
Insect Ecology

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***Disclaimer: Pictures were taken from the www web for teaching purposes only**

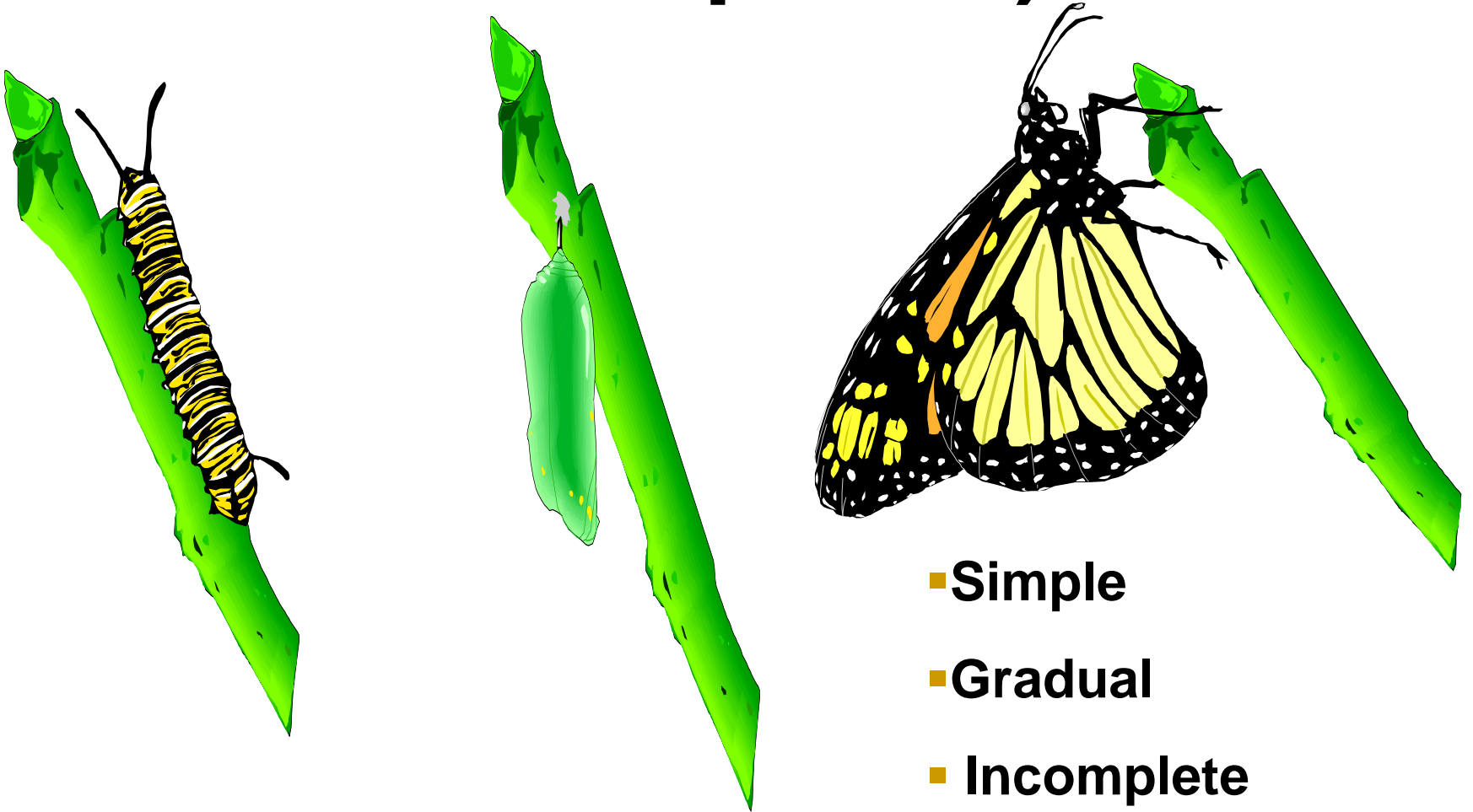
Outline

- **Insects adaptations**
 - **Metamorphosis**
 - **Temperature, water and humidity**
 - **Diapause**
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Summary

- **Segmented body divided into three sections: head, thorax, abdomen.**
 - **Mouth including mandibles.**
 - **Three pairs of legs attached to the thorax.**
 - **One pair of antennae.**
 - **External skeleton (exoskeleton)**
 - **Usually, one or two pairs of wings attached to the thorax**
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Metamorphosis (insect development)



