

PESTS OF TOMATO

3rd Semester

Ento - 232

Sr. No.	Common Name	Scientific Name	Family : Order :
1)	Tomato Fruit borer (Gram pod borer)	<i>Helicoverpa armigera</i> (Hubner)	Noctuidae Lepidoptera
2)	Leaf eating Caterpillar	<i>Spodoptera litura</i> (Fabricus)	Noctuidae Lepidoptera
3)	Fruit sucking moths	<i>Othreis fullonica</i> <i>O. materna</i>	Nocituidae Lepidoptera
4)	Jassids	<i>Amrasca biguttula biguttula</i> <i>Ishida</i>	Cicadellidae Hemiptera
5)	White fly	<i>Bemisia tabaci</i> (Gennadius)	Aluerodiadae Hemiptera
6)	Aphids	<i>Aphis gossypii</i> (Glover)	Aphididae
7)	Mealy bug	<i>Myzus persicae</i> (sulzer) <i>Ferrisia virgata</i> (Cokerell)	Hemiptera Pseudococcidae
8)	Hadda beetle	<i>Epilachna tridecastigma</i> (mulsant)	Hemiptera Coccinellidae
9)	Leaf miner	<i>Epilachna vigintioctopunctata</i> (F) <i>Liriomyza trifolii</i> burg.	Agromyzidae Diptera
10)	Thrips	<i>Thrips tabaci</i> (Lindeman) <i>Calliothrips indicus</i> (B)	Thripidae Thysanoptera
11)	Mites	<i>Tetranychus cinnabarinus</i>	Tetranychidae Acarina

1. Fruit borer : *Helicoverpa armigera* (Hub) Noctuidae : Lepidoptera → Polyphagous

Economic Importance : It is a major pest of tomato, widely distributed in the tropics, sub tropics & warmer temperate region of the world. It is a serious pest of gram & tur.

Markes of Identification : Moth : medium sized stout, light yellowish brown. Forewing are pale brown with a dark brown circular spot in the center. Hindwings are pale smoky-white with blackish border.

Caterpillar : 3 to 5 cm long greenish with dark broken gray lines along the side of body

site of oviposition:
leaves, flowers & fruits
pupation → in soil.

Life History :- Described under pear and borer

Nature of Damage : On hatching, young larvae feed on tender foliage. Full green larvae attack the fruits. (They bore circular holes & insert only a part of their body inside the fruits & eat the inner contents. If the fruit is bigger in size, it is only partly damaged by the caterpillar but later it is invariably invaded by fungi & bacteria & spoiled completely. The larvae move from one fruit to another & single caterpillar may damage & destroy 2 to 8 fruits.)

2015 Control Measures :-

1. In early stage of attack, handpicking of caterpillars & their destruction help in reducing the intensity of infestation.
2. Ploughing the field after harvest of the crop would expose the pupae which would be destroyed by birds.
3. Spraying the crop with 0.05% quinalphos or fenitrothion.
4. Apply Helicoverpa armigera nuclear polyhydrosis virus (HaNPV) @ 250 to 500 LE/ha
1mg spray NSKE @ 0.4%

2. Cutworm : Agrotis ipsilon Roll.

Described under potato.

3. Leaf Eating Caterpillar : Spodoptera litura Fab.

Marks of Identification : Moth: Stout, forewings are grayish brown patterned with wavy white marking, hind wings semi-hyaline white with dark brown marginal line. Caterpillar : Stout, 4-5 cm long, pale brown in colour with a greenish to violet tinge.

Host Plants :- Tobacco & tomato are the major hosts. Also recorded on banana, citrus, cabbage, cauliflower, cowpea, gram, castor, cotton, maize, okra, peas, rice, sorghum, etc.

L. H. :- Eggs : Laid in clusters on ventral side of tender leaves, covered with brown hairs.

I. P. :- 3 - 5 days & may extend 20 days in winter.

Larva : L. P. : 20 to 28 days & may extend 90 days in winter.

Pupa : Pupation takes place in soil in rough earthen cocoons P.P. 7 - 11 days & may extend 30 days in winter.

Moth : Adult longevity is 10 - 24 days.

Life Cycle :- Completed 30 - 40 days during summer & 18 - 20 weeks in winter.

2014

N. D. :- Freshly hatched larvae feed gregariously, scrapping the leaves from ventral surface but later these larvae disperse & feed voraciously at night on the foliage. During severe infestation entire crop may be defoliated over - night.

Control Measures :

1. Fields should be properly ploughed to expose & kill the pupae in the soil.
2. Flood irrigation to drown the hibernating caterpillars.
3. Collection & destruction of egg-masses & leaves with young larvae feeding gregariously.
4. Spraying with 0.05% dichlorvos / dusting with carbarly 10% dust.

2014
Q. White fly :

Bemisia tabaci Gen. Aleyrodidae : Hemiptera.

Aleyrodidae

Economic Importance : Commonly known as cotton white fly, found in most of the countries in tropics & subtropics. The infestation is sporadically severe.

Marks of Identification :- Nymph are oval scale like & greenish white in colour.

Adult : Minute insects, 1 mm long, covered completely with a white waxy bloom, wings are opaque & milky white in colour.

Host plants : Main hosts are cotton, tobacco & some winter vegetables, including tomato.

Life History : Reproduction is mostly oviparous, though parthenogenesis also occurs.

Only males emerge from unfertilized eggs whereas both sexes develop from fertilized eggs.

Eggs : Laid on under surface of tender leaves. I.P. 3-5 days in summer & may extend 5-33 days in winter.

Nymphs : Nymphal period 9-14 days in summer & 17-18 days in winter.

Pupa : Pupation takes place on leaves, P.P. 2-8 days. Adult longevity 2-5 days in summer & 24- days in winter.

Life cycle : Completed in 2-4 weeks. No. of generation : 12 / year.

The pest is more active during the dry season & its activity decreases with the onset of rains.

2014

Nature of Damage : Nymphs & adults suck the cell sap from ventral surface. As a result of their feeding the affected parts become yellowish, leaves wrinkle & curl downward & are ultimately shed. Besides the feeding damage, these insects also exude honey dew which develops sooty mould. In case of severe infestation, this black coating is so heavy that it interferes with the

Photosynthetic activity of plant resulting in stunted growth
transmitting leaf curl virus disease causing severe loss
uprooted & destroyed

This whitefly also acts as a vector.
Such plants are necessarily to be

Control Measures : 1. To prevent the damage or population build-up of this pest, spray with 0.05% formathion or dimethoate. In case of severe infestation spray the crop twice with 0.03% oxydemetonmethyl or thionexon will effectively check the pest population. or spraying the crop with 0.1% methyldemeton/diamethoate/0.05% fenprothrin.

Note : Pesticides should reach to the lower sides of leaves.

5. Mealy bugs : Ferrisia virgata Ck.

Pseudococcidae : Hemiptera

Economic Importance : It is a major pest of tomato, found all over Indian subcontinent & south-east Asia.

Marks of Identification : Crawlers : Freshly hatched crawlers are yellowish in colour & become pale white.

Adult females : Apterous, long, slender, slightly oval covered with dusty white waxy secretion & having a pair of conspicuous long glossy wax tassels at the caudal end.

Host Plant : Pest infests cotton, tomato, groundnut, guava, jute, sugarcane, sweet potato, beans, citrus etc.

Life History : Reproduction is sexual as well as parthenogenetic.

Eggs : Laid in clusters in cottony ovisac which remain concealed under female. On hatching, the crawlers remaining huddled together in cottony nest under the body of mother. I.P.:- 15 minutes to 4 hrs.

Nymphs : N.P. last for about 20-60 days in male & 19-47 days in female.

Adults : Longevity of male is 1-3 days while female 5-7 weeks.

The pest is found throughout the year, though it is less active during winter.

Nature of Damage : Crawlers become active & wander about, moving till they find a succulent spot for feeding, they puncture the epidermis, inject their toxic saliva & start sucking cell sap. The mechanical injury thus caused also serves as an entry for various disease producing organisms like bacteria & fungi. From 2nd instar onwards the nymphs secrete honey dew on which sooty mould may develop, which in turn hinders the photosynthetic activity of the plant resulting in stunted growth. Preadults & adults secrete a waxy mealy material.

PEST OF BRINJAL

2013

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Brinjal shoot & fruit borer	<i>Leucinodes orbonalis</i> (Guenee)	Pyrallidae Lepidoptera
2)	Brinjal stem borer	<i>Euzophera perlicella</i> (Ragonot)	Pyrallidae Lepidoptera
3)	Brinjal Leaf roller	<i>Antoba olivacea</i> (Walker)	Noctuidae Lepidoptera
4)	Hadda beetle / Epilachna beetle	<i>Epilachna clodecastigma</i> (mulsant) <i>Epilachna virginotopunctata</i> (fabricus)	Coccinellidae Coleoptera
5)	Brinjal Leaf hopper or jassids	<i>Amrasca biguttula biguttula</i> (Ishida)	Cicadellidae Hemiptera
6)	Leaf sucking bugs / Lace wing bug	<i>Urentius sentis</i> (Distant)	Tingidae Hemiptera
7)	Aphids	<i>Aphis gossypii</i> (Glover) <i>Myzus persicae</i> (Sulzer)	Aphididae Hemiptera
8)	White flies Tomato	<i>Bemisia tabaci</i> (Gennadius)	Aleuradidae Hemiptera
9)	Termites	<i>Trinervitermes biformis</i> (wasman)	Termitidae Isoptera
10)	Mites	<i>Tetranychus telarius</i> L.	Tetranychidae Acarina
11)	Nematode	<i>Meloidiogyne incognita</i>	Heteraderidae Tylenchida
12)	Greyweevil	<i>Mylloceris spp.</i>	

1. Brinjal shoot & Fruit borer-S.N. : *Leucinodes orbonalis* Pyralidae : Lepidoptera

Economic Importance : It is one of the most serious pests of fruits & plants. Long & narrow fruits are less susceptible to attack. 21% fruits are found damaged by this pest.

Marks of Identification : Moth : medium size. the forewings are whitish with large black & brown patches & dots all over.

Caterpillar : Small, light pink in colour.

Control Measures :

1. To check the spread of the pest remove & destroy all the affected leaves & twigs as soon as infestation is noticed
2. If large areas get infested spray with Carbaryl 0.4% or Acephate 0.1%.

6. Aphids : *Aphis gossypii* G. *Myzus persicae* S. Hem. Aphididae
7. Leaf Hoppers : *A. biguttula biguttula* Ishida. Hemiptera : Cicadellidae
8. Thrips : *Thrips tabaci* Lind. *Caliothrips indicus* B.
9. Mites : *Teranychus* spp - Red spider mite *Aceria* spp - Eriophied mite.

Nature of Damage : The affected parts become reddish brown & bronzy, wither & dry away. A severe infestation affects the flower & fruit formation.

C.M. :-

1. Clip off the affected leaves & burn or bury them in soil.
2. In case of severe infestation dusting with 300 mesh sulphur or spraying with wettable sulphur.

10. Leaf miner : *Liriomyza trifoli* burg. *Agromyzidae* : Diptera
- American serpentine leaf miner has entered in India with severd incidence in Maharashtra, Karnataka, A.P., Gujrat etc.

Mark s of Identification : Adult fly : 1.5-2.0 mm long, grayish black with yellow spot on top of thorax & has plum red eyes. Larva : Legless, orange yellow, about 2 mm. long.

Life History : Eggs : Laid singly in small incisions in the leaf with ovipositor. Pupation takes place in soil.

Nature of Damage : Maggots feed in between two layers of leaf on mesophyll making narrow serpentine mine that appears whitish when seen from upper surface, ultimately causing blotches & holes.

Control Measures : Monitoring the presence of flies by sticky traps & spray crop with insecticide.

Assignment : Describe the IPM Programme for tomato crop.

Host Plants : Polyphagous, brinjal, potato bitter gourd, pea pods, cucurbits etc

Life History : Eggs : 250, laid singly on ventral side of leaves, shoots, flower buds or sometimes on fruits. I.P. : 3-5 days in summer and 7-10 in winter days. Pupa : Pupa in boat shaped cocoons on plant P.P. : 7-10 days. Adult : life span : 2-3 days. The pest is active throughout the year. L.P. : 14-20 days.

²⁰¹⁸ Nature of Damage : Infestation starts few weeks after transplanting, the caterpillars bore into the growing shoots, midribs & petioles of large leaves & feed on internal tissues. As a result of damage, affected shoots wither & dry up & plants exhibit the symptoms of drooping. After fruit formation, larvae makes their entry under the calyx, when they are young. The holes, later plugged with excreta leaving no visible sign of infestation. Large circular holes seen on the fruits are the exit holes. Such fruits loose market value & are unfit for human consumption.

²⁰¹⁵ Control measures :

1. Continuous cropping of brinjal & potato should be avoided.
2. Removal & destruction of affected shoots & fruits alongwith larvae.
3. Spray with 0.2% carbaryl or dusting 10% carbaryl dust @ 20 kg / ha. 3-4 weeks after transplanting & second application 15 days after controls the pest effectively.

2. Jassids

Little leaf

Amrasca biguttula biguttula Ishida.
the pest is discussed under potato.

transmit viral diseases

Leaf hoppers

Amrasca biguttula
biguttula

3. Aphids

M. persicae Sulz.

the pest is discussed under potato.

4. White fly

Bemisia tabaci genn.

Aleurodididae : Hemiptera

Economic Importance : It is serious pest of brinjal now a days.

Marks of Identification : Adult : Fly is small, delicate insect with yellow body & hyaline wings dusted with waxy powder.

Nymphs : is small, sluggish & pale yellow.

Host plant : Polyphagous, feeds on brinjal, cotton, okra, potato cabbage, cauliflower, tomato, melon & some weeds.

Life History : Eggs : 119 laid singly on the underside of leaves

1 P : 3-5 days in summer & 5-33 days in winter

Nymphs : NP : 9-14 days in summer & 17-18 days in winter

Pupa : PP : 2-8 days, Pupation : On leaves.

Adult : longevity : 2-5 days in summer & 24 days in winter.

Life Cycle : Completed in 14-22 days. No. of generations : 10-12 / year.

Nature of Damage : Both nymphs & adults suck the cell sap from the underside of the leaves. In case of severe infestation the vitality of the plant is lowered & vegetative growth is checked. This result in shedding of flower buds & fruits. The insects also excrete honey dew on the leaves which encourages the development of black sooty mould, adversely affecting the photosynthesis. The attacked crop gives sickly appearance. Besides, the pest is known to transmit virus diseases in many crops.

Control Measures : Spray the crop with 0.1% methyl demeton / dimethoate / 0.5% fenprothrin as soon as incidence is noticed.

Minor pests :

5. Leaf roller : *Antoba olivacea* M
Pyralidae : Lepidoptera

Nature of Damage : Caterpillar folds the leaves from tip upwards & feeds within green matter. As a result, folded leaves wither & dry up. Larvae always found in the leaf folds.

Control Measures : 1. Removal & destruction of leaf folds along with caterpillar helps minimizing the infestation.

2. Dusting with 10% carbaryl dust @ 20-25 Kg / ha.

3. Spray with 0.2% carbaryl if infestation is severe.

6. Epilachna beetle : *Epilachna* spp.
Coccinellidae : Coleoptera

pest is described under potato.

7. Tingid Bug (Brinjal lace wing) *Urentius* sp.
Tingidae : Hemiptera.

Nature of Damage : Nymphs & adults suck the cell sap from the leaves. As a result the leaves become yellowish & found covered with excreta. The summer brinjal crop suffers most.

Control Measures : Spray with 0.5 % DDVP or dimethoate or dusting with 10% carbaryl dust @ 20 kg / ha.

8. **Mites :** *Tetranychus telarius* L.
Tetranychidae : Acarina

Nature of Damage : They are found in large colonies on underside of leaves covered with fine silky webs. As a result of their feeding, white specks appear on leaves. These later enlarge & leaf become discoloured & dries away.

Control Measures : Spray with 0.2 % sulphur control the mites effectively.

9. **Root knot Nematode :** *Meloidogyne* spp. It is described under potato.

10. **Grey weevil (Ash weevil) :** *Myliocerus* spp.
Curculionidae : Coleoptera

Nature of Damage : The adult weevil feeds on leaves giving shot hole appearance & the grubs feed on roots.

Control Measures : Dusting the crop with 2 % methyl parathion dust @ 20 kg / ha

Assignment : Describe the Integrated pests management (IPM) programme for brinjal crop.

PESTS OF CHILLI

PESTS OF BELL PEPPER

- 1) Thrips :- *Scirtothrips dorsalis* H.
- 2) Gall Midge :- *Asphondylia capsici*.
- 3) Mites :- *Polyphagatarrsonemus latus*(banks)

PESTS OF CHILLI

Major Pests

2015

1. Thrips : i) *Scirtothrips dorsalis* Hood.
Thripidae : Thysanoptera ✓
ii) *Thrips tabaci* Lind.

Economic Importance : In case of severe infestation 30-50% crop may lost. Also responsible for transmitting leaf curl disease.

Marks of Identification : Adult : Minute, delicate insect less than 1 mm. long & yellow in colour. Wings are fringed with hairs.

Nymphs : More minute & wingless. Yellowish. straw in colour.

Host Plants : Polyphagous onion, brinjal, cotton, mango, bottle gourd, guava.

Life History : Both sexual & parthenogenetic reproduction occur.

Eggs : Female lays 50 – 60 fertilized or unfertilized eggs inside the leaf tissues generally on lower side of the leaf. I.P. : 8 – 9 days.

Larva : L.P. 4 – 6 days. **Pupa :** Pre pupal & pupal periods are generally found in soil at a depth of 2.5 – 5 cm. The pest is more active during latter part of monsoon season especially during a dry days.

✓ **Nature of Damage :** Both nymphs and adult cause damage. They scrap the epidermis of leaves & suck the cell sap. The damaged leaves initially become whitish, later brown & ultimately dry. As a result, leaves curl & become small. Such symptoms locally known as "Murda" or "Bokadya." transmit leaf curl disease. Infested leaves start curling and crumbling.

✓ **Control Measures :** Spraying with 0.2% dimethoate / 0.2 % Carbaryl as soon as infestation is noticed. Repeated sprays should be given at an interval of 10 to 15 days.

2. Mites : *Tetranychus* spp Tetranychidae : Acarina.

These are white mites and not easily seen by naked eyes. They are found in large numbers on ventral side of leaves under a protective cover of fine webs. Both nymphs and adults suck the cell sap and devitalize the plants. Severally infested leaves show brownish patches & ultimately dry up. Leaves curl downward. The pest is very serious in dry or rainfed areas. It also act as vector for transmitting chilli 'leaf curl or murda disease.

2011, 2009

Control Measures : Spray 0.2 % Sulphur or 0.03 % Dicofol/Ethion 0.05% or dusting with Sulphur
@ 20- 25 kg / ha

3. **Aphids** : *Aphis gossypii* G. *Myzus persicae* Sulzer
Described under potato

4. **Cut worms** : *Agrotis ipsilon* Rott.
Described under potato.

5. **Termites** : *Odontotermes obesus* R. Termitidae : Isoptera.

This is highly polyphagous pest & has a very wide range of host plants.
Roots are occasionally damaged by termites. The incidence is more in sandy loam soils than in
clay soils.

Control Measures : Soil application of Indane 1.3 % dust @ 125 kg / ha. OR Methyl parathion 2
% dust @ 20 – 25 kg / ha.

6. **Rootknot nematode** : *Meloidogyne* spp. Described under potato.

7. **Fruit borer** : *Helicoverpa armigera* Hubn. *Spodoptera litura*

Nature of Damage : The caterpillar bore into fruits and cause severe damage.

Control Measures : Given under pea pod borer.

8. **White Fly** : *Bemisia tabaci* G.
Described under brinjal.

Exercise No. 4
PESTS OF POTATO

Sr. No.	Common Name	Scientific Name	Family : Order.
1)	Potato tuber moth	<i>Phthorimaea operculella</i> Zeller	Gelechiidae Lepidoptera
2)	Cut worm	<i>Agrotis ypsilon</i> (Hufn)	Noctuidae Lepidoptera
3)	Gram caterpillar Tomato fruit borer	<i>Helicoverpa armigera</i>	Noctuidae Lepidoptera
4)	Epilachna beetle	<i>Epilachna dodecastigma</i> M.	Coccinellidae Coleoptera
		<i>Epilachna vigintioctopunctata</i> F.	Coccinellidae Coleoptera
5)	White grub	<i>Holotrichia consanguinea</i>	Scarabaeidae Coleoptera
6)	Jassids/Green potato leafhopper	<i>Amrasca biguttula biguttula</i> <i>Ishid & Empaasca</i> spp.	Cicadellidae Jassidae
7)	Aphid	<i>Aphis gossypii</i> Glover	Hemiptera Aphididae
		<i>Myzus persicae</i> (sulz)	Aphididae
8)	Whitefly	<i>Bemisia tabaci</i> Gen.	Aleurodidae
9)	Mealybug	<i>Ferrisia virgata</i> (cicrell)	Pseudococcidae
10)	Thrips	<i>Scelenothrips indicus</i> Boan	Thripidae Thysanoptera
11)	Termite	<i>Odontotermes obesus</i> Ramb.	Termitidae Isoptera
12)	Mite	<i>Tetranychus telarius</i> L.	Tetranychidae Acarina
13)	Nematodes		

The crop is damaged by several pests in the field and in storage. The tuber moth assumes serious forms causing huge losses.

1. Tuber moth : *Phthorimaea operculella* Zedler.

Gelechiidae : Lepidoptera

Economic Importance : It is a cosmopolitan pest found in warmer countries throughout the world. It is not native of India but was first introduced in Bombay from Italy about 100 years ago. In India it is reported in U.P., Maharashtra, Bihar and Punjab. It is serious both in field and storage, but particularly more serious in storage. In the plains it is active throughout the year & passes its life cycle on potato plants in the fields from Nov. to March as a leaf miner or boring into petioles, terminal shoots and tuber underground, and from April to November in storage. It has been said that 30 - 70 % tubers get infested under indigenous methods of storage, if not properly attended. The temp. 86 - 100 F. is found most congenial for the pest activity.

