



## Papaya Mealy bug (*Paracoccus marginatus*) Management in Horticultural Crops

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### Introduction

Mealybugs (coccids) belong to the insect order homoptera and the super family coccoidea. They cause direct damage by way of feeding and in addition they also inject toxic saliva, excrete honey dew paving way for the growth of sooty mould fungus giving an ugly look resulting in poor quality of the produce. It also causes yellowing of leaves and malformation of affected portions due to salivary infection. They also cause indirect damage by way of spreading many viral diseases by acting as vector. The presence of red ants causes the nuisance while harvesting fruits/nuts in mango, coconut, guava, citrus, cotton, ornamentals, flower and medicinal crops etc. The honey dew also causes the sooty mould due to capnodium growth and it reduces the photosynthesis (Vijay and Suresh, 2013).

Of the known 35 families under Coccoidea, 20 families are recognized only in India of which, pseudococcidae is widely prevalent (Williams, 2004). However, at times mealy bug infestation may occur within the vegetative shoot apex and may be extremely difficult to detect. This ability of mealybugs to form dense colonies particularly with in the shoot apex often makes chemical control of this pest quite difficult.

Among the various coccids *Phenacoccus solenopsis* (solenopsis mealybug) has been recorded causing economic damage to many crops. Now a days it cause recent outbreak of many crops. In India, losses have been reported for cotton, bhendi, gingelly, sunflower, brinjal, chrysanthemum, marigold and tuberose (Suresh and Mohanasundaram, 1996). Its reducing yields 50 to 100 per cent. The other mealy bugs are *Maconeliococcus hirsutus* (Green) (Grapevine mealybug), *Phenacoccus solani* (Solanum mealy bug), *Phenacoccus madeirensis* (Green) (Maderia mealybug), *Nipaecoccus viridis* (Green) (Icberia mealybug), *Coccidohystrix insolita* (Green) (Brinjal mealybug), *Dysmicoccus brevipes* (Ckll.) (Pine apple mealybug), *Rastrococcus iceryoides* (Green) (Icerya mealy bug), *Paracoccus marginatus* (Ckll.) (Pappaya mealybug) and *Planococcus citri* (Risso) (Citrus mealybug) cause a severe damage by reducing the photosynthesis of the plant due to honeydew secretion and sooty mould attack in agricultural and horticultural crops (Ben-Dov, 1994). Among them papaya mealy bug cause serious damage in horticultural crops due to polyphagous in nature.

### Morphology

Mealy bugs are white to pink in colour and measure 3-4 mm in length. *Paracoccus marginatus* adult female body oval, somewhat rounded in lateral view; dark green almost black; 9-segmented antennae; legs red; covered by thin, white, mealy wax, with dark dorso

submedial bare spots on intersegmental areas of thorax and abdomen, these areas forming 1 pair of dark longitudinal lines on dorsum considerably in size of 4.5 mm length and 3.45 mm wide. Ovisac well developed ventrally; with 18 pairs of lateral wax filaments, posterior pairs longest, up to  $\frac{1}{4}$ <sup>th</sup> length of the body.

### ***Biology***

Reproduction is mostly parthenogenetically. The mature female lays eggs in an egg sac of white wax, usually clusters on the twigs, branches, or bark of the host plant but sometimes on the plants leaves and terminal ends, egg sac contain as many as 600 eggs majority of female resulting in explosive outbreak due to shortened life cycle and higher reproductive rate. Egg is creamy white in colour, slender in shape, varying from 0.3-0.4 mm in length. Eggs development takes between 3 and 9 days. Eggs hatch into nymphs called crawlers and are very mobile. In appearance, three nymphal instars in female and four in males which lasts for 22-25 days. The last instar of the male is an inactive stage with wing buds within a cocoon of mealy wax. Individual mealy bugs may take as long as 30 days to grow through all the nymphal stages under normal conditions.

### ***Mode of Transport***

Non-infected plants can be infected from infected plants as juvenile mealybugs can crawl from an infected plant to another plant. Small 'Crawlers' are readily transported by wind, rain, birds, ants, clothing and vehicle and may settle in cracks and crevices, usually on new plants. The wax, which sticks to each egg, also facilitates passive transport by equipments, animals or people. The female mealybug is not active and unable to fly. In fact, humans are great friends helping in transport of mealy bugs.

