

Insect Ecology

Reading Preview

Key Concepts

- Why are insects important in food chains?
- What are two other ways insects interact with their environments?
- What are some ways used to control insect pests?

Key Terms

- food chain • ecology
- producer • consumer
- decomposer • pollinator
- pesticide
- biological control

Target Reading Skill

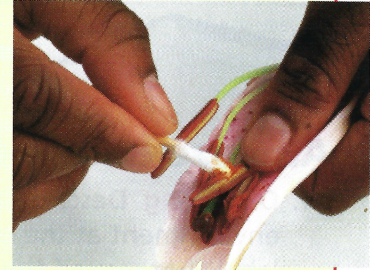
Building Vocabulary Using a word in a sentence helps you think about how best to explain the word. After you read the section, reread the paragraphs that contain definitions of Key Terms. Use all the information you have learned to write a meaningful sentence using the Key Term.

Lab
zone

Discover Activity

What Materials Carry Pollen Best?

1. Use an eraser to transfer some pollen between two flowers your teacher gives you.
2. Next, use a cotton swab to do the same. Did the eraser or cotton swab transfer pollen better?



Think It Over

Inferring How might its ability to transfer pollen between flowers affect an insect's role in the environment?

In a meadow, a caterpillar munches the leaves of a plant. Later that day, a bird eats the caterpillar. Years later, after the bird has died, a beetle eats the dead bird. The plant, caterpillar, bird, and beetle are all part of one food chain. A **food chain** is a series of events in which one organism eats another and obtains energy. The study of food chains and other ways that organisms interact with their environment is called **ecology**.

Insects and the Food Chain

A food chain starts with a **producer**—an organism that makes its own food. Most producers, such as grass and other plants, use energy from sunlight to make their food. In a food chain, producers are food for consumers. A **consumer** is an organism that obtains energy by eating other organisms. Some consumers, like caterpillars, eat producers, and some eat other consumers. Decomposers, such as carrion beetles, also play a role in food chains. A **decomposer** breaks down the wastes and dead bodies of other organisms. In a food chain insects may play the roles of consumer and decomposer. In addition, some insects are prey for other consumers.

Insects as Consumers of Plants The roles of insects in a food chain are shown in Figure 20. **Insects play key roles in food chains because of the many different ways that they obtain food and then become food for other animals.**

Many insects are consumers of plants. Perhaps you have tried growing tomato plants and seen how fat green caterpillars ate up the leaves. In fact, insects eat about 20 percent of the crops grown for humans. Insects eat most species of wild plants, too. Some insects eat the leaves of plants, while others eat the sap, bark, roots, and other parts of plants.

Insects as Prey Insects play another role in food chains—they are prey for many animals. That is, other consumers eat insects. Many fishes and birds eat insects to survive. For example, the main source of food for trout and bass is insects. Indeed, that’s why people use lures called “flies” to catch fishes like these. The lures look like the mayflies and stoneflies these fishes normally eat. Some species of birds feed their young, called chicks, only insects. And the chicks are big eaters! A single swallow chick, for example, may consume about 200,000 insects before it leaves the nest.

Math Skills

Percentage

A percentage is a ratio that compares a number to 100. If 25 percent of 900,000 insect species eat other insects, how many insect-eating species are there? Set up a proportion and solve it.

