Identification of Membracoidea (Leafhoppers and Treehoppers)

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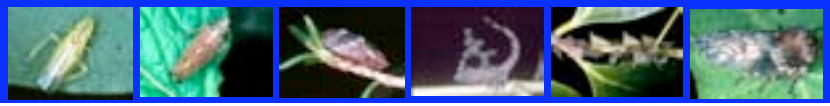


Outline

- Background--overview of classification, ecology, and distribution
- Morphological characters useful for identification
- Taxa of greatest economic importance
- Identification tools and other resources

Suborder Auchenorrhyncha: Classification

- Infraorder Cicadomorpha
  - Superfamily Cicadoidea (cicadas)
  - Superfamily Cercopoidea (spittlebugs)
  - **Superfamily Membracoidea (leaf- and treehoppers)**
- Infraorder Fulgoromorpha
  - Superfamily Fulgoroidea (planthoppers)

Membracoidea: Ecology/Behavior

- xylem, phloem, or mesophyll feeders
- free-living nymphs (aboveground)
- jumping adults




Membracoidea: Diversity

- **5 families**
- **25,000 described species (22,000 cicadellids)**
- **distributed worldwide, wherever vascular plants found**
- **includes many important pests**

Identification Requires:

- properly prepared specimens
- knowledge of morphological terminology
- access to appropriate literature and other identification tools

Membracoidea Identification: The Bad News

- Most keys based on adult males
- Species (and often higher level) identification usually requires removal and clearing of male abdomen
- Taxonomic literature large and obscure
- Different authors use different terminology
- Some genera comprise hundreds of species
- Most species never included in identification key

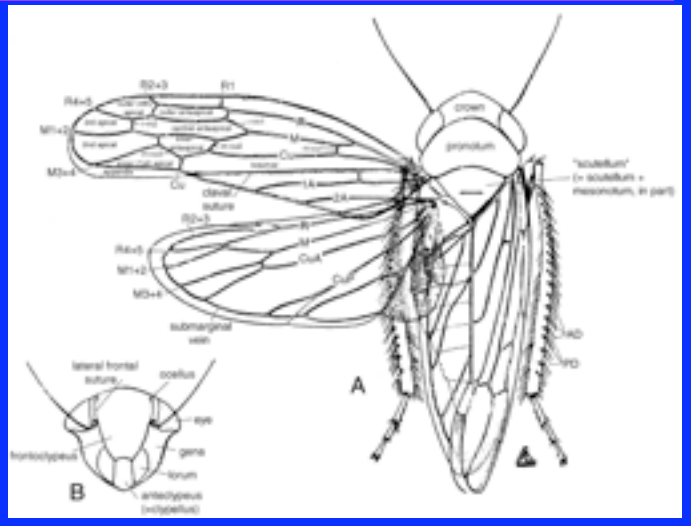
Membracoidea Identification: The Good News

- Male genitalia provide distinctive characters for diagnosing species
- Most economically important species belong to a few subfamilies, tribes, and genera
- Most species are rare, not encountered in agroecosystems
- Identification aids are available for many economically important taxa
- New identification tools are being developed

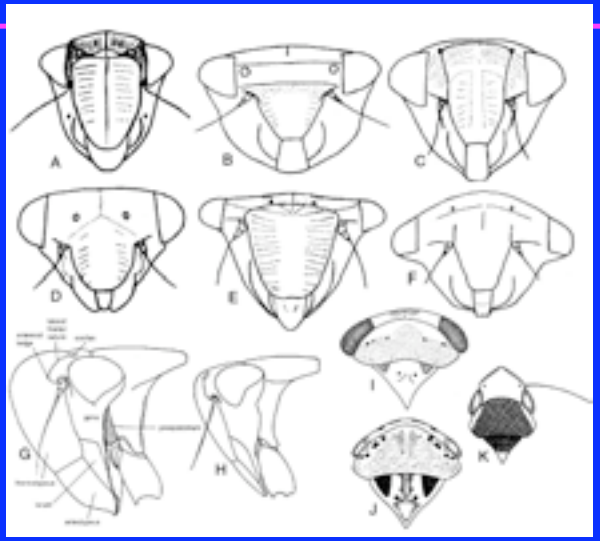
Identification Tools

- Catalogues and checklists: Metcalf Catalogue with supplements by Oman et al. (leafhoppers); McKamey (treehoppers)
- Taxonomic literature: vast and often obscure, includes mostly regional faunas
- Online resources: interactive keys, nomenclatural databases, sound recordings

