MAHARASHTRA AGRICULTURAL UNVERSITIES EXAMINATION BOARD, PUNE

SEMESTER END EXAMINATION

B.Sc. (AGRICULTURE)

Semester	:	V (Old)	Academic Year			:	2019-2020	
Course No.	:	ENTO – 353	Title	:	Crop Pests and Stored Grain Pests and their Management			
Credits	:	3 (2+1)						
Day & Date	:		Time	:	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 diagrams wherever necessary.

SECTION "A"

Q.1 Mention the major pests associated with sucking pest complex and bollworm complex of cotton. Describe the nature of damage and management practices for cotton pink bollworm and white fly of cotton.

Major pests associated with sucking pest complex (1 mark: Any two with scientific names)

Cotton aphid	*Aphis gossypii*
Leafhopper	*Amrasca devastans*
Thrips	*Thrips tabaci*
Whitefly:	*Bemisia tabaci*

Major pests associated with bollworm complex (1 mark: Any two with scientific names)

American bollworm	*Helicoverpa armigera*
Spotted bollworms	*Earias vitella & E. insulana*
Cotton pink bollworm	*Pectinophora gossypiella*

Nature of damage of cotton pink bollworm: (1.5 marks)

The caterpillars feed on buds and flowers. When they bore into flower buds, the flowers do not open and give rosette appearance. The young bolls, when attacked, are shed after a few days, but the larger bolls remain on the plant. Locules are damaged and interlocular burrowing is noticed. Seeds are destroyed and lint gets stained.

Management of cotton pink bollworm: (1.5 marks)

Use pheromone trap @ 12/ha. Collect and destroy the shed fruiting parts. Crush the pink bollworm larvae in the rosette flowers, Dispose off the crop residues, Avoid staking of stalks in the field. Avoid ratooning. Adopt proper crop rotation. Intercropping with pulses *viz.*, cowpea, greengram, blackgram and soybean reduce the bollworm incidence. Grow resistant cultivars like Lohit, Abadhita, Sujata, Digvijay. During boll and maturation stage, spray fenpropathrin 30 EC 250-340 ml or triazophos 40 EC 1.5 - 2.0 L or cypermethrin 10 EC 500-700 ml or quinalphos 20 AF 1.75 - 2.5 L in 1000 L of water/ha.

Nature of damage of cotton Whitefly: (1.5 marks)

Nymphs and adults suck the sap from the under surface of leaves results in premature defoliation, development of sooty mould, shedding of buds and bolls and poor boll opening. Transmits the leaf curl viral disease.

Management of cotton Whitefly: (1.5 marks)

Tolerant varieties - Amravathi, Kanchan, Supriya. Treat 1 kg seeds with Imidacloprid 48 FS 5 ml or Thiamethoxam 30 FS 1ml. Timely sowing, recommended spacing, Avoid alternative host crops, Adopt crop rotation with such as sorghum, maize etc. Judicious irrigation management and nitrogenous fertilizer application, Yellow sticky traps at 1 foot height. Spray NSKE 5% and neem oil 5 ml/L or *Verticillium lecanii* 1.15 WP 2.5 kg/ha. Avoid repeated spraying of synthetic pyrethroids. Spray Acetamiprid 20 SP 50 g or Monocrotophos 1000 ml or Imidacloprid 17.8 SL 100 ml or Dimethoate 500 ml or Profenofos 50 EC 1.0 L or Thiacloprid 21.7 SC 100-125 ml in 500 L water/ha.

Q.2 Give the scientific name, damaging stage, typical damage symptoms and describe the management practices for brown plant hopper and yellow stem borer of rice.

Scientific name of brown plant hopper: (1 mark)

Nilaparvata lugens

Damaging stage of brown plant hopper: (1 mark)

Nymphs and adults

Typical damage symptom of brown plant hopper: (1 mark)

The affected plant dries up and gives a scorched appearance called "hopper burn". Circular patches of drying and lodging of matured plants.