- Simple
- Gradual
- Incomplete
- Complete

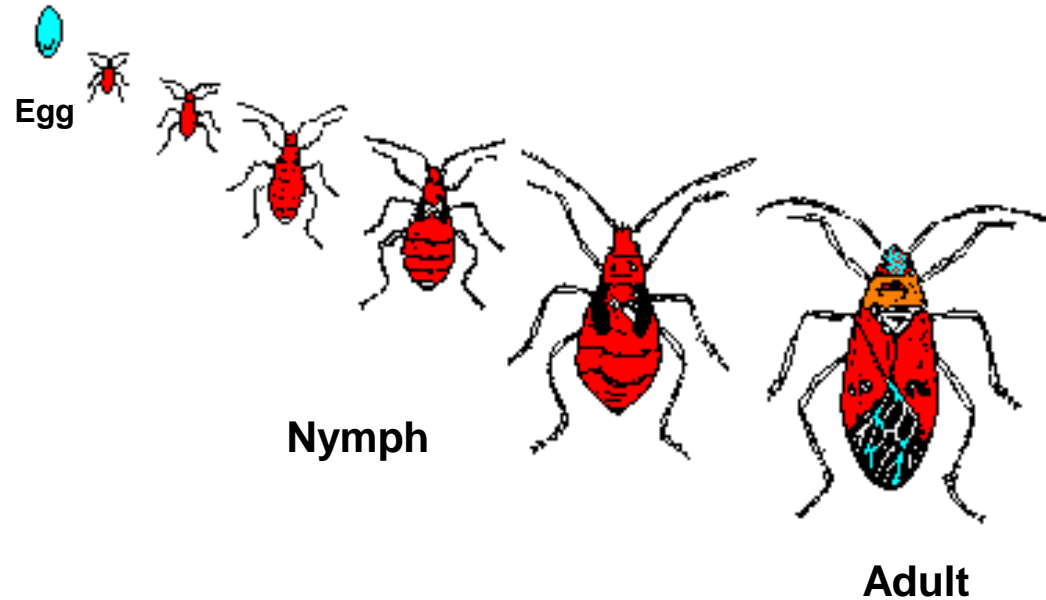
Simple metamorphosis

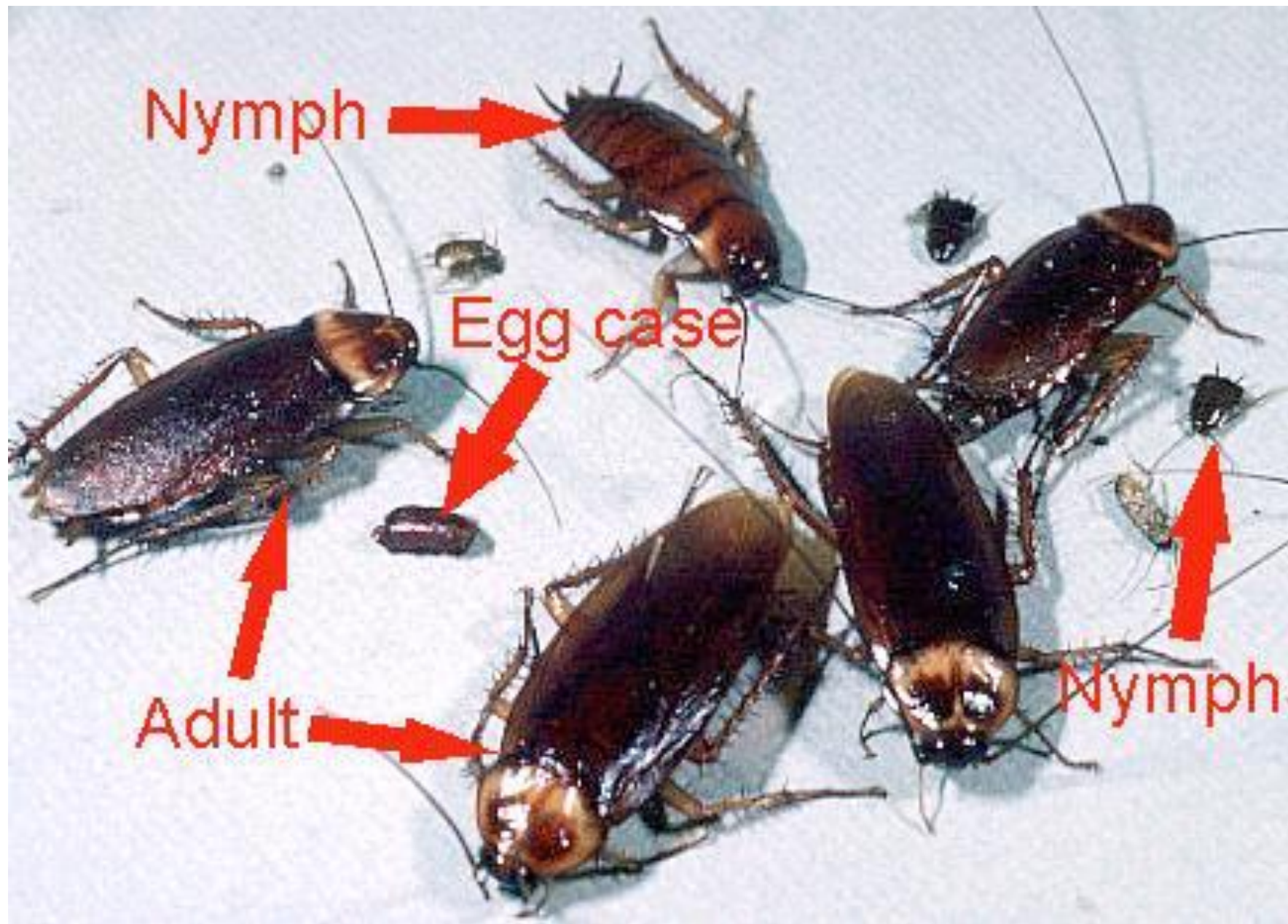
- There are a few primitive insects who do not undergo any metamorphosis
- Apterygota: springtails, proturans, diplurans, and bristletails
- Most common: silverfish, firebrats, springtails mostly
- The proturans and diplurans mostly show up in soil



Gradual metamorphosis

- These insects hatch from an egg and look much like miniature adults: **Nymphs**
- Lack wings and sexual organs until the final molt. Eat the same food as adults
