WEEK EIGHT AND NINE

TOPIC: PEST OF CROP

Overview:

1. Meaning of Pest
2. Classification of pest
- Insect pest
- Non-insect pest
3. Classification of insect pest based on mouth parts with example
- Biting and chewing
- Piercing and sucking
- boring
4. Important insect pest of major crop field and storage pest; life cycle, Economic importance, nature of damage, Prevention and control measure of the following major insect pest.
    - Cereals: stem borer, army worm, earworm, etc.
    - Legumes: pod borer, aphid, sucking bug and leaf beetle, etc.
    - Beverage: Cocoa myrid (capsid)
    - Tuber: yam beetle, cassava mealy bug, green spider mite, variegated grasshopper, etc.
    - Fruits and vegetable: thrips, grasshopper, leaf roller, scale insect.
    - Fiber: Cotton stainer, boll worms
    - Stored Produce: grain weevil, bean weevil

Objectives:

Student should be able to:

- State the meaning of pest
- Classify pest into insect and non-insect
- Classify insect pest based on mouth part based on their mode of mouth part
- Discuss the prevention and control measures of insect pest of major crops
- Recognize and name the important storage insect pest of farm produce.
- Describe the nature of damage to crop

Introduction

Pest is an organism that causes problem by damaging crops, food production, parasite to animal or being a nuisance and health hazard to human. Pest of crop plant attack crop either in the store or on the field leading to destruction plant part leading to low yield in quantity and quality.

Classification of pest

Pest are classified into two major groups as follows:

1. Insect Pest
2. Non-insect Pest:

Insect Pest:

They attack and destroy plant at different stages of their development. They are the most serious pest of agricultural importance. Examples of insect pest are grasshopper, locust, weevils, termites etc.

Non-insect Pest

These are bigger organism other than insect which are mammals or birds. They attack crop plant mostly cereals and other crops at different stage of growth and during storage, they are not as many as insect pests. Non-insect pest can be grouped into:

i. Rodents
ii. Monkeys
iii. Man
iv. Nematodes

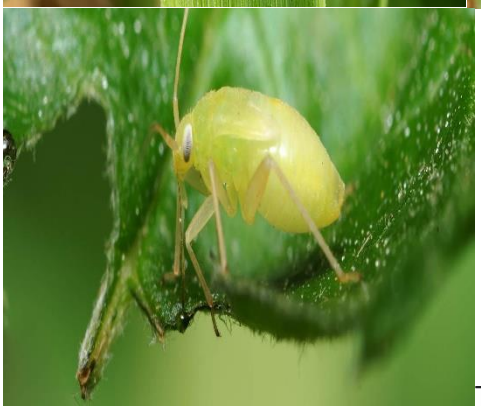
Classification of Insect Pest

Based on their mouth part for the mode of feeding, insect pest can be divided into three group:

- Piercing and Sucking Insect
- Biting and chewing insect
- Burrowing Insect

Piercing and Sucking Insect





These **piercing and sucking** habits of the insects lead to destruction of plant tissues, development of holes through which disease organisms can enter into the plant system and transfer or harmful germs from diseased plants to healthy ones by

inserting their mouth part called the **Proboscis** into plant tissue and suck the sap and juice of the plant. Examples of piercing and sucking insects are aphids, mealy bug, cotton stainers, thrips, white flies, butterfly etc

Aphid Cotton stainer Mealy bug

Biting and chewing Insect:

Chewing and biting pests bite using their strong mandible and maxillae (mouth part) and chew the leaves, stems, buds, flowers, and even the roots of plants. Damage caused by these insects includes holes in the leaves or stems; semi-circular holes along the edges of the leaves; discolouration on the surface or the edges of the foliage and flower petal; severed stems and leaves; and plant wilting. Examples are termites, grasshopper, leaf worm, mantids, locust, beetles etc.



Grasshopper Termite Leaf worm

Burrowing Insect

These insects, including their larvae are capable of boring into plant part and destroy the tissue of the plants, fruits or seed. Examples include bean beetles, stem borers, maize weevil and Rice weevil.

