True Bugs!

Hemiptera

Class: Insecta
Order: Hemiptera

Some basic facts about bugs:
- Order Hemiptera is the largest exopterygote order with >75,000 species
- The life cycle is hemimetabolous with 2-7 (typically 5) instars.
- Polymorphisms are common and viviparity and parthenogenesis occur in some groups
- Hemiptera include important pests.
  - direct damage to crops through feeding
  - vectors plant diseases
  - public health pests
- Some bugs are beneficial:
  - predacious Heteroptera natural enemies of crop pests.
  - Shellac and cochineal are derived from coccoids

Life cycle (of a cocoa mirid)

Egg

N1

N2

N3

N4

N5

Adult female

Hemimetabolous: incomplete metamorphosis, gradual changes of body form with each moult

Major morphological features of true bugs

- The order is very varied, both in structure and biology
- All have piercing/sucking mouthparts (maxillary stylets concealed in a grooved labium)
- Two pairs of wings (usually) with the forewings tougher in texture than the hindwings

"Typical" Hemipteran adults

Heteroptera
Auchenorrhyncha
Sternorrhyncha

Some authorities divide the Hemiptera into two suborders, Heteroptera & Homoptera. Others consider the Heteroptera (=Hemiptera) and Homoptera as separate orders.
Mouthparts: the rostrum

Chinery (1972) Insects of Britain

Classification of bugs

<table>
<thead>
<tr>
<th>Suborder</th>
<th>Economically important families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heteroptera</td>
<td>Reduviidae, Lygaeidae, Pentatomidae, Miridae, Nabidae, Cimicidae, Pynthocoridae, Coreidae, Anthocoridae</td>
</tr>
<tr>
<td>Coleorrhyncha</td>
<td>None (1 family only: the Peloridiidae)</td>
</tr>
<tr>
<td>Auchenorrhyncha</td>
<td>Cicadidae, Cercopidae, Cicadellidae, Delphacidae</td>
</tr>
<tr>
<td>Sternorrhyncha</td>
<td>Psyllidae, Aleurodidae, Aphididae, Adelgidae, Phylloxeridae, Cocccidae, Diaspididae, Margarodidae and Pseudococcidae</td>
</tr>
</tbody>
</table>

Order (old orders)

- Heteroptera
- Auchenorrhyncha
- Sternorrhyncha

Sub-order

- Heteroptera
- Homoptera

Families

- Seed bugs, shield bugs, capsids, bed bugs, water bugs, etc.

The rostrum position is diagnostic for the 3 major divisions

- **Heteroptera**: arises from anterior part of head (prognathous)
- **Sternorrhyncha**: displaced between anterior coxae
- **Auchenorrhyncha**: arises from rear of head

Common diagnostic features for the sub-orders

**Heteroptera**
- Commonly prominent triangular scutellum
- Forewings have a leathery basal portion and a membranous apical region forming the hemelytra
- Wings held flat over the abdomen at rest
- On head:
  - Rostrum arises from front of head (prognathous)
  - Large, sclerotized gular region

**Heteroptera**: Reduviidae, Lygaeidae, Pentatomidae

**Auchenorrhyncha**: Cicadidae, Cercopidae, Cicadellidae, Delphacidae

**Sternorrhyncha**: Psyllidae, Aleurodidae, Aphididae, Adelgidae, Phylloxeridae, Cocccidae, Diaspididae, Margarodidae and Pseudococcidae

The Heteroptera

When the forewings are fully developed they are horny/leathery at the base and membranous at the tip, hence the name.

Generalised hemelytra
Heteroptera: major divisions (Infra-orders)

- **Amphibicorisae** - water surface dwellers
  (= Gerromorpha)
- **Hydrocorisae** - true water bugs
  (= Nepomorpha)
- **Geocorisae** - terrestrial bugs
  - Cimicomorpha (predaceous)
  - Pentatomorpha (phytophagous)

Amphibicorisae - water surface dwellers
(= Gerromorpha)
- All predaceous
- Special adaptations include water repellent hairs
- Pondskaters (Gerridae) and water measurers (Hydrometridae) have acoustic communication
- *Microvelia* (Veliidae) is a rice planthopper n.e.

