

A GUIDE TO ORTHOPTERA AND ALLIED INSECTS

by

ITO Gen and Homathevi Rahman

Introduction

The order Orthoptera contains grasshoppers, locusts, crickets, katydids, and so on. They usually have hind legs with swollen femur specialized for jumping. In many groups, especially in the suborder Ensifera, male tegmen specialized for making sound. Many of them are plant feeders, and some of the plant feeders can be important pests in agriculture. Some common species live very close to us.

Orthopteran insects usually seen near our house

1. *Nisitrus vittatus* (Gryllidae)
This species can be seen on many kind of plants. Often they become pests of crops. In this photo it is eating petal of lily flower.
2. *Mecopoda elongata* (Tettigoniidae)
We can hear their loud songs in any place (e.g. on bushes in KK town). Some individuals are brown-coloured and others are green or pale green coloured.
3. *Discotettix belzebth* (Tetrigidae)
A forest species usually seen on mossy tree trunks. Almost whole body is covered with small plants which may belong to Bryophyte or Algae.
4. *Valanga nigricornis* (Acrididae)
A large grasshopper species usually seen on roadside. Body yellow, with small black marking. Seen eating flower of “Bunga Raya”.

Lifecycle

All Orthoptera insects are hemimetabolus, in another word, incomplete metamorphosis. After copulation female lay eggs into the ground (e.g. many Acridids), into tree stem (e.g. phaneropterine katydids), or into some materials. Hatched nymphs are small but similar to the adults except its wings and genitalic organs are not developed. After several molting, they become adult.

Before copulation many males of Ensifera make calling sounds for attract female. Usually they make sound by scraping their tegmen. Other means of sound producing are, tapping, drumming, vibrating, and so on.

How to collect them

Habitats

Pygmy grasshoppers (Tetrigidae) habit various environments and feed on detritus of plants, plant parts, mosses, and so on. Each species or group of tetrigids lives in a specific environment (e.g. riverside, arid ground, wetland, forest floor, mossy tree trunk). Tetrigids often exhibit mimesis and

resemble many natural objects such as stones, lichens, leaves, twigs and spines. Many tetrigrids are camouflaged on the ground or tree trunks by means of their body colours and their shapes.

Acridid grasshoppers also habit various environments: riverside, grassland, forest ridge, canopy, and so on. Many crickets are ground dweller. Some Orthoptera insects live through their life on trees (Gryllacridids, some crickets and katydid). Most of Rhabdophoridae live in forest floor and few of them live in caves. All Myrmecophilid crickets live with ants and feed on ants' food.

Collecting methods

- (1) Looking
Simple, and good method to observe their natural behavior.
- (2) Sweeping
If you have a difficulty with finding Orthoptera insects by looking method, please try this method. You may collect small katydids, crickets, grasshoppers, and so on.
- (3) Light trap
This is a very useful technique to collect species hard to catch in daytime or species living on canopy of high trees. For example, Pseudophyllinae katydids usually live on high trees, so difficult to find them at daytime. But it is relatively easy to collect them by this method.
- (4) Sound detect
Many species of Tettigoniidae and Gryllidae make sound for intraspecific communication, especially for sexual communication. They
- (5) Pitfall trap
Not so many Orthopterists use this method, because specimens caught are often not in good condition. But it is worth to try, because there may be species not caught by other methods. Ground walkers (some crickets) are difficult to catch, but they can caught by pitfall trap.

How to make and Preserve Specimens

We must dry insects quickly after killing them, because in the tropics dead insects, especially Orthoptera easily putrefy and militarize. Usually drying oven is used for this purpose. But in fields facilities are not usually available, so we enter them into a kind of paper envelope, and dry them naturally or by using drier if electricity is available. After come back to the laboratory, they will be softened and dried after pinning. The best kind of insect pin is stainless steel pin.

The position of specimen on the pin is important. If the length of pin above the specimen is not enough to pick it up it is problematic, because the specimen will be broken when it is pinched. But if the length of lower part is not sufficient for labeling and for pinning to basement, it is also problematic. So, we must determine the best position when pinning insects.

Specimens without data label has no scientific value. We must put a data label in which locality, date, collector's name, etc. should be written. White hard paper is preferable for data

label and identification label. Labels had better be printed by laser printer rather than be handwritten, because handwritten labels are often difficult to read and time consuming to write.

