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AMERICAN BEEKEPING FEDERATION

BEGINNING BEEKEEPING TOOLKIT

Welcome to the World of Beekeeping!

Thank you for contacting the American Beekeeping Federation. We have chosen the enclosed resources to provide the most basic information in starting your beekeeping adventure. We hope you find this information helpful as you begin or expand your beekeeping journey.

A great place to start your online search is on the ABF's website. We recently updated our site to include even more information for you!

We also encourage you to think about joining the ABF where you will have a connection to over 1,500 members, suppliers and beekeeping industry experts!

Happy beekeeping!

What's Included:

- F.A.Q.
- Information for Bee-ginners
- Honey Bees & Beekeeping Overview
- Wintering Your Hives
- The 4 P's that Affect Bees
- How Pesticide Exposure Spreads
- ABF Membership Application
- Latest Issue of the *ABF Quarterly*

Q&A: What's It Take to Get Started in Beekeeping?

By Delaware Beekeepers Association

Q: How much time does it take to keep bees?

A: Beekeeping is a seasonal hobby, and therefore, the time varies with the seasons. In the winter, there is practically nothing to do except to occasionally check for physical damage or snow blocking the entrances. The busiest time is in the early summer when each hive should be checked weekly to prevent swarming and to add additional honey supers. This needn't take longer than a few minutes once you get the hang of it.

Q: Is beekeeping hard work?

A: Beekeeping does require some strength, and a bit of physical labor, although both handicapped people and blind people have been known to keep bees. There are ways of reducing the physical labor involved. Join your local beekeeping association and find out how.

Q: How much will it cost me to get started?

A: There are several bee supply houses that offer a variety of beginner kits. These contain all the equipment you will need to start your first hive. The woodenware can often be purchased pre-assembled. While these kits are handy, they tend to have some things that may not be needed by the beginner (and are a little expensive). They range in price from $215 to more than $300.

Q: What equipment do I need to start keeping bees?

A: First you will need the hive. This consists of a bottom board, two hive bodies with frames and foundation, three medium honey supers with frames and foundation, an inner cover and an outer cover. Secondly, you will need a smoker and hive tool. Buy a large smoker with guard and the long hive tool.

Q: Do I need a bee suit?

A: You will need some sting protection. You can buy a veil and gloves for about $25, a full deluxe English-type bee suit and gloves for around $100 and several in between to fit your budget. While you may learn to shed your protection with time, good sting protection makes sense when you are just starting out.

Q&A: What's It Take to Get Started in Beekeeping?

By Delaware Beekeepers Association

Q: How much honey will I get?

A: That depends on the strength of the colony and the weather. While the Delaware average is around 50 pounds, strong colonies on a good honey flow have been known to make 100 to 200 pounds per year.

Q: Will I get stung?

A: To come to the point…yes. But, it really isn't as bad as you think. Stings on the hands and arms don't really hurt much if you learn to remove the sting properly. Some seasoned beekeepers actually enjoy the first stings of the year. It means that Spring is surely here.

Q: What do I do if I get stung?

A: Bite your tongue and pull out the stinger…quickly. Never grab the bulb (venom sac) of the stinger and pull. That squeezes all the venom into your skin like a hypodermic syringe. Instead, scrape the stinger off with a fingernail or the sharp edge of your hive tool. This grabs the shaft of the stinger and pulls it out, leaving most of the venom in the sac.

Q: If I swell when stung, am I allergic?

A: No. Swelling is the body's natural immune system at work. Some swelling is normal at first. With enough stings, swelling is non-existent.

Q: Where can I buy bees?

A: Most of the bee supply houses have bees for sale. There are some local producers who sell bees, and many suppliers are listed in the beekeeping periodicals.

Q: Can I keep bees in my garden?

A: Yes, you can. It is advisable that you use a gentle strain of bee and have the entrance facing away from work areas. Sometimes a barrier such as a low fence or hedge placed ten feet in front of the hive will force the bees to fly up and away from traveled areas of your property.

Q: Will bees bother my neighbors?

A: No, not usually. Remember to locate the bees' flight path away from traveled areas. Often, if the hives are hidden from view, no one knows they are there.

Mid-Atlantic Apicultural Research & Extension Consortium

Delaware, Maryland, New Jersey, Pennsylvania, West Virginia and the USDA cooperating

MAAREC Publication 1.2
February 2000

INFORMATION FOR BEE-GINNERS

The honey bee is the only source of honey and beeswax. Bees produce more than 260 million pounds of honey and about 5 million pounds of beeswax annually in the United States. However, these are merely by-products of the honey bee. The bees principal role is in the pollination of over 60 different crops. Bees annually cross-pollinate a number of important fruit and seed plants such as clovers, apples, lima beans, asparagus, buckwheat, cherries, pears, cantaloupes, watermelons, pumpkins, cucumbers, and many berries. In addition, they harvest and make available to man a portion of the nectar resources of the flowers. This nectar crop is a resource just as certainly as coal, lumber, game and shellfish, can be gathered only by means of the honey bee.

APICULTURE AS A HOBBY

Honey bees are kept by many persons as a hobby or as a sideline. Apiculture, which is the keeping of bees and a study of their life and habits, holds a fascination for people in all walks of life – both young and old. A few colonies to furnish honey for the home table or to effect pollination can be kept virtually anywhere.

Apiculture as a hobby can be a self-supporting avocation. It is especially attractive to those interested in natural science. It is a hobby which, if pursued intelligently, involves considerable reading, along with direct observation and study of the behavior of an interesting insect, and a knowledge of the various nectar-secreting and pollen-bearing plants.

APICULTURE AS A SIDELINE

As a sideline, beekeeping offers a splendid paying project for urbanite or farmer. Many beekeepers realize enough return from a sideline bee project to substantially reinforce their regular income. On the farm, the honey produced and farm pollination services are a valuable cash crop.

A few persons keep bees on a commercial basis. Prior beekeeping experience and a strong desire to work long hard hours are necessary for the commercial operator. The rewards of independent, outdoors-type work is a strong lure for the commercial or sideline beekeeper.

REQUIREMENTS FOR SUCCESS

Success in beekeeping requires an intimate knowledge of the biology of the honey bee, as all management practices are based on colony habits and bee behavior. This necessitates considerable reading on the one hand, and observation of the activities of bees in the hive and in the field on the other. A good reference text on honey bees will prove invaluable to supplement state and federal extension publications.

Apiculture cannot be successful unless modern equipment is used. There is no place for “box hives,” “gums,” “cross comb” hives or related receptacles. Comb must be kept within frames; full frames of good comb are needed in every hive body and super. Hives must be standard and frame removable.

