

**MANAGEMENT STRATEGIES OF MEALY BUG: A BIG THREAT TO AGRICULTURE**

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**M**ealybug (*Drosicha spp.*) is a polyphagous pest which attacks on a wide range of fruit crops, vegetable crops and as well as ornamental crops (Ganjisaffaret *al.*, 2019; Chowdhury and Sontakke, 2015). It is cottony in appearance, small oval, soft-bodied sucking insects. This is found on new emerging leaves as well as mature, stems, panicle, fruits and roots and is covered with white mealy wax, which makes them difficult to eradicate. They form colonies on the panicle, pedicel, stems and leaves developing into dense, waxy, white masses. They suck the cell sap from leaves and stems with the help of piercing/sucking mouthparts. The excess sap is excreted as honeydew which attracts ants and develops sooty mould on entire leaves surface, which inhibits the photosynthesis activity of plants.

It has been reported that mealybug causes economic damage to many crops. Losses are estimated to be in the range of 10-60 per cent depending on the crops. Mealybug is a major pest of grapes which reduces yields 50 to 100 per cent. It sucks the saps and causes serious damage and losses to the crops. Mealybugs secrete honeydew, which encourages the growth of sooty mould on leaf and photosynthesis process drastically reduces.

### Host range

It affects many agricultural crops including mango, guava, citrus, grape, fig, date palm, apple, avocado, banana, anona, mulberry, coffee, coconuts, soursop, peanut, beans, tomato, brinjal, okra, maize, sugarcane, soybean, cotton, rose, chrysanthemum, acalypha, hibiscus, croton (Bhau *et al.*, 2017). It also affects litchi leaf, shoot, panicle and fruit, causing fruit drop and deteriorate the quality of fruit.

## Morphology of mealybug

Adult mealybugs are soft-bodied, elongate oval and slightly flattened, segmented insects covered in white powdery wax. Mealybugs are white to pink in colour and measure 1.2-1.5 cm in length and 4-6 mm in width. Eggs, as well as crawlers (small mealybug), are pink in colour. The crawlers measure 0.3 mm in length. Adult females are 2.5– 4.0 mm long.



**Fig.1** Mealy bug shape and size **Fig.2** Mealybug on litchi panicle

## Mode of transport

Young mealybug (Crawler) is highly mobile. They crawl from infected plants or soil to non-infected plants. Small ‘crawlers’ are easily transported by wind, rain, birds, ants, clothing and vehicle and may settle in cracks and crevices, usually on new plants. Animals, people and equipment used in the field also acts as a carrier to bugs. Long-distance movement is mostly possible through carrying infested planting material and fresh fruit and vegetables across the country or even from one end of a farm to the other. Honeydew secreted by bugs attracts ants which carry mealybugs from one plant to others.

## Life cycle

Reproduction is mostly parthenogenetic. Eggs are laid in the egg sac of white wax, mostly in clusters on the twigs, branches, or bark of the host plant but sometimes on the plant’s leaves. About 600 eggs are present in the egg sac, and they are mostly female, resulting in the explosive outbreak. Eggs are minute, varying from 0.3 to 0.4 mm in length. Egg development takes between 3 and 9 days. Eggs hatch into nymphs called crawlers and are very mobile. In appearance, nymphs of both sexes resemble female adults. The three and four nymphal instars are found in female and male, respectively, which lasts for 22–25 days. The last male instar is inactive within a cocoon of mealy wax. Individual mealybug may take

as long as 30 days to grow through all the nymphal stages under normal conditions. They survive in cold conditions both on the host plant and in the soil. In warm climates, the insects stay active and reproduce round the year.



**Fig. 3** Mealy bug scrawling on the trunk

The female crawls down the mango tree in the month of April-May and enter in the cracks in the soil for laying eggs in large number encased in white egg sacs. Just after hatching, the minutes newly hatched pink to brown coloured nymph crawl up the tree. The eggs lie in diapause state in the soil till the return of the favourable condition in the month of November-December.

### **Nature of damage**

- Both adults and nymphs suck the plant sap and reduce the plant growth, destroy inflorescence and cause fruit drop.
- Plants become stunted and swollen when infested on the growing tip of young plants.
- Heavy clustering of mealybugs can be seen on fruit panicle and under leaf surface giving the appearance of a thick mat with a waxy secretion.
- They excrete a large amount of honeydew that attracts ants and helping the development of black sooty mould which inhibits the photosynthesis capacity of plants.
- Both nymphs and adults suck the cell sap from flowering panicle, fruit pedicel and leave, causing withering, yellowing and dropping of flowers and fruits.
- Severe infestation can cause defoliation and even death of the plant.
- Infested fruits can be entirely covered with the white, waxy coating of the mealybug.

- Infestation can lead to fruit drop, or fruit may remain on the plants in a dried and shrivelled condition. Mealybug infected fruits do not fetch a good market price.



**Fig.4** Mealy bug promoting sooty mould

### Association with ants

Mealybug infestation is associated with a high number of ants. The ants effectively ‘farm’ the mealybugs, feeds on their secretions of honeydew and in return, protecting them from predator ladybird beetles, parasites and other natural enemies. Options for controlling ants are limited, but the best are those that contain an attractant and a low concentration of toxicant so that foraging ants deliver the toxicant to the ant nest.

