

An introduction to scale insects

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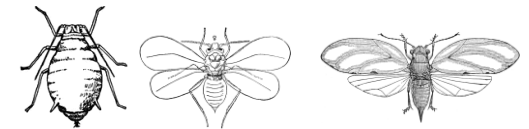
Scale Insects

Class Insecta

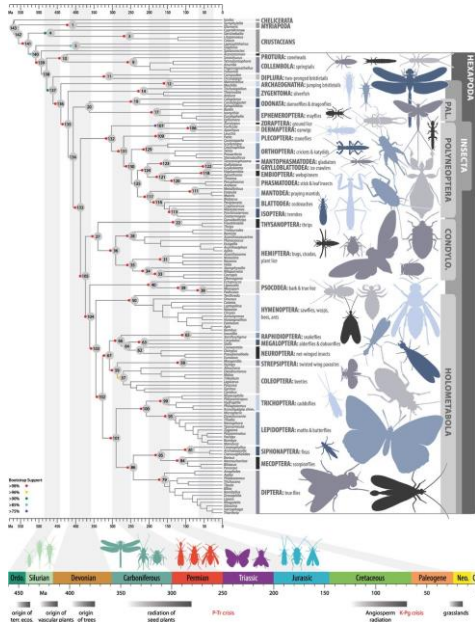
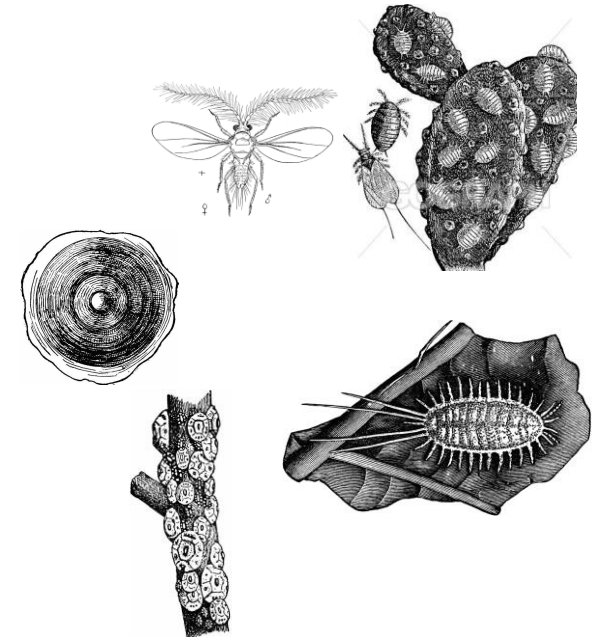
Order Hemiptera



