

Scale Insects

Order: Hemiptera

**Families: Diaspididae
(armored scales), Coccidae
(soft scales), Eriococcidae
(Felt scales), others**



Scale Insect Basics

- Scale insects feed on plant fluids using ‘piercing-sucking’ mouthparts
 - Insect order Hemiptera
 - Related insects include mealybugs, aphids and whiteflies



Willow aphids



Longtailed mealybug

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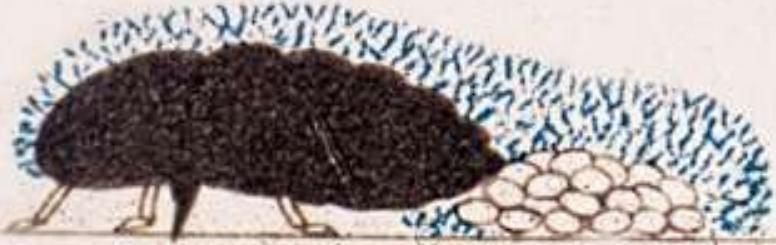
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There are two general types of scale insects:

'Soft' Scales



Armored Scales



Pine needle scale



Oystershell scale



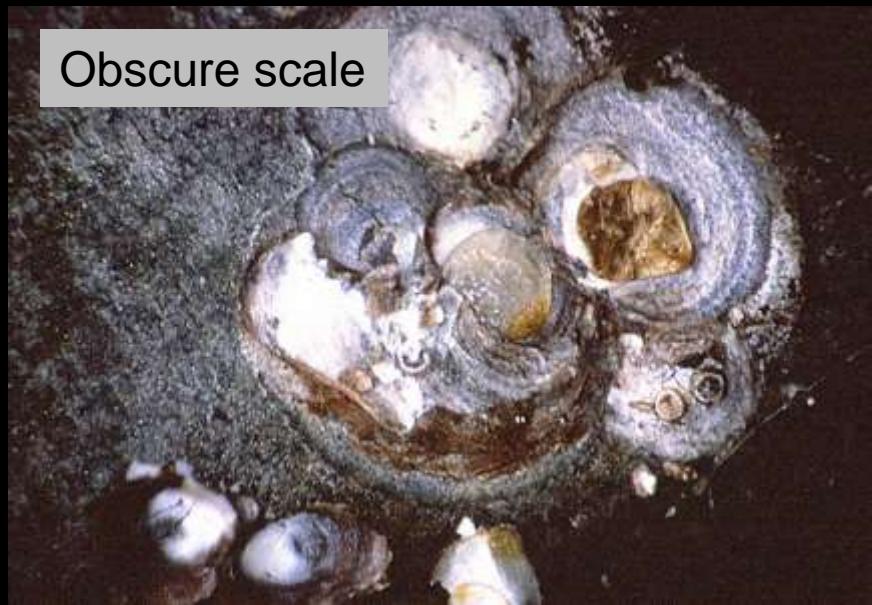
Armored Scales

Family Diaspididae

San Jose scale



Obscure scale



Oak lecanium



European elm scale



Soft Scales

Families Coccidae, Eriococcidae

Pine tortoise scale

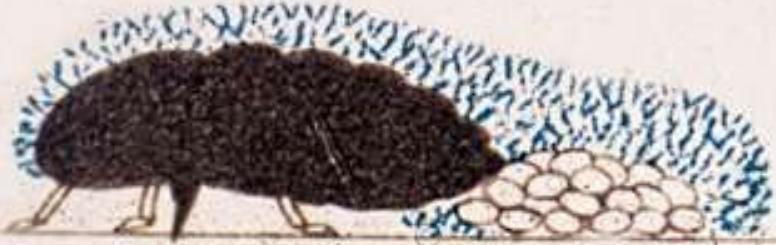


Cottony maple scale



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Armored Scales



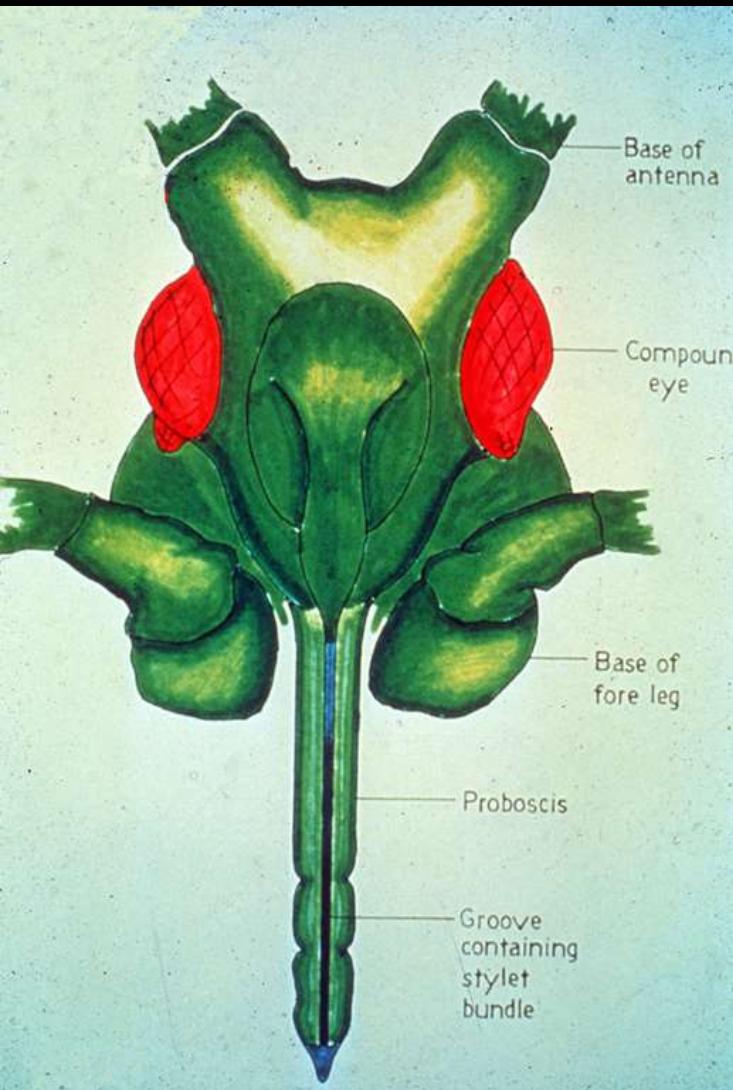
- Covering completely encloses, but is not attached to, the body
- Covering made up primarily of proteins and some waxes
- Two primary body forms (elongate, circular)

