticillium lecanii</i> and <i>Beauveria bassiana</i> during other months when humidity is low.	Fungal spores germinate and cause disease in the insect when optimum relative humidity (>60%) conditions prevail.

<b>Chemical control</b>					
Spray less hazardous insecticides, such as Acephate, 75 SP 1gm/l, Malathion 50 EC 2ml/l, Buprofezin 25 SC 1ml/l	When 10% infested plants observed of grade-2 (at least one stem completely colonized with mealybugs) in more than 40 plants per acre	WHO class III (Slightly hazardous) – Acephate, Malathion and WHO Class IV (Unlikely hazardous) – Buprofezin cause less harm to the environment.	Spray the chemicals first on plants around infested plants and then as spot application at the infested plants.	Avoid use of insecticides with high eco-toxicity such as methyl parathion, (classified by the World Health Organization (WHO) as WHO 1a: extremely hazardous), dichlorvos, methomyl, triazophos and metasystox and monocrotophos, (WHO 1b: highly hazardous).	Insecticides with high ecotoxicity should be avoided since they are not only ecologically hazardous, but also detrimental to predators & parasitoids wasps that control mealybugs and other insect pests. FAO specifically recommend class WHO1a and WHO1b insecticides for developing countries.
As the last option, spray moderately hazardous insecticides: Quinolphos 25 EC 5.0 ml/l Chlorpyriphos 20EC 3.0ml/l Profenophos 50EC 5.0 ml Thiodicarb 75WP 5.0gm/l	When > 10% infested plants observed to exceed grade 2 infestation in more than 40 plants per acre.	WHO class II (Moderately hazardous) – Quinolphos, Chlorpyriphos, Profenophos Thiodicarb cause comparatively less harm to the environment.			