Key to the identification of orchards insects according damages of plants and morphology

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- In Europe alone, there are almost 100.000 different named species of insects
- The great majority of insects are plant-feeders at some stage in their lives
- Insects are divided into two subclasses: the winged insects (Pterygota) and the wingless insects (Apterygota)
- Subclasses are diveded into orders
- Orders are subdivides into families, which contain a number species that are closly related to each other

Field key cover the main orders of insects

1. Insects wingless, very small, with caudal appendages (tails) folded springing organ …….Aptergota – Collembola

- - Insects winged, or – if wingless – then not as above (Collembola)……2
- 2. Insects with only one pair of wings, the hidwings reduced to knob-like structures [(halteres)……..Diptera
- - Insects with 2 pairs of wings ……..3
- 3. Both pairs of wings membranous, with veins, with or without colored scales ……..4
- - Front wings opaque, hard and leathery in texture .....…12
- 4. Wings covered with colored scales ……..Lepidoptera

Field key cover the main orders of insects

- - Wings not covered with scales, but may be hairy, usually transparent …….5
- 5. Wings hairless, longitudinal veins connected by numerous cross-veins ….6
- - Wings hairy or hairless, very few cross-veins present ……..9
- 6. Long tail-like appendages present on the end of the abdomen ……7
- - abdomen without long tail-like appendages (though shorter-pincer like appendages may be present) ……....8
- 7. Wings held vertically over body at rest; front wings much longer than hindwings; two or more tails present ……Ephemeroptera
- - wings held flat over body at rest; front wings and hind-wings roughly equal in size, tails always two ……..Plecoptera

Field key cover the main orders of insects

- 8 . Body long and thin, often brightly colored; antennae very short ……Odonata
- - Body variable, antennae long ……Neuroptera
- 9. Wings hairy ……Trichoptera
- - Wings not hairy, variable in other characteristics ……10

Field key cover the main orders of insects

- 10. Insects with piercing beak-like mouthparts, broad head and short antennae ……Hemiptera
- - Insects with various types of mouthparts, antennae longer than width of head ……..11
- 11. Small, squat insects, with piercing, beak-like mothparts and two tabular appendages abdomen ……..Hemiptera
- - Insects with hindwings much smaller than front wings; tabular appendages absent, but females have abdominal ovipositor or sting; mothparts usually adapted for biting ……..Hymenoptera
- 12. Front wings leathery in texture, but with distinct membranous tips. Piercing mouth parts ……..Hemiptera

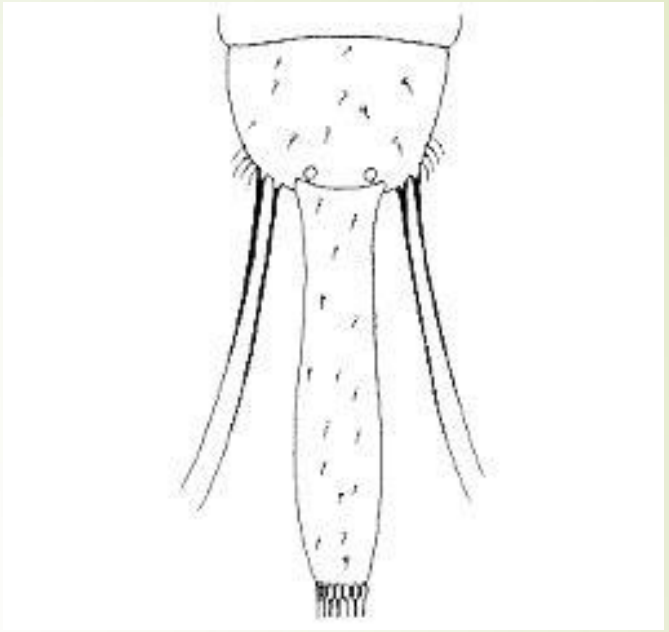
Field key cover the main orders of insects

- - Front wings wholly hard or leathery ……..13
- 13. Front wings hard, with no obvious veins, meeting along the centre of the back ……..14
- - Front wings distinctly veined, overlapping and held roofwise over the body ……..15
- - Mouthparts adapted for bitting, no ‘beak’ present ……16
- 16. Hind legs geatly enlarged and modified for jumping ……Orthoptera
- - Hind legs not adapted for jumping ……Blattodea

THYSANOPTERA

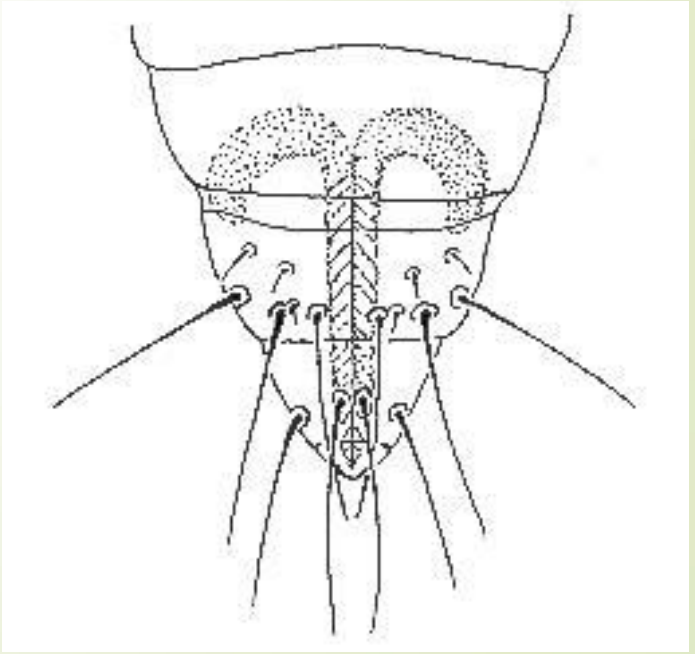
Terminal abdominal segments are in the form of a tube, not saw-like
(Tubulifera)

- Phlaeothripidae



Terminal abdominal segments taper to a point
(Terebrantia)

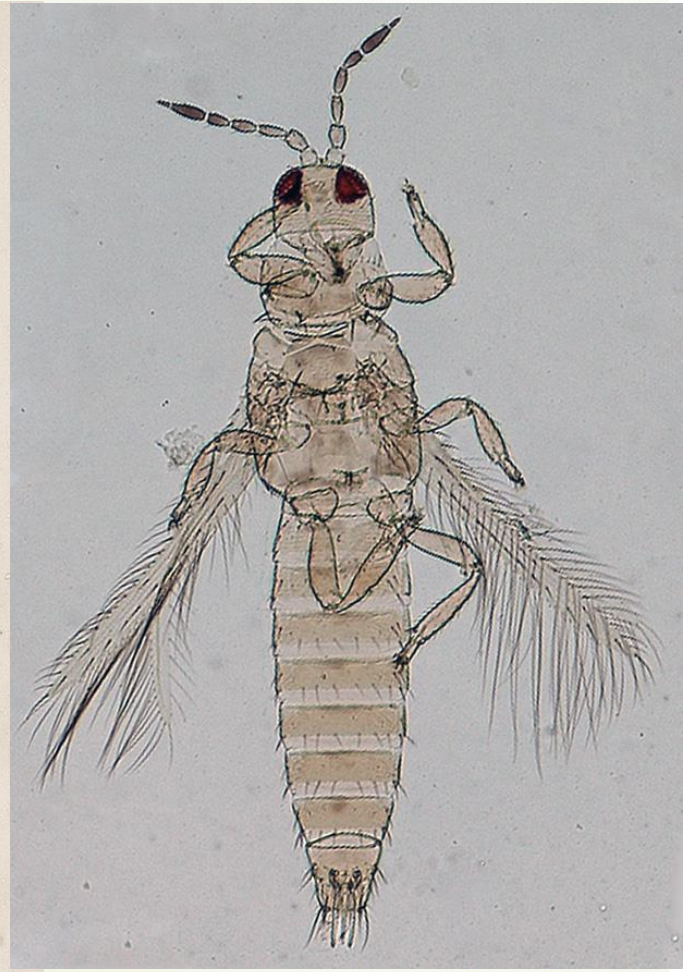
- Aelothripidae
- Thripidae



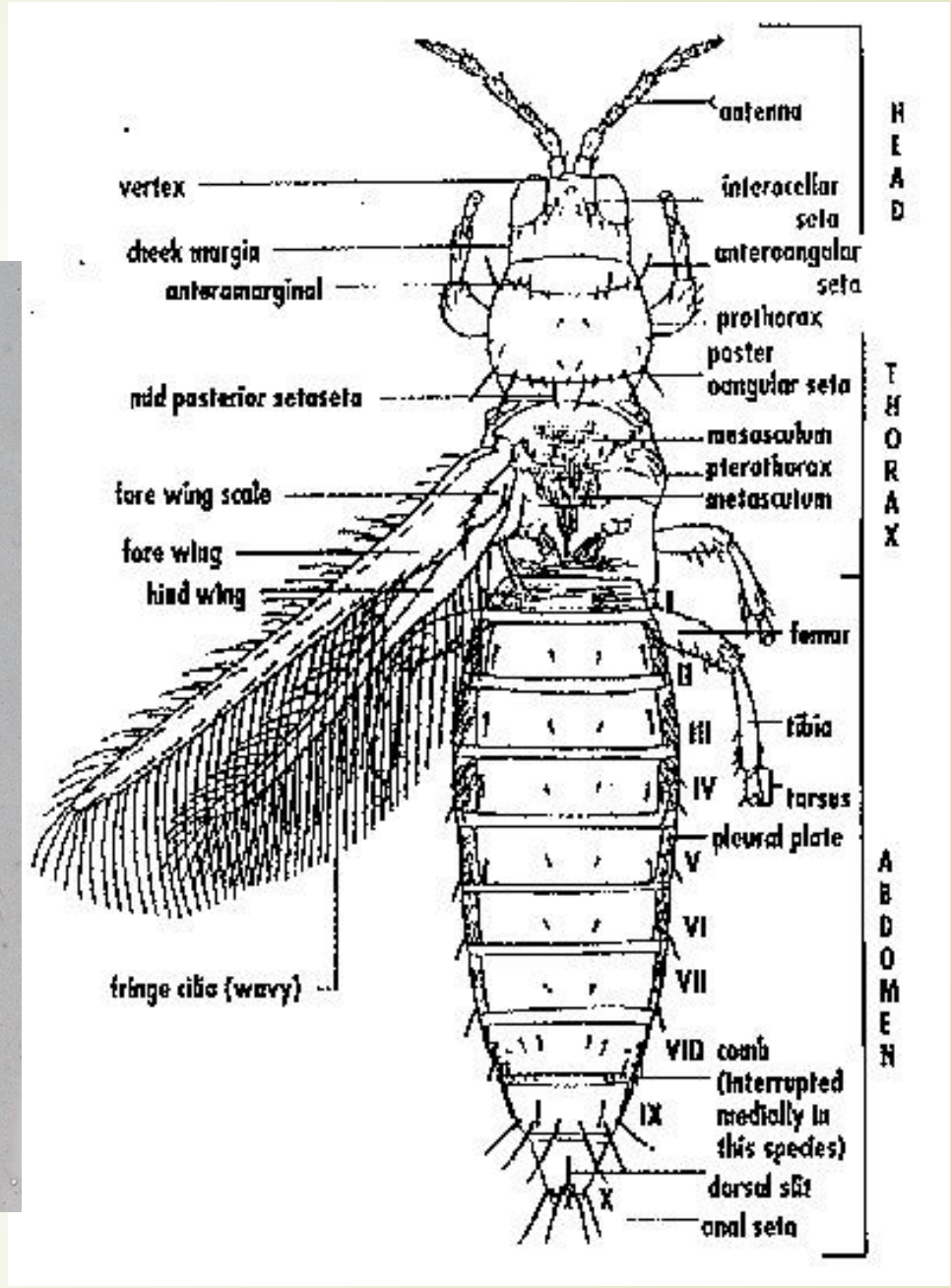
THRIPS - Thripidae

- Thrips are small plant pests used asymmetrical paired mouthparts to puncture cells on the leaf surface, and then to drink or suck plant juices.
- Characteristics are useful for field identification: Body size and color • Presence of wings in adult form • Damage symptoms • Known geographical distribution • Host preference and feeding location
- Thrips damage can be quite variable depending upon the pest species and host or cultivar. Some thrips may prefer feeding on the flowers, while others will be more readily attracted to the foliage. Typical flower damage includes browning and early flower drop. Thrips feeding damage on foliage can resemble other plant feeders with symptoms such as bronzing, flecking, silvering, and curling. Fruit damaged by thrips may be scarred, deformed or aborted.

