AEN 302

PESTS OF HORTICULTURAL CROPS AND STORED PRODUCES AND THEIR MANAGEMENT - (1+1)

(2017 Syllabus)

Practical Manual Cum Record

Dr. L. N. NISHA

Dr. M. AYYAMPERUMAL

Department of Agricultural Entomology
SRS Institute of Agriculture and Technology
Vedasandur- Dindigul District

2023

SRS INSTITUTE OF AGRICULTURE AND TECHNOLOGY

(Affiliated to Tamilnadu Agricultural University)

CERTIFICATE

Certified that this is the *bonafide* record Miss/Mr. _____ Id.No. _____ of III Year B.Sc. (Hons.) Agriculture for the course AEN 302- PESTS OF HORTICULTURAL CROPS AND STORED PRODUCES AND THEIR MANAGEMENT (1+1) offered during the VI Semester of_____

Course Teacher **External Examiner**

INDEX

Name:_____ **I.D. No.** _____

Ex. No.	Date	Title	Date of submission	Signature
1.		Pests of Brinjal, Bhendi and Tomato		
2.		Pests of Chillies, Onion, Garlic, Moringa and Amaranthus		
3.		Pests of Crucifers and Cucurbits		
4.		Pests of Mango, Citrus and Sapota		
5.		Pests of Banana, Grapevine and Guava		
6.		Pests of Pomegranate, Aonla and Papaya		
7.		Pests of Jack, Pine apple, Custard apple, Ber and Apple		
8.		Pests of Potato, Sweet potato, Tapioca, Yam and Colocasia		
9.		Pests of Coconut and Arecanut		
10.		Pests of Coffee and Tea		
11.		Pests of Cashew, Cocoa and Betelvine		
12.		Pests of Turmeric, Ginger and Coriander		
13.		Pests of Cardamom, Pepper, Curry leaf and Tamarind		
14.		Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers		
15.		Pests of Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna and Periwinkle		
16.		Pests of Lawn and stored products		

Ex.No.1 **PESTS OF BRINJAL, BHENDI AND TOMATO**

Date:

BRINJAL

1.	Shoot and fruit borer	*Leucinodes orbonalis*	Crambidae	Lepidoptera
2.	Stemborer	*Euzophera perticella*	Pyralidae	Lepidoptera
3.	Hadda / spotted beetle	*Henosepilachna dodecastigma, H. vigintioctopunctata*, *H. demurille*, *H.* implicata	Coccinellidae	Coleoptera
4.	Ash weevils	*Myllocerus subfasciatus*, *M. discolor*, *M. viridanus, M. maculosus*	Curculionidae	Coleoptera
5.	Brown leafhopper	*Cestius phycitis (Hishimonas phycitis)*	Cicadellidae	Hemiptera
6.	Aphid	*Aphis gossypii*	Aphididae	Hemiptera
7	Lacewing bug	*Urentius hystricellus*	Tingidae	Hemiptera
8.	Leafhopper	*Amrasca devastans*	Cicadellidae	Hemiptera
9.	Mealy bug	*Coccidohystrix insolitus*	Pseudococcidae	Hemiptera
10.	Pod bug	*Anoplecnemis phasiana*	Coreidae	Hemiptera
11.	Cow bug	*Tricentrus bicolor*	Membracidae	Hemiptera
12.	Thrips	*Thrips tabaci*, *Frankliniella schultzei*, *Scirtothrips dorsalis*	Thripidae	Thysanoptera
13.	Hard Scales	*Aonidiella aurantii, Aspidiotus destructor*	Diaspididae	Hemiptera
14.	Soft scale	*Parasaissetia nigra*	Coccidae	Hemiptera
15.	Whitefly	*Bemisia tabaci*, *Aleurodicus dispersus*	Aleyrodidae	Hemiptera
16.	Spider mite	*Tetranychus cinnabarinus*	Tetranychidae	Acari
17.	Budworm	*Scrobipalpa (Phthorimaea) blapsigona*	Gelechiidae	Lepidoptera
18.	Leaf roller	*Antoba olivacea*	Noctuidae	Lepidoptera
19.	Leaf webber	*Herpetogramma bipunctalis*	Pyralidae	Lepidoptera
20.	Sphingid	*Acherontia styx, A. lachesis*	Sphingidae	Lepidoptera
21.	Leaf Miner	*Scrobipalpa blapsigona*	Gelechiidae	Lepidoptera
22.	Hairy caterpillar	*Selepa celtis*	Noctuidae	Lepidoptera
23.	Grasshoppers	*Atractomorpha crenulata*, *Oxya japonica*, *Poekilocerus pictus*	Acrididae	Orthoptera
24.	Termite	*Trinervitermes biformis, Microtermes* sp	Termitidae	Isoptera

I BORERS

1. Shoot and fruit borer, *Leucinodes orbonalis*; F: Crambidae; O: Lepidoptera

General symptoms of damage are withered terminal shoots, bore holes on shoots plugged with excreta, shedding of flower buds, drying of leaves due to boring on petioles by larvae. Larva is pink in colour. Adult is medium sized moth with forewings having black and brown patches and dots. Hind wings are opalescent with black dots.

2. Stem borer, *Euzophera perticella*; F: Pyralidae; O: Lepidoptera

Stunted growth, withering and wilting of plants. Bore holes on stem and leaf axils are covered with excreta. Infestation is caused by larva. Larva is yellowish or light brown with red head. Moth is greyish brown, forewings with transverse lines and white hindwings.

II LEAF FEEDERS

3. **Spotted beetle (or) Hadda beetle,** *Henosepilachna vigintioctopunctata, H. demurille, H. implicata;* F: Coccinellidae; O: Coleoptera

Both grubs and adults feed by scrapping chlorophyll from epidermal layers of leaves which get skeletonized and gradually dry up. Grub is yellowish in colour and stout with spines all over the body. Adult is spherical, pale brown and mottled with black spots (6 or 14) on each elytra.

4. Ash weevils, *Myllocerus* sp.; F: Curculionidae; O: Coleoptera

Adults cause notching of leaf margins. Grubs feed on roots resulting in wilting of plants. Grub is small, apodous and white in colour. Adult: *M. subfasciatus*: Brown; M. *discolor*: Brown with white spots; *M. viridanus*: Small light green weevil

III. SAP FEEDERS

5. Brown leafhopper, *Cestius phycitis (Hishimonas phycitis)*; F: Cicadellidae; O: Hemiptera

Small light brown leafhopper. Both nymphs and adults suck plant sap and serve as vector of little leaf disease.

6. Aphid, *Aphis gossypii*; F: Aphididae; O: Hemiptera

Both nymphs and adults suck the sap and cause stunted growth, gradual drying resulting in death of the plants. Development of black sooty mould due to the excretion of honey dew. The aphids are greenish brown, soft bodied and small insects. The alate as well as apterous females multiply parthenogenitically and viviparously. A single female may produce 8-22 nymphs in a day which become adults in about 7-9 days. They are often attended by ants for the sweet honey dew secretion. Winged forms may be seen under crowded conditions.

7. Lacewing bug, *Urentius hystricellus*; F: Tingidae; O: Hemiptera

Nymphs and adults suck the sap from leaves resulting in yellowing. Affected leaves are covered with exuviae and excreta. Adult is straw coloured dorsally and dark brown to blackish ventrally. Pronotum and the forewings are reticulate.

BHENDI

1.	Shoot and fruit borer	*Earias vittella*, *E. insulana*	Nolidae	Lepidoptera
2.	Fruit borer	*Helicoverpa armigera*	Noctuidae	Lepidoptera
3.	Leaf roller	*Sylepta derogata*	Crambidae	Lepidoptera
4.	Semiloopers	*Anomis flava*, *Xanthodes graellsii*, *Tarache nitidula*	Noctuidae	Lepidoptera
5.	Jassids	*Amrasca devastans*	Cicadellidae	Hemiptera
6.	Aphid	*Aphis gossypii*	Aphididae	Hemiptera
7	Whitefly	*Bemisia tabaci*	Aleyrodidae	Hemiptera
8.	Red spider mite	*Tetranychus urticae*	Tetranychidae	Acari
9.	Stem weevil	*Pempherulus affinis*	Curculionidae	Coleoptera
10.	Shoot weevil	*Alcidodes affaber*	Curculionidae	Coleoptera
11.	Pod fly	*Melanagromyza obtusa*	Agromyzidae	Diptera
12.	Grasshoppers	*Poekilocerus pictus*, *Oxya japonica*	Acrididae	Orthoptera

13.	Aphid	*Aphis gossypii*	Aphididae	Hemiptera
14.	Red cotton bug	*Dysdercus koenigii*	Pyrrhocoridae	Hemiptera
15.	Dusky cotton bug	*Oxycarenus hyalinipennis*	Lygaeidae	Hemiptera
16.	Mealy bug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
17.	Soft scale	*Saissetia coffeae*, *Parasaissetia nigra*	Coccidae Diaspididae	Hemiptera
18.	Leaf weevil	*Myllocerus* sp.	Curculionidae	Coleoptera
19.	Leaf miner	*Trachys herilla*	Buprestidae	Coleoptera
20.	Chafer beetle	*Oxycetonia versicolor*	Cetonidae	Coleoptera
21.	Blister beetle	*Mylabris pustulata*	Meloidae	Coleoptera

BORERS

1. Shoot and fruit borer

Spotted bollworm, *Earias vittella*; F: Noliidae; O: Lepidoptera

Spiny bollworm, *Earias insulana*; F: Nolidae; O: Lepidoptera

The symptoms of attack are terminal shoots wither and droop, shedding of buds, flowers fruits eaten and seeds discoloured. The larva of *E. vittella* is chocolate brown with dorsum showing a white median longitudinal streak. In *E. insulana*: the last 2 thoracic segments and all the abdominal segments have two pairs of fleshy tubercles. Adults of *E. vittella* are buff coloured small moth, forewings buff coloured with a green wedge in the middle. Adults of *E. insulana* are buff coloured small moths and the forewings are uniformly green.

2. Bhendi fruit borer*, Helicoverpa armigera*; F: Noctuidae; O: Lepidoptera

The larvae cause regular circular boreholes on fruits, presence of granular faecal pellets outside the bore hole. Larva is seen hanging in the borehole with head and part of the abdomen thrust inside fruit. The larva is stout, light pink caterpillar and the adults are pale brown with yellow marking on forewings and white hindwings.

DEFOLIATORS

1. Leaf roller, *Sylepta derogata*; F: Crambidae; O: Lepidoptera

Leaves rolled in the form of trumpets and fastened by silken threads, defoliation. The larva is green, glistening with dark head and prothoracic shield. The adults are medium sized, yellowish wings with brown wavy markings.

2. Semiloopers: *Anomis flava, Xanthodes graellsii, Tarache nitidula*; F: Noctuidae; O: Lepidoptera

The larva causes defoliation leaving only the midribs. The larva of *A. flava* is green with five white longitudinal lines and red prolegs; *X.graellsii* - Green with a pair of horse-shoe shaped black mark on each segment and black warts on the abdomen; *T.nitidula* – Dark brown caterpillar. Adults of *A.flava* is medium sized, brown moth; forewings reddish-brown provided with dark coloured zig-zag bands. Hindwings are light brown; *X.graellsii* – yellowish with a brown streak; *T.nitidula* - Stout and white moth with black spots.

SUCKING PESTS

1. Leafhopper / Jassid, *Amrasca devastans*; F: Cicadellidae; O: Hemiptera

Nymphs and adults suck the sap and cause yellowing of leaves, crinkling, backward curling of leaves, bronzing and hopper burn. Plants become stunted. Nymphs are light green, translucent, wingless and wedge shaped and adults are slender green and wedge shaped insects.

2. Aphid, *Aphis gossypii*; F: Aphididae; O: Hemiptera

Due to aphids damage, the young plants become weak, leaf curl up and wither. Adults are soft, yellow, exist both in winged and wingless forms. Both forms reproduce parthenogenetically and are viviparous.

3. Whitefly, *Bemisia tabaci*; F: Aleyrodidae; O: Hemiptera

Nymphs and adults suck the sap and cause yellowing and curling of leaves. Plants become stutnted. Secrete honeydew which lead to sooty mould formation. Nymphs are oval and greenish yellow. Adults are minute with yellow body and hyaline wings dusted with a waxy powder. It transmits yellow vein clearing mosaic virus (YVMV).

4. Red spider mite *Tetranychus urticae* (Tetranychidae: Acari)

Nymphs and adults feed on ventral leaf surface, under protective cover of fine silken webs. As a result of their feeding numerous yellow spots appear on dorsal surface of leaves. Affected leaves gradually start curling, finally wrinkled and crumpled.

Adult: Ovate, reddish brown.

TOMATO

1.	Fruit borer	*Helicoverpa armigera*	Noctuidae	Lepidoptera
2.	South American tomato pinworm/ tomato leaf miner	*Tuta absoluta*	Gelechiidae	Lepidoptera
3.	Serpentine leaf miner	*Liriomyza trifolii*	Agromyzidae	Diptera
4.	Leaf eating caterpillar	*Spodoptera litura*	Noctuidae	Lepidoptera
5.	Whitefly	*Bemisia tabaci*	Aleyrodidae	Hemiptera
6.	Thrips	*Thrips tabaci*, *Frankliniella schultzi*	Thripidae	Thysanoptera
7.	Fruit sucking moth	*Eudocima (Othreis) materna* *E.phalonia* *E.homaena*	Noctuidae	Lepidoptera
8.	Spotted leaf beetle	*Henosepilachna vigintioctopunctata*	Coccinellidae	Coleoptera
9.	Cabbage green semilooper	*Trichoplusia ni*	Noctuidae	Lepidoptera
10.	Aphid	*Aphis gossypii*, *Myzus persicae*	Aphididae	Hemiptera
11.	Leaf hopper	*Amrasca devastans*	Cicadellidae	Homoptera
12.	Stem borer	*Euzophera perticella*, *Phthorimaea operculella*	Pyralidae Gelechiidae	Lepidoptera Lepidoptera
13	Red spider mite	*Tetranychus urticae*	Tetranychidae	Acarina

I BORER

1. Fruit Borer, *Helicoverpa armigera*; F: Noctuidae; O: Lepidoptera

Young larva feeds on tender foliage and from fourth instar onwards infests fruits. They make circular holes and thrust only a part of their body inside fruit and eat inner contents. Young larva is yellowish white but gradually becomes green. Full-grown larva is apple green in colour with white and dark grey-brown longitudinal lines and sparse short hairs. Adult is a light brown and medium sized moth with dull black border.

II. LEAF FEEDER

2. South American tomato pinworm/ tomato leaf miner, *Tuta absoluta,* F: Gelechiidae O: Lepidoptera

Larvae feed on leaves, stems, buds, calyces, young fruit or ripe fruit. Freshly hatched larvae are light yellow or green and only 0.5 mm in length. As they mature, larvae develop a darker green color and a characteristic dark band posterior to the head capsule. The adults are silvery brown, 5-7 mm long.

3. Serpentine leaf miner, *Liriomyza trifolii*; F: Agromyzidae; O: Diptera

Leaves are often with serpentine mines followed by drying and dropping of leaves due to infestation. Larva is orange yellowish and apodous. Adult is pale yellow fly.

4. Leaf eating caterpillar, *Spodoptera litura;* F: Noctuidae; O: Lepidoptera

The first instar larvae feed gregariously on the leaf by scrapping the epidermal layer, leaving the skeleton of veins. The skeletonized leaf may dry up. Then, the larvae move to other leaves and feed voraciously. Larvae also feed on young fruits.

Larva: Pale greenish with dark markings; yellow and purplish spots in the sub marginal areas; gregarious in the early stages.

Adult: Moth with wavy white markings on the brown forewings. Hindwings are white with a brown patch along the margin.

III. SUCKING PESTS

5. Whitefly, *Bemisia tabaci*; F: Aleyrodidae; O: Hemiptera

Nymphs and adults suck the sap and cause white chlorotic spots on leaves. Nymphs and adults secrete honeydew, which lead to sooty mould formation. Nymphs are oval and greenish yellow. Adults are minute with yellow body and hyaline wings dusted with a waxy powder.

6. Thrips: *Thrips tabaci*, *Frankliniella schultzi;* F: Thripidae; O: Thysanoptera

Both nymph and adult lacerate the tissue and suck the sap from the upper and lower surface of leaves and in cases of severe infestation they curl up and become crumpled. Silvery patches on the lower surface of leaves can be seen in early stages of attack.

Frankliniella schultzi - Vector of Tomato Spotted Wilt Virus.

Adults are small, slender, yellowish to brown with fringed wings and drift away on disturbance. Nymphs are very minute, slender, yellowish and microscopic.

7. Fruit sucking moths, *Eudocima (Othreis) materna, E. phalonia, E.homaena* F:Noctuidae; O: Lepidoptera

Adults suck the juice by piercing the fruits. Infested fruits will shrink, shrivel, rot and ultimately drop down, causing direct loss to harvestable produce. Larva feeds on the leaves of the creeper weed *Tinospora cardifolia* and *Cocculus* sp.

Larva: Semilooper with orange blue and yellow spots on velvetty dark speckled body. Moth: Stout built; with grey and orange coloured wings. *E. materna*: Three black spots on forewings and circular marking on hind wing. *E. phalonia*: Tripod black mark on the forewings and curved marking on the hind wings. *E.homaena:* Green stripe on the forewings and curved marking on the hind wings.

Ex.No.2. PESTS OF CHILLIES, ONION, GARLIC, MORINGA AND AMARANTHUS
Date:

CHILLIES

1.	Chilli thrips	*Scirtothrips dorsalis*	Thripidae	Thysanoptera
2.	Aphid	*Aphis gossypii*, *Myzus persicae*	Aphididae	Hemiptera
3.	Muranai mite/ Broad mite/ yellow mite	*Polyphagotarsonemus latus*	Tarsonemidae	Acarina
4.	Tobacco caterpillar	*Spodoptera litura*	Noctuidae	Lepidoptera
5.	Fruit borer	*Helicoverpa armigera*	Noctuidae	Lepidoptera
6.	Stem borer	*Euzophera perticella*	Phycitidae	Lepidoptera
7.	Cut worm	*Agrotis ipsilon*	Noctuidae	Lepidoptera

1. Chilli thrips, *Scirtothrips dorsalis;* F: Thripidae; O: Thysanoptera

Leaves become crinkled, curled upward and shed. Buds become brittle and drop down. Plants get stunted and bronzed. Nymphs and adults are tiny, slender, fragile and straw yellow in colour.

2. Green peach aphid, *Myzus persicae*; F: Aphididae; O: Hemiptera

Leaves get curled and crinkled coated with honeydew and sooty mould. Plants remain stunted. Adult is green in colour.

Aphis gossypii also attack which is yellow in colour.

3. Muranai mite, *Polyphagotarsonemus latus*, F: Tarsonemidae; O: Acarina

Down ward curling and crinkling of leaves due to sucking of sap by nymphs and adults followed by development of blister patches and petiole elongation. Adult is tiny, oval, glossy or whitish mite.

4. Tobacco caterpillar, *Spodoptera litura*; F: Noctuidae; O: Lepidoptera

Young larvae scrap the leaves on ventral side. Grown-up caterpillar completely defoliates. Larvae also feed on young fruits. Larva is pale greenish brown with dark markings. Yellow and purplish spots are seen on the submarginal areas. Adult is stout moth with wavy white markings on the brown forewings and white hindwings are having a brown patch along its margin.

5. Fruit borer, *Helicoverpa armigera*; F: Noctuidae; O: Lepidoptera

Young larvae feed on tender foliage and from fourth instar onwards attacks fruits. They bore circular holes and thrust only a part of their body inside fruit and eat inner contents. Freshly hatched larva is yellowish white but gradually become green. Full-grown larva is apple green in colour with white and dark grey-brown longitudinal lines and sparse short hairs. Adult is light brown and medium sized moth with dull black border.

6. Stem borer, *Euzophera perticella*; F: Phycitidae; O: Lepidoptera

Stunted growth, withering and wilting of plants, stem and leaf axils covered with excreta covering bore holes are the infestation caused by the larvae. Larva is yellowish or light brown with red head. Moth is with greyish brown forewings having transverse lines and white hind wings.

7. Cut worm, *Agrotis ipsilon;* F: Noctuidae; O: Lepidoptera

The greasy cut worms come out during night and cut the seedlings at ground level and eat tender leaves.

ONION & GARLIC

1.	Onion thrips	*Thrips tabaci*	Thripidae	Thysanoptera
2.	Onion fly	*Delia antiqua*	Anthomyiidae	Diptera
3.	Earwig	*Euborellia annulipes*	Forficulidae	Dermaptera
4.	Tobacco caterpillar	*Spodoptera litura*	Noctuidae	Lepidoptera
5.	Cutworm	*Agrotis ipsilon*	Noctuidae	Lepidoptera

1. Onion thrips, *Thrips tabaci*, F: Thripidae; O: Thysanoptera

Nymphs and adults congregate in dense masses in narrow spaces between the axils of the inner leaves. Faded and curled leaf tips are the symptoms and the bulb size is also reduced. Nymph is pale yellow. Adult is with fringed wings.

