

# Insects with Incomplete (Paurometabolous) Metamorphosis

# Orders with Complete Metamorphosis

|                                            |         |     |
|--------------------------------------------|---------|-----|
| Hemiptera (true bugs, scale insects, etc.) | 121,000 | 194 |
| Orthoptera (grasshoppers, crickets)        | 37,000  | 24  |
| Psocoptera (bark lice)                     | 10,000  | 18  |
| Odonata (dragonflies; damselflies)         | 9,000   | 11  |
| Blattodea (roaches)                        | 8,000   | ?   |
| Ephemeroptera (mayflies)                   | 4,000   | 1   |
| Plecoptera (stoneflies)                    | 4,000   | 0   |
| Mantodea (mantids)                         | 3,000   | ?   |
| Dermaptera (earwigs)                       | 2,000   | 4   |
| Pthiraptera (lice)                         | 2,000   | 2   |
| Isoptera (termites)                        | 1,000   | 4   |

# Order Ephemeroptera mayflies

- Incomplete metamorphosis
- Immatures are aquatic (naiads)
- Chewing mouthparts in immatures, adults do not feed
- Adults are short-lived, ephemeral
- Important in aquatic environments as food and water quality indicators

*Aquatic immatures  
are termed naiads*



*Naiads serve as a food  
resource and water  
quality indicators*





*Naiads  
leave water  
for final  
molt to  
adult*

*Adults are delicate appearing insects  
Some live as little as 24 hours - ephemeral!*



*Common  
At  
Lights*

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# *Mayfly Emergences*

*A Great Food  
Resource!*



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# Order Odonata

## dragonflies and damselflies

- Incomplete metamorphosis
- Immatures are aquatic (naiads)
- Immatures and adults with chewing mouthparts - both are predators
- Some with an unusual means of sperm transfer
- Green darner dragonfly - WA state insect



*Dragonflies are  
large predatory  
insects*

*Dragonflies cannot  
fold their wings  
over the abdomen*



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*Damselflies are usually smaller, more “delicate” appearing, and capable of folding their wings over the abdomen*



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*Naiads leave the water for their final molt to the adult stage*



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*Newly eclosed  
dragonfly  
expanding its  
wings and  
“drying”*

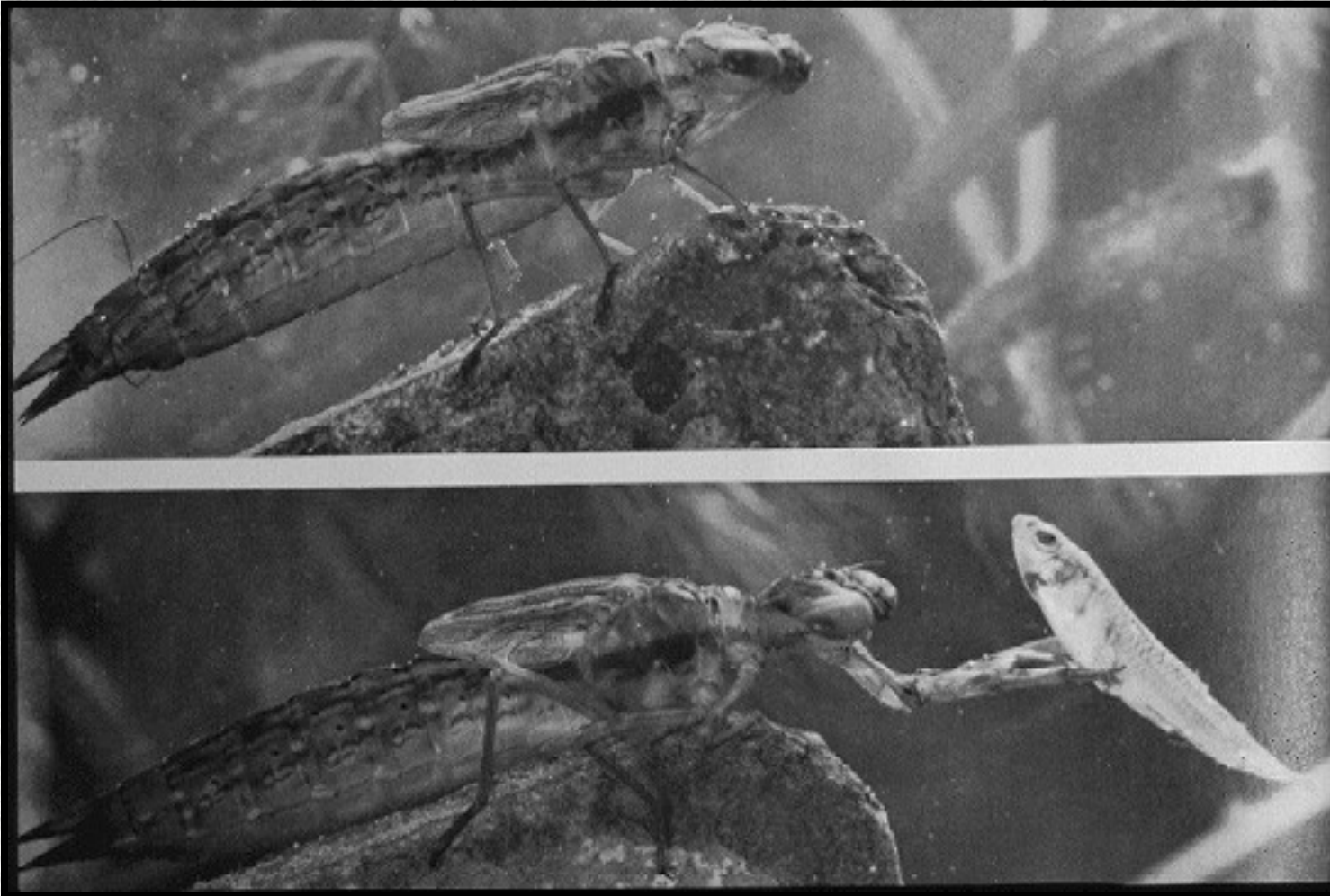
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*Eyes of Odonata are large with many facets -they have excellent eyesight*



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*Immatures (naiads) are also voracious predators*



*Note  
Wing  
Pads*

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*The wheel configuration is an unusual mating position*



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# Order Orthoptera

grasshoppers, locusts, crickets, katydids

- Incomplete metamorphosis
- Chewing mouthparts in both adults and immatures
- Most are phytophagous, some are omnivorous
- Some are serious pests
- Some produce sound

# *Jiminy Cricket!*



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*Most grasshoppers are  
Phytophagous*

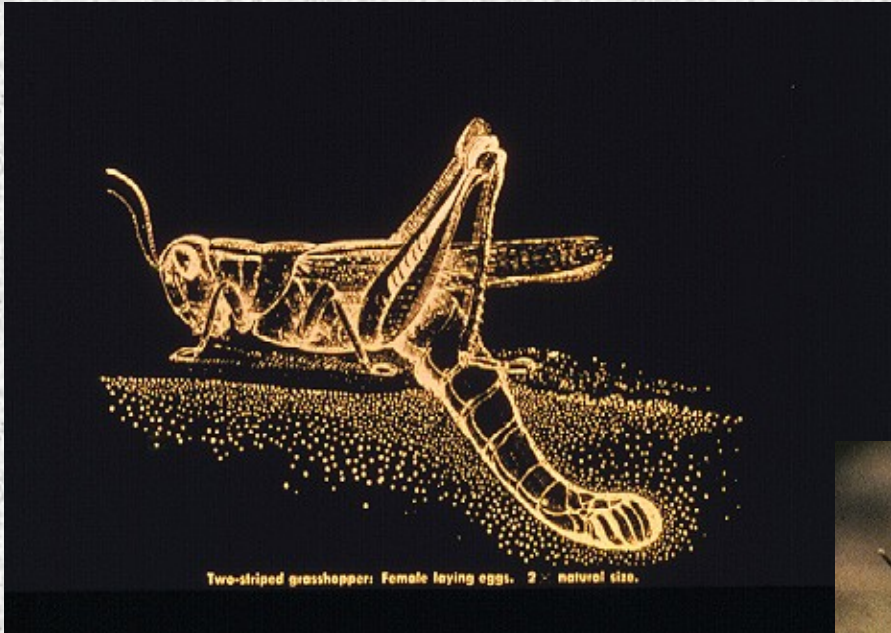
*Among the most  
pestiferous  
of insects*

## *A typical grasshopper*



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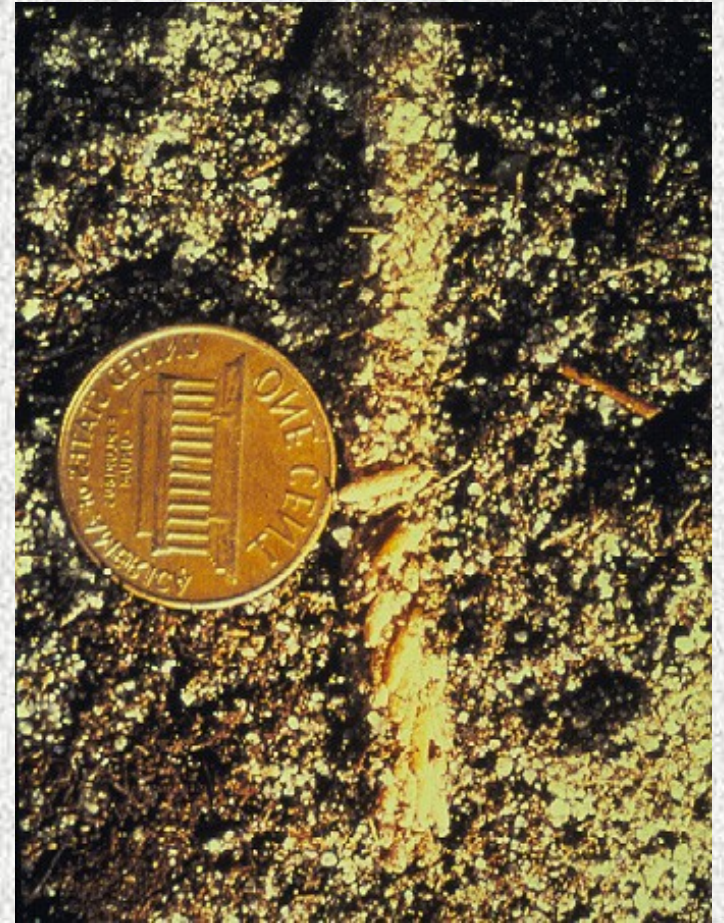
*Most grasshoppers  
oviposit an egg mass  
into the soil*