Soft Scales

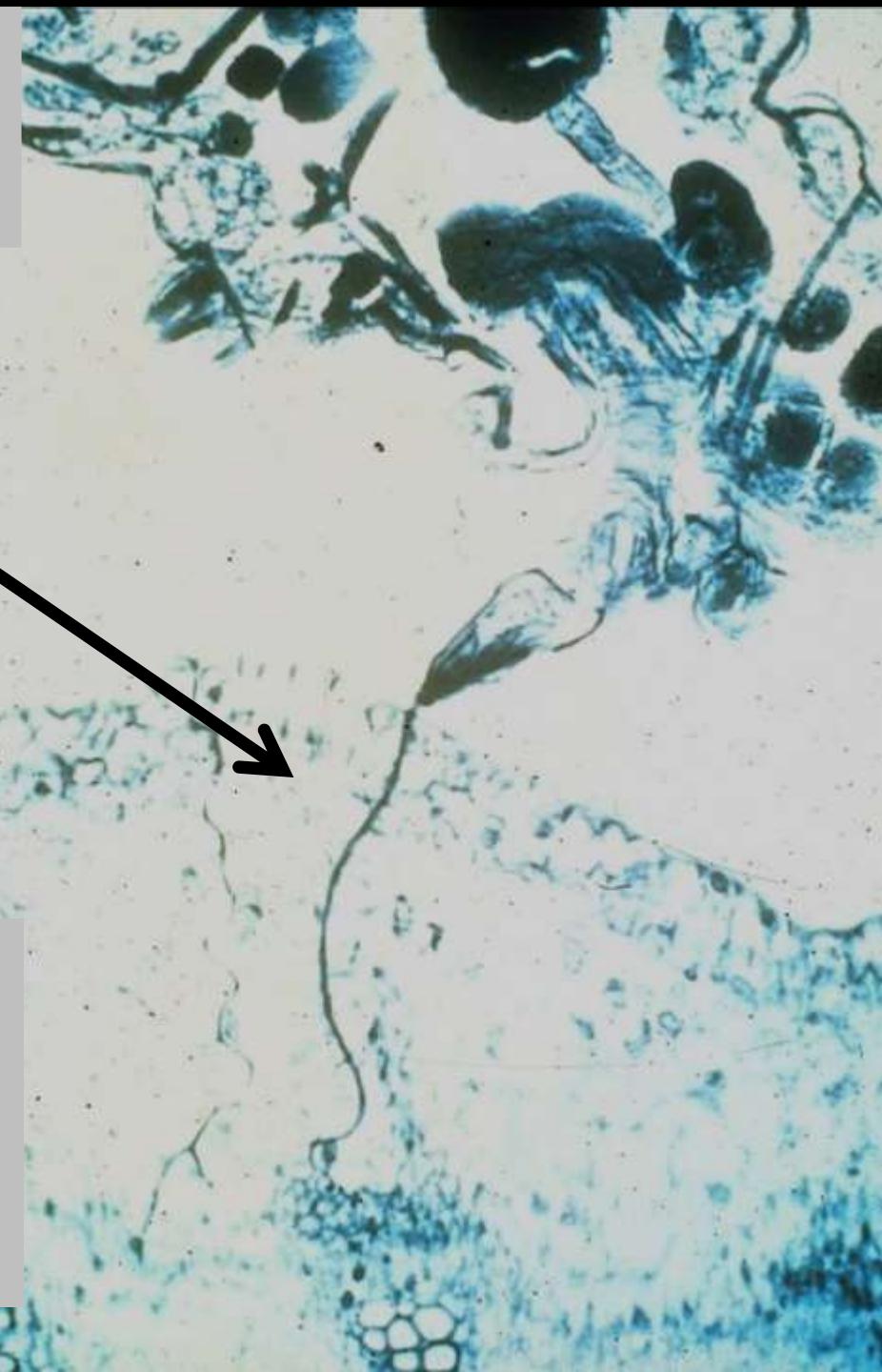
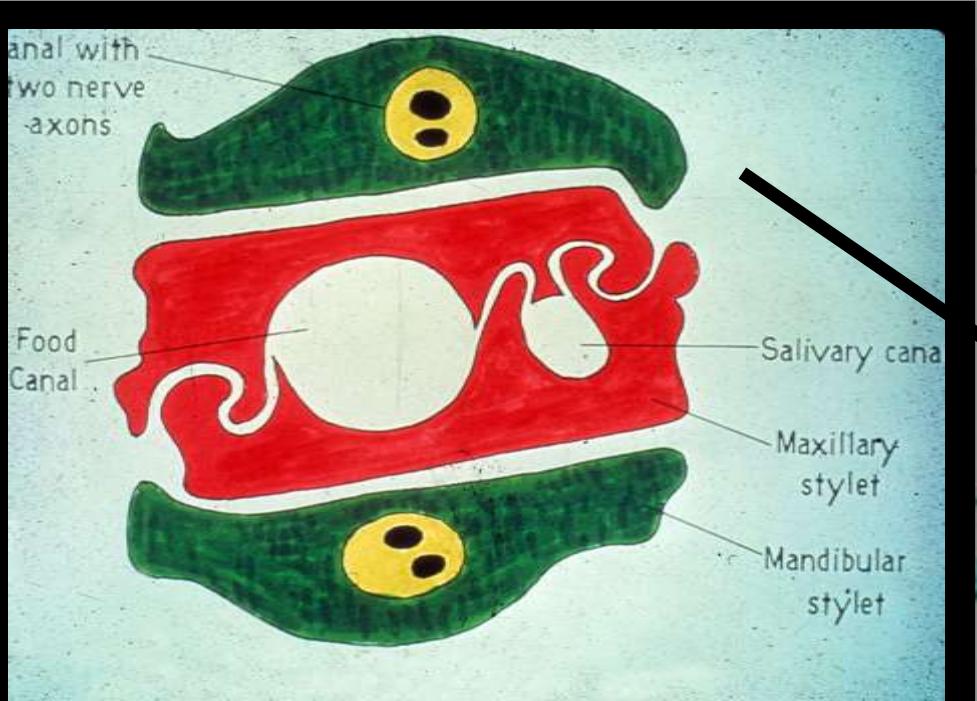