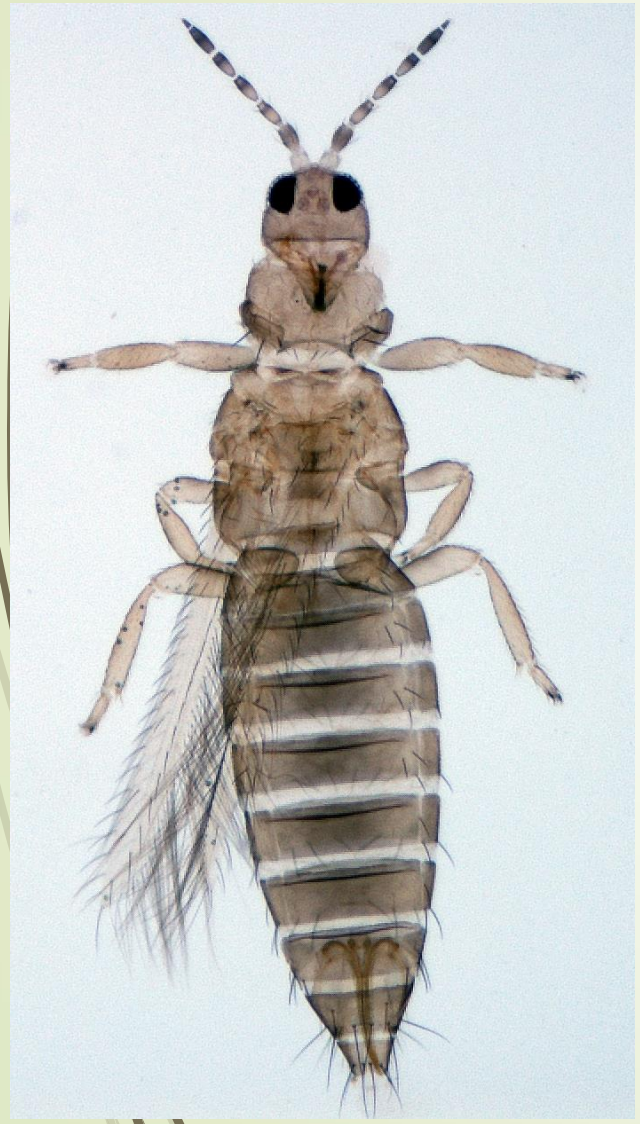
Thrips morphology



Thrips fuscipennis

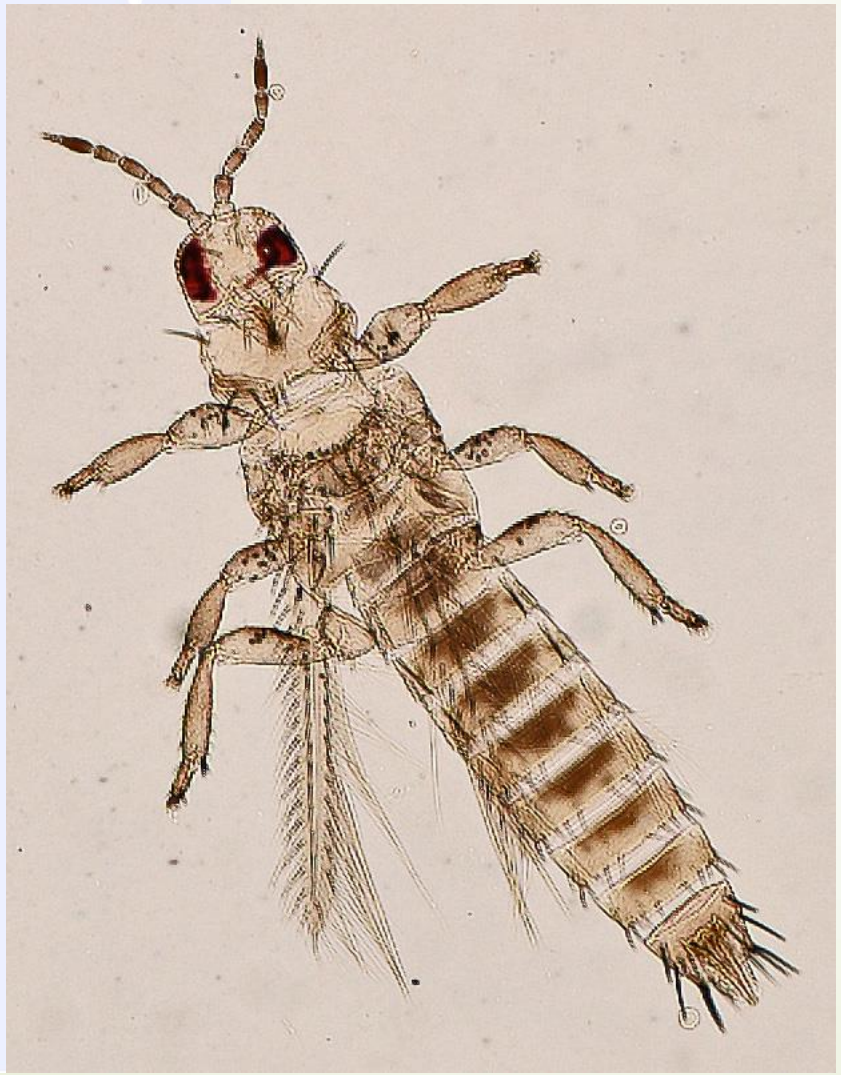


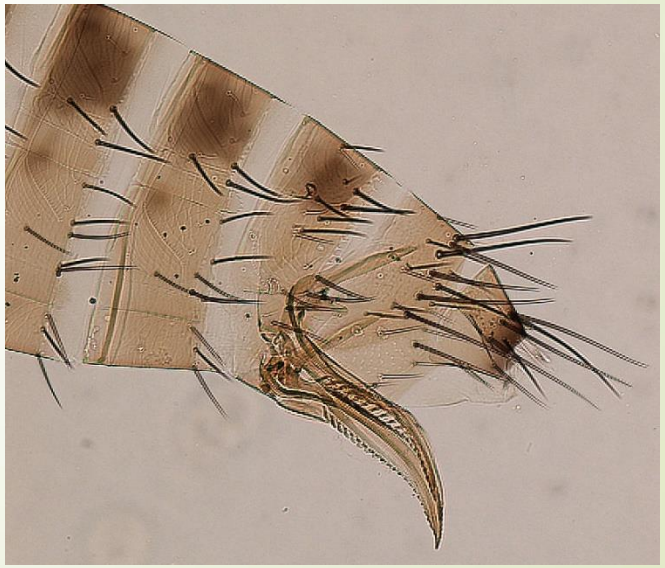
Onion thrips - *Thrips tabaci*



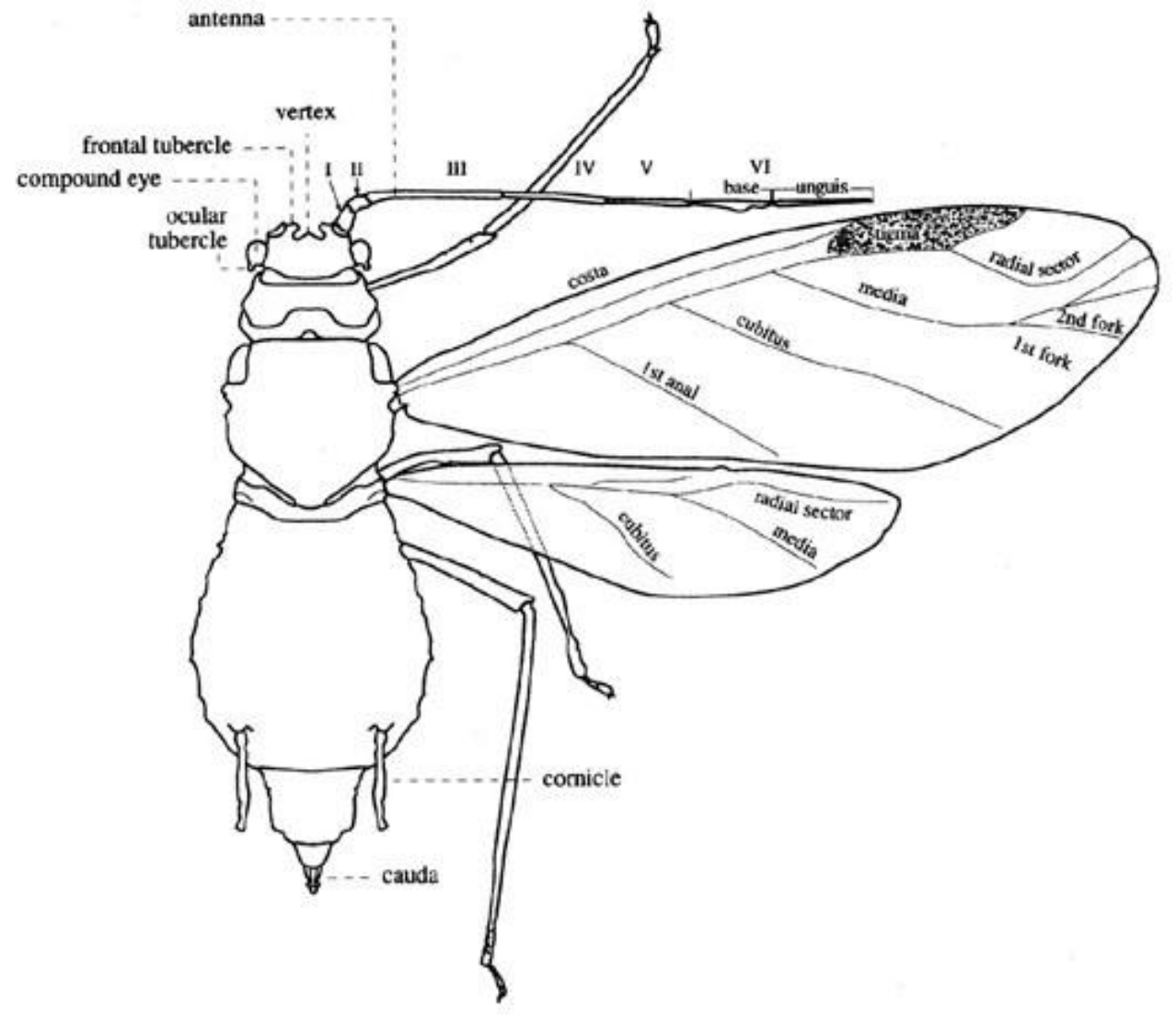
Thrips major

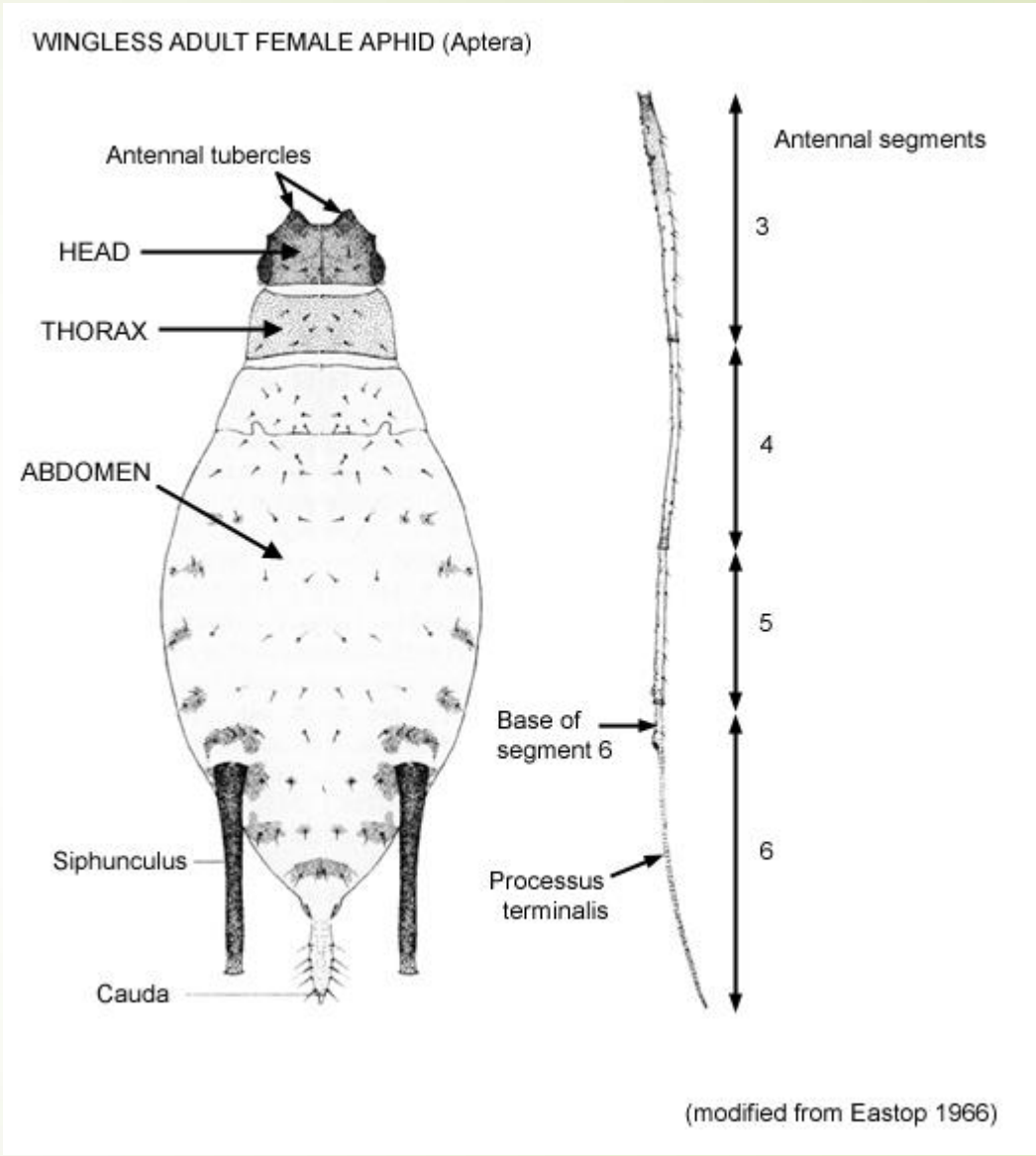
Western flower thrips
- Frankliniella occidentalis