Persons highly allergic to bee stings should not keep bees. Stings should not be frequent when colonies are handled properly and normal precautions are taken. They will, however, occur from time to time. Most persons develop a tolerance for bee venom. This reduces the sensitivity to pain and there is less swelling and reaction from the stings.

SIZE OF PROJECT

A beginner should start with 2 or 3 colonies. More than one colony is desirable because of the opportunity it gives for comparing colony growth and production. After a trial of one season or more, additional colonies can be added with great ease and little expense. An alternative method of starting would be to assist a neighbor beekeeper in his operation for one or more seasons.

EQUIPMENT NEEDED

A complete hive would require:

a. 1 metal covered top
b. 1 inner cover
c. 1 bottom board
d. 2 standard 10-frame hive bodies (each body contains 10 frames)
e. 1 queen excluder
f. 2 shallow 10-frame supers with frames

Also needed would be:

a. bee veil
b. bee smoker
c. hive tool
d. bee gloves and coveralls (optional)

Used equipment may be purchased from a beekeeper or new from a bee supply dealer. When obtaining used equipment check the condition of the equipment carefully and have it examined for possibility of disease by the Apiary Inspection Service. New bee equipment can be purchased from a national bee supply manufacturer, large mail order firms or from local bee supply dealers in most larger communities. Starter outfits are available as well; the complete equipment as listed above costs $250 or more.

Although factory-made equipment is ordinarily the most satisfactory, some persons prefer to construct their own hives. If you do this, it is a good plan to purchase or borrow a complete factory-made hive to use as a model. Be sure to reproduce all dimensions exactly: otherwise, the bees will build comb where it is not desired and your equipment may not be interchangeable.

STARTING WITH BEES

There are several methods of getting started:

1. Buy an established colony with all equipment from a local beekeeper. (It should be inspected by your State Apiary Inspector for bee diseases before purchase.)

2. Buy new (or used) equipment, and have a local beekeeper install in it either a swarm or a nucleus (3 frames with adhering bees). Alternately capture a swarm yourself and install it.

3. Buy new equipment and install in it a 3-lb package of bees with queen, purchased from a southern package bee producer.

Method #1 is by far the best for the individuals with some experience, as he/she can get advice from the seller, and the colony will be well established. Also, the established colony can make a surplus crop the first year of ownership. Methods #2 and #3 require some prior knowledge of how to install the live bees. It is not difficult and information on proper procedures is readily available. In Methods #2 and #3, a honey crop should not be expected the first year, although some surplus for harvest is possible.

WHEN TO START

The best time to start beekeeping is when the apple trees are in bloom in your locality. Don't buy bees late in the summer or fall unless you are prepared to give them special attention. Bee colonies started on new equipment have little chance of getting through winter if not started before June 15. The earlier the better. If a colony does not survive its first winter, try again. The second attempt frequently will be more successful.

TYPE OF HONEY TO PRODUCE

Honey bees will visit the most attractive flowers they can find. It is not possible to direct them to, or away from, specific flowers or areas. Colonies can be moved to take better advantage of crops. Each area of the state will have one or more dominant floral sources that will give honey produced in that section its distinctive smell, taste and color. Check with local beekeepers to determine the type of honey produced in your area.

To harvest the honey, the beekeeper can leave it in the comb or extract it to produce the liquid honey. Some beginners attempt to produce honey in the comb. A light foundation is needed in the frames in the super. The ripened honey is simply cut and put in plastic boxes or jars for use. Special supers can be purchased to have the bees store honey in one pound wooden boxes (comb honey) or 12 oz plastic rings (cobana honey). Liquid honey is produced by separating honey from the comb by crushing and letting the honey drain or by use of an extractor. Extractors are an additional cost ($200-400); some beekeepers rent extractors to beginners. An extractor spins the honey from the comb so the comb can be reused. The liquid honey is filtered through cheesecloth to remove pieces of wax and impurities. For several reasons it is easier to produce liquid honey versus honey in the comb.

WHAT TO EXPECT

No return on the project should be expected the first year from package bees, swarms or nuclei. However, if established colonies are purchased, a crop may be realized the first season. With experience, a colony should produce about 40 to 50 pounds of surplus honey. Production depends on a number of factors, not the least of which is the abundance of nectar-secreting plants. Some areas are better than others. Colonies can be kept anywhere and produce a surplus honey crop.

* * *

Keeping honey bees can be fun, rewarding and healthful. It is suggested you start small and expand as conditions permit. The most skillful beekeepers understand bee biology and adapt natural biology to their circumstances. One can, with a little patience and practice, have fun in the process.

MAAREC, the Mid-Atlantic Apiculture Research and Extension Consortium, is an official activity of five land grant universities and the U. S. Department of Agriculture. The following are cooperating members:

University of Delaware
Newark, Delaware

University of Maryland
College Park, Maryland

Rutgers University
New Brunswick, New Jersey

The Pennsylvania State University
University Park, Pennsylvania

West Virginia University
Morgantown, West Virginia

USDA/ARS
Bee Research Lab
Beltsville, Maryland

Requests for information or publications should be sent to: MAAREC, 501 ASI Building, University Park, PA 16802 Phone: (814) 865-1896 Fax: (814) 865-3048 Web site: http://MAAREC.cas.psu.edu

This publication is available in alternative media on request.

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Participants in MAAREC also include state beekeeper associations, and State Departments of Agriculture from Delaware, Maryland, New Jersey, Pennsylvania and West Virginia.

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Honey Bees and Beekeeping

Honey bees (Apis mellifera L.) are one of the most well-known, popular and economically beneficial insects. For thousands of years, man has plundered honey bee colonies to get honey, bee larvae and beeswax. In recent decades, bee plundering has given way to bee management. Now, honey bees are commonly kept in artificial hives throughout the United States, and a large and sophisticated beekeeping industry provides valuable honey, beeswax and pollination services. A large section of the industry, well represented in Georgia, is devoted to mass-producing queens and bees for sale to other beekeepers. Although many people make a living from bees, most beekeepers are hobbyists who have only a few hives and who simply enjoy working with these fascinating insects.

Honey Bee Biology

Honey bees, like ants, termites and some wasps, are social insects. Unlike ants and wasps, bees are vegetarians; their protein comes from pollen and their carbohydrate comes from honey, which they make from nectar. Social insects live together in groups, cooperate in foraging tasks and the care of young, and have different types, or "castes," of individuals. There are three castes of honey bees (see photos on page 4):

Workers - Reproductively underdeveloped females that do all the work of the colony. A colony may have 2,000 to 60,000 workers.

Queen - A fully fertile female specialized for producing eggs. When a queen dies or is lost, workers select a few young worker larvae and feed them a special food called "royal jelly." These special larvae develop into queens. The only difference between workers and queens is the quality of the larval diet. There is usually only one queen per colony. The queen also affects the colony by producing chemicals called "pheromones" that regulate the behavior of other bees.

