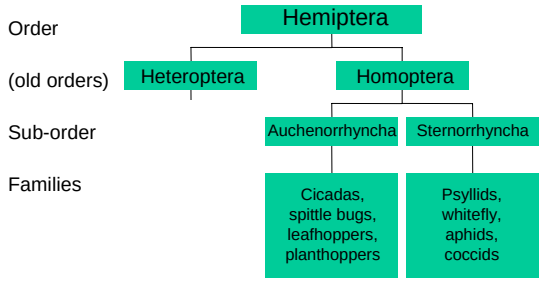
Auchenorrhyncha & Sternorrhyncha

Hemiptera 2

Imperial College London

RPB 2009; hemiptera2 v. 2.6

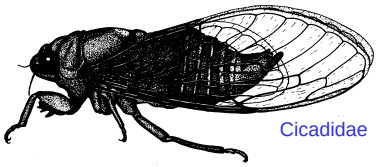


Formerly known as the Homoptera

Common diagnostic features for the 'Homoptera'

Auchenorrhyncha / Sternorrhyncha

- Forewings are uniform in texture
- Wings held roof-like over the abdomen at rest
- Rostrum arises from posterior of head (hypognathous)



Cicadidae

Why were they separated? Major differences

1. **Auchenorrhyncha**

   Cicadas and hoppers

   - Short, bristle like antennae; 3 segmented tarsi; ovipositor well developed; good fliers or jumpers;
   - Evolved towards increased wing development; jumping capacity and acoustic communication

2. **Sternorrhyncha**

   Psyllids, aphids, whiteflies, scales and mealybugs

   - Longer, filiform antennae; 1-2 segmented tarsi; ovipositor reduced; often relatively inactive (except psyllids)
   - Evolved towards reduction in structural complexity; increased biological complexity; nymphal sessility and protective devices (*e.g.* scales and galls)

1. Auchenorrhyncha: 2 super-families

A. Cicadomorph families

Cicadidae - the cicadas

- Large long-lived bugs
- Eggs laid in bark on twigs of trees or shrubs
- Nymphs feed underground on roots and have massive front legs for tunnelling
- Periodical cicadas have prime number breeding cycles (13-17 years) - avoidance of predators

Sound production

- Males produce characteristic 'song' (tymbals on abdomen)

DORSAL VIEW OF MALE CICADA
(close-ups of left tymbal with ridges)

http://www.landcareresearch.co.nz

Cicadetta montana

- In UK: subject to major conservation efforts (in New Forest), now probably extinct

Auchenorrhyncha: Membracidae - the tree-hoppers

Centrotus cornutus

- may be spectacular (pronotum)
- some economic species (minor)

Auchenorrhyncha: Cercopidae - the froghoppers

- Small, hopping adults
- Nymphs feed within frothy fluid (hence also known as spittlebugs or cuckoo spit)
- Feeding may cause stunting or necrosis

Sugarcane froghopper: *Aeneolamia varia saccharina*

- Cercopid causes “blight” of sugar cane in Trinidad (since 1863)
- Pest may reduce yields by up to 30% in Trinidad
- Nymphs (5 instars) envelop themselves in frothy spittle - difficult to control
- Biological controls invest -igated since 1916, entomo-pathogenic fungi most promising

Auchenorrhyncha: Cicadellidae (=Jassidae) - the leafhoppers

- Feed principally on leaves
- Saliva causes stunting (and “hopperburn” in some crops)
- Some species transmit plant diseases

Graphocephala fennahi

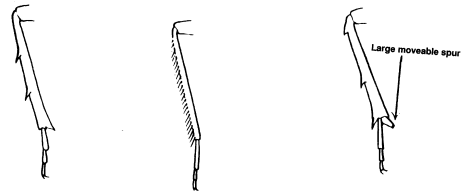
Many important Cicadellid pests

photo: IRRI

- *Empoasca* spp on potato and cotton
- *Nephotettix* spp on rice (virus vectors - *e.g.* tungro disease)
- *Homalodisca coagulata* - “glassy winged sharpshooter” - Californian vines (vector of bacterial Pierce’s disease)

http://bss.sfsu.edu

3 major economic families of Auchenorrhyncha: hind legs



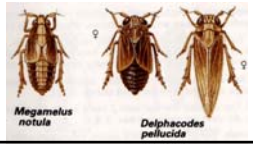
Froghopper	Leafhopper	Planthopper
Cercopidae	Cicadellidae	Delphacidae
Cicadomorpha		**Fulgoromorpha**

B. Auchenorrhyncha: Fulgoromorpha

Fulgoridae
(lantern flies - all tropical)

Auchenorrhyncha: Delphacidae - the planthoppers

- Distinguished by moveable spur on hind tibia
- Family Delphacidae has 300 genera and > 2,000 species
- Exist on every continent except Antarctica and in all major biomes
- Phloem feeders, especially on monocots
- Strong tendency to monophagy (74% single plant host)