APHIDS - Aphididae



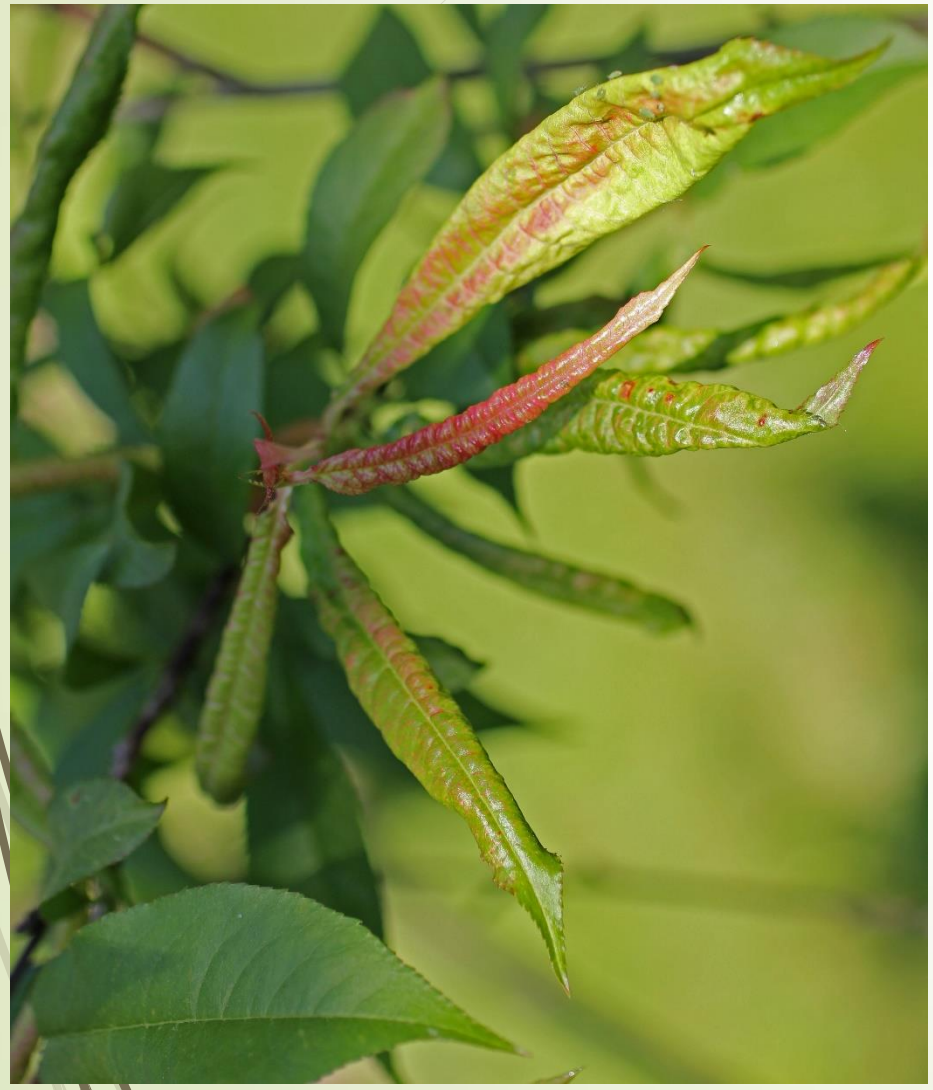


Aphis pomi

APHIDS - Aphididae

Myzus persicae

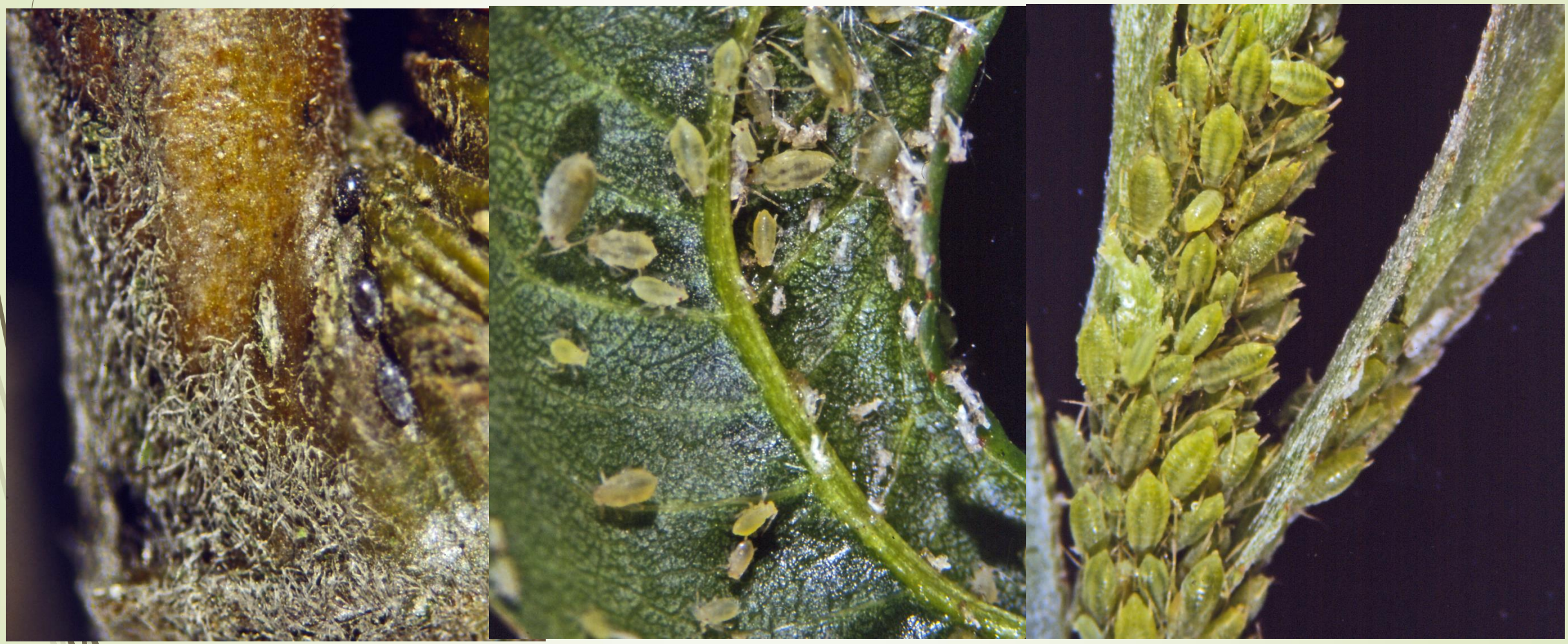
Myzus persicae



Dysaphis devecta

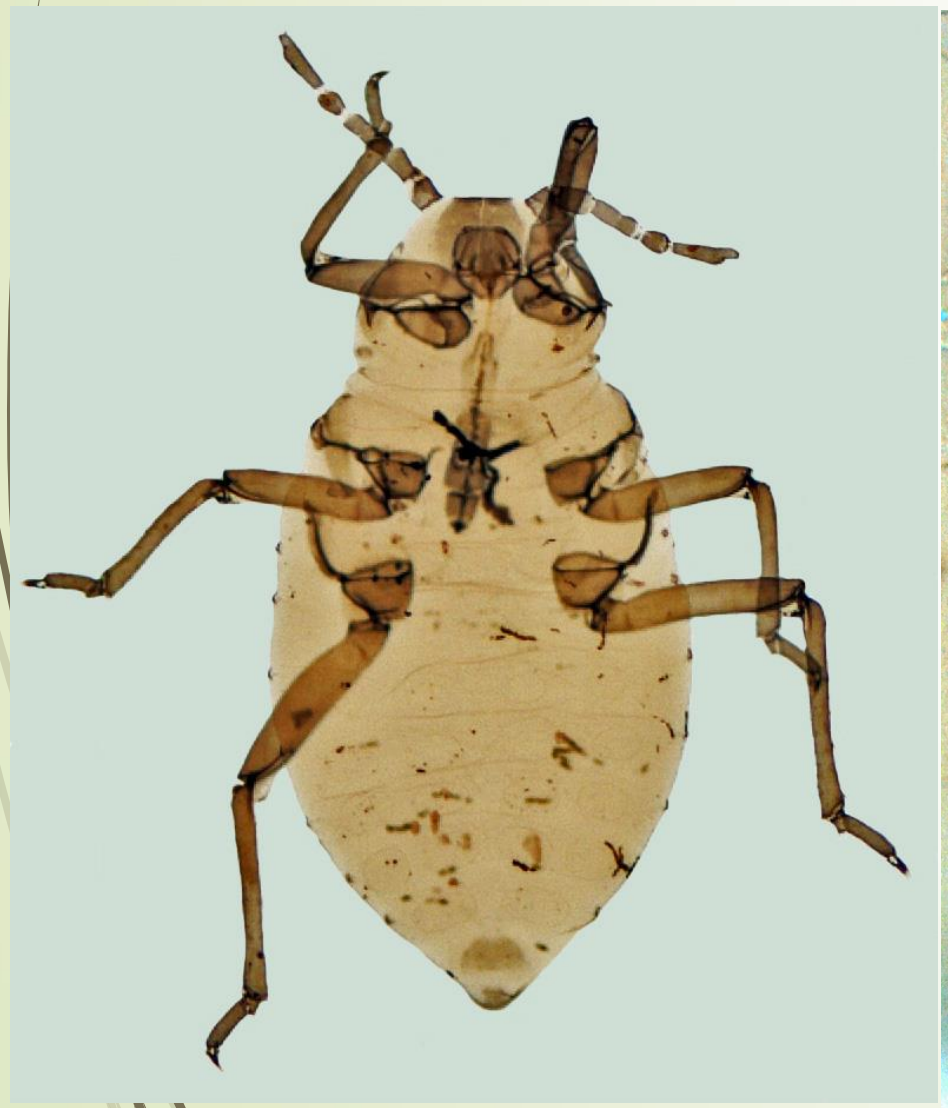
Dysaphis plantaginea

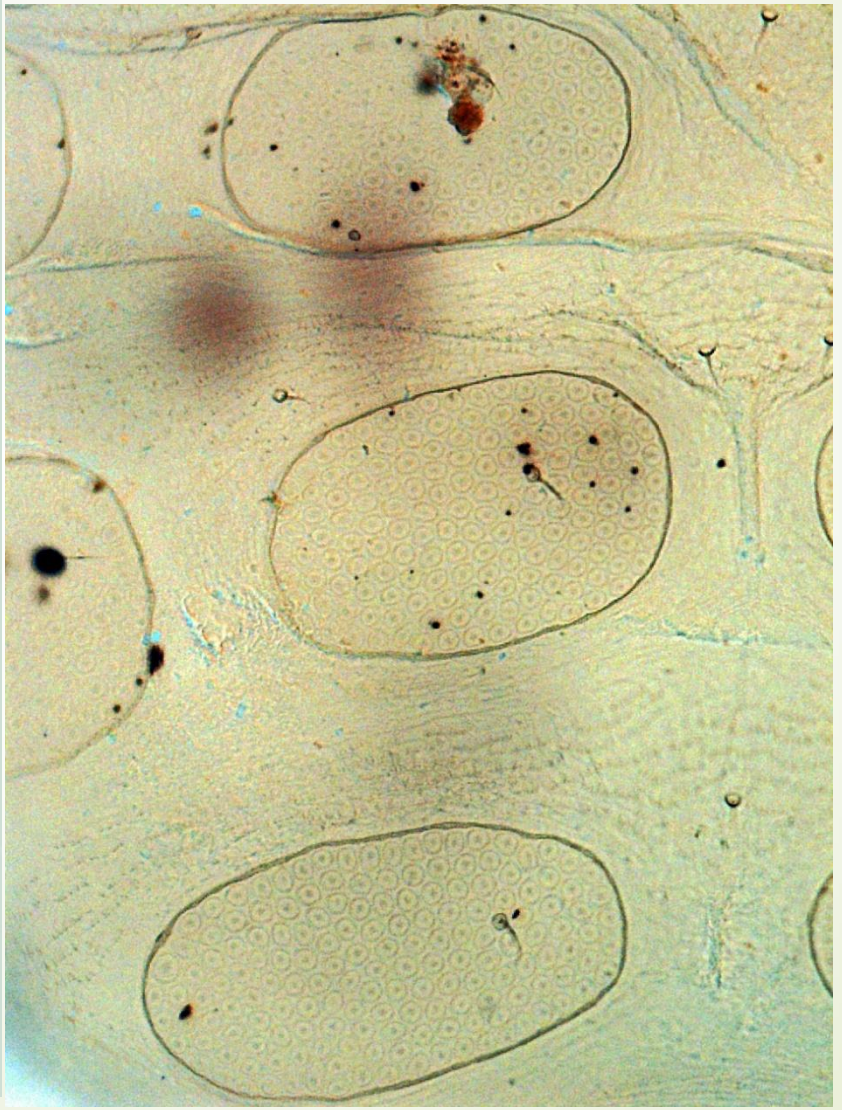
Rhopalosiphum insertum



Myzus cerasi

APHID FAMILIES – Wooly aphids - Pemphigidae





Eriosoma lanigerum

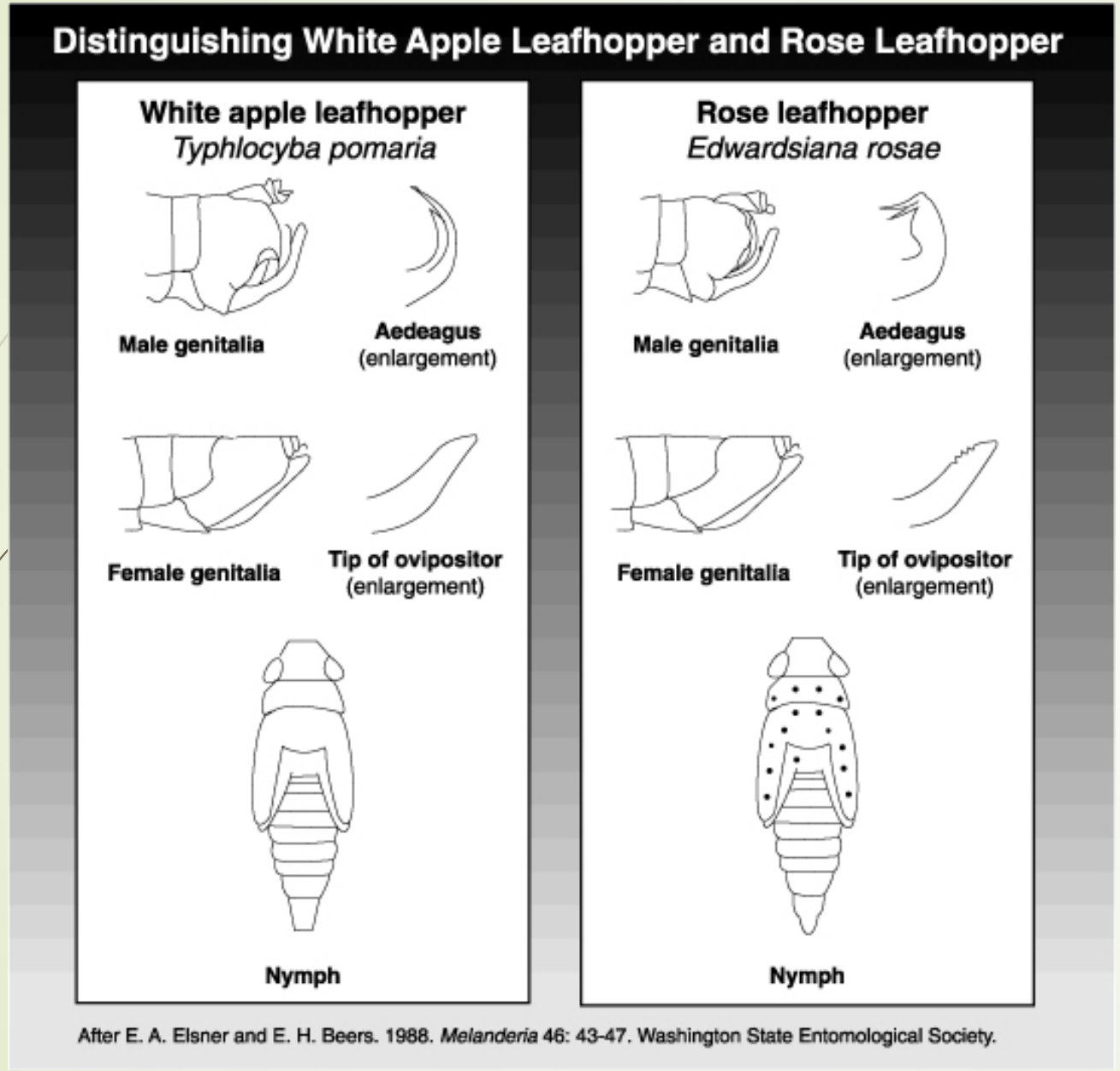
Leafhopper/Planthopper (Flatidae) and Psyllids

LEAFHOPPERS - Cicadellidae

Edwardsiana rosae

Empoasca viridis

Eupteryx sp.


Distinguishing White Apple Leafhopper and Rose Leafhopper
White apple leafhopper
Typhlocyba pomaria
Male genitalia
Aedeagus
(enlargement)
Female genitalia
Tip of ovipositor
(enlargement)
Nymph
Rose leafhopper
Edwardsiana rosae
Male genitalia
Aedeagus
(enlargement)
Female genitalia
Tip of ovipositor
(enlargement)
Nymph
After E. A. Elsner and E. H. Beers. 1988. Melanderia 46: 43-47. Washington State Entomological Society.

Citrus Flatid Planthopper – *Metcalfa pruinosa*

ARMORED SCALES - Diaspididae

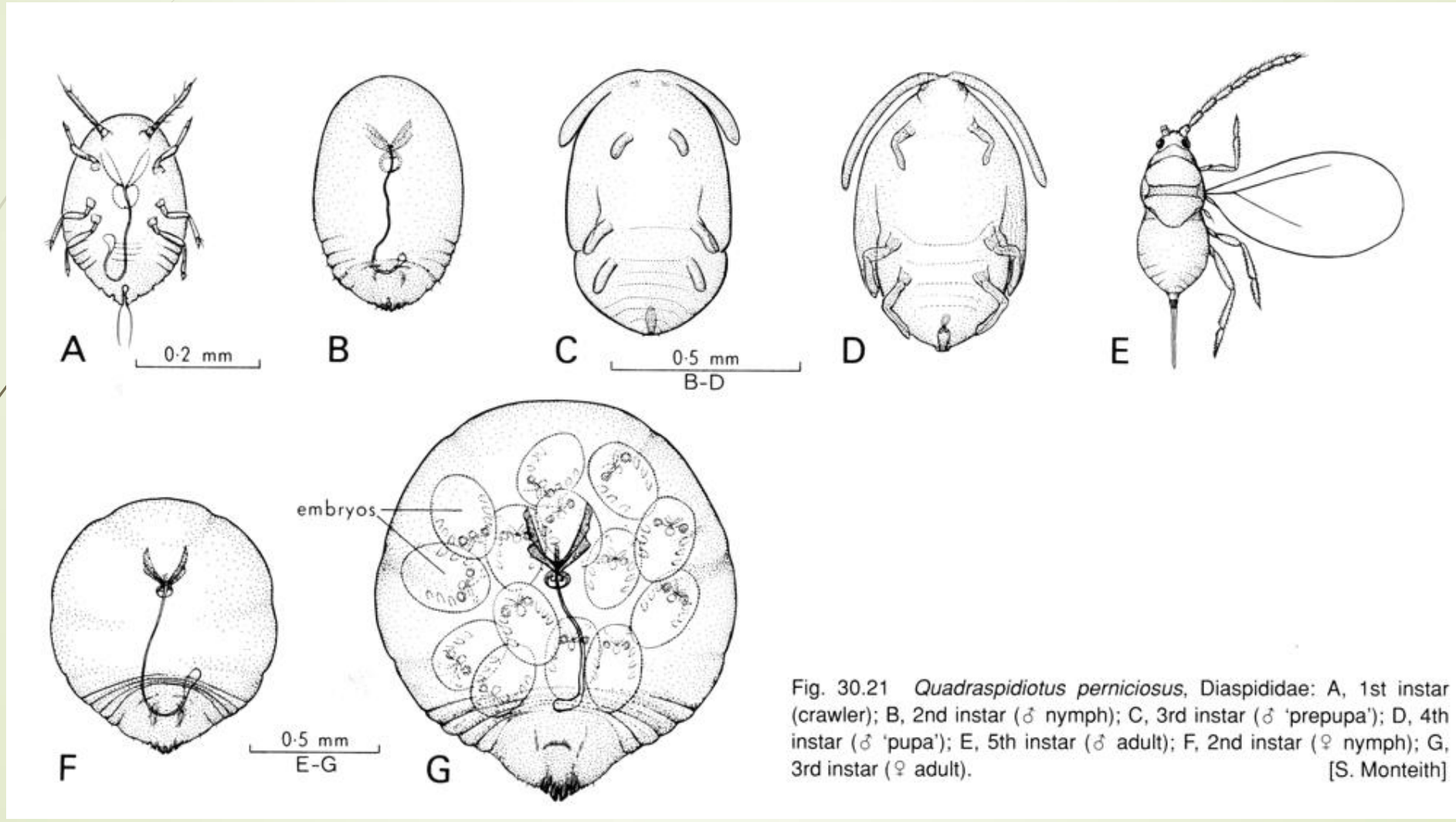
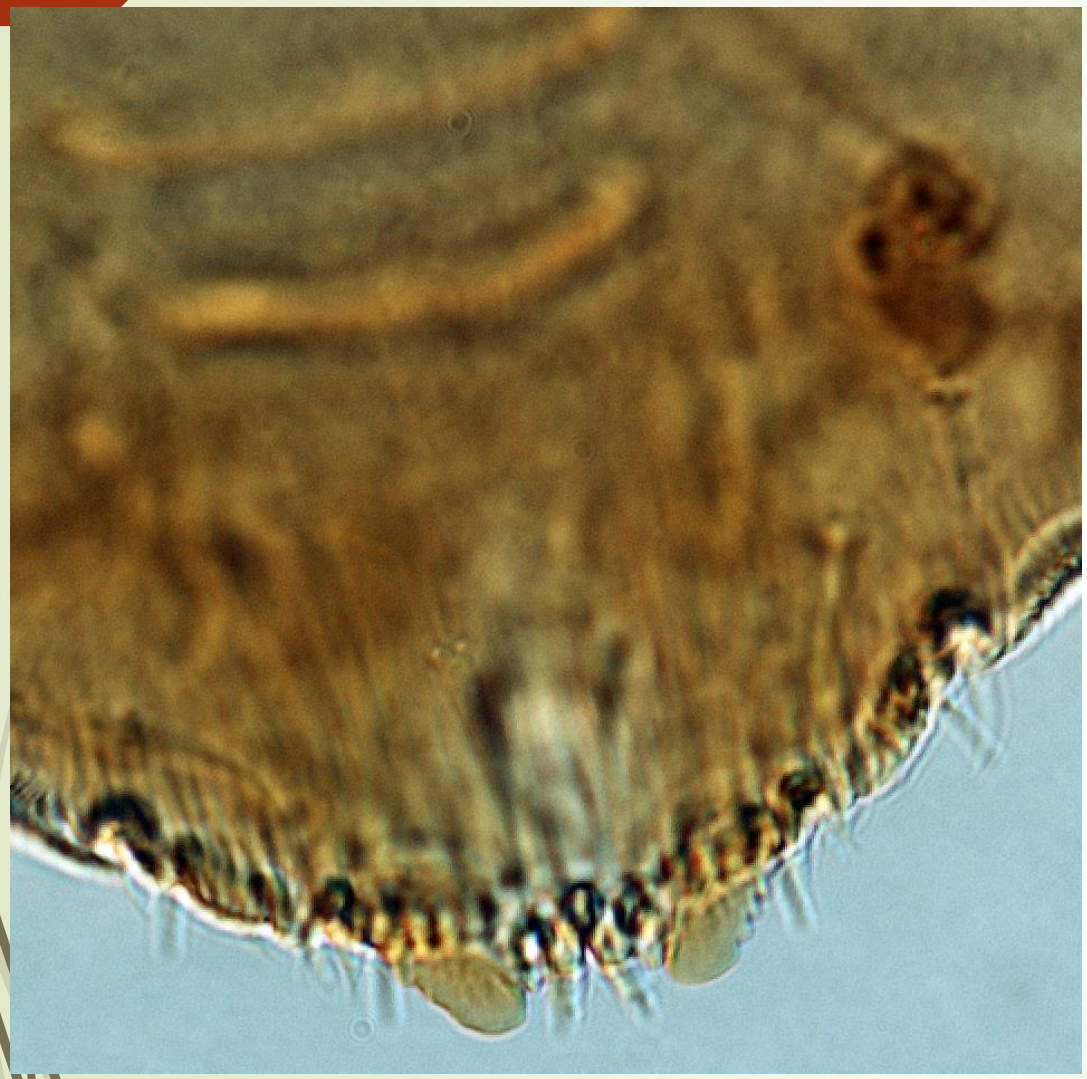
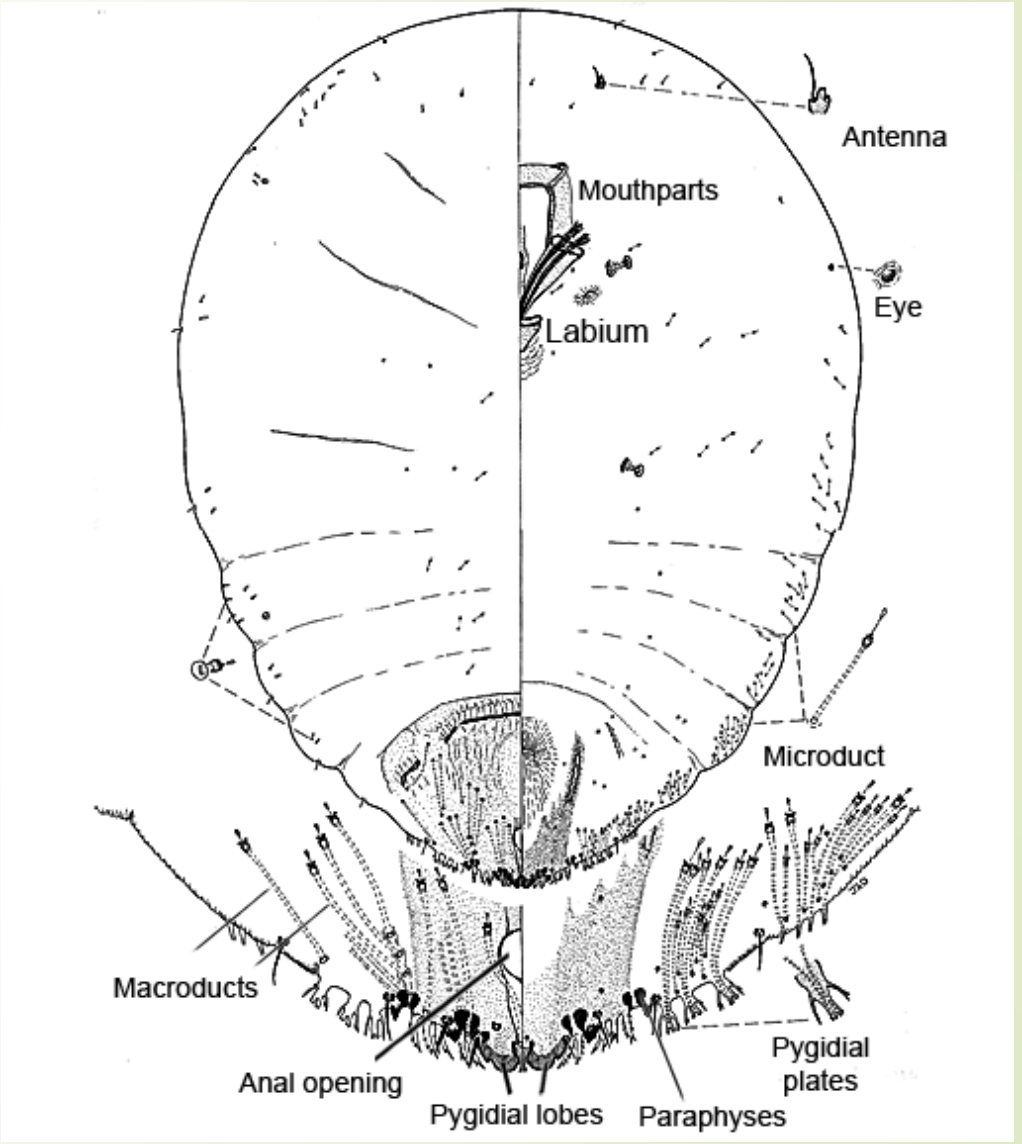


Fig. 30.21 *Quadraspidiotus perniciosus*, Diaspididae: A, 1st instar (crawler); B, 2nd instar (♂ nymph); C, 3rd instar (♂ 'prepupa'); D, 4th instar (♂ 'pupa'); E, 5th instar (♂ adult); F, 2nd instar (♀ nymph); G, 3rd instar (♀ adult). [S. Monteith]

