

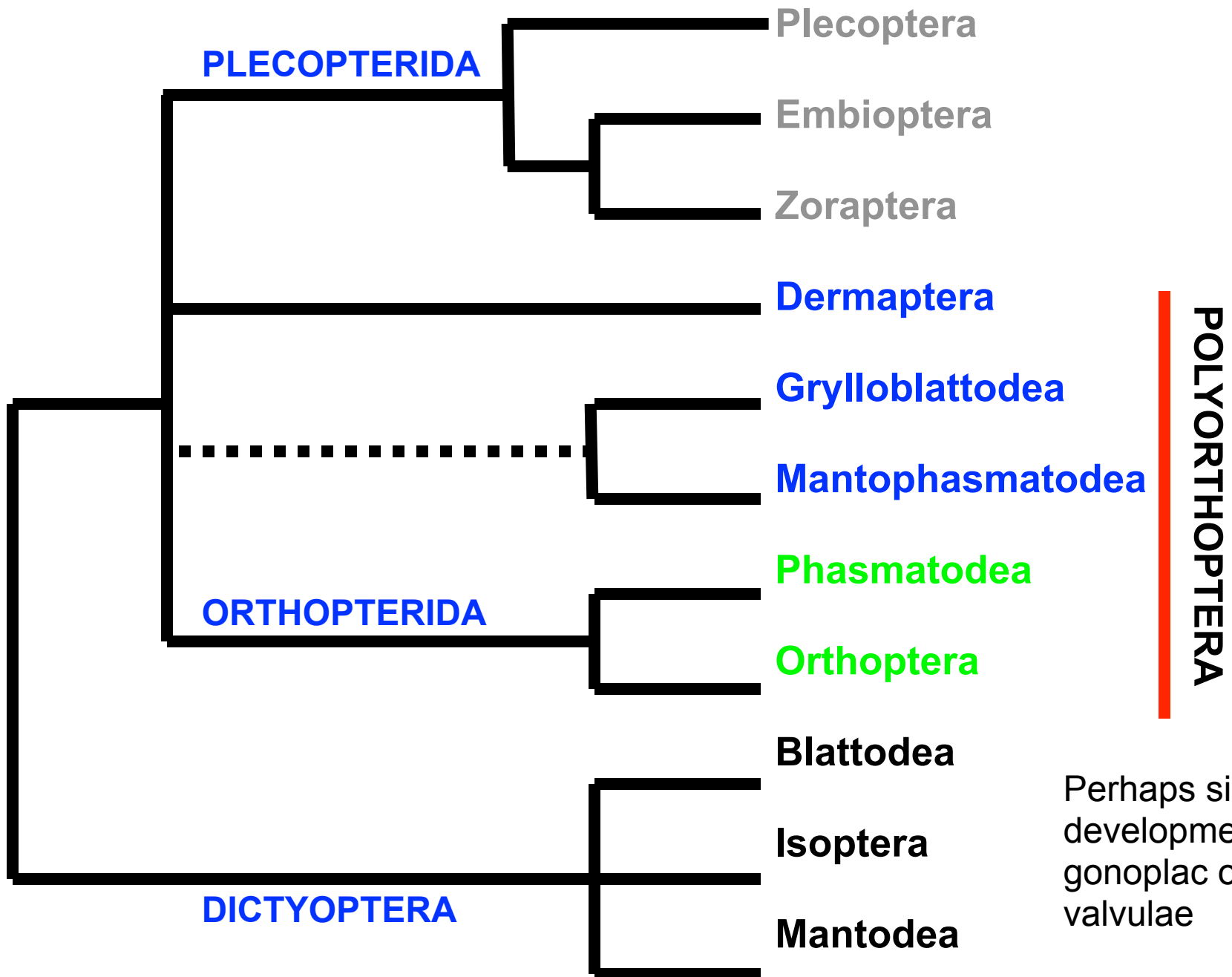
The Orthopteridan Orders

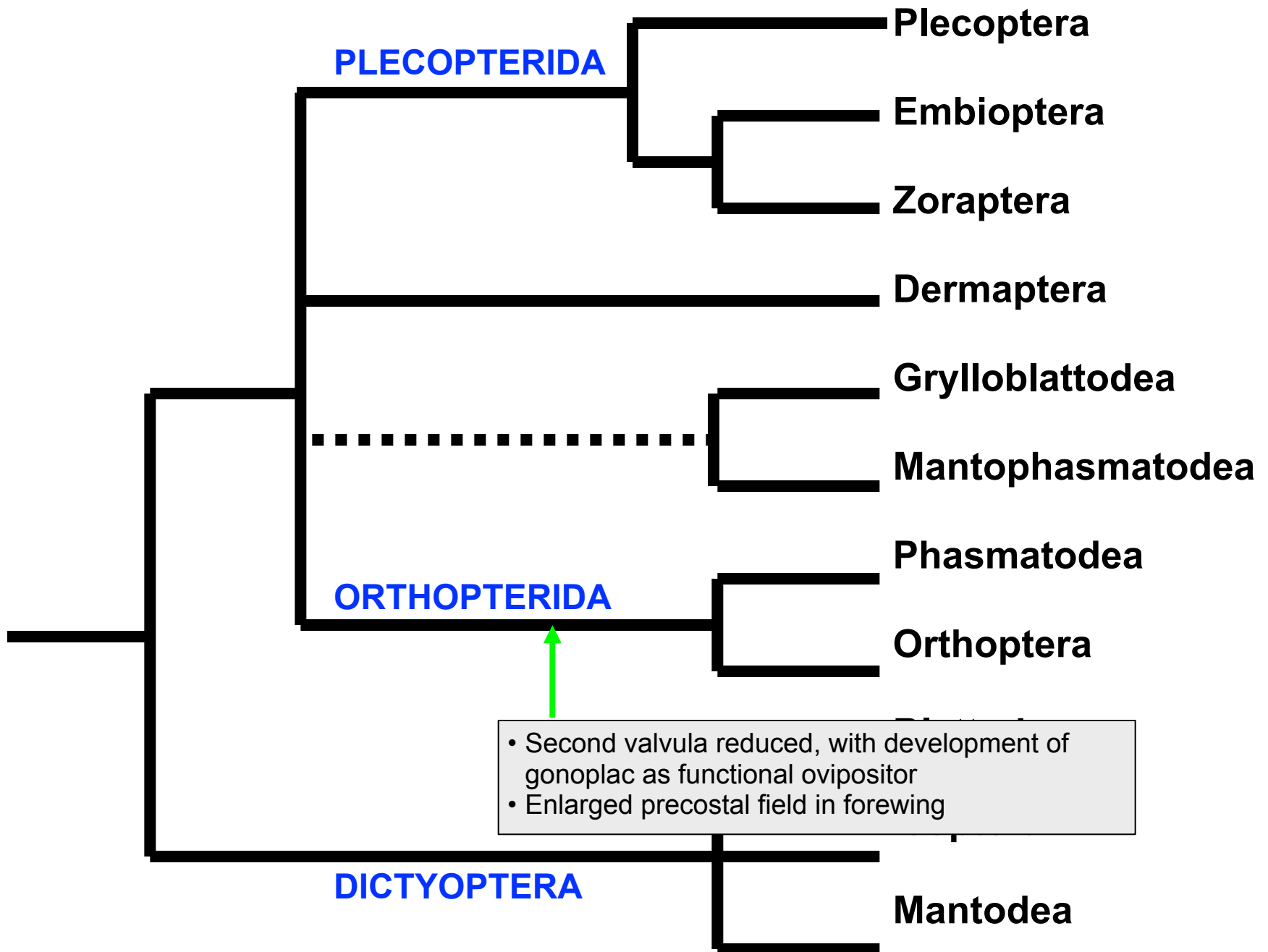


Orthoptera



Phasmatodea





ORTHOPTERA, *sensu stricto*

Grasshoppers, Locusts, Katydid, Crickets, Wetas



What is a “Weta”?