Drones - Male bees. A colony may have 0 to 500 drones during spring and summer. Drones fly from the hive and mate in the air with queens from other colonies.

The queen lays all her eggs in hexagonal beeswax cells built by workers. Developing young honey bees (called "brood") go through four stages: the egg, the larva (plural "larvae"), the inactive pupa (plural "pupae") and the young adult. The castes have different development times (Table 1).

Table 1. Development time of honey bee castes.

	Days after Laying Egg		
Stage	**Worker**	**Queen**	**Drone**
Hatching	3	3	3
Cell capped	8	8	10
Becomes a pupa	11	10	14
Becomes an adult	20	15	22.5
Emerges from cell	21	16	24

Newly emerged workers begin working almost immediately. As they age, workers do the following tasks, in this sequence: clean cells, circulate air with their wings, feed larvae, practice flying, receive pollen and nectar from foragers, guard hive entrance and forage.Unlike colonies of social wasps and bumble bees, honey bee colonies live year after year. Therefore, most activity in a bee colony is aimed at surviving the next winter.

During winter, bees cluster in a tight ball. In January, the queen starts laying eggs in the center of the nest. Becausestored honey and pollen are used to feed these larvae, colony stores may fall dangerously low in late winter when brood production has started but plants are not yet producing nectar or pollen. When spring "nectar flows" begin, bee populations grow rapidly. By April and May, many colonies are crowded with bees, and these congested colonies may split and form new colonies by a process called "swarming." A crowded colony rears several daughter queens, then the original mother queen flies away from the colony, accompanied by up to 60 percent of the workers. These bees cluster on some object such as a tree branch while scout bees search for a more permanent nest site - usually a hollow tree or wall void. Within 24 hours the swarm relocates to the new nest. One of the daughter queens that was left behind inherits the original colony.

After the swarming season, bees concentrate on storing honey and pollen for winter. By late summer, a colony has a core of brood belowinsulating layers of honey, pollen and a honey-pollen mix. In autumn, bees concentrate in the lower half of their nest, and during winter they move upward slowly to eat the honey and pollen .

Races of Honey Bees

Honey bees are Old World insects that were introduced into North and South America by European settlers. The most well-known races of honey bees in the New World are:

Italian bees, *Apis mellifera ligustica* - Originally from Italy, this is by far the most popular honey bee. Italian bees are yellow in color, relatively gentle, overwinter well and build up quickly in spring. They are easily provoked to rob weaker neighboring colonies and sometimes exhaust honey stores rapidly in winter.

Carniolan bees, *Apis mellifera carnica* - These bees originated in the Austrian Alps, northern Yugoslavia and the Danube valley. Gray/brown in color, they are extremely gentle, conserve winter food stores well and build up quickly in spring. Carniolan bees construct new comb slowly and swarm frequently.

Caucasian bees, *Apis mellifera caucasica* - These bees originated in the Caucasus mountains between the Black and Caspian Seas. They are lead-gray in color, very gentle and swarm infrequently. Caucasian bees overwinter poorly, build up slowly in spring, are susceptible to Nosema disease and gum up their hives with propolis (tree resins and beeswax).

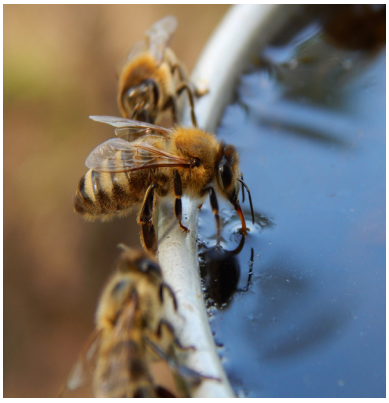
German black bees, *Apis mellifera mellifera* - Originally from throughout northern Europe, this was the first honey bee brought to the New World. They are brown/black in color and overwinter well. German black bees are nervous, aggressive and build up slowly in spring.

Africanized honey bee, *Apis mellifera scutellata* and its hybrids - These honey bees originated throughout east Africa. In the 1950s, this race was imported to Brazil and began migrating northward. Compared to European races, this bee and its hybrids are extremely defensive, have smaller nests and swarm more frequently. Africanized honey bees colonized certain regions of the United States in the 1990s.

Preparing to Keep Bees

Honey bees can be kept almost anywhere there are flowering plants that produce nectar and pollen. Choose a site for bee hives that is discrete, sheltered from winds and partially shaded. Avoid low spots in a yard where cold, damp air accumulates in winter. Your county Extension agent can give you names of local beekeepers and bee organizations that are sources of help and information.

Be considerate of non-beekeeping neighbors. Place hives so that bee flight paths do not cross sidewalks, playgrounds or other public areas. In dry weather, bees may collect water at neighbors' swimming pools or water spigots. Avoid this by giving your bees a water source in your yard such as a container with floating wood or styrofoam chips. The floating objects prevent bees from drowning.



Beekeeping Equipment

One new hive with bees and basic equipment costs about $150. Hive parts are cut to standard dimensions that mimic the space bees naturally leave between their combs. Always reproduce these dimensions exactly if you make your own bee hives. You will need the following equipment.

Bee hive (Figure 1), made up of:

- *Bottom board* - wooden stand on which the hive rests. Set bottom board on bricks or concrete blocks to keep it off the ground.
- *Frames and foundation* - wooden frames that hold sheets of beeswax foundation and are imprinted with the shapes of hexagonal cells. Bees use the foundation to build straight combs.
- *Hive body or brood chamber* - large wooden box (called a "super") that holds 10 frames of comb. This space (the brood nest) is reserved for the bees to rear brood and store honey for their own use. Either one or two hive bodies can be used for a brood nest. Two hive bodies are common in cold winter regions. Beekeepers in areas with mild winters successfully use only one hive body.
- *Queen excluder* - placed between the brood nest and the honey supers. This device keeps the queen in the brood nest, so brood will not occur in honey supers. An excluder is usually not necessary if two hive bodies are used.
- *Honey supers* - shallow supers with frames of comb in which bees store surplus honey. This surplus is the honey that is harvested.
- *Inner cover* - prevents bees from attaching comb to outer cover and provides insulating dead air space.
- *Outer cover* - provides weather protection.

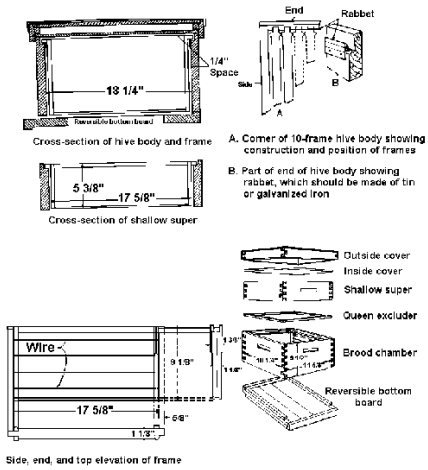


Figure 1. Plans and dimensions for a standard honey bee hive.

