UNIT-4

MAJOR INSECT PEST OF AGRONOMICAL CROPS

A. CEREAL CROPS

1. MAJOR INSECT-PESTS OF RICE

a. Rice yellow stem borer (*Scirpophaga incertulas;* Lepidoptera: Pyralidae)

Life cycle:-

Eggs 5-7 days Larva 3-6 weeks Pupa 8-14 days Adult

Damage:

- Caterpillars of yellow stem borer are destructive in nature causing direct damage to plant.
- Eggs are laid on the tip of the leaves. After hatching caterpillar enter into the rice stem after wandering 1-2 hours on rice plant. It feeds on soft part of stem for about a week and hollows out stem completely.
- Damage at vegetative stage causes death of central whorl and symptom is known as **"Dead heart**", while damage at reproductive stage of plant cause the death of emerging panicle known as **"White head".** This could be easily pulled out.


MANAGEMENT:

- Remove the plant having symptoms of dead heart, destroy egg masses and remove infested seedlings from nursery to prevent the population buildup of rice borers in furthergeneration.
- Collect and destroy all the rice stubbles at the time of first plowing after harvesting to prevent incidence of insects to the next year.
- Generally early planting of rice escape from borer infestation.
- Grow rice varieties such as IR-20, Taichung-176, chinung-142, Palung, Khumal-4, Chandina which are moderately resistant to stem borer complex.
- Spray *Bacillus thuringiensis (Bt*) based formulations such as DIPEL or BIOLEP @ 3 g per litre water during evening hours, repeat application at 10 days interval.
- *Trichogramma* can be very effective and economical control as it can eliminate the pest in the egg stage.
- Spray pesticides like Dursban 20% EC (chlorpyrifos) @ 2 ml per liter water three times at 30, 50 and 75 days after transplanting if more than 10% dead hearts appear in the fields or apply Carbofuran @ 1–2 kg a.i per hectare in the rice field.

b. Brown Plant hopper (*Nilaparvata lugens;* Homoptera: Delphacidae)

Excess population causes „**hopper burn**" usually observed in patches of the ripening phase of the crop. It also transmits „**Grassy stunt**" virus disease. Its activities in rice field starts from the middle of August and under favorable environmental conditions of drought.

Life cycle

Eggs 6-9 days Nymph 10-18 days Adult

Damage:-

- BPH sucks cell sap from leaf sheath. Infestation during early stage of plant growth reduces the number of tillers, plant height in general.
- Under severe infestation leaves appear dry and brown. Heavy infestation produce symptoms of **"hopper burn**" i.e. leaves become dry and brown after insect feeding and patches of burned plants are often lodged. The infested crop usually looks sick showing like the deficiency of nitrogen.
- BPH transmits the **grassy stunt, ragged stunt and wilted stunt** viral disease to rice plants. Attack may occur at any stage of the crop but mostly at 70 days old plant.

Managements

- Increasing the spacing of rice transplanting by 20× 15 cm for proper aeration in the field instead of practice of closer spacing (15×10 cm). Closer spacing is favorable for rapid build-up of hopper population.
- Follow alternate drying and wetting of field during peak infestation period and drain out the standing water from the field 2-3 times to create unfavorable conditions for population builds up of hoppers.
- Early planting within a given planting period, particularly in the dry season, reduces the risk of insect-vector disease.
- Crop rotation with a non-rice crop during the dry season decreases alternate hosts for diseases.
- Installation of light trap in the fields for mass trapping of hoppers and other insect-pest.
- Spray Buprofezin 25 EP @ 1g/liter water. Buprofezin is a contact action inhibitor. This has shown an excellent activity against BPH.
- Spray dursban 20% EC (chloropyrifos) @ 2ml/liter water or roger 30% EC @ 1ml/liter water to suppress outbreak of hoppers.

c. Rice Gundhi Bug/ Rice Ear Head Bug (*Leptocorisa oratorius;* Hemiptera: Coreidae)

Life cycle

Eggs 5-8 days Nymph 13-17 days Adult

Damage:

- Both nymph and adult suck cell sap from young shoot, leaves and soft grain by piercing and sucking mouth parts. Bugs generally prefer to attack at milky stage grain. Whitish spot appear at the site of feeding due to exudation.
- Black or brown spot appear around the holes made by bugs on which sooty mould may develop.
- The infested grain becomes discolored. In severe condition, rice field attacked by Gundhi bug emits a repugnant smell which gives to this pest the name **"Gundhi bug".**

Managements

- Removal of weeds and grasses in and out of paddy fields.
- Installation of light trap in the field to attract adult and nymph and kill them.
- Hanging of dirty trap (cattle urine soaked gunny bag or cow dung wrapped cloth) at crop height in field to attract the bug and destroy them.
- Synchronization of planting time in an area helps to reduce the damage in particular location.
- Conservation of natural predators of rice bugs like Tiger beetle.
- Predatory spiders and *Beauveria bassiana* also be useful to lower down its populations.
- Apply Malathion dust 5% @ 8kg/acre, Spray Thiodane (Endosulphan) 35%EC @ 2-3 ml/lit water or carbaryl during morning (upto 8 am) or in the evening time (after 4 pm) at milking stage of crop when 10 bugs per 100 panicles appear in the field.

2. MAJOR INSECTS PEST OF MAIZE

a. **Maize stem borer (*Chilo partellus*; Lepidoptera: Pyralidae)**

Within about a week eggs hatch into larvae which enter into the stem and proceed downwards. Young tender plants die due to the death of main stem whereas in mature plant they also attack on tassel and cobs. Plants are week sometimes may fall in wind. Life cycle completes inside the cobs and stems.

Life cycle

Eggs 4-5 days Larva 16-41 days Pupa 5-8 days Adult

Damage:

- Caterpillars are destructive causing direct damage to plant. A newly hatched larva first feed on leaf sheath which show transparent patches and later on turn yellow-brown and eventually dries up.
- Larvae feed on the soft tissues and make tunnel through the stem. Stems become weak and easily break down.
- Feeding of central part of plant causes **“dead heart”** in vegetative stage while causes **“white ears”** in reproductive stage.

Management:

- Destruction of infested plants as they serve as the carriers fed such to livestock. Do not feed such plants to animals.
- Use granules like Carbofuran inside the stem before they enter. Other tactics for the management of MSB is same as that of apply in rice stem borer

b. **White grubs (*Phyllophaga rugosa*; Coleoptera: Scarabaeidae)**

Larvae are primarily harmful whereas the adult also tear the leaves and attachment portion of maize and other vegetables. Adult lays eggs on grass or on the fresh dung. Upon hatching into the grubs within about 3 weeks they start to feed on the root of maize and grass. Inside soil they can live quite a long period up to 20 months. Pupal period lasts for about 6 months.



Managements

- Removable of weed hosts by cleaning nearby area.
- Do not use fresh dung.
- Apply continuous irrigation and the field is covered with water up to one weak.
- Deep ploughing after harvesting the crop allows exposure of grubs above ground which could be prayed by the bird and other natural enemies.
- Light trap may help monitoring and if we increase the number of traps which may help in trapping out adult population.
- Larvae are effectively controlled using insect‟s pathogenic fungi (*Metarhizium anisopliae*).
- Apply granular insecticide in soil application.

c. **Fall army worm (*Spodoptera frugiperda;* Lepidoptera: Noctuidae)**

Life cycle

Eggs 2-3 days Larva 2-3 weeks Pupa 20-25 days Adult

Nature of damage:

- Larvae cause damage by consuming foliage. Young larvae initially consume leaf tissue from one side, leaving the opposite epidermal layer intact.
- By the second or third instar, larvae begin to make holes in leaves, and eat from the edge of the leaves inward. Older larvae cause extensive defoliation.
- Fall armyworm will feed by burrowing through the husk on the side of the ear.

