Virginia Cooperative Extension

4-H Honey Bee Leaders Guide Book II

Veils, Smokers, and Supers: Equipment of Beekeepers

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Virginia Tech
Invent the Future

VIRGINIA STATE

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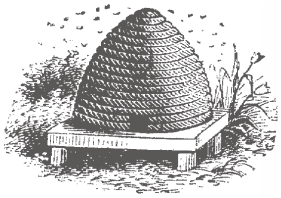
The honey bee project meets the following Virginia State Standards of Learning (SOLs) for the fourth, fifth, and sixth grades:



Grade 4

English

4.1 - The student will use effective oral communication skills in a variety of settings.
- 4.1a: Present accurate directions to individuals and small groups.
- 4.1c: Seek ideas and opinions of others.

4.6 - The student will demonstrate comprehension of information resources to research a topic. Key concepts include:
- 4.6a: Construct questions about a topic.
- 4.6b: Collect information, using the resources of the media center, including online, print, and media resources.
- 4.6c: Evaluate and synthesize information.

4.7 - The student will write effective narratives, poems, and explanations. Key concepts include:
- 4.7c: Organize a plan of writing to convey a central idea.

Science

4.1 - The student will plan and conduct investigations in which:
- 4.1a: Distinctions are made among observations, conclusions, inferences, and predictions.

4.5 - The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment. Key concepts include:
- 4.5b: Organization of communities.

Grade 5

English

5.1 - The student will listen, draw conclusions, and share responses in subject-related group learning activities. Key concepts include:
- 5.1c: Summarize information gathered in group activities.

5.8 - The student will write for a variety of purposes: to describe, to inform, to entertain, and to explain. Key concepts include:
- 5.8g: Using available technology to access information.

Science

5.1 - The student will plan and conduct investigations in which:
- 5.1g: Manipulated and responding variables are identified.
- 5.1h: An understanding of the nature of science is developed and reinforced.

Math

5.3 - The student will create and solve problems involving addition, subtraction, multiplication, and division of whole numbers, using paper and pencil, estimation, mental computation, and calculators.

5.11 - The student will choose an appropriate measuring device and unit of measure to solve problems involving measurement of:

5.11a: Length

Grade 6

English

6.1 - The student will analyze oral participation in small-group activities. Key concepts include:
- 6.1a: Communicating as leader and contributor.

6.5 - The student will read and demonstrate comprehension of a variety of informational selections. Key concepts include:
- 6.5a: Identifying questions to be answered.
- 6.5b: Making, confirming, or revising predictions.
- 6.5e: Organizing the main idea and details to form a summary.
- 6.5g: Selecting information sources appropriate for a given purpose.

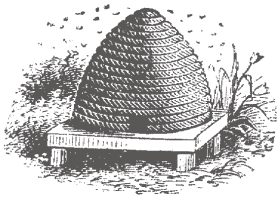
Science

6.1 - The student will plan and conduct investigations in which:
- 6.1f: A method is devised to test the validity of predictions and inferences.
- 6.1k: An understanding of the nature of science is developed and reinforced.

Math

6.8 - The student will solve multistep consumer-application problems involving fractions and decimals and present date and conclusions in paragraphs, tables, or graphs. Planning a budget will be included.

To the 4-H Leader: The beekeeping project books (1- 4) are intended to teach young people the basic biology and behavior of honey bees in addition to hands-on management skills. The honey bee project books begin with basic honey bee and insect information (junior level) and advance to instruction on how to rear honey bee colonies and extract honey (senior level). These project books are intended to provide in-depth information related to honey bee management, yet they are written for the amateur beekeeper, who may or may not have previous experience in rearing honey bees.



Acknowledgments

Author:

Dini M. Miller

Assistant Professor
Department of Entomology
Virginia Tech, Blacksburg, Va.

Introduction

With our understanding of honey bee biology and colony structure, we can begin to investigate the process of rearing bees for ourselves. To begin, we need a good understanding of the equipment we will need and how to use it. We will need to know the parts of the beehive and how to assemble them properly to facilitate bee rearing and honey production. Finally, we will need to handle bees within the hive. The Honey bee Project Book 2 provides the 4-H member with specific information about beekeeping, bee handling, and hive inspection.