*Eggs usually  
over-winter*



# *Grasshopper egg pods*



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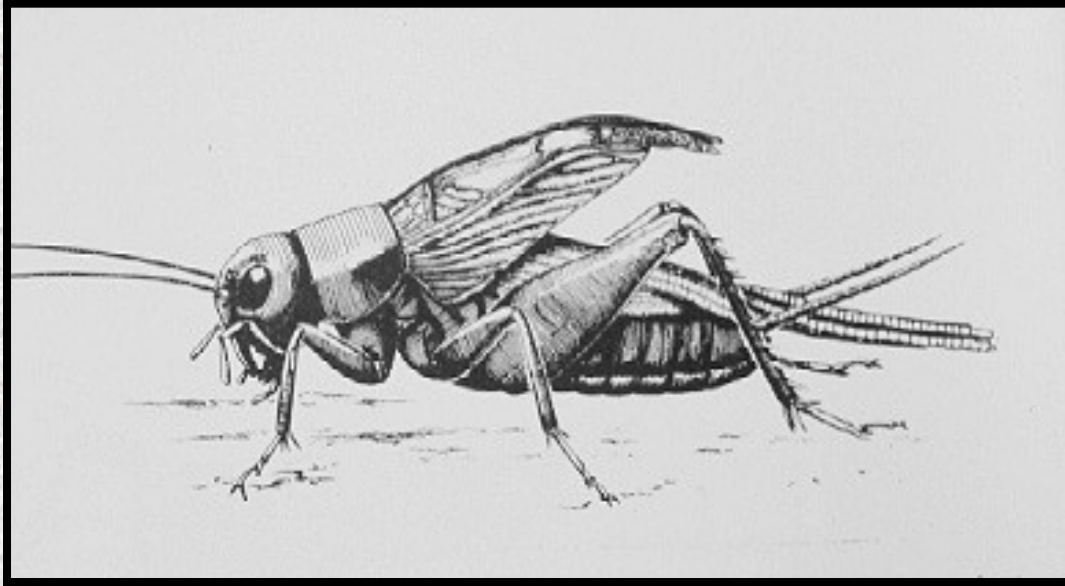


*Common field cricket*

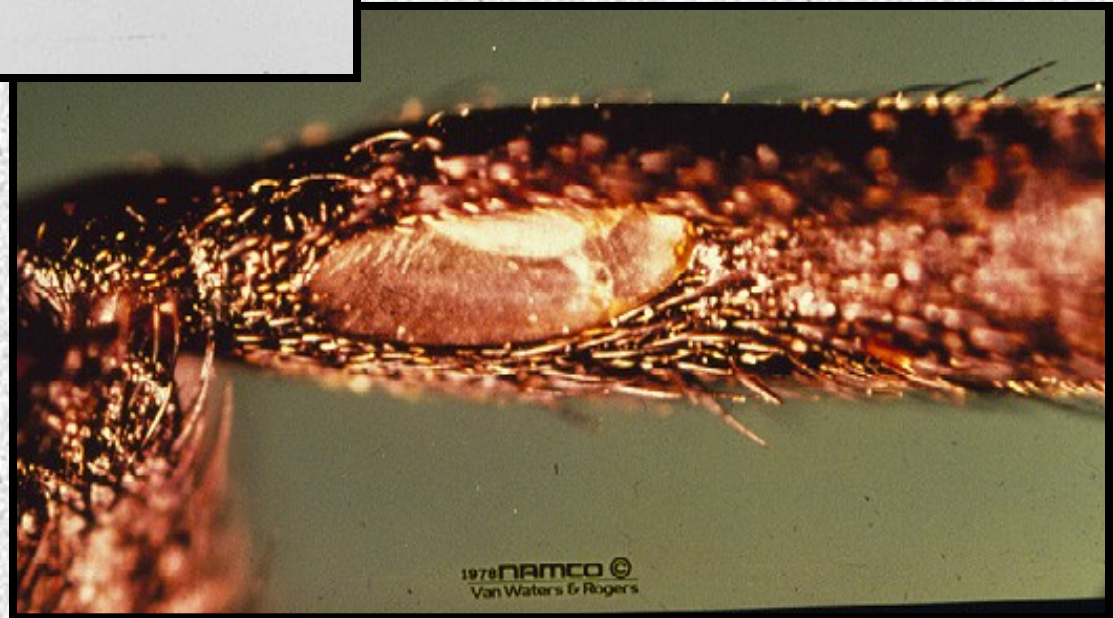


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# *Crickets “sing” and hear songs*



*The “ear” is  
found on the leg -  
A tympanum*





*Some interesting  
looking crickets*

*Adults!  
They are secondarily  
wingless*



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# *Katydid*s



*“Leaf”  
insects*



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*Camouflage*



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# *Camouflage* *"Blending-in"*



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# Order Mantodea

## praying mantids

- Incomplete metamorphosis
- Immatures and adults with chewing mouthparts - both are predators
- Eggs deposited in cases called oötheca

# *Praying mantids*

*voracious predators, capable of turning the head as if on a “neck”*



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*Mantids use their raptorial fore legs to capture prey*



Van Waters &  
1982 division of

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*Mantid nymphs are also predators*



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*Males are smaller than females*



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*Mantid eggs are deposited in cases called oötheca that are formed by the accessory glands*



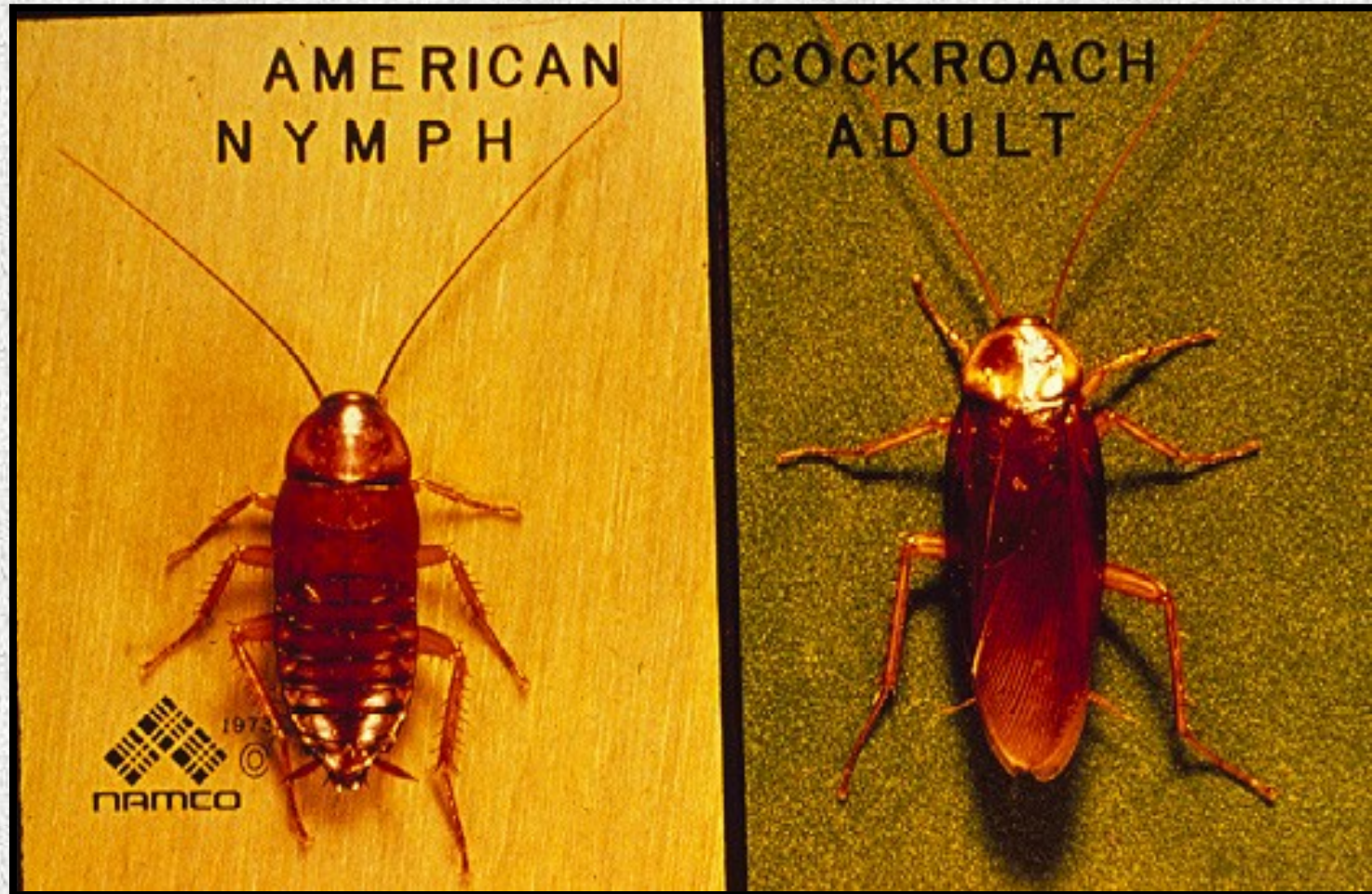
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# Order Blattaria

