Lecture: 6 Neck and Thorax

The Neck: Alternatively known as 'cervix' is the flexible region between the head and prothorax. Embedded in the cervix are two pairs of cervical sclerites, which serve as points of articulation for the head with the trunk. The two sclerites on each side are hinged with each other to form a single unit, which articulates anteriorly with the occipital condyle on the postocciput of the head and posteriorly with the prothorax. Frequently the cervical sclerities are fused with the pleurae of the prothorax.

Thethorax: is composed of three segments: the prothorax, mesothorax, and metathorax. The thoracic segments can be divided into three major sclerites that have their own special names: dorsal body plate tergum or nota, ventral body plate sternum and lateral plate pleuron. Each of these thoracic segments bears a pair of appendages and wings located on the mesothoracic and metathoracic segments, which together form the **pterothorax**. Almost all nymphal and adult insects have three pairs of thoracic legs – one pair per segment.

Thoracic nota: Dorsal body plate of each thoracic segment is called as pronotum, mesonotum and metanotum respectively.
Thepterothoracic nota each have two main divisions – theanterior wing-bearing alinotum and the posteriorphragma-bearing postnotum. These are firmly supported on the pleural sclerotization by means of the prealarand postalar arms, respectively. Lateral margins of the alinotum are constructed for articulation of the wing. (Fig.1))
Pterothoracic notum have 3 transverse sutures (antecostal, prescutal and scuto-scutellar) and 5 tergites (acrotergite, prescutum, scutum, scutellumandpost-scutellum)(Fig.1-A)). The antecostae of the primitive segments become greatly enlarged forming **phragmata**,to which the large dorsal longitudinal muscles are attached.

Thoracic sterna: the primary sclerotizations on the ventralside are segmental and inter segmental plates which often remain separate in the thorax, the inter segmental sclerite is produced internally into spine and is called spinasternum , while thesegmental sclerite is called the eusternum. Each eusternum may be simple or divided into separate sclerites – typically the presternum, basisternum and sternellum(Fig.2). The eusternum may be fused laterally with one of the pleural sclerites and is then called the laterosternite. Fusion of the sternal and pleural plates may form precoxal and postcoxal bridges.Arising from the eusternumispair of apophysis, the so- called sternal apophysis, the origin of these on the sternum is marked externally by pits joined by asulcus.In the higher pterygotes these apophyses are borne on a median internal ridge and form aY-shaped furca (Fig.3).

Thoracic pleura: The lateral wall of a thorathic segment between the notum and sternum is the pleura.In the pterothorax, the pleuron is divided into two main areas the anterior episternum and the posterior epimeron – by aninternal pleural ridge, which is visible externally asthe pleural suture (Fig.1). The pleural ridge runsfrom the pleural coxal process (which articulateswith the coxa) to the pleural wing process (whicharticulates with the wing), providing reinforcementfor these articulation points.

Extending between the two pleural processes is astrong internal plural ridge. The ridge may be invaginated at on pointedto form an internalarm, or pleuralapophysis (Fig. 3). As noted earlier, these apophyses combine with the pleural arms to form a rigid internal support. The latter provides attachment for the major longitudinal ventral muscles and certain muscles of the leg.The epipleurites aresmall sclerites beneath the wing and consist of thebasalaria anterior to the pleural wing process and theposterior subalaria, but are often reduced to just onebasalare and one subalare, which serve as attachmentpoints for some direct flight muscles. The trochantinis the small sclerite anterior to the coxa.Pterothoracicpleuron provides space for articulation of wings and legs. Thoracic appendages are three pairs of legs and two pairs of wings. Two pairs of spiracles are also present in the mesopleuron and metapleuron. Functions of thorax mainly concerned with locomotion.

