



Learning About Beekeeping



The 4-H Beekeeping manuals are for youth interested in learning about honey bees and beekeeping.

This manual, *Learning About Beekeeping*, introduces bees and beekeeping and is intended to prepare learners to set up their own hive. The next manual, *Working with Honey Bees*, guides learners to set up their first hive and learn how to keep records. The final manual in this series, *Advanced Beekeeping*, provides information on how to increase the size of the **apiary**, seasonal management, and troubleshooting problems.

Beekeeping can be a lifetime hobby for lifelong learners. A master beekeeper who worked with honey bees for more than 50 years said, "Every time I look into a **beehive**, I learn something new about the bees, and I see another reason why I like the bees so much." We hope that you, too, will enjoy beekeeping throughout your life and realize that you are providing a valuable service to others.

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Notes:

- The 4-H Beekeeping project manuals are not activity-based; rather they are a guide to help young people learn while working with a facilitator. These manuals contain a lot of text, so we recommend the facilitator read with level 1 members, pausing to discuss the questions and checking that the members understand the answers.
- Words in **bold** are defined in the glossary at the end of this manual.

Some of this information has been adapted from *Starting Right with Bees*, a publication by the editors and staff of *Gleanings in the Bee Culture* and the standard in learning about beekeeping for many years. Although the book is out of print, a wealth of information is available at their website, Bee Culture (www.beeculture.com/us/), where you can also sign up for Bee Culture Magazine.

CONTENTS

| | |
|-------------------------------------|----|
| The Value of Honey Bees | 4 |
| Bee Stings..... | 4 |
| A Brief History of Apiculture | 5 |
| Races of Honey Bees..... | 6 |
| Bee Growth..... | 7 |
| Honey Bee Castes | 8 |
| Bee Development | 10 |
| How Bees Make Honey..... | 11 |
| Honey Plants | 12 |
| Honeycomb and Bee Glue..... | 13 |
| Observing the Hive Entrance | 15 |
| Beekeeping Equipment..... | 16 |
| Other Equipment..... | 17 |
| Observing a Beekeeper | 18 |
| Sharing Your Knowledge | 19 |
| Learn More..... | 19 |
| Glossary | 20 |

The Value of Honey Bees

People and animals enjoy the honey that honey bees provide. You may have heard about or read *Winnie the Pooh* and know how much Pooh loves honey. Bees make **bee bread** out of honey to feed their young but often make more than they need so we can enjoy it too.

Honey bees make **perennial** nests of wax and have large populations. They pollinate many crops when collecting **nectar** to make honey, so they are important to gardeners and farmers. Honey bees pollinate about one-third of the food you eat and about 75% of all crops. Bees *must* pollinate some crops to produce the food we eat, including almonds, apples, blackberries, blueberries, cantaloupes, cherries, cucumbers, peaches, pears, persimmons, plums, pumpkins, raspberries, squash and watermelon. Clover must also be pollinated by bees. Some crops such as eggplant, grape, lima beans, peppers, soybeans and strawberries have higher yields if the honey bee visits them.

Honey bees are excellent pollinators for several reasons:

- They are hard workers. An individual bee may visit as many as a thousand flowers in one day. Their large, hairy bodies easily pick up and hold many tiny **pollen** grains.



- Honey bees visit only one type of flower on a nectar-collection trip.
- Honey bee beehives can be moved to areas where flowers need to be pollinated.

Because of these special bee qualities, American crop producers rent millions of colonies of honey bees each year to pollinate their crops.

Bee Stings

The only experience most people have had with bees is stepping on one when running barefoot through the grass. You already know that bees provide much more than stings, or you wouldn't be learning about honey bees. However, a "bee in the grass" experience teaches a fact about honey bees: They sting if they think they are in danger. Bees do not want to sting because they die after stinging something. However, they sting if they feel threatened.

A bee sting causes momentary discomfort for most people. It reminds us to slow down, be more careful and show greater respect for bees. It's important that you do not open a hive alone until you know your reactions to bee stings. Although a serious reaction is unusual, a few people have them, including difficulty breathing. See a doctor immediately if you or anyone you are with has a reaction to a bee sting. If you are highly allergic to stings, you must be particularly careful when working with bees.