## cockroaches

- Incomplete metamorphosis
- Chewing mouthparts in both adults and immatures - omnivorous in feeding habits
- Some are serious pests
- More tropical than temperate in distribution
- Eggs usually deposited in an oöthecum

*Cockroaches are pestiferous/nuisance insects when in contact with humans*



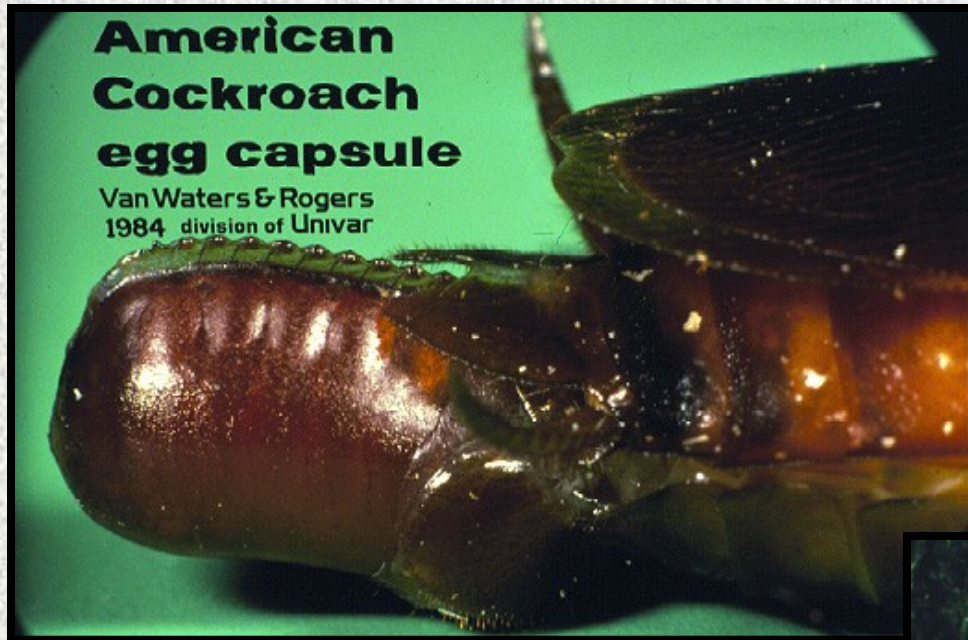
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*The forewing of a roach is called a tegmina*



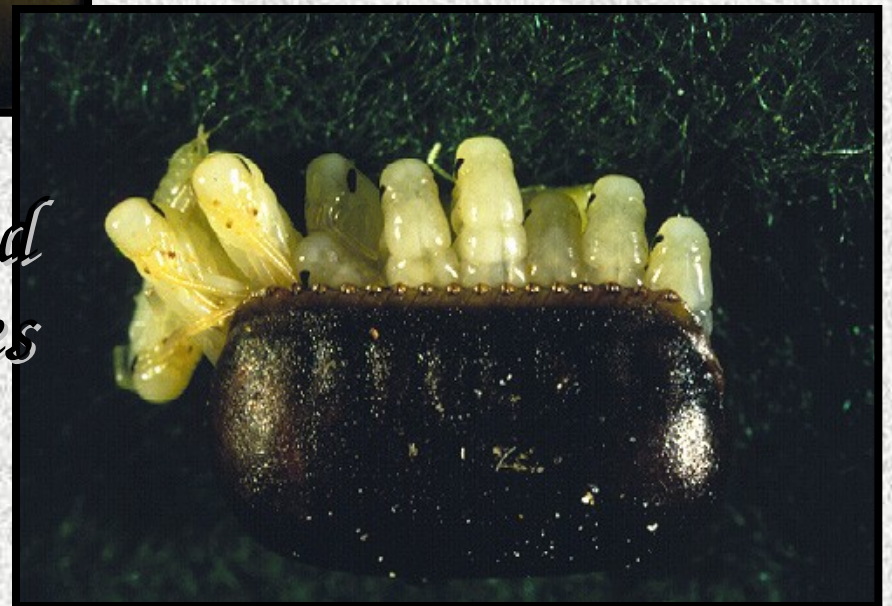
*Roaches are  
omnivorous feeders*

*Roaches can stink! - fat takes on food odors*



*Many roaches  
deposit eggs in an  
oothecum*

*Oötheca are deposited  
throughout structures*



*A good PCO (Pest Control Operator) can tell the infesting species by the oöthecum*





## *Molting*





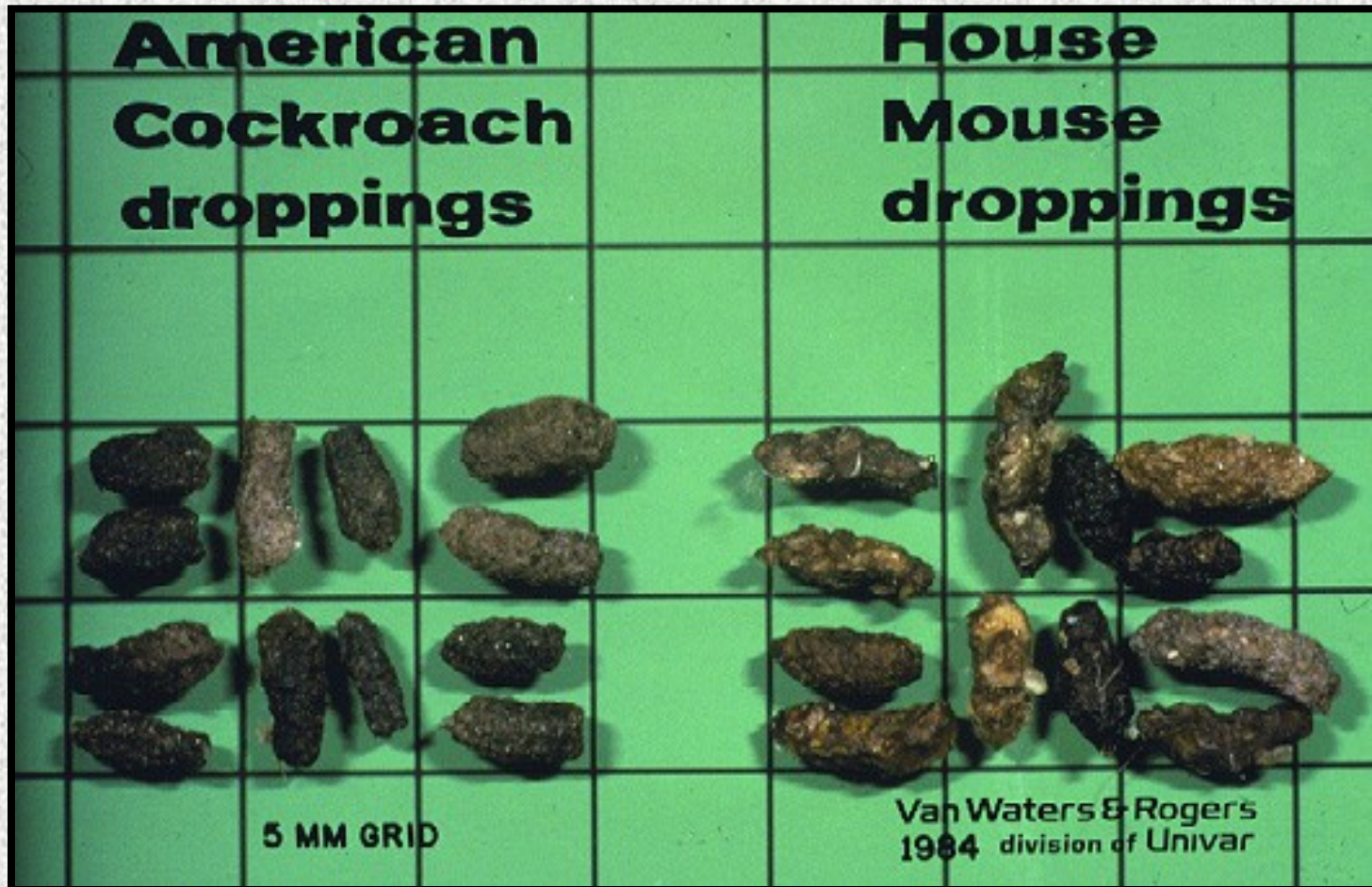
*Heard of a “roach”  
motel?*

*Take  
advantage of  
roach behavior*



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*Could you tell the difference between roach and mouse droppings?*



*There are some beautiful roaches in the tropics*



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*There are some big  
roaches out there!*



*Most roaches are  
tropical in  
distribution*



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# Order Isoptera

## termites

- Incomplete metamorphosis
- Chewing mouthparts - feed on cellulose with aid of gut symbionts
- Social insects
- Usually associated with the soil (moisture)
- Important in natural decomposition
- Can become very serious pests

*Termites are social insects - they live in colonies*



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*Termites and ants are very different insects!*