2. Onion fly, *Delia (=Hylema) antiqua*, F: Muscidae; O: Diptera

Maggots burrow down into the underground portion of the stem and bulb, resulting in withering of plants. Maggots also cause rotting of the bulbs in storage. Maggot is white in colour. Adult is slender, greyish fly having large wings.

3. Earwig, *Euborellia annulipes,* F: Forficulidae O: Dermaptera

Both nymphs and adults bore into the onion bulb and feed. The eggs are laid only in the tender leaf and the adult colour varies from pale yellow to grey with forceps like caudal cerci and white leg joints.

4. Tobacco caterpillar, *Spodoptera litura*, F: Noctuidae O: Lepidoptera

The larvae feed on the leaves and makes complete defoliation. The larva is pale greenish brown with dark markings and the adult is stout moth with wavy white markings on the brown forewings and having a brown patch along its margin.

5. Cutworm, *Agrotis segetum*; F: Noctuidae; O: Lepidoptera

Young larvae feed on leaves and the grown up larvae cut the stem at collar region. Larva is black colored with brown head. Adult forewing is grey with spot like markings. Hindwing is dull white.

MORINGA

1.	Pod fly	*Gitona distigma*	Drosophilidae	Diptera
2.	Bud worm	*Noorda moringae*	Crambidae	Lepidoptera
3.	Leaf caterpillar	*Noorda blitealis*	Crambidae	Lepidoptera
4.	Hairy caterpillars	*Eupterote mollifera*	Eupterotidae	Lepidoptera
5.		*Pericallia ricini*	Arctiidae	Lepidoptera
6.		*Metanastria hyrtaca*	Lasiocampidae	Lepidoptera
7		*Streblote (Taragama) siva*	Lasiocampidae	Lepidoptera
8.	Bark borer	*Indarbela tetraonis*	Metarbelidae	Lepidoptera
9.	Stem borer	*Batocera rubus*	Cerambycidae	Coleoptera
10.	Aphids	*Aphis gossypii*	Aphididae	Hemiptera
11.	Scale Insect	*Ceroplastodes cajani*	Diaspididae	Hemiptera
12.	Bud midge	*Stictodiplosis moringae*	Cecidomyiidae	Diptera
13.	Leaf eating weevils	*Myllocerus* spp.	Curculionidae	Coleoptera

1. Pod fly, *Gitona distigma,* F:Drosophilidae; O:Diptera

Maggots enter into tender fruits by making small-bore holes at the terminal end. This causes oozing out of gummy fluid from fruits, which ultimately results in the drying of fruits from tip to upwards. A maximum of 20-28 maggots are found in a fruit. Internal contents of the fruit rot.

Maggot: Cream coloured

Adult: Small yellowish fly with red eyes. Wings extend beyond body and have a dark spot near the coastal margin.

2. Bud worm, *Noorda moringae,* F: Crambidae; O: Lepidoptera

Larvae bore into flower buds and cause shedding. Larva is dirty brown with mid-dorsal stripe and black head with prothoracic shield. Adult is small with dark brown forewings and white hindwings with a brown border.

3. Leaf caterpillar, *Noorda blitealis, F:* Crambidae; O: Lepidoptera

Larva remains in a silken web in the undersurface of leaf and feeds on the leaflets reducing them into papery leaf. Larva is with brown head and without prothoracic shield. Adult is bigger than bud worm.

4. Moringa hairy caterpillar

***a. Eupterote mollifera,* F: Eupterotidae; O: Lepidoptera**

Caterpillars feed gregariously by scrapping bark and gnawing foliage. Severe infestation results in complete defoliation of the tree.

Full-grown caterpillars are brownish in colour with dense hairs. Hairs are irritating to touch. Adults are large-sized moths with light yellowish-brown wings having faint lines.

***b. Pericallia ricini,* F:Arctiidae; O: Lepidoptera**

The larva is robust, greyish black or blackish brown with red head and thick tuft of hairs arising from the body. The adult is greyish brown or black with black spots on wings. Hindwings are pink or red colour with black spots.

***c. Metanastria hyrtaca,* F: Lasiocampidae; O: Lepidoptera**

Larvae are seen in groups in tree trunks and feed gregariously, scrap the bark and gnaw the foliage resulting in defoliation of tree. Larva is brown and hairy. Adult is large sized, uniformly light yellowish brown in colour with faint lines on wings.

***d. Streblote (Taragama) siva,* F: Lasiocampidae; O: Lepidoptera**

Full-grown caterpillars are pale ochreous–brown in colour with small black spots and long lateral tufts of ochreous hair. Moth has greyish-white head and thorax and whitish abdomen. Forewings are beautifully coloured with reddish-brown spot ringed with white. Hind wings are white.

5. Bark caterpillar, *Indarbela tetraonis,* F: Metarbelidae; O: Lepidoptera

Young trees succumb to the attack. Caterpillars bore into the trunk or junction of branches make zig zag galleries. Presence of gallery made out of silk and frass is the key symptom. They remain hidden in the tunnel during day time, come out at night and feed on the bark. Under severe infestation, flow of sap is hindered, plant growth arrested and fruit formation is drastically reduced. *Larva:* Stout and dirty brown in colour. *Adult:* Pale brown with brown spots and streaks in forewings and white hindwings.

6. Stemborer, *Batocera rubus,* F: Cerambycidae; O: Coleoptera

Grub causes zigzag burrows beneath the bark, which results in death of the branch or stem. Adult feeds on bark of the young petiole and twigs. Grub is stout and yellowish. Adult is large sized beetle with yellowish brown elytra.

AMARANTHUS

1.	Amaranthus stem weevil	*Hypolixus truncatulus*	Curculionidae	Coleoptera
2.	Amaranthus caterpillar or webber	*Spoladea (Hymenia) recurvalis*	Crambidae	Lepidoptera
3.	Leaf webber	*Eretmocera impactella*	Heliodinidae	Lepidoptera
4.	Leaf webber	*Psara basalis*	Pyraustidae	Lepidoptera
5.	Tortoise beetle	*Aspidomorpha exilis*	Chrysomelidae	Coleoptera
6.	Grasshopper	*Atractomorpha crenulata*	Acrididae	Orthoptera
7	Leaf twisting weevil	*Apoderus tranquebaricus*	Curculionidae	Coleoptera
8.	Aphid	*Aphis craccivora*	Aphididae	Hemiptera
9.	Mealy bug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
10.	Thrips	*Euryaplothrips crassus Haplothrips ceylonicus*	Thripidae	Thysanoptera

1. Amaranthus stem weevil, *Hypolixus truncatulus;* F: Curculionidae; O: Coleoptera

Grubs bite stem, feed on pith region making irregular zigzag tunnels and fill with excreta. Stem splits longitudinally. Plants dry completely. Adult feeds on tender leaves, makes circular holes in stems, branches and mid-ribs. Attack causes stunting of plants, twisting and swelling of branches and stem, suppression of shoot and leaf production. Grub: Stout, curved, apodous and white in colour. Full-fed grubs form a greyish-brown hard compact gall like chamber and pupate therein.

Adult: Ash-grey in colour, with elbowed antennae and brown elytra.

2. Amaranthus caterpillar or webber, *Spolodea (Hymenia) recurvalis;* F:Crambidae; O: Lepidoptera

Webbing of leaves with silken threads and drying of webbed leaves. Larva: Greenish in colour with white lines and black crescents on thorax below lateral line. Fully fed, caterpillars drop down and pupate in soil. Adult: Dark brownish black moth with white wavy markings on the wings.

Ex.No.3. **PESTS OF CRUCIFERS AND CUCURBITS**

Date:

CRUCIFERS

1.	Diamondback moth	*Plutella xylostella*	Plutellidae	Lepidoptera
2.	Leaf webber	*Crocidolomia binotalis*	Crambidae	Lepidoptera
3.	Cabbage semilooper	*Trichoplusia ni*	Noctuidae	Lepidoptera
4.	Cabbage butterfly	*Pieris brassicae, P. rapae*	Pieridae	Lepidoptera
5.	Cabbage borer	*Hellula undalis*	Crambidae	Lepidoptera
6.	Mustard aphid	*Lipaphis erysimi*	Aphididae	Hemiptera
7	Cabbage aphid	*Brevicoryne brassicae*	Aphididae	Hemiptera
8.	Cabbage flea beetle	*Phyllotreta cruciferae*	Chrysomelidae	Coleoptera
9.	Mustard sawfly	*Athalia lugens proxima*	Tenthredinidae	Hymenoptera
10.	Painted bug	*Bagrada hilaris*	Pentatomidae	Hemiptera
11.	Cutworm	*Agrotis ipsilon*	Noctuidae	Lepidoptera
12.	Leaf miner	*Chromatomyia (Phytomyz) harticola*	Agromyzidae	Diptera
13.	Thrips	*Thrips tabaci*, *Caliothrips indicus*	Thripidae	Thysanoptera

1. Diamondback moth, *Plutella xylostella*; F: Plutellidae; O: Lepidoptera

Young caterpillars cause small yellow mines followed by scrapping of epidermal leaf tissues producing typical whitish patches. Full-grown larvae bite holes in the leaves. Larva is pale yellowish green in color, pointed at both ends with fine erect black hairs scattered over the body. Adult is small, greenish brown with pale whitish narrow wings. At rest a dorsal median patch of 3 diamond shaped yellowish white spots are clearly visible by joining both forewings. Hindwings have a fringe of long fine hairs.

2. Leaf webber, *Crocidolomia binotalis*; F: Crambidae; O: Lepidoptera

Young larvae feed gregariously on leaves, later web together the leaves and feed. Larva is with red head, brown longitudinal stripes and rows of tubercles with short hairs on its pale violaccous body. Adult is small with brown forewings having distinct wavy spots. Hindwings are semi-hyaline.

3. Cabbage semilooper, *Trichoplusia ni*; F: Noctuidae; O: Lepidoptera

Damaged leaves are with holes initially and the severe damage is represented by skeletonization. Larva is green color with light wavy lines and broad lateral stripes on either side. Adult is stout moth. Head and thorax are grey in colour and the abdomen is white with basal tufts. Grey wavy forewings are with a slender 'y' mark.

4. Cabbage butterflies, *Pieris brassicae; P. rapae*; F: Pieridae; O: Lepidoptera.

The caterpillar feeds on leafy vegetation irregularly (defoliation). Sometimes bores into the heads of cabbage. Larva is velvetty bluish green in colour with black darts and yellow dorsal and lateral stripes covered with white hair. Adult is with snow white forewings with black distal margin and black apical spots; hindwings are pure white.

5. Cabbage borer, *Hellula undalis*; F: Pyraustidae; O: Lepidoptera

Larva webs the leaves and bore into the stem, stalks or leaf veins. Larva is pale whitish brown with 4-5 purplish brown longitudinal lines. Adult is pale greyish brown with 4-5 purplish brown

longitudinal stripes. Adult is pale greyish brown moth with forewings having grey wavy lines. Hindwings are pale dusty.

6. Mustard aphid, *Lipaphis erysimi*; F: Aphididae; F: Hemiptera

Nymphs and adults suck the sap from the under surface of the leaves. Nymph is light yellowish green and adult is darker than nymph.

7. Cabbage aphid, *Brevicoryne brassicae*; F: Aphididae; O: Hemiptera

Nymphs and adults cause crinkling and cupping of distorted primordia. White cast skins are present at the base of the plant. Adult is yellowish green with wavy white filament over the body.

8. Flea beetles, *Phyllotreta cruciferae*; F: Chrysomelidae; O: Coleoptera

Adults feed on foliage of cabbage, cauliflower, radish etc. and make typical small shot holes. Adult beetles are elongate, oval, metallic bluish green in color**.**

9. Mustard sawfly, *Athalia lugens proxima*; F: Tenthredinidae O: Hymenoptera

Grubs nibble the margin of tender leaves and also make holes in the leaves

CUCURBITS

1.	Fruit flies	*Bactrocera cucurbitae* *B. zonata, B. ciliatus*	Tephritidae	Diptera
2.	Pumpkin beetles	*Aulacophora foveicollis,* *A. cincta, A.intermedia*	Chrysomelidae	Coleoptera
3.	Snake gourd semi looper	*Plusia (Anadevidia)* *peponis, A. signata* *A. orichalcea*	Noctuidae	Lepidoptera
4.	Leaf miner	*Liriomyza trifolii*	Agromyzidae	Diptera
5.	Pumpkin caterpillar/ gherkin fruit borer	*Diaphania (Cryptographis)* *indica*	Crambidae	Lepidoptera
6.	Stem gall fly	*Neolasioptera falcata*	Cecidomyiidae	Diptera
7	Stem borer /clear winged moth	*Melittia eurytion*	Aegeriidae	Lepidoptera
8.	Stem boring grey beetle	*Apomecyna saltator*	Cerambycidae	Coleoptera
9.	Plume moth	*Sphenarches caffer*	Pterophoridae	Lepidoptera
10.	Stink bug	*Aspongopus janus*	Pentatomidae	Hemiptera
11.	Spotted leaf beetle	*Epilachna* *vigintioctopunctata*	Coccinellidae	Coleoptera
12.	Flower feeder	*Mylabris pustulata*	Meloidae	Coleoptera
13.	Snake gourd stem weevil	*Baris trichosanthis*	Curculionidae	Coleoptera

1. Fruit flies, *Bactrocera (=Dacus) cucurbitae*; F: Tephritidae: O: Diptera

The maggots feed on the pulp of the fruits and the symptoms of damage include oozing of resinous fluid from fruits, distorted and malformed fruits, premature dropping of fruits and unfit for consumption. Maggot is white and apodous. Adult is with hyaline wings or brownish body with brown oval spot on either side of 3rd tergite.

2. Pumpkin beetle, *Aulacophora foveicollis; A. cincta; A. intermedia*; F: Chrysomelidae; O: Coleoptera

Grubs feed on the roots, stem and fruits that spread over the soil. Adults feed on leaf and flower. Grub is creamy yellow. Adult ***A. foveicollis:*** red. ***A. cincta***: grey with black having glistening yellow-red border ***A. intermedia***: blue in color.

3. **Snake gourd semilooper,** *Plusia peponis*; F: Noctuidae; O: Lepidoptera

Larva cuts the edges of leaf lamina, folds it over the leaf and feeds within the leaf roll. Larva is whitish green and the body is with black warts, off-white longitudinal stripes and a hump on its anal segment. Stout dark brown adult has shiny brown forewings.

4. **Serpentine leaf miner,** *Liriomyza trifolii*; F: Agromyzidae; O: Diptera

Leaves are often with serpentine mines followed by drying and dropping of leaves due to infestation. Larva is orange yellowish and apodous. Adult is pale yellow fly.

5. **Pumpkin caterpillar/gherkin fruit borer,** *Diaphania (Cryptographis) indica*; F:Crambiidae; O: Lepidoptera

Larvae web leaves and feed. Ovaries and young developing fruits are also eaten. Affected flowers bear no fruits and infested fruits become unfit for consumption. Larva is elongate bright green with a pair of thin white longitudinal lines on the dorsal side. Adult has transparent white wings with broad and dark brown marginal patches and orange coloured anal tuft of hairs in the female.

Ex. No. 4. **PESTS OF MANGO, CITRUS AND SAPOTA**

Date:

MANGO

1.	Mango hoppers	*Idioscopus niveosparsus, I. clypealis, Amritodus atkinsoni*	Cicadellidae	Hemiptera
2.	Flower webber	*Eublemma (Antoba) versicolor*	Noctuidae	Lepidoptera
3.	Gall midges	*Procystiphora mangiferae, Dasineura amaramanjarae, Erosomyia mangiferae*	Cecidomyiidae	Diptera
4.	Fruit fly	*Bactrocera dorsalis*	Tephritidae	Diptera
5.	Nut weevil	*Sternochetus mangiferae*	Curculionidae	Coleoptera
6.	Shoot webber	*Orthaga exvinacea*	Pyralidae	Lepidoptera
7	Leaf caterpillars	*Bombotelia (Penicillaraa) jacosatrix*	Noctuidae;	Lepidoptera
8.		*Euthalia garuda*	Nymphalidae	Lepidoptera
9.	Leaf midges	*Amradiplosis amaraemyia*	Cecidomyiidae	Diptera
10.	Leaf weevil	*Rhynchaenus mangiferae*	Curculionidae	Coleoptera
11.	Red tree ant	*Oecophylla smaragdina*	Formicidae	Hymenoptera
12.	Stem borer	*Batocera rufomaculata*	Cerambycidae	Coleoptera
13.	Leaf miner	*Acrocercops syngramma*	Gracillaridae	Lepidoptera
14.	Aphid	*Toxoptera odinae*	Aphididae	Hemiptera
15.	Castor slug	*Parasa lepida*	Cochlididae	Lepidoptera
16.	Leaf twisting weevil	*Apoderus tranquebaricus*	Curculionidae	Coleoptera
17.	Whitefly	*Aleu*rocanthus *mangiferae*	Aleyrodidae	Hemiptera
18.	Scale insect	*Chionaspis vitis*	Diaspididae	Hemiptera

I PESTS OF INFLORESCENCE/FRUIT

1. Mango hoppers, *Idioscopus niveosparsus, I. clypealis, Amritodus atkinsoni;*F: Cicadellidae; O: Hemiptera

Nymphs and adults cause withering and shedding of flower buds and flowers. Presence of small drops of honeydew on lower leaves followed by development of sooty mould. Clicking sound due to the movement of jassids amidst leaves is a common phenomenon.

I. niveosparsus - Three spots on scutellum; white band across the wing

I. clypealis - Two spots on scutellum and dark spots on the vertex

A. atkinsoni - Two spots on scutellum.

2. Flower webber, *Eublemma (Antoba) versicolor*; F: Noctuidae; O: Lepidoptera

Larvae web the inflorescence and tunnel the stalks. Larva is greenish yellow with light brown head and prothoracic shield. Adult female moth is with grey wings and male is with purplish pink wings.

3. Gall midges, *Procystiphora mangiferae, Dasineura amaramanjarae, Erosomyia mangiferae*; F: Cecidomyiidae; O: Diptera

Procystiphora mangiferae: Causes malformation and dropping of flowers. Maggot and adult are orange coloured. *Dasineura amaramanjarae*: Causes damage to flower buds and dropping of bud. *Erosomyia mangiferae*: Causes stunting and malformation of inflorescence. Maggot is yellowish.

4. Fruit fly, *Bactrocera dorsalis*; F: Tephritidae; O: Diptera

Semi-ripe fruits are with decayed spots and dropping of fruits. Maggot is yellowish. Adult fly is light brown with transparent wings.

5. Nut weevil, *Sternochetus mangiferae*; F: Curculionidae; O: Coleoptera

The infestation results in dropping of fruits at marble stage and tunnelled cotyledons. Ovipositional injuries and eggs are seen on marble sized fruits. Grub is fleshy, yellowish and apodous. Adult is brownish with short snout and papillate scales.

II LEAF FEEDERS

6. Shoot webber, *Orthaga exvinacea*; F: Pyralidae; O: Lepidoptera

Larvae cause webbing of terminal leaves and defoliation. Larva is pale green with brown head and prothoracic shield. Adult is brownish moth with wavy lines on forewings.

7. Leaf caterpillars, (a) *Bombotelia (Penicillara) jacosatrix*; F: Noctuidae; O: Lepidoptera;

(b) *Euthalia garuda*; F: Nymphalidae: O: Lepidoptera

a. Larvae cause defoliation of tender leaves. Larva is green or yellowish green, smooth with pink spots. Adult is with dark brown forewing and half of the hindwing is white.

b. Larva feeds the leaves irregularly and defoliates. Larva is greenish with a yellowish mid-dorsal line and long branched greenish hairs all over the body. Adult is medium sized greyish butterfly.

8. Leaf midges, *Amradiplosis amaraemyia*; F: Cecidomyiidae; O: Diptera

Larva induces different shapes and sizes of galls and malformation. Maggot is yellowish. Adult is tiny mosquito like fly.

9. Leaf weevil, *Rhynchaenus mangiferae*; F: Curculionidae; O: Coleoptera

Tender leaves are mined. Cholorophyll is scrapped and leaves crinkled. Adult is brown weevil with enlarged hind femur.

10. Red tree ant, *Oecophylla smaragdina*; F: Formicidae; O: Hymenoptera

Terminal leaves are stitched with silk threads in the form of nest, which remain green and presence of ants. They are orange red in colour. Queen is olive green in colour.