Managements

- Moth populations can be collected with blacklight traps and pheromone traps. Pheromone traps should be suspended at canopy height. Catches are not necessarily good indicators of density, but indicate the presence of moths in an area.
- Cultural techniques**:** Employed early planting and/or early maturing varieties. Early harvest allows many corn ears to escape the higher armyworm densities that develop later in the season. Reduced tillage seems to have little effect on fall armyworm populations although delayed invasion by moths of fields with extensive crop residue has been observed.
- Biological control**:** Although several pathogens have been shown experimentally to reduce the abundance of fall armyworm larvae in corn, only *Bacillus thuringiensis* presently is feasible, and success depends on having the product on the foliage when the larvae first appear.

- Host plant resistance**:** Partial resistance is present in some sweet corn varieties, but is inadequate for complete protection.

3. MAJOR INSECTS PEST OF WHEAT

However, following pests attack this crop at their different stages.

1. Pink borer, *Sesamia inferens*; Lepidoptra: Noctuidae
2. Wire worm, *Agriotes sp*.; Coleoptera: Elateridae
4. Army worm, *Mythimna separata*; Lepidoptra: Noctuidae
5. Grasshopper, (*Atractomorpha crenulata, Heiroglyphus bannian);* Orthoptera: Aridiidae
7. Common Cutworms*, Agrotis segetum;* Lepidoptera: Noctuidae
8. White grub, *Phyllophaga rugosa;* Coleoptera: Scarabaeidae

B. MAJOR INSECT-PEST OF PULSES/LEGUMINOUS CROP

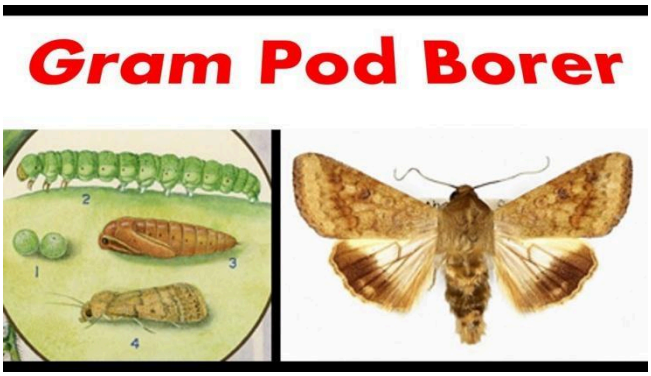
a. Gram pod borer (*Helicoverpa armigera;* Lepidoptera: Noctuidae)

Host:

- Chick pea, Cotton, Pigeon pea, Maize, Tomato, Potato.

Damage:

- Larvae feed on leaves (foliage) in initial stage of plant and after pod formation, larvae feeds on growing pods.
- Larvae make holes on pod and cause huge damage. Pulse grains are damaged largely by pod borers.



Life cycle

Eggs 4-6 days Larva 3-4 days Pupa 1-4 week Adult

Managements

- Follow clean cultivation and remove all the infested fruit from field to reduce the borer incidence and prevent migration of larva from one plant to another.
- Use pheromone trap with Helilure @ 15 traps per hac for mass trapping of adult moth. Lure should be changed once in 15 days.
- Use trap crop like tall and yellow type marigold.
- Spray *Bt.* based formulation like DIPEL or BIOLEP @ 3gm per lit water during evening time at 10 days interval.
- Spray neem based pesticides such as Margosom or Neemarin or Biomultineem @ 5ml per liter water
- Spray Thiodane 35% EC (Endosulfan) @ 1.5ml per liter water before the entry of larva into fruit.

b. Pod bugs (*Riptortus pedestris;* Hemiptera: Coreidae)

Life cycle:

Egg 1 week Nymph 16 days Adult

Damage:

Legume pod bug sucks cell sap from tender stems, pods, seeds and cause various level of damage depending upon the stage of growth of crop. Feeding of bug causes necrosis, pod malformation, premature drying of seeds, shriveling of seeds and loss of germination ability of seed.

Some visible symptoms are:

- Pods with black spots.
- Shedding of green pods.
- Poorly filled pods with shriveled grains inside.
- Loss of germination ability and formation of empty pods.

Managements

- Collect and destroy mature and immature bug manually.
- Application of Neem based pesticide like Margosom.
- Increase the activity of natural predators like ants, assasian bugs and birds to control them
- naturally.
- If application of chemical pesticides needed spray Roger @ 1-2ml/liter water.

c. **Soyabean hairy caterpillar (*Spilarctia casigneta;* Lepidoptera: Arctiidae)**

Life cycle

Eggs 8-13 days Larva 3-4 weeks Pupa 6-7 days Adult

Damage:

- Young larvae feed gregariously on chlorophyll mostly on the under surface of the leaves, due to which the leaves look like brownish-yellow in color.
- In later stages the larvae eat the leaves from the margin and leaves of the plant give an appearance of net or web.

Managements

- Collect and destroy caterpillars manually in small scale.

- Use leaves of Neem, Chinaberry @ 200gm of green leaves soaked for 12-15 hr in 1 liter of water.
- If use of chemical pesticide is needed spray Deltamethrin (0.004%) or Fenvelerate (0.004%).

d. **Pea leaf miner (*Phytomyza horticola;* Diptera: Agromyzidae)**

Host:

- Pea, mustard, potato, tomato, carrot, Berseem, cabbage etc.

Lifecycle

Egg 3-4 days larvae 7-8 days Pupa 1 week Adult

Damage:

- Damage is caused by larvae mining into leaves and petioles. They feed on chlorophyll between epidermis and hypodermis of leaf.
- Due to this, irregular white speckles are seen on leaves. The infested wilts and plant can‟t grow properly.



Managements

- Collect and destroy severely mined leaves.

- Use yellow sticky trap for monitoring and trapping purpose.
- Spray fruit extracts of chinaberry as feeding deterrent to the adults to reduce ovipositions rates.
- Use Roger 30% EC @ 1ml / ltr of water to manage leaf miner fly.
- Spray Nuvan 76%EC @1 ml / ltr water for management of adults.

C. MAJOR INSECTS PEST OF OILSEED CROPS

a. **Painted bug, (*Bagrada hilaris (cruciferarum);* Hemiptera: Pentatonidae)**

Life cycle

Eggs 1 week Nymph 3 weeks Adults

Damage:-

- Both nymph and adult are destructive and cause damage by sucking cell sap from young and tender parts of plant. Infested plant turns yellow and cannot grow further.
- White spots can be seen at the site of feeding. Young plants wilt and wither as a result of the attack. Adult bugs excrete resinous substances which spoils the pods.

Management: (same as other bugs)

b. **Soybean hairy caterpillar: (given in the pulses/ leguminous crops)**

c. **Mustard aphid (Lipaphis erysimi, Aphididae; Homoptera)**

Nature of damage:

- Both nymphs and adults suck cell sap from leaves, stems, inflorescence and the developing pods of plants. Due to the very high population of the pest, the growth of plant greatly reduced.
- The leaves acquire a curly appearance, the flowers fail to form pods formation and not produce healthy seeds.
- The honeydew excreted by the aphids provides congenial conditions for the growth to development of sooty mould on the plant.