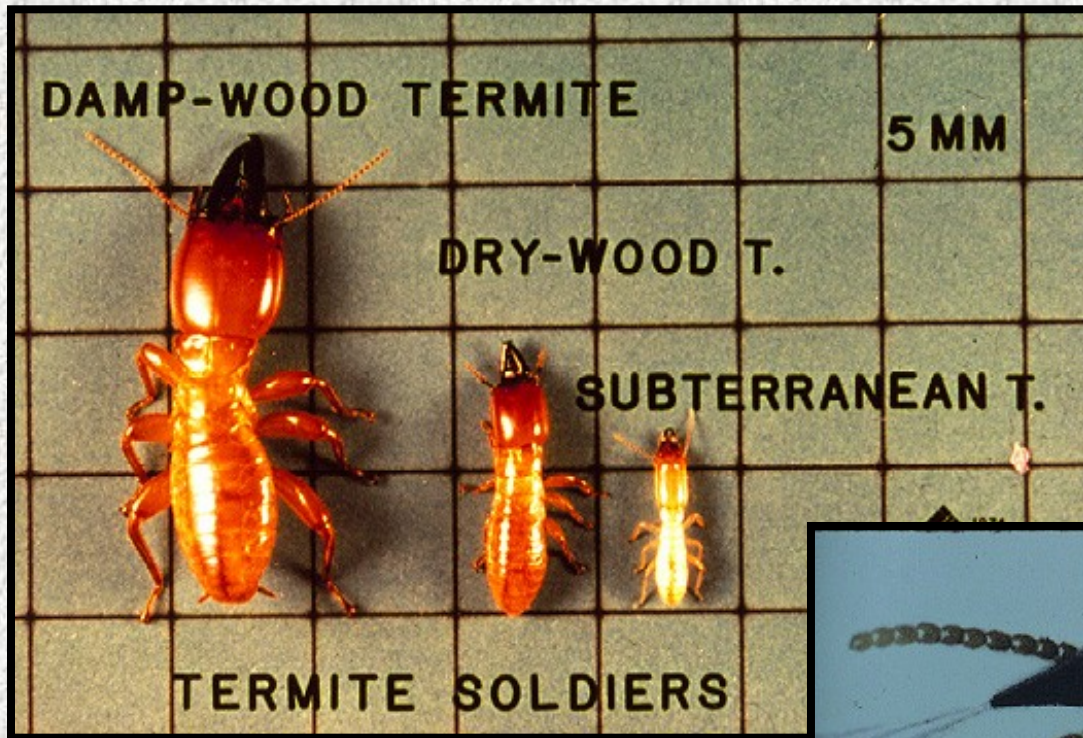


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*This queen may produce 10 million young during her life!*

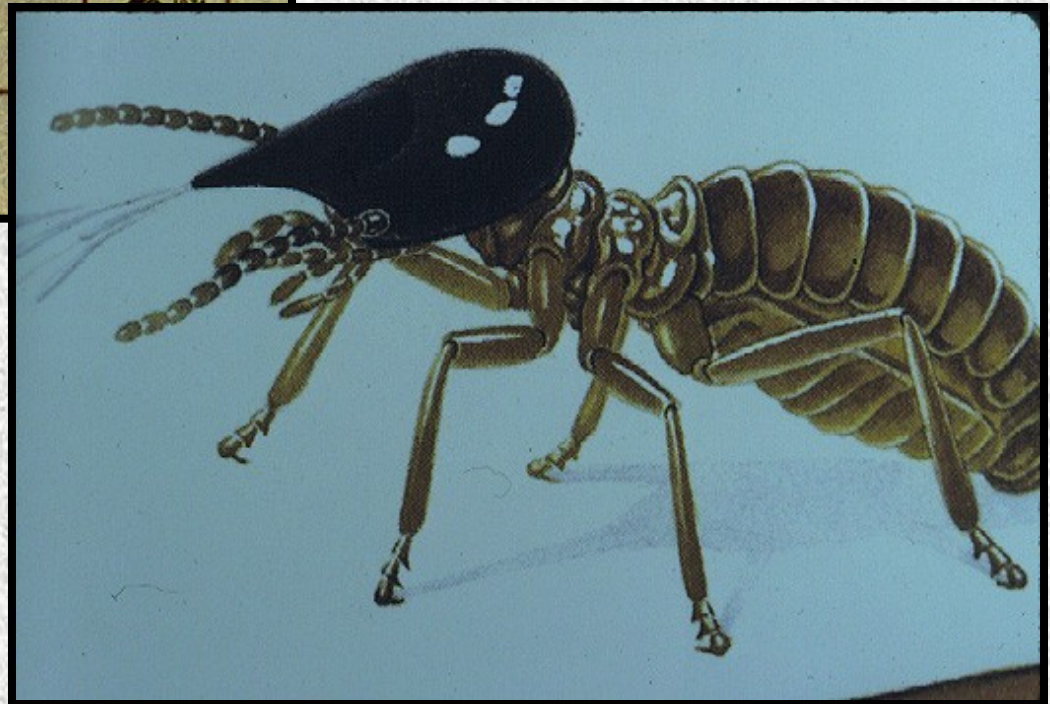


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*Protective caste -  
soldier*

*A nasute*



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## Dry-wood Termite damage & frass



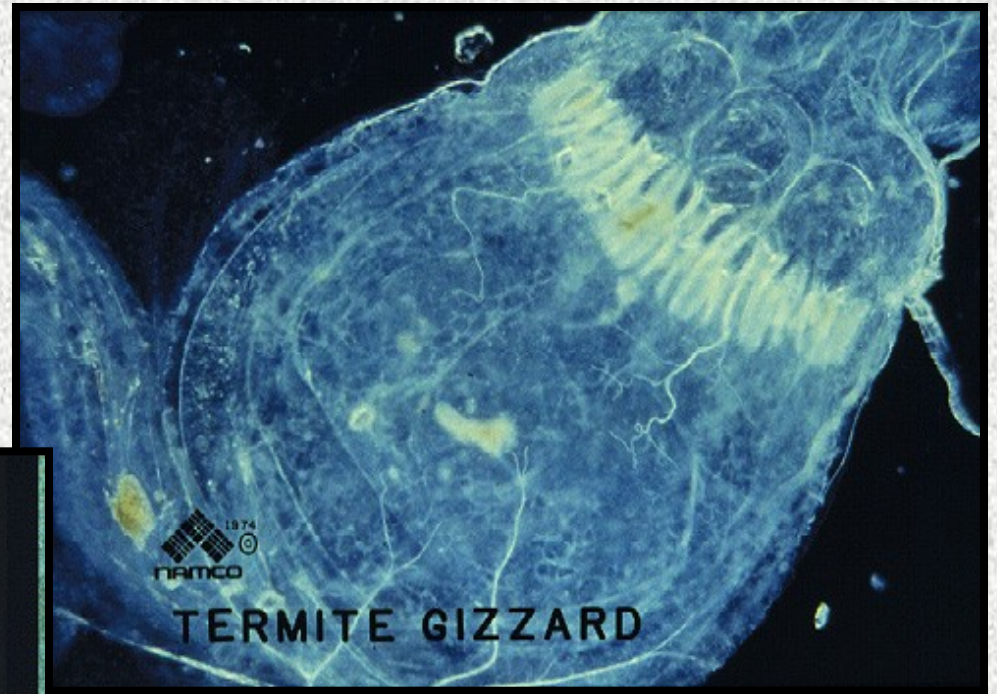
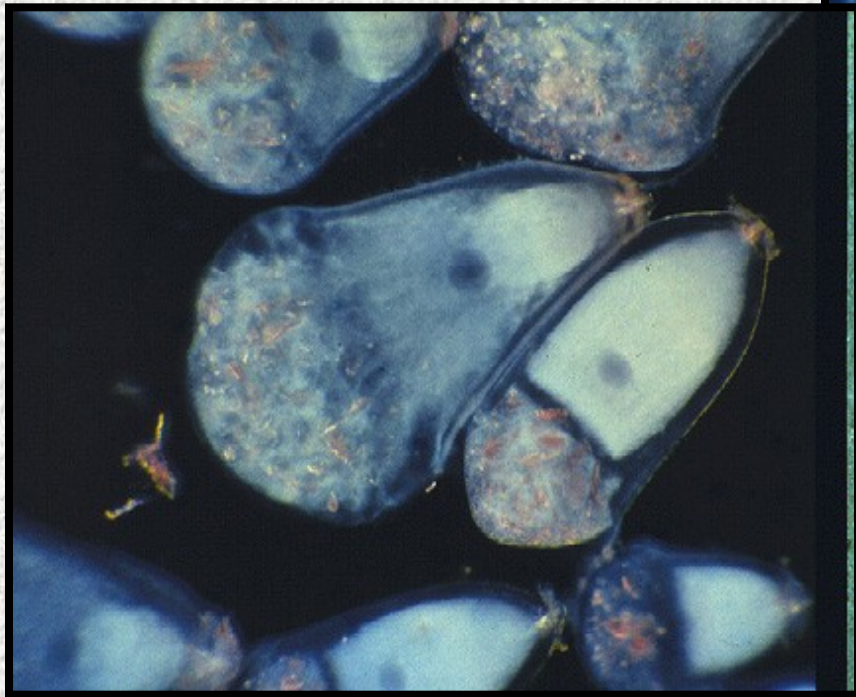
Van Waters & Rogers  
1981 division of

*Termites eat wood*



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*Termites cannot  
digest wood!*



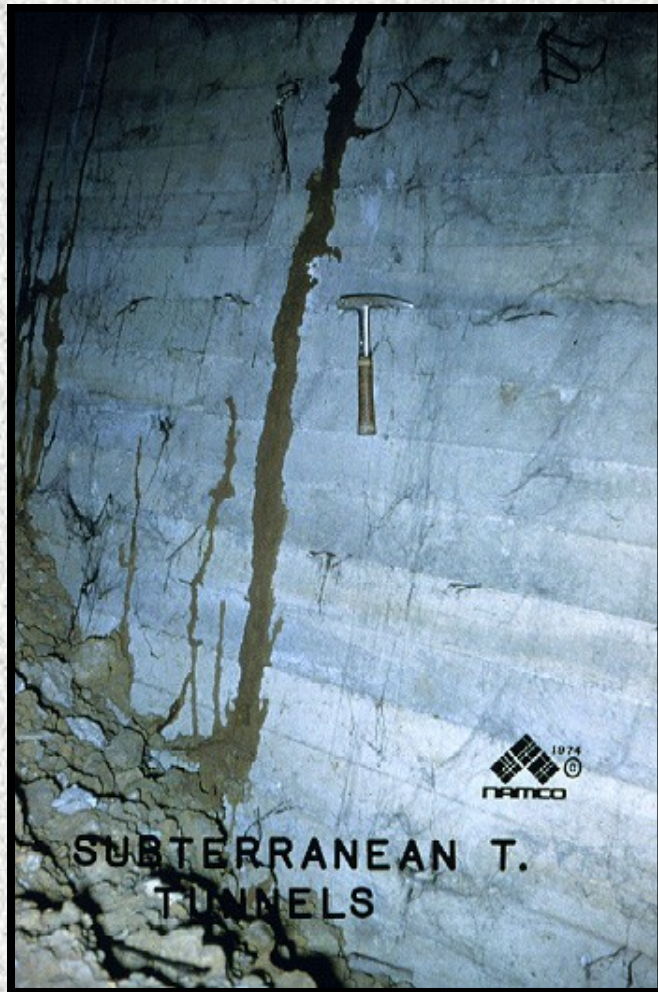
*They rely on  
internal gut  
symbionts*