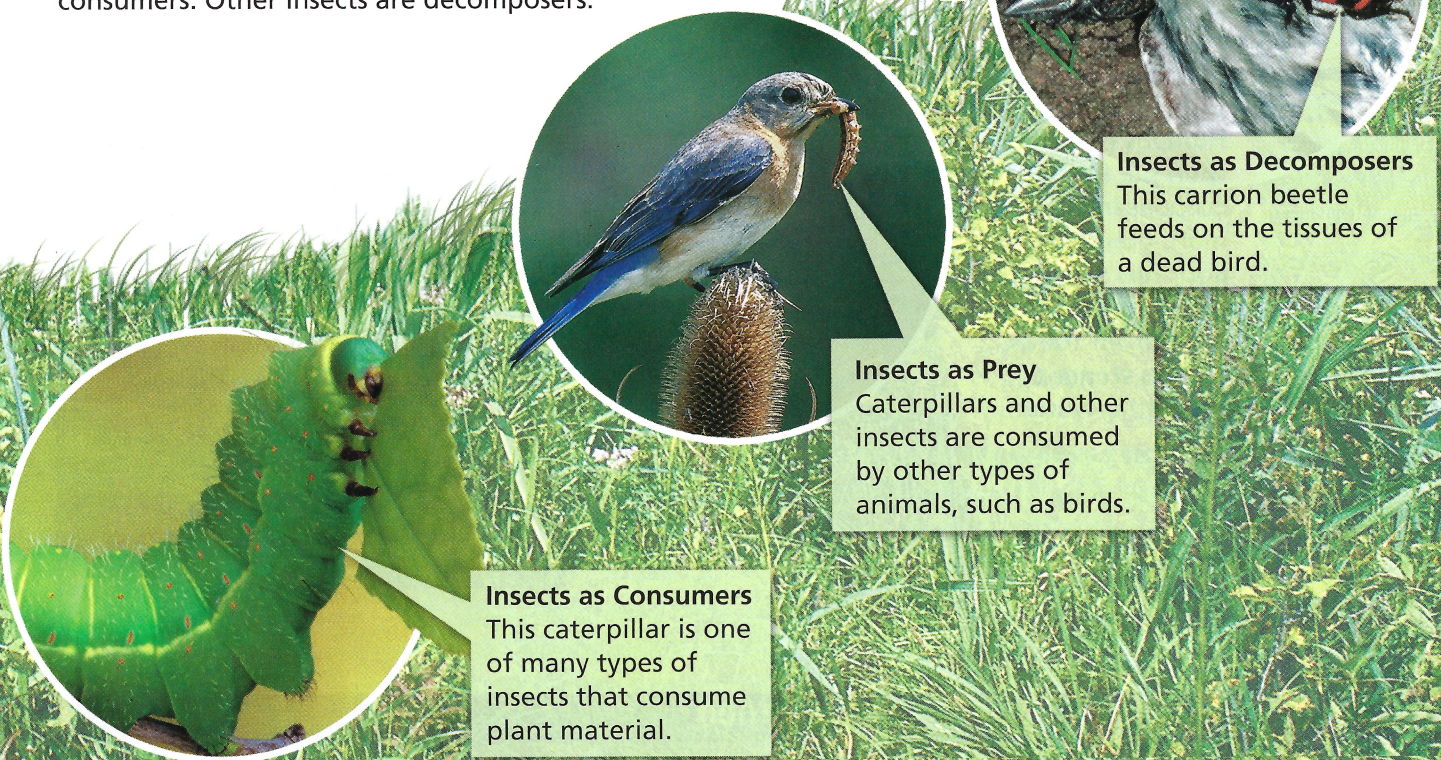
$$\frac{\text{Insect-eating species}}{900,000 \text{ insect species}} = \frac{25\%}{100\%}$$

$$\text{Insect-eating species} = 225,000$$

Practice Problem A swallow chick eats 200,000 insects. If 12 percent of the insects are beetles, how many beetles does it eat?

FIGURE 20
Insects in a Food Chain

In a food chain, some insects are consumers of plants. Some insects are prey for other consumers. Other insects are decomposers.



Insects as Consumers
This caterpillar is one of many types of insects that consume plant material.

Insects as Prey
Caterpillars and other insects are consumed by other types of animals, such as birds.

Insects as Decomposers
This carrion beetle feeds on the tissues of a dead bird.

Insects as Decomposers In a food chain some insects play the role of decomposers by breaking down the wastes and bodies of dead organisms. For example, in some tropical food chains, termites may break down up to one third of the dead wood, leaves, and grass produced there every year. In other food chains, flies and dung beetles break down animal droppings, called manure. By doing this, the buildup of manure from large animals is prevented.

The substances that insect decomposers break down enrich the soil. In addition, insect decomposers may burrow and nest in the ground. By doing so, these insects expose soil to oxygen from the air and mix up the nutrients in the soil.

Tech & Design in History

Products From Insects

Over the last few thousand years, insects have supplied humans with some important products.

100 B.C. Silk Draping
 Humans first spun silk from silkworm cocoons into fine fabrics more than 4,000 years ago. This silk draping, found in a Chinese tomb from 100 B.C., depicts scenes of the netherworld.