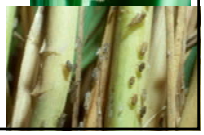


Planthopper pests

- Damage crops by feeding and as disease vectors
- The major pest of tropical rice is the brown planthopper, *Nilaparvata lugens* (also the white-backed planthopper: *Sogatella furcifera)*
- *Perkinsiella* spp (sugar cane)
- *Peregrinus maidis* (cereal crops)

Basic facts about the brown planthopper (BPH) *Nilaparvata lugens*

- 300-600 eggs per female
- Up to 12 generations per year in SE Asia
- Environmental cues (crowding, host quality) and genetics alter the proportions of macropterous (winged) and brachypterous (reduced wings) forms in time and space
- Long distance (>750 km) migrations occur regularly (aerial plankton)
- Ability to exploit patchy habitat



BPH, *Nilaparvata lugens* (continued)

- Pest status and damage levels of BPH have been enhanced by misuse of broad-spectrum insecticides (suppression of natural enemies) and some modern agricultural practices (N fertiliser & high yielding varieties improve host quality)
- Modern thinking involves IPM
  - host plant resistance,
  - limited and judicious use of insecticides to conserve …
  - natural enemies *e.g.* spiders and *Cyrtorhinus lividipennis* (Miridae)

Auchenorrhyncha: Fulgoromorpha

20 families (some more with pest status)

e.g. Cixiidae, Flatidae, Ricaniidae, Issidae, Tropiduchidae

Photo: Benoit Martha, ToLweb

Two Fulgoromorph palm pests

- **Tropiduchidae** Dubas Bug (dates): *Ommatissus lybicus*
- **Issidae** Coconut leafhopper *Zophiuma lobulata* (associated with Finschlafen's palm disorder)

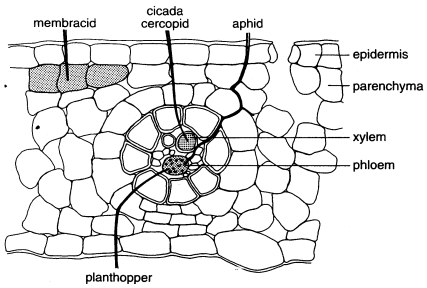
2. Sternorrhyncha

Aphidiae - true aphids

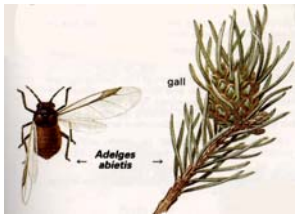
- Often complex life cycles
  - Polymorphism
  - Viviparity
  - Cyclical parthenogenesis
- Very important pests of many major crops
  - feeding damage
  - vectors of disease
  - *e.g. Mysus persicae, Aphis fabae, Brevicoryne brassicae*

Photo: Wikipedia

Diagrammatic cross section of part of a leaf showing the tissues from which various plant-sucking insects feed



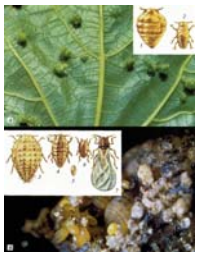
Sternorrhyncha: Adelgidae - conifer woolly aphids



- Differ from true aphids as all parthenogenetic morphs are oviparous and they have no siphunculi
- Host alternating 2-year cycle with *Picea* spp as primary host and other conifers as secondary hosts

Sternorrhyncha: Phylloxeridae - phyloxerans, "root aphids"

- Autoecious (whole life cycle within one individual plant)
- Form leaf and root galls
- Root feeding by the vine phyloxeran, *Viteus vitifolii*, was a serious problem in Europe until the use of American rootstocks



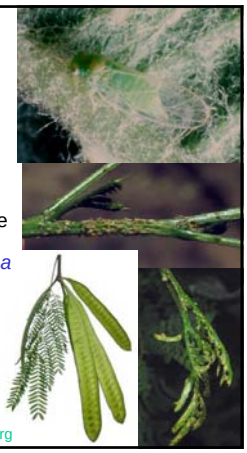
Sternorrhyncha: Psyllidae - jumping plant lice

- Psyllids are small (similar size of aphids) with strong jumping (especially hind) legs
- Incapable of sustained flight
- Nymphs often produce white waxy secretion
- Characteristic, simple wing venation, with a striking principal basal vein

Psyllid pests

- Middle ranking pests of fruit trees
  - *Psylla mali* on apples (right)
  - *Psylla pyricola* on pears
- Asian Citrus Psyllid, *Diaphorina citri,* vector of citrus greening bacterium *Liberibacter asiaticum*
- *Leucaena leucocephala*, is a fast growing, nitrogen-fixing tree native to Mexico & C. America
  - The psyllid *Heteropsylla cubana* is also native to Mexico and C. America
  - Present in small numbers throughout its natural range and causes little damage
  - Invasive pest species to new *Leucaena* plantings in Asia & Africa
  - …so classical biological control appropriate?

http://www.fao.org/forestry/49410/en/ken/
J D Ward, USDA Forest Service, www.bugwood.org



Psyllid for biological control of Japanese knotweed

Aphalara itadori (nymphs)