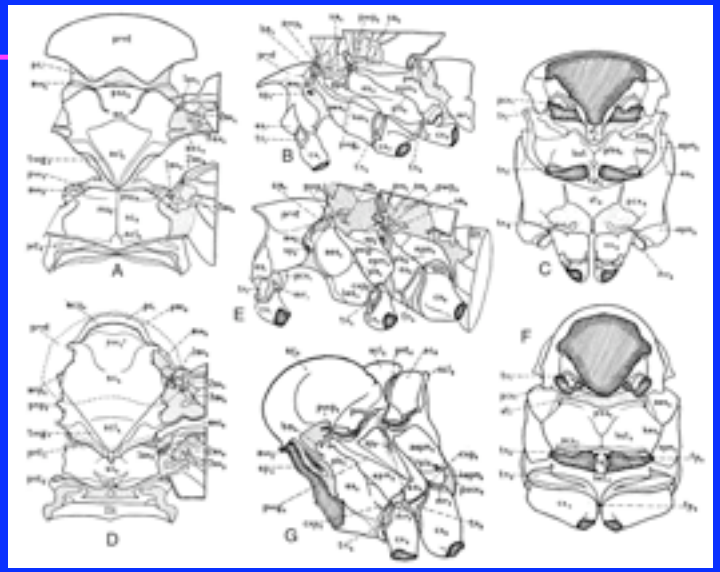
Membracoidea Morphology



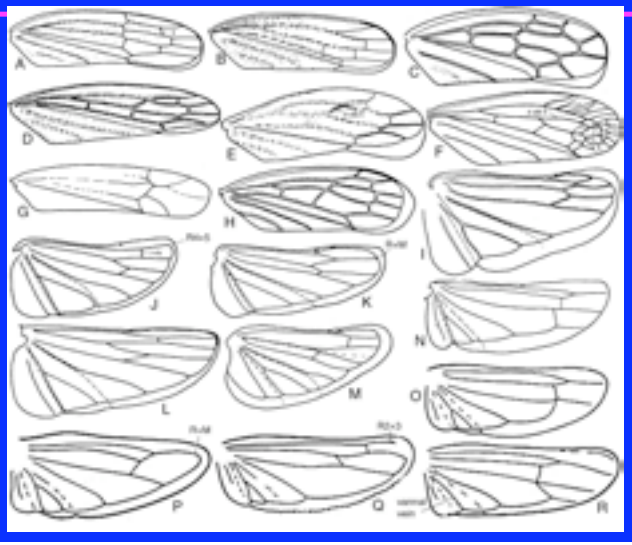
Membracoidea Morphology: Head



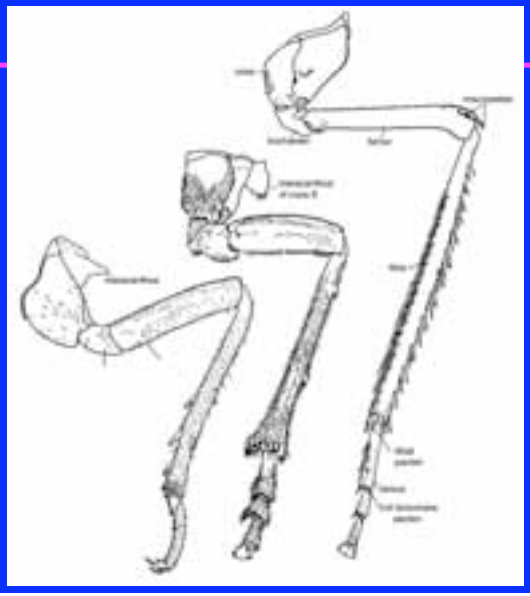
Membracoidea Morphology: Thorax



Membracoidea Morphology: Wings

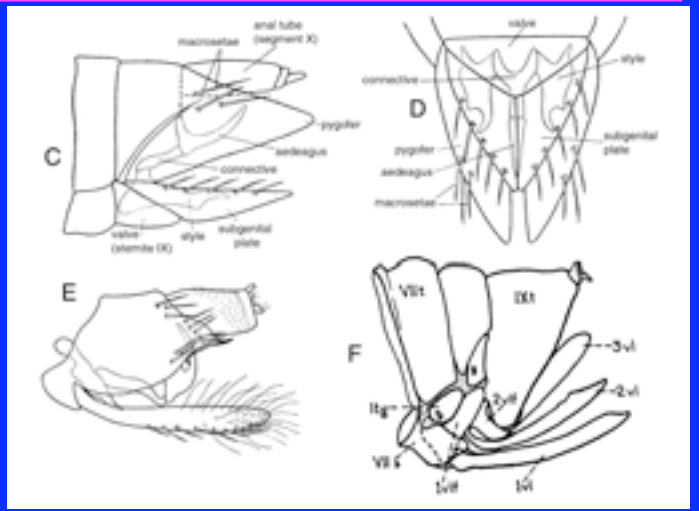


Cicadomorphan Morphology: Legs



Membracoidea Morphology: Legs

Membracoidea Morphology: Genital Capsule



Most diverse leafhopper lineages

- Deltocephalinae
- Typhlocybinae
- Cicadellinae (sharpshooters)

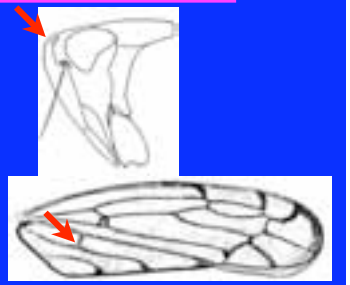
Deltocephalinae

- phloem feeders
- 6,500 species
- occur worldwide
- many specialize on grasses
- major pests (vectors)

K. Morishima

Deltocephalinae characters

- ocelli on anterior margin of head
- forewing with claval crossvein(s)
- male valve and subgenital plates triangular
- style broadly bilobed basally, articulated to subgenital plate



Deltocephalinae

