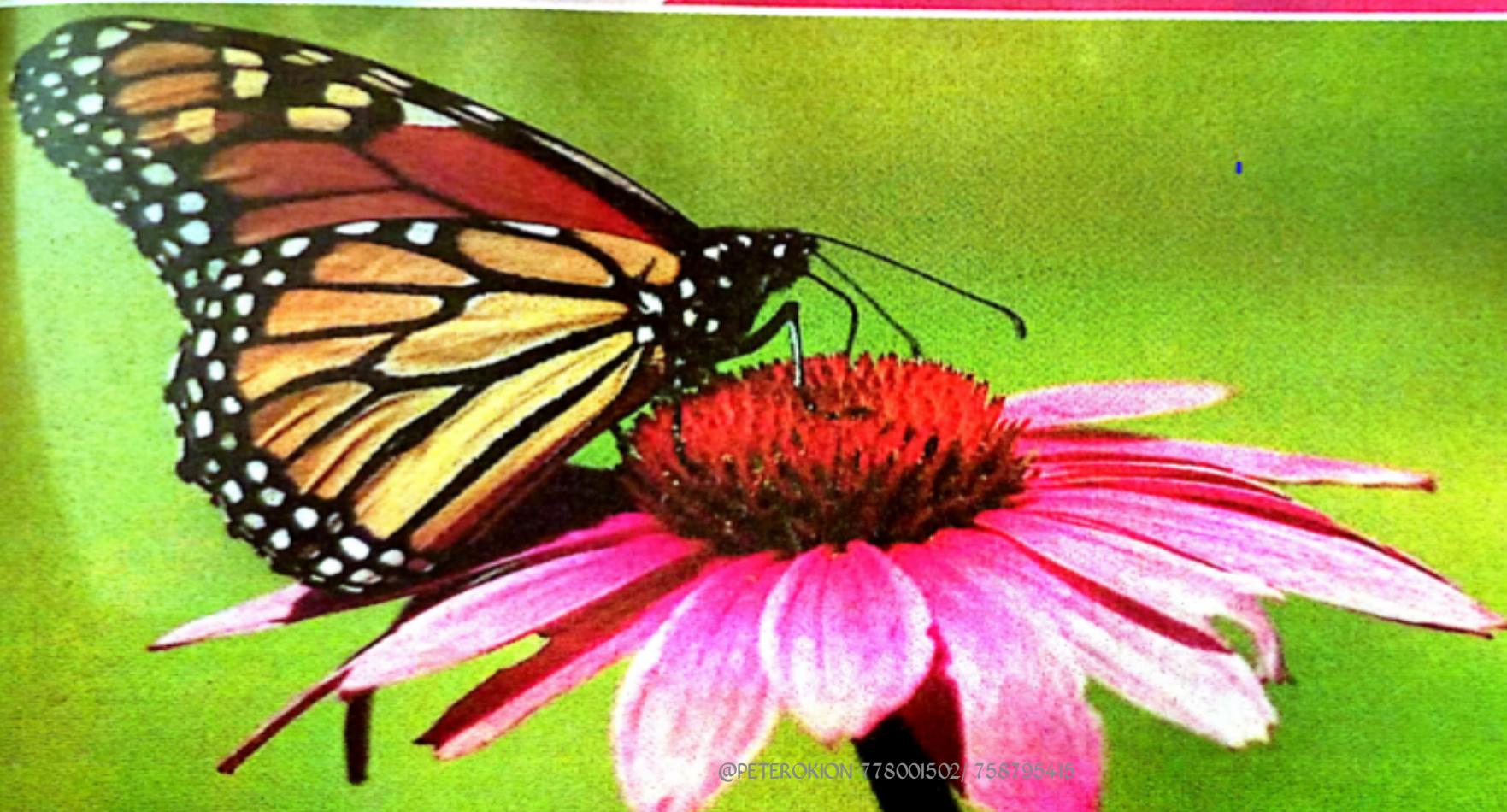


Chapter 4

Insects



INSECTS



By the end of this chapter, I should be able to;

- a) Identify the observable external features of a housefly, cockroach, mosquito, termite, bee and butterfly.
- b) Construct a dichotomous key
- c) Appreciate the useful and harmful effects of insects
- d) Know the different methods of controlling the harmful stages of insects

Introduction

QN: Can you identify some of the common insects we interact with in our environment?

- Do you remember the phylum and class to which they belong?
- Insects are invertebrates without a backbone whose body is covered with a hard outer covering called an Exoskeleton.
- Insects have for a long time been known as pollinators, honey producers, vectors, food and for beauty.

- **Habits and habitats of some common insects**

Cockroaches

- live in damp but warm places and are generally found in kitchens and cupboards.
- They are nocturnal animals hiding in holes and crevices during the day and coming out at night.
- They feed on plant and animal material.

- **Houseflies**

- live in warm places and are generally found everywhere around the homes.
- Houseflies breed in manure and decomposing material.
- They are seen flying around during the day and hiding away at night.
- They feed on anything whether plant or animal material and your food left uncovered.

Mosquitoes

- live in dark and cool places.
- The eggs, larvae and pupa are found in ponds, slow flowing water or in stagnant water in tins and broken bottles.
- They are nocturnal animals hiding in dark places during the day and coming out at dusk.

Honey bees

- live in various types of hives.
- They are social insects, exist in different castes i.e.
- Fly around during the day from one flower to another and at water points.
- When the sun goes down, they retire to their hives.
- They feed on nectar from flowers



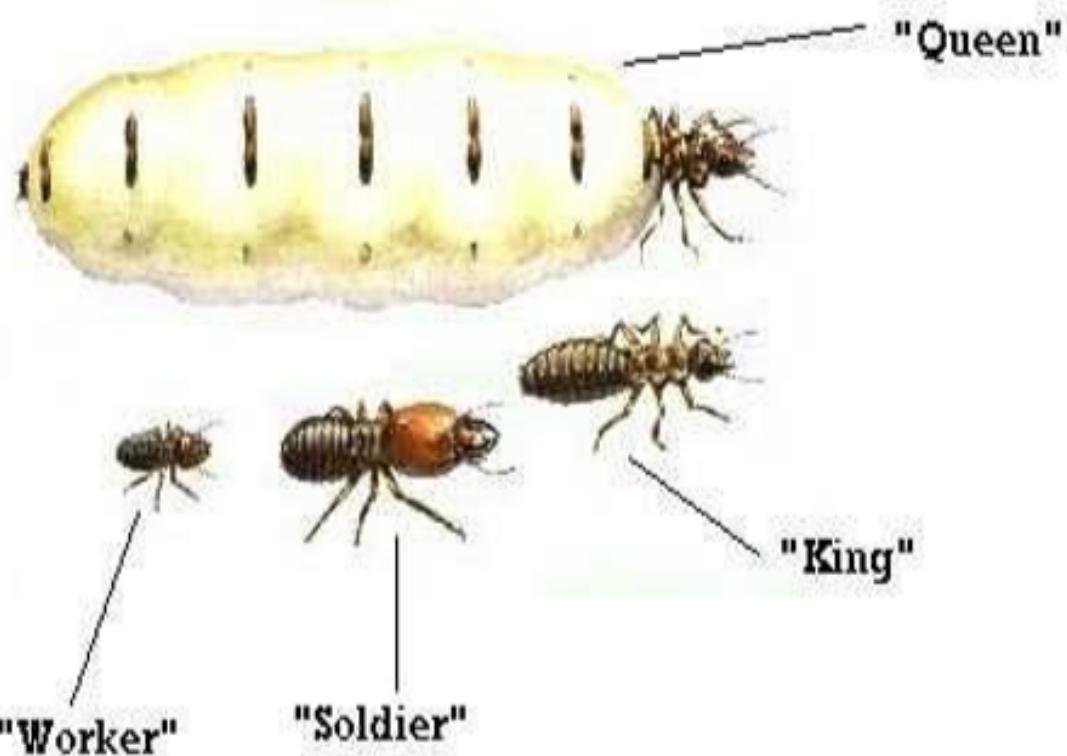


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Termites

- live in damp but warm termite mounds.
- They are social insects living in colonies
- They exist in 4 castes i.e.
.....
- They feed on fresh and dry plant material.

"Members of the Termite colony"





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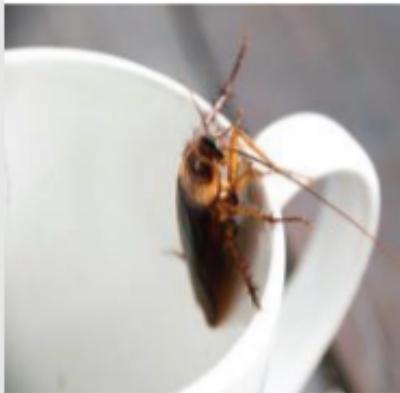


Butterflies

- live in various areas.
- Fly around during the day from one flower to another and at water points.
- When the sun goes down, they also hide in trees.
- They feed on nectar from virtually every flower available.



Characteristics of insects



Ctd

- i) Insects have three main body parts, namely: the head, thorax, and abdomen.
- ii) They have three pairs of walking legs on the thorax. One pair of walking legs per segment of the thorax.
- iii) They have a thorax divided into three segments i.e. prothorax, mesothorax and metathorax.

Exercise

- If a fellow student says a cockroach, termite and butterfly are all insects, how do you explain his/her statement using your observation of these insects

External features of insects

- All insects have a head, thorax and abdomen. These parts bear other structures that enable the insect to function normally and live well in its environment

Do all insects look exactly the same?
How are the insects below similar or different ?



