




All insects develop from eggs




Lady beetle egg masses



German cockroach with ootheca



Parasitic wasp laying egg in caterpillar



Grasshopper laying egg in ground

2

Insect Growth



With few exceptions (e.g., silverfish), only immature insects grow.

In order to grow, an insect must molt:

- shed their old cuticle
- form a new cuticle

3

Hormones


HORMONE - a chemical formed in an organ or body tissue that travels through the body and causes some effect on another body part.

- The primary hormone controlling molting is **ecdysone**.
- Juvenile hormone (JH)** is also involved in the molting process.

4

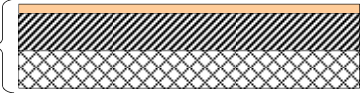
Hormone Production

Some insecticides mimic these hormones - prevent the insect from molting or maturing or cause it to become an adult too quickly.




5

REMEMBER: The outer layer of the exoskeleton is called the **cuticle**. The cuticle contains the chemical **chitin**.



Cuticle {



6



Insect Metamorphosis

- Metamorphosis refers to **a change in form**.
- Insects go through different **life stages** during metamorphosis.

Terms Used in Metamorphosis

Stage - a distinct period in development of an insect.

Instar – the insect’s form in between molts. Usually designated by numbers (e.g., 3rd instar). The instar number is one more than number of times it has molted (e.g., a 3rd instar insect has molted twice)

Knowing the instar of the pest may be important for control (older larvae may be harder to kill).

DiPel ES is a highly selective insecticide for use against listed caterpillars (larvae) of Lepidopterous insects. Close scouting and early attention to infestations is highly recommended. Larvae must eat deposits of DiPel ES to be affected. Always follow these directions:

Treat when larvae are young (early instars) and before economic thresholds of damage have been exceeded.

Larvae must be actively feeding on treated, exposed plant parts.

Thorough spray coverage is needed to provide a uniform deposit of DiPel ES at the site of larvae feeding. For some crops directed drop nozzles by ground machine are required.

Under heavy pest population pressure, use the higher label rates, shorten the spray interval, and/or increase spray volume to improve coverage.

Tank mixes with a contact insecticide may enhance control.

Repeat applications at an interval sufficient to maintain control, usually 3 to 14 days depending on plant growth rate, moth activity, rainfall after treating, and other factors. If attempting to control a pest with a single application, make the treatment when egg hatch is essentially complete, but before economic crop damage occurs.

A spreader-sticker or surfactant, which has been approved for use on growing and harvested crops should be added for hard-to-wet crops. (Not recommended for chemigation.)

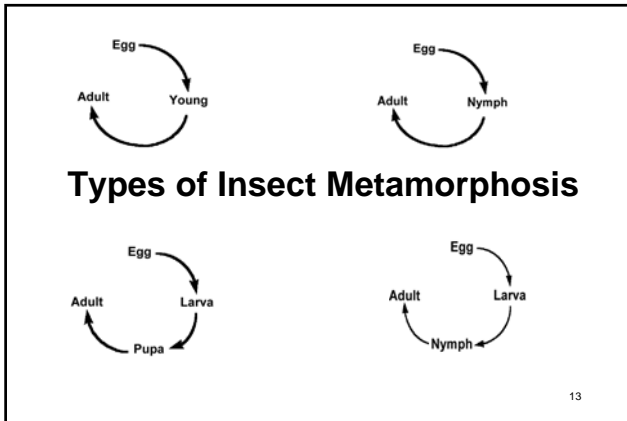
DiPel ES is a non-restricted use pesticide and does not require a restricted use permit for purchase or use.

Insect Life Stages

Egg - most insects deposit their eggs singly or in clusters. Some insects (e.g., aphids) deposit live immatures.

Immatures - young, nymphs or larvae. Usually the destructive stage of an insect.

Adults - primary purpose is reproduction.



No Metamorphosis

- Primitive wingless insects
- Little change in appearance (mostly change in size)
- Adults can molt
- Example - silverfish

14

Gradual Metamorphosis

- Gradual change in appearance
- Immatures (nymphs) and adults usually have the same food preferences.
- Most adults have wings; older nymphs have wing buds
- Adults do not grow or molt.
- Examples – cockroaches, termites, bed bugs, crickets, aphids

15

German Cockroach Life Stages

University of Nebraska Department of Entomology

16

Complete Metamorphosis

- Distinct changes in the insect's appearance.
- Immature = Larvae
 - usually look very different from adults
 - usually have different food preferences from adult.
- Examples – ants, wasps, fleas, flies, mosquitoes, butterflies & moths

17

Indianmeal moth larva

Indianmeal moth adult

Ladybeetle larva

Ladybeetle adult

18

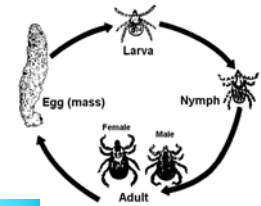
Complete Metamorphosis

- Pupal stage serves as a transition stage from larval form to the adult form
- Most adults have wings; larvae do not have wing pads.

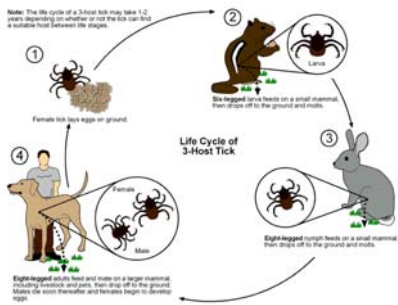


Modified Metamorphosis

- Ticks and mites
- Larva - 6 legs
- Nymphs & adults - 8 legs
- Larvae, nymphs and adults may have different host preferences



Modified Metamorphosis



Questions?