Specimens must be kept in specimen boxes. The specimen boxes must be kept in a dark and dry room. Naphtalene must be installed in specimen boxes to prevent invasion of some insects which eat specimens such as ants, booklice (Psocoptera: Liposcelidae), and so on.



A specimen box



Correct pinning and labeling

Morphology

Orthoptera insects usually have a large pronotum and long hind femora used for jumping. In many species the fore wings strengthened forming tegmina, and the hind wings are membraneous and folded like a sector. They normally have well developed compound eyes and three ocelli. Antennae are long and filiform in the suborder Ensifera consisting of more than 30 segments, but consisting of less than 30 segments in the suborder Caelifera. Mouthparts are chewing type. Cerci are normally short and one segmented. Females usually have well developed ovipositor, especially in the suborder Ensifera. It is the origin of the name, Ensifera, because many species of this suborder has ensiformed ovipositor.

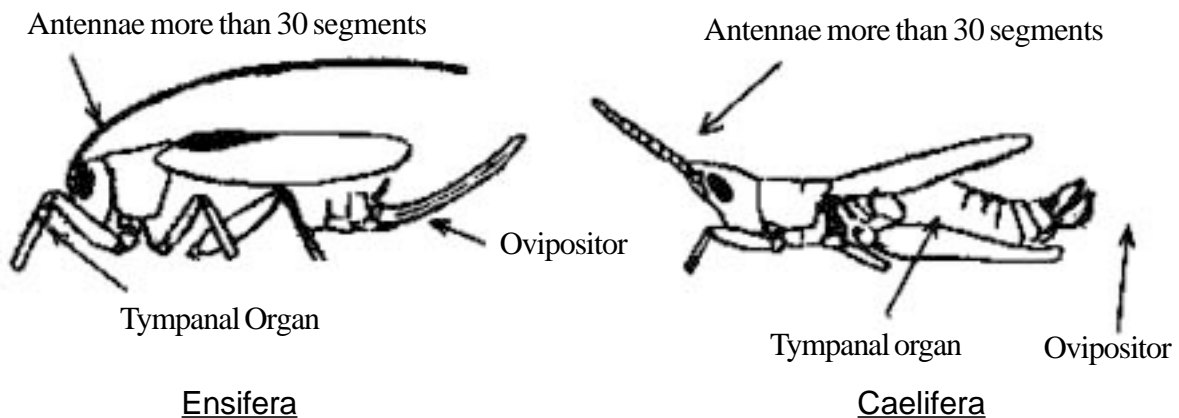
Classification

Very few groups of insects have a stable classification (e.g. Butterflies, some large beetles). Until recently this order have contained not only grasshoppers, katydids, and crickets, but also stickinsects (now Pasmatoidea), praying mantis (Mantodea), cockroaches (now Blattaria), and rock crawlers (now Grylloblattodea). Classification in this order is also not very stable. The following classification and key adopted here is most common one used by many authors: e.g. Ander (1939) and Rentz (1996).

Key to the suborders of Orthoptera

Antennae with more than 30 segments. Auditory organs, when present, located on fore tibiae. Stridulatory mechanisms, if present, located at base of the fore wings, usually in male. Ovipositor usually visible and having the valves articulated to form an elongate, sword-like, tubular or scythe-like extension of the abdomen.....**Suborder Ensifera**

Antennae with less than 30 segments. Auditory organs, when present, located on first abdominal tergite. Stridulatory specialisations of the fore wings, when present, located in the lateral part of the wings in their folded position. Ovipositor, when present, consisting of four separate hook-like valves.**Suborder Caelifera**



Key to Bornean families of Ensifera

- 1. Tarsi 3-segmented.....2
- Tarsi 4-segmented.....4



Tarsi 3-segmented



Tarsi 4-segmented

- 2(1). Fore legs suited for digging, with broad, flat femur and tibia with strong teeth.....Gryllotalpidae
- Fore legs normal, not specially modified.....3

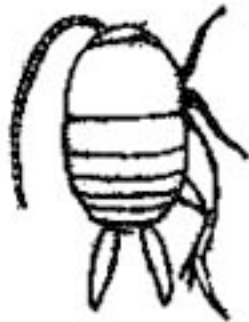


Gryllotalpidae



Gryllidae, Myrmecophilidae

- 3(2). Minute, wingless; hind coxae almost touching ventrally; eyes reduced; ocelli lacking.....Myrmecophilidae
- Without the above combination of characters.....Gryllidae