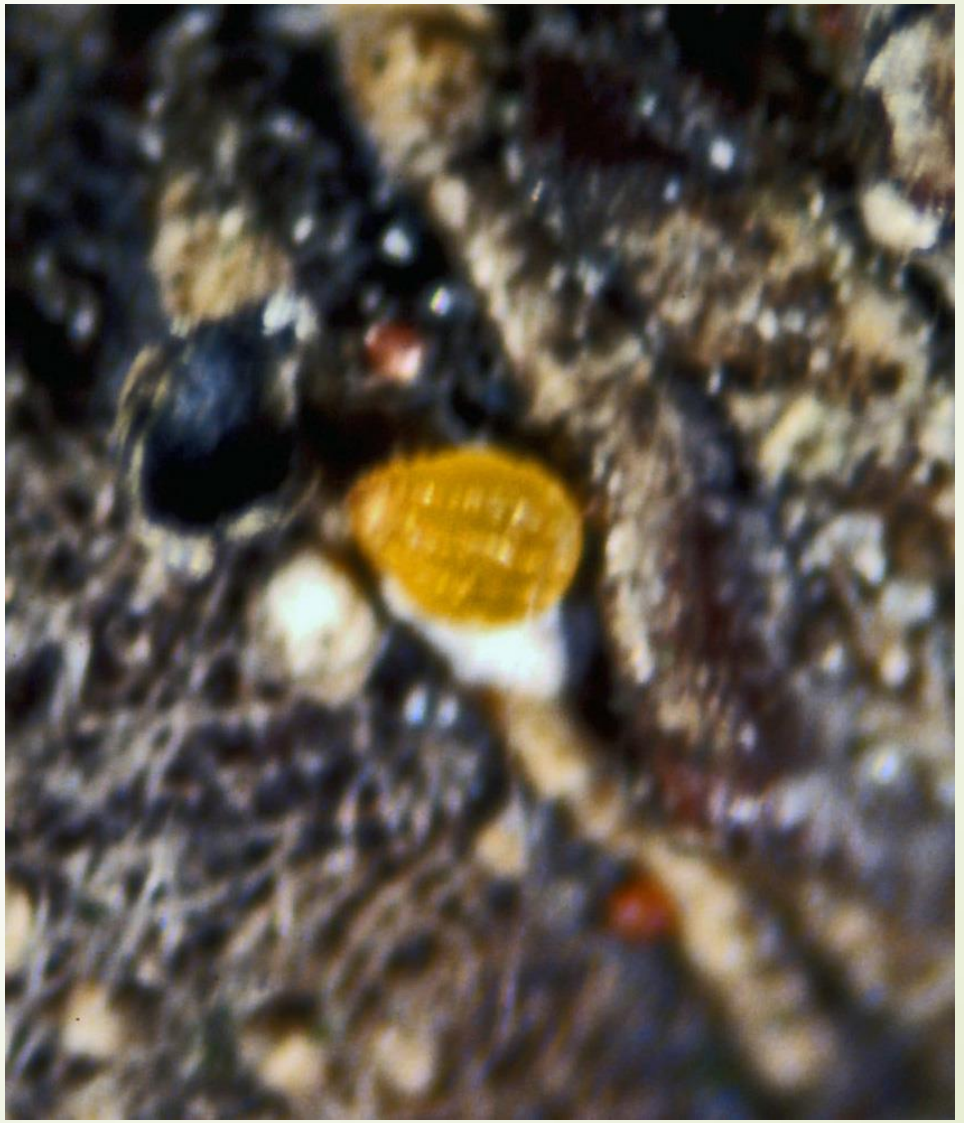
ARMORED SCALES - Diaspididae





Quadraspidiotus perniciosus

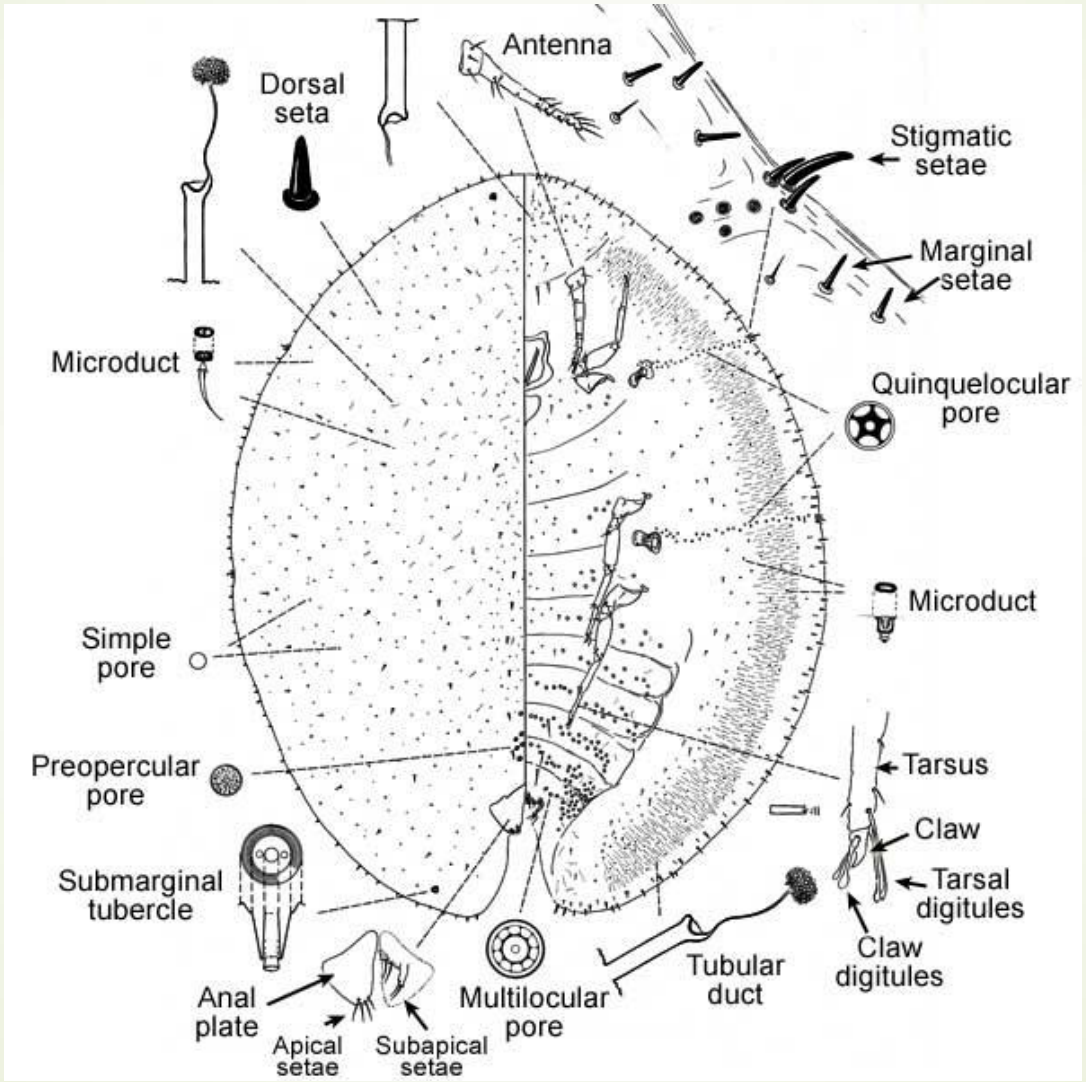
Quadraspidiotus ostraeformis



Pseudaulacaspis pentagona

Lepidosaphes ulmi

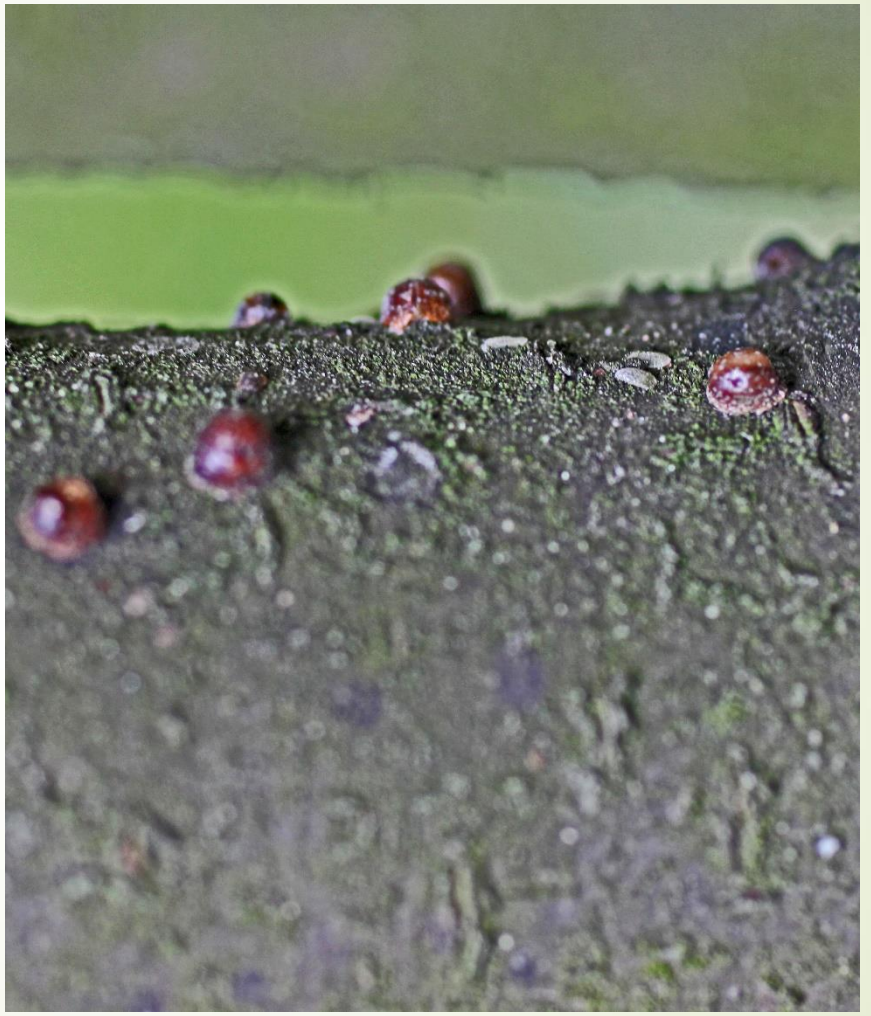
SOFT SCALES - Coccidae



Parthenolecanium corni

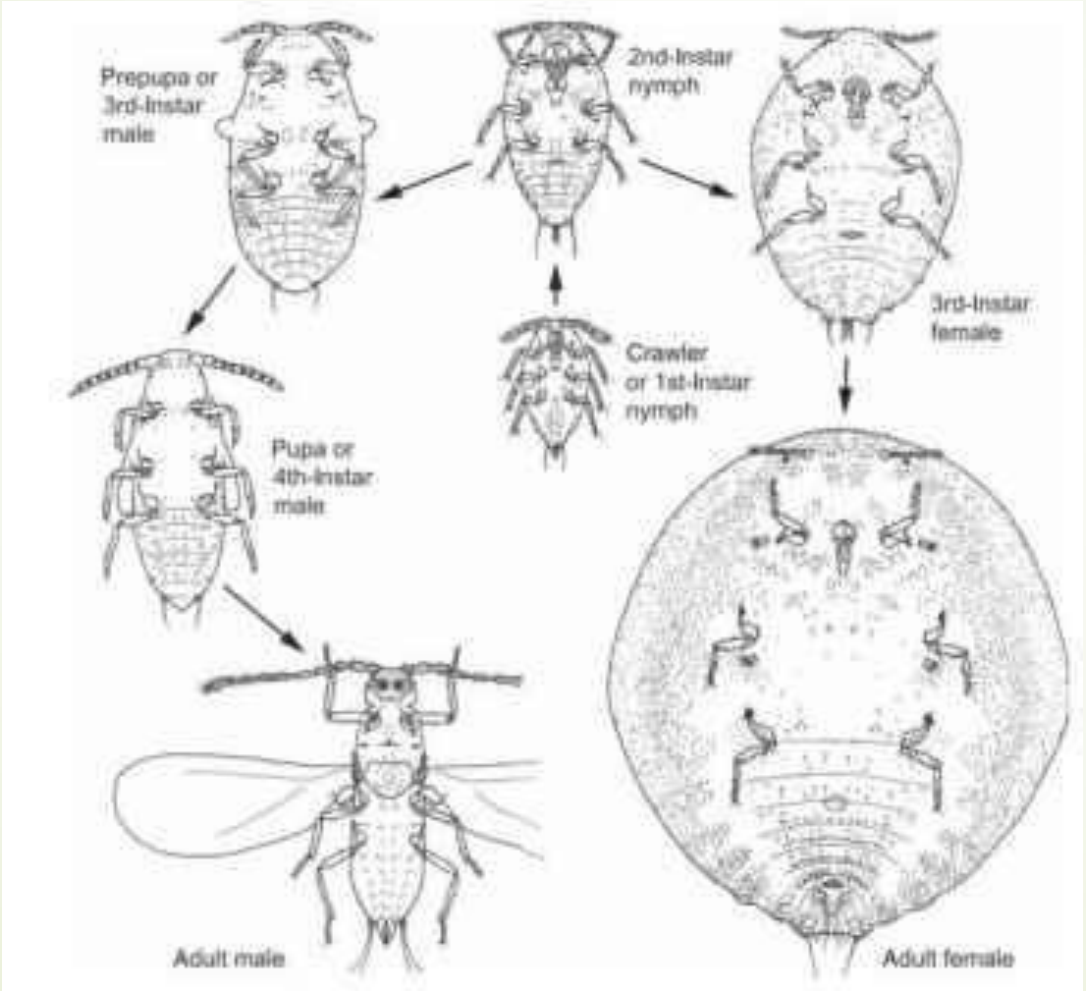
Coccidae

Pulvinaria regalis



Sphaerolecnium prunastri

MEALYBUGS - Pseudococcidae



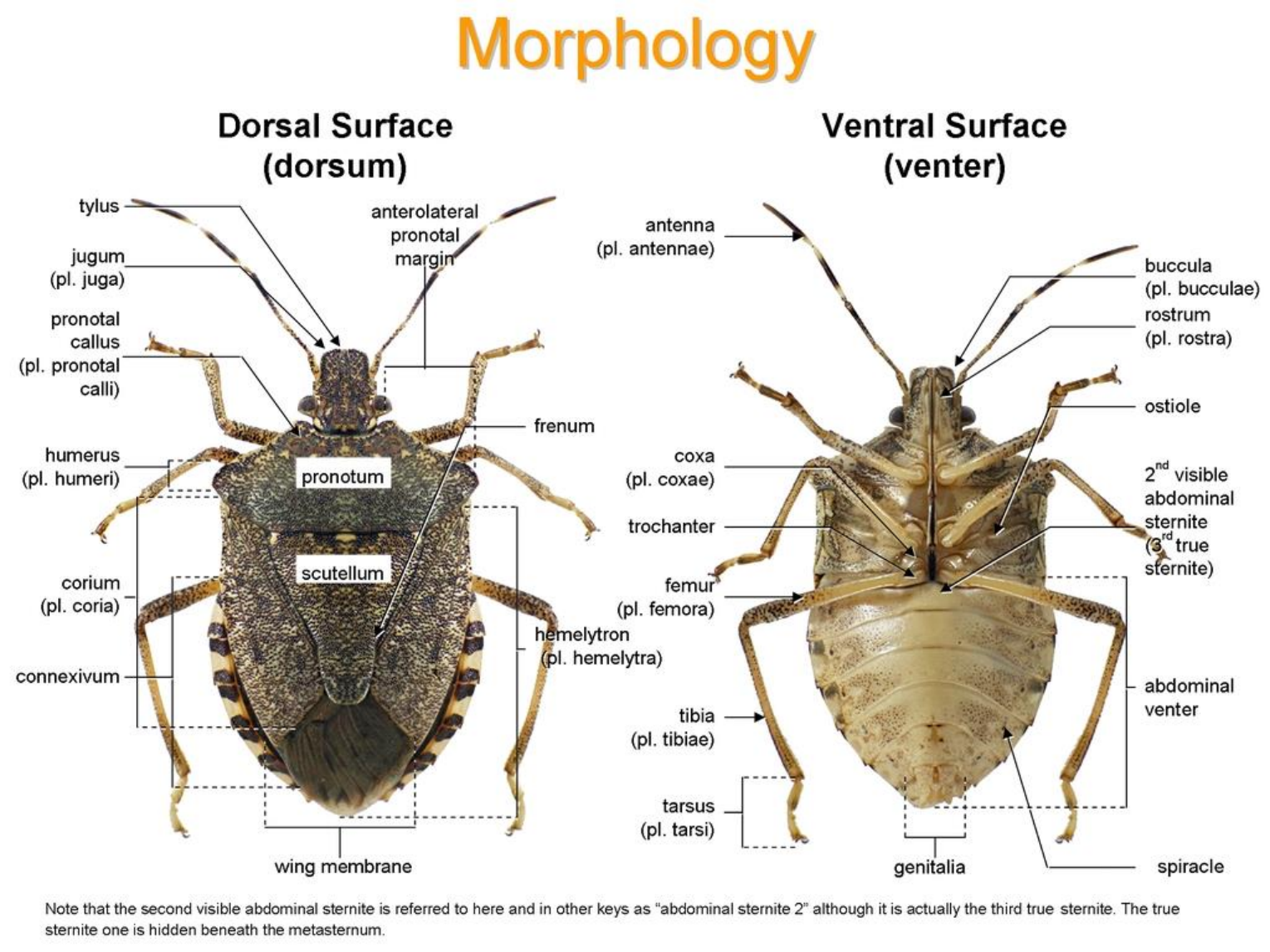
MEALYBUGS - Pseudococcidae

Phenacoccus aceris

LYGUS BUGS - Miridae

European tarnished pland bug – *Lygus rugulipennis*

STING BUGS - Pentatomidae



Note that the second visible abdominal sternite is referred to here and in other keys as "abdominal sternite 2" although it is actually the third true sternite. The true sternite one is hidden beneath the metasternum.

Sting Bugs (Pentatomidae)

Carpocoris sp.

Palomena prasina

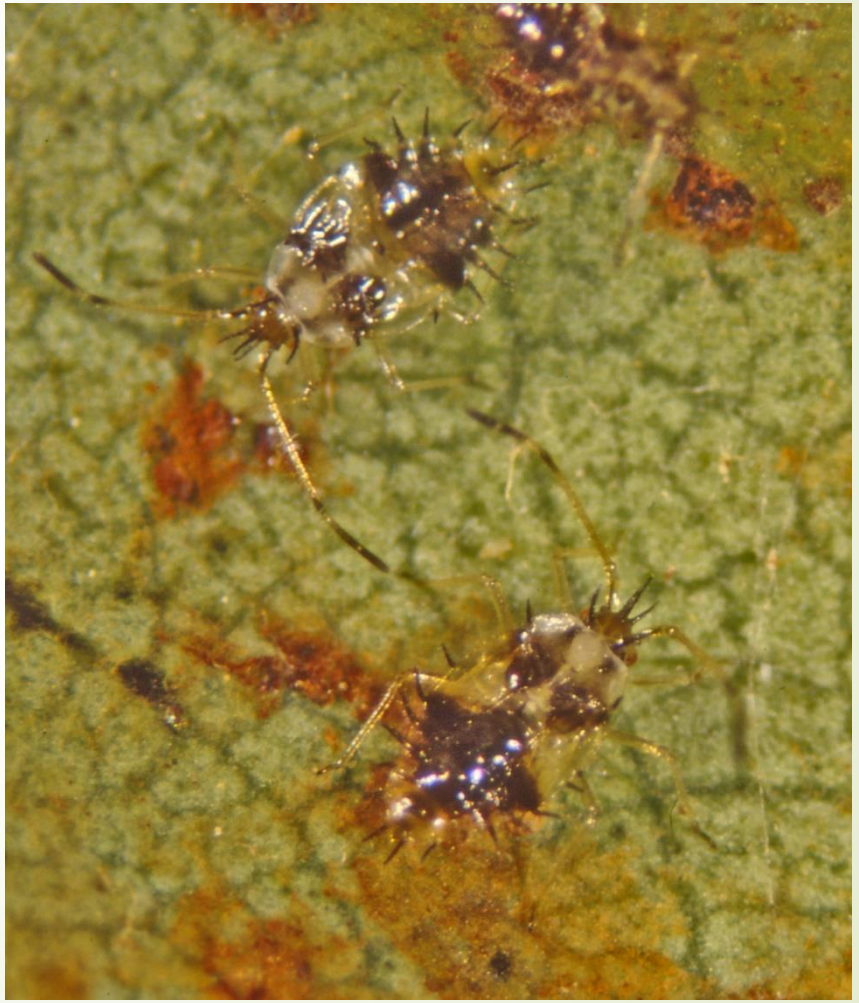
Leaf-footed Bugs (Coreidae) - *Coreus marginatus*

LACE BUGS - Tingidae

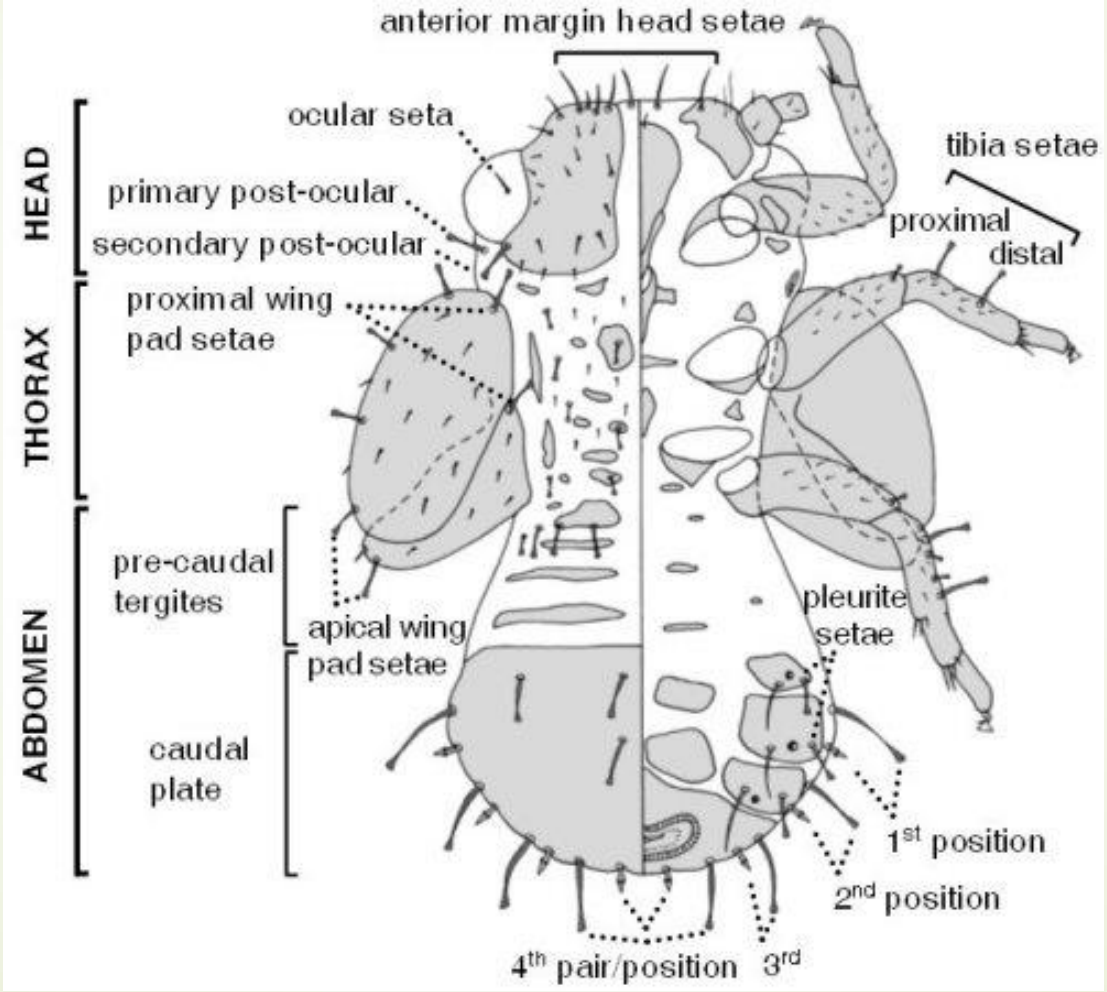
Stephanitis pyri ???