Marks of Identification Moth : Small, narrow winged & grayish brown. It is nocturnal in habit.
Caterpillars : Small, pinkish - white or pale greenish.

Host Plant : The caterpillars are reported to feed on leaves of potato, tobacco & tomato in field but potato tuber under storage are most vulnerable to its attack.

Life Cycle : Eggs : 150 - 250 eggs are laid singly near the eyes of exposed tuber or sometimes on underside of leaves. Incubation Period - 3-6 days.

Larva : Larval Period - 2-3 weeks.

Pupa : Pupation takes place in rough silken cocoons. Pupal period : - 7-10 days.

Life Cycle : Total period about 4 weeks. No. of generation : 8 - 9 / year.

2014
Nature of Damage : In early stage of the crop growth the pest is injurious to plant as leaf miner. It also bores into petioles and terminal shoots. The main danger is to tubers both in the field and under storage. The caterpillars bore the tubers and feed on the pulp. As result potato tubers rot. The presence of black excreta near the eye buds help to detect its presence in the tuber. On cutting such tubers, one can find the larva in the pulp.

2015
Control Measures : In field :

1. Timely earthing up of the crop to cover the exposed tubers, helps in reducing the intensity of infestation.
2. Spray with quinalphos or 0.1% carbaryl at 60 days after planting.
3. Heaps of harvested potatoes should not be kept exposed in the fields but covered with straw. The infested tubers should be rejected before storage.

2012

4. Release of egg larval parasitoid, Copidsoma koehleri B @ 20,000 mummies / ha at 7 days interval starting 45 days after planting or release of egg larval parasitoid Chelonus blackburni @ 60,000 adults / ha in 4 releases at weekly interval found to reduce infestation.

In storage :

1. The potatoes should be stored in well ventilated cool and dry places, with temp not exceeding 21°C
2. Covering of tuber with 1" layer of dry sand is cheap and highly effective remedy against the pest.
3. Fumigate the tuber with methyl bromide @ 1 Kg / 27 cu.m. for 3 hrs before storage.
4. Walls of godown should be sprayed with 1.5 % carbaryl at an interval of three months.
5. Treatment of seed potato tubers with 5 % malathion dust @ 125 g / 100 kg is reported to offer good protection against the pest. Such treated potatoes however, should not be used for consumption.
6. If cold storage facilities are available, the produce can be safely stored for a longer period.
7. Release of egg-larval parasitoid, Copidsoma koehleri B @ 500 pairs / quintal or C. blackburni @ 200 adults / quintal tubers in storage, helps in reducing the intensity of infestation.
8. Application of Bt powder @ 100 g / quintal tubers in storage also found effective in reducing the infestation of pest.

CP-1111

2. Cutworm : Agrotis ipsilon Rott.

OR : Lepidoptera Fam. : Noctuidae,

Economic Importance : Cosmopolitan pest, reported to occur throughout the country. It is serious in low lying areas which remain water logged for considerable time during the year. It causes severe damage in seedling stage. The damage to the crop varies from 12 - 35 %.

Marks of Identification : Moth : Medium sized, stout with grayish brown wavy lines & spots on fore wings. The moths are active at dusk and are attracted by light.

Caterpillar : 4-5 cm long, dirty black in colour and have habit of coiling at slightest touch.

Host Plant : Polyphagous - potato, pulses, barley, oat, tobacco, peas, gram, cotton, tomato, Lucerne, chillies, brinjal and other vegetables.

Life History : Eggs : 300-350 in clusters laid on ventral leaf surface or moist soil. I.P. : 4-5 days.

Larva : 1 P. - 3-5 weeks.

Pupa : Pupation in soil in earthen cocoons P P - 11-18 days.

Life Cycle : Completed in 5 - 9 weeks. It is cool climate pest active from October.

2015
/ Nature of Damage : The caterpillars hide during the day in cracks & crevices in soil or in debris around the plants & feed on tender leaves during night by cutting seedlings near ground level. The destruction is much more than actual feeding.

/Control Measures :

1. Heaps of green grasses may be kept at suitable interval in infested field during evening & collect next day early in the morning along with caterpillars & destroy.
2. Clean cultivation and mechanical destruction of caterpillars also help in reducing pest infestation.
3. 5% carbaryl poison bait @ 25 - 60 Kg / ha controls the pest effectively. (1 kg carbaryl 50 WP + 10 kg wheat bran + 1 kg jaggery & sufficient water.)
4. Apply lindane dust @ 125 kg / ha. before planting of potato crop.

3. Aphids : Myzus persicae Sukzer
Aphididae : Hemiptera

Marks of Identification : Adult : Oblong, tiny, yellowish, soft bodied insect with two projections called cornicles on dorsal side of the abdomen.

Host Plants : Polyphagous : Potato, brinjal, cabbage, radish, chilli, tomato, tobacco, sunhemp, sweet potato etc.

Life History : Alate and apterous forms reproduce parthenogenetically. Single female produces 8-22 nymphs/day. The nymph undergo 4 moults. A generation is completed in 7 - 9 days and several generations are completed in a season.

Nature of Damage : They are found in large number on underside of leaves & tender shoots. The nymphs & adults suck the cell sap as a result affected leaves turn yellow, get wrinkled & distorted. The aphids exude honeydews of which a fungus develops & rapidly covers the plant with sooty mould that interferes with photosynthetic activity of plant. The growth of the plant is stunted & the yield is adversely affected. Besides, they transmit various virus diseases such as "leaf curl," mosaic & vein necrosis & cause severe loss.

Control Measures : Spray with 0.05 % dichlorvos or 0.03 % dimethoate or oxydemeton methyl control the pest effectively. Repeat the spraying if necessary after 10 to 12 days.

4. Jassids : *Amrasca biguttuala* Ishida
Jassidae : Hemiptera

Economic Importance : It is predominant pest. Heavy infestation results in considerable reduction of tuber formation.

Marks of Identification : Adults : Greenish yellow with front wings having a black spot at the apical margin & two black spots on the vertex of the head.

Nymphs : are also green. They walk diagonally.

Host Plant : Potato, brinjal, cotton & other malvacious plants. (Polyphagous pest.)

Life History : Eggs : Whitish eggs are laid singly in leaf tissues along the veins. I.P. 1 week. ²⁰¹⁵

Nymphs : N.P. : 1 – 2 week (moult 5 times.)

Life Cycle : completed in a period of 1 month.

Nature of Damage : Both nymphs & adults suck the cell sap from the lower surface of leaves. The damaged leaves curl upwards along the margins, turn yellowish, then brown & show burnt patches which adversely affect the growth & yield.

Control Measures : Spray with 0.03 % dimethoate control the pest effectively.

Minor pests :

5. Epilachna beetle or : *E. vigintioctopunctata* F. *E. decastigma* M.
Haddabeetle Coccinellidae , Coleoptera

Marks of Identification : Beetle : Spherical, pale brown & mottled with black spots. *E. decastigma* has 6 spots on each elytra, while *E. vigintioctopunctata* has 14 spots on each elytra.

They are strong flier.

Grubs : Yellow with hairs on body.

Nature of Damage : Both grub & beetle eat the chlorophyll of leaf in between the veins & cause characteristic skeletonised patches on leaves

Hosts : Potato, tomato, brinjal, cucurbits, crucifers etc. It is a polyphagous pest.

Control Measures :

1. Hand picking of grubs and collection of beetles by hand nets during early stage of attack helps in reducing the intensity of infestation.
2. Spray with 0.05 % DDVP / Malathion. The details of this pest are given under cucurbits.

6. Thrips : *Selenothrips indicus* B. Thripidae : Thysanoptera
It is found damaging Potato in India a specifically in Southern States.
It is a tiny, slender, fragile insects adult having fringed wings.

Nature of Damage : The nymphs & adults scrap the epidermis of leaves (near the tip of leaves) & suck the oozing sap. As a result, light brown patches appear on infested leaves. The affected leaves curl & become dry.

Control Measures : Spray 0.05 % Dichlorvos or 0.2 % Carbaryl or 0.03% Dimethoate.

7. Mites : *Hemitarsonemus latus* Banks.
Tetranychidae : Acarina

Nature of Measures : They suck the cell sap from leaves. Badly attacked leaves show a peculiar bronzy & shiny appearance, which ultimately wither & dry.

Control of Measures : Spray with 0.2 % sulphur or 0.03 % dicofol or dusting with sulphur @ 20-25 kg / ha gives satisfactory control of the pest.

8. Root knot Nematode : *Meloidogyne* spp.

Nature of Damage : These are sedentary endoparasites, feeding on roots & cause galls or knots on the roots. Growth & yield is adversely affected.

Control Measures :

1. Application of non-edible oilseed cakes like neem or karanj @ 1500 ÷ 2000 kg / ha 3 Weeks before planting / sowing of crops gives satisfactory control
2. Follow suitable crop rotation Always take cereals after vegetable crops.
3. Collect & destroy galled roots of previous vegetable crops
4. Growing marigold in fields as inter or border crop makes the field free from plant parasite nematodes in soil.

Assignment : Describe the IPM programme for potato crop.

2015

RECEIVED NO. 6
PESTS OF OKRA

Sr.No.	Common Name	Scientific Name	Family	Order
1)	Shoot and fruit borer	a) <i>Earias vitella</i> F.	Noctuidae.	
	Spotted boll worm	b) <i>Earias insulana</i> B.	Lepidoptera	
2)	Bhendi fruit borer.			
2)	Leaf roller :	<i>Sylepta derogata</i> Fab.	Pyradidae	
	(Cotton Leaf Roller)		Lepidoptera.	
3)	Leaf hopper / Jassids	<i>Amrasca biguttula biguttula</i>	Cicadelidae.	
4)	Aphid	<i>Aphis gossypii</i> Glover	Hemiptera.	
5)	White fly	<i>Bemisia tabaci</i> Gennadius.	Aphididae.	
6)	Cotton grey weevil	<i>Myloccerus maculosus</i> D.	Hemiptera.	
7)	Mite	<i>Tetranychus telarius</i> L.	Aleurodidae.	
8)	Root knot Nematode	<i>Meridogyna incognita</i>	Hemiptera.	
			Cuculionidae	
			Coleoptera.	
			Tetranychidae	
			Acarina	
			Heteroderidae	
			Tylenchida	

Major Pests :

1. Shoot & fruit borer

Sylepta derogata Fab. *E. insulana* Boisdu
Lepidoptera : Noctuidae

Economic Importance : Serious pest of bhendi & cotton.

Marks of Identification : The moths are yellow green and measures about 25 mm across wings.
E. vitella - moths having small white forewings with broad greenish band in the middle.
insulana - the forewings are entirely greenish. Caterpillars of both species are brownish with having number of black & brown spots on the body & hence also called spotted bollworm. Length is 18 mm. The eggs are spherical in shape. Light bluish - green in colour.

Host Plants : bhendi, okra, ar-badi, hollyhock & several other malvaceous plants.

Life History : Eggs 60 - 432 laid on tender shoots, flower buds & young fruits. I.P. 3 - 7 days

Larva L.P. 9 - 11 days in summer & 20 days in winter.

Pupa : Pupation in the tough silken cocoons either on plant or in soil or among the fallen leaves & rubbish. P.P. 5 - 7 days in summer & 8 - 9 days in winter.

Life Cycle : Completed in 3 weeks in summer & 4 weeks in winter & there are 12 generations in a year.

²⁰¹⁵
Nature of Damage : Caterpillars bore into the tender shoots, flower buds & fruits. As a result, the shoots dry, flower buds & fruits drop prematurely. Fruits remaining on the plants get deformed & often show exit holes.

Control Measures : 1. Removal & destruction of infested shoots, fruits & shed material helps in reducing the intensity of infestation.

2. Destruction of alternate host from the fields.

3. Spraying with 0.2 % carbaryl or 0.1 % malathion or 0.01 % cypermethrin / fenvalerate. OR Quinalphos / Chlorpyrifos : 0.05 %. In severe infestation, 3 - 4 sprays should be taken at an interval 8 to 15 days.

Minor Pests :

²⁰¹¹
2. Leaf roller : *Sylepta derogata* Fb.

¹⁸
Nature of Damage : Damage is caused by the caterpillar. Young larvae feed on epidermis of ventral surface of leaves, after a couple of days, the caterpillars roll the leaves in funnel shape & feed from margin by remaining inside.

Control Measures : 1. Removal of leaf rolls & destruction along with caterpillars.

2. Dusting with carbaryl 10 % dust @ 20 kg / ha.

3. The infested fields should be irrigated and ploughed after harvest of crop to kill the hibernating caterpillar.

4. Spray 0.2 % Carbaryl or 0.05 % Fenitrothion or 0.1 % Dichlorvos.

3. Jassids : *A. biguttula biguttula* Ishida
Described under potato.

4. Aphids : *Aphis gossypii* Glover
Described under potato.

5. Mites : *Tetranychus* spp.
Described under brinjal & chillies

6. White fly : *Bemisia tabaci* G.
Adult of white fly are also responsible for transmission of the
"Yellow vein mosaic virus disease of okra". Also describe under brinjal.

7. Root knot nematode : *Meloidogyne* spp.
Describe under pests of potato.

Assignment Describe the IPM programme for okra crop.

Exercise No. 6

PEST OF CUCURBITS

W/Sr 2014

Sr.No.	Common Name	Scientific Name	Family : Order
1) 2015	Fruitfly (Melon fruit fly)	<i>Bactrocera cucurbitae</i> cog.	Trypetidae/Tephritidae. Diptera.
	a) Oriental fruit fly	<i>Dacus dorsalis</i> Hendel	
	b) Fruitfly (common)	<i>Dacus</i> spp.	
2)	Red pumpkin beetle	<i>Aulacophora foveicollis</i> Lucas	Chrysomelidae. Coleoptera.
	Black pumpkin	<i>Aulacophora intermedia</i> Jocaby	Chrysomelidae Coleoptera.
3)	Blister beetle	<i>Mylabris pustulata</i> (Thunberg) <i>Lytta</i> spp.	Meloidae Coleoptera.
4) 2015	Epilachna beetle / Hadda beetle	<i>Epilachna dodecastigma</i> Wiedemann <i>Epilachna vigintioctopunctata</i>	Coccinellidae Coleoptera Coccinellidae Coleoptera
5)	Jassids -	<i>Amrasca biguttula biguttula</i> (Ishids)	Coccinellidae. Hemiptera
6)	Aphid	<i>Aphis gossypii</i> Glover	Aphidae Hemiptera

Miner Pests

1)	Peach, Potato Aphids	<i>Myzus persicae</i> (Sulz)	Aphididae Hemiptera
2)	Leaf eating caterpillar	<i>Spodoptera litura</i> (Fabricius)	Noctuidae Lepidoptera
3)	Semilooper	<i>Plusia</i> spp.	Noctuidae Lepidoptera
4)	American bollworm	<i>Helicoverpa armigera</i>	Noctuidae Lepidoptera
5)	Cabbage Flea beetle	<i>Phyllotreta crucifera</i> (Goeze)	Chrysomelidae Coleoptera

20/5 Major Pests :

1. Fruit fly :

Bactrocera cucurbitae C.

(Melon fruit fly)

Dacus ciliatus L.

(Ethiopian fruit fly)

B. dorsalis H.

(Oriental fruit fly)

Tephritidae

Tephritidae :

Diptera

Economic Importance : These are cosmopolitan species causing huge annual losses to several vegetable & fruit crops. More than 50 % fruits are damaged by fruit flies. The Ethiopian fruit fly, *D. ciliatus* L. and melon fruit fly, *B. Cucurbitae* C are the pre dominant species damaging cucurbits & melon. The *D. zontus* S has been reported to damage long melon. Among the various species *B. cucurbitae* is most common and destructive on vegetables.

Marks of Identification : Adult fly are 4.5 mm long having wing expanse of 11 to 14 mm. Resemble common house fly but has conical, yellowish brown abdomen & transparent wings with grey spots & bands.

Maggot :

Small, dirty white, legless, tapering at one end. Full grown maggot are 5 - 10mm long and cylindrical.

20/12

Host Plants :

Gourds, melon, tondali, guava, mango, ber & other fruits.

Life Cycle :

Eggs : 200, laid just under the skin (epidermis) of the fruits. I.P. : 3 - 5 days.

Larv :

L.P. 2-3 weeks

Pupa :

Pupation in soil. P.P. 8 - 10 days.

lay eggs inside the fruits singly or in groups of 4-10. During rainy season the activity of melon fruit fly is at its peak while heavy rain stops breeding of Ethiopian fruit fly.

Nature of Damage : Maggots feed on pulp of the fruits. Infested fruits start rotting & rendered them unfit for human consumption. drop prematurely.

The young fruits can be destroyed in a few days. Older fruits show less symptoms, but on split opening, a mass of maggots in pulp is found. Infested fruits are also attacked by microbes.

Control Measures :

1. Clean cultivation – Removal & destruction of fallen fruits & infested fruits daily to minimize the intensity.
2. Deep ploughing to expose hibernating stages
3. Application of spray bait containing 20 ml malathion + 200 g. Jaggary + 20 lit. of water.
4. Spraying with 0.05 % malathion or 0.2% carbaryl at flowering reduce the intensity of infestation.

2. Pumpkin beetle : Red Pumpkin beetle : *Aulacophora foveicollis* L.

Black Pumpkin beetle : *A. intermedia* J.

Yellow Pumpkin beetle : *Ceratia cincta* F.

Chrysomelidae : Coleoptera.

Economic Importance : The red pumpkin beetle is the most destructive species, damage the young seedling & kill the same.

Adults : They are oblong and 5 – 8 mm long. Small, the elytra of red pumpkin beetle is pale orange yellow to deep pale brown while in case of black pumpkin beetle, it is black & it is yellowish in yellow pumpkin beetle.

Grub : The full grown grubs small about 12 mm in length. Small, slender, elongate, creamy yellow with brown head & legs.

Host Plants : All cucurbit. Among which, red pumpkin & cucumber and melon are heavily damaged by red pumpkin beetle.

Life History : Eggs : 150 – 300, laid in moist soil to the depth of 2.5 cm, near the plant in batches of 8-9.

Site of oviposition : - In soil.

L.P. : 5-27 days depending on temp. & moisture content of the soil.

Larva : L.P. 12-34 days. Pupa : Pupation in soil. P.P. 15-35 days.

Adult : Live for 20-197 days.

Life History : Completed in 52-270 days. The maximum activity of the pest is observed during hot weather, (Mar – May), reaching its peak in middle of April.

2014

2015

Nature of Damage ① Damage is caused by grubs as well as beetle. Beetles are mainly responsible for the damage of the plant above ground. They damage the leaves, flowers & fruits making irregular holes & causing death or retardation of growth. ② In case of heavy infestation, resowing is also required to be done. The grub live in the soil & feeds on roots & underground stem of the plant. Fruits and leaves also get damaged when comes in contact with the soil. Damaged roots, stems start rotting.

2014

Control Measures :

1. Preventive measures – burning of old creepers, ploughing & harrowing of field at harvest of the crops to destroy the stages of the pest.
2. Collection & destruction of beetles in early stage in infestation.
3. Spraying with 0.05 % malathion or dusting with 5 % malathion dust @ 10 kg / ha gives satisfactory control of the pests.
4. Apply 7 kg of Carbofuran 3 % G per ha 3-4 cm deep in soil near the base of plant just after germination.

3. Blister beetles : *Mylabris pustulatus* Th.
Maloidae : Coleoptera.

Economic Importance : Major pest causing considerable damage.

Marks of Identification : Beetles : Medium size having 3 black & 3 yellowish orange bands running vertically & alternately on elytra. When disturbed these beetles exude an acidic yellow fluid which contains cantharidin & causes blisters on human skin & hence the common name.

Hosts Plants : Polyphagous, infesting cucurbits, cotton, ground nut, millets, rose & okra.

Life History : Life cycle : Life cycle has not been fully worked out.

Eggs : Laid in soil. I.P. : 14 -- 15 days. 2015

Grubs : Found in soil & feed on eggs pods of grasshoppers & locusts.

Pupa : Pupation in soil. Hibernation takes place in pupal stage in soil.

Adults : Emerges out of soil around August & are active till early December.

2009

Nature of Damage : Adult beetles feed on pollens & petals of flower buds, as a result fruit set is adversely affected.

2014

Control Measures :

1. Hand collection & prompt destruction of beetles keep the population under check during early morning hours when beetles are less active.
2. Chemical control measures as given for pumpkin beetle.

4. Epilachna Beetle : *Epilachna dodecastigma* M. 2014
OR *E. vigintioctopunctata* Fab. ✓
Hadda Beetle : Coccinellidae : Coleoptera

Economic Importance : *E. vigintioctopunctata* is the most common & destructive species.

Marks of Identification : Beetles : Spherical, pale brown & mottled with black spots. *E. dodecastigma* has 6 spots on each elytra, while *E. vigintioctopunctata* has 14 spots on each elytra. They are strong flier.

Grubs : Yellow with hairs on their body.

Host Plants : Cucurbits, brinjal, potato, tomato etc.

Life History : Eggs : 120 – 180, laid in masses on ventral surface of leaves. I.P. : 2 – 4 days.

Larva : L.P. 12-18 days. Pupa : Pupation on leaves P.P. 3 – 6 days.

Life Cycle : Completed in 18 – 25 days in summer & may extend up to 50 days. 2019

Nature of Damage : 2014 2011

Both grubs and adults feed voraciously by scrapping the chlorophyll of leaves, causing characteristic skeletonization of leaf lamina, the affected leaves gradually dry and droop down. A severe infestation kills the young plants, while the older vines show stunted growth and poor yield.

Control measures : 2014

1. Hand picking of grubs and collection of beetles by hand nets during early stage of attack helps in reducing the intensity of infestation.
2. Spray with 0.05 % DDVP / Malathion.

