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# EXERCISE 20 THE COMMON COCKROACH *PERIPLANETA AMERICANA* – EXTERNAL FEATURES, DISSECTION AND TEMPORARY MOUNTS

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## 20.1 INTRODUCTION

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Cockroach is a reddish brown insect and is cosmopolitan in distribution. Cockroach is one of the commonest insects, easy to obtain, maintain in the laboratory for variety of studies and for performing physiological experiments. It is large in size, easy to handle and convenient for dissection and mounts. Its body is dorsoventrally flattened, elongated and bilaterally symmetrical. You can distinguish a male and female cockroach by examining its external features. You can observe the male and female reproductive organs by dissecting it. While dissecting the head and upper region of cockroach, you can observe the mouth parts and salivary glands and mount them,

### Objectives

After performing this exercise, you should be able to:

- trace its alimentary canal,
- mount its salivary glands,  
mount its mouth parts,
- trace male/female reproductive organs of cockroach and draw their labelled diagrams.

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## 20.2 MATERIAL REQUIRED

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1. Anaesthetized cockroach
2. Dissection Tray
3. Dissection Box
4. Record Book, pencil and eraser

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## 20.3 EXTERNAL FEATURES OF COCKROACH

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Take a freshly killed cockroach (killed with chloroform vapours) and put it in the dissecting dish. Identify and note the following features (Fig. 20.1):

1. Body is dorsoventrally flattened, elongated and bilaterally symmetrical.
2. Colour is reddish brown. There are two black patches on prothorax.
3. Body is covered by cuticular exoskeleton.
4. Body is differentiated into head, thorax and abdomen.

**Table 20.1: Differences between Male and Female Cockroach**

Male Cockroach	Female Cockroach
1. Abdomen narrow	1. Abdomen broad
2. Sternum of 7 <sup>th</sup> segment not bifid	2. Sternum of 7 <sup>th</sup> segment bifid and produced backwards into boat shaped genital pouch
3. Abdominal appendages - two pairs - anal cerci and anal styles	3. Abdominal appendages - one pair - only anal cerci (no anal styles)
4. Genital aperture between 9 <sup>th</sup> and 10 <sup>th</sup> sternum.	4. Genital aperture on 8 <sup>th</sup> sternum.

## 20.4 DISSECTION

### 20.4.1 Alimentary Canal of Cockroach

#### Procedure:

1. Put chloroformed cockroach in the dissecting tray with ventral side facing upwards to **determine the sex**. Now invert it so as to face the dorsal side upward for proceeding **with** the dissection.
2. Remove the wings and give **the** incision along **the** lateral sides, thereby cutting the arthrodial **membrane** between terga and sterna.
3. Remove **the** tergat plates one by **one** carefully **without** disturbing **the** internal organs.
4. Remove all **the** fat bodies with **the** help of brush and expose the alimentary canal and display it on **one** side of the body.
5. Separate out salivary glands from the crop and spread them carefully.

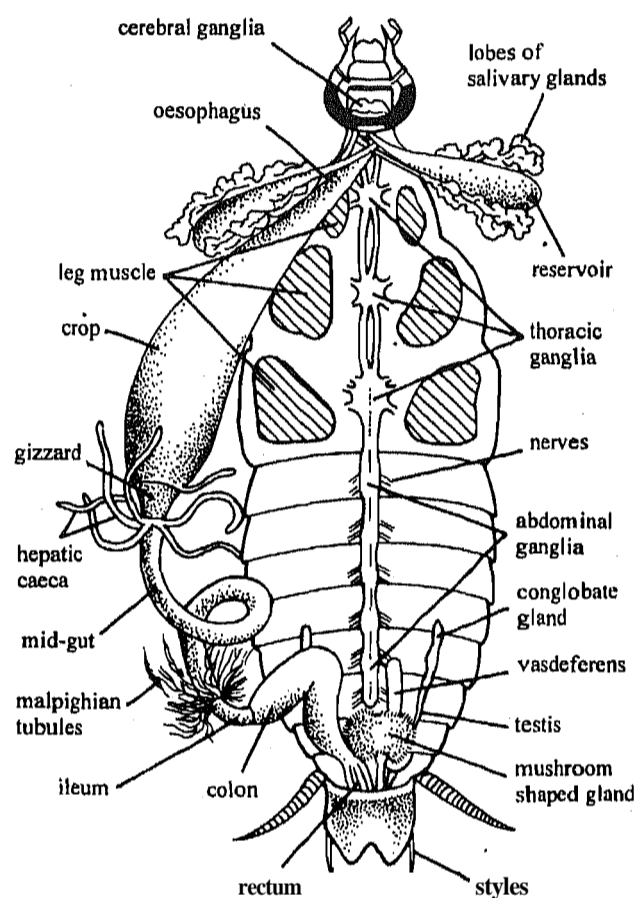


Fig. 20.3: Alimentary canal of a Cockroach.