Suborder Sternorrhyncha



Superfamily Coccoidea



Misof et al. (2014) *Science*



Scales are characterized by a single claw

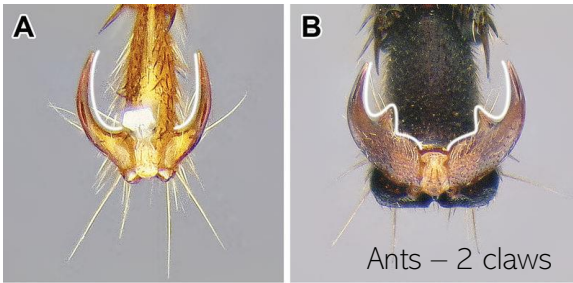


Image credit: ML Borowiec



Monarch butterfly - 2 claws

Image credit: Gerald M. Fauske



Image credit: Valerie A. Tornini

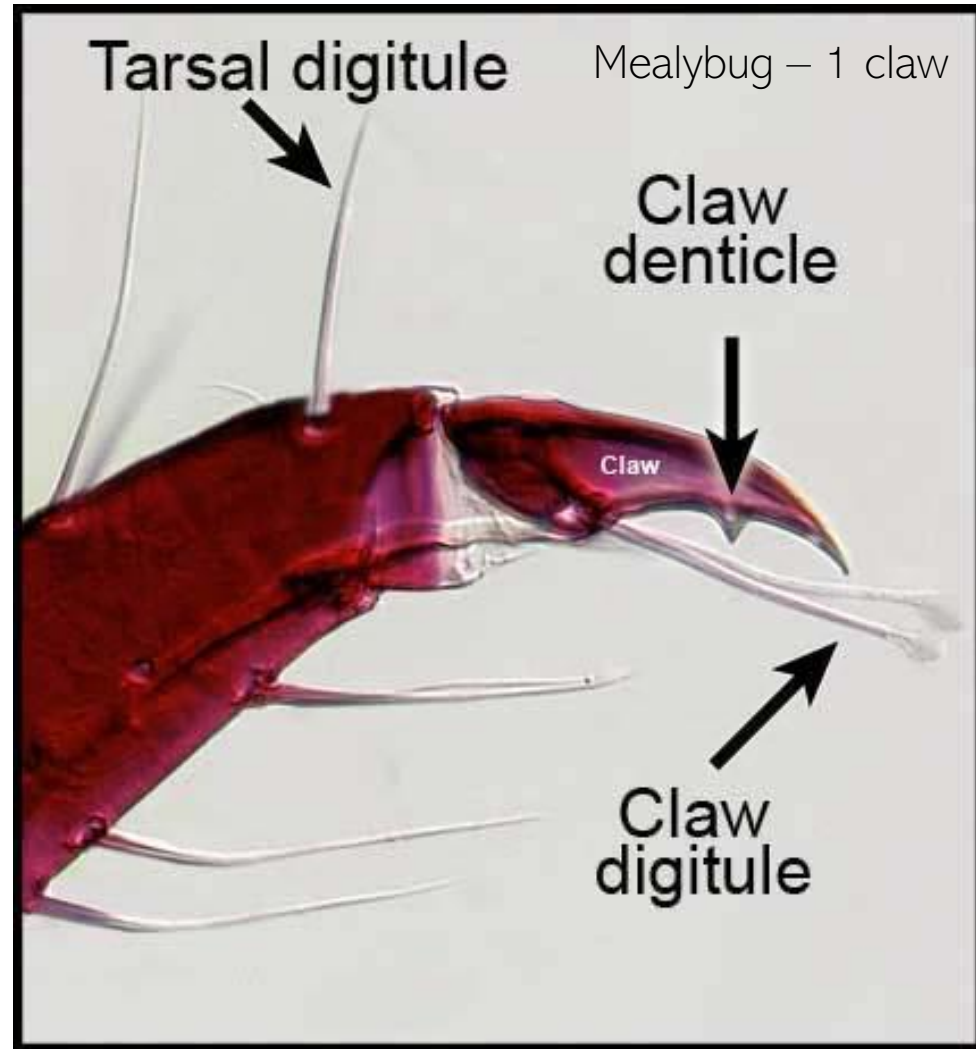


Image credit: ID Tools by D. Miller, A. Rung, G. Parikh, G. Venable, A.J. Redford, G.A. Evans, and R.J. Gill



Adult females are **neotenic** (i.e., sexually mature but morphologically they appear immature)



Adult males have a single pair of wings

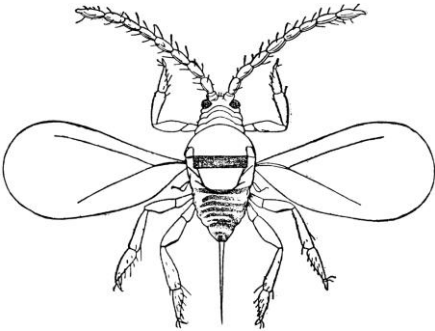


Image credit: John Horstman



Image credit: Ian Jacobs



Some hermaphrodites

- Cottony cushion scale (*Icerya purchasi*) has both hermaphrodites and males



Image credit: Peter Bryant



Image credit: Peter Hollinger

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Modes of reproduction

- Sexual
- Asexual (parthenogenesis)