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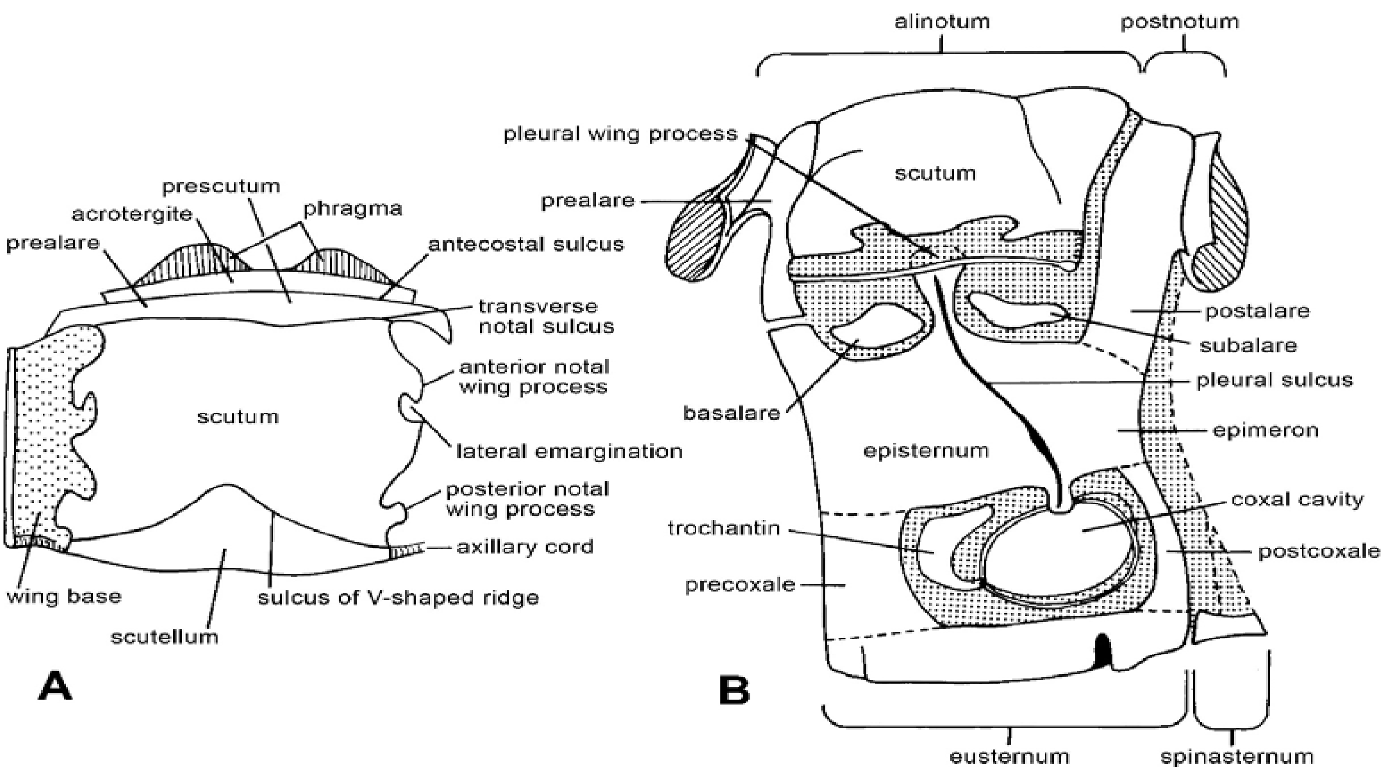


