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Insect pests of fruit crops and their management in coastal regions

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Mango

Mango Hoppers: *Idioscopus clypealis*, *I. niveosparsus* and *Amritodus atkinsoni* (Cicadellidae: Hemiptera)

Hoppers are the most serious insect pests of mango in India and major limiting factors for the mango production in the country.

Symptoms of damage

- Both the nymphs and adults suck the sap from the inflorescence causing withering and shedding of flower buds and flowers.
- Presence of honeydew secretion on leaves, inflorescence and on fruits with sooty mould growth.
- Characteristic clicking sounds of leaf hoppers can be heard under severe attack.
- Hoppers shelter in the cracks and crevices of the barks on the tree.
- Warm, humid weather favour the multiplication of the hoppers.

Identification and life cycle

- Nymphs are greenish with black or brown markings, resemble small adults but without wings.
- Adults are golden brown or dark brown resembling to bark colour wedge-shaped
- The total life cycle last for 2-3 weeks and complete 2-3 generation in the flowering period

Management

- Keep the orchards clean, avoid dense planting and prune overcrowded overlapping branches after rainy season.
- Spray Nimbicidin 0.2% or Azadirachtin 3000 ppm@2ml/l at initial stage of hopper population.
- Apply bio-agents, *Metarhizium anisopliae* @ 1x 10^8 cfu/ml or *Beauveria bassiana* @ 10^8 cfu /ml on tree trunk once during off season and twice at 7 days interval during flowering season.
- Spray Lambda cyhalothrin 5% EC@ 0.5 ml or imidacloprid 200 SL @ 0.25 ml/l or Thiamethaxam (0.05%) or propanophos (0.05%).
- Conserve the predators like *Chrysoperla zastrowi sillemi* and *Mallada boninensis*
- First spray should be done at early stage of panicle formation, second spray at full length stage of panicle and the third spray after fruit setting at pea size.

Adult flies

Materials for trap preparation

Attracted flies

Training on trap preparation

Fruit fly: *Bactrocera dorsalis* (Tephritidae:Diptera)

The oriental fruit fly *B. dorsalis* Hendel is a major and the most destructive fruit flies of mango. The quarantine pest causing severe economic damage to the growers. It is widely distributed throughout India and causing 25-50 per cent fruit loss.

Symptoms of damage

- The female flies lay eggs just below the epidermis of mature fruit. On hatching the maggots feed on fruit pulp.
- Presence of sting marks and bruising to the fruit skin is the external damage
- Appearance of brown patch around the place of oviposition and the infested fruits start rotting.
- Fruit flies affected fruits attract secondary infection

Identification and life cycle

- Adult female lay eggs just below the epidermis of mature fruit. Egg incubation period last for 1-2 days.
- Larvae are yellowish creamy apodous maggots. Larva takes 6-8 days to mature
- The larvae undergo pupation in soil
- Adults are reddish brown in colour with transparent wing

Management

- Collect and destroy all the fallen and infested fruits.
- Plough around the trees to expose and kill the pupae.
- Hot water treatment of fruits at 48 ± 10^0 C for 60 min.
- Spray Deltamethrin 2.8 EC @ 0.5 ml/l + Azadiractin (3000 ppm) @ 2 ml/l three weeks before harvesting of fruits
- Hanging of methyl eugenol wooden block traps soaked in ethanol, methyl eugenol and malathion (6:4:1) during fruiting period @10 traps/ ha

Grub

Pupa

Affected tree

Adults

Stem borer: *Batocera rufomaculata* (Cerambycidae: Coleoptera)

Symptoms of damage

- Presence of small bore holes at the collar region.
- Extrusion of frass (like coarse dust powder) through the holes at the collar region.
- Oozing or exudation of gum from the damaged portion at the base of cashew tree trunk.
- Grubs bore into the living tissue of bark and feed on the sub-epidermal and vascular tissues.
- Extensive tunneling in the stem and root region and the tissues are tunnelled in irregular fashion.

Identification and biology

- *B. rufomaculata* adults are greyish in colour and pronotum having two kidney-shaped orange yellow spots.
- The eggs are deposited into the live tissues in crevices of loose bark in the trunk and exposed roots.
- The eggs are creamy white in colour, oval in shape and look like rice grains. The egg incubation period was 4-8 days.
- The grub of *B. rufomaculata* also cream in colour and apodous.