Management

- Early sowing of mustard before 15th October will help to escape the attack of the pest and economic damage.
- Use tolerant varieties
- Installation of yellow sticky traps @ 10 traps/ ha .
- Biological control: Ladybird beetles are most efficient predators of the mustard aphid. A single adult beetle may feed an average of 10 to 15 adults/ day
- Botanical pesticides: Foliar spray of Neem oil 2 % and Neem Seed Kernel Extract (NSKE) 5 % effective against the mustard aphid .
- Foliar sprays with 625 ml of oxydemeton methyl (Metasystox) 625 ml of dimethoate (Rogor) 30 EC in 625 litres of water per ha or imidacloprid 0.01% or acetamiprid @ 0.01%.

UNIT- 5

MAJOR INSECTS PEST OF HORTICULTURAL CROPS

A. VEGETABLES

1. COLE CROPS(CABBAGE, CAULIFLOWER, BROCCOLI)

a. Cabbage Butterfly (*Pieris brassicae;* Lepidoptera: Pieridae)

Life cycle:

Eggs 4-6 days (summer) Larva 3-4 week Pupa 2 week Adult

9-10 days (winter)

Damage:

- Larvae cause direct damage to the plant by consuming young leaves.
- Soon after hatching larvae start to scrap the leaf surface whereas subsequent instars eats leaves from margin inwards. In severe condition, larvae may cause defoliation of entire leaves.

Management

- Collect and destroy egg mass and caterpillars in the early stage of attack.

- Follow clean cultivation and remove all alternate hosts.
- Cover fruit bearing plant with insect proof mesh to prevent form egg laying.
- Conserve natural larval parasitoids like *Cotesia glomeratus.*
- Use botanical materials like Garlic, Neem solution which act as repellent or anti-feedant.
- Spray commertial formulation of *Bacillus thuringiensis* @ 2g/lit at primordial stage.
- Spray insecticides like quinalphos 25% EC @ 1000 ml, or cypermethrin 25% EC @
- 200ml/400 lit water per hac at initial seedling stage infestation.

b. **Diamond back moth (*Plutella xylostella*; Lepidoptera: Plutellidae)**

- When at rest the triangular markings of opposite wings gives diamond shape, hence named **"Diamond black moth**"

Life cycle

Eggs 3-6 days Larva 14-21 days Pupa 4-5 days Adult

Symptoms of damage:

- Young caterpillars cause small yellow lines on leaves; they feed by scraping leaf tissue. The infested plant parts get converted into typical white patches.
- Scrapping of epidermal leaf tissues producing typical whitish patches on leaves. Full-grown larvae make bite holes in the leaves and feeds on curd.
- There is formation of undersized curd in cauliflower and head formation does not take place in cabbage in severe infestation.

Management

- Remove and destroy all debris and stubbles after harvest of crop.
- Collect and destroy larvae mechanically in early stage of infestation.

- Grow mustard as trap crop at 2:1 ratio (cabbage: mustard) to attract DBM .
- Intercrop tomato with cabbage to inhibit egg laying by moth.
- Pheromone traps with DBM lure@ 12trap/ha.
- Crop rotation with cucurbits, beans, peas, tomato and melon
- Apply *Bacillus thuringiensis* var *kurstaki* 2g/lit water.
- Use neem seed kernel extract 5% or neem based pesticide @ 5ml/lit water.
- Spray cartap hydrochloride 0.5% at 10, 20 and 30 DAS (nursery) and primordial stage.
- Spray 0.05% solution of Malathion 50% EC @ 2ml/liter water.
- Metacid and Folithion in initial stage of crop and Nuvan and Malathion at harvesting time can be used as a means of short term management.

c. Mustard Aphids (*Lipaphis erysimi*) and Cabbage Aphid (*Brevicoryne brassicae*); Homoptera: Aphididae

Host: Cabbage, radish, tomato, Rape, broccoli

******(damage and management same as mustard aphid in legumes)******

d. **Mustard sawfly (*Athalia lugens proxima*; Hymenoptera: Tenthredinidae)**

Host: -
Mustard, radish, rayo, cabbage, and cauliflower

Life cycle:-

Eggs 5-7 days Larva 4-10 days Pupa 15-23 days Adult

Damage:
- Female lay eggs on underside of leaf singly with the help of its sharp saw like ovipositor.
- Initially the larva nibbles leaves and later it feeds from the margins towards the midrib.
- The grubs are voracious feeder and make numerous shot holes and even riddled the entire leaves.
- They devour the epidermis of the shoot which results in drying up of seedlings and failure to bear seeds in older plants.

Managements
- Deep summer ploughing to destroy the pupa hidden in the soil.
- Early sowing to escape the infestation.
- Maintain clean cultivation and remove all the crop debris and weeds from field.
- Collection and destruction of grubs of saw fly in morning and evening by hand picking in small scale or by any other suitable method.
- Conserve larval parasitoide *Perilissus cingulator*, and the bacterium *Serratia marcescens* which infect the larvae of sawfly.
- Use of bitter gourd seed oil emulsion which act as an anti- feedant.
- Spray the crop with Malathion 50 EC @ 1000 ml/ha or quinolphos 25 EC @ 625ml/ha.

All this should be applied in about 600 to 700 litres of water per ha.

2. INSECTS PEST OF CUCURBITACEOUS CROPS

a. Red Pumpkin beetle (*Aulacophora foveicollis;* Coleoptera: Chrysomelidae)

Life cycle:

Eggs 6-7 days Larva (Grub) 13-25 days Pupa 7-17 days Adult

Nature of damage:

- Both adult and grub are destructive and cause direct damage to plant. The adult insect also feed on older leaves of plant by scrapping off their chlorophyll and thus leading to leaves net like appearance.
- The attacked plants may wither away and photosynthesis is directly affected. The larvae cause damage by boring into the roots and the underground stem portion and also by feeding on the leaves and fruits line in contact with the soil.
- The infested roots and the underground roots may rot due to infection by the saprophytic fungi. The young and smaller fruits of the infested crop may dry up, whereas mature fruits become unfit for human consumption.


Managements

- Collect and destroy of beetles during morning hour in early stage of infection.
- As insects pupate in the soil, deep ploughing should be done to kill grubs and pupae.
- Use Neem oil cake in the soil to kill the larvae.
- Apply pupal parasites such as *Opius fletcheri* and *O. compensans.*
- Soil drenching with contact pesticides like Chlorpyrifos.
- Spray Endosulphan or Malathion @ 2 ml /liter of water for effective control.

b. **Cucurbit Fruit fly (*Bactrocera cucurbitae;* Diptera: Tephritidae)**

Life cycle

Egg 2 days larva 4-9 days pupa 7 -11 days adult

Damage:

- The adult female lay eggs inside the fruits by puncturing it with its sharps ovipositor mostly in evening. The female releases gummy secretion on the puncture which makes the entrance water-proof.
- Within about a week the eggs hatch into the maggots which start to bore the pulp and feed on the pulp of fruits as well as on the immature seeds and cause premature dropping of fruits.
- The attack fruit decay because of secondary bacterial infection and give out foul smell and numerous maggots are seen when cut open.
- The mature larva comes out of the rotten fruits and may bury inside the soil as pupae.

Managements

- Follow clean cultivation, collect and destroy infested fruits.
- Deep ploughing to expose hibernating stages of fly.
- To prevent egg laying by adult, set up fly traps (pheromons trap) in the field with 1% Cue lure or Cintronella oil or Vinegar or Acetic acid or Lactic acid or ammonia liquid or Vanilla or Pollard mixture.
- Cover developing young fruits with paper or polythene cover or muslin cloth.
- Grow Maize plants as trap crop in rows at a distance of 8-10cm in cucurbit field as flies rest on such tall plants.
- Use extract of neem fruit, tobacco or zinger to repel female flies.
- Soil incorporation of Cabaryl 10 % dust can be done in fruit fly endemic areas to control fruit fly.
- Spray Malathion @ 2 ml/litre of water at fortnightly intervals.

c. **Cucurbit stink bug (*Aspongopus janus;* Hemiptera: Pentatomidae)**

Life cycle:

Eggs 3-5 days Nymph 4 weeks Adult

Damage:

- They suck the sap from the leaves and tender shoots and devitalize the plants. Both adult and Nymph cause damage with their piercing and sucking type mouth part.

