Science of Life Explorations

Biological Control and Beneficial Insects

Let’s Raise Lacewings
Beneficial insects are helpful to gardeners and farmers. As you know, insects have three or four stages of metamorphosis.

The immature stages of many beneficial insects are predators of pests. Often, people assume that any insect they find is a pest and may want to destroy it.

When you use the 6 steps of IPM, you will learn to find out more about the insect before you take any action.

What is a Lacewing?

Why is the lacewing a beneficial insect?

Can insects be raised in the classroom?

In this lesson, we will learn specifically about the beneficial Lacewing. Some of you will actually raise lacewings from eggs!

Raising lacewings is easy and will help you improve your scientific skills of observation and taking data. Insect life cycles occur naturally in the outdoors. Because they are no longer in their natural environment, you will be responsible for their well-being indoors. Following the easy directions should make this a successful project.

Are you ready to learn about the beautiful lacewing and its predatory larvae?
One of the most ferocious animals in the natural world is not the lion or tiger or bear... but the mighty lacewing larva. The adult lacewing is beautiful and gentle, but the larvae are killing machines!

How would you like to meet one of these up close? Well, be glad they are very small. They can give you a pinching bite if you are not careful.

But as you see they become beautiful adult insects. They are a great beneficial insect because they are such good predators!
There are many species of lacewings in North America. Some species are brown and some are green. If you are raising lacewings ordered from a company in California called Beneficial Insectary you will receive the Common Lacewing.

The Common Lacewing’s scientific name is *Chrysoperla rufilabris*. An INSECTARY is a place where insects are raised.

Because the lacewing is an insect, it has ___ main body regions, and ___ pair of jointed legs. Lacewings have two sets of wings. The adult is especially beautiful because of its wings. They are clear and IRIDESCENT.
You have seen other insect anatomy illustrations in previous lessons. Let’s look closely at the detail in an insect’s leg.

Insect legs include these parts: tarsus, tibia, femur, (Someone in your classroom also has similar parts!)

Do you see any similarity between the human leg and insect legs?
Mouthparts!
The lacewing's mandibles are used for both grasping and sucking. As you can see, they are serious tools for hunting and eating.

Lacewing mouthparts illustrations courtesy of Magdelene and Henry Hagedorn of the College of Life Science at the University of Arizona. Thanks!
Let’s learn about the lacewing lifecycle. Lacewings have a complete life cycle or metamorphosis. There are four stages - egg, larvae, pupae, adult.

![Lacewing Life Cycle Diagram](image)

Adult green lacewings live in fields, gardens and forests. They like to be in areas where there is water nearby. They are about 1/2 inch long, not including their wings. Their bodies are pale and they have shiny, copper-colored eyes. Their wings are clear with green veins, so they appear a light green.

Adult Green Lacewings live for up to six weeks. A female may lay 200 eggs in her lifetime. Eggs are attached to a leaf with a long hair-like FILAMENT. After a few days, the larvae hatch and emerge ready to eat pests.

To encourage these beneficial insects in your yard or garden, provide pollen and nectar producing plants. Some species of lacewings overwinter as adults if they find protected places away from extreme cold.
Eggs are oval and pale green in color. Just before the larvae HATCH, eggs become gray in color.

This egg has changed from green to gray. You can see the larva inside, ready to hatch.

A larva has just emerged, or hatched from this egg. Its first thought is finding food.

Lacewing larvae are also known as aphid lions. They are tiny upon emerging from the egg, but grow to 3/8 of an inch long. They attack their prey by seizing them with large sucking jaws. Then, like a straw, the hollow jaws draw out the body fluids of the pest.

Outdoors, each lacewing larva will devour 200 or more pests or pest eggs a week during their two week developmental period. They attack the eggs and larval stages of many soft-bodied insect pests. They will MOLT (outgrow their exoskeleton) twice, then will begin to produce a silken thread and spin a cocoon.
After many days of feeding, the larva creates a cocoon in which it will pupate into an adult. Similar to other larvae, it creates a thin strand of silk to create the cocoon. What other insect does this?

Approximately five days after the larva begins to pupate inside the cocoon, adult lacewings emerge to mate and repeat the life cycle.

