

PEST Management

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Mealy Bugs

Damage symptoms

- Initially the affected portion will be chlorotic, later changed to brown and dry away.
- These bug excrete honey dew and as a result infested portion becomes shiny and moist and to this, secondary infection by sooty fungus, *Capnodium* occurs results in black covering the affected parts.
- Papaya mealy bug is polyphagous pest. Symptoms can be observed on ground parts of leaves, stem and fruits as clusters of cotton like masses

Management

These three natural enemies *Acerophagus papaya*, *Pseudleptomastix mexicana* and *Anagyrus loecki* were imported to India July 15th 2010 from Puerto Rico under USDA -APHIS facilities (United States Department of Agriculture. Animal and Plant Health Inspection Service), mass multiplied at various laboratories and released in fields.

White fly

Symptoms

- Both the adults and nymphs suck the plant sap and reduce the vigor of the plant. In severe infestations, the leaves turn yellow and drop off. When the populations are high they secrete large quantities of honeydew, which favors the growth of sooty mould on leaf surfaces and reduces the photosynthetic efficiency of the plants.

Management : The natural enemies of whitefly are :

- Parasitoids: *Encarsia formosa*, *Eretmocerus* spp., *Chrysocharis pentheus*
- Predators: *Dicyphus hesperus* , Lacewing, Ladybird beetle, Big-eyed bugs (mirid bug) (*Geocoris*sp).

Aphids

Symptoms

- Infesting tender shoots and under surface of the leaves.
- Curling and crinkling of leaves
- Stunted growth
- Development of black sooty mould due to the excretion of honeydew

Management : The natural enemies of aphids are

- Parasitoids: *Aphidius colemani*, *Aphelinus* sp.,
- Predators: Fire ant, Robber flies, Big-eyed bug (*Geocoris* sp), Earwig, Ground beetle, Cecidomyiid fly, Dragon fly, Praying mantis, Lacewing, Ladybird beetle, Spider etc.

Red spider mites

Symptoms:

- Spider mites usually extract the cell contents from the leaves using their long, needle-like mouthparts. This results in reduced chlorophyll content in the leaves, leading to the formation of white or yellow speckles on the leaves.
- In severe infestations, leaves will completely desiccate and drop off. The mites also produce webbing on the leaf surfaces in severe conditions.
- Under high population densities, the mites move to using strands of silk to form a ball-like mass, which will be blown by winds to new leaves or plants, in a process known as “ballooning.”

Management : Natural enemies of red spider mite:

- Predators: Anthocorid bugs (*Orius* spp.), mirid bugs, syrphid/hover flies, green lacewings (*Mallada basalis* and *Chrysoperla* sp.), predatory mites (*Amblyseius alstoniae*, *A. womersleyi*, *A. fallacies* and *Phytoseiulus persimilis*), predatory coccinellids (*Stethorus punctillum*), staphylinid beetle (*Oligota* spp.), predatory cecidomyiid fly (*Anthrocnodax occidentalis*), predatory gall midge (*Feltiella minuta*), Predatory thrips etc.

Management of nematodes in papaya

Papaya crop in many farmers' fields has been observed to have infestation of nematodes viz. *Meloidogyne incognita*, *M. javanica* (root-knot nematodes) and *Rotylenchulus reniformis* reniform nematode).

These nematodes are microscopic and infect Papaya starting from nursery stage. Further, they are also infected with other pathogenic fungi and bacteria. Once these seedlings are infested the pathogen reaches the farmers field and cause the diseases in their fields.

Hence, it is important to know how to produce healthy seedlings of papaya. For controlling the diseases farmers use chemical pesticides which are expensive and also are hazardous.

Papaya seedlings are produced generally in substrate mixture in polythene bags. Many a times substrate mixture (sand + soil + FYM or any organic manure) harbor above mentioned nematodes and other pathogenic fungi and bacteria. Generally papaya seedling producers don't treat the soil mixture which is used for the production of papaya seedlings in their nurseries.

As such nematode infestation on the seedlings makes the way for the entry of various pathogenic fungi and bacteria. These nematodes and other pathogens multiply in the farmers' fields. As a consequence, soil in the farmers' field becomes sick and un-productive and ultimately soil becomes unfit for the cultivation over a period of time if proper measures are not taken to combat these nematodes and other pathogens.

Preparation of soil mixture for producing seedlings

Prepare 1 ton of soil mixture by mixing Neem cake @ 50kg + bio-pesticides – Trichoderma harzianum + Paecilomyces lilacinus + Pseudomonas fluorescens each @ 2kg /ton, can be used for producing the seedlings of Papaya.

Management of nematodes in the main field

Apply 200 g of neem/pongamia cake or 25 g of each of Trichoderma harzianum, Paecilomyces lilacinus, Pseudomonas fluorescens per pit at time of transplanting and the same dosage per tree after every 4 months of planting or Apply 100 g of neem or pongamia cake along with 2 kg of Farm yard manure enriched with bio-pesticides – Trichoderma harzianum + Paecilomyces lilacinus + Pseudomonas fluorescens at the time of planting and after words apply 4 more times the same dosage of bio-agent enriched farm yard manure at 6 months interval. (For a standing crop also apply 4 more times the same dosage of oil cake and bio-agent enriched farm yard manure at 6 months interval).

Application in new planting

[Seed treatment](#)

Pre-coat seeds with biopesticide before sowing.

- Add biopesticide Pseudomonas fluorescens at 20 ml/kg or 20 g/kg seed.

Substrate treatment

Preparation for raising seedlings.

- For substrate (propagating mixture) used in portrays/polybags mix biopesticide *Pseudomonas fluorescens* at 2 g/kg of substrate (cocopeat/potting mixture) and fill in portrays/polybags.
- For nursery beds drench with 3 lit of *Pseudomonas fluorescens* suspension / m² (add 5ml or 5g of formulation / lit of water) before sowing seeds.

Bed treatment

Preparation of main field before planting/ transplanting

- Enrichment of FYM with bio-pesticides: Mix two kg each of *Paecilomyces lilacinus*, *Pseudomonas fluorescens* and *Trichoderma harzianum* / *T. viride* in one ton of FYM and leave it in shade for 15 days at 25 – 30% moisture for multiplication of beneficial microbes.
- Soil has to be incorporated with 20 – 30 tons of FYM enriched with bio-pesticides before planting/ transplanting seedlings.

Application in standing crop

- Enrich neem cake with bio-pesticides: Mix two kg of each of *Paecilomyces lilacinus*, *Pseudomonas fluorescens* and *Trichoderma harzianum* / *T. viride* in one ton of neem cake and leave it in shade for 15 days at 25 – 30% moisture for multiplication of beneficial microbes.
 - Apply neem cake enriched with biopesticides in standing crop at 50 g/ m² once in a month.
 - Mix 20 kg of enriched neem cake mixture in 200 lit water, leave it for two days and this can be used for drenching beds @ 2 lit/ m² or filter it thoroughly and use it for spraying the foliage or sending along the drip, once in a month.
 - Spray Arka Plant Growth Promoter and Yield Enhancer (*Pseudomonas fluorescens* + *Trichoderma harzianum*) at 5 ml or 5g/lit, once in a month.
- Or send along the drip, Arka Plant Growth Promoter and Yield Enhancer (*Pseudomonas fluorescens* + *Trichoderma harzianum*) at 5 ml or 5g/lit, once in a month