

Florida Cooperative Extension Service
Institute of Food and Agricultural Sciences
University of Florida, Gainesville
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Pests on Stage

C. A. Boyles and P. G. Koehler*

Statement of Purpose

In the 1960's and 1970's, people began to worry about the harmful effects of pesticides and other poisons. Pesticides are needed to manage many pests of man, his crops and animals. To help protect soil, water and air (the environment), man no longer uses some pesticides.

Integrated Pest Management, (IPM), is an effective, but less harmful way of managing pests of all kinds. An IPM user looks at the whole picture — the pest, the host, and the environment. Then following IPM methods, the user chooses one or several ways to manage the pest.

Most pesticides are made from the same materials as gas and oil. Gas and oil are also used to apply pesticides. Through IPM, wiser use of pesticides helps to save energy.

The purpose of this project is for you to learn the basic ideas of IPM. You should be able to manage pests safely, using less energy and at a lower cost.

This book, **Pests on Stage**, helps explain the kinds of pests we try to manage in IPM programs. It will help you identify the beneficial as well as pest organisms.

Other 4-H IPM books you may get from the county Extension office are listed on the last page of this book.

To Help You

As you read this publication, watch for words written in **boldface italics**. Look in the section "To Help You" for an explanation of these words.

Acknowledgments

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Before You Begin

Please complete the questions below before you begin **Pests on Stage**.

Some of the questions will tell your leader something about you. Other questions will help your leader find out what you already know about pest management. Answer each question as well as you can, but don't worry if you can only answer a few. This is not a test, and you will not receive a grade for it. Take about ten minutes to work on these questions. When you finish this book complete the questions at the end. Your leader will be able to compare the two and show you how much you have learned.

I. Questions About You

1. What is your name? _____
2. How old are you? _____
3. What grade are you in? _____
4. How many years have you been in 4-H? _____
5. In what county? _____
6. Are you in a community 4-H Club, or in a school or other 4-H group? What Kind? _____
7. List the 4-H projects you are taking this year:

II. Questions about what you know

1. Can you name 3 pests?

2. Can you write down 3 ways pests cause damage?

3. Beside each of these statements, write whether you think it is true or false.

_____ A weed is a plant in the wrong place.

_____ Insects do not change in size or shape during their lives.

_____ Animals with backbones are not pests.

_____ Disease-causing organisms can damage pests.

4. On the left is a list of words. On the right are descriptions of these words. Match each word with its description.

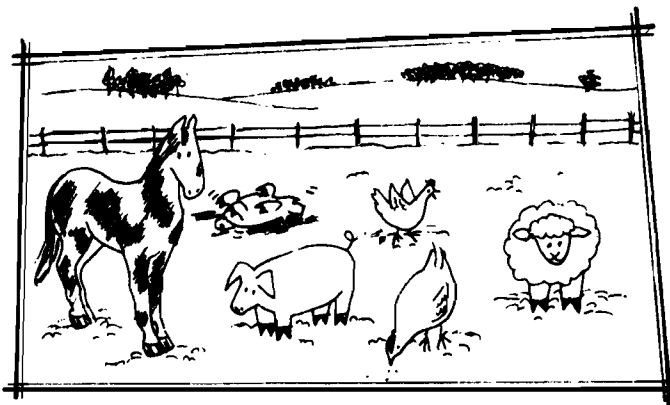
- | | |
|----------------|---|
| a. Crop | _____ A disease-causing organism. |
| b. Arthropods | _____ A tiny worm that lives in the soil. |
| c. Beneficial | _____ "Good" organisms. |
| d. Germinate | _____ Something that harms or annoys something of man's. |
| e. Environment | _____ This kind of plant gives something good to us. |
| f. Nematode | _____ The plant or animal that a pest lives on or feeds on. |
| g. Host | _____ Insects, mites, ticks, and spiders are all this. |
| h. Pest | _____ A plant's or animal's surroundings. |
| i. Pathogen | _____ The sprouting of a seed. |

Do They Help or Hurt?

Do you know the difference between a "pest" and a "beneficial?"

A "beneficial" is an organism (a plant or an animal) that helps man. It may be a plant that

provides us with food, like corn, beans, or oranges. It may be a plant that provides lumber for building or cotton for fabric. All of these plants are called **crop plants**.



Some beneficials are animals. Animals such as chickens and cows give us food. Sheep provide wool to keep us warm. Dogs protect us and work for us.

Some insects can also help us. They feed on pests that damage our plants and animals.

A "pest" is any organism that is damaging or annoying. Pests may harm you, your plants, animals, property, or environment.

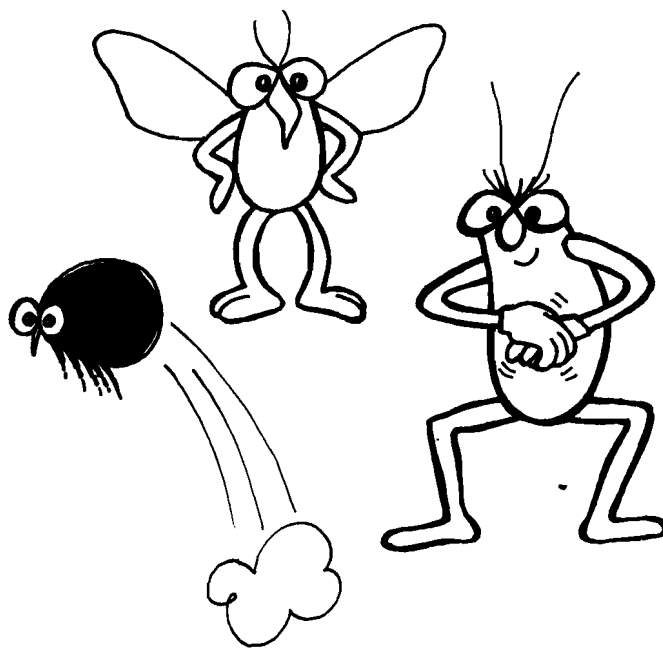
A pest may be an insect that feeds on your plants or animals. It may be a weed growing in a potted plant. Mildew on a pair of shoes in your closet is a pest.



The plants and animals that pests feed or live on are called **hosts**.

Some pests live closer to us than the ones on our crops. Cockroaches live in and around houses. Mosquitoes and fleas bite us.

When you think about pests, there is one important thing to remember. An organism is a pest because of how it affects man. A rabbit eating plants in the garden is a pest. A rabbit in the woods is not a pest. In the woods, it does not harm or annoy anyone. It does not **compete** with us for food.



It Is a Pest/It Isn't a Pest

Here is a list of organisms. In some places they are pests. In other places they are not pests.

In the middle column, try to write one place where each one can be a pest. In the right column, write one place where each one lives but is not a pest.

	It's a pest here.	It's not a pest here.
1. Cockroach	_____	_____
2. Rabbit	_____	_____
3. Plant with pretty flowers	<u>vegetable garden</u>	<u>flower bed</u>
4. Dog	_____	_____
5. Bird that eats seeds and sings	_____	_____
6. Root rot fungus	_____	_____

Five Groups of Pests

Different kinds of pests cause different types of damage. To understand what damage a pest causes, it would help to identify the pest.

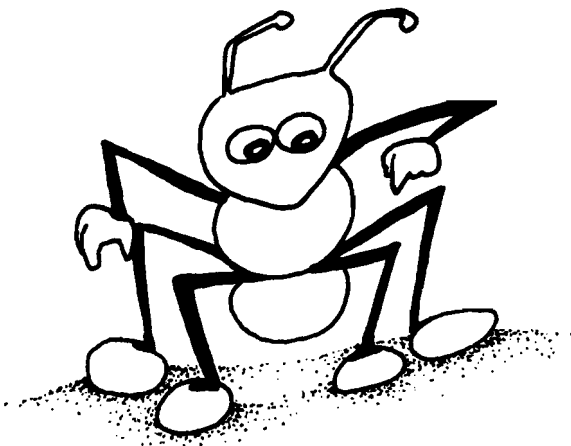
Pests can be divided into five groups:

1. Insects, Mites, Ticks and Spiders
2. Vertebrates (animals with backbones)
3. Weeds
4. Pathogens (disease causing organisms)
5. Nematodes

1. Insects, Mites, Ticks, and Spiders

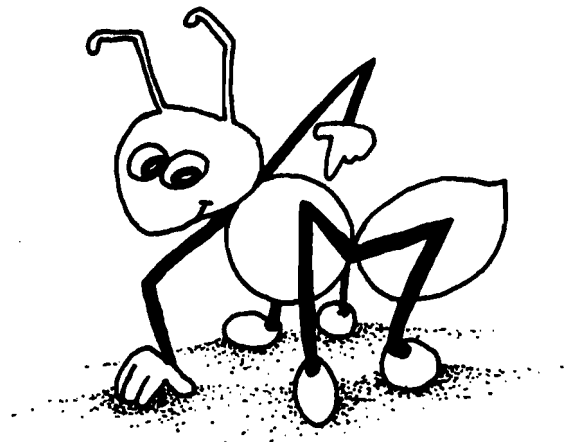
These pests as a group are called **arthropods**. This means "jointed feet." (If you look at an insect's legs, you'll see why.)

Arthropods can live almost anywhere. They can be found on the land, in the soil, or in the water. They may live in forests, in deserts, on animals, or in houses.



The largest group of arthropods is insects. Adult insects are different from other arthropods in two ways.

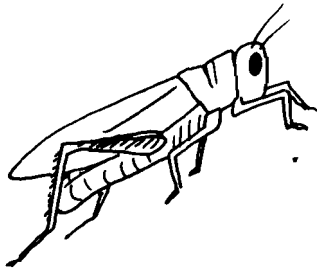
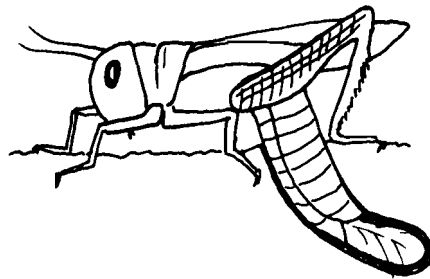
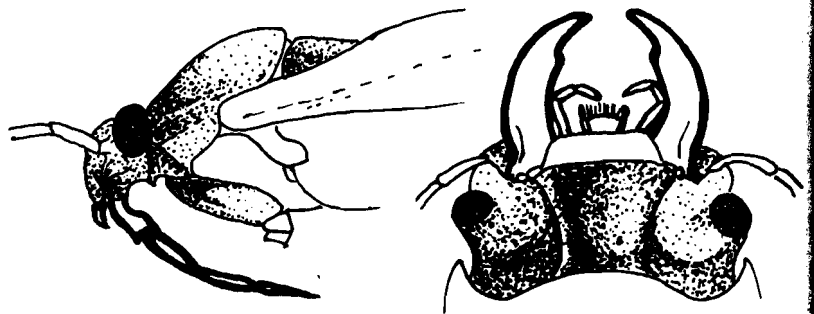
Adult insects have six legs, and three body parts.