#### Alimentary Canal

1. Oesophagus continues into the crop which is thin walled, elongated and **pear-shaped** structure extending **upto** the abdomen.

5. Head is roughly triangular and hangs at right angles to the axis of body. It bears compound eyes, antennae and mouth parts.

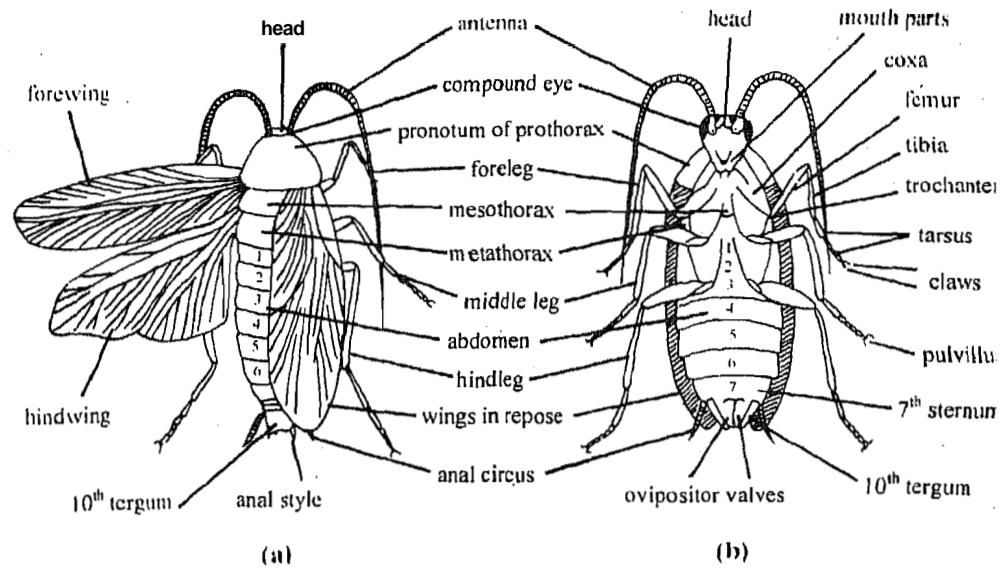


Fig. 20.1: (a) Dorsal view of a cockroach. (b) Ventral view of a cockroach.

6. Three segments in the thorax - prothorax, mesothorax and metathorax.
7. Two pairs of wings attached to mesothorax and metathorax dorsally.
8. Three pairs of legs attached to mesothorax and metathorax dorsally.
9. Out of two pairs of wings, first pair is thick and known as tegmina and second pair of wings is membranous.
10. Legs end in claws and are well adapted for walking on vertical surfaces. Each leg consists of coxa, trochanter, femur, tibia, tarsus, pulvillus and claws.
11. Ten segments in the abdomen which are without appendages. Terga of 8<sup>th</sup> and 9<sup>th</sup> are partially overlapped by the tergum of 7<sup>th</sup> segment. Tergum of tenth segment is bifid and carries anal cerci in both sexes. In case of male the abdomen also carries in addition to a pair of anal cerci one pair of anal styles. In the first abdominal sides of the body, eight pairs of spiracles or stigmata are present.
12. There are 10 pairs of spiracles, two of which are located on the sides of meso and metathorax and eight pairs on the sides of abdomen.

Differences between male and female cockroach are shown in figure (Fig. 20.2) and tabulated below:

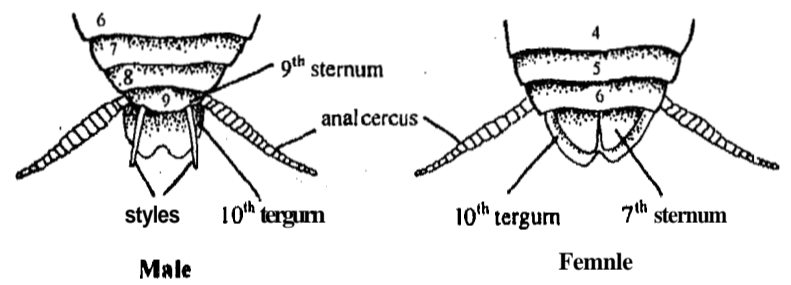


Fig. 20.2: Differences between male and female cockroach.