Managements

- Hand picking of adult and nymph in small scale.
- Predators include; Tachnid fly, *Trichopoda pennipes* that attack older nymphs and adults.
- Use botanical pesticedes like extract of Neem, Bakaino, asuro etc.
- Spray Malathion 50% EC @ 1.5ml/liter water.

3. INSECTS PEST OF SOLANACEOUS CROPS(Potato, Tomato, Chilli, Brinjal)

3.1 INSECTS PEST OF TOMATO

a. Tomato fruit Borer (*Helicoverpa armigera;* Lepidoptera: Noctuidae)

Host:

Tomato, Potato, Pigeon pea, Maize, Cotton

Life cycle

Eggs 4-6 days Larva 3-4 days Pupa 1-4 week Adult

Damage:

- Soon after hatching young larva start feeding by scraping tender foliage, buds and flower. Later on, older larva attack on fruit.
- Larva make circular hole and enter inside the fruit. It feeds on the inner content of fruit and cause damage.

- The infested fruit becomes messy, watery and is filled with skin cast. Fruit ripens prematurely and becomes unfit for consumption. Larval development takes place inside the fruit.

Managements

- Follow clean cultivation and remove all the infested fruit from field to reduce the borer incidence and prevent migration of larva from one plant to another.
- Deep summer ploughing to expose pupal stage and destroy them by natural enemies or dehydrating by scorching sun.
- Use pheromone trap with Helilure @ 15 traps per hac for mass trapping of adult moth. Lure should be changed once in 15 days.
- Intercropping susceptible plant with non-preferred host plants like wheat, coriander, barley etc.
- Use trap crop like yellow type marigold.
- Release of *Trichogramma chilonis* in borer infested field for 6 times
- Spray *Bt.* based formulation like DIPEL or BIOLEP @ 3gm per lit water during evening time at 10 days interval.
- Spray neem based pesticides such as Margosom or Neemarin or Biomultineem @ 5ml per liter water
- Spray Thiodane 35% EC (Endosulfan) @ 1.5ml per liter water before the entry of larva into fruit.

b. **Tomato leaf minor, *Tuta absoluta* Meyrick; Lepidoptera: Gelechiidae**

Life cycle:

Egg 4-7 days larva 11 days Pupa 5 days Adult

Damage:

- Larvae feed the all green tissue of leaves and move toward the fruit.
- The damage caused by the pest can occur throughout the entire growing cycle of the crop affecting not only the leaves but also buds, stem and fruit.
- Heavy infestations result in the death of the whole plant and consequently the entire field.


Managements

- Destruction of infested tomato plants , plant parts and maintain field sanitation.
- Cultural practices such as crop rotation, solarisation, and the elimination of symptomatic leaves.
- Destroy eggs, larvae and pupae in the field to be planted.
- Best practice is to use plastic mulch to help identify and reduce pupation in the soil.
- Perform mass trapping with pheromone and light traps seven (7) days before transplanting to trap Tuta moths in the main field.
- Spray a neem oil or bio-pesticide (*Bt*) as soon as there are >5 Tuta moths trapped per day in any of the pheromone traps.
- Spray chemical pesticide as a last resort rescue operation.

c. Whitefly (*Bemisia tabaci*; Homoptera: Aleyrodidae)

Damage:

- Whiteflies ingest plant juices and in turn produce a sticky substance known as honeydew.
- Honeydew left on its own can cause fungal diseases to form on leaves. Plants will become extremely weak and may be unable to carry out photosynthesis.
- Leaves may dry out and turn yellow, and growth will be stunted.
- Whitefly also transmit virus causing **Yellow mosaic disease and leaf curl virus disease**.

Managements

- Use natural enemies such as spiders, which catch large numbers of adult whiteflies in their webs. Ladybirds, hoverfly and lacewing larvae will also eat whitefly.
- Intercrop non preferred crops such as wheat, barley, with main crop reduce whiteflies infestation.
- Yellow sticky traps should be placed in field to catch adult whitefly.
- Destroy leaves that have large infestations of whitefly larvae since many whitefly adults will still develop and hatch from detached and discarded leaves.
- Encourage insectivorous birds by hanging feeders during the winter months and provide nesting boxes in the spring.
- Spray neem based insecticides such as altineem @3-5 ml/liter water to manage early instar whitefly.
- Spray Roger 30% EC @ 1ml/liter water.

3.2 INSECTS PEST OF POTATO

1. Potato tuber moth (*Phthorimaea operculella;* Lepidoptera: Gelechiidae)

Host:
Potato, Tomato

Life cycle:

Egg 1 week larvae 2 – 3 week pupa 1 week adult

Damage:

- Damage is caused by larvae by tunneling in leaves. The mines have a blotchy appearance, and are often associated with brown and dying bits of tissue.
- One larva makes 3-4 tunnels, gradually filling them with excrement. They create twisting tunnels in fruits and tubers.

- In potatoes, towards the end of the season, the caterpillars move down the plant towards the exposed tubers in the soil.
- Infestation can continue in the potato store room infested potatoes soon become filled with unsightly black tunnels. Larvae can be seen if we cut infested tuber.

Managements

- Controlling alternate weed hosts, clean harvesting of potatoes and careful ridging during and at the end of the growing season.
- Releasing egg-larval parasitoid. *Chelonus blackbumi* at 30,000/ha twice, 40 and 70 days after planting helps in management.
- Seed tubers should be free from PTM infestation.
- Synchronize planting time of potato in localities.
- Practice deep planting of tubers (upto 10cm).
- Harvest tubers before drying or yellowing of plants.
- Spray Roger 30% EC @ 1.5ml/liter water.

b. Red Ants (*Dorylus orientalis;* Hymenoptera: Formicidae)

Host: Potato, Cauliflower, Cabbage, Radish, Carrot, Tree tomato.

Damage:

- Worker ants are responsible for damage in crops. They feed on underground parts of plant like roots, tubers and underground stems.

- Plants infested by red ants wilts, turn yellow and dies because of hindrance in translocation of nutrients and water from underground part to foliage.
- During early infestation, wilting of plant is temporary that occurs during day time and recovers in morning. Permanent wilting occurs in severe infestation.

Managements

- Follow cultural practices like deep ploughing which diturb the ant colony before planting of crop.
- Drench aqueous solution of Azadirachtin @ 100 ml per plant in soil near plant stems.
- Drench soil around plant with 24 hr fermented and diluted cow urine (5 parts water in 1 part urine) mixed with tobacco dust @ 100 ml/plant at tuber initiation stage and repeat treatment after 30 days of first treatment.
- Apply Chloropyrifos 10% G @ 1 kg per 500m2 before planting. Application of Chloropyrifos in soil has been found effective to manage red ants.

3.3 INSECTS PEST OF BRINJAL

a. Brinjal Shoot and Fruit Borer(*Leucinoides orbonalis*; Lepidoptera: Pyralidae)

Life cycle:

Egg 1 week → Larva 12-22 days → Pupa 6-17 days → Adult

Damage:

- Larva is most destructive and bore in to the terminal shoots in young plants, causing withering of terminal shoots.
- Heavy infestation leads to drying of leaves due to boring of petioles, shedding of flower, buds.