A giant cricket!

New Zealand Maori name of *wetapunga* that was given to the giant weta. *Wetapunga* translates roughly to "God of ugly things." Wetas and king crickets occur principally in New Zealand and Australia. Can reach 90 mm (3.5 in) and 70 grams (2.5 oz).

Orthoptera

Ensifera

Stenopelmatoidea

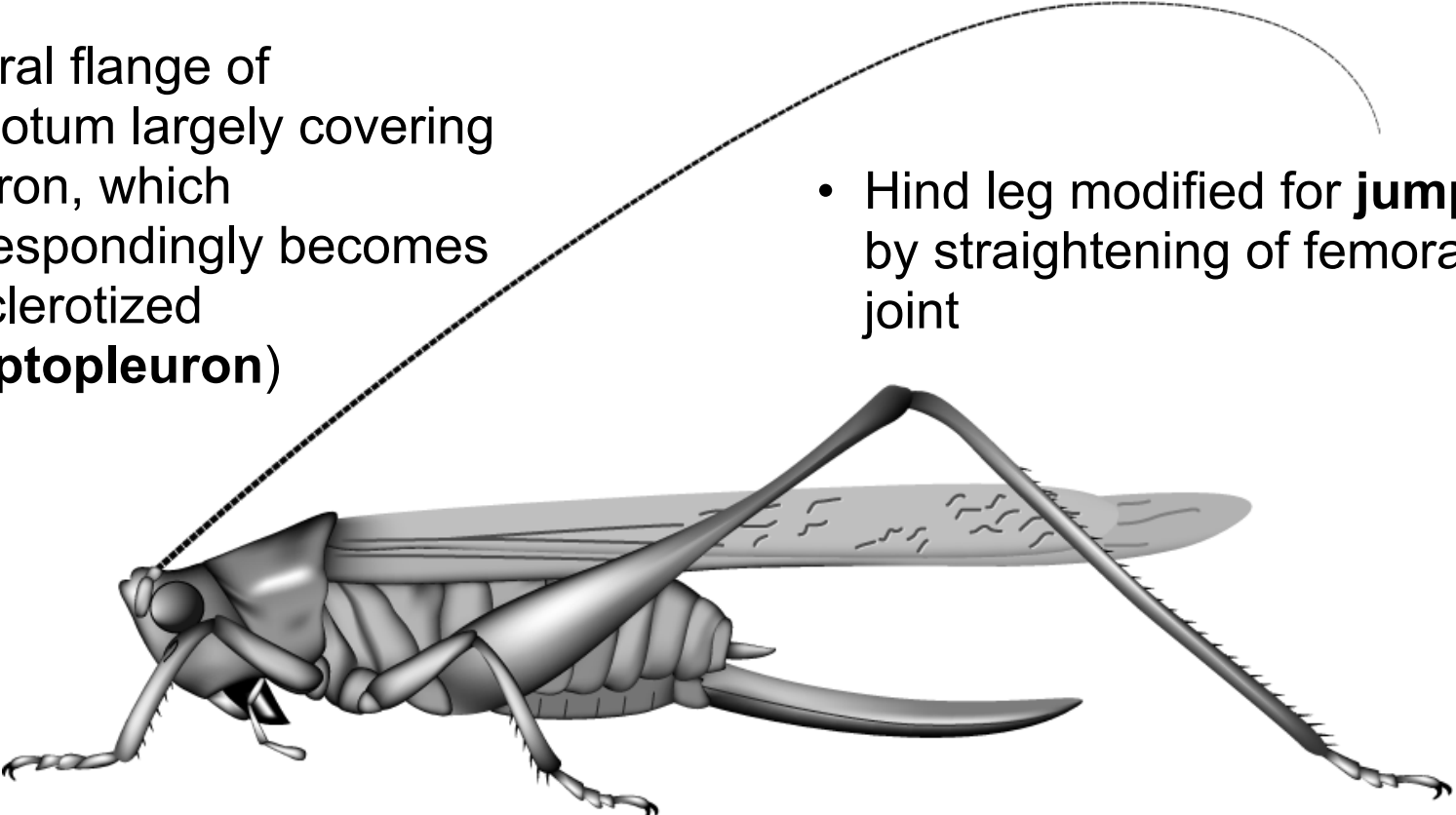
Anostomatidae



ORTHOPTERA, *sensu stricto*

Grasshoppers, Locusts, Katydid, Crickets, Wetas

