# BEEKEEPING IN ARKANSAS

UofA DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
*University of Arkansas System*

MP577

# Beekeeping in Arkansas

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# Is beekeeping right for you?

**A better question may be:**
Are you right for beekeeping?

**Do you enjoy being outdoors and exploring the wonders of nature?**

**Do you enjoy gardening and caring for living things?**

**Do you enjoy woodworking and hands-on activities?**

**Are you interested in managing a small business?**

**Would you like to take part in the heritage of an ancient and noble craft?**

**Are you willing to put in hard work for a rewarding and enjoyable hobby?**

**If you can answer "*YES*" to most the questions above, then beekeeping might be right for you!**

## Saving the bees?

Ever since Colony Collapse Disorder brought the fate of pollinators to prominent public attention in 2006, beekeeping has emerged as a popular activity that connects people with the natural world. The number of hobbyist beekeepers has steadily increased over recent years, but this is not necessarily the solution that bees need.

Honey bees are not actually native to North America. They were introduced from Europe in the early 1600s with countless other plant and animal species. An estimated 4,000 types of bees were already present here, of which an estimated 400 or more are native to Arkansas. While immensely beneficial as pollinators, honey bees also compete for resources with many native bee species, and are not always the most efficient pollinators for all cultivated crops or wild plants.

Continuous global movement of honey bees over the years has introduced numerous exotic pests and pathogens into the U.S. that require competent and knowledgeable beekeepers to maintain good colony health. Simply crowding more poorly-managed bees into the landscape will not solve these problems, but often actually makes them worse.

Beekeeping can be challenging work. It can be expensive to start, and has a steep initial learning curve. Honey bees sting, bee suits are hot, and bee hives are heavy. Bees are living creatures which require a commitment to good care.

If you don't think you are up to the challenges and commitment of keeping your own bees, but still want to help, then **plant more flowers!** Improving floral nutrition, through better habitat stewardship and environmental conservation, will do more for all pollinator species and other kinds of wildlife than simply putting some honey bees in a box.

Despite these challenges (and maybe because of them) successful beekeeping is rewarding and enjoyable. Just be prepared to become a committed bee-*keeper*, not just a casual bee-*haver*!

**Honey bees do not simply need more beekeepers. What they really need now are better beekeepers!**

# Beekeeping in Arkansas

Blessed with a mild climate and an abundance of natural and agricultural areas, Arkansas can be a productive place to raise honey bees. From humble roots in the distant past, modern beekeeping can be enjoyed as a pleasant hobby, grow to become a small sideline business or even be a significant commercial enterprise.

You don't have to live in the country to keep honey bees. They can make themselves at home in urban areas as well. Most communities do allow beekeeping within city limits, but check with your local municipal codes to see if there are any zoning restrictions, limits on the number of bee colonies you can keep on a city lot, or how close your hives may be placed to property boundaries and neighbor's houses. Be aware of additional rules or restrictions imposed by property owners associations. And, of course, you should use good common sense and try to be a courteous neighbor.

In addition to any local ordinances, keeping honey bees in Arkansas is regulated by the Arkansas Department of Agriculture. Their purpose is not to restrict or unduly burden beekeepers, but rather to promote a healthy honey bee population that will support pollination of our state's valuable agricultural sectors and many wild areas.

Arkansas law requires beekeepers to register the locations of all apiaries. This process is simple and without cost. Registered beekeepers who suspect problems with their honey bee colonies may request a visit from their apiary inspector, who can assess and advise on the condition of your colonies. This service is available at no charge.

In order to limit the accidental transport or spread of contagious honey bee pathogens or disease, all bee colonies must be inspected prior to sale or movement into, out of, or within the state of Arkansas.

To register your apiary location, or to request a free hive inspection, contact:

**Arkansas Department of Agriculture**
**Apiary Section**
**(501) 225-1598**
**www.agriculture.arkansas.gov/plant-industries/regulatory-section/apiary**

# Some Common Questions

### How much does it cost to get started?

Beekeeping can be started on a budget, and improved over time, but most of your costs will be up front for the honey bees, hives and other tools. If you initially invest a little more in quality equipment, and take care of it, your beekeeping supplies should last you a long time. Because prices change over time, you should compare quotes from some of your local suppliers or mail-order companies for the current cost of a beginner beekeeper kit that contains all the basic components. This publication will explain the basic equipment you will need to get started.

### How many hives should I start with?

It is recommended that hobbyists begin with two hives. If you start with only one colony, but have no prior experience, you may not notice if a hive is having problems until it is too late. But if you have two hives, and one is thriving while another is not, you can compare them and hopefully identify (and correct) potential issues much earlier. If you lose a queen bee (a common beginner problem) you can raise a new one from another colony. Managing two bee hives is really no more work than one, but jumping in with too many hives right away can be overwhelming for a beginner. Make sure you are comfortable working with a few colonies before you take on bigger challenges.

### How much space do I need?

Bee hives don't take up much space. Once bees are out of the hive, they can forage for food up to several miles away. You don't need acres of farmland or wildflowers to maintain a few bee hives, but just enough room for you to work comfortably around them. Let the bees do the rest.

### Will I get stung?

Yes, all beekeepers occasionally get stung. Will you get used to it? No, it always hurts. Stings are supposed to hurt. This is the bees' way of letting us know we did something wrong. It may have been an accident, but we should take note and learn to not do it again. Honey bees are reluctant to sting, because it is fatal to them. However, they will do so if they feel that they, or their hive, is threatened. Dress appropriately to keep yourself and others safe, and learn to work your bees gently and efficiently to keep them in a good mood.

## What do you need?

To keep some backyard honey bees you will need a little space, some special tools, the honey bees themselves, and the hives for them to live in. Everything you need is available from mail order suppliers who specialize in beekeepers' needs. There are also several local suppliers in Arkansas where you can purchase most everything you will need. You can find a current list of suppliers at **arbeekeepers.org/links**.

Bee hives don't require much space, but they should not be placed near areas of excessive activity for your family, pets or neighbors. Use common sense and be considerate. A barrier of thick vegetation or a privacy fence will encourage your bees to fly higher as they come and go from your property, avoiding most people.

## Don't bee alarmed

Honey bees are not naturally aggressive creatures, but they may react defensively (by stinging) when they feel that their hive is threatened. Honey bees communicate their distress to each other by emitting **alarm pheromone**, a chemical odor which other bees detect, and will cause them to quickly become more defensive as well. Smoke temporarily masks the bees' ability to communicate this signal. Using a **bee smoker** keeps your bees calm, docile and more pleasant to work. A quality smoker should last many years.

## Dress for the occasion

While honey bees don't necessarily want to sting, they will defend themselves and their hive if they feel they are in danger. By using a little smoke and manipulating hives gently, beekeepers can reduce the chances of upsetting their bees. Occasional stings (usually due to our own carelessness) are an inevitable part of keeping bees. While working colonies, beekeepers should always wear the protective clothing that is appropriate for their skill level and comfort. At a minimum, a **bee veil** keeps bees away from the head and face. Additionally, **bee gloves** can protect the hands and arms. A full **bee suit**, with a zip-on veil and elastic cuffs at the wrists and ankles, offers the most protection, but these can be bulky and hot during the summer. Beekeepers should dress to feel secure for the task at hand. As you gain experience, you will also gain more confidence and become adept at handling your honey bees safely and gently.

## Tools of the trade

Your **hive tool** gives you the leverage to open up bee hives and easily remove frames for inspection. These are versatile and inexpensive, but easy to misplace, so consider getting an extra one. A soft **bee brush** is used to gently move honey bees around on the comb without upsetting them. They are handy when removing combs for extraction, and to brush away stray bees from your clothing once you have finished examining your hives.


***A basic set of good quality beekeeping tools, well-maintained, should last for many years.***
*[photos © Hudson Valley Bee Supply]*

# Bee hives

The bee hive is the bees' house, where they live and raise their young, and where they store their surplus honey. There is no perfect bee hive, and many types are in use today, each with their own advantages, and suitable for different styles of beekeeping. No matter what type of hives beekeepers choose, they must have removable combs so that the brood nest can be inspected for bee health.

The basis for modern beekeeping with movable combs is the **bee space**. When constructing combs, honey bees always leave a gap between them ranging from 1/4" to 3/8". Any space in a hive that is larger than 3/8" the bees will utilize for building additional comb. Any gap smaller than 1/4" is inaccessible to the bees, and will be filled with resinous **propolis** to seal out drafts and prevent the entry of small pests. The discovery and application of this critical dimension has truly revolutionized the beekeeping industry. When modern hives are built to retain this 3/8" gap between all the wooden parts, the bees leave that space open for their own travel, and will not seal hive components together, or build combs that beekeepers must destroy. Respecting the bee space makes things easier for both bees and beekeepers.

*The telescoping cover is a heavy lid that protects the hive from the elements. A metal or light-colored plastic covering sheds water and helps to reflect some summer heat.*

*The inner cover creates a dead air space for insulation from the heat and cold, and it makes the telescoping cover much easier to remove.*

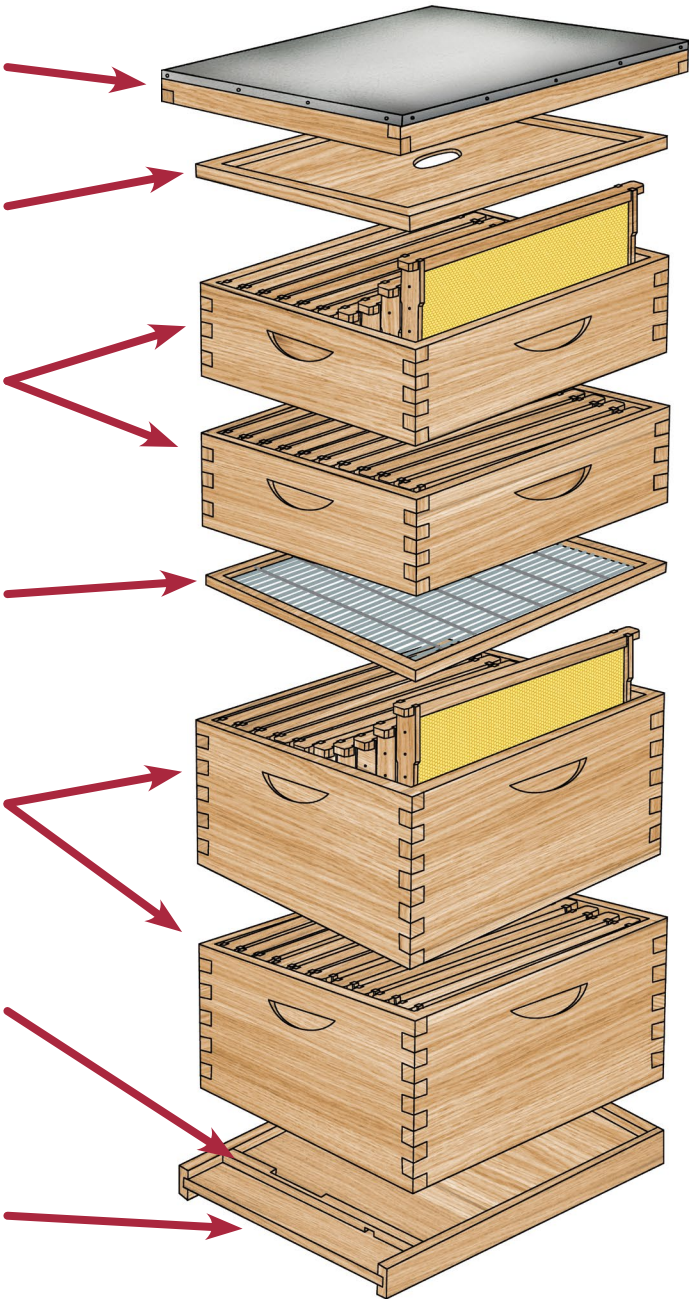
*The honey supers are extra boxes added on top of the hive as needed give the bees more room to store their surplus honey. These are removed by the beekeeper when the honey is harvested. Several standard sizes are available from beekeeping suppliers.*

*A queen excluder keeps the queen bee in the brood chambers below, as she is too large to pass through the excluder. This prevents her from laying eggs in the honey supers above. These are optional items, but can be useful.*

*The brood chambers contain the bees' living quarters. The queen bee lays eggs in the combs here, and the developing brood is nurtured. Pollen is stored here, to feed the young bee larvae. Some honey is also stored here for the bees' immediate use.*

*An entrance reducer is a notched wooden block that can be placed across the front of the hive. This adjusts the size of the opening to help a small colony better guard their home, and is also used during winter to keep out mice.*

*The bottom board is simply the floor of the bee hive. It has traditionally been made of solid wood, but some beekeepers now use a floor of 1/8" screen, allowing for better ventilation, and which can help to reduce some bee hive pests when used properly.*