- Boring of larvae on fruits causes fruit rotting and loss of yield. Fruits are found with bore holes, holes are filled with larval excreta.

Managements

- Destruction of infested stems, fruits and fallen leaves from the orchard.
- Crop rotation, Solanaceous crop year after year in the same field cause increased infestation.
- Grow location specific eggplant varieties moderately tolerant to EFSB
- Root treatment with imidachloprid solution (1 ml per lit water) before transplanting.
- Grow barrier crops such as maize around the eggplant crop field.
- Install pheromone trap with Lucin-lure for monitoring of male moth. .
- Apply neem cake @ 250 kg per hectare and azadiractin 1% @ 3 ml per litre water at 30 days after transplanting.
- Spray *Bacillus thuringiensis* (*Bt*) based commercial formulations such as DIPEL or BIOLEP @ 3gm per ltr in the evening hours at 10 days interval.
- Soil application with granular insecticides like carbofuran 3G, cartaf hydrochloride 4G.
- Spray chloropyrifos 20%EC

b. Brinjal leaf roller, *Eublemma olivascea*; Lepidoptera: Noctuidae

- Caterpillars roll leaves and feed on chlorophyll while remaining inside the folds. The folded leaves wither and dry up.

Control:

- Collection and destruction of infested leaves along with insects in the initial stage help to minimize the infestation.
- Spraying of Carbaryl (0.1%) or Malathion (0.05%) controls the pest effectively.

3.4 INSECTS PEST OF CHILLLI

a. Chilli thrips, (*Scirtothrips dorsalis*; Thysanoptera: Thripidae)

Lifecycle

Egg 6-8 days larvae 6-8 days pupae 2-3 days adult

A chilli thrips.

Photo from the University of Florida files

Damage:

- Both adult and larvae suck cell sap from leaf and apical buds. Infected part turns brown, leaf curls plants get diseased and growth is checked.

Management

- Field sanitation.
- Collection and destruction of affected plant parts.
- Crop rotation with legumes.
- Use some natural predators of thrips, like predatory mites (*Euseius sojanensis*), predatory thrips *(Frankilothrips vispiformes*).
- Spray malathion 50% EC @ 1 ml / litre water

B. INSECTS PEST OF FRUITS CROP

1. Tropical fruits(Mango, Litchi, Papaya, Banana)

1.1 Insects Pest Of Mango

a. Mango mealy bug (*Drosicha mangiferae;* Homoptera: Pseudococcidae)

Life cycle:

Eggs 2-3 month Nymph 3 month Adult

Damage:

- Both nymph and adult of mealy bug suck cell sap form leaf, young shoots and fruits.
- This results in drying of plant and fruit becomes juiceless. Infected fruit falls and causes heavy loss.
- Mealy bug secrets honey dew and favor the development of sooty mold. This hinders photosynthesis of plant.

Managements

- Nymph can be prevented from crawling up trees by using 8-10 cm wide plastic band with greasy material like castor oil or plastic sheets around the trunk at about 1cm above the ground.
- Dig the soil around the tree trunk to expose the eggs and mix 5% BHC or Chlordane @150-200gm/tree.
- Remove the weeds in the orchard in December to January, especially under tree canopy.
- Spray Sevin 50% wp @ 20gm/10 liter water.

- Spray Metasystox 25% EC @ 10ml/10 liter water.

b. Mango stem borer (*Bactocera rufomaculata;* Coleoptera: Cerembycidae)

Life cycle:

Eggs 1-2 week → Larva (Grub) 3-6 month → Pupa 1-2 month → Adult

Damage:

- Adult female deposits eggs singly on the bark or in crevices in tree trunk. Grub is mainly destructive causing damage to tree with its strong biting type mouth part.
- Grub makes zigzag burrows beneath the bark and tunnel into the trunk of main stem moving upward and feeding on the internal tissues.
- Grub when reach sapwood, the infested stem dies and tree withers away. Adult beetle feeds on the bark of young twigs and petiole.

Managements

- Exclude alternative host trees and remove the infested branches.
- Destroy all the infested plant parts and kill the larvae inside.
- Insert long wire into the hole on tree to kill the larvae and pupa inside.
- Remove the loose bark around the hole and inject 5ml kerosene or petrol with cotton into hole and close the hole with mud.
- Inject 5-10 ml Dichlorovos 76% EC @ 4 ml/liter water into the hole using syringe without needle and seal the hole with clay.

c. Oriental fruit fly, *Bactrocera dorsalis;* Diptera: Tephritidae

****(DAMAGE AND MANAGEMENT SAME AS OTHER FRUITFLY WHICH WE HAVE STUDIDED ABOVE)****

1.2 INSECTS PEST OF BANANA

1. **Banana Rhizome(corm)weevil (*Cosmopolites sordidus*; Coleoptera: Curculionidae)**

Life cycle:

Eggs 7-14 days Larva 4-6 weeks Pupa 1-2 weeks Adult


Damage:

- It damages the rhizome of banana. Adult can live in the rhizome of the banana plant. Sick appearance and yellow lines on the top leaves are early symptoms.
- Where as in advanced stage of infestation, plant show tapering of the stem at crown region, reduction in leaf size, poor bunch formation and choked throat appearance due to grub damage in corms Both grub and adult causes direct damage to plant.
- Grub feeds on rhizome while adult feeds on pseudostem. Then grub bore into pseudostem base and rhizome.
- If tunneling of pseudo stem base and rhizome is severe plant becomes weak and easily topples down against the gust of air.

Managements

- Use healthy suckers for planting.
- Rhizome can be submerged water mixed with insecticide for 2 days before planting is suitable for controlling pest in plant and it prevent new attack of pest.
- Clean the rhizome with a knife to remove pest inside the rhizome.
- Crop sanitation also important to reduced pest population .Remove harvested stems and weeds.
- Keep pheromone (cosmolure) trap @ 5 traps / ha.
- Use healthy, uninfected sucker or rhizomes for planting time. Wash the suckers and dip in a solution of Chlorpyriphos 20 EC @ 2.5 ml/l before planting.

- Soil application of carbofuron@ 20g/plant during 3rd, 5th & 7th month after planting.
- In case of post-planting infestation, spray the pseudostem and drench around the base of the tree with Chlopyriphos 20 EC @ 2.5 ml/l. After one week spray and drench with Malathion 50 EC @ 2 ml/l.

b. Banana leaf and fruit scaring beetle (*Nodostoma viridipennis;* Coleoptera: Chrysomelidae)

Damage:-

- Adult damage the crop mostly. Adult beetles feed on tender leaf and young fruit by scarring the surface.
- Due to feeding of adult several spots appear on leaf and fruit surface. Later on these spots become hole in leaf while reduces the quality of fruit for human consumption.


Managements

- Follow clean cultivation and sanitation in the orchards.
- Deep ploughing of infested field so that eggs, larva and pupa of scarring beetle can be destroyed.
- Wrapping of fruit in small scale by muslin cloth or plastic bag.
- Spray Thiodane 35% EC @ 1ml/liter water or carbaryl (0.1%)

1.3 INSECTS PEST OF LITCHI

a. **Litchi bug (*Tessaratoma papillosa*; Hemiptera: Pentatomidae)**

Life cycle:

Eggs 5-12 days Nymph 25-35 days Adult

Damage:

- Both adults and nymph fed mostly on tender plant parts such as growing buds, leaf petioles, fruit stalks and tender branches of litchi tree.
- Excessive feeding caused drying of growing buds, tender shoots and ultimately fruit drop.
- The bugs when feed on the developing fruit, it causes the fruits to fall a couple of days later.