Butterfly



Bee



Cockroach



Termite

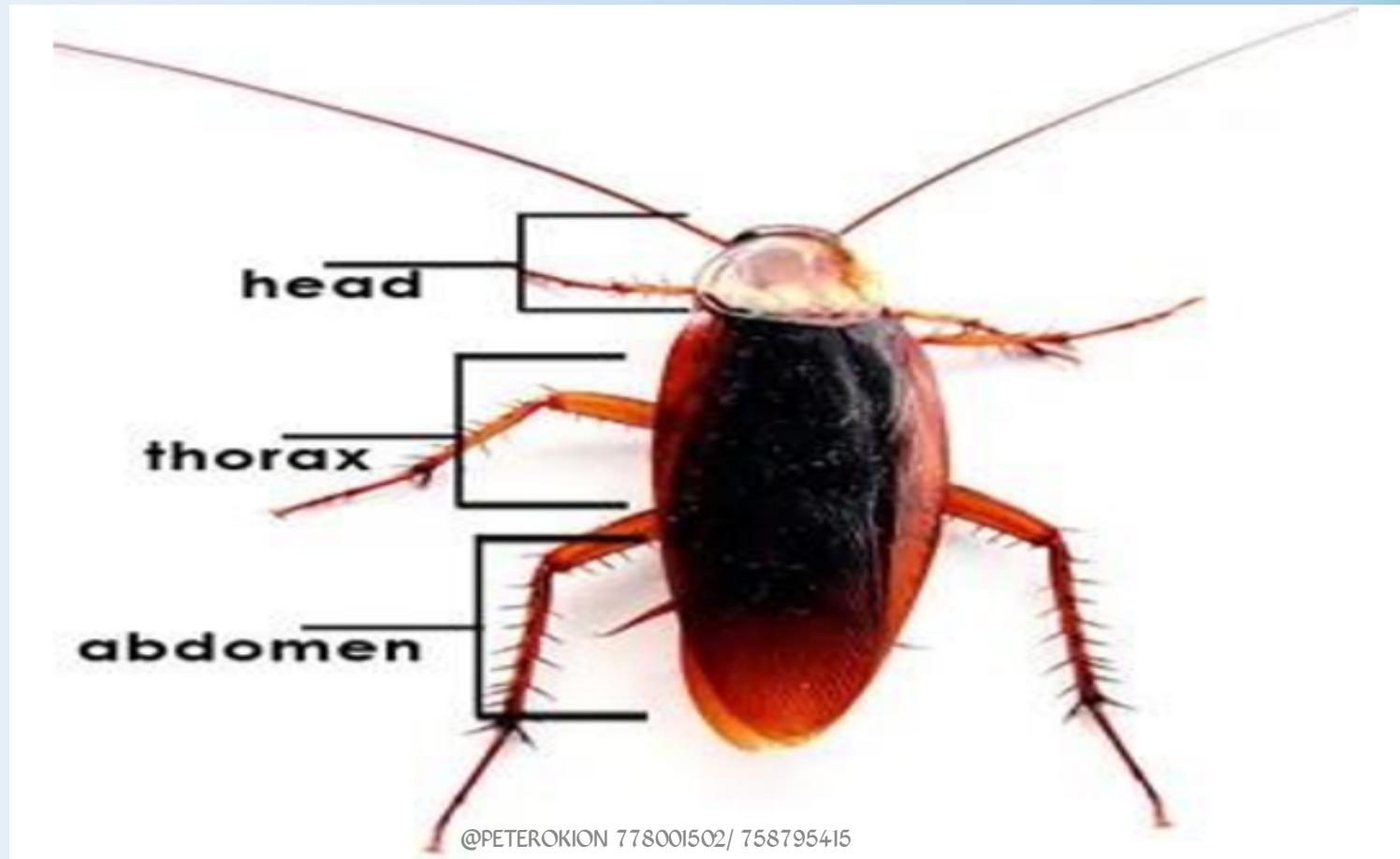


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Mosquito



Housefly

Three main parts of an insect



Drawings of the views of a cockroach

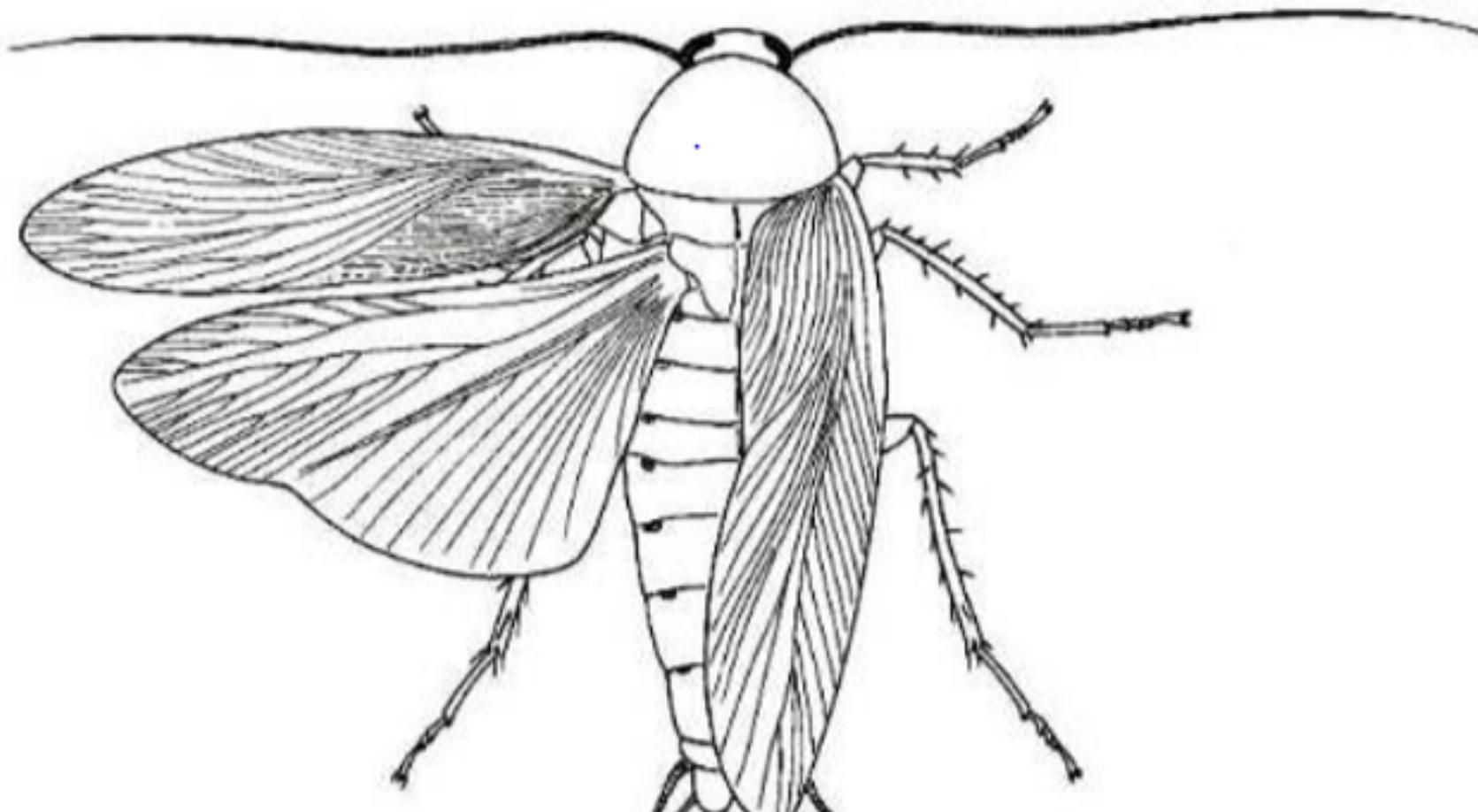
Dorsal view (back view)



