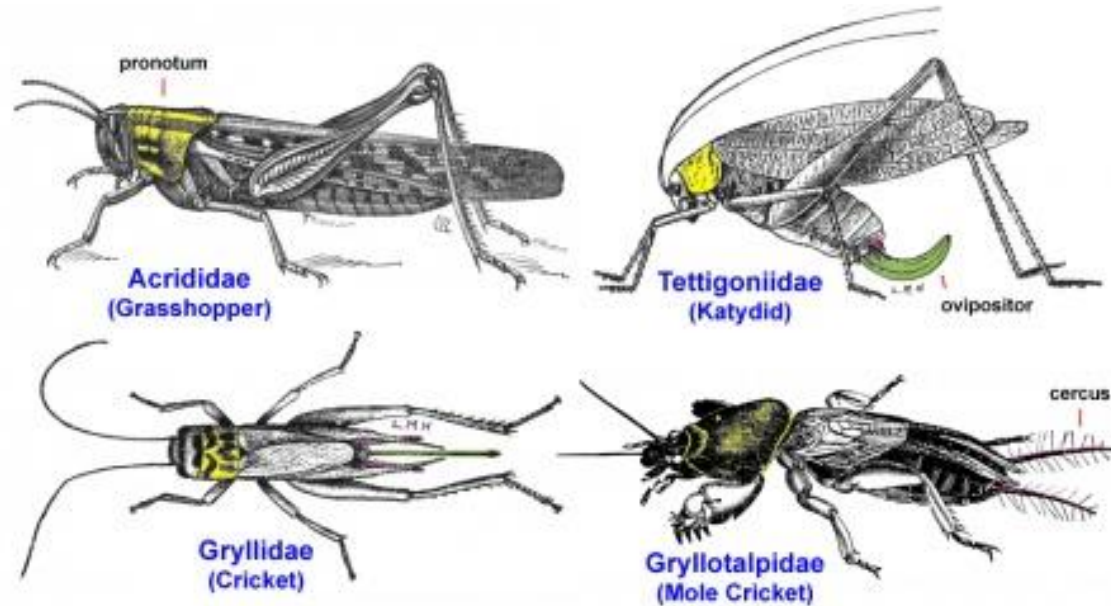


ORDER: ORTHOPTERA

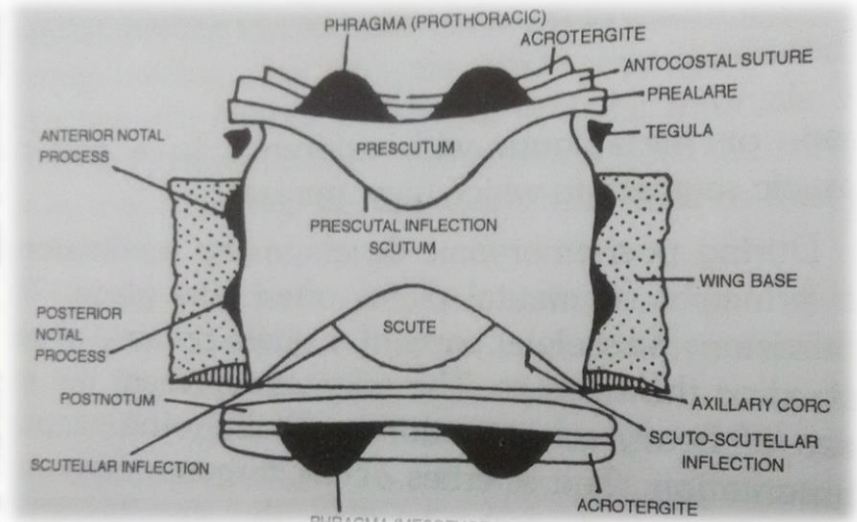
Orthos = straight Pteron = wings

Straight winged insects



Includes grasshoppers, locusts, Crickets and Mole crickets

- 1) Usually medium or large sized insects with elongated body
- 2) Head is hypognathous or prognathous
long (suborder – **ensifera**) or short (**caelifera**) usually filiform antennae
- 3) Biting and chewing mouth parts with well developed mandibles
- 4) Prothorax large and its notum extends laterally to conceal a great deal of propleurons
Meso +meta -pterothorax and its notum is divided into **prescutum, scutum and scutellum**