- 23 tribes recognized by Oman et al. (1990)
- subsequent analyses show that several other family-group taxa belong here

Eupelicini

Koebeliini

Deltocephalinae-like subfamilies

- these group with Deltocephalinae in recent analyses
- more detailed analyses underway

Stegelytrinae

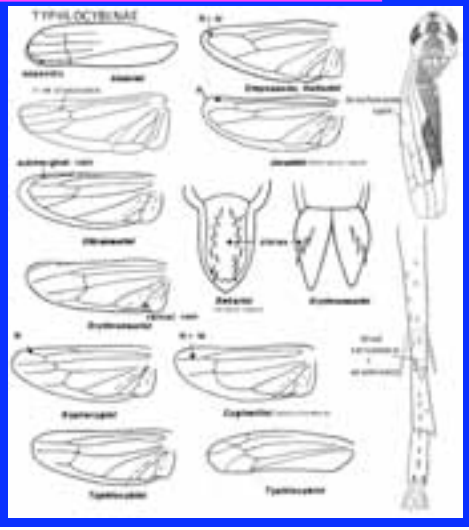
Typhlocybinae

- mesophyll (lacerate/flush) feeders--unique feature of this subfamily
- 5,200 described species
- occur worldwide
- most diverse in forests
- most are host specialists
- includes major pests

K. Morishima

Typhlocybinae characters

- forewing without closed anteapical cells
- hind tarsomere I acuminate



Cicadellinae

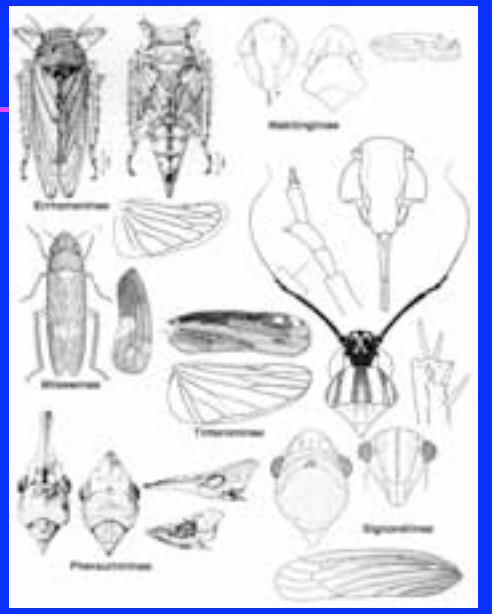
- xylem feeders
- 3,100 described species
- mostly tropical in wet habitats
- mostly host generalists?
- vectors of *Xylella*
- none introduced into U.S. but some U.S. spp. introduced elsewhere

Molomea sp.