Ventral view

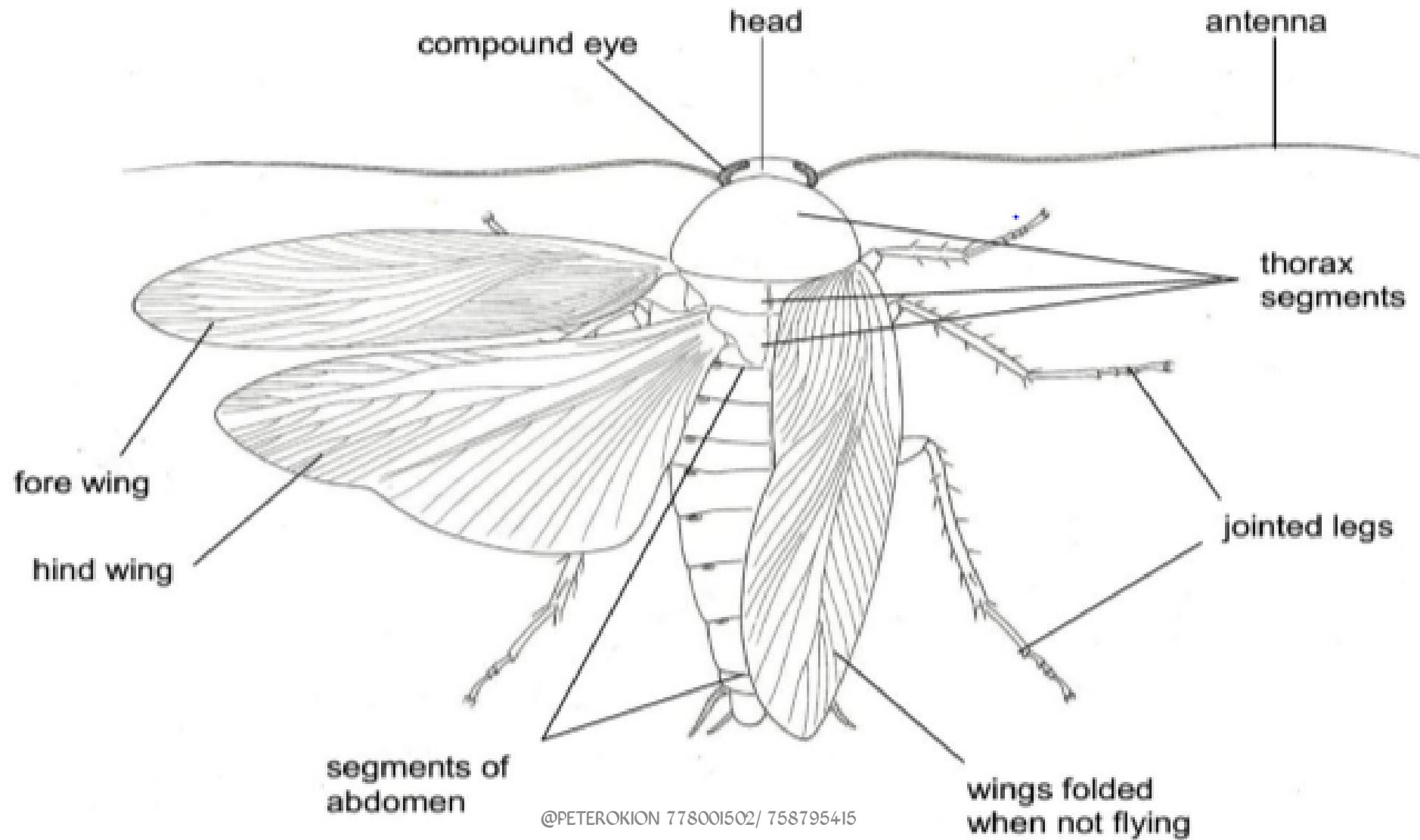


Dorsal view with wings spread out

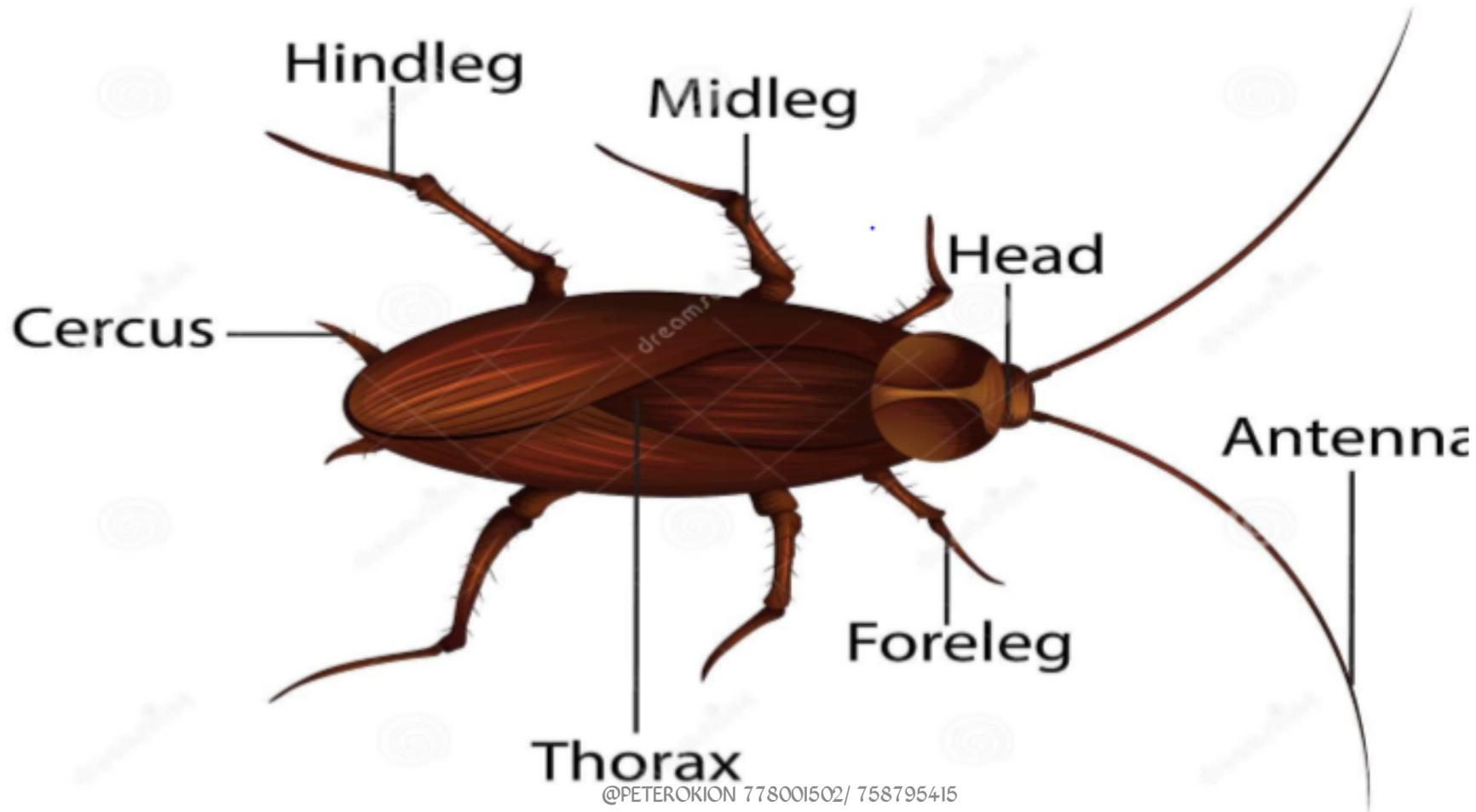


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A drawing of the dorsal view of the cockroach with the left wings spread



External anatomy of a cockroach



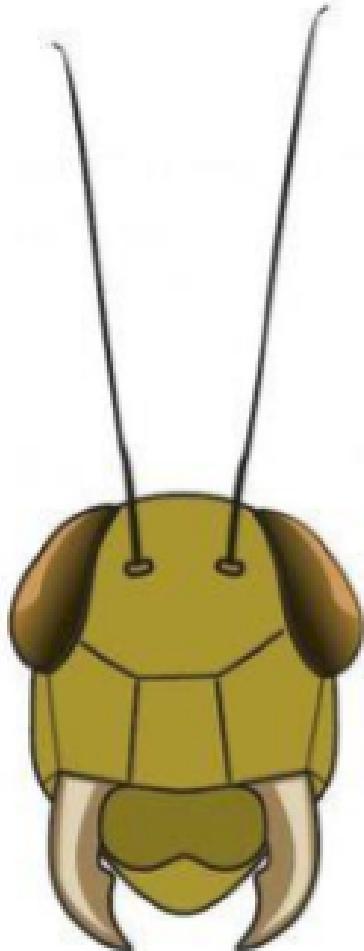
The Head of an Insect

- The head of an insect bears antennae, mouth parts suited to the type of food the insect feeds on and may or may not have eyes.
- If the insect has eyes they are either simple or compound

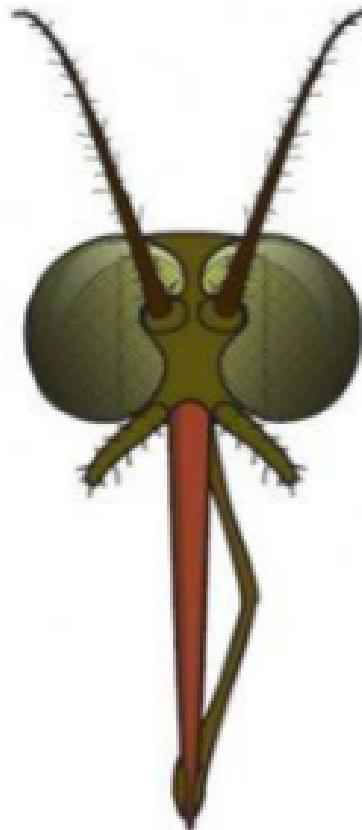
Activity: fill the table below using the pictures given

Feature	Cockroach	Bee	Housefly	Butterfly	Mosquito	Termite
Type of mouth parts						
Antennae Number Length						
Eyes Number Type						

Insect Mouthpieces



Chewing

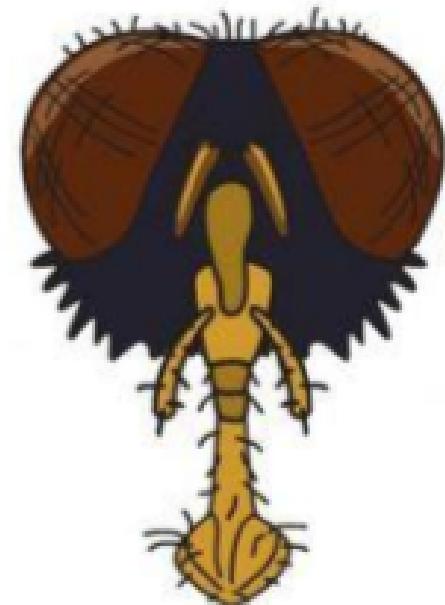


Piercing-sucking

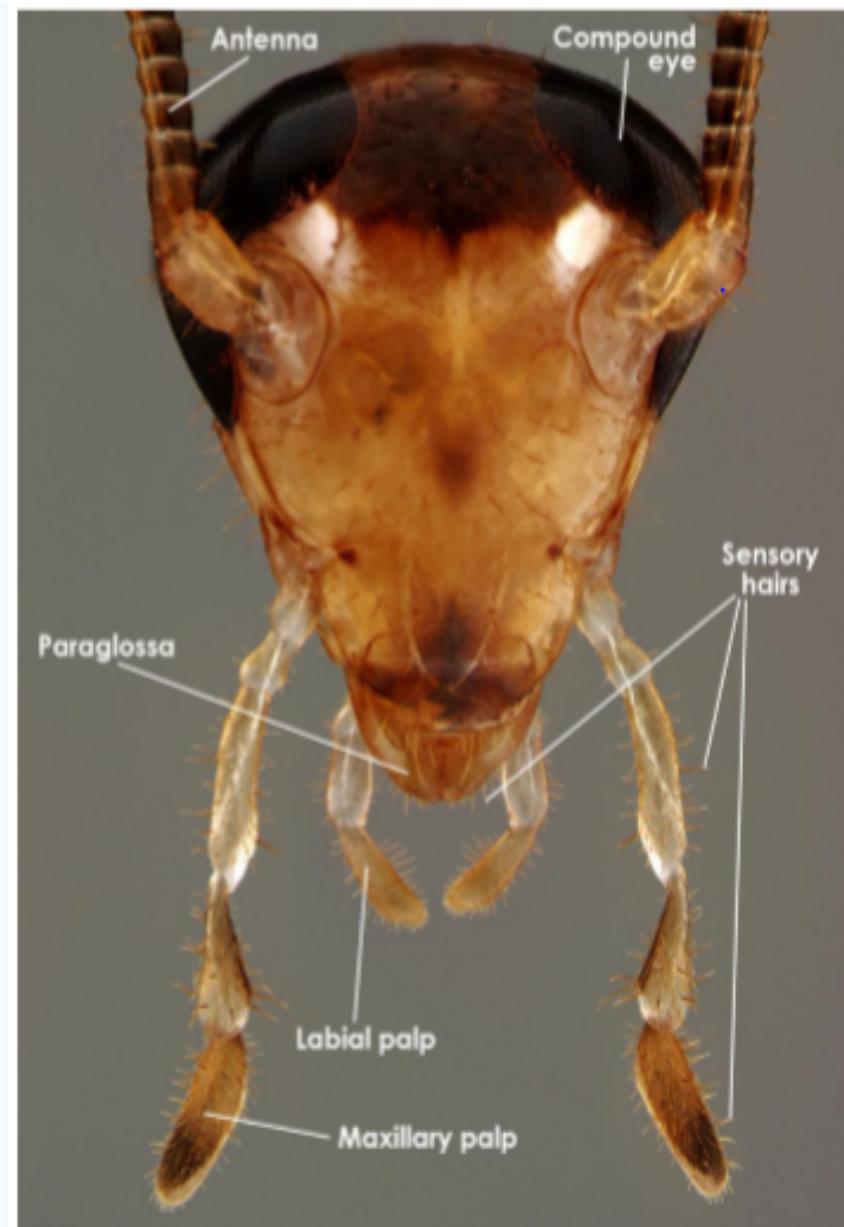
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Siphoning