Image credit: Entocare Biologische Gewasbescherming

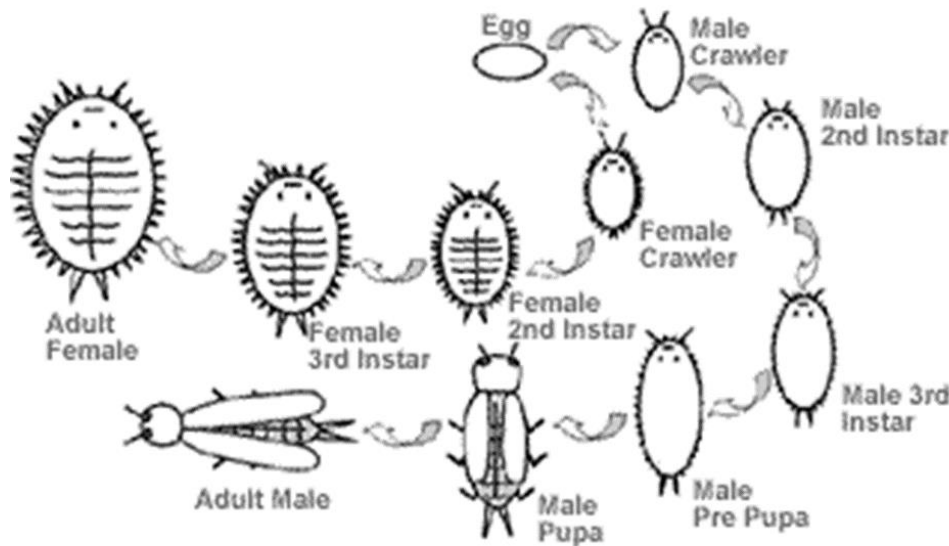
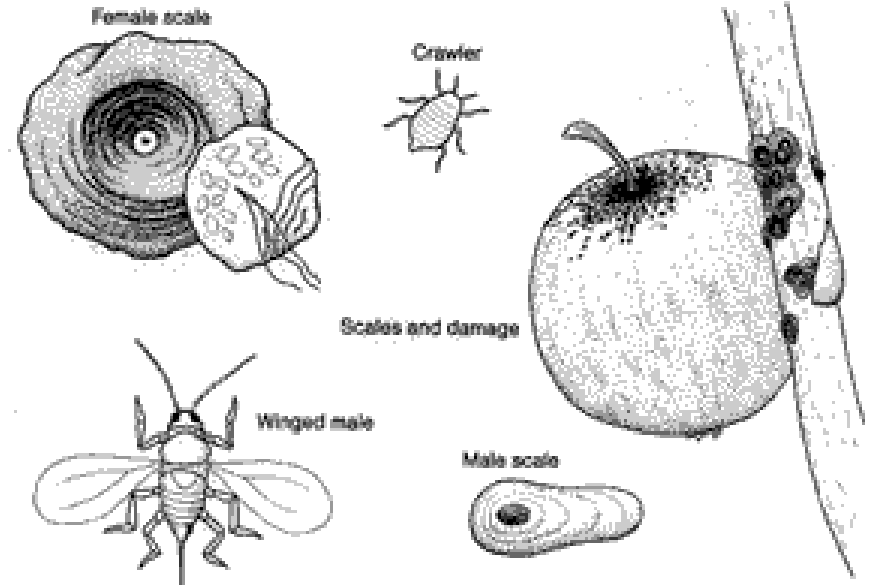


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Image credit: Donald Owen



- General life cycle
 - Eggs
 - Crawler (mobile)
 - 2nd instar