A.D. 1200 Medieval Bee Hives
 Collecting honey to eat and wax for candles and other products became much easier when humans began keeping bees. At first, humans made hives from mud or clay. In the middle ages, bees were kept in inverted woven baskets, called skeps, like those shown above. Today, honeybees are kept in wooden boxes.

100 B.C. A.D. 1000 1250

Insects as Food for Humans Did you know that insects were an important source of nutrition for prehistoric humans? Even today, insects are collected and eaten by people in many parts of the world. In some Mexican villages, dried grasshoppers are ground up and mixed with flour to make tortillas. In other parts of the world, the larvae of certain species of beetles are roasted over an open fire. Ants, crickets, and cicadas are just a few of the other types of insects eaten by humans.

Maybe you are thinking, “Yuck! I’d never eat an insect.” Even if you’d never allow an insect on your dinner plate, you are likely to have used the products of insects in other aspects of your daily life. You can see some of the major uses of insect products through history in the timeline below.



Reading Checkpoint

What is an animal that breaks down wastes and dead organisms called?

Writing in Science

Research and Write

Research one of the products described in the timeline below. Then write an advertisement for the product. Include information about the species of insect used to develop the product, and details about how the product is made.



1518 Cochineal Dye

Explorer Hernando Cortez reported the use of the red dye, cochineal, in Mexico. The dye is extracted from a tiny cactus-eating insect called the cochineal scale. Today, humans use the dye to color some textiles, foods, and cosmetics.

1500

1920s Shellac Records

Humans make shellac from a waxy substance secreted by the lac scale insect. Shellac has been used to seal furniture, polish floors, and coat records. Shellac was especially important to the record industry in the 1920s and 1930s (until synthetic vinyl came along in the 1940s).



1750



1980s Firefly Light

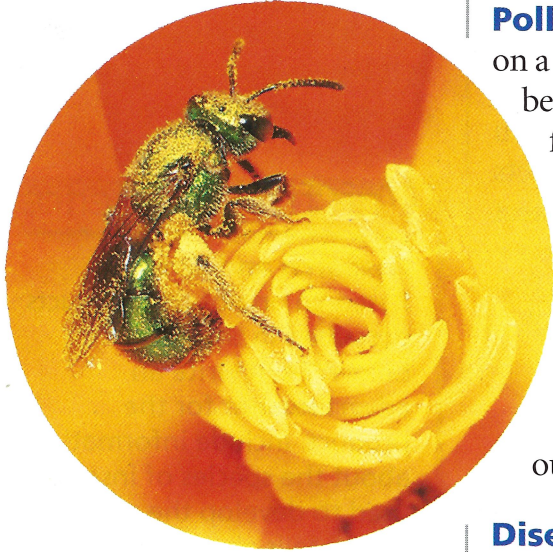
Since the 1980s, scientists have used the light-producing chemicals from fireflies in many applications, including the study of genes and diseases.

2000

FIGURE 21

A Bee as a Pollinator

This bee is getting dusted with yellow pollen as it drinks nectar from the flower. **Observing** On which of the bee's structures can you observe pollen grains?



Other Interactions

Besides eating and being eaten, insects interact in other ways with the living things in their environments. **Two ways insects interact with other living things are by moving pollen among plants and by spreading disease-causing organisms.**

Pollen Carriers Have you ever seen a bee crawling into a flower on a warm summer day? Have you wondered what it is doing? The bee is helping itself to the plant's nectar and pollen, which are food for bees. But plants also need to share their pollen with other plants. Pollen contains cells that become sperm cells, allowing plants to reproduce. When the bee crawls into a flower to obtain its food, it gets dusted with pollen, as shown in Figure 21. Then, as the bee enters the next flower, some of the pollen on its body is left in the second flower. An animal that carries pollen among plants is called a **pollinator**. Bees are pollinators, and so are many beetles and flies. Without pollinators, some plants cannot reproduce.

Disease Carriers Not all interactions between insects and other living things have happy endings. While some insects transfer pollen, others spread diseases to both plants and animals, including humans. Insects that spread diseases include some mosquitoes and fleas. These insects often have sucking mouthparts that pierce the skin of their prey, providing an opening for the disease-causing organisms to enter. Diseases that are carried by insects include malaria, which is spread by mosquitoes. Malaria causes high fevers and can be treated with medicines today.