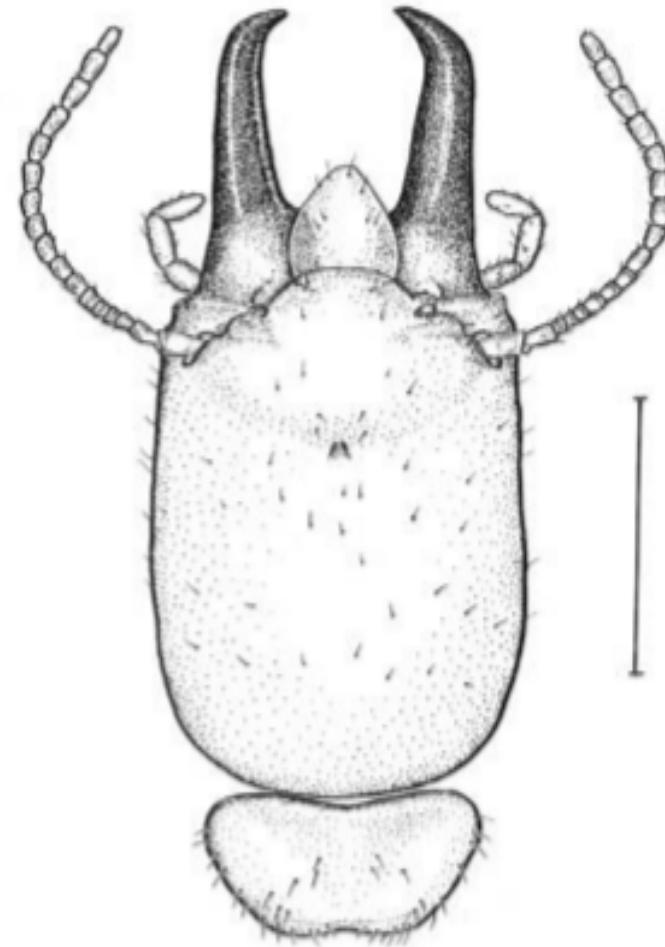
Sponging

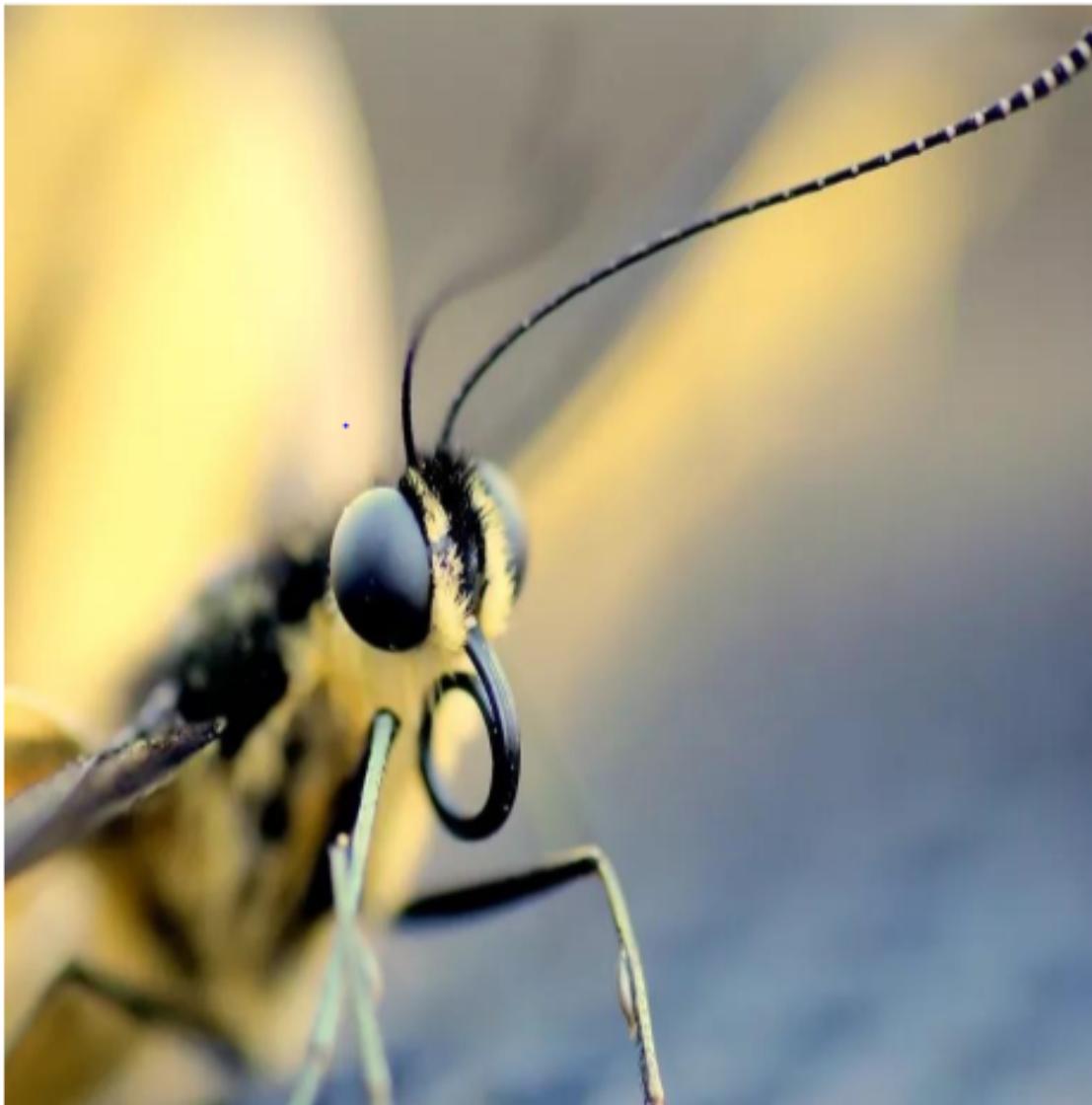
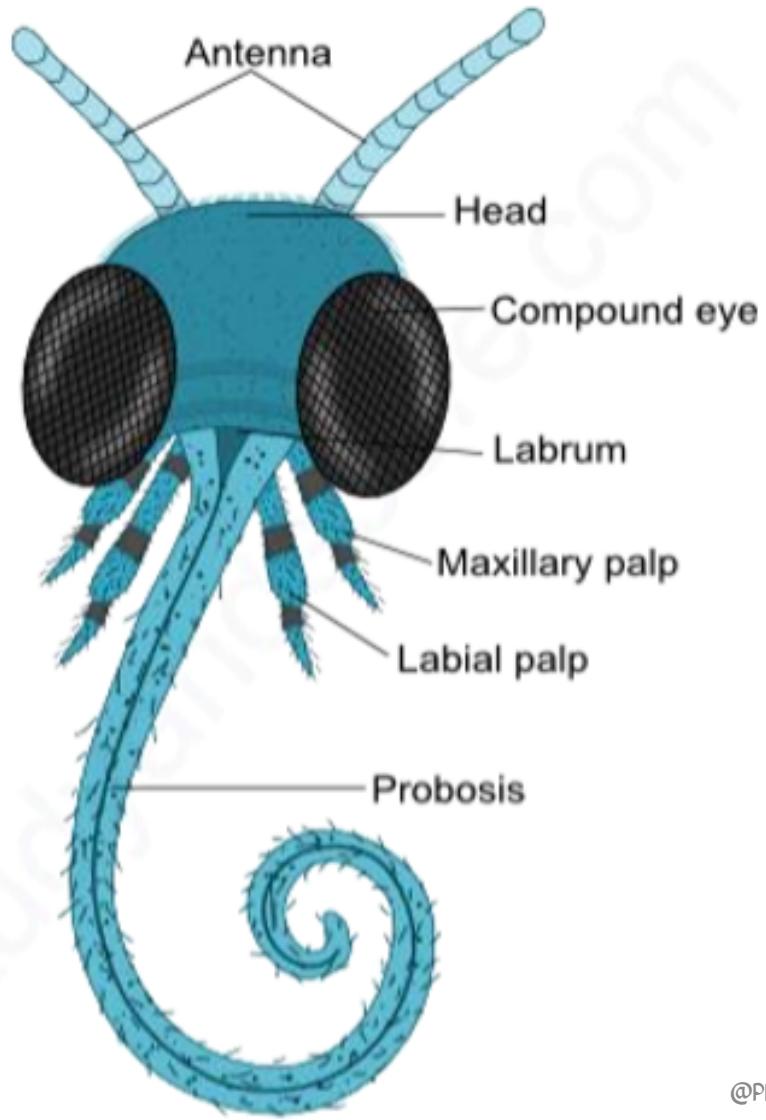


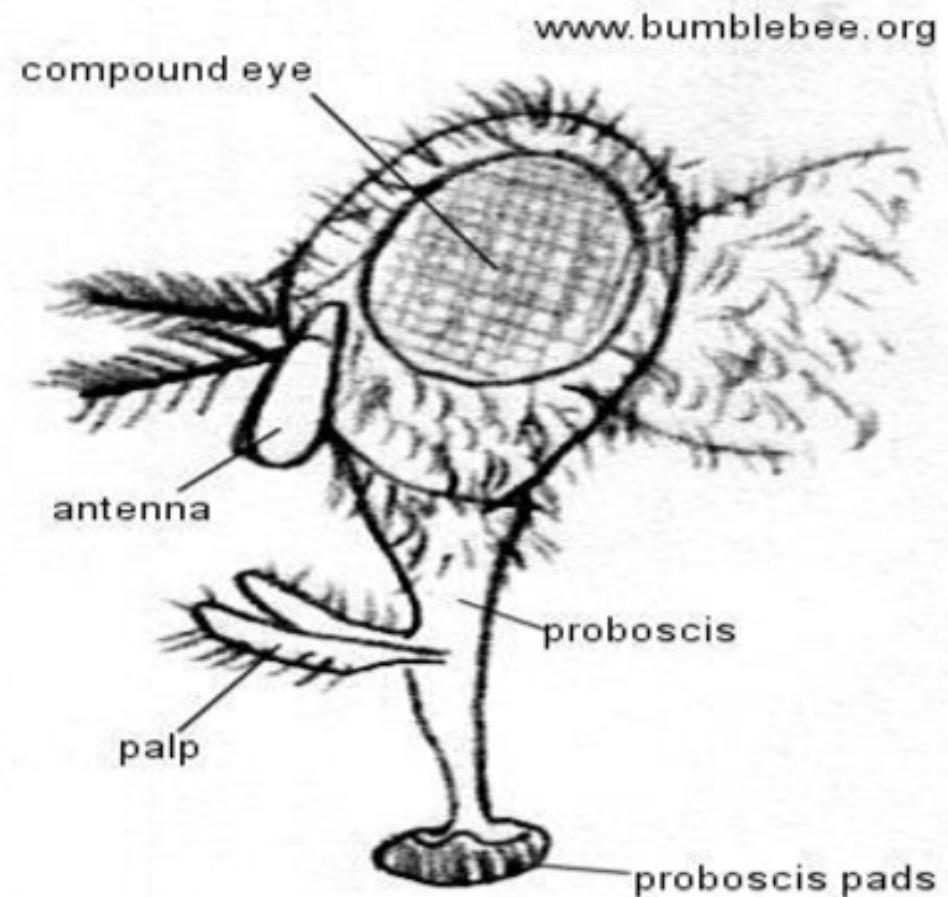


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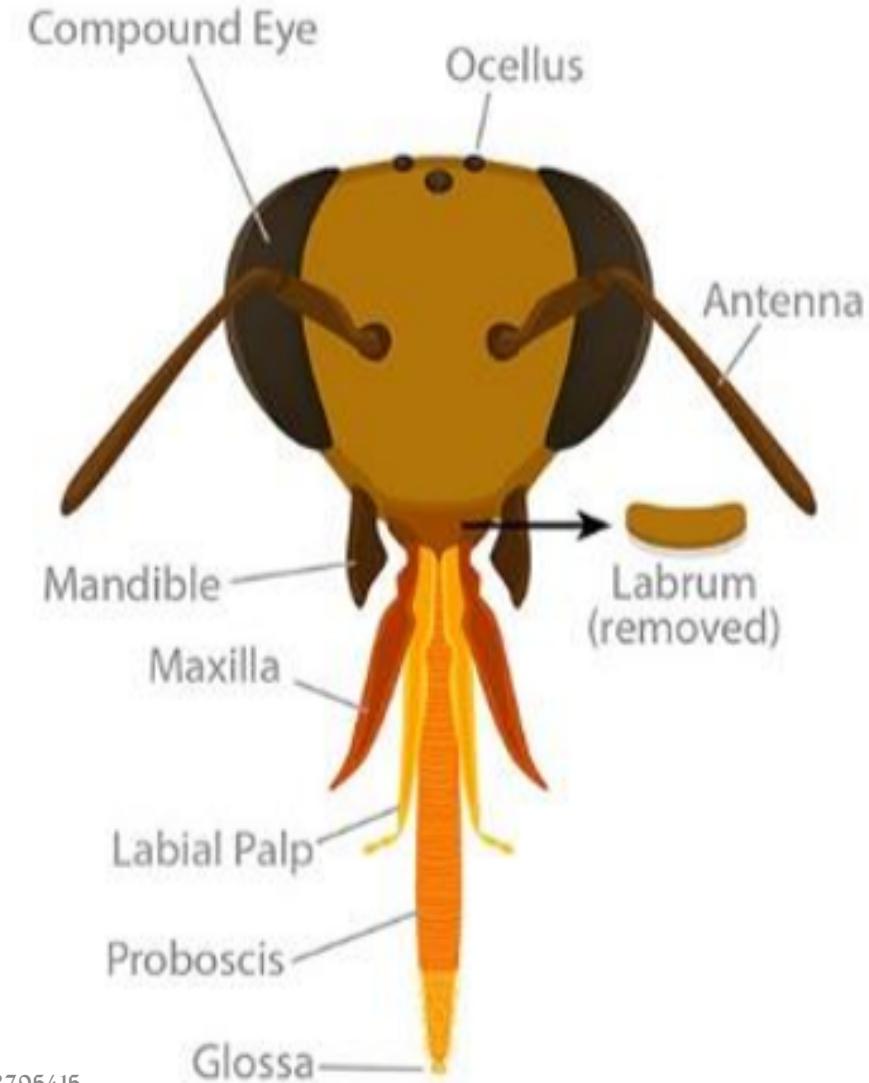