Managements

- This pest is combated by shaking the trees in winter, collecting and dropping them into kerosene.
- The eggs are in group and visible which can be removed and destroyed.
- There are natural enemies which parasitize 70 to 90 per cent of eggs laid late in the season. The adults are attacked by several fungi, birds and red ants may also be used as biological means of control.
- If chemicals are used, the timing of sprays is critical because the bugs vary in their susceptibility to insecticide at different times of the year, depending on body fat content and its nature. Many of these bugs may be controlled with dimethoate and fenitrothion.

b. **Bark eating caterpillar, *Inderbela spp*; Lepidoptera: Metarbelidae**

1.4 INSECTS PEST OF PAPAYA

a. **Papaya Fruit Fly *(Toxotrypana curvicauda)***
b. **Thrips *(Thrips parvispinus)***
c. **Papaya mealybug *(Paracoccus marginatus Williams)***
d. **Aphids *(Myzus persicae)***

****(MAINTAIN THE NOTE OF THESE INSECTS BY READING ABOVE NOTE)****

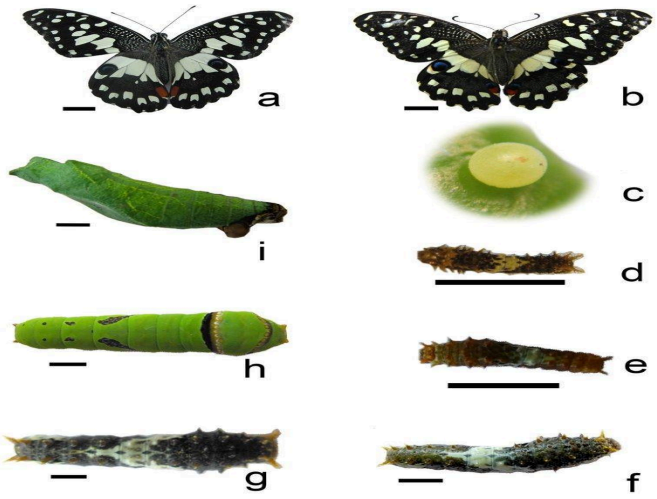
2. INSECTS PEST OF SUB-TROPICAL FRUITS (Citrus, Pomegranate, Kiwi)

2.1 INSECTS PEST OF CITRUS

a. **Lemon Butterlfy (*Papilio demoleus;* Lepidoptera: Papilionidae)**

Life cycle:

Eggs 3-8 days Larva 11-40 days Pupa 12-20 weeks Adult



Damage:

- Larvae are most destructive and soon after hatching they start feeding on young and tender leaves. Young plants are especially damaged heavily.
- When number of larva is high all parts of leaves are eaten away leaving mid rib only.
- Heavily infested plant do not bear fruit, if fruit sets they are of small sized.

Managements

- Hand picking and destruction of larvae in small scale.
- Release egg parasitoides *Trichogramma spp* for biological control of lemon butterfly.
- Apply sevin 50 WP @ 20 mg / 10 litre of water
- Malathion 50 % EC @ 20ml/10 litre of water

b. Citrus leaf miner, *Phyllocnistis citrella;* Lepidoptera: Phyllocnistidae

Life cycle:

Eggs 5-10 days Larva 5-30 days Pupa 5- 25 days Adult

A citrus leafminer caterpillar clearly visible through the top of its mine.

Photo by Jonas Janner Hamann, Universidade Federal de Santa Maria (UFSM), Bugwood.org

Damage:

- After hatching, larvae feed on green materials between epidermis and hypodermis. They make tunnel moving forward and make irregular zig-zag path within leaf lamina.
- Irregular white lining on leaf indicate the larval infestation. Photosynthesis is adversely affected and there is predictable reduction in yield.
- In severe condition, leaf becomes deformed, curls irregularly and finally dries up. Citrus leaf miner helps for development of **citrus canker.**

Managements

- Collect and destroy the infested leaves.
- Pruning of affected plant parts during winter.
- Spray Neem cake solution as repellent.
- Spray Metasystox 25% EC@ 10ml/10liter water.

c. **Citrus Psylla (*Diaphorina citri;* Homoptera: Psyllidae)**

Life cycle:

Eggs 6-20 days Nymph 10-30 days Adult


Damage:

- Both nymphs and adults of citrus psylla suck cell sap from tender and young portion of
- plant like flower bud, twigs, young leaf, tender branches etc.
- It secrets honey dew which favors the development of sooty mold. Photosynthesis of plant is adversely affected.
- Plant becomes dwarf and fruit lacks juice and taste. There is dropping of fruit and leaves. *D. citri* is vector of citrus greening and causes die back.

Managements

- Natural enemies of *D. citri* include Syrphids, Chrysopids, at least 12 species of Coccinellids, and several species of parasitic wasps, the most important of which is *Tamarixia radiata* (Waterston).
- Apply neem oil @ 5ml/liter water.
- Dip root of saplings in 0.1% solution of dichlorvos or fenitrothion just before planting.
- Spray Roger 30% EC @ 2ml/liter water.

2.2 INSECTS PEST OF POMEGRANATE

a. Pomegranate butterfly (*Virachola Isocrates*; Lepidoptera: Lycaenidae)

Life cycle:

Egg 7-10 days larvae 18-47 days pupae 7-34 days Adult

Damage:

- After hatching, bore into fruit and feed upon internal portion, as a result fruit droop.
- Entry hole heals up immediately so symptoms may not appear externally and fruit seems as healthy but inside seeds are eaten.
- Larvae come out by making hole and juice appear at hole, at that time 50% damage occurs in fruit.

Management

- Collect and destroy the infested fruits.
- Wrapping of fruit with the help of muslin cloth or by plastic bags in small scale.
- Spray Sumicidin 20% EC @ 1ml / 2 ltr of water at the time of flowering and fruiting.

b. Fruit sucking moths (*Eudocima fullonica & E. maternal*)

Nature of Damage

- It is only the moths that are destructive to citrus fruits.
- The moths are distinguished by having particularly well developed proboscis with dentate tips with which they are able to pierce the ripening fruits.
- The moths are nocturnal in habit and may be seen flying about in orchards after dusk especially during rainy season.
- The damaged fruits soon start rotting as the punctured regions are easily infected with bacteria and fungi and ultimately the fruits drop prematurely

Management

- Systematic destruction of weed host plants on which the caterpillars feed in the vicinity of orchards helps to check the pest population.
- Bagging of fruits has been suggested in small scale.
- Creating smoke in the orchards after sunset may keep the pest at bay.
- Covering the entire orchard with nylon net followed by spray with contact insecticide has been recommended.
- Spraying oil emulsions once in 10 days to act as a deterrent.
- Poison baiting (20 g malathion 50% W.P. + 200 g jaggery or molasses in 2 L of water) has been found quite affective

2.3 INSECTS PEST OF KIWI

a. Leafrollers

- Leafroller caterpillars are considered minor pests of kiwi, but the pests can take a toll when they feed on the fruit.
- Avoid chemicals, as these may kill beneficial insects, like tachinid flies and parasitic wasps, which prey on leafrollers.
- Bacillus thuringiensis (Bt) is a safe, non-toxic treatment. Pheromone traps are also an effective means of control.

b. Thrips

- These tiny kiwi fruit pests generally don't kill the plant, but they can do their fair share of leaf damage, causing stunted growth when they suck out the succulent plant juices.
- Slender insects with fringed wings, thrips are often kept in check by blasting the affected areas with a strong stream of water.
- Insecticidal soap sprays are usually effective but must be repeated regularly

c. **Boxelder bugs**

3. INSECTS PEST OF TEMPERATE FRUITS (APPLE, GRAPES, STRAWBERRY)

3.1 INSECTS PEST OF APPLE

a. Wooly aphid (*Eriosoma lanigerum;* Homoptera: Aphididae)

Damage:

- Some species feed in groups and cause swellings on bark or roots. Cankers and burs or burls can develop on limbs.
- On roots, nodular masses of gall tissue may form. Foliage-feeding species can cause infested leaves to curl, distort, discolor, or form into galls.
- Some species secrete honeydew, which results in growth of blackish sooty mold.