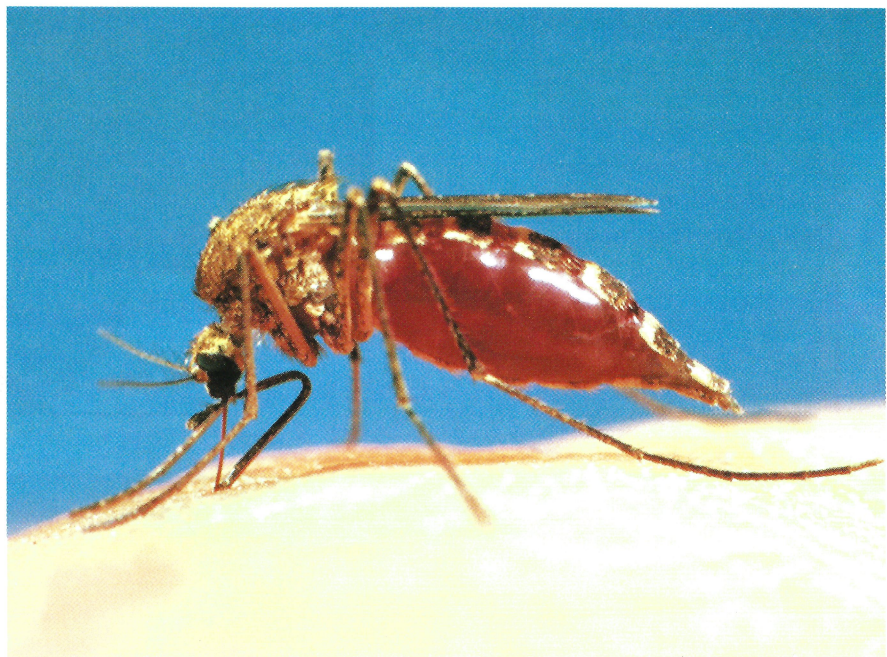


What is a pollinator?

FIGURE 22

Disease-Causing Mosquito

A mosquito like the one shown here can spread disease-causing organisms such as malaria among humans.



Controlling Pests

Some insects are harmful, even though they don't spread diseases. Harmful insects are called pests. **To try to control pests, people use chemicals, traps, and living things, including other insects.** Chemicals that kill pests are called **pesticides**. However, pesticides also kill pollinators, such as bees, and can harm other animals.

What are the alternatives to pesticides? Biologists are using their knowledge of insect ecology to develop new pest controls. One such control is a trap that attracts mosquitoes in a way similar to how humans attract mosquitoes. Another control is to surround crops with wild plants that are bad-tasting or even poisonous to the harmful insect.

People may prefer to use biological controls. A **biological control** is a natural predator or disease released into an area to fight a harmful insect. For example, ladybugs, which eat other insects, have been introduced to some areas where crops grow to control aphids. Aphids are tiny insects that damage plants by sucking plant sap.



**Reading
Checkpoint**

What is a chemical intended to kill pest insects called?

FIGURE 23
Biological Control
Ladybugs are used as biological control agents against aphids. Here, one ladybug consumes its prey.



Section 4 Assessment

 **Target Reading Skill Building Vocabulary**
Use your sentences to help answer the questions.

Reviewing Key Concepts

- Defining** What is a food chain?
 - Interpreting Photographs** What three roles do insects play in the food chain shown in Figure 20?
- Reviewing** Besides their role in food chains, what are two other ways insects interact with their environment?
 - Summarizing** What effect do pollinators have on their environment?
 - Predicting** What would a world without pollinators be like?
- Reviewing** How can insect pests be controlled?
 - Comparing and Contrasting** How are the effects of using biological controls similar to the effects of using pesticides? How are they different?
 - Applying Concepts** Some insect species are harmful only in areas of the world where they do not normally live but have been accidentally released. Why might this be?

Math Practice

- Percentage** Suppose 33 percent of the 50 tons of wood produced in one year by a forest is consumed by termites and other insects. How many tons do the insects eat?