- 5) Winged or wingless.
- 6) front wings are long, narrow, many veined, thickened and are known as **tegmina**
In **Tetiigidae**, front wings are reduced to scale like, structures
Hind wings are **membranous**, broad, many veined and when at rest folded fanwise beneath the forewings
Well developed anal vein is present in hindwings



6) Specialized stridulatory organs are present and males alone can produce sound

Alary type (cricket & Long horned grasshoppers)

sound is produced by rubbing a sharp edge (**scraper**) at the base of one forewing along a file like ridge (**file**) on the ventral side of the other forewing

Bases of forewings at rest lie one above the other and possess the file and the scraper

But the **file is longer in upper wing and scraper is better developed in lower wing**

The forewings are elevated at about 45° when the sound is produced

Femoro alary type (Short horned Grasshoppers)

The femur of hind legs consists the file and it is rubbed against the tegmina



- 7) Auditory or **tympanal** organs are also well developed and are located on either side of the **first abdominal segment** or at the **base of fore tibiae**

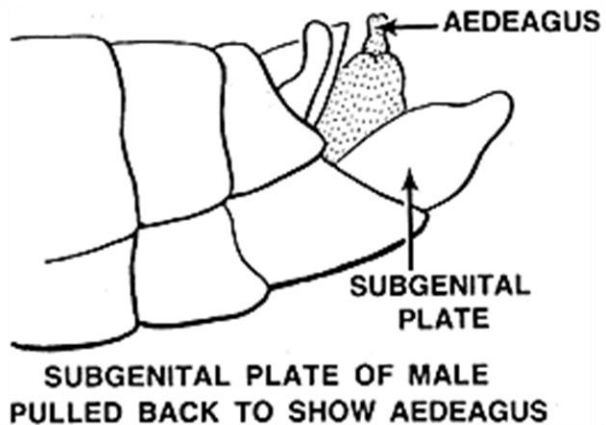


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- 8) Legs normally developed, fore legs modified for **digging (fossorial)** as in **molecrickets** or hind legs modified for **jumping (saltatorial)** as in **grasshopper** Tarsi 3 or 4 segmented.



9) Male genitalia concealed by the **boat shaped** 9th abdominal sternum called **Aedeagus**



10) Females with well developed ovipositor with 3 pairs of valves for **inserting eggs in soil**

11) Anal cerci well developed, usually short and unsegmented

12) Metamorphosis simple or incomplete

| Sub Order Ensifera | Caelifera |
|---|---|
| Includes Long horned grasshoppers, Crickets and Mole crickets | Includes Shor horned Grasshoppers and Locusts |
| Antennae are longer than the body | Shorter with less than 30 segments |
| Tymapnal organs on fore tibia | On 1st abdominal segment |
| Alary type | Femoro alary type |
| Long ovipositor | Short or absent |

Family: Tettigoniidae (Long horned grasshopper & Katydids)

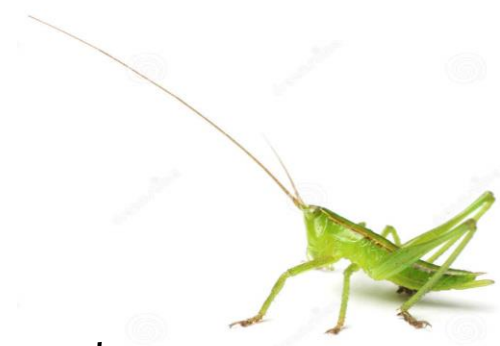
1. Cryptic Colouration
2. Antenna As Long As Or Longer Than The Body
3. Tarsus 4 Segmented
4. Stridulation - Alary Type
5. Mainly Herbivorous But Some Carnivorous



Eg : **Surface Grasshopper** – *Conocephalus Indicus*

Family: Gryllidae (Crickets)

1. long antennae, Behind the head is a smooth, robust pronotum
2. The abdomen ends in a pair of long cerci(spikes)
3. females have a long cylindrical ovipositor
4. The hind legs have enlarged femur , providing power for jumping
5. The front wings are adapted as tough, leathery elytra
6. It is by rubbing parts of these together that some crickets chirp



Acheta domesticus- The **house cricket**

Family: Gryllotalpidae (Mole Crickets)

