Model Answer Paper

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END THEORY EXAMINATION
B. Sc. (Hons.) Horticulture

Semester	: III (New)	Term	: I	Academic Year	: 2022-23		
Course No.	: H/ENTO-232	Title	: Insect Pests of Vegetable, Ornamental and Spice Crops				
Credits	: 3 (2+1)						
Day & Date	:	Time (hrs.)	: 3 hrs.	Total marks	: 80		

Note
1. Solve **ANY EIGHT** questions from **SECTION "A"**.
2. All questions from **SECTION "B"** are compulsory.
3. All questions carry equal marks.
4. Draw neat labeled diagrams wherever necessary.

SECTION – "A"

Q.1 Write scientific name, nature of damage and control measures for red pumpkin beetle and melon fruit fly.

Ans (1) Red pumpkin beetle :

Scientific name : *Raphidopalpa foveicollis* L. **1 mark**

Nature of damage : **2 marks**

On hatching, grubs feed on the roots and underground portion of host plants and also fruits touching the soil. The damaged roots and infested underground portion of the stems start rotting due to secondary infection by saprophytic fungi and the unripe fruits of such vines dry up. Infested fruits become unfit for human consumption. Adult beetles are mainly responsible for the damage of the plant above ground attacking on the flowers, leaves and fruits. Adult beetles feed voraciously on leaf lamina making irregular holes. They prefer young seedlings and tender leaves. Damage at that stage may even kill the seedlings. The beetles are active from March to October, though the peak period of activity is April to June.

Control measures : **1 mark**

i) Preventive measures like burning of old creepers, ploughing and harrowing of field after harvest of crops are recommended for the destruction of adults, grubs and pupae.

ii) Collection and destruction of beetles in early stage of infestation.

iii) Dusting with 5 per cent carbaryl or 5 per cent malathion dust is effective and safe to use.

iv) Spraying with 0.05 per cent dichlorvos (DDVP) or 0.2 per cent carbaryl OR 0.05 per cent malathion has also been suggested.

(2) Melon fruit fly :

Scientific name : *Bactrocera cucurbitae* **1 mark**

Nature of damage : **2 marks**

On hatching, maggots feed inside on the pulp of fruits. The infested fruits can be identified by the presence of brown resinous juice which oozes out of the punctures. These punctures serve as entry for various bacteria and fungi. As a result, infested fruits start rotting, get distorted and malformed in shape and fall down prematurely. About 50 per cent fruits are damaged by this pest.

Control measures : 1 marks

i) Grow resistant and early maturing varieties e.g. Arka tinda – a variety of round melon.

ii) Fruits should be harvested before they start ripening.

iii) Fallen fruits should be collected and destroyed.

iv) Installation of "Rakshak" fruit fly traps containing Cuelure developed by Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli @ 4 traps/ha.

v) Raking soil or ploughing after harvest to destroy hibernated pupae.

vi) Application of spray bait containing 20 ml malathion + 200 gms jaggery + 20 litres of water.

vii) Spray malathion 0.05 per cent OR 0.2 per cent carbaryl during flowering to reduce intensity of infestation.

Q.2 **State nature of damage and control measures for the following pests (ANY FOUR)**

1) Jasmine thrips 2) Aster leaf hopper 3) Gerbera mites
4) Gladiolus seed corm maggot 5) Jasmine budworm

Ans **(1) Jasmine thrips :**

Nature of damge : 1 mark

Both nymphs and adults feed on tender shoots, tender leaves and petals of flower by rubbing their mouth parts over tender portion and feeding on oozing sap of the crop plant. Appearance of the plant and flowers adversely affected due to such feeding by the pest. The insect cause decaying look to the crop.

Control measures : 1 mark

Spray malathion 0.05 per cent or dimethoate 0.03 per cent or methyl demeton 0.02 per cent immediately after incidence is noticed.

(2) Aster leaf hopper :

Nature of damage : 1 mark

Adults as well as nymphs suck the cell sap from plants as a result leaves and petals become curly, disfigured and discoloured which affect the quality and marketability of china asters.

Control measures : 1 mark

Spray the crop with 0.03 per cent malathion or 0.02 per cent diazinon or 0.2 per cent carbaryl for effective control of the pest.

(3) Gerbera mites :

Nature of damage : 1 mark

Mites cause the damage by sucking the cell sap from tender portions of the gerbera plant and affect the growth and quality of plant and flowers. The leaves become rusty, flowers get disfigured.