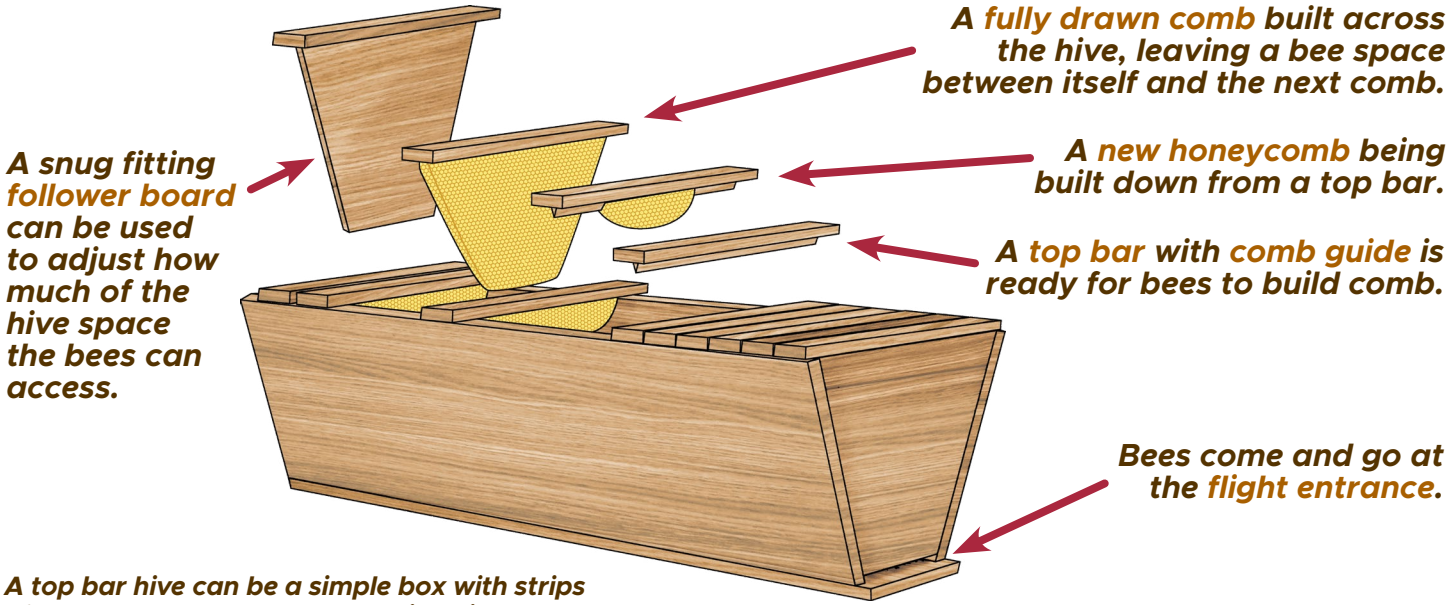
*Basic components of a modern Langstroth hive.*

Most beekeepers use a traditional **Langstroth hive**. These stacks of wooden boxes are likely the type with which most people are familiar. These hives are modular and versatile, and can be expanded or consolidated as the bees need more or less room, and all the parts are manufactured to standard dimensions to be interchangeable. Most honey extracting equipment and beekeeping tools are also designed for use with these hives. Each box holds removable wooden **frames**. Each frame has a sheet of wax or plastic **foundation**, imprinted with a precise hexagonal pattern to encourage the bees to draw out a straight, uniform beeswax honeycomb in the center of each frame. Frames and foundation come in several standard sizes. By encouraging the bees to build combs in frames, beekeepers can handle and remove them, and examine a colony without disturbing or destroying the bees' hard work.

The modern Langstroth bee hive is like a highly efficient multi-storied building. These hives allow access to any part of the hive, to inspect the colony for health issues, to assess available space and to easily remove surplus honey. The dimensions of a modern hive should be manufactured to be precise and consistent. Each part has a specific function, and these components all work together to form both a home for the bees and a honey factory for the beekeeper. This design allows for simple manipulation of frames of bees and honey. We can manage the bee population and encourage a surplus of honey beyond what the bees need for themselves. Beekeepers can harvest this surplus honey each year.

Some beekeepers use **top bar bee hives**. Originally intended to be a simple and sustainable design for beekeepers in developing countries who traditionally practiced destructive honey hunting of wild bees, this style has gained popularity in the U.S. for its simplicity and economical startup costs. This hive is essentially a long box with narrow strips of wood laid across the top. The bees construct a single honey comb hanging down from each of these top bars. The bars often have a thin wooden **comb guide**, which is coated in wax, to encourage the bees to build the combs in a straight line. The sides of a Kenyan top bar hive are angled, which discourages the bees from attaching the combs to the inner walls of the hive.

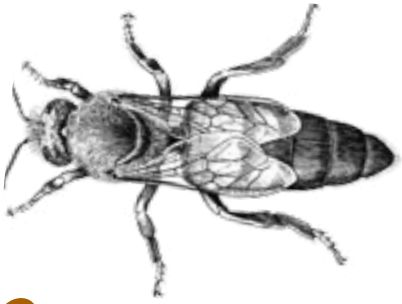
Beekeepers can lift a single comb to inspect different areas of the hive, to harvest a single honey comb or to rearrange the combs as needed. A **follower board** fits snugly inside the hive, and is used to adjust the volume of space the bees have access to. When the bees need more room, the follower board is moved, and empty top bars are placed between fully drawn combs, to encourage the bees to draw out new combs that fit in the **bee space**. This type of hive requires no heavy lifting to inspect, but does not produces as much honey per colony as a Langstroth hive. However, beekeepers harvest more beeswax with these hives, which can be sold or used to make additional products. Care must be taken when inspecting these hives, because soft wax combs can easily be broken off of top bars during inspection.




*A top bar hive can be a simple box with strips of wood across the top. Bees will build wax combs hanging down from each of these bars.*

# The Three Bees

There are three types of honey bees in a colony. Each bee has its own specialized role to play, and each is important for the success of the colony. Beekeepers should be able to recognize each type of bee in the hive, and understand the biology and duties associated with each.



## Queen

The queen is the heart of a productive honey bee colony. There is typically only one queen, and she will be the mother of all the other bees in the hive. She is the only colony member capable of laying fertilized eggs, and is therefore vital to colony success. A well-cared for queen may be able to produce well over 1,000 eggs per day. In order to produce so many offspring, a queen must consume many times her own body weight each day. The only food she normally eats is a rich, nutritious substance produced by the worker bees called royal jelly. In addition to eggs, queens produce important chemical pheromones that help regulate colony functions and keep it cohesive by imparting a distinct odor to each hive member. A mature egg-laying queen cannot fly well, and will not normally leave the hive. She can be recognized by her long abdomen, which extends well beyond the tips of her wings. Many beekeepers mark their queens with a dot of paint to make them easier to spot. A queen bee is said to said able to live up to 5 years, but rarely lasts longer than 2 or 3 before being replaced.

## Worker

Worker bees are all non-reproductive females. They are the smallest bees in the hive, but by far the most numerous. As their name implies, these bees perform all of the necessary tasks inside the hive. Workers feed and tend to the young brood as well as their queen. They also regulate the temperature in the hive, actively heating or cooling the brood nest as needed to maintain a constant perfect temperature to incubate the young. Workers secrete flakes of pure beeswax, which they will use to build and repair the honey combs. They also constantly clean the hive, removing debris and dead bees and other insects that may wander in. Workers visit flowers outside the hive, pollinating plants and bringing back both pollen and nectar for the colony to use as food. Worker bees transform this nectar into honey, which is stored for the bees to eat during winter, when no flowers are blooming. Workers are also the only bees that can sting to defend their hive, which is fatal to them. In the spring and summer workers may live up to 6 weeks, while winter bees can survive for up to 6 months.

## Drone

Male honey bees are known as drones, because of their distinct deep buzzing sound. Beekeepers can easily recognize them on the comb by their stout bodies and large eyes, which meet on the tops of their heads. These bees normally make up no more than 15% of a hive's population. Drone bees do not participate in any of the daily labor inside their hive. Drones have no stingers, and cannot even help protect the colony. Their only purpose is to mate with a new queen bee from another colony, maintaining genetic variability within the honey bee population. They spend part of each sunny day in search of a virgin queen. If successful, a drone will die soon after mating. Those that are unsuccessful in finding a mate might live up to eight weeks, but any drones remaining in the hive in late fall will be ejected before winter so they will not have to be fed. A queen bee can select the sex of the eggs she produces, and will cease making drones in the fall, then begin producing them again in the spring.

# Life cycle of a honey bee

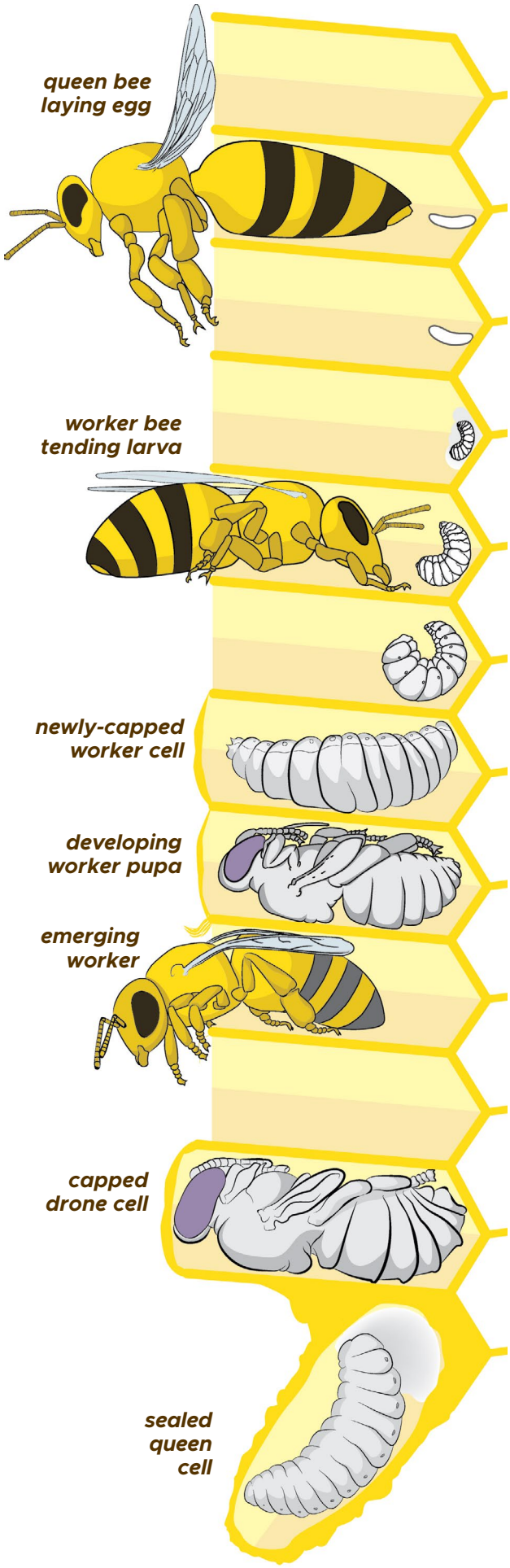
Understanding the development cycle of honey bees is important for colony management. Many beekeeping decisions are best timed to take advantage of the natural process of brood production.

The queen bee deposits a fertilized egg in a brood cell, which will hatch in 3 days. The resulting larva will be fed with nutritious royal jelly, which is produced by young workers called **nurse bees**. After 3 days of this diet, most larvae are then switched to a diet of pollen and nectar, known as **bee bread**, for another 3 days.

After 6 days of feeding, the brood cell is sealed with a wax cap by the workers. The larva will spin a cocoon and undergo complete metamorphosis. After about 12 days in this pupal stage, a fully developed adult will chew open the cap on her cell, and emerge. A worker takes 21 days to develop from an egg to an adult bee.

Drone bees develop from unfertilized eggs. Their larval phase is similar to that of a worker, but they remain in the pupal stage for about 15 days; requiring 24 days from egg to adult. Drone cells are slightly larger in diameter than worker cells, and when capped they protrude slightly above the surface of the comb. Queens cease producing drone brood in the fall, but start again in the spring. The appearance of the first spring drones suggests that bees will begin preparations to swarm in the next few weeks. Beekeepers may not appreciate drones, which do not forage or produce honey, but a healthy drone population is a good sign. A colony will not rear drones if they are nutritionally stressed. A colony producing only drone brood, however, is a symptom that the hive may be queenless.

If a colony needs to rear a new queen, workers will feed a few selected larvae continuously with abundant royal jelly, rather than switching their diet to bee bread, causing these larvae to develop into queens. Workers also transform the horizontal brood cells into distinct vertical **queen cells**, hanging off the comb surface. Queen bees pupate rapidly, developing from egg to adult in only 16 days. A mature virgin queen will take a series of mating flights over several days, after which she will normally remain in the hive, producing eggs and pheromones for the rest of her life. She will never leave the hive again unless it is with a swarm.



## Getting your first bees

The best time to start beekeeping is in the spring, so that new colonies can take advantage of abundant spring flowers to build up their populations and store up surplus honey. However, bees are usually in high demand and may be in short supply in the spring. They are living creatures and can only be produced for sale when conditions are right. Bees are usually available in Arkansas beginning in mid-April, but you may need to contact a supplier to reserve your purchase as early as January to ensure delivery.

## Package bees

Honey bees can be purchased and shipped through the mail in a screen package, which usually contains 3 pounds of worker bees and one queen in a special protective cage. Upon arrival, the queen's cage is placed in the new hive, and the rest of the bees are simply poured in with her. This is a good method for starting new colonies if there are no local beekeepers in your area selling bees. You may be contacted by your local post office to pick up your live bees in person, rather than having them delivered to your home by a letter carrier. You should inspect the queen immediately to be sure she is alive, and contact the supplier if there is any problem. There are numerous videos and tutorials online demonstrating how to install package bees.