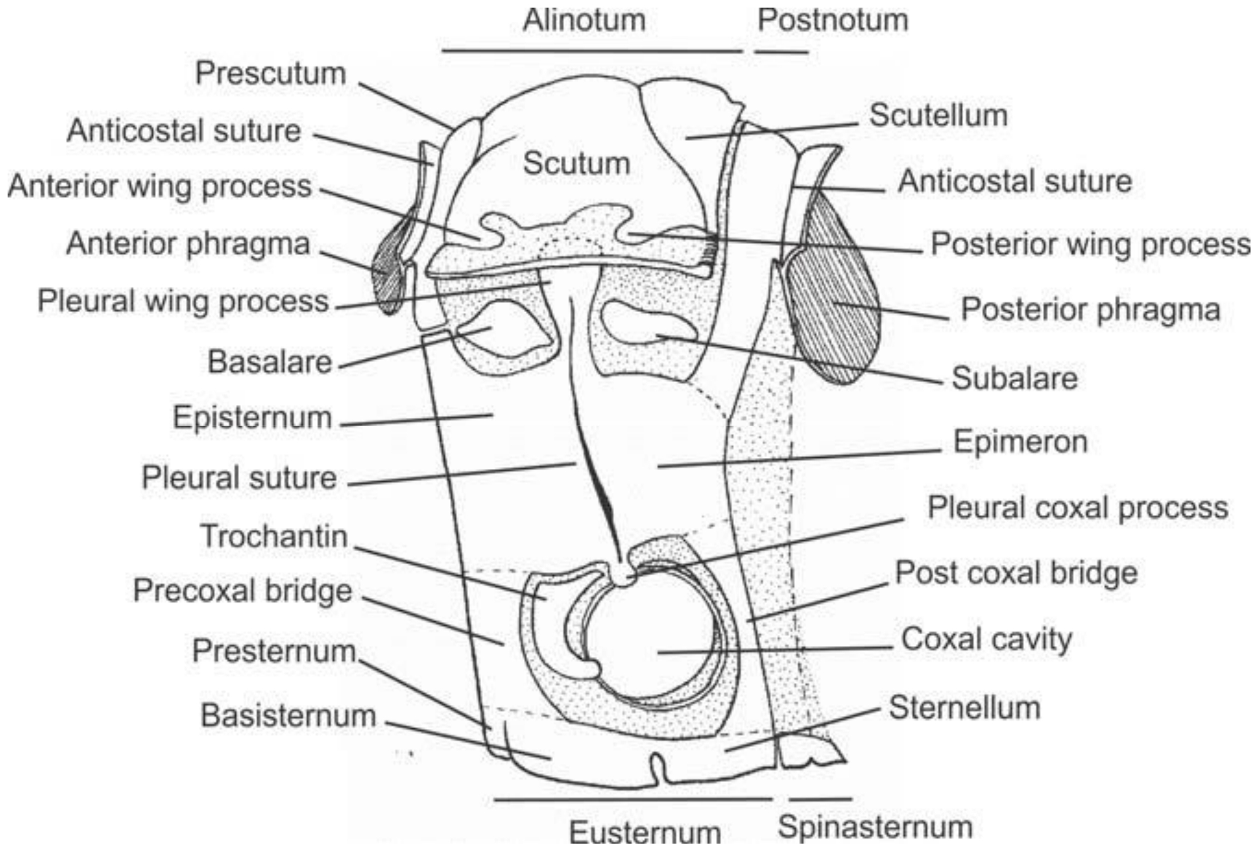


FIGURE 1. (A) Dorsal view of a generalized alinotum; and (B) lateral view of a typical wing-bearingsegment.

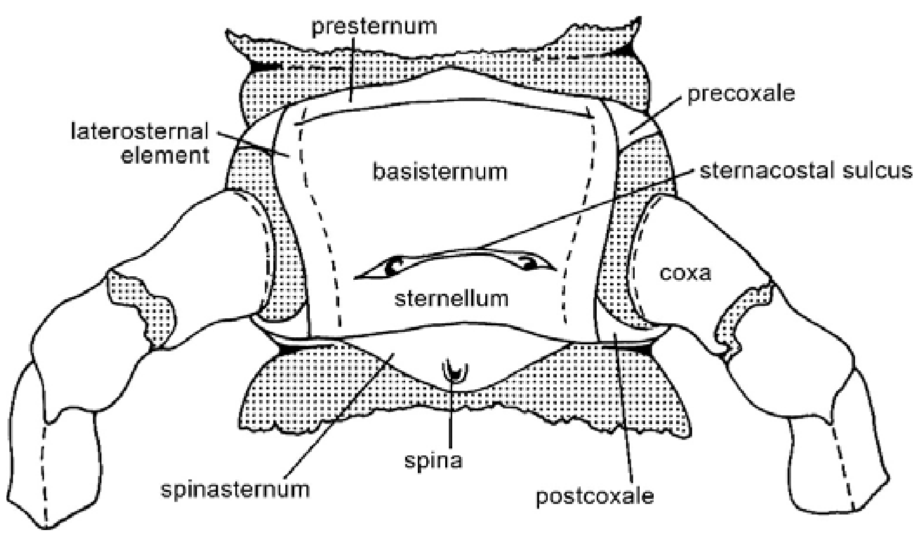


FIGURE2. Ventral view of a generalized thoracic sternum.