Control measures : 1 mark

Spray 0.01 per cent abamectin 1.8 EC or 0.05 per cent profenofos 40 EC or 0.04 per cent dicofol or kelthane or dimite as soon as incidence is noticed.

(4) Gladiolus seed corn maggot :

Nature of damage : 1 mark

Damage to the gladiolus consists primarily of feeding on the soil covered sprouts and in case of severe infestation all the primary shoots are attacked. Several maggots may be seen feeding in a single shoot. Due to feeding activity the shoots are destroyed and it affects the vigour and quality of plant.

Control measures :

Application of Phorate 10 G @ 10 kg per ha or Carbofuran 3G @ 16.5 kg per ha in the soil controls the pest effectively. **1 mark**

(5) Jasmine budworm :

Nature of damage :

The caterpillar bore into immature bud and feed on the internal contents. The larva feed voraciously on the corolla leaving only the corolla tube in mature buds. In case of younger buds the larva remains outside the buds and feed on the inner floral whorl through a small hole in the corolla tube. The infested flower turns violet and eventually dries out. A single larva may damage up to 6 buds. **1 mark**

Control measures :

Spray the crop with 0.03 per cent dimethoate or 0.01 per cent cypermethrin as soon as the incidence of pest is noticed. **1 mark**

Q.3 **Enlist five important pests of roses. Write in detail nature of damage and control measures for rose aphid and rose bud borer with their scientific names.**

Ans **Enlist five important pests of roses :** **1 mark**

i) Rose aphid ii) Bud borer iii) Thrips iv) Rose leaf hoppers
v) Two spotted spider mite

(1) Rose aphid :

Nature of damage : **2 marks**

Cool and cloudy weather during October-February favour pest build up. Blackish green coloured aphids cluster on tender shoots, buds, flower and lower surface of leaves. Both nymph and adult suck cell sap and devitalize the plants. The tender shoots wither, bud dropped down prematurely and flower loose their beauty and lasting capacity. Heavy incidence favours development of black sooty mould.

Control measures : **1 mark**

i) Spraying with dimethoate 0.03 % or oxydemeton methyl 0.03 % or malathion 0.03 % give effective control of aphid up to 25 days.

ii) Neem or pongamia oil 1.0 % followed by dimethoate 0.03 % or oxydemeton methyl 0.05 % offers effective control in openly cultivated roses.

iii) Spraying with imidacloprid 0.007 % or cartap hydrochloride 0.05 % controls aphids in polyhouses.

(2) Rose bud borer :

Nature of damage : **2 marks**

Infestation of bud borer is severe in open cultivated roses from January to March. Larvae bore in to buds by making holes and feed on growing petals. Caterpillar also damage flowers by eating petals and leaving excreta. **1 marks**

Control measures :

i) Application HaNPV @ 250 L.E. / ha.

ii) Application of *Microbracon bravicornis, Chelonomus narayani, Tetrastichus israelae.*

iii) Application of biopesticide *B.t.* @ 1.5 g/lit.

iv) Collection and destruction of larvae.

v) Release *Trichogramma chilonis* @ 75,000 adults/ha.

vi) Ploughing of soil will expose the pupae to sunlight and predators.

vii) Spraying with 4 % NSKE.

viii) Spraying with ethofenprox 0.01 % controls the pest effectively.

Scientific name of Rose aphid : *Macrosiphum rosaeformis* Das and **Rose bud borer :** *Helicoverpa armigera* Hub. **1 mark**

Q.4 Define surveillance, enlist different sampling techniques and write in brief about importance of ecology in insect pest management.

Ans **Define Surveillance :** **1 mark**

When survey of the same area/plot or locality is carried out at regular intervals to record some observations or to ascertain the changes in the subject of study, it is called as surveillance.