3. SP

Exercise No. 7

PEST OF LEGUMINOUS VEGETABLES

(1) Cowpea , (2) Cluster bean , (3) Doliechos bean , (4) Garden pea , (5) French bean

Pest of Cow pea

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Pea stemfly / beanfly	<i>Ophiomyia phaseoli</i> (Tryon) (coq)	Agrimyzae Diptera
2)	Pea blue butterfly	<i>Lampides boeticus</i> L.	Lycaenidae Lepidoptera
3)	Pulse beetle / Oriental Cow Pea Bruchids	<i>Callosobruchus chinensis</i> (L) ea <i>callosobruchus</i> sp	Bruchidae Coleoptera.
4)	Deccan grasshopper	<i>Colemania sphenariodes</i>	Acrididae Orthoptera
5)	Pea aphids	<i>Acyrtosiphum pisum</i>	Aphididae
	Gr. Nut aphids :	<i>Aphis craccivora</i> (Koch) (Harris)	Hemiptera
6)	Whitefly	<i>Bemisia tabaci</i> (Gennadius)	Hemiptera Aleurodidae
7)	Thrips	<i>Caliothrips indicus</i> (Bengali)	Thripidae Thysanoptera

Miner Pest

1)	Pea pod borer	<i>Etiella zinckenella</i>	Pyrilidae Lapidoptera
2)	Cowpea pod bug	<i>Chauliops fallax</i> (Scott)	Lygecidae Hemiptera

PESTS OF GARDEN PEA

1)	Pea aphid	<i>Macrosiphum pisi</i> K.	Aphididae Hemiptera
2)	Pea leaf miner	<i>Chromatomya horticola</i> Gourell	Agromyzidae Diptera
3)	Pea stemfly	<i>Ophiomyia phaseoli</i> Tryan	Agromyzidae Diptera
4)	Pea Pod borer	<i>Helicoverpa armigera</i> (Hubner) <i>Etiella zinckenella</i> (Tril)	Noctuidae Lepidoptera
5)	Pea weevil	<i>Bruchus pisorum</i>	Bruchidae Coleoptera

PESTS of BEANS

French bean & cluster bean

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Aphids (Green aphid)	<i>Aphis craccivora</i> Koch	Aphididae Hemiptera
2)	Sap sucking bug (Lab lab bug)	<i>Coplosoma cribraria</i> F.	Corimelaenidae Lepidoptera
3)	Pod borer	<i>Helicoverpa armigera</i> (Hub)	Noctuidae Lepidoptera
4)	The spiny pod borer	<i>Etiella zinckenella</i> (Treistscke) <i>Adisura atkinsoni</i> Moore	Pyrilidae Lepidoptera
5)	Plum moth	<i>Exelastis alomosa</i> Walsingham	Pterophoridae Lepidoptera
6)	Hairy caterpillar	<i>Amsacta</i> spp.	Arctidae Lepidoptera
7)	Leaf eating caterpillar	<i>Acherontia styx</i>	Spingidae Lepidoptera
8)	Leaf miners	<i>Cosmopteryx mimetis</i> Meyrick <i>Cosmopteryx phaeogastra</i> (M) <i>Cyphosticha coerulea</i> (M)	Cosmopterygidae Lepidoptera
Miner pests			
1)	Beat army worm / Leaf eating caterpillars	<i>Spodoptera exigua</i> (Hub) <i>Spodoptera litura</i> (Fab)	Noctuidae Lepidoptera
2)	Stem boring beetle	<i>Sagra nigrila</i> Oliver	Chrysomelidae Coleoptera

Major Pests :

1. Gram pod borer : *Helicoverpa armigera* Hub. Noctuidae : Lepidoptera

Economic Importance : Cosmopolitan, most serious pest of peas & beans.

Marks of Identification : Moth : Medium sized, light yellowish brown. forewings are pale brown with black spots. Hindwings are lighter in colour having smoky dark margins.

Host Plant : Polyphagous : gram, tur peas, tomato, tobacco, cotton, safflower etc.

Life History : Eggs Laid singly on tender parts of plant 1 P 6 - 7 days

Larva : L P 2 weeks

Pupa : Pupation in soil in earthen cocoons near the plants. P.P. 1 - 4 weeks.

Life cycle : Completed in 4 weeks.

The pest is active from Nov. - Mar. & hibernates in pupal stage till next season.

Nature of Damage : On hatching caterpillars start feeding on tender leaves. After pod formation, they make holes in pods & feed on developing seed by inserting anterior - half portion of their body inside the pods.

Control Measures :

1. In early stage of attack, handpicking of caterpillars & their destruction help in reducing the intensity of infestation.
2. Ploughing the field after harvest of the crop would expose the pupae which would be destroyed by birds.
3. *Helicoverpa armigera* nuclear polyhedrosis virus (HaNPV) 250 LE/ha.
4. Release eggs of *Trichogramma chilonis* 1 lakh / ha.
5. Use of Pheromone traps.
6. Spraying of Neem Seed Kernel Extract 5%.

2. **Aphids** : *Aphis craccivora* Koch & *Macrosiphum pisi* K. *Aphis* spp. Aphidae : Hemiptera.

Economic Importance : In severe infestation, the plants may dry. This is cosmopolitan in distribution and has been reported as a severe pest of Indian bean and cluster bean.

Host Plants : Peas, beans etc.

Nature of Damage : Both nymphs & adults suck the cell sap from leaves. As a result leaves turn yellowish & often distorted. They are also found feeding on the stem, young shoots & tender pods.

Control Measures : Spray with 0.03% dimethoate or 0.05% malathion as soon as incidence noticed.

2012
Minor Pest :

3. **Pulse beetle** : *Callosobruchus chinensis* Linn.
Bruchidae : Coleoptera

Economic Importance : Minor incidence of pest is noticed in field on pods from which the infestation is brought in the storage.

Marks of Identification : Adults beetles . Oval dark brown, 3 – 4 mm in length, 2 ivory coloured spots in the middle of dorsal side of the body.

Grubs : White , cylindrical, fleshy with brownish mouth-parts , always found inside the grains.

Host Plants : Mug, gram, tur, bean, masur, udid etc.

Life Cycle : Eggs : are laid singly on the surface of grains in storage. In field, eggs are laid on green pod's which carry infestation in store. I.P. 4-5 day's. Larva : L.P. 2-3 weeks.

Pupa : Pupation inside the seed or grain P.P. : 4-8 day's.

Adult : Live for 10 day's or more.

2012

Nature of Damage : It is a major pests of pulses in storage. However, field infestation is also common. The young grubs burrow into the pods & feed on developing seed / grain. The holes seen on the pulses are the exist holes from where the adults have emerged. Such grains are unsuitable for sowing.

Control Measures : Spraying with 0.05% malathion as soon as infestation is noticed.

2012

4. Stem fly or Collar borer : *Ophiomyia phaseoli* T.
Agromyzidae : Diptera.

Economic Importance : The pest is very destructive to different beans & the infestation starts from second week after sowing , reaches peak in the 10th week & then decreases gradually.

Host Plants : Polyphagous : Beans, peas, grams, cowpea & sweet pea

Marks of Identification : Adult fly : Metallic-black, 2.0-2.5 mm long & hyaline wings.

Maggot : Initially white colour, later becoming yellowish.

Life History : Eggs : Singly in leaf tissues or tender stems. I.H. 2-4 days.

Maggot : Last for 9-12 days. Pupa. Pupations in affected stems P.P. 18-19 days.

Life cycle : Completed in 2.5-4 weeks. No. of generations : 8-9 / years.

2015

✓ **Nature of Damage :** On hatching maggots bore the leaves bore inside the petioles and tender stem and tunnel downwards. Sometimes adult females also puncture the leaves. affected leaves turns yellow, while the stem droop down and gradually wither away.

✓ **Control Measures :** 1) Spraying with 0.03% dimethoate as soon as infestation is noticed.
2) Remove all the affected branches during stage of attack.

5. **Jassids :** *Empoasca spp.*

6. **Thrips :** *Caliothrips indicus* Bag.

7. **Mites :** *Tetranychus telarius* Linn

These pests have been discussed earlier.

Exercise No. 8

PEST OF LEAFY VEGETABLE

- 1) Amaranthus 2) Fenugreek 3) Palak 4) Lettuce.

PEST OF AMARANTHUS

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Stem weevil	<i>Hypolixus truncatulus</i> (Bohe man)	Curculionidae Coleoptera
2)	Leaf eating caterpillar	<i>Eretmocera impectella</i> (walker) <i>Hymenia recurvalis</i>	Heliodinidae Lepidoptera Pyraustidae Lepidoptera
Miner Pests			
1)	Caster capsule borer	<i>Dichocrocis punctiferalis</i> (Guenee)	Pyalidae Lepidoptera
2)	Pod borer	<i>Helicoverpa armigera</i>	Noctuidae Lepidoptera
3)	Tobacco leaf eating caterpillar	<i>Spodoptera litura</i> (Fab)	
4)	Beet army worm	<i>Sopodoptera exigua</i> (Hubner)	Noctuidae Lepidoptera
5)	Cotton aphid / Bean aphid / Gr. Aphid / Peach aphid	<i>Aphis craccivora</i> Koach <i>Myzus persicae</i> (sulz)	Aphididae Hemiptera Aphididae Hemiptera
6)	Mealy bugs	MEALY BUGS <i>Aspidiotus perniciosus</i>	Pseudococcidae Hemiptera
7)	Thrips	<i>Aleolothrips collaris</i> Priesner <i>A. fulvicollis</i> Bangall	Thripidae Thysanoptera
8)	Termites	<i>Microterms</i> spp.	Termitidae Isoptera

PESTS OF SPINACH (Palak)

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Aphids	i) <i>Lipaphis erysimi</i> Kaltenbach	Aphididae Hemiptera
		ii) <i>Myzus persicae</i> (sulzer)	Aphididae Hemiptera
2)	Blue beetle	<i>Altica caerulea</i> (Baly)	Alticidae Coleoptera
3)	Grass hopper	<i>Atractomorpha crenulata</i> (Fabricius)	Acrididae Orthoptera
4)	Leaf eating Caterpillar	<i>Hymecia recarvalis</i> (Fabricius)	Pyraustidae Lepidoptera

Leafy vegetables : 1. Amaranthus, 2. Coriander, 3. Methi, 4 Spinach, 5. Radish, 6. Salad crops (Celery, lettuce, and parsley)

1)	Cutworm	<i>Agrostis spp.</i>	Noctuidae : Lepidoptera
2)	Aphids	<i>Acyrtosiphon malvae</i>	Aphididae : Hemiptera
3)	Leaf eating caterpillar	<i>Hymeria recurvata</i> (Fabricius) Noctuidae : Lepidoptera	
4)	Grasshoppers	<i>Atractomorpha crenulata</i>	Acrididae : Orthoptera
5)	Amaranthus stem weevil	<i>Hypolixus truncatulus</i> (Bohemian)	Curculionidae : Coleoptera
6)	Termites	<i>Odontotermes obesus</i> R.	Termitidae : Isoptera
7)	Mites	<i>Tetranychus spp.</i>	Tetranychidae : Class - Acarina
8)	Mustard sawfly	<i>Athalia lugens proxima</i> (Klug)	Tenthredinidae : Hymenoptera
9)	Flea beetles	<i>Phyllotreta cholanica</i> D.	Alticidae : Coleoptera
10)	Leaf minor	<i>Leromyza trifoli</i>	Agromyzidae : Diptera
11)	Leaf Hopper	<i>Amrasca biguttula biguttula</i> <i>Ish</i>	Jassidae : Hemiptera

1. Flea beetles : *Phyllotreta cholanica* Or : Coleoptera

Economic Importance : Pest of major importance in leafy vegetables, causes heavy damage to young plants. In serious incidence resowing is necessary.

Host Plants : Radish, spinach, lettuce, salad crops, tomato & potato.

Marks of Identification : It is small insect about 2 mm long & oblong – narrow in shape. Its upper side is metallic bronze in colour with greenish blue reflections, while underside and antennae are black.

Nature of Damage : Beetle prepares minute holes on the leaf lamina, the young plants are badly damaged.

Control Measures : Spraying the crop with 0.2% carbaryl or 0.05% malathion..

2. Aphids : *Acyrtosiphon malvae* Aphididae : Hemiptera

The aphids are highly polyphagous pests having a very wide range of host plants.

Host Plants : Safflower, radish, spinach & salad crops.

Marks of Identification : Aphids are tiny, yellowish, soft bodied insect. Adult is oblong, 1 mm long & has 2 projections called cornicles on the dorsal side of the abdomen.

Life History : Reproduce parthenogenetically. A single female produce 25 – 35 nymphs / day. The nymphs undergo four moults before reaching the adult stage. A generation is completed in 10 – 12 days. Several generations / year.

Nature of Damage : Colonies of the aphids consisting of adults and various stages of nymphs, can be seen on tender stems & underside of leaves. They suck the cell sap. The affected plant parts fade, curl and dry up. Besides the direct damage by feeding, these insects also excrete a honeydew which favours the growth of sooty mould as a result, growth of the plants retarded and quality as well as quantity of the edible portion is adversely affected.

Control Measures :

- i) Removal & destruction of affected plant parts alongwith the aphids as soon as infestation is noticed.
- ii) Spraying with 0.05% acephate / dimethoate.
Appropriate waiting period should be observed before harvesting of the crop.

3. **Amaranthus stem weevil :**

S.N. : Hypolixus truncatulus

Coleoptera : Curculionidae

It is almost specific pest of amaranthus, widely distributed in India and neighbouring countries. The pest attacks both wild & cultivated crops. Varies with large leaves being comparatively more damaged than those with prominent stems.

Host Plants : Amaranthus.

Nature of Damage : On hatching, the grub bore into the stems & feed on pith region, making irregular zigzag tunnels, which are also filled with the excreta. The affected stems becomes weak & often split longitudinally due to transpiration & this results in excessive evaporation, the plants get desiccated & ultimately dry up completely. Adults feed on tender leaves and stem.

Marks of Identification : Eggs are smooth, pale yellow in colour. The grubs are stout, curved, legless, white in colour. Adults are ash – grey in colour.

Adult female bite circular holes in stem and lay eggs in the hole.

Life History : Oviposition : Inside stem, I.P. : 5 to 6 days. L.P. : 10 to 12 days.

Pupation : In stem. P.P. : 8 to 10 days. Adult Period : 12 to 66 days.

Control Measures :

- i) Remove & destroy all wild Amaranthus plants growing in the vicinity of cultivated crops.
- ii) Remove and destroy all the affected plants with grubs inside.
- iii) Spraying the crop with 0.05% dichlorovos or malathion is effective as soon as infestation is noticed.

4. Leaf eating caterpillars : It is a sporadic pest of Amaranthus & is widely distributed in the Indian subcontinent. It is also distributed in tropical & subtropical regions, including Africa, Asia, Australia & Hawaii Islands.

Host Plants : Amaranthus, spinach, grassland & pastures.

Nature of Damage : On hatching, the caterpillar feeds on epidermis & on tissues of leaves, later on they web together with the leaves & silken threads secreted by them & feed within. Gradually these webbed leaves become completely devoid of chlorophyll & dry up.

Marks of Identification : Eggs are very small in size, snow white in colour. Caterpillars are greenish in colour with white lines on thorax. Adults are small sized, black coloured, slender bodied moths.

Life History : Oviposition Leaves, preferably on top shoots. I.P. : 3 to days.

Larval period : 12 to 16 days . Pupation : In the soil Adult period – 6 to 10 days. A life cycle completed in 3 to 4 weeks

Control Measures : To control these caterpillars, spray with 0.05% malathion or 0.1% carbaryl.

PESTS OF LETTUCE

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Melon / cotton aphids	<i>Aphis gossypii</i> Glov	Aphididae Hemiptera
2)	Potato aphid	<i>Macrosiphum euphorbiae</i> (Thos)	
3)	Shallot aphid	<i>Myzus ascalonicus</i> Don.	
4)	Peach potato aphids	<i>Myzus persicae</i>	
5)	Lettuce aphid	<i>Nasonovia ribis – nigri</i> Mosley	
6)	Lattuce root aphid	<i>Pemphigus bursarius</i> L.	Pemphididae Hemiptera
Miner Pests			
1)	Tortrix moth	<i>Cnephasia spp.</i>	Totricidae Lepidoptera
2)	Common cut worm	<i>Aqrotis segetum</i> (D&S) <i>Aqrotis dahlia</i> (Hub)	Noctuidae Lepidoptera Noctuidae Lepidoptera
3)	Large yellow Underwing	<i>Noctua Pronuba</i> L.	Noctuidae Lepidoptera

Exercise No. 9

PESTS OF COLE CROPS

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Diamond back moth	<i>Plutella xylostella</i> Linnaeus	Plutellidae Lepidoptera
2)	Leaf webber	<i>Crociodomia binotalis</i> Zeller	Pyraustidae Lepidoptera
3)	Cabbage butterfly	<i>Pieris brassicae</i> L.	Pieridae Lepidoptera
4)	Cabbage borer	<i>Hellula undalis</i> (Fab)	Pyraustidae Lepidoptera
5)	²⁰¹⁵ Mustard sawfly	<i>Athalia lugens</i> Proxoma Kulg	Tenthridinidae Hymenoptera
6)	²⁰¹³ Aphids	<i>Brevicorne brassicae</i> <i>Linnaeus</i>	Aphididae Hemiptera
7)	Painted bug	<i>Bagrada picta</i> (f)	Pentatomidae Hemiptera
8)	Leaf miner	<i>Liriomyza brassicae</i> Riley	Agromyzidae Diptera
9)	Cabbage flea beetle	<i>Phyllotreta cruciferae</i> (Goeze)	Chrysomelidae Coleoptera
Miner Pests			
1)	Aphids (Plant lice)	<i>Lipaphis erysimi</i>	Aphididae Hemiptera
2)	Aphids	<i>Myzus persicae</i>	
3)	Thrips	<i>Thrips tabaci</i> Lideman <i>Coleothrips indicus</i> Bangall	Thripidae Thysanoptera
4)	Bihar hairy Cater pillar	<i>Spiolosoma oblique</i> Walke:	Arctidae Lepidoptera
5)	Cut worms	<i>Agrotis ipsilon</i> Hufnagel	Nactudae Lepidoptera
6)	Cabbage green Looper	<i>Trichoplusia ni</i> (Hubner)	Noctuidae Lepidoptera
7)	Mite	<i>Tetranychus neocaledonicus</i>	Tetranychidae Acarina

Major Pests :

1) Diamond back moth : *Plutella xylostella* L.

2011
Plutellidae : Lepidoptera

Economic Importance : It is one of the serious pests of cruciferous crops throughout the world. It is cosmopolitan in distribution.

Marks of Identification : Moth : Small, brownish grey in colour, have three pale whitish triangular spots on their hind margins of forewings which form a diamond pattern when the insect is at rest with wings folded along the body.

Caterpillar : Small, greenish, smooth with some scattered hairs & tapering at both the ends.

Host Plant : Cabbage, cauliflower, knolkhol, mustard, radish etc.

Life History : Eggs : 57, singly along the veins on lower surface of leaves at night.

I.P. : 7 days. Larva : L.P. 2 weeks.

Pupa : Pupation on the leaves in thin silken cocoons, P.P. : 1 week.

No. of generations : 5-7/year pest is active throughout the winter season

985 **Nature of Damage :** Young larve feed on epidermis of leaves while full grown larve bore inside the heads. Round transperant patches appear on leaves due to feeding. In case of severe infestation then plant may be completely skelotonised

Control Measures :

1. Spraying with 0.05% malathion or malphos or fenitrothion control the pest effectively.
2. Spraying with Bt (*Bacillus thuringiensis*) @ 1 to 1.5 kg / ha.
3. Spraying with 4% NSKE. It is necessary to add wetting spreading agent viz ; teepol / sandovit @ 1 ml / lit.
4. Trap cropping with mustard crop attracts 80-90% moths for colonization.
5. Tomato when intercropped with cabbage reduces laying by diamond back moth.
6. After harvest of crop remove all the plant residue of previous crops.

985 2. Mustard sawfly : *Acanthosia prunivora* Klug.

2011
Tenthredinidae : Hymenoptera

Economic Importance : Most destructive pest of cruciferous crops & is especially serious on radish & mustard.

Marks of Identification : Adult : Flies are small black in colour, with wings having black veins. They have two pairs of wings.

Larva : Small, black & smooth, have a tendency to curl up & drop on the ground when disturbed.

Host Plants : Cabbage, cauliflower, knolkhol, mustard, radish & turnip.

Life History : Eggs : 30 – 35, singly in the leaf tissues on the lower surface close to the margins with the help of saw like ovipositor, I.P. : 4 – 6 days.

Larva : L.P. – 2 weeks. Pupa : Pupation in soil in earthen cocoons.

P.P. : 10 – 12 days. Adult : Lives for 3 – 5 days.

The pest remain active throughout the year except April & May. The peak period of activity is during Sept. to Dec. after which the activity declines.

2011
Nature of Damage : Larvae feed on leaves from margin inward, mostly during morning & evening. They cut small holes into the leaves & skeletonize the plant. Frequently large number of larvae can be found on each leaf.

2011
Control Measures :

- 1) Hand picking of larvae.
- 2) Spray with 0.05% malathion or 0.1% carbaryl or 0.02% diazinon controls the pest effectively. Quinalphos or Chlorpyrifos 0.05%.

3. Aphids : *Brevicoryne brassicae* Linn

Aphididae : Hemiptera

Economic Importance : It cause considerable damage in case of severe infestation.

Marks of Identification : Adult aphids are very small, soft bodied insects, yellowish green in colour. They have cornicles on abdomen.

Host Plants : Cruciferous crops, brinjal, potato, chillies, tomato, lepu, sunhemp, sweet potato, chakwat, geranium, fennel etc.

Life History : Only females are noticed in Maharashtra state. They reproduce viviparous parthenogenetically & single female produces 12-24 young ones (nymphs). The nymphs become mature within 7 – 9 days & start reproducing. The life cycle is completed in 11 to 45 days.

Nature of Damage : Nymphs & adults suck the cell sap from lower surface of leaves. Their continuous feeding lead to general yellowing of leaves & subsequent drying. Besides, the pest excrete sugary substance which spread on leaf surface & attract the black fungus. that hampers the photosynthetic activities of plant.