 - 3rd instar/pupa (males)
 - Adult



REFERENCE: The life cycle of Vine mealybug (Annecke & Moran, 1982)

- Males typically have an additional one or two instars

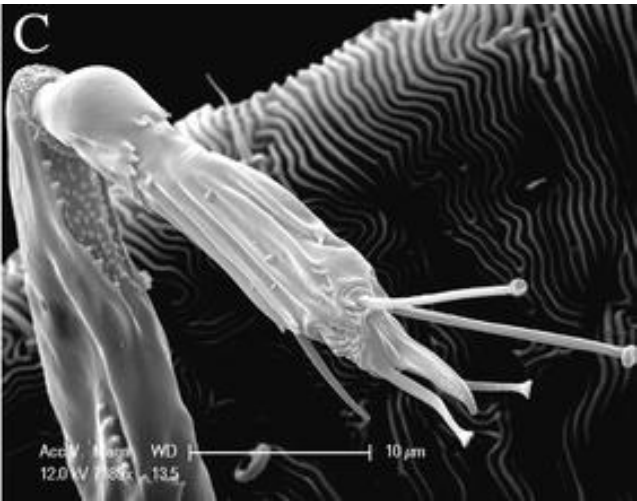
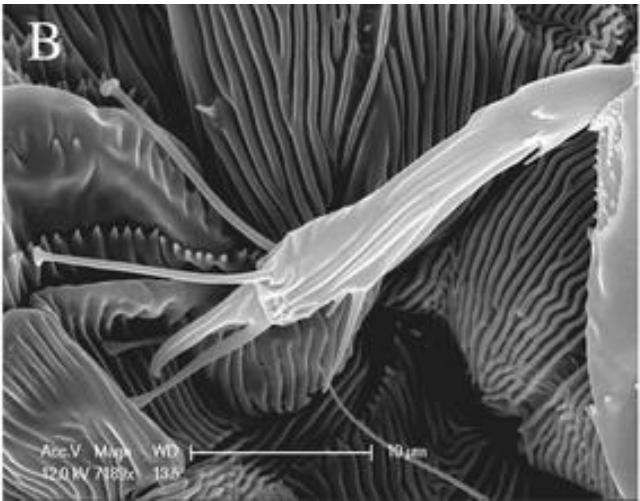
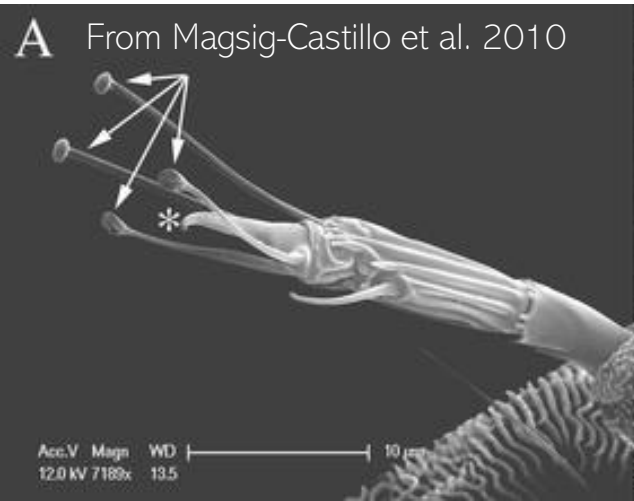
♀ ♂