Management

- Periodical monitoring of trees having any damage symptoms like gummosis and frass material near the base of tree trunk.
- Remove dead trees and trees beyond recovery at least once in 6 months may reduce the spread of stem and root borer infestation.
- Mechanical removal of the immature stages (grubs) of the pest during initial stages of infestation.
- Treat the infested trees of the trunk region up to one meter height from the ground level and on exposed roots with Fipronil @ 2 ml in one litre of water or Imidacloprid @ 2 ml in one litre of water. If fresh infestation occurs repeat the treatment after 30-45 days.

Larva inside the web

Leaf webbing

Leaf webber: *Orthaga exvinacea* (Pyralidae: Lepidoptera)

Symptoms of damage

- Larvae feed on leaf surface gregariously and later they make web of tender shoots and leaves together and feed within.
- Many caterpillars can be found in a single web

Identification and life cycle

- Larvae are greenish pale in colour with prothoracic shield
- Adults are brown in colour with wavy lines in fore wings
- It complete life cycle in 3-4 weeks

Management

- Mechanical removal of infested webs along with larva and pupa
- Pruning of overcrowded and overlapping branches
- Clean cultivation and summer ploughing check the population
- Spray with quinalphos (0.05%).

Shoot borer: *Clumetia transversa* (Noctuidae: Lepidoptera)

Symptoms of damage

- Larvae bore into young tender leaves and downward tunnelling of young shoots
- Stunting of seedlings with terminal bunchy appearance.
- Drooping of leaves and terminal wilting of shoots

Identification and life cycle

- Larvae are yellowish orange in colour
- Adults are stout greyish brown in colour

Management

- Affected shoots should be clipped off and destroyed.
- Spray quinalphos (0.05%) at fortnightly interval from the commencement of new flush.

Affected leaves

Mealybug colonies

Scales

Scales on trunk

Mealybug: *Drosicha mangiferae* (Coccidae: Hemiptera)

Symptoms of damage

- Both the nymphs and adults suck the sap from the leaves, inflorescence causing withering and shedding of flower buds and flowers.
- Honeydew secretion encourages the development of sooty mould growth on leaves, inflorescence and on fruits

Management

- Clean cultivation and removal of weeds from the orchards
- Deep ploughing of the orchard during November-December
- Raking of soil around the tree trunk to expose the immature stages to the natural enemies
- Banding of tree trunk with polythene sheets (400 gauge) 30 cm above ground level and should be done around November -December.
- Conserve and encourage the coccinellid predators
- If population is severe spray carbosulfan (0.05%) or Dimethoate (0.04%)

Scale insect: *Chloropulvinaria polygonata, Aspidiotus destructor* (Diaspididae: Hemiptera)

Symptoms of damage

- Nymphs and adults suck the sap from the leaves and other tender parts
- Honeydew secretion encourages the development of sooty mould growth on leaves and fruiting bodies
- Severe infestation affects the fruit bearing

Management

- Pruning of infested plant parts and destroy them immediately.
- If population is severe spray imidacloprid 17.8 SL (.005%) or dimethoate (0.06%)
- Mechanical removal of ants may encourage the natural enemies to control the insect.

Affected plant

Rotting of corms

Photo credit: TNAU Agri tech portal

Banana

Rhizome weevil *Cosmopolites sordidus* (Curculionidae: Coleoptera)

Symptoms of damage

- The young grub and adult bore into the base of suckers, roots and rhizome/ corm.
- Presence of tunnels on the pseudostems.
- Affected plants shows yellowing and withering of leaves,
- It affects the plant vigour, root destruction, reduced fruit production
- Infested plants are easily blown over by the wind.

Identification and life cycle

- Adult female lay eggs singly in small cavities at the base of pseudostem. The eggs are white in colour and elongate to oval in shape.
- Apodous grubs creamy white in colour with red head
- Adult weevils are black in colour with long curved snout.

Management

- Adopt clean cultivation with the suckers pruned periodically and infested clumps are removed and destroyed
- Follow crop rotation with non-host crops like paddy and sugarcane
- Periodical removal of weeds, suckers and infested clumps
- Application of carbofuran 3G @ 40g and neem cake @ 500 g/plant at planting and then at three months after planting.
- Before planting, the suckers should be dipped in 0.1 per cent quinalphos emulsion.
- Use of pheromone trap @ 16 traps /ha
- Application of bio control agents, *Beauveria bassiana* and *Metarhizium anisopliae*, causes more than 90% mortality of the weevils.