1. Forelegs are fossorial with short, broad femur and Tibia with toothed projections
2. Burrowing in Habit

Gryllotalpa gryllotalpa -Common Mole Cricket



Family: Acrididae (Short horned grasshopper)

1. Antennae filiform shorter than the body with less than 30 segments
2. Pronotum saddle shaped
3. Auditory or tympanal organs situated one on either side of 1st abdominal segment
4. Stridulation femoro – alary type. The ridge on inner side of hind femur with Peg like projections (acting like a file) is rubbed against the hardened radial vein of Tegmina
5. Hind legs modified for jumping. Tarsus 3 segmented.
6. Ovipositor short and well developed. Its valves are short and curved.
7. These are plant feeders and are often very destructive.

Eg: Rice grasshopper - *Hieroglyphus banian*

Rice small grasshopper - *Oxya chinensis*

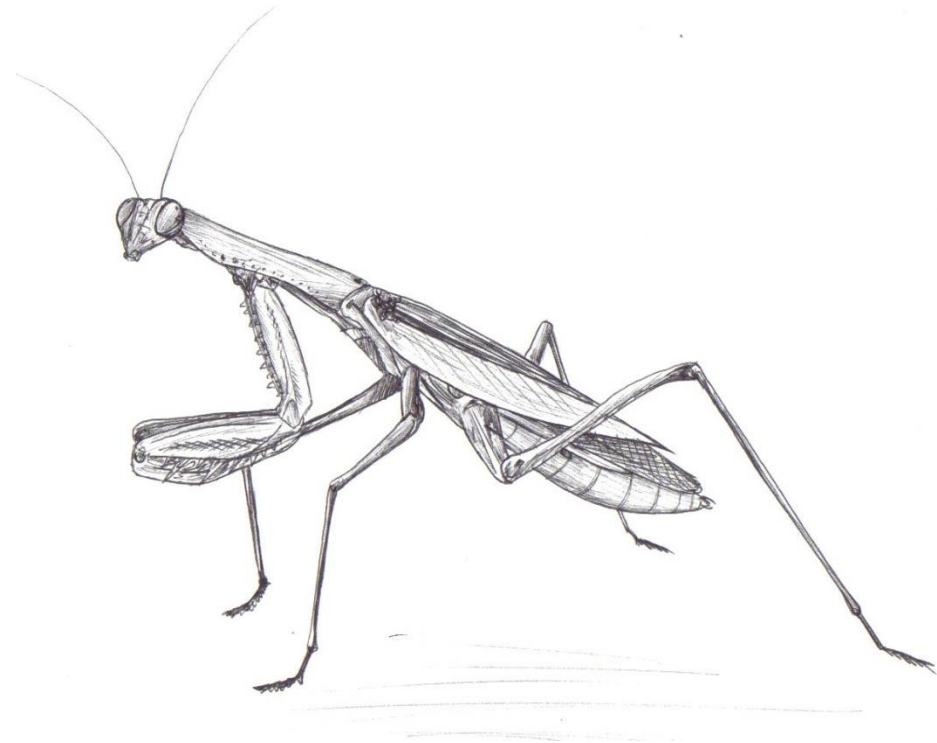
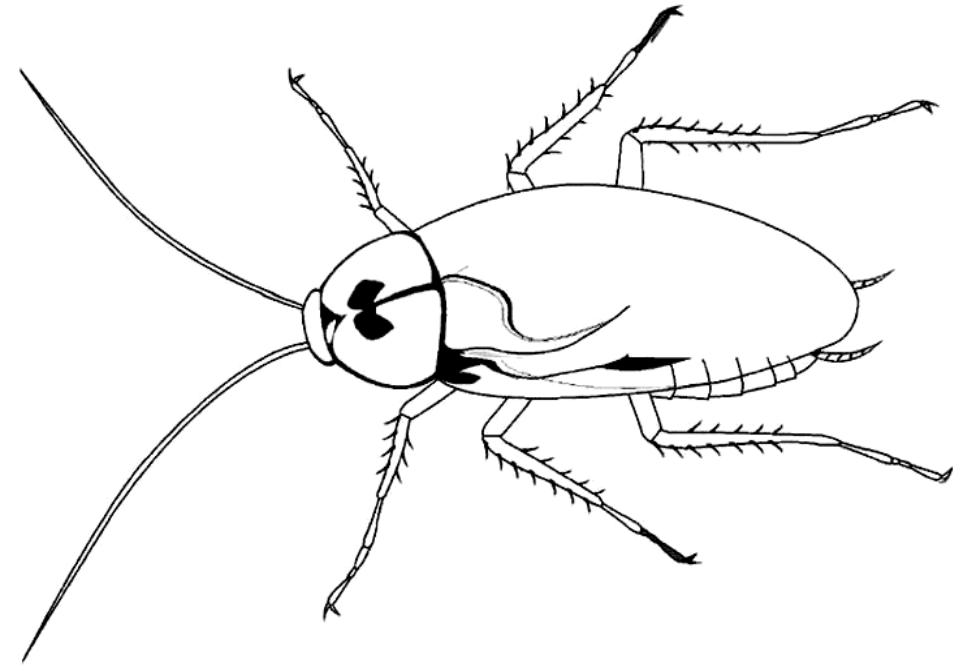
Cotton grass hopper - *Cyrtacanthacris ranacea*

