Taxonomy and Biology of the "Orthopteroid" insects

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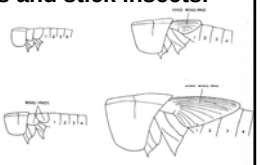
Orthoptera

Greek: *orthos*: straight
ptera: wings

- **Closely related to earwigs and stick insects.**
- **Biting mouthparts.**
- **Medium to large <u>exopterygote</u> insects**
- **<u>Neoptera</u>: ability to fold wings back over their abdomen, using special structures at the base of their wings (occasionally 2[ary] loss)**



ToLWeb*: Hexapoda, Insecta …

- Insecta, Pterygota
  - Ephemeroptera
  - Odonata
  - **Neoptera**
    - Orthoptera (*sensu stricto*)
    - Dictyoptera
      - Mantodea (mantids)
      - Isoptera (termites)
      - Blattaria (cockroaches)
    - other Orthopteroid orders
    - Hemipteroids
    - Endopterygota

*The Tree of Life Web Project (ToL) http://tolweb.org/Insecta

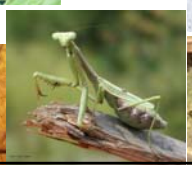
Orthopteroid orders

Dermaptera (earwigs)

Grylloblattodea (rock crawlers)

Phasmida (stick and leaf insects)

Dictyoptera

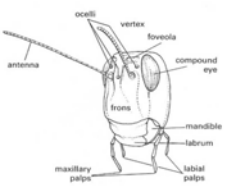


GRASSHOPPERS
AND ALLIED INSECTS
of Great Britain and Ireland

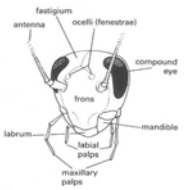
Judith A. Marshall and E. C. M. Haes
Illustrated by Denys Ovenden

Head & mouthparts

Grasshopper



Cockroach



Phasmida: stick & leaf insects

- Large insects, often exquisitely camouflaged
- Sexual dimorphism usual
- Distinctive single eggs (often resembling seeds)
- Feed almost exclusively on the leaves of Angiosperms (probably originally exploited niches provided by these plants in later Cretaceous Period)
- No native British spp.

Phasmida as pests

Eurycantha calcerata

Orthoptera *sensu stricto* (formerly Saltatoria)

- **A group of more than 20,000 species which vary enormously in abundance, biology, size, population characteristics, *etc*.**
- **Found in all but the coldest parts of the world - but mostly tropical.**
- **There are major pests but other species are threatened with extinction, relatively few are of economic importance.**
- **Most species are phytophagous although some species are carnivorous.**

Common diagnostic features (for sub-orders & families)

- Relative proportion and shape of legs, tarsal segments
- Antennae & cerci
- Method of stridulation and auditory organs
- Reproductive organs
- Others: shape of pronotum, palps, *etc*.

- **NB**: Colour often **NOT** a good guide for identification

Orthoptera: 2 Sub Orders

Antennae with >30 segments (usually long and thread-like) [except Cooloolidae];

If present, auditory (tympanal) organs on the fore tibiae;

If exhibited, stridulation by rubbing together of fore wings.

Often nocturnal

ENSIFERA

Antennae with <30 segments (usually not thread-like);

If present, auditory (tympanal) organs at the base of the abdomen;

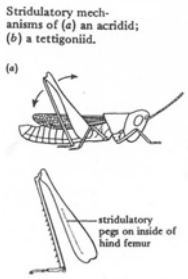
If exhibited, stridulation usually by rubbing pegs on inside of hind femur against ridge on fore wings.