Smoker - the most valuable tool for working bees. A smoker calms bees and reduces stinging. Pine straw, grass and burlap make good smoker fuel.

Hive tool - ideally shaped for prying apart supers and frames.

Veil and gloves - protect head and arms from stings. After they gain experience, most beekeepers prefer to work without gloves.

Feeders - hold sugar syrup that is fed to bees in early spring and in fall.

Consult the list of addresses of bee equipment suppliers. Exterior wooden parts should at least be coated with good oil-based paint. To maximize the life of exterior parts, first dip them in copper naphthenate wood preservative, then paint them. Assemble interior frames with wood glue and nails.

Buying and Moving Colonies

The easiest, and sometimes the best, way to start keeping bees is to buy two established colonies from a reputable local beekeeper. Buying two colonies instead of one lets you interchange frames of brood and honey if one colony becomes weaker than the other and needs a boost. Before buying, arrange to inspect the colonies. Ask the seller to provide a recent certificate of inspection from the state Department of Agriculture. Buy bees in standard equipment only. Competent beekeepers usually have one or two hive bodies on the bottom board with shallower honey supers above. Question the seller if supers are arranged differently. The condition of the equipment may reflect the care the bees have received, so be suspicious of colonies in rotten, unpainted wood. Once the colony is opened, the bees should be calm and numerous enough that they fill most of the spaces between combs.

Be sure each super has at least nine frames of comb. Inspect combs in the deep supers for brood quality. Capped brood is tan/brown in color. A good queen will have at least five or six combs of brood, and she will lay eggs in a solid pattern so that there are few skipped cells. Look for symptoms of brood disease and wax moth larvae (see "Honey Bee Diseases and Pests").

Bee hives are easiest to move during winter when they are lighter and populations are low. Moving hives is a two-man job. Close the hive entrance with a piece of folded window screen, seal other cracks with duct tape, fasten supers to each other and to the bottom board with hive staples and then lift the hive into a truck bed or a trailer. Tie the hives down tightly. Remember to open hive entrances after the hives are relocated.

Installing Packaged Bees

Another way to start keeping bees is to buy packaged bees and queens and transfer the bees into new equipment. Bees are routinely shipped in 2- to 5-pound packages of about 9,000 to 22,000 bees. Once your packages arrive, keep the packages cool and shaded. Set up a bottom board with one hive body and remove half its frames. Make some sugar syrup (one part sugar:one part water) and spray the bees heavily through the screen; bees gorge themselves with syrup and become sticky, making them easy to pour. Pry off the package lid, remove the can of syrup provided for transit, find and remove the queen suspended in her cage and re-close the package. The queen cage has holes at both ends plugged with cork, and one end is visibly filled with white "queen candy." Remove the cork from this end and suspend the queen cage between two center frames in your hive. Workers will eat through the candy and gradually release the queen. Next, bounce the package lightly to shake all bees into a clump on the bottom, quickly take off the lid and shake the bees into the hive on top of the queen. As the bees slowly spread throughout the hive, gently return the frames you removed earlier. Carefully place the inner and outer covers on your new colony and feed your bees sugar syrup continuously until natural nectar flows begin. After two days, check to see if the bees have released the queen from her cage. If she was released, you will probably find her slowly walking on one of the center combs. If bees have not yet released her, return the queen cage to the hive until she is released. A week after the queen's release, check the colony again. By this time, you should find white wax combs under construction with cells containing syrup, eggs or young larvae. If you do not find eggs, the queen may be dead and she must be replaced immediately. Order another queen and introduce her as before.

Catching Swarms

Another way to get started is by finding and installing swarms. Sometimes swarms cluster on accessible places such as low tree branches, and property owners are usually eager for a beekeeper to remove them. If you find a safely accessible swarm, get a five-gallon plastic bucket with some kind of perforated cover such as window screening. Spray the swarm heavily with sugar syrup, place the bucket underneath it, then give the branch a sharp shake to dislodge bees into the bucket. Cover the bucket and install the swarm in a hive as you would packaged bees (except for the steps on installing a caged queen). Your county Extension agent will be glad to take your name as a referral for swarm calls.

Honey Bee Management

Management is scheduled around natural nectar flows. Beekeepers want their colonies to reach maximum strength before the nectar flows begin. This way, bees store the honey as surplus that the beekeeper can harvest instead of using the honey to complete their spring build-up. Nectar flows are very different between north and south Georgia (Table 2, page 6) so plan your beekeeping tasks according to the nectar flows in your area.

Feeding and medicating should be done from January through February. Queens resume laying eggs in January, after which brood production accelerates rapidly to provide the spring work force. Some colonies will need supplemental feeding. If colonies are light when you hoist them from the rear, they need sugar syrup. Mix syrup (one part sugar:one part water) and feed the bees heavily. Commercially available pollen supplements provide extra protein for population growth. Feed all medications (see the section on "Honey Bee Diseases and Pests") early enough to allow for labeled withdrawal periods before nectar flows begin.

By mid-February, the hives are ready for detailed inspection. On warm days (at least 45 degrees F), check the colonies for population growth, the arrangement of the brood nest and disease symptoms. Colonies with less brood than average can be strengthened by giving them frames of sealed brood from stronger neighbors. If you use two hive bodies, most of the bees and brood may be in the upper body with little activity in the bottom one. If so, reverse the hive bodies, putting the top one on the bottom. This relieves congestion and discourages swarming. If you use one hive body, relieve congestion by providing honey supers above a queen excluder. Swarming should be avoided because it severely reduces colony strength.

Mail-order queens are usually available by the last week in March. Annual requeening, whether in early spring or in fall, is one of the best investments a beekeeper can make. Compared to older queens, young queens lay eggs more prolifically and secrete higher levels of pheromones which, in turn, stimulate workers to forage, suppress swarming and suppress disease outbreak. To requeen a colony, find, kill and discard the old queen. Let the colony remain queenless for 24 hours and then introduce the new queen in her cage as described in the section "Installing Packaged Bees." With a new queen, you can also make a new colony by taking frames of brood, honey and bees from a strong colony (leaving behind the old queen), placing them in a new hive body with a new queen and then moving the new hive to a new location. This controlled "splitting" of a colony lets a beekeeper manage the swarming process; congestion and the swarming urge are relieved in the strong colony, and the removed bees are housed in a managed hive instead of lost.

If you feed your colonies, medicate them, requeen them and control swarming, they should be strong enough to collect surplus nectar by mid-April. This is the time to add honey supers above the hive bodies.