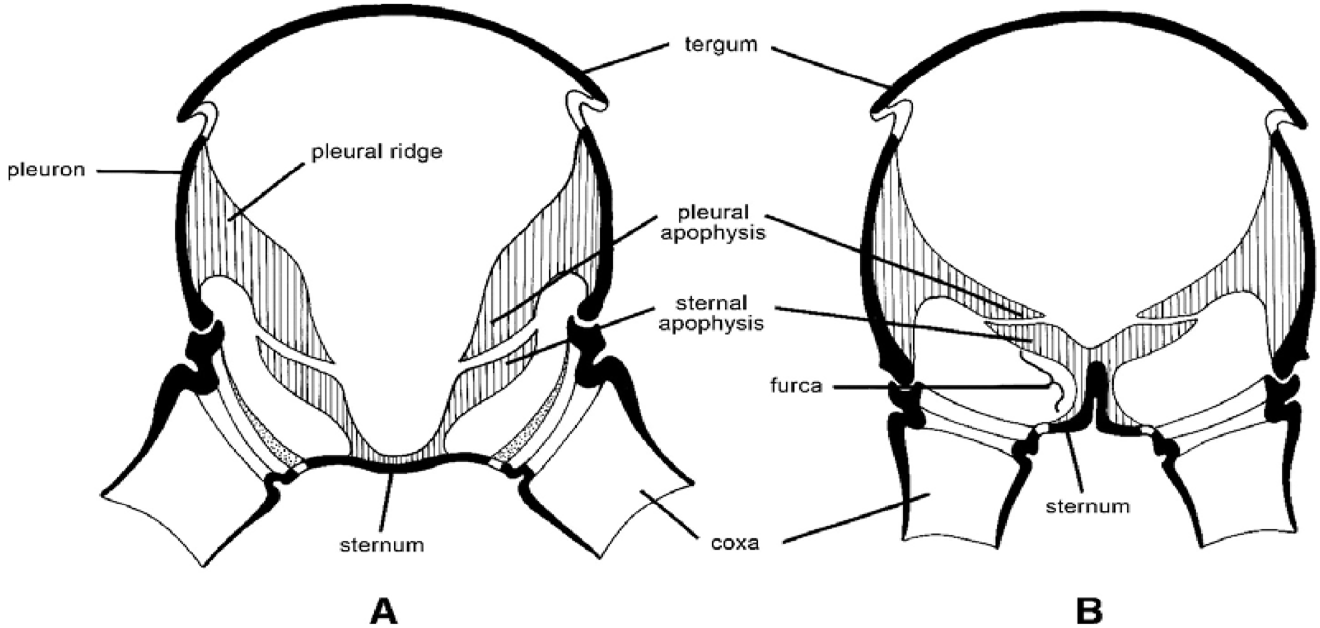


FIGURE 3. Diagrammatic cross-sections of the thorax to show the endoskeleton.(A) Normal condition; and(B) condition when furca present.

Legs

In most adult and nymphal insects, segmented fore,mid and hindlegs occur on the prothorax, mesothoraxand metathorax, respectively. Typically, each leg hassix segments and these are, from proximal to distal: coxa, trochanter, femur, tibia,and tarsus.

Structure of leg (Fig. 4-A)

1. Coxa: It is the functional basal segment and it is rigidly fixed to thorax or weakly articulated.
2. Trochanter : It is very small and the second segment. It is articulated with coxa and more or less fixed to femur.
3. Femur: It is the largest, strongest segment and is articulated with the tibia.
4. Tibia : It is equal or more than the length of the femur, articulated with tarsus.
5. Tarsus: it is the largest segment of the leg and usually divided into subsegmentstarsomeres. The number of tarsomeres vary from 1-5 and are movable one on the other. Among the 5 segments, 1st segment is large, big or broad in size known as basitarsus. The tarsus at its end consists of pretarsus which is in the form of a pair of claws and cushion like **pulvilli**. In between the claws, if there is lobe like structure, it is known as "**aroleum**" (Fig. 4-B) as in Orthoptera (grasshopper) and if it is bristle like structure, it is called "**Empodium**"(Fig. 4-C) as in Diptera.

Leg modifications(Figure 5)**.** The functions for which the legs have become modified include jumping, swimming, grasping, digging, sound production, and cleaning.