- Examples are grasshoppers, thrips, termites, lice, true bugs and aphids
- Aphids usually skip the egg stage producing live young





Nymph

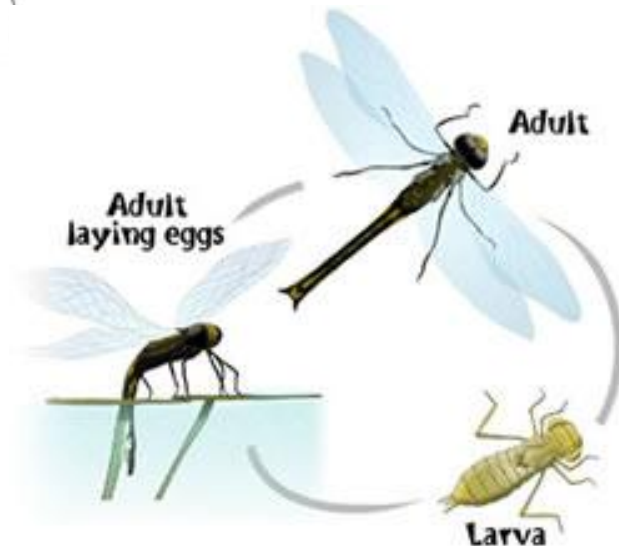
Egg case

Adult

Nymph

Incomplete metamorphosis

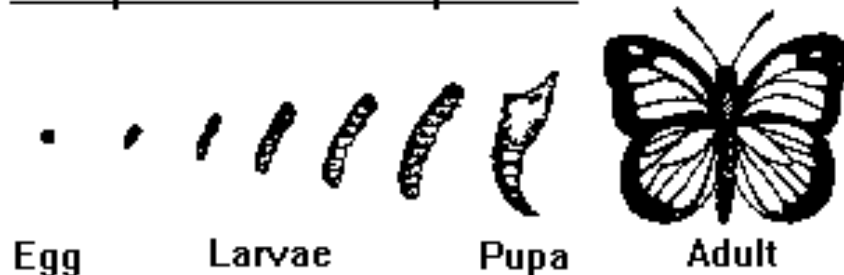
- This term refers to insects who spend part of their life cycle in water: **Naiads**
- Naiads eat a different food than the adults
- Mayflies, stoneflies and dragonflies are good examples
- The final change to an adult occurs not in a pupa, but inside the last naiad stage