Add plenty of supers to accommodate incoming nectar and the large bee populations; this stimulates foraging and limits late-season swarming. As nectar comes in, bees place it in cells and evaporate it to about 18 percent water content. When bees cap the honey, it is considered ripe. At harvest time, use commercially available bee repellents to drive bees from the supers.

Not all honeys are alike. Usually, lighter honeys command higher prices, and most beekeepers try to keep darker honeys from mixing with lighter ones. For example, beekeepers in north Georgia remove supers with dark tulip poplar honey before it can mix with incoming sourwood honey, which is lighter. Consult Table 2 and local beekeepers to determine the proper time to remove your honey.

During late summer and early autumn, brood production and honey production drop. Unlike in spring, you should now crowd the bees by giving them only one or two honey supers. This forces bees to store honey in the brood nest. Colonies are usually overwintered in two hive bodies or in one hive body and at least one honey super. If you overwinter in one hive body and a honey super, remove the queen excluder so the queen can move up into the honey during winter. Colonies should weigh at least 100 pounds in late fall. If they are light on stores, feed them a heavy syrup (two parts sugar:one part water).

Table 2. Major Pollen & Nectar Sources of Georgia.

Months	Plant	Provides
North & Central Georgia		
February	maple	pollen, nectar
March	dandelion	pollen
April	black locust	nectar
April - June	clovers*	nectar
mid April - mid May	tulip poplar	nectar
late June - July	sourwood * (in mountains)	nectar
late September	goldenrod	pollen, nectar
South Georgia		
January - February	maple	pollen, nectar
February - March	spring titi	nectar
early April	black gum tupelo *	nectar
April	tulip poplar	nectar
late April	high bush gallberry*	nectar
May	low bush gallberry*	nectar
late May	palmetto	nectar
late July	pepper bush, soybean	nectar
September-October	goldenrod	pollen, nectar
* *Premium honeys*		

Processing Honey

Honey is sold as “extracted” honey - bottled, liquid honey that has been extracted from the combs; “comb” honey - honey still in its natural comb; and “chunk” honey - a bottled combination of extracted and comb.

Honey extracting equipment for the hobbyist is specialized and represents a one-time investment of about $500 for new equipment. Used equipment is often available at significant savings. These are the basic tools and procedures for extracting honey:

Uncapping knife - A heated knife for slicing off the cappings from combs of honey.

Uncapping tank - A container for receiving the cappings. Wet cappings fall onto a screen, and honey drips through to the bottom of the tank and out a spigot.

Extractor - A drum containing a rotating wire basket. Uncapped combs are placed in the basket and the basket is turned by hand or by motor. Honey is flung out of the combs onto the sides of the tank and drains through a spigot.

Strainer - A mesh of coarse screen or cloth directly under the extractor spigot. This filters out large debris such as wax and dead bees.

Storage tank - A large tank with a spigot, or “honey gate,” at the bottom. As honey settles in the tank, air bubbles and small debris rise to the top and can be skimmed off, allowing honey that is bottled from the honey gate to be clear and attractive.

Sometimes extracted honey granulates. This is a natural process, and the honey is still perfectly edible. If bottled honey granulates, loosen the lid and place the jar in a pan of water on a stove. Heat and stir the honey until it re-liquifies.

Comb honey requires little specialized equipment, so it is a good way for a new beekeeper to get started. Supply companies offer special comb honey supers for producing comb honey in round or square 1-pound sections. “Cut-comb” honey is the easiest and least expensive honey to produce. With cut-comb, the entire comb is cut away from the frame then further cut into smaller sections and packaged in special plastic boxes. Regardless of these variations, all comb honey requires a special extra-thin foundation. Freeze comb honey overnight before it is sold to kill any wax moth eggs and larvae.

Chunk honey is made by placing a piece of cut comb honey in a jar and filling up the rest of the jar with extracted honey. Remember to freeze the comb honey first.

Wax cappings are a valuable by-product of extracting. After cappings have dripped dry, wash them in water to remove all honey. Melt the cappings, strain the wax through cheesecloth and pour it into bread pans or a similar mold. Supply companies can render your beeswax bricks into new foundation at considerable savings.

Pollination

Many valuable crops benefit from insect pollination (the transfer of pollen from one flower to another flower). This process increases fruit yield and, often, the size of the fruit. Honey bees are important pollinators because they can be managed and easily moved to crop sites. In the United States, the added value to agriculture from honey bee pollination is more than $9 billion annually, and many beekeepers earn extra income from renting colonies for pollination. In Georgia, bee hives are rented to pollinate apples, blueberries, cucumbers and watermelons. Professional recommendations vary for the number of hives needed for good pollination, but for these crops one colony per acre is commonly used.

Stings

Anyone who keeps bees will inevitably get stung. Consider this before you invest in a beekeeping hobby. You can greatly reduce stinging if you use gentle, commercially reared queens, wear a veil, use a smoker and handle bees gently. Experienced beekeepers can handle thousands or even millions of bees daily and receive very few stings.

A bee sting will cause intense local pain, reddening and swelling. This is a normal reaction and does not, in itself, indicate a serious allergic response. With time, many beekeepers no longer redden or swell when they are stung (however, it still hurts!). An extremely small fraction of the human population is genuinely allergic to bee stings. These individuals experience breathing difficulty, unconsciousness or even death if they are stung and should carry with them an emergency kit of injectable epinephrine, available by prescription from a physician.

When a bee stings, the stinger and poison sack remain in the skin of the victim. Always scrape the stinger and poison sack out of the skin with your fingernail or a hive tool; never pull it out because this squeezes the remaining venom into the skin.

Honey Bee Diseases and Pests

Honey bee brood and adults are attacked by bacteria, viruses, protozoans, fungi and exotic parasitic mites. Additionally, bee equipment is attacked by other insects. Disease and pest control requires constant vigilance by the beekeeper. By law, all colonies in Georgia must be registered with the Georgia Department of Agriculture. Every beekeeper is responsible for contacting the Department for an inspection at least once every 18 months (every 12 months for queen and package bee producers). See your county Extension agent for help in registering and inspecting your hives.

American foulbrood (AFB) is a bacterial disease of larvae and pupae. The bacteria form highly persistent spores that can be spread by adult bees and contaminated equipment. Infected larvae change color from a healthy pearly white to dark brown and die after they are capped. Cappings of dead brood sink inward and often are perforated. Check for AFB by thrusting a small stick or toothpick into the dead brood, mixing it, then withdrawing the mass. Brood killed by AFB will be stringy and rope out about 1 inch. Colonies with AFB must be burned by a state bee inspector. The State of Georgia pays beekeepers a monetary compensation to help replace the loss. To prevent AFB, feed colonies the antibiotic Terramycin® according to label instructions in early spring and fall. Allow at least four weeks from the last Terramycin® treatment until the first nectar flow.