Enlist different sampling techniques : **3 marks**

- In situ count
- Knock down (by jarring, by chemicals, by heating)
- Netting
  - Sweep netting
  - Vacuum netting
  - Aerial netting
- Trapping
  - Light trap
  - Bait trap
  - Pheromone trap
  - Malaise trap
  - Suction trap
  - Window trap
  - Water trap
  - Sticky trap
  - Pitfall trap
- Mark, release and recapture technique
- Sequential sampling

Importance of ecology in insect pest management : **4 marks**

Ecological studies assist or help pest control programs by explaining pest problems and suggesting alternate ways of combating insects. The outbreaks of the pests can be predicted. The ecological studies investigate the causes for the changes in population number and the mechanism of natural control. The key mortality factors in the natural population help to integrate the various methods of control, without disturbing the balance of nature. The pest surveillance programs form part of ecology. Forecasting of the possible attack by different pests can be done accordingly the control measures can be initiated in time. Suitable chemicals can be selected depending on the presence or absence of natural enemies. As such ecological studies form a basic part of the approach to the integrated pest management (IPM).

Q.5 Write nature of damage, host plants and suggest management strategies for the following pests. (ANY TWO)

1) Pollu beetle **2) Cardomom thrips** **3) Turmeric rhizome fly**

Ans **(1) Pollu beetle :**

Nature of damage : **2 marks**

Damage is caused by both adults and grubs. Adult causes damage by feeding

on the leaves, the growing shoot tip and on the surface tissues of the tender spikes. Feeding on the spikes leads to their partial damage. The grubs damage by boring into the growing tips, into spikes and into the berries. The shoot tip die and dry up together. The spikes infested by the grubs also die, dry up and may drop. The attacked berries appear dark in colour, are hollow inside and crumbled when pressed. Such berries are known locally as "pollu berries". Up to 35 per cent of the berries are lost in this way by the attack of the grubs. Single grub destroys around 3-4 or even more berries during its life time.

Host plants : **1 mark**

Black pepper.

Management strategies : **1 mark**

Spraying quinalphos 25 EC 0.05 per cent, first at the time of spike initiation and then a month when the berries are still tender can control the pest effectively.

(2) Cardomom thrips :

Nature of damage : **2 marks**

The pest is active throughout the year except the rainy season. The nymphs and adults suck the cell sap from tender blossoms and the bunch part of the cardamom. The severe infestation causes heavy curling of leaves and stunting of crop, buds and flowers are damaged. Yield loss may be from 10 to 90 per cent.

Host plants : **1 mark**

Cardamom, Tea, Grapevine, Castor, Cotton etc.

Management strategies : **1 mark**

Spray 0.1 per cent dimethoate or 0.1 per cent quinalphos as and when the pest is noticed.

(3) Turmeric rhizome fly :

Nature of damage : **2 marks**

The maggots bore into the rhizomes of ginger and turmeric and damage them. The yellowing of plants and rotting of rhizomes takes place due to severe infestation of pest. The maggots pave way for the invasion by the fungus (*Pythium* spp., *Sclerotium* spp.) and the nematodes (*Meloidogyne* spp.).

Host plants : **1 mark**

Ginger and Turmeric.

Management strategies : **1 mark**

i) Select healthy rhizomes for planting.

ii) Treat the rhizome sets by dipping in carbaryl 50 WP (0.4 per cent) suspension for 10 minutes before planting.

iii) Apply insecticides three times at monthly interval by broadcasting them at the base of the plants followed by light irrigation.

Carbofuron 3G @ 33 kg/ha or Carbaryl 10 D @ 20 kg/ha

iv) Remove and destroy the rotten rhizomes from the field along with maggots after harvest of crop to check the breeding of the pest.

v) Destroy stray plants in off season.

Q.6 Describe in brief:
1) IPM in protected cultivation
2) Management of pests of storage and processed vegetables, ornamentals and spices.

Ans (1) IPM in protected cultivation :

Enlist important pests in protected cultivation: **1 mark**

Aphid, Caterpillars (*Helicoverpa armigera, Spodoptera litura*), Leaf miner, Mites, Thrips, White fly, snails and slugs etc.

Integrated Pest Management in brief: **3 marks**

(I) Avoidance :

(i) Use of physical barriers : Use of insect proof screens, provision of double door, ultra-violet radiation absorbing sheets,

(ii) Sanitation and Cultural practices : Pre-season clean up, balanced use of fertilizers, pinching and pruning, plant quarantine, trap crops/indicator plants,

(II) Early detection : Scouting and early detection are critical to manage the insect infestation successfully. Monitoring or scouting is the regular, systematic inspection of the plants and exteriors to identify and assess pest problems. It includes inspection of foliage and flowers and the use of insect traps.