Life Skills Objectives:

- Learning through observation, problem solving, and critical thinking.
- Working together by cooperating and communicating.

Learning objectives:

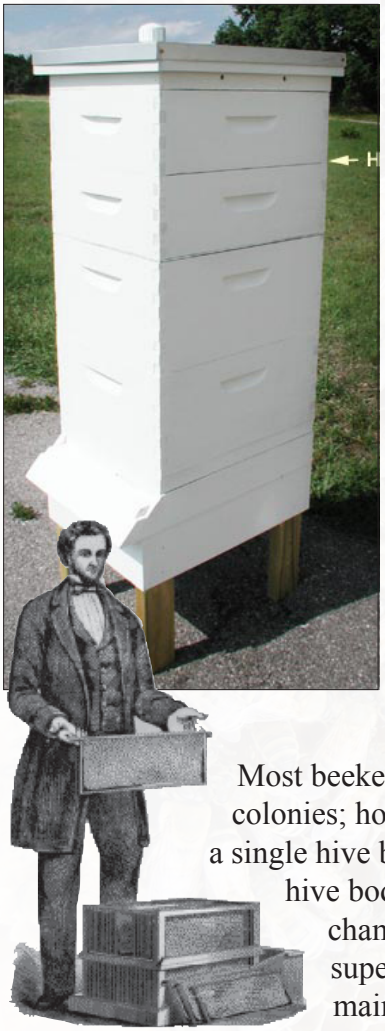
1. To become familiar with each part of the standard beehive and its function.
2. To correctly assemble a honey bee beehive.
3. To properly perform a honey bee colony inspection.

Caution

If anyone in your club is known to have severe allergic reactions to bee stings, they should not participate in this project.

The Bees' Home

Humans keep bees, but honey bees are not considered domesticated in the sense that a dog, cat, or cow is. It makes no difference to the bees whether they live in a hollow tree or in a human-made hive in someone's backyard. They are, therefore, not dependent on humans. However, beekeepers can help the bees by managing their living space and stimulating their activity. This bee management helps the beekeeper as well as the bees. One of the beekeeper's first tasks is to get the bees into a living situation where he or she can inspect their progress from time to time. A hollow tree or other natural nest site is not very convenient for inspection; so honey bees are kept in human-made houses called beehives. The standard beehive that was developed in 1851 has changed very little since.



L.L. Langstroth discovered the "bee space," which in turn led him to invent a beehive that is now standard in the United States and many other countries. Langstroth found that a space of 1/4 to 3/8 inch was too wide to induce bees to deposit propolis (a type of glue that bees use to close off areas in the hive) and too narrow for comb building. Yet the space was large enough to permit the free passage of bees. So the Langstroth or standard hive is 18 1/4 inches long by 14 5/8 inches wide inside, opens at the top, and contains 10 hanging frames inside that are 9 1/8 inches high by 17 5/8 inches long. Each frame is surrounded by a 1/4-inch bee space. With this bee space conserved, each frame containing comb can be easily removed and inspected without disturbing the rest of the hive.

The bee comb is constructed of wax. The comb consists of six-sided cells constructed on each side of a central rib. The cells are always constructed parallel to the ground. These cells are the storage containers for the bee colony and serve as a nursery for rearing young bees. The standard beehive provides 10 wooden frames or racks for the bees to build a comb on. The frames reinforce the comb so it can be handled without fear of breaking the delicate wax. Sometimes horizontal wires are added to further strengthen the comb. These wires are threaded through holes in the frame's end bars, pulled taut with pliers and tied off at small nails hammered in the end bar. The beekeeper often provides a starter sheet of wax on the frame to give the bees a guide for building their comb. This is called the foundation, and sometimes has 10 vertical wires running through it to further strengthen the comb.