SYNAPOMORPHIES

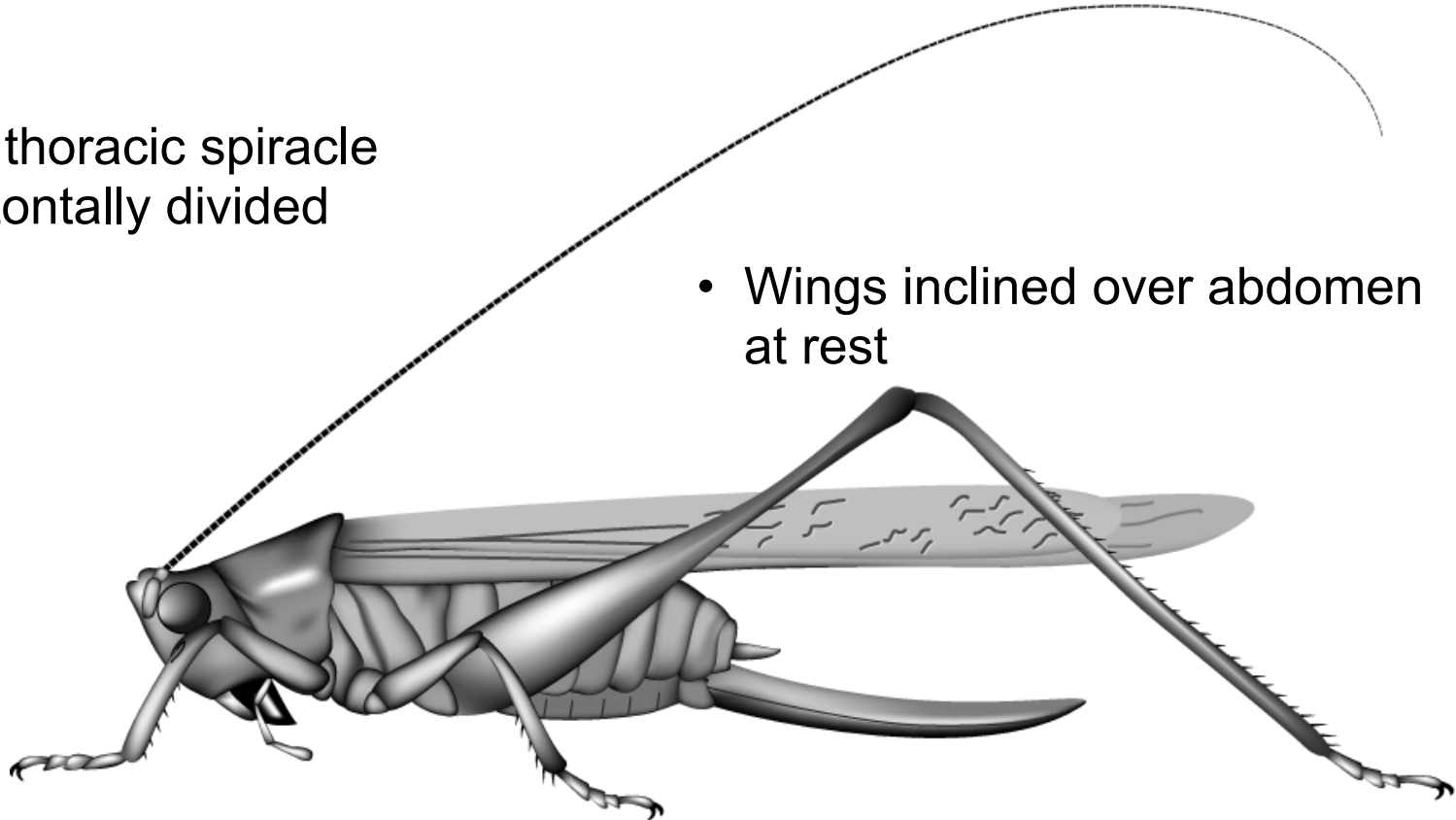
- Lateral flange of pronotum largely covering pleuron, which correspondingly becomes desclerotized (**cryptopleuron**)
 - Hind leg modified for **jumping** by straightening of femoral/tibial joint
 - **Femur enlarged** to accommodate large tibia extensor muscle
 - Hind tibia with **2 dorsal rows of teeth**
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ORTHOPTERA, *sensu stricto*

