

**Vocabulary** \_\_\_\_\_

abdomen  
 antennae  
 aposematic coloration  
 beneficial insects  
 bioluminescence  
 Coleoptera  
 complete metamorphosis  
 elytra  
 exoskeleton  
 honeydew  
 larva, larvae  
 luciferin  
 luciferase  
 negative geotropism  
 pupa, pupae  
 thorax

**Resources on the Internet** \_\_\_\_\_

[www.nhm.ukans.edu/ksem/beetles](http://www.nhm.ukans.edu/ksem/beetles) — The Coleopterists Society provides beetle-related links to other sites.

[www.entsoc.org](http://www.entsoc.org) — This site includes links to just about any bug-related site on the Web.

[www.sasionline.org](http://www.sasionline.org) — The Sonoran Arthropod Studies Institute is a non-profit organization dedicated to arthropod research and education projects.

[www.nhm.org](http://www.nhm.org) — The Natural History Museum of Los Angeles County's web site includes pages devoted to the Insect Zoo.

**Suggested Reading for Educators** \_\_\_\_\_

Bellamy C., Evans, A.V., 1996. *An Inordinate Fondness for Beetles*. Henry Holt Publishing, New York, NY.

Echols, J.C., 1993. *Ladybugs*. Lawrence Hall of Science, Berkeley, CA.

White, R., 1983. *A Field Guide to the Beetles of North America*. Peterson Field Guide Series. Houghton Mifflin, Boston, MA.

**TEACHER'S GUIDE BY:** \_\_\_\_\_

**SARAH S. THOMPSON**  
*Education Specialist — Insect Zoo*  
 Natural History Museum of  
 Los Angeles County

**ARTHUR V. EVANS, D.Sc.**  
*Insect Zoo Director*  
 Natural History Museum of  
 Los Angeles County

**COMPLETE LIST OF TITLES** \_\_\_\_\_

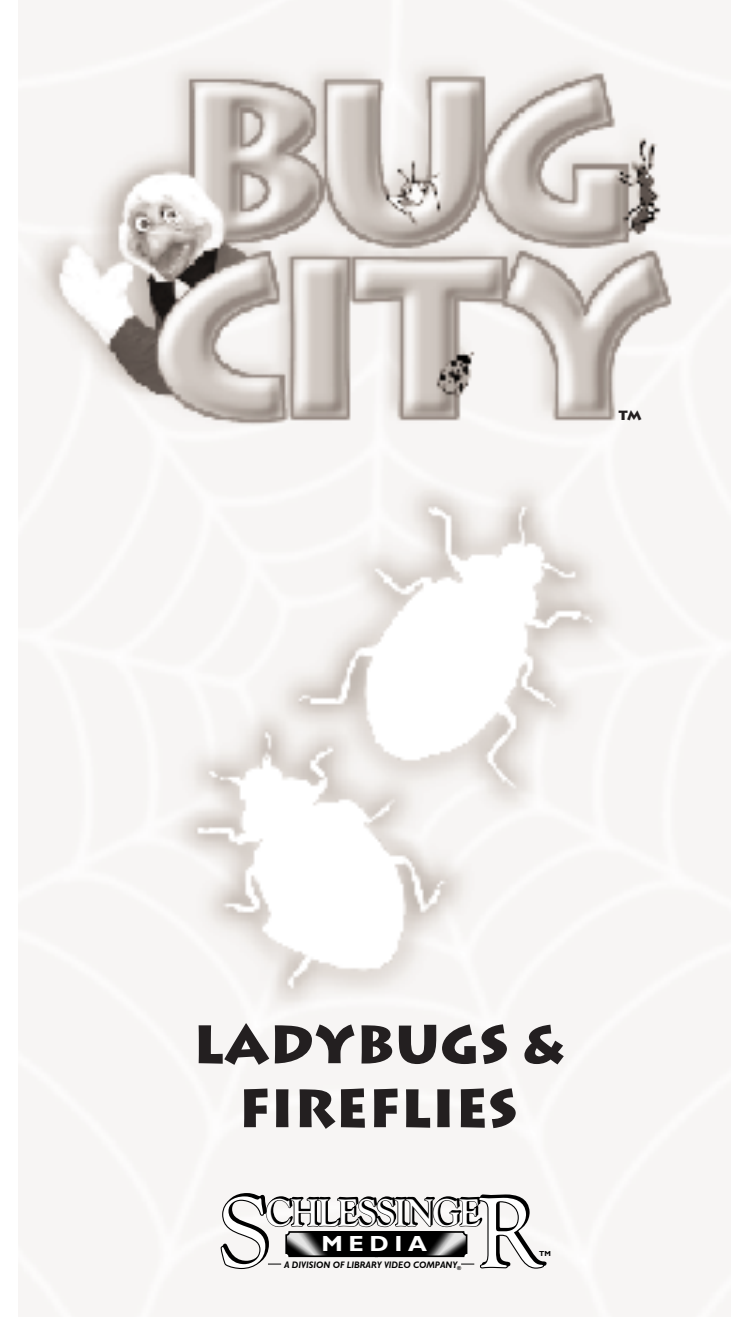
- ANTS
- AQUATIC INSECTS
- BEES
- BEETLES
- BUTTERFLIES & MOTHS
- CRICKETS, GRASSHOPPERS & FRIENDS
- FLIES & MOSQUITOES
- HOUSE & BACKYARD INSECTS
- LADYBUGS & FIREFLIES
- SPIDERS & SCORPIONS

