

III. Integrated Pest Management strategies

The following Good Agricultural Practices should be adopted for the management of various pests of sapota:

- Collect and destroy the mealy bug infested leaves, twigs and fruits.
- Flooding of orchard with water in the month of October kill the eggs.
- Ploughing of orchard in November.
- Avoid plant stresses - healthy plants are much less susceptible to attack
- Release *Cryptolaemus montrouzieri* beetles @ 10/tree or @ 30 larvae/plant twice at 15 days interval.
- The Coccinellid *Menochilus (Chilomenes)* sex maculatus (F) is a predator of the nymphs and adults, and the Hymenopterous parasite *Anaysis alcocki* (Ashm.) *Anagyrus dactylopii* and *Aenasius advena* are three parasitoids on mealy bugs.
- Release of coccinellid *Scymnus coccivora* @ 10 beetles /tree or @ 30 larvae/plant is a good predator of both nymphs and adults.
- Collect fallen infested fruits and destroy them.
- Provide summer ploughing to expose the pupae.
- Immersion of fruits in hot water (45 to 47°C) for 60 minutes to kill eggs and maggots
- Use 10 traps per acre of methyl eugenol.
- Field release of natural enemies *Opius compensates* and *Spalangia philippines*.
- Apply well rotten sheep manure @ 4 t/ acre in two splits or poultry manure in 2 splits
- Control ants and dust which can give the scale a competitive advantage.
- Field release of ladybird beetle.
- Spray dormant oil in late winter before spring.
- Spray horticultural oil, if needed, year round.
- Adopt bagging of fruits.
- Use of braconid parasitoids (*Apanteles* spp.) to parasitize larvae

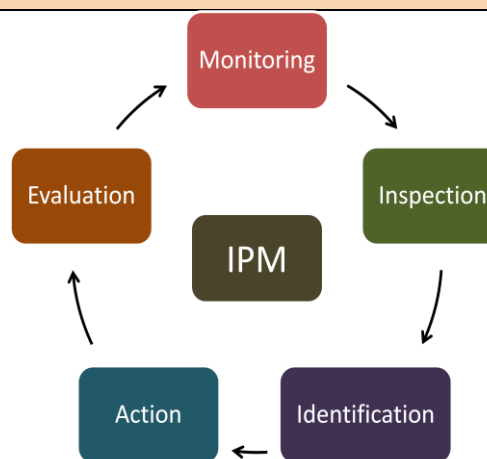


Biodiversity in natural enemies: Parasitoids



Biodiversity in natural enemies: Predators

Important activities for pest free sapota production for export



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Integrated Pest Management (IPM) in Sapota (*Manilkara zapota*) for export purpose



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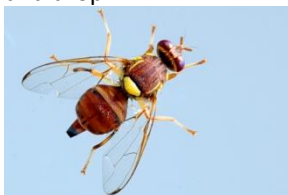
Sapota (*Manilkara zapota*) commonly known as “chiku” belongs to family Sapotaceae. It is an important fruit crop in India. The crop is attacked by more than 25 insect pests and 4-5 diseases which infest the crop from seedling to harvest. Amongst them, Leaf webber (*Nephopteryx eugraphella*), Green scale (*Coccus viridis*), Fruit fly: *Bactrocera* (*Dacus*) *dorsalis*, Bud borer (*Anarsia achrasella*), Striped Mealybug (*Ferrisia virgata*), Mealy bug (*Rastrococcus iceryoides*) and Sapota Seed Borer (*Trymalitis margarias*) are most serious pests from quarantine point of view as these pests may find a place in the pathway of okra fruits export to European Union.

I. Identification of important pests

1) Fruit fly (*Bactrocera zonata*):

Under optimum conditions, a female can lay more than 3,000 eggs during its lifetime, but under field conditions from 1,200 to 1,500 eggs per female is considered to be the usual production. Development from egg to adult under summer conditions requires about 16 days. The mature larva emerges from the fruit, drops to the ground, and forms a tan to dark brown puparium. Pupation occurs in the soil. About nine days are required for attainment of sexual maturity after the adult fly emerges. Adults are brown or dark brown with hyaline wings and yellow legs.

Maggots bore into the semi ripened fruits and feed on the pulp. Affected fruits become shrivelled, deformed, rot and drop.



2) Seed Borer (*Trymalitis margarias*):

Sapota seed borer exclusively feeds on endosperm of the seed. Newly hatched larva enters into the seed through the pulp and feeds exclusively on endosperm of the seed.

Its entry into the seed is seen as streak and later it disappears as the seed hardens. Black larval head capsule is seen in the hole on the cotyledons. Earlier instars are not visible in the seed and could not be detected from outside. Full grown larvae prepare a tunnel to come out from the fruit for pupation. Through this exit hole the fungus as well as ants enters inside the fruits and the fruit becomes unfit for consumption. Due to the infestation of this pest, quality of the fruit deteriorates and hence the market price goes down and farmers also lose their goodwill in the market.



3) Fruit borer (*Heterographis bengalella*):

Eggs are laid singly on immature fruit. Upon hatching, the caterpillar bore into the fruits where they pupate. Fully developed gray to black coloured caterpillars are about 20 mm long. Adults are light brown with transparent wing. Caterpillar makes irregular tunnels and damages the mesocarp by feeding the internal content of the fruits. The presence of excreta of the caterpillars near the entry holes on the affected fruits the growth of affected fruits is arrested and later fall down.



4) Mealy bug (*Rastrococcus iceryoides*):

Pink colour nymphs and adults of the mealy bug are present in colonies on the lower surface of the leaves, inflorescence, branches, fruits and near the fruit stalk. Nymphs and adults suck the cell sap from the leaves and fruits weakening the fruit bearing branches. In case of

severe infestation, the affected leaves turn yellowish and fruiting is reduced.

During feeding, bugs secrete honey dew on which sooty mould develop producing characteristic black coloring on the affected part of the tree.

Insects are oval in shape with pinkish waxy particle on their bodies. All three instars of female and the second instar male possessed a pair of short waxy anal projection.



4) Green scale (*Coccus viridis*):

The adults are elliptical, reddish brown with short anal process. The adult female is reddish which is coated with a thick layer of pinkish-white wax.

Nymphs and adults suck the sap from leaves resulting yellowing of leaves. Nymphs are pale lemon yellow in colour while Adults are green, flat oval soft scale



II. Pest Surveillance

Weekly monitoring should be done through pest scouting with the help of monitoring devices like pheromone and colored sticky traps. For field scouting 300 fruits from 100 plants per acre should be observed. Minimum 15 spots at reasonable distance with each other following a cross diagonal pattern moving zig zag manner for counting all type of insects. Pest monitoring for fruit flies using traps should be done regularly from fruiting stage onwards. If 95% plants are found free from insect pests then the field will be considered fit for export.