- Armored scales: 3, 5
- Soft scales: 3-4, 5
- Mealybugs: 4, 5



Modes of dispersal

- Crawlers
 - Wind
 - Phoresy
- All stages
 - Humans



Plant feeders (plant parasites)

- Piercing sucking mouthparts
- Produce honeydew (with some exceptions)
- Have to get rid of honeydew

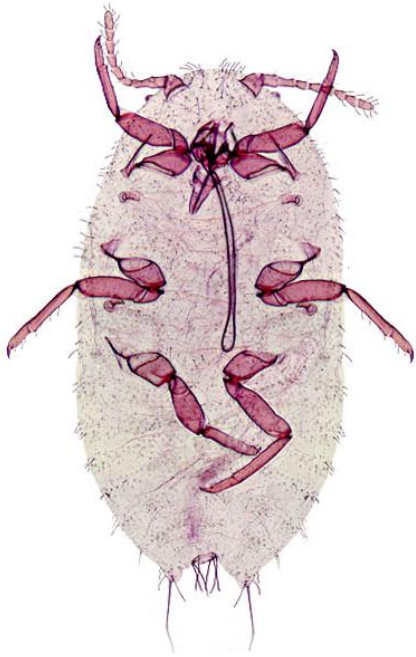


Image credits: idtools.org/id/scales/



Often tended by ants for honeydew



Image credit: Seidai Nagashima



Image credit: Scott Frazier



Image credit: Steven Shattuck



Image credit: Wetterer & Espadaler 2010



- Bees also take honeydew!
- Giant pine scale in Greece & Turkey



Image credit: Diomidis Spinellis



Image credit: Ünal et al. 2017



ixnlattis33.blogspot.gr



Natural enemies



Image credit: Associates Insectary

© Guido Böhne 2011



Image credit: M. Merchant

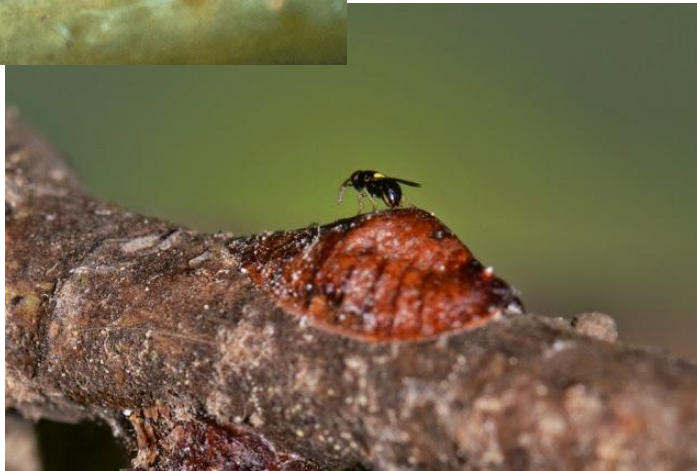


Image credit: Dana, Abundant Nature



Image credit: G. Böhne

- Mealybug destroyer beetle larvae mimic mealybugs



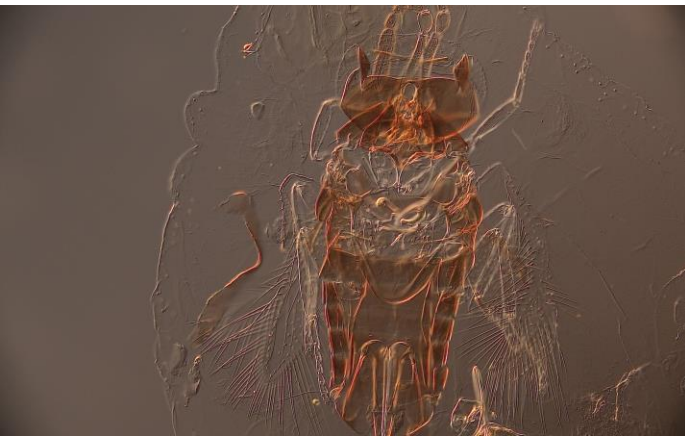


Image credit: Erin Powell





Image credit: W. Cranshaw



Image credit: Lyle Buss



Image credit: M. Byron



Image credit: H. Baas



Image credit: BBC/Sky News



Image credit: M. B. Stoetzel



Image credit: Hlavjenková, H. Šefrová



Image credit: Lyle Buss

Why are they important?

- Billions \$\$\$\$\$\$ in product loss and control expenses
- Common and widespread in greenhouses, landscapes, nurseries, orchards and forests



Image credit: Muniappan et al. 2012



Image credit: Missouri Botanical Garden



Image credit: gardenworld.net.au



Why are they important?

- Chlorosis of leaf material
- Twig die-back, wilting
- Honeydew and sooty mold
- Wax
- Disease transmission

Image credit: Stocks et al. 2010



Image credit: Gill et al. 2019

Image credit:
dontmovefirewood.org



Image credit: Diepenbrock & Ahmed 2020



Why are they important?



Image credit: Tim Holmes

- Easily transported: small, cryptic, may only require one individual
- Rapid generation time
- Resistance to chemical controls
- Introduction to novel habitat:
 - New plants susceptible to attack
 - Absence of native predators, parasitoids, and pathogens

Image credit: Joyce Gross



Why are they important?

- San Jose scale (*Quadraspidiotus perniciosus*)
- Asian origin
- Devastating to fruit trees
- First found in California in 1870
- Spread to 33 states by 1897
- First record of insecticide resistance (1915)
 - Lime-sulphur spray

Image credit: entoweb.okstate.edu



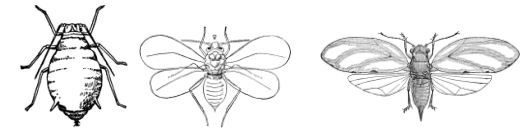
Scale Insects

Class Insecta

Order Hemiptera



Suborder Sternorrhyncha



Superfamily Coccoidea

Family Diaspididae

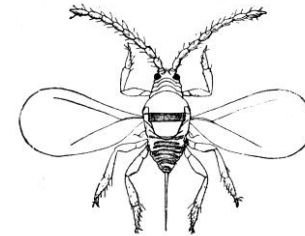
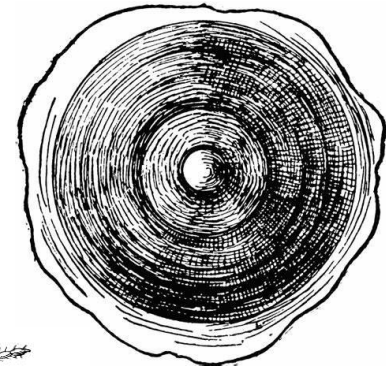