European foulbrood (EFB) is a bacterial disease of larvae. Unlike with AFB, larvae infected with EFB die before they are capped. Infected larvae are twisted in the bottoms of their cells, change to a creamy color and have a smooth "melted" appearance. Because EFB bacteria do not form persistent spores, this disease is not as dangerous as AFB. Colonies with EFB will sometimes recover on their own after a good nectar flow begins. To prevent EFB, treat colonies with Terramycin® as described above.

Chalkbrood is a fungal disease of larvae. Infected larvae turn a chalky white color, become hard, then turn black. Chalkbrood is most frequent during damp conditions in early spring. Colonies usually recover on their own.

Nosema is a widespread protozoan disease of adult bees and is especially common in north Georgia. In spring, infected colonies build up very slowly or not at all. Bees appear weak and may crawl around the front of the hive. Discourage nosema by selecting hive sites with good air flow. Damp, cold conditions seem to encourage this disease. Treat nosema by feeding the drug Fumidil® B in sugar syrup in spring and fall. Do not feed the medication immediately before or during a nectar flow.

Small hive beetles (SHB) were first found in Georgia in 1998. These beetles are native to southern Africa where they cause only minimal damage to honey bees. In the Southeastern United States, however, they can be a serious stress on weakened colonies or on colonies that are managed in an unnaturally small state such as queen mating nuclei or observation hives. The adult beetles are about 1/4-inch long, black, very active, and heavily armored so that they are hard to kill (see page 5). The larvae superficially resemble wax moth larvae, but SHB larvae are smaller, more robust, and do not display repellency toward sunlight (see page 5). The best prevention is to keep bee colonies strong and free from other stressors. Adult beetles can be trapped with any number of beetle traps available in beekeeping catalogs, even though the efficacy of traps is not good. Larvae pupate in the soil in front of hives, and research has shown that predatory soil nematodes Steinernema riobrave and Heterorhabditis indica, available from organic farm suppliers, provide good control of SHB larvae and probably help reduce local SHB populations.

Tracheal mites were first detected in Georgia in 1986 and have since caused high colony death rates throughout the state. The microscopic mites enter the tracheae (breathing tubes) of young bees. Inside the tracheae, mites block air exchange and pierce the walls of the tubes to suck blood. Symptoms resemble those of nosema. Bees become weak, crawl at the hive entrance and sometimes uncouple their wings so that all four wings are visible. Colony death rates are highest during winter and early spring. If you suspect tracheal mites, see your county Extension agent for help in diagnosing the disease. Infested colonies are treated with Miticur® or special formulations of menthol.

Varroa mites were first found in Georgia in 1989. These mites are about the size of a pin head and are copper in color. Female mites cling to adult bees and suck their blood. Females then enter a bee brood cell and produce several offspring which, in turn, suck the blood of the developing bee. Infested colonies almost always die within three to four years unless they are treated. Colony mite levels can be minimized by keeping apiary densities (hive numbers per site) as low as practically possible, using genetically mite-resistant queens, and using screen hive floors. Colonies historically respond well to Varroa miticide applications in late July and again in periods of low brood production, usually November - December. Miticides currently efficacious against Varroa in Georgia include amitraz (Apivar®), oxalic acid, formic acid (MiteAway Quick Strips®), or thymol (Apiguard® and Api-Life VAR®).

Wax moths are a notorious pest of beekeeping equipment. Adult moths lay eggs near wax combs, then their larvae hatch and begin burrowing through the combs to eat debris in the cells. Moth larvae ruin combs and plaster them with webbing and feces. Honey bees are usually very good at protecting their colonies from moth larvae. If moth damage is found in a colony, there was some other problem (usually queen loss) that weakened the colony first. Moth damage is most common in stored supers of comb. Protect stored supers by stacking them no higher than five hive bodies. Tape shut all cracks, put paradichlorobenzene crystals at the top of the stack and cover the stack with a lid. Replenish the crystals as they evaporate.

Honey Bee Biology

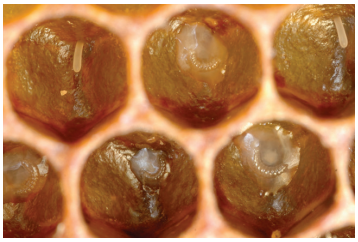
Worker

Queen

Drone

Four Stages of Development

Egg

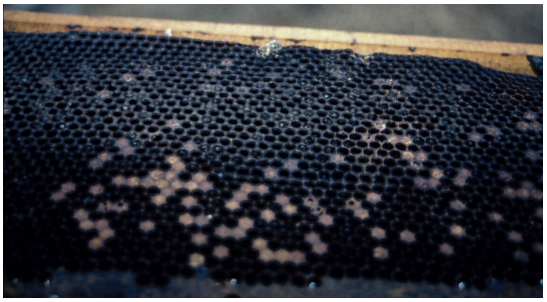


Young Larva *(plural "larvae")*

Mature Larvae

Pupa

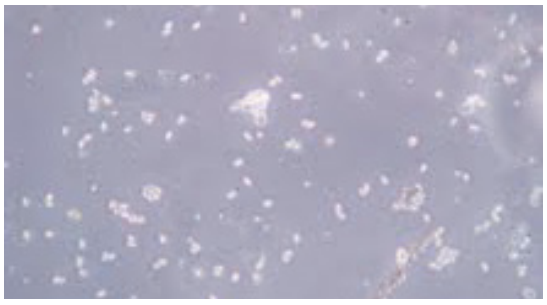
Honey Bee Diseases and Pests



American foulbrood: "Larvae that die from AFB dry to a brittle scale that adheres tightly to the cell floor. In this image, the comb is held upside down to allow sunlight to shine on the cell floors and reveal that many of them have scales."

European foulbrood: Black, grey, twisted larvae.

Chalkbrood



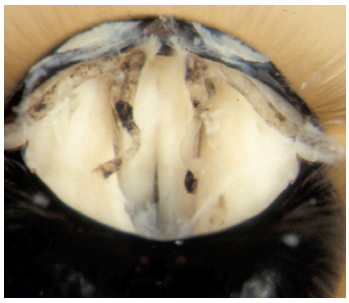
Nosema: Nosema spores can be detected by regular light microscopy when a slurry made of ground bee abdomens is examined at 400X magnification. *(Photo by: T. C. Webster, Kentucky State University)*

Small Hive Beetles Larvae *(Photo by: J. D. Ellis, University of Florida)*

Small Hive Beetles *(Photo by: J. D. Ellis, University of Florida)*

Varroa mites

Wax moths



Tracheal mites: The main thoracic tracheal trunks are exposed in these two bees. The tracheal system at left is clear and unscarred. The system at right is blackened with scar tissue resulting from tracheal mite damage.