III BORERS

11. Stem borer, *Batocera rufomaculata*; F: Cerambycidae; O: Coleoptera

The grub causes drying of terminal shoots in early stage of attack. Wilting of whole tree can be seen when damage occurs at the main stem. Grub is linear, fleshy and apodous. Adult is greyish beetle with two pink dots and lateral spine on the thorax.

PESTS OF MINOR IMPORTANCE

12. Leaf miner, *Acrocercops syngramma*, F: Gracillaridae; O: Lepidoptera

13. Aphid, *Toxoptera odinae*, F: Aphididae; O: Hemiptera

14. Castor slug, *Parasa lepida*, F: Cochlididae; O: Lepidoptera

15. Leaf twisting weevil, *Apoderus tranquebaricus*, F: Curculionidae; O: Coleoptera

16. Whitefly, *Aleu*rocanthus *mangiferae*, F: Aleyrodidae; O: Hemiptera

17. Scale insect, *Chionaspis vitis*; F: Diaspididae; O: Hemiptera

CITRUS

1.	Orange borer	*Chelidonium cinctum, Chloridolum alcamene*	Cerambycidae	Coleoptera
2.	Citrus leaf miner	*Phyllocnistis citrella*	Gracillaridae	Lepidoptera
3.	Citrus butterfly	*Papilio demoleus, P. polytes*	Papilionidae	Lepidoptera
4.	Fruit sucking moth	*Eudocima (Othreis) materna, E. phalonia, E.homaena*	Noctuidae	Lepidoptera
5.	Rust mite	*Phyllocoptruta oleivora*	Eriophyidae	Acarina
6.	Psyllid	*Diaphorina citri*	Psyllidae	Hemiptera
7	Black fly	*Aleurocanthus woglumi*	Aleurodidae	Hemiptera
8.	Aphids	*Toxoptera citricida T. aurantii*	Aphididae	Hemiptera
9.	Scale insects	*Lepidosaphes beckii*	Diaspididae	Hemiptera

I. INTERNAL FEEDERS

1. **Orange borer,** *Chelidonium cinctum, Chloridolum alcamene*; F: Cerambycidae; O: Coleoptera

The grubs cause drying of terminal shoots in the early stages, followed by wilting of thicker branches and main stem. Grub is creamy white with flat head. Adult is dull metallic green to dark violet or shiny blue beetle with yellow band across the middle of the elytra.

2. **Citrus leaf miner,** *Phyllocnistis citrella;* F: Gracillaridae; O: Lepidoptera

The infestation by the larva results in leaves with serpentine mines and distortion of the leaf lamina. Larva is minute, reddish or yellowish and apodous. Adult is minute moth with a black spot at the tip of the forewing.

II LEAF FEEDER

3. **Citrus butterfly,** *Papilio demoleus, P. polytes*; F: Papilionidae; O: Lepidoptera

The larva causes defoliation of tender leaves. Larva in its early stage resembles bird dropping. Grown up larva is cylindrical, stout and green with brown lateral oblique bands. Adult is dark brown swallow tail butterfly with numerous yellow markings.

III SAP FEEDERS

4. **Fruit sucking moth,** *Eudocima (Othreis) materna, E phalonia, E.homaena*; F:Noctuida; O: Lepidoptera

Adults suck the juice by piercing the fruits. Infested fruits will shrink, shrivel, rot and ultimately drop down, causing direct loss to harvestable produce. Larva feeds on the leaves of the creeper weed *Tinospora cardifolia* and *Cocculus* sp. Larva: Semilooper with orange blue and yellow spots on velvetty dark speckled body. Moth: Stout built; with grey and orange coloured wings. *E. materna*: Three black spots on forewings and circular marking on hindwing. *E. phalonia*: Tripod black mark on forewings and curved marking on hindwing. *E.homaena:* Green stripe on forewing and curved marking on hindwing.

5. **Rust mite,** *Phyllocoptruta oleivora*, F: Eriophyidae; O: Acarina

Feeding by adults and nymphs causes silvery, scaly or rusty black discolouration on the fruits. The affected fruits are smaller and the rind of injured fruit is thicker.

PESTS OF MINOR IMPORTANCE

6. **Psyllid,** *Diaphorina citri*; F: Psyllidae; O: Hemiptera

7. **Black fly,** *Aleurocanthus woglumi*; F: Aleyrodidae; O: Hemiptera

8. **Aphids,** *Toxoptera citricida*, *T. aurantii*; F: Aphididae; O: Hemiptera – Vector for citrus tristeza virus
9. **Scale insects,** *Lepidosaphes beckii*; F: Diaspididae; O: Hemiptera

SAPOTA

1.	Chickoo moth or leaf webber	*Nephopteryx eugraphella*	Phycitidae	Lepidoptera
2.	Budworm	*Anarsia ephippias*	Gelechiidae	Lepidoptera
3.	Fruit fly	*Bactrocera dorsalis, B. zonata*	Tephritidae	Diptera
4.	Hairy caterpillar	*Metanastria hyrtaca*	Lasiocampidae	Lepidoptera
5.	Ash weevil	*Myllocerus spp*	Curculionidae	Coleoptera
6.	Leaf twisting weevil	*Apoderus tranquebaricus*	Curculionidae	Coleoptera
7	Leafminer	*Acrocercops syngramma*	Gracillaridae	Lepidoptera
8.	Whitefly	*Trialeurodes ricini*	Aleyrodidae	Hemiptera

1. Chickoo moth or leaf webber, *Nephopteryx eugraphella,* F: Phycitidae; O: Lepidoptera

Leaves are webbed together in a bunch and chlorophyll is scrapped by the larva. Clusters of dried leaves are hanging from the webbed shoots. Flower buds and tender fruits are bored, become withered and shed. Larva is pinkish in colour with three dorso-lateral brown stripes on each side. Adult moth is greyish with hairy brown forewings or black spots and semi hyaline hindwings.

2. Budworm, *Anarsia ephippias,* F: Gelechiidae; O: Lepidoptera

Floral buds and flowers are webbed together and shed. Larva is small, slender, pinkish brown in colour with black head and yellowish brown prothoracic shield. Adult is grey coloured moth with black patch on wings.

3. Fruit fly, *Bactrocera dorsalis, B. zonata;* F: Tephritidae; O: Diptera

Semi–ripe fruit show decayed spots and fruits drop later. Maggot is yellowish. Adult fly is light brown with transparent wings.

4. Hairy caterpillar, *Metanastria hyrtaca,* F: Lasiocampidae;O: Lepidoptera

Larva feeds on leaves irregularly and causes defoliation. Larva is greyish brown, stout and hairy. Adult is stout greyish brown moth. Male is with pectinate antenna and chocolate brown patch in the middle of forewings. Female is bigger in size than male and has wavy transverse bands on wings.

5. Ash weevil, *Myllocerus spp.,* F: Curculionidae; O: Coleoptera

Leaf margins are notched by adults. Roots are eaten away by the grubs. Small white apodous grubs are found feeding on roots. Adult weevil is greenish white elytra having dark lines.

6. Leaf twisting weevil, *Apoderus tranquebaricus,* F: Curculionidae; O: Coleoptera

The grub rolls leaf terminal results in drying. Grub is yellowish and apodous. Adult is reddish brown weevil.

7. Leafminer, *Acrocercops syngramma,* F: Gracillaridae; O: Lepidoptera

Mining of tender leaves in whitish blotches is the symptom of damage. Larva is reddish brown and minute.

8. Whitefly, *Trialeurodes ricini*, F: Aleyrodidae; O: Hemiptera

Continuous desaping results in water soaked spots on the leaves.

Ex. No. 5. **PESTS OF BANANA, GRAPEVINE AND GUAVA**

Date:

BANANA

1.	Rhizome weevil	*Cosmopolites sordidus*	Curculionidae	Coleoptera
2.	Pseudostem borer	*Odoiporus longicollis*	Curculionidae	Coleoptera
3.	Banana aphid	*Pentalonia nigronervosa*	Aphididae	Hemiptera
4.	Lacewing bugs	*Stephanitis typicus*	Tingidae	Hemiptera
5.	Thrips	*Helionothrips kadaliphilus*, *Thrips florum*, *Chaetanothrips signipennis*	Thripidae	Thysanoptera
6.	Scale	*Aspidiotus destructor*	Diaspididae	Hemiptera
7.	Leaf feeder	*Pericallia ricini*	Arctiidae	Lepidoptera
8.	Tobacco caterpillar	*Spodoptera litura*	Noctuidae	Lepidoptera
9.	Bagworm	*Kophene cuprea*	Psychidae	Lepidoptera

1. Rhizome weevil, *Cosmopolites sordidus*; F: Curculionidae; O: Coleoptera

The grub causes death of unopened pipe and withering of outer leaves. Grubs bore into the rhizome and cause death of the plants. Grub is apodous and yellowish white with red head. Adult is dark coloured weevil.

2. Pseudostem borer, *Odoiporus longicollis*; F: Dryophthoridae; O: Coleoptera

The grub makes bore holes and tunnels in the pseudostem and causes wilting of the plant. Grub is apodous and creamy white with dark head. Adult is robust reddish brown and black weevil.

3. Banana aphid, *Pentalonia nigronervosa*; F: Aphididae; O: Hemiptera

Nymphs and adults are seen in colonies on leaf axils and pseudostem and suck the sap. Nymphs and adults are dark in colour. Winged adults are with black veined wings. Act as vector of bunchy top virus disease.

4. Lacewing bugs /Tingid, *Stephanitis typicus*, F: Tingidae; O: Hemiptera

Both nymphs and adults feed in colonies on undersurface of leaves and cause discolouration. Adults are small, dull-coloured or white bugs with transparent shiny lace-like reticulate wings, nymphs are black coloured.

GRAPEVINE

1.	Grapevine stem girdler	*Sthenias grisator*	Cerambycidae	Coleoptera
2.	Grape vine flea beetle	*Scelodonta strigicollis*	Eumolpidae	Coleoptera
3.	Grapevine thrips	*Rhipiphorothrips cruentatus*	Thripidae	Thysanoptera
4.	Grapevine mealy bug	*Maconellicoccus hirsutus*	Pseudococcidae	Hemiptera
5.	Leaf roller	*Sylepta lunalis*	Crambidae	Lepidoptera
6.	Sphingid	*Hippotion celerio*	Sphingidae	Lepidoptera
7.	Leaf miner	*Phyllocnistis toparcha*	Gracillariidae	Lepidoptera
8.	Plume moth	*Oxyptilus regulus*	Pterophoridae	Lepidoptera
9.	Fruit sucking moth	*Eudocima* spp. *Acanthodelta (Achaea) janata*	Noctuidae	Lepidoptera

1. Stem girdler, *Sthenias grisator*; F: Cerambycidae; O: Coleoptera

Grub bores into the bark and tunnels into the dry wood resulting in wilting of branches and then the entire vine. They cut the bark in a circular ring like fashion (girdling) which leads to the drying of the region above the cut. Adult is medium sized and grey coloured with a white spot in the centre of each elytron.

2. Flea beetle, *Scelodonta strigicollis,* F: Eumolpidae; O: Coleoptera

The adults bite small holes on tender leaves and the root is damaged by the grubs. Adult is reddish brown, shiny beetle with six spots on elytra.

3. **Thrips** - Fruit rust thrips - *Rhiphiphorothrips cruentatus* and Flower thrips - *Scirtothrips dorsalis,* F: Thripidae; O: Thysanoptera

Both nymphs and adults lacerate leaves causing silvery white patches on leaves with black excreta. Severe infestation results in yellowing and withering. Young nymphs reddish to yellowish- Pupates on leaves, pupae mobile and crawl away when disturbed. Adult is minute, blackish brown with yellowish wings.

4. Mealy bug, *Maconellicoccus hirsutus* F: Pseudococcidae; O: Hemiptera

Nymphs and adults suck the sap from leaves, shoots and fruits that results in crinkling and yellowing of leaves and rotting of berries. Honey dew secretions and sooty mould (black powdery coverings) on leaves, shoots and branches. Nymphs are pinkish in colour. Adult females are pinkish and sparsely covered with white wax.

GUAVA

1.	Tea mosquito bug	*Helopeltis antonii*	Miridae	Hemiptera
2.	Fruitfly	*Bactrocera* (Dacus) *diversus*	Tephritidae	Diptera
3.	Fruit borer	*Virachola* (*Deudorix*) *isocrates, Rapala varuna*	Lycaenidae	Lepidoptera
4.	Fruit borer/ Castor capsule borer	*Dichocrocis* (*Conogethes*) *punctiferalis*	Crambidae	Lepidoptera
5.	Mealy bug	*Ferrisia virgata, Maconellicoccus hirsutus Paracoccus marginatus*	Pseudococcidae	Hemiptera
6.	Spiralling whitefly	*Aleurodicus dispersus*	Aleyrodidae	Hemiptera
7.	Aphids	*Aphis gossypii*	Aphididae	Hemiptera
8.	Scarlet mite	*Brevipapus phoenicus*	Tenuipalpidae	Acari
9.	Guava scale	*Chloropulivinaria psidii*	Coccidae	Hemiptera
10	Bark caterpillar	*Indarbela tetraonis*	Cossidae	Lepidoptera
11.	Whitefly	*Aleurotuberculatus psidii*	Aleyrodidae	Hemiptera
12.	Thrips	*Selenothrips rubrocinctus*	Thripidae	Thysanoptera

1. Tea mosquito bug, *Helopeltis antonii*; F: Miridae; O: Hemiptera

Corky scab formation on fruits is the symptom of damage. The infestations caused by the nymphs and adults include inflorescence blight, terminal drying of young shoots and water soaked lesions followed by brownish spots at the feeding sites. Nymphs and adults are reddish brown, elongate bugs with black head, red thorax and black and white abdomen.

2. Fruit fly, B*actrocera diversus* F:Tephritidae; O: Diptera

Maggots bore into fruits and feed on soft pulp. The infested fruits show small cavities with dark greenish punctures and when cut open, the wriggling maggots are seen inside. The infestation causes rotting and dropping of fruits. Maggot is pale cream in colour and cylindrical. Adult is smoky brown with greenish black thorax having yellow marking.

3. Fruit borer, *Virachola* (*Deudorix*) *isocrates*; *Rapala varuna*; F: Lycaenidae; O: Lepidoptera

Infected fruits are with boreholes plugged with anal segment of the larva. Severe infestation results in fruit rotting and dropping. Larva is dirty dark brown, short and stout built covered with short hairs. Adult is bluish brown butterfly. Female is with 'V' shaped patch on forewing. *Rapala varuna*; Fruits are with boreholes. Adult is metallic red coloured butterfly.

4. Fruit borer/ Castor capsule borer, *Dichocrocis* (*Conogethes*) *punctiferalis*;
F: Crambidae; O: Lepidoptera

Larva bores into the young fruits which dry up and fall prematurely, bore holes plugged with excreta. Larva is pale reddish brown with numerous tubercles on body. Adult medium sized bright orange-yellow color has numerous black dots on wings.

5. Mealy bug, *Ferrisia virgata*; F: Pseudococcidae; O: Hemiptera

Premature dropping of fruits. Presence of white, cottony-nymphs and adult mealy bugs on the leaves and twigs resulting in stunted growth. Crawlers are yellowish to pale white in colour. Adult female is long, slender having a pair of long glossy wax filaments at caudal end.

6. Spiralling whitefly, *Aleurodicus dispersus* ; F: Aleyrodidae; O: Hemiptera

Adults and nymphs congregate heavily on the lower surface of leaf, suck the sap and cause premature leaf drop, chlorosis, yellow speckling, crinkling and curling. Honey dew secretion also leads to the development of sooty mould fungus. The copious white, waxy flocculent material secreted by all the stages of the pest is readily spread by wind and thus cause public nuisance. Adults are larger than many of the whitefly species and white in colour with waxy coating on the body. Eyes are dark reddish brown. Fore wings are with three characteristic spots.

7. Aphid, *Aphis gossypii*; F: Aphididae; O: Hemiptera

Nymphs and adults cause yellowing of tender shoots and wilting. Curling and crinkling of leaves, stunted plants with honeydew secretion and sooty mould are the symptoms of damage. Large number of aphids are seen on tender / apical shoots. Nymph is greenish brown or yellow in colour. Adult is yellowish green to dark green in posterior side.

8. Scarlet Mite: *Brevipalpus phoenicus*; F:Tenuipalpidae; O: Acari

Mite lays eggs on stalks of fruits, calyx and leaves. Both nymphs and adults suck the cell sap from fruits which results in browning of nodal regions and appearance of brown patches on calyx and surface of fruits. In severe infestation, these symptoms cover the entire surface of fruits leading to splitting of fruits.

9. Guava scale, *Chloropulvinaria psidii*; F: Coccidae; O: Hemiptera

Yellowing of leaves. Adult female is long with white ovisac and resembles mealy bug.

Ex.No. 6. **PESTS OF POMEGRANATE, ANOLA, PAPAYA**

Date:

POMEGRANATE

1.	Anar butterfly / Fruit borer	*Deudorix (Virachola) isocrates / Rapala varuna*	Lycaenidae	Lepidoptera
2.	Castor semilooper	*Acanthodelta (Achaea) janata*	Noctuidae	Lepidoptera
3.	Fruit fly	*Bactrocera zonata*	Tephritidae	Diptera
4.	Fruit borer	*Dichocrocis* (*Conogethes*) *punctiferalis*	Crambidae	Lepidoptera
5.	Aphid	*Aphis punicae*	Aphididae	Hemiptera
6.	Whitefly	*Siphoninus phillyreae*	Aleyrodidae	Hemiptera
7.	Mealybug	*Ferrisia virgata* *Pseudococcus lilacinus*	Pseudococcidae	Hemiptera
8.	Thrips	*Retithrips syriacus,* *Rhipiphorothrips cruentatus*	Thripidae	Thysanoptera
9.	Slug caterpillar	*Latoia (Parasa) lepida*	Cochlididae	Lepidoptera
10.	Hairy caterpillar	*Euproctis fraterna* *Somena (Porthesia) scintillans*	Lymantriidae	Lepidoptera
11.	Leaf mite	*Aceria granati*	Eriophyidae	Acari
12.	Red spider mite	*Tetranychus punicae*	Tetranychidae	Acari
13.	Bagworm	*Clania crameri*	Psychidae	Lepidoptera

1. Fruit borer, *Deudorix (Virachola) isocrates,* F: Lycaenidae; O: Lepidoptera

Infested fruits are with bore holes plugged with anal segment of the larva. Severe infestation results in fruit rotting and dropping. Larva is dirty dark brown, short and stout built covered with short hairs. Adult is bluish brown butterfly. Female is with 'V' shaped patch on forewing.

2. Castor semilooper: *Acanthodelta (Achaea) janata* F: Noctuidae; O: Lepidoptera

Larva feeds on leaves while the adult moth pierces the fruits with its proboscis for feeding, causing injury on the surface of fruits. Larva is a semilooper with varying shades of colour with black head and a red spot on the third abdominal segment and red tubercles in the anal region. Adult is a pale reddish brown moth with black hindwings having a median white spot on the outer margin.

3. Fruit fly, *Bactrocera zonata,* F: Tephritidae; O: Diptera

Rotting of fruit is the symptom of infestation. The maggots feed on the pulp of the fruits and the symptoms of damage include brown resinuous fluid from fruits, distorted and malformed fruits premature dropping of fruits and unfit for consumption. Maggot is white and apodous. Adult is with hyaline wings or brownish with pale yellow band on 3rd tergite.

4. Shoot and fruit borer, *Dichocrocis* (*Conogethes*) *punctiferalis,* F: Crambidae; O: Lepidoptera

Larvae make holes on fruits. Larva is pale greenish with pinkish tinge and fine hairs with dark head and prothoracic shield. Adult is medium sized and pale yellowish moth with small black spots on the wings.

5. Aphids, *Aphis punicae,* F: Aphididae; O: Hemiptera

Both nymphs and adults cause yellowing and wilting of terminal shoots. They are pale green in colour. Winged and wingless aphids are common.

ANOLA

1.	Fruit borer	*Deuodorix (Virachola) isocrates*	Lycaenidae	Lepidoptera
2.	Leaf roller	*Caloptilia (=Gracillaria) acidula*	Gracillariidae	Lepidoptera
3.	Bark eating caterpillar	*Indarbela tetraonis*	Cossidae	Lepidoptera
4.	Shoot gall maker	*Betousa stylophora*	Thyridae	Lepidoptera
5.	Aphid	*Setaphis bougainvilleae*	Aphididae	Hemiptera
6.	Whitefly	*Trialeurodes rara*	Aleyrodidae	Hemiptera
7.	Mealy Bug	*Ferrisia virgata*	Pseudococcidae	Hemiptera
		Nipaecoccus viridis	Pseudococcidae	Hemiptera

1. Fruit borer, *Virachola isocrates*, F: Lycaenidae, O: Lepidoptera

It causes severe damage to the fruits, which led to significant economic loss to the growers. It attacks all the varieties of amla. The caterpillar burrows into the fruit in different phases of maturity. The light brown young caterpillar is found to attack the tender fruits, while the grown up blackish brown hairy caterpillar attacks even the matured fruits. Matured fruits start decaying from one side, which gradually spreads all over, before they fall off. Adult is bluish brown butterfly. Female is with 'V' shaped patch on forewing.