*Subterranean termites are common in eastern WA*

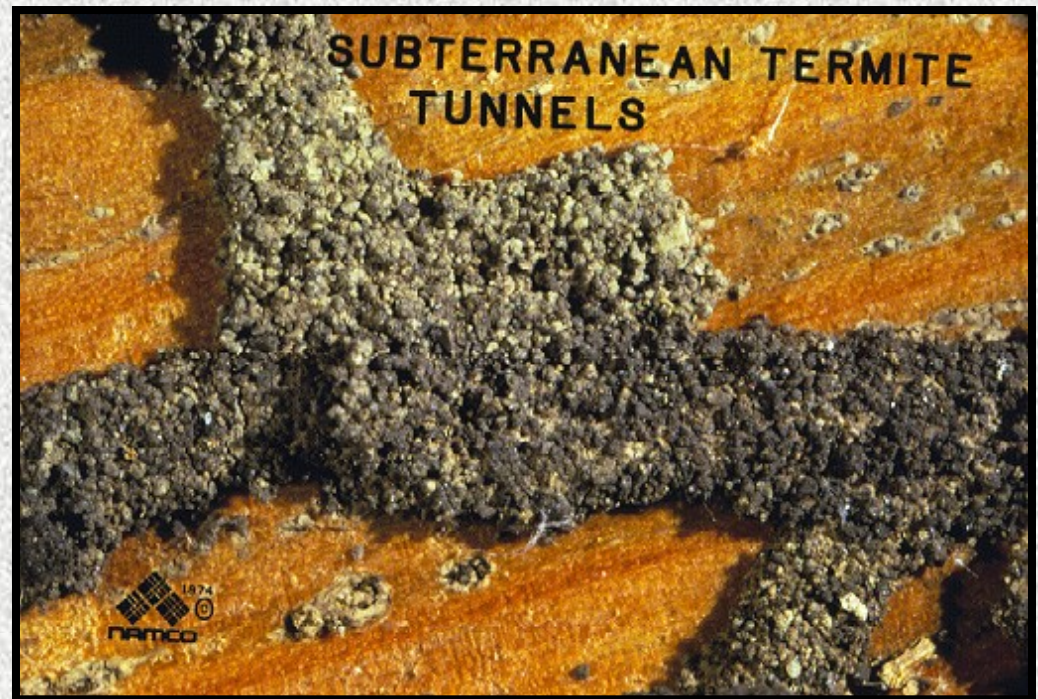


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*Subterranean termites maintain contact with the soil*



*Build "mud" tunnels*



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# *A swarm of termite reproductives in East Africa*



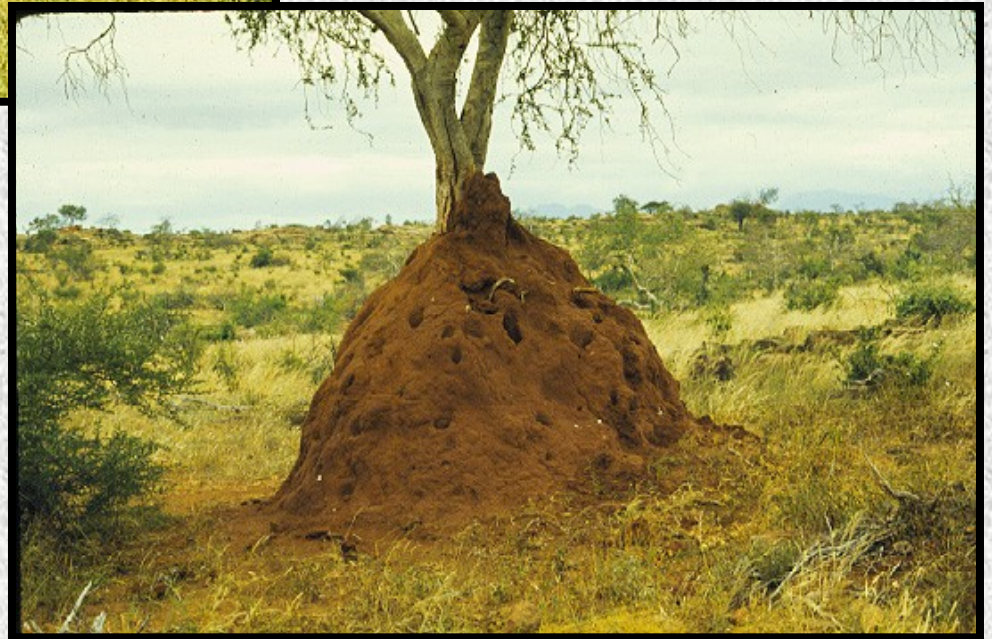
*Food*

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## *Termite mounds in Africa*

*Mounds are like  
High-rise  
Air-conditioned  
buildings*



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# Order Dermaptera

## earwigs

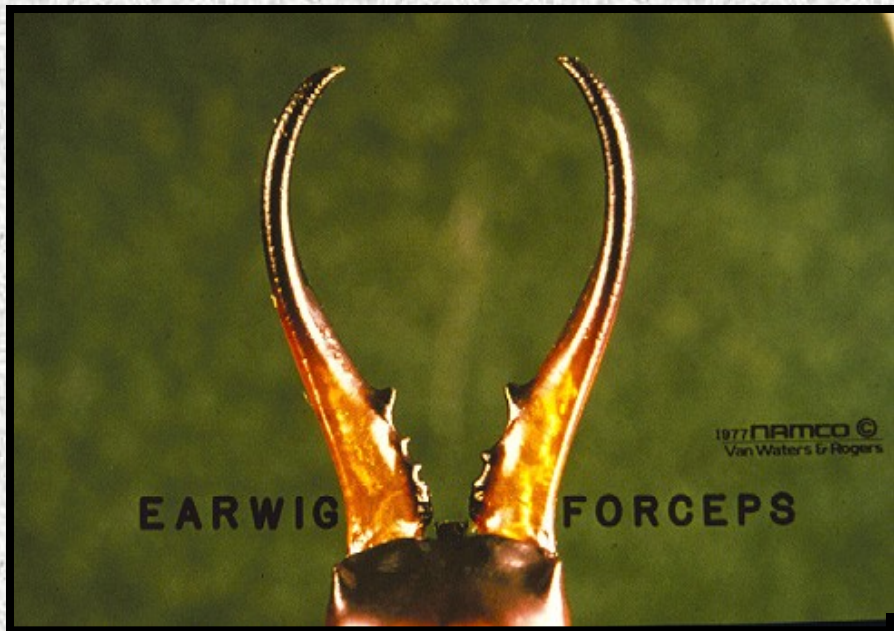
- Chewing mouthparts
- Hindwings are ear-shaped
- Distinctive cerci
- Do not enter ear to feed on brain
- Can be a nuisance



*Earwigs are very distinctive*

*Earwigs are omnivorous feeders*





*Very distinctive cerci*

*The hindwing is  
“ear” shaped*



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# *Earwig nymphs receive some parental care*



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# Order Plecoptera

## stoneflies

- Incomplete metamorphosis
- Immature is aquatic (naiad)
- Chewing mouthparts in immatures and adults (adults may not feed)
- Important aquatic food source
- May be important in water quality studies

*Stonefly naiads are usually found in fast-moving, cool waters.*

*They are an important part of the aquatic food chain*

*Water  
Quality  
Indicators*



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*Stonefly adults rarely move far from the stream  
Often copied by fly fisherpersons*



*Some adults  
emerge in  
winter*

# Order Pthiraptera

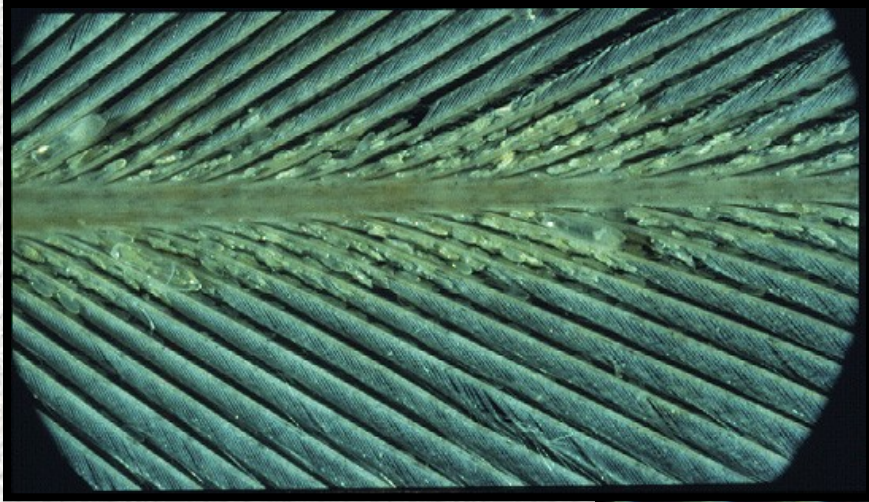
## chewing and sucking lice

- Incomplete metamorphosis
- Chewing lice (Mallophaga) feed mainly on birds - feathers, skin, hair, debris
- Sucking lice (Anoplura) feed mainly on mammals - blood
- Lice are secondarily wingless
- Eggs called nits when glued to hairs
- Can be serious pests

*Chewing lice (Mallophaga) have chewing mouthparts  
The head is as wide as the thorax*