Image credit: Matt Bertone



The armored scales

Family Diaspididae



Image credit: Brian Bushe



Image credit: Claude Pilon



Image credit: www.nt.gov.au



Image credit: infonet-biovision.org

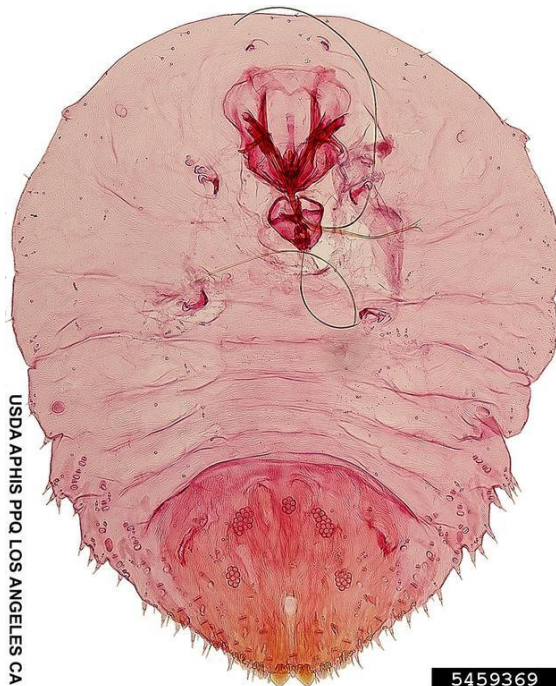
Armored scales: Most speciose family

- Worldwide: over 2,690 species
- United States: nearly 340 species
- Florida: over 170 species



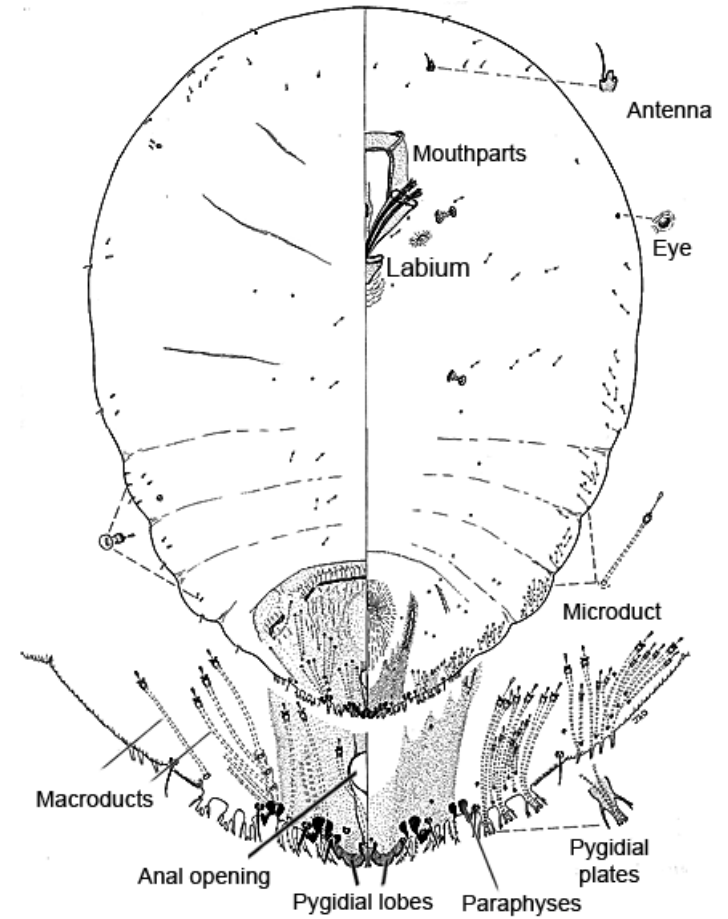
Armored Scales

- Form a scale cover (test) out of wax
 - Solid, not powdery wax
- Previous molts (exuvia) included in cover
- Have miniature trowels in the form of lobes attached to a pygidium
- Cover can be flipped, body is not attached
- *Legs absent*
- Antennae unsegmented



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Cover or “test” is composed of wax produced by the various life stages and their shed skins