### ***Symptoms of attack***

Infested growing points become stunted and swollen. Heavy clustering of mealybugs can be seen under leaf surface giving the appearance of a thick mat with waxy secretion. They excrete copious amount of honey dew that attracts ants help in development of black sooty mould which inhibits the plants ability to manufacture food. Both nymphs and adults suck the sap from leaves causing withering and yellowing of leaves. It severely affects the stems due to development of dense colonies. In guava serious attack results in retarded growth and yellowing of leaves by the way of feeds on soft tissues and injects saliva that causes curling and contortion of leaves.



Fig. 1: Papaya mealybug infestation in Guava

### **Management**

Mealybug control often involves the control of care taking ants that are important for the proper development of mealybugs. Management of mealybugs, it is important to know the species present as management programs for the various mealybugs may differ. Plant protection products are of limited effectiveness against mealybugs because of their habit of hiding in crevices and the presence of wax covering of its body. Management of mealybugs involves the following tactics.

### **Cultural control**

Crop residues in previously infested fields should be removed and burnt. Crop residues and grass left in the field may harbor mealybug populations which may invade the new crop. Field borders should be free from weeds and debris that may support mealybugs between plantings. Weeds also provide alternate weed host for ant populations between periods where mealybug infestations are small. Removal of alternate weed host *viz.*, *Parthenium hysterophorus*, *Abutilon indicum*, *Triaunthema postulacastrum*, *Amaranthus viridis* etc. in and nearby crop. Can't grow the same families of crop in and nearby field.

### **Biological control**

Biological control is considered the most effective long-term solution to the mealybug infestation because the parasites and predators are self-perpetuating, persist even when the mealybug is at low population densities, and they continue to attack the mealybugs, keeping populations below economic injury levels. Biological control by release of natural enemies has proved very successful. Among the biological control agent's introduction of *Cryptolaemus montrouzieri*, *Anagrus pseudococci*, *Harmonia*, *Leptomastix dactylopii*, *Scymnus coccivora*, *Hypoaspis* sp., *Verticillium leccanii* and *Beauveria bassiana* are effective in managing the infestation. *Hypoaspis* is a small mite that feeds on crawlers. The entire population of mealybugs may not be suppressed by coccinellids. There is a need to integrate other control tactics along with conservation and augmentation of coccinellids to manage mealybugs. *C. montrouzieri* is commonly called the Australian ladybird beetle or the mealybug destroyer. The larvae feed on mealybug eggs and young crawlers. The life span of the *C. montrouzieri* is two months. During this time, the mealybug destroyer can lay up to 400 eggs. It is capable of eating 3,000- 5,000 mealybugs in various life stages. Biological control in grapes includes one to three releases of *C. montrouzieri* at 10 per tree or @ 5,000 beetles /ha, two times in a season especially during August – September and December-January.

Release of imported encyrtid parasitoids such as *Acerophagous papayae*, *Anagrus loeckii* and *Pseudoleptomastix mexicana* is being currently used to manage papaya mealybug. Among them *A. papayae* was successfully eliminated the papaya mealybug population. It attacks the mealybugs in two ways. The adult wasp punctures a mealybug and extracts fluid from the wound. The female wasp feeds on the fluid of the dying mealybug, which provides nutrient to wasp's eggs for development. Fully developed adult wasp comes out of the mummy of the mealybug by cutting a circular hole in the end of the mummy and crawls out.



### ***Chemical control***

Any insecticides used against mealybugs should be carefully selected to avoid injury to natural enemies. Pest monitoring: Crawler is the most susceptible stage to identify the crawlers in earlier stage easily to manage the insecticides under field conditions. Plant protection products are of limited effectiveness against mealybug because of its habit of hiding in crevices, and the waxy covering of its body. Most granular insecticides are ineffective, therefore systemic insecticides are used to control heavy infestations. Spray profenophos 50 EC @ 2 ml/l (or) dichlorvos 76 EC @ 2 ml/ l (or) acephate 75 SP @ 2g/lit, chlorpyriphos 20 EC @ 2ml/l (or) Imidacloprid 17.8 SL @ 0.5 ml/l (or) Thiamethoxam 25 WDG @ 0.5 ml/l (or) FORS @ 25g/l (or) Buprofezin 25 SC @ 0.75 ml/l (or) Azadirachtin 1% @ 2ml/l (or) dimethoate 30 EC @ 2ml/litre of water at 15 days interval.

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