Management practices of brown plant hopper: (1 mark)

Use resistant varieties like Aruna, Abhay, Asha, Divya, Neela. Avoid close planting and use of excessive nitrogenous fertilizers. Intermittent draining. Use light traps. Avoid use of synthetic pyrethroids. Spray neem seed kernel extract 5% (25 kg/ha) (or) neem oil 2% (10 L/ha). Spray imidacloprid 17.8 SL 125 ml or acephate 75 SP 625 g or Dichlorvos 76 WSC 350 ml or Chlorpyriphos 25 EC 1250 ml or Benfuracarb 3 GR 3.3 kg or Clothianidin 50 WDG 20-24 g or Imidacloprid 70 WG 30-35 g or Fipronil 5 SC 1.0 -1.5 L/ha.

Scientific name of yellow stem borer of rice: (1 mark)

Scirpophaga incertulas

Damaging stage of yellow stem borer of rice: (1 mark)

Caterpillar

Typical damage symptom of yellow stem borer of rice: (1 mark)

Stem drying of the central shoot "dead heart" in the young seedlings, and drying of the panicle in grown up plant called "white ear".

Management practices of yellow stem borer of rice: (1 mark)

Resistant varieties *viz*., Ratna, Jaya, IR 20, Saket, Clip the seedling tips before transplanting. Collect & destroy the egg masses. Avoid close planting and continuous water stagnation at early stages. Collect and destroy the dead hearts and white ears. Light traps to attract and kill the moths. Pheromone traps. Release *Trichogramma japonicum* twice on 30 and 37 DAT @ 5 cc/ha. Apply carbofuran 3 G @ 25 kg or chlorantraniliprole 0.4 G 10 kg or fipronil 0.3 G 17-25 kg or cartap hydrochloride 4 G 18.75 kg or spray acephate 75 SP 666-1000g or cartap hydrochloride 50 SP 1 kg or chlorantraniliprole 18.5 SC 150 ml or flubendiamide 20 WG 125 g or lambda-cyhalothrin 5 EC 250 ml or thiacloprid 21.7 SC 500 ml using water @ 500 L/ha.

Q.3 Enlist the major pests of pigeonpea with scientific names. Mention the site of oviposition, nature of damage and management practices for pigeonpea pod borer and pod fly.

Scientific names of major pests of pigeonpea (2 marks – Any four)

Pigeonpea pod borer: *Helicoverpa armigera*

Pod fly: *Melanagromyza obtusa*

Plume moth: *Exelastis atomosa*

Spotted pod borer: *Maruca testulalis*

Bean Aphids: *Aphis craccivora*

Leaf hopper: *Empoasca kerri*

Whitefly: *Bemisia tabaci*

Pigeonpea pod borer: (3 marks – 1 each)

a) **Site of oviposition**: Singly on leaves, buds, Calyx of flowers

a) **Nature of damage:** Caterpillar first feeds on foliage, buds and flowers; later bores into pods and feeds on developing seeds. Large irregular holes on pods, absence of seeds in pods are the symptoms of attack.

b) **Management practices**: Grow resistant varieties like ICPL 332 or ENT – 11. Install bird perches @ 50/ha. Light trap, Pheromone traps @ 5./ha. Spray nuclear polyhedrosis virus (HaNPV) @ 500 LE/ha, Spray Indoxacarb 15.8 SC @ 335 m or Spinosad 45 SC 125-160 ml or Methomyl 40 SP 750-1125 g or Lambda cyhalothrin 5 EC 400-500 ml in 700-1000 L of water per ha.

Pod fly: (3 marks – 1 each)

a) **Site of oviposition**: Inside the pod wall

b) **Nature of damage:** Maggots bore into the soft seeds and feed on grains. Damaged seeds are shriveled, discolored and are unfit for consumption and germination is affected on account of fungal growth.

c) **Management practices**: Early sowing in endemic areas. Grow resistant varieties like PPE 45-2. Spray lambda cyhalothrin 5 EC 400 -500 ml or Lufenuron 5.4 EC 2.5 L with 700 L water/ha

Q.4 Give the scientific name, typical damage symptoms and management practices for sugarcane top shoot borer and safflower aphid.

