



SOUTH CAROLINA FAMILY AND COMMUNITY LEADERS
Affiliated with National Volunteer Outreach Network, Country Women's Council, U.S.A., Associated
Country Women of the World and in partnership with Clemson University Cooperative Extension Service
SCFCL website: <http://www.scfcl.com>

Leader Training Guide

Honey Bees and Beekeeping

Objectives:

- Develop an appreciation of the role of honey bees in agriculture
- Gain a basic understanding of honey bee biology
- Learn about the basics of beekeeping

Lesson Overview/Introduction:

Honey bees play a vital role in agriculture – as managed pollinators, they contribute to the \$15 billion of increased crop value each year (USDA-ARS). In South Carolina, honey bees are important pollinators of squashes, apples, and berries, among other crops. In 2014, the honey produced in SC brought in more than \$1.86 million (USDA-NASS 2014). Unfortunately, colony losses are higher than what is considered acceptable by beekeepers – a national survey reported 42.1% of managed colonies died in 2014, the second highest annual loss recorded to date (BIP 2015). The causes of colony losses range from pests and disease to management issues to environmental conditions. Current research is investigating these areas and attempts to come up with remedies and suggestions for management practices.

There are many reasons to keep bees – agriculture drives many commercial beekeepers, but other people keep bees for honey or merely for enjoyment, as these are fascinating animals. This lesson will go over some of the basic biology about honey bees, what is involved in beekeeping, and the importance of bees and beekeeping to agriculture. There are many ways to keep honey bees so a general approach will be presented and other methods can be found in the resources listed at the end of the lesson.

Lesson:

Bee Biology

Honey bees are social insects that live in large, highly organized colonies of individuals and exhibit highly altruistic behavior. A honey bee colony has 3 types of bees – workers, drones, and a queen. The queen and workers are all females but only the queen has reproductive functions; the workers “give up” their own reproduction to assist in raising their sisters. The queen is the mother of all of the bees in the hive – her job is to reproduce. She produces both fertilized (female) and unfertilized (male) eggs – at the peak of the season, she can lay up to 1,000-1,500 eggs each day. She produces chemical odors (pheromones) that allow the workers and drones to recognize her. Drones are male bees and when mature, they fly to congregation areas to look for a virgin queen to mate with; their sole function is reproduction, they do no work. Worker bees are a different story – these female bees are the bees you see outside foraging on flowers. As adult worker bees age, they perform different tasks. Young bees perform nest cleaning and nursing behavior (feeding developing bees). Then they progress into handling and processing food stores.

Before they become foragers (at around 3 weeks of age), some individuals become guards and protect the hive from predators and bees from a different colony. Finally, the progression ends with foraging – this is a risky and costly task that usually results in the end of the bee’s life after 2-3 weeks of this behavior. One of the most interesting behaviors honey bees perform is a “waggle dance” to recruit and direct other bees to profitable floral resources. This figure eight dance indicates the direction and distance to these food patches. Honey bees typically forage within a couple miles of their hive, but if resources are limited, they can fly five miles out to find suitable forage.

Beekeeping

Just as there are many ways to keep bees, there are many types of equipment that can be used. Most beekeepers today use a Langstroth hive that consists of a bottom board with entrance gap, a number of hive boxes (in various depths – deep, medium, and shallow), an inner cover, and an outer cover. Deep hive boxes are typically used for rearing brood (developing bees) while shallow boxes are used for honey – when full, these shallow boxes can weigh ~40 pounds so a deep box would be a very heavy load to lift! A queen excluder can be placed between boxes to control the movement of the queen and the distribution of brood in the hive – you do not want developing bees on the frame you want to extract honey from! Each removable frame is made of plastic or wood with a plastic or wax sheet of “foundation” that is imprinted with patterns of hexagonal cells.

In addition to equipment, a well-prepared beekeeper must have the appropriate protection and tools for beekeeping. A bee veil is key for protecting one’s face and neck from stings. A bee suit or jacket will provide protection for one’s body and gloves provide coverage for hands and arms for beginning beekeepers (gloves can be cumbersome so more experienced beekeepers go without them). Light colored suits and clothing make beekeeping in sunny and hot conditions more comfortable and bees do not respond well to dark clothing, as you may end up looking like a natural predator (e.g. bear) to them. The essential tools for working with honey bees are a smoker and a hive tool. Smokers burn fuel like pine needles and wood shavings and the smoke functions to cover any alarm pheromone emitted by worker bees. The hive tool is like a mini crowbar and allows for the separation of hive boxes and frames within the boxes.

Beekeeping has a seasonal aspect to it – hives are most active in the spring and summer and spend the late fall and winter in more of a dormant phase. In the spring, the queen gets back into the reproductive swing of things and starts laying more eggs, which leads to an increase in the worker bee population. The bees forage for nectar and pollen and store ripened nectar (honey) for periods when floral resources are not available and weather does not allow for foraging (the winter). In the late summer and fall, the queen slows down her egg laying and the colony starts to prepare for the winter – the physiology of the bees changes and activity decreases. There is very little to no brood (developing bee) production during the winter – because dying bees are not replenished, this is a critical period for the bees in terms of survival.