- Covering is attached to body; underside is not covered
- Covering made up of waxes
- Body forms tend to be elongate-oval, more rounded at maturity

Piercing-sucking mouthparts



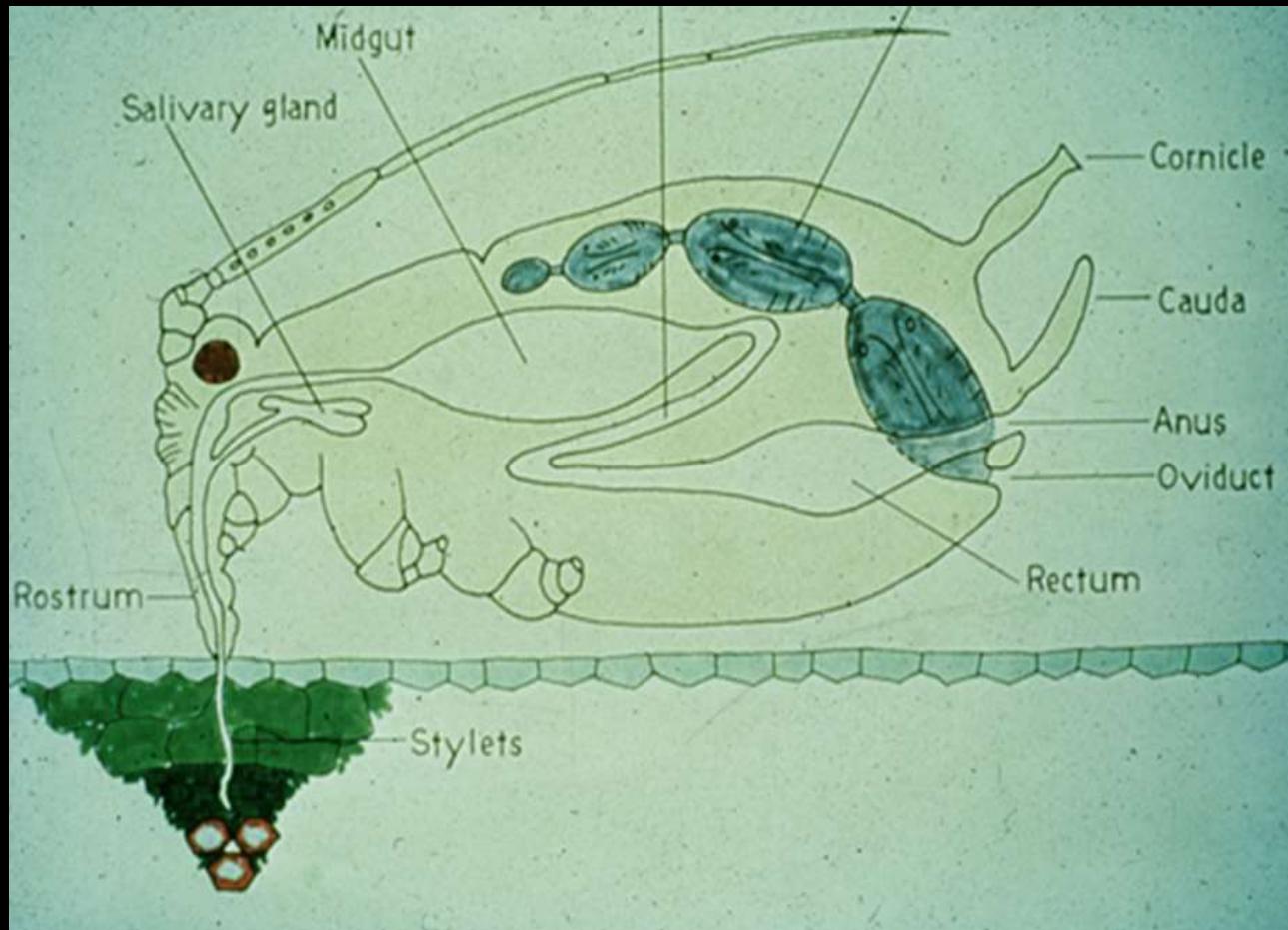
The mandibles are on the outside of the stylet bundle. They are used to penetrate the plant.



The maxillae are on the inside of the stylet bundle. They are paired and interlock. A food canal and parallel salivary canal are formed by the paired maxillae.