Scientific name of sugarcane top shoot borer: (1 mark)

Scirpophaga excerptalis

Typical damage symptoms of sugarcane top shoot borer: (1 mark)

Dead heart in grown up canes; parallel row of shot holes in the emerging leaves and red tunnels in the midribs; bunchy top appearance due to side shoots.

Management practices of sugarcane top shoot borer: (2 marks)

Grow resistant varieties: Co 724, Co 1111, Collect and destroy the egg masses, Release *Isotima javensis* @ 100 pairs/ ha (prepupal parasitoid); egg parasitoids: *Telenomus beneficiens, Trichogramma chilonis;* larval parasitoids: *Goniozus indicus,* Spray Chlorantraniprole 18.5 SC 375 ml in 1000 l. water per ha

Scientific name of safflower aphid: (1 mark)

Uroleucon compositae

Typical damage symptoms of safflower aphid: (1 mark)

The height, number of leaves and shoots are reduced significantly. The plants become weak, stunted dry up. Seed yield is affected. The aphids secrete honeydew which attracts a black sooty mould. Photosynthesis is adversely affected.

Management practices of safflower aphid: (2 marks)

Early sowing of the crop, Rational use of nitrogenous fertilizers. Grow coriander with safflower, Use of biorational approach. Spray 250 ml of dimethoate 30 EC or monocrotophos 36 SL or 625 ml of chlorpyriphos 20 EC in 750 litres of water/ha and repeat the spray after 15 days. Conserve parasitoid *Aphidencyrtus sp.* and predator *Brumoides suturalis.*

Q.5 Write in brief about (Any two) :

A) Mango hopper (4 marks)

Scientific name : *Idioscopus clypealis, Amritodus atkinsoni*

Site of oviposition : Into the tissues of the young leaves

Nature of damage : Both nymphs and adults suck the sap from tender shoots and inflorescence resulting in withering and shedding of flower buds and also wilting and drying of shoots and leaves. The flower stalks and leaves in infested trees become sticky due to the deposition of honey-dew secreted by the hoppers that encourages the growth of black sooty mould on foliage and other parts.

Management practices : Avoid close planting, Pruning of dense canopy, Avoid excess use of nitrogenous fertilizers, Spray dimethoate 30 EC or monocrotophos 36 SL 2.5-3.3 L or malathion 50 EC 1.5 -2.0 L in 1500 – 2000 L of water per ha or acephate 75 SP @ 1 g/L or buprofezin 25 SC 1-2ml/L of water or imidacloprid 17.8 SL 2-4ml/tree or lambda cyhalothrin 5 EC 0.5-1.0ml/L of water at 10 -15 L of water per tree. Spray neem seed kernel powder extract 5 per cent.

B) Citrus fruit sucking moth (4 marks)

Scientific name : *Othreis materna, O. fullonica*

Site of oviposition : On wild plants and weeds like *Tinospora cordifolia, Cocculus pendulus, C. hirsutus*

Site of pupation : In soil

Nature of damage : Adult moth pierces the fruits for sucking the juice and makes characteristic pin-hole damage in fruits. Bacterial and fungal infections at the site of attack. Whole fruit turns yellow, drops from tree and looks like a premature fruit. In severe cases, all fruits are lost.

Management practices : Destroy the weed host. Apply smoke to repel adult moth, light traps to attract adults. Cover the fruit with perforated polybags. Bait with fermented molasses / jaggery (10 g/ L) + malathion 50 EC 1 ml/L or Dispose fallen fruits, Spray with 2.5 kg of carbaryl 50 WP in 1000 L of water per ha at the time of maturity of fruits.

C) Pomegranate fruit borer (4 marks)

Scientific name : *Virachola* (*Duodorix*) *isocrates*

Site of oviposition : Singly on calyx of flowers and on tender fruits

Site of pupation : Inside the fruits

Nature of damage : Larvae bore inside the developing fruits and feed on pulp and seeds. Rind exhibit round bore holes. Infested fruits are attacked by bacteria and fungi, fall off and give an offensive smell.