All insects are not alike. Some insects may have no wings. Others have one or two pairs of wings.



Insect mouthparts may differ, too. Some insects have mouthparts that chew. Others have mouthparts that pierce and suck.

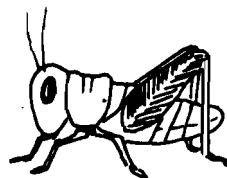
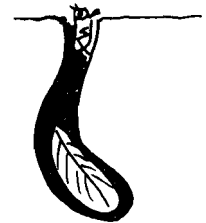


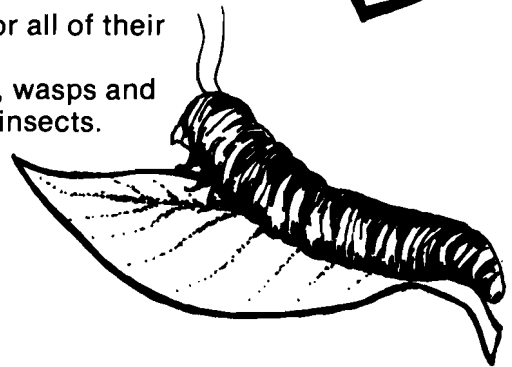
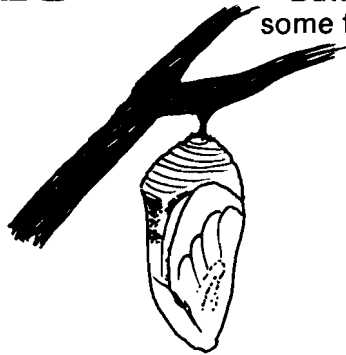
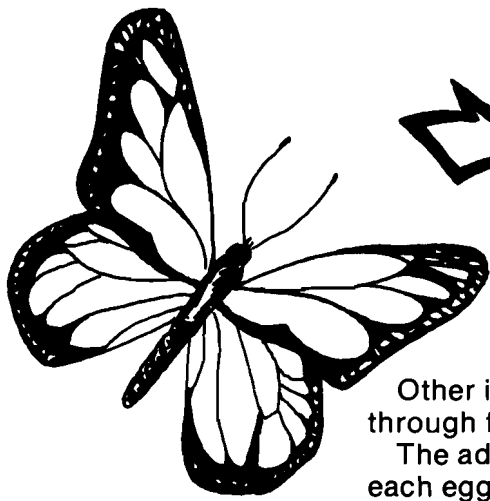
Many insects change size, but their shape remains almost the same.

The adult lays eggs. A wingless nymph hatches from each egg. The nymph feeds and grows . . . until it becomes an adult, usually with wings.

Pests like these are destructive all of their lives except while they are eggs.

Grasshoppers, lice, termites, and stinkbugs belong in this group.



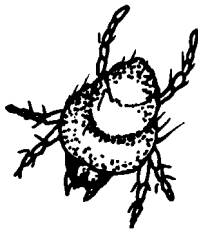
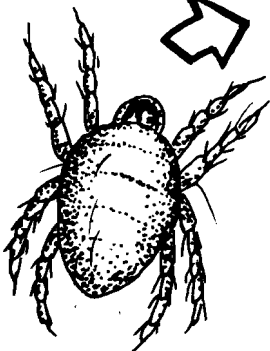


Other insects change completely. They go through four stages of development.

The adult lays eggs. A larva hatches from each egg. The larva grows in size without changing its shape and then enters a pupa or changing stage. Finally, the adult emerges from the pupa.

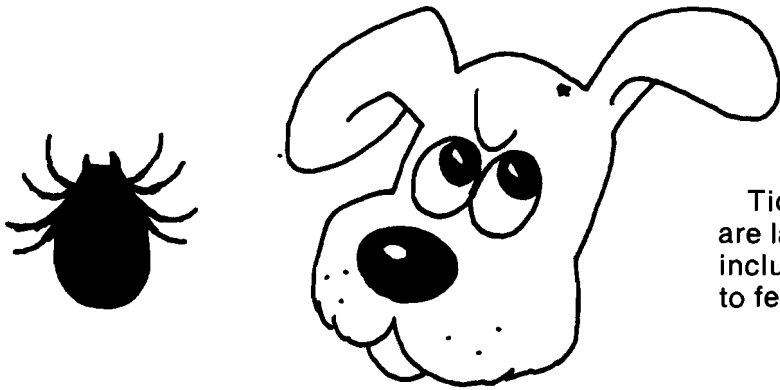
Insects of this kind cause most or all of their damage while they are larvae.

Butterflies, moths, beetles, bees, wasps and some flies belong to this group of insects.

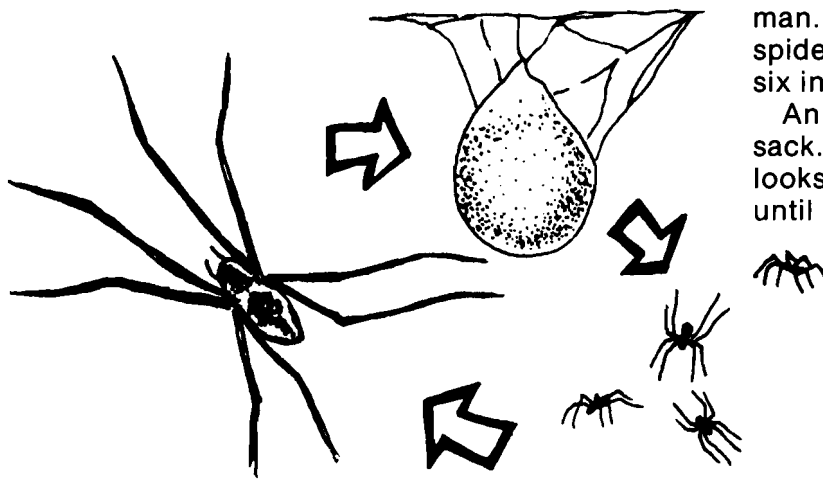


Mites, ticks, and spiders are all related to insects. They grow in similar ways. Most mites are only about the size of this dot. They do not have wings. Some mites feed on plants, some live on animals, and some live and feed on insects.

An adult mite lays eggs. A six-legged nymph hatches from each egg. As the nymph grows, it develops two more legs.



Ticks grow the same way mites do. Ticks are larger than mites. They live on animals, including man. They suck blood. They need to feed on blood to complete their life cycle.



Only a few kinds of spiders are harmful to man. Most of them eat insects. Some kinds of spiders are very small, but others may grow to six inches or longer.

An adult spider lays eggs, usually in an egg sack. Each egg hatches into a tiny spider that looks like an adult. The spider grows in size until it becomes an adult.

Activities

Before beginning the activities, ask your 4-H Agent for a 4-H Entomology Project Book. It will give you additional information on how to study, collect, identify and preserve insects.

Catch several arthropods that have been pests. Prepare the insects for study using the information in your project book. If you do not have access to a microscope, use a magnifying glass.

Look carefully at the arthropod.

Is it an insect, tick, spider or mite? _____

Describe it. How many legs and body parts does it have? Does it have wings? What kind of mouthparts does it have?

Take the pest to your leader, county agent, parent or science teacher. Have them help you identify the pest.

What is the name of the pest you are studying? _____

Try to find out as much information as you can about the pest. Where does it live, what does it eat? What kind of temperature does it need to survive?

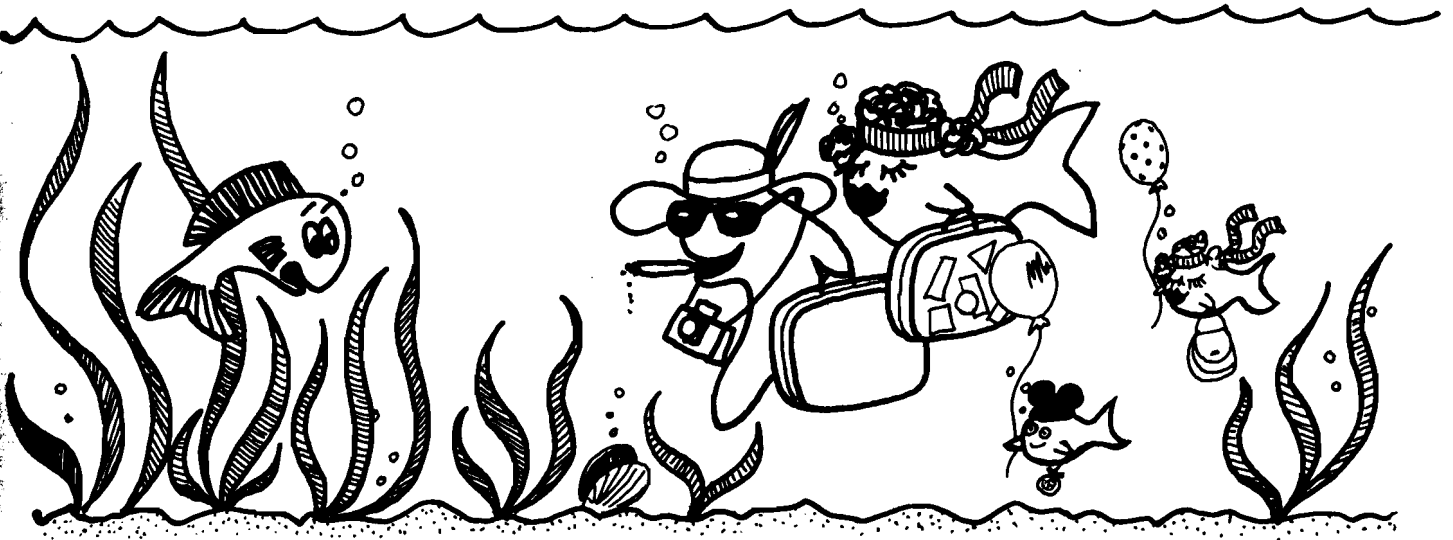
When you have all the information, write a short description.