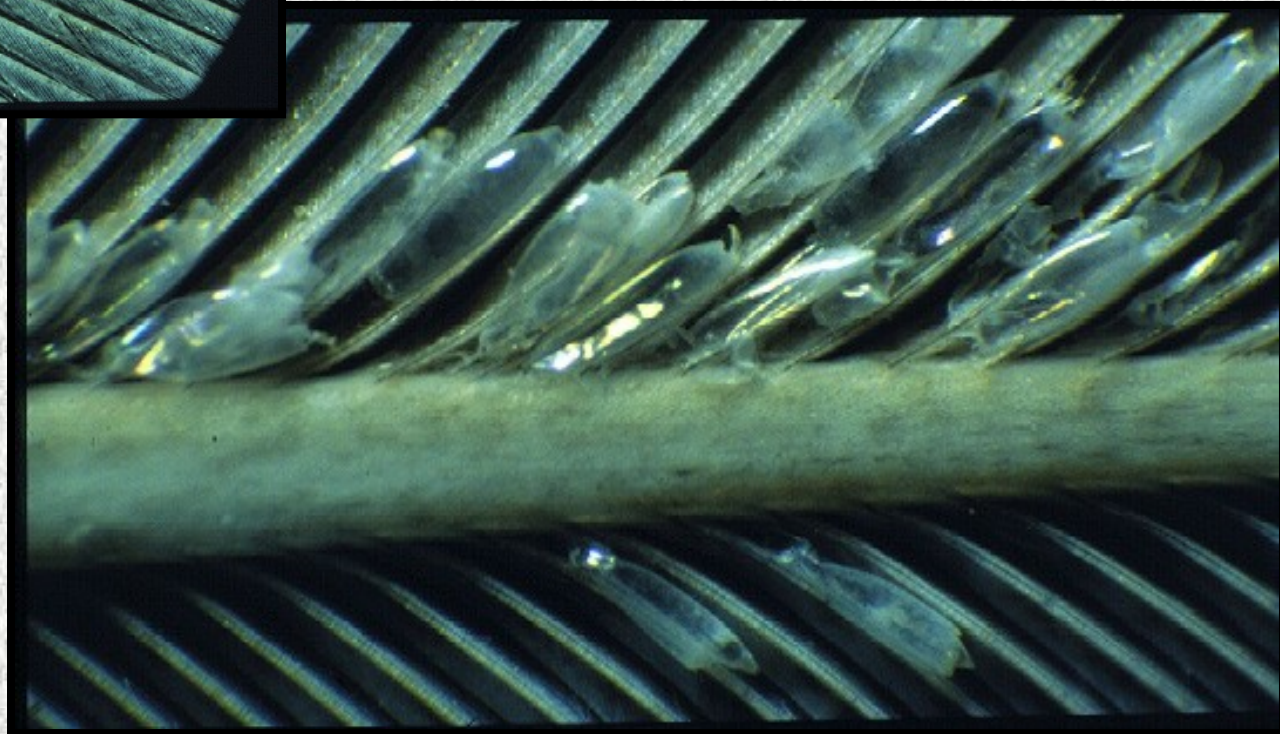


*Most feed  
on birds*



*Feed on feathers,  
skin, blood, debris*

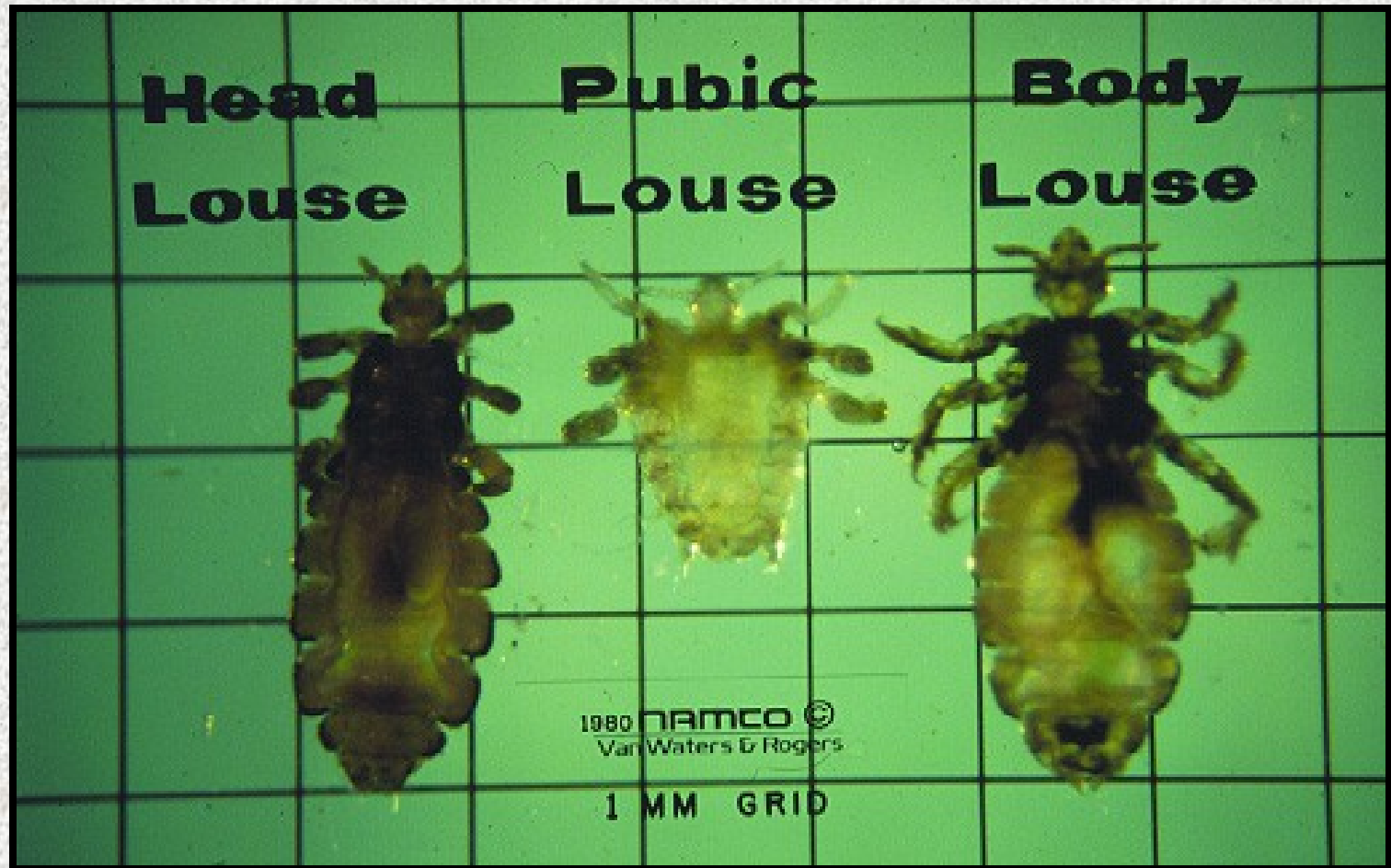
*Eggs are  
laid on the  
shafts of  
feathers*



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*There are three types of sucking lice found on humans.*

*All  
feed on  
blood*



*Head lice remain on the body when not feeding*

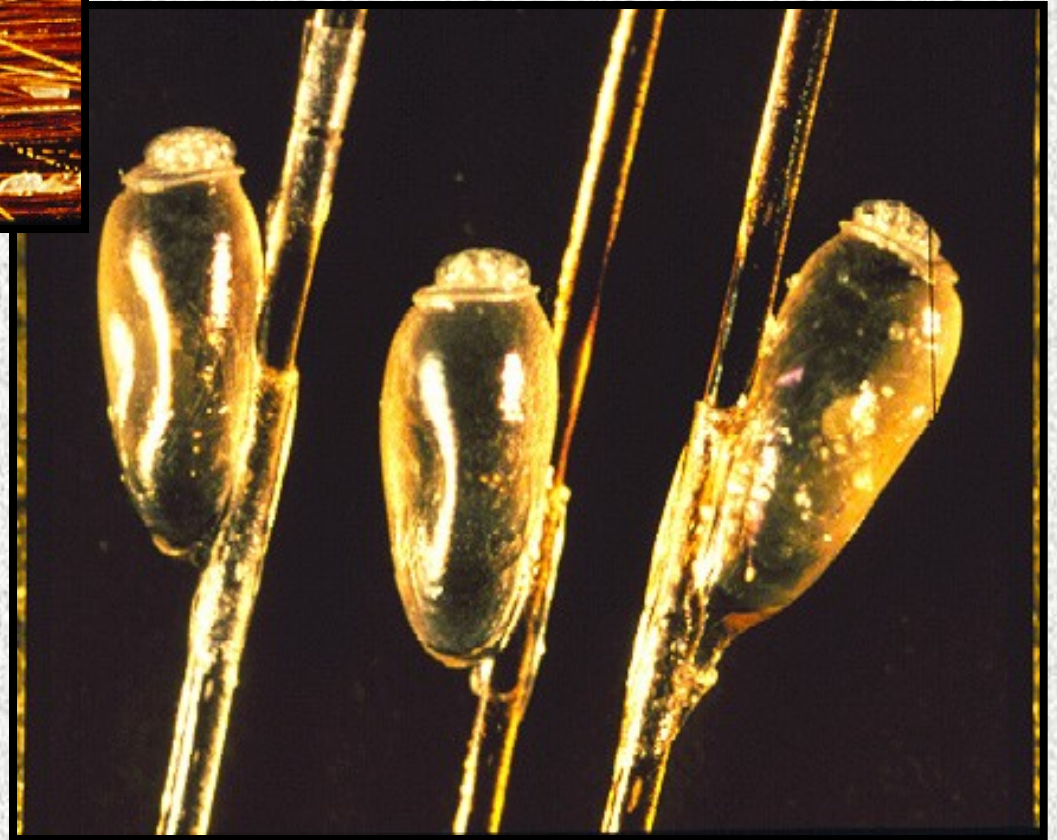


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*Head lice glue their eggs  
to hair shafts*

