

## WEEK 3 BASIC SCIENCE

### TOPIC: PESTS AND DISEASES OF CROPS:

**SPECIFIC OBJECTIVES:** By the end of this lesson, students should be able to;

1. Define pest.
2. Classify pests based on the parts of crops they attack and their animal types.
3. Explain the life cycles of some pests.
4. Discuss methods of pest control.
5. List diseases of crops and their causative agents.
6. Suggest ways of controlling crop diseases.

**PEST:** A pest can be defined as any animal (or plant) which causes damage to crops or livestock thereby reducing their yields and economic values. Pests are living organisms which may bite, destroy food crops, damage property or otherwise make lives more difficult.

**Classification of Pests:** Pests can be classified based on;

- A. The part of crops/plants they attack
- B. The type of animal

**A. Based on the part of plants they attack, pests can be classified as;**

- i. Leaf feeders
- ii. Root feeders
- iii. Stem borers
- iv. Young shoot feeders
- v. Fruit and seed eaters
- vi. Pests of stored grains

I. **Leaf feeders:** These are pests that feed mainly on the leaves of plants. They are referred to as defoliators because they cause the removal of leaves (foliage) of crops, a process known as defoliation. Pests that feed on the leaves of plants are mostly insects such as grasshoppers, beetles, pecan leaf case bearer, moth caterpillar, butterfly caterpillar, sawfly larva, etc. Snails also feed on the leaves of plants. Plants that are usually devastated by these pests include cassava, soya bean, maize, pumpkin, etc.

II. **Root feeders:** Some pests feed on the roots of crops/plants. These pests live mostly inside the soil. They either prune off roots below the surface or suck root fluids which make them wilt or stunt the growth of the crop. Examples of root feeders are beetles, gnats, grubs, meadow mice, root-knot nematodes, etc.

- III. **Stem borers:** These are mostly insects that attack the stems of plants/crops. These insects bore or make holes in the stem of crops and feed on the vascular tissues. The boring activities of these insects weaken the plants and make them fall even with the slightest wind. Examples of boring insects are maize weevils, moths, etc.
- IV. **Young shoot feeders:** Some pests feed on young shoots of some crops. The pests pierce into the shoots and suck juices from the shoots. These actions of pests prevent water and mineral salts from reaching the leaves resulting in wilting of the leaves. Examples of young shoot feeders include water flies, aphids, rabbits, slugs, mice, etc.
- V. **Fruit and seed eaters:** A wide variety of pests feed on the fruits and seeds of different plants. Examples include cotton stainer, weevils, fruit flies, etc. Cotton stainer feeds on the seed of cotton plant using its piercing and sucking mouthparts which pierces through the cotton bolls and stain it yellow. The cotton stainer also attacks other crops like okra, tomato, orange, etc. Fruit flies pierce through the pulp and seeds of fruit such as pawpaw and lay eggs inside the fruit.
- VI. **Pests of stored grains:** Some pests, both insect pests and rodents infest harvested or stored crops especially cereal grains such as rice, wheat, sorghum, millet, and other crops like groundnut and beans. Insect pests involved are weevils, beetles, moths while rodents include rats, rabbits, etc.

## **B. Based on the type of animal, pests are classified into two**

### **I. Invertebrate pests**

### **II. Vertebrate pests**

- I. **Invertebrate pests** are pests that do not have backbone. Many pests that attack crops both in the farm or when stored belong to this category. Invertebrate pests include the nematodes (unsegmented worms) and insects/arthropods. Examples of invertebrate pests are grasshopper, cotton boll weevil, fruit flies, beetles, ticks, caterpillars, crickets, termites, wood ants, etc.
- II. **Vertebrate pests** are animal pests that possess backbones. They include mammals such as rats, rabbits, grass cutters, pigs, monkeys, squirrels, deer and birds such as guinea fowl, weaver birds, pigeon, quail, etc.