Grasshoppers, Locusts, Katydid, Crickets, Wetas

SYNAPOMORPHIES

- First thoracic spiracle horizontally divided
- Wings inclined over abdomen at rest
- Wing pads of late nymphal instars twisted



Suborder Ensifera - crickets, katydids, wetas
(10 families)

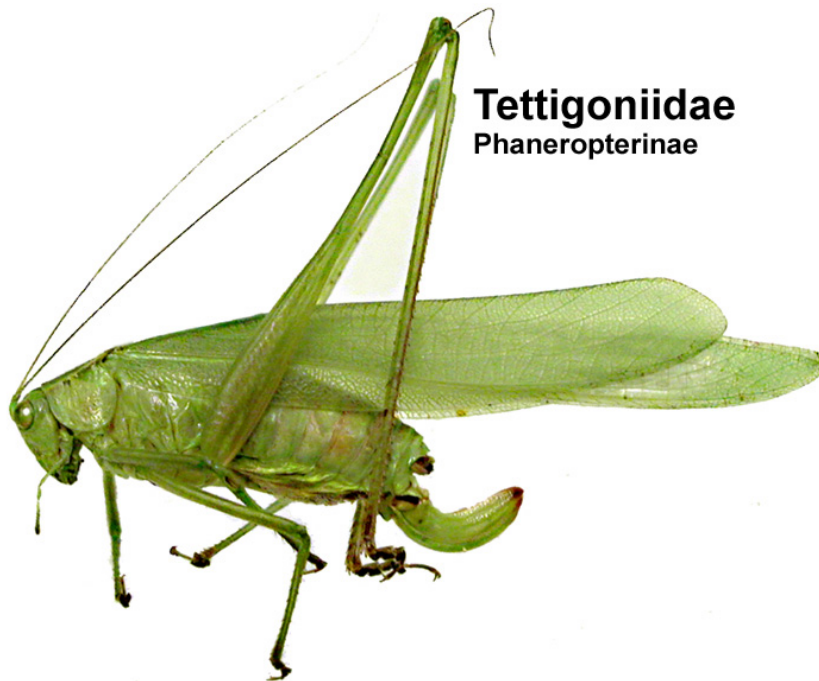
Suborder Caelifera - grasshoppers, locusts, & relatives
(20 families)

Suborder Ensifera - crickets, katydids, wetas

(10 families)

Synapomorphies

- Antennae longer than body, thin, with many more than 30 segments
- Anal fan in hind wing includes at least the anterior and posterior cubital areas