**LIFE CYCLE OF A LACEWING**
Compare the anatomy of the ladybug and the lacewing!

**Ladybug has:**

**Lacewing has:**

<table>
<thead>
<tr>
<th>Ladybug has:</th>
<th>Lacewing has:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 soft wings only</td>
<td></td>
</tr>
<tr>
<td>2 soft and 2 hard wings</td>
<td></td>
</tr>
<tr>
<td>short, round abdomen</td>
<td></td>
</tr>
<tr>
<td>long abdomen</td>
<td></td>
</tr>
<tr>
<td>larvae are predators</td>
<td></td>
</tr>
<tr>
<td>beneficial insect</td>
<td></td>
</tr>
<tr>
<td>complete metamorphosis</td>
<td></td>
</tr>
<tr>
<td>fuzzy white ball pupal stage</td>
<td></td>
</tr>
<tr>
<td>dark round pupal stage</td>
<td></td>
</tr>
</tbody>
</table>

Place each of the items in this list where it belongs under ladybug or lacewing. You may use them in both columns if it is true of both.
Now that you have learned about the lacewing, let's raise some of these interesting beneficial insects in our classroom! We'll review as we proceed.

You will be able to raise lacewings throughout their entire life cycle

Can you remember what the stages are?

You'll start with the eggs, next is ______________________

which grows until it is ready to become a ____________________.

Finally you will see the _________________ lacewing and can release it.

Your class will be divided into groups. Each group will be responsible for raising lacewings from egg to adult, and make scientific observations about the process.

Your teacher will help you get started!

Step 1: You will receive lacewing eggs and moth eggs. The moth eggs are a source of food for the larvae once the eggs hatch. Below is a photograph of a lacewing egg as it is found in nature. The adult female attaches each egg to a leaf surface with a tiny, flexible stalk. Some of the eggs you receive may have a bit of the stalk attached. The stalk is called a FILAMENT.

Examine the eggs carefully with a hand lens or magnifier. The color of the eggs may differ because the egg changes color as it gets closer to hatching. Young eggs are bright green and become yellow, then gray just before hatching. Do you see any differences in color?

The eggs should all hatch within 24 hours of each other. Do you have food ready for them?
The small larvae must eat within a few hours of hatching or they will die. Add one fourth of a spoon of moth eggs into each petri dish. You will feed the larvae two more times over the next few weeks.

The photograph to the left shows a larva hatching. Below is an empty egg case.

Despite the availability of moth eggs, lacewing larvae may choose to feed on each other. This is called CANNIBALISM and is common in lacewings and some other insects. Only one larva needs to survive in each dish. You will be able to guess which one will be the survivor, because it will grow larger and faster than the others. This aggressive nature is used in the wild to reduce pest populations.

Many people think that lacewing larvae resemble tiny alligators! Their huge mouthparts make them fierce predators!
Lacewing larvae will molt within the first day or two because they are growing so quickly. You may not notice this, but with a magnifying glass, you might see what appears to be small, dark larvae that are not moving. These are often the molted exoskeleton, or a 'cast skin'.

Feed the hungry larvae more moth eggs in a few days, usually about 7 days after they’ve hatched. They will have molted twice by now and you will soon see the small, white fuzzy ball in the dish. It may be under old eggs, but it is there. It is the cocoon of the larvae, made with a silk-like material. Inside the cocoon, a larva is transforming into an adult.

It will be about 10 to 23 days from the time eggs hatch till the adult emerges from the cocoon. This process is dependent on the temperature in your classroom. If it is cool, it will take longer.

You will be amazed when that aggressive larva emerges as a beautiful, delicate-looking adult!

Look at the lovely wings of the adult. Why do you think it is called a lacewing?

The adults feed on nectar and HONEYDEW and do not eat insects. Only the larvae are predators. Release your adults into your garden or into a greenhouse where insecticides have not been used. The life cycle of the lacewing will start all over again.
Review and test:

1. The lacewing is a beneficial insect. During which stages of its life cycle is it a predator?
   
   ___ adult and larvae  ___ larvae only
   ___ adult only  ___ nymph only

2. What type of mouthparts do lacewing larvae have?
   
   ___ chewing  ___ piercing and sucking  ___ sponging

3. Circle the correct sentence:
   
   Lacewings have complete metamorphosis.
   Lacewings have incomplete metamorphosis

4. Using some or all of these choices, list in order the life cycle of the lacewing starting with the egg, (larvae, nymph, adult, egg, pupae):
   