Rice Weevil Maize Weevil Stem Borer

Effect/Economic Importance of Pest

- As a result of the procurement of chemicals and labor incurred by their implementation, they raise the cost of production during the process of regulating them.
- Some are carriers or disease vectors, e.g. Aphids are vectors of the famous bean mosaic virus and white flies as tomato leaf curl virus vectors.
- They cause injury that can predispose the crop to attacking disease.
- They decrease the quality of goods both in the field and in the store, e.g., potato tuber moth (PTM) On Irish potatoes
- They make fruits and vegetables unattractive and unmarketable.
- Owing to their feeding on the leaves and the harvestable parts of the crop, they usually decrease the yield of crops.
- They may also cause the complete death of crop plants where the whole plant succumbs to the damage caused by the insect, resulting in profit reduction or total loss. Example of Banana Weevil *Cosmopolites Sordidus*.

Important insect pest of major crop field and storage pest

Pest	Crop attacked	Life Cycle	Nature of Damage/Economic Importance	Prevention and control measures
Stem Borer *Coniesta ignefusalis* 	Cereals: Rice, Maize, Sorghum, Millet, Guinea corn	- Eggs are laid by adult moths in batches and have a yellow colour. - The larval stage constitutes the most damaging developmental stage of the pest. - The larvae of the stem borer survive in the residue of the crop.	- Feed on the internal cavity of the plant. - Destruction of central leaves (dead-heart) and tissues. - They are concealed inside the stem through boring of holes, so flow of water and nutrient from the root to the rest of the lant is impeded.	- Use of biological control by intercropping cereal with repellent crop so that the moth is pushed away such as Desmodium with millet. - Plant crop early to avoid infestation. - Clean up and destroy harvest residue. - Plant non-host crops such as cowpea, among the host plants
army worm *Spodoptera frugiperda*  Armyworm larvae  Adult armyworm	Rice, sorghum, Wheat, Maize	- Eggs are laid in tight cluster of 100-300 on the undersides of the leaves usually covered with scales. - Diet and temperature determine the length of the different life cycle phases.	- Young larvae eat one side of the surface of the leaf tissue. - They cut the base of the plant and attack the reproductive and young fruit. - Armyworm larvae cause extensive loss loss of leaves, feeding on seedlings up to the destruction of Buds and growing point	- Biological control with the use of Bio-insecticides containing neem extraxct or introduction of predators such as spined soldier bug, ground beetle, flower bugs, etc. - Use of insecticides. - Plant early to avoid peak population. - Plough the land to expose larvae and pupae to high temperature.

Earworm *Helicoverpa zea*  Prefers the fruiting stage of the host but will also attack the foliage.	Maize, sorghum	- Female moth lay white dome-shape egg singly on fresh silk or foliage, hatching 3-10 days. - Larval development takes about 18 days before they pupate in the soil and remain for about 8-14days.Development from egg to adult takes 3 to 4 weeks during the summer	- Larvae feed on the silk hair and then bore themselves into the ear. - Damaged leaves or affected plant creates an ideal environment for infection with other diseases. - Older caterpillars feed on older leaves and tunnel into fruit	- Biological control with the application of bio-insecticide, mineral oil or neem oil applied to the silk of each ear can prevent earworm invasion. - Till the soil in between season to expose pupae to harsh weather, bird and other predator. - Control weed in and around the field. - Plant resistant or tolerant varieties.
Pod borer *Maruca vitrata* or *Crochiphora testulalis*  	Legumes: groundnut, pigeon pea, cowpea, yard long bean It also affects other agricultural and horticultural crop such as chilli, sunflower, sorghum, tomato, cotton, etc.	- Eggs are pale cream, translucent (that is, they allow light through), and laid singly on the stems, young leaves, flowers and pods. - They hatch and the caterpillars feed inside the flowers for about a week; then they move to the pods. - They grow to 18 mm before they exit the pods and pupate in the soil.	- The larvae feed on the buds and flowers and bore into the pod to eat the developing seeds. - Seeds within damaged pods are totally or partially eaten by bean pod borer larvae. - In peanuts, bean pod borer larvae may web young leaves together and may tunnel into plant stems. - The flowers and pods are bound together by a frass-covered web, produced by the larvae. - Entry holes also let in water, which damage	- Do not plant crop on the same piece of land for more than two seasons (rotate cowpea with maize or another non-host). - Deep plough and harrow to kill larvae/ pupae or expose them to direct sunlight and predators. - Use resistant/tolerant varieties and/or early maturing varieties if they are available. - Plant early to avoid the period of heavy infestation. - Prune leaves with white silk threads that stick together and also remove older leaves to allow