Myrmecophilidae



Gryllidae

- 4(1). Tegmen, when present, usually tough, distinctly different from hind wings; male tegmen with stridulatory file.....Tettigoniidae
- Tegmen, when present, soft and membranous, without stridulatory file.....5

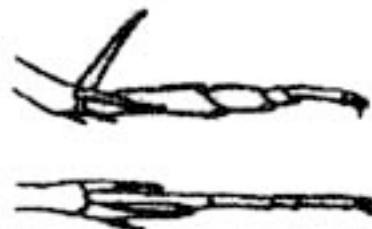


Here is the stridulatory file Tettigoniidae

- 5(4). Tarsi depressed, flattened with pads.....Gryllacrididae
 Tarsi laterally compressed, without distinct pads.....6



Gryllacrididae

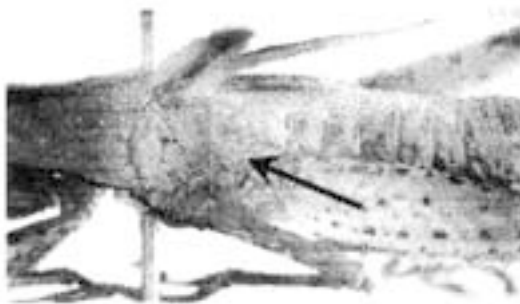


Stenopelmatidae, Rhaphidophoridae

- 6(5). Base of hind femur incised or notched. Tibial auditory tympana present in most species.....Stenopelmatidae
 Base of hind femur rounded. Tibial auditory tympana absent
 Rhaphidophoridae

Key to Bornean families of Caelifera

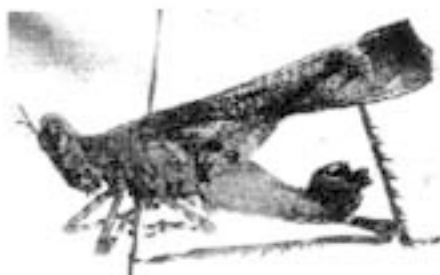
1. Tarsi of all legs 3-segmented.....2
 Tarsi of fore and middle legs at most 2-segmented.....5
 2. Tympanal organ primarily absent.....3
 Tympanal organ present, if absent, secondary.....43.



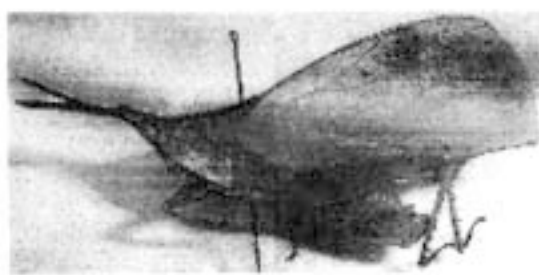
Tympanal organ absent

Pseudopyrgus curtipennis
 Trigonopterygidae

3. Antennae very short, filiform, thin. Face flattened.....Eumastacoidea
 Antennae moderately long, thick. Head acutely conical.....Trigonopterygidae



Eumastacoidea



Trigonopterygidae

4. Fastigium of vertex with a median longitudinal sulcus.....Pyrgomorphidae
 Fastigium of vertex without median longitudinal sulcus.....Acrididae

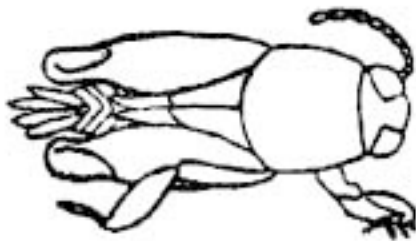


Pyrgomorphidae



Acrididae

5. Pronotum produced backward over abdomen. Tegmen vestigial. Fore and middle tarsi 2-segmented, hind tarsi 3-segmented.....Tetrigidae
 Pronotum not covering abdomen. Hind tarsus 1-segmented.....Tridactylidae



Tridactylidae



Tetrigidae



A hind leg of *Tridactylus* sp.

References

- Ander, K. 1939. Vergleichend - Anatomische und Phylogenetische Studien Uber die Ensifera (Saltatoria). *Opuscula Entomologica*, 2: 1-306.
- Hiura, I. et al. 1978. *The legend of the 5th occasional exhibition at Osaka Museum of Natural History, "The singing insects"*. Osaka Museum of Natural History.
- Rentz, D. 1996. *Grasshopper country*. University of New South Wales Press. 284 pp.