Mostly diurnal

CAELIFERA

acknowledgement: Oliver Cheesman

Stridulation



Caelifera: Acrididae

Ensifera: Tettigoniidae

Grasshopper songs

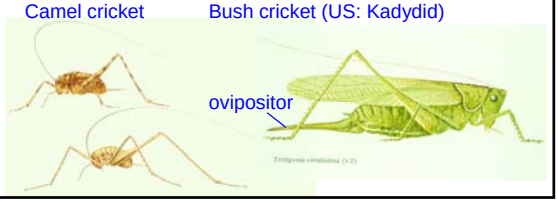
tympanal organs on 1st abdominal segment (behind 3rd legs)

Species	Song type	Pulse structure	Song characteristics to human ear
Stenobothrus lineatus	Normal		Continuous warbling note
	Courtship		Series of clicks
	Copulation		Series of clicks
Omocestus viridulus	Normal		Continuous trill
	Courtship		Series of clicks after normal song
	Copulation		Series of clicks
Chorthippus brunneus	Normal		Single pulse at irregular intervals
	Courtship		Series of clicks
	Copulation		Series of clicks

1. Ensifera

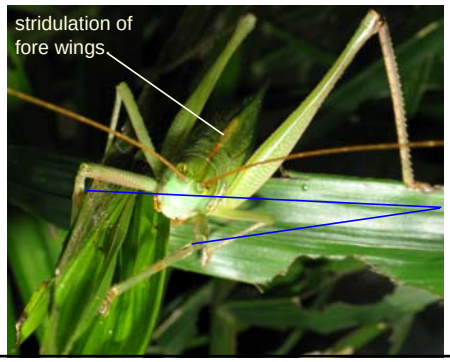
Tarsi 4-segmented; Auditory and stridulatory apparatus usually absent	Tarsi 4-segmented; Auditory and stridulatory apparatus usually present	Tarsi 3-segmented; Auditory and stridulatory apparatus usually present
GRYLLACRIDOIDEA	**TETTIGONIOIDEA**	**GRYLLOIDEA**
RAPHIDOPHORIDAE	TETTIGONIIDAE	GRYLLIDAE
GRYLLACRIDIDAE etc.	HAGLIDAE	GRYLLOTALPIDAE

Camel cricket — Bush cricket (US: Kadydid)



ovipositor

Tettigoniidae: bush crickets (katydids)



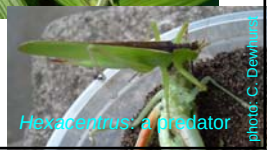
stridulation of fore wings

tympanal organs on fore tibiae

Tettigoniidae: occasional pests & natural enemies (e.g. "sexavae" on oil palm

Segestidea defolaria

Segestes nymph (parthenogenetic)



Hexacentrus: a predator

photo: C. Dewhirst

Gryllotalpidae: Mole crickets

"*Gryllotalpa africana*" - pest of upland rice and vegetables in Africa and Asia.

- Now known to be several species - distinguished by song

Crickets (Gryllidae) in the UK

house cricket *Acheta domesticus* — wood cricket — field cricket *Gryllus campestris*

Orthoptera in the UK

- In the UK, a number of Orthoptera are on the very northern edge of their wider geographic range.
- Orthopteran fauna shows a very strong southerly bias in distribution. Many species restricted to the far south of the country, especially southern coastal margin.
- Approximately a quarter of these: occasional migrants, accidental introductions or established exotic species (*e.g.* house cricket *Acheta domestica*).
- 30 Orthoptera are considered native to the British Isles, of which 27 occur on the mainland:

Tettigoniidae (10 spp)
Gryllidae (3 spp)
Gryllotalpidae (1 sp)
Acrididae (10 spp)
Tetrigidae (3 spp)

Orthoptera: conservation

6 species have recognised conservation status in the UK

	Common name	Red Data Book	Mainland distribution
Gryllotalpa gryllotalpa	mole cricket	EN	scattered records in England
Gryllus campestris	field cricket	EN	1 southern site
Decticus verrucivorus	wart-biter	VU	5 southern sites
Stethophyma grossum	large marsh grasshopper	VU	Dorset/New Forest

EN: endangered, VU: vulnerable

Protected species

"Flagship" species: protected in their own right, but also to conserve important habitats.

photos: courtesy Oliver Cheesman

2. Caelifera

Hind tarsi 3-segmented [middle segment reduced in Tetrigidae]

ACRIDOIDEA

EUMASTACOIDEA

TETRIGOIDEA

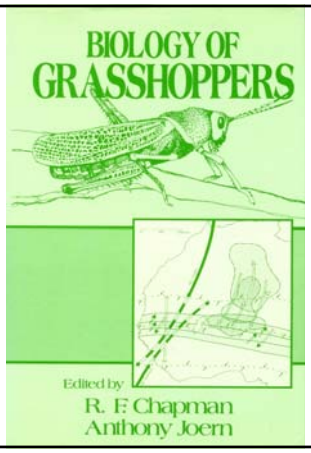
Hind tarsi 1 or 2-segmented

TRIDACTYLOIDEA

Trigonopterygoidea , etc.