Calotropis grasshopper - *Poecilocerus pictus*



ORDER: DICTYOPTERA

Dictyo: Net and Pteron: wings



Cockroaches & Mantids

1. Head is usually hypognathous
2. Mouth parts **mandibulate or biting and chewing type**
3. Antennae filiform, invariable
4. Forewings modified into tegmina with marginal costal vein
5. Hind wings have a Large anal lobe in a fan like fashion
6. Tarsus – 5 segmented
7. A pair of many segmented cerci are present
8. Specialized stridulatory and auditory organs are absent
8. Eggs are laid in **ootheca**

Dictyoptera is divided into two suborders viz., Blattaria (cockroaches) and Mantodea (preying mantids).

There are two important families viz., **Blattidae** includes Cockroaches and **Mantidae** includes mantids

Ex:

Periplanata americana- **American Cockroach**

Blatta orientalis- **Oriental Cockroach**

Mantis religiosa- **Preying Mantid**

Gongylus gongylodes- **Indian Rose Mantid**

| Blattidae | Mantidae |
|---|---|
| Head is not mobile in all directions | Head is mobile in all directions |
| Head is hidden by the pronotum | Pronotum does not cover the head |
| Two fenestrae (degenerated ocelli) occur in the place of ocelli | Three ocelli are present |
| Pronotum is shield like | Pronotum is elongate |
| Legs are cursorial and are adapted for running | Forelegs are raptorial middle and hindlegs suited for walking |
| Gizzard is powerfully armed with chitinous teeth to grind food | Chitinous teeth are absent in gizzard |
| Female does not devour the male during mating | Often (but not always) devours the male during mating |
| Eggs are laid inside a chitinous ootheca | enclosed in solidified foam Ootheca non chitinous |
| Nymphs are not cannibalistic | Nymphs are cannibalistic |
| No mimicry is found | Mimic leaves and flowers |
| Omnivorous | Carnivorous |
| Found in household, dead wood, litter etc. | Found mostly outdoors |
| Economic importance: They feed on food stuff, clothes and paper. They impart a foul smell to the food by contaminating with excreta. Hence they are harmful | Economic importance: They are predators on moths, flies, grasshoppers, caterpillars, etc. Hence they are beneficial |