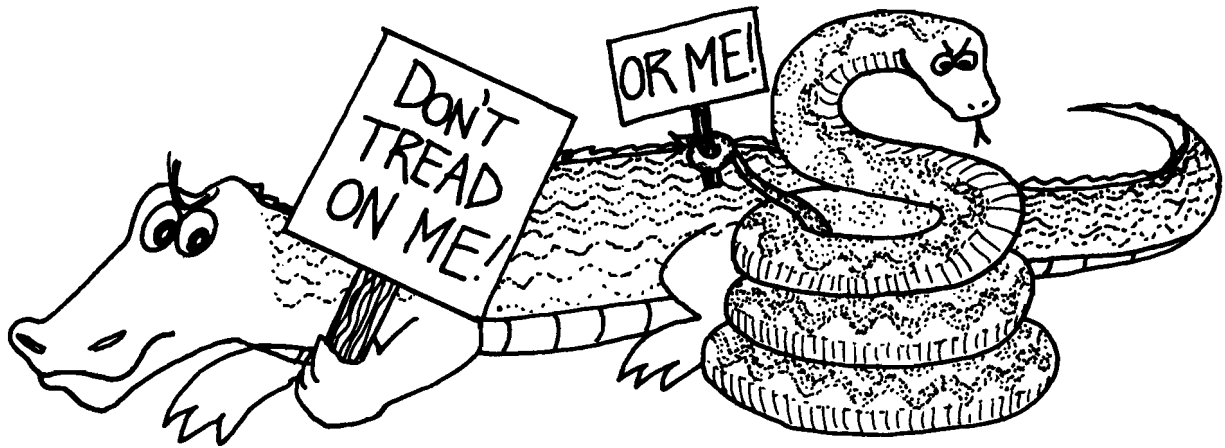
2. Animals with Backbones

Animals with backbones are called **vertebrates**. Several groups of vertebrates may become pests.

Fish. Fish can be pests. However, most fish problems have been caused by man. We have

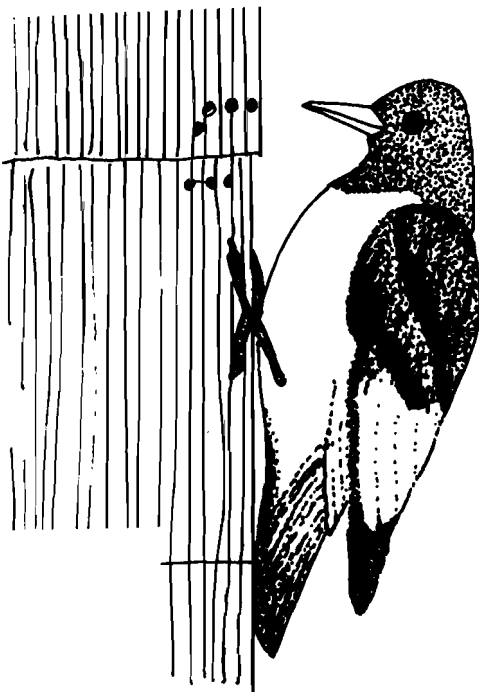
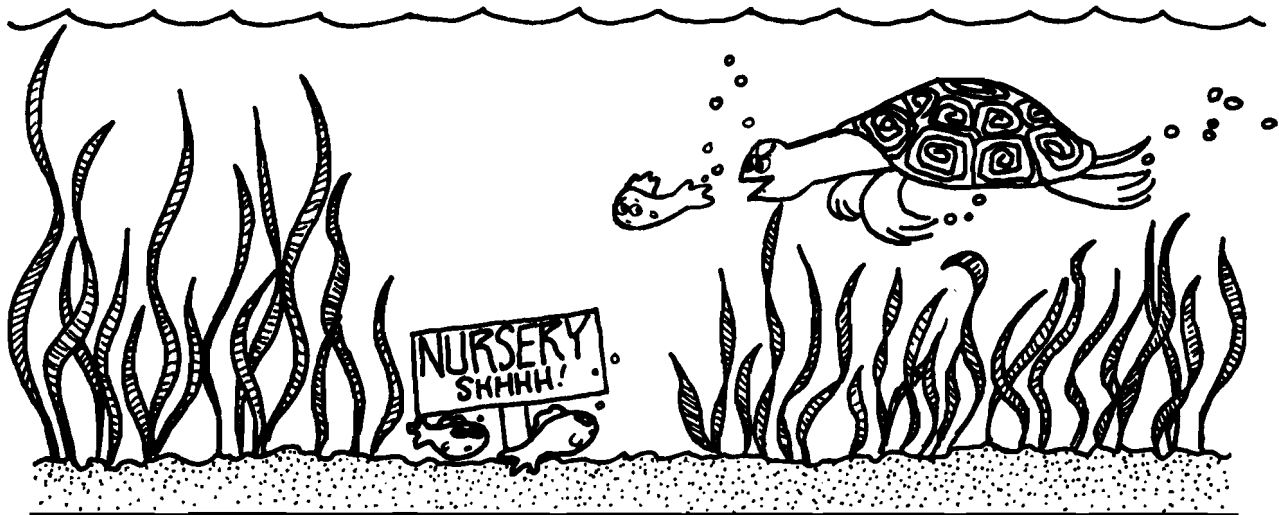
put fish from other places into local lakes and streams with "native" fish. Sometimes these "imported" fish compete with the local fish that we eat. They may eat vegetation that local fish need for their food and homes.





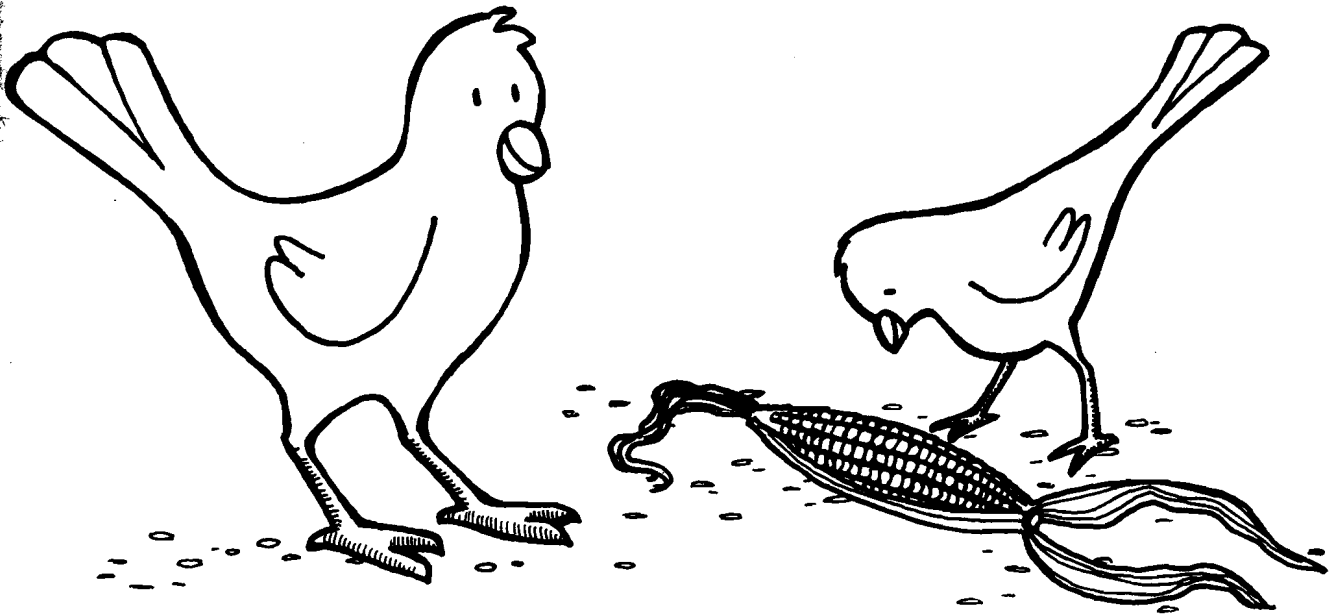
Snakes, alligators, and turtles. Alligators and poisonous snakes can be a real problem

sometimes. All of these animals can be a problem where fish are being raised.



Birds. Different kinds of birds cause different problems. Woodpeckers damage houses and other buildings.

Many birds eat seeds, nuts, and fruit that people grow.



Mammals. Many kinds of mammals can cause problems.

Rats and mice can sometimes carry diseases that infect man. These diseases can be transferred by insects.

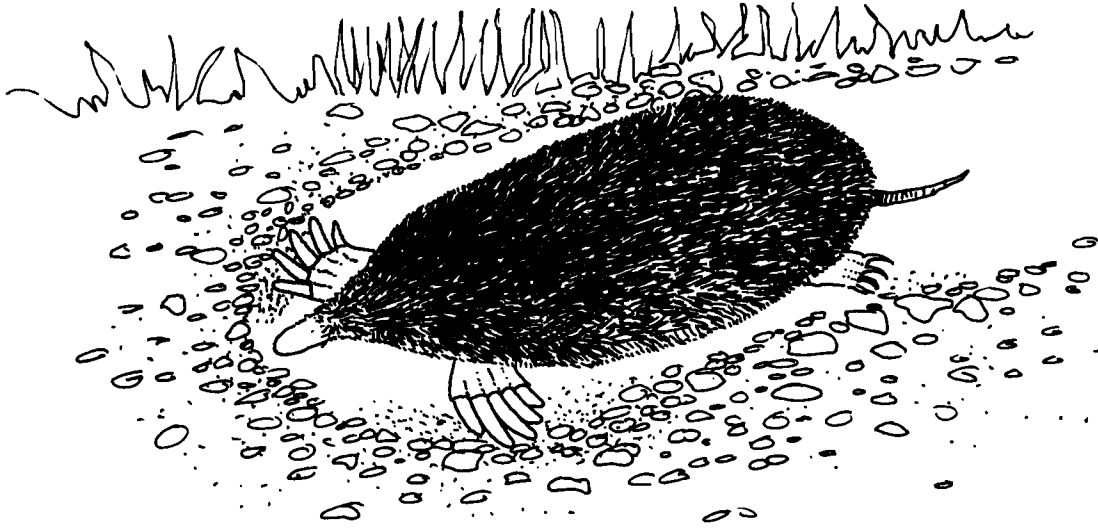




Many mammals can damage crops.
Examples are deer, rabbits, and squirrels.

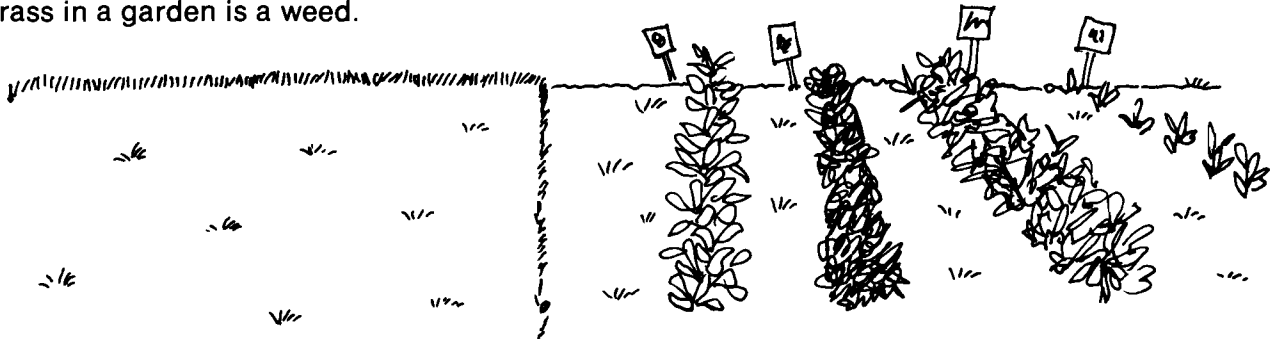


Some mammals can also damage lawns.
Moles dig tunnels under the grass.