Complete metamorphosis

- One of Nature's best tricks
- This growth form is representative of the majority of insects by numbers
- Ones we see most are the beetles, wasps, butterflies and moths, flies, and fleas
- The process involves 4 totally different life stages: egg, larva, pupa and adult

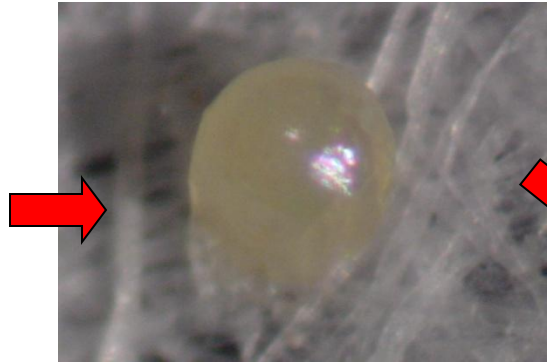
Complete Metamorphosis



Butterflies/Moths



Adults



Egg

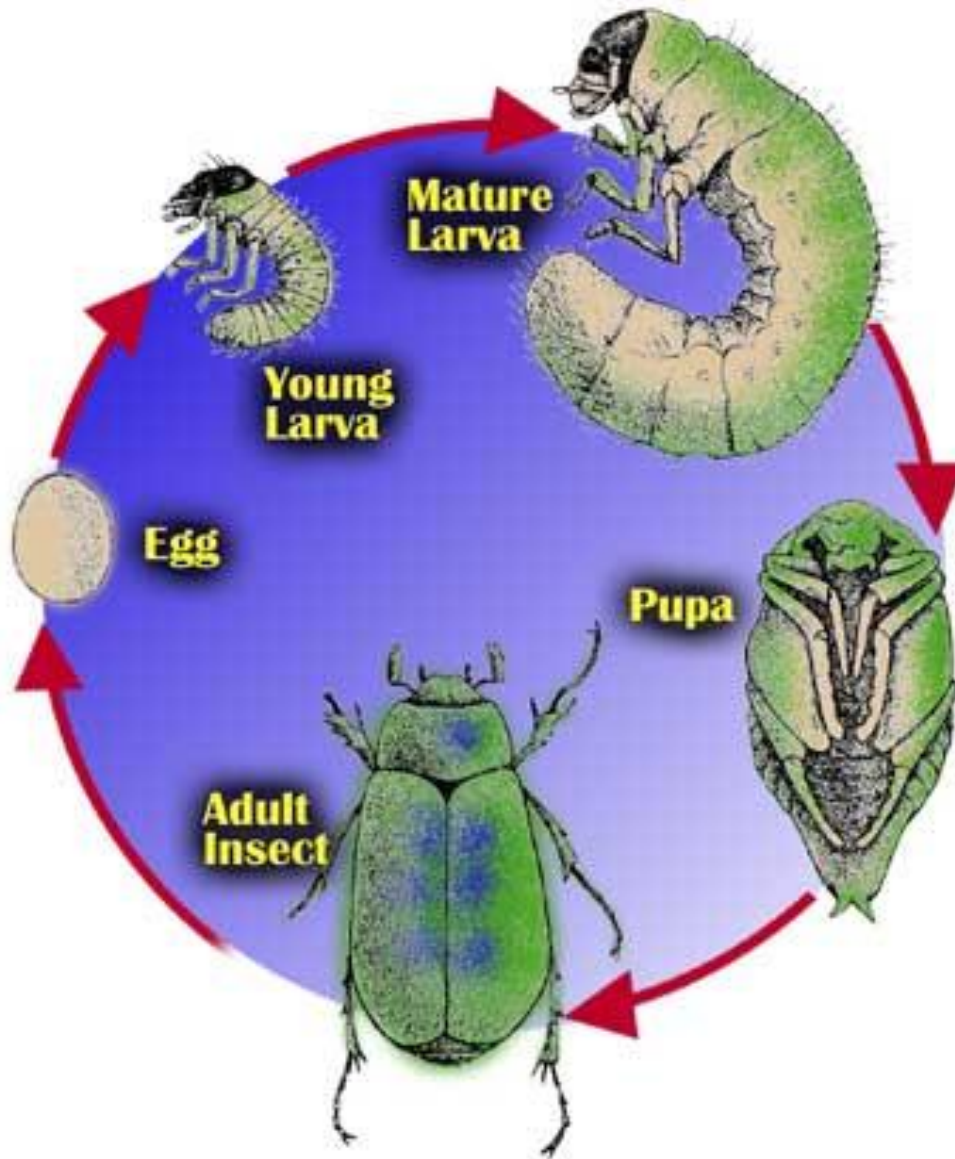


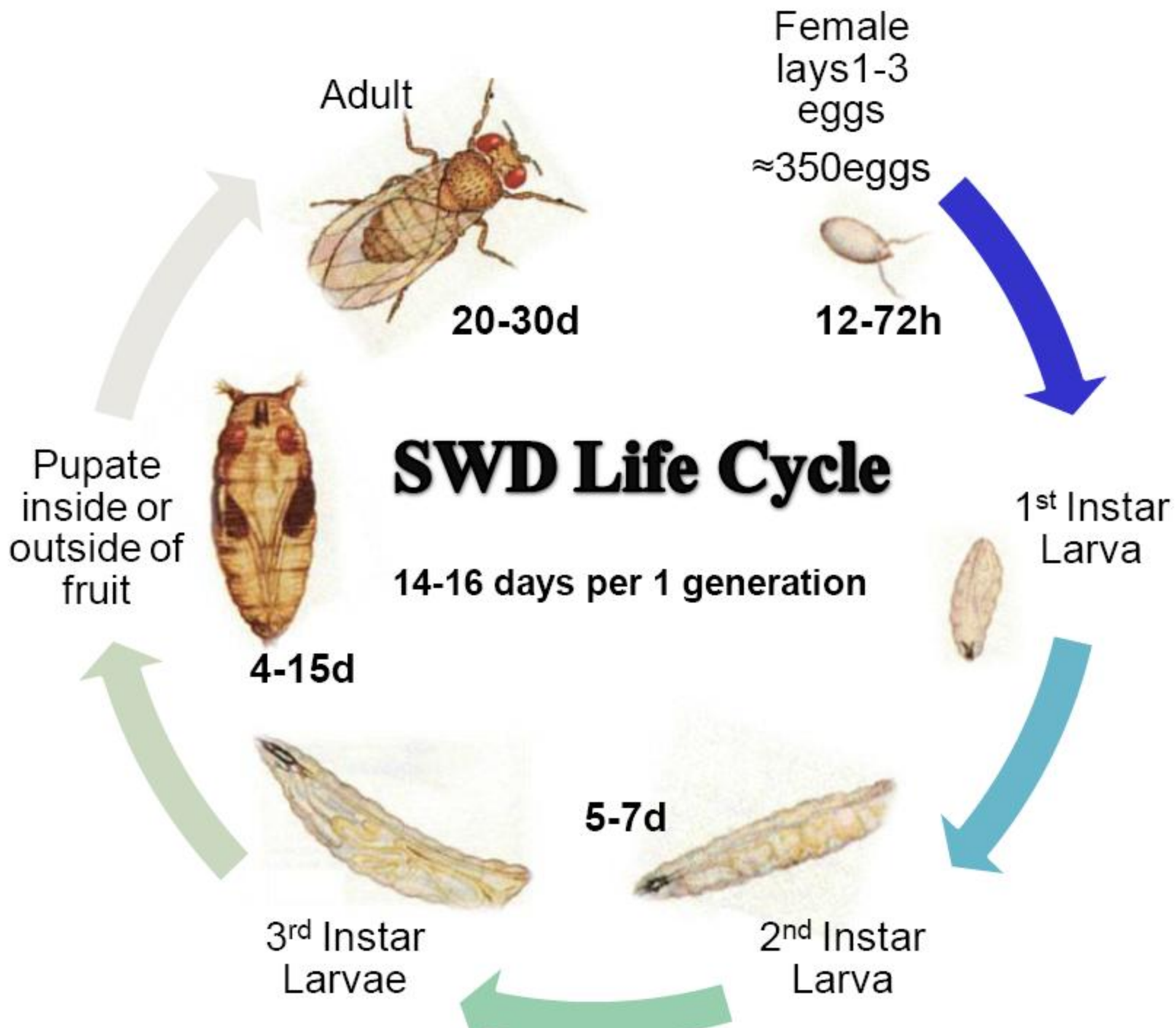
Larvae



Pupae

Beetles





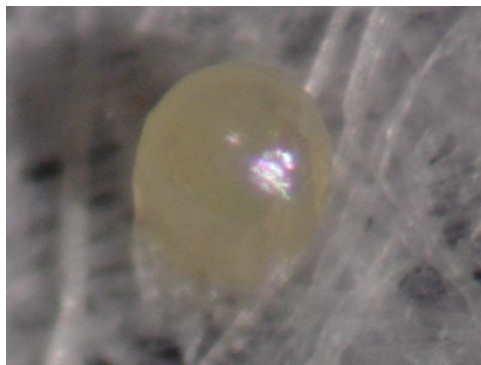
Environment effects on development

- **Temperature**
 - **Humidity**