Stephanitis rhodoendri
Stepanitis oberti
Stepahnitis takeyai

LACE BUGS - Tingidae



JUMPING PLANT LICE - Psyllidae



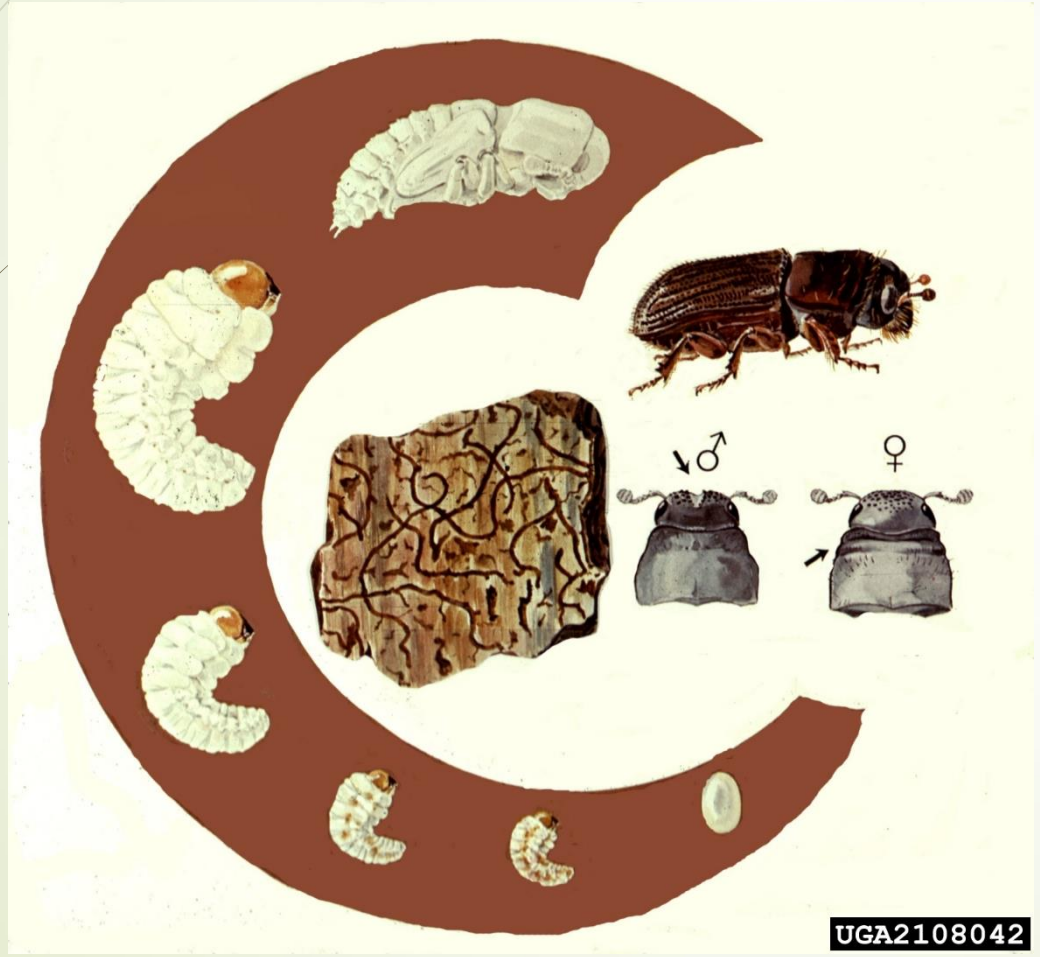
JUMPING PLANT LICE - Psyllidae

Cacopsylla pyri

JUMPING PLANT LICE - Psyllidae

Psylla mali

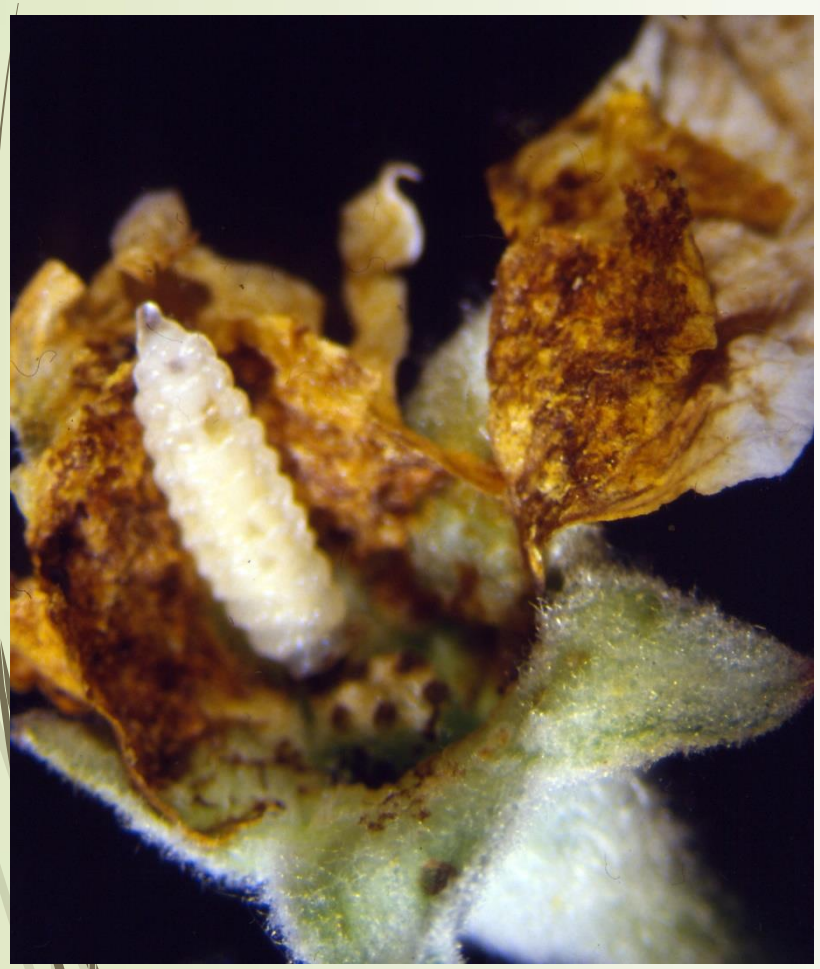
BARK BEETLE/AMBROSIA BEETLE - Scolytidae



BARK BEETLE/AMBROSIA BEETLE - Scolytidae

pear blight beetle
Xyleborus dispar

Curculionidae
Anthonomus pomorum



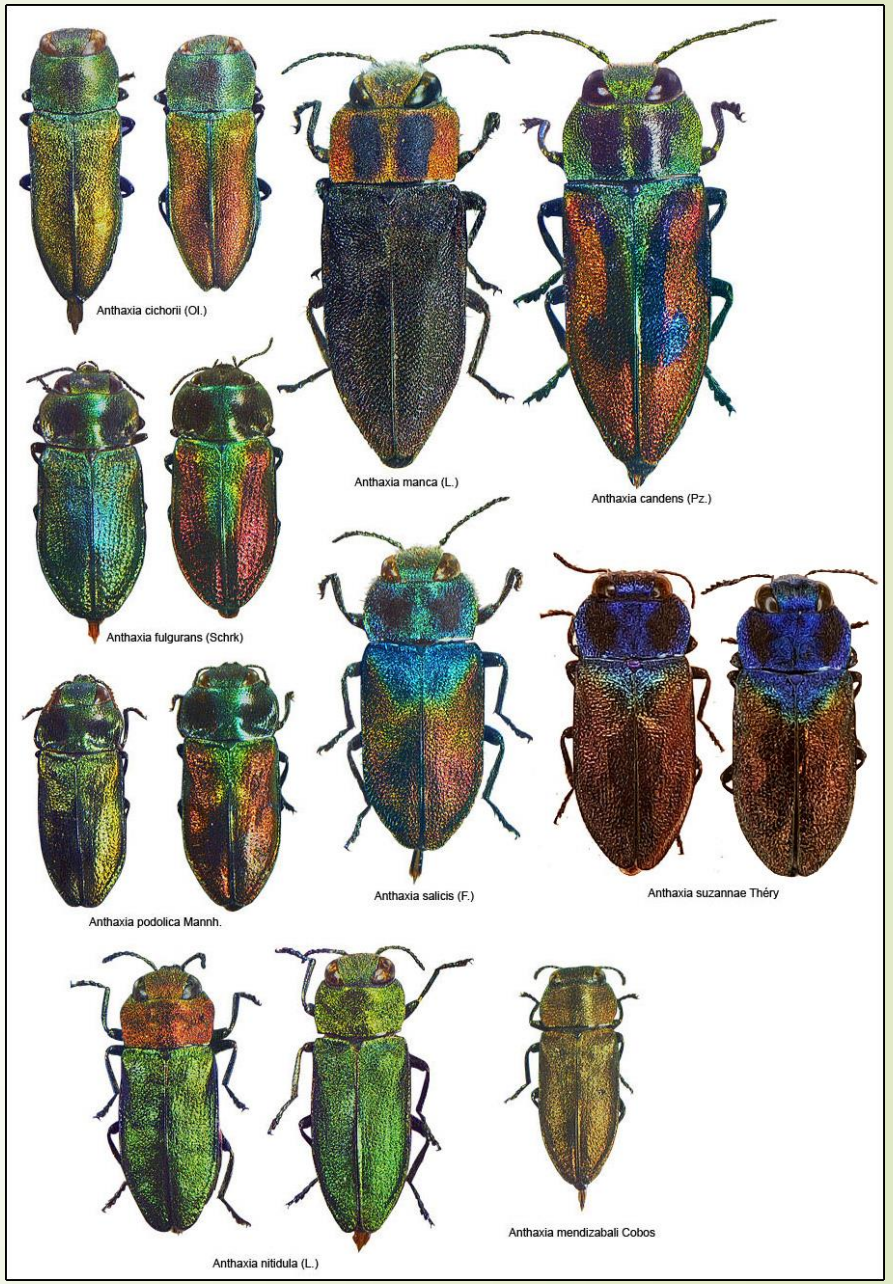
WEEWILS – *Otiorhynchus sulcatus*

WEEWILS - Curculionidae

Phyllobius argentatus

JEWEL BEETLE - Buprestidae

- ***Agrilus planipennis***

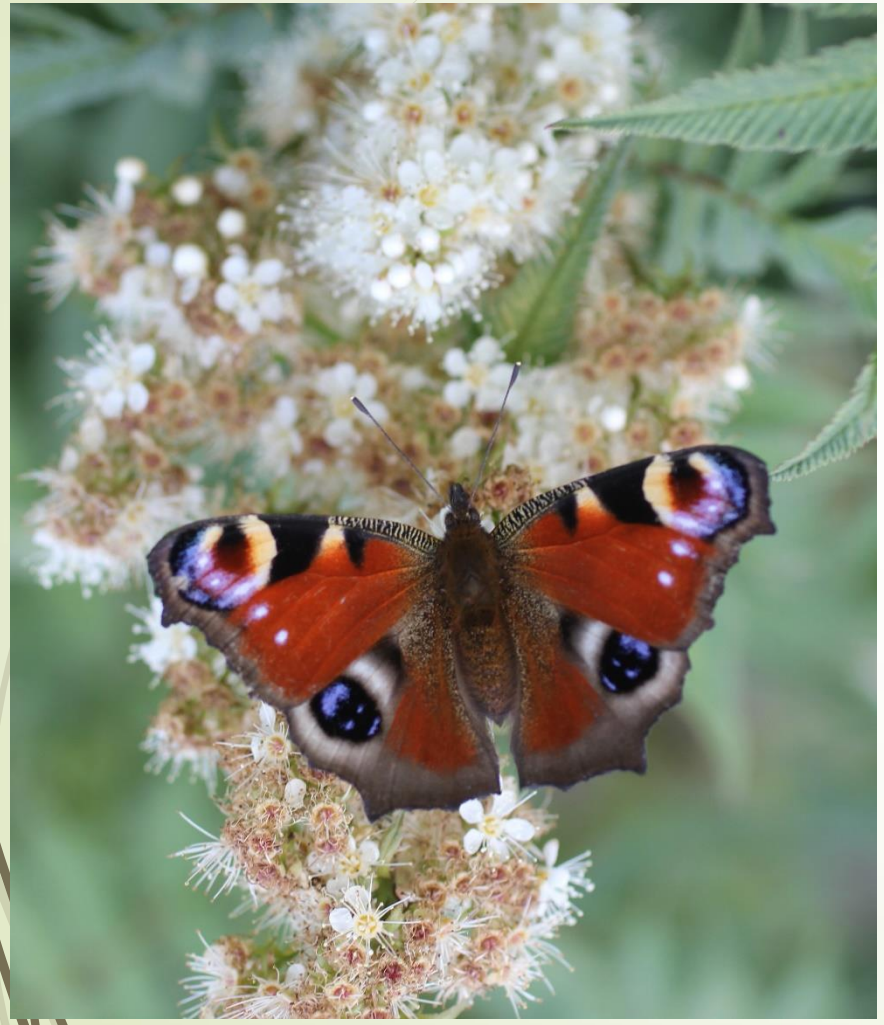


JEWEL BEETLE - Buprestidae

- ***Agrilus cuprescens***

Agrilus sinuatus

Butterflies and moths



TWIRLER MOTH - Gelechiidae

Tuta absoluta

TWIRLER MOTH - Gelechiidae

- A large family of small to medium-sized moths, wingspan 9-22mm. Many species are rarely seen, except when attracted to light, and are often difficult to name to species level. The moths rest with the wings folded flat or partially rolled with the antennae often lying above the forewings.Several subfamilies are recognised, but not listed separately here.

- The larvae of each species will normally feed on only a single family of plants, but over thirty plant families are used, the most common being Compositae, Leguminosae, Caryophyllaceae and Rosaceae. Ten species, in four genera, feed exclusively on mosses.

PYRALID MOTH - Pyralidae

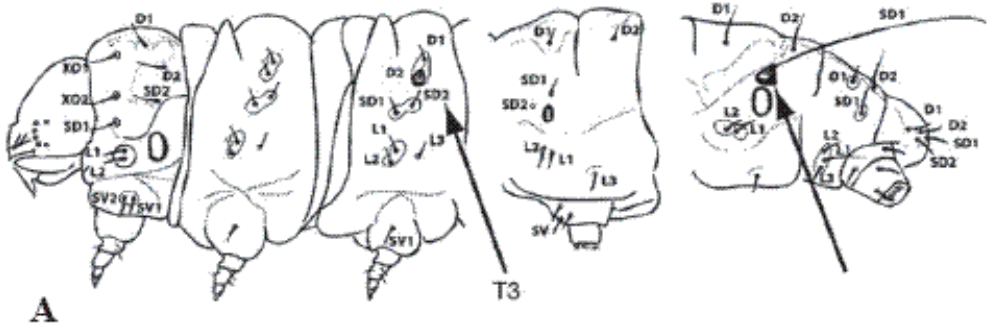


Figure 3. **A.** Pyralidae, sclerotized ring at base of SD1 of A8, Chrysaugine, sclerotized ring at base of SD1 of metathoracic segment 3. **B.** Pyralidae, sclerotized ring at base of SD1 of A8, Galleriinae, sclerotized ring at base of SD1 of abdominal segment 1.

Crambidae - *Duponchelia fovealis*

Tineidae – *Opogona sacchari*

LEAF BLOTCH MINER MOTHS - Gracillariidae

Gracillariinae: small moths (wingspan 9-16mm) some of which have striking wing-patterns. At rest the moths adopt a characteristic posture, with the front raised and forelegs displayed. The larvae at first mine leaves, sap-feeding on the epidermis in early instars. Later feeding is in a full-depth mine. Most species complete their feeding on the surface of the leaf, constructing folds or cones of the leaf-edge

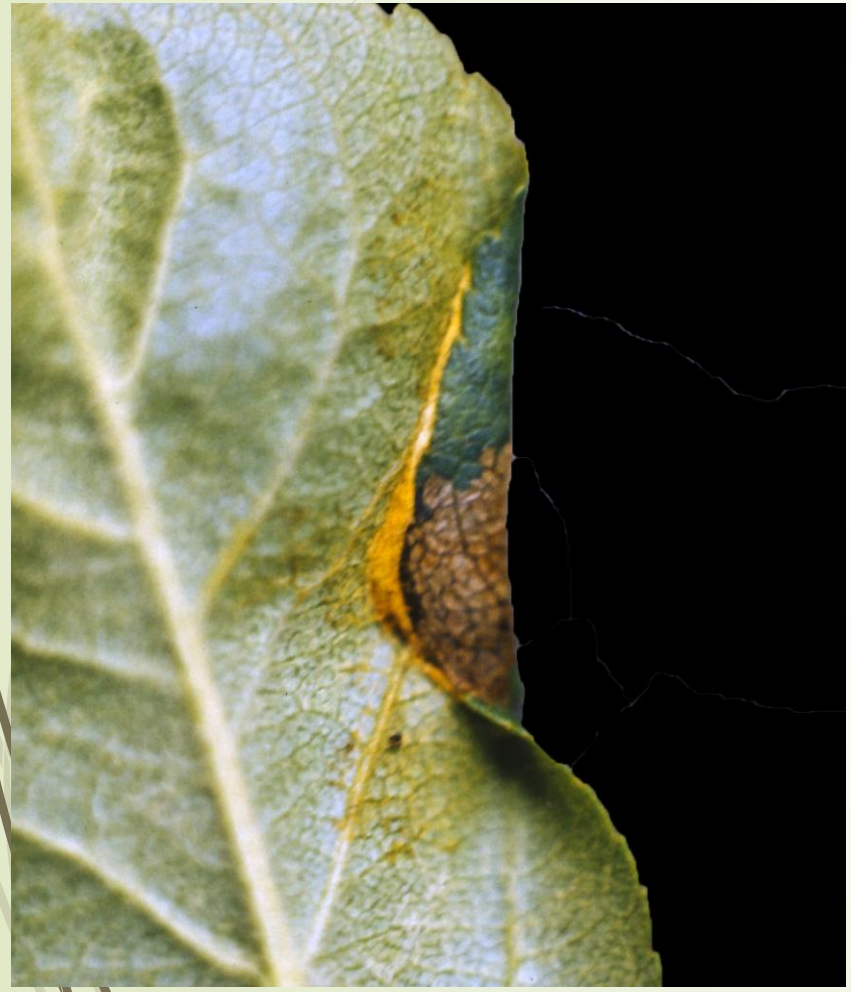
- **Lithocolletinae**: very small moths (wingspan 6-10mm) generally with a pattern of white streaks (strigulae) on a brown or orange ground-colour. The larvae feed within a leaf-mine, most of which have characteristic "concertina" folds caused by silk-spinning contracting the leaf surface. The pupa remains in the mine. One recent immigrant has spread throughout the county in only twelve months during 2006. This is *Cameraria ohridella* (366a) whose mines are now disfiguring the leaves of white-flowered horse-chestnuts.