Unwanted Honey Bee Colonies

When honey bees swarm and establish new colonies, they often move into hollow trees or voids inside walls of houses. Non-beekeepers are not accustomed to the sight of natural bee colonies, and they may react toward them with fear and hostility. Beekeepers are frequently asked to rid someone of unwanted bee colonies.

Someone with a natural bee colony should first decide if a problem truly exists. Honey bees, even those in walls of houses, do not cause any structural damage. Bees high in a tree or in the walls of an upper story are usually so far removed from people that there is virtually no chance of stinging. Unless people directly encounter the bees, the property owner should consider them an interesting opportunity to study nature.

If you decide to eradicate honey bees from a wall void, be prepared to pay for the services of an experienced beekeeper and a carpenter. To permanently solve the problem, the entire nest and the bees must be removed and the entrance resealed. It is not enough to simply spray inside the nest entrance with an insecticide because after the insecticide degrades, the cavity and combs are attractive to future swarms of bees. Moreover, if bees in a wall are killed but the nest is not removed, the combs are no longer ventilated and wax and honey may melt and stain interior walls. An experienced beekeeper can expose the nest and remove the bees and comb. The property owner is responsible for hiring a carpenter to reseal the void.

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Healthy colonies are typically able to survive North American winters.

The Winter Cluster

Winter can be the final stressor that finishes off unhealthy bees and weak hives. It is typical for 15 to 28 percent of all hives to not survive the winter. There are two factors that allow bees to endure frigid winter temperatures:

1. Enough stored honey that the bees can eat
2. An adequate number of bees to cluster and keep the overwintering colony warm

If the colony is insufficiently strong going into winter, or it does not have enough provisions to last through the winter, its chances of survival are greatly reduced. Second to *Varroa* mites, winter starvation is believed to be the most common cause for colony mortality.

Note the dead bees in this comb and the empty honey cells. Most of the bees on this comb died while searching for food. © Alex Wild

Honey bees do not hibernate. Because they are small, a bee's internal temperature will rapidly take on the outside temperature, which can be lethal during a North American winter. However, Western or European honey bees have adapted a survival strategy of clustering together in a mass to generate and conserve heat.

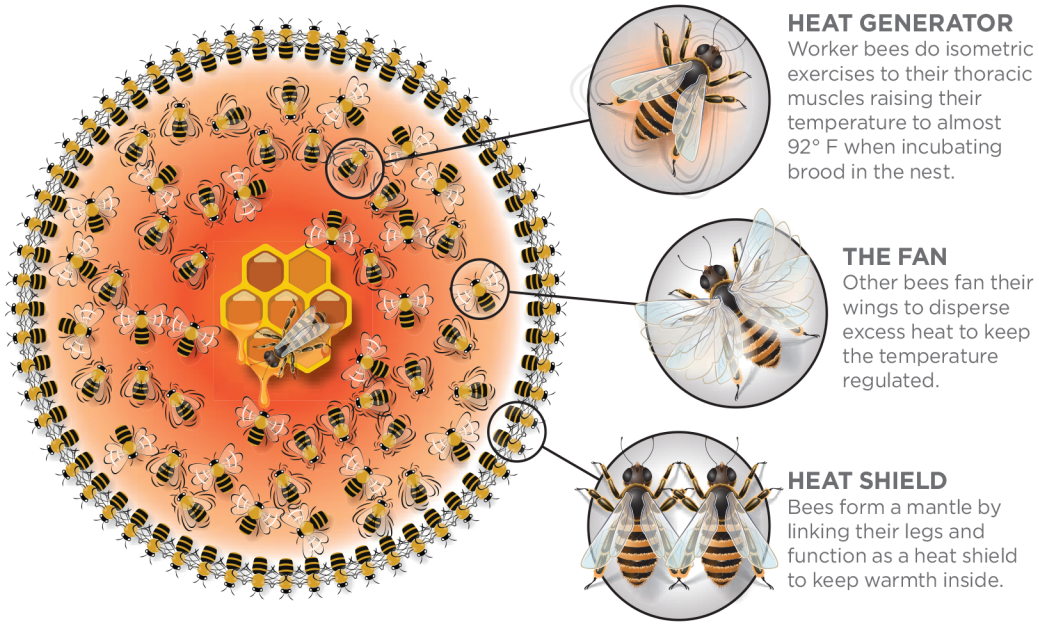
In late fall, a bee colony contains about half the number of adult workers it had in the summer, but there is no brood to care for, and foraging is complete for the year. The colony's goal heading into winter is to maintain sufficient temperatures to keep the colony alive. Bees accomplish this by forming a tight ball (cluster), which is interrupted by wax combs that provide insulation.

On the outside of the cluster are a mantle of bees that connect their legs together and essentially form a shell. These bees serve as a heat shield to help retain the heat within the cluster. In the interior, workers perform "isometric exercises," while remaining virtually motionless and vibrate their thoracic muscles. Shivering their muscles generates heat.

Individual bees take turns heating themselves to almost 100°F. Other bees will fan their wings to disperse excess heat, and regulate the amount of carbon dioxide in the cluster. The individual bees take turns heating themselves up, fanning, and serving as mantle bees, rotating in and out of the ball with the queen safely in its center.

A WARM HEART OF THE HIVE

HOT IN THE CORE
A tight ball of worker bees form in the core to generate heat to keep the queen at 70°–80° F. Honey, also in the core is the high octane fuel for the bees.



HEAT GENERATOR
Worker bees do isometric exercises to their thoracic muscles raising their temperature to almost 92° F when incubating brood in the nest.

THE FAN
Other bees fan their wings to disperse excess heat to keep the temperature regulated.

HEAT SHIELD
Bees form a mantle by linking their legs and function as a heat shield to keep warmth inside.

They do not heat the whole hive, but focus on keeping the core of the cluster (where the queen is) at 70-80°F. When the bees begin rearing brood again in late winter, they will need to increase the temperature of the hive to 93°F. Generating all that heat requires more honey to fuel the energy the bees are expending. So, stored honey is located nearby the cluster. The cluster will stay in one area until they have depleted the honey reserves. Without food, the bees are forced to move to a new area of the comb that contains honey.

Honey bees that experience extended periods of cold can still face serious problems. If -10°F temperatures persist for weeks on end, bees can become chilled to the point that they are unable to move to the comb to where honey is stored. Prolonged cold can kill the cluster, and bees starve to death when they are unable to access honey.

These photos show a cluster of honey bees in late February. Within minutes, the bees on the lid (on the left side of the bottom photo) were dead, because there were not enough bees to keep them from freezing.