2. Leaf roller *Caloptilia (Gracillaria) acidula* F*:* Gracillariidae O:Lepidoptera

Slender yellow larvae mine part or whole of the leaflets of compound leaves and leaflets turns pale brown or dark brown. In severe attack, the leaflets are twisted up to form cocoons. Adult is a small, brownish moth

3. Bark eating caterpillar, *Indarbela tetraonis;* F: Metarbelidae; O: Lepidoptera

Larvae construct loose irregular webbing of silken threads and make tunnels in the main trunk and branches

4. Shoot gall maker, *Betousa stylophora.* F: Thyridae; O: Lepidoptera

Young caterpillar bore into the apical portion of the shoot and make tunnel resulting in development of gall. Apical growth is arrested and side shoots develop below the gall.

5. Aphid, *Setaphis bougainvilleae,* F: Aphididae; O: Hemiptera

Nymph and adults suck sap by remaining on the undersurface of leaves.

6. Whitefly, *Trialeurodes rara;* F:Aleyrodidae; O:Hemiptera

Nymphs and adults suck the sap from undersurface of leaves resultig in yellowing of leaves on dorsal side in patches

7. Mealy Bug, *Ferrisia virgata*; F: Pseudococcidae; O: Hemiptera

Presence of white, cottony-nymphs and adult mealy bugs on the leaves and twigs resulting in stunted growth. Crawlers are yellowish to pale white in colour. Adult female is long, slender having a pair of long glossy wax filaments at caudal end.

PAPAYA

1.	Papaya mealybug	*Paracoccus marginatus*	Pseudococcidae	Hemiptera
2.	Whitefly	*Bemisia tabaci*	Aleyrodidae	Hemiptera
3.	Aphids	*Aphis gossypii, Myzus persicae*	Aphididae	Hemiptera
4.	Fruit fly	*Bactrocera (Dacus) dorsalis*	Tephritidae	Diptera
5.	Ash weevils	*Myllocerus spp*	Curculionidae	Coleoptera
6.	Scale insect	*Aspidiotus destructor* *Aonidiella orientalis*	Diaspididdae	Hemiptera

1. Papaya mealybug, *Paracoccus marginatus,* F: Pseudococcidae; O: Hemiptera

The mealybug infestation appears on above ground parts on leaves, stem and fruits as clusters of cotton-like masses. The insect sucks the sap by inserting its stylets into the epidermis of the leaf, fruit and stem,while feeding, it injects a toxic substance into the leaves, resulting in chlorosis, plant stunting, leaf deformation or crinkling, early leaf and fruit drop, and death of plants. The honeydew excreted by the bug results in the formation of black sooty mould which interferes in the photosynthesis process and causes further damage to the crops. Heavy infestations are capable of rendering fruit inedible due to the buildup of thick white waxy coating. When live specimens collected from papaya are crushed on paper, the body color would be yellow; but when killed and preserved in 80 per cent alcohol at room temperature, the body contents would turn completely black within 48 hours. Females have no wings and move by crawling short distances or by being blown in air currents.

2. Whitefly, *Bemisia tabaci;* F:Aleyrodidae; O:Hemiptera

Nymphs and adults suck the sap from undersurface of the leaves and it transmits Papaya Leaf Curl Virus. The infested plant shows leaf curling, crinkling , distortion of leaves, reduction of leaf lamina, rolling of leaf margins inward and downward, thickening of veins, leathery, brittle and distorted. Plants stunted and does not produce flowers and fruits.

3. Aphids, *Aphis gossypii, Myzus persicae;* F: Aphididae; O: Hemiptera

It transmits *Papaya Ring Spot Virus.* The affected leaves show vein clearing, puckering, distal parts of leaves roll downward and inwards, mosaic mottling, dark green blisters, leaf distortion which result in shoe string symptom and stunting of plants. On fruits circular concentric rings are produced.

4. Fruit fly, *Bactrocera (Dacus) dorsalis,* F: Tephritidae; O: Diptera

Maggots puncture into semi-ripe fruits which lead to oozing of fluid, brownish rotten patches on fruits and dropping of fruits. Maggot is yellowish. Adult fly is light brown with transparent wings.

5. Ash weevils, *Myllocerus spp*.; F: Curculionidae; O: Coleoptera

Grubs feed on the roots while adult cause notching of leaf margin

Ex. No. 7. PESTS OF JACK, PINE APPLE, CUSTARD APPLE, BER AND APPLE
Date:

JACK

1.	Shoot and Fruit borer	*Diaphania (Glyphodes) caesalis*	Crambidae	Lepidoptera
2.	Banyan tussock moth	*Perina nuda*	Lymantriidae	Lepidoptera
3.	Spittle bug	*Cosmocarta relata*	Cercopidae	Hemiptera
4.	Mealy bug	*Icerya aegyptiaca*	Monophlebidae	Hemiptera
5.	Aphids	*Aphis odinae*	Aphididae	Hemiptera

1. Shoot and Fruit borer, *Diaphania (Glyphodes) caesalis*; F:Crambidae; O: Lepidoptera

An important pest of jack. The caterpillar is reddish brown with black spots and bores into the tender shoots and developing fruits, occasionally causing substantial damage.

2. Spittle bug, *Cosmocarta relata;* F: Cercopidae; O: Hemiptera

The bugs appear on the tender shoots and foliage causing the leaves to curl up and some times they appear in swarms covering the whole area with frothy secretion

PINE APPLE

1.	Mealy bug	*Dysmicoccus brevipes*	Pseudococcidae	Hemiptera
2.	Scales	*Diaspis bromeliae*	Diaspididae	Hemiptera
3.	Thrips	*Holopothrips ananasi*	Phlaeothripidae	Thysanoptera
4.	Fruit Borer	*Strymon megarus*	Lycaenidae	Lepidoptera

1. Mealy bug, *Dysmicoccus brevipes,* F: Pseudococcidae; O: Hemiptera

They appear as cottony, small, oval, soft -bodied sucking insects . They are in variety of forms, of which pink coloured ones are commonly referred to as pineapple mealy bug. Bugs suck the sap from leaves causing the plant to wilt.

2. Fruit Borer, *Strymon megarus;* F: Lycaenidae; O: Lepidoptera

Insect is able to attack fruits even after the dry petal stage and affect developing slips as well. The larvae bore into the fruit causing holes and uneven fruit development. In most cases fruit borer attack occur during flowering and formation of the fruit, though this borer can attack slips and rarely act as a leaf miner. The reddish coloured caterpillar penetrates the inflorescence and remains in the tissue for 15 days, tunnelling and destroying the tissue. After this phase it moves to the base of the peduncle changing into a brown pupa 12 mm long and 5 mm wide and a few dark spots and emerges 7 to 10 days later as a reddish coloured butterfly.

CUSTARD APPLE

1.	Fruit borer	*Heterographis bengalella*	Phycitidae	Lepidoptera
2.	Fruit fly	*Bactrocera (Dacus) zonata*	Tephritidae	Diptera
3.	Mealy bug	*Ferrisia virgata* *Maconellicoccus hirsutus*	Pseudococcidae	Hemiptera
4.	Scales	*Aonidiella orientalis* *Parasaissetia nigra*	Diaspidiae Coccidae	Hemiptera Hemiptera

1. Fruit borer, *Heterographis bengalella,* F:Phycitidae; O:Lepidoptera

Black coloured larva bores into the fruit, makes tunnels and feeds on the internal content which results in dropping of fruits.

2. Fruit fly, *Bactrocera (Dacus) zonata,* F: Tephritidae; O: Diptera

Maggots puncture into fruits and feeds on the fruit which results in shrivelling, malformation and dropping of fruits. Maggot is yellowish. Adult fly is light brown with transparent wings.

3. Mealy bug, *Ferrisia virgata*, *Maconellicoccus hirsutus,* F: Pseudococcidae; O: Hemiptera

Adults and crawlers suck the sap from leaves, young shoots and fruits. Leaves become yellowish and the size of the fruit is reduced.

BER

1.	Fruit fly	*Carpomyia vesuviana*	Tephritidae	Diptera
2.	Fruit borer	*Meridarchis scyrodes*	Carposinidae	Lepidoptera
3.	Green slug caterpillar	*Thosea sp.*	Limacodidae	Lepidoptera
4.	Mite	*Larvacarus transitans*	Tenuipalpidae	Acari
5.	Grey hairy caterpillar	*Thiacidas postica*	Noctuidae	Lepidoptera

1. **Fruit fly,** *Carpomyia vesuviana,* F: Tephritidae, O: Diptera

It is the monophagous pest of ber. The ovipositional punctures of ber fruit fly on the fruits gives them rough appearance which later turn into black sunken spots. The maggot makes galleries towards the centre and feeds on the pulp. As a result, the fruits become rotten and emit strong disagreeable odour and finally fruit will drop to the ground. The maggots are yellowish in colour. Adults are small fly with black spot on thorax and dark spots on the wings.

2. **Fruit borer,** *Meridarches scyrodes,* F: Carposinidae ; O: Lepidoptera

The larva bores holes on the fruits and result in fruit dropping. The larva is reddish brown in colour, adults are dark brown moth.

APPLE

Major pests				
1.	Apple woolly aphid	*Eriosoma lanigerum*	Pemphigidae	Hemiptera
2.	San Jose scale	*Quadraspidiotus perniciosus*	Diaspididae	Hemiptera
3.	Cottony cushion scale	*Icerya purchasi*	Margarodidae	Hemiptera
4.	Apple codling moth	*Cydia pomonella*	Tortricidae	Lepidoptera
5.	Stem borer	*Apriona cinerea*	Lamiidae	Coleoptera
6.	Fruit fly	*Bactrocera zonata*	Tephritidae	Diptera
7.	Tent caterpillar	*Malacosoma indica*	Lasiocampidae	Lepidoptera
Minor pests				
8.	Fruit piercing moth	*Calpe aphideroides*	Noctuidae	Lepidoptera
9.	Leaf miner	*Gracillaria zachrysa*	Gracillariidae	Lepidoptera
10.	Psyllid	*Psylla mali*	Psyllidae	Hemiptera
11.	European red mite	*Panonychus ulmi*	Tetranychidae	Acarins

1. Woolly aphid, *Eriosoma lanigerum,* F: Pemphigidae, O: Hemiptera

Nymphs and adults cause weakening and death of smaller plants, galls on the roots and white woolly patches on the trunk. Purplish aphids are covered with white cottony mass.

2. San Jose scale, *Quadraspidiotus perniciosus,* F: Diaspididae, O: Hemiptera

The infested region in bark becomes reddish pink followed by purple colouration in the fruits. Female is round, slightly convex with a black pustule. Male is linear in shape.

3. Cottony cushion scale, *Icerya purchasi* F: Margarodidae O: Hemiptera

Nymphs and adults cause yellowing of leaves. Female is with cottony ovisac. Nymph is pinkish crawler with long antenna and group of hairs.

4. Codling moth, *Cydia pomonella,* F: Tortricidae; O: Lepidoptera

Larvae burrow into the fruit and feed on the pulp; fruits distorted, fruit drop, and fruits can't be marketed. Larva enters through calyx, feeds up to the central core; larval period is around one month, then it comes out and falls on the ground. It shelters in cracks and crevices of the bark, then it spins silken cocoon; pupa is yellowish brown; Larvae is pinkish white caterpillar with brown head; moth is brown; forewings are dark greenish, marked with wavy lines blend with bark making inconspicuous.

5. Stem borer: *Apriona cinerea; F:*Lamiidae; O:Coleoptera

Grub feeding results in branches having small circular hole with mass of excreta. Chewed up wood particles protrude out; bark gnawed and leaves defoliated; shoots with circuitous galleries; trunk hollowed out and the infested trees remain stunted. Adult beetles feed on bark and have an unusual habit of cutting more than they actually consume. Vitality and productivity is greatly impaired. Grub is creamy yellow with dark brown, flat head. Adult is an ashy grey beetle with numerous black tubercles at the base of elytra.

6. Fruit fly: *Bactrocera zonata;* F: Tephritidae; F: Diptera

Maggots feed on the fruits causing rotting and dropping of fruits. Maggot is dirty white, acephalic and apodous. Adult fly is small, reddish brown with yellowish cross band on the abdomen.

7. Tent caterpillar: *Malacosoma indica* F: Lasiocampidae; O: Lepidoptera

Caterpillar feeds gregariously on foliage, leaving behind only the mid rib and other harder veins. The entire plant is defoliated and they feed on soft bark of twigs. The larva has black head and abodomen. Adult is light brown colour.

Ex. No. 8 PESTS OF POTATO, SWEET POTATO AND TAPIOCA, YAM AND COLOCASIA

Date:

POTATO

1.	Potato tuber moth	*Phthorimaea operculella*	Gelechiidae	Lepidoptera
2.	Cutworms	*Agrotis ipsilon, A. segetum, Xestia C. nigrum and Peridroma saucia*	Noctuidae	Lepidoptera
3.	White grubs	*Holotrichia excisa H. repetita, H. notaticollis Anomala communis, A. nathani*	Scarabaeidae	Coleoptera
4.	Bihar hairy caterpillar	*Spilosoma obliqua*	Arctiidae	Lepidoptera
5.	Hadda Beetles	*Epilachna dodecastigma, Henoesepilachna vigintioctopunctata*	Coccinellidae	Coleoptera
6.	Egg plant shoot borer	*Leucinodes orbonalis*	Crambidae	Lepidoptera
7.	Aphids	*Aphis gossypii, Myzus persicae Lipaphis erysimi, Brevicoryne brassicae*	Aphididae	Hemiptera
8.	Leafhoppers	*Empoasca kerri*	Cicadellidae	Hemiptera
9.	Whiteflies	*Bemisia tabaci*, *Trialeurodes vaporariorum*	Aleyrodidae	Hemiptera
10.	Thrips	*Selenothrips indicus*	Thripidae	Thysanoptera
11.	Green stink bug	*Nezara viridula*	Pentatomidae	Hemiptera
12.	Green leaf Beetle	*Chalaenosoma metallicum*	Chrysomelidae	Coleoptera
13.	Tussock moth	*Dasychira mendosa*	Lymantriidae	Lepidoptera

1. Potato tuber moth, *Phthorimaea operculella*; F: Gelechiidae; O: Lepidoptera

It is a pest of field and storage. Larva tunnels into foliage, stem and tubers, which leads to loss of leaf tissue, death of growing points and weakening or breaking of stems. In tubers, irregular galleries are formed near tuber eyes. Larva is white to yellow or greenish turns red at pupation. Moth is small with silvery body. Forewing is grey-brown with minute dark spots and has a narrow fringe of hairs. Hindwings are dirty white.

2. Root grubs /White grubs**,** *Holotrichia conferta*; *Holotrichia excisa, H. repetita* , *H. notaticollis,* F: Scarabaeidae; O: Coleoptera

Anomala communis, A. nathani F: Scarabaeidae; O:Coleoptera

Grubs feed on roots and tubers; Adults feed on foliage during night; damage more during autumn. Adult: Brown beetle with pale prothorax. Larva: 'C' shaped grub with orange head

3. Bihar hairy caterpillar: *Spilosoma obliqua* F:Arctiidae O: Lepidoptera

It attacks a wide range of cultivated crops including potato. Among vegetables, preferred host of *S. obliqua* is sweet potato.

4. Cutworms

Common cutworm, *Agrotis segetum*; **Black cut worm:** *Agrotis ipsilon;* **Spotted cut worm:** *Xestia C. nigrum;* **Variegated cut worm:** *Peridroma saucia*; F: Noctuidae; O: Lepidoptera

Young larvae feed on leaves and the grown up larvae cut the stem at collar region.

Cutworm species	Larval description	Adult description
A. segetum	Black coloured with brown head. Triangular spots at spiracular region	Fore wing is grey with peg and spot like marking. Hind wing is dull white. Male has bipectinate antenna and female has filiform antenna
A. ipsilon	Black with pale mid-dorsal stripes. Head is pale-brown	Fore wing is pale brown with dark purplish brown along costal end. Hind wing is white with brown tinge. Male has bipectinate antenna and female has filiform antenna
Xestia C. nigrum	Brownish larva with series of black markings on lateral area	Reddish brown forewing with concave sunken pale area. Hindwing is dull brown
Peridroma saucia	Light brown with 4-7 yellowish markings on mid-dorsal line	Reddish brown forewing with dark brown margin. Male has bipectinate antenna and female has filiform antenna

SWEET POTATO

1.	Sweet potato weevil	*Cylas formicarius*	Apionidae	Coleoptera
2.	Hairy caterpillar	*Creatonotus gangis*	Arctiidae	Lepidoptera
3.	Blue pansy	*Precis orithya*	Nymphalidae	Lepidoptera
4.	Leaf folder	*Brachmia convolvuli*	Gelechiidae	Lepidoptera
5.	Tortoise beetles	*Aspidomorpha miliaris* *Metriona circumdata* *Chirida bipunctata*	Chrysomelidae	Coleoptera
6.	Sphinx caterpillar	*Agrius convolvuli*	Sphingidae	Lepidoptera
7.	Stem borer	*Omphisa anastomosalis*	Crambidae	Lepidoptera
8.	Spiny beetle	*Oncocephala tuberculata*	Hispidae	Coleoptera
9.	Brown looper	*Hyposidra successaria*	Geometridae	Lepidoptera
10.	Sweet potato hopper	*Exitianus indicus*	Cicadellidae	Hemiptera
11.	Fig bug	*Riptortus linearis*	Coreidae	Hemiptera
12.	Lygaeid bug	*Graptosethus servus*	Lygaeidae	Hemiptera
13.	Mealy bugs	*Geococcus coffeae*	Pseudococcidae	Hemiptera

1. Sweet potato weevil: *Cylas formicarius* F:Apionidae O: Coleoptera

Thickening and malformation of vines and often cracking of the tissue, discoloration, cracking or wilting of damaged vines, the infested tuber is often riddled with cavities or tunnels, spongy and brownish to blackish in appearance. Rotting of tuber start from the top and develop an unpleasant smell and a bitter taste. Grub is whitish, apodous with brown head. Adult is ant-like, slender bodied having elongate snout-like bluish-brown head with non-geniculate antenna, bright red thorax and legs and brownish-red abdomen.

2. Hairy caterpillar: *Creatonotus gangis* F:Arctiidae O: Lepidoptera

Larva is cylindrical, slightly tapering posteriorly and dark violet to black in colour. Meso and meta thorax are light golden-yellow. The head is black, hairy with characteristic yellow stripe dorsally.

Adult is having shiny black head. Forewings are straw coloured with pinkish tinge and a transverse black band at the centre. Hindwings are whitish with few black dots at the margin.

3. Blue pansy: *Precis orithya* F:Nymphalidae O: Lepidoptera

Larva feeds on sweet potato leaves and *Striga*, a weed parasite on sugarcane roots. Moths are medium-sized with only two pairs of functional legs. More than half of fore wings are velvety black. Hind wings are blue shaped with velvety black towards the base, thus wing pattern resembles the pansy flower.

4. Leaffolder: *Brachmia convolvuli* F:Gelechiidae O:Lepidoptera

The early instar larva scrapes the tender surface tissues of leaves remaining in thin webbings. Later on leaves folded longitudinally and green tissues eaten resulting in drying of leaves. Folds are usually single, but sometimes two folds are made, or two leaves are joined together. Full-grown larva is slightly flattened and tapering towards both ends. Head is reddish-brown, glossy and flattened; thorax and two abdominal segments are velvety black and other segments are yellowish-white with a velvety black band. Adult moth is small, slender and greyish-brown in colour

5. Tortoise beetles: *Aspidiomorpha miliaris, Chirida bipunctata, Cassida circumdata* F: Chrysomelidae: O:Coleoptera

The early instar larva grub scrape on the upper surface of the leaves and the late instar grub and adults bite large round holes in the leaves. Grubs are green, oval, flat with spiny processes covering the body and anal projection always carry debris on its back. *Aspidiomorpha miliaris* -Broad oval shaped brownish red in colour with black dots *Chirida bipunctata* - Small metallic green in colour with six black spots on elytra *Cassida circumdata* -Broad oval shaped, greenish yellow in colour with green crescent mark in middle

TAPIOCA

1.	Whitefly	*Bemisia tabaci*	Aleyrodidae	Hemiptera
2.	Spiralling whitefly	*Aleurodicus dispersus*	Aleyrodidae	Hemiptera
3.	Cassava mealy bug	*Ferrisia virgata*, *Paracoccus marginatus*	Pseudococcidae	Hemiptera
4.	Cassava scale	*Aonidomytilus albus*	Diaspididae	Hemiptera
5	Thrips	*Frankliniella spp, Corynothrips* spp, *Caliothrips* spp.	Thripidae	Thyasnopters
6	Mite	*Tetranychus urticae* *Eutetranychus orientalis*	Tetranychidae	Acari

1. Whitefly: *Bemisia tabaci* F:Aleyrodidae O: Hemiptera

Nymphs and adults suck the sap which results in chlorotic spots on the leaves and irregular yellowing of leaf tissue. Severe infestation results in premature defoliation. Sooty mould develops over the honey dew secreted by the insects. It is a vector of Indian cassava mosaic disease virus. Nymph is greenish yellow, oval in outline. Adult is minute insects with yellow body covered with a white waxy bloom.