Homalodisca vitripennis

Cicadellinae-like subfamilies

- most placed in Cicadellinae (s.l.) by Oman et al.
- now considered separate subfamilies
- only Phereurhininae related to Cicadellinae, s.s.



Evacanthinae (=Nirvaninae)

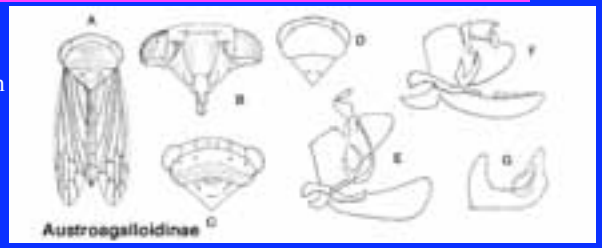
- worldwide
- recently elevated to subfamily and redefined to include Nirvaninae (sensu Oman et al.)

Evacanthini

Nirvanini

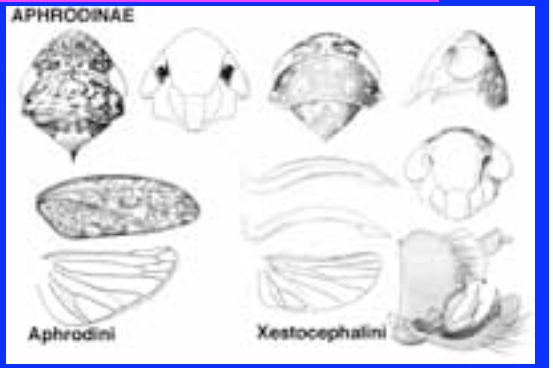
Austroagalloidinae

- 1 endemic *Eucalyptus*-feeding Australian genus
- head w/ distinct dorsal shelf
- similar to Eurymelinae



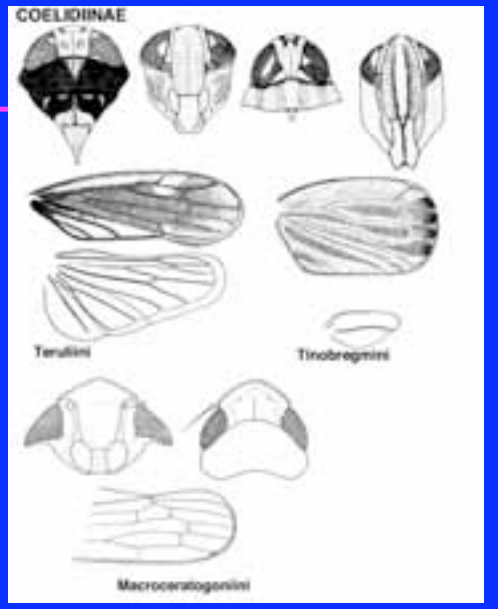
Aphrodinae (sensu stricto)

- mosty Holarctic with 1 genus distrib. worldwide
- on herbs
- similar to Deltocephalinae



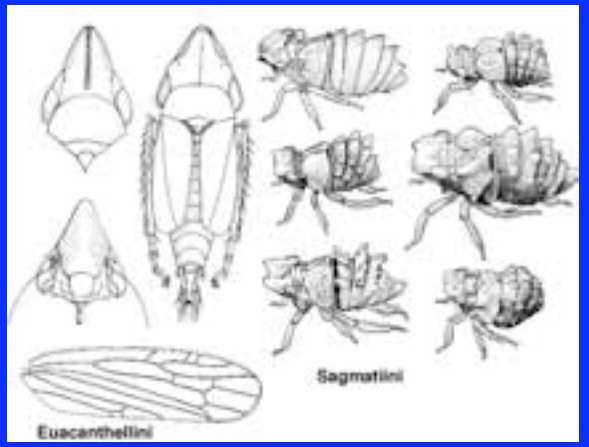
Coelidiinae

- pantropical
- on herbs and woody hosts
- revised comprehensively by Nielson
- 2 tribes (Equeefini and Macroceratogoniini added since Nielson's revision



Euacanthellinae

- small group restricted to Old World S. Hemisphere
- similar to Aphrodinae (s.s.)