The assembled beehive sits on a bottom board that provides the colony with protection. An entrance cleat is often used during cold weather when a small bee entrance is desired. The hive body, or brood chamber, sits on the bottom board. The hive body contains frames on which the honey bees build comb and is where the bee larvae are reared and the queen is confined. Most beekeepers use two hive bodies for their colonies; however, beginners usually start with a single hive body. Supers (medium or shallow hive bodies) are placed above the brood chamber(s) for the storage of honey. A super has frames with comb just like the main hive body, but is not as deep. A queen excluder may be placed between the hive body and the honey supers. The excluder confines the queen to the hive body so she cannot lay eggs in the honey super. Finally, an inner cover tops the entire array of boxes. The inner cover usually has an oblong hole in the center to improve ventilation and provide access for smoking the hive (see Beekeeping Tools). An outer cover placed over the inner cover keeps rain out.

The beehive top to bottom

Many beekeepers will customize their hive to suit their individual needs. They may add additional supers and brood chambers or they may eliminate the hive stand. It is important to familiarize yourself with the basic components of a beehive and be able to describe their functions.

Telescoping hive cover: A cover that fits over the sides of the top super to protect the hive and provide proper ventilation. Sometimes has a galvanized metal top.

Inner cover: Creates dead air space for insulation from heat and cold. Placed between the outer cover and supers or hive bodies. Also prevents the bees from sealing the top cover onto the super.

Shallow super: For surplus honey storage. Bees store their extra honey in these supers. The supers have an inner depth of 5 11/16 inches. They are placed over the queen excluder. Additional supers can be added to accommodate additional honey flow.

Medium deep super: For surplus honey storage or may be used as hive bodies. They are 6 5/8 inches in depth. They are also placed over the queen excluder and additional units may be added as needed. They may also be used as part of the hive body, in which case they are placed under the queen excluder.

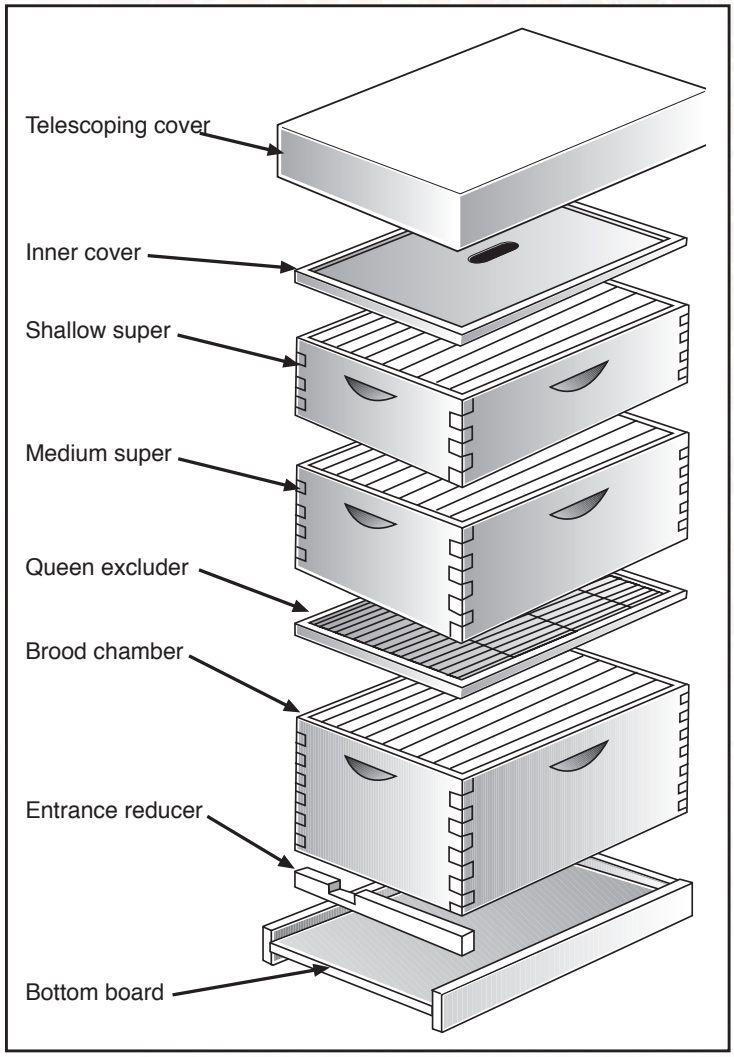
Queen excluder: Keeps the queen bee in the brood chambers, because she is too large to pass through the excluder. The queen excluder is placed between the hive bodies containing the brood nest and the honey super(s).