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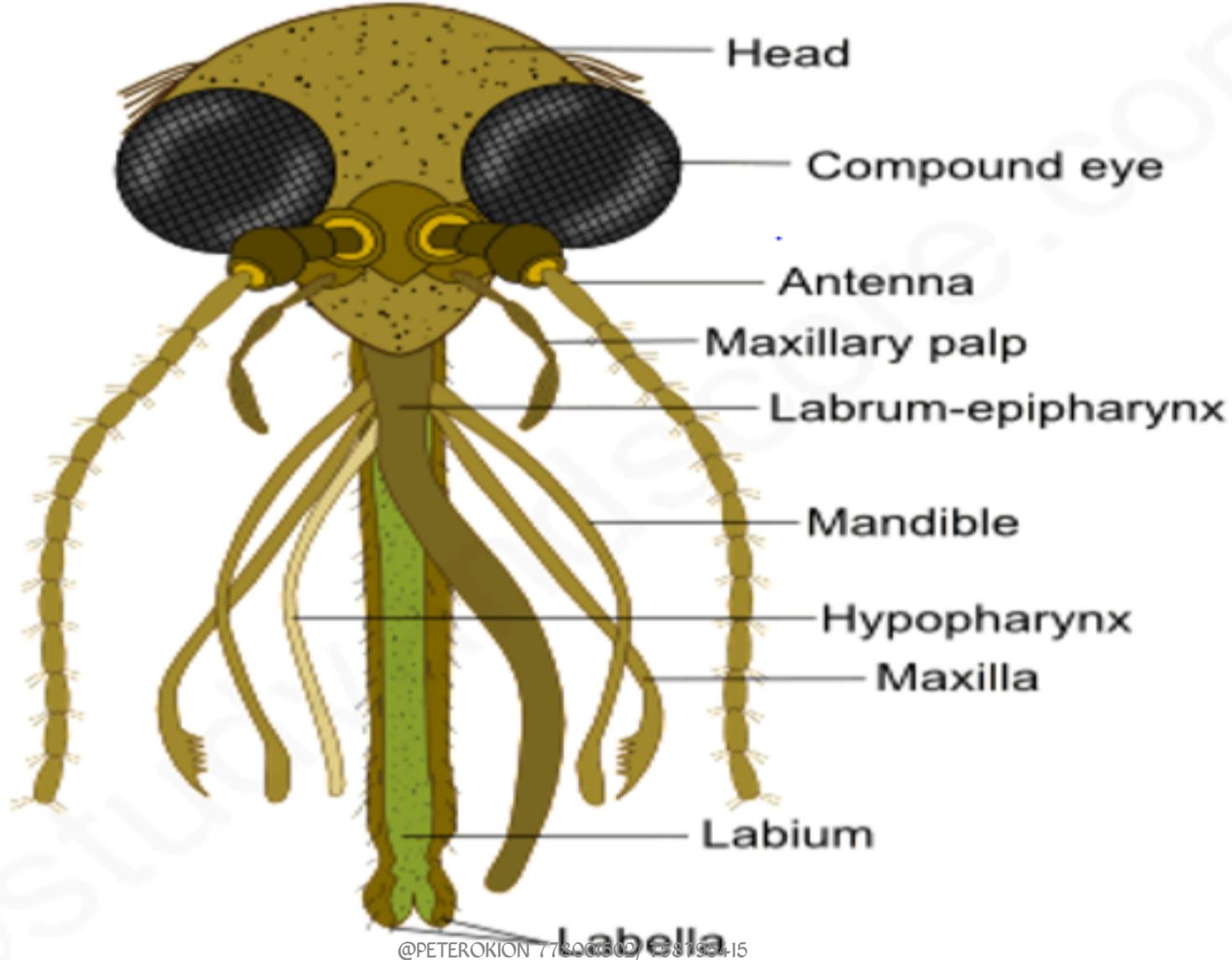
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Feature	Cockroach	Bee	Housefly	Butterfly	Mosquito	Termite
Type of mouth parts	Sucking and chewing	Chewing and lapping	Siphoning	Siphoning and sucking	Piercing and sucking	Biting
Antennae Number Length	One pair Long	One pair Short	One pair Short	One pair Short	One pair Short	One pair Short
Eyes Number compound Simple eyes Type	One pair Three Compound and simple	One pair Three	One pair Three	One pair Three	One pair Three	No eyes

Exercise

1. What is the function of the antennae to the insect?
2. Suggest with reasons, the insect that is suited to feed on the following foodstuffs:
 - a) Rotting materials b) blood c) solid foods d) nectar
3. It is very hard to catch a housefly. Basing on the features seen on the table, how true is the statement?
4. Cockroaches usually move very fast but they never knock objects. Suggest how they are able to avoid knocking objects

soln

- 2 a) housefly: breaks down small organic particles by digesting them with saliva and then sucking them in through the proboscis
- b) mosquito: has piercing and sucking mouth parts to pierce the skin and access blood in blood vessels
- c) cockroach: has biting and chewing mouth parts, to bite solid foods and then eventually crush them
- d) Bee: has sucking tube to suck up fluids
3. The statement is true because the housefly has large compound eyes that gives a wider range of vision
4. Cockroaches have long antennae to sense the objects at a distance before reaching them

The Thorax of an Insect

- The thorax of an insect bears its legs and may or may not have wings

Characteristics features on the thorax of insects

Feature	Cockroach	Bee	Housefly	Butterfly	Mosquito	Termite
Wings Number Texture						
Legs Number Length Nature						
Number of segments						

Feature	Cockroach	Bee	Housefly	Butterfly	Mosquito	Termite
Wings Number Texture	2 pairs Inner smooth Outer rough	2 pairs All smooth	One pair Smooth	2 pairs	One pair Smooth	No wings
Legs Number Length Nature	6 Long ✓ Same length ✓ Hind with thickest coxa ✓ Have spines ✓ Glossy surface ✓ A pair of sharp claws ✓ Glandular pad between claws	6 Short ✓ Hind legs are larger than the rest ✓ Fore legs have prongs ✓ Hind limbs have pollen brushes and basket	6 Short Same length ✓ Hairy	6 Short Same length	6 Long ✓ Hind limbs are longer than the rest	6 Short Same length
Number of segments	3	3	3	3	3	3

Exercise (in groups)

1. Suggest the features that enable the cockroach to move along;
 - a) Smooth surfaces like roofs of buildings
 - b) Rough surfaces like walls
2. Some insects do not have wings. State examples of such insects and explain how they achieve locomotion
3. Make a drawing of the hind leg of a cockroach and label all the parts

Soln

- 1. a) they have glandular pads that secrete of sticky substances for firm grip on smooth surfaces
 - b) they have sharp claws for firm grip on rough surfaces
- 2. termites, fleas, lice, silver fish and firebrats.
 - by walking, since their legs have the same length which enables them to move fast

The abdomen of insects

Feature	Cockroach	Bee	Housefly	Butterfly	Mosquito	Termites
Shape						
Texture						
Attachments						

Feature	Cockroach	Bee	Housefly	Butterfly	Mosquito	Termites
Shape	<ul style="list-style-type: none"> ✓ Broad in females ✓ Narrow in males ✓ Dorso-ventrally flattened 	<ul style="list-style-type: none"> ✓ Thick and blunt at the end in drones ✓ Long and pointed in workers and queens 	Blunt ended	Narrow	Elongated and narrow	Blunt ended
Texture	<ul style="list-style-type: none"> ✓ Smooth ✓ Glossy 	<ul style="list-style-type: none"> ✓ Rough Hairy ✓ Scales 	<ul style="list-style-type: none"> ✓ Smooth and hairy 	Rough with scales	Smooth	Smooth
Attachments	<ul style="list-style-type: none"> ✓ Anal styles and anal cerci in males ✓ Anal cerci and podical plates in females 	<ul style="list-style-type: none"> ✓ Sting in workers only Reproductive structures on queen bees 	<ul style="list-style-type: none"> ✓ Expanded organ ovipositor ✓ Anal cerci on the last segment in males 	Finger-like cerci	Reproductive structures (gonopore)	Reproductive structures

Exercise one

1. What is the role of the different attachments on the abdomen of insects ?

2. How do you think the shape of the abdomen of a cockroach maybe of importance to its survival?

Soln

1. The anal cerci is for sensitivity, styles for copulation and podical plate is for holding eggs
2. The cockroach is dorso-ventrally flattened which enables it to fit into narrow cracks and hide away from its enemies

Exercise two

- When Luwum dipped the head of a cockroach in water for a day, the cockroach stayed alive but when He dipped the entire abdomen in the water for a day, the cockroach died. Suggest explanations for the observations Luwum made.

Soln

- The respiratory surfaces of a cockroach are on the abdomen not on the head thus when the abdomen is dipped in water, the cockroach suffocates and dies

Activity

- Use the flow chart below to identify which of the insects are represented by the letters A to F