Control Measures :

- 1) Nursery spray with 0.04% endosulfan / 0.03% dimethoate. 0.5% malathion. Field application with 0.05% malathion as soon as infestation noticed.
- 2) Mustard as trap crop.
- 3) Spray NSKE 4%.
- 4) As soon as the infestation starts, cut the infected plant parts and destroy.

Minor Pests :

4. **Leaf Miner :** *Liriomyza brassicae* R.

Agromyzidae : Diptera.

Nature of Damage : Larvae mine into the upper epidermis of leaf causing serpentine mines. Severe infestation on seedlings, result into their death. (Young crop is badly damaged by this pest.)

Control Measures :

- 1) Affected leaves should be removed & destroyed if the infestation is more.
- 2) Spraying with 0.2% carbaryl reduce the infestation.

5. **Fla beetles :** *Phyllotreta cruciferae* G.

Chrysomelidae : Coleoptera.

Nature of Damage : The beetles occasionally appear in large numbers and damage the plants by biting small holes on the foliage.

Control Measures : Dusting of 10% carbaryl dust @ 20 kg / ha. or spraying with 0.05% Quinalphos.

6. **Painted bug :** *Bagrada cruciferarum* K.

Pentatomidae : Hemiptera.

Nature of Damage : Both nymphs & adults suck the cell sap from the leaves. Infested plant finally dry up. Clean cultivation.

Control Measures :

- 1) Removal of weeds helps in reducing the infestation of bugs.
- 2) Dusting with 10% carbaryl dust @ 20 kg / ha.
- 3) Spraying of dimethoate / Methyl demeton 0.05%.

7. Cabbage butterfly : *Pieris brassicae* linn

Pieridae : Lepidoptera.

①

Nature of Damage : Young larvae scrap the leaf surface in masses but later ones eat away the leaves at the margins inwards, leaving intact the major vein alone. Leaves are skelclorocut. Sometimes caterpillar bores the heads of cabbage and cauliflower.

②

Site of Oviposition : Eggs are laid in clusters on Ventral surface on leaves.

Site of Pupation : Pupation takes place on leaves and stem of host plants.

Control Measures : Spraying with 0.2% carbaryl controls the pest effectively.

- 1) Hand picking and destruction of caterpillar is early stage.
- 2) Spray 0.05% dichlorvos or 0.1% malathion.
- 3) Spraying with B.T. @ 1 kg / ha.



Assignment : Describe the IPM Programme for cabbage / cauliflower.

8. Cabbage head borer : *Hellula undalis*

Order : Lepidoptera

Marks of Identification : Moths are pale greyish-brown, forewings have grey wavy lines hind wings pale dusky. Larva – 15-18 mm long, pale whitish brown.

Life History : Egg are laid on ventral side of leaves.

Nature of Damage : The caterpillars mine the leaves along the side veins and make it a white papery structure filled with its excreta, 3rd instar on ward, C-feed on chlorophyll of leaves and leaf petioles protected by a silken covering and finally bore into the stem or cabbage heads. Infected plants loose vigour and became deformed heads.

Control Measures :

- 1) Mechanical destruction of caterpillar.
- 2) Spray 0.05% quinalphos, malathion 0.1%.
- 3) Dusting with 5% Carbaryl or Malathion.

Exercise No. 10

PEST OF SWEET POTATO

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Sweet potato weevil	<i>Cylas formicarius</i>	Curculionidae
		<i>falricius</i>	Coleoptera
2)	<u>Green tortoise</u> <u>beetle</u>	<i>Meltriona circumdata</i>	Chrysomelidae
		Harbest	Coleoptera
3)	Leaf eating caterpillar Sphinx	<i>Herse convolvuli</i> L.	Sphingidae
			Lepidoptera
4)	<u>Sweet potato</u> <u>butterfly</u>	<i>Acraea acerata</i> Hew	Nymphalidae
			Lepidoptera
5)	Whitefly	<i>Bemisia tabaci</i> Gem	Aleurodidae
			Hemiptera
Miner Pests			
1)	Migratory locusts	<i>Lucusta migratoria</i> sapp.	Acrididae
			Orthoptera
2)	Small rice grasshopper	<i>Oxya</i> spp.	
3)	Cotton aphid	<i>Aphis gossypii</i> Glow	Aphididae
			Hemiptera
4)	Striped Mealy bug	<i>Fernsia virgata</i>	Pseudococcidae
			Hemiptera
5)	Rice cutworm	<i>Spodoptera litura</i> (F)	Noctuidae
			Lepidoptera
6)	Blister beetle	<i>Mylabris</i> ssp.	Meloidae
			Coleoptera

Major Pests :

1. Sweet potato leaf : *Agrius convolvuli* L.
caterpillar or Sphingidae : Lepidoptera.
Sphinx caterpillar

Economic Importance : It occasionally assumes serious form & causes economic loss.

Marks of Identification : Moth : Stout, pale grey coloured with black pointed head. The abdomen has pink & white lateral bands.

Caterpillar : Full grown caterpillar is robust, dark brown with reddish patches on sides & sharp curved horn-like process at tail end, about 8 – 10 cm long.

Host Plants : Sweet potato, mug, udid, & til. (Polyphagous pest)

Life History : Eggs : Seed like laid singly on leaves, I.P. – 5 – 10 days.

Larva : L.P. – 2 – 3 weeks.

Pupa : Pupation in the soil, hard earthen cells in soil. P.P. – 7 -11 days. The pest hibernates in pupal stage.

Life Cycle : Completed in 4 – 15 weeks.

S.O. : Pest is active in monsoon.

Nature of Damage : Caterpillars feed on leaves voraciously. In case of severe infestation defoliate the plant.

Control Measures :

1. Hand picking & destruction of caterpillar in early stage of infestation.
2. Ploughing the field after harvest will expose the pupae.
3. Dusting the crop with 10% carbaryl dust @ 20 kg / ha.
4. Spraying with 0.05% dichlorovos can effectively control the pest.

2. **Sweet potato weevil** : *Cylas formicarius* fb. ✓
Curculionidae : Coleoptera

Economic Importance : Serious pest of sweet potato, loss of tubers to the extent of 60-70% has been reported.

Marks of Identification : Adult weevil : Small, ant-like, 6-8 mm long steel black in colour with brown elongated snout like head having bright red thorax and legs and brownish-red abdomen.

Grub : Small, legless & pale yellow in colour.

Host Plants : Sweet potato only. It is specific pest of s.p.

Life History : Eggs : 100-200, on the tubers & stems of vines by making small cavities.

I.P. : 5-10 days.

Larva : L.P. 2-3 weeks.

Pupa : Pupation in the larval burrows in vines.

P.P. 7 days.

Life cycle: Completed in 4 - 5 weeks

Carry over: Pest is carried from one field to another through the infested vines & from season to season by breeding in tubers left over after harvest

Nature of Damage : The grub infest vines (stems) bore into stems & cause tunneling inside feed on soft tissues. The grubs as well as adults bore into tubers, both in field & godowns, feed on inner content & spoil them. Dark black patches are noticed on the tubers & stems.

Control Measures :

1. Healthy cuttings should be selected for planting.
2. After harvest of the crop vines should be collected & destroyed. Earthing up the crops 30 and 60 days after planting.
3. Follow proper crop rotation.
4. Spray with 0.1% carbaryl followed by 0.15% malathion at 10 days interval.
5. Apply phorate 10 G in the soil at planting @ 10 kg / ha.
6. In godowns treat outside of the bag containing tubers with 5% malathion or carbaryl dust.

Exercise No. 11

PESTS OF YAM

Sr. No.	Common Name	Scientific Name	Family : Order
Major Pests			
1)	 Yam beetle	<i>Prionoryctes caniculus</i> Arr.	Scarabaeidae Coleoptera
2)	Greater Yam beetle	<i>Heteroligus meles</i> (Billb)	Scarabaeidae Coleoptera
Minor Pests			
1)	Aphid	<i>Aphis gossypii</i> Glov.	Aphididae Hemiptera
2)	Kenya Mealybug	<i>Planococcus kenyae</i> (Le. Pelley)	Pseudococcidae Hemiptera
3)	Citrus Mealy bug	<i>Planococcus citri</i> (Risso)	Pseudococcidae Hemiptera
4)	Spittle bug	<i>Ptyelus grossus</i> F.	Cercopidae Hemiptera
5)	Yam scale	<i>Aspidiella hartii</i> (ckll)	Deaspididae
6)	Coconutscale	<i>Aspidiotus destructor</i> sing	Diaspididae
7)	Mosquito bug	<i>Helopeltis</i> Sp.	Miridae
8)	Leaf footed plant bug	<i>Leptoglossus australis</i> (F)	Coreidae
9)	Yam skipper (Water snow flat)	<i>Tagiades litigiosa</i>	Hesperiidae
10)	Chaffer Grub	<i>Schizonycha</i> sp.	Scarabaeidae Bolopptera
11)	Black cereal Beetle	<i>Heteronychus</i> spp.	Scarabaeidae
12)	Lesser yam beetle	<i>Heteroligus opium</i> (Burm)	Scarabaeidae
13)	Leaf beetle	<i>Crioceris livida</i> Dalm	Chrysomelidae
14)	Long horn beetle	<i>Apomecyna parumpunctata</i>	Cerambycidae
15)	Yam weevil	<i>Palaeopus dioscorae</i> Pierce	Cuculionidae

1) Yam beetle : *Prionoryctes caniculus* (Arr.)

Fam. Scarabaeidae Order : Coleoptera.

Marks of Identification : Larva are white or Grey with pale brown head capsule. Adults are black and black.

2015
Damaging stage : Larva and Adult

Host Plants : Yam tubers, roots of other Plants such as banana, coffee, grasses etc in marshy areas.

Nature of Damage : Holes are bored in the tubers by both larva and Adult, but mostly by the feeding adults, the feeding lesions generally being hemispherical and 1-2 cm in diameter. The adults do the damage on their feeding migration from swampy area in the forests.

Life History : Eggs are laid in moist soil early in the dry season. The polyphagous young Larvae initially feed on organic debris and later feed on roots. At this stage the larvae are usually in swampy areas where yams are not often available. After pupation in these areas the adults emerge early in the rainy season, usually a storm bringing at least 1-5 cm of rain is required to stimulate emergence of most of the adults. After emergence the adults make their migratory flight to the feeding area where the yams grow. At this stage beetles are sexually immature and this migration is referred to as the feeding migration. On the arrival in the yam fields, the beetles burrow in the soil around the base of the yam plants and here they feed on the tubers making holes and tunnels. At the end of the rainy season the adults fly back to the breeding grounds in the swamps or river flood plains.

Control Measures : The best results have been obtained by dusting the planting setts with carbaryl 10% dust. (Beetle can effectively be controlled by spraying with carbaryl.)

2) Yam Scales : S.N. *Aspidiella hartii*

Marks of Identification : Both nymphs and adults are whitish yellow in colour and are usually found clustered on tubers but occasionally on aerial parts of the plants.

Nature of Damage : Both nymphs and adults suck the cell sap from tubers and become unfit for use as planting material. The attack is found in field as well as in storage. Such tubers shrivel.

Control Measure :

1) Use healthy tubers for planting.

2) Do not grow yams in the fields immediately following harvest and alternate host ginger which is the main.

3) Prune and destroy the affected plant parts in initial stage of attack.

- 4) Dip the seed material in 0.3% dimethoate just before planting
- 5) Spray with 0.5% diazinon or dimethoate.

dimethoate

Spray
deep seed

~~0.5% diazinon~~

PEST OF COLOCASSIA

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Small grasshopper	<i>Gesonina punctifrons</i>	Acrididae Orthoptera
2)	Banana aphids	<i>Pentalonia nigronervosa</i>	Aphididae Hemiptera
3)	Lacewing bug	<i>Stephanitis typicus</i> D	Tingidae
4)	Thrips	<i>Heliothrips indicus</i> Bug	Thripidae Thysanoptera
5)	Tobacco Leaf eating caterpillar	<i>Spodoptera litura</i> (f)	Noctuidae Lepidoptera
6)	Flea beetle	<i>Monolepta signata</i> ol.	Chrysomelidae Coleoptera
7)	Mites	<i>Tetranychus urtica</i> Koach <i>Tetranychus neocaledonicus</i>	Tetranychidae Acarina Tetranychidae Acarina
8)	Colocossia Leaf hopper	<i>Tarophagus proserpina</i>	

Exercise No. 12

PEST OF ROOT CROPS (Radish, Carrot, Turnip, and Best Roots)

PESTS OF RADISH

Sr. No.	Common Name	Scientific Name	Family : Order
1)	Aphid	<i>Brevicornye brassicae</i> L. <i>Lipaphis crysimi</i> (Katenbha) <i>Myzus persicae</i> (sulzer)	Aphididae Hemiptera Aphididae Hemiptera
2)	Mustard sawfly	<i>Athalia lungens proxima</i> Klug	Tenthredinidae Hymenoptera
3)	Diamond back moth	<i>Plutella xylostella</i> L	Plutellidae Lepidoptera

Minor Pests

1)	Grass hopper	<i>Atractomorpha crenulata</i> F.	Acrididae Orthoptera
2)	Whitefly	<i>Bemisia tabaci</i>	Aleurodidae Hemiptera
3)	Thrips	<i>Thrips tabaci</i>	Thripidae Thysanoptera
4)	Leaf eating caterpillar	<i>Spodoptera litura</i> F.	Noctuidae Lepidoptera
5)	Flea beetle	<i>Chaetoenema basalis</i> Baly.	Alticidae Coleoptera
6)	Weevil	<i>Aplon amplum</i> Faust	Curculionidae Coleoptera

PESTS OF CARROT

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Leaf hopper	<i>Empoasca punjabensis</i> Pruthi	Cieadellidae Hemiptera
2)	Pea leaf miner	<i>Phylomyza airtcarins</i> Meign	Agromyzidae Diptera
3)	Cutworm	<i>Agrotis ipsilon</i> Hugnaged	Noctuidae Lepidoptera
4)	Flea beetle	<i>Chaetoenema basalis</i> Baly	Alticidae Coleoptera

PESTS OF TURNIP

- 1) Mustard sawfly
- 2) Cabbage butterfly

Miner Pests

- | | | |
|----|------------------|---|
| 1) | Aphid | a) <i>Brevicaryne brassicae</i>
b) <i>Myzus persicae</i> |
| 2) | Leaf miner | <i>Phylomyza atricarins</i>
Meign |
| 3) | Cutworm | <i>Agrotis ipsilon</i> |
| 4) | Diamond backmoth | <i>Plutella maculipennis</i> L. |
| 5) | Flea beetle | <i>Chaetoenema basalis</i>
Baly |

PESTS OF BEETROOT

- | | | |
|----|-------------------------|------------------------------|
| 1) | Cut worm | <i>Agrotis ipsilon</i> (fuf) |
| 2) | Leaf eating caterpillar | <i>Spodoptera litura</i> (b) |
| 3) | Blue beetle | <i>Altica cyanea</i> v |

Alticidae
Coleoptera

PESTS OF BULB CROPS

PESTS OF ONION AND GARLIC

Sr. No.	Common Name	Scientific Name	Family : Order
Major Pests			
1)	Onion thrips <u>2018</u>	<i>Thrips tabaci</i> Lind	Thripidae Thysanoptera
2)	Onion fly	<i>Delia antiqua</i> (meign)	Anthomyiidae Diptera
3)	Bean seedfly	<i>Delia platura</i> (meign)	
4)	Beet army worm	<i>Spodoptera exidua</i> (Hub)	Noctuidae Lepidoptera
Minor Pests			
1)	Ear-wing	<i>Euborellia annulipes</i> Lubs	Forficulidae
2)	Shallot aphid	<i>Myzus ascalonicus</i> Don.	Aphididae Hemiptera
3)	Peach / potato aphid	<i>Myzus persicae</i> (sulz)	
4)	Turnip aphid	<i>Lipaphis erysimi</i> (kalf)	
5)	Thrips	<i>Aeolothrips</i> spp.	Acolothripidae Thysanoptera
6)	Gr. nut thrips	<i>Caliothrips indicus</i> Bag.	Thripidae Thysanoptera
7)	Black cut worm	<i>Agrotis ipsilon</i> (Roth)	Noctuidae Lepidoptera
8)	American bollworm	<i>Helicoverpa armigera</i> (Hub)	
9)	Rice cut worm	<i>Spodoptera litura</i> F.	
10)	Cotton leaf worm	<i>Spodoptera littoralis</i> Boisd	
11)	Onion Leaf miner	<i>Phytobia cepae</i> (Her)	Agromyzidae Diptera
12)	Onion mite	<i>Aceria tubipia</i> (K)	Eriophulidae Acarina

PESTS OF TAPIOCA

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Scale insect	<i>Anidomytilus albus</i>	Diaspididae
		Cklla	Hemiptera
2)	Mealy bug	<i>Pseudococcus spp.</i>	Pseudococcidae
			Hemiptera
3)	Aphid	<i>Rhopalosiphum esculentum</i>	Aphididae
		Ray	Hemiptera
4)	Thrips	<i>Retithrips syriacus</i> Mayel	Thripidae
			Thysanoptera
5)	Stem borer	<i>Sybra praausta</i> Pascoe	Cerambycidae
			Coleoptera
6)	Termites		Isoptera
7)	Mites	<i>Tetranychus urticae</i> Koch	Tetranychidae
		<i>Tetranychus neocaledonicus</i>	Acarina
		Andre	

PESTS OF DRUMSTICKS

Sr. No.	Common Name	Scientific Name	Family : Order
1)	Leaf eating Caterpillar	<i>Eupterote mollifera</i> Walker	Eupteralidae Lepidoptera
2)	Black hairy Caterpillar	<i>Pericallia ricini</i>	Aretidae Lepidoptera
3)	Leaf eating Caterpillar	<i>Noorda blitealis</i> walker	Pyalidae Lepidoptera
4)	Moon moth	<i>Actias silence</i> (Hubner)	Saturniidae Lepidoptera
5)	Trunk borer	<i>Indarbela tetraonis</i> moore	Metarbelidae Lepidoptera
6)	Stem borer / Longicorn beetle	<i>Botocera rubus</i> L.	Cerambycidae
7)	Beetle grub	<i>Holotrichia reynaudi</i> Blanchard <i>Holotrichia rustica</i> B.	Meloidae Coleoptera
8)	Leaf eating weevils	<i>Myloccerus spp.</i>	Coleoptera
9)	Bud borer	i) <i>Stictodiplosis moringae</i> Mani ii) <i>Norda mortingal</i> Tams	Cecidomyiidae Diptera Pyralidae / Lepidoptera
10)	Aphid	<i>Aphis crassivora</i>	Aphididae Homoptera
11)	Whitefly	<i>Trialeurodes vava</i> DUMHIER	Fulgoroidea Homoptera
12)	Scale insects	<i>Ceroplastodes cajani</i> M. <i>Diaspidiotus spp.</i>	Coccidae Diaspididae Homoptera
13)	Thrip	<i>Scirtothrips dorsalis</i>	Thripidae Thysanoptera
14)	Termite	<i>Neotermes fletcheri</i> Holmgren	Termitidae Isoptera

1) **Leaf eating caterpillars :** *Eupterote mollifera walker* : Family Eupterotidae Order Lepidoptera

Economic Importance : It is the most destructive and specific pest of drumstick tree.

Marks of Identification : caterpillars are brownish in colour, densely hairy. Adults are large sized moths uniform light yellowish brown in colour, forewings are suffused with brownish rufous.

Host Plants : Drumsticks.

Nature of Damage : On hatching, the caterpillars feed gregariously by scrapping the bark and gnawing the foliage. A severe infestation may result in complete defoliation of the tree.

Life History : Eggs are laid in clusters on leaves and tender stems. Moths appear with the onset of monsoon. I.P. 6 days. L.P. 12-14 weeks. P.P. 8-10 weeks and there is only one generation in a year.

Control Measures : 1. When serious infestation is observed spray the trees with 0.2% carbaryl or 0.1% malathion.

2. **Black Hairy caterpillar :** *Perieallia ricini* (fab)

Farm : Arctidae : Order Lepidoptera.

Host Plants : Banana, cotton, cucurbits, castor, cow pea, black gram, soy bean, tea, yam etc.

Marks of Identification : Caterpillar dark brown in colour, specked with white and have dorsal and lateral tufts of long hair, (dark).

Adult : Moths are stout with fuscous-brown fore wings having numerous pale black ringed spots in the interspaces. Abdomen and hind wings are crimson in colour having black bands and spots.

Nature of Damage : On hatching the caterpillars feed on leaf laning, initially by scrapping epidermal layers and later by cutting blades.

Life Cycle : Eggs are laid in clusters on ventral surface of leaves. I.P. 4 days. L.P. 26-32 days and P.P. 10-12 days. Life cycle is completed in 40 days.

Control Measures : As above.

3) **Leaf eating caterpillar :** *Noorda blitealis* walker

Farm : Pyralidae : order Lepidoptera

It is a sporadic, serious pest of drumstick tree. Specially in south India.

Marks of Identification : Larvae are yellowish green, Adults are medium sized moths, fore wings have rectangular apex with outer margin erect and are uniform dark in colour with a small white streak at the inner area of base. Hind wings are hyaline with broad black marginal band narrowing toward and side.

Host Plants : Drum shick.

Nature of Damage : caterpillars feed on leaf lamina. Peak periods of infestation are during March-April and December-January. When over medium infestation may defoliate the entire tree.

Life Cycle : Eggs laid in batches usually on ventral surface of leaves. 1 days. L.P. 7-15 days. P.P. 6-9 days.

Control Measures : Spraying the trees with 0.2% carbaryl, or 0.1% malathion.

4) **Moon Moth :** *Actias selene* (Hubner)

Farm : Saturnidae : Order : Lepidoptera.

It is widely distributed all over India and is found in almost all the area growing temperate fruit trees.