To order other titles in this series, call

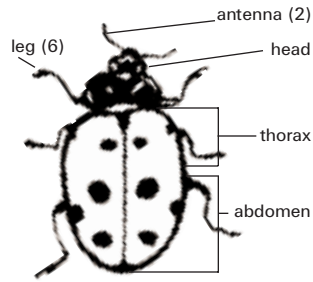
**800-843-3620**

**SCHLESSINGER**  
**MEDIA**  
— A DIVISION OF LIBRARY VIDEO COMPANY, —

Copyright 1998 by Schlessinger Media, a division of Library Video Company  
 P.O. Box 580, Wynnewood, PA 19096 • 800-843-3620  
 Produced and directed by David Yarnell Productions • Executive Producer, Andrew Schlessinger  
 All rights reserved



Imagine an insect that wears its red color like a stop sign, warning other animals that it tastes bad. This insect flies hundreds of miles once a year to winter resting sites, where it huddles with thousands of others of its kind to stay warm. This insect is a fierce predator in your garden, consuming hundreds of plant pests in its lifetime; yet it is gentle with humans. This insect is the ladybird beetle, more commonly known as the ladybug. Ladybugs and their relatives, the fireflies, are just two of the many fascinating beetles that inhabit our gardens.



Ladybugs and fireflies are both insects. Instead of an internal skeleton, they have a hardened shell that protects their bodies called an exoskeleton. All insects have six legs as adults, one pair of antennae and three body sections. The head contains the mouth parts and the sensory organs; the thorax contains muscles needed to move the legs and wings, if any; and the abdomen is where the internal organs needed for respiration, digestion and circulation are located. Ladybugs and fireflies are both members of the order *Coleoptera* ("sheath-winged" insects), characterized by their hardened forewings, called elytra, that protect the hindwings. Most beetles have mouth parts designed for chewing, and they have heavily armored bodies.

## Ladybugs

There are 400 different kinds of ladybugs in the United States; some are yellow with black spots, some are green, and some are black with red spots. Whatever color they are, most ladybugs are considered by humans to be beneficial insects. They consume aphids, insects that cause much damage to plants by sucking out plant fluids. There are species of ants that actually herd and protect aphids for a sweet substance called honeydew that aphids produce. This sweet treat is eaten by the ants. Because ladybugs eat between 10 and 100 aphids in a day, ants will chase ladybugs away from their aphid herds. The ants may have difficulty in defending their herds because the ladybug's shell is hard and slippery.

Red ladybugs wear their colors like an advertisement. Like other brightly colored animals (such as the poison dart frog), they taste bad and can exude a yellowish fluid from their leg joints to discourage any predators who might not have gotten the message. They can fly away from danger, but they also hang onto a plant with sticky suction cup feet and wait for danger to pass by, or even play dead. Ladybugs always walk upwards, away from gravity. This is called negative geotropism (geo=earth, tropism = towards something), and it is helpful to the ladybug when searching for aphids, which are often found at the tips of plant branches.

Ladybugs undergo a process called complete metamorphosis; there are four major stages in their life cycle, each of which looks different from the next. Ladybugs hatch from eggs laid in clumps of 200 to 1,000 in the spring. The ladybug larvae are black and protected by bristles all over their bodies. The larvae immediately get to the business of eating, consuming far more aphids than the adults. After 3-6 weeks the larvae form pupae, where the dramatic transformation of larva to adult takes place, and emerge several weeks later as adults. Several times per year, adults migrate to areas with more abundant food. However, in the western United States, they gather in enormous numbers and spend the winter in sheltered canyons, even though there are no insects for them to feed on. Human ladybug collectors take full advantage of this phenomenon, collecting the hibernating ladybugs and selling them to nurseries for biological pest control.

## Fireflies

Fireflies are not flies at all, but beetles that have the amazing ability to produce light in their bodies. This process is called bioluminescence and is still not fully understood by humans. Fireflies create light in part by mixing two chemicals in their abdomens, luciferin and luciferase. These chemicals must be mixed together in the presence of oxygen; to control the number and duration of light flashes, fireflies control the flow of oxygen to their light-producing organs. In some southeast Asian countries, thousands of fireflies gather en masse in certain trees, all frantically flashing at each other to attract mates. Soon all the fireflies are flashing in a rhythm, like an audience clapping in unison. These trees become so brightly lit with fireflies that sailors at sea can use them to navigate back to land.

Bioluminescence is a form of insect communication: males and females that are ready to mate locate each other by the pattern of flashing lights. Different species of fireflies have different flashing patterns and different colors of light, from greenish to orange, depending on the species and its diet. In this country, fireflies are solitary, only coming together to mate. A male firefly flies around in search of a female. Females usually sit on a perch and answer these flashes only when they are interested in mating. With a penlight, you can "answer" a male firefly's flashes as he flies nearby, delaying your answer a few seconds like a female would. Sometimes a male will fly closer to investigate this potential mate. Fireflies, like other beetles, undergo the four life stages of complete metamorphosis. The larva may glow, though it does not yet flash.

## Explore Negative Geotropism in Ladybugs

1. Collect ladybugs or buy some in a nursery.
2. Divide students into groups of four or five and give each group a glass jar with a lid and 1-2 ladybugs to observe.
3. The ladybugs can be kept for a short time in jars with leaves and branches to climb on, but they need many live aphids to eat. If you have a plant with aphids, simply break off an infested branch and place in each of the ladybug jars. If you can't find aphids to feed the beetles, only keep the ladybugs for a day in the classroom, and then release them.
4. Have students gently place beetles on a twig held vertically, then turn the twig upside down and watch the beetle again crawl upwards.

## Suggested Extensions

Have students investigate which animals exhibit aposematic coloration (colors as a warning). Using examples such as the brightly hued poison dart frog, monarch butterfly and coral snake, explore which colors mean STOP in the animal world. Examine how these colors are used in our culture, from stop signs to fire engines.

Students can draw the beetles, labeling parts of the beetle's body (head, legs, antennae, elytra; thorax is a little hard to spot).