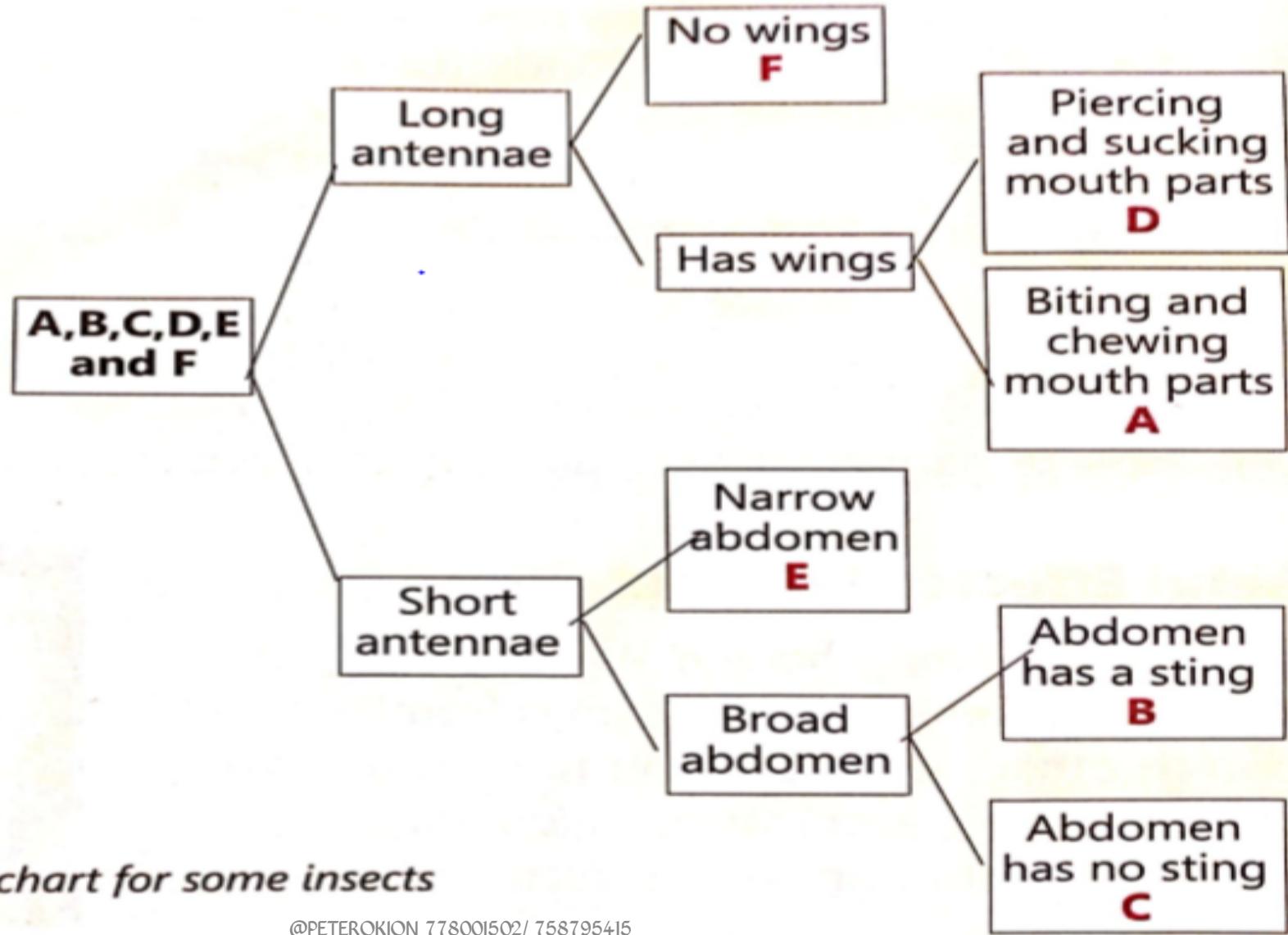


Figure 4.2: A flow chart for some insects

Effects of insects

- Do you think that MAN can live without insects?
- What is the relationship between insects and flowers ?
- Insects have got an effect on our lives, the effect can be useful or harmful

Exercise

1. Why can't flowering plants live without insects ?
2. How does the presence of mounds in the area affect the distribution of plants ? Explain your answer
3. How do farmers in your area benefit from the action of termites ?

soln

1. Without insects such plants would not be able to reproduce sexually as there would be no pollination of their flowers that leads to their fertilization to produce seeds in fruits used for propagation
2. The plant density is greater in areas near the mounds than in areas far from the mounds; due to the digging of termites and due to their decomposition of plant material, the mound soils are generally more fertile than other soil encouraging more plant growth

3. Uses of termites;

1. Farmers use termites mounds as gardening beds to grow vegetables due to the high nitrogen content of their dirt
2. They feed their fish on termites
3. The soil from mounds is used as a natural fertilizer in crop fields
4. They dig tunnels allowing rain to fall deeper into the ground, retaining moisture at a higher rate
5. Dig tunnels in the soil increasing on its aeration and hence improving its fertility
6. They breakdown dead plant and animal materials increasing on their rate of decomposition to form humus that improve the fertility of soil

Useful Effects of Insects

Do you enjoy eating honey? Where does the honey you enjoy eating, comes from? In which other ways have you benefited from the existence of insects? *Figure 4.3* shows some importances of insects.



Honey from bees



A boy eating a queen termite
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Silk worm producing silk



A butterfly pollinating a flower

Useful effects of insects

Bees

1. Produce honey used in making of foods, drinks, health products and beauty products
2. Secrete bee wax which is used as an ingredient I furniture wax, beauty products, lip balm, chewing gum etc.
3. Bee wax is also used to make candles
4. Its used as a protectant for some foods and as natural preservative in products that may get spoilt

Butterflies

1. They are indicators of healthy environment and healthy ecosystem
2. They are important in biological control of pests
3. They produce chemicals that chase away predators and parasites which have been exploited economically

Harmful effects of insects

- Have you ever suffered from diarrhea? The cause can be related to the behavior of insects. Similarly, farmers have suffered the harmful effects of insects. In which way do you think this could be?
- E.g. caterpillars eat away the green parts of leaves; this reduces the surface area for photosynthesis reducing plant growth
- Use the pictures below;



A mosquito biting a person



Caterpillars eating a leaf



Cockroaches eating abandoned bread



A man looking at a pole eaten by termites



Houseflies contaminating food



Bean weevils eating beans

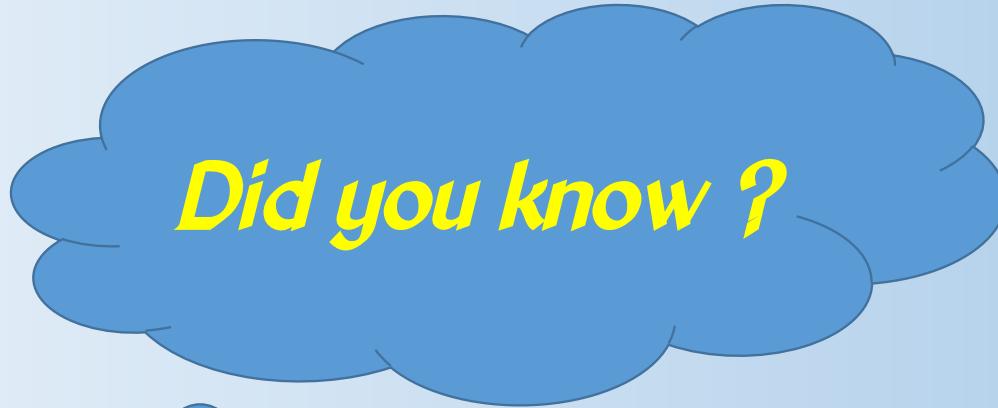
Figure 4.1: Harmful effects of insects
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Exercise

- Little Akello left her food uncovered on the verandah during lunch. On her return, she found houseflies all over the plate. She chased away the flies and ate the food. After a few days, she fell sick and had to spend some days away from school.
 - **QN:** what do you think caused her sickness?
with reasons, advise her on what she can do to avoid suffering from the same sickness again.

Soln

- The houseflies spread germs into her food using their hairy bodies
- By covering her food and washing her hands with clean water and soap before eating



Did you know ?

•

Houseflies are able to see behind due to the presence of compound eyes

Exercise : the pictures below show stages of insects that are useful to humans and their environment



A



B

Figure 4.5: Stages of insects

Questions

1. Study the pictures carefully and suggest how the stages of insects, A and B are useful to you and your environment.

2. When Ochrom accidentally touched a housefly while preparing to eat, he ran very fast and washed his hands again before he could start eating. Why do you think Ochrom's action was necessary?

Soln

1. In stage A, the housefly larva decomposes the dead organic matter reducing the accumulation of waste materials.
in stage B, the adult bee is pollinating a flower to form fruits e.g. maize, a main source of food

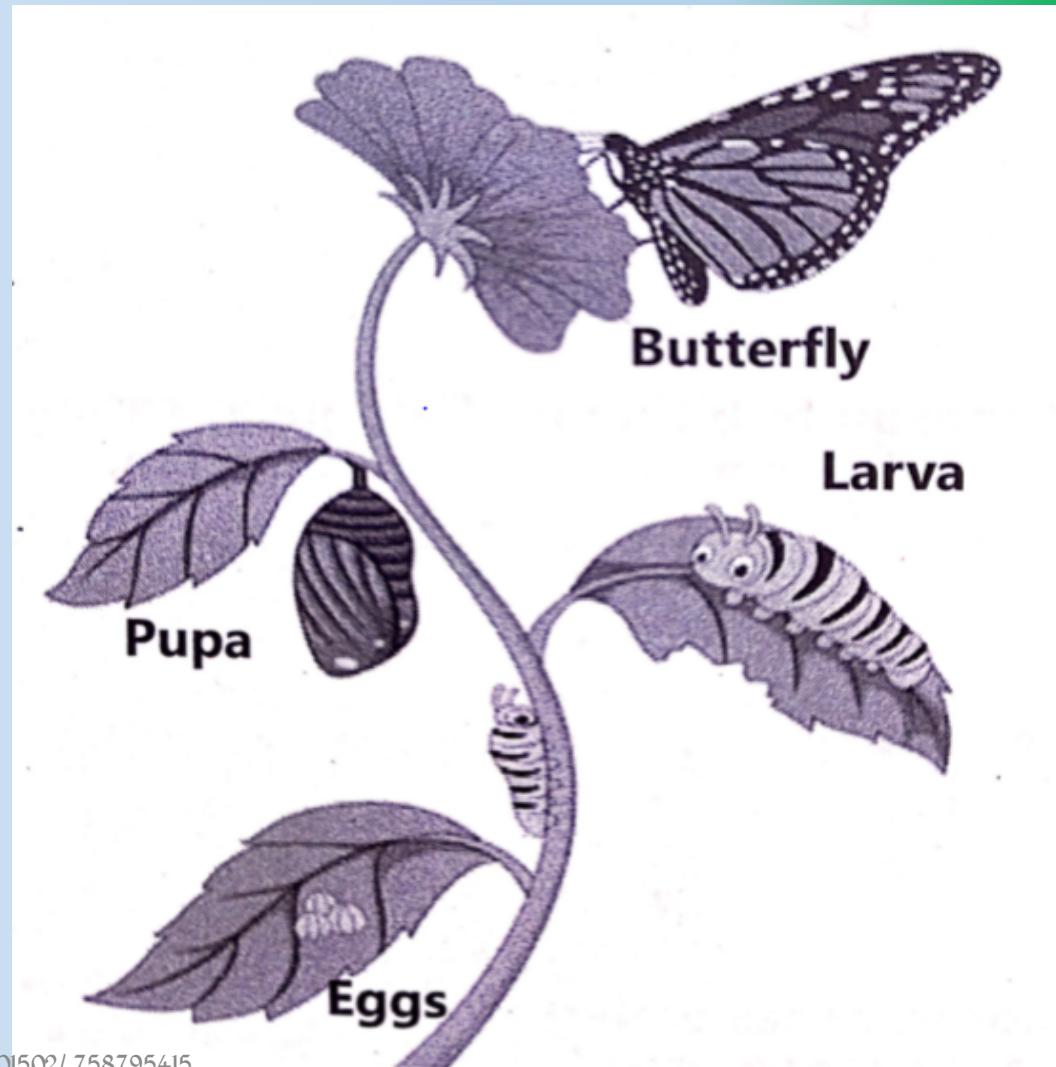
Life cycles of insects

Assignment

1. In groups, research about the life cycles of the following insects; butterfly, mosquito, housefly, cockroach, termites and bees.
1. Write a report on your findings. In the report, include the following: number of stages, diagrams of the cycles and time taken to complete the cycle