Marks of Identification : Caterpillar are smooth apple green in colour (100-150 mm long) Adults are big, pinkish moth, wings are whitish at the base, pale greenish all over and yellowish near the margin with a conspicuous cross band and white eye spot in the center. Hind wings have a long tail, pinkish in colour. Wing expanse is 130-160 (mm) and 140 to 180 mm.

Nature of Damage : Caterpillar feed voraciously on leaves and no time the tree become defoliated.

Control Measures : Spray the tree with 0.2% carbaryl, or 0.1% malathion.

PESTS OF ROSE

Sr.No.	Common Name	Scientific Name	Family : Order
1) 	Aphids		Aphididae
	i) Cotton aphids	<i>Aphis gossypii</i> Glover	Hemiptera
	ii) Green peach aphid (potato)	<i>Myzus persicae</i> (Suzer)	Aphididae Hemiptera
	iii) Rose aphids	<i>Microsiphum rosaeformis</i>	Aphididae Hemiptera
2) 	i) Thrips	<i>Rhipiphorothrips cruentatus</i> Hood	Thripidae Thysanoptera
	ii) Onionthrips	<i>Thrips tabaci</i> Lind	Thripidae Thysanoptera
3)	Jassids		
4)	Rose Leaf hopper	<i>Edwardsiana rasae</i> L.	Cicadellidae Hemiptera
5) 	Red spider mite	<i>Tetranychus cinnabarinus</i> Boisduval	Tetranychidae Acarina
6)	Termites	<i>Microtermes obesi</i> Halm <i>Odontotermes obesi</i> Ramb	Termitidae Isoptera
7) 	Scales		
	i) Red Scale	<i>Lindingaspis rossi</i> (mask)	Coccidae Hemiptera
	ii) California	<i>Aoxidiella aurantii</i> Mask	Coccidae Hemiptera
8)	Leaf cutting bees	<i>Megachile anthracina</i> <i>Megachile disjuncta</i> fab	Megachilidae Hymenoptera Megachilidae Hymenoptera
9)	Caster semi Looper	<i>Achaea Janata</i> L.	Noctuidae
10)	Tussock caterpillar	<i>Euproctis fraterna</i> moore <i>Euproctis scintillans</i> wlk	Lepidoptera Lymontridae Lepidoptera
11)	Leaf eating caterpillar	<i>Laloida</i> (parasa <i>Lepida</i> Grammer	Limacodidae Lepidoptera

12)	Grampod borer	<i>Helicoverpa armigera</i> (hub)	Noctuidae Lepidoptera
13)	Bud borer	<i>Argyroplote aprobola</i> Meyr	Eucosmidae Lepidoptera
14)	Chaffer beetles	<i>Oxyctonia versicolor</i> F.	Cetoniidae
15)	Rose weevil	<i>Mylocerus richardi</i> Nathan	Scarabacidae Coleoptera
16)	Chafferbeetle	<i>Anomala</i> spp.	Chrysomelidae Coleoptera
17)	Nematodes		

Rose, the queen of the flowers, suffer from about 50 insect's, few species of mites & nematodes. Of these only 8 pests are of economic importance.

1. Aphids : 1) *Macrosiphum euphorbis* Thomas
2) *Macrosiphum rosae* Linnaeus
3) *Macrosiphum rosaeformis* Das
(Aphididae : Hemiptera).

These are minute, more or less globular, light green to deep green individuals. They occur in cluster on tender shoots, buds, flowers & reary on flower surface leaves. Both nymphs & adult suck the cell sap & devitalize the plant, the tender shoots wither, buds drop down prematurely & flowers loose their beauty & lasting capacity. Aphids are more common on the crop during winter season. They reproduce pathenogenetically & their population increase rapidly within short time. Nymphal stage last for 12-18 days.

Control Measures :

- 1) Aphid can easily be controlled by spraying with 0.03 % demethoate, monocrotophos or 0.1 % malathion.
- 2) Soil application of 10% phorate granules may also prove effective in controlling the pest.
- 3) Spraying of neem oil 2%.

2. Jassids : *Empoasca* spp. (Jassidae : Hemiptera)

Marks of Identification : These are small, light grey or pale green, wedge shaped insects, often become abundant during pre-monsoon period (April-May).

Nature of Damage : Nymph & adult suck the cell sap from leaves, injecting their toxic saliva into the plant tissues. In case of severe infestation leaf margins turn yellowish & gradually entire lamina become yellow & wrinkled. Damaged plant wither & shows sickly appearance it is shading pest, plant in shady places are attacked more & prefers varieties having broad & succulent leaves.

Control Measures : It can be controlled by spraying of 0.05% DDVP or Monocrotophos as soon as infestation is noticed. Soil application of 10% phorate granules may also help to control the population.

2013/ **Thrips :** (i) *Rhipiphorothrips cruentatus* Hood (iii) *Thrips coloratus* preinse
(ii) *Retithrips syriacus* Mayerr (iv) *Thrips florum* Schmutz

Thripidae : Thysanoptera

First two species are reported to feed on leaves while next two are found on flowers. First one is more common & found all over India. Besides, Host plant roses it also attacks arecanu, cashewnut, crotons, custard apple, grapevine, jamin etc. Adults are blackish brown & nymphs are reddish. Both the stage are observed on underside of leaves during March to November (Nymph & adults with rasping mouth parts scrape the tissue from leaf surface as well as petals & suck the cell sap, oozing out from wound). The attacked leaves show brown patches, get distorted finally wither & drop down. This adversely affect the flowering capacity by shedding of flower buds. Brown patches on petals affects the beauty of flowers. These insects leave minute excreta around their colony on the under side of leaves. The activity of the pest is more under cloudy weather conditions. (April-June & Sept-Dec.) & overwintering takes place in soil from November to March.

✓ **Control Measures :** Spraying with 0.05% Monocrotophos or dimethoate or methyl demeton 2-3 times at 15 days interval or 0.1% lindane or dusting with 2% methyl parathion dust will effectively control the pest. Soil application of 10% phorate granules will also give sufficient protection against the pest.

2011/ **4. Scale Insects :** *Aonidiella aurantii* Mskell (Diaspididae : Hemiptera)

These are tiny reddish brown immovable insects mostly cover the shoots. Crawlers & adults, with their piercing & sucking type of mouthparts, suck the sap from stem, tender branches & even leaves. In case of severe infestation yellowing & shedding of leaves, stunted growth & even death of the branches may be observed. Pest is active throughout the year, but can be more virulent during March-June & September-November.

Control Measures : Prune & destroy the infested leaves & twigs. Spraying with 0.08% Dimethoate or 0.05% Malathion will bring the pest under check.

5. Leaf cutting bees : *Megachile anthracina* Smith, *Megachile disjuncta* Fabricius
(Megachilidae : Hymenoptera)

Leaf cutting bees are hairy, medium sized, dark insects. They build mud cells in crevices & cavities in hedges, deadwood & neglected dwellings. Leaf cutting bees cause characteristic damage to the rose leaves by cutting neat, circular or oval patches from leaf margins. The cut portions of leaves are used in their nest cells. The damage caused by bees is generally not serious nature. The bees are active before & after the monsoon.

Since bees are useful for pollination & damage caused by them is not much, no special control measures need to be adopted. Foliar sprays used against other pests will, however check the activity of bees.

6. Digger Wasp : *Ammophilla* Spp. Sphecidae : Hymenoptera

Soon after the pruning of rose plants in October, the cut branches are attacked by digger wasp. These wasps enter from cut ends, tunnel through the pith & burrow downwards to build their nests within. As a result of this burrowing a fungus causing the 'dieback' disease often enters into the branch & consequently the branch begins to die from tip downwards. The digger wasp preys on flies & paralysed flies are carried into the burrow & stored as a food for the young ones.

Control Measures : To check these wasps from entering into the stems, paint the cut ends with 2% methylparathion dust + Copper fungicide (1:1).

- 90%
7. Chaffer beetle : *Adoretus* Spp. (Scarabidae : Coleoptera)

Adult are reddish, chestnut, coloured beetle, lay their eggs in soil. Grubs are large sized, fleshy, white in colour.

Nature of Damage : Adult beetle feed on leaves causing irregular cuts & punctures. Voracious feeding of beetles badly defoliate the plants particularly in monsoon season. They also feed on buds and tender shoots. Grub feed on roots.

Host Plant : Pest being polyphagous, apart from roses, also feeds on grapevine, guava, loquat & phalsa.

Control Measures :

- 1) Deep ploughing to expose eggs, grubs and pupae to natural enemies.

- 2) While carrying out earthing up, weeding or any other soil operation, grubs should be carefully collected & destroyed.
- 3) The infested area should be treated with 2% Methyl parathion dust.
- 4) The plants should be sprayed with 0.2% carbaryl or 0.05% quinalphos or chlorpyrifos to kill the beetles feeding on foliage during evening. The treatment should be repeated at two weeks interval.

7. Termites or White ants : *Termes spp.*, *Microtermes Obeşi* Termitidae : Isoptera

These are highly evolved social insects, with well organized colonies, where there is a perfect division of labour the different castes of individuals, each of which perform specific duties. They have very complicated peculiar mode of underground existence. They construct different types of nests at various depth. The worker is the damaging stage, comes out of nest & forage for long distance & damage the newly planted rose beds. They are particularly destructive to rose cutting before they are able to establish.

Control Measures :

- 1) Locate & destroy the termitoria & killing the queen is the most effective & practical control. Fumigate the termitoria with CS_2 / Methyl bromide.
- 2) In standing crop apply 5 lit. lindane 20 EC / ha in irrigation water.
- 3) Before planting treating the soil with 2% Methyl parathion dust about 3 g. per pit or soil drenching with Chlorpyrifos 0.05% or Malathion 0.1%.
- 4) Deep ploughing destroys termite colonies.

20/2 8. Mites : *Tetranychus telarius* Linnaeus red spider mite ✓ *Teranychus urticae* Koch two spotted spider

These are small creatures belonging to class Arachnida. They have oval unsegmented body & four pairs of legs. Most of these are polyphagous. *T. telarius* L. popularly known as red spider mite has a world wide distribution attacking number of plants like castor, cotton, okra, tomato, brinjal etc. besides rose. Mites found on underside of the leaves & are protected by silk webbing. Both Nymph & adult suck the cell sap causing blotches on the leaves, which ultimately dry up & leaves fall down. These mites appear with the onset of monsoon & are most active during September to January. Afterwards their activity declines till April, when they disappear due to excess heat.

Teranychus urticae Koch known as two spotted spider mite, is a pest world wide importance infesting more than 150 host plants. Recently Thomson seedless grape & rose gardens in Maharashtra were found to be heavily infested by these species. The pest is becoming more serious day by day, particularly in the areas where grapevine & roses are grown side by side.

side Apart from roses & grapevine these mites are also thrive well on papaya pangara brinjara marigold, & weeds like cocks comb, dudhani & tandulia

Marks of Identification : The mites are yellowish white in colour with two prominent black spots on the abdomen. Nymphs are generally white in colour and black spots on dorsum.

Nature of Damage : Both nymphs and adult suck the cell sap from leaves and twigs. Infested leaves turn yellowish with whitish spots along with leaf veins, later on brownish burnt patches develop on the leaves, which wither & finally dry

Control Measures :

- 1) Cutting and burning of severely infested plants.
- 2) Proper ventilation, irrigation and clean cultivation.
- 3) New miticides viz. Mitac 0.05% or Cascade 0.015% or Vertimec 0.025% sprays combat mite problems in polyhouse roses.
- 4) Spray Dicofol or Ethion 0.05% or Wettable Sulphur 0.3%, 2 to 3 times at 15 days interval for control of pest in open roses.
- 5) Soil application of aldicarb 10 G @ 16-kg / ha. around the base of plant by ring method has also been found effective in controlling two spotted spider mite

10. Nematodes : *Hoplolaimus Spp.* *Xiphinema Spp.* *Helicotylenchulus Spp.*
Meloidogyne javanica Chitwood Phylum : Nematelminthes

These are minute, microscopic organism confined mostly to root zone of the plants. Nematode injury to the roots results in symptoms of malnutrition, decreased shoot growth, ~~unproductivity~~ and increased susceptibility to disease producing organisms. The *Meloidogyne javanica* cause galls on roots. The affected plants become smaller in size, root system becomes necrotic, growth is stunted.

For the control of these pests fumigate the rose beds 4 – 6 weeks before plantation with ED B ethylene dibromide @ 250 ml / ha.

In addition to the above pests, there are number of pests found occasionally damaging rose plants. e.g. hairy caterpillar, *Euproctis lunata*, W.E. fraterna Moore, castor semilooper *Acheoia janata* Lin, crab caterpillar *Statoropus alternus* Feg. leaf eating caterpillar *Spodoptera litura* Boisduval, Stem girdles *Sthenias grisator* Fab. & Blister beetle *Mylabris pustulatus* Thunberg etc.

PESTS OF CHRYSANTHEMUM

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Aphid		
	i) Chrysanthemum aphid	<i>Microstiphoniella sanbarni</i> Willete	Aphididae Hemiptera
	ii) Peach leaf curling aphid	<i>Brachycaudus helichrysi</i>	
	iii) Cotton aphid	<i>Aphis gossypii</i> Glover	
	iv) Green potato aphid	<i>Myndus persicae</i> suz	
2)	Mirid bug	<i>Trialestes pallidifera</i> wlk	Miridae Hemiptera
3)	Bihar hairy caterpillar	<i>Spilosoma oblique</i> walkes	Arctidae Lepidoptera
4)	Tobacco Caterpillar	<i>Spodoptera litura</i> F.	Noctuidae Lepidoptera
5)	Leaf miner	<i>Phytomyza syngenesiae</i> Hardy	Agromyzidae Diptera
6)	Blister beetle	<i>Epicauta Mannerheim</i> malkin	Meloidae Coleoptera
7)	Red spider mite	<i>Tetranychus urticae</i> Koch	Tetranychidae Acarina
8)	Onion thrips	<i>Thrips tabaci</i> Lind	Thripidae Thysanoptera
9)	White grub	<i>Holotrichia consanguinea</i> Banch	Melolonthidae Coleoptera
10)	Shoot miner	<i>Psilla nigricornis</i> Fab	Psilidae Diptera
11)	Stalk borer	<i>Papaipema nebris</i> Guen	Nictuidae Lepidoptera
12)	Chrysanthemum Gall Midge	<i>Diarthronomyia</i> (Rhopalomipia) <i>Chrysanthemi ashberg</i>	Cecidomyiidae Diptera
13)	Chrysanthemum Caterpillar	<i>Hedylepta</i> (Laprosema) <i>indicate</i> (fab)	Pyrilidae Lepidoptera
14)	Earwing	<i>Forficula auricularia</i> L.	Forficulidae Dermeptera

pests of Chrysanthemum : About 80 different insect pests are reported to infest the chrysanthemum. Of these 11 pests are important and are described as below.

✓ 1. Aphids : *Macrosiphoniella sanbarni* Gill

Aphididae : Hemiptera

It is dark chocolate brown insect, found always in clusters on tender terminal shoots and on underside of leaves. Due to the continuous sucking of sap, shoots are distorted, leaves are teared and malformation of flowers takes place. They are also the carrier of 'aspermy virus' disease of chrysanthemum.

Aspermy

✓ Control Measures : Aphids can be controlled by spraying 0.02% methyl demeton or 0.05% malathion or Diamethoate 0.03%.

2. Thrips : *Thrips tabaci*, *Microcephalothrips abdominalis* Thripidae : Thysanoptera

They are black & so minute that they can easily be seen with naked eye. They can be noticed by tapping a plant over a white paper.

Nature of Damage : They usually attack the flowers but can also be observed on underside of leaves giving silvery appearance to the leaves.

Control : As given under aphids.

2017

3. White fly : *Trialeurodes vaporariorum* Aleurodidae : Hemiptera.

They are whitish and mostly found on green house plantation. The nymphs are like scales attached to underside of leaves. They give out certain amount of honeydew resulting into formation of sooty mould, giving black appearance.

Control Measures : Under green house pest can be controlled by spraying with 0.4% neem ark + 0.05% quinalphos or 0.1% padan. (Cartap hydrochloride).

4. Leaf Hoppers : *Erythroneura palidifrons* Spp. (Jassidae : Hemiptera)

The nymphs & adults feed on the leaves. The cell walls are pierced & the cell contents are sucked out, resulting into several white bleached area on leaves. In severe cases leaves become variegated & turn completely white.

Control Measures : Spraying the crop with 0.05% methyl demeton or malathion will control the pest effectively.

5. Mealy Bug : *Phenacoccus gossypii* Hemiptera

It is primarily a pest of chrysanthemum in green house. Potted plants grown closely are severely infested with mealy bugs. Ants are mainly responsible for the spread of these insects.

Control Measures : Pest can be controlled with 0.1% malathion or 0.5% dimethoate. Spread of mealy bugs can be prevented by killing the ants with suitable insecticide or ant baits.

6. Leaf miner : *Phytomyza syngenesiae* Diptera

The larva feeds on the inner tissues of the leaf just under the upper epidermis making irregular tunnels especially near the margins.

Control Measures : Two sprays with 0.05% diazinon or monocrotophos or trizops 0.06% at 7 days interval will effectively control the pest.

7. Gall midge : *Diatronomyia chrysanthemum*

This pest is primarily a pest of greenhouse and is little known to infest garden plants. The larvae enter the leaf & stimulate the formation of small pimple like galls.

Control : Spraying of 0.02% monocrotophos is very effective against the gall midge.

8. Chrysanthemum lacewing bug : *Corythucha marmoratus* Hemiptera

Adult stage of this pest has lace like wings. Both nymphs and adults suck the cell sap from leaves, causing bleaching of the leaves and injury to the stems. Aster and scabiosa are the other plants attacked by this pest.

Control Measures : Spray with 0.05% malathion 50 EC or 0.2% carbaryl 50 WP directing the spray material mainly to the lower surfaces.

9. Termites : *Reticulitermes flavipes* Termitidae Isoptera

Like other garden plants, roots of the chrysanthemum are some time attacked by termites. These are more frequently the pest of field as well as greenhouse plants. Termites feed on the woody tissues of the roots and stems destroying many plants.

Control Measures :

- 1) Give frequent irrigation and avoid drying of plants.
- 2) Use 2% methyl parathion dust in soil.
- 3) Dig out the termitaria fumigate with CS_2 / Methyl bromide.

10. Leaf nematodes : *Aphelenchoides ritzemabosi*

Phylum : Nematoda

Since long back this nematode has been known to be a pest of greenhouse chrysanthemum, but only in recent years has become very injurious to hardy chrysanthemums grown outdoor. When the stems are wet, the worms swim up through the film of water & enter the stomata of leaves. The first symptom of infestation is appearance of yellowish brown spotting on leaves. The spots are more or less bounded by the larger veins, subsequently enlarge. The symptoms may be confused with the leaf spot disease caused by fungus, but the spots produced by nematodes on leaves are brownish & not black.

Control Measures : Following management practices may be followed against the pest.

1. Propagating material should be used by taking cutting from the tops of long vigorous shoots.
2. Avoid replanting of chrysanthemums in the same area year after year.
3. Commercial growers can spray methyl parathion @ 0.05%, 3 times, at 2 – 3 weeks interval from July to September.

Similarly, the root rot nematode *Meloidogyne incognita* & *M. hapla* also infest the roots of chrysanthemums.

11. Mites : *Tetranychus urticae* Koch.

Tetranychidae : Acarina

Two spotted spider mite (*Tetranychus urticae*) causes distorted foliage, shriveled & discoloured blooms. Detail description about the species has been given under roses.

Control :

- 1). Mites can be controlled by spraying with 0.2% wettable sulphur or 0.03% dicofol or 0.01% Vertimek.
- 2) Soil application of aldicarb 10% G @ 16 kg / ha.

Apart from the pests already described stalk borer (*Papaema nebris*). European corn borer (*Dstrinia numbilatis* Hubner,) cutworm (*Peridroma saucia*), are the other pests infest the chrysanthemum occasionally.

PESTS OF CARNATION

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Red spidermite	<i>Tetranychus urticae</i> Koch	Tetranychidae Acarina
2)	Green peach / potato aphid	<i>Myzus persicae</i> sulz	Aphididae Hemiptera
3)	Onion thrips	<i>Thrips tabaci</i> lind	Thripidae Thysanoptera
4)	Gram pod borer	<i>Helicoverpa armigera</i> (Hub)	Noctuidae Lepidoptera
5)	Carnation tortrix moth	<i>Tortrix pronubata</i> meyr	Tortricidae Lepidoptera
6)	Carnation fly	<i>Hylemyia briennecens</i>	Anthomyiidae Diptera

2015/ 1) Red Spider mite : *Tetranychus telarius* Koch.
Fam : Tetranychidae Order – Acarina,

Marks of Identification : The adult is scarlet red.

Nature of Damage : Mite feed on underside of the leaves, suck the cell sap, and as a result the leaves turn pale yellow and dust coating and fine webs. In severe infestation plants become stunted and the flowers also invaded. Plant growth, crop quality, yield and vase life of carnation flowers decreased with increasing mite population.

Control Measures : Plant protection operations are initiated when the density of mite is 1 / leaf.

- a) Cutting and burning of severely infested plant parts:
- 1) Use variety having straight and flat leaves which are proved to be resistant.
- 2) Spray kelthane (Dicofol) @ 2 ml / litre or wettable sulphur @ 3 gm / litre or Ethion 2 ml / litre.
- 3) Spraying of insecticides like Formothion, or Dimethoate, or Triazophos or Dichlorvos gives effective control the pest.

2) Green peach aphid : *Myzus persicae* (sulz)

Nature of Damage : Both nymph and adult suck the sap from leaves and retard growth of plant. In severe infestations they leave sticky deposits on the leaves and flower buds.

Control Measure : Spray Diazinon 20 EC or Dimethoate 30 EC 2 ml / litre of water before the opening of flowers.

3) Onion Thrips : *Thrips tabaci* Lind

Nature of Damage : Both the nymphs and adults suck the sap from the tender portions of the plants causing them to turn yellow and patchy often with black specks and slight crinkling. A severe attack adversely affects growth of plant, feeding on flowers causes streaks and making them unsuitable for marketing. The dark red and pink cultivars are very susceptible.