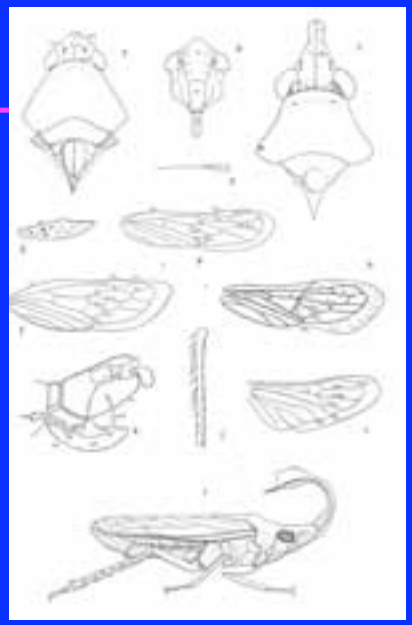


Eurymelinae (s.s.)

- Australian
- gregarious, ant-mutualistic
- on *Eucalyptus*

Hylicinae

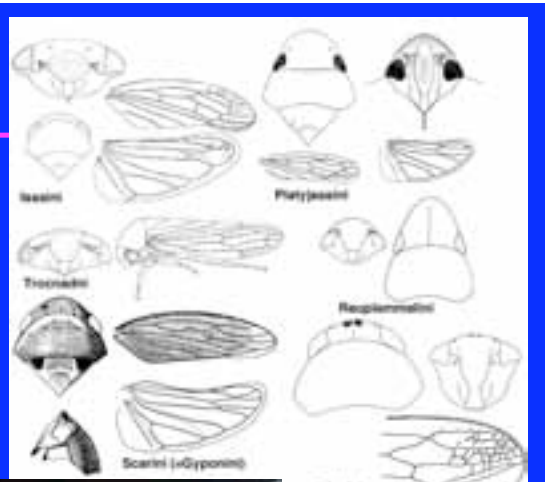
- restricted to Old World tropics
- arboreal
- treated as separate family by Evans



Iassinae (s.l.)

- Iassini worldwide, other tribes restricted
- nearly all arboreal


Iassini

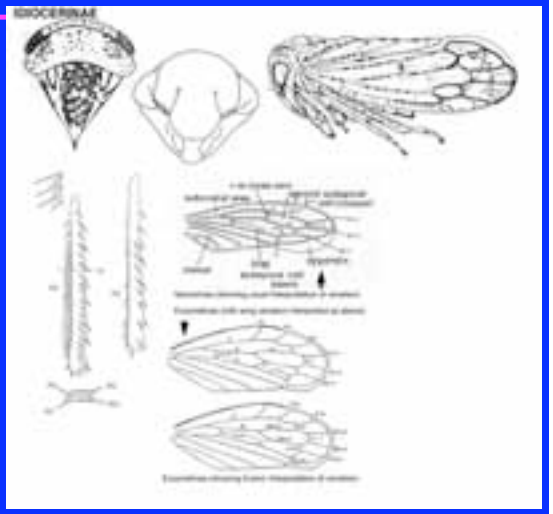



Scarini


Krisnini

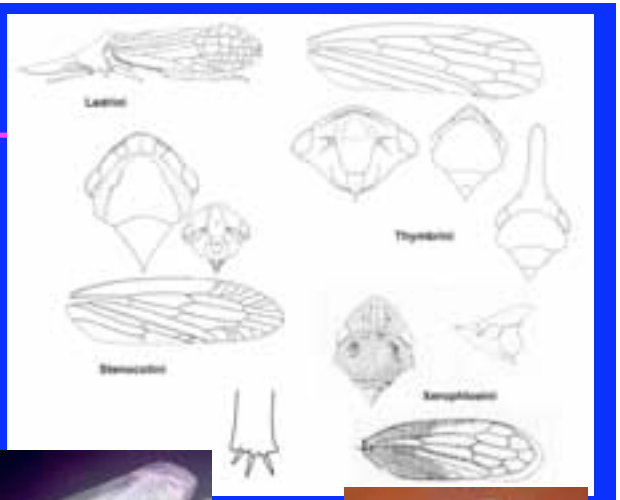
Idiocerinae

- worldwide
- arboreal
- similar to Eurymelinae



Ledrinae

- worldwide
- arboreal except grass-feeding Xerophloeini (not related to others?)
- most diverse in Old World tropics
- similar to Iassinae