## LIFE CYCLES OF SOME PESTS:

### Life Cycle of Beetle:

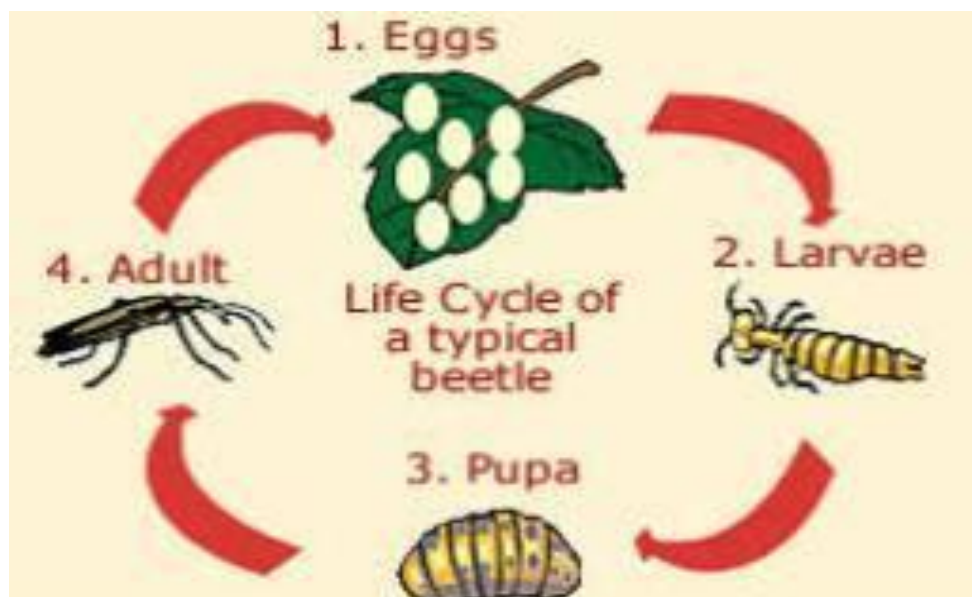
Beetles under complete metamorphosis which means that they pass through four stages of development i.e. Egg→larva→pupa→adult (imago). The male and female beetles mate for the introduction of spermatozoa into the female reproductive system and for the fertilization of eggs. This kind of fertilization is called internal fertilization.

**Egg stage:** The life cycle of beetle begins with the female beetle laying hundreds of tiny, oval, white or yellow eggs usually on a leaf, in the soil or in rotten wood depending on the species involved. For instance, the leaf beetles are leaf rollers. They bite sections of leaves to cause them to curl inwards and then lay their eggs inside the leaves for them to be protected. It usually takes 4-19 days for the eggs to hatch into the larval stage.

**Larval stage:** The larva of beetle is called grub. The larva eats tremendous amount of food and continues to grow, shedding its exoskeleton many times while it grows. This process of removing the exoskeleton is known as **ecdysis** or **moulting**.

**Pupa stage:** This is the resting stage where gradual transformation into the adult stage takes place. The pupa does not move about and seems to be inactive. The pupa stage usually occurs during winter and can last for about 9 months. After pupating, an adult beetle emerges.

**Adult beetle:** Adult beetle feeds, move about and mate with the opposite. After mating, the female beetle lays eggs for the beginning of another generation.