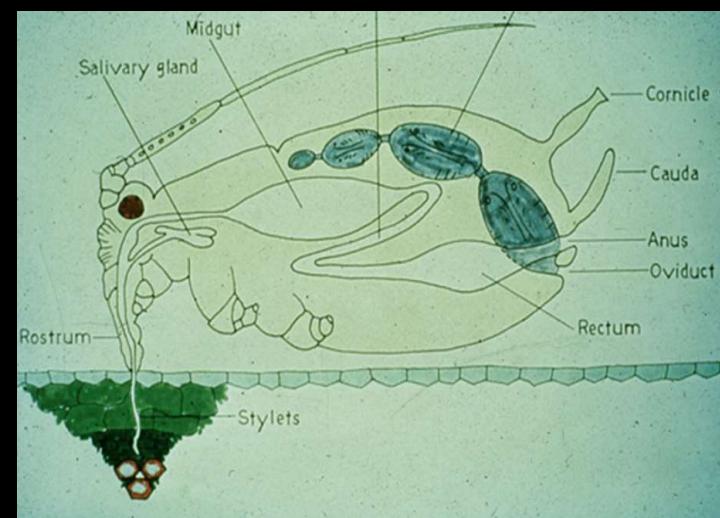
Scale Insect Feeding

- Soft scales feed on the fluids of the phloem



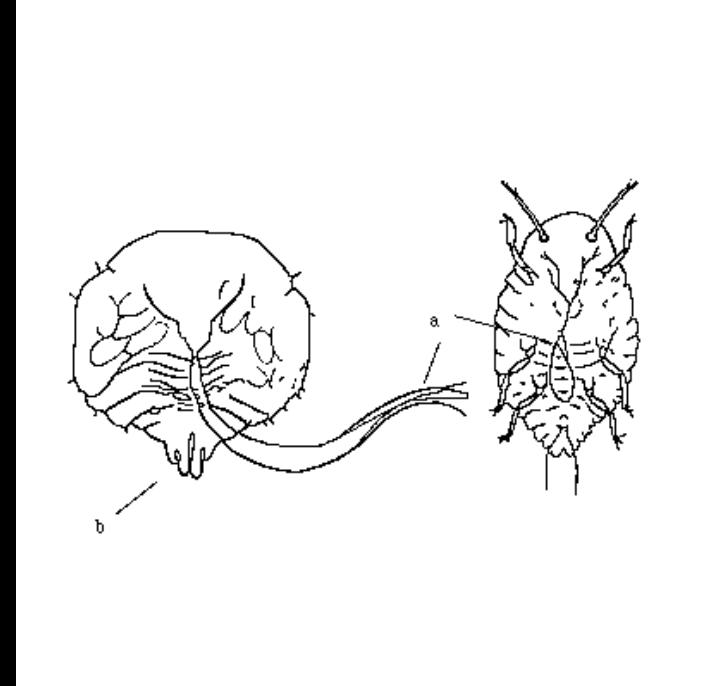
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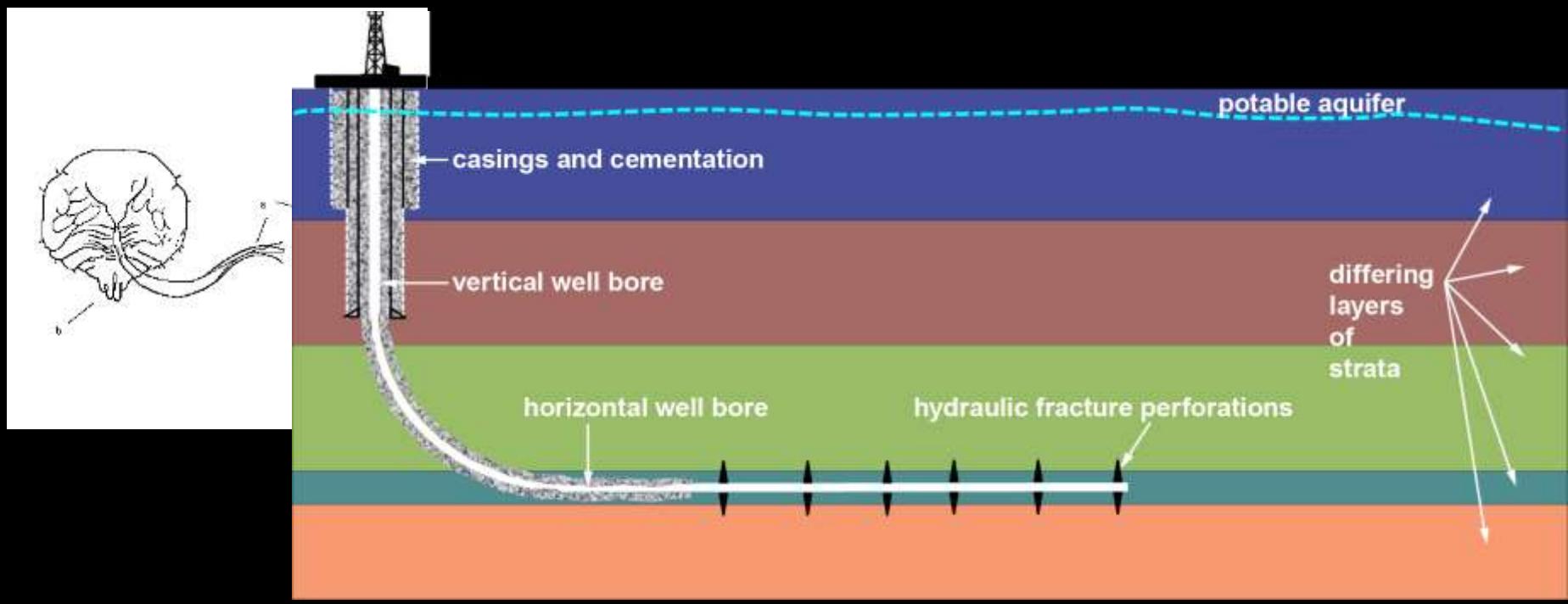
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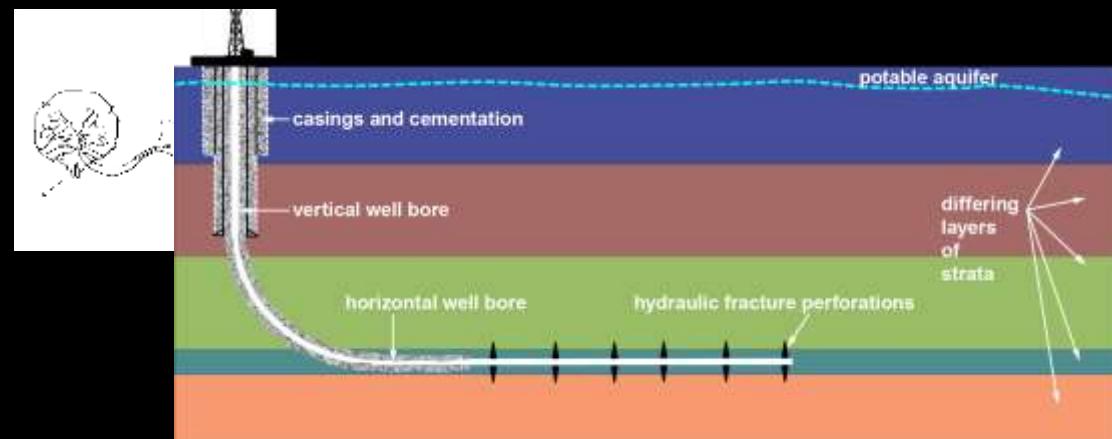


Scale Insect Feeding

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- Armored scales feed on cell contents, often in cambium



No honeydew!



Males?



Some scale insects rarely or never produce males

If they do the **males** are much smaller than the **females**.

Males?