Gummy exudation

Extrusion of frass

Photo credit: TNAU Agri tech portal

Banana Pseudostem weevil *Odoiporus longicollis* (Curculionidae: Coleoptera)

Symptoms of damage

- Presence of small pinhead sized holes on the stem.
- Fibrous extrusions from bases of leaf petiole and exudation of a gummy substance from the holes on the pseudostem.
- Rotting occurs and foul odour is emitted due to secondary infection of pathogens.
- When the true stem and peduncle are tunnelled after flowering, the fruits do not develop properly, become dehydrated with premature ripening of the bunch.

Identification and life cycle

- Adult females lay eggs at the cut ends of pseudostem. The eggs are creamy in colour.
- Legless grubs are yellowish white in colour with dark brown head.
- Adults are brownish black in colour.

Management

- After harvesting the bunch, remove the pseudostem from ground level and destroy them.
- Follow crop rotation with non-host crops like paddy and sugarcane
- Periodical removal of weeds, suckers and infested clumps
- Keep longitudinal split Pseudostem traps @ 100/ha for trapping weevils.
- Inject 2ml triazophos solution (350 ml in 150 ml water). Two injections per plant at 2 and 4 feet above the ground level till flowering.
- Longitudinal split stem traps swapped with *Beauveria bassiana* 3ml/100 ml water @ 15 ml/ trap.

Affected plant

Defoliation

Eggs

Larva

Pupa

Banana skipper or leaf roller *Erionota thrax* L. (Hesperiidae: Lepidoptera)

Symptoms of damage

- Caterpillar cuts the leaves at the edges and makes a series of cylindrical rolls
- Heavy infestation can damage the whole banana leaf, leaving only the midrib intact and resulted in smaller bunch size
- Leaf roller shelter is larger in size and easily noticeable in distance

Identification and life cycle

- Adult lay eggs in small groups on the leaves. After emergence, the larvae construct a leaf roll shelter and causing damage
- The caterpillar has a dark head and is covered in white, waxy powder.
- It pupates within the leaf roll shelter

Management

- Mechanical practices such as removal of eggs by clipping off leaves, clipping off leaf rolls and the collection and destruction of larvae, pupae and adults.
- Bird depredators like House crow *Corvus splendens*, Crow pheasant *Centropus sinensis*, White headed babbler *Turdoides affinis* and Indian tree pie *Dendrocitta vagabunda* were found effective in reducing the population.
- Install twigs or poles near the banana plantations so that crows and other birds can come and eat the larvae of the banana skipper.
- Chemical control measures are seldom required, but if the manual removal of the leaf rolls is not possible farmers could mix 4-5 ml of neem oil in a litre of water and spray it on the leaves.

Affected fruits

Severely affected fruits

Predator

Affected leaf

Papaya

Papaya mealybug *Paracoccus marginatus* (Hemiptera: Pseudococcidae)

Symptoms of damage

- Presence of cotton-like masses of mealybug colonies on leaves, stem and fruits.
- Nymphs and adults sucks the sap from leaf, fruit and stem which result in chlorosis, plant stunting, leaf deformation or crinkling, early leaf and fruit drop, and death of plants.
- Development of black sooty mould due to honeydew excreted by the mealybugs which interferes the photosynthesis process of the plants
- Movement of red and black ants indicates the mealybug infestation.
- Heavy infestation leads to the build-up of thick white waxy coating on fruits which make them unfit for consumption.

Identification and life cycle

- Females lay around 100 to 600 eggs. Eggs are greenish yellow and are laid in an ovisac.
- Egg incubation period is about 10 days
- Adult females have no wings and have three instars
- Adult males have four instars

Management

- Periodical monitoring and scouting to early detect the presence of the mealybug
- Pruning of infested branches and burning them
- Removal of weeds/alternate host plants like Hibiscus, Parthenium etc. in and nearby crop
- Avoiding the movement of planting material from infested areas to other areas
- Prevention of the movement of ants and destruction of already existing ant colonies
- Conserve and encourage the native natural enemies which naturally regulating the mealybug populations.
- Under natural condition, the lepidopteran predator, *Spalgis epius* voraciously feeding on various life stages of mealybugs.
- Release of *Acerophagus papayae* @ 100 parasitoids / field / village or block.
- Use of botanical insecticides such as neem oil (1 to 2%), NSKE (5%), or Fish Oil Rosin Soap (25g/litre of water) should be the first choice.