*A 3-pound package of bees, ready to install.*

## Nucleus colonies

A nucleus colony (or "**nuc**") is a miniature bee hive, with a queen and 3-5 frames of brood, food (honey and pollen) and a small population of adult bees. Because a nuc contains a laying queen and developing brood, it can quickly build up into a productive colony. However, because they have a growing population and limited food stores, the bees must have access to the outside to forage for pollen and nectar. For this reason, nucs cannot be shipped through the mail. They can, however, be sealed for a day or two for transport. It is important to open the entrance again as soon as they have been placed where the colonies will stay. Allow the bees a few days to orient to their new location, then transfer each of the frames, with bees, into a larger hive, which should be placed in the exact location the nuc box has been sitting. Do this before the nuc hive becomes crowded, or the bees may attempt to swarm, significantly reducing the population of the new hive.

Most nucleus hives contain "deep" frames. If you plan to use "medium" frames for the brood boxes, or will be using a top bar hive, consider purchasing package bees instead.

*A nuc colony ready to transfer to a full hive.*

## Capturing a swarm

When honey bee colonies become crowded in the spring, they will rear new queen bees and prepare to swarm. The old queen leaves the hive with around 50-65% of the workers to start a new colony. The rest of the bees remain with their new queen, who inherits an established colony full of brood and stored food. This is how honey bee colonies reproduce and spread throughout the landscape.

The bees that leave their hive will stay together and typically land nearby, forming a large mass on a tree limb, fence post or other structure. This mass of bees is called a **swarm**. Most of the bees in a swarm are relatively inactive. A minority of scout bees will search the area for a hollow tree or other suitable cavity in which to establish a new hive. When they find a good site, these scouts will lead the other bees to their new home.

The resting swarm that we see is a temporary phenomenon, and will usually disappear within a few hours to a few days. If a beekeeper finds a resting swarm, it can be easily shaken into an empty hive, a bucket, or even a cardboard box, and simply poured into a ready hive. If treated gently, the bees will usually stay in the hive provided and begin making themselves at home. If drawn combs are added to the hive, the queen can begin laying eggs right away, increasing the likelihood that they will accept the hive. Let your local county extension office know that you are willing to collect bee swarms if they are reported. Most of your neighbors will appreciate your taking them away, and admire your giving them a good home. Aside from your time and effort, these bees are essentially free. But hoping for a convenient swarm may not be the most reliable method of starting your first bee hive.

*A swarm of honey bees can be easily hived.*

## Buy a full size colony

If you know a local beekeeper in your area, you may be able to purchase a complete hive full of bees. However, if you have no prior experience keeping honey bees, starting with large colonies may be overwhelming because of the number of bees and combs to inspect, and the potential for it to include problems such as hives pests or diseases you may not recognize.

Starting out small, with brand new equipment and healthy bees, allows a new beekeeper to watch the colony drawing new combs and producing more bees. You can observe the queen laying eggs and learn about the different stages of honey bee development as you watch the colony grow.

*Full-sized colonies can be overwhelming for an inexperienced beekeeper to start with.*

# Spring

The best time to start beekeeping is in the spring, so that your new hives can take advantage of abundant spring flowers to build up their populations and store up honey for both the hot dry summer and the long cold winter months. Don't expect to harvest surplus honey during the first year (although you may be surprised and be able to take a little). The bees will consume a considerable amount of honey to produce beeswax to build out their honey combs during their first season. Focus on becoming familiar with handling your bees and keeping them healthy, so they will survive their first winter.

New colonies should be fed sugar syrup if needed, to give them extra resources to draw out their comb. Consider feeding overwintering colonies that may have consumed all their food if spring flowers have not yet begun to bloom.

Successfully overwintered colonies will have a great advantage over new spring colonies. These will start the year with fully drawn combs, so that when flowers begin to bloom, the bees can begin filling empty cells with nectar right away rather than having to consume it to produce beeswax. Overwintered colonies will also be able to start producing brood much earlier. Package bees and nucs for sale are usually not available until the middle of April. By this time, an overwintered colony will likely have twice the population, and may be preparing to swarm.

Beekeepers should inspect their hives weekly in the spring, once temperatures are regularly above 60°F. Ensure the growing colony has sufficient space for both brood and honey. Inspect the brood nest regularly to be sure the queen is laying well, the larvae appear healthy, and to monitor for swarm cells.

The appearance of drone brood is a sign that colonies may begin preparations to swarm within a few weeks. Extra queen cells can be placed in hives that need them, or can be used to make splits and increase the number of colonies managed.

Add honey supers as needed, usually beginning around early April in the southern part of the state, a few weeks later in northern areas.

# Summer

The nectar flow, or honey flow, is the period when abundant flowers are in bloom in your area. For much of Arkansas this occurs from April to June, although it varies a little each year depending on weather and location. Beekeepers should be ready with honey supers they can add to their colonies as needed.

In much of Arkansas the nectar flow will end around the middle of June, as rains stop and fewer wildflowers bloom during the hot, dry part for the summer that beekeepers call the nectar **dearth**. During this time, bees may be consuming more honey than they are bringing in. Be sure to provide colonies with continuous fresh **water** if there is no natural source of water (such as creek or pond) within 1/4 mile of the apiary.

In agricultural parts of the state, irrigated farmland may provide bees with good forage throughout the summer. Irrigation keeps wild plants and flowering weeds blooming both before and after crops such as soybeans flower. Increased use of herbicides around farm land in recent years has significantly reduced the availability of wild forage sources in some areas. Also these landscapes pose an increased risk of pesticide exposure for colonies near crop land. Beekeepers should be aware for these considerations before placing bees near crops.

First year colonies may be off to a slow start, having to draw out foundation into comb before they can rear brood or store honey. If package bees or nucs were not installed until late in the spring, these colonies may require substantial feeding with sugar syrup, because they will have consumed the majority of the nectar they found producing new beeswax and rearing brood, without being able to store much surplus honey. These colonies should be fed continuously if needed until all combs are drawn and sufficient syrup has been is stored as honey.

Honey can be harvested as soon as it is capped by the bees. Avoid harvesting uncapped honey, because it can contain too much moisture, and may ferment. Also avoid harvesting so much honey so that your bees become stressed during the dearth and require you to feed them emergency sugar syrup.

# Autumn

Arkansas does not have a reliable fall honey flow like some other parts of the country, but sometimes when we have a wet summer, and fall temperatures stay mild, our bees can find abundant fall flowers to help them build up their colony strength before winter.

Honey bees need honey of course. They survive the winter by turning sugars into heat energy. Adult bees can survive on honey for a long time, but they need other nutrients found in the pollen they eat. Bees require vitamins and dietary proteins to maintain their own health, but also to produce the royal jelly they feed to the brood and to their queen.

Fall bees consume copious amounts of pollen, and store extra proteins in special organs called **fat bodies**. These stored proteins will be metabolized and turned into royal jelly to feed the queen during winter, but also used to feed developing brood in the late winter and early spring, when the queen resumes laying eggs, but before flowers are again in bloom.

Bees that are heavily parasitized by **varroa mites** have reduced ability to store proteins and reduced ability to produce royal jelly. These bees also typically have higher levels of mite-vectored viruses, which reduce their life spans. Treating colonies to reduce varroa mites is an essential part of bee management, especially in the early fall. Fall bees produce overwintering bees, which must be healthy and well fed to survive this long period. Even if mites are eliminated, those bees that were parasitized as pupae may be unable to rear healthy bees. It can take up to three brood cycles for a colony to fully recover from a heavy varroa mite infestation. Do this early in the fall to ensure a healthy winter population.

Plan to take your colony losses in the fall, rather than over winter. Instead of trying to overwinter two weak colonies, combine them into a single stronger one with a better chance of survival. If this colony thrives, it can be split again in the spring.

Prepare your hives for winter by consolidating the hive volume, and rearranging the combs if necessary. Bees move upwards during winter, so it is important to have your queen and brood nest in the lowest hive body with sufficient food above them. In Arkansas, a minimum of 45-50 pounds of honey is recommended. This is slightly more than a medium hive body, and slightly less than a deep.

If you have any doubt about the amount of food they have stored, err on the side of caution and feed them more. Providing too much sugar syrup is much cheaper than replacing bee colonies that have starved.

# Winter

There is little for beekeepers to do in their hives during winter except to occasionally check if sufficient food remains. When temperatures are below 55°F (13 C) honey bees cluster together around their queen to keep her warm. The bees in the center of this cluster shiver their wing muscles to actively generate heat. The bees on the outside of this cluster rest and feed on stored honey. They also form an insulating layer to keep heat inside. The active bees will later move to the outside to rest and feed, and those on the outside will move inward to warm up and take a turn generating heat. The cluster also moves upward, all winter long, onto combs containing more honey.

Beekeepers can tilt a hive back, without opening it, to assess how heavy it feels. A top-heavy hive is likely in good shape, but a light hive may need food. You can gently lift the hive lid to look at the top bars of the uppermost hive body. If you can see the cluster of bees, they are likely running low on food. If you cannot see the bees, but can hear them buzzing below, they likely still have food above the cluster and are safe for now. Honey bees do not heat their entire hive, but only the cluster, so opening the hive very briefly should not cause them harm. However, these wintering bees do not like to be disturbed, and may react defensively. Consider this when you open the lid and peer inside for a close look. Try to minimize disturbances and manipulations in cold weather.

If you need to supplement your bees' food during winter, place the food in the hive, near the cluster, and not at the entrance. See the section on **feeding your bees** (page 24).

Winters with wild fluctuating temperatures are more stressful on bees than long cold periods. On warmer days, bees will fly out, looking for flowers that are not yet in bloom. Prolonged flights will reduce their overwintering lifespans, and they will expend considerable energy doing so, and will therefore consume stored honey much faster.

Winter is a time to repair, repaint and replace old worn out equipment, while there are no bees inside. These wooden boxes must stay out in the weather for years, and can last a long time if kept in good shape. Protect your investment by keeping your woodenware in good condition, like any other building you own.

Consider the past year with your bees. Plan to repeat your successes and learn from any mistakes. Consider expanding your operation or trying different techniques. Read a good book on beekeeping for fresh ideas. If you plan to grow your operation, look into reserving more bees to buy before it's too late.

## Handling honey bees

Even the most gentle honey bees cannot be considered truly domesticated. Bees often fare quite well without us, but bees can be satisfied living in hives we provide for them, and will tolerate a great deal of manipulation. Some beekeepers can work their hives without getting severely stung because they have a good fundamental understanding of honey bee behavior. Experience can teach what to expect bees to do under certain conditions, and how to encourage them to respond in a desired manner.

The best time to work with bee hives is in the middle of a bright sunny day, when a large portion of the colony will be out foraging, leaving mostly younger nurse bees in the hive, which are less prone to defensiveness. Avoid disturbing bees on rainy days, or in cold conditions, when they are likely to be more defensive.

When working a hive, avoid standing in front of the entrance, forcing bees to have to fly around you as they enter or exit. Use a gentle amount of smoke when opening a hive and lift frames slowly and deliberately, without knocking or shaking the hive. When inspecting a frame, stand with the sun coming over your shoulder and hold the comb so that the sunlight illuminates the bottoms of the cells you are examining. Keep frames in a vertical orientation and try to avoid holding them flat, allowing thin nectar to run out. Honey bees organize their nest for efficiency and to keep their brood safe and at the right temperature, so always replace frames in the same positions and orientations you found them unless you have a specific reason to rearrange the combs.

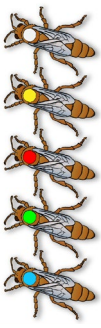
***Inspect bee hives regularly to assess colony health and available space for brood and surplus honey.***
*[Photo by Stephen Repasky]*

## Inspecting a bee hive

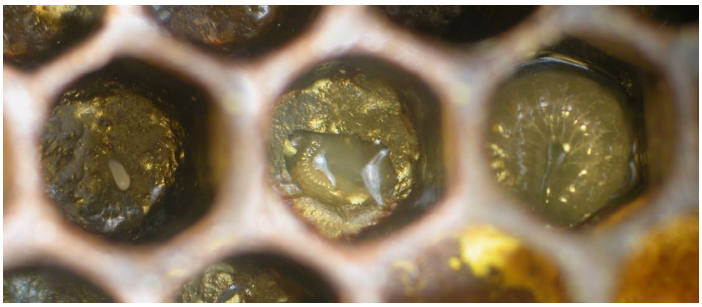
An important part of modern beekeeping is maintaining honey bee colony health. The only way to really know how your bees are doing is to open the lid and look inside. When you inspect a bee hive you will assess the health of the queen, the brood and the workers. You will also assess the amount of space available in the hive for brood and food storage, and whether to adjust that space, based on the season.

The queen bee is the heart of a colony and she is vital to its future. Her large size is makes her distinct and she is usually found surrounded by a group of attending workers. But a queen can be difficult to spot among the many other bees, even for experienced beekeepers. Marking her with a dot of colored paint makes it much easier to keep track of a queen. Also, the appearance of an unmarked queen will alert a beekeeper that she has been replaced. An international color code (below) designates her age, indicating the year she was produced and mated.