Pine needle scale



Oystershell scale



Armored Scales

Family Diaspididae

San Jose scale



Obscure scale



Some Important Armored (Hard) Scales in Colorado

- Oystershell scale
- Pine needle scale
- Black pineleaf scale
- Poplar/willow scale



Oystershell Scale

Lepidosaphes ulmi





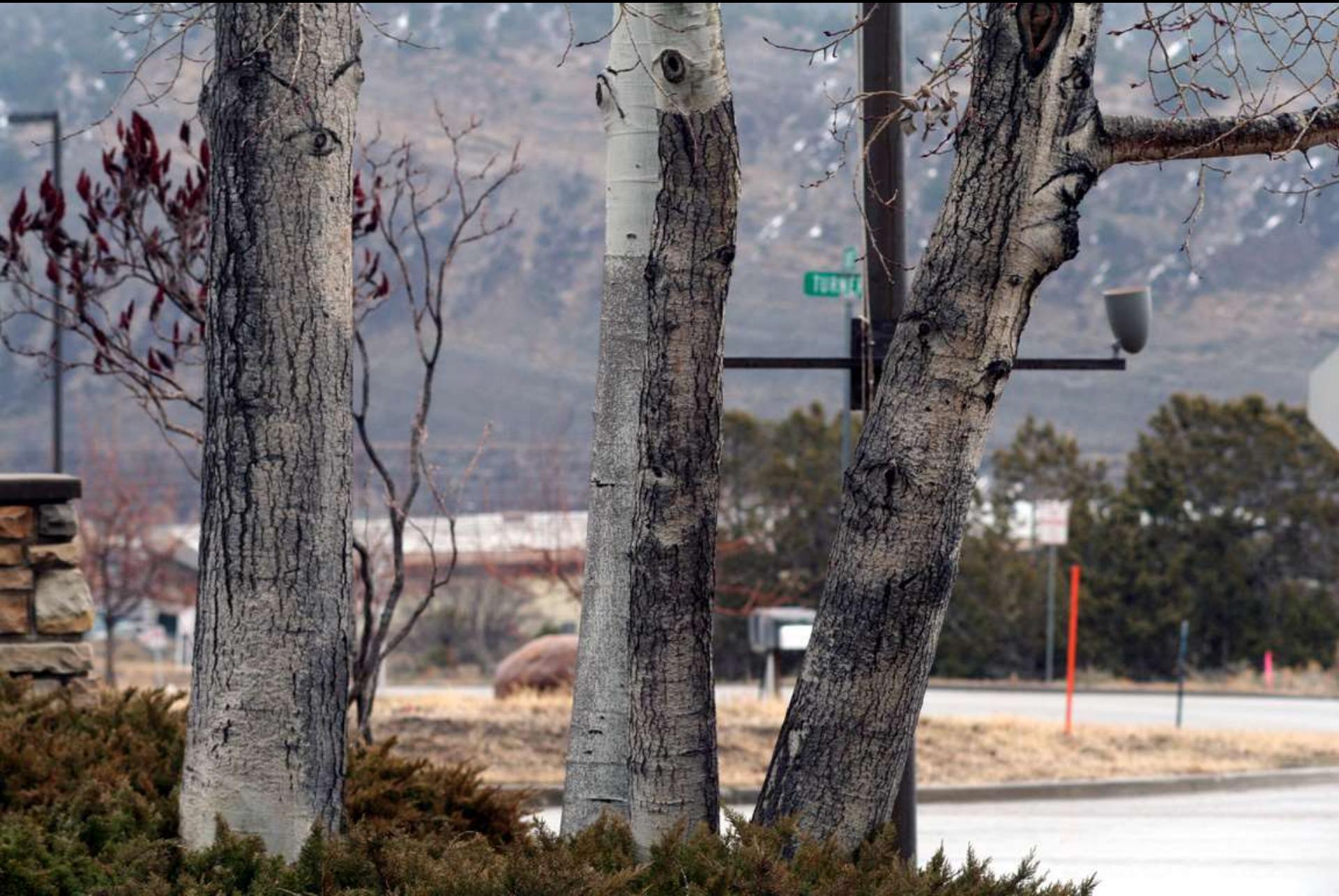


Oystershell scale can develop thick colonies on the bark of susceptible hosts

Bark cracking is a common symptom of current or previous oystershell scale infestation of aspen



Oystershell scale infested trees. Note bark cracking.





**Oystershell scale flipped over to exposure lower surface.
Some eggs are visible at right where the 'test' has torn.**



Oystershell scale eggs (left) and recently hatched eggs, producing the “crawler” stage

Eggs, under the cover of the mother, are the overwintering stage.



The crawler stage usually occurs in late May and early June. It lasts for about a week.

It is the only mobile stage of the oystershell scale – and all other armored scales.





Within about a week the crawlers have either 'settled' or died. They remain in place where they settled for the rest of their life.





Pine Needle Scale

Hosts: Pines, spruce







Mother scale and recently laid eggs. Eggs are the primary overwintering stage.





Crawlers usually occur in early to mid May (ca. lilac full bloom)

Settled crawlers of pine needle scale on needles



Pine needle scale in mixed stages of development





Natural Enemies of Pine Needle Scale



Lady beetles that specialize in armored scales (*Coccidophilus* spp., *Chilocorus* spp.)



Natural Enemies of Pine Needle Scale



Parasitic Wasps



Poplar/Willow Scale



UGA5024021



Bark cracking
(right) and bubbling
(below) associated
with poplar scale
on aspen



Oak lecanium



European elm scale



Soft Scales

Families Coccidae, Eriococcidae

Pine tortoise scale



Cottony maple scale



Some Important Soft Scales in Colorado

- Brown soft scale (indoors only)
- European elm scale
- Pine tortoise scale
- Cottony maple scale