Management practices : Mechanical - Bagging of developing fruits with cloth or paper bag. Remove and destroy affected fruits. At the beginning of fruit formation spray with carbaryl 0.2%, Deltamethrin 0.002% or Fenvalerate 0.005 % or Quinolphos0.06 %.

Q.6 Enlist the preventive and curative measures for management of stored grain pests. Describe any one preventive and curative measure.

Preventive measures (3 marks – at least 6 points)

1. Remove all debris in the godown.
2. Clean and maintain the threshing floor/yard free from insect infection.
3. Clean the machines like harvester and thresher before their use.
4. Make the trucks, trolleys or bullock carts free from infestation.
5. Clean the godowns/ storage structures before storing the newly harvested crop.
6. Plaster the cracks, crevices, holes found on walls, and floors with mud or cement and white wash the stores before storing of grains.
7. Disinfest the storage structures receptacles by spraying malathion 50 EC @ 3 lit 100 m before their use.
8. Spraying of botanicals or contact insecticides during crop maturity stage prevents the ovipositon in field.

Curative measures (3 marks - at least 6 points)

1. Dry the produce to have moisture content below 10% to prevent the buildup of pests.
2. Sun dry storage bags, bins etc.
3. Seed purpose: Mix 1 kg of activated kaolin (or) malathion 5 D for every 100 kg of seed and store/pack in gunny or polythene lined bags.
4. Grain purpose: Mix 1 kg activated kaolin for every 100 kg of grain and store.
5. Split and store pulses to escape from the attack by pulse beetle.
6. Store the food grains in air tight sealed structures to prevent the infestation.
7. Sieve and remove all broken grains.
8. Stitch all torn out bags before filling the grains.
9. Treat the walls, dunnage materials and ceilings of empty godown with malathion 50 EC 10 ml/L (or) DDVP 76 WSC 7 ml/L1 at 3 Ll spray solution/10 sq.m.
10. Treat the alleyways and gangways with malathion 50 EC 10 ml/L or DDVP 76 WSC 7 ml/ L (1 L of spray fluid/270 m3).
11. Spray malathion 50 EC 10 ml/ L with @ 3 L of spray fluid / 100 m2 over the bags.
12. Use EDB ampoules at 3 ml/quintal for wheat and pulses and 5 ml/ quintal for rice and paddy.
13. Use EDCT at 30 – 40 litres/ 100 cubic meter in large scale storage and 55 ml/quintal in small scale storage.
14. Fumigation: Use fumigants like ethylene dibromide (EDB), ethylene dichloride carbon tetra chloride (EDCT), aluminium phosphide (ALP) to control stored produce pests effectively.

Describe any one preventive and curative measure (2 marks – one each)

Q.7 Write in detail about the nature of damage and management practices for brinjal shoot and fruit borer and okra shoot and fruit borer.

Nature of damage for Brinjal shoot and fruit borer, *Leucinodes orbonalis* (2 marks)

Larva bores into tender shoots and causes withering of terminal shoots, also bores petioles of leaves, flower buds and developing buds. Withering of leaves, shedding of buds and make fruits unfit for consumption. Attacked fruits are with boreholes plugged with excreta. Fruits become out of shape.

Management practices for Brinjal shoot and fruit borer, *Leucinodes orbonalis* (2 marks)

Avoid continuous cropping of brinjal and ratooning. Resistant varieties - Pusa purple round, Pusa purple Long, Collect and destroy the damaged tender shoots, fallen fruits, Use light traps @ 1/ha, Release egg parasitoids *Trichogramma chilonis* @1.0 lakh/ha. Spray *B. thuringiensis* - Dipel @ 1.5 to 2 ml /L of water. Spray Quinalphos 25 EC 1.5 L

or NSKE 5% or Azadirachtin 1.0% 1.0-1.5 L or Fenpropathrin 30 EC 250-340 ml or Thiodicarb 75 WP 625-1000 g or Flubendiamide 20 WG, 375 g in 500 – 750 L water/ha.