			the remaining non-eaten seeds.	more sunlight to reach the leaves and stems of the plants. - Neem products have proven to be effective against the larvae and are more cost-effective than synthetic insecticides
Aphids 	Cowpea, pigeon pea, soybean,		- Some species carry plant virus that leads to the development of other diseases. - Aphids produce honey dew which leads to the development of moulds by fungi on the leaves. - Severe infestation causes shoots and leaves to curl, wilt and yellow. - They suck out fluid from tender plant tissue, resulting to a reduced plant vigour and stunted growth.	- Usage of insecticidal soap solution or solution based on plant oil, e.g., neem oil. - Control uses of insecticide. - Remove infected plant part. - Removal of plant debris from previous cultivation. - Eradication of weed in and around the field.
Leaf Beetle *Cerotoma trifurcate*	Cowpea, pea, soybean	Adult female lays egg in the upper two inches of soil near the plant stem about 125-250 eggs. - Larvae – grub-shaped, whitish, dark brown at both ends, segmented and have	- The transmission of bean pod mottle virus, cowpea mosaic virus, and southern bean mosaic virus is known to bean leaf beetles.	- Application of chemical insecticide. - Perform crop rotation. - Plow deep and avoid planting other legumes nearby.

		6 very small legs near the head. They are approximately 3/8 inch long when fully grown. - Larvae live in the soil where they feed on plant roots and have three instars. - Larvae develop to pupae in about 23 days. Warmer soil temperatures can shorten larval development time. - Pupation is completed in about a week and adults emerge from the soil.	- Adults feed on the leaves causing defoliation. As defoliation increases, yield decreases. - Larvae feeding on the root and root noodles causes damages which can reduce nitrogen fixation. - Adults also feed on the pods causing scarring. Pod damage can decrease yield and reduce seed quality. - Damaged pods are also predisposed to secondary infection by bacteria and fungi which may cause rotting and discoloration.	
Coooa mirids *Sahlbergella singularis* 	Cocoa, tea	- Adult female mirid insert her eggs in the green shoots, stems and pod. - The egg hatch in 13 - 18days and young nymphs begin to feed on the tree at night. - The life cycle is completed in about 40-50days.	- The feeding injury of these insects allows a die back fungi (Promote fungal Promote fungal infection), *Calonectria rigidiscula* to infect the cocoa tree. - Mirid bugs cause bugs cause lesions on pods.	- Foliar application of convectional insecticides.

			- The attack of capsid in cocoa plantation leads to capsid pockets and stag head. Destroy immature pods and destroy growing point.	
Yam beetle *(Heteroligus meles)* 	Tuber e.g., Yam	- In the soil near river banks, the beetles lay eggs and these hatches to produce creamy-white to grey larvae that feed on grass roots and other organic matter. - It takes 22-24 weeks from egg to adult, and emergence coincides with the beginning of rain and the planting of yams. -Just before harvest, further attack occurs as the beetles feed voraciously again and then migrate to the breeding sites.	- The adult beetles, beginning just after planting and continuing until harvest, feed on the yam planting material (sets) as well as the tubers. - The beetles leave tiny ones 1-2 cm deep round holes that allow secondary disease infections and cause the tubers to rot, leading to significant losses after harvest. - It will cause the plant to wilt and die if the attack is serious.	- Dust yam setts with ash during storage to repel and reduce population of beetles in barn. - Dip yam setts in insecticide solution. Treated setts can only be used as planting materials. - Yam farms should not be sited near swampy areas which serve as breeding sites for the beetles. - Plant yam later in the season (March-April) instead of earlier (Nov-Dec) to avoid beetle outbreak period - Do not store infested tubers for next season as this will serve as source of infestation, sort them out for sale or consumption. - Remove alternative host plants such as false yam and other edible root crops