Soft Scale Example – Cottony Maple Scale



**Overwintering stage –
Adult females that have
not matured eggs.**





Females swell with eggs in late spring







Crawlers move to the leaves in summer

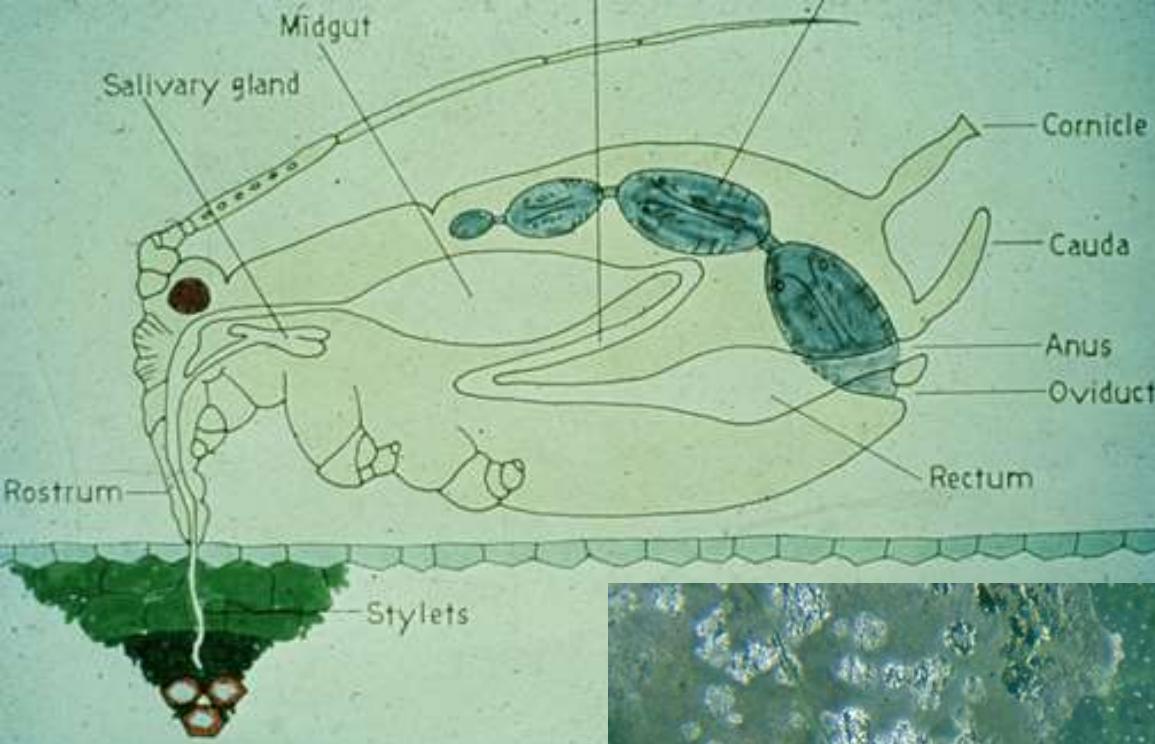




Overwintering stage –

**Adult females that have
returned to the twigs in
late summer.**



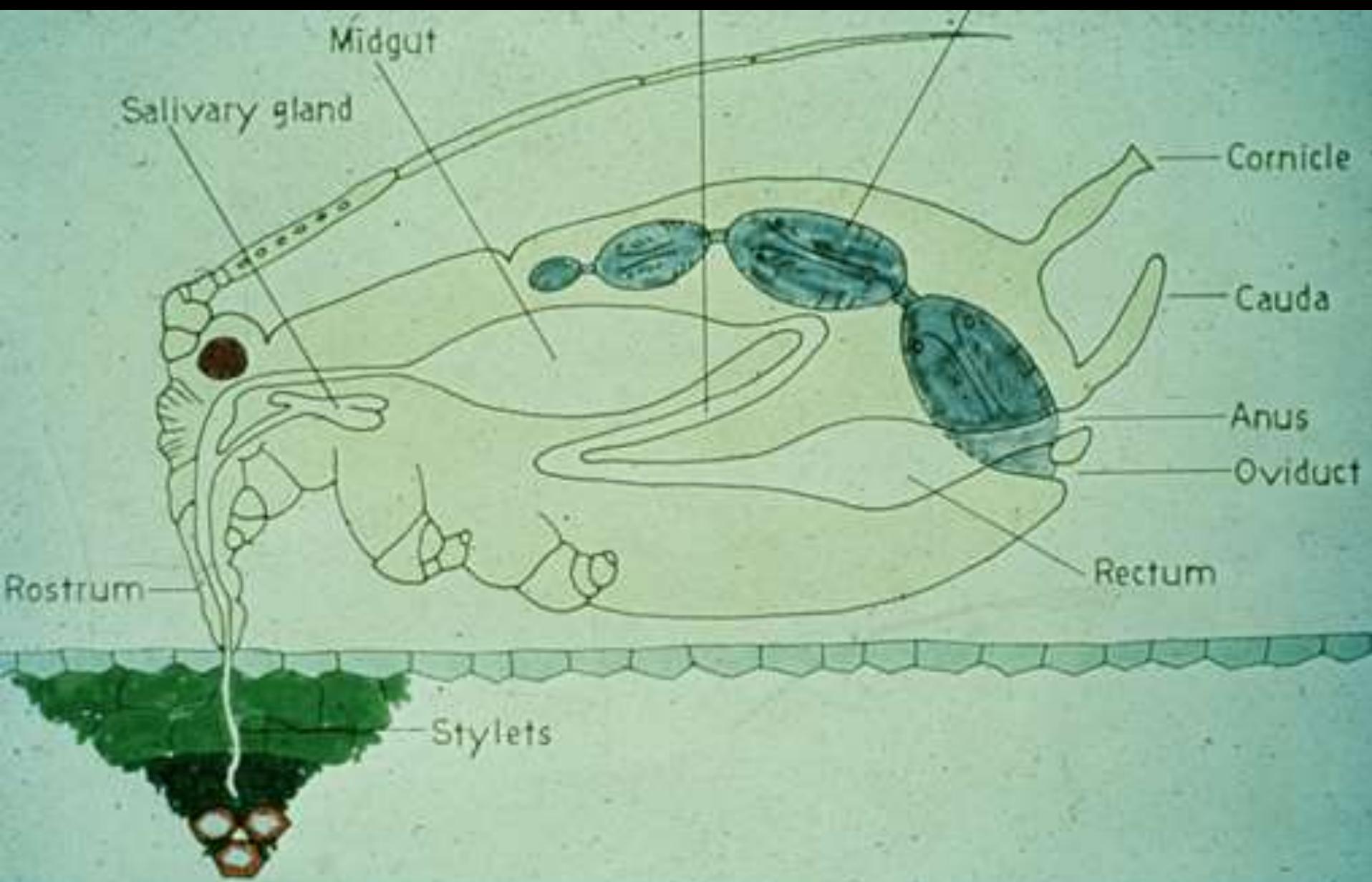


Like aphids, soft scales suck sap from the phloem and excrete honeydew.