Mites

Webbings

Red spider mite: Tetranychus spp (Acarina: Tetranychidae)

Symptoms of damage

- Presence of webs on the under surface of leaves and fruit peduncle
- Yellow colour spot on the leaves
- Crinkling and curling of leaves
- Fruit scaring reduces the market value of the fruit
- Complete drying of fruiting bodies

Management

- Clean cultivation
- Remove and burn all the affected leaves and plant parts
- Regular monitoring through scouting will help in early diagnosis
- Regular irrigation will help in check the population
- Use Azadirachtin spray 5ml/litre of water
- Use predatory mite *Phytoseiulus persimilis*

Adult

Pupae

Larvae

Affected field

Watermelon

Cucumber moth *Diaphania indica* (Lepidoptera: Pyralidae)

The cucumber moth, *Diaphania indica* (Saunders) (Lepidoptera: Pyralidae), is a polyphagous pest and is particularly serious on cucurbits. It is also known as the cotton caterpillar and pumpkin caterpillar.

Host plants: Muskmelon, cucumber, gherkin, bottle gourd, bitter gourd, snake gourd, watermelon, squash cucumber, pumpkin, bottle gourd, sponge gourd and ridge gourd.

Symptoms of damage

- Young larva scrapes the cholorophyll content and primarily feed on leaves of cucurbitaceous plants
- Presence of webs the leaves and feeds within.
- It also feeds on flowers and bores into developing fruit. It can also feed on and puncture the skin of young fruit, especially the fruits that touch leaves.

Management

- Surveillance and monitoring the pest population and timely diagnosis
- Collection and destruction of early instar caterpillars
- Set up light traps 1/acre to attract adult moths
- Timely and community based approach for the management
- Erection of bird perches (@ 10 / ha) encourages the predation by carnivorous birds.
- Need based application of any one of the bio pesticides based on the ETL
- Spinosad 45 SC at 0.2ml/l
- *Bacillus thuringiensis* 2ml/l
- *Beauveria bassiana* (WP)1.0 x 10^9 conidia/ml @10g/l
- *Metarizhium anisoplie* (Oil based)1.0 x 10^9 conidia/ml @ 0.5 ml

Affected fruit

FAW Larva

Pupae

Female

Male

Fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae)

Damage incidence Fall armyworm *Spodoptera frugiperda* was recorded on watermelon.

Symptoms of damage

- Young larva scrapes the cholorophyll content and primarily feed on leaves of cucurbitaceous plants
- Presence of webs the leaves and feeds within.
- It also feeds on flowers and bores into developing fruit. It can also feed on and puncture the skin of young fruit, especially the fruits that touch leaves.

Management

- Surveillance and monitoring the pest population and timely diagnosis
- Collection and destruction of early instar caterpillars
- Set up light traps 1/acre to attract adult moths
- Timely and community based approach for the management
- Erection of bird perches (@ 10 / ha) encourages the predation by carnivorous birds.
- Installation of pheromone traps @ 5/acre for monitoring of adults
- Need based application of any one of the bio pesticides based on the ETL
- Spinosad 45 SC at 0.2ml/l
- *Bacillus thuringiensis* 2ml/l
- *Beauveria bassiana* (WP)1.0 x 10^9 conidia/ml @10g/l
- *Metarizhium anisoplie* (Oil based)1.0 x 10^9 conidia/ml @ 0.5 ml.
- Apply Azhadirachtin 1% EC @ 10,000 ppm or neem oil @ 5 ml/lit as oviposition deterrent on one week after sowing

Affected leaf

Whiteflies colonies

Guava

Spiraling whitefly: *Aleurodicus dispersus* (Hemiptera: Aleyrodidae)

Symptoms of damage

- Nymphs and adults of the whitefly suck the sap on the under surfaces of the leaflets.
- It also secretes copious amount of honeydew which promotes the development of sooty mould growth that hinders photosynthesis activities of the plant