Host Plants : Onion, tuberose, carnations.

Control Measures : Spray dimethoate 30 EC @ 1 ml or fenitrothion 50 EC @ 3.5 ml / litre or malathion @ 2 ml / litre of water as soon as the pest appears.

4) Bud borer OR Gram pod borer : *Helicoverpa armigera*.

Nature of Damage : Larva bores into young bud making a round clear cut hole. It feeds on internal contents of buds leaving empty calyx intact. The infested buds fail to open occasionally they also feed on the young shoots.

5) Cornation tortrix moth : *Tortrix pomivora* Meyr.

Marks of Identification : Moths are small, have grey brown fore wings. The caterpillars are small yellow or green in colour.

Nature of damage : On hatching, the young larvae find a suitable site among the leaves and fasten, some of the leaves together with silken threads and feed inside the shelter. Injury is usually found around the growing points of the shoots, but the caterpillars may also bore into the flower buds.

Control : Mixture of carbaryl + Kalthane is proved to be effective.

2015

6) Carnation fly : *Hylemya briennescens*

Fam Anthomyiidae

Order Diptera

Nature of damage : The maggot bores in to leaves & growing tips of young plants. More particularly those plants growing outdoors. They may be responsible for the death of young plants by tunneling down the apical shoots.

Control Measures :

- 1) . Apply Carbaryl 4 G @ 10 kg / ha or Lindane 6 G @ 10 kg / ha or Phorate 10 G @ 10 kg / ha. to the soil followed by light irrigation.
- 2) . Spray Malathion 50 EC @ 2 ml / litre of water.

Exercise No. 18
PESTS OF JASMINE

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Budworm	<i>Hendecasis duplifascialis</i>	Pyrustidae
		Hmpsn	Lepidoptera
2)	Leaf webworm	<i>Nausinoe geometralis</i>	Pyraustidae
			Lepidoptera
3)	Gallery worm	<i>Elasmopalpus jasminophagus</i>	Phycitidae
			Lepidoptera
4)	Leaf caterpillar	<i>Glyphodes glauculalis</i>	Pyralidae
			Lepidoptera
5)	Black hairy caterpillar	<i>Pericallia ricini</i> Fb	Arcitiidae
			Lepidoptera
6)	Gall mite or Eriphyd mite	<i>Aceria jasmini</i> Channa	Eriophyidae
			Acarina
7)	Thrips	<i>Thrips</i>	Thripidae
		<i>Isoneurothripa orientalis</i>	Hemiptera
		Bagn	
8)	California red scale	<i>Aonodiella aurantii</i>	Coccidae
		Mask	Hemiptera
9)	Tingid bug	<i>Corythauma ayyri</i> (Drake)	Tinigidae
			Hemiptera
10)	Jasmine bug	<i>Antestiopsis Antestia</i>	Pentatonidae
		<i>cruciata</i> F.	Hemiptera
11)	Lace wing bug	<i>Leptofarea ayyari</i>	
	Rincid bug	<i>Ricanio fenestrata</i> Fb	

1) Bud Worm : *Hendecasis duplifascialis* Hmpsn.
fam : Pyraustidae : Order : Lepidoptera.

Hendecasis
duplifascialis

Marks of Identification : Larva is greenish with black head.

Nature of Damage : The larva bores in to immature bud and feed on internal content. Larva attacks on 2-3 buds and the buds are webbed together by silken thread. Pupa in Soil.

2) **Gallery Worm** : *Elasmopalpus jasminophagus* Hmpsn

F am : Phycitidae Order – lepidoptera

Marks of Identification : The moth is small and dark grey in colour, caterpillar is green with red head and prothorax and lateral brown streaks on the body.

Host Plants : Jasmine.

Nature of Damage : Caterpillar is the damaging stage. They web terminal leaves, shoots, and flowers and feed on them. Pupation takes place in the galleries.

Control Measures : Spray dimethoate 30 EC @ 2 ml / litre of water or quinal phos 0.05%.

3) **Leaf web worm** : *Nausinoe geometralis*

F am : Pyraustidae Order : Lepidoptera.

Marks of Identification : It is a medium sized moth with light brownish wings. wings have white spots. The caterpillar is green with dark warts giving rise to thin hairs and has black streaks on the side of thorax.

Nature of Damage : Caterpillar webs leaves together and remain inside and cause damage by feeding on them.

Damaging Stage : Caterpillar.

Life History : The female lays 15-20 greenish – yellow eggs on the leaf lamina. I.P. 3 – 4 days, L.P. 12 – 15 days. The larva spin extensive webbing in the shaded portion of the plant around the leaves on which they feed and pupate within the web. The pupal period 6 – 7 days. and life cycle is completed in 22 – 24 days.

Control Measures :

- 1) Hand picking of larva and remove webbings alongwith pupae.
- 2) Spray dimethoate 30 EC @ 2 ml / litre & water or Quinalphos 25 EC @ 0.05% or Fenvelerate 0.01%.

- 4) Leaf eating Caterpillar : *Glyphodes glaucalis* Gr
Fam : Pyralidae : Order : Lepidoptera.

Makes of Identification : The moth is light blue, in colour, and the caterpillar is green.

Nature of Damage : Caterpillar cause damage by feeding on the leaves.

Control Measures : Spray methylparathion 50 EC @ 2 ml / litre of water.

- 5) Black hairy caterpillar : *Pericallia ricini* Fb.

Fam : Arctidae Order : Lepidoptera.

Host Plants : Jasmine

Damaging stage : Caterpillar.

Marks of Identification : The moth is stout with fuscous forewings, bearing pale ringed black spot, crimson hindwings and crimson abdomen having black bands on it. The larva is dark brown or black having thick hairs.

Nature of Damage : Caterpillars cause damage by feeding on leaves.

Life History : The female lays eggs in clusters of upto 170 on underside of the leaves. I.P. 4 – 5 days, larval period 26 – 32 days, pupal period 10 -12 days. Pupation on plants in cocoons. Total life cycle is completed in about 40 days.

Control Measures : Spray methyl parathion 50 EC @ 1 ml / litre or malathion 50 EC @ 2 ml / litre or fenitrothion 50 EC @ 1 ml / litre of water.

- 6) Gall mite or Eriophyd mite : *Aceria jasmine* Channa.

Fam : Eriophyidae Order : Acarina.

Marks of Identification : The female is cylindrical measuring about 150 μ long & 44 μ thick the males are rare.

Nature of Damage : These mites make webs which give the appearance of white hairy out growth on the leaf surface, on tender stems and on the flowers buds. As a result of feeding malformation of vegetative growth and floral parts take place and consequent reduction in growth & yield.

Control :

- 1) Sprays of monocrotophos 0.05% or phosalone 0.07% or Imazophos 0.1% at 14 days interval are effective
- 2) Or dusting of sulphur dust @ 20 kg / ha.

Exercise No. 19

PESTS OF MARIGOLD, ASTER, TUBEROSE

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Hairy caterpillar	<i>Diacrisia oblique</i> Walker	Arctiidae Lepidoptera
2)	Gram pod borer	<i>Helicoverpa armigera</i> Hunder	Noctuidae Lepidoptera
3)	Leaf hopper	<i>Empoasca fabal</i> (Harris)	
4)	Aster leafhopper	<i>Macrostes fascifrons</i> Stahl	Cicadellidae Hemiptera
5)	Gr. nut aphid	<i>Aphis crossivora</i> Koch	Aphididae Hemiptera
6)	Blister beetle	<i>Epicaula manerheim</i> Maklin	Meloidae Coleoptera
7)	Red spider mite	<i>Tetranychus urticae</i> Koch	Tetranychidae Acarina

PESTS OF ASTER

1)	Aphid	<i>Microsiphum artemisiae</i>	Aphididae Hemiptera
2)	Cyclamen mite	<i>Steneotarsonemus pallidus</i>	Tarsonemidae Acarina
3)	Crysanthemum Lace bug	<i>Corythucha marmorata</i>	Tingidae Hemiptera
4)	Chrysomelid beetle	<i>Anlacophora foveicollis</i>	
5)	Leaf miner	<i>Lyriomyza trifoli</i>	
6)	Flower caterpillar (<i>H. armigera</i>)		

PESTS OF TUBEROSE

1)	Red spidermite	<i>Tetranychus ulricae</i> Koch <i>T. telarius</i> L.	Tetranychidae Acarina
2)	Thrips (Caranotom)	<i>Thrips tabaci</i> Lind	Thripidae
	Aphids		Thysanoptera
3)	Cabbage (white) butterfly	<i>Pieris brassicae</i> Lim	Pieridae Lepidoptera
4)	Bud borer	<i>Helicoverpa armigera</i>	
5)	Pentatomid bug	<i>Nezara viridula</i>	Hemiptera

Pests of Aster and Tuberose.

- 1) Cyclamen mite : *Steneotarsonemus pallidus*.

Family : Tarsonemidae : Order : Acarina. *class -*

Nature of Damage : Mite live and feed inside the folds of young leaves. Infested plants show stunted growth and brown scarrings along the stems. In case of heavy infestation small green rosettes are produced in place of flowers.

Control Measures : Spray kelthane @ 1 ml / litre of water or wettable sulphur @ 3 gm / lit.

- 2) Chrysanthemum lacebugs : *Corythucha marmorata*

Fam : Tingidae : Order : Hemiptera

Nature of Damage : Both nymphs and adults suck the sap from the leaves. As a result of feeding leaves get bleached.

Control Measures : Spray diazinon @ 2 ml / litre of water / malathion 50 EC @ 2 ml / litre of water or carbaryl 50 w.p. @ 2 ml / litre.

PESTS OF GLADIOLUS

Sr. No.	Common Name	Scientific Name	Family : Order
1)	The gladiolus Thrips	<i>Taeniothrips simplex</i> More	Thripidae Thysanoptera
2)	Honey suckle thrips	<i>Thrips flavus</i> Schrons	Thripidae Thysanoptera
3) 2 elm	Seed corn maggot	<i>Hylemyia cilicula</i>	Anthomyidae Diptera
4)	Tarnished plang bug	<i>Lygus linea</i> Laris (pdeb)	Mindae Hemiptera
5)	Aphids (cotton)	<i>Aphis gossypii</i> (Glover)	Aphididae Hemiptera
6)	Potato aphid Gram pod Borer	<i>Myzus persicae</i> (sulz) <i>Helicoverpa armigera</i> (Hub)	Noctuidae Lepidoptera
7)	Cutworms (Grasy worm) Tobacco caterpillar	<i>Agrotis ipsilon</i> Roll <i>Spodoptera litura</i>	Noctuidae Lepidoptera Noctuidae Lepidoptera
8)	Cabbage semilooper	<i>Ttichoplusia spp.</i>	Noctuidae Lepidoptera
9)	Cabbage white butterfly	<i>Pieris brassicae</i> L.	Pieridae Lepidoptera
10)	Red spider mite Bulb	<i>Rhizoglyphus echinopus</i> (fum and rob)	Tenipalpidae Acarina
11)	Mealy bug	<i>Ferrisia Virgata</i>	

PESTS OF LILY

1)	Lily caterpillar	<i>Polytela gloriosae</i> F <i>Btilhys crini</i> lb	Noctuidae Lepidoptera
2)	Gladiolus Thrips	<i>Taeniothrips simplex</i> More	Noctuidae Lepidoptera
3)	Green peach aphid	Liliolirion varicosa <i>Myzus persicae</i> (Sulzer)	Aphididae Hemiptera

PESTS OF GLADIOLUS

Taeniothrips simplex. fam : Thripidae

1. Gladiolus thrips :

Nature of Damage : The yellow coloured nymphs and black adults damage leaves and spikes by rasping tissues and sucking the sap (ozzing). Affected leaves and spikes develop silver streaks, turn brown, get deformed and dry. When attack on bud, flowers, the bud do not open regularly and leaves show unnatural whitish grey glistering. Corms storage are also attacked by thrips. Infested corms are sticky, get shriveled and produce weak plants.

Host Plant : Lily and Gladiolus.

Control Measures :

- 1) Spray Acephate 0.1% 2-3 times at 10 days interval
- 2) Storing of infested corms at 2°C for 6 weeks and treating them in hot water 46°C. completely kill the thrips. OR
- 3) At the time of flower emergence spike may be sprayed with Malathion 50 EC 2 ml / litre of water.

2. Cut worms : *Agrotis segetum*

Nature of Damage : Female moth lays eggs near ground level on plant parts. Larvae feed on emerging shoots at night. Grown up clay coloured larvae cut the plant at ground level. Plants are vulnerable to attack up to 3 Leaf stage. Cut worm also damage under ground corms and developing spikes.

Control Measures :

- 1) Ploughing during summer exposes pupae to predators.
- 2) Poison bait consisting of carbaryl or malathion 0.1% in wheat bran and molasses scattered in the field controls larvae.
- 3) Spray of Quinalphos 0.05% protects foliage.

3. Leaf eating caterpillar : *Spodoptera litura*.

Nature of Damage : Ash coloured eggs are laid in groups on lower side of leaves. Early instar larvae feed on lower surface of leaves by scrapping and skeletonizing them. Greenish brown mature larvae feed voraciously during nights on leaves.

Control Measures :

- i) Collection & destruction of eggs masses and larvae reduces pest build.
- ii) Deep ploughing in summer exposes pupae to predators
- iii) Sprays of Quinolphos 0.05% or Carbaryl 0.2% or Chlorpyrifos 0.05% give protection to foliage.
- iv) NSKE 4% is effective against early instar larvae.

PESTS OF CROSSANDRA, ORCHIDS, GERBERA, DAHLIA

PESTS OF CROSSANDRA

Sr.No.	Common Name	Scientific Name	Family : Order
1)	Tussock caterpillar :	<i>dasychira mendosa</i> Hb	Lymantridae Lepidoptera
2)	Leaf scale insect :	<i>Temnaspidiolus excissus</i> (Gr.)	Diaspidae Hemiptera
3)	Gr. Aphid :	<i>Aphis craccivora</i> Koch	Aphididae Hemiptera

PESTS OF ORCHIDS

1)	Brown soft scale other soft scale :	<i>Coccus hesperidum</i> Linn <i>Lecanium tormicaril</i>	Coccidae Hemiptera
2)	Hard Scale :	<i>Aspidiotus destructor</i> Sign.	Diaspidae Hemiptera
3)	Mealy bugs :	<i>Ferrisia virgata</i> cockerel <i>Pseudococcus lilamentous</i> Var. <i>Corymbatus</i>	 Pseudococcidae Hemiptera
4)	Two spotted Mite :	<i>Tetranychus urticae</i> Koch.	
5)	Cockroach :	<i>Periplanata americana</i> L.	Blattidae Dictyoptera
6)	Snail & Slugs		

PESTS OF GERBERA

2013

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1)	Broadmite :	<i>Polyphagotarsonemus latus</i> Banks	Tarsonemidae Acarina
2)	Leaf Miner :	<i>Liriomyza</i> spp.	Agromyzidae Diptera

PESTS OF DAHLIA

Twospotted spidermite/

Tetranychus urticae

Tetranychidae

Red Spidermite

Koch.

Acarina

Onion thrips

Thrips tabaci Lind

Thripidae

Green House thrips

Heliothrips haemorrhoidalis

Thysanoptera

Bouche

Thripidae

European

Pyrausta nubilalis Hubner

Thysanoptera

Corn borer

Pyraustidae

Aphids

Lepidoptera

Aphididae

Hemiptera

i) Peach aphid

Myzus persicae (Sulz)

ii) Leaf curl aphid

Brachycaudus helichrysi

Kalt.

iii) Potato aphids

Macrosiphum euphorbis Th.

iv) Bean aphid

Aphis fabaescopali

Capsid bug

Lygus regulipennis popp.

Minidae

Minid bugs

Lygocoris pabulinus L.

Hemiptera

Earwigs

Forticula auericularia L.

Forticulidae

Dermaptera

Miner Pests

Stalk borer

Papaipema nebris Guen.

Noctuidae

Leafhopper

Empoasca fabae Horris

Cicadellidae

POLYPHAGOUS PESTS

Material : Preserve specimens & damaged plant parts.

2015

1. White grub : 1) *Holotrichia serrata* F., 2) *H. consanguinea* Bl.
3) *Leucopholis lepidophora* Burm.

Scarabaeidae : Coleoptera.

Economic Importance : It is a cosmopolitan & polyphagous species having been reported from most of the States of the country since last 10 to 15 years grub is posing a great threat to the cultivation in some pockets of Maharashtra state. It is in endemic form in some pockets of Ahmednagar, Buldhana, Dhule, Jalgaon, Kolhapur, Osmanabad, Parbhani, Sangli, Satara & Wardha districts.

Marks of Identification : Adult : Beetle is stoutly built, reddish brown, 22 – 25 mm in length & head is oblique.

Eggs : Creamy white, oval / spherical, 2 mm diameter.

Grub : About 47 mm. long white in colour with dark brown head having powerful mandibles & 3 pairs of prominent thoracic legs.

Host Plants : White grubs are polyphagous.

Larval Hosts : Attack number of crops like sugarcane, groundnut, jowar, maize, paddy, tobacco, vegetables, etc. & Grasses. Perennial trees like guava, citrus, peach etc. are also reported to be attacked by the grub.

Adult Hosts : The adult beetles feed on leaves of neem, shevaga, ber, tamarind, bel, gulmohor.

Life History : The emergence of beetle begins after first pre – monsoon showers (May / June), emergence confined to early evening, after the sunset, mating takes place on neem & babul trees. Beetles return to soil before sunrise & female start laying the eggs singly in earthen cells at the depth of 7 – 10 cm. soil. A female lays 50 – 70 eggs. Incubation period 9 – 24 days.

Grub : Grub moults twice & become full grown in 5 – 9 months.

Pupal stage : Pupation in soil. Pupal stage last for about 14 – 29 days.

Adult : Though adults are formed during Nov. & Dec. they don't emerge until the first pre – monsoon shower in May or June. The Longevity of adult after emergence is 47 – 97 days. Only one generation is a year.

Carry Over : Through the adult beetle newly formed beetle remains in quiescent stage in soil & emerges when cloudy weather & light showers prevail in the month of May / June.

Seasonal Occurrence : The pest is active in Kharif season.

Nature of Damage : The grubs feed on roots & rootlets of plant & infested plants become yellowish & dried up. The attacked plant can be easily pulled out from the soil.

Management Practices :

- 1) Collection of beetles by shaking host trees (neem / babhul / ber) at night hours & their destruction in kerosinized water.
- 2) Collection & destruction of grubs from the field at the time of weeding & interculturing.
- 3) Flooding of the fields.
- 4) Spray the host trees like neem, babhul & ber with 0.1% carbaryl in monsoon on community basis. The emergence of beetles is observed immediately after the first pre-monsoon showers. (May / June). (Note : Leaves of treated host tree should not be fed to animals upto 10 days after treatment.)
- 5) Soil application with quinalphos 5 G / phorate 10 G / carbofuran 3 G @ 25 kg / ha. at the time of land preparation or application of FYM.
- 6) In case *L. lepidophora* around Kumbhi river in Kolhapur Dist. use rotavator in May, in white grub affected area for the destruction of different stages of white grub.

2. Termites or : i) *Odontotermes obesus* R.

White ants : ii) *Microtermes obesesi* H. Termitidae : Isoptera.

Economic Importance : Termites are polyphagous insects, reported from many parts of Maharashtra. The infestation of termites is more in sandy loam soils. They inflict more serious damage in the unirrigated areas.

Marks of Identification : These are social insects living in a colony. Polymorphic forms are noticed.

A) Reproductive caste : (winged) : They live in royal chamber.

Queen : Developed from fertilized eggs. It is much larger in size & has a creamy white abdomen which is marked with dark brown strips. It lives for 5 - 10 years & lays thousand of eggs.

King : Developed from fertilized egg. It is much smaller than queen & slightly bigger than workers. It is secondarily wingless insect.

B) Sterile caste : (wingless)

Workers : Develop from fertilised egg. They are whitish yellow, head wider than reproductive castes. Mandibles are stronger, meant for feeding on. They avoid light & need high humidity for their survival.

Soldiers : Developed from unfertilized eggs. They have large head & strongly chitinated sickle shaped mandibles, defend the colony by fighting. (mandibulate type soldiers).

Host Plants : Termites are polyphagous feeding on crops like wheat, sugarcane, groundnut, cotton, chillies, brinjal, fruit trees etc.

Life History : Soon after, first monsoon showers, the sexual forms leave their colony for nuptial flight during evening. After a short flight mating takes place, they shed their wings & queen & king settle down in the soil. The female burrows in the soil, lay eggs & establish new colony. The queen gradually grows in size & start egg laying very rapidly at the rate of one egg per second or 70,000 to 80,000 eggs in 24 hours. It lives for 5 to 10 years. It can live for several years also. There is only one queen in a colony. Incubation period is one week in summer & within 6 months larvae develop to form soldiers or workers. The reproductive castes when produced mature in 1 - 2 years.

2012

Nature of Damage : Workers of termites feed on the roots & stem parts of the plants. This resulting in drying of plants. Other forms do not cause any direct damage to the crop.

Management Practices :

- 1) Locate termitoria (mounds) & destroy queen by digging out termitoria or fumigating with fumigants like CS₂ / methyl bromide / CS₂ + chloroform mixture @ 250 ml / mound.
- 2) Termite damage in standing crop can be minimized by application of 5 lits. of lindane 20 EC / ha. into irrigation water or field spreading of 1 lits. of lindane mixed with sand or soil, followed by light irrigation.
- 3) Keep the crop healthy and vigorous shortage of water leading to initial drying of the plant, may lead termite infestation. Hence it is very necessary to keep the crop healthy and vigorous.

3. Locust :

Species : Locust are the species of grasshoppers, which under certain favourable conditions, multiply, congregate, move together in their nymphal stages as band and the resultants swarms fly to distant areas in dense. Their epidemics occur in all continents. There are nine well recognized species. The following species occur in India.

1. The Bombay locust : *Pantanga succinata* L.
2. The Migratory locust : *Locusta migratoria* L.
3. The Desert locust : *Schistocerca gregaria*. Very common, most destructive.