**Honeydew droplets excreted by
soft scale**



Honeydew Producing Insects*

- Aphids
- Soft scales
- Whiteflies
- Mealybugs
- Psyllids (some)
- Leafhoppers (phloem feeding species)



*All suck sap from the phloem

Sooty Molds

Fungi that grow on honeydew-contaminated surfaces



**Sooty mold on bark of
elm resulting from
European elm scale
honeydew**



European Elm Scale





Overwintering stages of European elm scale on twigs



Crawlers appear in midJune and are present for about a month



European elm scale crawlers





European elm scale nymphs originally move to leaves where they feed during much of summer



**Honeydew is excreted.
Where it lands and
persists, sooty molds
grow.**





Branch ‘flagging’ in late summer can be due to stress associated with high scale populations.



Crawlers return to twigs in late summer for overwintering.

Soft Scales vs. Armored Scales



Soft scales produce honeydew

Armored scales do not produce honeydew



Soft Scales vs. Armored Scales



Soft scales typically produce several hundred eggs

Armored scales typically produce a couple of dozen eggs



Soft Scales vs. Armored Scales



Soft scales retain mobility through their lifetime, moving from foliage to twigs

Armored scales are only active during the crawler period



Soft Scales vs. Armored Scales



Soft scales typically produce crawlers for several weeks in late spring and early summer

Armored scales typically produce crawlers for a week or two in spring



Principles of Scale Control

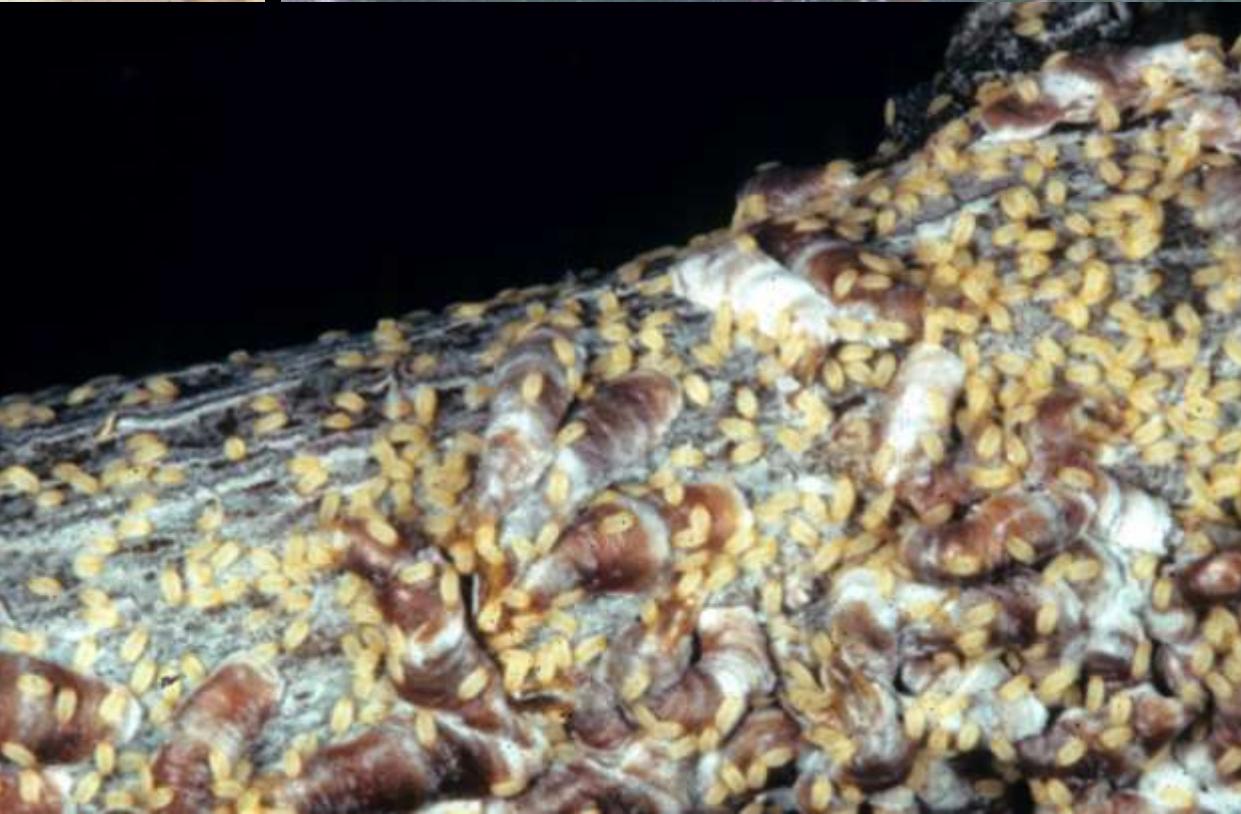
- Hand removal
- Sprays directed at crawlers
- Oils
 - Dormant season treatment
 - Post-crawler treatment
- Systemic insecticides