 Cassava Mealy Bug Cassava mealy bug	Cassava	- Without mating, females produce eggs and lay up to 500 on the tips of the shoot, on the underside of the leaves and on the leaf stalks. - The eggs hatch, and before being adult, the nymphs or "crawlers" scatter to the top of the plant, settle, moult twice. - With temperatures of 28oC being optimum, the life cycle lasts about 50 days. - Spread occurs when crawlers travel over short distances on their own, or longer when carried by wind currents, cars, livestock, birds, on clothes, and when cuttings are exchanged or distributed.	- The mealybug sucks plant sap, causing leaves to distort, fall, and stems to dieback. - As the mealybugs feed, honeydew is expelled, falling onto leaves which become colonised by sooty mould fungi; these reduce the exchange of gases and photosynthesis, so weakening the plants further.	- Biological control includes the introduction of natural predators; ladybird beetles, parasitoid wasp, hoverflies, etc aid in preventing the spread of the population. - Foliar application of insecticide can be effective. - Remove and destroy infected plants or plant part. - Eradicate weed in and around the area. - Monitor the field regularly for the signs of the pest.
Green Spider mite  *(Mononychellus tanajoa or M. progresivus)*	Cassava	- There are four stages: a six-leg larva, two nymphs, and an adult. It takes about 12 days at 27°C from egg to adult. At first, adults are green; they become yellowish-green later. - For about 12 days, the adult female lives and lays about 60 eggs. Slightly larger	- They feed on the underside of young leaves by inserting their piercing and sucking mouth part into individual cells and extracting the cell content. - They attack the terminal shoot resulting in a	- Plant at the onset of the rains to encourage vigorous growth and thereby increase tolerance to mite attack. Cassava plants aged 2-9 months are the most vulnerable to infestation. - Use clean plant material for planting.

		than males, they grow to 0.8 mm. - During dry seasons, populations are greatest. - precipitation (Rainfall) helps to wash the mites from the leaves.	characteristic called 'candle stick', which refers to the necrotic and shedding of shoot tips. Initial damage appears as yellowish "pinpricks" on the surface of young leaves. Heavily attacked leaves are stunted, deformed, with poor growth, death and leaf fall.	- Use of acaricide abamectin is found effective for the control of the pest. - Predatory mite and parasitic fungi can be used in the biological control of the pest. - Plant good varieties with tolerance to mite. - Regularly monitor the field for symptoms and sightings of the mite and avoid transportation of infested material to market or other field as this is the main cause of dispersal.
Variegated Grasshopper  *(Zonocerus variegatus)*	Cassava, yam	Any plant offering shade is used as an egg-laying site, particularly isolated shrubs and shrubs on the edge of denser vegetation; these sites are very often within 30 m of fields of cassava (Manihot esculenta). The dark brown eggs, numbering 17-98, are laid in a mass underneath the soil or in leaf litters near the base of the bush.	- Z. variegatus can act as vector of cassava bacterial blight. - Variegated grasshopper feed primarily on leaves damaging the margin and cutting out portion of the leaf. - Tuber yield is reduced as a result of defoliation. Insect might even feed on stem, attacking the growing point of the plant and the	- Monitor the field regularly for characteristic signs and the present f grasshopper nymph and adult. - Deep ploughing is recommended to expose the eggs to predators. - Insecticides can be used to spray all instars of Z. variegatus.