Leaf Blotch miner moths (Gracillariidae)

Phyllonorycter blancardella

Leaf Blotch miner moths (Gracillariidae)

Callisto denticulata



LEPIDOPTERA – Nepticulid moth (Nepticulidae

Apple pigmy moth - *Stigmella malella*

LEAF MINER - Lyonetidae

- **Small, mainly pale-coloured moths which fly by day. Some species are shining white with a pattern of black and yellow stripes at the tip of the forewing. The larvae mine leaves or the bark of twigs**

Pear leaf blister moth

- *Leucoptera scitella*

LEAF MINER - Lyonetidae

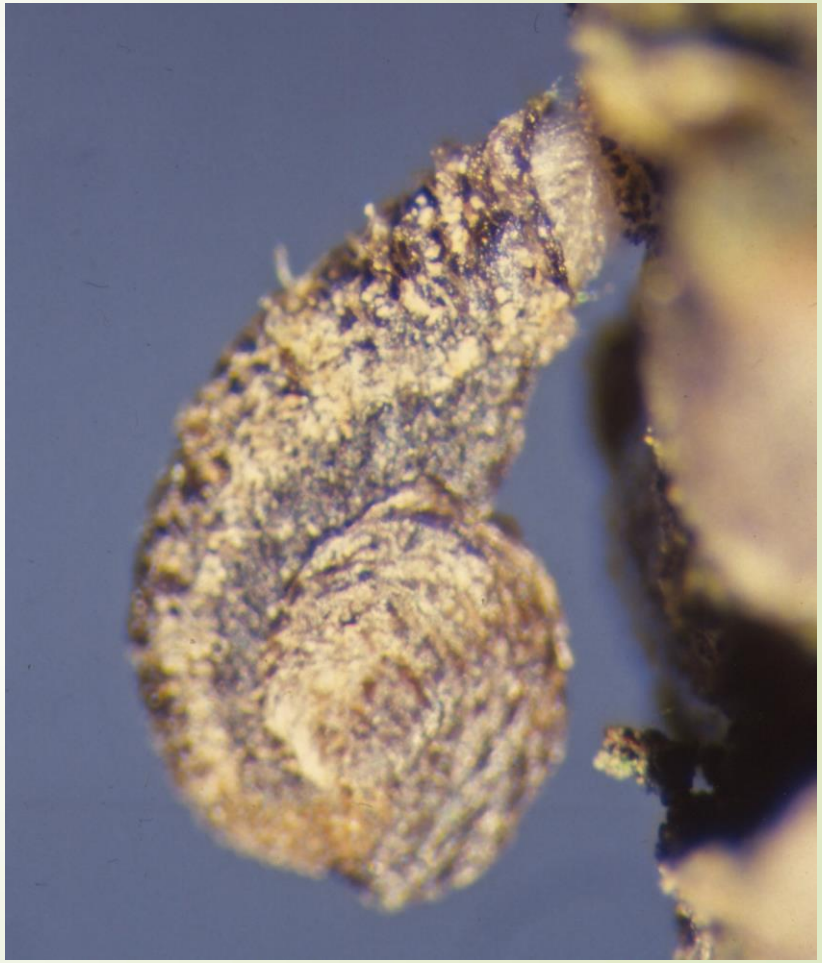
Apple leaf miner - *Lyonetia clerckella*

CASEBEARER MOTHS - Coleophoridae

- Narrow-winged moths, small to medium-size (wingspan 7-22mm). Many species are superficially similar, and require dissection to confirm the species. Most are easier to name from the larval cases.
- The larvae construct silk cases, often using portions of leaf or eaten-out seed-heads as part of the case.
- Most feed exclusively on one plant species, or on closely related plants. The shape of the case, the foodplant, and method of feeding is sufficient to enable most species to be named.
- Most leaf-feeding species make a succession of small mines, with a hole, usually on the leaf underside, where the case has been fixed before the larva moves on and repeats the process. In each mine the feeding is confined to the area that the larva can eat out without leaving the safety of its case.

CASEBEARER MOTHS - Coleophoriidae

Coleophora hemorobiella



ERMINE MOTHS - Yponomeutidae

- A large and varied family of small to medium-sized moths. The larval feeding includes borers in buds, shoots or catkins (*Argyresthia*), in communal webs (*Yponomeuta*), or singly on the surface of leaves. The main groups are:
- Subfamily **Argyresthiinae:** These moths rest in a characteristic "head-down" position with the hind-legs held closely against the raised abdomen.
- **Yponomeuta**: These are known as "small ermines"because of their wing-patterns, white with small black dots. Their larvae feed

ERMINE MOTHS - Yponomeutidae

- **Rufous-tipped Swammerdamia Moth - *Swammerdamia pyrella***

ERMINE MOTHS - Yponomeutidae

- **Apple Ermine moth - *Yponomeuta malinellus***

Tortricidae

- **Subfamily Tortricinae**: the moths are usually brown or fuscous, the forewings typically with three transverse bands of darker colour. Wingspan 11-29mm.
- **Subfamily Olethreutinae**: the moths are similar to the Tortricinae, but with the transverse bands on the forewings not clearly marked. Typical markings include a series of fine lines (strigulae) on the leading edge of the wing.
- A diagnostic circular patch of scales (the ocellus) is often present in the outer corner (tornus) of the wing. Wingspan 8-27mm.

CLEARWING MOTHS - Sesiidae

Synanthedon tipuliformis

- *Synanthedon myapiformis*

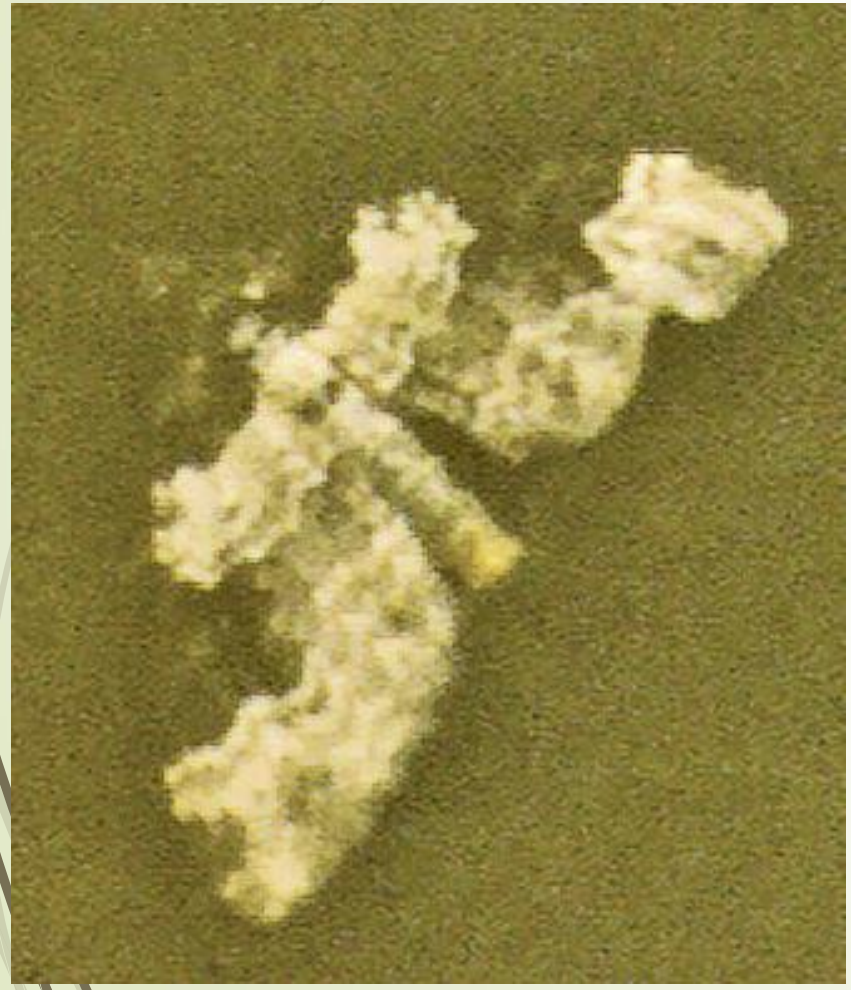
GEOMETRID MOTHS - Geometridae

- Adults with tympanic handle („ansa”) curving over abdominal tympanum. Generally slender bodied with broad wings, well suited to sheltered vegetation, especially forest. Small to large moths (10-100 mm)
- Larvae usually have only one pair of prolegs and anal claspers

Operophthera brumata

GEOMETRID MOTHS - Geometridae

Mottled umber moth - *Hibernia defoliaria*



TORTRICID MOTHS - Tortricidae

Olethreutinae

Imago. Head. Scales of antenna arranged in one row per flagellomere. Wings. Pattern: Costa of forewing with costal strigulae; speculum often developed. New interpretation and terminology of the forewing pattern in *Tortricidae* is by RAZOWSKI (2003). The pattern is developed by expression of pigment between transverse lines called the connecting lines which join dark dots occurring along wing edges (cf. Fig. 1). There are nine dis-

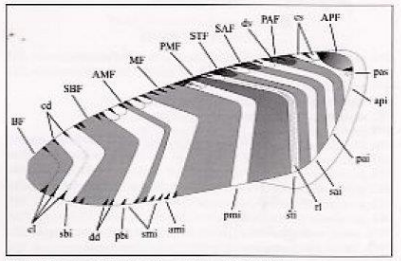


Fig. 1. Diagram of the forewing pattern of *Tortricidae*.
Fasciae: BF – basal fascia; **SBF** – subbasal fascia; **AMF** – antemedian fascia; **MF** – median fascia; **PMF** – postmedian fascia; **STF** – subterminal fascia; **SAF** – subapical fascia; **PAF** – preapical fascia; **APF** – apical fascia.
Interfasciae: sbi – subbasal interfascia, **ami** – antemedian interfascia, **smi** – submedian interfascia, **pmi** – postmedian interfascia, **sti** – subterminal interfascia, **sai** – subapical interfascia, **pai** – preapical interfascia; **cl** – connecting lines; **dd** – dorsal dots; **dv** – dividing; **pas** – postapical strigula; **rf** – refractive line. Note: marginal dots marked only along costa (cd) and in basal part of dorsum (dd), terminal dots not figured; costal strigulae (cs) of basal part of costa omitted, terminal strigulae except for the postapical strigula (pas) and terminal dots omitted; only an example of refractive line (rf) figured (between PMF and STF). (After RAZOWSKI, 2003)

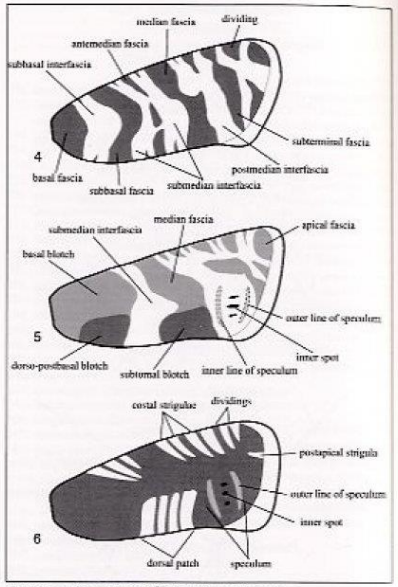
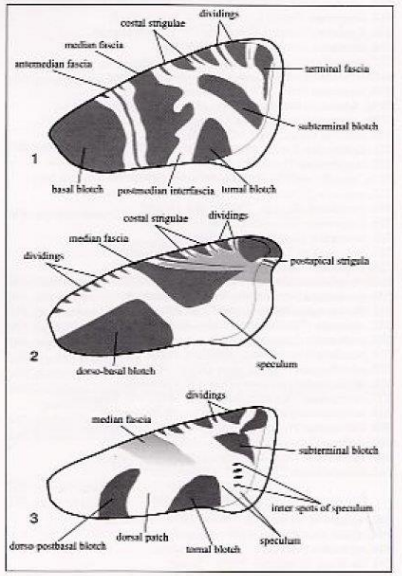


Fig. 2. Forewing pattern of *Olethreutinae*, diagrams.
1 – *Olethreutini*; 2 – *Enarmonilini*; 3–5 – *Eucosmini* 6 – *Grapholitini*



tinct fasciae (including the base and apex), one permanently reduced fascia between the median and postmedian fasciae, and eight interfasciae. In the majority of species the pattern is obscured by variable expression of adjacent elements. The pattern in *Olethreutinae* is more generalized than in *Tortricinae* and *Chlidanotinae*, but may be specialized to varying degrees. Generally, *Olethreutinae* have more distinct costal strigulae and usually well developed speculum.
The most common types of markings and the most frequently used terms are illustrated (Fig. 2).
Venation: In forewing median stem usually present within the cell; chorda occasionally preserved. Scent organs:Costal fold in male often developed; cubital pecten and anal roll usually developed. Other scent organs as groups of scales on hind legs or developed on/in the abdomen (RAZOWSKI 1990). Pheromones except for *Microcorsini*, *Gatesclarkeini* and *Bactrini* based on 12 C-chains (HORAK & BROWN 1991).
Male genitalia (Figs 3–6). Uncus and socius usually well developed;

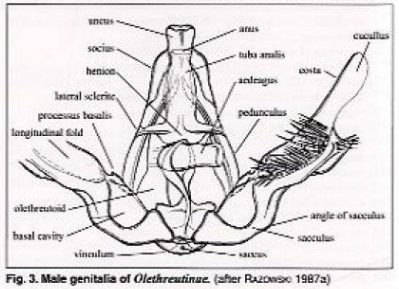
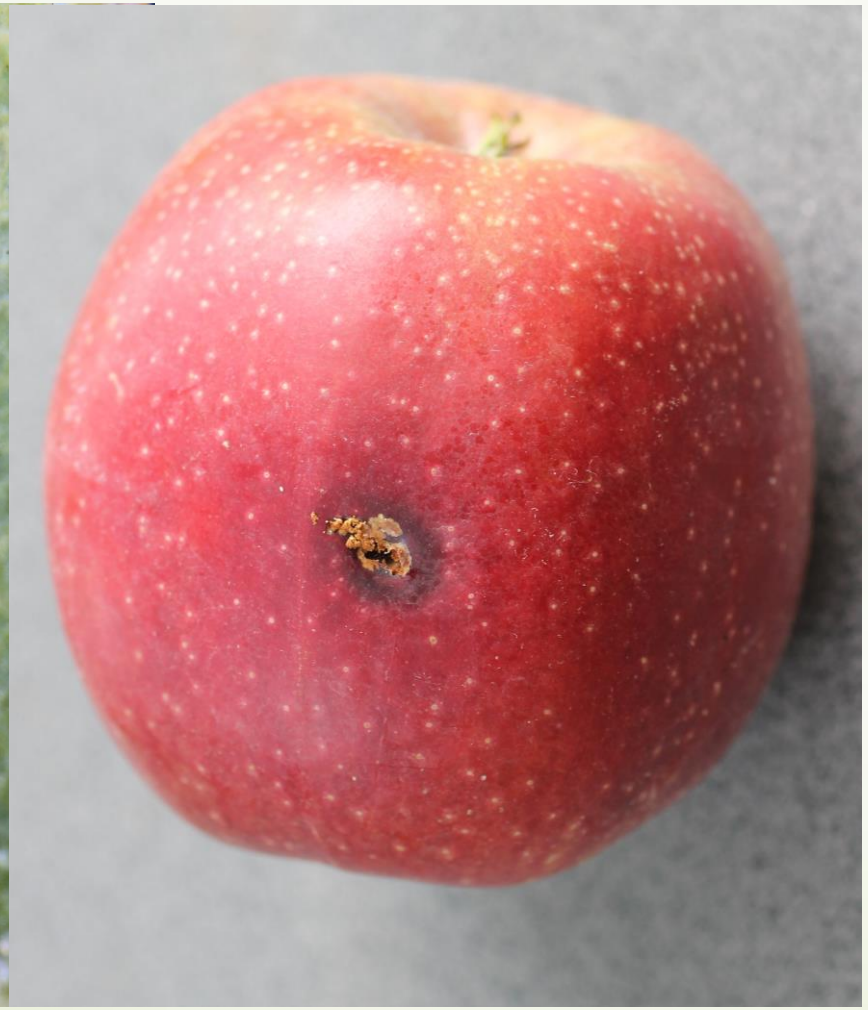


Fig. 3. Male genitalia of *Olethreutinae*. (after RAZOWSKI 1987a)

TORTRICID MOTHS - Tortricidae

- **Codling Moth** - *Cydia pomonella*



TORTRICID MOTHS - Tortricidae

- **Fruitlet mining tortrix moth - *Pammene rhediella***

TORTRICID MOTHS - Tortricidae

- **Plum Fruit Moth** – *Grapholita* (*Aspila*) *funebrana*

TORTRICID MOTHS - Tortricidae

- **Eyespotted Bud Moth - *Spilonota ocellana***

TORTRICID MOTHS - Tortricidae

- **Marbled Orchard Tortrix - *Hedya nubiferana***

TORTRICID MOTHS - Tortricidae

- ***Large Fruit-tree Tortrix Moth - Archips podana***

TORTRICID MOTHS - Tortricidae

- **European Leafroller Moth – *Archips rosana***

TORTRICID MOTHS - Tortricidae

- ***Dark Fruit Tree Tortrix - Pandemis heparana***

TORTRICID MOTHS - Tortricidae

- **Summer Fruit Tortrix Moth - *Adoxophyes orana***

TORTRICID MOTHS - Tortricidae

- ***Cherry Bark Tortrix - Enarmonia formosana***

CUTWORMS – Noctuidae/Agrotinae

Cutworms are the larvae of various species of Noctuidae moths.

Cutworm larvae (from top): Sandhill cutworm, variegated cutworm, black cutworm, dingy cutworm, claybacked cutworm

They are usually green, brown, grey, or yellow, often with longitudinal stripes, up to 5 cm in length.