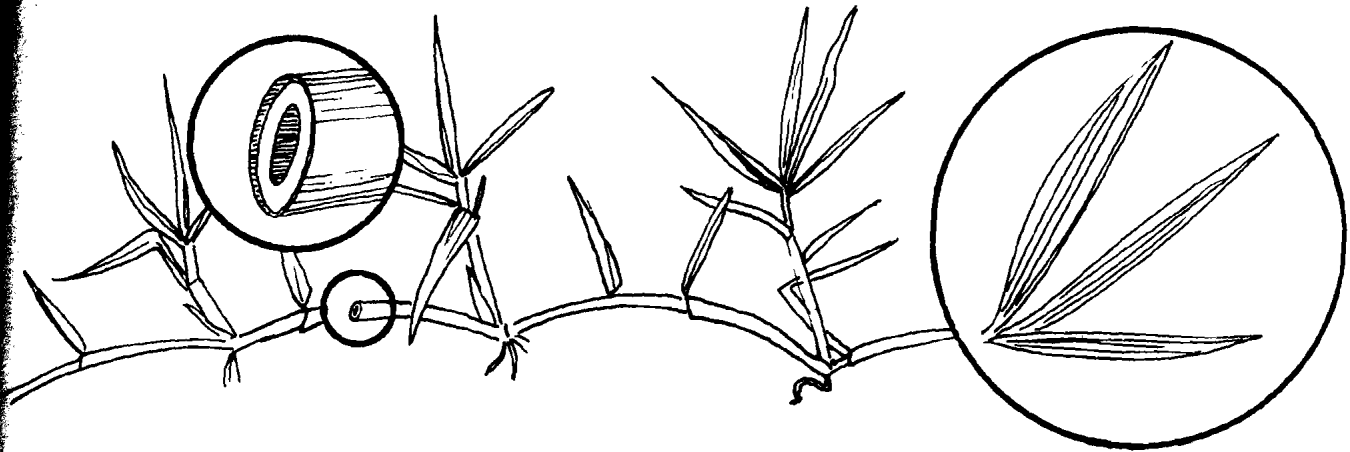
3. Weeds

A "weed" is a plant in the wrong place. For example, grass in a lawn is where it should be. Grass in a garden is a weed.

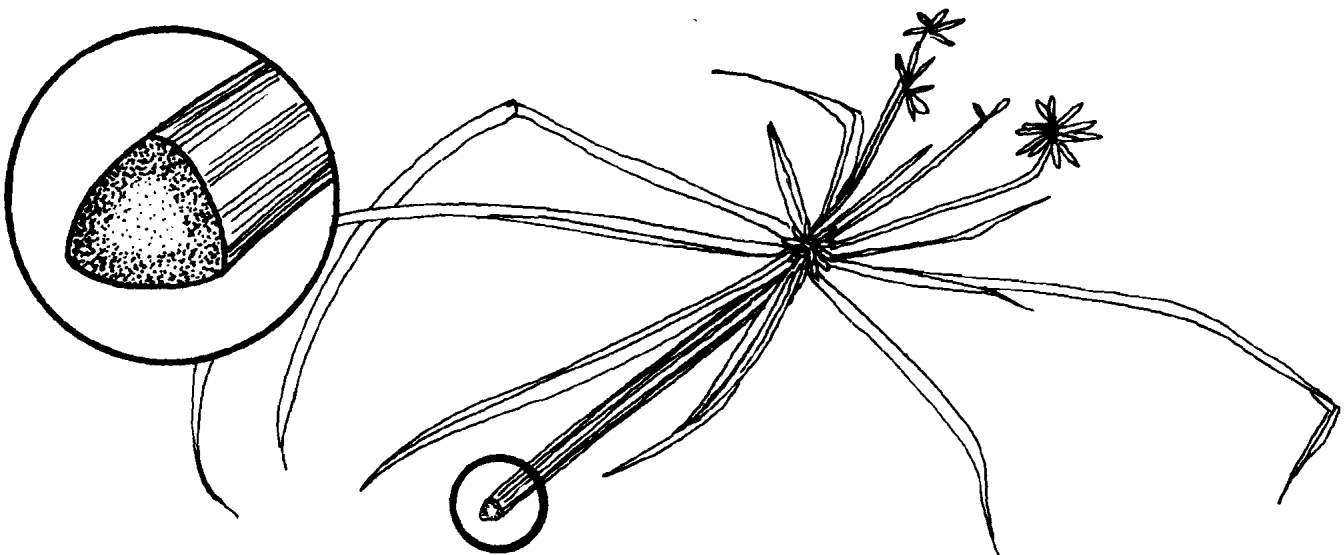


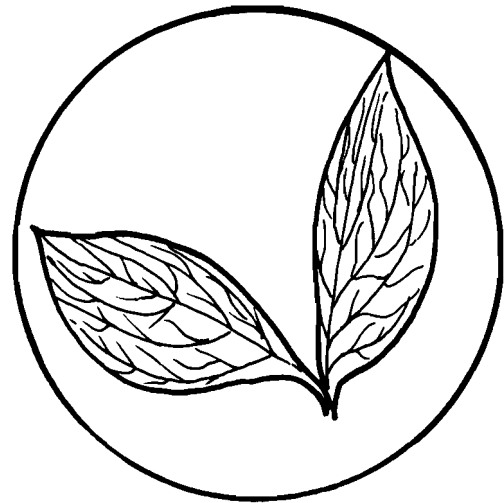
You should know about several groups of weeds. Each group needs different controls. The three most common groups of weeds are grasses, sedges, and broadleaves.

Grasses have long, narrow leaves. The leaf veins are side-by-side. The stems are usually hollow, except at the joints, where they are solid.

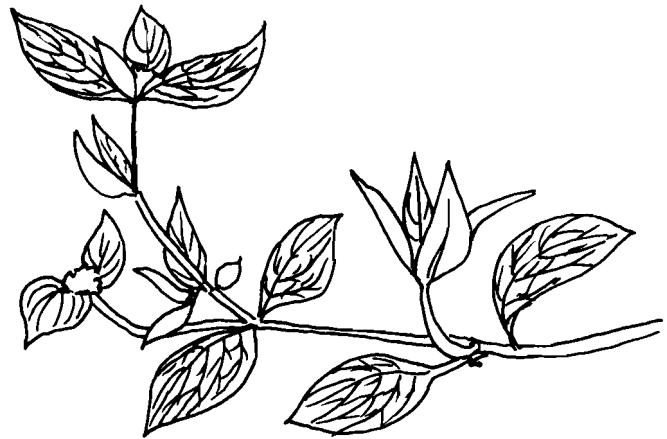


Sedges look a lot like grasses. They have long narrow leaves that stick out from the stems in three directions. The stems are triangular in shape and solid inside.



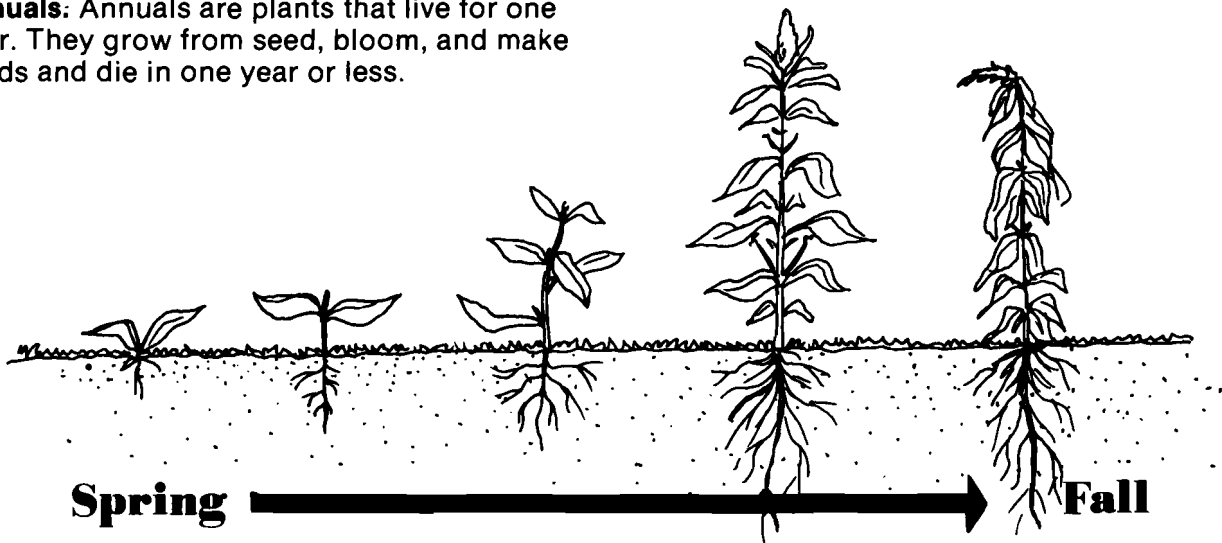


Broadleaves have leaves as wide as they are long. The leaves may be almost any shape. Leaf veins usually form a net-like pattern. Broadleaf plants often have colorful flowers.



Weeds can also be separated by life cycle. The three most common groups are **annuals**, **biennials**, and **perennials**.

Annuals: Annuals are plants that live for one year. They grow from seed, bloom, and make seeds and die in one year or less.