Cotton stainer  *Dysdercus andreae*	Cotton	- Female lays whitish yellow eggs in batches of up to 100 in plant debris or moist soil or in crevices in the ground. - They hatch to produce reddish-orange nymphs. Initially the nymphs are wingless, but wings develop gradually as the nymphs grow. - In the region where the eggs have been laid, the nymphs are found together and later scatter to search for food (seeds and bolls). The nymphal period lasts for about 21-35 days. Adults feed by sucking sap from seeds.	- With the aid of their piercing mouth parts, both adults and nymphs feed primarily on the seeds, sucking out the juice. - Insects are also vectors which stain the lint yellow or brown which enables the transmission of fungal infections *(Nematospora sp.).* - They pierce through the boll and suck the seeds reducing germination capability and the quality of the seed oil and the cake. - Severe bug attack affects yield, oil content and the marketability of the crop.	- A number of natural enemies' target cotton stainers. Assassin bugs, ants, spiders, birds and parasitic flies are the most common ones. - Hand pick and kill the bugs. This is possible in small plots and at the beginning of infestations, and will help to minimize population density.

Boll-worm *Helicoverpa armigera* 	Cotton	- Eggs are laid at night usually on the tender terminals of the top third of the plant. The female moth will lay 1,000 to 3,000 eggs and after 2 to 8 days. - Depending on temperature, the eggs hatch and the larvae commence feeding close by the oviposition site. - The life cycle can thus be 25 to 35 days depending upon temperature, and six generations per year can be produced three of which could be on cotton.	Boll worm reduces yields through fruiting point damaged buds, flowers, young and mature bolls. - Feeding damage often provides entry for disease organisms, which can lead to boll rot. - Larvae change from fruit to fruit, especially when there are small fruiting points. 5-15 fruiting spots can be affected. The larger larvae can penetrate large bolls.	- Destruction of infected plant - Monitor plants for eggs and young larva by handpicking and destroying them. - Predatory insects can be introduced into the field to control the population of the boll worm. - Use of registered chemicals to control the population of the pest.
 **Thrips**	Vegetables and fruits; cabbage, cucumber, okra, Chilli, Tomato, Banana, Grape, melon, etc	- Egg-to-adult growth takes approximately 16 days in the thrips life cycle: - Eggs inserted into the plant tissue by the sharp egg-laying tube (ovipositor) of the female hatch in around 6 days. - The completion of two larval stages takes approximately 6 days; then, the prepupal and pupal stages take an additional 4 days. Fifty or more can be	- They are vectors of broad range virus. - Their feeding ruptures cells, causing stunted plants and crinkled leaves that curl upward. - Severe infestations can destroy terminal buds, causing excessive branching of the plants and delayed plant growth.	- Remove infected plants and any plant debris and destroy them. - Many small predators such as predaceous thrips, minute pirate bugs, and spiders feed on thrips. - Use of effective contact insecticide. - Plant resistant varieties. Monitor field regularly and avoid planting susceptible plants next to weedy

		produced by each female. - Thrips can reproduce without mating. Mated females produce both males and females; unmated females produce only males.	- Thrips attack leaves, leaf buds, and very small squares (flower buds), causing a silvering of the lower leaf surface, deformed or blackened leaves, and terminal and square loss.	arears and alternative host.
 **Grasshopper**	Tomato, wheat,	- The female grasshopper lays the eggs either under the ground or on litters of leaves after fertilization. A sticky substance is then sprayed on the eggs by the female to create an egg pod. About 10 to 300 eggs are in an egg pod. - After ten months, when the season is warm, the eggs hatch and come out as nymph. - They roam around searching for plant foliage to eat as the nymphs emerge from their respective nests. - The nymph appears similar to the adult grasshopper, but there are no reproductive organs or wings.	- Grasshopper feed primarily on leaves damaging the margin and cutting out large portion of the leaf. - Insect may also attack grain, pod, fruits, shoots and destroying reproductive part. An early hatch of grasshoppers may completely destroy newly germinated seedlings of some crop. This occurs when the grasshoppers invade the crop from heavily infested stubble.	- Grasshoppers have many natural enemies that help control their populations. insects that feed on grasshoppers, such as the larvae of blister beetles, bee flies, robber flies, ground beetles, flesh flies and tangle-veined flies. Birds (quail, turkey, larks, etc.). - One way to control grasshopper populations is to eliminate sites where they might deposit eggs. - Deep ploughing is recommended after harvesting to expose the eggs masses to predators. - Monitor the field regularly for characteristic sign of damage and presence of nymph and adult.