2. Gizzard is rounded in shape and is thick walled muscular structure present at the base of crop.
3. **The mesenteron** is characterized by the presence of eight tubular enteric caecae at the anterior end and numerous hair like malpighian tubules at the posterior end.
4. Ileum, colon and rectum not markedly differentiated.
5. Rectum opens to the exterior by anus.
6. A pair of salivary glands present in the prothorax. Each is differentiated into a receptacle and a glandular portion. Separate ducts arise from each of them and unite to form the common efferent salivary duct opening at the base of hypopharynx (Fig. 20.3).

**Note:** The same specimen could be used to proceed observations on reproductive system if not disturbed or mutilated, otherwise take a fresh specimen for the next dissection.

#### 20.4.2 Male Reproductive Organs of Cockroach

##### Procedure

1. Take chloroformed male cockroach with dorsal side facing upwards and cut on either lateral side and pin the animal in the tray.
2. Without disturbing the fat bodies, remove the tergal plates one by one carefully.
3. Locate whitish honey comb like structures, the testes on either lateral side close to the arthrodial membrane from segment 4<sup>th</sup> to 6<sup>th</sup>.
4. After locating testes, remove fat bodies and alimentary canal.
5. Trace vas deferens from the posterior end of testis and clear up the remaining structures.
6. Cut the tergum of last abdominal segment in order to expose the genital chamber and its copulatory appendages.

##### Observations

1. Two testes present in segment fourth to sixth one on either side.
2. Two vasa deferentia arising one each from the posterior end of each testis.
3. One ejaculatory duct present midventrally as thick and wide muscular duct.
4. One mushroom gland - white mushroom-shaped structure present above the union of two vasa deferentia.
5. Conglobate gland is leaf like which is placed below the ejaculatory duct.
6. Around the male genital pore are found gonapophyses, pseudopenis, titillator, and right and left phallobes (Fig. 20.4 a).

#### 20.4.3 Female Reproductive Organs of Cockroach

##### Procedure

Step 1 and 2 are same as in the procedure for male cockroach (having selected a female cockroach this time).

3. Locate two white prominent ovaries in the posterior part of abdomen and then remove the fat bodies with the help of the forceps and brush.
4. Locate two oviducts on either side attached to posterior margin of ovary.
5. Now remove last abdominal ganglion of the ventral nerve cord. Below this are located spermatheca and vagina.
6. The colleterial glands which are milky white and highly branched are present in the posterior part of abdomen.

##### Observations

1. Paired ovaries one on each side in the abdominal cavity and consists of 8 ovarioles.
2. Oviducts are short and wide tubes joining medially to open into the vagina.
3. Spermathecae which consists a sac-like structure and a filamentous coiled position, is present at the junction of vagina with the genital chamber.
4. Colleterial glands open into the genital pouch (Fig. 20.4 b).