CUTWORM -

- **Dun-bar moth - *Cosmia trapezina***

TUSSOCK MOTHS - Lymantriidae

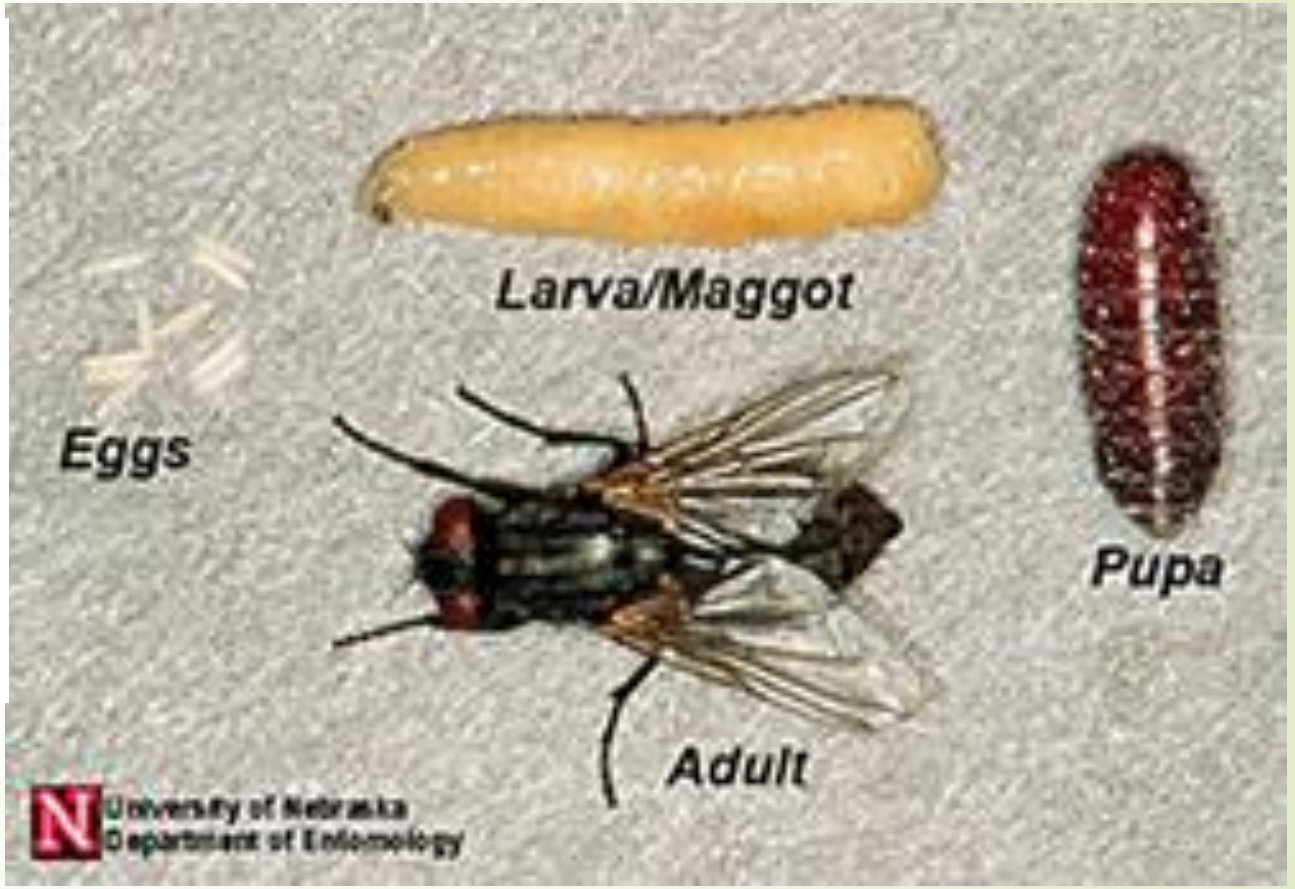
- *Orgyia antiqua*

TUSSOCK MOTHS - Lymantriidae

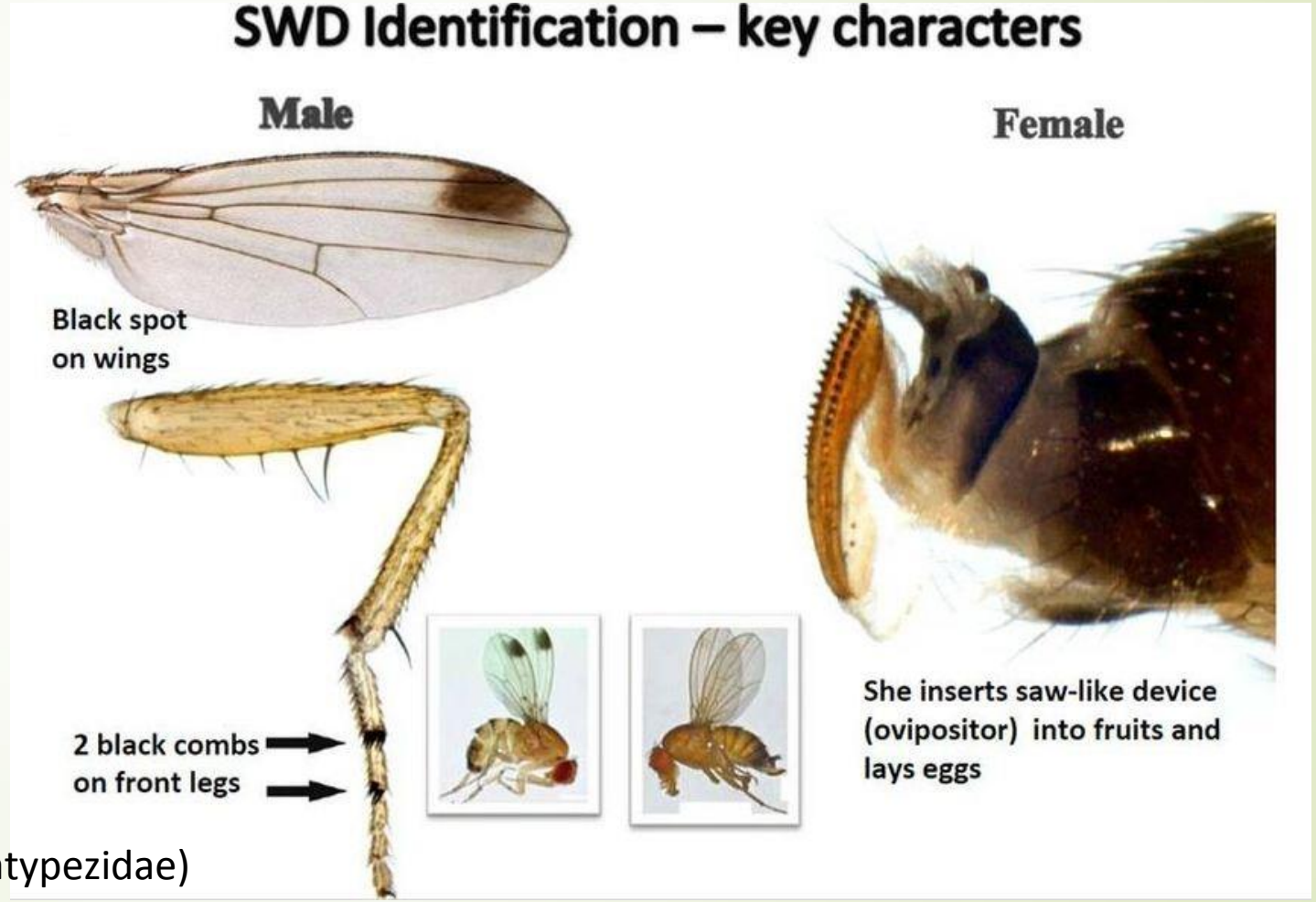
- *Lymantria dispar*

FLIES - DIPTERA

Figure 80. Family DROSOPHILIDAE

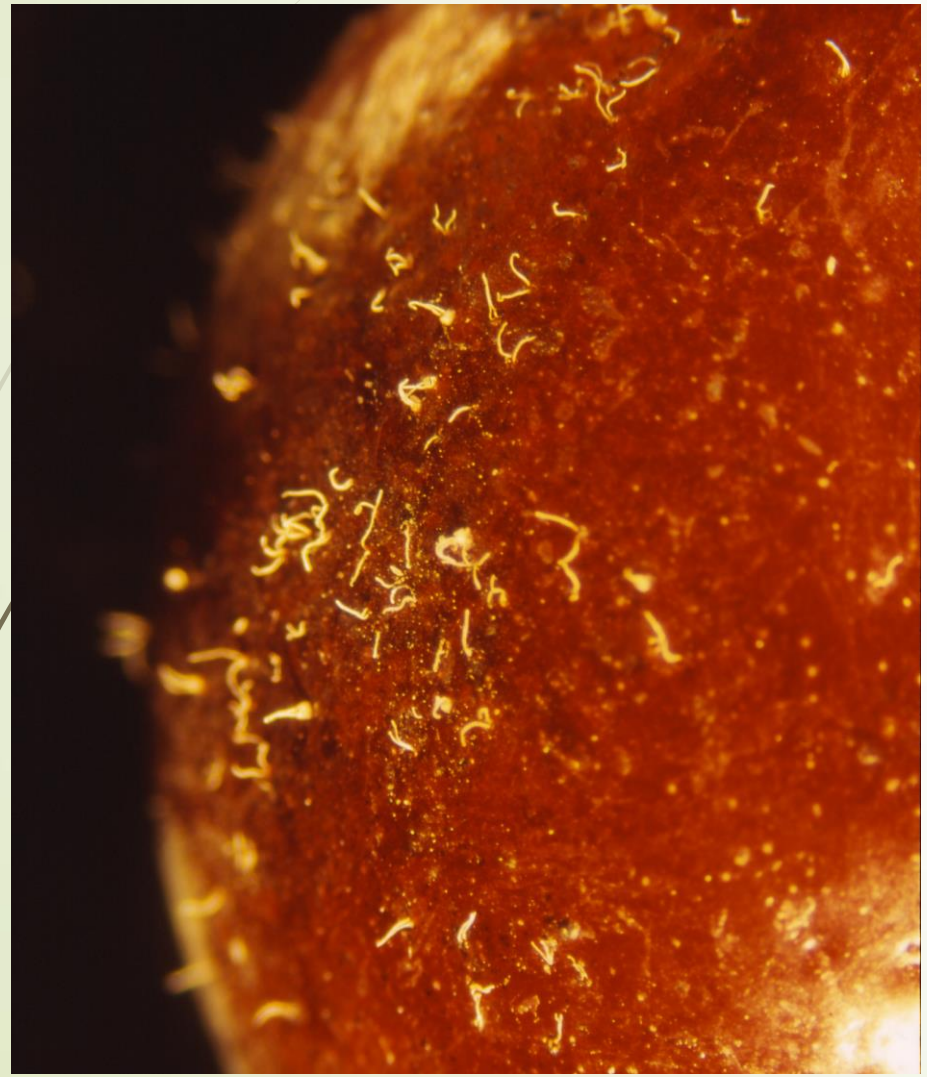


VINEGAR FLIES - Drosophilidae

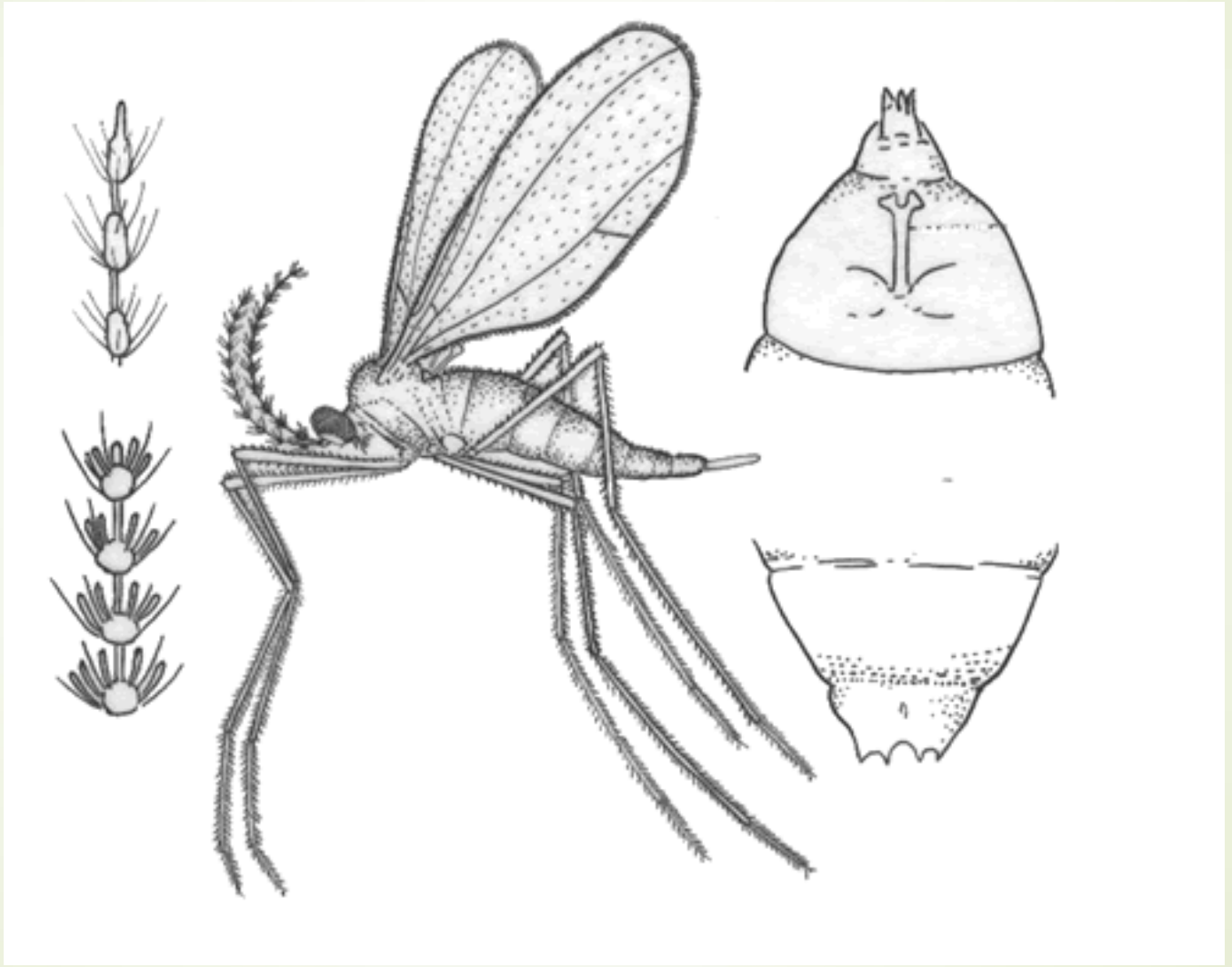


Fungus feeding – Flat-footed flies (Platypezidae)
Grossoseta pacifica

Drosophila suzuki

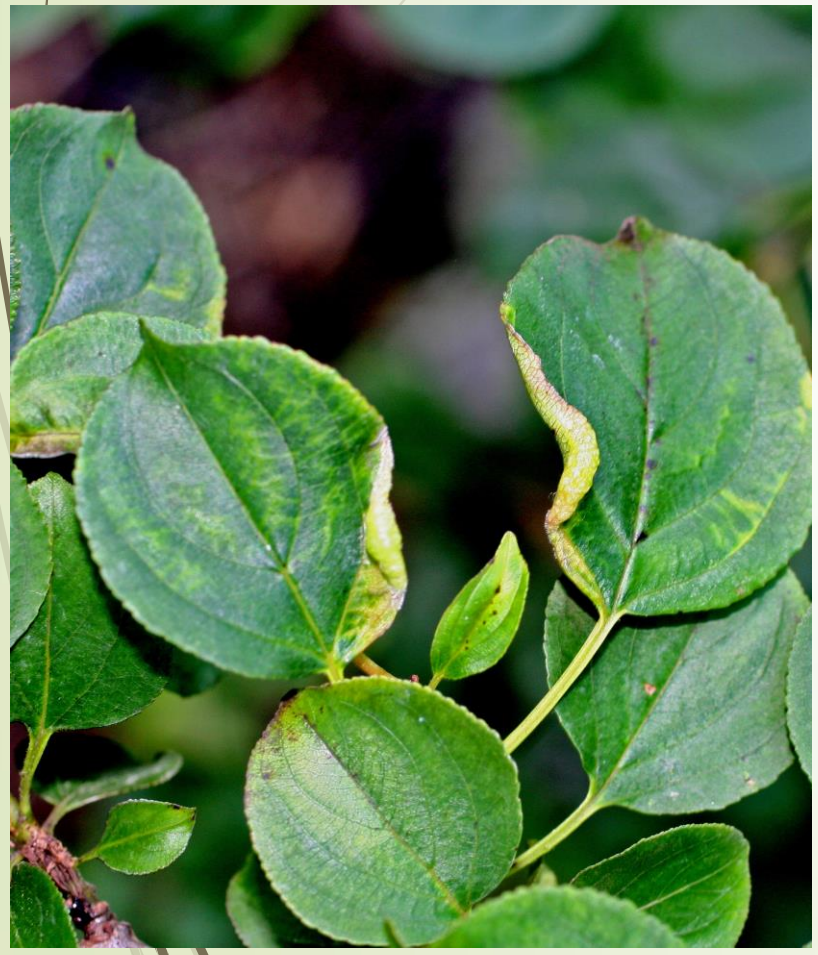


GALL MIDGES - Cecidomyiidae

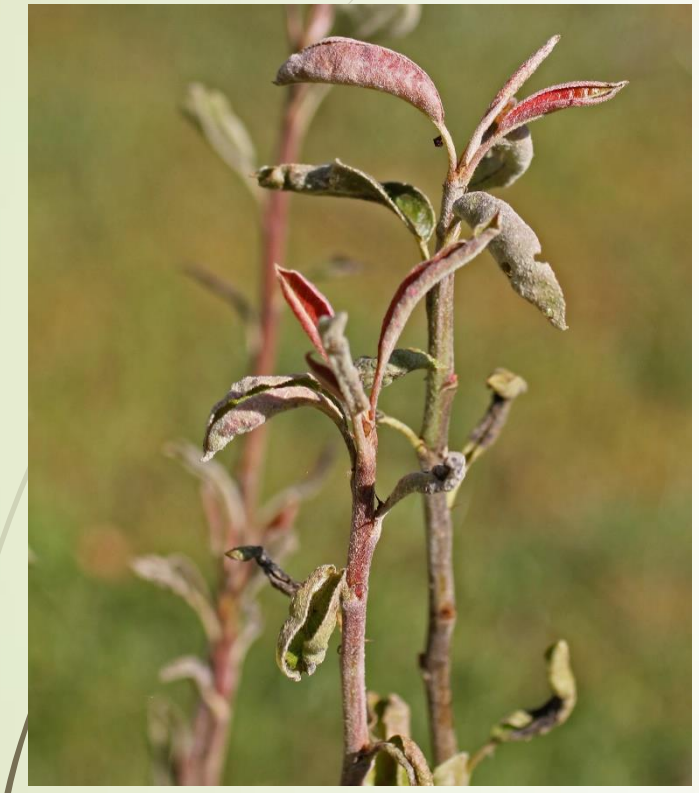


GALL MIDGES - Cecidomyiidae

- **Apple Leaf Midge - *Dasineura mali***

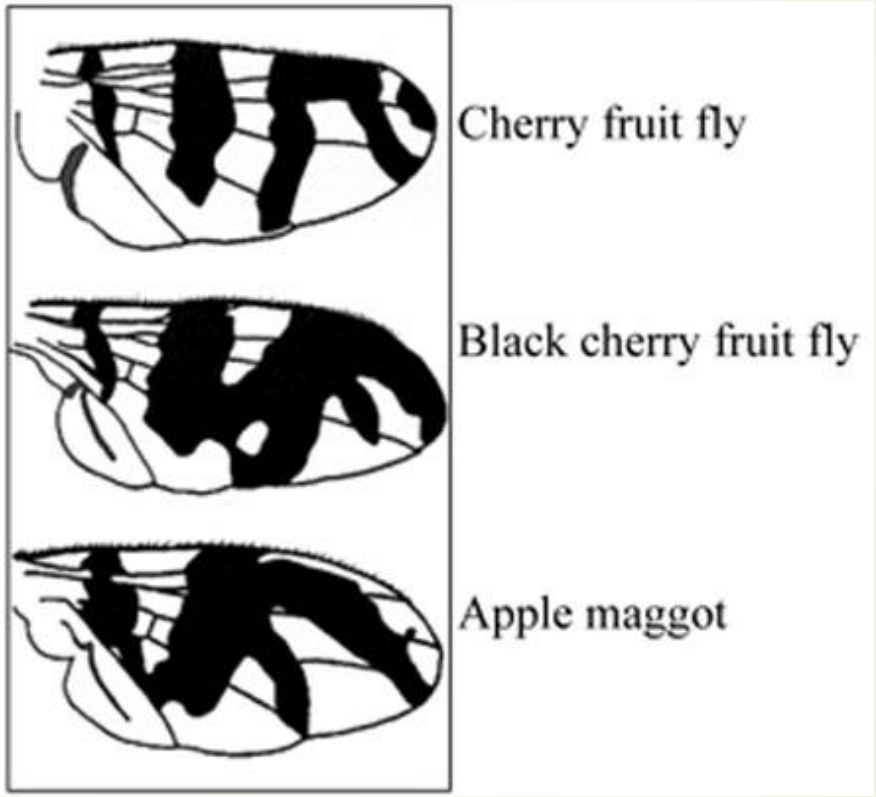


GALL MIDGES - Cecidomyiidae



CHERRY FRUIT FLIES - Tephrididae

Rhagoletis cingulata
R. fausta



CHERRY FRUIT FLIES - Tephrididae

Fruit Fly Wing Band Patterns

Western cherry fruit fly

Cherry (Eastern cherry) fruit fly

Black cherry fruit fly

Walnut husk fly

Apple maggot/Snowberry fruit fly

Currant fruit fly

Photo Credits: Naomi DeLury, Howard Thistlewood, Michael Weis and Jacqueline Sztepanacz, Agriculture & Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland.