Managements

- Their numbers are kept low with natural predators like lacewings, ladybugs, hover flies, and parasitic wasps.
- Prune out and destroy infested branches along with aphid colonies.
- Release nymphal parasitoid *Aphelinus mali* to suppress aphid population.
- Dip roots of saplings in 0.1% fenitrothion or dichlorvos solution just before planting.
- Spray Biomite or Ramban @ o.66ml per liter water as foliar spray in apple trees.
- Spray mineral oil such as Agri – SERVO @ 10 – 15 ml per liter water as foliar spray in apple trees.
- Incorporate Disiston 5%G or Thimet 10%G @ 40-50g per plant in the trench around root zone of apple tree to suppress the population of aphid in orchard.

b. **Codling moth (*Cydia pomonella*; Lepidoptera: Noctuidae)**

Life cycle:

Eggs 4-12 days Larva 21-30 days Pupa 8-12 days Adult


Damage:

- After hatching caterpillar bore into fruit and feed on pulp. This reduces both quality and quantity of fruit.
- The caterpillar‟s exit hole is often visible in the side of the ripe fruit or at the 'eye' end (opposite to the stalk)**.**
- When the fruit is cut open, the tunnel and feeding damage inside the core can be seen, together with the caterpillar‟s excrement pellets

Managements

- Use pheromone trap to attract male moth and to kill them @ 2-4 trap/ hac.
- Release pathogenic nematode (*Steinernema carpocapsae*), microscopic worm-like creature that enters the bodies of caterpillars and infects them with a fatal bacterial disease.
- Maintain field sanitation
- Neem based pesticicdes
- Bt based formulations

c. San Jose Scale (*Diaspidiotus perniciosus;* Homoptera: Diaspididae)

Damage:

- San Jose Scales feed by sucking plant juices from twigs, branches, fruit, and foliage. If uncontrolled, they can kill the host tree as well as make the fruit unmarketable.
- Although scales live primarily on the tree bark, the first indication that San Jose Scale is in the orchard may be small red spots on fruit or leaves.
- Yellow spot appear on the leaves, twigs or fruit at the point of feeding.


Managements

- Select planting material from scale free area.
- Encourage building of lady bird beetle population in scale infested area.
- Pruning of infested branches and twigs during dormant period and destroy them.
- Spray mineral oil such as Agri – SERVO @ 10 – 15 ml per liter water as foliar spray in apple trees..
- Dip roots of saplings in 0.1 % solution of dichlorovus just before planting.
- Spray Roger 30% EC (Dimethoate) @ 2ml/liter water.

3.2 INSECTS PEST OF GRAPES

a. Grape Berry Moth

Damage:

- The grape berry moth is the most common and destructive of all grape insect pests.
- Adult moths lay eggs near bloom and the larvae that hatch from these feed on young berries.
- As the berries enlarge, the larvae bore a small hole in the side of the berry and tunnel through the interior, causing the berry to drop early.
- Later in the season, as ripening begins, the wounds caused by berry moth larvae are readily colonized by rot organisms that can then invade and destroy part or all of the fruit cluster.

Management:

- ****Same as other moths studied above****

b. Grape Phylloxera

Damage:

- The leaf galls caused by grape phylloxera are unsightly and do little damage, however, infestation of the roots can be difficult to control and can lead to decline of vines.
- Severe infestations can cause defoliation and reduce shoot growth. Hosts include cultivated and wild grapes.

Management :-

- ******Same as citrus psylla*****

c. **Aphid (Do yourself)**

d. **Mealybug (Do yourself)**

3.3 INSECTS PEST OF STRAWBERRY

a. **Tarnished plant bug (Lygus bugs) *Lygus lineolaris***

Damage

- The piercing-sucking feeding by Lygus bugs are one of the causes of irregularly-shaped, catfaced strawberries.
- The insects damage fruit by puncturing individual seeds; this, in turn, stops development of the berry in the area surrounding the feeding site.
- Straw brown seeds that are large and hollow are a good indication of lygus bug damage.

Management

- Predators that feed on the nymphal stages of lygus bug include bigeyed bugs, *Geocoris* spp., damsel bugs, *Nabis* spp., minute pirate bugs, *Orius tristicolor*, and several species of spiders.
- Control weeds along roadways, ditches, and field borders to help prevent spring buildup of lygus bugs.
- Weed control should be carried out in March and early April while lygus are still nymphs.
- Once adults are present on weeds, they will migrate into strawberries when the weeds are removed.
- Neem based pesticides
- Bt based formulations.
- As chemical roger can be used.

b. Western flower thrips

- Both nymphs and adult thrips can injure the plant by rasping the plant bud, flower, leaf tissues and then sucking the exuding sap.
- Thrips feeding on strawberry blossoms cause the stigmas and anthers to turn brown and wither prematurely, but not before fertilization has occurred.
- With high populations, the surface of the berry may become cracked and discolored

Management:- (*Same as other thrips***)**

C. MAJOR INSECTS PEST OF CUT FLOWERS (Gladiolus, Carnation, Rose, Gerbera, Orchid)

1. Major Insects Pest Of Rose

a. APHIDS (*MACROSIPHUM ROSAE*)

Damage:

- Both nymphs and adults of aphids cause damage by sucking the plant-sap.
- Aphids often colonize and concentrate on tender growing tissues, like terminals and flower buds; they can cause distorted or stunted growth.
- Aphids excrete a sticky substance known as honeydew, which contains large amounts of undigested sugars.
- Honeydew accumulates on leaves and supports a black fungal growth known as sooty mold.

Management:

- There are many naturally occurring factors like predators, parasites, and diseases that help keep aphid populations under check.
- Maintain filed sanitation, destruction weeds.
- When large populations of aphids are detected on terminals or buds, a forceful spray of water to physically wash them off the plant may be effective.
- Neem based pesticides.
- Excessive amounts of nitrogen fertilizers must be avoided as this encourages aphids.