The Four P's that Affect Bees

When it comes to the factors that affect honey bees, we can look at the four P's:

1. Pathogens
2. Pests
3. Poor nutrition
4. Pesticides

Although multiple factors (either singularly or in combination) can threaten a colony's ability to survive, it is the fourth P (pesticides) that can be particularly challenging for bee colonies when bees forage in treated agricultural or nonagricultural sites. The colony-level effects of pesticides can vary greatly based on when the bees were exposed.

For example, in the spring and early summer, a colony is growing because nectar and pollen are abundant. So, at these times, losses from a pesticide application may not be as significant or as noticeable if the same number of deaths occur in late summer and early fall when the hive is in natural decline and the colony requires a minimum level of bees (cluster size) to keep the colony warm during the coming winter.

THREE STRESSORS TO A HIVE

HIVES UNDER ATTACK

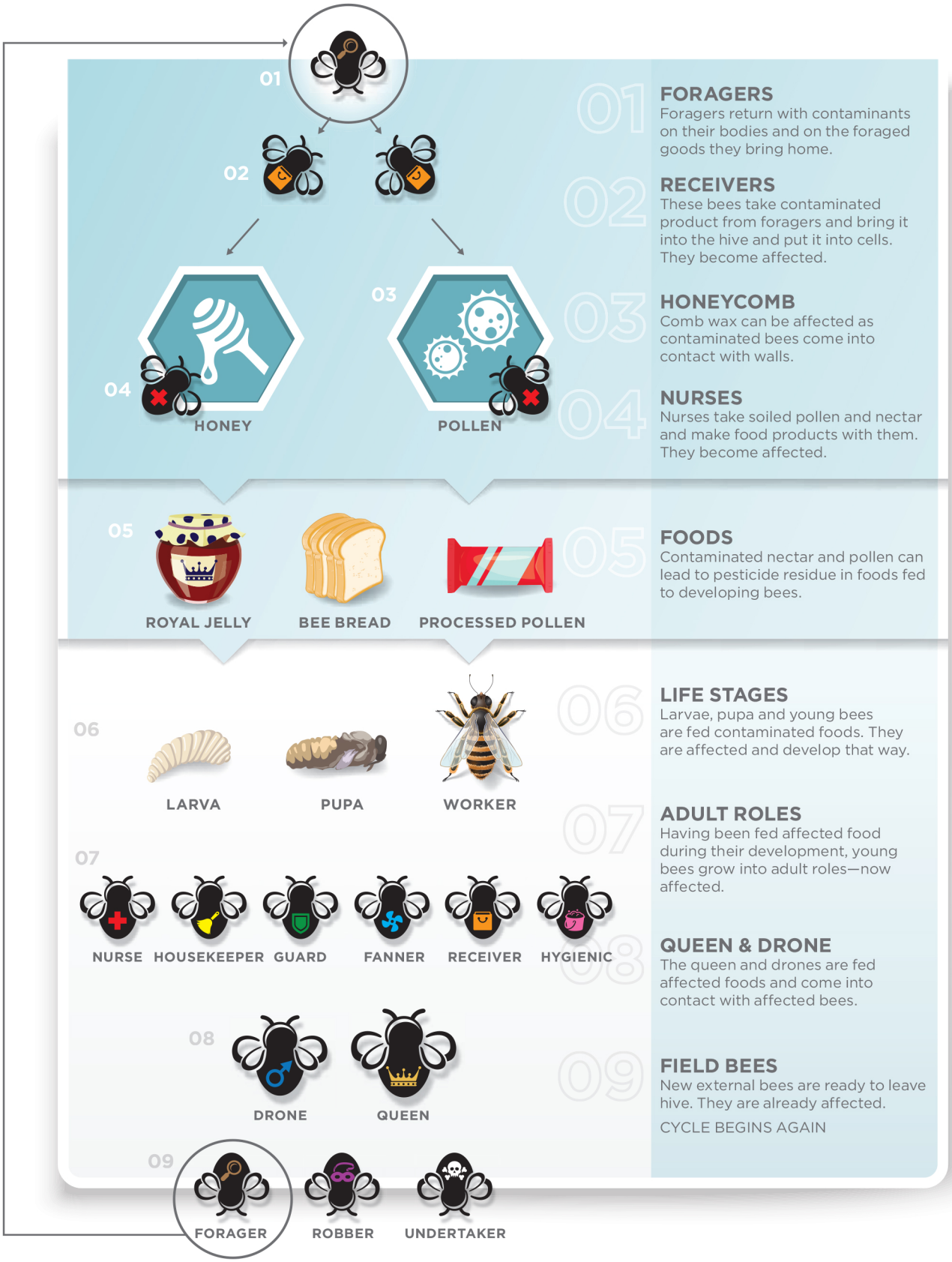
The colony is faced with many potential threats to its livelihood. Mitigating these threats is a constant struggle.

A colony will employ safeguards to stay viable, even after many bees have been killed. If an event kills too many foragers, the colony will have nurse bees accelerate their behavioral development and become precocious foragers. On the other hand, if pesticide residues were brought to the hive in the pollen or nectar and kills nurse bees, then some of the foragers can revert back to working inside the hive. These are biological responses that help the colony buffer itself against higher than normal losses (that is, compensate for or recover from such losses).

However, there can be serious short-term repercussions of turning nurse bees into foragers, such as having fewer workers available to rear brood, control temperatures, and clean the hive. Precocious foragers may be more susceptible to predation, because they have not had sufficient time to learn how to forage effectively, or their body physiology is not yet developed to meet the rigors that come with constant foraging. Precocious workers often have shorter lifespans and, at least initially, tend to be less efficient foragers.

As we will explore in the sections that follow, pesticide exposure is not always easy to characterize. Pinpointing a cause can be a real challenge.

HOW PESTICIDE EXPOSURE SPREADS



01 **FORAGERS**
Foragers return with contaminants on their bodies and on the foraged goods they bring home.

02 **RECEIVERS**
These bees take contaminated product from foragers and bring it into the hive and put it into cells. They become affected.

03 **HONEYCOMB**
Comb wax can be affected as contaminated bees come into contact with walls.

04 **NURSES**
Nurses take soiled pollen and nectar and make food products with them. They become affected.

05 **FOODS**
Contaminated nectar and pollen can lead to pesticide residue in foods fed to developing bees.

06 **LIFE STAGES**
Larvae, pupa and young bees are fed contaminated foods. They are affected and develop that way.

07 **ADULT ROLES**
Having been fed affected food during their development, young bees grow into adult roles—now affected.

08 **QUEEN & DRONE**
The queen and drones are fed affected foods and come into contact with affected bees.

09 **FIELD BEES**
New external bees are ready to leave hive. They are already affected.

CYCLE BEGINS AGAIN