   ______________________  ______________________  ______________________  ______________________  ______________________

5. Lacewing larvae ________ their exoskeletons __________ times before they spin a cocoon.

6. Lacewing eggs are found one at a time at the end of a tiny stalk called a filament.
   
   ___ true  ___ false

7. On the lines below, write a complete sentence describing one interesting thing you have learned about lacewings.

   __________________________________________
   __________________________________________
   __________________________________________
Vocabulary

cannibalism - an animal that feeds on others of its own kind

filament - a fine thread-like fiber, stalk or wire

honeydew - a sweet, sticky substance secreted by some insects

insectary - a laboratory area that is dedicated to raising insects

iridescent - having the quality of reflecting light in rainbow colors

molt - to shed some of or all of the outer covering of an animal; insects molt their exoskeleton as they outgrow it
Pg 3 Lacewings are among the most successful beneficial insect, yet few people are familiar with them. The adults can sometimes be seen at night near lights.

There is a pest insect called the lace bug; it is a completely different insect than the lacewing.

Pg 4 The contrast in the adult and larval stages of the lacewing is extreme! These illustrations do not represent the true scale of size.

Pg 5 Students should see some resemblance between the legs of the human and the insect; some portions have similar names, both legs are jointed. The coxa is similar to the hip socket.

Pg 6 Lacewing larvae have classic sucking-piercing mouthparts. It is hard to miss them! Remind students that many animals also have a mouthpart called a mandible. It is the name for the jaw.

Pg 7 This is a good time to reinforce previous lessons about insect life cycles:

Complete metamorphosis includes four phases: egg, larva, pupa, adult

Incomplete metamorphosis includes three phases: egg, nymph and adult

Ask students to place a capital letter M between the three larval stages to remind them that the lacewing molts twice. They will be asked this during the review test.

Pg 9 Many moths and butterflies create a cocoon in which they pupate. The cocoon is small and white or may appear gray. Remember, room temperature is a factor in the amount of days for each stage of the life cycle.
Compare the anatomy of the ladybug and the lacewing!

**Ladybug has:**

- 2 soft and 2 hard wings
- short, round abdomen
- larvae are predators
- beneficial insect
- complete metamorphosis
- dark round pupal stage

**Lacewing has:**

- 2 pairs of soft wings
- long abdomen
- larvae are predators
- beneficial insect
- complete metamorphosis
- fuzzy white ball pupal stage

Now that you have learned about the lacewing, let's raise some of these interesting beneficial insects in our classroom! We'll review as we proceed.

You will be able to raise lacewings throughout their entire life cycle.

Can you remember what the stages are?

You'll start with the eggs, next is **larva** or **larvae**

which grows until it is ready to become **pupa** or **pupae**.

Finally you will see the **adult** lacewing and can release it.

Pg 13 In our experiences with raising lacewings, we found that cocoons were not as easy to spot as we’d expected. Some were under debris. Just when we thought too much time had passed and we’d failed in our project we started to see beautiful lacewing adults in each petri dish. Because it was winter, we found a home for them in a heated greenhouse nearby. Students will enjoy looking each day to see what is happening to the lacewings and will be as excited as we were when our adults appeared despite our concern we hadn’t followed the directions properly.
Review and test:

1. The lacewing is a beneficial insect. During which stages of its life cycle is it a predator?
   
   ___ adult and larvae          ___ adult only
   ___ adult only                ___ larvae only
   ___ larvae only               ___ nymph only

2. What type of mouthparts do lacewing larvae have?
   
   ___ chewing                ___ piercing and sucking
   ___ sponging              ___

3. Circle the correct sentence:
   
   Lacewings have complete metamorphosis.
   Lacewings have incomplete metamorphosis

4. Using some or all of these choices, list in order the life cycle of the lacewing starting with the egg, (larvae, nymph, adult, egg, pupae):
   
   egg,         larvae,            pupae,          adult     

5. Lacewing larvae ________ their exoskeletons ________ times before they spin a cocoon.

6. Lacewing eggs are found one at a time at the end of a tiny stalk called a filament.
   
   ___true    ___false

7. On the lines below, write a complete sentence describing one interesting thing you have learned about lacewings.

   __________________________________________________
   __________________________________________________
   __________________________________________________
   __________________________________________________