(III) Curative measures :

(i) Biological control : Use of biological control agents like parasitic wasps (*Encarsia formosa*), leaf miner parasitoid (*Diglyphus isaea*), predatory mites (*Phytoseiulus persimilis, Amblyseius spp.*), Lady bird beetles (*Cryptolaemus montrouzeri, Hippodamia convergens*), green lacewings (*Chrysoperla carnea*).

(ii) Chemical control : Under protected environment, in order to avoid the contamination of produce from pesticide residues, use of pesticides having less persistence and adopting suggested waiting period between last insecticidal application and harvesting can be followed. Botanicals pesticides, microbial pesticides, Insect Growth Regulators (IGR) and to some extent synthetic organic insecticides.

(2) Management of pests of storage and processed vegetables, ornamentals and spices.

Enlist important pests : **1 mark**

Cigarette beetle, Drug store beetle, Fig or Almond moth, Indian meal moth etc.

Management in brief :

i) Sun drying : **3 marks**

Produce is spread in the open exposed to the sun for varying periods depending upon the initial moisture and intensity of heat. Floors used for drying are either plastered with mud or bitumen or in some cases cemented. One ton of produce takes about 10 m^2 of space. Recently, heated as well as unheated air and some chemicals are also used for drying produce.

ii) Surface treatments :

Thorough cleaning of the facility, white washing, placing dunnage between the produce and the floor, building uniform sized rectangular stacks, filling the facility to capacity, regular inspections and maintaining hygienic conditions during storage.

iii) **Improved storage receptacles :**

The produce can be best protected by using improved insect proof receptacles. The metal bins are now available for storing small quantities of produce. For storing larger quantities, it is advisable to construct improved godowns.

iv) **Fumigation :**

Fumigation may be defined as the treatment of commodity or a space with a gaseous material to kill the insect pest present. They are highly volatile and able to penetrate deep and kill insect within a large mass of food stuff. Fumigation is possible only under air tight conditions. For large scale fumigation, however, the dump method is used. Common fumigants used are Ethylene dibromide, ED/CT mixture, Methyl bromide etc.

Q.7 **Enlist any five important pests of tomato and write in detail about nature of damage and control measures of tomato fruit borer and white fly along with their scientific names.**

Ans **Enlist any five important pests of tomato :** **1 mark**

i) Tomato fruit borer ii) White fly iii) Tomato leaf miner iv) Aphid v) Thrips vi) Mites

(1) Tomato fruit borer :

Nature of damage : **2 marks**

The caterpillar causes damage initially by feeding on the foliage for couple of days and subsequently boring into fruits and feeding on the internal tissues by introducing its head and anterior half part of the body alone within. Larva is migratory in habit. It moves from one fruit to another damaging as many as 2 to 8 fruits in its life time. Young larvae feed on tender foliage while advanced stage larvae (4^{th} instar onwards) attack the fruits.

Control measures : **1 mark**

i) Hand picking of caterpillars and their mechanical destruction in the early stage of infestation can keep the population of this pest under check.

ii) Deep ploughing after the harvest of crop helps to destroy hibernated pupae.

iii) Infested fruits should be collected and destroyed promptly.

iv) Mass release *Trichogramma pretiosum* egg parasite 50,000 adults/ha five times at weekly interval from initiation of flowering.

or

Give five sprays of *Ha*NPV 250 LE (larval equivalent) @ 500 ml/ha at weekly interval after initiation of 50 per cent flowering.

or

Spray 5 per cent Neem Seed Extract (NSE) @ 500 gm / 500 litres of water.

v) Trap crops like **"Lubia"** or **"Marigold"** may be planted around the border of main crop.

(2) White fly : **2 marks**

Nature of damage :

Both nymphs and adults suck the cell sap from ventral surface of leaves. As a result, infested leaves become yellowish, wrinkled, curled downwards and are ultimately shed. The vitality of the crop is reduced. Consequently, the growth of the plant is adversely affected and when the attack appears late in the season, the yield is lowered considerably. Pest also acts as a vector transmitting **"leaf curl"** virus disease.

Control measures : 1 mark

i) Installation of yellow sticky traps in the field.

ii) Spray 0.03 per cent dimethoate or 0.03 per cent oxydemeton methyl as soon as incidence is noticed.