Frames: A wooden structure that holds the wax comb foundation. Frames are placed in the hive bodies for brood rearing and in the supers for storing honey.

Full depth hive body or "brood chamber": Where the bees live. The queen lays eggs and the brood is raised in these chambers. Honey is also stored for the bees' food. It is placed directly above the bottom board. For mature colonies, two hive bodies are needed to provide sufficient space for the bees, brood, and food honey.

Bottom board: Forms the floor of the hive. A wooden entrance reducer is often used to keep out cold and foraging rodents, while still allowing bees to go in and out.

Hive stand: Keeps the hive off the ground to keep the hive bottom dry and insulates the hive.



Foundation types:

Plain Brood: Made of 100 percent pure beeswax. This wax is plain (not wired) to be used for brood or extracting.

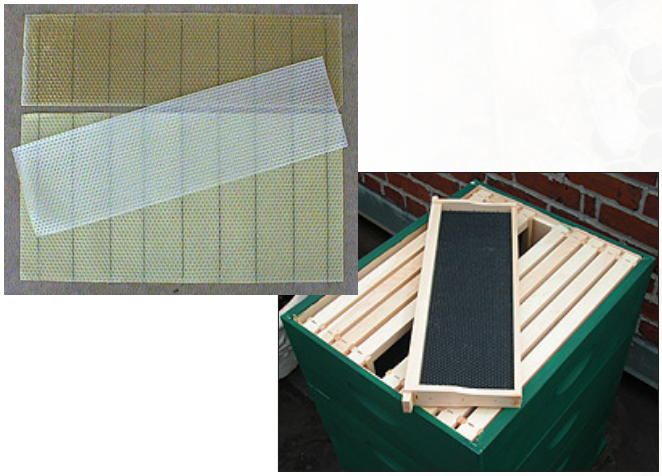
Wired Brood: Made of 100% pure beeswax. 10 closely crimped wires in each sheet. Use this foundation for brood or extracting. Cross wires are recommended for deep frames.

Duragilt: Made with plastic inner core and coated on both sides with beeswax and metal edges to reinforce and strengthen.

Duracomb: Made with plastic inner core and coated on both sides with beeswax. Support pins are needed to add strength.

Plasticell: Made of plastic and may be purchased plain or coated with beeswax.

Cut comb and thin surplus: Made with 100 percent pure beeswax. Made for chunk honeycomb and comb honey cut from frame.



Where do the bees come from?

Colonies can be started from packages (a wire-screened box containing worker bees and a queen) or from nucs, small nucleus colonies that a beekeeper buys and then transfers into his own hives (bees, brood, and frames of comb). Most bee vendors advertise in beekeeping journals, but your local Extension agent is also a good source of information on where to obtain bees.

Where should the beehive be located?

Honey bees can be kept almost anywhere in Virginia. There are several essential elements required for maximum performance from the bee colony.

1. Ideally, an abundant source of nectar and pollen (flowering plants) should be near the apiary.

2. Nectar and pollen producing plants that bloom in the late summer, fall, winter, and early spring are the most beneficial for brood rearing and overwintering.

3. Colonies also need a good source of clean water within a quarter mile of the hive. In hot weather, bees in strong colonies may need a gallon of water a day. The water is used to cool the interior of the hive.

4. A container of water with a landing area enables the bees to take up water without getting wet. Wood blocks, cork, rocks, gravel, or burlap cloth can be used in the container to provide a stand for watering bees.

5. Honey bee colonies need to be located in areas that are sunny in the morning and shaded in the afternoon.

6. Hives should be located on a hillside or in an area with a slight slope to help drain away moisture and humid air.

7. A good vegetative growth on the north side of the hive should be available to protect colonies from cold winter winds. Trees and shrubs also make good windbreaks for protecting colonies.