- Dimethoate 30 EC 2 ml/l or imidacloprid 0.5 ml/l can be sprayed to reduce the aphid populations.

b. WHITEFLIES (*Bemisia tabaci*)

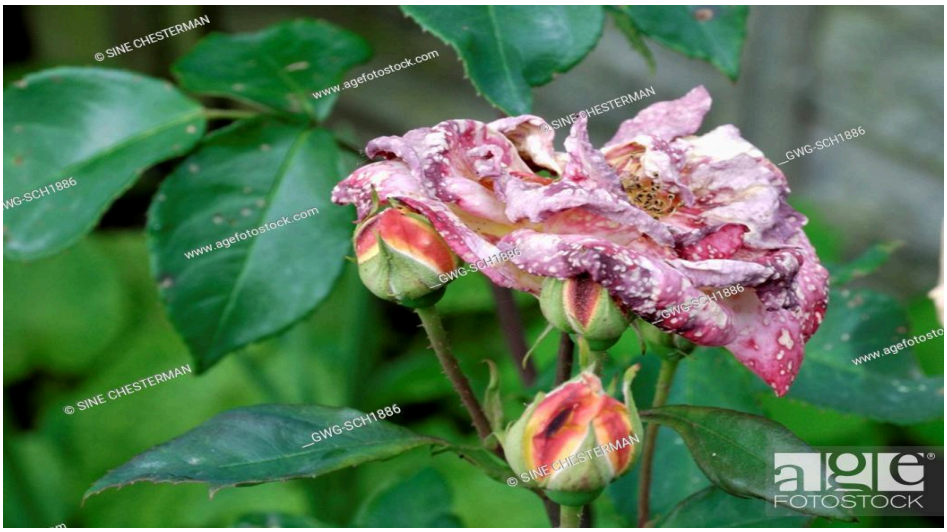

Damage:

- Like aphids and thrips, whiteflies suck plant sap from rose plants, because of continuous sucking light yellow patches that appear on leaves and tender plant parts.
- They have a tendency to build to high populations and their ability to produce large amounts of honeydew, which eventually results in a sooty mold that imparts black color to the plant

Management:

- Unnecessary insecticide treatments, which can disrupt natural biological control can be avoided.
- Excessive amounts of nitrogen fertilizers can be avoided as this encourages whitefly populations and increase the cost of cultivation.
- Yellow sticky traps can be used at the rate of 4 per acre in order to attract the whiteflies.
- Dimethoate 30 EC 2 ml/l or imidacloprid 0.5 ml/l or thiamethoxam 25 WDG 0.3 g/l can be sprayed for quick reduction in the pest population.

c. THRIPS: (*RHIPIPHOROTHRIPS CRUENTATUS HOOD)*



Damage:

- On roses, thrips (both nymphs and adults) cause damage mainly by feeding on flowers. Thrips injury reduces the aesthetic value of the rose blooms, and severe infestations can prevent buds from opening.
- The feeding injury results in silvery or bleached damaged areas, on flower petals, that eventually turn brown and dry up.
- Because feeding is often concentrated on young, actively growing tissues, petals, and leaves are often crinkled or distorted.

Management:

- Excessive amounts of nitrogen fertilizers should be avoided as this encourages thrips populations.
- Blue sticky traps at the rate of 4 per acre may be placed in order to attract the thrips and kill them.
- Acephate 75 SP 1.5 g/l or imidacloprid 0.5 ml/l or thiamethoxam 25 WDG 0.3 g/lt can be sprayed for rapid recovery of damaged plant parts.
- Spinosad is one of the more effective foliar treatments for thrips control on roses.

2. Major insects pest of gladiolus

a. Thrips (*Taeniothrips simplex*):

Gladiolus flowers damaged by gladiolus thrips.
Photo by J. R. Baker, NC State University

Damage

- Nymphs and black adults damage leaves and spikes. Affected leaves and spikes develop silver streaks, turn brown, get deformed and dry if damage is severe.
- Attack on young plants reduces flower production. The pest also attacks corms under storage.
- Infected corms become sticky, shrivel and produce weak plants when planted.

Management

- Field sanitation, destruction of weeds.
- Neem based pesticides
- Bt based formulations.
- Spraying of Methyl Demeton 25EC or Dimethoate 30EC @2ml/litre of water at 10 days interval provides significant control of thrips.
- Storing of infested corms at 2OC for 6 weeks and later treating them with hot water at 46OC completely kills the thrips on gladiolus corms.

b. Cut Worms *(Agrotis segetum):*

Damage

- The pest attacks mainly the newly planted gladiolus plants. Hatched larvae feed during nights on emerging shoots.

- Grown up larvae, which are clay coloured, cut the plants at ground level. Plants are vulnerable to attack upto 3rd leaf stage.
- They also damage underground corms and developing spikes.

Control:

- Ploughing during summer exposes the pupae to predators.
- Poison bait consisting of Carbaryl or Malathion @ 0.1%, wheat bran and molasses scattered in the field effectively controls the larvae.
- Sprays of Methyl Parathion @0.05% or Quinalphos @0.05% provides protection to foliage from cutworms

c. **Leaf Eating Caterpillar** *(Spodoptera litura):*

Damage

- This caterpillar mainly damages foliage of gladiolus plants.
- The young larvae feed on lower surface of leaves by scraping while greenish-brown mature larvae feed voraciously during nights on these leaves.

Control:

- Collection and destruction of egg masses and leaves infested with young larvae reduce pest build up.
- Setting up of light traps attracts adult moths and helps in monitoring pest population. Deep ploughing in summer exposes pupae to predators.

- Spraying of Quinalphos @0.05% or Carbaryl @0.1% or Chlorpyriphos @0.05% gives protection to foliage from the leaf-eating caterpillar.


3. Major insects pest of carnation

a. **Mites (***Tetranychus urticae*)


Damage:

- Both the nymph and adult suck the sap from undersurface of the leaves and affected leaves turns pale and have dusty coating and fine web.
- In severe attack, the plant growth become stunted.

Management

- When the density of mites reaches 1/leaf, initiate management measures.
- Straight and flat leaved varieties are resistant to pest.

- Manage proper aeration/ventilation.
- Discard plant and leaf debris.
- Spray azardiractin 3ml/lit of water.
- Spray dicofol @ 2ml/lit. of water.

b. Borer (*Helicoverpa armigera)*


Damage:

- The larva feed on leaves, flower buds and flowers. They make round holes in buds and flower heads.
- The infested bud fails to open. Attack of this pest is more during warm condition.

Management

- Use spodolure and helilure as pheromone trap.
- Collect and destroy larva.
- Spray neem based pesticides.
- Spray cypermethrin @ 1.5ml/lit. of water.

c. Thrips

*****(same as rose)*****

4. INSECTS PEST OF GERBERA

a. Aphids

Damage

- Feeding by these pests can cause leaf curling, yellowing and distortion.
- Aphids also excrete a sticky sweet substance known as honeydew that hosts the development of unsightly sooty mold and attracts ants.

Management

- Avoiding the use of excessive or fast-release nitrogen fertilizer,
- Keeping nearby areas free of weeds,
- Avoiding the use of broad-spectrum insecticides and controlling ants all help to limit aphid problems.
- Where aphids are present, spraying the Gerberas with a strong spray of water
- Pruning of heavily infested leaves and if necessary
- Applying an insecticidal soap or narrow-range horticultural oil offer control.

b. Mites

Damage

- Multiple types of mites, including spider, broad and cyclamen mites, can feed on Gerberas. Spider mites look like tiny moving dots to the naked eye, while the others cannot be seen without a microscope.

- Spider mite damage appears as a stippling and bronzing or yellowing of leaves and premature leaf drop. Feeding by the other mites shows as distorted or dwarfed leaves and foliage.

Management

- Providing the daisies with adequate irrigation
- Avoiding the use of broad-spectrum pesticides
- Isolating infested plants away from healthy ones are viable control techniques.

5. INSECTS PEST OF ORCHID

a. Scale insect

Damage

- Scale are sucking insects that attach to and feed on the underside of leaves, in leaf axils, on pseudobulbs and on rhizomes.
- They often are hidden under old leaves and pseudobulb sheaths.
- Severe infestations cause chlorotic areas to appear on the leaves and plant surfaces which will yellow and may darken and can cause the leaf to drop prematurely.

Management

- Maintain field sanitation, removing of weeds.
- Use of resistant varieties
- Use of neem based pesticides
- Use of bt based formulation.
- Spray isopropyl or imidacloprid @ 1.2-2 ml/lit. of water.

b. Mealybug (same as studied above)

c. Thrips (same as studied above)

**********THANK YOU**********