1. Bombay Locust : *Patanga succinata* L.

- i) The area of distribution : India, Ceylon, and Malaysia. In India-area extending From Gujarat to Madras and in certain areas upto Bengal. Swarms 1835-45, 1864 -66, 1901-08 resulted in heavy damage to crop.
- ii) Breeding grounds : Open areas of Westerns Ghats in monsoon.
- iii) No. of broods : 1 in a year (diapause in adult).
These hoppers do not congregate to form bands but remain scattered among crops or grasses.

2. Migratory : *Locusta migratoria* L.

- i) Distribution : Europe, Africa, East asia, & Australia. Swarms : In India they were observed in 1898 in Madras, & in Bangalore 1954.
- ii) Breeding grounds : Breeds in spring in Pakistan & resultant adults migrates into the desert areas of India as individuals & breed during summer in Rajasthan - Gujarat areas of India. Scattered locust may gather in ecologically favourable pockets & lay eggs innumerable i.e. there are several broods in a year

3. Desert Locust : *Schistocerca gregaria*

~~the desert locust is a pest of world wide importance as it is known to migrate in swarms~~
from one country to another.

- i) Distribution : It is an International pest affecting about 60 countries, mainly India, Pakistan, Afghanistan, Arabia, Persia, Iraq & Africa.
- ii) Breeding regions : The pest breed during the spring season in coastal & other areas of West African countries like Persia where the winter rains bring about the required degree of soil moisture & vegetation. The adults emerging from this breeding stage migrate eastward to Pakistan and India by about the beginning of monsoon.
- iii) The Phase Theory of Locust : The phase theory was first put forth by Uvarov on the basis of his studies on *Locusta* in Russia. Previously *L. migratoria* & *L. danica* were recognized as two distinct species as they exhibited marked differences in colour

morphology, physiology & behaviour. Investigations by Uvarov however revealed that the *L. migratoria* & *L. danica* were the same species which existed in 2 phases.

Two forms gregarious & solitary are connected by intermediate form transiens. This theory was subsequently confirmed for other species of locust also. Gregarious phase exhibit black colour pattern & same is absent in solitary. Solitary has uniform colour which resembles that of vegetation on which they live. Under laboratory condition the colour of the solitary phase hoppers can be changed into that of gregarious by breeding them under crowded conditions & vice-versa.

Reasons of out break : In breeding regions there are regular showers of rainfall in both the rain fall belts, which brings about the required degree of soil moisture & vegetation. However, strong winds do not scatter the swarms.

Nature of Damage : Locust are voracious feeders, each adult, consuming its own weight of vegetation daily. It is estimated that 1 sq. km. Biggest 300 sq. kilometer swarm is on record. Similarly, hoppers eat 6 – 8 times more than their own weight. It has been assessed that in India during 1926 – 31 plague, the damage caused to crops, fodder etc. was about 10 crores of rupees and consequential loss to premature death of cattle & other livestock was incalculable.

Methods of Locust Control : The chief aim of locust control is to destroy the locust in all its stages.

- 1) **Destruction of eggs :** Locating the egg laid areas is almost importance, then trench them around, so as to entrap the young hoppers as they move out after hatching. Even actual destruction of eggs on organized scale may be carried out by ploughing, & hand digging.
- 2) **Hopper control :** The mechanical method include entrapping. Making hopper bands in 2' X 2' trenches & burying. The chemical method include use of poison baits & dusting of insecticides. Dusting of 2% methyl parathion dust against hoppers @ 25 to 30 kg / ha. has been found to bring a complete control of these pests.
- 3) **Control of adults or winged locust swarms :** Dusting of 2% methyl parathion may be carried out to achieve better control when swarms are resting on bare ground at night or on early morning can be beaten or swept up & destroyed. If they are resting on bushes or hedges, they can be easily burnt with help of flame throwers.

When flying locust are about to descend in large swarms in cultivation areas, best way to tackle them is to prevent them by creating a cloud of smoke or by burning refuse etc. Spraying with neem kernel suspension as a deterrent to the crop, has also been tried with success. Recently with the introduction 'aerial application' of insecticide the control of locust swarms has become easier. The advantage associated with aerial spraying are :

- i) Vast areas can be treated in relatively short time.
- ii) The swarm in flight can also be treated.

iii) When swarms settle down in a particular area that area can be quickly covered by aerial application.

iv) The moment of swarm can be watch with ease, Locust control organizations.

In India : Locust warning organisation of the Govt. of India was established from April 1939. In 1942 a coordination Anti locust scheme was put into operation. **In the World :** United Nations Special Fund Desert Locust Project which was sponsored by the F.A.O. in 1960. This is being subscribed by several countries including India. Its purpose is to develop more effective & less expensive control of the desert locust.

Exercise No. 23

STUDY OF NON-INSECT PESTS

1) MITES

CHARACTERISTICS OF MITES :-

- 1) Body is divided into two Cephalothorax & abdomen.
- 2) Young one has 2 pairs of legs while adults have 4 pairs.
- 3) They are very small in size.
- 4) They are injurious to plants.
- 5) Many spp. are parasite on animals & man.
- 6) Piercing, sucking, mouth parts.

Class : Arachinda

Order : Acarina

Mites are polyphagous pest feeding on pet animals, skin of man & cultivated trees. Even these mites are observed in fresh water, streams, lakes & ponds. They belong to family

- 1) Tetranychidae
- 2) Eriophyidae.

1) Tetraonychidae : Mites are tiny, sometimes even greater than 100 in length. They possess 4 pairs of legs in nymphs & adult stage have paired jointed chelated appendages called as enclured.

2) Eriophyidae : The mite is vermiform having 2 pairs of legs. Mouth parts adopted for biting, piercing, sucking, 3 nymphal & adult stage. The nymphal stage called as protonymph, deutonymph, tritonymph, protonymph (Larvae) Eriophyidae have only 2 nymphal instars.

Nature of Damage : Vary as per the crops.

Control Measures :

- 1) A number of natural enemies have been on various mites.
- 2) Sulphur extensively used 25 kg / ha dust or
- 3) Use of Acaricides in kelthane, Aramite (Dicofol).

2) STUDY OF RODENTS

Rat is non insect pest coming under vertebral group of animals is a serious pest of field crops which includes cereals pulses, vegetables & fruits crops

In India five different spp. of rodents are known to be serious in Agriculture which are given below.

1) HOUSE RAT :-

2013

S.N. :- Rattus rattus

Order :- Rodentia

Family :- Muridae

Marks of Identification :-

They are grayish black in colour, small eyes. Long hairy ear, snout is pointed, tail is thin, uniformly dark & is equal to length of head & body. They weight upto 150 – 200 gm. Their excrete is banana shaped & found scattered. They have only one pair of teeth in both the jaws.

Life Cycle :-

Breeds throughout the year with 5 – 7 litters / year. Each liter consist of 6-14 young ones. Gestation period 25 days. It totally nocturnal. A good swimmer & climber. Life span is about 2 years.

Nature of Damage :-

They causes damage to every commodity. They act as vector for plague.

2) HOUSE MOUSE :-

S.N. :- Mus musculus

Marks of Identification :-

Dark brown colour, body with snout hairs. Weight about 25 – 35 gms. There are smallest rodents. Tail is longer than body. Ears are round, dropping (Excreta) is spindle shaped & scattered.

Life Cycle :-

Breeds throughout the year with 7 – 8 litters / yr. 5 – 6 young ones per litters. Gestation period 3 weeks. This rat prefers to stay in house & in dark place nocturnal in habit & very agile. It can penetrate a hole less than 1.2 cm.

Nature of Damage :-

Their infestation or near presence imparts typical odour to store room. They feed on grains, vegetable, meat, fruits etc. This spp acts as carrier for a parasite called salmonella responsible for food poisoning. They also spread ring worms.

3) BROWN RAT :-

S.N. :- Rattus norvegicus

Marks of Identification :-

It has soft skin, brownish grey colour body & whitish belly. Weight upto 200 - 300 gm. snout is blunt. Tail shorter than body, ear small. dropping spindle shaped & found in groups.

Life Cycle :-

Breeds throughout the year 6 - 14 litter / year 5 - 7 young ones / litter. Gestation period 4 weeks. It is habituated of making burrows. Normally lives in sewage tanks. It remains in the radius of 20 - 30 met from its residence. Life span about a year.

Nature of Damage :-

They damage to store product, wood, bamboo, irrigation pipes & papers etc.

4) SMALLER BANDICOOT / INDIAN MOLE RAT / SMALL GHOOSE :-

S.N. :- Bandicota bengalensis

Marks of Identification :-

Body is robust, dark brown / black. Head short pea like, ear are small, weight upto 300 gm. dropping are oval & scattered.

Life Cycle :-

Breeds round the year with 5 - 10 litter / year 5-6 young one / litter life span 7 - 8 months.

Nature of Damage :-

It is omnivorous, damage standing crops, sugarcane, coconut, cereals. It is also famous for hoarding / holding grains in its burrow (6 kg grains is reported). It is also a plague carrier.

5) LARGER BANDICOOT / LARGE GHOOSE.

S.N. :- Bandicota indica

Marks of Identification :-

Larger in size, with a ferocious appearance. Head is broad, ears small, rough hairs on body. Eye brow are typically white. Body colour is brownish black. Weight about 800 - 1500 gm. Body length 51 - 88 cm. fore limbs are shorter than hind limbs. Droppings are spindle shaped & scattered.

Life Cycle :-

Same as in smaller Ghouse.

Nature of Damage :-

It makes big burrow (under ground) which makes the foundation, store rooms, field bunds, rail tracks weak damage big fruit trees. Hold grains in their burrows.

Rodent Management :-

2015

- 1) Preventive :- Rat proofing, clearing & sanitation.
- 2) Mechanical Control :- Mechanical traps, sound repellents, rat hunting out etc.
- 3) Cultural Method :- Especially in field crops. It includes deep ploughing, reconstruction of bunds, flooding of fields, destruction of weeds.
- 4) Biological / Natural Control :- Most feasible & effective it includes rat poisons.
 - a) Single dose poison :- Zn phosphide (acute poison).
 - b) Multiple dose / Chronic poison :- Warfarin, bromadiolol.

Bait composition for acute poison for (100 gm).

Zn phosphide 2 gm + food material 50 gm + sweet oil 2 gm + jaggery 6 gm.

For multiple dose poison :-

Poison 5 gm + flour 450 gm + jaggery 15 gm + sweet oil 10 ml.

For drinking water :

Poison 1 gm + water 450 ml.

Fumigants - HCN, Aluminium phosphide, $AlPO_4$, EDB are mostly use fumigants 3 gm tab / burrow 2-3 times pre-baiting is needed.

Q.013 3) STUDY OF NEMATODES.

It is a microscopic thread like worm with unsegmented body comparatively tough & transparent skin. They pierce the plant cells with hollow needle-like stylets emerging from the pharynx & suck the exuding fluid. They are unisexual and oviparous. No metamorphosis but larva undergoes series of moults.

They are grouped as follows

- A. Endoparasites
 - i. Sedentary (do not move)
 - ii. Migratory
- B. Semi end parasitic
 - i. Migratory
 - ii. Sessile
- C. Ectoparasites
 - i. Migratory
 - ii. Sedentary
- D. Mostly endoparasitic.

S.N. :- *Praetylechus coffee*
Meloidogyne spp
Tylenchulus semipenetrans (Citrus nematode)

Order :- Tylenchida

Fa. :- Dorylaimida

Phylum :- Nematoda.

It is a polyphagous pest. It attacks Banana, Citrus, Grapes, Papaya, Peach & Pineapple. It is commonly found in every region.

It causes damage to young leaves, shoot, tender parts of plants, leaf yellowing, retarded, falling of mature plants under wind pressure, deep lesions on rhizome and roots reduction in fruit yield.

Control Measures :-

- a. Crop rotation.
- b. Application of Neem cake (400 g / plant) once at planting & second 4 month after.
- c. Use nematode free planting material.
- d. Seedling root dip in hot water at 45 – 50 degree Celsius for 25 min.
- e. Treat nursery bed with carbofuran (4 kg / ha) & main field with carbofuran (2 kg / ha.)
- f. Organic amendments.

3) Pepper Leaf Gall Thrips :-

S N *Ganaikothrips Kamayi*

M.I. :- This is a black thrips about 2.8mm in length commonly found in Kerala.

ND :- The thrips and its larvae feed on the leaves and cause marginal folded galls on them. The attacked leaves become deformed as a result of formation of marginal tubular galls. Leaves are crinkled and reduced in size.

Life history :-

The eggs are laid singly within marginal leaf folds or on the leaf surface. They hatch in 6-8 days. The first and second nymphal instar last for 4-6 and 5-7 days where as the prepupal and pupal instar last for 1-2 and 3 days respectively.

Control Measures :- Spray monocrotophos 0.05% or dimethoate 0.06% on tender leaves.

4) Pepper Mealy Bugs :-

S.N. *Ferrisia virgata*, *Pseudococcus viridatus* Order : Hemiptera

MI :- Insects are soft bodied, small and oval shape pinkish brown in colour and colonies are always covered with whitish powder. Total life period ranges from 18 to 28 days.

ND :- Both nymph and adult suck the cell sap and devitalize the plant to such an extent that sometimes plants succumb. It is a serious pest in Kerala and Mysore.

Control Measures :-

- 1) Raking of the soil and mixing of insecticide.
- 2) Destroy by rubbing the insect where they are shelter.
- 3) Spraying with 0.05% malathion is effective or dimethoate 0.03%.

5) Scale Insects :-

S.N. *Laphidosaphes piperis*

Scale insects cause serious damage to black pepper vines at higher altitudes and also to other rooted plants in nurseries in the plains. Pest infestation is more severe during post monsoon and summer period. Damaging stage is adult. Pepper scale like a spherical dark grey boat shape encrustation on main stem and leaves of vine.

Nature of damage : chlorotic patches on leaves wilted and dried leaves and stem. Adults and larvae suck cell sap from leaves, stems and berries resulting in wilting and drying. Severely infested vine gradually dry up.

Control Measure:-

1) Destroy severely infested plant parts spray with 0.1% dimethoate (30 EC) Or Monocrotophos. Repeat spray after 21 days.

2) Spray Neem seed kernel extract 5%.

Bioagents :- *Encarsia launbari* (parasitoid) *Ilada bonanensis* (Predator)

6) Pepper Gall Midge :-

S.N. *Cecidomyia mala*.

Eggs are laid on the young midrib found embedded in pulp of berries and attachment of berries to the main stem. After 10-15 days the berries fall on ground to pupate in soil. They attack berries in the beginning but appear stunted. Later on swelling may be caused on tender stalk and shoots also.

6) Root Knot Nematode :-

S.N. *Meloidogyne incognita*

M.I. : These are microscopic organisms found in soil. Male is worm like with smooth translucent. It moves freely in capillary moisture. Female is lemon shape and can't move.

N.D. : Feeds on roots and forms galls on them. Attack plants remain stunted and show symptoms of yellowing and shorting of leaves. Appearance of flower is also delayed.

Control Measure:-

1. Use of nematode free cuttings for raising new plantation. Use resistant variety to root knot nematode, pepper CLT, P-812.
2. Apply Phorate 10 G, Carbofuron 3 G or Aldicarb 5 G at rate of 1 gram a.i. (active ingredient) per vine two times in year, first in May-June on the onset of monsoon and second last week of October around the vine within the soil.
3. Amendments of soil with some oil cakes viz. Karanj, Neem @ 2.5 tons/ha.

8) White fly

S.N. - *Aleurocanthus pipiens*

Family - Aleurodidae Order - Hemiptera

Non-Insect Pests:

1) Burrowing nematode

S.N. - *Radopholus similis*

2) Root knot nematode

S.N. - *Meloidogynae incognita*

1) Pollu Beetle/Flea Beetle :-

S.N. - *Longitarsus nigripennis*

Host plant - pepper

Pollu beetle is specific pest of black pepper. Both adults and grubs causes damage to berries.

Mark of Identification :-

The adult is a small yellow and blue flea beetle with stout hind legs. The fullfed grub is about 5 mm long yellowish with black head

²⁰¹²
Nature of Damage :- Damage is caused by both Adult and grubs. Adult causes damage by feeding on leaves growing shoot tips as on tender spike. The feeding on spikes lead to their partial damage. The grub damage by boring into growing tips spikes and into the berries. The shoot tips and also the spike tied up together, about 53% fall of spike have been reported. The attacked berries appeared dark and hallow inside and crumble when pressed, locally known as pollu berries. About 35 % berries are lossed. The infestation is more in shedded condition in the plants.

Life History :-

²⁰¹²
A female beetle scoops out shallow holes on growing shoots tips or on tender berries. The Eggs may be stuck to the surface of tender spikes or one or two eggs may be laid in each hole. About 100 eggs are laid by female. Egg hatch in 5 to 8 days. The grubs emerging out of the eggs laid on shoot, tie spike bores into and feeds on the inner content likewise it bores into berries and escape in about 10 days. The grubs become full grown in 10 to 30 days, damaging about 4 to 5 berries during this period. The full grown grub steps to the ground and pupate in an earthen cell

insol at a depth to 5 to 7.5 cm deep. The adult emerges out 6 to 7 days after pupation but continue to remain within the pupal cell for 2-3 days. The total life cycle takes 39 to 50 days for completion. There occurs 4 overlapping generation during July to Jan. Breeding stops Dec. onwards until new tender flushes appear March-April onwards.

2.12 Control measures :-

- 1) Tilling soil at the base of vine at regular interval can reduce the population considerably.
- 2) Minimise shade in plantation from June to October.
- 3) Spray the vines twice with Quinolphos 0.02% or Dimethoate 0.06% / first spraying at berry formation stage (July Aug) and second month afterwards or in early October.
- 4) Neem gold 0.6% during Aug. Sept. Oct.
- 5) Use of resistant varieties like - Uthirankotta I & II, TMBV, & Shimoga.
- 6) By pruning branches of shade tree before the onset of monsoon, help in reducing the build up of pest population.

2) Top Shoot Borer :- S.N. *Cydia hemidoxa*, Fa: Tortricidae, Or : Lepidoptera

It occurs commonly in Kerala and serious pest of pepper.

MI :- Adult is small beautiful moth with basal half of the fore wings black and distal half orange red. Caterpillar is grayish green in colour and measure 12 to 14 mm in length.

N.D. :- Female laid eggs on tender terminal shoots. Larvae bore into tender terminal shoots and feed on internal tissue and retard growth of young vines resulting in decaying and blackening of affected terminal shoots. The growing shoot is killed as a result of attack by caterpillars. They pupate within larval tunnels for 8 to 10 days. Pest infestation is higher during Sept-Oct, when numerous succulent shoots are available on vines.

Some biogents are recorded *Apanteles* spp. *Eudensus* Spp. *Goniozus* spp. upto 20% parasitism is observed.

Control Measures :- Spraying of monocrotophos 0.05 % during the July and Sept.

4) SLUGS & SNAILS.

Slugs & Snails are the animals from invertebrate group. They differ from each others, where a calcium cup called shell is present, is called snail while the other without shell & worm like is called slug. Important spp. noted as pests are –

<i>Achatina fulica</i> -	Giant African snail (GAS)
Order -	Mollusca
<i>Ariophanta bajadera</i> -	Common land snail.

Marks of Identification :-

They have a big size shell some time of coconut size with cryptic colour. Body is fleshy with two tentacles always coming out as a secondary organs. Eggs are round just like sergo grains & laid in soil in clusters.

Nature of Damage :-

Adults & younger are voracious feeders. They defoliate the plants completely also feed on the bark of plant. They are most harmful in vegetable cultivation, floriculture etc. They are present in Thane district viz ; Chinchavali, Wargoan area.

Life Cycle :-

Animal is hermaphrodite i.e. both the sex organ are present in a single individual but mating is necessary to exchange the sperms. After mating which deposits about 500 – 1000 eggs in soil near humid area. Eggs are highly resistant to temperature. Egg period last for a week & young ones comes out. They start feeding on available food. As they grow they change their shell / shell size increases. They become adult within 3 – 4 months. Hibernation in adult stage in soil.

Control Measures :-

- Deep ploughing the land to expose the hibernating snails.
- Collection & destruction of snails immediately after the showers of the rains & also the egg masses wherever observation.
- Baiting the snail with Metaldehyde (at present banned).
- For GAS isoamyl acetate act as attractant.
- Waste leaves of cabbage / cauliflower are placed in field in the form of small heaps. Early morning collect the attracted snails & put in common salt water.

Pests of Black Pepper

It is king of spices is being cultivated on large scale in India About 20 insect Spp. have been recorded damaging pepper plantation Important pests are.

- 1) Pollu beetle/Flea beetle.

S. N. - *Longitarsus nigripennis*

family - Alticidae Order- Coleoptera

- 2) Pepper leaf gall thrips

S N. *Gynaikothrips karnyi*

Family - Thripidae order-Thysanoptera

- 3) Pepper mealy bug

S.N. - *Pesudococcus viridatus*

family - Pseudococcidae Order -Hemiptera

- 4) Pepper Scale

S.N. - *Lapidosaphes piperis*

Family. - Occidae Order - Hemiptera

- 5) Muscele Scale

S.N. - *Pinnaspis aspidistrae*

family - Diaspididae Order -Hemiptera

- 6) Top Shoot borer

S.N. - *Cydia hemidoxa*

family - Tortricidae Order -Lepidoptera

- 7) Pepper gall midge

S.N. - *Cecidomyia malanbarensis*

Family - Cecidomyae Order - Deptera

7) Burrowing Nematode :-

S N *Radopholus similis*

ND Cause slow wilt disease, leaf yellowing, shading of leaves, cessation of growth, dieback, & pike heading, death of vines. Dark lesions on roots and reducing yield 38 to 65 %.

Control Measure:-

- 1) Use nematode free seedlings.
- 2) Apply Phorate 3 gm per vine in May -June and Sept – Oct.