Scientific name of Tomato fruit borer : *Helicoverpa armigera Hub.* and 1 mark
White fly : *Bemisia tabaci*

Q.8 **Write short notes (ANY TWO)**
1) Pea pod borer **2) Insecticide residue** **3) Okra shoot and fruit borer**

Ans **(1) Pea pod borer :** Scientific name, order, family, their nature of damage and control measures. 4 marks

Scientific name : *Etiella zinckenella* Treitschke

Order and Family : Lepidoptera; Pyralidae

Nature of damage :

The injury is caused by larvae which consumes floral part, newly formed pods and feed on the developing seeds. One or rarely two larvae may be seen in a single pod. After feeding a larva moves to another pod. Due to feeding on grains, the reduction in yield up to 5 per cent may occur.

Control measures :

1. Collection and destruction of infested plants parts in the initial stage of attack.

2. At flowering initiation, spray the crop with 0.2 per cent Carbaryl 50 WP and repeat the treatment after three weeks, if necessary for effective control of the pests.

(2) Insecticide residue : Definition of insecticide residue, maximum residue limit (MRL), LD_{50} and LC_{50}, toxicity and its types. 4 marks

(i) Definition of Insecticide residue : Insecticide residues are referred to as the quantities of persistent insecticide that pollute the environment (air, water and soil) and food stuffs (grains, vegetables, fruits, milk and meat).

(ii) Maximum residue limit (MRL): The maximum residue limit is the maximum amount of pesticide residue that is expected to remain on food products when a pesticide is used according to label directions, that will not be a concern to human health.

(iii) LD_{50} and LC_{50}: LD_{50} (median lethal dose) is the amount of the substance required (usually per body weight) to kill 50% of the test population.

LC_{50} (median lethal concentration) is defined as the lethal concentration required to kill 50% of the test population.

(iv) Toxicity and its types :

Toxicity is the degree to which a chemical substance or a particular mixture of substances can damage an organism (humans or animals).

1. **Acute toxicity** involves harmful effects in an organism through a single or short-term exposure.

2. **Sub-chronic toxicity** is the ability of a toxic substance to cause effects for more than one year but less than the lifetime of the exposed organism.

3. **Chronic toxicity** is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous

exposure, sometimes lasting for the entire life of the exposed organism.

(3) Okra shoot and fruit borer : Scientific name, order, family, their nature of damage and control measures. **4 marks**

Scientific name : *Earias vitella, Earias insulana*

Order and Family : Lepidoptera; Noctuidae

Nature of damage :

In the beginning of the crop growth (when the crop is only a few weeks old), larvae bore into the tender top shoot and feed internally causing shoots to droop, wither and dry up. When flowers, flower buds and fruits appear, the larvae are seen boring into them and feeding internally. The infested flowers and flower buds drop down prematurely. Damaged fruits present deformed appearance. The infested fruits show holes plugged with excreta. Infested fruits fetch less price in the market. The severely infested fruits are made unfit for human consumption.

Control measures :

i) Removal and destruction of infested shoots and fruits and shed materials helps in reducing intensity of infestation.

ii) Use Trichocards of 1cc each @ 4-5 cards /ha.

iii) Give four sprays of following insecticides at 15 days interval starting from 15 days after germination

Cypermethrin 25 EC 0.01 per cent or Fenvalerate 20 EC 0.01 per cent or Deltamethrin 2.8 EC 0.01 per cent or Lambda cyhalothrin 5 EC 0.0015 per cent or Profenofos 50 EC 0.08 per cent.

Q.9 Write in detail nature of damage, enlist host plants and suggest control measures for diamond back moth and cabbage butterfly.

Ans (1) Diamond back moth :

Nature of damage : **2 marks**

The newly hatched larvae feed on the epidermal tissues of the leaves producing typical whitish patches. The advanced stage larvae feed on the leaf lamina by biting small holes in the leaf lamina. These larvae also bore into the heads of cabbage and cauliflower. In case of severe infestation, plant may be completely skeletonized.

Host plants : **1 mark**

Cabbage, Cauliflower, Knol-khol, Radish, Turnip, Mustard *etc.*

Control measures : **1 mark**

Pest can be controlled effectively by spraying quinalphos 25 EC - 0.05 per cent or *B.t.* formulation (*Bacillus thuringensis*) @ 1 kg / ha, or abamectin 1.8 EC - 0.001 per cent.