Nature of damage of Okra shoot and fruit borer, *Earias vitella* (2 marks)

Larva bores into tender terminal shoots in the vegetative stage and flower buds, flowers and young fruits in the fruit formation stage. The damaged shoots droop, wither and dry up. The infested fruits present a deformed appearance and become unfit for consumption. Bore holes - plugged with excreta.

Management practices of Okra shoot and fruit borer, *Earias vitella*. (2 marks)

Collect and destroy infested shoots, buds, flowers and fruits. Remove the alternate hosts, Release egg parasitoid *T. chilonis* and larval parasitoid *Chelonus blackburnii*. Release first instar larvae of *Chrysoperla carnea* @ 1 lakh/ha. Set up light traps, Set up pheromone traps @ 5/ha. Spray *B.t* formulation such as dipel @ 2 g / lit. Spray or NSKE 5% or Azadirachtin 5% 400 ml or Fenpropathrin 30 EC 250-340 ml or Pyridalyl 10 EC 500-750 ml with 500 L – 700 L water/ha.

Q.8 Write in brief with emphasis on the scientific name, damaging stage, nature of damage and management practices for Tea mosquito bug and Sorghum shoot fly.

Tea mosquito bug:

Scientific name: (1 mark)

Helopeltis theivora

Damaging stage: (1 mark)

Adults and nymphs

Nature of damage: (1 mark)

Adults and nymphs suck the sap from buds, young leaves and tender stems by puncturing with needle like stylets and injecting toxic saliva. Punctures appear as reddish brown water soaked spots. Necrosis. Leaves curl up, become badly deformed and remain small. Gradually, shoots dry up.

Management practices: (1 mark)

Collect and destroy the damaged plant parts, Spray profenofos 50 EC 800-1000 ml or Thiamethoxam 25 WG 100 g or phosalone or chlorpyriphos or dimethoate at 1000ml/ha with 500 L water/ha.

Sorghum shoot fly:

Scientific name: (1 mark)

Atherigona soccata

Damaging stage: (1 mark)

Maggot

Nature of damage: (1 mark)

The maggot cuts the growing point resulting in "dead heart". Side tillering is initiated.

Management practices: (1 mark)

Resistant varieties IS 18551, Maldandi and Phule Yashoda, Early Sowing, Higher seed rate, Fishmeal trap, Seed treatment with imidacloprid, Granular application of phorate 10 G 25kg/ha, Spray dimethoate 30 EC @ 500 ml/ha.

Q.9 Write a short note on (Any two) :

A) Termites in sugarcane B) Chilli thrips C) White grub

A) Termites in sugarcane:

Scientific name : (1 mark)

Odontotermes obesus

Damaging stage : (1 mark)

Workers

Nature of damage : (1 mark)

Poor germination of setts, semi-circular feeding marks on the leaf margin. Entire shoot dries up and can be pulled out. Setts are hollow inside and filled with soil. Cane collapses if disturbed; rind filled with mud.

Management practices: (1 mark)

Locate and destroy the termite colony, Destroy the affected setts from the field Treat setts with Imidacloprid 70 WS 100-150 g per 100 setts. Spray chlorantraniprole 18.5 SC 500-625 ml or imidacloprid 17.8 SL 350 ml with 500 L water/ha.

B) Chilli thrips:

Scientific name : (1 mark)

Scirtothrips dorsalis

Damaging stage : (1 mark)

Nymphs and adults

Nature of damage : (1 mark)

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

Management practices: (1 mark)

Resistant varieties like G5, K2, X 235. Carbofuran 3G @ 200g/ 40 m^2 area in the nursery, Dip the roots of seedlings in monocrotphos 36 WSC @ 0.05% before transplanting. Spray Imidacloprid 17.8 SL 125-250 ml or 70 WS / 100 kg seed 1.000-1.5L , Lambda cyhalothrin 5 EC 300 ml or Ethion 50 EC 1.5-2.0 L or Spinosad 45 SC 160 ml or Fipronil 5 SC 800-1000 ml or Thiacloprid 21.7 SC 225-300 ml or Dimethoate 30 EC 500 ml water 500 L/ha. with water 500 L/ha.