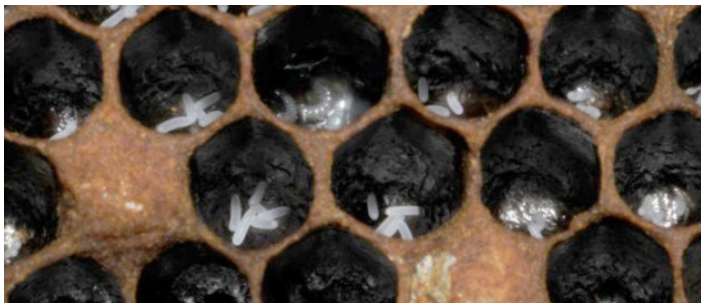
It is not necessary to examine every frame in the hive on every visit. There is also no need to locate the queen during each inspection, although spotting her is reassuring. Finding eggs in the brood nest is proof enough that a queen is active, or has been within the last few days. As long as eggs or young larvae (resting in royal jelly) are visible, the colony should be able to rear a new queen if needed. Even if you are unable to locate the queen, be assured that your colony will be able to continue in the event that anything happens to the queen they have.

| *years ending in:* | | *queen marking color:* |
|---|---|---|
| *1 or 6* |  | *white/gray* |
| *2 or 7* | | *yellow* |
| *3 or 8* | | *red* |
| *4 or 9* | | *green* |
| *5 or 0* | | *blue* |

***International queen marking color code is designated by the last digit of the year in which the queen was produced and mated. Colors repeat every five years.***



*Brood cells each contains a single egg or larva. The larva in the center of this photo lies in a small pool of royal jelly, provisioned by the nurse bees. It is still young enough to be reared into a queen. The larger, older larva on the right has been switched to a diet of bee bread and will now develop into a worker.*



*Some worker bees will begin to lay eggs in the absence of a queen. However, laying workers cannot mate and can produce only unfertilized drone eggs. A conspicuous symptom of laying workers is the presence of multiple eggs in each brood cell.*
*[photo courtesy Michael Palmer]*

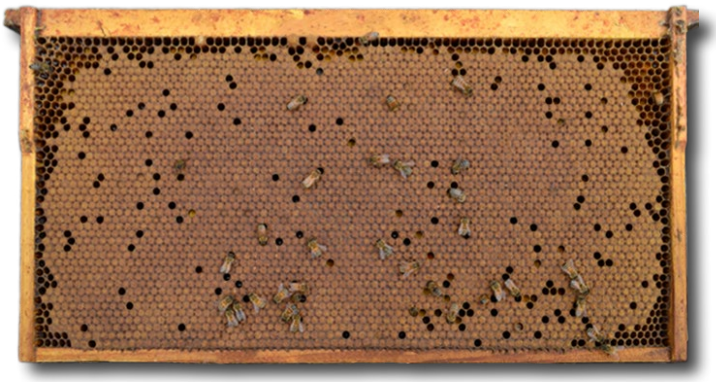
## Reading brood frames

A beekeeper can often assess the health and quality of a queen by observing the queen's **brood pattern**, or pattern of egg laying. This is most easily determined by examining areas of capped brood.

If nearly every cell in a large area of the brood nest is uniformly capped, then the queen is likely in excellent health, and is being fed well by her workers. This suggests that the rest of the colony is probably also doing well. However, if the capped brood pattern is very spotty or irregular, with lots of randomly spaced empty cells, the queen may be failing. She could simply be getting old, or she may be young but was not well-mated, and cannot produce many fertilized eggs. An inbred queen, which has mated with a brother or other closely-related drones, can produce a poor brood pattern and should be replaced. A colony infected with a **brood disease** may have a good queen, but the sick or dying larvae are being removed by the workers, leaving many empty cells in the brood pattern. Some colonies also actively remove pupae infested with varroa mites. This hygienic behavior is considered a good trait, promoting better colony health, although it may give the appearance of a poorly laying queen. When a poor brood pattern is observed, a beekeeper should examine the cells in the brood nest carefully to determine what the problem may be. If you lack sufficient knowledge to do so, consult an experienced beekeeper or contact your local apiary inspector.

In addition to capped brood, examine cells for eggs and uncapped larvae. The brood nest should contain eggs, open brood and capped brood in approximately a 1:2:4 ratio, so that for every egg seen, there should be 2 larvae and 4 capped cells. This is due to the number of days an egg or larvae remain in each state (3, 6, 12).

If capped brood is visible, but no eggs can be found, the queen may have recently disappeared. Look for queen cells, or introduce a mated queen in a cage.



*A solid brood pattern suggests the colony contains a healthy well-fed queen. A few empty cells are normal. They may contain pollen or nectar, or were not clean when the queen was laying on this particular frame.*

*A spotty brood pattern has many empty cells among the capped brood. This suggests the queen may be laying poorly, that she is aged, was inbred or that the hive is stressed by disease, mites or poor nutrition.*

# Population dynamics

As you examine colonies, most of the bees you see will be workers. The size of the worker population can be a good indicator of the colony's overall health. Colony populations will change throughout the season in response to local conditions and food availability. But nutritional stress, parasites or diseases can keep the worker population from reaching its potential. While many viruses can affect adult bees, few have obvious visible symptoms. A poor quality queen can also keep a colony from thriving. If one colony is slow to build up in the spring, for example, while others are thriving, careful inspection, consideration and intervention may be necessary.

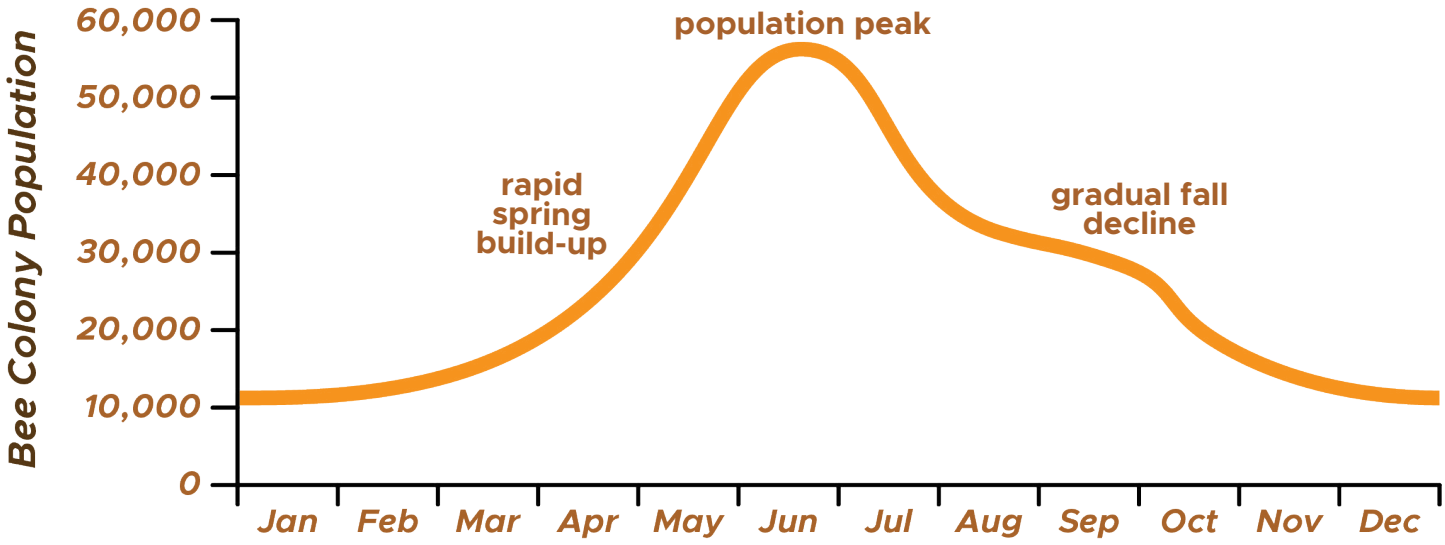
In the spring, expect colony populations to expand rapidly as temperatures warm and flowers bloom. The abundance of nectar and pollen being brought into the hive allows the bees to feed their queen a protein-rich diet. The queen responds by dramatically increasing egg production. Because eggs are produced at a rate faster than the bees die off, the number of bees increases exponentially.

The colony population will peak around the middle of sumer. This corresponds with end of spring rains and the beginning of a long hot, dry period with fewer flowers in bloom. In beekeeping this is known as the **summer dearth.** As a response to less forage available, the queen's egg production slows. Workers begin dying off naturally at a rate faster than they are being replaced, so the colony population begins declining. Milder temperatures and more rain at the end of summer can stimulate flowers to bloom. This extra food may induce a slight boost to the bee population, but should not be counted on for a significant honey flow in most of Arkansas.

Fall bees should be healthy and well fed in order to raise a generation of workers that can survive the winter. Unlike their short-lived spring and summer sisters, these overwintering bees must survive for 4-6 months, to keep the queen alive and help to rear the first larvae next spring just before flowers begin to bloom again, and the colony population will once again rapidly increase.

Normally, up to 15% of the bees in a hive might be **drones**. Their population increases rapidly in spring, beginning a few weeks before the swarming season. Few drones are reared in summer and fall, and none in winter, because they are only needed when new queens are produced.

A high proportion of drones in the hive suggests that a queen may be failing or has disappeared. If a colony is unable to quickly rear a replacement for a lost queen, some workers that mature in the absence of queen pheromones will develop ovaries and begin producing eggs. However, these **laying workers** are unable to mate, and can thus produce only unfertilized eggs, which become drones. Over time, workers die out and the colony fills with drones, which consume all stored food. When this happens, it can be difficult to introduce a new queen, and these colonies should be combined with a strong queen-right colony.



# Swarming

A healthy honey bee colony will usually try to **swarm** one or more times each spring. This is a natural and normal process for honey bees, and is how their species reproduces at the colony level. They take advantage of abundant floral resources to build up their numbers before and after the swarm departs. In the wild, this behavior helps ensure the species can multiply and spread, but in managed colonies, swarming reduces the workforce population that beekeepers desire for pollination and honey production.

When a swarm is not quickly spotted and recaptured, it will seek to build a new nest in a suitable cavity, such as a hollow tree. In an urban environment, however, where hollow trees may be more rare, swarms often take up residence inside of hollow walls and other structures.

Collecting a swarm is relatively simple if they are within reasonable reach. Because they have no brood or food to protect, a swarm is rarely defensive unless provoked, and can often be simply shaken from a tree branch into a container for transport back to an apiary, and then introduced into an empty hive. Removing an active bee colony from a structure, however, can be difficult, time consuming and potentially expensive for the homeowner. Be a good neighbor and do your best to keep swarms under control.

Trying to prevent all swarming can be challenging, however, because doing so works against the strong survival and reproductive instincts of the honey bees. Swarming should be discouraged with good management, to prevent honey bees from becoming a nuisance to neighbors. Ensure that each hive has sufficient space in the spring to accommodate both rapid brood production and the storage of abundant nectar. This may require adding another brood chamber, honey super, or both. Avoid over-supering bee hives, however. Adding excessive space to a hive that the bees cannot use right away can allow secondary pests such as **wax moths** and s**mall hive beetles** to become established inside hives.

Remain vigilant for signs of swarm preparation. Honey bee colonies will begin rearing drones about a month before they raise new queens for swarming. This ensures that when new queens emerge, there will be no shortage of drones available with which to mate. Drone production is associated with abundant pollen foraging, and will also coincide with rapid worker population buildup. It takes 16 days for an egg to mature into an adult queen. Once drone brood is observed in spring, colonies should be inspected at least every 14 days for signs of queen cells.

Colonies will not swarm if they do not have a new queen, but simply removing queen cells is not a good way to prevent swarming. The bees will usually try to rear ones right away, so this is a temporary technique at best. Rather, use queen cells that the colonies produce to requeen hives that need it or to start new colonies. Beekeepers can **split** growing colonies in the spring before they swarm. This essentially mimics what the bees are trying to accomplish instinctively on their own. If you don't need additional colonies from splits or swarms you capture, you can often sell them to other beekeepers to help fund your own operation. Just be sure to have them inspected first (page 2).

***Newly-emerged bee swarms are usually docile if not provoked and can be fairly easy to relocate.***
*[photo by Benjamin Aaron]*

***Once a bee swarm has established itself inside a wall or structure, it can be difficult to remove.***
*[photo by Benjamin Aaron]*

# Splitting bee colonies

Creating **splits** is the division of one honey bee colony into two (or sometimes more) smaller colonies. Doing so retains the total number of workers, rather than allowing colonies to swarm and losing up to two thirds of their population.

Once a colony begins creating new queen cells, they are usually committed to swarming. Splitting the colony and moving the old queen to a new hive may be the best strategy. Beekeepers can use this technique to minimize losses from swarming, to expand the size of an apiary or to produce nucs for sale to others. Inexpensive cardboard or plastic 5-frame nuc boxes are excellent to make up nucs that will be soon moved or sold. Standard wooden 5-, 8- or 10-frame hive bodies can also be used to split colonies that will remain in the same apiary.

The resulting splits will need to have sufficient resources to be successful. Each will need a queen, a queen cell, or a frame of brood from which to rear one. Each split also needs a frame containing a good amount of bee bread (stored pollen) and one containing honey. A frame of uncapped brood will encourage nurse bees to remain and tend the larvae. A frame of capped brood does not need to be fed, but will emerge in the new hive and help to populate it with young bees.