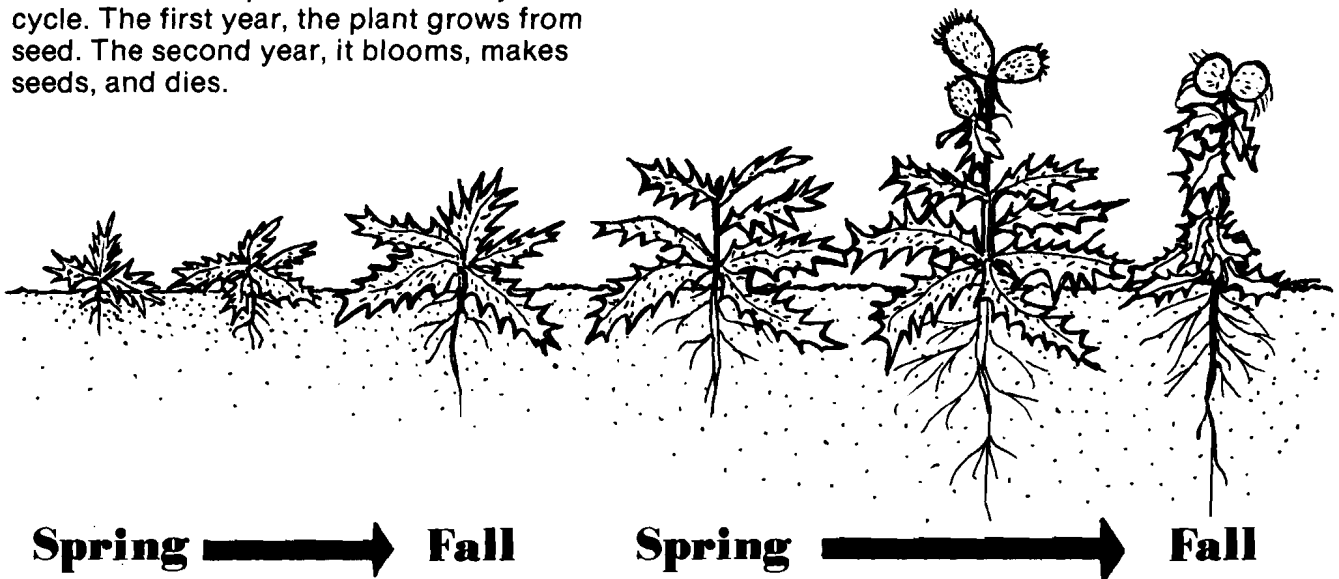




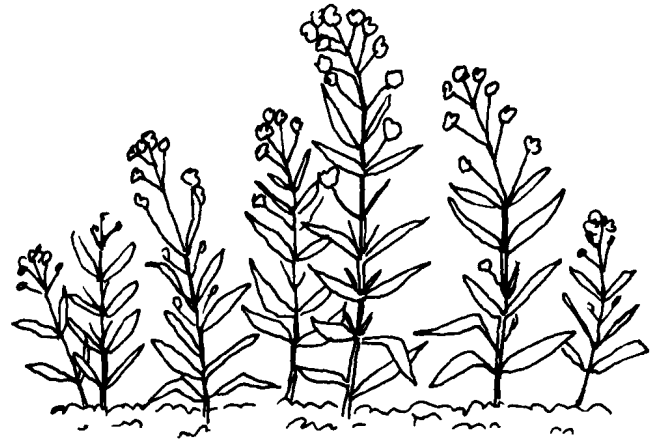
Crabgrass and *Oxalis* are examples of annual weeds.



Biennials. These plants have a two-year life cycle. The first year, the plant grows from seed. The second year, it blooms, makes seeds, and dies.



False dandelion and cudweed are examples of biennial weeds.



Perennials. These plants live two years or longer.
Some grow from seeds. Others grow from large roots or underground stems. Many die

back during the winter.
Dogfennel and dollarweed are examples of perennial weeds.



Activities

Weeds can be pests if they are growing in your garden or lawn. Pick an area such as a flower bed. Ask your Extension Agent for publications on common weeds in your area or check out a book from your local library. See how many of the weeds you can identify. Draw a picture of each one.

1. This weed is called:

It looks like this:

What kind of life cycle does it have?

To what group does the weed belong?
(grasses, sedges, or broadleaves).

2. This weed is called:

It looks like this:

What kind of life cycle does it have?

To what group does the weed belong?
(grasses, sedges, or broadleaves).

3. This weed is called:

It looks like this:

What kind of life cycle does it have?

To group does the weed belong?
(grasses, sedges, or broadleaves).

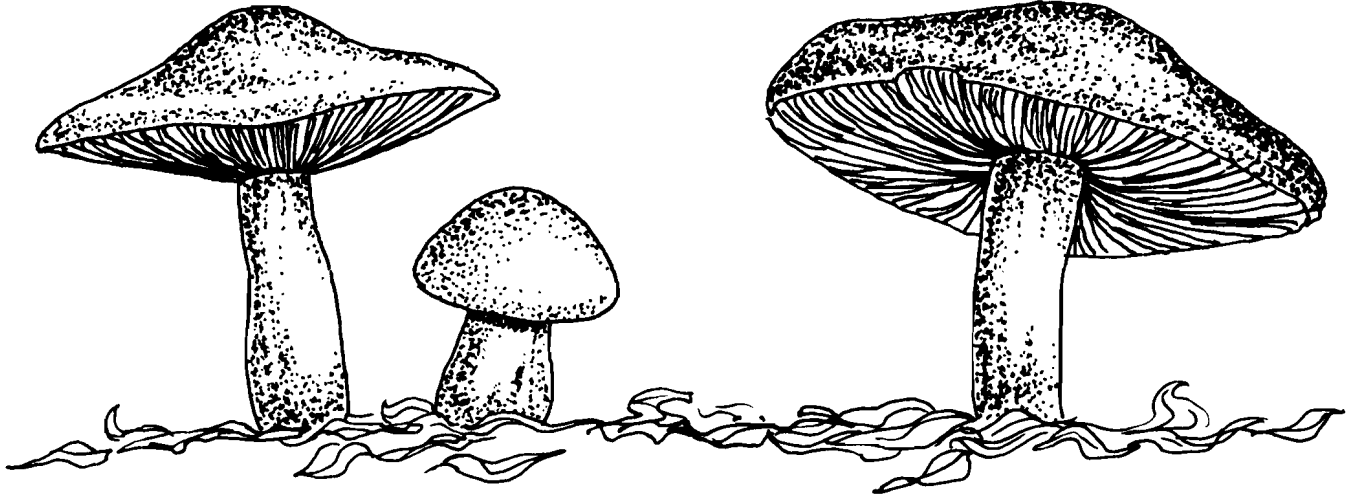
4. Disease-causing Organisms

Organisms that cause diseases are called **pathogens**. These are three main groups of pathogens: fungi, bacteria, and viruses.

Fungi. These are simple plants. They do not have roots, stems, or leaves. They do not have

the green coloring that most plants have.

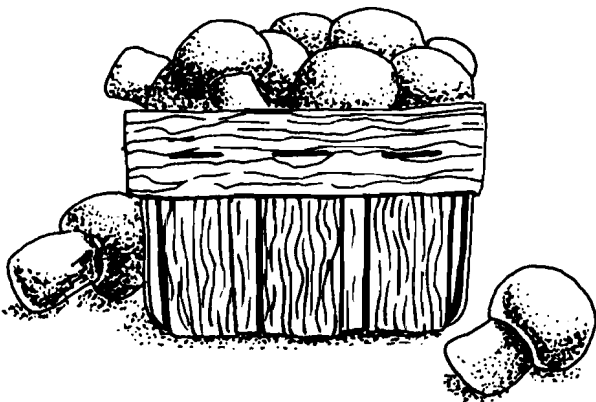
Without this green coloring, called **chlorophyll**, fungi cannot use sunlight to grow. Instead, fungi must get food from other sources.



Some fungi live and feed on other organisms. They are called **parasites**.

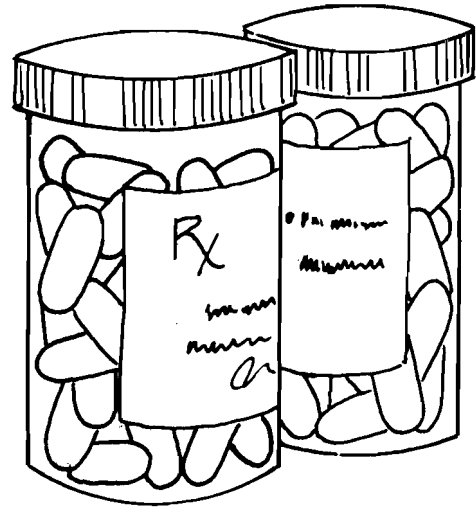
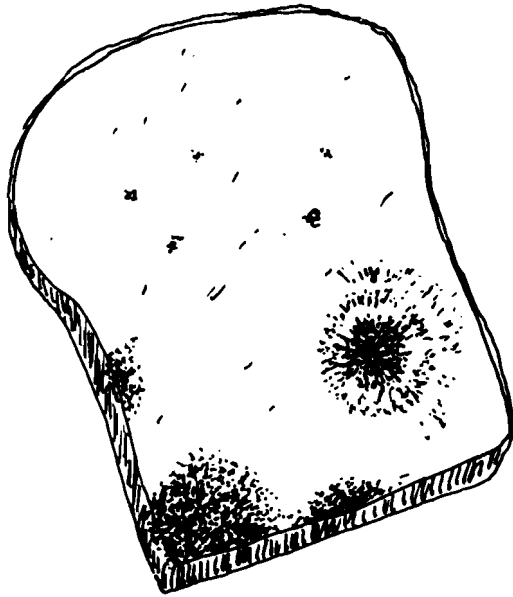
Some fungi live on dead plant or animal matter. They are called **saprophytes**.

We are surrounded by many kinds of fungi. Not all of them cause diseases. Mushrooms you buy at the store are one kind of fungus. Mold or mildew on your shoes is another kind.



Some fungi are very important to us. For example, some of the molds that spoil food

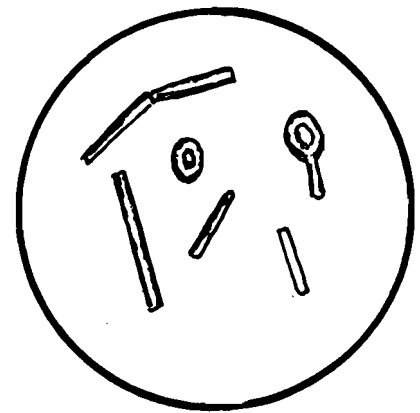
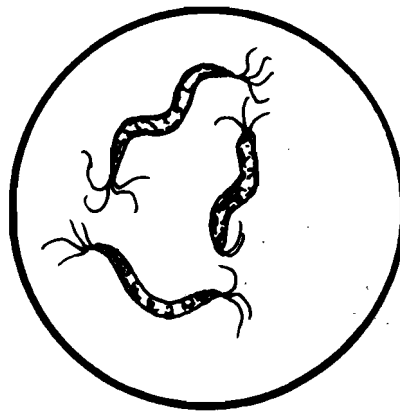
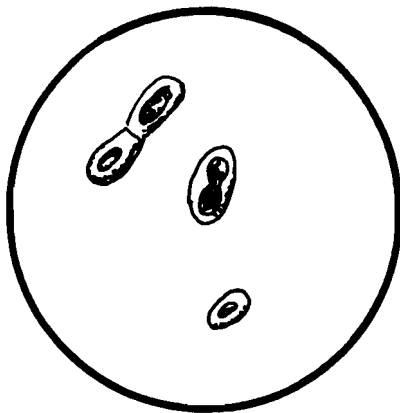
can also be used to produce drugs. These drugs can cure many of our diseases.