- Number of rings or layers are diagnostic of the stage of development

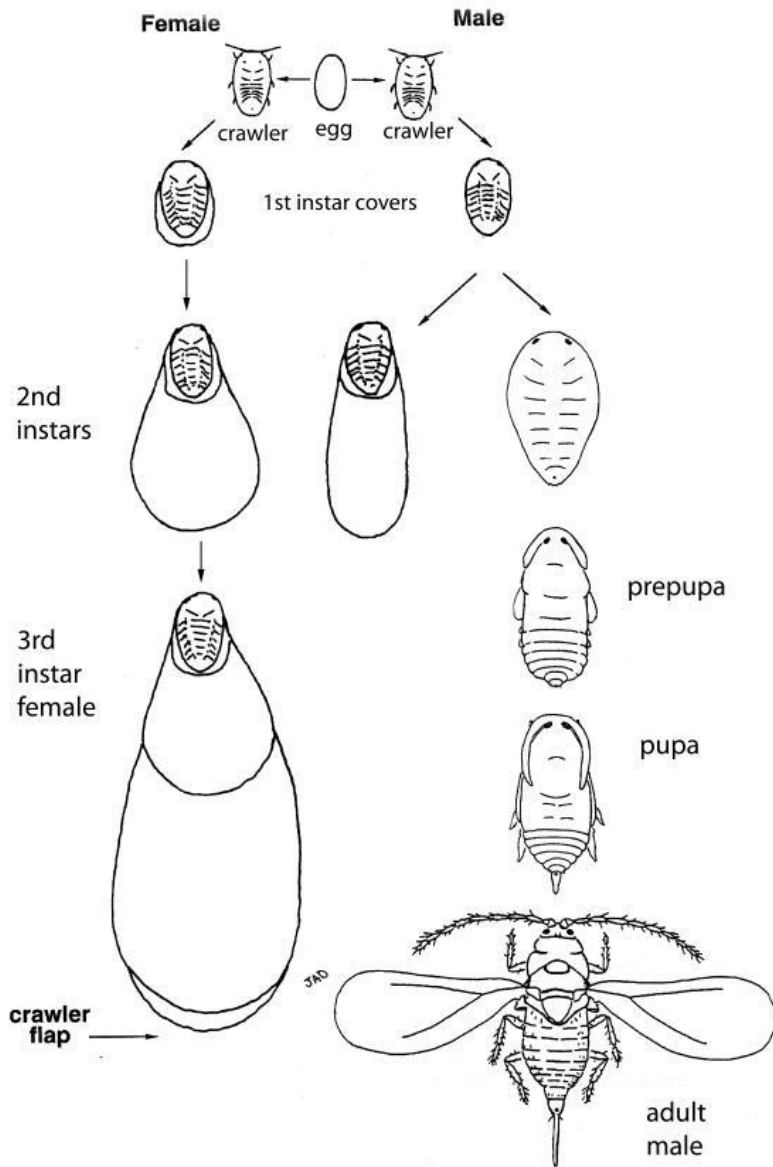


Image credit: N. A. Martin



Image credit: Jon Sullivan

Adult females with the cover flipped over



White Peach Scale

Image credit: John Davidson



False Oleander Scale

Image credit: Chazz Hesselein



A black thread scale insect with its armor removed to show the scale's body.

Photo by John A. Davidson, Univ. Md. College Pk. Bugwood.org

Differentiating male pupae from females



Image credit: brisbaneinsects.com



UGA5121074

Image credit: USDA ARS



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Image credit: Donald Owen

Armored scales do not produce honeydew

But they still make a mess and cause substantial damage!



Image credit: F. W. Howard



Image credit: Kenneth Bader

Cycad scale
Aulacaspis yasumatsui

Purple scale

Lepidosaphes beckii



Image credit: Katja Schulz

Florida red scale, *Chrysomphalus aonidum*

Image credit: G. Pellizzari



Coconut scale

Aspidiotus destructor



Image credit: Grahame Jackson

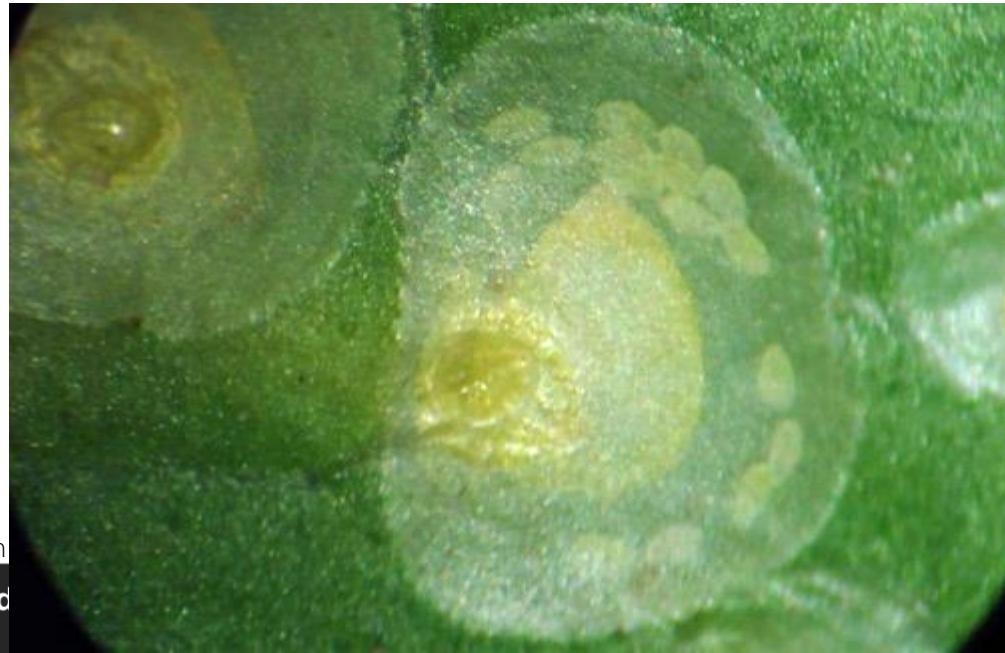


Image credit: Salahud din



Tea scale (*Fiorinia theae*)