Gently move each of these frames into their new box with the bees still on them, then brush extra bees from several combs of open brood into the new hive as well. The older foraging bees usually return to their original hive, but the younger nurse bees will remain to tend the brood and queen.

***A split should contain all the resources bees need to start a new colony, including food, brood, a queen or queen cell, adult bees and room to grow.***

An empty drawn comb will give the bees a place to immediately store additional food, and will allow a queen to continue laying without interruption.

If a colony is creating queen cells in preparation to swarm, each of those cells can be carefully cut out and moved to a new hive when capped. An entire frame containing one or more queen cells can also be moved into a split. Leaving a laying queen in her original colony, while removing a few frames of bees and a queen cell creates a small split that will grow over time while allowing the original colony to continue growing without interruption. However, if the colony is preparing to swarm, removing queen cells will likely not stop them.

Relocating the original queen to a broodless hive mimics the natural conditions of a swarm. By placing this queen and a reduced population of workers in a new hive where they are not crowded, the swarming instinct is likely to be interrupted. Give this split at least one empty drawn comb so that the queen can immediately continue laying. Once she has begun producing brood, the colony should stay and begin storing food and drawing out additional foundation into combs. Monitor the original hive to be sure a replacement queen is successfully reared. She will be unlikely to swarm until the following year.

If done early enough in the season, a new queen can still develop and head a productive colony. Making splits that require colonies to rear their own queens can usually be done any time after adult drones are observed in hives.

If eggs and queen cells are present in a populous hive, but the queen cannot be located, beekeepers can perform a walk-away split. Divide all resources (frames of honey, bee bread, capped brood, uncapped brood, and empty combs) evenly between two hives. Move all frames gently, with the adult bees still on them. If there are queen cells, leave several in each split. Return in 3 days and look for eggs. The daughter colony without a queen will have no eggs, while the split with the queen should have eggs. Remove all developing queen cells from the queenright split, and allow the queenless split to rear a new queen. If neither hive has evidence of eggs, it may have already swarmed; leave queen cells in both halves.

# Queen production

The bees need only one queen, and will raise a new one only under specific circumstances. Queen bees are reared in distinct elongated vertical cells that are provisioned with lots of royal jelly.

Strong colonies tend to rear new queens in the spring or early summer, in preparation for **swarming**. The queen initiates swarming as a response to a growing colony population. She deposits eggs in **queen cups**. These are shallow vertically-oriented cells, typically built on the lower edges of combs, or where damaged combs have been repaired. Workers recognize that larvae in downward-facing cells should be reared as queens, and will elongate their cells and provision them with abundant royal jelly.

Workers evaluate a queen based on her ability to produce numerous chemical pheromones. These signals help them recognize their queen and encourage them to loyally tend her, as well as imparting a distinct odor to all colony members. When workers determine that a queen is failing (due to age or injury) they may begin to rear queen cells from suitable larvae, enlarging existing brood cells and provisioning them with extra jelly to eat. These are usually found around the upper portion of the brood nest. When a new queen emerges, the workers protect her, and will soon dispatch their old queen. This process of natural replacement is called **supersedure**. Sometimes a new daughter queen will coexist with her mother for a time, both laying eggs, but this is usually temporary.

If a queen dies or disappears, there is no source of queen pheromones in the hive. Within just a few hours workers will recognize a drop in pheromone levels, and will begin raising **emergency queens**. They select a number of suitable young worker larvae, enlarge their cells, and provision them with extra food. The bees must work quickly to raise a replacement queen, because within a few days all brood in the hive will be too old to be reared as queens. They will usually rear multiple queen cells at once. These can be found anywhere in the brood nest, and will all be in the same stage of development. The first mature queen to emerge will try to kill her rivals before mating flights.

When beekeepers notice a colony is rearing queens, they should consider why the bees are doing so, and determine if the colony requires any intervention. If the colony is preparing for swarming, for instance, splitting it may be warranted. If there are many queen cells on multiple frames, these can be used to start multiple splits or requeen other colonies. If the bees are attempting to supersede their queen, evaluate the colony's overall condition and determine if allowing them to do so will improve the colony. If the bees are rearing emergency queens, try to determine what may have happened to the original queen, and allow them to continue rearing or provide them a new queen.

Beekeepers can use the bees' natural instincts to initiate queen rearing. If you suspect a colony is queenless, provide it with a frame of eggs and young larvae from another colony (brush off the adult bees first). If the colony is indeed queenless, they will usually attempt to rear new queens from this brood. If they do have a queen or a queen cell that you missed, then they will simply raise those new larvae as their own workers.

Beekeepers can select individual larvae from a hive with good qualities and carefully transfer them into shallow wax or plastic queen cups. When these are placed into a queenless hive in a vertical orientation, the bees instinctively raise them to be queens. There are many methods to induce bees to rear queens. For more detailed information on queen production, refer to the UA Extension publication **MP518**, "Raising Quality Queen Bees" (**uaex.uada.edu/publications/pdf/mp518.pdf**).

***Honey bee queens are reared in distinct elongated vertical cells that are provisioned with ample jelly.***

# Requeening a colony

Replacing a queen bee will change the genetics of every member in the hive within six weeks, as the workers die off and are replaced by the offspring of the new queen. Introducing a new queen can help the colony improve their health, temperament or productivity.

A queen can live for several years, but as she ages, her egg production may slow down, and she may be more prone to swarming. A vigorous young queen is more likely to head a strong, productive colony. Some genetic lines of honey of bees are more susceptible to diseases than others. Replacing a colony's queen is the best method to control some diseases, such as **sacbrood virus** or **European foulbrood**. Doing so not only changes the genetics but also provides a break in the brood cycle to help the workers remove sick brood, and halts the transmission cycle. Some colonies are also more defensive than others, which is related to both genetic traits and environmental conditions. If a colony seems to always be very prone to stinging without provocation, requeening can often help.

Honey bees are able to raise a new queen if they need one, as long as they have larvae of an appropriate age and sufficient food to make royal jelly. If a colony is discovered to be queenless, adding a frame of young brood from another colony can provide them with larvae from which to rear a queen, as well as brood to rear into young nurse bees, giving the colony a boost in population. The colony should be inspected weekly to ensure that the bees start queen rearing, and that she later successfully mates and begins laying.

A queen cell from another hive can also be introduced into a queenless colony. The bees will likely accept it and continue to rear it as their own. Individual queen cells should be handled very carefully to avoid injuring the developing queen. To avoid handling a queen cell, an entire frame containing one or more queen cells can also be moved from one colony to another. Gently brush the bees from the frame, into their own hive, before moving the frame.

A mated queen can be purchased from a breeder and introduced into a colony in a protective cage. The new queen does not smell familiar to the workers at first, and they may try to kill her. The cage protects her, but allows the bees in the colony to slowly become accustomed to her scent and begin to accept her as their queen. Cages are usually plugged with a dense sugar candy, which the bees consume over several days, releasing the queen after a period of safe introduction.

***Honey bee colonies can raise new queens on their own as long as they have larvae of a suitable age. They will also accept a queen cell produced by another colony, either moved by itself or on a frame of other brood. Beekeepers can introduce a mature, mated queen in a cage from another source. The cage protects her from the workers who do not yet recognize her scent or accept her as their queen. Providing a mated queen keeps the colony productive without a lengthy break in brood production.***

## Uniting bee colonies

A small, weak colony headed by a poor queen, or one that has lost its queen and begun to dwindle in size, can be merged with a strong colony to save the remaining bees and conserve the drawn combs and stored food resources. Honey bees are loyal to their own queen and colony, all of whom share the odor of their own queen's pheromones. They will consider foreign queens and workers as rivals, and will attempt to kill or drive them out. To combine two colonies, a beekeeper must first remove (kill) the queen from the weaker (less populous) colony to avoid this conflict.

Remove the lid and inner cover from the stronger queenright colony. Place two sheets of newspaper across the top of this hive and make a few thin cuts in them, allowing odors to pass through, but not bees. Stack the weaker queenless hive on top of this newspaper, lining up the corners of all hive bodies, and replace the lid. Provide a top feeder to the weaker colony during the process if it does not have sufficient stored honey. The bees in the top hive body will soon lose their loyalty to their old queen as her pheromones dissipate. As the bees on both sides begin to chew through the paper and interact with each other, the queenless bees above will begin to take on the pheromones from the queen below. After 4-5 days, open the colony and remove the remains of the newspaper, then rearrange the boxes and combs as necessary.

***The "newspaper method" can be used to peacefully unite two honey bee colonies into one hive.***

## Africanized "Killer" Bees

**Africanized honey bees** (AHB) are a hybrid cross of the gentle race of European bees we maintain for honey and a more defensive race from the African savanna. Both are the same species of honey bee, *Apis mellifera*, but after many generations separated by geography, each has adapted to their own environments, with different behaviors. African bees were imported to Brazil in 1956 as part of a program to breed a tropically-adapted bee that was both gentle and highly productive for honey. Swarms of these African bees escaped, however, and have continued to breed with local European bee populations, creating the Africanized honey bee, which popular media has called the "killer" bee.

Africanized bees tend to be more defensive than pure European stock, reacting more quickly to disturbances and readily stinging in greater numbers. Their colonies have more guard bees and will defend a larger radius around the hive. AHB also tend to swarm multiple times per year, and will abscond more readily, abandoning their hive if disturbed or if conditions are poor. Africanized colonies tend to have smaller populations and thus store less honey per hive, making them less able to survive extended periods of dearth or long winters. They also lack the ability to cluster effectively during cold weather to survive winter conditions. These traits make Africanized honey bees less desirable for beekeeping, and have limited their ability of to spread naturally into higher latitudes.

Over many years their range has expanded north, reaching Texas in 1990 and Arkansas in 2005. Africanized honey bees are currently found in a few counties in southern Arkansas (Miller, Lafayette and Union), with neighboring counties considered to be at risk. Continual monitoring by the Arkansas State Plant Board suggests that AHB have, so far, not become more widely established in the rest of the state. However, extreme caution is advised for anyone attempting to move or relocate bees from this area, or to capture and keep swarms or feral colonies. Also, avoid purchasing bees from areas of the country known to have Africanized bees.

# Producing Honey

Harvesting fresh honey is your reward for a year of beekeeping labor. Every batch of honey is unique. The different flowers that bees visit throughout the season all impart subtle variations in the color, flavor and aroma of honey. Distinct differences can be detected in the honey from two colonies within in the same apiary or those that are miles apart. Honey from the same hives can vary from year to year because of changes in the abundance and diversity of flowers blooming in the area. Spring honey tends to be lighter in color and have a more delicate flavor, while later summer honey tends to be darker in color and have a more robust flavor.

Many beekeepers harvest honey once each year, blending the entire season's crop together. Some beekeepers, however, will pay close attention to blooming plants, and will harvest honey several times per year, or will separate honey supers filled at different times in the season, to bottle varietal honeys with different qualities.

The **nectar flow** is the time of year when flowers bloom abundantly. In most of Arkansas, this period is typically mid-spring to mid-summer, although variations in annual weather patterns and local geography can alter these dates by several weeks. Areas with intensive agriculture can experience long nectar flows where irrigation keeps crop plants and flowering weeds blooming throughout the hot summer.

Beekeepers should add **honey supers** to colonies as needed, beginning just before the nectar flow. Empty combs encourage bees to collect and store more nectar. If an optional **queen excluder** is used, it should be placed above brood boxes, but below honey supers. Add an additional super to the top when the previous one is about 75% full of unripe nectar, to continuously encourage foraging. However, do not over-super. Adding too many empty boxes on a hive at once give opportunistic pests (wax moths and small hive beetles) more room to hide where honey bees won't notice them.

Making honey is a complex process for the bees. They collect tiny drops of nectar from multitudes of flowers on each foraging trip from the hive, storing it internally in their **honey crop**. Back at the hive, these foragers transfer their nectar load to younger workers. These bees process the nectar, adding enzymes that chemically alter the sugars, turning nectar into honey. Bees must also remove most of the moisture from the nectar and store it in open honey comb cells. When the moisture content of honey is below 18.6% it will resist fermentation by naturally occurring yeasts.

***Honey bees may visit dozens of different flower species and millions of individual blooms during the season. Each of these imparts characteristics that affect the color, flavor and aroma of the resulting honey, making each batch unique. By extracting different batches of honey separately, a beekeeper can produce and sell multiple varieties of honey.***

***This frame of honey is not yet ready. The bees have sealed the cells on the upper part of the comb, but the unripe nectar in the lower cells still contains too much moisture. It's best to put these frames back in the hive and wait for the bees to finish the job. Trust your bees to cap the cells when the honey is just right.***
*[photo courtesy Ron Miksha]*

Bees preserve the **ripe honey** by placing a wax capping on each cell after the moisture content has been reduced, to prevent the honey from reabsorbing moisture from the air. When frames are completely capped, they are ready to harvest. Frames that have not been capped likely still contain excess water. If unripened honey is bottled, it can ferment in the jar. An instrument called a **refractometer** can determine the precise moisture content of honey, but if the bees have capped it, you can usually trust their judgment.

When honey is ready to be harvested, a beekeeper must first remove the bees from the honey combs. In the past, devices called **bee escapes**, with one-way exits for the bees, were used to direct them from the honey supers. Now that small hive beetles are common in Arkansas, bee escapes are no longer recommended because these beetles, left unconstrained by the bees, can ruin a honey crop in just a few days.