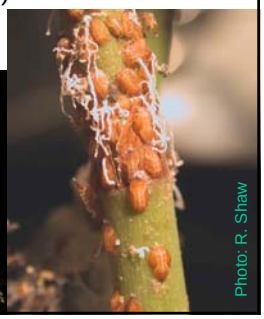


Photo: R. Shaw

Impact of *Aphalara itadori*

photos: courtesy R. Shaw

Sternorrhyncha: Aleyroididae - whiteflies

- Very small adults with wings covered in waxy white powder
- Active 1st instar nymph, later nymphs sessile and scale-like
- Very important pests:
  - *Bemisia tabaci* on cotton, tobacco etc. (>300 hosts)
  - *Trialeuroides vaporariorum* in glasshouses
  - *Aleyrodes proletella*, cabbage whitefly on crucifers
  - *Aleurocanthus woglumi*, citrus blackfly

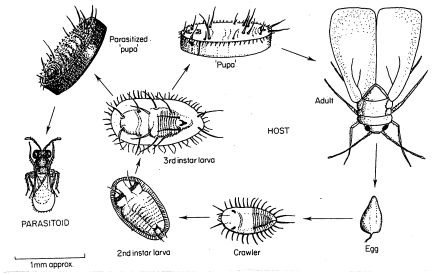
Some basic facts about whiteflies

- 1,200 described species, 15 of which are serious pests
- Traditionally found in the tropics, but now in temperate zone
- Most monophagous, but most important pest species are polyphagous
- Pests of annual, perennial and protected crops
- Damage is direct via feeding and honeydew contamination and also indirect as vectors of disease

More basic facts about whiteflies

- Adults v. small, moth like with waxy dusting.
- 6 life stages: egg, 1st instar nymph (crawler), 2 sessile nymphal stages, a 4th instar (pupa) and adult
- > 200 eggs per female
- 3 week life cycle
- Pest status enhanced by overuse of pesticides
- Modern controls include more selective chemicals, parasitoid natural enemies (*Encarsia formosa*), entomopathogenic fungi, predatory beetles and bugs and plant resistance

Life cycle of a glasshouse whitefly and its parasitoid



Sternorrhyncha: Coccidae - the soft scales

- Females are apterous
- Scale-like and often parthenogenetic.
- Important pests include *Coccus* spp on fruit trees

Milviscutulus mangiferae

www.fsca-dpi.org/FloridaInsectGallery/hemiptera.htm

Pseudococcidea - mealybugs

- Relatively mobile compared with Coccoidea
- Usually covered by copious waxy filaments
- May cause damage by toxic saliva or disease spread (*e.g.* cocoa swollen shoot virus by *Planococcoides* spp.); cosmetic damage to ornamentals



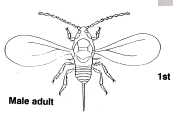
Some facts about scales & mealybugs

- Hosts are mainly woody plants *e.g.* citrus and coffee
- Important secondary resurgence pests and most stages difficult to kill with insecticides
- Most highly modified of all plant bugs
  - Females oviparous or viviparous, often obscurely segmented with atrophied appendages, scale like body with waxy or powdery coating. 50 - 400 eggs laid under scale.
  - Males often 2 winged (no hind-wings) and in some species never recorded or rare.
  - Dispersive (crawler) first instars

Diaspididae - armoured scales

- Scale not attached to body (unlike soft scales)
- Females lack legs and antennae
- Males winged but rare or absent
- Many important pests in orchards *e.g.*:
  - San Jose Scale (first pest to be recorded as resistant to pesticides in 1908)
  - Mussel Scale & oystershell scales

Lifestages of the oystershell scale

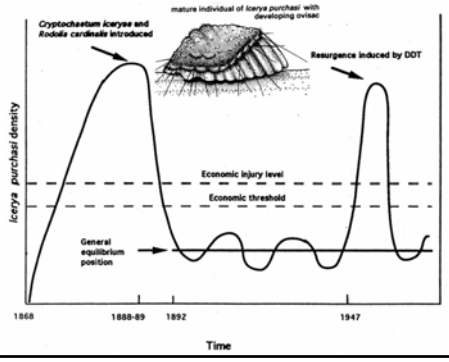


Sternorrhyncha: Margarodidae - ground pearls

- Large, waxy scales
- Cottony cushion scale is a serious citrus pest
- First major example of 'modern' biological control in 1890s - brought under control by an imported natural enemy, the Vedalia ladybird (*Rodolia cardinalis*)

Icerya purchasi (male)

Classical biological control and resurgence



The role of entomopathogenic fungi

Homopteran natural enemies include:

- *Aschersonia* spp.
- *Hirsutella* spp.
- *Fusarium coccophilum*
- *Lecanicillium lecanii* (=*Verticillium*)
- *Metarhizium* spp. incl. *M. flavoviride*

Summary

- Auchenorrhyncha (cicadas and hoppers)
  - ➢Mobile: often good fliers or jumpers
- Sternorrhyncha (psyllids, aphids, whiteflies and scales)
  - ➢Often sessile (esp. immature stages), simplified structures
- Both of the above contain important pest species: including plant disease vectors; insecticide-induced resurgences frequent
- Natural enemies (predators, parasitoids, EP fungi) are crucial for pop. regulation.