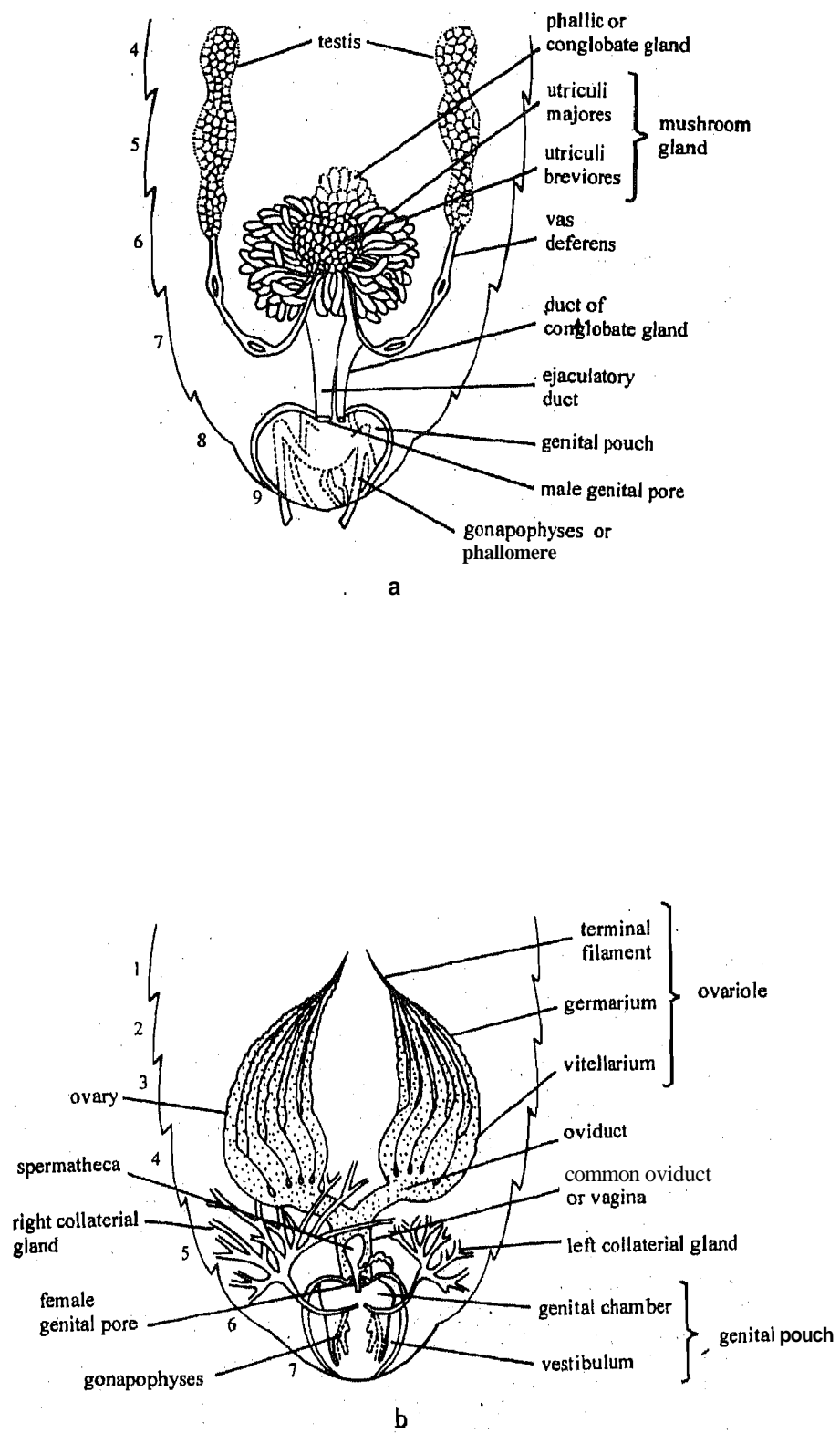


Fig. 20.4: Cockroach. a) Male reproductive system, b) Female reproductive system.

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## 20.5.1 Mouth-Parts

You **have** already carried out an exercise on preparing permanent mount of mouth parts of cockroach in Exercise 18. Here, it is simply a repetition, but only to prepare a temporary mount so as to relate them with the alimentary canal.

## Procedure

**Remove** the mouth parts one by one as described below and place them in a drop of water on a clean slide in a manner as shown in Fig. 20.5.

1. Hold cockroach on the neck region with your hand with ventral surface facing you.
2. Locate the lower lip (labium) of mouth which is a flattened plate on the floor.
3. Hold it from its base with the help of a pair of forceps and pull it out. This is labium.
- A.** Next, remove maxillae from the sides and then the mandibles underneath them.
5. Below the labium is present hypopharynx in the middle line.
6. Finally take out upper lip called **labrum**.

## Observations

1. Mouth-parts mandibular type, i.e. biting and chewing type.
2. Mandibles plate-like and broad. The inner margins are serrated (toothed) adapted for biting the food.
3. Maxillae consist of:
  - i) Protopodite – basal part, formed of **cardo** and stipes
  - ii) Exopodite – outer part, forming maxillary palp.
  - iii) Endopodite – inner part, formed of lacinia and galea
4. Labium **which** forms the lower lip is composed of:
  - i) basal part having submentum, mentum and prementum.
  - ii) paired labial palps which represent the outer part.
  - iii) inner part which is formed of glossae and paraglossae.
5. Hypopharynx tongue like with opening of salivary glands.
6. Upper lip formed by **labrum** and epipharynx (Fig. 20.5).

