

Today we begin a series of lectures on the orthopteroid orders. This group of orders is sometimes referred to as the **Polyneoptera**. These are the more primitive orders of the Neoptera. The Orthopteroid orders include the Orthoptera, Phasmatodea, Grylloblattodea, Mantophasmatodea, Dermaptera, Plecoptera, Embiidina, Zoraptera, Isoptera, Mantodea, and Blattodea. The relationships between these orders are still rather obscure (look at family tree in fig. 6-1 on p. 156).

The last version of your text has adopted the more recent view that there are a number of valid orders within the orthopteroid orders. In the older versions, the Grylloblattodea, Phasmatodea, Orthoptera, Mantodea, and Blattodea were all lumped together in the order Orthoptera. It should be realized that there is not complete consensus on this classification and which of these orders should remain separate or combined to form larger orders. Once again, we will follow the classification given in your text.

### ORTHOPTERA

Orthoptera are the grasshoppers, katydids, and crickets. The order name means straight (ortho-) winged (-ptera). They are hemimetabolous.

The antennae may be short or long, and the mouthparts are mandibulate. They may be winged or wingless; if they are winged, they usually have 4 wings and the forewings are usually elongate, many-veined, and somewhat thickened (**tegmina**); the hindwings are membranous, broad, many-veined, and at rest they are usually folded fanwise beneath the forewings; one or both pairs of wings may be reduced or absent. The hind femora are more or less enlarged. The ovipositor may be short or long. The cerci may be 1- to many-segmented, and the tarsi may be 3- to 4-segmented.

Remember that the older versions of your text also included the rock crawlers, walkingsticks, praying mantids, and cockroaches in the Orthoptera with a number of suborders. Now, these have been given order status. The Orthoptera in the strict sense is now divided into 2 suborders: the Caelifera and the Ensifera.

Suborder Caelifera: These are called the short-horned grasshoppers because the antennae nearly always are relatively short (usually half the length of the body or less). Many can stridulate by rubbing hind leg against the fore wing (but see Romaleidae below). The tympana, if present, are located on the sides of the first abdominal segment. The tarsi have 3 or fewer segments; and the ovipositor is short. These are generally alert, active, diurnal species with good vision. Their primary mode of defense is escape, but some species will kick legs, try to bite (larger species can break skin), regurgitate crop contents, and/or autotomy may occur.

A. Family Tetrigidae: These are the pygmy grasshoppers and grouse locusts (fig. 11-9). There are about 1000 species worldwide. These are generally relatively small, less than 15mm. They are characterized by the pronotum which extends backward over the abdomen and is narrowed posteriorly. Also the front wings are vestigial, and the front and middle tarsi are 2-segmented, the hind tarsi are 3-segmented (tarsal formula 2-2-3; the remaining grasshopper families have 3-3-3); the arolia are lacking. These overwinter as adults. They are not usually economically important. They are often found in moist situations where they feed primarily on algae or detritus; they are usually good swimmers.

B. Family Romaleidae: These are the Lubber grasshoppers. This family used to be considered a subfamily within the Acrididae. They have a different stridulatory mechanism - front wing rubs the hind wing. Hind tibiae with both inner and outer immovable spines at apex (remember: spines are non-moveable; spurs are moveable). Most of these are western in distribution, but there is at least one species that occurs in the southeast. These are the grasshoppers that are often used to study in biology classes for dissections. They are often fairly large and black in color with some other colorful markings.