2. Spiralling whitefly: *Aleurodicus dispersus,* F:Aleyrodidae O:Hemiptera

Nymphs and adults suck the sap which results in yellowing of leaf tissue. Sooty mould develops over the honey dew secreted by the insects. Severe infestation results in premature defoliation. Eggs are laid in concentric rings covered with mealy coat. Nymphs are with numerous

evenly spaced short glass like rods of wax on the sides of the body. Adult is powdery white, active during early morning hours.

3. Cassava mealy bug: *Ferrisia virgata, Paracoccus marginatus* F: Pseudococcidae; O: Hemiptera

Suck the sap from shoot tips, on the lower surface of leaves, and on stems. During feeding it injects a toxin into the cassava plant causing deformation and compression of terminal leaves into "bunchy tops". Length of internodes is reduced, and stems are distorted.

4. Cassava scale: *Aonidomytilus albus* F: Diaspididae:O: Hemiptera

Infest stem portion. Leaves of affected plants discoloured and dry up and the plants become stunted. Adult is a white, elongate hard scale.

5. Thrips: Frankliniella spp, Corynothrips spp, and Caliothrips spp. F;Thripidae; O: Thyasnoptera

The leaves do not develop normally, leaflets are deformed and show irregular chlorotic yellow spots. Brown wound tissue appears on the stems and petioles and internodes are shortened. The growing points may die, causing growth of lateral buds which also may be attacked, giving the plants a witches' broom-like appearance. The attack is most frequent during dry periods and plants will recover when the rain starts. Thrips can cause 15-20% yield loss.

6. Mite: *Tetranychus urticae, Eutetranychus orientalis* F.Tetranychidae; O.Acari

Mites attack foliage and cause speckling, withering and drying. Severe infestations are observed during dry period.

YAM

1. Scale insects*, Aspidiella hartii,* F: Diaspididae O: Hemiptera

Nymphs and adults cause damage. Tubers and aerial parts clustered with whitish yellow insects from field to storage. Even though it won't affect yield sometimes foliage cause poor growth and tubers may show delay in germination or even stopped. Stored tubers shrivel and become unfit for use as seed material.

2. *Aspidiotus destructor,* F: Diaspididae O: Hemiptera

Both nymphs and adult females suck the sap from leaves and shoots affecting plant growth. Oval translucent, yelllowish brown in colour with waxy material. Adult: Female: Circular, semitransparent and pale brown.

3. Yam beetles, *Galerucida bicolour*, *Lema lacordairei,* F: Galerucidae O: Coleoptera

Grubs skeletonise the leaves and later bore into leaf stalks and even main stem. Both gruns and adults cause damage. ***G.bicolour***; Grubs are white in colour. Adults are red and black coloured beetles. ***L.lacordairei***: Grub: Yellow with small head, narrow thorax and thick fleshy abdomen. Adults have yellow body and blue elytra.

4. Mealybugs: *Rastrococcus* spp. F: Pseudococcidae; O: Hemiptera

Flattened oval to round disc-like insect covered in waxy substance on tree branches; insects attract ants which may also be present; insect colony may also be associated with growth of sooty mould due to fungal colonization of sugary honeydew excreted by the insect.

COLOCASIA / TARO

1. Army worm, *Spodoptera exigua*, F:Noctuidae; O:Lepidoptera

Young larvae scrap the leaves on ventral side. Grown-up caterpillar completely defoliates. Larvae also feed on young fruits. Larva is pale greenish brown with dark markings. Yellow and

purplish spots are seen in the submarginal areas. Adult is stout moth with wavy white markings on the brown forewings and white hindwings with a brown patch along its margin.

2. Flea beetles, *Monolepta signata*; F: Chrysomelidae; O: Coleoptera

Minute eggs are laid in soil cracks around the base of the host plant. Minute worm- like larvae live in the soil and feed on small plant roots and root hairs. The hard forewings are black with two yellowish markings, one in front and the other behind the middle. Head, thorax and abdomen are reddish brown in older beetles and much brighter in younger beetles. Beetles are about 3–3.8 mm long with long antennae. Adults make large holes in leaves by feeding lef tissues. Adults are conspicuous and commonly found on leaves.

3. Whitefly, *Bemisia tabaci ;* F:Aleyrodidae; O:Hemiptera

Nymphs and adults suck the sap from undersurface of the leaves and it transmits Papaya Leaf Curl Virus. The infested plant shows leaf curling, crinkling, distortion of leaves, reduction of leaf lamina, rolling of leaf margins inward and downward, thickening of veins, leathery, brittle and distorted. Plants stunted and does not produce flowers and fruits.

4. Aphids, *Aphis gossypii*; F:Aphididae; O:Hemiptera

Nymphs vary in color from tan to grey or green. The body of adult is varied from light green mottled with dark green, but also are whitish, yellow, pale green, and dark green forms. Cotton aphids feed on the underside of leaves, or on growing tip of veins, sucking nutrients from the plant. The foliage may become chlorotic and die prematurely. Their feeding also causes a great deal of distortion and leaf curling, hindering photosynthetic capacity of the plant

5. Banana aphid, *Pentalonia nigronervosa*; F: Aphididae; O: Hemiptera

Banana aphids are the pest of taro mainly found in the lower region of the leaf along mid rib. Damage is caused by both nymphs and adults by sucking cell sap. Black sooty mould develops on honey dew secreted by aphids on leaves. Dry condition favours population flair up.

6. Lacewing bugs /Tingid, *Stephanitis typicus*, F: Tingidae; O: Hemiptera

Banana lace bug is also the pest of taro mainly feed on leaves. Lace bugs develop through three life stages: egg, nymph, and adult and have several generations a year. Females insert tiny, oblong eggs in leaf tissue and cover them with dark excrement. Lace bugs can overwinter as eggs in leaves of taro. All life stages can be present throughout the year in leaves and petiole of leaves . Adults and nymphs feed on the lower leaf surface, mostly in the region of the midrib. Feeding causes small white spots on the upper leaf surface opposite to the feeding site; chlorotic spots and dark excreta marks are left on the lower leaf surface. On taro leaves, the stylets are inserted through the stomata, rupturing cell walls, and terminating in the phloem.

7. Silver striped Hawk moth, *Hippotion celerio*; F: Sphingidae, O: Lepidoptera

Larvae may be green, yellowish green or even brown. They have a dark broken mid- dorsal line and a creamy dorso- lateral line from the fifth segment to the horn. The head is round, and usually a dull green colour. The larva has a horn which is usually long and straight. There is a large yellow and green eyespot on the third segment and a smaller one on the fourth segment. Small- to-large holes in the leaf margin is typical damage symptom. The larvae, particularly during the later stages, feed voraciously, leading to severe defoliation, the leaves may be consumed down to ground level. The larvae also feed on young succulent stems and shoots and the newly sprouted shoots.

Ex. No. 9 **PESTS OF COCONUT AND ARECANUT**

Date:

COCONUT

1.	Rhinoceros beetle	*Oryctes rhinoceros*	Scarabaeidae	Coleoptera
2.	Red palm weevil	*Rhynchophorus ferrugineus*	Curculionidae	Coleoptera
3.	Black headed caterpillar	*Opisina arenosella*	Cryptophasidae	Lepidoptera
4.	White grub	*Leucopholis coneophora*	Melolonthidae	Coleoptera
5.	Termite	*Odontotermus obesus*	Termitidae	Isoptera
6.	Scale insect	*Aspidiotus destructor*	Diaspididae	Hemiptera
7.	Lacewing bug	*Stephanitis typicus*	Tingidae	Hemiptera
8.	Coconut Eriophyid mite	*Aceria guerreronis*	Eriophyidae	Acari
9.	Slug caterpillar	*Parasa lepida* *Contheyla rotunda*	Cochlidiidae	Lepidoptera
10.	Mealy bug	*Pseudococcus longispinus*	Pseudococcidae	Hemiptera
11.	Coconut skippers	*Gangara thyrsis* *Saustus gremius*	Hesperiidae	Lepidoptera
12.	Coconut rugose spiralling white fly	*Aleurodicus rugioperculatus*	Aleyrodidae	Hemiptera

1. Rhinoceros beetle, *Oryctes rhinoceros,* F: Scarabaeidae; O: Coleoptera

Damage is caused by adult beetles which burrow the leaf sheaths near the crown and cut across the leaf in the folded condition. The damaged leaves show characteristic clippings or holes in the leaflets. The infestation will result in stunting of trees and death of growing point. Adult beetle is stout, black, about 5 cm long and has a long horn projecting dorsally from the head in male, a short horn in female. The grubs feed on decaying vegetable matter and in manure pits at a depth of 5-30 cm.

2. Red palm weevil, *Rhynchophorus ferrugineus,* F: Curculionidae; O: Coleoptera

A few small holes with protruding chewed fibrous material and oozing out of a brown liquid from such holes indicate early infestation. In advanced stage of attack the central shoot shows sign of wilting and on large mass of grubs, pupae and adults are seen inside the trunk. The reddish brown weevil has six dark spots on thorax and in the male a conspicuous long snout has a tuft of hairs.

3. Black headed caterpillar, *Opisina arenosella (=Nephantis serinopa),* F:Cryptophasidae (Xyloryctidae); O: Lepidoptera

The larvae live on the undersurface of leaflets within galleries of silk and frass material and feed by scrapping the green matter. The caterpillar is greenish brown with dark brown head and prothorax, and reddish mesothorax.

4. White grub, *Leucopholis coneophora,*F:Melolonthidae; O: Coleoptera

The grubs feed on roots and cause stunting and delayed flowering. Adult beetles emerge after monsoon showers.

5. Termite, *Odontotermes obesus,* F:Termitidae; O: Isoptera

Termites damage coconut seedlings.

6. Scale insect, *Aspidiotus destructor,*F:Diaspididae; O: Hemiptera

The undersurface of leaflets is infested by scale in large numbers causing yellowing in patches.

7. Lace wing bug, *Stephanitis typicus***,** F: Tingidae; O:Hemiptera

The nymphs and adults of the lacewing bug feed by sucking the sap from the undersurface of leaflets causing white spots on the upper surface.

8. Perianth mite, *Aceria (=Eriophyes) guerreronis,*F:Eriophyidae; O: Acarina

The mite infests and develops on the meristematic tissues under the perianth. Initial symptoms exhibits triangular pale white or yellow patches close to the perianth. Continuous feeding results in necrosis of tissues leading to formation of brown color patches, longitudinal fissures and splits on the outer surface of the husk; oozing of brown gummy exudation; reduced nut size and copra content and malformation of nuts. The mite is vermiform, elongate body with 2 pairs of legs in the anterior part of the body; head with piercing and sucking mouth parts.

9. Coconut rugose spiralling white fly, *Aleurodicus rugioperculatus,* F: Aleyrodidae, O: Hemiptera

RSW adults are about three times larger than the commonly found whiteflies and are lethargic by nature**.** RSW adults can be distinguished by their large size and the presence of a pair of irregular light brown bands across the wings. Males have long pincer like structures at the end of their abdomen. Females lay eggs on the lower surface of leaves in a concentric circular or spiral pattern and cover it with white waxy matter. Eggs are elliptical and creamy white to dark yellow in color. RSW whitefly has 5 developmental stages. The nymphs are light to golden yellow in color, and will produce a dense, cottony wax as well as long, thin waxy filaments (Stocks and Hodges 2012) which get denser over time. The puparium of this species is used for taxonomic identification. Infestation of this pest usually does not kill the host plant, but it may interfere with the normal growth of its host. The infestation results in the premature drying of leaflets. Population completely cover leaflets and were even observed on the inflorescence, pedicle and exocarp which results in reduction in fruit set and nut yield/tree. Feeding by this pest not only causes stress to its host plant, but the excessive production of wax and honeydew creates an enormous nuisance in infested areas. The presence of honeydew results in the growth of fungi called sooty mold, which then turns everything in the vicinity covered with honeydew black with mold.

ARECANUT

1.	Inflorescence caterpillar	*Tirathaba mundella*	Pyralidae	Lepidoptera
2.	Spindle bug	*Carvalhoia arecae*	Miridae	Hemiptera
3.	Inflorescence aphid	*Cerataphis lataniae*	Aphididae	Hemiptera
4.	Scale insect	*Icerya aegyptica*	Margarodidae	Hemiptera
5.	Root grub	*Leucopholis burmeisteri* *L. coneophora* *L. lepidophora*	Scarabaeidae	Coleoptera
6.	Thrips	*Rhiphiphorathrips cruentatus*	Thripidae	Thysanoptera
7.	Black headed caterpillar	*Opisina arenosella*	Oecophoridae	Lepidoptera
8.	Leaf caterpillar	*Elymnias caudata*	Nymphalidae	Lepidoptera

1. Inflorescence caterpillar, *Tirathaba mundella* F: Pyralidae O: Lepidoptera

Caterpillars feed on the inflorescences (tender female flowers) and rachillae. It webs tender branches of the inflorescence with silken thread. Unopened spathe with bore hole at the base. Spathe opening is delayed. Larva is dirty yellow or white with brown head. Adult is a small moth with ashy wings.

2. Spindle bug, *Carvalhoia arecae* F:Miridae O:Hemiptera

Nymphs and adults inhabit the inner most leaf axils, usually below the spindle. Suck the sap from tender leaflets and spindle. In severe infestation, blackish brown linear lesions formed on the spindle leaf, leaves become stunted, twisted, dried and shed. Nymphs are light violet brown, with greenish yellow with border of the body. Adult is brightly coloured with red and black.

3. Inflorescence aphid, *Cerataphis lataniae* F:Ahididae O:Hemiptera

Inflorescence and young nuts smeared with sooty mould and premature shedding of nuts.

4. Scale insect, *Icerya aegyptiaca* F:Margarodidae O:Hemiptera

Stalks and base of the ripe nuts with black necrotic patches.

5. Root grub, *Leucopholis burmeisteri* F: Scarabaeidae O; Coleoptera

Grubs feed on growing roots. Infested palms show a sicky appearance and yellowing of leaves. Adult beetle is chestnut brown in colour.

Ex. No. 10 **PESTS OF COFFEE AND TEA**

Date:

COFFEE

1.	White stem borer	*Xylotrechus quadripes*	Cerambycidae	Coleoptera
2.	Red borer	*Zeuzera coffeae*	Cossidae	Lepidoptera
3.	Shot hole borer	*Xylosandrus compactus*	Scolytidae	Coleoptera
4.	Berry borer	*Hypothenemus hampei*	Curculionidae	Coleoptera
5.	Green scale	*Coccus viridis*	Coccidae	Hemiptera
6.	Mealy bug	*Ferrisia virgata , Planococcus lilacinus, P. citri*	Pseudococcidae	Hemiptera
7.	Root mealy bug	*Geococcus coffeae*	Pseudococcidae	Hemiptera

1. White stem borer, *Xylotrechus quadripes* F: Cerambycidae; O: Coleoptera

Presence of ridges on the stem, yellowing of leaves, wilting of branches and occasional drying of plants are the symptoms caused by the grub. Grub is white or yellowish, anterior broader and tapering towards tail. Adult is black, elongate beetle with grey pubescence on the head, thorax and elytra and characteristics white markings on the elytra.

2. Red borer, *Zeuzera coffeae* F: Cossidae; O: Lepidoptera

The larvae cause wilting of branches or plant. Bore holes are often plugged with excreta at the base of the plant. Larva is orange red and smooth. Adult is with dirty white bands and black or steel blue spots on the wings.

3. Shot hole borer, *Xylosandrus compactus* F: Scolytidae; O: Coleoptera

Adult and grub tunnel the under surface of the green succulent branches between nodes which leads to the death of branches. Grub is milky white and apodous. Adult is reddish brown to brown with a short cylindrical body.

4. Berry borer, *Hypothenemus hampei* F: Curculionidae; O: Coleoptera

The coffee berry borer female attacks immature and mature coffee berries from about eight weeks after flowering upto harvest season (>32 weeks). Females bore a hole into the coffee berry and then construct galleries in the seeds (beans) where the eggs are deposited, followed by white colour grub feeding on the coffee seed. The symptoms of damages are pin hole at the tip of the berries (navel region), premature fall of young berries, increased vulnerability of infested ripe berries to fungus or bacterial infection and reduction in both yield and quality of coffee. Adult is black in colour and the males are wingless.

5. Green scale, *Coccus viridis* F: Coccidae; O: Hemiptera

Severe infestation resulting in discoloured leaves and fruits. Infested leaves are often covered with sooty mould. Tender shoots and under surface of leaves are covered with sooty mould. Nymph is pale and lemon yellow in colour. Adult is green coloured, flat oval, soft scale with a very distinct intestinal loop of black spots visible through dorsum.

TEA

1	Tea mosquito bug	*Helopeltis theivora*	Miridae	Hemiptera
2	Mites			
	Red spider mite	*Oligonychus coffeae*	Tetranychidae	Acari
	Scarlet mite	*Brevipalpus californicus*	Tenuipalpidae	Acari

	Purple mite	*Calacarus carinatus*	Eriophyidae	Acari
	Pink mite or orange mite	*Acaphylla theae*	Eriophyidae	Acari
	Yellow mite	*Polyphagotarsonemus latus*	Tarasonemidae	Acari
3.	Shot hole borer	*Euwallacea fornicates*	Scolytidae	Coleoptera
4	Sapling borer	*Sahyadrassus malabaricus*	Hepialidae	Lepidoptera
5.	Flushworm	*Cydia leucostoma*	Tortricidae	Lepidoptera
6.	Tea tortrix	*Homona coffearia*	Tortricidae	Lepidoptera
7.	Tea leaf roller	*Caloptilia theivora*	Gracillariidae	Lepidoptera
8.	Scales	*Saissetia coffeae*	Coccidae	Hemiptera
9.	Thrips	*Scirtothips bispinosus*	Thripidae	Thysanoptera
10.	Tea jassid	*Empoasca flavescens*	Cicadellidae	Hemiptera
11.	Aphid	*Toxoptera aurantii*	Aphididae	Hemiptera

1. Tea mosquito bug, *Helopeltis theivora* F: Miridae; O: Hemiptera

Adults and nymphs suck the sap from buds, young leaves and tender stems by puncturing with needle like stylets and injecting toxic saliva. These punctures appear as reddish brown water soaked spots. Later they coalesce together to form necrosis. Due to intensive feeding, leaves curl up, become badly deformed, remain small and shoots dry up gradually. Adult is black with red thorax, black and white abdomen and greenish brown wings. Body is small, slender with long antennae. An erect knobbed process on the scutellum is characteristic of the species. Nymphs are greenish yellow in colour.

2. Mites

i. Red spider mite, *Oligonychus coffeae* F: Tetranychidae; O: Acarina

Feeding by nymphs and adults causes the leaves to become bronzed dried and crumpled. Nymph and adult are brick red in colour and rounded.

ii. Scarlet mite, *Brevipalpus californicus*; F: Tenuipalpidae; O: Acarina

The infestation results in brownish leaves. Large number of mites will be seen near the petiole and along the midrib. Nymph and adult are orange and flattened ovate mite.

iii. Purple mite, *Calacarus carinatus* F: Eriophyidae; O: Acarina

This species causes brown or coppery brown or smoky discoloration of leaves. Adult mite is dark purple to pink in colour with characteristic white sides running along the back.

iv. Pink mite or orange mite, *Acaphylla theae* F: Eriophyidae; O: Acarina

Continuous desapping causes the leaves turn pale and curl upward. Under severe infestation, leaves become leathery and brown. Damages are often to top 10-15 cm tender leaves. Assam type of tea is susceptible. Nymph and adult are microscopic, orange coloured and carrot shaped with two pairs of legs.

v. Yellow mite, *Polyphagotarsonemus latus* F: Tarsonemidae; O: Acarina

The damage is restricted to top two to three leaves and the bud. Leaves become rough and brittle. Corky line or patches appear on the lamina. Internodes shortened, stunted and deformed. Mites are pale yellow in colour. Male is shorter than female with tapering abdomen and a sucker. Fourth pair of leg is provided with a curved tooth and a pair of whips. They carry female on their back. Female is bigger than male with two pairs of whip.