Tettigoniidae
Phaneropterinae



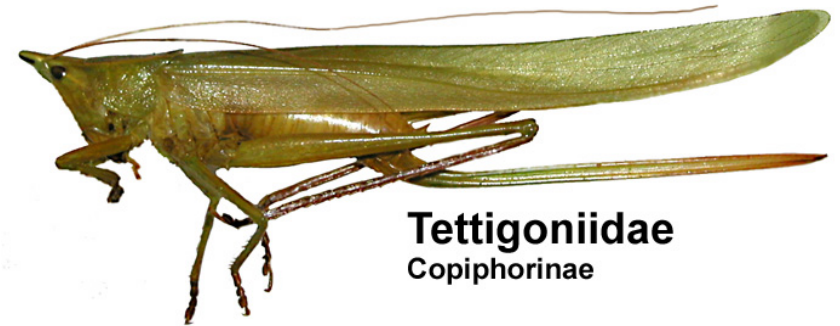
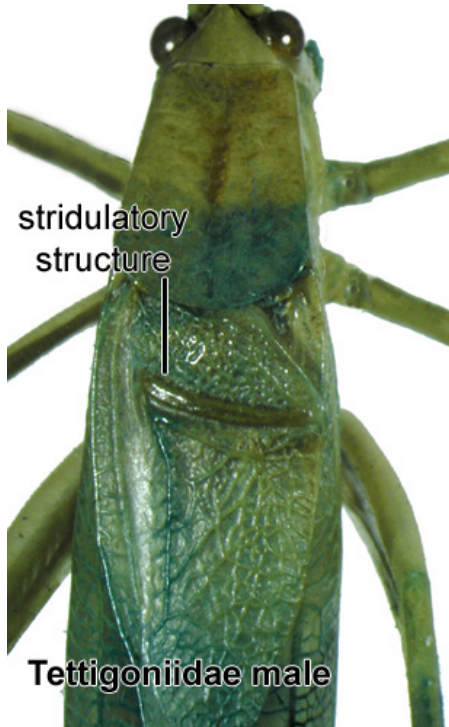
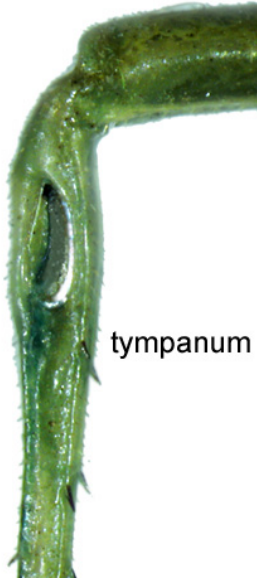
Tettigoniidae
Brazil

Suborder Ensifera - crickets, katydids, wetas

Other characteristics:

- Fore tibiae usually with basal, oval, or slit-like **tympanal** organ
- **Bases of tegmina** modified for **stridulation**
- Ovipositor long, sword-, dagger-, sickle-, or needle-like

Tettigoniidae male



Suborder Ensifera - crickets, katydids, wetas

Habitat & Habits:

- Largely nocturnal
- Phytophagous, detritivorous, carnivorous
- Arboreal, subterranean, and cave-dwellers (genus *Ceuthophilus* with 100s of species)
- Eggs generally deposited separately, frequently in living plant tissue
- Little economic importance, except for **Mormon Cricket**

Diversity & Distribution:

- 10,000 species world, mostly tropical
- About 600 species in North America

Mormon cricket, *Anabrus simplex*

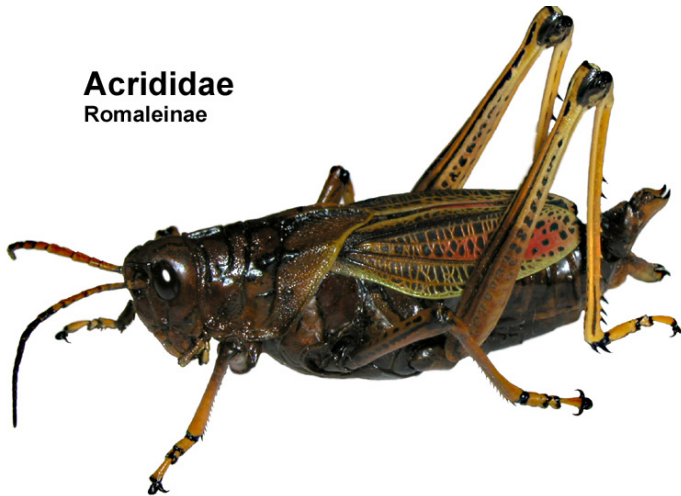


Suborder Caelifera - grasshoppers, locusts, & relatives (20 families)