- C. Family Acrididae: These are the short-horned grasshoppers (also sometimes called locusts). This family includes most of the commonly encountered grasshoppers. There are about 10,000 species. The pronotum is not prolonged backward over abdomen. Also the wings and tympana (on the sides of the 1st abdominal segment) nearly always present; all tarsi 3-segmented; and the arolia is present. Hind tibiae with only the inner immovable spine at apex, the outer one is lacking. The ovipositor is short. Most are rather drab colored (gray or brown mottled), but many have rather brightly colored hind wings. These include some of the important pest species. They overwinter as eggs with the eggs being laid in the ground. Many of these species do stridulate. This family is divided into a number of subfamilies:
1. Subfamily Cyrtacanthacridinae: These are the spur-throated grasshoppers. These are usually very large grasshoppers. The prosternum has a median spine or tubercle. The mesosternal lobe (fig. 11-5E, stl) is longer than wide, and the inner margin is usually angulate. Hind wings are usually hyaline. Hind legs of males without row of stridulatory pegs. Some (all?) have vertically striped eyes in life - may not show after death. Antennae slightly longer than in Melanoplinae. There is only one genus, *Schistocerca*, in this subfamily, but it does contain the desert locust, *S. gregaria*.
  2. Subfamily Melanoplinae: This subfamily used to be considered part of the Cyrtacanthacridinae, and has only recently been split out into its own subfamily; it is sometimes called the Catantopinae. The prosternum also has a median spine or tubercle, but the mesosternal lobe (fig. 11-5D, stl) is wider than long, and the inner margins are rounded. Hind wings are usually hyaline. Hind legs of males lack the row of stridulatory pegs. The eyes may or may not be striped, but if they are striped, the stripes will be horizontal. Antennae slightly shorter than in the Cyrtacanthacridinae. The slant-faced illustration on your handout no longer belongs in the Melanoplinae (it now belongs in the Leptysminae). The largest genus in this subfamily is *Melanoplus* which includes most of the common pest species. Some species build up such large numbers that they have huge migratory swarms.
  3. Subfamily Gomphocerinae: These are the slant-faced grasshoppers. Nearly all of these species used to be included in the Acridinae; now the Acridinae is restricted to only a few species (1 in the eastern U.S.). Prosternum without median spine or tubercle. Hind wings usually hyaline. The hind femora of males have a row of stridulatory pegs. The face is slanting backwards, sometimes very strongly so. These are normally found along wet marshes or in wet meadows.
  4. Oedipodinae: These are the band-winged grasshoppers. Prosternum without median spine or tubercle. The pronotum usually has a strong median ridge and the caudal margin is produced posteriorly forming a right angle. Hind wings usually colored, but if hyaline, then hind femora of males with row of stridulatory pegs. The face is vertical or nearly so. These often occur in areas of sparse vegetation. This family does include several pest species. These make a cracking sound as they fly.
- D. Family Tridactylidae: These are the pygmy mole crickets. There are about 75 species worldwide. They have 3 small ocelli; the antennae are 10-12 segmented; the body is not pubescent; the length less than 10mm; the front and middle tarsi are 2-segmented, and the hind tarsi are 1-segmented or absent; the hind tibiae have 1-4 pairs of slender plates which are used in swimming; the tip with 2 spurs of unequal length. The front legs are fossorial. These insects are burrowing in habit and occur along the shores of streams and lakes where they apparently feed on algae. These are relatively small (less than 10mm). These do occur in our area.

Suborder Ensifera: This suborder includes the katydids and crickets. The antennae nearly always are long and hair-like. The tympana, if present, are located at the base of the front tibiae. They still have saltatorial hind legs. The tarsi are 3- or 4-segmented. The ovipositor is relatively long, either sword-shaped or cylindrical. If they can stridulate, they do so by rubbing the two forewings together. Most are nocturnal; they rely primarily on **crickets** for defense. Tactile senses are important, but vision and hearing are also good.

- First 2 families (Stenopelmatidae and Rhabdophoridae): Wings usually absent, but if present, then with 8 or more principal longitudinal veins; males lack stridulatory structures on wings; tibiae may or may not have tympana; usually gray or brown in color.

A. Family Stenopelmatidae: These are the Jerusalem, sand, or stone crickets. This family used to be included as a subfamily of the Gryllacrididae (note: the Gryllacrididae is now represented in North America by a single eastern species - does not occur in ND). They are relatively large insects with the head and abdomen rather large. They are usually brownish in color with black bands on the abdomen. They are generally found under stones or in loose soil. There 9 North American species which are mainly western in distribution, but I believe that one of the species does occur in North Dakota. The antennae are separated at the base by the length of the first antennal segment. Some communicate by drumming (tapping abdomen on substrate). Weda in New Zealand and Australia.

B. Family Rhabdophoridae: These are the cave and camel crickets. This also used to be included as a subfamily in the Gryllacrididae. These insects are usually brownish in color and they are rather hump-backed in appearance (fig. 11-10 in your text). They are often found in caves, in hollow trees, under logs and stones, and in other dark moist areas. The antennae are contiguous at the base.