**Scraping
oystershell
scale**



Crawler treatments



*Crawler stages of scale
insects are highly
vulnerable to insecticides!*





Monitoring for Scale Insect Crawlers Using Double-sided Sticky Tape



Photographs courtesy of University of California Statewide IPM Program

Monitoring for Scale Insect Crawlers Using Double-sided Sticky Tape



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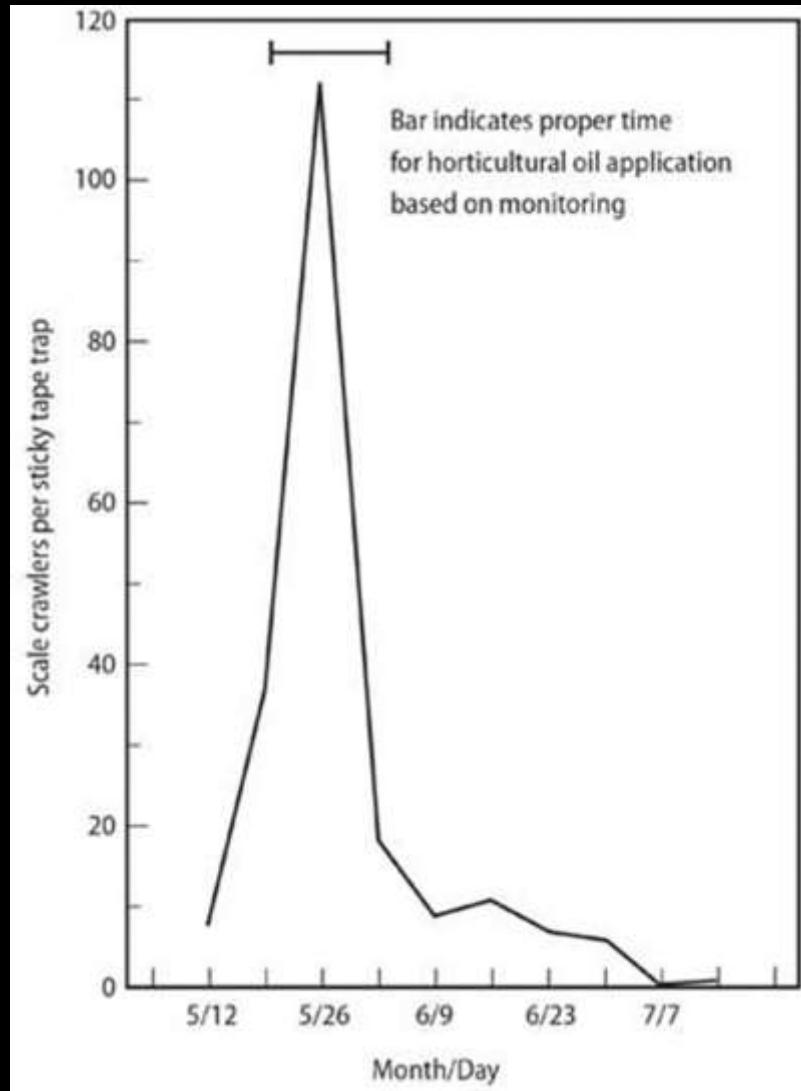
Crawler Treatments with Residual Activity (weeks)

- **Persistent pyrethroids**
 - Bifenthrin (Onyx, Talstar)
 - Permethrin (Astro, etc.)
 - Cyfluthrin (Tempo)
- **Carbaryl (Sevin)**
- **Pyriproxyfen (Distance, Fulcrum, etc.)**
- **Acetamiprid (TriStar)**
- **Dinotefuran (Safari, Zylam, etc.)**

Contact Treatment *without* *Residual Effects*

- Horticultural oils
- Insecticidal soaps

Timing: *Around
peak period of
crawler activity*



Soaps vs. Oils against young scales



Oils: Better on armored scales

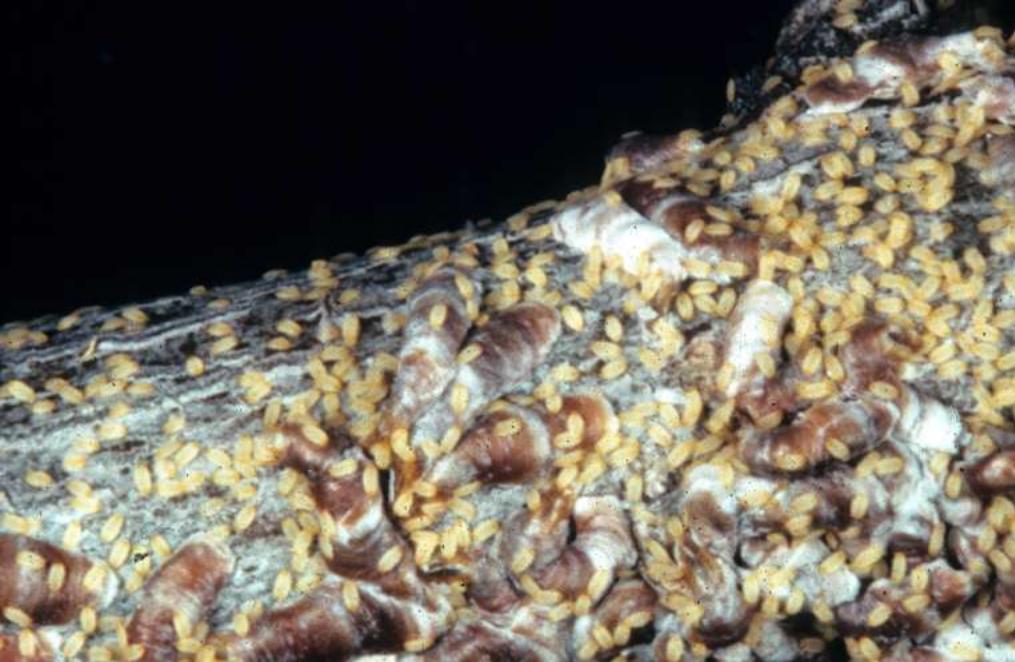


Soaps: Better on soft scales





Oils used during the dormant season can help control scales – *with very little impact on natural enemies*



Current horticultural oils can be used on trees with foliage.

Crawlers and young settled scales are targets.



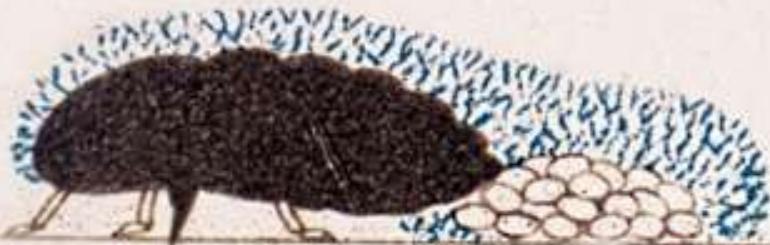
Systemic Insecticides and Scale Insects?

- **Soil applications**
 - Dinotefuran (Safari, Zylam, Transtect)
 - Acephate (Orthene, Lepitect)
 - Imidacloprid (Merit, Mallet, Zenith, etc.)
 - *Soft scales only*
- **Trunk spray applications**
 - Dinotefuran (Safari, Xylam, Transtect)
 - Acetamiprid (Tristar)

Systemic insecticides applied to the soil for root uptake are primarily effective against phloem-feeding soft scales

'Soft' Scales

Armored Scales



Scale insect control

Imidacloprid applied
as soil drench?



Soft Scales vs. Armored Scales



Feeding Site: Cells,
often of the cambium

Armored scales do not
produce honeydew

Feeding Site: Phloem

Soft scales produce
honeydew





**Imidacloprid
Control Range**

Yes – Soft Scale



**No – Armored
Scale**