8. An apiary should be near a hard-surface road. It may be necessary to visit the colony in all kinds of weather.

Beekeeping Tools

The standard beehive is the key to keeping bees effectively. There are, however, some other tools you need to examine a beehive properly. The first and perhaps most important is the veil that covers the head. Many kinds of veils are shown in bee-keeping catalogues. Get a good one and place it snugly around your shoulders and neck to keep the bees out. Another essential tool is a bee smoker. A smoldering fire is built in the can of the smoker. The attached bellows is used to blow smoke into the beehive and quiet the bees. Finally, there is the hive tool, which is used to pry the frames apart.

Helmet and Veil

Bee smoker

Hive Tool

Dressing for success

Before handling any group of bees it is important to wear the appropriate clothing. Dress in light-colored, cotton or rip-stop nylon clothing. Wear your bee helmet and veil with the netting of the veil snug around your shoulders. Wrap your pants legs around the tops of your boots and secure them in place with rubber bands or tape. This will prevent bees that may drop from frames from crawling up your pants legs. Put on gloves before opening the hive.

Preparing for honey bee stings

Bee stings are not a problem for 99 percent of the population. However, some people are hypersensitive to bee venom and develop an anaphylactic reaction within minutes of being stung. A person suffering an allergic reaction must receive medical attention immediately. Commercial bee-sting kits are available by prescription. The kits contain a preloaded syringe of epinephrine hydrochloride and antihistamine tablets. Those who have shown evidence of increasingly severe reactions to bee stings should keep the necessary medications available at all times. Allergy medication can be carried to relieve the sting reaction in individuals who are not dangerously sensitive. Fortunately, most people do not experience anything other than localized swelling, redness, and pain as a result of being stung. The stinger can simply be removed with a knife blade or fingernail by scraping along

the skin surface. Immediate removal of the stinger and the application of honey from the comb will soothe the affected area. Most beekeepers develop a tolerance to the stings and their reaction to stings is much reduced after frequent, repeated stings.

Inspecting a Colony

Perform the first several inspections with an experienced beekeeper. This will reduce your risk of getting stung and avoid possible damage to the hive or bees from mishandling. Limit your colony inspections to days when the temperature is 60ºF or warmer, the sun is shining, and winds are calm. Work with slow, steady movements. Handle the parts of the hive carefully to avoid bumping or shaking the bees off of the frames.

1. Light your smoker and fill the can with fuel such as dried pine needles, grass, leaves, burlap fabric, or cotton cloth. Do not use materials of animal origin such as wool fabric, fur, or feathers because these products leave a persistent smell when burned that will taint the hive.

2. Approach the colony from the back or side of the hive. Lightly smoke the entrance by gently puffing smoke into the opening along the front. Lift the outer cover up 2 to 3 inches along one side. Gently blow in a few puffs of smoke then let the cover down. Wait a few minutes then slowly remove the outer cover. Lightly smoke the hole in the center of the inner cover. Place the outer cover on the ground near the front of the hive. Remove the inner cover and place it cleat side up across the outer cover so you now have a base for stacking the supers or hive bodies as you inspect them.

3. Using the hive tool, gently insert the flat end of the tool between frames and gently seperate each end. Gently remove a frame from the body. Hold the frame in front of you with one hand on each side of the top bar. Observe the bees in the comb. Ask the beekeeper to help you inspect the frames for the following items:

- Areas of cells with brood – a prolific queen will have a laying pattern of brood over most of the frame with very few skipped cells.
- Capped cells with pupae – worker bee cells are capped over 5 1/2 days of larval development. Inside each cell a larva will pupate and change into an adult. Adult queens, drones, and workers develop at different rates. Worker bees develop in 21 days, drone bees develop in 23 days, and a queen bee develops in 16 days.
- Eggs inside the cells – eggs laid by the queen stand on end in the bottom of the cells, one to a cell.