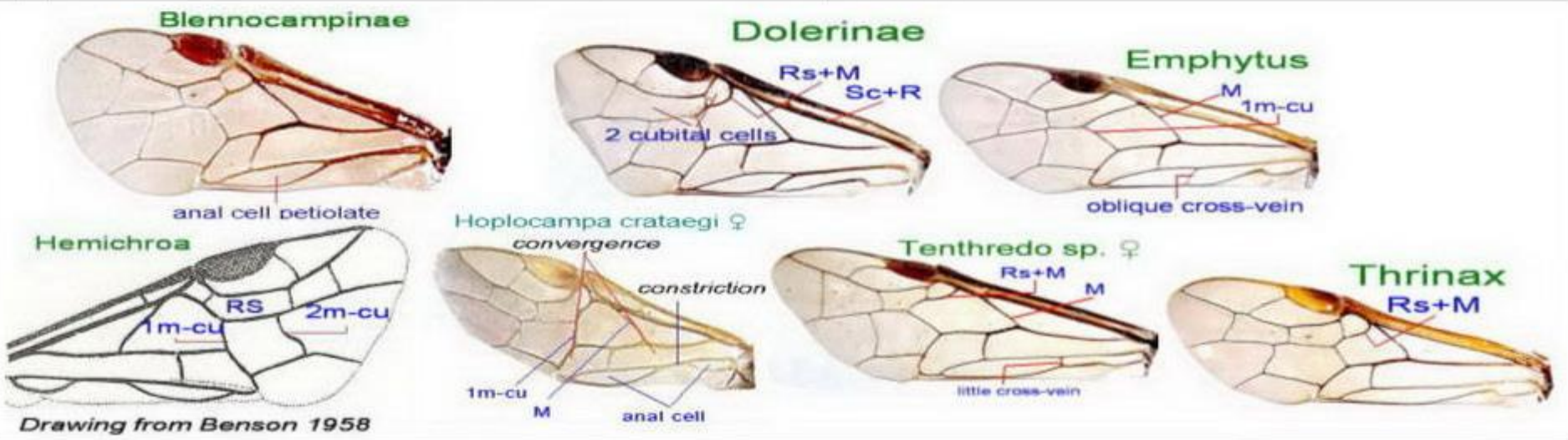
CHERRY FRUIT FLIES - Tephrididae

- **European Cherry Fruit Fly - *Rhagoletis cerasi***

linidae

KEYS of sub-families of TENTHREDINIDAE (With RADIAL CELL divided) — **D & JP Balmer**

- Extreme base of Rs+M recurved back towards stigma just before it joins Sc+R			
- 2 cubital cells [*Anal cell with oblique transverse vein*]		Dolerinae	
- 3 cubital cells			
- Antennae with 7-8 segments		(in Phyllotominae)	Heptamellus
- Antennae with 9 segments	[*Selandriinae in FE*]	(in Selandriinae)	Pseudotaxonus - Selandria - Stromboceros - Strongylogaster - Thrinax
[*M finishes with the starting point of Rs+M or very close*]			
- Extreme base of Rs+M **not** recurved back towards stigma just before it joins Sc+R			
- Anal cell petiolate		Blennocampinae	
- Anal cell **not** petiolate			
- M &1m-cu converge towards the stigma [*Convergence is not always obvious !*]			
- 1m-cu & 2m-cu reach only the cell Rs	[*Length insectes : 5/8 mm.*]	(in Nematinae)	Dineura *(pars)* - Hemichroa
- 1m-cu & 2m-cu reach respectively 1R1 & Rs			
- Anal cell with oblique cross-vein	[*Length insectes : 5/6 mm.*]	(in Phyllotominae)	Caliroa
- Anal cell constricted into 2 cells	[*Length insectes : 3/7 mm.*]	(in Nematinae)	Hoplocampa
- M &1m-cu **not** converge towards the stigma			
- M finishes with the starting point of Rs+M or very close [*Anal cell with a long oblique cross-vein*]	[*Allantinae in FE*]	(in Selandriinae)	Ametastegia - Athalia - Emphytus - Empria - Eriocampa - Harpiphorus - Taxonus
- M finishes far of the starting point of Rs+M [*Anal cell without a long oblique cross-vein* **except** Siobla]		Tenthredininae	*of which* Tenthredo

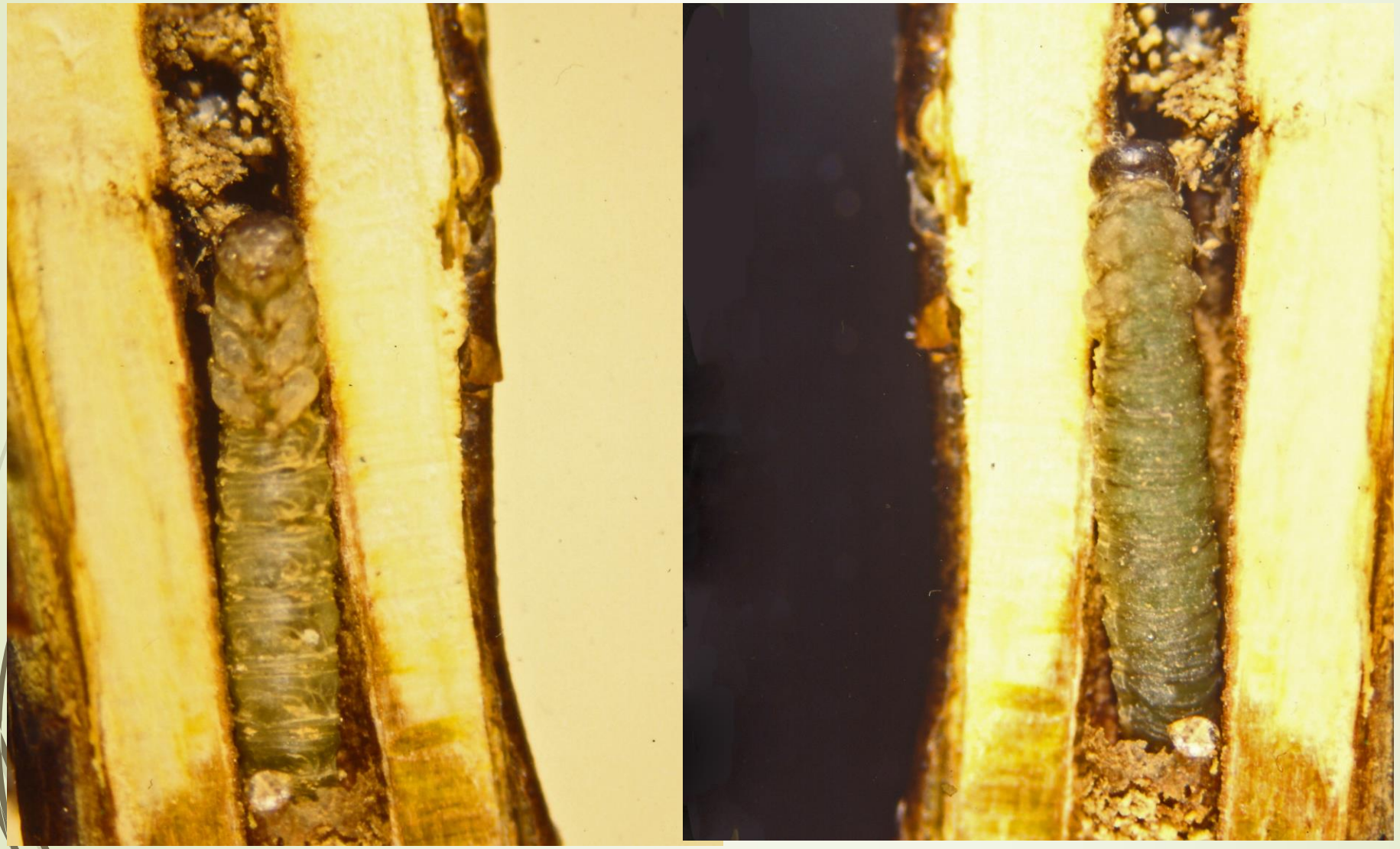


COMMON SAWFLIES - Tenthredinidae

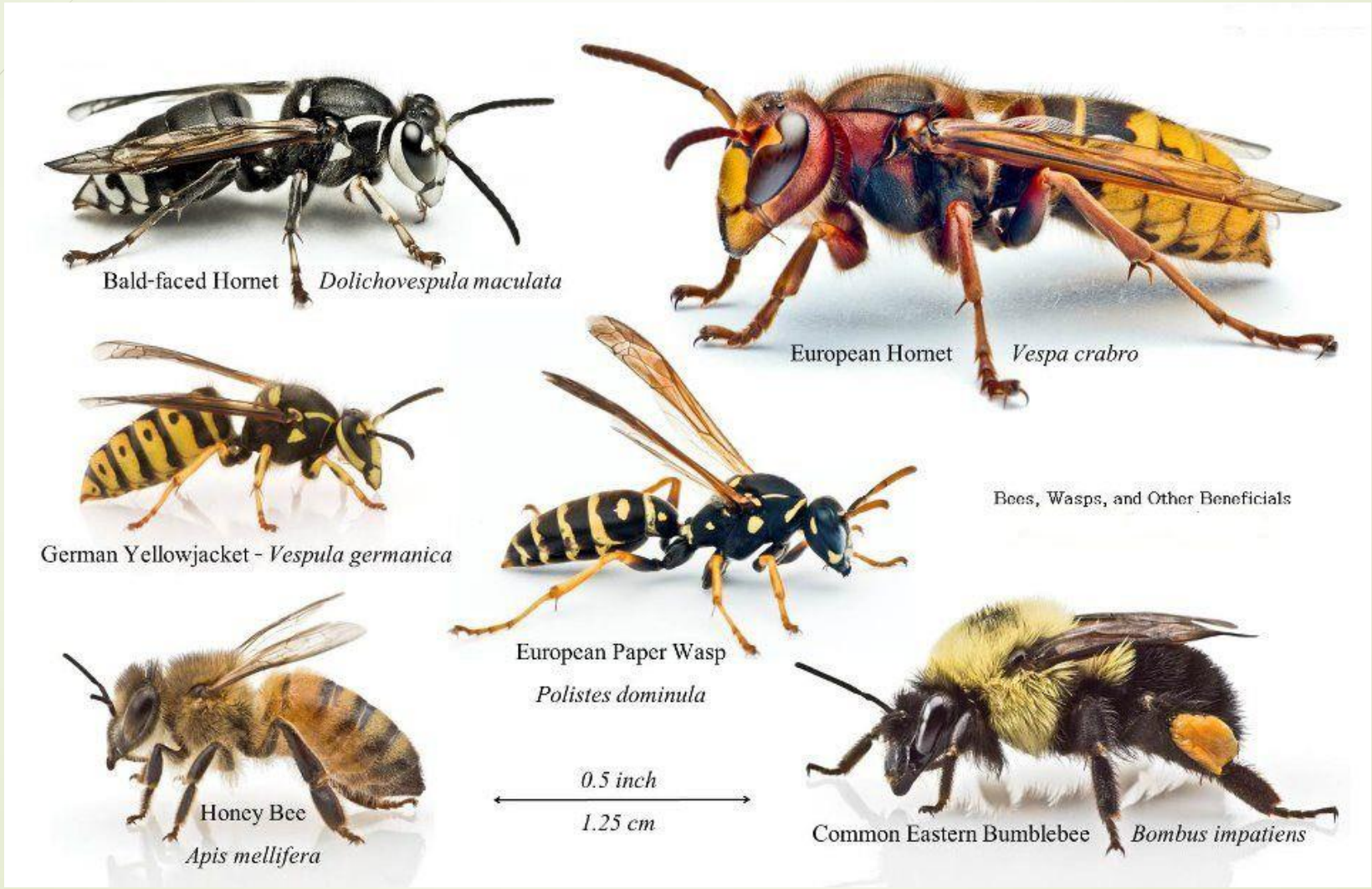
Pear Slug - *Caliroa cerasi*

Apple sawfly – *Hoplocampa testudinea*

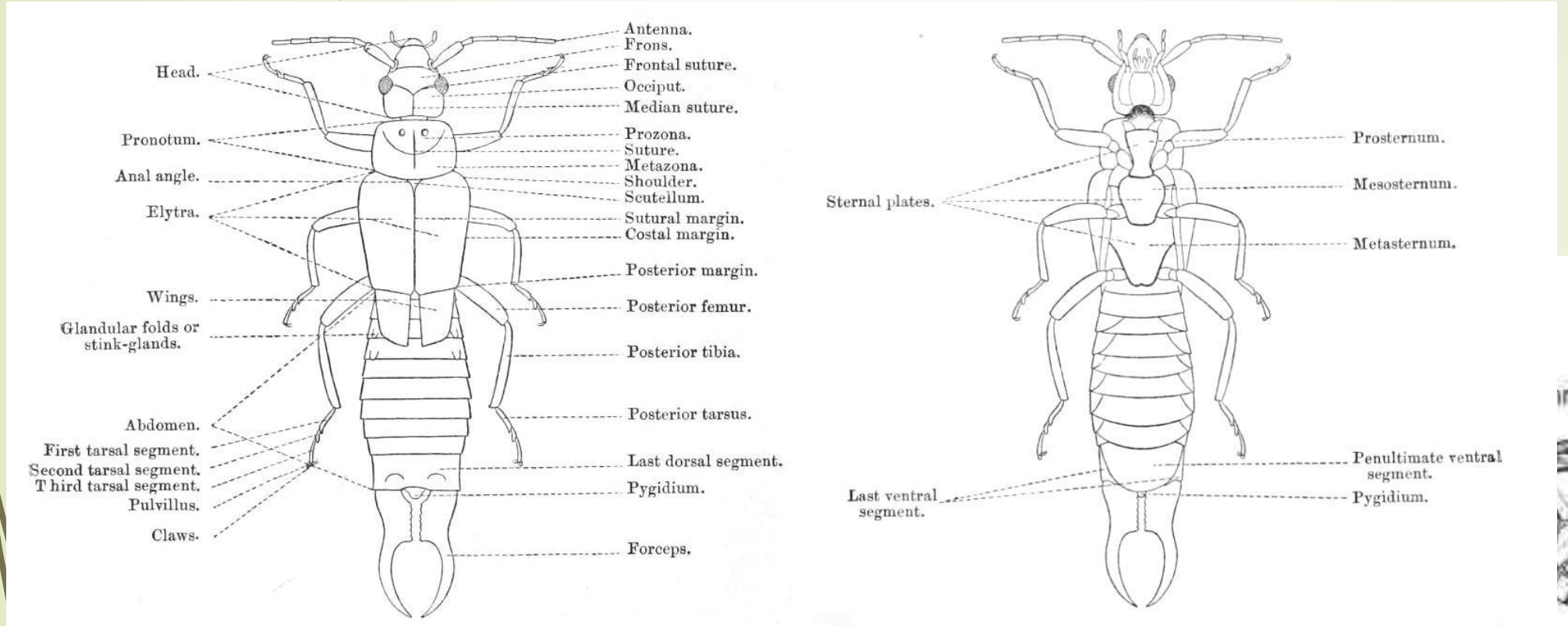
Ametastegia glabrata



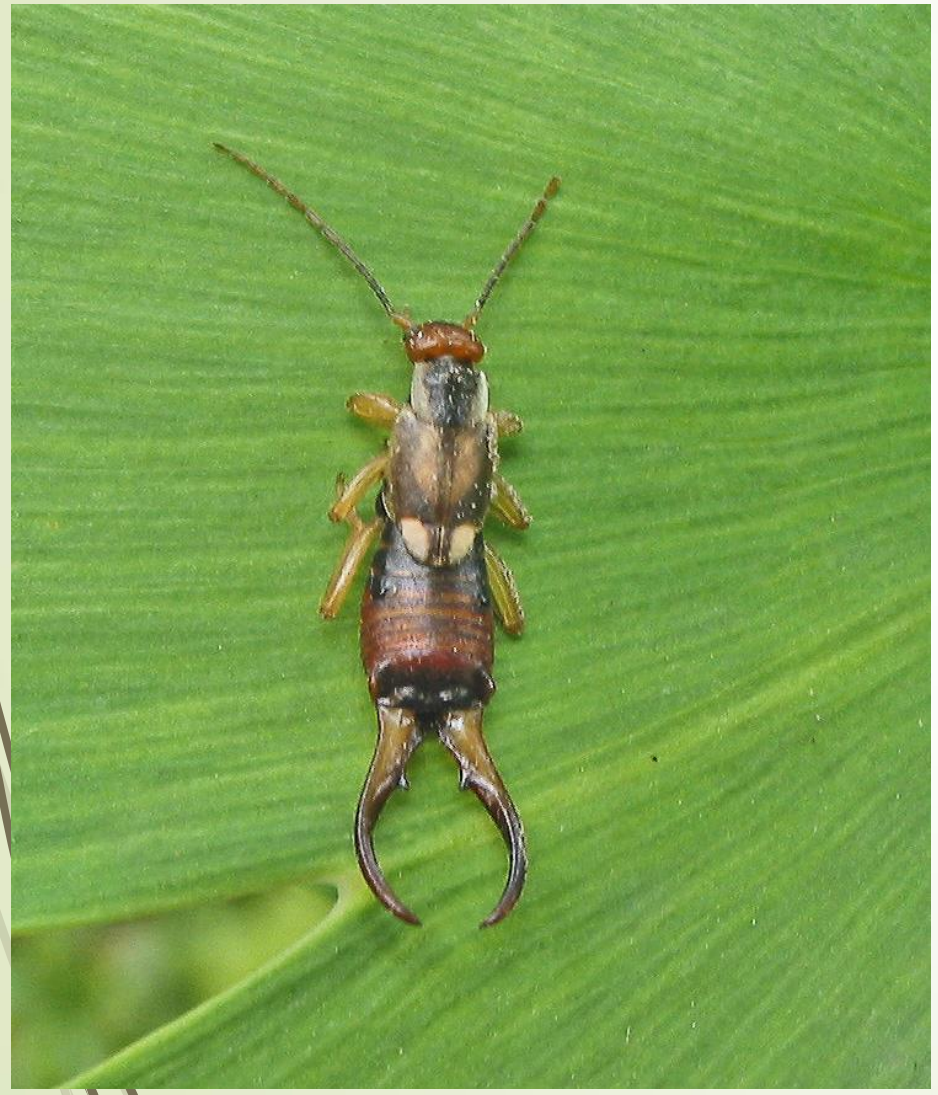
YELLOWJACKETS - Vespidae



EARWIGS - Dermaptera



European Earwig - *Forficula auricularia*



Thank You for Your attention