



## Biology, Nature of Damage and Management of Papaya Mealybug, *Paracoccus marginatus* Williams and Granara de Wilink (Pseudococcidae: Hemiptera)

**Harishkumar J<sup>1\*</sup>, Subhash S<sup>1</sup>, Abhishek TS<sup>2</sup>, Suresh Kumar Mahala<sup>3</sup>, Yashasvini Goswamy<sup>3</sup>, Karthik Ramappa<sup>4</sup> and Mahesh Pathak<sup>5</sup>**

<sup>1</sup>PhD Scholar, Dept. of Studies in Sericulture, Manasagangothri, Mysore, Karnataka

<sup>2</sup>PhD Scholar, Dept. of Entomology, Lovely professional University, Punjab

<sup>3</sup>MSc Scholar, Dept. of Entomology, CSKHPKV, Palampur, Himachal Pradesh

<sup>4</sup>PhD Scholar, Dept. of Entomology, CSK HPKV, Palampur

<sup>5</sup>Professor, School of Crop Protection, CPGS-AS, CAU(I), Meghalaya



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\*Corresponding Author

**Harishkumar J\***

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### INTRODUCTION

The papaya mealy bug, *Paracoccus marginatus* (Pseudococcidae: Hemiptera) is small sap sucking insect, native to Mexico and Central America, had invaded to the Caribbean in 1994, later to Florida, USA in 1998. Then, subsequently mealybug had spread into pacific region in april 2002, later Hawaii island of Maui in May 2004. In India it was first reported in Coimbatore, Tamil Nadu, where papaya mealybug had infested to 1500 acres of mulberry plantations.

Papaya mealy bug is highly polyphagous known to feed mainly on *Carica papaya*, *Ambrosia cumanensis*, *Parthenium hysterophorous*, *Achalypha* sp., *Manihot cholristca*, *Manihot esculenta*, *Mimosa pigra*, *Hibiscus* sp., *Sida* sp., In addition, various authors viz., Miller and Miller (2002) listed 35 plant species, reported papaya mealybug known to feed over 60 plant species belongs to 25 genera. Papaya mealybug is sexually dimorphic, where adult males are having wings and females are apterous, the nymphs and adults used to suck the sap from every part of the plant. So, infestation of papaya mealybug can be easily distinguished with the infestation of pink mealybug, as pink mealybug infests only apical portion of the plant where as papaya mealybug known to feed on every part of the plant. Among the different natural enemies attacking papaya mealy bug, three species of exotic parasitoids viz., *Acerophagous papayae*, *Pseudleptomastix mexicana*, and *Anagyrus loeckii* became revolutionary in restricting the mealy bug population, subsequently which saved INR 1,623 crores (Ballal CR 2022)

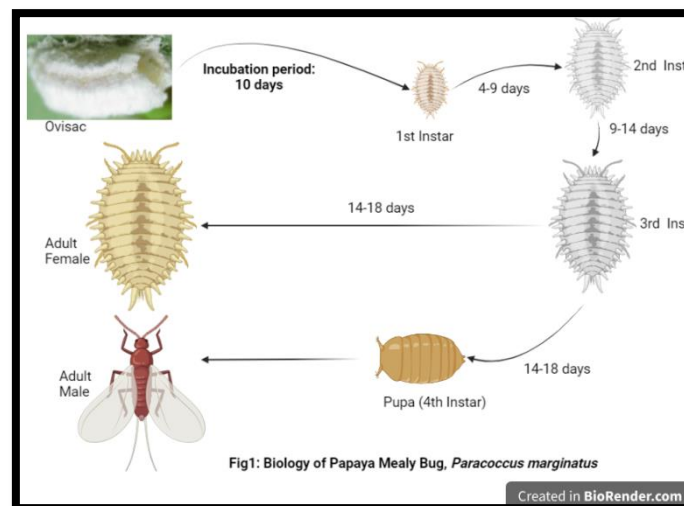
### Biology of Papaya mealybug, *Paracoccus marginatus* (Pseudococcidae: Hemiptera)

**Egg:** Greenish yellow eggs are laid in eggs sac by adult females, where each ovisac is three to four times that of body length of female. Ovisac develop on ventral side of adult females and contains 600-900 eggs. Usually, eggs will hatch in 4-10 days in summers, where as it will take 10-15 days in winters.

**Nymphs:** First instar nymphs are call crawlers, they are highly mobile, female crawlers have four instars where as male crawlers have five instars, male fourth instar produced in cocoon known as pupa. Once the crawlers find the niche, nymphs start exploiting the niche by piercing and sucking through stylets. Subsequently, the later instars will lose mobility and nymphs will become sedentary. During course of development

mealybug will secrete and embed themselves in white waxy coating. Total nymphal duration completes as early as 40-45 days in Summer to as late as 70-75 days in winter.