 - **Diapause**

Temperature

- **Poikilothermic (body varies directly with environmental changes)**
 - **Optimal temperatures**
 - **Sub-optimal temperatures**
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Potato tuberworm



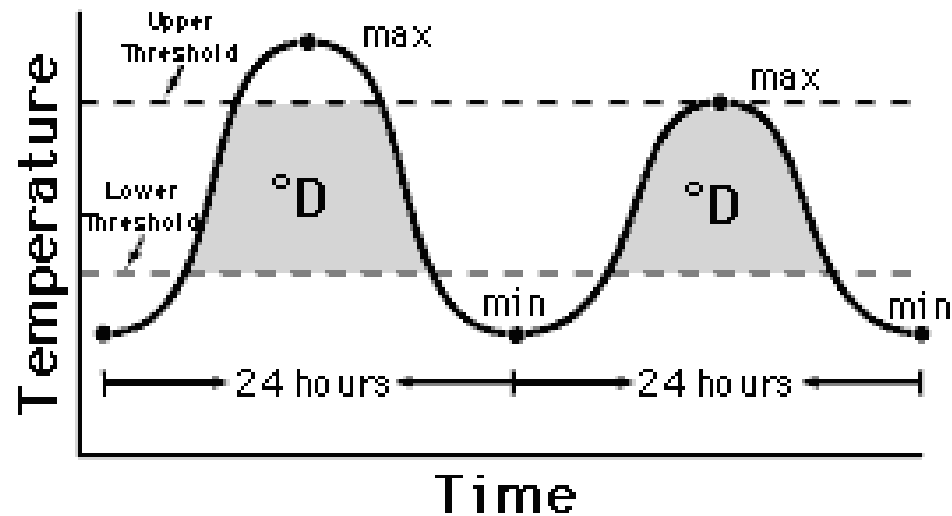
Effects of temperature-Potato Tuberworm

DEVELOPMENTAL EXPERIMENTS AT HAREC -- RESULTS

Temperature	Mean Egg Duration	Mean Larval Duration	Mean Pupal Duration
50 F	41.3 days	90.9 days*	74.3 days*
61 F	15.0 days	33.7 days	27 days*
72 F	7.2 days	15.5 days	12.5 days
82 F	4.2 days	9.0 days	7.9 days
93 F	3.2 days	6.9 days	5.9 days

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- **When temperatures are higher, organisms develop faster.**
 - **Insects require a certain amount of “heat” to develop from one point in their life cycles to another: physiological time.**
 - **The amount of “heat” required to complete a given organism's development is often expressed in units called degree-days ($^{\circ}\text{D}$).**
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- **Upper and lower developmental thresholds have been determined for some organisms.**
- **Thresholds vary with different organisms.**



<http://uspest.org/wea/>

Drosophila suzukii, the Spotted Wing Drosophila (SWD)