Synapomorphies

- Antennae short, less than 30 segments
- Reduction of ovipositor to 2 valvular pairs

Acrididae
Romaleinae



Acrididae
Oedopodinae



Dissosteira carolina



Suborder Caelifera - grasshoppers, locusts, & relatives

Other characteristics:

- Sides of base of abdomen with **tympanal** organs
- **Stridulatory organs**, when present, involve rubbing edge of **tegmen** with pegs on inside of **hind femur**
- Ovipositor short



Suborder Caelifera - grasshoppers, locusts, & relatives

Habitat & Habits:

- Largely diurnal
- Almost exclusively phytophagous
- Eggs are laid in "pods" held together by foamy secretions and buried in ground
- Gregarious behavior and sustained migration common
- Many are injurious to crops

Diversity & Distribution:

- 11,000 species world, better represented in temperate regions than Ensifera
- About 650 North American spp., most are large and easy to identify (200 species in *Melanoplus*)

Singing in Orthoptera

- With cicadas the most vocal of all insects
- Calls are species specific and taxonomically useful
- Males chorus to females (do not sing)
- Occurs most commonly on warm evenings and nights
- Not all groups sing
- File and scraper on forewings (Ensifera) produces sound amplified by “mirrors” - special membranous areas - on wings
- Femur scraped against tegmen (Caelifera)
- Sound determined by number of ridges or teeth on files, their size and density, size and position of mirror, frequency of rubbing, etc.

Singing in Orthoptera

- Cyndrachetidae (Caelifera) scrape mandibles together
- Gryllotalpidae (Ensifera) build underground chambers - amphitheaters - in tunnel to amplify sound
- Stenopelmatidae (Ensifera) drum to produce substrate vibrations
- Tympana detect songs (both sexes have tympana) -
 1. On foretibiae in Ensifera; position forelegs forward and spread apart to better detect sound.
 2. On side of first abdominal segment in Caelifera
- Songs temperature dependent in snowy tree cricket, rate increases with temperature - can roughly determine temp. by rate of chirping:
$$\#chirps/15 \text{ sec} + 40 = F^{\circ}$$

Singing in Orthoptera

- Context-dependant songs
 1. calling songs - attract females
 2. courtship songs - induce copulation
 3. fighting songs - between males
- Songs also attract parasitoids (e.g. certain tachinid flies) and predators (bats). These flies possess a unique “ear” for hearing cricket songs. Attracted to “sexiest” part of song.

Singing Insects of North America

<http://entnemdept.ufl.edu/walker/buzz/>

ORTHOPTERA, *sensu stricto*

Collecting & Preserving:

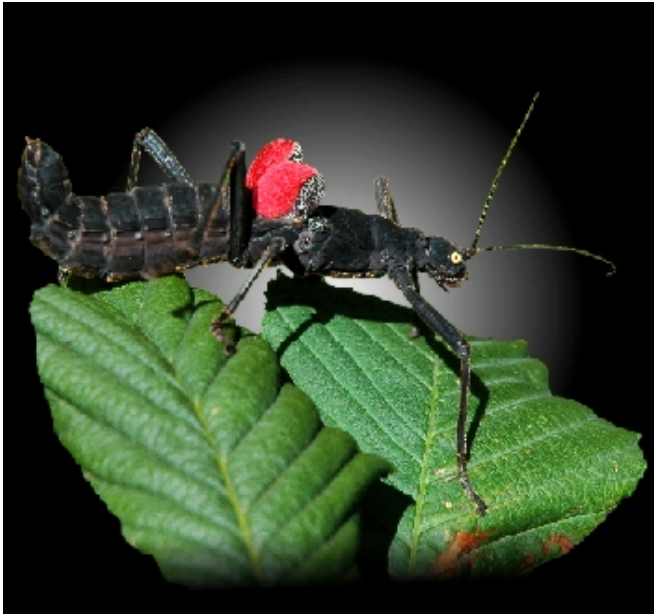
- Sweep netting or set out oatmeal bait and collect at night; tettigoniids will come to light; search chorusing males at night with flashlight
- Pin a few specimens with left wing spread
- Eviscerate abdomens of large specimens, replace contents with cotton