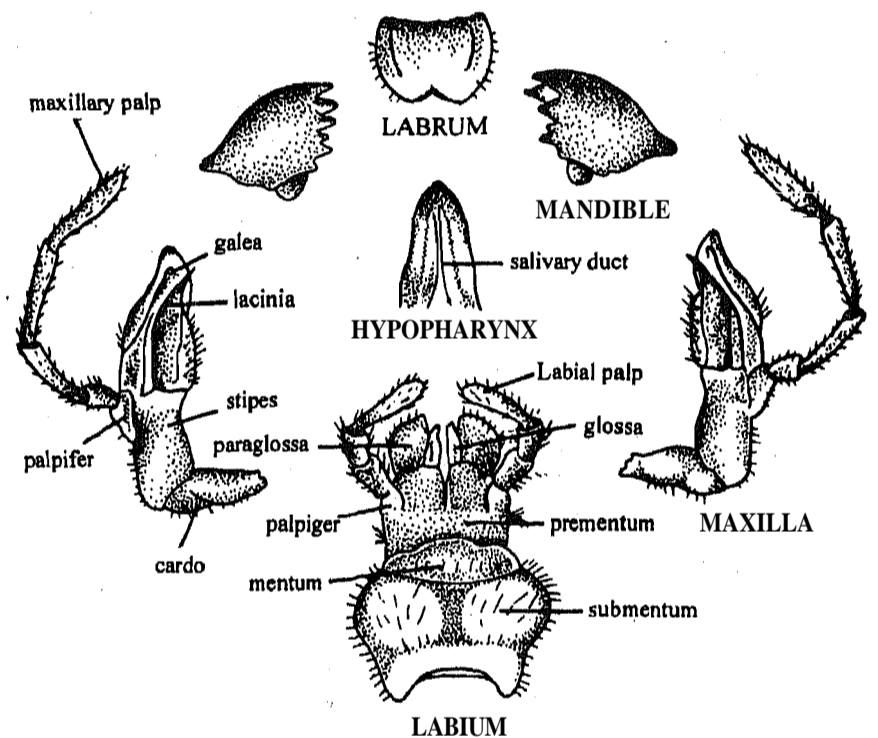


Fig. 20.5: Mouth-parts of cockroach.

## 20.5.2 Salivary Glands

### Procedure

1. Pin a freshly ecdysoformed cockroach in the dissecting tray with the dorsal side facing upwards.
2. Cut open on either lateral side.
3. Remove tergal plates one by one upto the head region.
4. Locate the crop.
5. Carefully search for white coloured flattened glandular structure around the anterior part of the crop.
6. Clear them upto the neck. Then gently turn over the head.
7. Clear the neck region in order to expose the efferent salivary duct.
8. Remove the labium, hold the hypopharynx and pull out the glands.
9. Keep it in a watch glass in water.

Or

Stretch the glands on a slide and fix them in 70% alcohol, wash and do single (eosin or borax carmine) staining for mounting. Mount on a slide by properly stretching in water and put a coverslip.

### Observations

1. Salivary glands are located in the prothorax of cockroaches and open at the base of hypopharynx.
2. Each salivary gland has a glandular part and the reservoir.
3. In the glandular part, there are four main lobes. The lobes have separate salivary ducts, which ultimately join together to form the common salivary duct.
4. There are two reservoirs with separate ducts.
5. Ducts of reservoirs join the common salivary duct to form efferent salivary duct.
6. Salivary glands are source of digestive enzymes which help in digestion of food (Fig. 20.6).

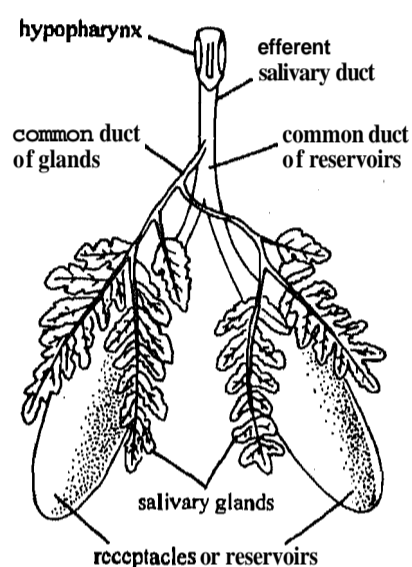


Fig. 20.6: Salivary glands of cockroach.

## 20.6 PRECAUTIONS TO BE TAKEN IN DISSECTIONS

1. In fixing animal, stick the pins obliquely and not vertically so that their heads do not come in the way or obscure the dissection.
2. Never cut away any thing until you are quite certain about what you are removing.
3. Dissections should be done in water. The water must completely submerge the dissection.

4. Always keep the water clean in the dissecting dish during dissection by changing it, whenever required so that visibility remains good.
5. Black paper your dissection for good display.
6. *Invertebrates* are always dissected from the dorsal side.

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### 20.7 TERMINAL QUESTIONS

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1. Which type of mouth-parts are present in cockroach and what for?  
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2. How can you differentiate male and female cockroach just by observing them externally?  
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3. List the parts of alimentary canal in a sequence starting from mouth and ending at anus.  
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