If harvesting honey from only a few supers, a hobbyist beekeeper can simply remove individual combs and gently brush the bees back into their hive, then place the capped comb into another hive body, covering it quickly with a lid to prevent stray bees from finding it again. Avoid using excess smoke during the process, as this can affect the flavor of the honey.

For beekeepers with more than a few hives, a **fume board** is very efficient. These consist of a wooden frame with an absorbent cloth stretched across it. A liquid bee repellent (available from beekeeping supply companies) is sprayed onto the cloth, which is then placed on top of a honey super to be harvested. Vapors from this liquid quickly drive the bees downward and out of the super, which can then be easily removed from the hive. Fume boards can quickly clear supers in warm weather, but may work more slowly when temperatures are cool. As soon as the bees have moved down, the honey supers are taken off and covered to protect them from robbing while the next is cleared.

Once the honey supers have been removed from the hive, combs are uncapped and extracted. An **uncapping knife** is used for this process. Some beekeepers use a hot knife, which quickly melts through the wax and slices off the cell cappings. Others use a cold uncapping knife, with is often serrated, and easily slices through the cappings. A curved tip and offset handle allow the blade to cut just below the edge of the wooden frame. Don't cut too deeply into combs. Remove just the cappings, so as to preserve the comb intact for the bees to use again next year. This step is messy and should be done over an uncapping tank, which has a grating to separate the wax from the honey.

Once frames have been uncapped, they are placed into a barrel-like extractor, which spins the frames rapidly, separating the honey from the combs by centrifugal force. Honey drips down the inside of the barrel, slowly collecting at the bottom, where it can exit to be strained and collected in another container.

***Basic equipment used to harvest honey at home includes an uncapping knife (either electric hot knife or a cold blade), an uncapping tank, an extractor, strainers and a settling tank.***
***[photos © Betterbee]***

# Bottling honey

Freshly extracted honey contains small bits of wax, pollen and other impurities, as well as air bubbles. It should be strained to remove the larger particles, but should ideally be allowed to settle before bottling to improve clarity. Honey is heavy, and after a few days at room temperature air bubbles and most fine particles that can pass through a strainer will float to the top, where they can be skimmed off.

A **settling tank** has valve near the bottom, called a **honey gate**, which is designed to efficiently stop and start the flow of thick liquids. Filling jars or bottles from the bottom of the tank helps ensure you produce a clean, pure product.

Even though pint and quart jars are common for packaging at home, honey is a food, not a drink, and should be labeled for sale by net weight and not volume. Honey bottled for retail sale should be labeled in both pounds/ounces and grams.

Honey enjoys an excellent reputation as a natural sweetener and good honey, thoughtfully packaged, commands a premium price in a market with consumers seeking local honey.


***Because honey has a low risk of bacterial contamination, it is among a number of products that can be legally produced, packaged and sold from the home without health department oversight.***

Pure honey is naturally antiseptic and ready to consume. It needs no heating or pasteurization, and does not require refrigeration to remain shelf-stable as long as it remains sealed against high humidity. Most supermarket honey has been heated and filtered at a bottling facility to slow the rate at which it crystallizes and make it easier to pump through the bottling equipment.

All honey will eventually crystallize. The inclusion of small particles, such as pollen grains, tend to cause honey to crystallize more rapidly. The formation of crystals does not mean that honey has spoiled, and it can be returned to a liquid state by gently heating it in a container of warm water (~100 °F). The term **raw honey** refers to honey that has not been excessively filtered or heated, and is considered a premium product that many customers will seek out.

Local honey is often touted as a natural remedy for allergies, based on the theory is that consuming honey produced by bees in your area exposes you to small amounts of local pollen. Over time, this exposure is thought to desensitize your immune system, potentially reducing allergic reactions. However, scientific evidence supporting this idea is limited. While fresh honey is a delightful treat and can soothe a sore throat, it should not be advertised as a reliable medical treatment for allergies.

Raw honey can contain spores of the common bacterium *Clostridium botulinum*. Most people over the age of two years will have developed an immunity to botulism, but some doctors have cautioned against feeding honey to infants.

Because honey has a very low risk of bacterial contamination, Arkansas law allows individuals to produce, package and sell it from home. In addition to extracted honey, beekeepers can also produce and sell comb honey, chunk honey, creamed honey and flavored honey. For an overview of regulations and guidelines on sanitation, bottling and labeling of home-produced hive products, consult the Extension publication **FSPP320**, "The Arkansas Food Freedom Act & Hobbyist Beekeeper Operations" (uaex.uada.edu/publications/pdf/FSPPC320.pdf).

# Planting for bees?

Habitat loss is one of the most serious drivers of pollinator decline around the world. Wild areas continue to disappear, and are increasingly replaced by urban, agricultural or recreational landscapes that are not managed to be beneficial to wildlife. Planting flowers, while conserving and connecting wild areas that remain, are vital to maintaining an environment suitable for honey bees, native bees and other pollinators. Though they are small, bees play an out-sized role in maintaining our environment. A healthy landscape that sustains multiple pollinators in turn promotes a diverse plant community, which is the basis for a healthy terrestrial ecosystem.

No single type of flower provides all the nutrients honey bees require. Good habitat includes a variety of flower shapes, sizes and colors that will bloom in continuous succession all season long. Landscape to incorporate a variety of flowering plants: forbs, vines, shrubs and trees that will continuously offer nutritious pollen from early spring, throughout the dry summer, and into late fall. Every bit helps!

A colony of honey bees can forage in a radius of several miles around their hive if necessary, but will usually stay within 2 miles or closer to their home as long as food is available. This is an enormous territory for an insect that is only about 3/4" long! A radius of just a quarter mile encompasses more than 125 acres. Planting to increase honey production is rarely worth the effort and expense unless a beekeeper is already planning to grow a crop that also attracts bees.

***Small honey bees forage over an enormous territory, up to 3 miles or more away from their hive. For this reason planting for honey production is impractical.***

| Radius (miles) | Area (acres) |
|---|---|
| 0.25 | 126 |
| 0.5 | 503 |
| 1 | 2,011 |
| 1.5 | 4,524 |
| 2 | 8,042 |
| 2.5 | 12,566 |
| 3 | 18,096 |

Beekeepers who also raise livestock should consider the value of **clovers and other legumes** in pastures and hay meadows. Legumes obtain nitrogen from the air and fix it into the soil. This nitrogen is used primarily by the plant, but some is available in the soil for other plants to absorb. Clovers and other legumes can also increase forage quality of pastures, hays or silages. Legumes are higher in crude protein and digestibility than most grasses commonly grown in Arkansas. As a result, animal performance can improve when clover is included in pastures, even though total forage yield may not increase. For more details, see UA Extension publication **FSA3137**, "Annual and Perennial Forage Clovers for Arkansas" (uaex.uada.edu/publications/pdf/FSA-3137.pdf).

Beekeepers should recognize a flower known as **bitterweed**, *Helenium amarum* (pictured below). These yellow blooms are common along roadsides and in pastures in Arkansas starting in late summer. The plant itself is distasteful to livestock, but highly attractive to bees, ensuring it is not grazed on, but is pollinated and reseeds. The nectar from this flower produces a bitter distasteful honey. If mixed with other honey varieties during extracting, can ruin the flavor of an entire crop. When these flowers begin to bloom, beekeepers are advised to begin harvesting their own honey, and let the bees use the bitter nectar for their own winter stores. Its pollen is nutritious and often plentiful at a time when few other flowers are blooming. The bees don't mind the flavor, so they will consume this honey before supers are stacked back onto the hives for next spring's nectar flow.

**Bitterweed, *Helenium amarum*, grows wild all across Arkansas, blooming from late summer through fall. While highly attractive to bees, it has a nectar that produces a bitter, unpalatable honey.**

# Feeding bee colonies

There is no better food for honey bees than their own honey. Ideally they will forage for all the nutrition needed for a balanced diet. At times, however, it maybe beneficial or necessary to supplement a bee colony's food stores.

In the **spring**, when establishing new colonies, the bees have a tremendous job of drawing out new combs from foundation before they can begin rearing brood or storing surplus food. Honey bees must consume the sugar in approximately 1 pound of honey to produce just 2 ounces of beeswax. In spring, feed bees 1:1 syrup (1 part sugar to 1 part water). This thinner mixture simulates a nectar flow, and because it has more water than thicker fall syrup, it encourages bees to draw out more comb in order to store all the "nectar" coming in. Overwintered colonies may be low on stored honey by early spring, before flowers are blooming abundantly. This can be a critical time for colonies starting to rear brood, and may require emergency food to help them survive until nature provides more flowers.

Few flowers bloom during the **summer** dearth. When hot, dry conditions prevail for extended periods, bees often consumes more honey than they produce. In agricultural parts of the state, irrigated farmland may support a continuous nectar supply all summer. Urban colonies, too, may be surrounded by irrigated gardens and landscape plants. But colonies in other rural locations may need help. Never harvest all of the honey from your hives just as summer begins, but leave enough for their use as well. A general rule is to leave at least frame of honey for every frame of adult bees in the hive. Colonies also need a consistent supply of fresh **water** to help cool their hives in the summer heat.

**Autumn** in Arkansas brings relief in terms of rain and milder temperatures, but rarely produces a nectar flow, and should not be relied upon to fully replenish the bees' winter stores, especially if the summer was extremely hot and dry. Different regions of the state vary greatly in their fall flowers. As soon as a beekeeper's surplus honey has been harvested, hives should be consolidated to the number of boxes intended for overwintering. Ensure that the queen and all brood, and any frames containing pollen, are in the lowest hive body. Frames containing honey should be placed above the brood. Put capped frames of honey in the outside positions of the upper box, with empty frames in the center. Feed syrup as needed to encourage bees to fill in all upper frames, and allow bees to fill empty cells in the lower box as the brood nest shrinks. Fall syrup is mixed 2:1 (2 parts sugar to 1 part water). Thicker syrup is more efficient for the bees to store without having to remove as much excess moisture before capping.

Little effort is required in the south to care for honey bees in the **winter**. As long as they have food and a sufficient population, bees will cluster together and keep themselves warm. Winters with alternating periods of warm and cold weather cause bees to consume honey faster. On warm days the bees will fly, scouting for spring flowers that are not yet available. This fruitless foraging activity burns many calories, depleting winter stores more quickly than if the colony had remained in their cluster all winter.

Beekeepers can gently tilt a hive back on its bottom board periodically during the winter months. The relative weight and center of gravity of the hive should indicate much honey remains. Bees can also survive opening the hive briefly in cold weather. If you peek under the lid during winter and can hear the bees, but not see them, there is a good chance they still have sufficient food above them. If you open the hive and the cluster is already visible near the inner cover, they are likely running low on food and would benefit from emergency feeding.

**Internal syrup feeders** are recommended if daily high temperatures remain below 55°F. Honey bees will not be able to efficiently take syrup from an entrance feeder during cold conditions. Granulated sugar can be fed to bees if prepared syrup is not available. Place sugar directly on top of the inner cover, or on a sheet of newspaper placed on the top bars. Sugar

can also be fed in division board feeders or hive top feeders. Lightly moisten the sugar to help bees begin consuming it. **Candy boards** or fondant blocks can also be used to feed colonies. Directions for making these can be found online.

Honey is the best food for bees, but never feed colonies honey purchased from any unknown source. Many store-bought brands of honey (particularly from overseas sources) contain spores of American foulbrood. These bacteria are harmless to humans, but can induce lethal infections if fed to honey bee colonies.

Never feed brown sugar, molasses or artificial sweeteners to honey bee colonies. Unrefined sugars contains excess plant material that cannot be digested by honey bees. Bees that are confined in their hive for extended periods (due to excess cold or wet weather) must store bodily wastes until conditions are right for cleansing flights. Bees that consume raw sugars, will have substantially more waste, and may exhibit symptoms of dysentery in the hive, which could be confused with symptoms of nosema disease. If you must feed your bees sugar syrup, use only refined white sugar.

Honey contains traces of pollen, which provides bees with proteins and micronutrients not found in sugar syrup. Commercially available amino acid solutions can be added to increase the nutritional value of syrup. Also, some essential plant oil mixtures can be added to stimulate bees to consume syrup by giving it an enticing scent (which plain sugar syrup also lacks), and preventing syrup from growing mold if bees don't consume it quickly.

Never feed colonies of bees if they are filling honey supers you plan to harvest and bottle. Real honey is only produced from nectar that bees collect for themselves from flowers. Remove all honey supers before feeding syrup!

If colonies require spring medications fed in syrup, the bees should consume all medicated syrup at least 4 weeks before honey supers can be placed on hives to avoid contamination of honey for human consumption.

## Starvation

A common cause of winter mortality is starvation. Rather, the bees freeze to death because they have run out of honey stores to convert into heat energy. Dead bees will be found in the spring with their heads in cells, as if they had been searching for food. Usually a small cluster of dead bees is found on the comb, often with the queen, while many others will have fallen to the bottom of the hive.

Occasionally a colony is found to have starved just a few inches from combs full of honey. This is usually after a sudden period of extremely cold weather, causing the bees to tightly cluster and consume all the food within reach. Individual workers are unable to move away from the warmth of the cluster to seek food and the cluster itself is unable to break up and move around the edges of the empty comb and onto frames with honey. This can only be avoided if there is ample food above the cluster, onto which they can easily move.