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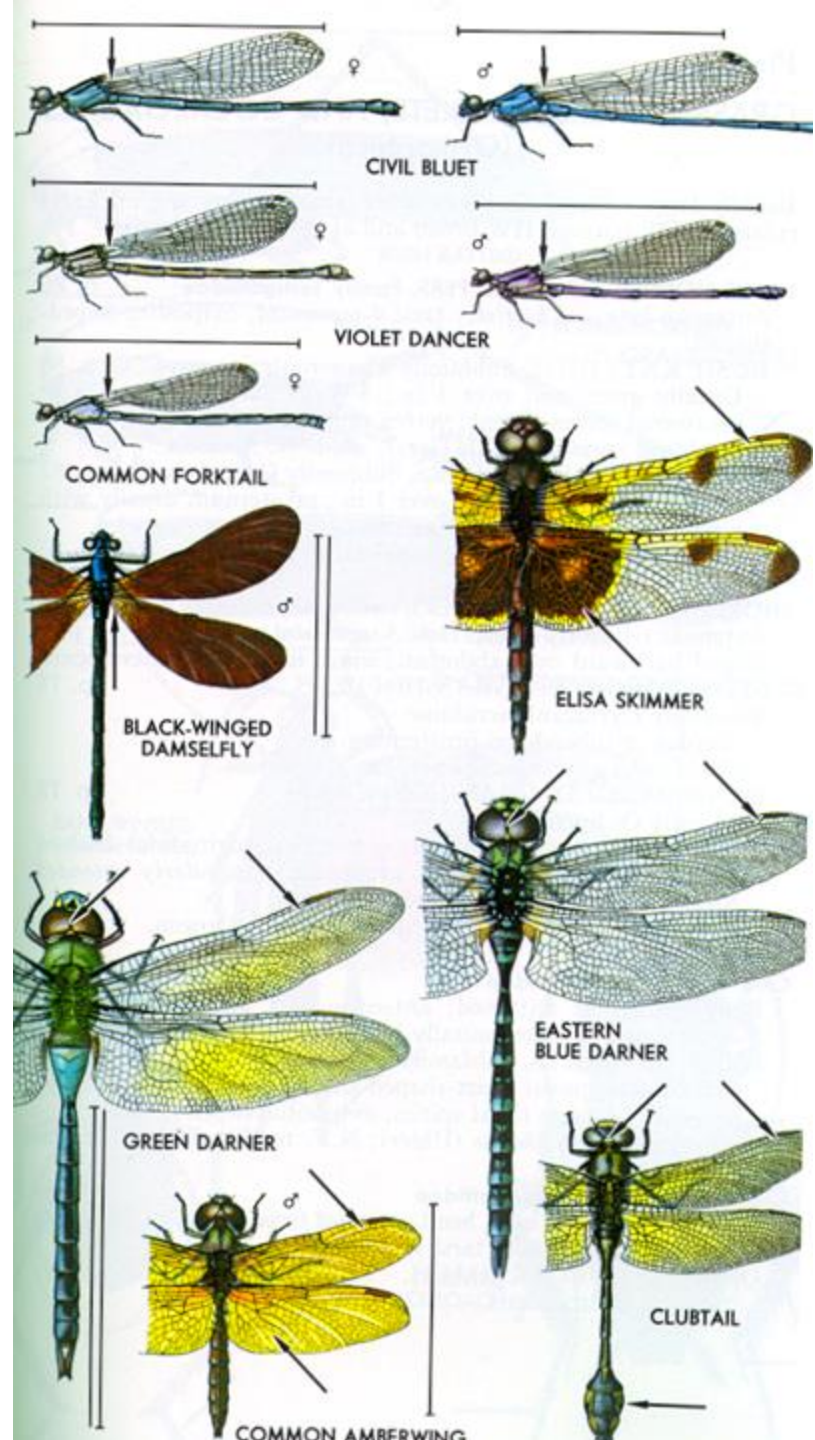


Jimmy Hoffman/Solent

Ravy

Order Odonata

Dragon flies
&
Damse flies



- **Order Odonata: Dragon & Damselflies**
- **Permothemis (Archodonate fossil)** is a connecting link between Ephemeroptera and Odonata
- Clypeus is divided into **Ante and post clypeus**
- In Nymphs labium is modified into a **prehensile Mask**
- Can **collect prey during flight** and also can consume while flying
- Prothorax reduced to **neck** and meso+meta forms pterothorax
- **Prehensile legs can form basket** like structure to catch the prey
- Membranous wings with a characteristic dark spot **Pterostigma** b/w costa and radius
- **Proventriculus** is developed in nymph with chitinous teeth
- Six **rectal gills** are **respiratory and osmoregulatory** in nymphs
- On **2nd and 3rd sternum**, appears a **secondary copulatory apparatus** with sac, hamules and penis
- Divided into 2 sub orders based upon specific characters

| Character | Zygoptera | Anisoptera |
|--------------------|-------------------------------------|---------------------------------------|
| Wings | similar held vertical above abdomen | Dissimilar and held flat over abdomen |
| Compound eyes | Widely separated and button like | Large and meet at mid dorsal line |
| Ovipositor | Well developed | Absent |
| Penis | Unjointed | Jointed |
| Nymphs Respiration | Caudal gills | Rectal gills |
| Includes | Damselflies | Dragonflies |