**Female adult:** Females are wingless, move by short distance via crawling. Body is covered with series of short caudal waxy filaments around the margin of the body, they are yellowish green in colour, body 2.2mm length and 1.4 mm width. Papaya mealybug can be distinguished by two main unique keys, viz., presence of oral-rim tubular ducts dorsally which is only present in marginal areas of the body and another one is absences of pores on the hind tibiae. Another diagnostic key which separates from tukra mealy bug is, presence of eight antennal segment in papaya mealybug where as in tukra mealy bug its nine antennal segments.



**Male adult:** Males are winged, and they are pink in colour, especially during pre-pupal and pupal stages, where as nymph will be yellow in colour, and the length of adult males is 1.0 mm and width at thorax is 0.3 mm, furthermore, adult males having 10 segmented antennae, sclerotized head, thorax and distinct aedeagus.

**Nature of Damage:** Once crawlers hatch from the eggs, move in all the directions and infest every part of the plants above the ground portion, during course of development nymphs

as usual secrete waxy coat over the body, subsequently whole plant cover with the thick waxy coat. Damage symptoms of papaya mealybug can be easily diagnosed with the pink mealy bug/tukra mealy bug, where symptom is restricted to the only apical leaves. Mealybugs tends to suck the sap continuously from the phloem tissue through stylets. When mealybug suck the sap, they also inject phytotoxic enzymes due to injecting of these chemicals' leaves will curl, become yellow, premature drop, stunting of plants

subsequently plant will die. In addition, due to enormous secretion of honey dew, there is luxurious growth of sooty mould fungus, due to which plants will become dark in colour, so

papaya fruits. Subsequently the taste and marketing value will decrease which results in huge economic crisis.



**Fig. 2: Infestation by *Paracoccus marginatus* (a): fruits; (b): leaves**

**Source: Sharma and Muniappan. 2022**

### Management

**Biological Control:** There were minimum 30 invasive insects from last century, but there was no invasive pest was managed as shortly as papaya mealy. The management of papaya mealybug was made possible under the module of classical biological control (**Ballal CR. 2022**), where National Bureau of Agriculturally Important Insects (NBAII), Bengaluru associated with USDA-APHIS, Puerto Rico Centre and brought 3500 individuals of *Acerophagous papayae*, 1500 individuals of *Pseudoleptomastix mexicana*, and 1500 individuals of *Anagyrus loeckii* during 2010, later mass multiplied and released in farmers field, however *A. papayae* was multiplied large scale then other 2 parasitoids (**Shylesha et al. 2010**). Surprisingly, within 3 months of release, there was 80-90% reduction of *Paracoccus marginatus* population leads to formation new healthy shoots of papaya and *Morus* plants. As a result of Classical Biological Control there was total benefit of \$524 million to \$ 1.34 billion in five years (2010-2015). Nevertheless, Entomopathogenic fungi such as *Verticilium lecanii*, *Beauveria*

*bassiana* and *Metarhizium anisopliae* are also known to cause 40-50% mortality to *P. marginatus*, so entomopathogenic fungi can be integrated with parasitoids to get the additional effect

### Cultural and Mechanical Control:

- Monitoring and regular survey to early detection of mealybug presence
- Pruning of infested part of the plant
- Burning of crop residues
- Avoiding flood irrigation
- Encouragement of Sprinkler irrigation
- Sanitization of farm equipment's to avoid the spread of mealybugs
- Removal of alternate hosts such as *Hibiscus*, *Parthenium* etc around the field
- Application of Sticky bands or alkathene sheets around the stem to prevent the crawler's movement.
- Locating and destroying formicid colonies in the field

**Chemical Control:** Identification of ant colony, and drenching the ant colony with monocrotophos. According to study made by Seni and Sahoo Thiamethoxam 25WG @62.5

g a.i./ha showed the best result, and lambda cyhalothrin @37.50 g a.i./ha can be used as best knockdown chemical, further, systemic organophosphates and contact insecticides are also useful in limiting the pest population, However, the mealybug occur in embedded waxy coats, insecticide should be mix with soap solutions to get the better results as well as multiple spraying is required to control the pest.

### CONCLUSION

In the history of classical biological control, the management of papaya mealybug, *Paracoccus marginatus* remains marvellous story, where, with the help of three hymenopteran parasitoids the pestiferous

*Paracoccus marginatus* got controlled, this success broadens the path of classical biological control of other invasive insects also.

### REFERENCES

- Ballal, C.R., 2022. Success Stories in Biological Control: Lessons Learnt.
- Shylesha A N, Joshi S, Rabindra R J, Bhumannavar B S. 2010. Classical biological control of the papaya mealybug. National Bureau of Agriculturally Important Insects, September. [http://agritech.tnau.ac.in/crop\\_protection/pdf/mealybug.pdf](http://agritech.tnau.ac.in/crop_protection/pdf/mealybug.pdf).