LIFE CYCLE OF BEETLE

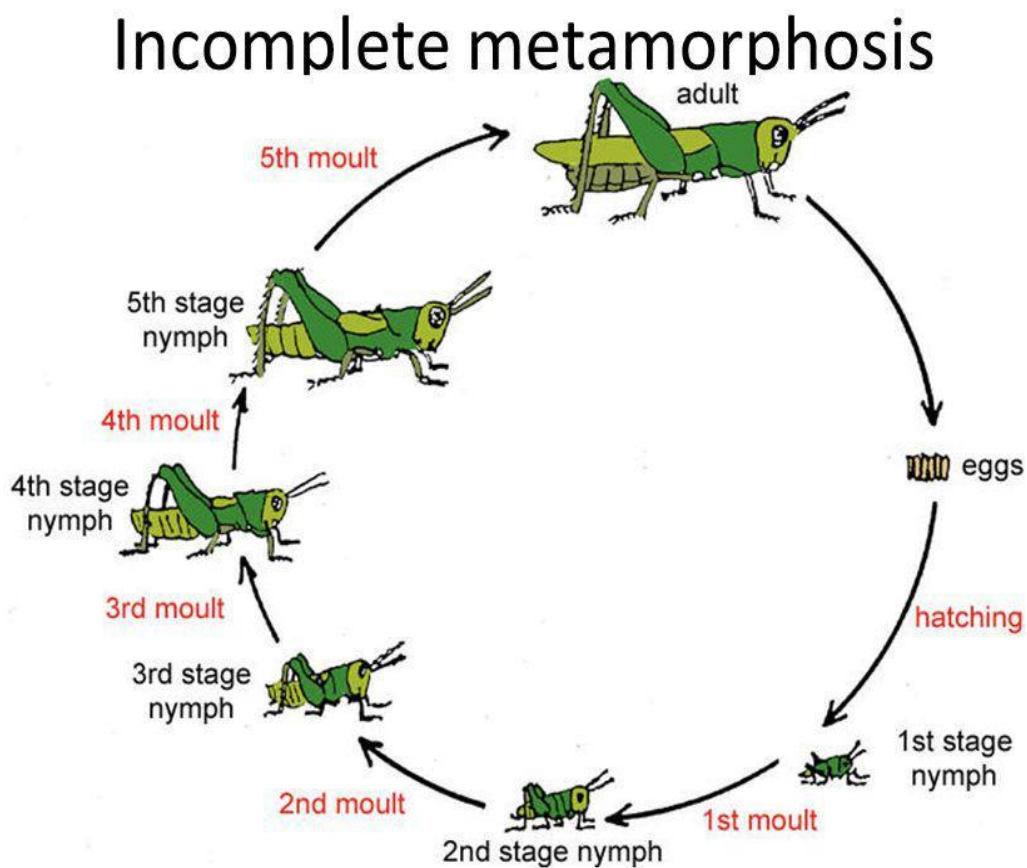
## Life Cycle of Grasshopper

Grasshopper undergoes incomplete metamorphosis which involves three major stages—the eggs, nymphs and adults. The male and female grasshoppers mate for fertilization to take place.

**Egg stage:** The female grasshopper lays fertilized eggs either underneath the sand (about 1-2 inch depth) or among leaf litters. Immediately after depositing the eggs with the help of the ovipositor, a sticky substance is shed over them which harden to form egg pod. There are usually more than 10 egg pods, each of which contains about 10- 200 rice shaped eggs. The eggs remain dormant for months (about 10 months) especially during winter. When the weather becomes warm, the eggs hatch into nymphs.

**Nymph stage:** The nymphs feed on soft and succulent plant foliage. Nymphs are miniature versions of adult grasshoppers except they are light in colour, smaller in size and wingless. Nymphs undergo 3-6 moults and change their forms before becoming adults. As they moult, they increase in size and wing pads gradually develop on the thorax part of the body. After about 25-30 days, the wings develop completely and they become adults.

**Adult stage:** This is the final stage of development. At this stage, the grasshopper gain sexual maturity after about 15 days and the cycle continues.



LIFE CYCLE OF GRASSHOPPER

## CONTROL OF PESTS:

Pests of crops can be controlled through the following methods;

1. Physical method
2. Cultural method
3. Chemical method
4. Biological method
  1. **Physical method:** This involves the removal of pests by hand-picking of insects and their larvae, setting traps or sticky boards to catch rodents, shooting rodents with gun, fencing round the farm with wire nets. This method of pest control is used when the number of crops affected is small or when the pest population is still small.
  2. **Cultural method:** This method involves the use of farm practices to prevent or control pests especially on the field. Cultural method aims at modifying the pests environment to make it unfavourable for the pests to survive. Some cultural method strategies include crop rotation, mixed cropping, early planting, regular weeding, use of resistant varieties, etc.
  3. **Chemical method:** This involves the use of chemicals to eliminate or control pest population. These chemicals can be in form of powder, liquid, granules and emulsions. Examples of chemicals used are
    - i. Pesticides- chemicals used to control pests
    - ii. Avicides—chemicals used to control birds
    - iii. Rodenticides-chemicals used to control rodents
    - iv. Nematicides—used to control nematodes
    - v. Insecticides—used to control insects
  4. **Biological method:** Biological control involves the introduction of the natural enemies of the pests to control or keep the pest population under control. Such enemies eat up the pests thereby reducing their populations.

Three **categories** of natural enemies of insect pests are *predators, parasitoids and pathogens*.