Acrididae: biology

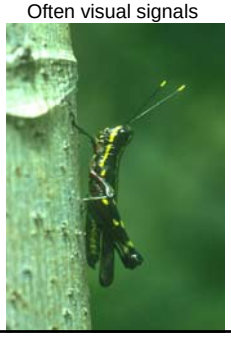
1990:
(but pathogen chapter out of date!)



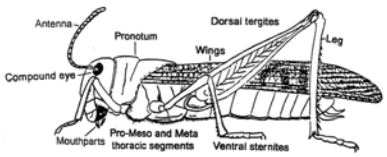
Acrididae: grasshoppers & locusts

Field
Often cryptic: stridulation

Tropical forest
Often visual signals



Morphology

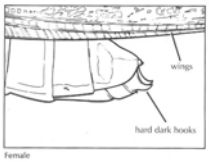


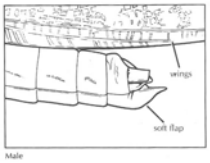
tympanal organ (when present) on 1st abdominal segment

S: spiracles

Genitalia

Ovipositor valves - short and stout for digging abdomen capable of great elongation …





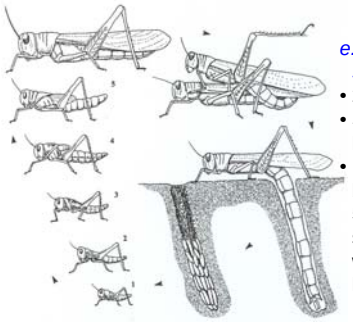
Chorthippus parallelus (the meadow grasshopper)

- Normally brachypterous
- May become macropterous in hot summers

(apterous: wingless)

Ritchie et al. (1987) *Ecol. Entomol*. **12**, 209-218.

Acrididae: life cycle



e.g. Desert locust *Schistocerca gregaria*:

- 2-6 months total
- Solitarious form may have 6 instars
- Female lays eggs in bare sandy soil: moist 50-100 mm below surface (probes surface with abdomen before laying)

Acrididae: grasshoppers & locusts

Pyrgomorph
aposematic coloration common

Poekilocerus bufonius

Acridomorph
frequently cryptic

Locustana pardalina (brown locust)

Eumastaceidae: *Plagiotriptus* (*Manowia*): a forest defoliator of C&E. Africa

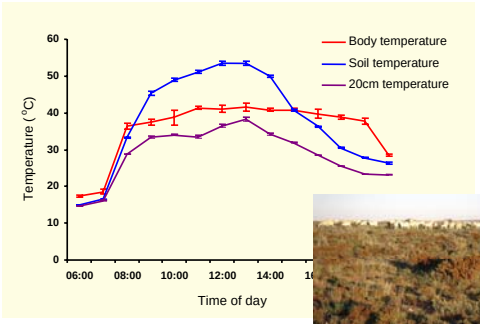
Plagiotriptus: management

- eggs laid in soil near base of trunk
- sticky bands used to prevent nymphs climbing to canopy

Thermoregulation

Hopper band of brown locust (in S. Africa)

Body temperature of brown locust in relation to ambient temperature in the Karoo, S. Africa



Summary

- "Orthopteroid" orders: medium to large exopterygote insects with biting mouthparts
- Orthoptera *sensu stricto* with 2 main groups:
  Ensifera: crickets, bush crickets, *etc.*
  Caelifera: grasshoppers, groundhoppers, *etc.*
- Most species in tropics - in N. Europe at edge of their range and may be protected
- Locust & grasshoppers most important pest species - knowledge of biology and ecology important for control strategy …