Hydrocorisae - true water bugs
(= Nepomorpha)
- Mostly predaceous & live under water
- Antennae concealed in grooves, breathe via air bubble, siphon or plastron
- Water scorpion (Nepidae), backswimmer (Notonectidae), water boatmen (Corixidae), toe-biters (Belastomatidae)

Heteroptera: Geocorisae
A - predaceous terrestrial bugs
(= Cimicomorpha)
Predaceous families include:
- assassin bugs (Reduviidae),
- bed bugs (Cimicidae),
- damsel bugs (Nabidae)
- flower bugs (Anthocoridae)

Reduviidae - the assassin bugs
- Most predate other insects and many have evolved to mimic their prey
- (apparently) 3 segmented rostrum
- Some suck the blood of birds and mammals …
Disease vectors
- *Rhodnius prolixus* & *Triatoma spp.* - “kissing bugs” - transmit Chagas’ disease (*Trypanosoma cruzi*: a flagellate protozoan)

Cimicidae - the bed bugs & flower bugs
- *Cimex spp.* wingless bloodsuckers of birds & mammals
- *Cimex lectularis* is the common bed bug
- Flower bugs are winged and capture their insect prey on flowers

Then

And now …

“They’ve had an incredible impact on high-end hotels. If the word ‘bedbug’ gets out, it scares a lot of people away.”

**Mike Lawton**, Entomologist for *Western Exterminator* on the return of the bedbug. 2003.

Nabidae - the damsel bugs
- Predaceous on various insects including aphids and caterpillars
- 4 segmented rostrum
- Large species can pierce human skin

Anthocoreidae (also sometimes called flower bugs)
- beneficial insects; most species are predaceous on various other insects, including significant crop pests
  - Includes *Orius spp.* - “pirate bugs” - here predating *Bemisia* whitefly nymphs

http://creatures.ifas.ufl.edu
Heteroptera: Geocorisae
B - Phytophagous terrestrial bugs
(= Pentatomorpha)
Phytophagous families include:
– seed bugs (Lygaeidae),
– shield bugs (Pentatomidae),
– capsid bugs (Miridae)
– cotton stainers (Pyrrhocoridae)

Pentatomidae - shield or stink bugs
– > 3000 species in family
– Called “shield bugs” for their shape
– Called “stink bugs” for their noxious alarm pheromones

Pentatomid pests species include:

- *Eurigaster* spp. “sunn pests” - cereals in the Middle East
- *Nezara* spp. on vegetables (ubiquitous)
- *Scotinophara* spp.
  - rice black bug
- *Antestiopsis* spp.
  - African coffee
- *Bathycoelia thalassina*
- Various fruit piercing bugs

Lygaeidae - seed or ground bugs
– Mainly seed-eating although some are partly predatory
– Ground dwelling
– Hibernate as adults
– Pests include
  – chinch bug, *Blissus leucopterus*, on cereals (USA)
  – milkweed bug, *Onocleptus fasciatus*

Coreidae - leaf footed bugs
– Nearly all species are fruit feeders
– Most are dull brown & v. similar
– Hibernate as adults

Important pests of several crops …

– Rice bugs:
  – *Leptocorisa* spp in SE Asia
  – *Stenocoris* spp. in Africa
– *Anasa tristis* (squash bug) on cucurbits
– *Pseudotheraptus wayi* on coconuts (E Africa)
Miridae - capsid bugs
- Largest heteropteran family, > 6,000 species
- Well developed cuneus on forewing: separates from other families
- Mainly fruit and seed feeders - several pest species, but...
- *Cyrtorhinus lividipennis* is an important predator of rice planthoppers & leafhoppers

Mirid pests include:
- *Lygocoris pabulinus*, the common green capsid - blemishes fruit
- *Lygus* spp. on potatoes
- Cocoa mirids: *Sahlbergella singularis* & *Distantiella theobroma* in W. Africa (other spp. in SE Asia & Pacific)
- *Helopeltis* spp. - tea, cocoa, etc…

Miridae: *Helopeltis* spp.
- Crop hosts include tea, cocoa, cashew & guava
- Mirids cause damage to shoots, branches, fruit
- *Afropeltis* spp. in Africa

Pyrrhocoridae - cotton stainers
- *e.g. Dysdercus* spp. - becoming more important with GM cotton?
- Cause stains within maturing cotton bolls dramatically reducing value of crop

Summary
- Hemiptera are hemimetabolous insects with piercing & sucking mouthparts
- **Hemi-elytron characteristic of Heteroptera**
- Aquatic and terrestrial families
- Geocoridae (terrestrial) include:
  - Predaceous families - NEs and public health pests
  - Phytophagous terrestrial bugs - many pest spp.
- The rostrum position is diagnostic for the 3 major divisions of Hemiptera; Auchenorrhyncha and Sternorrhyncha to follow …

Summary:
- Most Hemiptera are terrestrial and phytophagous; but some Heteropteran families are carnivorous & aquatic
- Many phytophagous bugs feed by tapping into phloem, others feed on xylem, parenchyma, seeds or pollen. Predatory species feed on tissues or blood
- Many plant pests, often small insects with short life cycle → prodigious rates of reproduction.