Bacteria. Bacteria are so tiny that you would need a microscope to see them. Bacteria are everywhere.

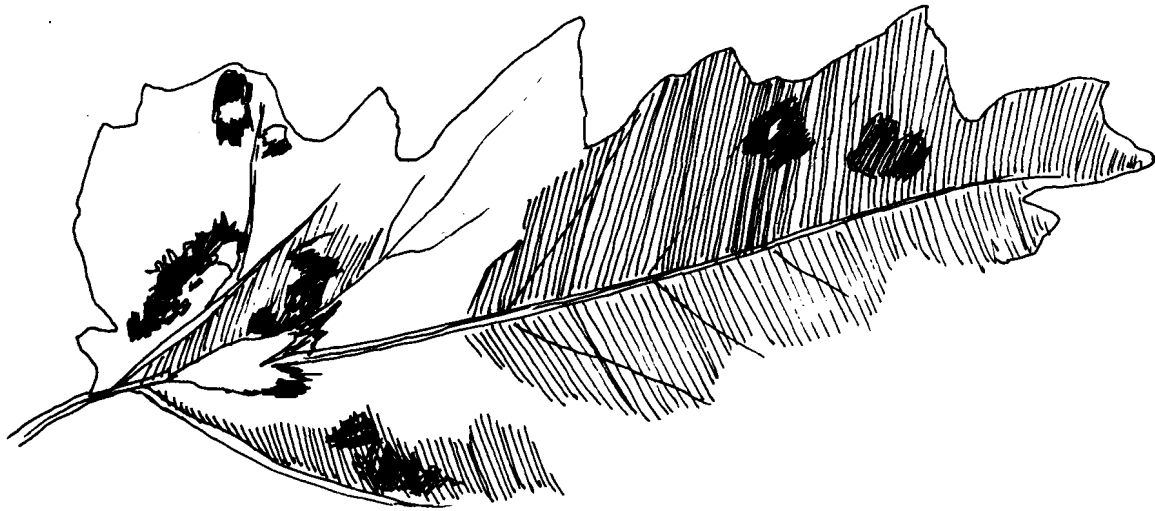
Bacteria can sometimes be a problem in the home. They can get into food that is not

handled or stored properly. Some of them can produce poisons in food. These poisons can sometimes cause sickness or death. Some bacteria can cause disease in man.



Viruses. Viruses are even smaller than bacteria. Some viruses cause plant diseases. Other kinds cause diseases in animals or man. In order for a virus to live and reproduce, it must be inside a living cell of its host.

When a pathogen attacks a plant, the plant may change in some way. It may wilt or get spots on fruit, or turn yellow. We call these changes the *symptoms* of disease.

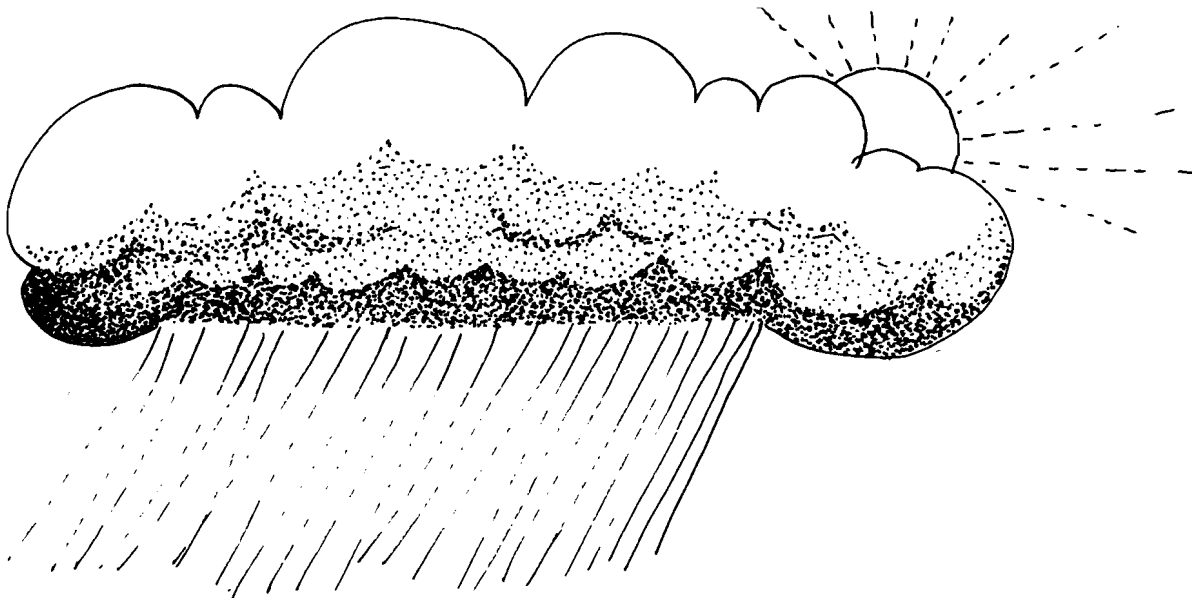


Some kinds of plants have few disease problems. One reason is that not all pathogens affect all plants. Most kinds of pathogens affect only one or a few kinds of plants.

Even if a pathogen is on a plant that it can damage, it may not cause any harm. The

environment must be right for the pathogen to damage the plant. For example:

Fungi need wet weather before they can cause damage. They have seed-like structures that need water before they germinate and begin to grow.



Bacteria also need wet weather. Wind and rain can force them into the surface of a plant.

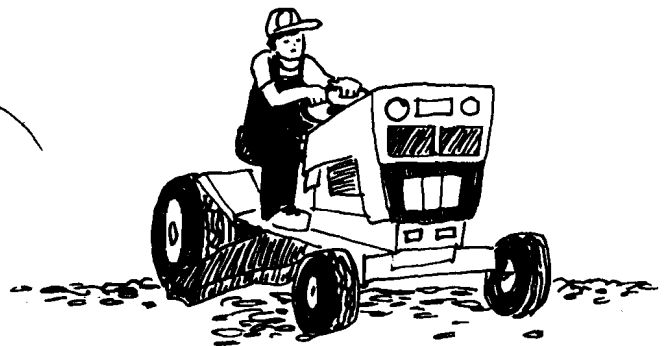
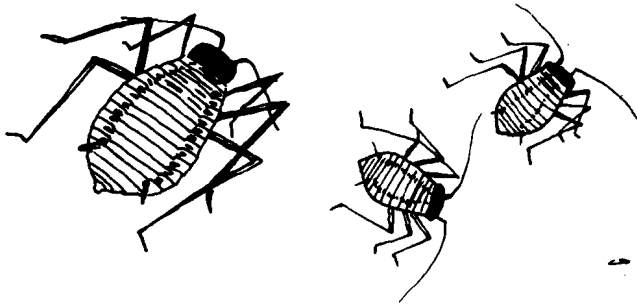


Or, they may get into the plant through a wound or damaged place.



Viruses need other organisms to move them from place to place. Insects called **aphids** sometimes move viruses. Insects that move

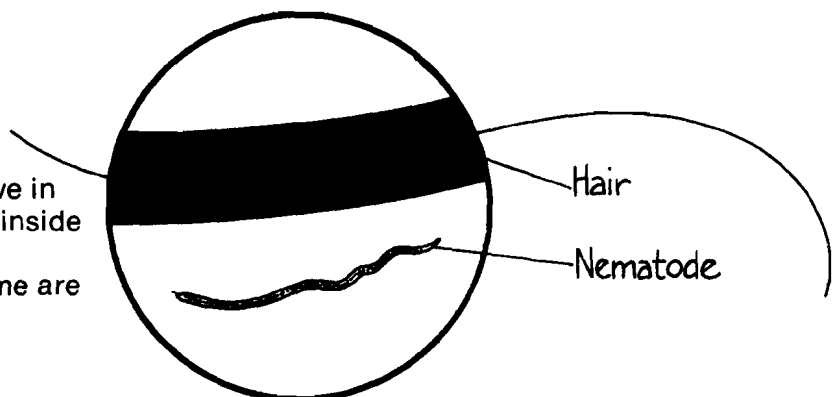
viruses are called **vectors**. Viruses can also be moved by tractors and other equipment.



5. Nematodes

Nematodes are tiny worms. Some live in water or the soil. Others may also live inside plants and damage them.

Plant nematodes are very small. Some are smaller in diameter than a hair.