### Management of mealybug

#### Cultural and mechanical Control

- ✓ Physical barriers such as ant fences can be applied parallel to the periphery of the field to keep ants away from the field and subsequently help in controlling mealybug populations.
- ✓ Orchard floor management: Cover crop plants between and under rows of fruit crops which provide alternative habitats and hosts, and pollen and nectar as alternative food sources for parasites and predators may help maintain these beneficial populations when mealybug numbers are low.
- ✓ All crop residues in the orchard should be removed and burnt. Crop residues and grass left in the orchard may harbour mealybug populations which may invade the new crop.
- ✓ The field should be free from weeds and crop residues. Weeds also provide an alternative host for ant populations between periods where mealybug infestations are small.
- ✓ Do not move any plant material with suspected mealybugs.
- ✓ Equipment should be thoroughly washed before moving to a new plant or new field.

- ✓ Manual picking of mealybugs can be done in small plants or where the infestation is in an early stage or apply a strong jet of water to remove bugs.
- ✓ Flooding of orchards with water in October kills the eggs in mango orchard.
- ✓ Ploughing the orchards in November exposes the eggs to sun's heat.
- ✓ Apply sticky bands like 'Track-trap' on the main stem to prevent crawlers of mealybugs reaching the bunch.
- ✓ Fasten 400 gauge alkathene sheets of 25 cm width to the tree trunk besides raking the soil around the tree trunk.
- ✓ Destroy ant colonies during land preparation because their nests are located near the soil surface.
- ✓ Cover crops have been used to improve soil health and lower pest densities by increasing natural enemy diversity. In vineyards, parasitoids that attack mealybugs could utilize floral nectaries found on some cover crop species as a food source to increase adult longevity.

### **Physical Control**

After pruning, the cuttings infested shrubs or trees lying around must be immediately burnt to control further dissemination of mealybug.

### **Chemical Control**

- ✓ Chemicals are not very much effective against mealybug because of its habit of hiding in crevices and the waxy covering of its body which protect mealybug and because pesticides cannot penetrate the heavy waxy layer of waxes that shield the body. Systemic insecticides are used to control heavy infestations, whereas most of the granular pesticides are not effective.
- ✓ In case of old trees remove loose bark to expose hiding population of mealybugs and swab stem and arms with dichlorvos 76 EC @ 2 ml + 2 g of fish oil in a litre of water.
- ✓ Mixing of 2 per cent methyl parathion dust or 1.5% chlorpyrifhos dust @ 250 gm per tree.
- ✓ Spray 0.04% monocrotophos or 0.06% dimethoate if nymphs have already ascended the tree.

- ✓ Destroy ant colony with a drenching of chlorpyrifos 20 EC @ 2.5 ml/l or apply 5% malathion dust @ 25 kg/ha as the ants provide them protection from parasitoids and predators helps in spreading the crawlers to other plants.
- ✓ Neem kernel extracts and a commercially produced neem extract-based product (Rakshak) induces mild ovicidal action and appreciable nymphal and adults mortality.

### Biological Control

Biological control is most effective and long-term solution to the mealybug infestation (Ghosh 2020) because the parasites and predators are self-perpetuating, persists even when the mealybug is at low population densities, and they continue to attack the mealybugs, keeping populations below economic injury levels.

- ✓ The coccinellid beetles such as *Cheilomeness exmaculata*, *Rodolia fumida*, *Scymnus coccivora* and *Nephusre gularis* are important predators of mealybug nymphs.
- ✓ Biological control by the release of natural enemies has proved very successful. Among the biological control agents introduction of *Cryptolaemus montrouzieri* (Australian Ladybird), *Anagyrus pseudococci*, *Leptomastix dactylopii*, *Hypoaspis* sp., *Verticillium lecanii* and *Beauveria bassiana* are effective in managing the infestation.
- ✓ *Hypoaspis* a small mite that feeds on crawlers.
- ✓ Soil application of the spores of the fungus, *B. bassiana* reduces the further reduction of the pest population.

### Mating Disruption

The synthetic sex pheromone can be used to disturb the mating process in mealybug. The significant reduction of the males can be achieved by mass trapping. In fact, males are attracted from a distance of at least 100 m from the pheromone source

### Ant control

Ants are associated with mealybug and it may disrupt the activity of natural enemies of pests, parasitoids. There are documented 295 ant species in citrus orchards, but not all of them establish mutualistic relationships with honeydew producers. Some species, when present in high densities, disrupt the biological control of mealy bugs. Therefore, disrupting the activity of ants is a practical tactic to enhance the biological control of mealybugs. Tactics

available to manage ant populations include: (i) insecticide-treated baits; (ii) sticky bands strapped or taped around the tree trunk; (iii) spraying the trunks or placing insecticide-treated bands around them; and (iv) ground or foliar treatment with insecticides.

### Conclusion

The mealybug is still a major problem and causes severe damage in many crops due to the presence of a vast range of host and persistence round the year, but its significance has not been realized. Alteration of environmental factors may affect their life cycle, thereby effecting the time of infestation. A very little work has been done towards implementing Integrated Pest Management to control the mealy bugs. To mitigate the fruit loss due to mealy bug infestation, the integrated approaches can be very useful.

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