Colonies that are found to have little food during cold weather should be provided with emergency food. If a wintering colony is discovered dead with food in it, place all frames of honey into another hive, and store all other combs safely. If left unattended when the weather warms, a dead-out will be robbed by other bees, and the hive may become infested with small hive beetles and wax moths.

***Honey bees that died of winter starvation will typically be found with their heads in the bottoms of cells, as if they had been searching for food.***
*[photo by Alex Wild, alexanderwild.com]*

## Honey bee health

Our honey bee (*Apis mellifera*) is not native to North America; it was introduced by European settlers in the early 17th century. These bees were also transported to many other regions around the world where they interacted with different bee species, and encountered new hive pests, parasites, and exotic pathogens. As global travel and trade expanded, honey bee stocks continued to be relocated, inadvertently carrying pests and diseases with them. In modern agriculture, millions of bee colonies are regularly moved for pollination each year. Consequently, many organisms affecting honey bee colony health have become widely distributed, making the bee colony health a crucial aspect of contemporary beekeeping.

For more detailed information about bee hive pests, diseases and treatments, see UA Extension publication **MP-547**, "Honey Bee Health" (uaex.uada.edu/publications/pdf/MP547.pdf) and publication **MP-144**, "Insecticide Recommendations for Arkansas: Bee Hive Pests" (uaex.uada.edu/publications/pdf/mp144/MP144_2023_BeeHivePests.pdf).

## Bee diseases

Numerous pathogens can infect honey bees. Many can be present in hives at latent levels without showing obvious symptoms until colonies become stressed by other pathogens or environmental factors such as poor nutrition or pesticide exposure. Many of the most serious bee diseases are uncommon in Arkansas, but knowledge of their pathology and the ability to recognize symptoms is important for beekeepers. If you suspect a health problem in your bee colonies, but feel unable to accurately diagnose it, contact your apiary inspector (see page 2).

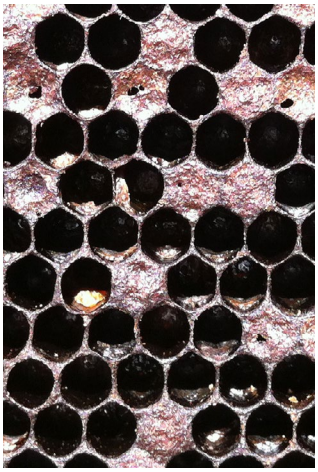


photo by Jon Zawislak, uaex.uada.edu/bees

photo by Virginia Williams, USDA-ARS.

***Sunken, perforated cappings and darkened scales on the bottoms of cells, often accompanied by a strong sour odor, are all symptoms of American foulbrood infection, a serious and contagious disease that can rapidly spread to other honey bee colonies. The "ropiness" test can be used to quickly diagnose AFB in the field. Suspected cases should immediately be reported to local apiary inspectors.***

## American foulbrood

**American foulbrood** (AFB), a disease caused by the bacterium *Paenibacillus larvae*, is the most serious and lethal pathogen that can infect honey bees. Uncontrolled, it spreads easily to other hives, killing an entire apiary as weakened colonies are robbed by stronger ones. Only the larvae are susceptible to AFB, while adult bees are immune. Nurse bees contaminate larval food with bacterial spores, causing the larvae to die soon after cells are capped. The capped cells may appear sunken or be perforated with small holes. Dead larvae become tough dry scales, stuck to the insides of cells, and difficult for housecleaning bees to remove. Their attempts to do so help spread bacteria.

If a toothpick is inserted into a larval cell and stirred, then slowly withdrawn, the remains of an infected larva will be drawn out in a gooey string. This "ropiness" test can be used to diagnose AFB in the field. Contact state apiary inspectors immediately if you suspect AFB.

American Foulbrood produces dormant spores that are highly resistant to extremes of heat, cold or drying out. These spores can persist for many decades on old beeswax combs and woodenware. It is therefore unwise to reuse old beekeeping equipment with an unknown history. Laws in most states, including Arkansas, requires the destruction of AFB-infected colonies and the burning of all contaminated woodenware.

# European foulbrood

**European Foulbrood** (EFB) is caused by the bacteria *Melissococcus plutonius*. This pathogen may be present in hives at a latent level, only becoming apparent when colonies are under stress. It is most common in springtime, when colony populations are growing, but weather is unpredictable and forage is not yet abundant. EFB affects only young larvae, which die before cells are capped, so the disease can be detected by inspecting the brood nest. Open brood cells may contain off-white, yellow, brown or gray larvae possibly with tracheal tubes visible beneath the skin. Larvae may appear twisted, curled, or melting down. A sour odor may or may not be apparent. Dead larvae form a rubbery scale which worker bees can remove, but may not be able to keep up with a heavily-infected colony. EFB does not form long-lasting resistant spores, so it is possible for a colony to recover from a mild infection. Antibiotics have traditionally been used to treat for EFB. Beekeepers can also break the brood cycle to halt disease transmission by shaking all adult bees onto new foundation in a new hive and discarding all old combs and brood. Replace or cage the queen for 2 weeks, while feeding with sugar syrup to encourage wax production.

# Sacbrood

**Sacbrood disease** is caused by a virus, likely transmitted from nurse bees to brood in food. Infected larvae will fail to pupate after cells are capped, and remain on their backs in a distinct "canoe" posture. Adult bees may uncap cells, revealing larvae with abnormally small heads, curved up, and which are gray to light brown or dark brown in color. Adults will remove dead larvae, which may spread the disease. If not removed, larvae dry out and adhere to the cell. A poor brood pattern is often apparent. Adult bees exhibit no overt symptoms, although high viral levels contribute to shorter lifespans and overall colony weakening. No practical cure exists to treat bee viruses. Re-queening usually clears up the infection by breaking the brood cycle and introducing new genetic stock, which may be more resistant, while giving bees a chance to remove the remains of infected larvae.

***Visible symptoms of EFB include discolored larvae, curled or twisted in their cells, or may appear to be melting down. These die before the cells are capped, and can be removed by worker bees.***
*[photos by Michael E. Wilson, beeinformed.org]*

*photo by Jon Zawislak uaex.uada.edu/bees*

*photos by Michael E. Wilson, beeinformed.org*

***Larvae with characteristic symptoms of sacbrood virus. Infected larvae are noticed in cells that have been chewed open because they failed to pupate.***

# Nosema

**Nosema disease** is caused by *Nosema ceranae*, a unicellular parasite that inhabits the digestive tract of multiple bee species. Thought to be one of the most widespread diseases affecting adult honey bees, nosemosis likely plays an indirect role in high colony losses, and yet it remains somewhat mysterious. It has been shown to act synergistically with some pesticides, increasing their toxicity to bees and leading to higher bee colony mortality.

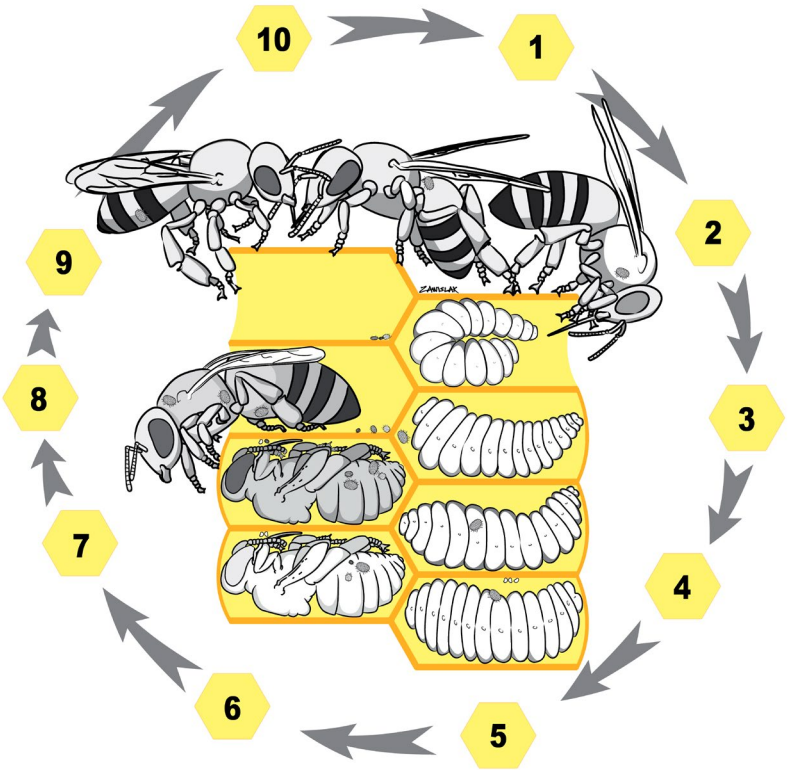
It is likely present in many colonies without causing noticeable effects until bees become stressed (by mites, poor nutrition, or other pathogens), allowing the microbes to evade a bee's immune system. A severe infection impairs foraging behavior, reduces brood care, shortens life spans and decreases winter survival. Young adult bees may not digest food at all, and become incapable of producing brood food. These bees may skip nursing duties and prematurely begin foraging, which significantly shortens their lives and puts pressure on other bees to tend brood. Queens that become infected are usually superseded. Severe infections result in weak colonies and high winter mortality even when overt symptoms are not obvious.

# Varroa mites

The **varroa mite** (*Varroa destructor*) is considered the greatest threat to honey bees and beekeeping around the world. While only about 1/16" wide, these parasites are very large in proportion to the body size of their host, and can have a severe impact on honey bee health. Varroa mites spend much of their lives hidden in brood cells, and even if they are not apparent, beekeepers should assume that some mites are present. These tiny external parasites feed on fluids and protein reserves in adult honey bees and pupae, and reproduce exclusively within sealed brood cells. Mite feeding physically weakens developing pupae and impacts their immune system, while vectoring numerous viruses. The result is a mite-virus complex that is more dangerous to bee health than either mites or viruses alone. Because there are currently no practical treatments for honey bee viruses, managing for low mite populations is the best strategy to limit virus transmission.

Varroa mites prefer drone brood over worker brood. Worker bees pupate in 12 days, while drone cells remain capped for 15 days. This extra time allows mites higher reproductive potential when infesting drone cells. Varroa infesting worker brood have an average of 1.5 mature female offspring, while mites on drone brood average 2.5 viable daughters. Therefore, limiting excess drone comb within a hive can help limit the population growth of varroa mites.

When brood is available, varroa typically spend 4-5 days in the phoretic stage before seeking a suitable cell for reproduction. Mites spend the majority of their lives in the reproductive phase, sealed protectively inside brood cells. However, most treatments affect only the phoretic mites. Understanding the life cycle of the varroa mites is key for beekeepers to effectively treat colonies and manage varroa infestations.




# Varroa life cycle

The life cycle of a varroa mite has two distinct phases. During the **phoretic phase**, mated female mites attach themselves to adult honey bees (1), and are carried through the hive. They are often found on nurse bees that remain in the brood nest, tending and feeding larvae (2). Phoretic mites must enter a honey bee brood cell to begin their **reproductive phase**. A mature female mite, called a **foundress**, enters a brood cell just prior its being capped (3). Once sealed inside, the mite opens a feeding wound on the bee pupa, infecting it with any viruses she carries (4). The foundress will soon begin laying eggs (5). The first will always be a male, followed by several female eggs over several days. Offspring hatch and mature, feeding on the same pupa, removing nutrients from the developing bee and picking up viruses that they will later vector to other bees (6). Mature sibling mites mate within the brood cell (7). When the adult bee later emerges (8), the foundress is released along with her mature female offspring. Male mites and immature females remain in the cell to die (9) and will be removed by housecleaning bees. The male mite's entire life is spent in the capped cell. Mites that emerge will quickly seek a host bee (10), and may change hosts multiple times. Phoretic mites prefer to remain and feed on middle-age nurse bees that tend late-stage brood, increasing opportunities to invade larval cells just prior to capping.

## Varroa mite treatments

When using any pesticide product, remember: **the label is the law**. Read and follow all product directions, including the use of protective safety equipment and removal of the product from the hive after a prescribed period of time. This is often 42 days (two brood cycles), which ensures that mites sealed in brood cells will be exposed to a treatment product at least once during their brief phoretic phase. Following recommended timing insures the product is removed from the hive before it dissipates, exposing the mites to a weaker dose, which they are more likely to survive and pass on resistance traits to offspring.

**Synthetic miticides** act on the central nervous system of varroa. Plastic strips, impregnated with a pesticide, are placed between brood combs. Phoretic mites are killed after bees contact and spread this material. Due to overuse and evolving resistance, many of these products are becoming ineffective at killing varroa mites. Chronic exposure to low doses of some of these compounds can also impact honey bee health. These products should not be used during the nectar flow, when supers are on, and bees are storing honey for human consumption.

Some concentrated **organic acids** can effectively kill varroa without significantly impacting bees or affecting the quality of honey. However, if not used properly, these can cause serious effects on bee health, including queen or brood mortality, or complete colony death. Some organic acids can be used during the nectar flow. Follow specific label instructions for each product, including timing, safety precautions and the appropriate temperature range in which it is effective.

Many concentrated plant **essential oils** have acaricidal properties. Thymol is one of the most effective, and may be mixed with other ingredients in commercial formulations. These products must volatilize in the hive, and their effectiveness is temperature dependent. Consult individual product labels for specific instructions. Some essential oils can be toxic to bees, and experimentation with non-commercial mixtures is risky to the colony. Essential oils should not be applied during the nectar flow.