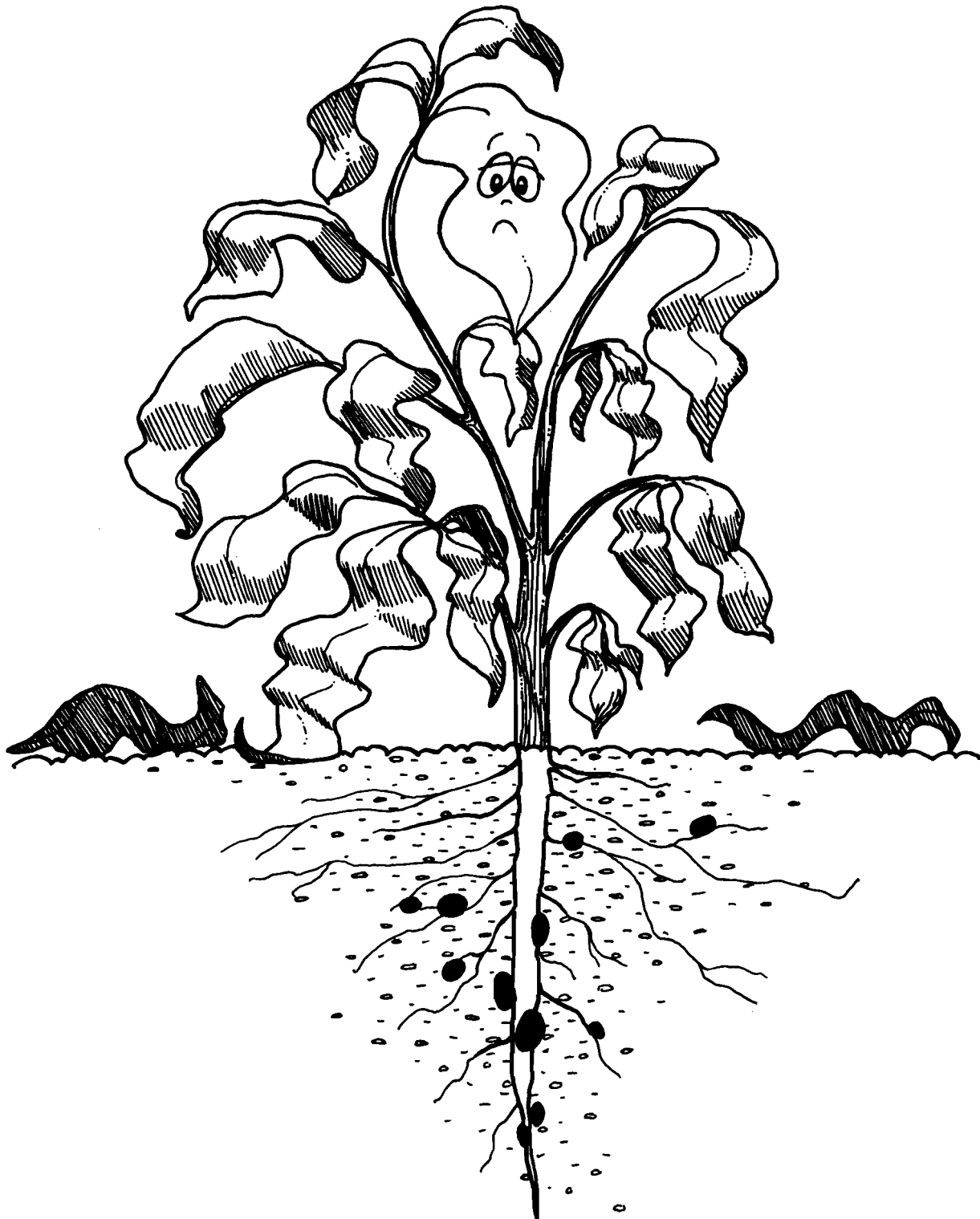


Plant nematodes have a sharp hollow "needle" they use for feeding. They can poke a hole in plant parts and suck out the plant juices. Some kinds feed on roots, some feed on stems, and others feed on leaves.

Leaves may turn yellow or brown on plants

infested with nematodes. Nematodes may cause roots to develop "knots" or galls on them. Plants may finally wilt and die.

Nematodes can increase disease problems. Some kinds of diseases get into the plant through little holes the nematodes make.



Activities

- I. People often take diseased plants to the Extension agent to get the disease and its cure identified. Ask your Extension agent if he can save these diseased plants for you to look at.
 1. Make a list of these plants that you have seen and draw a picture of each.
 2. Ask your agent or leader what to look for to identify each of these diseases. List them.
 3. Is the damage caused by a pathogen, an animal, or a nematode?

Name of Diseased Plant	What is Wrong With the Plant?	What caused the damage?	Picture of diseased leaf, root, stem, etc.
1.			
2.			
3.			
4.			
5.			

II. Find a picture of the following pests.

1. Nematodes
2. Viruses
3. Bacteria
4. Fungi

Draw a picture of each. Give the name of each pest and a short description.

Summing Up

This unit, **Pests on Stage**, is designed to give you some general information on pest biology.

Why is pest biology so important to Integrated Pest Management?

IPM is a special program created to manage pest problems using a good-sense approach.

In order to successfully complete an IPM program, there is a six step process that must be followed.

The six steps are:

1. Identification — This means knowing as much as possible about the pest. What kind of pest it is, where and how it lives. Even the kind of weather the pest likes is important information.

2. Prevention — Sometimes pest problems can be prevented. This is done by changing certain factors to make it difficult for pests to live.

3. Monitoring — Keeping track of pests by scouting. Scouting is done by counting the number of pests in a given area. If there are enough pests in the area, a decision can be made to treat.

4. Prediction — The facts from scouting are important. They can be used to predict how much damage a pest could cause.

5. Decision — Using facts gathered from the first four steps, the IPM user is able to decide what to do based on facts.

6. Evaluation — Throughout the program the treatment may be evaluated. This allows any necessary changes in the treatment.

Knowing about pest biology is important to all six of these steps.

1. Studying pest biology will help you identify the pest.

2. It will give you an idea of what to do to prevent a pest from becoming a problem.

3. It will help you find the places you need to look in order to monitor pests.

4. You will be able to predict whether the number of the pests will decrease, stay the same, or increase.

5. Studying pest biology will help you make decisions concerning the pest problem.

6. It will help you evaluate how well your management program is working based on a knowledge of the pest.

Studying pest biology will also explain the difference between a pest and a beneficial organism.

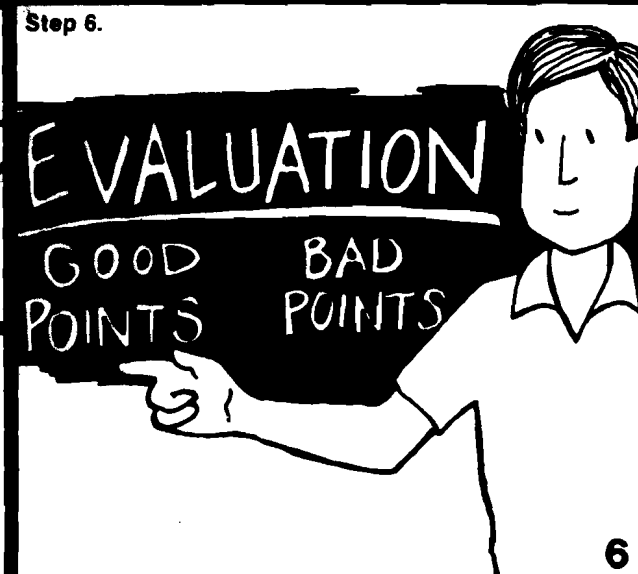
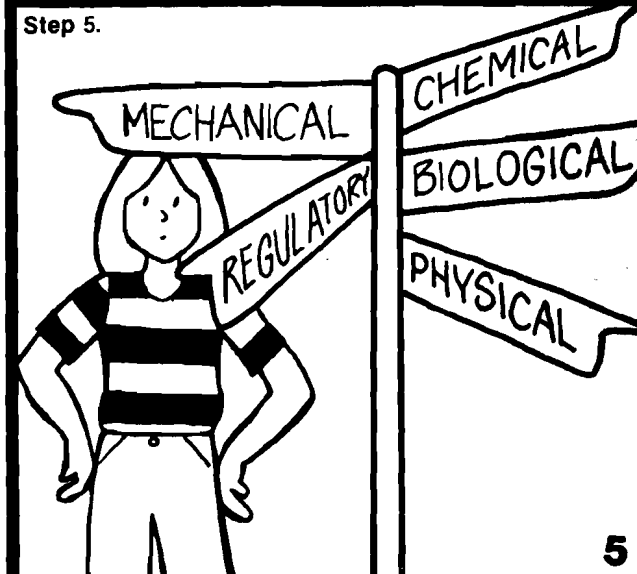
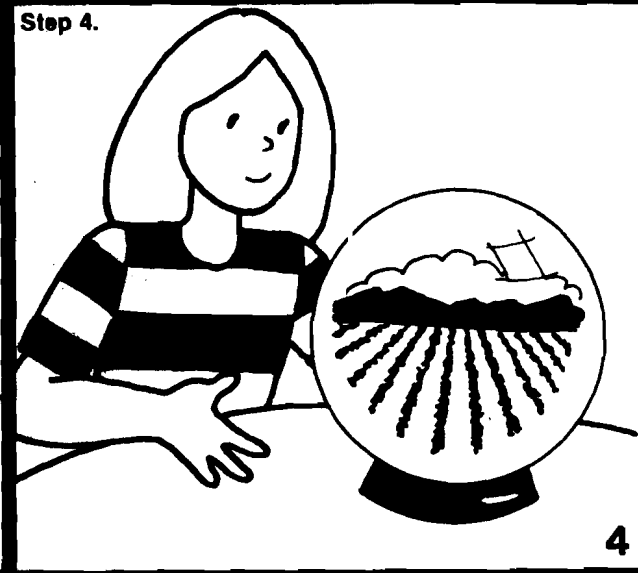
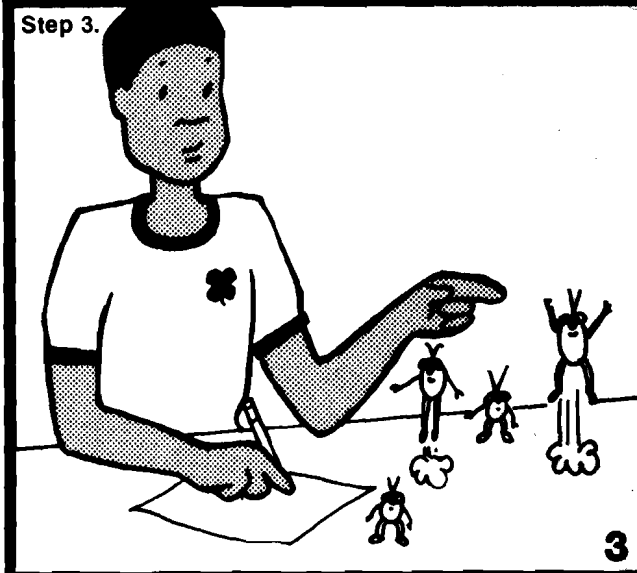
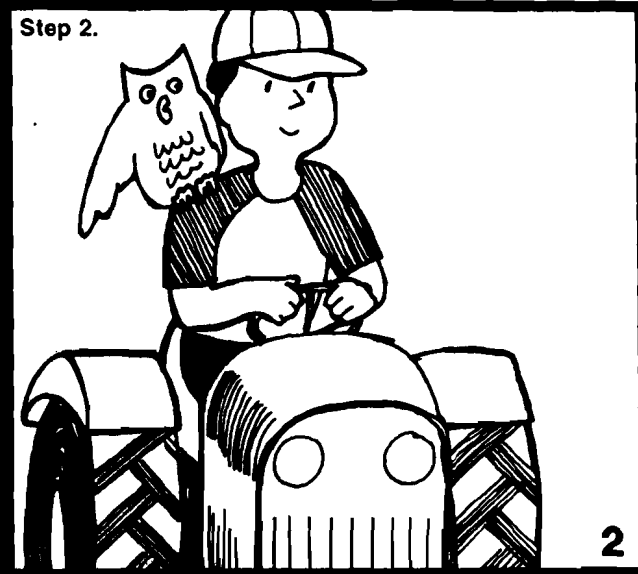
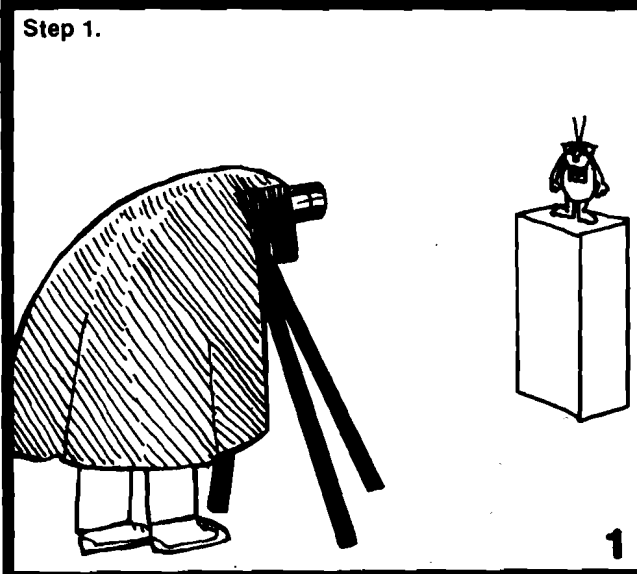
Matching

On the left is a list of words and terms. One tells something about a pest.