In Orthoptera and a few Coleoptera (e.g., flea beetles) the femur on the hindleg is greatly enlarged to accommodate the extensor muscles of the tibia used in jumping. In swimming insects, the tibia and tarsus of the hind legs (occasionally also the middle legs) are flattened and bear rigid hairs around the periphery. Legs modified for grasping are found in predaceous insects such as the mantis and giant water bug, in ectoparasitic lice, and in males of various species where they are used for hanging onto the female during mating. In the mantis, the tibia and femur of the foreleg are equipped with spines and operate Together as pincers. The foreleg of a louse is short and thick and has at its tip a single, large tarsal claw that folds back against the tibial process. Suctorial pads have been developed on the fore limbs in males of many beetle species. In *Dytiscus*, for example, the first three tarsomeres are flattened and possess large numbers of cuticular cups, two of which are extremely enlarged. The forelegs of soil-dwelling insects such as the mole cricket, cicadas, and various beetles are modified for digging. The legs are large, heavily sclerotized, and possess stout claws. The tarsomeres are reduced in number or may disappear entirely in some forms. In many Orthoptera sounds are produced when the hind femora, which have a row of cuticular pegs on their inner surface, are rubbed against ridged veins on the fore wing. Modifications to the forelegs for cleaning purposes are found in many insects. In certain Coleoptera and Hymenoptera, for example, the honey bee, a notch lined with hairs occurs on the metatarsus of the foreleg through which the antenna can be drawn and cleaned. The hindlegs of the bee are modified for pollen collection. Rows of hairs, the comb, on the inner side of the first tarsomere scrape pollen off the abdomen. The rake, a fringe of hairs at the distal end of the tibia, then collects the pollen from the comb on the opposite leg and transfers it to the pollen press. When the press is closed, the pollen is pushed up into the pollen basket, where it is stored until the bee returns to its nest.