3. Shot hole borer, *Euwallacea fornicates* F: Scolytidae O: Coleoptera

Presence of round shot holes in primary branches. Mortality of buds and dieback symptoms in branches occur. Presence of circular or longitudinal tunnels inside the stem. Female beetle is black,

small and cylindrical. Infested branches and stems show small holes from which powdery matter is thrown out by the insect inside and gradually dry up and die.

4. Sapling borer, *Sahyadrassus malabaricus* F: Hepialidae **O**: Lepidoptera

Presence of chewed tissue at the collar region.The tunnel mouth is covered by a thick mat of bark, wood and frass particles held together by silk (particle mat cover); sapling break off at the point of injury. Adult moths hang vertically by the support of two pairs of legs. Third pair of legs is weak and has scent glands in male.

5. Flushworm, *Cydia leucostoma* F: Tortricidae O: Lepidoptera

Brown colour caterpillar ties the margin of tender leaves and forms a case enclosing the bud. Affected leaves become rough, crinkled and leathery. Shoot growth is arrested when buds are damaged. Adult is a very small blackish brown moth

6. Tea tortrix, *Homona coffearia* F: Tortricidae O: Lepidoptera

Larva makes leaf nest by webbing the leaves. Adult is greenish with black prothorax or brown coloured bell shaped moth. Male is smaller than male. Larva is greenish with black prothorax.

7. Tea leaf roller, *Caloptilia theivora* F:Gracillariidae O:Lepidoptera

Second instar larva mines the tender leaf and reaches leaf margin. Fourth instar larva rolls the leaves from tip downwards. Larva is yellowish. Adult is small, longer antenna than the body with golden iridescent patches in forewing and abdomen.

8. Scales, *Saissetia coffeae,* F:Coccidae O:Hemiptera

Hemisherical brown scales are present on the midrib and stem with sooty mould on lower leaves. Nymph is white and adult male is winged. Female is sedentary.

9. Thrips, *Scirtothrips bispinosus* F: Thripidae; O: Thysanoptera

The creamy white nymph and brown colour adult cause brown streaks near the midrib

10. Tea jassid, *Empoasca flavescens* F:Cicadellidae O:Hemiptera

Yellowing, marginal browning and cupping of leaves are the symptoms of damage. Nymphs and adults are green coloured and wedge shaped.

11. Aphid, *Toxoptera aurantii* F:Aphididae O: Hemiptera

Colonies of aphids are seen on tender shoots of tea immediately after pruning. Leaves curl up and shoot growth is stunted. Ants attend aphids for their honeydew. Honey dew fallen on the leaves facilitates the growth of black sooty mould fungus. Adult is dark brown in colour. Both alate and apterous forms exist.

Ex. No.11 **PESTS OF CASHEW, COCOA AND BETELVINE**

Date:

CASHEW

1.	Stem and root borer	*Neoplocaederus ferrugineus*	Cerambycidae	Coleoptera
2.	Tea mosquito bug	*Helopeltis antonii*	Miridae	Hemiptera
3.	Leaf miner	*Acrocercops syngramma*	Gracillariidae	Lepidoptera
4.	Shoot and blossom webber	*Lamida moncousalis*	Pyraustidae	Lepidoptera
5.	Apple borer	*Nephopteryx eugraphella*	Phycitidae	Lepidoptera
6.	Shoot and Inflorescence caterpillar	*Hypatima haligramma*	Gelechiidae	Lepidoptera
7.	Thrips	*Rhipiphorothrips cruentatus, Solenothrips rubrocinctus*	Thripidae	Thysanoptera
8.	Bark borer	*Indarbela tetraonis*	Cossidae	Lepidoptera
9.	Slug caterpillar	*Parasa lepida*	Cochlididae	Lepdioptera
10.	Leaf feeder	*Cricula trifenestrata*	Saturniidae	Lepidoptera
11.	Looper	*Oenospila flavisucata*	Geometridae	Lepidoptera
12.	Apple and nut borer	*Thylocoptila paurosema*	Phycitidae	Lepidoptera

1. Stem and root borer, *Plocaederus ferrugineus*; F: Cerambycidae; O: Coleoptera

The symptoms of damage are presence of small bore holes and extrusion of frass (like coarse dust powder) at the collar region, oozing of gum at the base of cashew tree trunk, the grubs that hatch out bore into the bark and feed on the sub-epidermal and vascular tissues. Extensive tunnelling in the stem and root region and the tissues are tunnelled in irregular fashion. As a result of damage the supply of water and nutrients is arrested by which the leaves turn yellow and are shed and finally leads to the death of the tree. Affected trees also tilt on one side due to loss of anchorage, if the injury is severe on anchoring roots. The adult is a medium sized (25-40 mmlong), reddish-brown long horned beetle. The grown up grubs are off-white in colour measuring about 7-10 cm in length.

2. Tea mosquito bug, *Helopeltis antonii*; F: Miridae; O: Hemiptera

Both nymphs and adults of this mirid bug suck sap from the tender flushes, young shoots, inflorescence, panicles, growing young nuts and apples. Occurrence of dark brown patches on green tender stem of young shoots and inflorescence rachis. Feeding on tender leaves causes crinkling and curling. Affected shoots show longblack lesions. The infested immature nuts have characteristic eruptive spots, shrivel and fall off. Heavily infested trees show scorched appearance, leading to the death of shoots and growing tips. Severely affected branches may lead to the secondary infection by fungus (*Botrydiplodia theobromae*) causing die back disease. The adult bug is reddish-brown, about 6-8 mm long with a black head, red thorax, black and white abdomen. The nymphs are wingless and smaller, but otherwise resemble the adults. The young nymphs are orange coloured and ant-like with longlegs.

3. Leaf miner, *Acrocercops syngramma*; F: Gracillaridae; O: Lepidoptera

Mining of tender leaves in whitish blotches is the symptom of damage. Larva is reddish brown and minute. Adult is silvery grey moth with fringes of hairs on the wing margins.

4. Shoot and blossom webber, *Lamida moncusalis;* F: Pyraustidae O: Lepidoptera

Presence of web on the terminal portions of new shoots and blossom is the initial symptom of infestation. The caterpillars are remaining inside the web and feed on them. The incidence is found severe mostly on young trees. The caterpillar is dark green in colour with yellow longitudinal bands and pinkish dorsal lines.

5. Apple borer/ chikoo moth, *Nephopteryx eugraphella;* F: Phycitidae O: Lepidoptera

The larva makes bore holes on the tender cashew apple. The larva is dark pink and the adult is medium sized moth with dark forewings and pale hindwings.

6. Shoot and Inflorescence caterpillar, *Hypatima haligramma;* F: Gelichiidae O: Lepidoptera

The larva causes webbing of tender leaves and inflorescence. The larva is yellowish brown and the adult is black tiny moth.

7. Thrips, Flower thrips, *Rhynchothrips raoensis*; F: Thripidae O: Thysanoptera

Foliage thrips, *Selenothrips rubrocinctus* F: Thripidae O: Thysanoptera

Adults and nymphs are seen in colonies on the lower surface of leaves and suck the sap from leaves, inflorescence and apples and nuts. As a result of their rasping and sucking activity, the leaves become pale brown, scab on floral branches, apples and nuts, forms corky layers on the affected parts. In severe cases there will be shedding of leaves and stunting of growth of trees. They are minute, slender, fragile, soft bodied, fast moving insects and adults have fringed wings. The nymphs of red-banded thrips *S. rubrocinctus* can be distinguished by their greenish yellow colour and red bands across the first and last abdominal segments.

8. Bark borer, *Indarbela tetraonis;* F: Cossidae; O: Lepidoptera

The larva causes zig-zag galleries and silken webbed masses comprising of chewed material and excreta of larva. The larva is 4.0 to 4.5 cm long, stout and dirty brown fore wings and the adult is pale brown with brown spots on the forewings.

9. Slug caterpillar, *Parasa lepida;* F:Cochlididae; O: Lepdioptera

Defoliation and larva leaving only the midrib and veins. Larva has greenish body with white lines and four rows of spiny scoli tipped red or black, which cause irritation and pain. Adult moth has green wings with prominent dark patch at the base of each forewing.

10. Leaf feeder, *Cricula trifenestrata;* F: Saturniidae O: Lepidoptera

Stout, dark brown wild silk caterpillar appears in large numbers sporadically and cause extensive defoliation of trees reducing panicle emergence.

11. Looper, *Oenospila flavisucata;* F: Geometridae; O:Lepidoptera

Larvae feed on tender leaves by rolling them. They pupate in rolled leaves.

12. Apple and Nut borer, *Thylocoptila paurosema;* F: Pyralidae; O: Lepidoptera

The caterpillars attack the fruits at all the stages and cause shrivelling and pre mature fall of nuts. In the early stages, the young larvae move to the joints of nut and apple scrape the epidermis and then bore into them. In later stages, they bore into tender apples and nuts and feed on them. The borer affected nuts do not develop, become shrivelled and dried up resulting in pre mature fall of nuts and apples. The borer tunnel near the junction of apples and nuts, and the entry holes are plugged with excreta. The adult is a medium sized moth with dark forewings and pale dark hindwings.

COCOA

1	Tea mosquito bug	*Helopeltis antonii*	Miridae	Hemiptera
2	Bark caterpillar	*Indarbela tetraonis*	Cossidae	Lepidoptera
3	Cocoa pod borer	*Conopomorpha cramerella*	Gracillaridae	Lepidoptera
4	Pod borer	*Dichocrosis (Conogethes) punctiferalis*	Crambidae	Lepidoptera
5	Mealy bugs	*Planococcus lilacinus, P. citri, Paracoccus marginatus, Rastrococcus iceryoides*	Pseudococcidae	Hemiptera
6	Aphids	*Toxoptera aurantii* *Aphis gossypii*	Aphididae	Hemiptera
7	Flatid plant hopper	*Pochazia striata*	Ricaniidae	Hemiptera

1. **Tea mosquito bug,** *Helopeltis antonii*, F: Miridae; O: Hemiptera

Both nymphs and adults pierce the surface of cocoa stems, branches and pods, killing the penetrated host cells and producing unsightly necrotic lesions. Mirids feeding on shoots often result in the death of terminal branches and leaves, causing dieback. Pests usually occur on trees exposed to sunlight since such trees tend to bear more fresh shoots and pods. Although the insect is attracted to trees exposed to sunlight, after locating their source of food they inhabit shady areas on trees.

2. **Bark caterpillar**, *Indarbela tetraonis,* F: Metarbelidae; O:Lepidoptera

The larva causes zig-zag galleries and silken webbed masses comprising of chewed material and excreta of larva. The larva is 4.0 to 4.5 cm long, stout, and dirty brown forewings and the adult is pale brown with brown spots on the forewings

3. **Cocoa pod borer**, *Conopomorpha cramerella* F: Gracillaridae; O: Lepidoptera

The larva attacks both young and mature cocoa pods and tunnel into the centre of the fruit, where they feed on the seeds for about two to three weeks. The larva chew it way out of the fruit to pupate. A common symptom of infested pods is unevenness and premature ripening. Infestation of young pods results in heavy losses because the quantity and quality of the bean becomes seriously affected. The moth is 7mm long and brown in colour with a white strip on the forewings.

4. **Pod borer,** *Dichocrosis (Conogethes) punctiferalis;* F: Crambidae; O:Lepidoptera

5. **Mealy bugs,** *Planococcus lilacinus, Planococcus citri, Paracoccus marginatus* and *Rastrococcus iceryoides*; F: Pseudococcidae; O: Hemiptera

It colonizes on the tender parts of the plant such as growing tips of the shoots, the terminal buds, the flower cushions, the young cherelles and mature pods. Feeding of mealy bugs induces cherelle wilt.

6. **Aphids,** *Toxoptera aurantii* and *Aphis gossypii*; F: Aphididae; O: Hemiptera

They colonize on the under side of tender leaves, succulent stem, flower buds and small cherelles. Heavy infestation may occur during hot summer and after rainy season which brings about premature shedding of flowers and curling of leaves.

7. **Flatid plant hopper,** *Pochazia striata* F: Ricaniidae; O: Hemiptera

BETELVINE

1	Aphid	*Aphis gossypii*	Aphididae	Hemiptera
2	Mussel scales	*Lepidosaphes cornutus*	Coccidae	Hemiptera
3	White fly	*Aleurocanthus nubilans* *Dialeurodes pallida*	Aleyrodidae	Hemiptera

4	Mealy bug	*Geococcus citrinus*	Pseudococcidae	Hemiptera
5	Shoot bug	*Pachypeltis politus*	Miridae	Hemiptera
6	Leaf eating caterpillar	*Spodoptera litura*	Noctuidae	Lepidoptera
7	Termite	*Odontotermes obesus*	Termitidae	Isoptera
8	Green looper	*Synegia sp.*	Geometridae	Lepidoptera
9	Giant African snail	*Achatina fulica*	Achatinidae	

1. Aphid, *Aphis gossypii*, F: Aphididae O: Hemiptera

Yellow coloured aphids are responsible for crinkling and curling of the leaves, stunted plants, blighted appearence and development of black sooty mould.

2. Mussel scales, *Lepidosaphes cornutus,* F: Coccidae O: Hemiptera

Both nymphs and adults infest the leaves, petioles and main veins. The scale infested leaves loose their colour, exhibit warty appearance, crinkle and dry up ultimately. The affected vines wilt in due course. Female is boat shaped, broad at thee posterior and tapering end. Male are winged.

3. White fly, *Aleurocanthus nubilans,* F: Aleyrodidae O**:** Hemiptera

Both nymph and adults infest the leaves which results in chlorotic spots on the leaves. Nymphs are oval in outline. Adults are small insects with white waxy bloom.

4. Shoot bug, *Pachypeltis politus*, F: Miridae O: Hemiptera

Infested leaves exhibit dry spots, shriveling, fading and drying symptom. Adult bug is elongated and reddish brown.

Ex. No. 12 **PESTS OF TURMERIC ,GINGER AND CORIANDER**

Date:

TURMERIC & GINGER

1.	Shoot borer	*Dichocrosis (Conogethes) punctiferalis*	Crambidae	Lepidoptera
2.	Rhizome scale	*Aspidiotus hartii*	Diaspididae	Hemiptera
3.	Leaf roller	*Udaspes folus*	Hesperiidae	Lepidoptera
4.	Rhizome maggot	*Formosina flavipes*	Chloropidae	Diptera
5.	Bihar Hairy Caterpillar	*Spilosoma obliqua*	Arctiidae	Lepidoptera
6.	Thrips	*Panchaetothrips indicus*	Thripidae	Thysanoptera
7.	Flea beetle	*Lema praeusta*	Chrysomelidae	Coleoptera
8.	Turmeric scale	*Aspidiotus cucumae*	Diaspididae	Hemiptera
9.	Lacewing bug	*Stephanitis typicus*	Tingidae	Hemiptera
10.	Leaf thrips	*Panchaetothrips indicus* *Anaphothrips sudanensis* *Asprothrips indicus*	Thripidae	Thysanoptera

1. Shoot borer, *Dichocrosis (Conogethes) punctiferalis,* F: Crambidae O: Lepidoptera

The larvae bore into pseudostem and feed on internal tissues. The presence of a borehole on the pseudostem with frass and the withered central shoot are the symptoms of pest infestation. The adult is a medium sized moth with a wingspan of about 20 mm; the wings are orange yellow with minute black spots. Fully grown larvae are light brown with sparse hairs.

2. Rhizome scale, *Aspidiotus hartii*, F: Diaspididae O: Hemiptera

It infests rhizomes in the field (at later stages of the crop) and in storage. Adult (female) scales are circular and light brown to grey and appear as encrustations on the rhizomes. They feed on sap and when the rhizomes are severely infested, they become shrivelled and desiccated affecting its germination.

3. Leaf roller, *Udaspes folus*, F: Hesperiidae O: Lepidoptera

Leaves become folded or rolled longitudinally. Greenish larva feeds within leaf folds and pupates inside the same leaffolds in a thick mass of white waxy fluff. Larvae are smooth green with black head and constricted neck. Adults are brownish black butterfly with eight white spots on different size on each forewing and a large white batch on each hindwing.

4. Rhizome maggot, *Formosina flavipes,* F: Chloropidae O: Diptera

Freshely hatched maggots bore into rhizomes, roots and pseudostem. Maggots are responsible for causing the rhizome rot. Adults are having metallic grey colour body with transparent wings.

5. Lacewing bug, *Stephanitis typicus,* F: Tingidae O: Hemiptera

Adults with transparent shiny lace like reticulate wings and black coloured nymphs suck the sap from the lower surface of the leaves which result in grey yellow spots on leaves and stunted growth.

6. Thrips, *Panchaetothrips indicus,* F: Thripidae O: Thysanoptera

Infested leaves become rolled up, turn pale and gradually dry up.

CORIANDER

1. Whitefly, *Bemisia tabaci* (Aleyrodidae: Hemiptera)

The nymphs and adults suck sap of the plants and adversely affect their growth. Nymphs are oval and greenish yellow. Adults are minute with yellow body and hyaline wings dusted with a waxy powder.

2. Aphid, *Hyadoaphis coriandri* (Aphididae: Hemiptera)

Both nymphs and adults congregate colonise on ventral surface of leaves and suck cell sap. Due to copious production of honey dew, leaves give a glistening appearance in thebeginning, but later covered with sooty mould fungus. Nymphs and adults are yellowish green.

3. Pentatomid bug, *Agonoscelis nubilais* (Hemiptera: Pentatomidae)

Adult and nymphs suck the sap from leaves and stem. Heavily infested plants show stunting. Adults are yellowish.

Ex. No. 13. **PESTS OF CARDAMOM, PEPPER, CURRY LEAF AND TAMARIND**

Date:

CARDAMOM

1.	Cardamom thrips	*Sciothrips cardamomi*	Thripidae	Thysanoptera
2.	Cardamom whitefly	*Dialeurodes cardamomi*	Aleyrodidae	Hemiptera
3.	Cardamom aphid	*Pentalonia nigronervosa*	Aphididae	Hemiptera
4.	Shoot, panicle & capsule borer	*Dichocrosis (Conogethes) punctiferalis*	Crambidae	Lepidoptera
5.	Rhizome weevil	*Prodioctes haematicus*	Curculionidae	Coleoptera
6.	Early capsule borer	*Lampides elpis*; *Jamides* sp	Lycaenidae	Lepidoptera
7.	Hairy caterpillar	*Eupterote cardamomi*	Bombycidae	Lepidoptera
8.	Galerucid borer	*Thamnuroides cardamomi*	Galerucidae	Coleoptera
9.	Shootfly	*Formosina flavipes*	Chloropidae	Diptera
10.	Brown scale	*Saissettia coffeae*	Diaspididae	Hemiptera
11.	Root borer	*Hilarographa caminodes*	Yponomeutidae	Lepidoptera
12.	Skipper butterfly	*Plesioneura alysos*	Hesperiidae	Lepidoptera
13.	Looper	*Eumelia rosalia; Ansiodes denticulatus; Thalassodes sp*	Geometridae	Lepidoptera
14.	Cutworm	*Arcilassia plagiata*	Noctuidae	Lepidoptera
15.	Lacewing bug	*Stephanitis typicus*	Tingidae	Hemiptera
16.	Root knot nematode	*Meloidogyne* spp.		
17	Red spider mite	*Dolyhotetranychus floridanus*	Tetranychidae	Acari

1. Cardamom thrips, *Sciothrips cardamomi*, F: Thripidae, O: Thysanoptera

Adults and nymphs cause damage to panicle and capsules. Thrips lacerate the surface tissues with mandibles and suck the exuding plant sap. Injury to panicles result in its stunted growth, and the injury on tender capsules develop as scabby growth on capsules. Affected capsules appear malformed, shrivelled and sometime with gaping slits. Yellowish nymph and greyish brown adult with two pairs of fringed wings.

2. Shoot/ Panicle/ Capsule borer, *Dichocrosis (Conogethes) punctiferalis*, F: Crambidae, O: Lepidoptera

Pseudostem with bore holes plugged with excreta. Deart heart, panicles and spikes dry up above the point of infestation, larvae also damage the seed and cause empty capsules. Larvae are pale greenish with pinkish tinch and fine hairs with dark head and prothoracic shield, Adult is a medium sized moth, pale yellowish with small black spots on the wings.

3. Cardamom whitefly, *Dialeurodes cardamom*, F: Aleyrodidae, O: Hemiptera

Nymphs and adults remain in colonies on the lower leaf surface and suck sap. As a result, chlorotic patches appear on the leaves followed by gradual yellowing and drying. Sooty mould development occurs due to honeydew secretion. Adult is small with two pairs of white wings. Nymphs are pale green to greenish yellow in colour.