One of the most exciting (and messy) beekeeping activities is extracting honey. Honey bees collect nectar from flowers, add enzymes to break down the sugars, store it in the cells in the colony, evaporate the water by fanning, and seal the cells with wax when the water content is ~15-20% water. In the summer, beekeepers then harvest frames or boxes of frames of sealed honey. The wax cappings are removed either by a hot or cold knife, scratchers, or punches. The frames

are then inserted into an extractor, which functions like a centrifuge and spins the honey out from the frames. Extractors can have a hand crank or a motor. A spout at the bottom of the extractor allows for the honey to be run through a filter and into a five-gallon bucket or container. After letting the honey settle for at least a day, the honey can be bottled. Honey bees also produce wax, which can be used for candles and cosmetics.

Issues in Beekeeping

There are many challenges for bees and beekeepers - the major categories are pathogens, parasites, management issues, and environmental stressors. In the last 10 years, a lot has been learned about these issues but the solutions to the problems have been more difficult to identify. Honey bees can carry a variety of pathogens, from microsporidia that can invade the gut to several viruses that can lead to deformation and paralysis to highly contagious bacteria that kills off developing bees. One of, if not the most major, challenges in beekeeping worldwide is the Varroa mite. This mite lives in the hive and feeds on developing and adult bees and can vector/spread several different viruses. Additionally, there are hive pests that can attack weak hives (due to pathogens, pests, poor management, etc.) – examples of these are wax moths and small hive beetles, which feed on eggs/larvae, honey, and pollen. Hive management issues include migratory beekeeping, overharvesting of honey, overcrowding, allowing pest and pathogen issues to go untreated. Much of honey bee health research investigates the effects of environmental stressors on honey bees – these include nutrition and pesticides. As with any living organism, having a plentiful, long-lasting, and highly nutritious diet is key for having healthy bees. Even though the diet of honey bees is simple (nectar for carbohydrates and pollen for protein), not all proteins are created equally and not all plants provide plentiful nectar – therefore, beekeepers are encouraged to keep their hives in locations where there is diverse forage for the sake of obtaining all the necessary nutrients and to have forage available as much of the year as possible. Africanized bees also pose a threat, albeit limited, to SC beekeepers.

Lesson Summary:

The role of honey bees in our day-to-day lives may not be obvious if you are unaware of their role as pollinators. These are interesting animals with a complex natural history. Honey bees can be kept for a number of reasons – pollination, honey production, or as a hobby. Beekeeping is an exciting activity, but protective measures and the right equipment make it even more fun! Keeping healthy and productive bees is not always easy and there are several challenges that bees and beekeepers face, but when productive and healthy, honey bee hives will produce an excess of honey, which can be harvested by beekeepers and given away as gifts or sold.

Suggested Activities:

Demonstrate gained knowledge of bee biology – describe the different castes of honey bees, describe the life cycle of honey bees, describe the various roles/tasks a honey bee performs throughout its life.

Visit a local apiary:

- Fill out an inspection form while going through a hive (see Sources/References)
- Identify the queen, workers, and drones – estimate the number of each within the colony.
- Identify nectar, honey, brood (developing bees), and pollen – estimate how many floral resources have been visited based on the various colors of pollen.

- Assist in the extraction of honey (depending on the beekeeper, this may happen Jun-Aug and possibly again in the fall if there has been a strong fall nectar flow).
- Observe a forager performing the waggle dance.

Suggested Materials:

- Purdue University's 4-H beekeeping booklets are practical for any beginning beekeeper, not just youth
- Leaders may consider purchasing a 'dummy' hive to use in demonstrations – photographic inserts are available for purchase that illustrate various concepts in bee biology and beekeeping

Lesson Prepared by: Dr. Jennifer Tsuruda, Clemson University Apiculture Specialist; June 2015

Lesson Reviewed by: Millie Davenport, Clemson Extension Consumer Horticulture Agent

Sources/References:

USDA-NASS (2014) Annual Report on Honey:

<http://usda.mannlib.cornell.edu/usda/current/Hone/Hone-03-20-2015.pdf>

Bee Informed Partnership (BIP) (2015) Preliminary Results: Honey Bee Colony Losses in the U.S., Winter 2014-2015. <http://www.extension.org/pages/58013/honey-bee-winter-loss-survey#.VZPzI1YnMpE>

Indiana 4-H Beekeeping – Helper's Guide. Purdue Extension 4-H-576-W

4-H Beekeeping – Division I – Understanding the Honey Bee. Purdue Extension 4-H-571-W

4-H Beekeeping – Division II – Working with Honey Bees. Purdue Extension 4-H-586-W

4-H Beekeeping – Division III – Advanced Beekeeping Methods. Purdue Extension 4-H-593-W

http://www.extension.org/bee_health – this website has information about basic beekeeping as well as overviews of some of honey bee research that has been conducted across the Extension programs across the U.S.

<http://scliving.coop/sc-life/sc-life-features/practical-beekeeping/>

<http://www.beeculture.com>

<https://www.mannlakeLtd.com/newsletter/Hive-Inspection-Sheet.pdf>

<http://www.honey.com>