On the right is a list of descriptions. Each one describes one of the words on the left.

Match the words on the left to the descriptions on the right. Write the number of each word beside its description. An example is done for you.

- | | | |
|----------------|-------|---|
| 1. Symptoms | _____ | An organism that helps man. |
| 2. Vertebrates | _____ | Insects, mites, ticks, and spiders. |
| 3. Weed | _____ | Live for one year. |
| 4. Beneficial | _____ | The plants or animals that pests feed or live on. |
| 5. Arthropods | _____ | Animals with backbones. |
| 6. Hosts | _____ | Organisms that cause diseases. |
| 7. Annuals | _____ | A plant in the wrong place. |
| 8. Nematodes | _____ | Changes that take place in a diseased plant. |
| 9. Pathogens | _____ | Live longer than two years. |
| 10. Perennials | _____ | Tiny worms. Some feed on plants and damage them. |



Crossword Puzzle

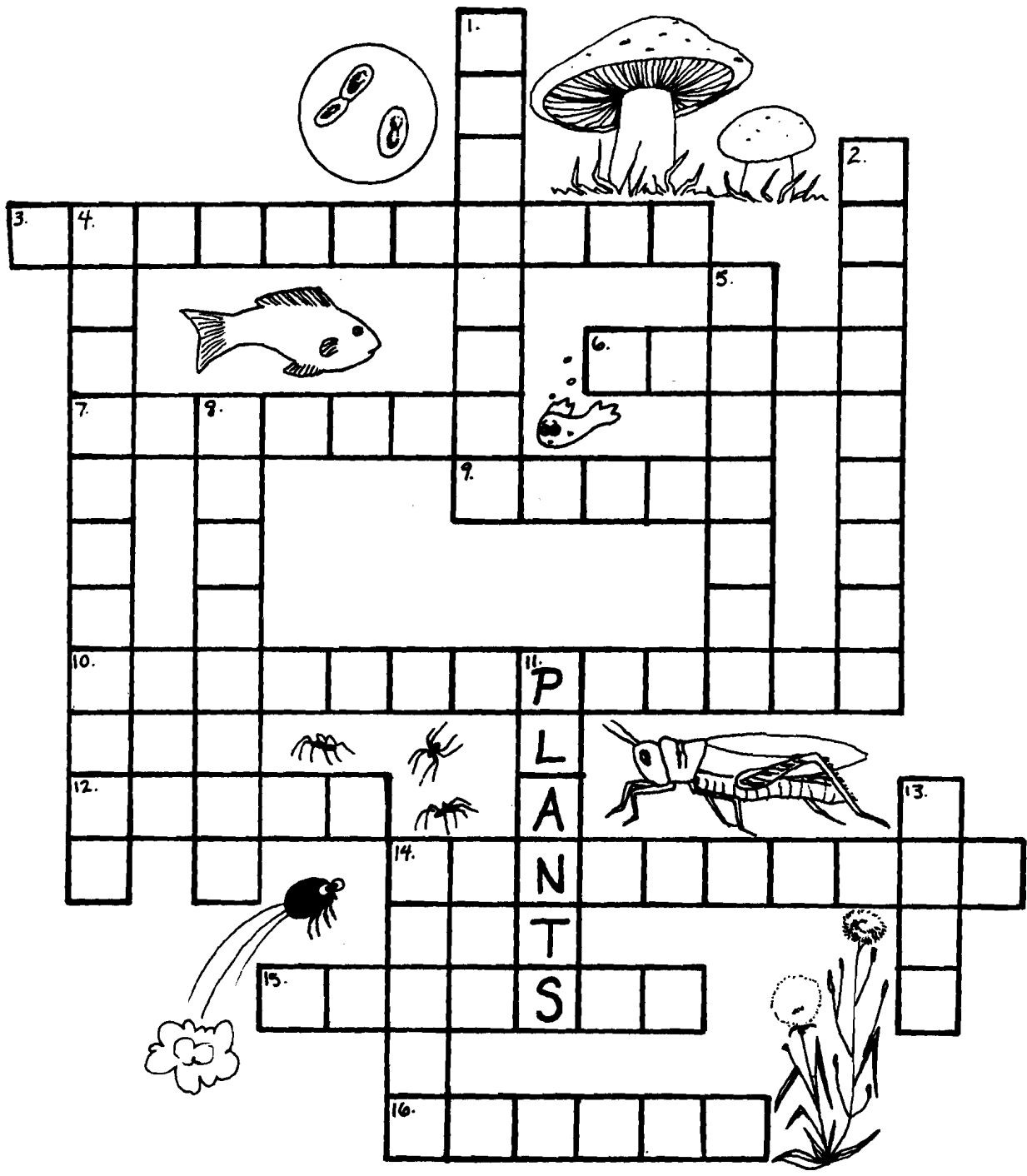
Here is a crossword puzzle. In case you have never worked one, this is how you do it: You are given a set of clues. Each clue describes a word you learned in this unit. Figure out what each word is and write it in the row of boxes that begins with the same number that the word is. An example is given for you: Clue number 11 Down is "Crop _____." The word is "plants." It has been filled in for you. If you have trouble, your leader can help you.

Across:

3. Animals with backbones.
6. A _____ hatches from an egg and becomes a pupa.
7. The biggest group of arthropod pests.
9. These dig tunnels under the grass.
10. The changes that an insect or other arthropod goes through during its life cycle.
12. An immature insect that is similar to an adult.
14. An organism that helps man.
15. Even smaller than bacteria.
16. Have long, narrow leaves, and solid, triangular stems.

Down:

1. Any kind of living thing.
2. Tiny worm. Some feed on plants and damage them.
4. A plant's or an animal's surrounding.
5. Have long, narrow leaves and hollow stems.
8. Changes that take place in a diseased plant.
11. Crop _____.
13. _____ and mice can sometimes carry diseases that affect man.
14. Eat seeds, nuts, and fruit that people grow.



Glossary — To Help You

1. **Arthropod** — An invertebrate animal with jointed legs and segmented body parts. Examples: insects, spiders and crabs.
2. **Bacteria** — Microscopic organisms that live in soil or water, on plants, or in the bodies of animals or man. Sometimes bacteria causes diseases.
3. **Beneficial** — Helpful; something that is good, or that helps something else.
4. **Beneficial Organism** — A plant or animal that helps control a pest species, or helps plants or animals in some way.
5. **Chlorophyll** — The green coloring matter contained in leaves. It is needed for photosynthesis to provide plant food.
6. **Compete, Competitors** — Two or more plants or animals trying to use the same resource, and each one reduces the amount of the resource that the other one can use.
7. **Environment** — Surroundings, including anything that affects man, other animals or plants.
8. **Gall** — A hard, knobby “swelling” on some part of a plant.
9. **Germinate** (germinating) — The sprouting of a seed, and early growth of the tiny plant below the soil.
10. **Host** — Any plant or animal that shelters or gives a home to a parasite or other natural enemy.
11. **Larva** — One stage in the life of some insects. A larva hatches from an egg. When it has grown as large as it is going to, it becomes a pupa, and then an adult. Some kinds of larvae are caterpillars, or maggots, or grubs.
12. **Maggot** — The young or immature form of a fly. Maggots look like short, fat worms.
13. **Metamorphosis** — the changes that an insect or other arthropod goes through from the time an egg is laid until it becomes an adult.
14. **Mildew** — a soft, fuzzy growth, usually whitish or gray.
15. **Nematode** — A tiny worm-like organism that lives in the soil and damages the roots of plants. Nematodes may live in the soil, in water, in animals, or in plants.
16. **Nymph** — An immature insect that is similar to the adult it will become.
17. **Organisms** — Living things; includes all animals and plants.
18. **Parasites** — An animal or plant that lives on or in another organism, from which it gets food and shelter. In **IPM**, a natural enemy that kills pests. Parasites are usually smaller than the pests. Example: fly maggots eating large caterpillars.
19. **Pathogen** — Very tiny organism that causes a disease. The three types of pathogens are fungi, bacteria, and viruses.
20. **Pest** — An organism that hurts something or is bad for something that belongs to man. A pest may be an insect, a plant, an animal, a disease, or any other kind of organism.
21. **Pupa** — One stage in the life of some insects. Some pupae are also called cocoons. A pupa is the “resting” stage in the insects life. An adult insect will hatch from it. Pupa — Plural of pupa.
22. **Saprophyte** — An organism that lives on dead or decaying organic matter.
23. **Symptom** — An indication or evidence of disease.
24. **Vector** — An organism that carries pathogens from one host to another.
25. **Vertebrates** — Animals that have a backbone. Such as, a fish, bird or mammal.
26. **Weed** — A plant that is growing in the wrong place. To a farmer, a flower in the middle of a cornfield may be a weed. To a home gardener, the same flower may not be a weed at all, but a very desirable plant.

Name _____

Now That You Are Finished

Now that you are finished with this book, answer the following questions. They are the same questions that you answered before you began. You are not going to receive a grade on your answers. Comparing these answers with your first answers should show you how much you have learned.

1. Beside each of these statements, write whether you think it is true or false.

_____ A weed is a plant in the wrong place.

_____ Insects do not change in size or shape during their lives.

_____ Animals with backbones are not pests.

_____ Disease-causing organisms can damage pests.

2. Can you name 3 pests?

3. On the left is a list of words. On the right are descriptions of these words. Match each word with its description.

- a. Crop
- b. Arthropods
- c. Beneficial
- d. Germinate
- e. Environment
- f. Nematode
- g. Host
- h. Pest
- i. Pathogen

_____ A disease-causing organism.

_____ A tiny worm that lives in the soil.

_____ "Good" organisms.

_____ Something that harms or annoys something of man's.

_____ This kind of plant gives something good to us.

_____ The plant or animal that a pest lives on or feeds on.

_____ Insects, mites, ticks, and spiders are all this.

_____ A plant's or animal's surroundings.

_____ The sprouting of a seed.

4. Can you write down 3 ways pests cause damage?

Remove this page and hand in to your leader