				- Remove weeds which serve as alternative host.
Leaf Roller  Species include fruit tree leaf rollers, variegated leaf rollers, red banded leaf rollers, oblique branded leaf rollers and omnivorous leaf rollers.  Leafroller caterpillar  Fruit-tree leafroller moth	Vegetables (Egg plant), ornamental trees and fruit tree	The leafroller eggs are laid on branches or twigs. Eggs hatch into tiny larvae, at first, the larvae stay together and feed on the undersides, only later staying alone inside folded leaves. - Larvae feed on leaves for about 30 days then pupate in a loose cocoon, which they form in a rolled leaf or similar shelter. Eight to 11 days later the adult emerges from the pupa.	- The larvae feed on unfolded leaves and also inside fruit and berries. As they feed, the rolled leaves become brown and die. - Leaf roller caterpillars fold the host plants' leaves and stick them together with silk webbing to create a shelter where they can safely feed on the leaves. - The young caterpillars feed on the leaves' inner surfaces, but they will eat through the leaves until the caterpillar reaches maturity. For host plants, this damage may be severe.	- For an organic alternative to kill leaf roller, use Organic Caterpillar BioControl, a bio-control product containing the naturally occurring soil bacterium Bacillus thuringiensis kurstaki (Btk) that can be used to protect vegetables, crops, fruit trees and ornamentals. - Beneficial insects such as ladybirds and bees are not harmed and there is no withholding period. - leaf rollers often establish on weeds so regularly weeding, cleaning and mowing will help to prevent infestations from these sources. - Remove and destroy infected leaves, caterpillar, and waste by burning it.

Leaf Beetle 	Vegetables e.g., pepper, okra, tomato		- Feeding by the adults appears as holes eaten through the leaf or skeletonization of the lower side of the leaf. - Reduction in yield and quality of vegetative part as a result of feeding habit of adults and larvae.	Spray with appropriate insecticide.
Scale insect 	Fruits and vegetables	- Eggs are laid underneath the scale covering of the adult female. When the eggs hatch, tiny immatures, known as nymphs, emerge. - Nymphs have legs and antennae and are called “crawlers” because they walk away from the maternal scale to settle at new feeding sites. - When the crawlers arrive at a suitable location, they insert their mouthparts into the plant, and begin to feed on the plant’s sap.	Scale insects feed by piercing-sucking mouth parts by sucking sap from trees and shrubs. - Sap feeding by scale insects may cause leaf yellowing or wilting, plant stunting or unthrifty appearance. - When infestations are large, the death of all or part of the plant. - Weakened plants can lose vigour and become more vulnerable to drought-induced injury, attack by otheir insects (such as borers), or infection by diseases.	- Parasitoids (small parasitic wasps) and predators (such as lady beetles) can attack and significantly reduce scale insect populations. Mechanically removing scale insects may be practical in certain situations such as small infestations on small trees and shrubs. - Heavily infested stems can be pruned out and discarded to reduce scale populations. - Insecticide applications may be warranted when natural enemies and mechanical controls are not sufficient to prevent plant injury.