4. Cardamom aphid, *Pentalonia nigronervosa,* F: Aphididae, O: Hemiptera

It is a vector of Katte or marble mosaic disease in small cardamom. Adults are dark brown winged and wingless aphids. Winged aphids have a prominent black veins on the wings and hence the name *nigronervosa*.

5. Early capsule borer, *Lampides elpis*; *Jamides* sp, F: Lycaenidae, O: Lepidoptera

Larvae bore and feed on inflorescence, flower buds, flowers and capsules. Infested capsules become empty with a big circular hole, turn yellowish brown, which decay and drop off in the rainy season. Larvae are flat, trowl shapped covered with dense hairs covering all over the body. Wings are bluish with metallic lusture on upper surface and borded with a white thin line and black shade.

6. Hairy caterpillar, *Eupterote cardamomi,* F: Bombycidae, O: Lepidoptera

Caterpillars are gregarious in habit. They feed voraciously on leaves and defoliate whole plant. Larvae are robust, bluish black with pale brown head and have white hairs and dorsal conical tuft of hairs. Adults are large moth, pale yellow with wavy lines and a series of spots near the outer margin of wings.

PEPPER

1.	Pollu beetle	*Longitarsus nigripennis*	Alticidae	Coleoptera
2.	Top shoot borer	*Cydia hemidoxa*	Eucosmidae	Lepidoptera
3.	Berry gall midge	*Cecidomyia malabarensis*	Cecidomyiidae	Diptera
4.	Marginal gall thrips	*Liothrips karnyi*	Thripidae	Thysanoptera
5.	Pepper mussel scale	*Lepidosaphes piperis*	Diaspididae	Hemiptera
6.	Soft scale	*Marsipococcus marsupiale*	Coccidae	Hemiptera
7.	Coconut scale	*Aspidiotus destructor*	Diaspididae	Hemiptera
8.	Whitefly	*Aleurocanthus piperis*	Aleyrodidae	Hemiptera
9.	Wild silkworm	*Cricula trifenestrata*	Saturniidae	Lepidoptera

1. Pollu beetle, *Longitarsus nigripennis,* F: Alticidae ; O : Coleoptera

Grubs bore into the berries and feed on entire internal contents. Affected berries are with exit holes, dry up later, turn dark and hollow and crumple when pressed. Irregular feeding holes are seen on leaves. Young grub is with transparent body and grown up is yellow or brownish. Adult is oblong beetle with broad body and shiny black elytra and enlarged hind femur.

2. Marginal gall thrips, *Liothrips karnyi,* F: Thripidae O: Thysanoptera

Leaves margins are folded beneath forming marginal galls as a result of feeding by white or creamy white nymphs and black adults.

3. Top shoot borer, *Cydia hemidoxa,* F: Eucosmidae O: Lepidoptera

Caterpillar damage terminal shoots of pepper vines by boring into them resulting in drying of shoot. Adult moth is small. Basal half wing is black and distal half is red. Hind wings are greyish in colour. Full grown caterpillar is greyish green in colour.

CURRY LEAF

1.	Psyllid bug	*Diaphorina citri*	Psyllidae	Hemiptera
2.	Citrus butterfly	*Papilio demoleus*	Papilionidae	Lepidoptera
3.	Bark borer	*Indarbela tetraonis*	Cossidae	Lepidoptera
4.	Citrus black fly	*Aleurocanthus woglumi*	Aleyrodidae	Hemiptera
5.	Leaf roller	*Tonica zizyphi*	Oecophoridae	Lepidoptera

1. Psyllid bug, *Diaphorina citri* (Psyllidae: Hemiptera)

The nymphs and adults suck sap of the fresh leaves and tender parts of the plants and thus vitality of infested plants reduced, giving them a sicky appearance. Nymphs secrete drops of sweet thick fluid on which a black fungus develops. Adult is brown with its head lighter brown and pointed. The

wings are membraneous semitransparent with a brown band in the apical half of the forewings. The hindwings are shorter and thinner than forewings. The nymphs are flat, louse like and orange-yellow and congregated large numbers on young leaves and buds.

2. Citrus butterfly, *Papilio demoleus, P. polytes* (Papilionidae: Lepidoptera)

Larva defoliates tender leaves. Young larva resembles bird droppings. Grown up larva is cylindrical stout and green with brown lateral oblique bands. *Papilio demoleus* adults are dark brown with numerous pale yellow markings. *P. polytes* are black butterfly with white markings.

3. Leaf roller, *Tonica zizyphi* (Oecophoridae: Lepidoptera)

Yellowish green caterpillar with black head rolls the leaves and feed on green matter. Adults are small brown moths.

4. Bark borer: *Indarbela tetraonis* (Cossidae: Lepidoptera)

The larva makes zigzag galleries in tender shoots causing wilting of the shoot. It remains in small tunnel concealed in silken webbed masses comprising of charred material and excreta at the axils of branches and feed on the bark by scraping. The full grown caterpillar is pale brown with a dark head. The pale brown moth has wavy grey markings on the wings.

5. Citrus black fly: *Aleurocanthus woglumi* (Aleyrodidae: Hemiptera)

Nymphs and adults infest tender shoot and leaves causing drying of tender shoots. Adult fly is dark orange with smoky wings and fore wings having whitish areas.

TAMARIND

1	Hard scale	*Aspidiotus tamarindi*	Diaspididae	Hemiptera
2	Soft scale	*Saissetia oleae*	Coccidae	Hemiptera
3	Fruit borer	*Argyroploce illepida*	Eucosmidae	Lepidoptera
4	Inflorescence webber	*Laspeyresia palamedes*	Eucosmidae	Lepidoptera

1. Hard Scale, *Aspidiotus tamarindi*; F: Diaspididae O: Hemiptera

Both nymphs and adults are yellowish in colour and cover leaves, fruits, twigs and suck the sap. Infested plant are devitalized which results in premature shedding of buds, flowers and fruits.

2. Fruit borer, *Argyroploce illepida;* F: Eucosmidae O: Lepidoptera

Infested fruits have holes plugged with excreta. Cream coloured larva bores into fruits and feeds on the pulp and internal content. Hollow seeds are filled with faecal pellets and loose galleries of silk and excreta. Adult moth has brown wings with single brown spot at the lower margin of the forwing.

3. Inflorescence webber, *Laspeyresia palamedes;* F: Eucosmidae O: Lepidoptera

Creamy larvae bore into tender buds and web together buds and flowers. They pupate in a cocoon within webbing. Moths are small and dark with shiny forewings bearing white lines.

Ex. No. 14. **PESTS OF ROSE, JASMINE, CROSSANDRA, CHRYSANTHEMUM,**
Date: **TUBEROSE AND CUT FLOWERS**

ROSE

1.	Rose thrips	*Rhipiphorothrips cruentatus*	Thripidae	Thysanoptera
2.	Red scale	*Lindingaspis rossi*	Coccidae	Hemiptera
3.	Rose aphid/lice	*Macrosiphum rosaeformis, M. rosae*	Aphididae	Hemiptera
4.	Red spider mite	*Tetranychus urtcae*	Tetranychidae	Acarina
5.	Hairy caterpillar	*Orgyia (=Notolopus) postica Euproctis fraterna*	Lymantriidae	Lepidoptera
6.	Castor semilooper	*Achaea janata*	Noctuidae	Lepidoptera
7.	Flower chaffer beetle	*Oxycetonia versicolor*	Cetoniidae	Coleoptera
8.	Leaf folder	*Acleris extensana*	Tortricidae	Lepidoptera
9.	Leaf cutting bee	*Megachile anthracina*	Megachilidae	Hymenoptera

1. Rose thrips, *Rhipiphorothrips cruentatus,* F: Thripidae; O: Thysanoptera

Nymph is red in colour. Adult is dark brown or black in colour. Nymphs and adults lacerate the tissues from the under surface of the leaves and suck the oozed out sap. Silvering or white streaks appear on the infested leaves. Leaves show brown patches and get distorted, finally wither and drop down. Infested flowers do not open; flowers fade and fall down prematurely.

2. Rose scale, *Lindingaspis rossi,* F: Diaspididae; O: Hemiptera

Adults are red in colour. Reddish brown waxy scale found on the lower portion of the old stem. Female - wingless comparatively large. Scales completely cover the stem. Affected portion of the plant dries up. In server infestation, the whole plant may die.

3. Rose aphid, *Macrosiphum rosaeformis,* F: Aphididae; O: Hemiptera

Aphids are small, pear shaped and soft bodied. They are light blackish green in colour. Clusters of aphids are seen on tender shoots, buds and flowers. Both nymphs and adults are found in clusters on the tender shoots, flowers and buds and suck the sap. Withering of tender shoots, buds fall off prematurely and the flowers show fading.

4. Red spider mite, *Tetranychus urticae,* F: Tetranychidae; O: Acarina

Nymphs and adults are red in colour. They feed on the undersurface of leaves and are found covered with silken webs. Yellow spots appear on the upper surface and leaves turn reddish due to feeding. Affected leaves finally wither. Growth and flower production are adversely affected.

5. Castor semilooper, *Achaea janata*, F: Noctuidae; O: Lepidoptera

Moth is stout, greyish brown with black blotches on hindwings. Full grown caterpillar is smooth, dull greyish brown with white or brown stripes along the body. Caterpillars feed voraciously on the foliage.

6. Flower chaffer beetle, *Oxycetonia versicolor,* F: Cetoniidae; O: Coleoptera

Adult beetles are red in colour with black markings. The beetles feed on buds and flower that result in irregular feeding marks.

7. Leaf cutter bee, *Megachile anthracina,* F: Megachilidae; O: Hymenoptera

Adult are hairy, medium sized dark insects and the base of the abdomen is tinged with reddish brown colour. They build cells in crevices and cavities in hedges, dead wood etc. Leaf cutter bee cuts the leaf margin in a semicircular fashion and use the leaf bits for the construction nest cells.

JASMINE

1.	Budworm	*Hendecasis duplifascialis*	Crambidae	Lepidoptera
2.	Gallery worm	*Elasmopalpus jasminophagus*	Pyralidae	Lepidoptera
3.	Leaf webworm	*Nausinoe geometralis*	Crambidae	Lepidoptera
4.	Jasmine eriophyid mite	*Aceria jasmini*	Eriophyidae	Acarina
5.	Leaf roller	*Glyphodes unionalis*	Crambidae	Lepidoptera
6.	Redspider mite	*Tetranychus urticae*	Tetranychidae	Acarina
7.	Jasmine bug	*Antestia cruciata*	Pentatomidae	Hemiptera
8.	Green plant hopper	*Flata ocellata*	Flatidae	Hemiptera

1. Bud worm, *Hendecasis duplifascialis,* F: Crambidae; O:Lepidoptera

Larva is greenish with pale body hairs and black head. Adult is small white moth with black wavy lines on hindwings and abdomen. Caterpillar makes hole on the flower bud and feeds on the inner content. Larva attacks 2 -3 buds. Petals are eaten by the larvae. Damaged buds are with boreholes and often webbed with silken threads. Webbings are soiled with excreta.

2. Gallery worm, *Elasmopalpus jasminophagus,* F: Pyralidae; O:Lepidoptera

Caterpillar is green with a red colour head and lateral brown streaks on the body. Adult is small and dark grey. Caterpillars make tunnels of silk and excreta outside the buds and seen feed on the buds.

3. Leaf webber, *Nausinoe geometralis,* F: Crambidae; O:Lepidoptera

. Larva is green with dark warts. Adult is with light brownish wings having white spots. Leaves are webbed with loose silken threads and then skeletonised.

4. Jasmine eriophyid mite, *Aceria jasmini,* F: Eriophyidae; O: Acarina

Female is cylindrical vermiform with two pairs of legs. Measures about 150- 160 µ long and 44µ thick. This is mainly seen in mullai jasmine. Severe infestation results in felt like hairy outgrowth (white velvety erinium) on the surface of the leaves, tender stem and flower buds.

5. Leaf roller, *Glyphodes unionalis,* F: Crambidae; O: Lepidoptera

Caterpillar is green in colour. Adult is a white moth with brown lines along the costal margin of forewings. Caterpillar rolls the leaves and feeds on them.

6. Redspider mite, *Tetranychus urticae,* F: Tetranychidae; O: Acarina

Nymphs and adults are red in colour. Eggs are laid on the ventral surface of the leaves, whitish and spherical shape. Feed on the undersurface of leaves and covered with silken webs. Yellow spots appear on the upper surface and turn reddish as a result of feeding. Affected leaves finally wither away. Growth and flower production are adversely affected.

7. Jasmine bug, *Antestia cruciata*, F: Pentatomidae; O: Hemiptera

Nymph is dark brownish black and round. Adult is shield shaped and dark brown in colour with orange and white marking on wings. Nymphs and adults suck the sap from tender shoots and buds which prevent flower formation.

CROSSANDRA

1	**Aphids**	*Aphis sp*	Aphididae	Hemiptera
2	**Crossandra bug**	*Cynenica affinis*	Pentatomidae	Hemiptera

1. Aphids, *Aphis sp*, F: Aphididae; O: Hemiptera

Both nymph and adult suck the sap from tender leaves and inflorescence. The infested inflorescence fail to open and the leaves dry off.

2. Crossandra bug, *Cynenica affinis*, F: Pentatomidae; O: Hemiptera

These are small bugs with greenish, brownish marking on the body. Both the nymphs and adults suck the sap from tender leaves, spikes, as a result brown lesions seen on the infested parts followed by drying and dropping of the affected parts.

CHRYSANTHEMUM

1	Black aphid	*Macrosiphoniella sanborni*	Aphididae	Hemiptera
2	Leaf folder	*Hedylepta* (*Lamprosema*) *indicata*	Pyraustidae	Lepidoptera
3	Thrips	*Microcephalothrips abdominalis* *Haplothrips ramakrishnae* *Frankliniella* sp, *Thrips* sp	Thripidae	Thysanoptera
4	Bud borer	*Helicoverpa armigera*	Noctuidae	Lepidoptera
5	Leaf miner	*Liriomyza trifolii*	Agromyzidae	Diptera
6	Papaya mealy bug	*Paracoccus marginatus*	Pseudococcidae	Hemiptera

1. Aphid, *Macrosiphoniella sanborni,* F: Aphididae; O: Hemiptera

Dark brown colour aphids cause yellowing, premature leaf fall, withering, stunted growth, leaf curling, decrease in flower size and unopened flowers.

2. Leaffolder, *Hedylepta* (*Lamprosema*) *indicata,* O: Pyraustidae; F: Lepidoptera

The larva is green with white stripes and the adult is orange moth with dark lines. The larvae fold the leaves.

3. Thrips, *Microcephalothrips abdominalis, Frankliniella* sp, *Thrips* sp, F: Thripidae; O: Thysanoptera

The nymphs and adults infest the flower heads by lacerating the sepals and feeds on the oozing sap. This leads to withering, silvering, mottling, distortion of leaves and damaged flowers

4. Bud borer, *Helicoverpa armigera* , F: Noctuidae; O: Lepidoptera

Larva feeds on the buds and flowers.

TUBEROSE

1.	Bud Borer	*Helicoverpa armigera*	Noctuidae	Lepidoptera
2.	Stripped mealybug	*Ferrisis virgata*	Pseudococcidae	Hemiptera
3.	Thrips	*Thrips flavus, T. tabaci*	Thripidae	Thysanoptera
4.	Aphids	*Aphis craccivora*	Aphididae	Hemiptera
5.	Ash weevils	*Myllocerus sp*	Curculionidae	Coleoptera
6.	Red spider mites	*Tetranychus urticae, T. telarius*	Tetranychidae	Acarina
7.	Bulb mite	*Rhizoglyphus echinopus*	Tenuipalpidae	Acari

1. Bud Borer, *Helicoverpa armigera***,** F: Noctuidae; O: Lepidoptera

Larva bore into buds and flowers and feeds on the internal content.

2. Stripped mealybug, *Ferrisia virgata* ; F: Pseudococcidae; O: Hemiptera

Nymphs and adults suck the sap from the base of the plants and this leads to yellowing, drying of leaves, sooty mould over the leaves and reduction of flower yield.

3. Thrips, *Thrips flavus*; *T. tabaci,* F: Thripidae; O: Thysanoptera

Thrips suck the sap from leaves, flower stalk and flowers. Sometimes, these are associated with a contagious disease known as 'bunchy top', where the inflorescence is malformed.

4. Aphids, *Aphis craccivora*, F: Aphididae; O: Hemiptera

These are tiny insects, soft bodied, green, deep purple or black in colour. These usually occur in clusters and feed on flower buds and young leaves.

5. Ash weevils, *Myllocerus* sp; F: Curculionidae; O: Coleoptera

The weevils feed on the edge of the leaves, producing a characteristic notched effect. Larvae feed on roots and tunnel into the bulbs.

6. Red spider mites, *Tetranychus urticae, T. telarius* F:Tetranychidae ; O:Acari

Mites are red or brown in colour. They thrive well under hot and dry conditions, usually on the undersides of the leaves, where these make webs, if allowed to continue. Mites suck sap, which results in the formation of yellow speckles and streaks on the foliage. In due course of time, leaves become yellow, silvery or bronze and distorted.

7. Bulb mite, *Rhizoglyphus echinopus*, F: Tenuipalpidae; O: Acarina

Mites are yellowish white in colour with a pink tinge. Shines like bead and slow moving. Both nymphs and adults feed on the bulbs. The outer crust of the bulb scales become hardened and turn light chocolate brown in colour. Scale of the bulb gets dried and broken into fine filaments.

CUT FLOWERS

CARNATION

1. Green peach aphid, *Myzus persicae*, F: Aphididae; O: Hemiptera

Nymphs and adults cause yellowing and drying of tender shoots. Clusters of aphids are seen on tender shoots, buds and flowers. Aphids are small, pear shaped and soft bodied. They are light blackish green in colour.

2. Carnation tortrix moth, *Tortix pronubata*, F: Torticidae; O: Lepidoptera

Larva fasten the leaves together with silken threads and feeds on the leaves. Larva is yellow or green in colour. Adult is a small moth with greyish brown wings.

3. Grass mite, *Siteroptes framinum,* F: Siteroptidae; O: Acari

Feeding by nymphs and adults causes the leaves to become bronzed dried and crumpled. Nymph and adult are brick red in colour and rounded.

4. Western flower thrips, *Frankliniella occidentalis*, F: Thripidae; O: Thysanoptera

It feeds on leaves, flowers, or stems. The undersides of leaves are spotted with small black specks. The lacerated leaves are with yellow patches and black spots of excreta. Flowers become flecked, spotted, and deformed and many buds fail to open. Nymph is red in colour. Adult is dark brown or black in colour.

5. Cyclamen mite, *Steneotarsonemus pallidus*, F: Tarsonemidae; O: Acari

The damage by this mite includes irregular deformities of growth pattern, rosette type growth, irregular fruit or leaf growth, and even the total destruction of the growing tips. The immature stage is opaque white, almost transparent. A triangular enlargement is seen at the posterior end of the body. Adults vary from milky-white to yellowish brown and are elliptical in shape.

6. Variegated cutworm, *Peridroma saucia*, F: Noctuidae; O: Lepidoptera

Larva cut the young plants at the base or near the ground level. The worms generally are brownish grey, mottled, with a darker brownish dorsal line and five or less brownish gray pyramidal

marks on the rear dorsal sides of the larvae. There is usually a dark "W" mark on the top of the eighth abdominal segment.

GERBERA

1. Aphids, *Myzus persicae*, F: Aphididae; O: Hemiptera

Nymphs and adults cause yellowing and drying of tender shoots. Clusters of aphids are seen on tender shoots, buds and flowers. Aphids are small, pear shaped and soft bodied. They are light blackish green in colour.

2. Army worm, *Spodoptera exigua*, F: Noctuidae; O: Lepidoptera

Young larvae scrape the leaves on ventral side. Grown-up caterpillar completely defoliates. Larvae also feed on young fruits. Larva is pale greenish brown with dark markings. Yellow and purplish spots are seen in the submarginal areas. Adult is stout moth with wavy white markings on the brown forewings and white hindwings with a brown patch along its margin.

3. Spider mite, *Oligonychus spp,* F: Tetranychidae; O: Acari

Feeding by nymphs and adults cause the leaves to become bronzed dried and crumpled. Nymph and adult are brick red in colour.

4. Mites, *Polyphagotarsonemus latus,* *Steneotarsonemus pallidus;* F: Tarsonimidae; O: Acari

Leaves and flower buds are adversely affected. Flowers become malformed and unsaleable. Male mites are small and white to pale yellow in colour. Females are yellowish and bigger than the males.

5. Flower thrips, *Thrips orientalis*; F: Thripidae; O: Thysanoptera

The lacerated leaves are with yellow patches and black spots of excreta. Nymphs are red in colour. Adult is dark brown or black in colour.