## Sampling varroa mites

Varroa infestations should be kept below 3% (or 3 mites per 100 bees). For an accurate estimate, count the number of mites in a sample of at least 300 bees (about 1/2 cup). Collect adult bees from combs containing open brood cells, as nurse bees are most likely to carry phoretic mites. Be sure to avoid collecting the queen! For detailed information consult UA Extension publication **MP547** "Honey Bee Health" (uaex.uada.edu/publications/pdf/MP547.pdf).

## Recovering from Varroa

Bees with a heavy virus load are unhealthy. They typically have shorter lifespans, produce less brood food and will be poorly prepared to overwinter successfully. Even if mites have been largely eliminated, damaged workers are tasked with raising a new cohort of bees. This second generation of workers may have a much lower virus load, but will have been reared by weakened nurse bees, not as capable of producing royal jelly to feed them, and may still have compromised health. With fewer mites and lower virus loads, each successive generation should receive better nutrition and have improved health. Strong, healthy, well-fed bees are needed to survive winter and thrive the following spring.

It takes 21 days to raise a worker bee from an egg. Because it can take several brood cycles to recover from a heavy mite infestation, bee colonies may need 6-12 weeks from the time a beekeeper applies a treatment until significant improvement in bee health is achieved. Plan to treat colonies in the late summer, as soon as surplus honey has been harvested. This gives colonies time to recover from mite infestations and rear fall bees that are healthier and better fed, that can raise winter bees to be strong, healthy and full of stored proteins. These workers will be best equipped to survive the cold and rear the earliest spring brood, by metabolizing their stored proteins to create the royal jelly they need to feed larvae, and keep the colony going until spring flowers bloom.

# Small hive beetles

The small hive beetle (SHB), *Aethina tumida*, is an invasive pest from sub-Saharan Africa. Adult beetles are about 1/4" long, and are small enough to evade guard bees and hide in inaccessible niches in the hive. They lay eggs in cracks and crevices to avoid detection. Adult beetles can be a nuisance, but strong bee colonies can usually keep them under control and remove limited eggs and beetle larvae. If a bee population is insufficient, however, the beetle population can overwhelm the bee colony. This can be due to a gradual or sudden reduction in the number of adult bees due to diseases, mites, swarming, prolonged queenlessness or because of beekeeper manipulations such a colony split.

If not kept in check by bees, adult beetles will mate and lay eggs, which can hatch in just a few days. Larvae are scavengers, and immediately begin to consume pollen, honey, bee eggs and brood, or even dead beetles. When feeding, small hive beetle larvae introduce a yeast that causes honey to ferment and run out of the cells. The resulting ruined honey is referred to as "slimed." A heavily infested colony may cause the remaining bees to abscond and completely abandon the hive. The odor of fermenting honey signals that the colony is weak, and attracts more adult beetles from outside. Manage the adult beetles to prevent larvae from causing damage.

Larvae feed and grow for about 7-14 days, before migrating out of the hive to pupate in the soil. They will burrow down 4-10 inches, and then emerge as adults in 2-4 weeks, depending on soil temperature and moisture. Adult beetles can go for several days without feeding, and are able to fly several miles to find new colonies to infest.

Chemical controls for small hive beetles are ineffective in the hive. Drenching soil beneath bee hives with permethrin (GardStar®) after a large emergence of larvae can reduce the number of pupating beetles that survive to reinfest other colonies, however it will not prevent adult beetles from flying from other locations. Some species of entomopathogenic nematodes can be applied to the soil as a biological control, to help reduce the survival of hive beetle pupae.

The key to preventing serious damage from SHB larvae is to control the population of adult beetles. Numerous traps have been developed for use inside bee hives to help control SHB. None of them are perfect but any of them, used correctly, can help keep beetle populations down. Regularly monitor hives and eliminate other stressors to maintain strong bee colonies so that the bees can help keep beetles under control.

For more detailed information, see UA Extension publication **FSA7075, "**Managing Small Hive Beetles" (uaex.uada.edu/publications/PDF/FSA-7075.pdf).

***Small hive beetle adults are common invaders in southern honey bee hives. While they can be a nuisance to bees and beekeepers, adult beetles do little damage until they are allowed to reproduce.***
***[photo by Jessica Louque, Smithers Viscient, bugwood.org]***

***Small hive beetle larvae feed on honey in a bee hive, introducing a yeast that causes honey to ferment and become "slimed" in the comb. Control adult beetles to keep them from producing larvae.***
***[photo by James D. Ellis, Univ. of Florida, bugwood.org]***

# Wax moths

The wax moth, *Galleria mellonella*, is a ubiquitous and opportunistic pest of bee hives. Wax moths do not kill healthy and active bee colonies, even though they are often blamed by beekeepers. Female moths enter weakened, dwindling or poorly guarded hives and deposit clusters of eggs in crevices, which help them avoid detection and removal by bees. Moths will also enter unoccupied equipment in storage and lay eggs directly on combs. One moth can produce up to 1800 eggs, deposited in clumps of 50-150 at a time. Eggs hatch in about 5-8 days, depending on temperature.

The caterpillars (called **wax worms**) begin to burrow through the wax combs, just below the cappings. Honey bees will sometimes uncap rows of adjacent brood cells in an effort to find and remove tunneling wax worms, resulting in a condition beekeepers call **bald brood**. As these larvae burrow through combs, they spin layers of silk webbing to protect themselves from bees. This webbing can sometimes trap developing bees in their cells, causing them to die without emerging as adults.

Wax worms are scavengers that will consume pollen, honey and beeswax. They are especially attracted to used brood combs that contain cast honey bee pupal skins and propolis. Combs that have only been used for honey storage are much less attractive to wax worms, but it will still be consumed if infestations are large.

Wax moths also infest empty bees hives and stored combs. Freezing unused combs is an effective treatment and storage method, but may not be practical. Chemical fumigants (paradichlorobenzene) and organic Bt (*Bacillus thuringiensis*) products can also be effective to protect stored combs, but not to treat hives with live bees inside. **Never use moth balls (napthalene) in or on beekeeping equipment!**

The best defense against wax moths is to keep colonies strong and healthy, and maintain hives in good repair, to prevent wax moths from entering. A strong colony should patrol all combs and remove moths, eggs and caterpillars.

The presence of wax moths in a hive suggests other underlying problems that beekeepers may need to address. A colony's population may simply be too small for the size of its hive. Remove unused supers and consolidate it to a volume suitable for the current season so that bees can better patrol the inside of the hive for pests. If a small infestation of wax moths is discovered, freeze affected frames for 24 hours and place them into a strong colony to clean up. Otherwise, scrape the combs completely from the frames and replace the foundation.

***The wax moth seeks out old beeswax combs on which to lay eggs and reproduce. Strong, healthy colonies in well-maintained hives are the best defense against wax moth infestations.***
***[photo by Ben Sale, flickr.com, CC BY 2.0 DEED]***

***The wax worm can be a destructive pest in weak colonies and in stored equipment. These larvae consume brood combs and leave a mess of silk webbing and feces in the hives they infest.***
***[photo by Rob Snyder, beeinformed.org]***

## Moving bee hives

Arkansas law requires that honey bee hives must receive a health inspection from the state's Department of Agriculture before they can be legally moved. This is to minimize the spread of honey bee diseases and protect all beekeepers.

Bees fly during the day but remain in the hive at night. Therefore, after dark, temporarily seal the entrance to the hive with a block of wood, a piece of window screen, or other material. Secure all boxes, bottom board and lid together using a ratchet strap or other means and tie down the hive on a truck or trailer. Place the hive at its new location and allow the bees to settle for a little while before unsealing the entrance. The bees will emerge and begin to orient themselves to their new surroundings. Foraging bees are familiar with many visual landmarks in a large radius around their home. Moving hives a short distance may confuse the bees, because they recognize their surroundings and many will return to the former location of their hive. When colonies are moved outside of their former foraging territory, they will reorient on the new location. Therefore, a good general rule of thumb is to move bee colonies **fewer than 3 feet or more than 3 miles** at any one time.

*To move a hive, securely strap it all together and close the entrance after dark, when all bees are inside.*

## Record keeping

Accurate record keeping is a valuable habit. When you inspect a hive, record the details of what you see and what you did when you inspected. Note when you feed the colony, add supers, requeen them, when swarm cells are observed, the quality of the brood pattern, and any signs of pests or diseases. Also note mite infestation levels and when treatments or medications were applied.

An example of a hive inspection record sheet is included in the back of this publication. Keep copies of it in a binder, create a custom record sheet, or simply make notes in your own notebook. If a problem is discovered in a colony, referring to previous inspection details can help a beekeeper understand when and why things might have gone wrong and how to avoid similar problems in the future.

Record when you super colonies, when you harvest honey and how much honey you take from each hive and each bee yard. You may find that some of your hives or apiaries are consistently more productive than others.

Also keep track of where you purchase queens, nucs and packages to help you make informed choices about where to buy more in the future. If you raise your own queens, refer to your notes to determine which colonies have been the healthiest and most productive. Breed queens from these to improve the overall quality of your stock. Evaluate swarms you have captured from other places as potential breeder stock too.

Honey bee activities are closely linked to the flowers in bloom in your local area, which are linked to temperature and day length. Note when you see prominent plants or trees begins to flower, as well as what your honey bees are doing in their hives at that time. You will find that when these particular flowers begin to bloom again next year, your bees will be doing the same things. By paying attention to your local flowers, you can learn to predict when brood rearing should be increasing, when swarm season will begin, and when your honey flow should be starting.

# Bee Hive Inspection Record uaex.uada.edu/bees

| | |
|---|---|
| **apiary location:** | **weather conditions and temperature:** |
| **date & time:** | |

| | | | | |
|---|---|---|---|---|
| **hive name or number** | | | | |
| **notes on hive equipment, condition & arrangement** | | | | |
| **activity at entrance** | ☐high ☐med ☐low | ☐high ☐med ☐low | ☐high ☐med ☐low | ☐high ☐med ☐low |
| **carrying pollen** | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no |
| **signs of robbing behavior** | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no |
| **colony temperament?** | ☐ calm<br>☐ nervous<br>☐ aggressive | ☐ calm<br>☐ nervous<br>☐ aggressive | ☐ calm<br>☐ nervous<br>☐ aggressive | ☐ calm<br>☐ nervous<br>☐ aggressive |
| **worker population** | ☐high ☐med ☐low | ☐high ☐med ☐low | ☐high ☐med ☐low | ☐high ☐med ☐low |
| **drone population** | ☐high ☐med ☐low | ☐high ☐med ☐low | ☐high ☐med ☐low | ☐high ☐med ☐low |
| **queen sighted** | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no |
| **queen marked** | ☐ yes, color:<br>☐ no | ☐ yes, color:<br>☐ no | ☐ yes, color:<br>☐ no | ☐ yes, color:<br>☐ no |
| **eggs present** | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no |
| **open brood present** | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no |
| **capped brood present** | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no | ☐yes ☐no |
| **brood pattern** | ☐ excellent<br>☐ fair<br>☐ poor/spotty | ☐ excellent<br>☐ fair<br>☐ poor/spotty | ☐ excellent<br>☐ fair<br>☐ poor/spotty | ☐ excellent<br>☐ fair<br>☐ poor/spotty |
| **stored pollen / bee bread** | ☐ little/none<br>☐ adequate<br>☐ lots/surplus | ☐ little/none<br>☐ adequate<br>☐ lots/surplus | ☐ little/none<br>☐ adequate<br>☐ lots/surplus | ☐ little/none<br>☐ adequate<br>☐ lots/surplus |
| **hive pests sighted** | ☐ SHB adults<br>☐ SHB larvae<br>☐ wax moths<br>☐ wax worms<br>☐ other: | ☐ SHB adults<br>☐ SHB larvae<br>☐ wax moths<br>☐ wax worms<br>☐ other: | ☐ SHB adults<br>☐ SHB larvae<br>☐ wax moths<br>☐ wax worms<br>☐ other: | ☐ SHB adults<br>☐ SHB larvae<br>☐ wax moths<br>☐ wax worms<br>☐ other: |
| **disease symptoms** | ☐ AFB<br>☐ EFB<br>☐ sacbrood<br>☐ chalkbrood<br>☐ nosema | ☐ AFB<br>☐ EFB<br>☐ sacbrood<br>☐ chalkbrood<br>☐ nosema | ☐ AFB<br>☐ EFB<br>☐ sacbrood<br>☐ chalkbrood<br>☐ nosema | ☐ AFB<br>☐ EFB<br>☐ sacbrood<br>☐ chalkbrood<br>☐ nosema |
| **varroa mite sampling method** | ☐ sugar shake<br>☐ alcohol wash<br>☐ sticky board count | ☐ sugar shake<br>☐ alcohol wash<br>☐ sticky board count | ☐ sugar shake<br>☐ alcohol wash<br>☐ sticky board count | ☐ sugar shake<br>☐ alcohol wash<br>☐ sticky board count |
| **varroa mite infestation (per 100 bees)** | | | | |
| **date of last varroa treatment** | | | | |
| **method of last varroa treatment** | | | | |
| **interesting observations, hive manipulations other notes** | | | | |

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