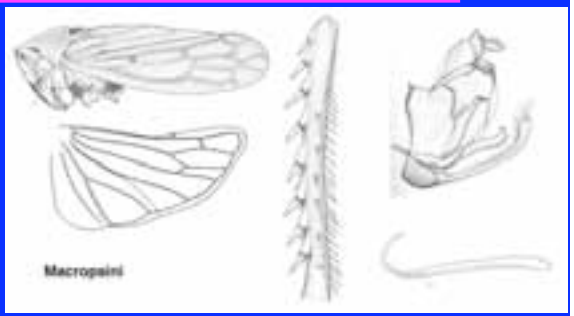

Stenocotis nymph


Proranus


Ledropsis

Macropsinae

- worldwide except South America
- arboreal


Macropsini

Megophthalminae (s.l.)

- worldwide
- concept broadened since Oman et al.
- sister group of treehoppers

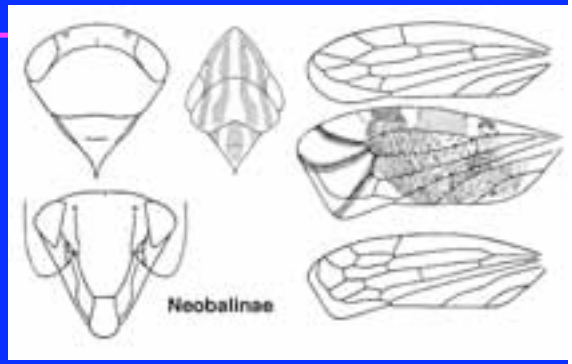
Agalliini

Megophthalmini

Neobalinae

- Neotropical
- arboreal?
- usually brightly colored
- resemble Deltocephalinae and Coelidiinae

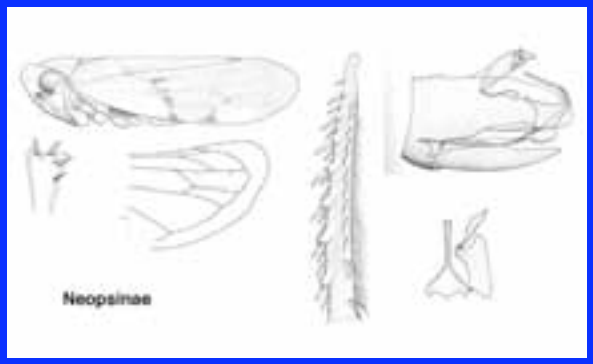
Calliscarta



Perubala

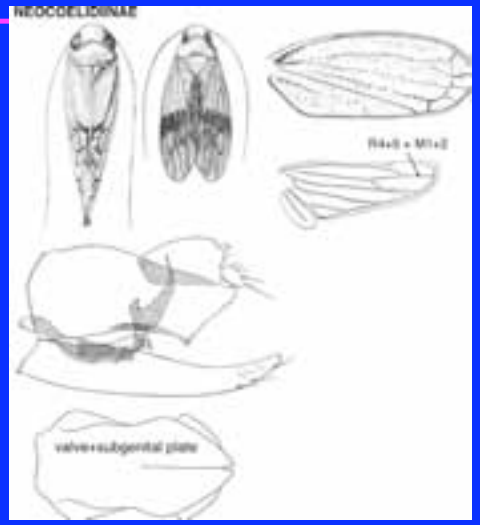
Neopsinae

- South American
- resemble Macropsinae and Tartessinae



Neocoelidiinae

- Neotropical
- related to Deltocephalinae ?