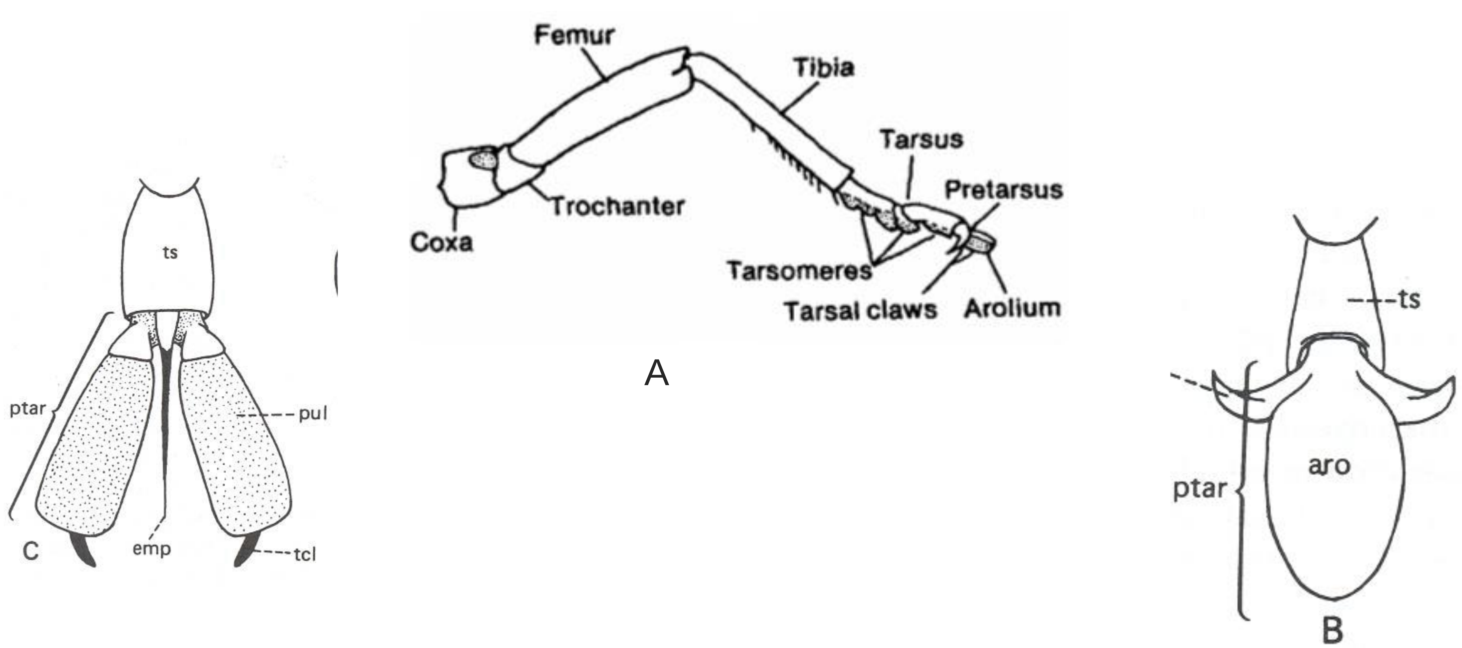


Fig 4.A-Structure of typical insect leg; B-Arolium; C-Empodium

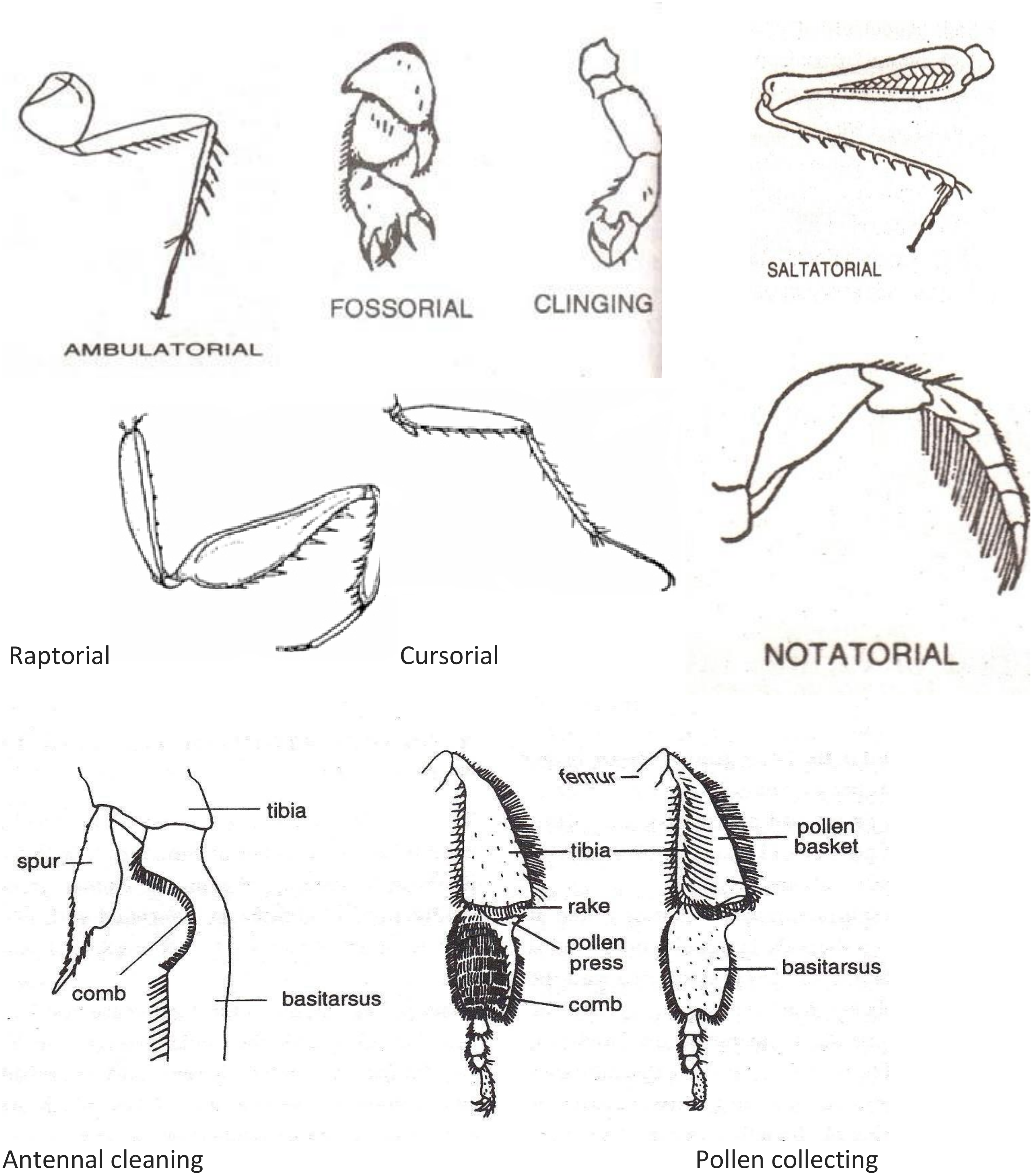
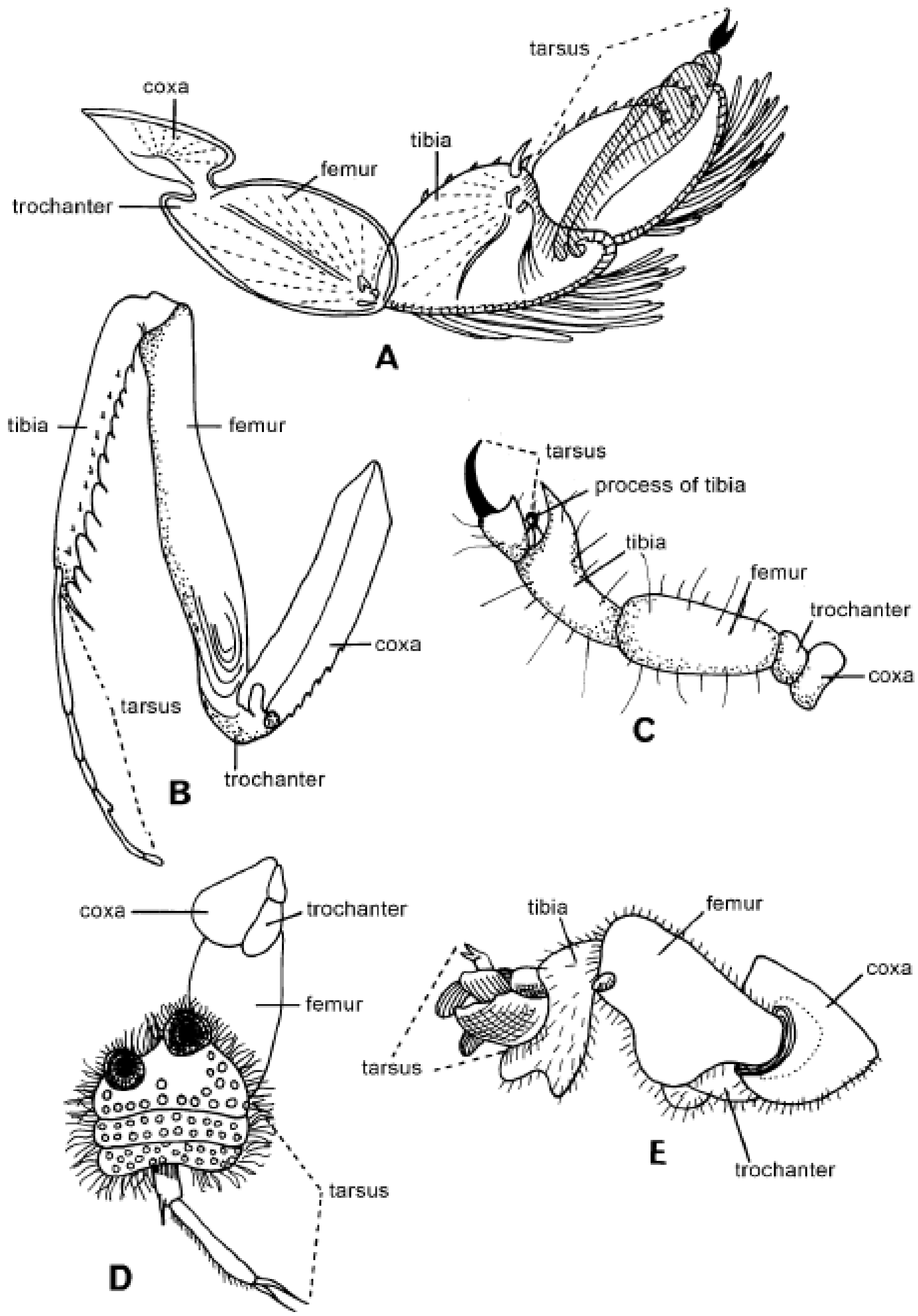
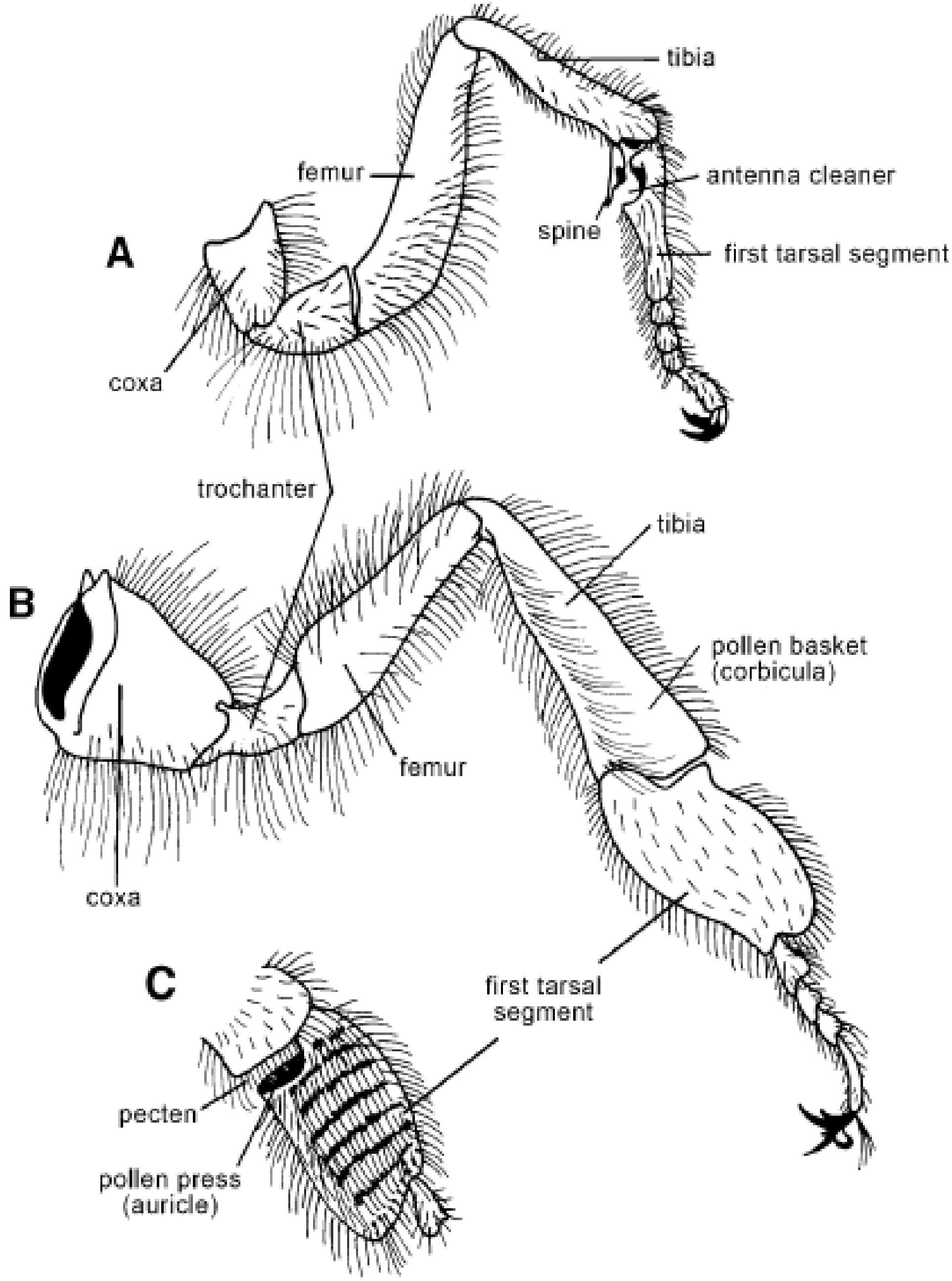


Fig.5 **Leg Modification**.Saltatorial – jumping; Raptorial -- seizing; Fossorial – digging; Natatorial – swimming; Cursorial – running; Ambulatory- walking



tarsus
coxa
tibia
femur
trochanter
A
tibia
femur
coxa
tarsus
trochanter
B
tarsus
process of tibia
tibia
femur
trochanter
coxa
C
coxa
trochanter
femur
tarsus
D
tibia
femur
coxa
tarsus
trochanter
E


A
tibia
femur
antenna cleaner
spine
first tarsal segment
coxa
trochanter
B
tibia
pollen basket
(corbicula)
femur
coxa
C
first tarsal
segment
pecten
pollen press
(auricle)