Mealybugs

Family Pseudococcidae



Image credit: BioBee



Image credit: Erin Powell



Image credit: UGA, Bugwood

Worldwide: over 2000 species
United States: over 340 species
Florida: 67 species

Field characters

- Mealy or powdery white wax coating body
- Some have protruding wax filaments
- Legs typically present
- Antennae with variable number of segments

Nipaecoccus spp.



Image credit: von Ellenrieder et al.



Image credit: Carrillo et al.

Soft Scales

Family Coccidae



Image credit: Mary Keim



Image credit: Salvador Vitanza



Worldwide: over 1200 species
United States: over 100 species
Florida: 57 species

Mango shield scale
Ilviscutulus mangiferae



Field characters

- Highly variable: round, oval, flat, pyriform
- Wax cover can be very thin and nearly invisible, or very thick
- Anal plates/anal cleft can be seen with hand lens or under dissecting microscope on species without much wax
- Only some species produce ovisacs

Saissetia spp.



Image credit: Lyle Buss

Ceroplastes spp.



Image credits: K. Zimmerman



Image credits: M. A. Barakat

Banana-shaped scale *Prococcus acutissimus*



Image credits: R. J. Gill

Green soft scale, *Coccus viridis*



Image credits: USDA-ARS



Image credit: C. Eiseman



Image credit: E. Ruden



Image credit: J. Cowles

Minor scale families



Image credit: fl nature, Bugguide



Image credit: E. Golden



Image credit: R. Gill

UGA5122

Palmetto Scale: Halimococcidae

- Only one species in Florida, *Comstockiella sabalis*
- Very similar to armored scales but DOES NOT incorporate immature stages shed skins, as is in Diaspididae
- Only on **palms**

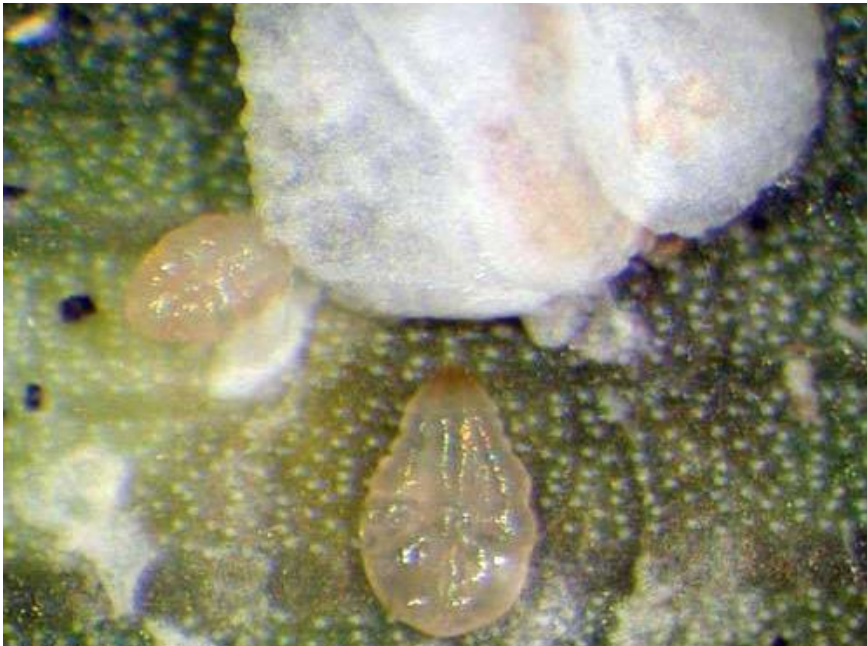


Image credit: A. Hamon



Image credit: J. Davidson



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Date palm scale: Phoenicococcidae

- One species worldwide: *Phoenicoccus marlatti*
- Pest of date palms and other palms
- Red bodies with flakey wax
- No legs, single segmented antennae



Image credit: Lyle Buss



Image credit: Lyle Buss

Next up: Phantasma scale