- Remaining 3 families: Wings present (but may be small), and with fewer than 8 principal longitudinal veins; males with stridulatory structures on front wings; front tibiae usually with tympana; color variable, but often green.

A. Family Tettigoniidae: These are the long-horned grasshoppers & katydids. The tarsi are 4-segmented. The auditory organs, when present, are located at the base of the front tibiae. The ovipositor is laterally flattened and bladelike. Most species are plant feeding, but a few (Copiphorinae and Conocephalinae) are predaceous. They usually overwinter as eggs which are often inserted into plant tissues. This family is divided into a number of subfamilies.

1. Subfamily Copiphorinae: These are the cone-headed grasshoppers. These have long bodies, and the head is usually conical in shape (**fastigium** - apex of head, vertex between the compound eyes). The ovipositor is long and sword-like. Some will be green and some will be brown. These are often found in high grass or weeds (not arboreal).

2. Subfamily Phaneropterinae: These are the katydids. These usually lack prosternal spines, and the hind wings are usually longer than the front wings. Most of these species are green in color, but there are some unusual pink forms.

3. Subfamily Pseudophyllinae: These are the true katydids. These have the front wings oval and convex, with the costal field broad, with many parallel transverse veins. The prosternal spine present. These are usually green. These are usually arboreal in habit and as such are not collected as often as the other katydids.

4. Subfamily Conocephalinae: These are the meadow grasshoppers. These are small to medium sized and have slender bodies. There are no spines on dorsal surface of the fore tibiae. They are usually greenish in color. They are usually found in wet grassy meadows.

5. Subfamily Decticinae: These include the shield-backed grasshoppers and includes the Mormon cricket which does occur in North Dakota. There are one or more spines on dorsal surface of the fore tibiae. These are usually brown or black in color, short-winged, and the pronotum extends back to the abdomen. They are relatively large (over 25mm).

B. Family Gryllidae: These are the crickets. The tarsi are 3-segmented (2nd small). The ovipositor is needle-like or cylindrical (except Trigonidiinae with ovipositor compressed and upcurved). The forewings (tegmina) bent down rather sharply at sides of body, variable in length; the hind wings are long, short, or absent. The tympana are usually present and located on the front tibiae. The males have stridulatory organs on the front wings. They usually overwinter as eggs which are usually laid in the ground or in vegetation. There are more 900 species. This family is divided into a number of subfamilies in which you need to know three:

1. Subfamily Oecanthinae: These are the tree crickets. Most tree crickets are slender, whitish or pale green in color. They lack ocelli. Many, but not all, species occur in trees. Many of the tree crickets lay their eggs in the bark or on stems which can seriously damage the twigs. The males and females do not look alike (see fig. 11-16 on p. 224), the males have broad wings for singing.

2. Subfamily Nemobiinae: These are called the ground crickets. They are common insects in pastures, meadows, and along roadsides. They are usually less than 12mm in length and a brownish color. The ocelli are present. Spines of hind tibiae are long and movable (spurs). The last segment of the maxillary palps are at least twice as long as the preceding segment.

3. Subfamily Gryllinae: These are the house and field crickets. These are usually dark colored, either brownish or black, and larger than the ground crickets (usually 14mm or greater in length). The ocelli are present. Spines on hind tibiae are stout and immovable. The last segment of the maxillary palps are only slightly longer than the preceding segment. The field crickets are very common insects in pastures, meadows, along roadsides, and in yards where they sometimes enter houses. Some of these species are very similar and difficult to distinguish. One interesting way they are distinguished is by differences in their songs.

C. Family Gryllotalpidae: These are the mole crickets. The forelegs (tibia and basal tarsal segment) are very broad and spade-like, fitted for digging (fossorial). Also they have 2 large ocelli (the compound eyes are reduced); antennae are relatively short, but have more than 11 segments; body pubescent; length, 18mm or more; tarsi 3-segmented, best seen in middle and hind legs. The ovipositor is vestigial. Mole crickets are usually brownish in color and are pubescent. These insects burrow in the ground and especially in the south they can be important turf pests, particularly in golf courses. These are often attracted to lights. The females will exhibit maternal care by watching over the eggs for up to 3 weeks and then the young for up to another 4 weeks.