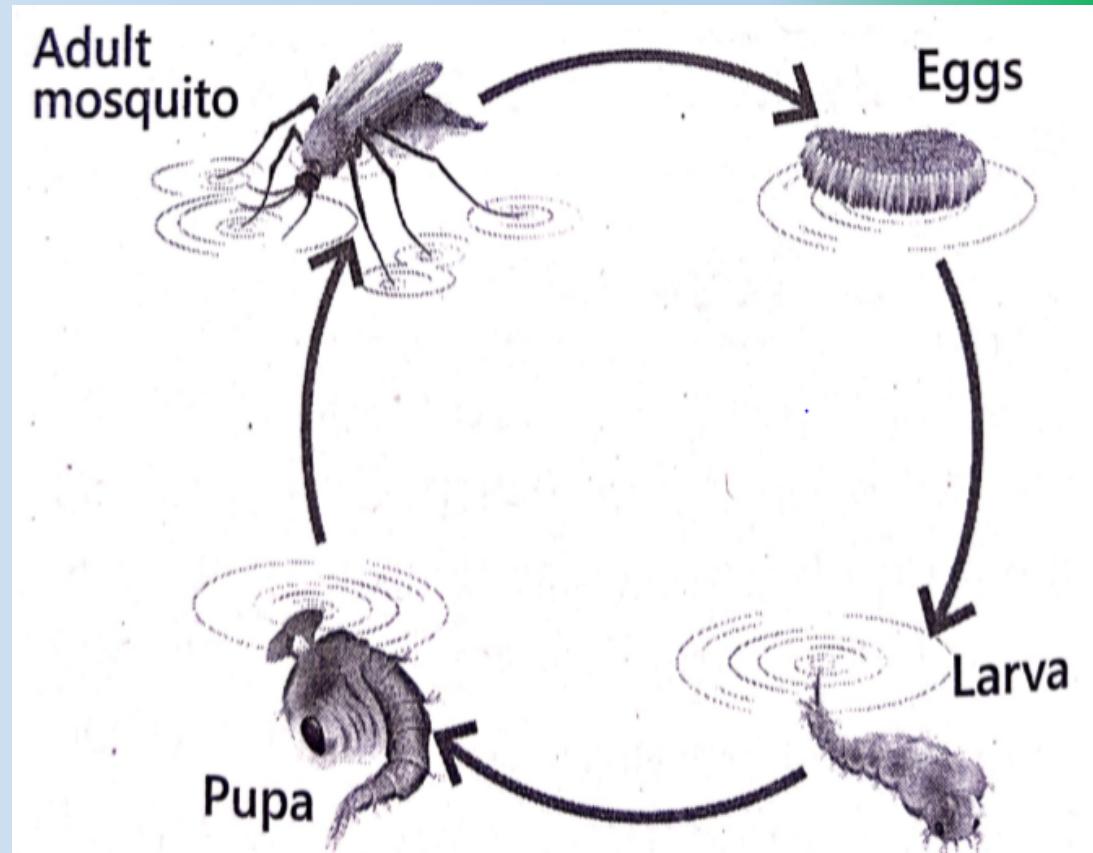
Life cycle of a butterfly

- A butterfly undergoes four(4) stages of development or complete metamorphosis.
- The stages are; eggs, larva, pupa, and adult.
- The duration for the lifecycle of a butterfly is one month.



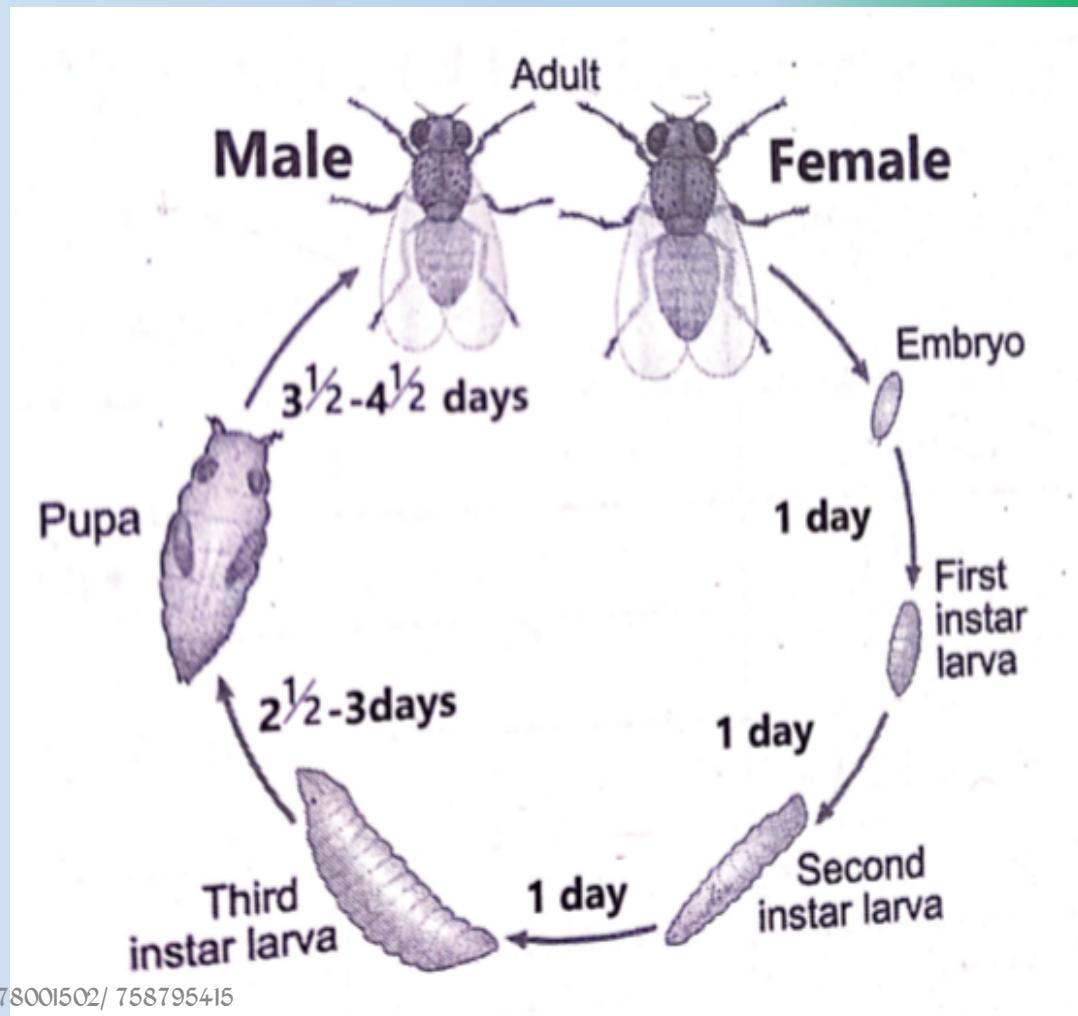
Life cycle of a mosquito

- A mosquito undergoes four(4) stages of development or complete metamorphosis.
- The stages are; eggs, larva, pupa and adult.
- The duration for the lifecycle of a mosquito is approximately 8 to 10 days



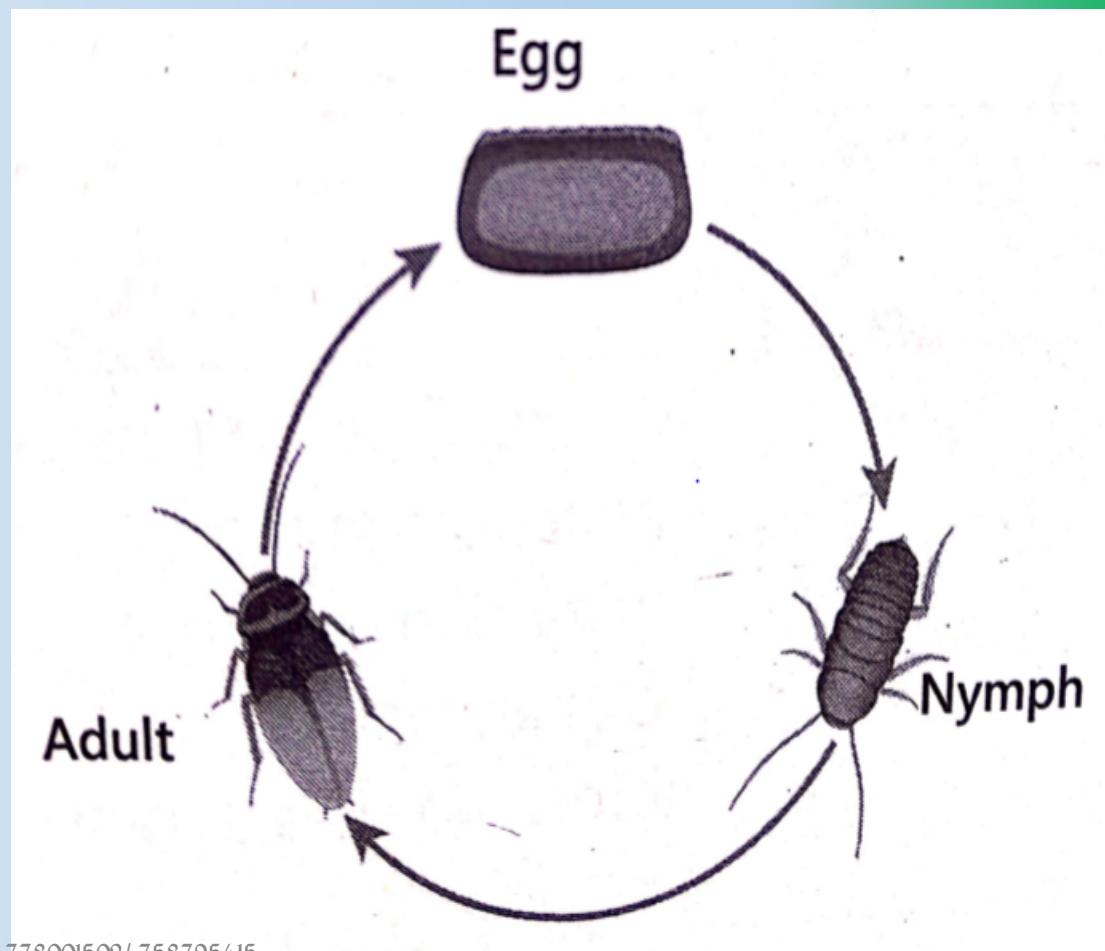
Life cycle of a housefly

- A housefly undergoes four(4) stages of development or complete metamorphosis.
- The stages are; eggs, larva, pupa and adult
- The duration for the lifecycle of a housefly is 7 to 10 days