....an invasive pest attacking fruit



<http://swd.hort.oregonstate.edu>



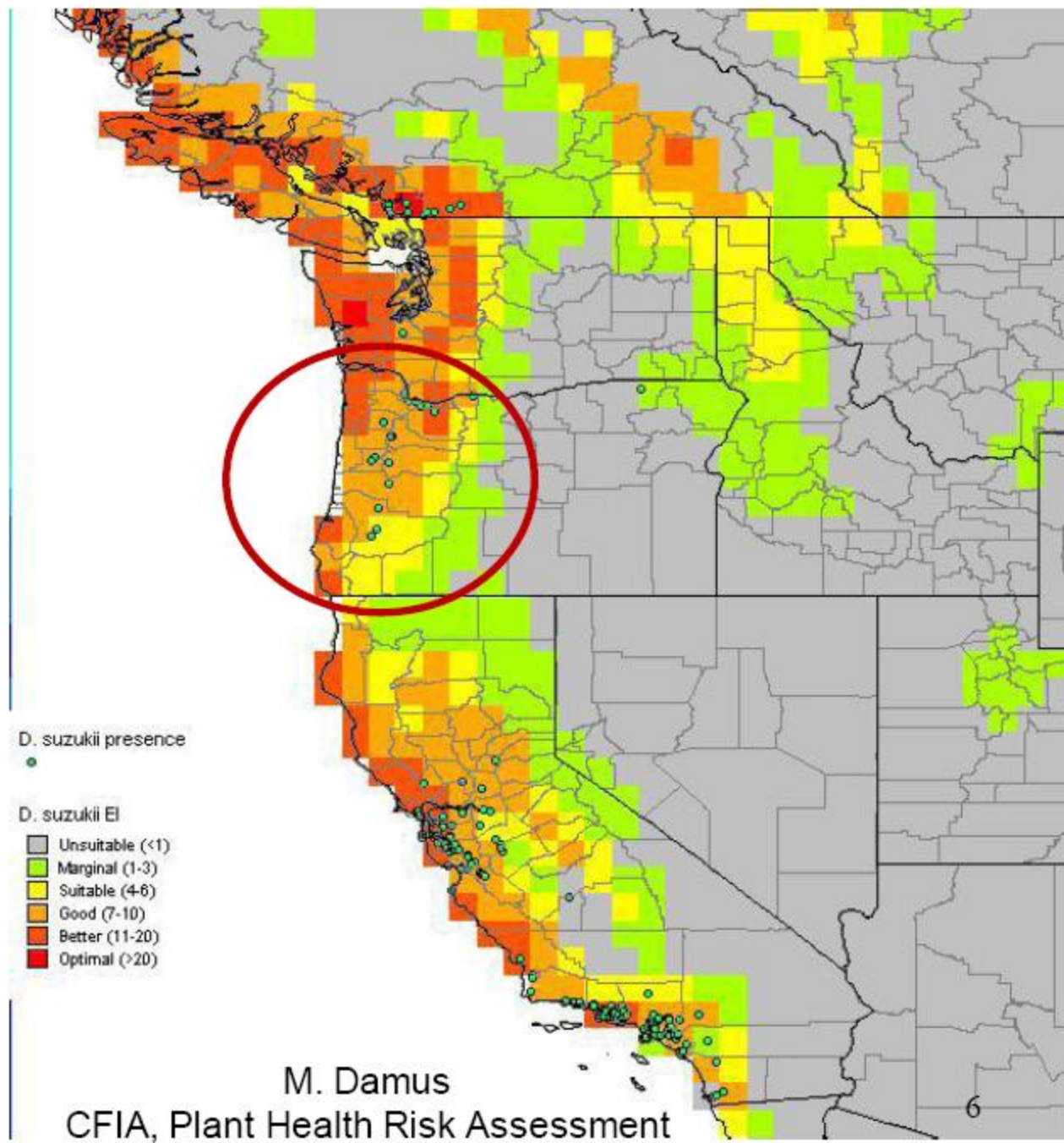
Areas Suitable for SWD

Model matches SWD's response to climate that is suitable for SWD to complete its cycle.

Oregon: Good to Better

Climate parameters:

- Moisture
- Temperature
- Light
- Heat Stress
- Dry Stress
- Wet Stress
- Hot-wet Stress



<http://uspest.org/risk/models?spp=swd>

Humidity

- **Low moisture can affect the development, longevity and oviposition of insects**
 - **Relative humidity (RH)**
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Diapause

- **Temperature and humidity can directly or indirectly interrupt insect development**











Effect of presence of a pupal case and duration that PTW pupae remained in the soil on survival (mean \pm SE) during winter of 2007, in Hermiston, OR