- i. A predator is a large animal which kills and feeds on a smaller animal called the prey.
- ii. A parasitoid is any organism (especially insects) that is parasitic during part of its life cycle (e.g. larva) which eventually kills its host.
- iii. Pathogens are microorganisms that cause diseases to plants and animals such as viruses, bacteria, protozoa and fungi.

## DISEASES OF CROPS:

A plant disease can be defined as the departure or deviation of the plant from the normal state of health, presenting marked symptoms or outward visible signs. Many diseases of crops are caused by microorganisms such as viruses, bacteria, fungi and also by nematodes/round worms. Some diseases of crops occur as a result of nutrient deficiency. Microorganisms that cause diseases are called pathogens. Some of the pathogens are transmitted by some insects or rodents called vectors. The vectors do not cause diseases but transfer the pathogens to the host/plant. The pathogens infest some parts of plants and disrupt their functions and growth rate which leads to low crop yield. The table below shows some diseases of crops, their causative agents, mode of transmission, symptoms and control measures;

Name of Disease	Causal organism	Method of transmission	Symptoms and economic importance	Prevention and control measures
Maize smut	Fungus (Ustilago maydis)	i. Air borne ii. Spores deposited on fruits	i. Reduced yield ii. Galls on ears, leaves and tassels which later turn black.	i. Destroy diseased plants ii. Use resistant varieties iii. Seed treatment
Rice blight	Fungus (Pyricularia oryzae)	i. Airborne ii. Spores deposited on leaves	i. Small longitudinal red spots on leaves which turn grey or brown ii. Reduced yield	i. Use clean seeds ii. Avoid heavy use of nitrogen fertilizers iii. Use resistant varieties
Coffee leaf rust	fungus	i. By wind ii. By rain splash	i. Yellow or brown spots on leaves ii. Orange powdery mass on the leaf iii. Reduction in yield iv. Dropping of leaves	i. Plant seeds from healthy plants ii. Use resistant varieties iii. Spray with copper fungicides
Rosette disease of groundnut	virus	By piercing and sucking insect (Aphid)	i. Yellow leaves with mosaic mottling ii. Stunted plant with curled leaves iii. Wilting and death of plant iv. Shortening of internode	i. Early planting ii. Crop rotation iii. Use insecticide iv. Uproot and burn infected plants v. Use resistant varieties
Cassava mosaic	virus	i. Through piercing and sucking	i. Mottling of leaves	i. Use resistant varieties ii. Uproot and burn infected plant iii. Spray with insecticide to kill vector iv. Use disease free stem cuttings

		ii. insect (whitefly) Infected plant cuttings	ii. Mosaic pattern on leaves iii. Stem/leaf distortion iv. Stunted growth v. Reduction in yield	v. Farm sanitation
Leaf blight of cassava	Bacterium (Xanthomonas manihotis)	i. Infected cutting ii. Rain splashing iii. Insects iv. Tools	i. Blighting of leaves ii. Wilting of plant iii. Falling off of leaves iv. Reduced yield v. Canker of stem vi. Die-back of stem	i. Use resistant varieties ii. Use disease free cuttings iii. Early planting iv. Practice crop rotation
Root knot of tomato/okra	nematode	Nematodes in soil	i. Knotting or galling of roots ii. Retarded growth iii. Reduction in yield	

**Evaluation Questions:** Students should answer the following questions;

1. Define pest.

2a. List four pests of crops (b) Discuss one of the pests under the following;

- i. Crops attacked
- ii. Economic importance/effects on crops
- iii. Control measures

3. Name three classes of pests based on the part of crops they attack.

4. With the aid of diagrams, describe the life cycle of a named pest.

5. Briefly explain two methods of pest control.

6. Explain one crop disease under the following;

- i. Causative agent
- ii. Method of transmission
- iii. Symptoms/economic importance
- iv. Prevention and control measures

### ASSIGNMENT

- 1) Discuss two processes that remove oxygen from the atmosphere.
- 2) State six importance of water to living organisms.
- 3) Briefly explain the following;

- a. Ammonification.
- b. Nitrification
- c. Nitrogen fixation

4. Differentiate between oviparity and viviparity.

5. Name four oviparous animals.