6. Whiteflies, *Trialeurodes vaporariorum, Bemisia tabaci,* F: Aleyrodidae, O: Hemiptera

White chlorotic spots appear on leaves, which later coalesce to form reddish yellow area that extends from veins to the outer edges. Leaves fall prematurely. Number and quality of flowers, squares and bolls gets reduced. Nymphs and adults secrete honeydew, which lead to sooty mould formation. Nymphs are oval and greenish yellow. Adults are minute with yellow body and hyaline wings dusted with a waxy powder.

Ex. No. 15 **PESTS OF GLORIOSA, COLEUS, PHYLLANTHUS ASWAGANTHA, SENNA AND**
Date: **PERIWINKLE**

GLORIOSA

1. Lily caterpillar, *Polytela gloriosae,* F: Noctuidae; O: Lepidoptera

Early instars feed on chlorophyll of the leaves. Later instars feed voraciously leaving only the hard stem of the plant. The larva is black with red and white spots on the body and the adult is brown with yellow and red markings.

2. Semilooper, *Plusia signata,* F: Noctuidae; O: Lepidoptera

Caterpillar feed on the leaves. Larva is green colour with brown spots on the body surface. Adult is medium sized, brown coloured moth with white streaks on the forewing.

3. Leaf eating caterpillar, *Spodoptera litura,* F: Noctuidae; O: Lepidoptera

On hatching, clusters of young larvae feed gregariously by initially scraping the surface of the leaf. Later instars disburse and move to other leaves and feed voraciously, producing large irregular holes and may leave only the veins. High infestation causes severe defoliation. The newly hatched larvae are greenish with a dark longitudinal band on each side. The larvae are pale greenish brown with dark markings and the body have rows of dark spots or transverse and longitudinal grey and yellow bands. They gradually turn brownish black as they mature. The fully grown larva is stout and cylindrical measuring 30-50 mm in length.

4. Thrips, *Thrips tabaci,* F. Thripidae; O. Thysanoptera

Immature and adult thrips feed with a punch-and-suck behavior that removes leaf chlorophyll causing white to silver patches and streaks. Nymph is white to pale yellow in color. Adult is elongate, yellow and brown body with two pairs of fringed wings. This pest is vector of Gloriosa Necrosis Virus.

COLEUS

1. Tingid bug, *Monantha globulifera,* F: Tingidae ; O: Hemiptera

Black spiny nymphs and lace winged adults suck the sap from leaves. Attacked leaves develop yellow patches, become brown, shrivel and dry up in severe cases.

2. Spike borer, *Helicoverpa armigera,* F: Noctuidae; O: Lepidoptera

Larvae initially feed on foliage and later damage developing spikes.

PHYLLANTHUS

1.	Aphid	*Macrosiphum euphorbiae*	Aphididae	Hemiptera
2.	Whitefly	*Bemisia tabaci*	Aleyrodidae	Hemiptera
3.	Thrips,	*Thrips tabaci*	Thripidae	Thysanoptera
4.	Red spider mite	*Tetranychus urticae*	Tetranychidae	Acari

1. Aphid, *Macrosiphum euphorbiae,* F: Aphididae; O: Hemiptera

Nymphs and adults suck the sap from leaves, weakening and early wilting of the plant, infested leaves show leaf chlorosis, withering and premature dropping of leaves, finally death of the plant. Aphids are elongated pear shaped body with large red eyes, black cornicles and pinkish in colour.

2. Whitefly, *Bemisia tabaci***,** F: Aleyrodidae; O: Hemiptera

Nymphs and adults suck the sap from leaves, weakening and early wilting of the plant, leaf chlorosis, leaf withering, premature dropping of leaves and death of the plant

3. Thrips, *Thrips tabaci,* F: Thripidae; O: Thysanoptera

Nymphs and adults lacerate the leaves, leaf curling, withering and death of the plant**.** nymphs and adults are pale yellowish in colour.

4. Red spider mite, *Tetranychus urticae,* F: Tetranychidae; O: Acari

White spots developed on the feeding sites, in severe case, the whole leaf became white and drying. Nymphs and adults are red in colour. Eggs are laid on the ventral surface of the leaves and are whitish, spherical in shape.

PERIWINKLE

1.	Sphingid larvae	*Deilephila nerii*	Sphingidae	Lepidoptera
2.	Leaf eating caterpiller	*Anomis flava*	Noctuidae	Lepidoptera
3.	Leafhopper	*Macrosteles fascifrons*	Cicadellidae	Hemiptera
4.	Grass hopper	*Acrida exaltata*	Acrididae	Orthoptera

1. Sphingid, *Dilephila nerii*; Sphingidae; Lepidoptera

Larvae cause severe damage to plants by feeding extensively on leaves, buds and flowers. Adult has a greenish head, with rufous in front and a grey band on vertex. The thorax is green, and the collar outlined in grey. There is a triangular grey patch on the vertex. Adult lays pale glossy green eggs. The larvae are not typical of hawk moth caterpillars, with the horn on the terminal segment being less pronounced than usual, and absent in some species. The head and thoracic segments can be retracted into the first and second segments of the abdomen, which then appear enlarged and display eye-spots.

2. Leaf eating caterpillar - *Anomis flava*; Noctuidae; Lepidoptera

Anomis flava has an uninterrupted succession of generations. The caterpillars are notable for their feeding traces. They usually sit on the underside of leaves. Larva Green with five longitudinal white stripes and red prolegs. Pupates inside leaffold. Adults have reddish brown wings with wavy markings. It shows a clear sexual dichroism. Males are darker and the females more yellowish.

3. Leafhopper, *Macrosteles fascifrons,* F: Cicadellidae; O: Hemiptera

Small, greenish, wedge shaped sucking insects that cause leaf-flecking and yellowing. This pest transmits aster yellow disease, which causes yellowing, distortion and stunting of plants.

Ex. No. 16 **PESTS OF LAWN AND STORED PRODUCTS**

Date:

LAWN

1. Armyworms, *Spodoptera frugiperda and Peridroma saucia,* F: Noctuidae; O: Lepidoptera

Caterpillars first skeletonize the grass blades and later create bare spots. The caterpillar is greenish when small, dark brown when mature.

2. Cutworms, *Agrotis* spp., F: Noctuidae; O: Lepidoptera

Several species of cutworms (e.g., black or granulate cutworms) occur, but seldom are serious pests in turfgrass. Larvae usually dig a burrow in the ground or thatch (or use an aeration hole) and emerge at night to chew off grass blades and shoots. Damage may appear as circular spots of dead grass or depressed spots that look like ball marks on golf greens.

3. Fire Ants, *Solenopsis invicta*, F: Formicidae; O: Hymenoptera

The red imported fire ant is an introduced pest that creates large mounds in turfgrass and inflicts painful bites and stings to people, pets, livestock and wildlife. Mounds can also damage mowing, harvesting, or electrical equipment.

4. Hunting Billbug, *Sphenophorus venatus verstitus,* F: Curculionidae*;* O: Coleoptera

These are white, legless grubs with brown head capsules. Adults are black weevils. Adults have a raised Y-shaped area surrounded by curved lines on the prothorax and rows of large and small pits on the wing covers.

5. Mole Crickets, *Scapteriscus* spp., F: Gryllotalpidae; O: Orthoptera

Three mole cricket species (tawny, southern, and short-winged; *Scapteriscus* spp.) are significant pests in turf. Damage is caused by mole cricket tunneling in the soil, which exposes and dries out roots. Nymphs and adults of the tawny and short-winged mole crickets feed on roots and grass blades at night.

6. Rhodesgrass Mealybug, *Antonina graminis,* F: Pseudococcidae; O: Hemiptera

It prefers Rhodesgrass, Johnsongrass, bermudagrass and St. Augustinegrass. Infested grass plants gradually turn brown and die. St. Augustinegrass may become discolored and develop spots.

7. Spittle bugs, *Propsapia bicincta,* F: Cercopidae; O: Hemiptera

The two-lined spittlebug, *Propsapia bicincta* damage turfgrasses, especially bermuda, St. Augustine, centipede, bahia, crab, Johnson and orchard grasses. It also feeds on many crops, ornamentals and weeds. Nymphs and adults both suck plant juices. In centipede grass a reddish-purple and/or white stripe may run lengthwise down on damaged grass blades. Heavy infestations may kill, wither or reduce the growth of turfgrasses.

8. White Grubs, *Cyclocephala* spp and *Phyllophaga* spp, F: Melolonthidae; O: Coleoptera

Larvae are C-shaped grubs. They are whitish in color with dark areas at the rear and a brownish head. The adults are scarab beetles. Grubs become most damaging in August and may continue feeding until January.

STORED PRODUCTS

I. Primary storage pests: Insects that damages whole grains are primary storage pests

A. Internal Feeders

1.	Rice weevil	*Sitophilus oryzae, S. zeamais, S. granarius*	Dryophthoridae	Coleoptera
2.	Lesser grain borer	*Rhyzopertha dominica*	Bostrychidae	Coleoptera
3.	Angoumois grain moth	*Sitotroga cerealella*	Gelechiidae	Lepidoptera
4.	Pulse beetle	*Callosobruchus chinensis, C. maculatus*	Bruchidae	Coleoptera
5.	Cigarette beetle	*Lasioderma sericorne*	Anobiidae	Coleoptera
6.	Drug store beetle	*Stegobium paniceum*	Anobiidae	Coleoptera
7.	Tamarind Beetle	*Pachymeres gonagra*	Bruchidae	Coleoptera
8.	Sweet Potato weevil	*Cylas formicarius*	Apionidae	Coleoptera
9.	Potato tuber moth	*Phthorimoea operculella*	Gelechiidae	Lepidoptera
10.	Arecanut beetle	*Araecerus fasciculatus*	Anthribidae	Coleoptera

B. External Feeders

1.	Red flour beetle	*Tribolium castaneum*, *Tribolium confusum*	Tenebrionidae	Coleoptera
2.	Indian meal moth	*Plodia interpunctella*	Phycitidae	Lepidoptera
3.	Fig moth or almond moth	*Ephestia cautella*	Phycitidae	Lepidoptera
4.	Rice moth	*Corcyra cephalonica*	Galleriidae	Lepidoptera
5.	Khapra beetle	*Trogoderma granarium*	Dermestidae	Coleoptera

II. Secondary storage pests: Insects that damage broken or already damaged grains secondary storage pests.

1.	Saw toothed grain beetle	*Oryzaephillis surinamensis*	Silvanidae:	Coleoptera
2.	Long headed flour beetle	*Latheticus oryzae*	Tenebrionidae	Coleoptera
3.	Flat grain beetle	*Cryptolestus minutas,*	Cucujidae	Coleoptera
4.	Grain lice	*Liposcelis divinitorius*	Liposcelidae	Psocoptera
5.	Grain mite	*Acarus siro*	Acaridae	Acari

I. PRIMARY STORAGE PESTS

A. Internal Feeders

1. Rice weevil: *Sitophilus oryzae* F: Dryophthoridae O: Coleoptera

Both the adults and the grubs cause damage to rice, sorghum, wheat, barley, maize. The developing larva lives and feeds inside the grain causing irregular holes of 1.5 mm diameter on grains of rice, sorghum, wheat, barley, maize before harvest and in storage. The weevils destroy more than what they eat. Grub is white and apodous with yellowish brown head. Adult is small reddish brown weevil with four yellow spots.

2. Lesser grain borer: *Rhyzopertha dominica* F: Bostrychidae O: Coleoptera

Both the adults and the grubs cause damage to wheat, rice, maize, sorghum, barley, lentils, army biscuits, ship biscuits, stored, dried potatoes, corn flour, beans, pumpkin seeds, tamarind seeds and millets. The adults and grubs bore into the grains feed and reduce them to mere shells with many irregular holes.

The adults are powerful fliers and migrate from one godown to another, causing fresh infestation. Adults produce a considerable amount of frass, spoiling more than what they eat. The larva is about 3mm long, dirty white, with light-brown head and a constricted elongated body. The adult is a small cylindrical beetle measuring about 3 mm in length and less than 1 mm in width. It is shining dark brown with a deflexed head, covered by a crenulated hood-shaped pronotum.

3. Angoumois grain moth: *Sitotroga cerealella* F: Gelechiidae O: Lepidoptera

The damage is at its maximum during the monsoon. Only the larvae cause damage by feeding on the paddy, wheat, maize, sorghum, barley, oats grain kernels before harvest and also in storage. The larva bores into grain and feeds on its contents. Exit holes of 1 mm diameter with or without a trap door, are seen on the affected cereal grains. As it grows, it extends the hole which partly gets filled with pellets of excreta. It imparts unhealthy appearance and smell. In a heap of grain, the upper layers are most severely affected. A full grown larva is about 5 mm long, with a white body and yellow brown head. The adult is a buff, grey yellow, brown or straw coloured moth, measuring about 10-12 mm in wing expanse. The characteristic feature is the presence of the narrow pointed wings fringed with long hair.

4. Pulse beetle: *Callosobruchus maculatus* (*chinensis*) F: Bruchidae O: Coleoptera

The adult and grub feed on gram, mung (*Phaseolus aureus*), mothbean (*Phaseolus aconitifolius*), peas, cow peas, lentil and arhar (*Cajanus cajan*), cotton seed, sorghum and maize grain by making a small hole. Infested stored seed can be recognized by the white eggs on the seed surface and the round exit holes with the 'flap' of seed coat. Kabuli types are particularly susceptible. Larva is whitish with a light-brown head. The mature larva is 6-7 mm long. The adult beetle measuring 3-4 mm in length, is oval, chocolate or reddish brown and has long serrated antennae, truncate elytra, not covering the pygidium.

5. Cigarette beetle: *Lasioderma serricorne* F: Anobiidae O: Coleoptera

Both grubs and adults bore into tobacco products viz., cigarettes, cheroots and chewing tobacco. Presence of circular pin head sized bore holes on processed tobacco is the typical symptom of attack. It also attacks the grain of wheat, peanut, cocoa, bean, cotton seed etc.Adult light brown round beetle with its thorax and head bent downwards and this presents a strongly humped appearance to the insect. The elytra have minute hairs on them. Antenna is of uniform thickness. Grub is whitish and hairy.

6. Drug store beetle: *Stegobium paniceum* F: Anobiidae O: Coleoptera

Circular pin-head sized bore hole on turmeric, coriander, ginger, dry vegetable and animal matter. Adult reddish brown small beetle has striated elytra and measured 3 mm long. Antenna is clubbed. It lays the eggs in batches of 10 – 40. Grub is not hairy but is pale white, fleshy with the abdomen terminating in two dark horny points.

7. Tamarind beetle: *Pachymeres gonagra* F: Bruchidae O: Coleoptera

Small grey coloured adult. It makes circular holes on fruits of tamarind both in tree and storage.

8. Sweet potato weevil: *Cylas formicarius* F: Apionidae O: Coleoptera

Whitish apodous with brown head. Adult is slender ant like with a long snout and shiny black with reddish brown thorax and legs. Grubs and adults bore into the tubers and make them unfit for consumption. Damage occurs both in field and storage

9. Potato tuber moth: *Phthorimoea operculella* F:Gelechiidae O:Lepidoptera

Larva is pale greenish. Adult is small with narrow fringed wings; forewings grey brown with dark spots and hindwings dirty white. Damage occurs both in field and storage. Tubers bored by caterpillars associated with fungal or bacterial infection.

10. Arecanut beetle: *Araecerus fasciculatus* F: Anthribidae O: Coleoptera

Internal content is eaten leaving outer coat intact. Causes more contamination than the actual damage. Coffee, cocoa, spices, maize, groundnut, brazilnut, dried cassava roots and processed foods. Adult is greyish brown.

B. External Feeders

1. Red flour beetle: *Tribolium castaneum* F: Tenebrionidae O: Coleoptera

Both the larvae and adults cause damage in wheat-flour, dry fruits, pulses and prepared cereal foods, such as cornflakes. The greatest damage is during the hot and humid monsoon season. The larvae are always found hidden in the food. The adults, however, are active creatures, but mostly found concealed in flour. Adult construct tunnels as they move through flour and other granular food products. In severe infestation, the flour turns greyish and mouldy, and has a pungent, disagreeable odour making it unfit for human consumption. The young larva is yellowish white and measures 1 mm in length. As it matures, it turns reddish yellow, becomes hairy and measures over 6 mm in length. The adult is a small reddish-brown beetle, measuring about 3.5 mm in length and 1.2 mm in width. The last antennal segment is transversely rounded.

2. Indian meal moth: *Plodia interpunctella* F: Phycitidae O: Lepidoptera

It infests grains, meals, breakfast foods, soybean, dried fruits, nuts, dried roots, herbs, dead insects, etc. Only the larva causes damage. Crawling caterpillars completely web over the surface of a heap of grains with silken threads. The adults fly from one bin to another and spread the infestation. Larva is white, often tinged with green or pink, a light-brown head, On reaching maturity, the larva is 8-13 mm in length. The adult moth is about 13-20 mm in wing expanse with a coppery lustre.

3. Almond Moth / Fig moth: *Ephestia cautella* F: Pyralidae O: Lepidoptera

It is a serious pest of dried fruits such as currants, raisons, dried apples, dates, berries, figs, almonds, walnuts, tamarind seeds, etc. It has also been recorded on lac, malted milk, dried mango, pulp, garlic bulbs, various cereal grains and grain products. The caterpillars make tunnels in the food materials. The number of silken tube is sometimes extremely high and these clog the mill machinery where the infested grains have been sent for milling. The adult moth has greyish wings with transverse stripes on the outer region and the wing expanse is about 12 mm. The full-grown larva is white with pinkish tinge.

4. Rice moth: *Corcyra cephalonica* F: Pyralidae O: Lepidoptera

It infests rice, sorghum, maize, gram, groundnut, cotton-seed, milled products, cocoa beans and raisins. The larvae alone damage the grains of rice and maize by feeding under silken webs. When infestation is high, the entire stock of grains may be converted into a webbed mass. Ultimately, a characteristic foul odour develops and the grains are rendered unfit for human consumption.

5. Khapra beetle: *Trogoderma granarium* F: Dermestidae O: Coleoptera

The Khapra beetle will attack any dried plant or animal matter. It prefers grain and cereal products, mainly wheat, barley, oats, rye, maize, rice, flour, malt, and noodles. It can also feed on animal products such as dead mice, dried blood, and dried insects. Fresh yellowish-white larva grows 4mm long and turns brown. The adult is a small dark-brown beetle, 2-3 mm long, with a retractile head and clubbed antennae. The entire body is clothed with fine hairs.

II. SECONDARY STORAGE PEST

1. Saw toothed grain beetle: *Oryzaephilus surinamensis* F: Cucujidae O: Coleoptera

It feeds on grains, dried fruits etc by scarving of grain surface or burrowing holes in them. It attacks rice, wheat, maize, cereal products, oil seeds and dry fruits. It is slender, dark, narrow, flattened beetle having a row of saw like sharp teeth on each side of the prothorax. The antenna is clubbed and elytra cover abdomen completely. The larva is slender, pale cream in colour with slightly darken patches on each segment.

2. Long headed flour beetle: *Latheticus oryzae* F: Tenebrionidae O: Coloeptera

Both grubs and adult beetles feed on the milled products. It occurs as secondary infestation in stored grain. It attacks cereal flour, packaged food, rice and rice products. Occurs as secondary infestation in stored sorghum, wheat, etc. The beetle is light brown in colour with elongated body, measuring 2 -3 mm in length and resembles *Tribolium castaneum*. The grub is small, white active which feeds voraciously. Head is longer in proportion to the body than that of *Tribolium*, paler and brighter than *Tribolium*.

3. Flat grain beetle: *Cryptolestes minutus* F:Cucujidae O:Coleoptera

Both grubs and adults feed on broken grains or on milled products. In case of heavy infestation it cause heating in grain and flour. It attacks rice, maize, wheat with excessive broken, different flours, ground nut particularly with high moistures and mouldy grains. It is smallest among the stored grain insect pests. It is light to dark reddish brown beetle measuring 1.5 mm to 2.0 mm. The larva is cigar like yellowish white with two reddish brown spots at anal segment.

4. Grain lice: *Liposcelis divinitorius,* O: Psocoptera :

They are scavengers affecting only germ portion in heavy infestation. It thrives on insect fragments and broken grains. It attacks all starchy material. It is pale grey or yellowish white coloured, small, pin head sized louse with filiform antenna.

5. Grain mite: *Acarus siro, F:Acaridae; O:* Acari :

It feeds on the surface of the grains. It attacks cereal grains, flour and other eatables. It is pale straw to dark reddish brown mite. It lays about 100 eggs. The eggs are hatched into 6 legged larvae which moult into nymphs having 8 legs. There are 1-3 instars. The life cycle is completed in 9-12 days at 23 ^{0} C and 70 % relative humidity.