Pests of Nutmeg and Clove

- | | | |
|-----------|---|----------------------------|
| 1) Nutmeg | - | <i>Myristica fragrans</i> |
| Family | - | Myristicaceae |
| 2) Clove | - | <i>Syzygium aromaticum</i> |
| Family | - | Myristicaceae. |

Among the various tree spices grown in India. Nutmeg clove & cinnamon are grown in hilly region of kerala, Tamil nadu & Karnalaka.

Important Pests of Nutmeg :-

- | | | |
|------------------|---|-------------------------------|
| 1) Nutmeg weevil | - | |
| S.N. | - | <i>Araecerus fasciculatus</i> |
| Family | - | Brenthidae |
| Order | - | Coleoptera |

2) Scale insects : (Black Scale)

- | | | |
|--------|---|-----------------------|
| S.N. | - | <i>Saisetia nigra</i> |
| Family | - | Coccidae |
| Order | - | Hemiptera |

Important Pests of Clove :-

1) Scale insects : (Black Scale)

- | | | |
|--------|---|-----------------------|
| S.N. | - | <i>Saisetia nigra</i> |
| Family | - | Coccidae |
| Order | - | Hemiptera |

2) Mealy bugs :-

- | | | |
|--------|---|--------------------------|
| S.N. | - | <i>Pulvanacia psiodi</i> |
| Family | - | Pseudococcidae |

Order - Hemiptera

3) Stem borer

S.N. - *Sahydrassus melaboricus*

Family - Hepiodidae

Order - Lepidoptera

1) Nutmeg Weevil -

S.N. - *Araecerus fasciculatus*

Family - Brentidae

Order - Coleoptera

Host - Coffee, bean & nutmeg.

Mark of Identification :

The adult is small brown beetle about 3 mm in body length. It looks rather like bruchids in appearance but has distinctively clubbed antennae. Adults fly strongly.

Life history

Eggs are laid singly on ripening or fully ripe seeds and the white legless larvae burrow into the seeds. Each larvae usually spending its immature life inside the same seed. Pupation takes place in the seeds.

Nature of damage :-

Larva bore inside the kernel and feed on internal content. It is a important pest of store products.

Control measures :-

Ware house infestations are generally controlled by the regular fumigation.

2) Scale insects/Nigra scale/ Black scale

S.N. - *Saisetia nigra*

Family - Coccidae

Order - Hemiptera

Host

- It is polyphagous spp found on citrus spp rubber coconuts and other ornamental crops

Mark of Identification :-

The adult scales are oval and convex in shape. Measuring 2 to 3 mm in length and 1.5 to 2 mm in breadth. Young scales are generally paler. But adults are dark brown or occasionally black in colour. Males are winged and females are wingless.

Life cycle :-

The female scale reproduce parthenogenetically and lay eggs under the scale. Egg stage lasts for 4-8 days. Nymphal period is about 36-40 days. Female longevity about 44-67 days.

Nature of damage :-

Oval dark scale clustered on twigs, shoots and leaves, sometimes causing leaf distortion and often associated with sooty mould. Severe infestation cause the shoot wilts. Withering of seedlings and young plants in the nursery. Adults and larvae feed on plant sap and cause wilting and drying of seedling and young plant.

Control measures :-

- 1) Natural parasitism and predation usually control the pest population.
- 2) Spraying of 0.05% Dimethoate or 0.1% Malathion or 0.05% Quinolphos.
- 3) Collection and destruction of infested plant parts.

✓ Stem borer :-

S.N. - *Sahydrassus melaboricus*

Family - Hepiodidae

Order - Lepidoptera

✓ Nature of Damage :-

It is the most serious pest of clove, larva after hatching enter into the stem and girdle the main stem of young twigs and basal region. The girdle portion and borer holes are covered with mat like frass (Webbing) material. After entering in to the stem, goes downward and chewed xylem and phloem tissues. As a result food flow is arrested, some times crop may be killed.

Marks of Identification

Adult moth grayish brown, longitudinal strips on fore and hind wings. Larva is yellow in colour with dark black head. Make galleries and enter into the stem and feed on internal tissues. Larva develop within 25 days and pupate inside the stem only. Pupal period is 8 days. Life cycle completes within 35 days.

Control measures :-

1. Follow up cultural practices i.e. keep the basal part of stem clean from weeds.
2. Remove all webbings and kill larva by inserting iron hooks or plug the cotton swab soaked in petrol or insecticides.
3. Clean the stem by removing frass and apply tar. Give the spray of 0.07 % phosalone (Contact insecticide) or 0.01 % carbaryl or 0.05% quinalphos. These are recommended for spray or inject in the bore hole.
4. *Metarrhiziumfungus* is used to kill the larvae and adults.

PESTS OF CINNAMON

Cinnamon is one of the oldest spice known to man kind and the dried inner bark of the tree is the spice of commerce. The important insect pest attacking these trees are.

1) Cinnamon butterfly

S.N. - *Chilasia clytia*

Shallow tailed butterfly *papilio spp.*

Family - Papilionidae

Order - Lepidoptera

2) Cinnamon leafminer

S.N. - *Phyllocnistis chryophthalmia*

Family - Phyllocnistidae

Order - Lepidoptera

3) Fig leaf psylla

S.N. - *Pauropsylla depressa*

Family - Psyllidae

Order - Hemiptera

4) Jute hairy caterpillar / Tussock caterpillar

S.N. - *Dysanthera mendosa*

Family - Lymanthridae

Order - Lepidoptera

20/5 1) Cinnamon butterfly :-

S.N. - *Chilasia clytia* ✓

Shallow tailed butterfly *papilio spp.*

Family - Papilionidae

Order - Lepidoptera

This is the most serious pest of cinnamon nursery and plantation and is generally seen during the post monsoon period.

Marks of identification :-

Freshly hatched larva is black in colour with white patches which later undergoes various changes in colour pattern. The upper side of the adult butterfly is rich velvety brown, while on underside of the body the colour varies from soft pale brown to rich dark velvety brown.

✓ Nature of Damage :-

After hatching the 1st instar larva start feeding on the lamina of freshly emerged leaves. Later instars feed voraciously on tender leaves leaving only the midribs with portion of veins. In case of severe infestation the growth of the plant is adversely affected.

Life cycle :-

The female butterfly lays eggs singly on the upper and lower surface of young leaves, petiole and even tender shoots. Eggs are small, round and pale yellow in colour. The larvae hatch out in 4 to 5 days. The larva moults 5 times to complete its development in 12 to 18 days. The pupation takes place in rough silken padding on the stem prepared by larva. The pupal period and the total life cycle completed in 24 & 36 days resp. 20/5

Control Measures :-

1. Follow cultural practices and maintain hygiene in the field.
2. Collect larvae and pupae & destroy it.
3. Pest can be kept under check by collecting the butterflies with the help of net.
4. Destroy the alternate host
5. Spray the crop with 0.05 % Quinalphos 25 EC.

2) Cinchona Leaf Miner :-

S.N.	-	<i>Phyllocnistis chrysophthalma</i>
Family	-	Phyllocnistidae
Order	-	Lepidoptera

Infestation is more common during the monsoon period. And generally nursery plants are seriously affected.

Marks of Identification :-

The adult moth is small, minute having black spots on the tip of wings. The larva is faint yellow in colour and remains undermined. The wings are fringed with minute hairs.

Nature of damage :-

The insects infest tender leaves and is more serious on young plants. After hatching the apodous (without legs) larvae feed on epidermal cells of the leaf in a zigzag manner resulting in yellowing and drying of infested leaves. The larva mines between epidermal layers of leaf in a zigzag manner which results in distortion of leaf lamina. Serious infestation causes retardation in growth. Leaves with blister-like patches.

Life cycle :-

The adult female lays single eggs near midrib of the leaf which hatch within 2 to 10 days. The larvae pass through 4 instars. The larval period ranges from 5 to 20 days depending on season. The pupal period varies from 6 to 20 days. The number of generations in a year may range from 9 to 13.

Control Measures :-

- 1) Spray Quinalphos (0.05%) during emergence of new flushes is an effective measure for controlling the pest infestation.

Pests of Cardamom

Enlist 4

Cardamom

S.N.	-	<i>Elletaria cardamomum</i>
Family	-	Zigiberaceae

Popularly known all queen of spices due to its's delicate aroma. Cardamom in one of the most expensive spice in the world. The dried fruit of perennial rhizomatus herbs mainly cultivated in kerla, Karnataka and T N. at higher altitudes. The total production of cardamom in country in about 173000 tonns from an area of 102.70 ha. The major pests of cardamom are all follows

1) Wingless grasshoppers :

S.N.	-	<i>Orthacris spp.</i>
Family	-	Acrididae
Order	-	Arthoptera

2) Banana lacewingbug

S.N.	-	<i>Stephanitis typica</i>
Family	-	Tingidae
Order	-	Hemiptera

3) Leaf hoppers

S.N.	-	<i>Tettigoniella ferruginea</i>
Family	-	Cicadellidae
Order	-	Hemiptera

4) Cardamom thrips

S.N.	-	<i>Sciothrips cardamomi</i>
Family	-	Thripidae
Order	-	Thysanoptera

5) Bud worm

S.N.	-	<i>Acanthopsyche bipan</i>
Family	-	Psychidae
Order	-	Lepidoptera

6) Stem borer/ panicle borer/capsule borer

S.N.	-	<i>Dichocrosis punctiferalis.</i>
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Family - Pyraustidae

Order - Lepidoptera

7) Leaf roller

S.N. - *Plasionera alysa*

Family - Pyraustidae

Order - Lepidoptera

8) Root borer

S.N. - *Hilarographa caminodes*

Family - Pyraustidae

order - Lepidoptera

9) Cut worm

S.N. - *Agrotis ypsilon*

Family - Noctuidae

Order - Lepidoptera

10) Cardamom hairy caterpillar :-

S.N. - *Lenodera vittata/Attacus atlas*

Family - Lesiocrampidae / Saturniidae

Order - Lepidoptera

11) Root grubs

S.N. - *Basilepta fulvicanae*

Family - Emaulipidae

Order - Coleoptera

12) Aphids :-

S.N. - *Pentalonia nigronervosa*

Family - Aphididae

Order - Hemiptera

13) Whitefly

S.N. - *Dialeurodes cardamomi*

Family - Aleurodidae

Order - Hemiptera

14) Rhizome Weevil

S.N. - *Prodiocetes haematicus*

Family - Carculionidae
order - Coleoptera

15) Leaf roller/Hairy caterpillar

S.N. - *Eupterote cardamomi*
Family - Eupterotidae
Order - Lepidoptera

1) Aphids/Banana Aphids :-

2012

S.N. - *Pentalonia nigronervosa*
Family - Aphididae
Order - Hemiptera

Marks of Identification

The wingless aphid is dark brown pyri-form measuring 1.3 mm in length and with 6 segmented antennae which are longer than the body. Abdomen is dark brown, shining and slightly bulged. The winged form is dark brown, elongated and pyri form. They are longer than the wingless form.

Nature of damage :-

2012

The aphids feed on the leaf sheath and pseudostem. The insect cause little direct damage but is of considerable significance being a vector of cardamom mosaic or also known as kattle disease or Amomum mosaic and fourkey disease. The aphids are disseminated in cardamom plantation mostly by crawling from plants by the contact of foliage at the top and along the soils. The differentiating spike and the floral part are very susceptible to aphid attack. The infestation occurs mainly during May & Nov.

Life history :-

Imp.

The reproduction takes place parthenogenetically. The longevity of adult varies from 8 to 26 days. A single female may produce as many as 4 offsprings in 24 hr. with an average of 14. The development is completed through 3 and four moults. There are 2-24 generation in a year.

Control Measures :-

1. Spray with Dithionous acid or D.D.T. at intervals of two weeks. The spray should cover the leaf whorls and collar region (the region which touch to the soil).

- 2 Uproot and burn all the affected collateral host if any
- 3 **Biological Control** - *Coccinella transversalis* have often recorded.

Entomofungus *Verticillium intelexum*.

4. Soil application of granular insecticides Phorate 10G or Carbofuron 3G.

28/12/2) Cardamom Thrips :-

S. N. - *Sciothrips cardomomi*

Family - Thripidae

Order - Thysanoptera

The cardamom thrips is the most destructive pest of cardamom in south India. The adult is grayish-brown and measures 1.3. mm in length.

host plant

Nature of damage :-

The thrips cause damage by sucking cell sap. Adult and larvae lacerate and feed on plant sap from tender shoots panicles and capsules. The attack on flower stalk result in shedding of flowers, panicles, stalk also become stunted and do not bear flowers. And it also attack on growing buds, the bract perianth, unopened flower and buds as a result malformation, corky crustation on skin of developing capsules. Pods shrivelled & such affected pods lack their fine aroma and their seeds are also poorly developed. The total average loss 10 to 17%.

Life cycle :-

The pest is active throughout the year except during the monsoon season. The female lay 5 to 71 eggs at randomly on all feeding area of the plants. The young nymphs emerge from the eggs in 9 to 12 days. The first two nymphal instars are active and grow by feeding on plant saps. Life cycle is completed in 25 to 30 days.

Control measures :-

1. Spray 0.05% Dimethoate 30EC or Quinolphos 25 EC as incidence is noticed.
2. Regulate the shade in plantation.
3. Remove dry leaf sheath before first spraying.
4. Use resistant varieties.
5. The natural enemies like *Crysopa spp.* and anthodarid bugs are general predators predale

on the adults and larvae in the field.

3) Stem & capsule borer / Panicle and Capsule borer :- ²⁰¹³ ²⁰¹⁵

S. N. - *Dichocrosis punctiferalis* -

Family - Pyralidae

Order - Lepidoptera

It is a serious pest. Its incidence more occur in cardamom nursery and plantation also.

Mark of Identification :-

The full grown caterpillar measures 25 to 30 mm in length reddish brown with black blotches all over the body. And pale strips on the lateral sides. The moths are orange yellow with black marking on both wings.

²⁰¹⁵ Nature of damage :-

The pest infestation is mainly during Sept.-Oct. & Jan.-Feb. coinciding with panicle, capsule and shoot formation stage. It is a serious pest in nursery plants. It bore into the stem and causes the death of central shoots. In the earlier stage larvae bores into panicles and immature capsules and later stage into shoots and feed on internal tissues. It also eats away the tender seeds of the young berries.

²⁰¹⁵ Control measures :-

1. The infested shoot and capsule may be collected & destroyed.
2. Spray of carbaryl 2.5 Kg/ha and repeat at 18 days interval.
3. Spray monocrotophos 0.075% or fenitrothion 0.075% during Jan/ Feb and Sept / Oct.

Site of oviposition:- lay eggs on leaves and soft part of the plant.

Site of pupation:- Inside the seed or some time in brass that collects after feedings.

2011

(1) Rhizome Fly :-

S. N. - *Mimegralla coeruleifrons*
 Family - Micropisidae
 Order - Diptera

(2) Shoot borer :- (Caster Capsule borer)

S. N. - *Dichocrosis punctiferalis*
 Family - Pyralidae
 Order - Lepidoptera

(3) Turmeric skipper :-

S. N. - *Udaspes folas*
 Family - Hesperidae
 Order - Lepidoptera

(4) Bihar hairy caterpillar :-

S. N. - *Spilosoma oblique*
 Family - Arctidae
 Order - Lepidoptera

(5) Banana lace wing bug :-

S. N. - *Stephanistis typica*
 Family - Tingidae
 Order - Hemiptera

2011

(6) Yam Scale/ Rhizome scale

S. N. - *Aspidiella hartii*
 Family -
 Order - Hemiptera

(1) Rhizome Fly :- *Mimegralla coeruleifrons*

Order - Diptera

Economic Importance :-

Rhizome fly is becoming serious menace in the cultivation of turmeric and ginger crop in recent year in M S.

Marks of Identification :

Adult flies are mosquito like but large in size with slender body and long legs. The body is black in colour transparent wings with ash colour spots. Eggs are small creamy white in colour apodus and measure 9-15 mm length and 1-9 mm in breadth.

✓ **Nature of Damage :** The maggots on hatching bore into the shoots and finally feeds on developing rhizomes, resulting into rotting of rhizomes. Dead hearts are also seen due to primary injury of the maggots which bore the shoots in the beginning.

Life history : Flies are noticed in the month of Aug.-Sept. The eggs are laid on lower surface of leaves as on exposed rhizome or on surface of the soil. The maggots on hatching bore in the shoots and finally feed on developing rhizomes, pupation takes place in decaying rhizome or in the soil. The incubation period is of 3.5 days, the larval period last for 13.8 days. The pupation lasts for 13.5 days. The fly completes 1+ 5 life cycle in 38-62 days.

✓ **Control measures :**

- 1) Preventive measure like destruction of stray plants in off season.
- 2) Selection of healthy rhizome for planting.
- 3) Removal and destruction of dead hearts and rotting rhizomes after the harvest of crop may help to check breeding of pest.
- 4) Crop rotation with cereals, pulses or oil seed crops.
- 5) Planting material should be treated with Quinalphos 25 EC 20ml + Carbendazim 50wp 10g in 10l water before planting.
- 6) Cover the exposed rhizomes with soil by earthing up operation in the month of July to Sept.
- 7) Soil application by broadcasting insecticides at the base of plants at monthly intervals of any one of following like Quinalphos 5G/Phorate 10G @ 20 kg/ha followed by light irrigation or spraying with 0.05% Quinalphos 25 EC as soon as the infestation is noticed.

2. Bihar Hairy caterpillar : *Spilosoma oblique* Arctiidae : Lepidoptera

Pest is distributed in Bihar, UP, MP and Punjab. It is polyphagous pest. Damaging stage is caterpillar.

Mark of Identification : The full grown caterpillar which measures 40-50 mm in length and profusely cover with long grayish hairs. The moth measure about 50 mm across the wing spread. The head, thorax and underside of the body are dull yellow. The antennae and eyes are black.

Life history : The moths lays eggs 412 light green, sperical eggs in cluster on underside of leaves. The eggs hatch in 8-13 days and during first two stages the tiny caterpillar feeds gregariously but afterwards they dispersed widely in search of food. When fully grown larva spin a loose silken ca ccon in which pupation takes place in plant debris or in soil. The pupal stage last 1-2 weeks.

The life cycle is completed in 6-12 weeks. There are 3-4 generation in year.

Nature of Damage :

Caterpillar eat leaves and soft portion of stem and branches. In severe infestation the plant may be completely defoliate.

Control Measures :

- 1) Since moths are attracted towards light, the light traps should be set up as soon as rain start.
- 2) Collect the eggs masses and young caterpillars in early stage and destroy them.
- 3) Chemical control – should be result as quickly as possible before larva develops the migratory tendency. Spraying of 1.25 lit. of Quinalphos 25 EC or D.D.V.P. 100 EC or Chloropyriphos 20 EC in 500 lit. of water.

3. Banana Lace Wing bug : *Stephanitis typica*, Tingidae : Hemiptera

Host plants – Banana, coconut, cardamom.

Nature of damage – The adult and nymphs feed on leaf sap, leaves may be dwarfed and destroyed with yellow patches and necrotic spots. Nymphs and adult may be seen congregated on under surface of leaves combines effects of either feeding and toxic saliva may be serious.

Lifecycle :

Eggs are laid in parenchymatus tissue of leaves. There may many generation in a year on perennial host.

Control Measures :

- 1) Spray Malathion 0.1% for control of pest.
- 2) Care has to be taken that the spray should reach to the underside of leaves.

EXERCISE NO. 29
PEST OF CORIANDER, FENNEL AND CUMIN

Fam. Umbelliferae

- 1) Aphids S.N. – *Myzus persicae*
- 2) White fly S.N. – *Bemisia tabaci*
- 3) Pentamid bug – S.N. – *Agonocelus nubilia*
- 4) Leaf eating caterpillar S.N. – *Agrotis spp.*, *Helicoverpa armigera*
Spodoptera spp.
- 5) Tobacco eating caterpillar – S.N. – *Spodoptera litura*
Family – Noctulidae : Lepidoptera

1) Tobacco leaf eating caterpillar S.N. – *Spodoptera litura*, Family – Noctulidae : Lepidoptera

Economic importance – Cosmopolitan and polyphagous infesting various crops in the world.

Marks of Identification : Moths are medium size, stern with forewing gray to dark brown in colour with wavy marking. Hind wings are whitish with brown border. Larva caterpillars are strongly built pale greenish brown and smooth with dark margin on prothoracic plate.

Nature of damage – The caterpillar when young feed gregariously on leaves and juicy stem and becomes isolated at later stage of growth. In severe case plant defoliated.

Host plants – Tobacco, brinjal etc.

Life history – Eggs are laid in masses, covered with brown hairs on tender leaves. On hatching the larva feed gregariously on soft tissue during night and become isolated when full grown.

Control measures :

- 1) Collection of egg masses and caterpillars at initial stage
- 2) Ploughing after harvest of crop, destroy the pupal stage in the soil.
- 3) At early stage of infestation dusting with carbaryl 10% @ 20 kg/ha or spraying with Quinalphos 0.05%.
- 4) Spraying of fungal insecticide like *Verticellium lecanii* @ 3 gm/lit
- 5) Spraying of SLNPV 250 LE/ha is effective for control of this pest.
- 6) Use of pheromone traps @ 8 to 10 traps/ha is useful for minimizing the population of this pest.

✓✓✓✓✓

✓ 4) Rhizome Scale (*Aspidiotia hirtii*). Hemiptera

This pest infests the rhizome under storage

✓ **Nature of Damage :** Adults and larvae feed on plant sap, leading to shrivelling of rhizomes and buds resulting in poor germination.

✓ **Management :**

- 1) Discard severely infested rhizomes.
- 2) Soak seed rhizomes in Quinalphos (0.1%) prior to storage and sowing.

5) Turmeric skipper : *Udaspes folus*, Lepidoptera

Nature of Damage : The infestation of this pest is observed from Aug to Nov. The caterpillar after hatching rolls the leaves around its body and feed inside.

Control : 1) Collection and destruction of the affected leaves along with larvae.

- 2) Spray the crop with Carbarl 50 WP 40 gm or Monocrotophos 36W:3C 15 ml per 10 lit. of water.