A Brief History of Apiculture

Bees and beekeeping (**apiculture**) originated in Europe, Asia and Africa. Drawings on rocks found in Spain that date back 9,000 years show women taking honey from wild bee colonies. Early people took honey from hollow-tree hives that they found in the forests. In the autumn these early bee-hunters killed or chased the bees away from their homes so they could take all of the honey. Honey was important at that time as the only source of concentrated sugar.

As humans learned more about bees, they found that they didn't have to kill the bees to collect honey. They found ways of controlling their bees and taking only some of the honey so colonies could survive from year to year and produce enough honey for both the bees' and the beekeepers' needs. Early beehives were made of clay pots, straw baskets and hollow logs capped with straw or clay roofs.

Europeans brought *Apis mellifera*, the species of bee that produces honey, to North America in the 1600s. The continent had some native bees. However, of the 20,000 bee species worldwide, only the honey bee produces honey, except for the *Melipona* (commonly called stingless) bee. (Native species of these stingless honey bees had been cultivated in the Americas for thousands of years and are still cultivated today in tropical and subtropical regions.)

Scientists began studying the habits of honey bees, hoping to find new ways to control them. Equipment that we use today was developed in the 1850s, when an American minister, Lorenzo Lorraine Langstroth, helped make moveable **frames** popular. He revolutionized beekeeping by using **bee space** in his hives to keep the bees from cementing the frames. Bee space is an open space of about 3/8 inch that the bees leave between their **honeycombs** so they have room to move and work. Based on his bee space idea, Langstroth built the first modern beehive with frames of combs that could be easily removed from a wooden box. His invention led to many improvements in beekeeping equipment since that time.

Quiz Yourself

- Honey bees pollinate about _____ of the food we eat and about _____ % of all crops.

- Honey bees are excellent pollinators because

 _____.

- Bee space is an open space of about 3/8 inch that the bees leave between their honeycombs so that

 _____.

- Another term for beekeeping is
 _____.

Races of Honey Bees

Bees from a particular place are called a **sub-species**. A bee sub-species is commonly called a **race**. One race of honey bees that evolved for a particular habitat often look and act differently than other races of bees. Variations in color, size and habits are the bees' way of adapting to an area's climate and geography.

All honeybees were originally brought to North America from other countries. Most bees in this country have been **hybridized** for desirable traits and particular uses. Hybridized queens are more expensive than non-hybrid queens but can be used to improve a **colony**. If your bees replace a hybridized queen, however, she may not have desired characteristics.

Six races of honey bees are commonly found in the U.S. Each has some characteristics that are useful to understand.

Italian bees: The Italian bee is light-colored with yellow and tan stripes. They were imported from Italy, as their name implies. They are the most popular bees in the U.S. because they are usually gentle and less likely to **swarm** (leave the hive in a group to start a new colony) as other races of bees. They generally maintain a high colony population from early spring until late fall and produce beautiful white wax cappings on their honey. However, they are more likely to rob honey from weaker hives than the other two races, are not as winter hardy and may be more susceptible to **brood** diseases.

Carniolan bees: The Carniolan bee is gray/brown and sometimes almost black. This race originated in Austria, Bulgaria, central Europe, Hungary, Romania and Yugoslavia. They are the second-most popular honey bees in the U.S. Carniolans are quiet and gentle. They tend to increase their colony population rapidly in the spring, but this increase in colony size can make them more likely to swarm.

Caucasian bees: The Caucasian bee is light gray. They originated in the Caucasus mountains between the Black and Caspian Seas. They are also quiet and gentle. These bees overwinter poorly and build their colony slowly in spring, so they're less likely to swarm than some races. They are susceptible to **Nosema** disease and tend to **propolize** (glue up) inside their hive.

German black bees: The German black bee originated in northern Europe and was the first honey bee brought to the U.S. They are brown or black and overwinter well. German black bees are nervous and aggressive and build the colony up slowly in spring, so they're not a good choice for the beginning beekeeper.

Russian bees: The Russian bee is more resistant to Varroa and tracheal mites than other honey bees. They also tend to produce as much honey as standard bee stocks, if not more. Russian bees also are well suited to climates with long and/or cold winters such as Colorado. These bees are considered moderately gentle. Russian bees have good grooming habits, which helps reduce the overall mite population.