*Eggs glued to  
hairs are called  
“nits”*



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*Body lice leave the body after feeding*



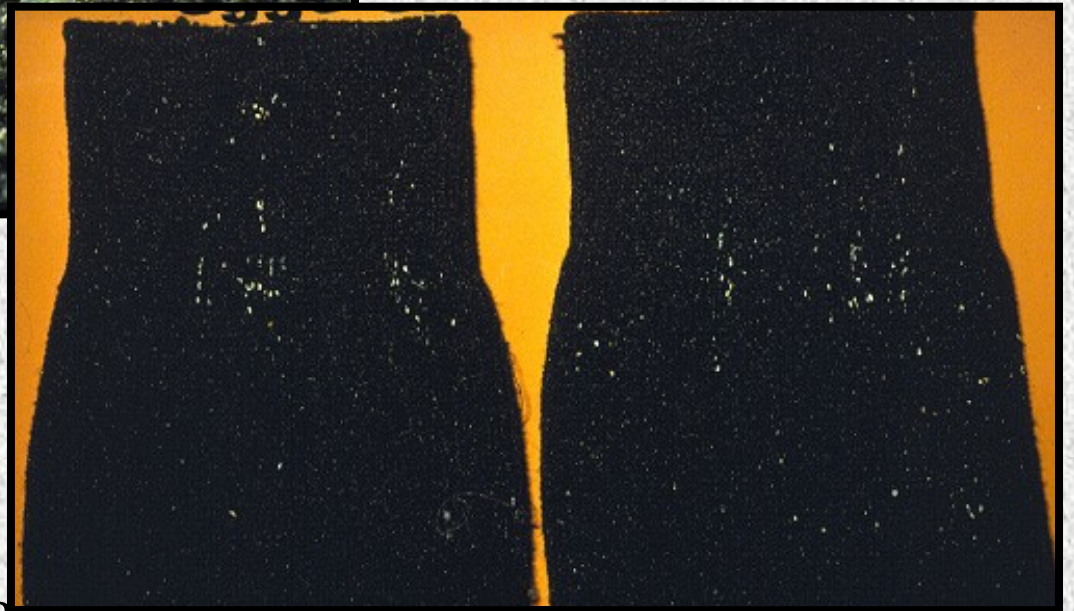
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☹ Eggs are laid on clothing and in bedding

☹ Easy to contact



*Seam  
squirrels*



*The crab or pubic louse*  
*Found on coarse body hairs*

*Eggs laid*  
*on body*  
*“nits”*

*Cause*  
*severe*  
*itching*



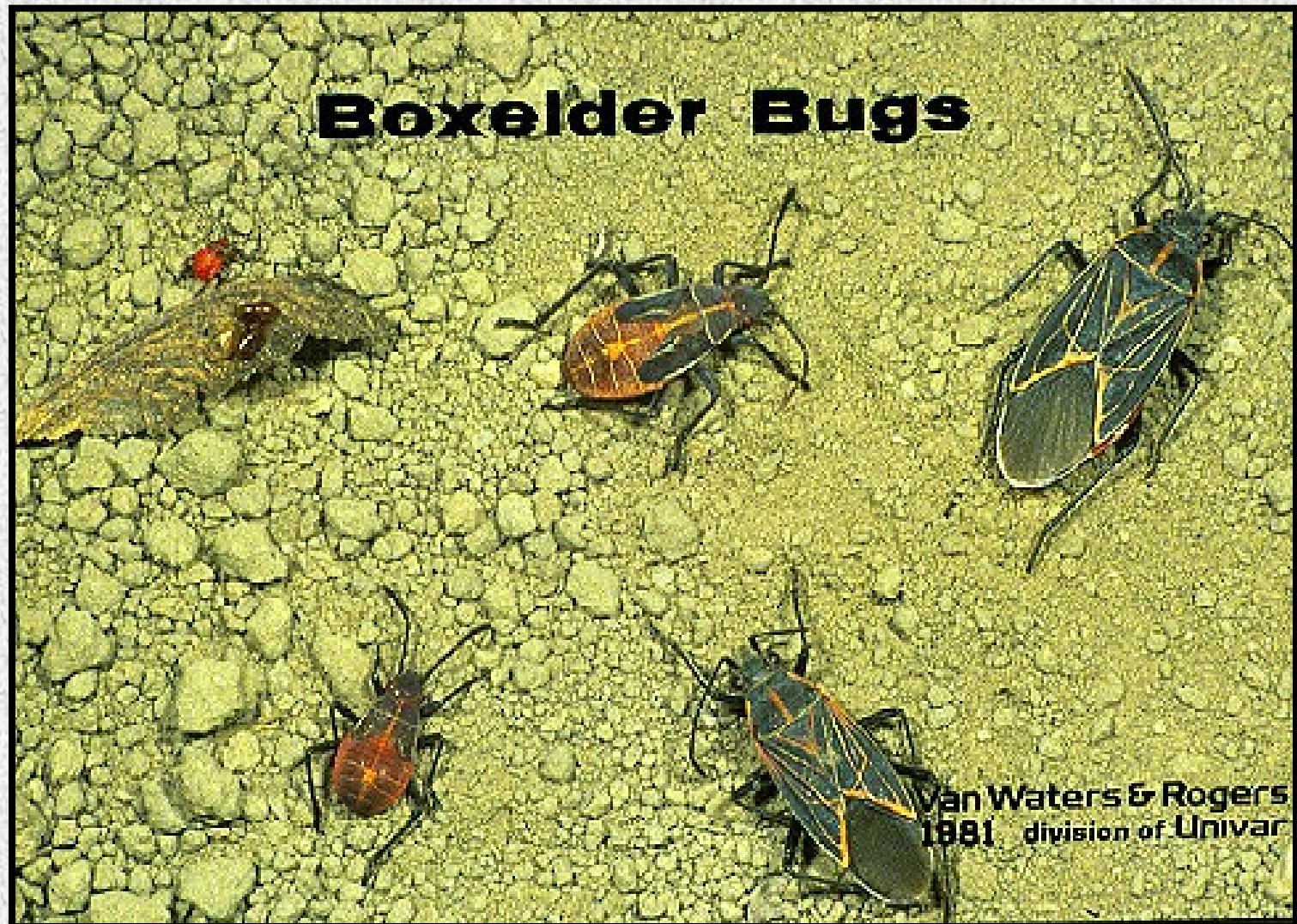
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# Order Hemiptera

## true bugs

- Incomplete metamorphosis
- Front wing called a hemelytron
- Piercing and sucking mouthparts
- Feeding habits varied - plant juices, some predators, some parasites
- Occur in varied habitats

# *Hemipteran - True Bug! - Lifecycle*



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*Egg*  
*Nymph*

*Adult*

*True bugs have  
piercing and  
sucking  
mouthparts*



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# *Wing of a true bug - hemelytron*



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*Many true bugs are phytophagous*

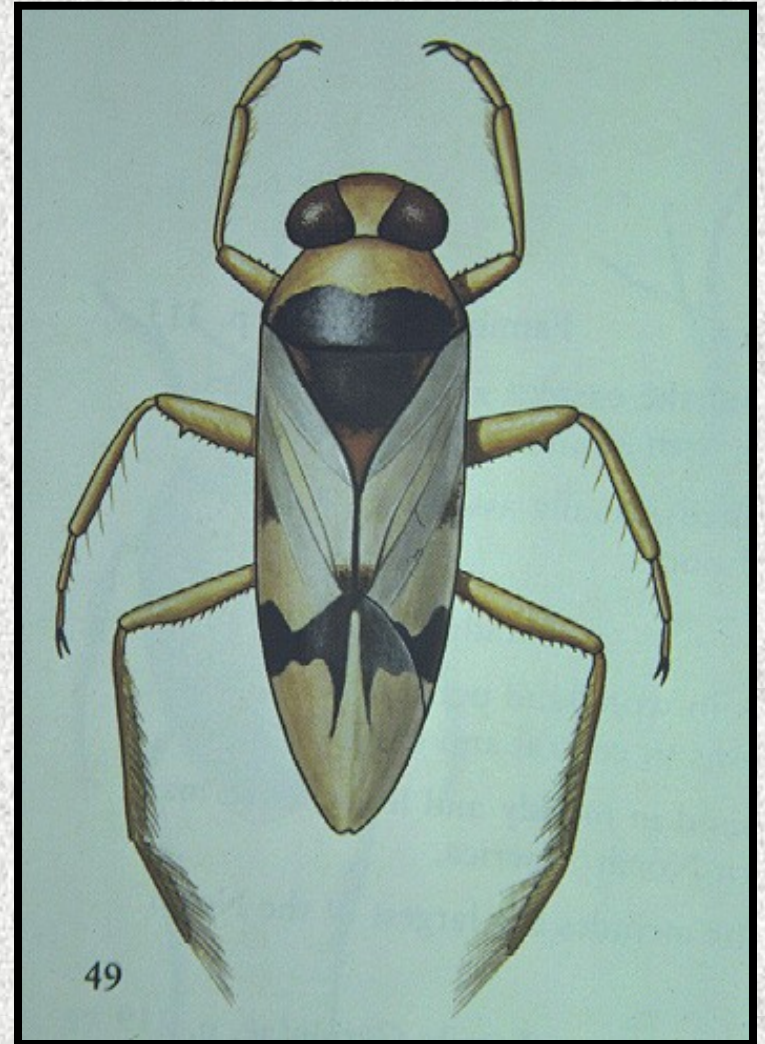
*This type of  
damage is  
called  
“cat-facing”*



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*Many true bugs  
are aquatic*



*Many true bugs are predators*



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**Bed Bug adult  
feeding on blood**