Management

- Monitoring the population of whiteflies through instalment of yellow sticky traps
- Regular survey and monitoring the pest activities at weekly intervals
- Follow proper spacing and intercultural operations
- Application of recommended doses of fertilizers
- Installation of yellow sticky traps on the palm trunk @ 15 /acre
- Use forced water spray on the lower surface of leaflets to dislodge the adult populations
- Installation of yellow light traps.
- Augment/ conserve the coccinellids and neuropteran predators
- Periodic release of *Dichochrysa* sp. nr. *astur* @ 1000 eggs/ha at 15 days interval
- Foliar application of entomopathogenic fungus, *Isaria fumosorosea* @ 10×2^8 spores/ml (5g/litre of water) at 15 days interval
- Under severe outbreak condition neem oil 1% may be applied
- Starch solution 1% mixed with detergent/ Khadi soap @ 5g/ litre of water may be used to dislodge the sooty mould growth on the leaves

Affected fruit

Mealybug colonies

Custard Apple

Custard mealybugs: *Ferrisia virgate; Maconellicoccus hirstus* (Hemiptera: Pseudococcidae)

Mealy bug species *viz*., Striped mealybug, *Ferrisia virgata* (Cockerell), Pink mealy bug, *Maconellicoccus hirstus* (Green), Citrus mealybug, *Planococcus citri* (Risso), Passion vine mealybug, *Planococcus pacificus* Cox (Hemiptera: Pseudococcidae) and Mango mealybug, *Perissopneumon ferox* Newstead are the major one causing significant fruit yield loss.

Symptoms of damage

- Both nymphs and adults suck the sap through piercing and sucking action.
- It infests fruit stalks, leaves and terminal shoots causing, yellowing and drying symptoms.
- Bugs excretion contains honeydew which encourages the growth of sooty mold on leaves and fruits and also attracts black ants which help in the spread of these mealy bugs.
- The sooty mould also reduces the photosynthetic efficiency of the plant.

Management

- Collection and destruction of all infested plant parts such as leaves, peduncle, twigs and fruits.
- Racking of soil around the tree region during flowering and repeat after one month upto75cm depth.
- Pruning of branches attached to ground and banding of stem bottom with polythene sheet (30 cm wide) pasted with grease would be effective to control further spread.
- Application of 5% neem seed kernal extract or spot application of neem oil 5ml/lit along with detergent 1g/lit on infested parts would arrest further spread.
- Release of *Cryptoleamus montrouzieri* (ladybird beetle) @ 10 Nos./ tree would be effective to predate upon the eggs and nymphs of the mealy bugs.
- Spray biopesticides viz., *Verticillium lecanii* (Potency 2 X 10^8 C.F.U /gm) 10gm/l and *Beauveria bassiana* (Potency 10^8 spores/ml) 10ml/l.

Minor insect pests of custard apple

Fruit fly, *Dacus zonatus* (Diptera: Tephritidae)

Symptoms of damage

- Maggots feed on the fruit flesh causing the fruit to rot.
- Maggot bore into the semi ripened fruits and cause direct damage by puncturing the fruit skin to lay eggs.

Management

- Fly can be controlled by destroying all damaged and fallen fruits and by ploughing round the trees in January and February to kill the pupae.
- Collection of fallen infested fruits and dispose them by dumping in a pit and covering with soil.
- Provide summer ploughing to expose the pupa and monitoring the activity of flies with methyl eugenol sex lure traps would be effective.
- Use bait spray combining any one of the insecticides and molasses or jaggery 10 g/l, fenthion 100EC 1ml/l, dimethoate 30 EC 1 ml/l 2 weeks interval before fruit ripening will reduce the egg laying.

Fruit borer, *Anonaepestis bengalella* (Lepidoptera: Pyraulidae)

Symptoms of damage

- Caterpillar bore into the fruits and making irregular tunnels and damaging mesocarp.
- The presence of excreta of the caterpillars near the entry holes on the affected fruits. The growth of affected fruits is arrested.

Management

- Collect and destroy the damaged fruits.
- Clean cultivation
- Racking of soil around the tree region during flowering and repeat after one month upto75cm depth.


Dichlorvos 76% EC
NUVAN
Methyl Eugenol
Ethanol
insecticides