			While feeding, soft scale insects excrete a sweet, sticky substance called honeydew. The honeydew may encourage a fungus called sooty mould that gives the plants a characteristic black, “sooty” appearance	
 **Grain Weevil** Maize weevil  (*Sitophilus zeamais*) Rice Weevil *(Sitophilus oryzae)*	Wheat, Maize, rye, oats, barley, sorghum, Rice	The female lays about 200 eggs at a rate of 2-3 per day depending upon temperature and humidity. - Placing each one in a small hole bored in the grain and sealing it in with a mucilaginous plug of saliva. - At 18-20°C the eggs hatch in 8-11 days to give small, white, legless larvae which feed on the endosperm of the grain. - Only one larva develops in small grains such as wheat and rice but large grains such as maize will support the development of several. - Larvae are never free-living and develop entirely within the grain.	- Reduction in the weight and quality of grain as a result of the adult and larvae feeding on the endosperm. - The germ is not always attacked so germination may take place, producing a weak seedling which is vulnerable to attack by moulds, bacteria and other insects. - Infested grain will usually be found heating at the surface, and it may be damp, sometimes to such an extent that sprouting occurs - Tainting with white, dusty excreta which contaminate the product as well as	- Stores should be soundly constructed to ensure maintenance of correct storage conditions and allow for easy cleaning. They should be insulated, well ventilated and damp-proof. - Stores should be kept scrupulously clean and farm stores should be thoroughly cleaned before harvest. - Fumigation of the store to kill exposed adult, larvae and pupae.

 Granary weevil *(Sitophilus granarius)*		- They moult four times, finally pupating within the grain after 6-8 weeks. - The adults emerge after a further 5-16 days and will live for about 9 months.	rendering it unpalatable. - They damage and render grains unattractive by creating holes in the grain.	
Bean beetle (Cowpea weevil) *Callosobruchus maculatus* Bean beetle (*Callosobruchus maculatus)* 	Cowpea, soyaban, pigeon pea, Bambara groundnut	- Adult females will lay (oviposit) single fertilized eggs on the external surface of a dry bean seed in the field. - Individual eggs (0.75 mm long) are oval or spindle shaped, clear, shiny, and firmly glued to the bean surface. - The larva that hatches from the egg burrows from the egg through the seed coat and into the bean endosperm without moving outside the protection of the egg. - The larva burrows and feeds on the bean endosperm and embryo, undergoes a series of molts, and burrows to a position just underneath the	- The insect attacks the fruiting stage, seeds and all stored grains and products.	- Chemical pesticides used for the control in the field and under storage. - Fumigation of the storage facility Seed treatment with phostoxin. - If available plant resistant varieties. - Harvesting at the right time to prevent infestation of pods in the field

		seed coat prior to pupation. - Pupation is the complete metamorphosis of the larval maggot to a winged adult.		

Summary:

1. Pest is an organism that causes problem by damaging crops, food production, parasite to animal or being a nuisance and health hazard to human

2. Pest are classified into two major groups as follows:
   - Insect Pest: They attack and destroy plant at different stages of their development. They are the most serious pest of agricultural importance. Examples of insect pest are grasshopper, locust, weevils, termites etc.
   - Non-insect Pest: These are bigger organism other than insect which are mammals or birds. They attack crop plant mostly cereals and other crops at different stage of growth and during storage, they are not as many as insect pests. Non-insect pest can be grouped into:
     - Rodents
     - Monkeys
     - Man
     - Nematodes
3. Based on their mouth part for the mode of feeding, insect pest can be divided into three group:

- Piercing and Sucking Insect
- Biting and chewing insect
- Burrowing Insect

4. Effect/Economic Importance of Pest include the following:

- As a result of the procurement of chemicals and labor incurred by their implementation, they raise the cost of production during the process of regulating them.
- Some are carriers or disease vectors, e.g. Aphids are vectors of the famous bean mosaic virus and white flies as tomato leaf curl virus vectors.
- They cause injury that can predispose the crop to attacking disease.
- Etc.,

5. See table above on the nature of damage, life cycle, prevention and control measure and economic importance of major insect pest of crop.

Assessment:

1. In a tabular form, state the crop affected, nature of damage/economic importance, prevention and control measures of the following pest:
    a. Cowpea weevil
    b. Cotton stainer
    c. Cassava Mealy bug
    d. Thrips
    e. Aphids
2. Briefly discuss the lifecycle and the nature of damage of the following insect pest
    a. Variegated grasshopper
    b. Leaf roller
    c. Pod borer
    d. Boll worm
    e. Armyworm
3. State 5 effect/economic importance of insect pest
4. Briefly explain the classification of insect pest according to their mouth part