C) White grub:

Scientific name: (1 mark)

Holotrichia sp.

Damaging stage: (1 mark)

Grubs

Nature of damage: (1 mark)

Yellowing and wilting of crop/leaves. Affected plants come off easily when pulled. Cause extensive damage to roots. Yield is severely reduced.

Management practices: (1 mark)

Set up light trap to attract and destroy the adults, adequate irrigation, Crop rotation, Collect and destroy the adult beetles from Neem, Ber, *Ailanthus* and *Acacia*. Spray Imidacloprid on neem or ber trees when defoliation is noticed.

Q.10 Give a brief account about site of oviposition, damaging stage, nature of damage and management practices for diamondback moth and *Pollu* beetle on pepper.

Site of oviposition of diamondback moth (1 mark)

On the leaves (Lower surface)

Damaging stage of diamondback moth (1 mark)

Caterpillar

Nature of damage of diamondback moth (1 mark)

First instar larvae mine epidermal surface of leaves producing typical white patches. Larvae, second instar onwards feed externally making holes on the leaves and soil them with excreta. Heavy infestations leave little more than the leaf veins.

Management practices for diamondback moth. (1 mark)

Grow mustard as trap crop. Install pheromone trap. *Bacillus thuringiensis* @1 g/L or NSKE 4% spray. Conserve larval parasitoids viz.. *Cotesia plutellae*. spray insecticide at primordial or head initiation stage. Azadirachtin 0.03% 2.5 L or Lufenuron 5.4 EC 600 ml or Chlorantraniprole 18.5 SC 50 ml or Indoxacarb 14.5 SC 200-265 ml or Emamectin benzoate 5 SG 200 g or Fipronil 5 SC 800-1000 ml or Thiodicarb 75 WP 1.0-1.3 kg or Quinalphos 25 EC 1000 ml with 500 -1000 L water/ha

Site of oviposition of *Pollu* beetle (1 mark)

On the berries

Damaging stage of *Pollu* beetle. (1 mark)

Grubs

Nature of damage of *Pollu* beetle. (1 mark)

The grubs bore into the berries of pepper. Berries dry up and turn dark in colour. Berries are hollow and crumble when pressed. Such berries are called "POLLU" (Empty). Grub also eat the spike causing it to dry up.

Management practices of *Pollu* beetle. (1 mark)

Rake the soil and incorporate quinalphos 1.5 D or carbaryl 5 D, @ 25 kg/ha to kill the pupae in the soil, Spray dimethoate 30 EC 1.5 L or quinalphos 25 EC 2.0 L in 500 - 1000 L of water per ha.

SECTION "B"

Q.11 Do as directed

A) Give the damaging stage/stages of the following pests.

1. Sugarcane pyrilla : **Nymphs and adults**
2. Mustard sawfly : **Grubs**
3. Onion thrips : **Nymphs and adults**
4. Pulse beetle : **Grubs and adults**

B) Give the site of oviposition for the following pests.

1. Potato tuber moth: **Near eyes of exposed tubers/ ventral surface of leaves.**
2. Red cotton bug : **In soil**
3. Rhinoceros beetle : **In manure pits**
4. Fruit fly : **Under the soft skin of fruits**

Q.12 A) Match the pairs of insect-pest with typical damage symptoms

1.	Sugary malady (*Chikta*) in sorghum	C)	**Aphids**
2.	Brown patches on guava fruit	D)	**Scarlet mites**
3.	Silver shoots in paddy	A)	**Gall midge**
4.	Series of holes and diamond shaped cuttings in fronds of coconut.	B)	**Rhinoceros beetle**

B) Answer the following in one sentence:

1) Name the host plant of adult white grub. **Neem/Acacia/Ber/Drumstick**

2) The greening virus in citrus is transmitted by **Citrus psylla**

3) Name the vector of pigeonpea sterility mosaic **Eriophyid mite – *Aceria***

4) Mention the lure used for monitoring of gram pod borer **Helilure.**

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