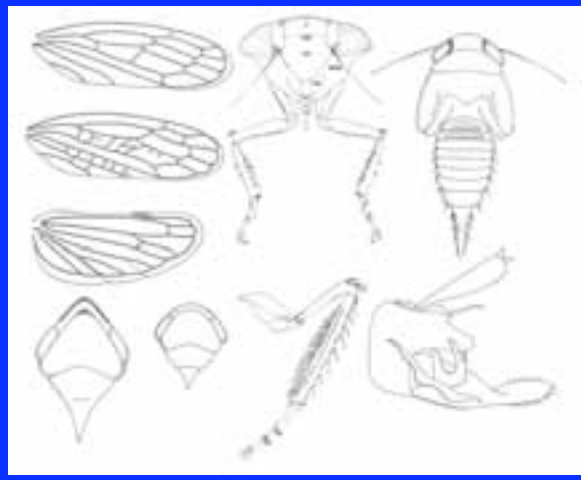


Nioniinae

- worldwide exc. Australian and Palearctic regions
- similar to Macropsinae

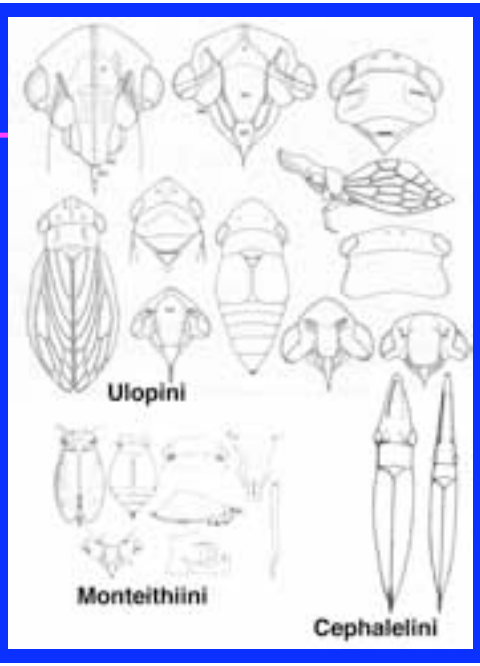
Tartessinae

- Australian w/ 1 Oriental genus
- similar to Coelidiinae



Ulopinae

- Old World
- resemble Megophthalminae

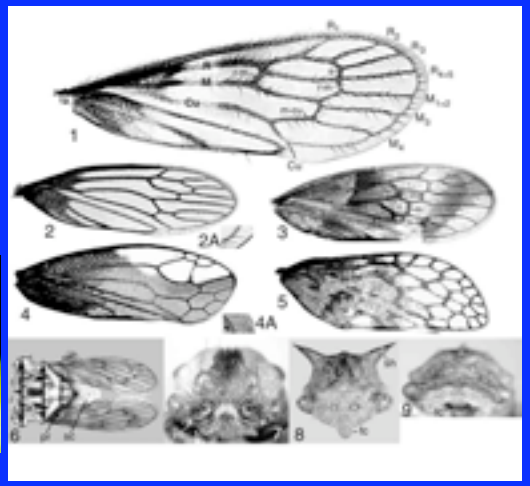


Treehoppers

- 3 families
- mostly New World; Centrotinae and *Darthula* in Old World
- mostly arboreal
- many are ant-attended and have parental care

Nicomiinae (=Centronodinae??)

- Neotropical
- most lack posterior pronotal process
- revised by Albertson & Dietrich (2005, 2006)



Stegaspidinae

- Neotropical with 1 genus in Nearctic
- pronotum extends over but does not conceal scutellum
- forewing venation diagnostic

Stegaspidini

Microcentrini

Centrotinae

- largest subfamily
- mostly Old World and North American
- pronotum extends over but (usually) does not conceal scutellum
- genera revised by Wallace & Deitz

Boocerini

Leptocentrini

Centrodontini

Membracinae

- forewing exposed
- hind tibia row III reduced or absent

Hypsoprorini

Membracini

Hoplophorionini

Aconophorini

Heteronotinae

- forewing exposed, m-cu1 absent
- frontoclypeus usually scoop-like

Darninae

- paraphyletic w/ respect to Smiliinae
- united by symplesio-morphies


Procyrtini


Cymbomorphini


Darnini


Hyphinoini

Smiliinae

- New World, diverse in Nearctic
- forewing with R4+5 and M1+2 partially or completely confluent
- probably polyphyletic


Smiliini


Amastrini


Ceresini


Acutalini


Polyglyptini

Aetalionidae

- Neotropical w/ 1 Oriental genus
- pronotum not extended over scutellum
- forewing R and M fused basally
- female pygofer with posteroventral processes


Aetalioninae


Biturritiinae