Van Waters & Rogers

*Bedbugs are  
parasitic*

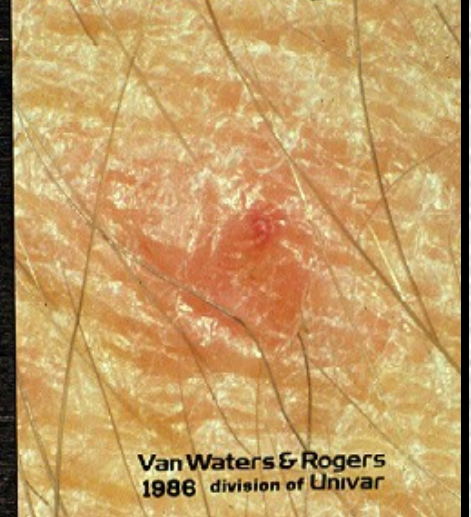
*Leave host after  
feeding*

*Bedbugs appear  
To be making  
A comeback!*

**Bed Bug  
excrement  
left near  
wound**



**Bed Bug bite  
on 7th day**



Van Waters & Rogers  
1986 division of Univar



*"Kissing Bugs"*

*Sign of Romana  
Chagas Disease*



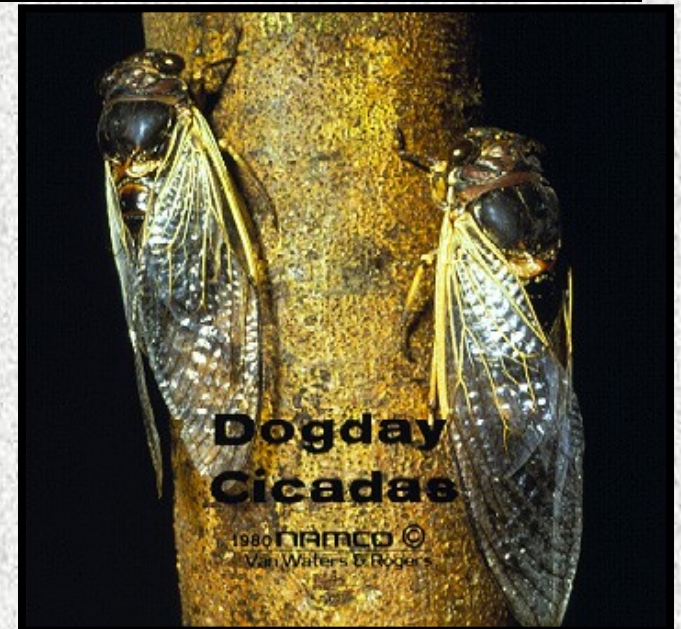
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# Order Hemiptera

(cont.) aphids, leafhoppers, scales, whiteflies, psyllids

- Incomplete metamorphosis
- Piercing and sucking mouthparts
- All feed on plant juices
- Front and hind wings (when present) are similar
- Some are serious pests

# *Cicada*



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# *Leafhoppers*



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# *Spittlebugs*



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*Many aphids are parthenogenetic*



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*Many homopteran populations can build very quickly*



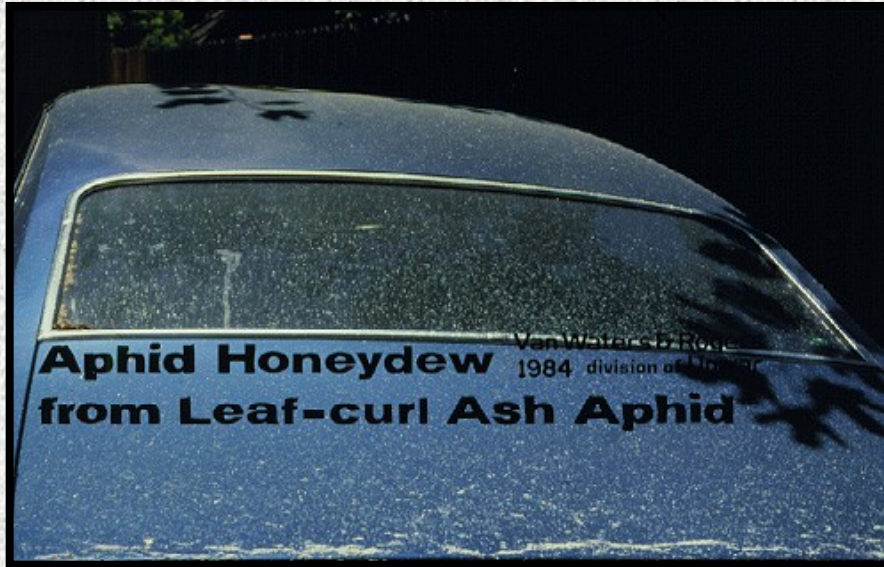
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# *Cooley Spruce gall aphid*



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*Honey-dew is the sugary secretion of some homopterans*



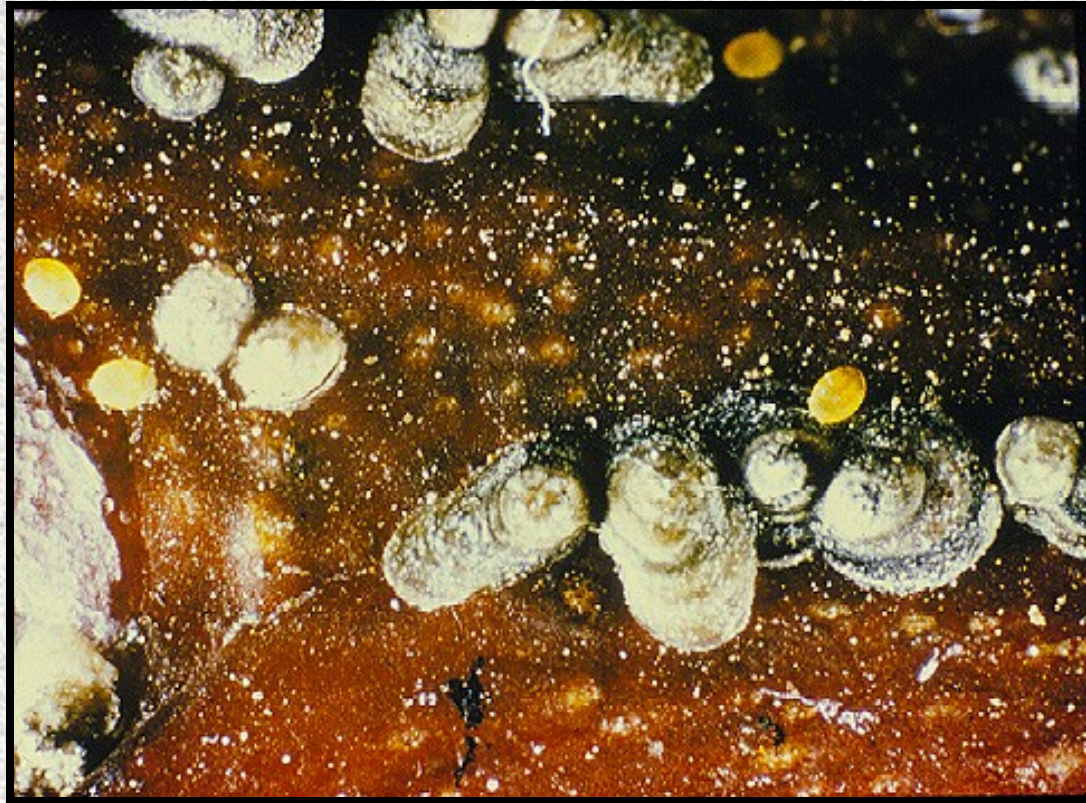
*Don't park under a maple tree!*



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*Scales cover themselves in a waxy secretion*

*San Jose Scale*



*Scale removed*



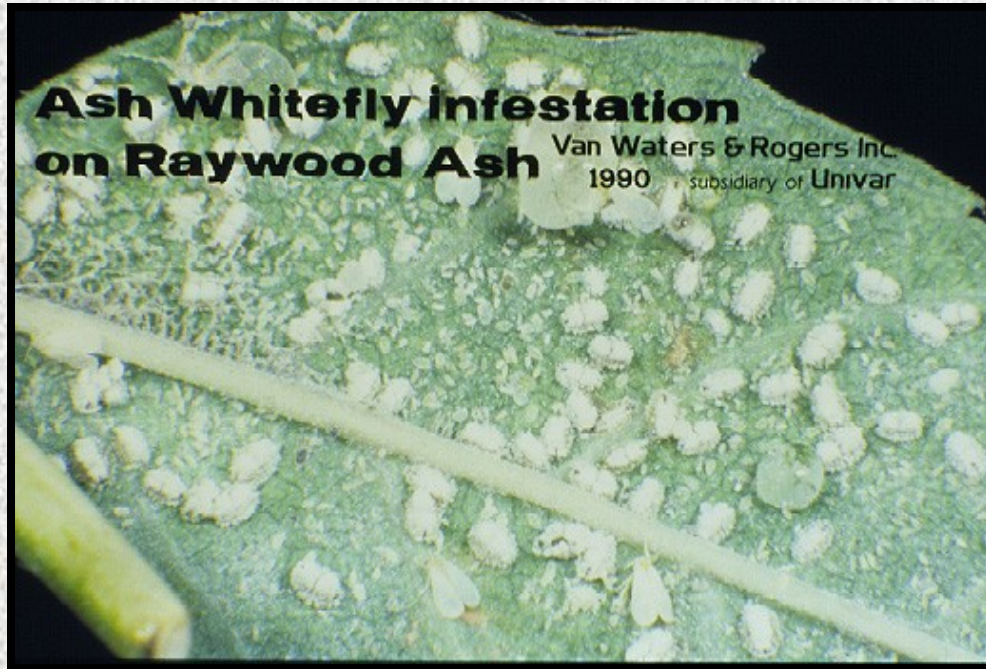


*Cottony maple scale*

*Pine needle scale*



# *Whiteflies can be pests, especially in greenhouses*



*Rapid population Growth!*



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*A beautiful homopteran!*



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*There are some big homopterans!*

*Alligator  
"bug"  
Peanut-head*



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