Africanized honey bees: Africanized bees are golden yellow with brown bands and a little smaller than the others. They are a hybrid from an African race of bees imported into Brazil in South America in 1956. These bees are highly defensive and often considered aggressive. They are much more likely to sting than other bees and once disturbed, chase people and animals that come near their hive. They are not likely to sting when foraging on flowers away from the hive. Africanized bees are now present in some of the southern U.S. but are not well adapted to the cold winters so have not moved

north. Some traits make them well adapted to the tropics, such as a tendency for the colony to grow very rapidly and to swarm often. We do not know if Africanized bees will adapt to our climate by mating with our European races of bees. If this happens, they may become less aggressive. Africanized bees have been found in the United States, and most bees probably have some African bee genetics. Africanized bees are sometimes transported to northern states in packages that beekeepers have purchased from the south.

Quiz Yourself

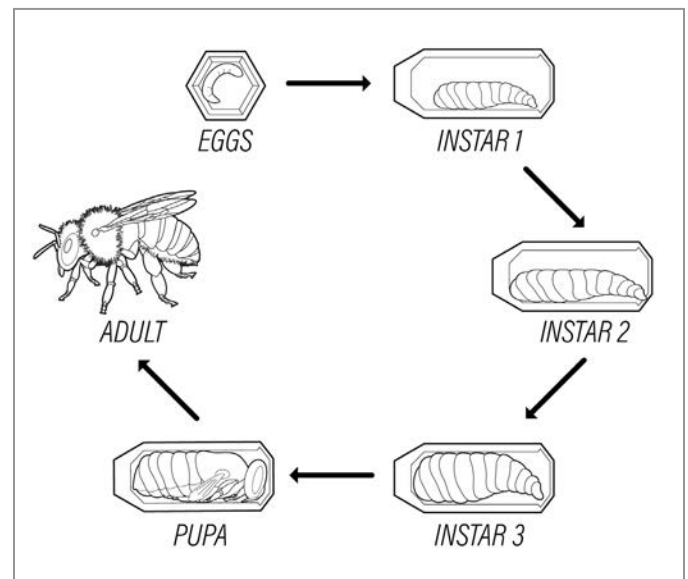
- Bee sub-species are commonly called a _____ .
- The original bee races have been hybridized for desirable traits and particular uses. A hybrid is _____ .

Bee Growth

Bees go through complete **metamorphosis** — four stages — as they grow. None of the stages look at all like the others. These stages are **egg**, **larva**, **pupa** and **adult**. As shown in the drawing, an instar is a stage between two periods of molting, when the developing bee casts off its exoskeleton.

Fleas, flies, beetles and moths also belong to this group. Some insects such as grasshoppers and termite go through gradual metamorphosis with just three stages of gradual metamorphosis: egg, nymph and adult.

Note: Eggs hatch, but adult bees emerge.



Honey Bee Castes

Note: Much of the following information has been adapted from *Starting Right with Bees*.

Bee colonies include a queen mother (female), some **drones** (males) and many workers (females). The different types are called **castes**. The queen and worker bees are females, and the drones are males. The queen lays all the eggs for the colony, one per honeycomb **cell**. Drones mate with a virgin queen to fertilize the eggs. The worker bees do many jobs.

- **Queen:** A colony has one queen whose sole duty is to lay eggs. Queens produce a variety of pheromones that regulate behavior of workers and help swarms track the queen's location during the swarming. Bees raise a new queen when the old one starts to fail or is injured, lost or killed, or to provide a queen for a swarm. A queen egg develops (through metamorphosis) into a **larva**, which is fed a large amount of **royal jelly** for five days. Worker bees then seal the cell and the larva spins a cocoon, becoming a pupa. She remains in the pupal state for seven or eight days. The new queen then works her way out of the pupae with her mandibles and the help of worker bees.

She is now an adult bee. The new queen roams over the combs for five or six days seeking and destroying other virgin queens or queen cells that may be in the hive. She then flies out of the hive and mates with 10 or more drones. She does this only once in her life and can then lay eggs for several years. She begins to lay eggs two to three days after mating. The queen lays all the eggs in the hive and determines if they will be worker bees or drones. **Unfertilized** eggs become drones. Fertilized eggs become worker bees.