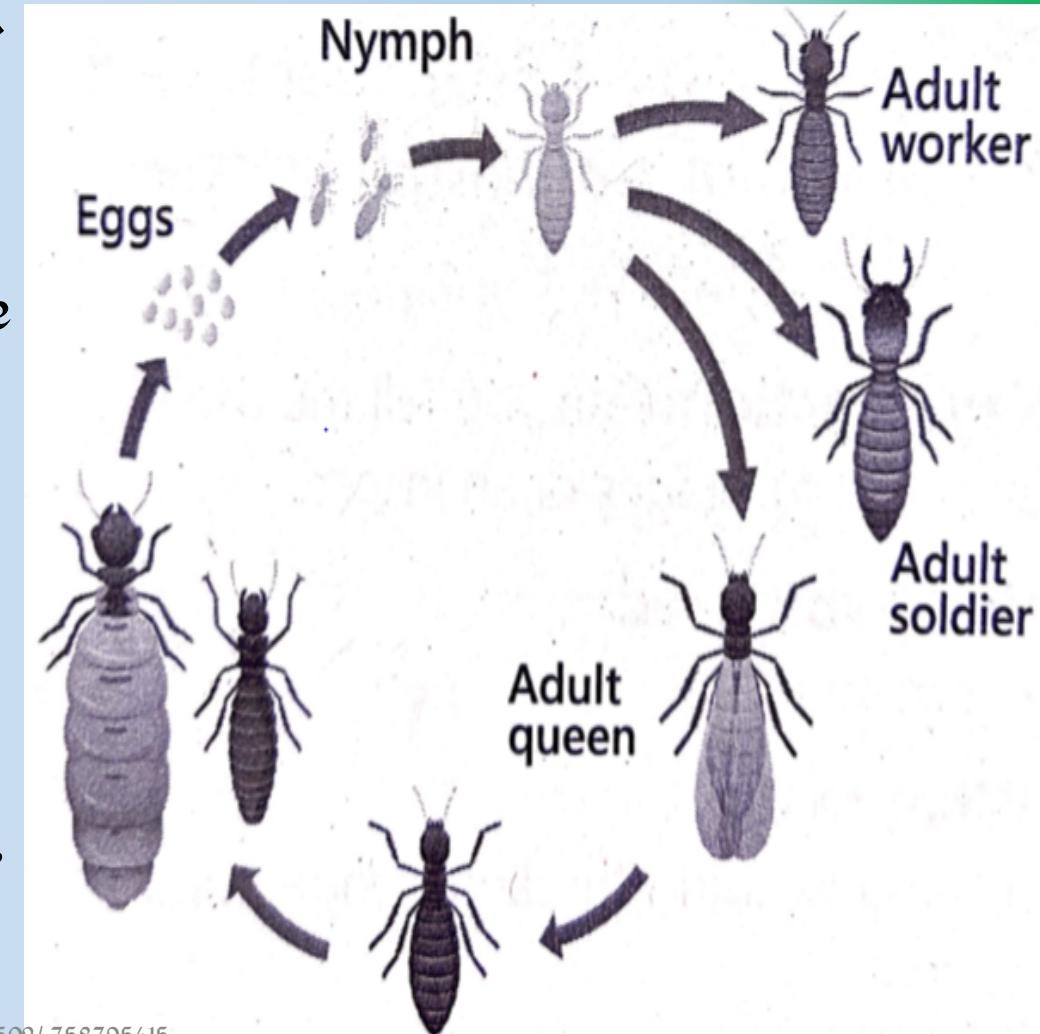
Life cycle of a cockroach

- A cockroach undergo three(3) stages of development or incomplete metamorphosis.
- The stages are; eggs, nymph and adult.
- The duration for the life cycle of a cockroach is 50 to 60 days



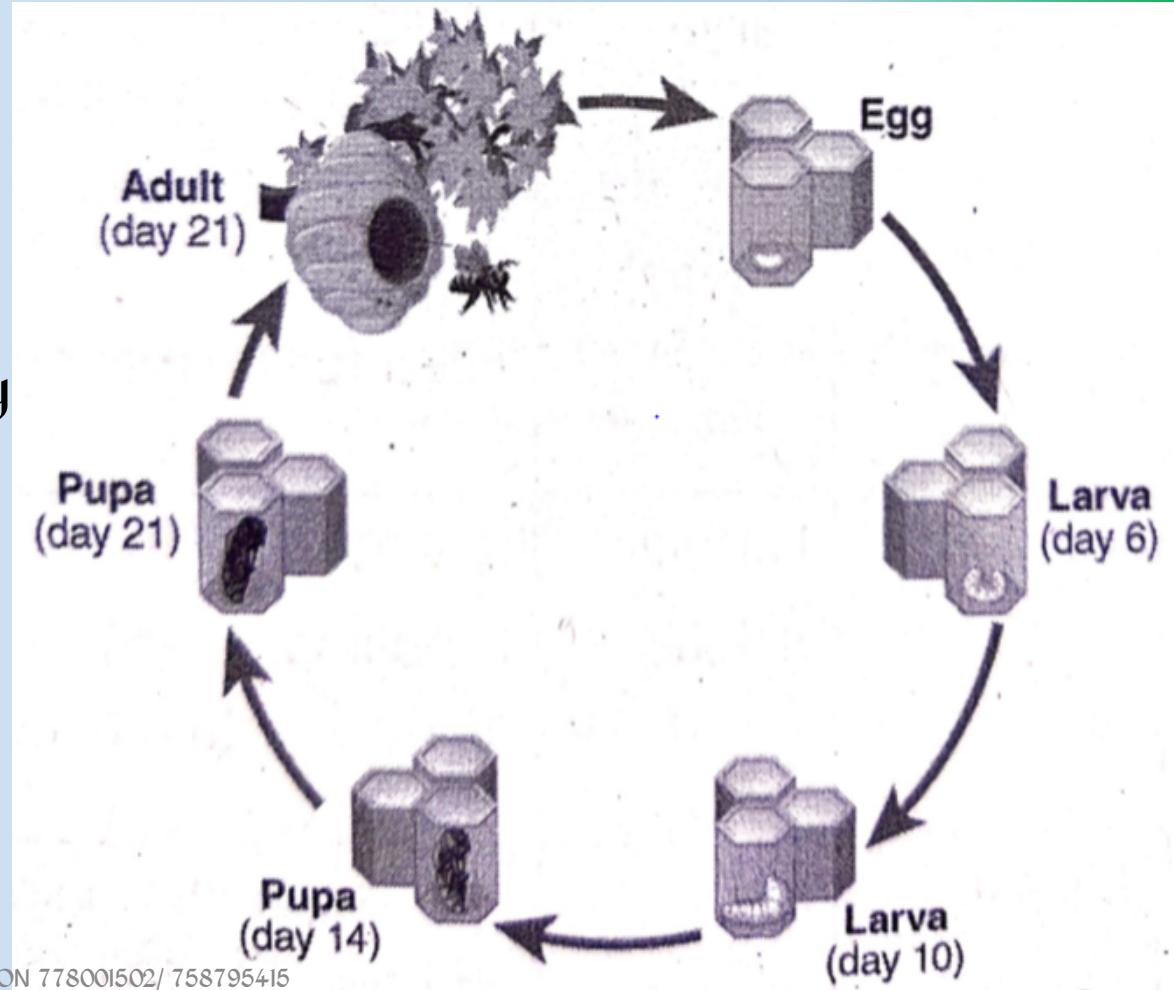
Life cycle of a termite

- Termites undergo incomplete metamorphosis. A termite's life cycle can result into 3 different **caste types** i.e. **Queen, workers and soldiers.**
- Eggs hatch into larvae. The larvae can become one of the castes; worker, soldier or **secondary reproductive termite**. The larvae can become a worker or soldier and its life cycle ends. The larva can become a reproductive termite that become a **king or queen termite** for another colony
- The queen has the longest life span on average of **25 years**. The workers and soldiers' life spans vary from **12 to 24 months**



Life cycle of a Bee

- Honey bees develop in four(4) distinct life cycle phases; egg, larva, pupa and adult.
- The total development times vary among the three castes of bees but the process is the same:
- 24 days for drones, 21 days for worker bees and 16 days for queens



Harmful and useful stages of insects; complete the table below;

Insect	Useful stages	Comment	Harmful stages	Comment
Housefly				
Mosquito				
Termite				
Cockroach				
Bee				
Butterfly				

Insect	Useful stages	Comment	Harmful stages	Comment
Housefly	Larva	<p>It reduces the bulk of waste minimizing environmental risk of its disposal</p> <p>Feed for animal nutrition</p>	Adult	It spreads pathogens attached on their hairy bodies from contaminated breeding sites to other organisms
Mosquito	Larva Adults	<ul style="list-style-type: none"> ✓ It is food to fish ✓ It pollinates aquatic plants as they obtain nectar 	Adult	Female anopheles mosquitoes are vectors for plasmodium parasites
Termite	Adult	<p>It digs tunnels in soil aerating the soil</p> <p>It facilitates decomposition of materials increasing soil fertility</p> <p>Queens are fed on by humans</p>	Adult	<ul style="list-style-type: none"> ✓ It destroys crops by feeding on them for example cutting stems of trees and maize

Cockroach	Adult	It helps in decomposition of materials	Adult	Vectors for pathogens Destroy property such as paper and clothes
Bee	Adult	It produces honey extracted for use by people It produces bee wax for use by man	Adult	It stings people causing irritation of the skin It makes noise disrupting feeding in animals like elephants
Butterfly	Larvae	It produces silk (silkworms) used in textile industries	Larvae	It destroys crops in fields by feeding on them
	Adult	It is a basis for art and design It pollinates flowers of plants		

Exercise

1. Why is it necessary to study the life cycle of insects ?
2. People near a landing site were given mosquito nets during the campaign to reduce malaria but some used the nets for fishing and poultry keeping, while others sold them. The landing site was also near a huge forest. Later on, people started falling sick of malaria.
 - a) Which insect made the people at the landing site to fall sick?
 - b) How did the insect infect these people?
 - c) Advise the people at the landing site on what they can do to control the insect
3. Explain the relationship between insects and plants.

Methods of controlling Harmful stages of insects

Activity

in groups, discuss how the harmful stages of insects identified in pictures below can be controlled

2. Prepare a presentation advising the class on ways of controlling the harmful stages of insects



A



B



C



D



E

Figure 4.6: Ways of controlling harmful insects

Ctd

Control of mosquito larvae

1. Introduction of mosquito eating fish
2. Pouring oil on stagnant water
3. Draining away stagnant water

Control of adult mosquitoes

1. Fumigating houses
2. Spraying using insecticides
3. Painting the house with bright colors
4. Ensuring that rooms are well lit
5. Clearing bushes around homes

Control of caterpillars

1. Hand picking and killing them
2. Physical prevention by fencing them out using fine mesh netting
3. Repelling them using plant extracts
4. Using decoy/trap crops that attract caterpillars leaving desirable plants free from caterpillars
5. Practicing crop rotation to cut the life cycle of caterpillars short
6. Planting strong scent herbs e.g. rosemary, lavender that repel caterpillars
7. Introducing biological enemies e.g. chicken, ladybugs, parasitic wasps
8. Spraying with insecticides

Control of termites

1. Pouring termicides in termite mounds
2. Placing termite baits, which kill termites in the ground
3. Using termite barriers e.g. termite shields to avoid attack by termites
4. Fumigating items having termites

Control of houseflies

1. Improvement of environmental sanitation and hygiene by
.....,,
2. Protection of food, eating utensils and people from contact with flies by
.....,,,,
3. By killing flies directly e.g. by use of traps and sticky tapes.
4. Spraying using larvicides, insecticides e.g. doom

Activity of integration

In one of the village meetings in your community, a member has raised a concern about insects spreading and causing several diseases to them, which has forced the members to spend a lot of money on treatment. Most members in the community are in support of a suggestion that they should use insecticides to kill all insects.

You have been asked to explain and help the community members appreciate that insects are harmful to humans but humans cannot live an effective life without insects. You also explain the effect of using insecticides on the environment.

Task: write a speech you will present to the community members about the importance of insects and how one can control the harmful ones



Figure 4.7: Importance of insects

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Test yourself

1. Compare the life cycle of a cockroach with that of a housefly.
2. If you were to choose from a bee, a cockroach and a butterfly which one would you choose to keep at your home? Why?
3. Houseflies spread diseases e.g. cholera to people, hence they are planning to get rid of them. Assuming you are a housefly, in a short paragraph plead to the members of the community not to destroy you.
4. There is a rapid increase in cases of malaria in your area, what measures can you put in place to eradicate malaria from your village?
5. While reading a science book, Peter came across a statement “fish feeds on mosquito larva”. How can he use this knowledge to keep his community members that live in a flooded area safe from malaria?
6. The data below was obtained from a certain household. Use it to answer questions that follow

Ctd

Insect	Number of organisms
Cockroach	200,000
Housefly	300,000
Butterflies	100,000
Mosquitoes	350,000
Bees	50,000

Qns:

- a) Make a circle graph (**pie chart**) that shows the percentage of each insect in the household

- b) From the graph in (a) above, state the disease the household is most likely to suffer from. Suggest reasons for your answer.

END