(2) Cabbage butterfly :

Nature of damage : **2 marks**

The damage is caused by the caterpillars only. Freshly hatched caterpillars scrape the leaf surface and feed on the green matter initially. Later on the older larvae eat up the leaves from margins inward, leaving intact the main vein. Sometimes the leaves of entire plant are eaten up and the plant is defoliated.

Host plants : **1 mark**

Cabbage, cauliflower, knoll-khol, turnip, raddish, sarson and other cruciferous plants.

Control measures : 1 marks

i) Hand picking and mechanical destruction of caterpillars during early stage of attack can reduce the infestation.

ii) Spraying with 1 litre of Malathion 50 EC (0.1 %) in 625 litres of water/ha and repeat the spraying at 10 days intervals, if necessary.

Q.10 State nature of damage

1) *Cylas formicarius* **2) Cinnamon butterfly**

3) Onion thrips **4) Potato tuber moth**

Ans 1) *Cylas formicarius* :

Nature of damage : 2 marks

This is important pest of sweet potato both in the field and in storage. The grubs bore into the tubers and feed on the pulp making them unfit for human consumption. The grubs may induce terpenoid production inside the tuber. The grubs also bore into the vines by making a hole at collar region. As a result, the thickness of vine is enlarged forming gall like structure at the point of pest infestation. The adults feed on leaves, vines and tubers but cause negligible damage. Loss in yield to the extent of 60 to100 per cent has been reported.

2) Cinnamom butterfly :

Nature of damage : 2 marks

On hatching the first instar larva starts feeding on the lamina of the freshly emerged leaves. The later instars feed on the tender leaves voraciously leaving only the mid-ribs with portions of veins. In case of severe infestation, the growth of the plant is adversely affected.

3) Onion thrips :

Nature of damage : 2 marks

Nymphs and adults cause damage by scrapping epidermal tissues of leaves and sucking oozing cell sap. As a result, whitish patches are seen on the leaves. In case of severe infestation, it gives whitish appearance to the whole plant. If attack appears during later stage of crop, the bulbs remain undersized and get distorted in shape and there is no seed setting in the flowers. It is a major pest of onion and garlic from November to May.

4) Potato tuber moth :

Nature of damage : 2 marks

Pest causes damage to potato crop both in the field as well as in the stores. In the field, caterpillars feed on plant by mining into the leaves, by boring into petioles, terminal shoots and potato tubers underneath the soil. The infested leaves show blisters on them, while the shoots wither and wilt.

In storage, caterpillars are found boring into the stored potato through minute hole made near eye bud and feeding on the pulp. The infested potatoes ultimately rot and are made unfit for seed purpose as well as human consumption. The secondary infection of bacteria sets on such infested tubers. The presence of black spot and fecal matter around eye buds helps to detect the pest infestation in storage. A single potato may have several caterpillars. As a result of pest infestation, the pulp and the eye buds of potatoes are destroyed. Under indigenous storage methods, pest causes losses to the extent of 30 to 70 per cent.

Q.11 A) Give the site of oviposition of the following 4 marks

1) Epilachna beetle : On lower surface of leaves
2) Bell pepper thrips : Inside the leaf tissues on lower surface of leaves
3) Melon fruit fly : Under the rind of developing fruits.
4) Aster leaf hopper : Into the soft plant tissue

B) Give the site of pupation of the following 4 marks

1) Lily moth : In soil
2) Brinjal shoot and fruit borer : On shoots, fruits or in soil
3) Mustard saw fly : In soil
4) Tomato leaf miner : On the ground

Q.12 Do as directed 8 marks

1. Scientific name of sweet potato leaf eating caterpillar is *Agrius convolvuli.*
2. First instar grub of blister beetle is called as triungulin.
3. What is the long form of *Ha*NPV - *Helicoverpa armigera* Nuclear Polyhedrosis Virus.
4. Damaging stage(s) of onion fly – maggot.
5. Give the name of two important pests of Amaranthus – Amaranthus leaf eating caterpillar, cut worm, leaf miner, mustard sawfly, leaf hopper, aphid etc.
6. Common name of *Salyadrassus malabaricus* is clove stem borer.
7. Enlist names of two systemic insecticides – Dimethoate, Imidacloprid, Lambda cyhalothrin, Monocrotophos, Clothainidin, Fipronil, Thiamethoxam, Acephate etc.
8. *Pentalonia nigronervosa* transmits katte viral disease of cardamom.

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