- Larvae in the cells – in 3 days, eggs hatch into larvae. Healthy larvae or young brood are pearly white. Gray, yellow, brown, or black larvae are diseased, chilled, or injured.
- All colonies should have a reserve of honey and pollen stored in the frames. Hives should have a minimum of 15-20 pounds of honey at any time (2 1/2 - 3 full depth frames of honey) and approximately 50 pounds going into winter.
- Two or more eggs attached on the sides of the cell – these eggs are from a laying worker. Laying worker colonies are not common, as workers do not develop the ability to lay eggs unless the queen is absent and most of the brood is gone.
- Sunken, perforated cell caps – cell caps of healthy brood are convex. Cell caps of unhealthy brood are often concave and perforated with small holes.

When inspecting a hive, it is a good idea to examine all of the frames containing brood. After removing the first frame, it should be set on the ground leaning against the front or side of the hive. This creates a space in the hive, making it easier to work the bees. When the next frame is removed, it can be placed in the space left by removing the first frame. The process is repeated until all of the frames have been inspected. The frame should be replaced in their original positions when the inspection is complete.

Why inspect colonies?

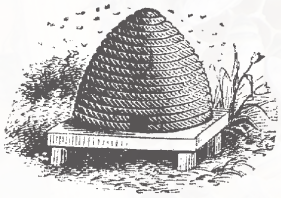
Colonies are inspected for a variety of reasons. The most important reason is to maintain the health of the colony. When the colony is opened, the beekeeper can feed the colony, treat disease or pest problems, re-queen, replace damaged combs with foundation, add an empty super, or remove a super of honey. If you intend to work on the colony during your inspection, it is very important to prepare the materials you will need in advance. Be sure to have them near you when the colony is opened. Always have a smoker available to keep the bees calm.

Summary

The standard beehive we use today was developed in the 1851 by L.L. Langstroth. The Langstroth hive is based on the concept of "bee space" and contains 10 frames on which the bees can build comb. Each frame is surrounded by a 1/4-inch "bee space." The hive consists of "hive bodies" which contain the honey bee brood and "supers" where the honey is stored. Bee colonies must be inspected on a regular basis to make sure the bees are healthy and the colony is growing. To inspect a beehive you must have the proper tools, a bee veil to prevent stings, a smoker to calm the bees, and a hive tool. Always be prepared for honey bee stings when inspecting a hive. People who are allergic to bee stings should avoid working with bees or have a bee-sting kit available at all times.

Additional Learning Activities

1. Describe the function of the major parts of the Langstroth or standard beehive. Arrange the parts of the hive in the proper order from top to bottom. Demonstrate to your leader that you can assemble the hive boxes in the proper order.
2. Locate three resources that have bee packages for sale. List the types (races) of bees each resource has available (Italian, Carniolans, etc.), the different package sizes (2-pound, 3-pound, etc.) and the cost of the packages (include shipping costs). List the races, sizes, and cost of the bees in a table.
3. Demonstrate to other 4-H members the proper protective clothing you wear when working with bees. Describe what to do if a bee stings someone who is allergic to bee venom versus someone who is not allergic.
4. Contact a beekeeper and ask to accompany him/her on one of his/her hive inspections. Ask the beekeeper to tell you how he/she decided on the location of the hives. Share this information with your 4-H group.
5. In the presence of an experienced beekeeper, perform a hive inspection as described in this project book. Wear the proper protective clothing; use the smoker and a hive tool. Document your inspection by having the beekeeper take the following 3 pictures of your inspection: 1) inspecting the brood comb, 2) identifying the queen bee, and 3) pointing out the comb containing honey.
6. Using a digital or disposable camera, take pictures of possible locations for your future apiary. Explain the advantages and disadvantages of each location, like access to water, near flowering plants, etc.
7. Start investigating how making honey from different nectar sources influences the taste. Your 4-H leader will provide you with several different types of honey to taste. Record the different honey nectar sources below. Which honey did you like the best? Which did you like the least? If you were going to locate your apiary near a nectar source (type of flowering plants) which would it be?
8. Make a diagram of the honey bee's development in the cell. Include the length of the egg, larval, and pupal stages and the adult at emergence.
9. Private investigation: It is well known that beekeepers want to protect their bees from insecticides. However, almost all agricultural crops that rely on bees for pollination are also treated with insecticides. Using any sources you like, including people, find out how farmers and beekeepers go about protecting bees from insecticide.



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