PHASMATODEA - Walkingsticks and leaf insects

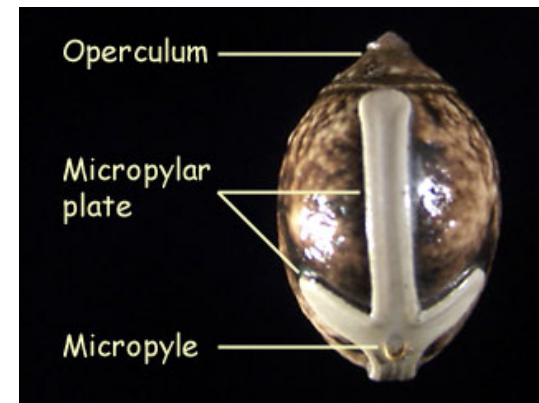


PHASMATODEA - Walkingsticks and leaf insects

SYNAPOMORPHIES



- Prothorax with repellent **defensive glands** opening near anterior dorsolateral corner
- Males with “**vomer**” - sclerite on 10th sternum that permits males to clasp females during copulation
- Eggs thick shelled, with **operculum**, a lidlike section of the oocyte, and unique structure of micropyle



PHASMATODEA - Walkingsticks and leaf insects

SYNAPOMORPHIES



Others, from Kristensen 1991

- Paraglossa with additional, dorsal, flexor muscle
- Pretarsal arolium enlarged
- Male without gonostyli on abdominal segment 9
- Female with subgenital plate ("operculum") formed by enlarged sternum 8; ovipositor short
- Cerci unsegmented
- Mesenteron posteriorly with pyriform, filament-bearing processes
- Spermatozoon without mitochondria; axoneme with two dense sheaths surrounding outer and inner singlets respectively

Suborder Timematodea - 1 family Timematidae containing 21 species all in the genus *Timema* and found only in western North America, most in California

Suborder Euphasmatodea - walking sticks, stick insects, and leaf insects



Timema



Agathemera

PHASMATODEA - Walkingsticks and leaf insects

Other characteristics:

- Greatly elongate (can reach 22 inches!), either cylindrical and resembling twigs or flattened and resembling leaves - exhibit incredible protective resemblance and diversity of forms
- Winged or apterous
- Forewings short, reduced; hindwings when present either short or long
- Legs and thorax long and slender
- Only 2 nymphal molts
- Eggs resemble seeds
- Males << females



PHASMATODEA - Walkingsticks and leaf insects

Habitat & Habits:

- Herbivorous - feed on leaves at night, hide during day via protective coloration and form.
- Display “swaying” behavior and “catalepsy” and also startle behavior, defensive spines, or “autotomy.”
- Nymphs can regenerate legs unlike other insects.
- Most exude foul smelling, irritating defensive fluid.
- Many females are parthenogenetic, males unknown.
- Eggs are scattered or flung by the female and fall to the leaf litter; some deposit in soil or cement eggs to leaves.
- Eggs resemble seeds and are also cryptic. Sometimes picked up by ants and taken to colony.
- *Diaperomera femorata* is a pest of hardwood forests in Minnesota

PHASMATODEA - Walkingsticks and leaf insects

Diversity & Distribution:

- Mostly found in Indo-Malaysian region (3,000 species).
- Very poorly represented in our area, only 31 spp. in 5 families in U.S., mostly in southern states.

PHASMATODEA - Walkingsticks and leaf insects

Collecting & Preserving:

- Best collected by shaking or beating vegetation.
- Pin, but use cross pins for support if necessary.