During the busy season a queen can lay over 1,000 eggs per day. The **honey flow** and strength and needs of the colony regulate her laying. There must be enough young worker bees to feed the larvae and incubate the eggs at a constant 95°F (34.6°C). The queen must lay many eggs in the

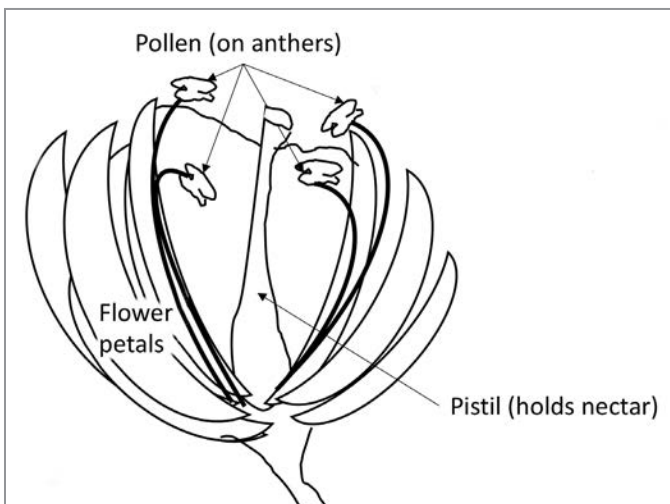
summer because the workers only live for six weeks. The population must reach over 40,000 individuals to have enough bees to collect ample honey stores for winter survival. The queen can be the mother of 75,000 workers in one season and may have as many as 500,000 offspring in her lifetime. In temperate regions the usual laying season is February to October. Queens can lay either worker or drone eggs. Although queens may live for three to four years, queens over one year of age usually do not reproduce as well, so many beekeepers replace their queens annually.

- **Drone.** A drone is an unfertilized male honey bee. It has half the number of chromosomes as a worker or queen. Drones do not have organs for gathering nectar or secreting wax or a stinger. They do not work; worker bees even feed them. A drone's entire function is to mate with the virgin queen so she can lay fertile eggs that develop into worker bees who build a colony. Drones that mate with a queen die soon after. Once the honey flow and mating seasons are over, any remaining drones are pushed out of the hive to die.
- **Worker bees.** Worker bees collect, store and cure flower nectar to make honey. They collect and store pollen and secrete **beeswax** to make the honeycombs. They are also the guards, nurses and cleaning crews of the hive. Age regulates each job that a worker performs:
 - **Cleaners.** Young worker bees clean cells in the brood.
 - **Nurses.** A worker's next job is to take care of larvae, secrete food and help keep the brood warm. These nurse bees may also help feed and lick the queen, ventilate the hive and help ripen honey. They secrete wax and begin comb-building if it is needed. Beeswax is produced only by young worker bees.

- *Field bees* (also called foragers). At three weeks of age, the worker bee begins to move out of the warmer brood nest to the honey **supers** and soon begins gathering nectar and pollen. Pollen is produced in the male part of a flower called the anthers. Nectar is held in the pistil, as shown in the drawing below. Field bees collect pollen from flowers in the form of tiny pellets and carry it back to the hive in small, basketlike pouches on their back legs. This pollen varies in color depending on the type of flower it comes from. Field bees also collect water, nectar and **propolis**. Water is used to cool the hive. Workers gather propolis from resinous buds, pine sap, and other gummy substances to use as a varnish or glue. It cements things together and fills in cracks or uneven surfaces inside the hive.

- *House bees*. House bees patrol the comb and remove debris and litter, usually depositing it outside. If something too large to move, like a mouse, dies in the hive the bees cover it with a layer of propolis.
- *Guard bees*. Guard bees check each bee that enters the hive to make sure it belongs to the colony and alert the other bees if an intruder tries to enter.

Mature worker bees rule the colony. They direct the queen's life and drive out drones when the honey flow is over. Most worker bees live six weeks or less, except for worker bees born in the fall. These bees have more fat cells than others, rarely leave the colony and do little foraging so they can take care of the hive over winter. They live from four to six months.



Quiz Yourself

- The castes of honey bees are

- The queen's only job is

- A drone is an

- Which caste collects, stores and cures flower nectar and pollen; secretes beeswax; and serves as the guards, nurses and cleaning crews of the hive?
